NAVY MARINE ACQUISITION REVIEW COMMITTEE. VOLUME 1, REPORT

Navy Marine Corps Acquisition Review Committee

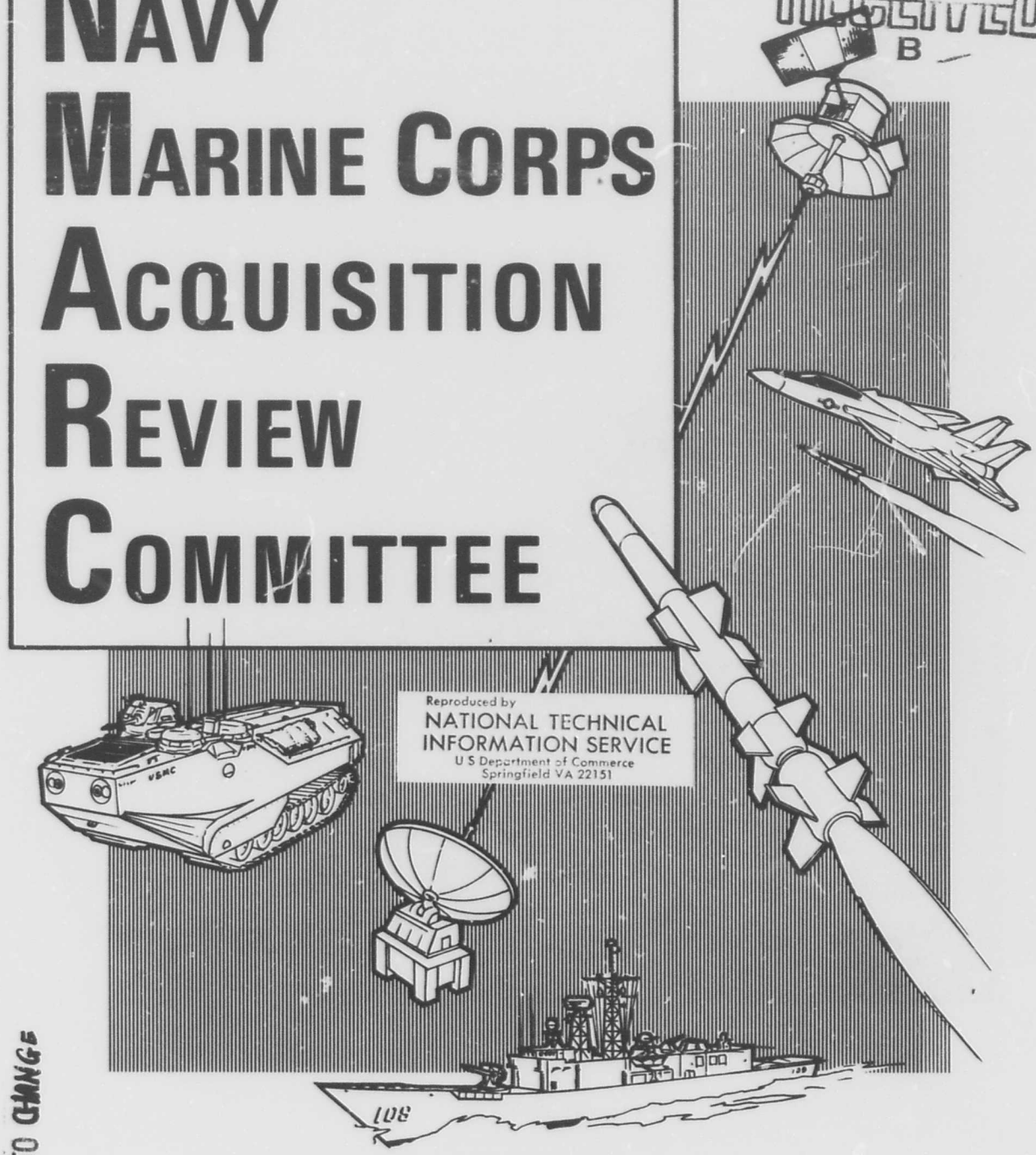
Prepared for:

Department of the Navy

January 1975

REPORT OF THE

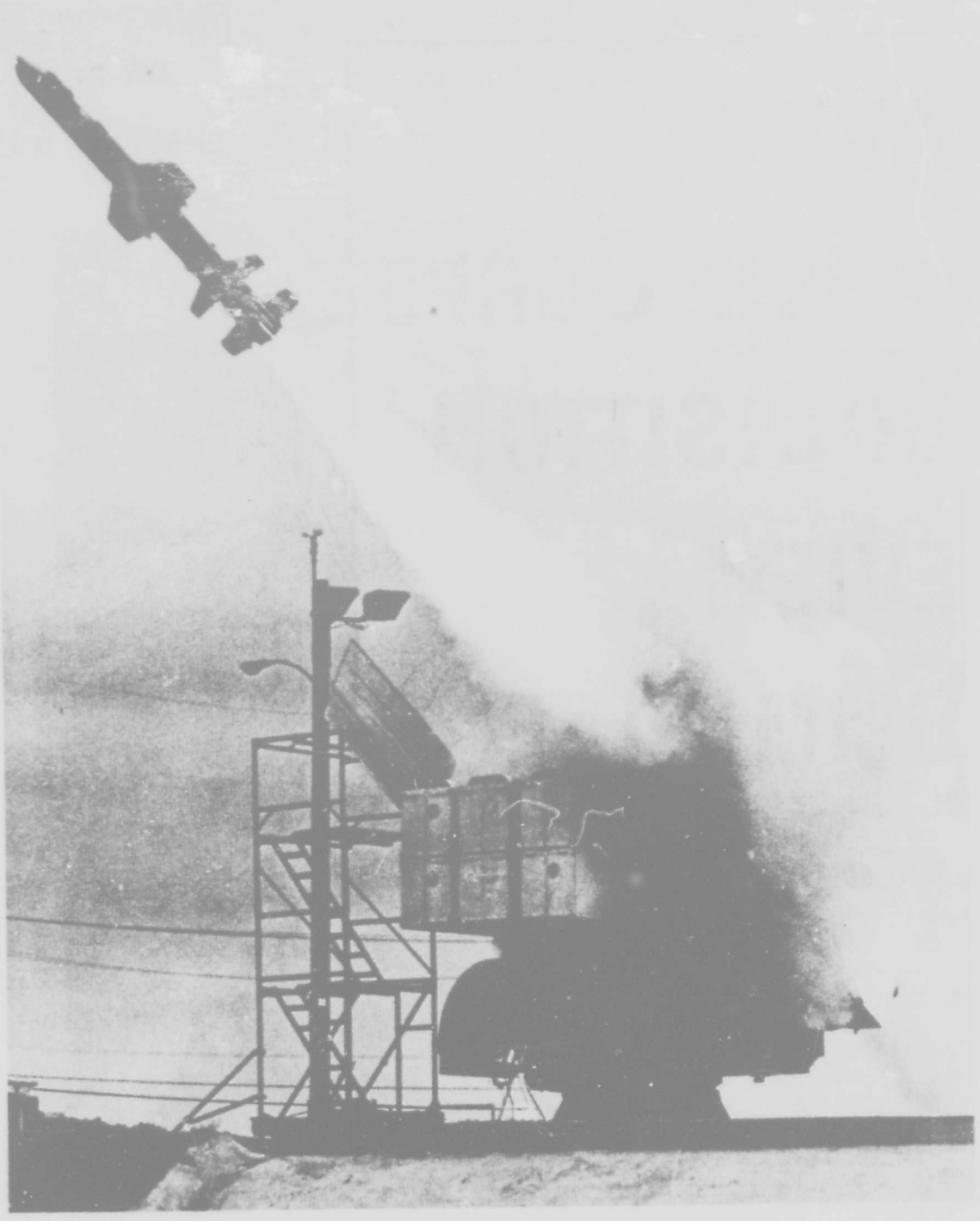
NAVY MARINE CORPS ACQUISITION REVIEW COMMITTEE



VOLUME I

OFFICE OF THE SECRETARY OF THE NAVY

January 1975



Harpoon Missile

DEPARTMENT OF THE NAVY
HEADQUARTERS NAVAL MATERIAL COMMAND
WASHINGTON, D C 20360

IN REPLY REFER TO

31 January 1975

Honorable J. Wm. Middendorf
Secretary of the Navy
Washington, D C. 20350

Dear Mr. Secretary:

I am pleased to forward the final report of the Navy and Marine Corps Acquisition Review Committee (NMARC).

In approaching the study, the NMARC was impressed by the broad scope of the Navy mission. The weapon system acquisition process is extremely complex in terms of organization, policy and procedure, and the NMARC became increasingly aware of the wide spectrum of factors, many of which cannot be controlled by the Navy, that influence the process. Many of these factors, such as inflation, material shortages, and declining budgets, impact on the entire Department of Defense. In order to investigate the Navy's problems, it was also necessary to examine the role of the Office of the Secretary of Defense in the acquisition process. Because of the magnitude of the problems facing the Navy, and the relatively short duration of the study, the NMARC made a conscious decision to concentrate on issues that would result in potentially high payoff recommendations. Further, the NMARC set the objective of developing practical recommendations that could be implemented by the Navy with existing personnel and financial resources, and that would achieve measurable results. I believe the NMARC has accomplished that objective, and that the suggestions are worthy of the Navy's consideration.

As you know, the NMARC panelists and integrating group were selected principally among corporate executives and other senior industry personnel. I believe the NMARC Report is a tribute to the fact that these gentlemen, who of necessity were preoccupied with their business operations, devoted substantial time to both committee work and travel in examining the acquisition policies and procedures used by the Navy. Their performance was most gratifying to me as Study Director and they are wholly responsible for what I believe is a worthy product. Also, I would be remiss if I failed to mention the complete cooperation of the Navy, Marine Corps, and Office of the Secretary of Defense. Without their cooperation, a meaningful study would have been impossible. Finally, I want to compliment you on the selection of the NMARC Staff support personnel. The staff devoted many hours for each hour of committee deliberation, and provided us with pertinent information that permitted us to confine our discussions to matters of substance.

Although we have concluded the study phase of the NMARC effort, the entire committee or individuals will be glad to meet with you to discuss and clarify any part of the report. Further, several of the NMARC members have suggested that the committee meet with you during the next year to review the progress on implementing the NMARC recommendations. I concur in that suggestion.

In concluding, Mr. Secretary, I want to say that it has been an honor and distinct pleasure serving as Study Director, and I look forward to meeting with you in the not too distant future.

Sincerely yours,

JAMES M. ROCHE

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I. INTRODUCTION

The Navy and Marine Corps Acquisition Review Committee (NMARC) was established by the Secretary of the Navy in August 1974 to assess the organization, management, staffing, and procedures used by the Department of the Navy in developing and producing major weapon systems. It was created in response to the need to find ways of reducing acquisition costs while maintaining the quality of weapon systems and ensuring the national defense.

This chapter discusses the current nature of the weapon systems acquisition environment, especially as it affects the Navy's capabilities to meet its own and the Marine Corps' requirements. It is organized in the following sections:

- The acquisition environment
- Other acquisition studies
- Acquisition in the Navy.

Appendix I-A describes the purpose, scope, organization, and chronology of the NMARC study effort.

1. THE WEAPON SYSTEM ACQUISITION ENVIRONMENT

Today's weapon systems acquisition environment, which strongly influences the outcome of individual acquisition programs, results from the interaction of several major elements, including:

- The Navy mission
- Technology
- National priorities
- The industrial base
- Inflation
- DOD/industry relationships.

These elements are discussed in the subsection that follow.

(1) The Navy Mission

The principal mission of the Navy is to assure free use of the seas, in support of national policy and in accordance with the national strategy. Control of the seas is a prerequisite to projection of naval power, the conduct of sustained operations, and the flow of vital raw materials.

While the basic mission of the Navy has not changed since the early part of this century, the nature of its execution has been and will continue to be a function of the international political situation. Today that situation is influenced primarily by several developments including the following:

- Soviet military capability continues to enlarge.
- The Soviet Unit has taken its place as a major maritime nation.
- The Peoples' Republic of China is expanding its naval forces and is developing a long-range nuclear delivery capability.
- Hostilities continue in Southeast Asia, despite the 1973 Paris agreements.
- Resumption of war in the Middle East is an ever-present threat.
- The southern flank of NATO has been weakened as a result of the conflict between Turkey and Greece over the status of Cyprus.

Each of these conditions poses a potential threat to the interests of the United States that can best be countered through the existence of U. S. naval power. Nevertheless, the U. S. Navy today possesses the lowest force level it has known since before 1950—about 500 ships. Although the Chief of Naval Operations has set a goal of restoring force levels to at least 600 ships, the ability of the Navy to meet its commitments with such a force level will depend in large measure upon the effectiveness of the weapon systems installed in and supported by those snips.

The challenge then, is to rebuild the fleet and deploy ships, aircraft, and weapon systems abreast of the best naval technology and geared to the threat, in an adverse acquisition environment.

(2) Technology

The pace of technological advancement, competition for scarce resources, and the general drive for economy and efficiency combine to produce strong pressures from both within the Navy and external to it to avoid duplication or overlap of research and development effort. On the other hand, a certain amount of duplication and parallel effort are frequently the price of the innovation necessary to counter the threat. The success of major system acquisition depends heavily on the availability of a variety of emerging technologies from which new system solutions can be drawn. Lacking a broad technology base, the Navy is faced at the outset with a narrower range of technological choices and reduced competition in system development and acquisition. Thus, it has become necessary to support and develop the technology base continuously while at the same time ensuring efficient application of the resulting technology. In sum, the Navy's success will depend upon the degree to which these influences can be balanced and the available resources applied in order to provide a wider range of alternatives from which the most suitable can be selected to meet the operational needs.

(3) National Priorities

Proper technology advancement and application must be achieved in the face of fluctuating priorities and competing demands upon available resources. Changing national priorities have reduced the percentage of the Federal budget now devoted to defense to the lowest point since 1946. Within that reduced percentage, resources available for actual system hardware development and acquisition are further constrained by the increased costs of personnel associated with establishing pay comparability and an all-volunteer force. These conditions, aggravated by a degree of public apathy about defense, impede the Navy's ability to replace aging obsolescent weapon systems and to maintain a ready and effective naval capability.

(4) The Industrial Base

Changing world economic and political conditions have similarly adversely affected the industrial base. For instance, in light of considerably increased commercial shipbuilding activity, shipbuilders are less anxious to construct naval ships than was the case in the past. In addition, several large commercial shipyards are experiencing extremely high personnel turnover rates. These factors are causing a decline in expertise and experience in our nation's shipyards with a resultant degradation in ability to perform complex types of work associated with naval ship construction.

The aerospace industrial base is also being adversely affected but as a result of different influences. The prevailing low level of military and commercial aircraft production has created certain excess capacity, has resulted in heightened competition for military business, and has created a potential for unrealistically low initial contract awards.

Both undercapacity and overcapacity extremes are damaging to the overall defense industrial base. These extremes in industrial capacity also contribute to strained Government/industry relationships, increased costs, and reduced levels of defense capability available to the nation.

(5) Inflation

The current inflationary economy is seriously disrupting Defense acquisition programs, as it is all major public and private programs. The inflationary impact on Defense programs is especially severe because the programs are examined in great detail in connection with the annual authorization and appropriation hearings, and because the rate of inflation is especially high in high-technology programs. Congressional scrutiny can be expected to be even more intense as the new Congressional Budget Office and the new committees created by the Congressional Budget and Impoundment Act of 1974 become fully operable. As costs escalate, practical limits are reached that operate either to reduce the scope of given programs or to cancel them entirely in order to maintain a total defense budget of acceptable proportions. As programs

are reduced in scope through Navy, DOD, or congressional action, either the unit cost of remaining units is increased and fewer units are bought, or the capability of the weapon system must be reduced. Increased unit costs often result in charges of mismanagement, while decreased weapon capabilities may detract from the ability of the Navy to meet its security commitments in a dynamic threat environment.

(6) DOD/Industry Relationships

The problems discussed above, combined with other economic considerations, such as tight money, high interest rates, and material shortages, contribute further to the adversary relationship between the Navy and industry. The results are seen in the lengthy discussions on progress payments, escalation provisions, allowability of interest and profitability of Navy business, and recently increased reluctance to do business with the Government. The economic health of the nation depends upon a business environment in which industry can operate profitably to create needed employment, goods, and services. Much evidence indicates, however, that the environment is growing increasingly hostile as each party seeks to protect more closely his own interests. Progress must stem from a reversal of this trend and increased efforts on the part of both the Government and industry to improve their business relationships.

It is generally acknowledged that to maintain desired industrial capacity and to carry out needed acquisition programs, industry should, for example, be provided with reliable, long-range planning data. The inability of the Navy to carry out such plans due to constrained budgets, the deteriorating world situation, changing national priorities, and resulting budget actions by the Office of the Secretary of Defense and the Congress has eroded industry confidence in its earlier long-range planning efforts.

There is hope that the newly created Congressional Budget Committees will assist in obtaining improved stability and commitment to the long-range planning efforts conducted by the Executive Branch. Only if this hope is fulfilled can the initiatives available to the OSD and the Navy be fully effective in recreating an environment in which the DOD and industry will deal with each other on a sound, businesslike basis.

2. OTHER ACQUISITION STUDIES

The acquisition environment described in the previous section has given rise to numerous studies into the practices and policies for effecting major weapon system procurements. Among the most notable of these studies are the following:

- The Report of the Commission on Government Procurement, December 1972, which addresses procurement by all Government agencies, including the Department of Defense

- Cost Growth in Major Weapon Systems, March 1973, which was sponsored by the Comptroller General of the United States

- Report of the Army Material Acquisition Review Committee (AMARC), April 1974, which addresses material procurement problems in the Army

- Project Ace Findings and Progress Report, June 1974, which is a continuing effort by the U. S. Air Force to identify and resolve key problems in the acquisition and ownership of Air Force weapon systems.

The most comprehensive and far-reaching recent study was that of the Commission on Government Procurement. Two years of intensive study resulted in a number of specific recommendations for improving the acquisition of major Defense systems, some of the more significant of which are summarized as follows.

- Program needs and goals should be established independently of any system product. They should be based on long-term projections of missions, capabilities, and deficiencies.

- Alternative means for fulfilling operational needs should be explored thoroughly prior to selection of a preferred system.

- Competition should be maintained whenever possible through initial development stages.

- Full production of a preferred system should be delayed until the need has been reaffirmed and system performance has been thoroughly tested and evaluated in an environment approximating expected operating conditions.

- The effectiveness of acquisition managers should be increased by providing policy guidelines within which experienced managers may apply simplified contractual arrangements and priced production options when technical risks have been largely eliminated.

- Experienced program managers should be developed and assigned at the initiation of an acquisition program. These managers should receive full delegated authority for technical and program decisions except those that relate to establishment of mission needs, approval among alternative systems for demonstrations and limited production, and release for full production.

The Commission's report and the other precedent studies provided an extremely useful basis for defining the areas upon which the NMARC focused its efforts. In addition to these studies, recommendations for NMARC investigations were solicited and received from the National Security Industrial Association and from the commanders of major acquisition commands within the Navy itself. These recommendations were deeply appreciated and contributed materially to helping the NMARC shape its course.

3. ACQUISITION IN THE DEPARTMENT OF THE NAVY

Although precedent studies identified opportunities for improving the weapon system acquisition process, the need remained to focus on the identification and resolution of those major problem areas peculiar to Navy and Marine Corps weapon procurements. The purpose of this section is to identify related aspects of Navy and Marine Corps acquisitions, particularly the following:

- The organization for acquisition
- The nature and diversity of Navy weapon systems
- Project management in the Navy
- Program performance.

Although these points are discussed in detail in Chapter II, "Overview of the NMARC Studies," and the reports of the various functional panels (Chapters III through VII), they are included here to provide a general orientation in the subject matter of this report.

(1) The Organization for Acquisition

The organization of the Department of Navy for weapon acquisition is depicted in Figure I-1. In contrast to the bilinear organization in force prior to 1966 in which the acquisition arm of the Navy reported directly to the Secretary of the Navy through his Assistant Secretaries, the Chief of Naval Operations (CNO) and the Commandant of the Marine Corps (CMC) are now directly in the acquisition chain. The CNO and the CMC are responsible for the following:

- Determining the requirements for weapon systems to meet specified threats within their mission areas as defined by the Joint Chiefs of Staff
- Making resource allocation decisions among:
  - Alternative weapons to meet a particular threat
  - Operating, logistic support, and acquisition requirements.

Most major weapons used by the Marine Corps, such as the LVTP-7 (see Figure I-2) are actually acquired for them by either the Navy or the Army. Consequently, the NMARC study has not treated Marine Corps procurement in great depth, except as it is involved as part of a larger Navy procurement.

The Chief of Naval Material (CNM), a four-star admiral, is responsible for all aspects of the weapon system acquisition process involved in meeting the requirements defined by the CNO. Execution of this mission is accomplished through the following organizations:

FIGURE I-1
Organization for Navy Acquisition

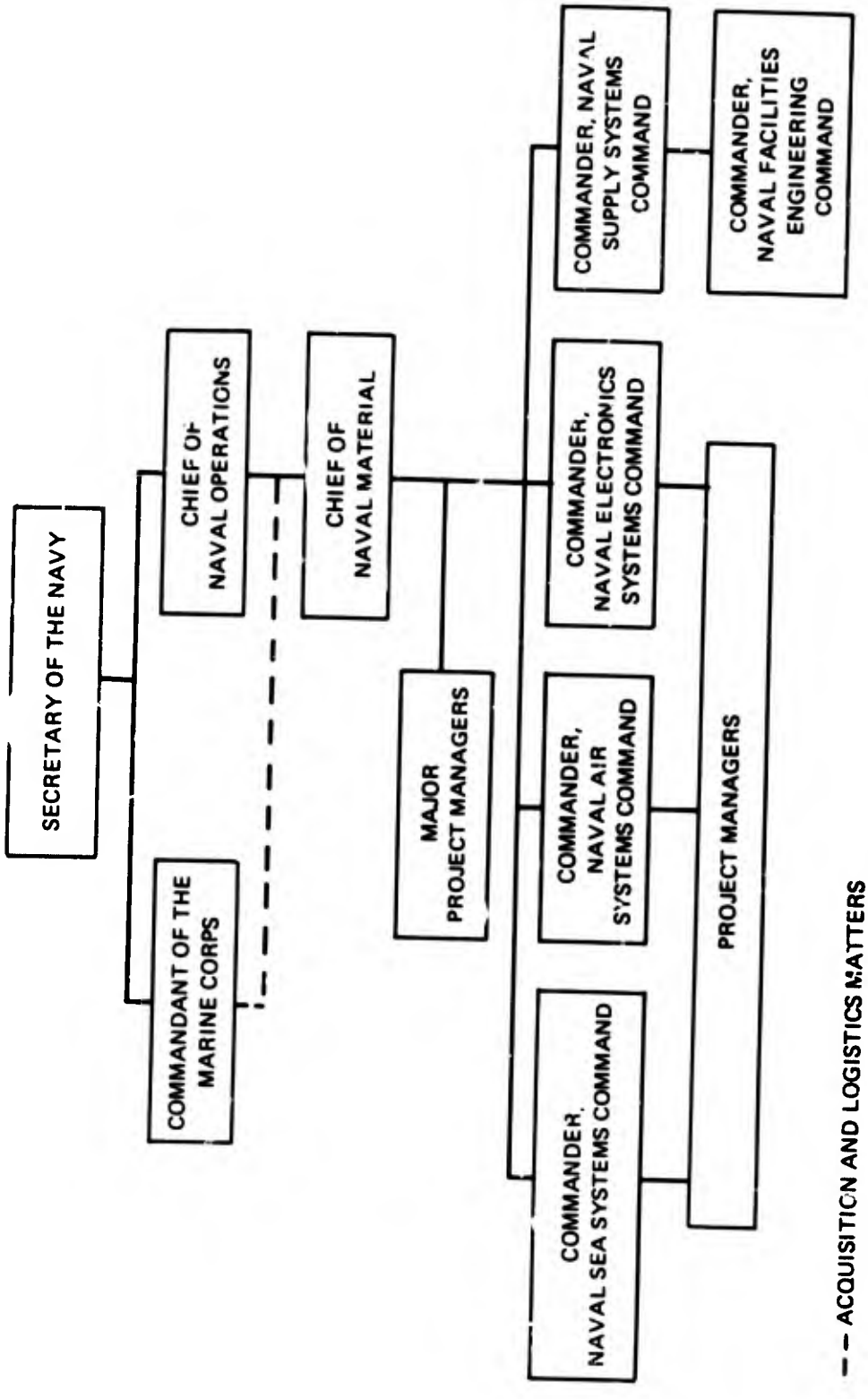
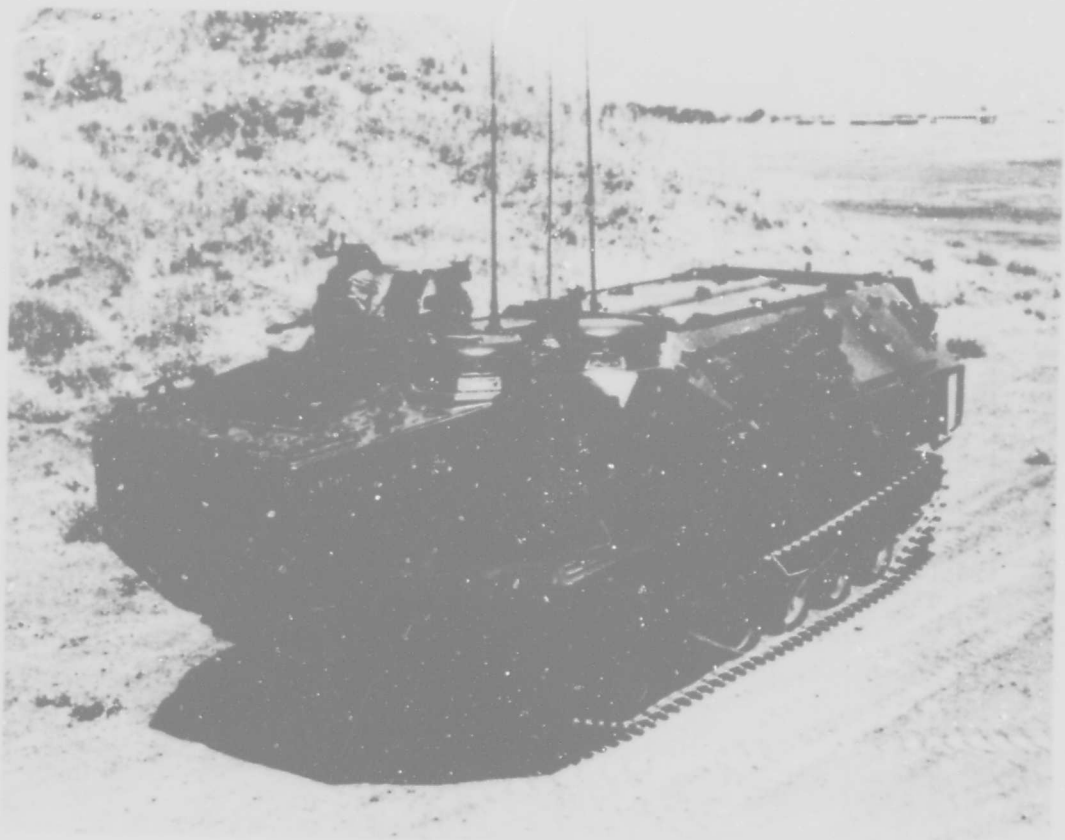


FIGURE I-2
Assault Amphibian Personnel
and Cargo Carrier (LVTP-7)



- A major project management office, e.g., the Strategic Systems Project Office, responsible for the Polaris/Poseidon weapon systems

- Three "hardware" Systems Commands (SYSCOMs) and the designated project managers reporting to the SYSCOM Commanders, including the following:

  - The Naval Air Systems Command

  - The Naval Sea Systems Command (recently formed through the merger of the Naval Ship Systems Command and the Naval Ordnance Systems Command)

  - The Naval Electronic Systems Command.

The SYSCOMs are responsible for both the management of major systems acquisitions and the support of those systems currently operational in the Fleet.

Two additional systems commands report to the Chief of Naval Material:

- The Naval Supply Systems Command
- The Naval Facilities Engineering Command.

The Naval Supply Systems Command is charged with developing and maintaining systems for assuring the availability of weapons-related repair parts and general and consumable supplies where and when required. The Naval Facilities Engineering Command may be considered as the counterpart to the Naval Sea Systems Command for shore-based facilities. This command is charged with managing the construction and maintenance of naval shore facilities in both CONUS and overseas locations.

Since these two organizations are not usually directly involved in the acquisition of major weapon systems, their roles have not been highlighted in this report.

(2) Diversity of New Weapon Systems

One of the most striking features of the Navy's acquisition environment is the diversity of weapons to be procured and the widely varying and demanding operating regimes for which they must be suited. Included among the major hardware systems procured by the Navy are:

- Surface ships, including aircraft carriers, destroyers, amphibious warfare ships, mobile logistic support ships, and other auxiliaries
- All types of aircraft, such as fighters, bombers, antisubmarine warfare aircraft, helicopters, and other special-purpose aircraft; these include both land- and sea-based aircraft types
- Submarines both for tactical employment and for launching long-range ballistic missiles
- Nuclear propulsion plants for submarines and surface ships*
- Weapons, ordnance, communications, and sensor systems for air, sea, land, and subsurface platforms
- Amphibious craft and aviation and electronic systems for the Marine Corps.

Some examples of major Navy systems currently under acquisiton are:

- Spruance class (DD-963) destroyer (see Figure I-3)
- CVAN-68 (see Figure I-4)

* Nuclear propulsion will be extended to all future acquisitions of major combatant strike force ships as a result of congressional determination contained in Title VIII of Public Law 93-365 (the 1975 Defense Appropriations Authorization Act).

FIGURE I-3
Spruance-Class Destroyer
(DD-963)

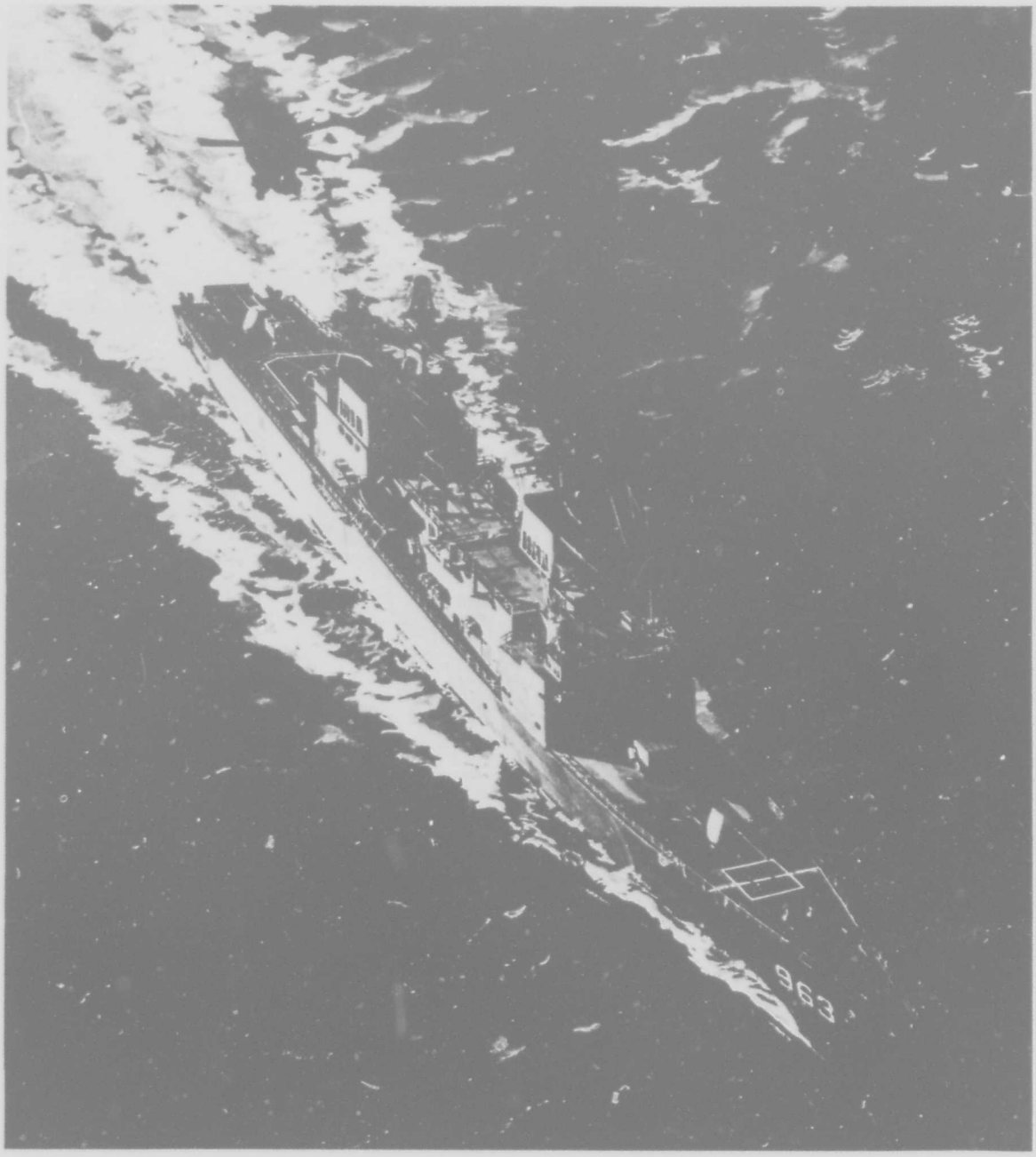


FIGURE I-4
Nuclear-Powered
Attack Aircraft Carrier (CVAN-68)

- F-14 fighter aircraft (see Figure I-5) and associated Phoenix missile system
- F-4 Phantom aircraft (see Figure I-6)
- S-3 antisubmarine aircraft (see Figure I-7)
- Trident nuclear powered missile submarine (see Figure I-8)
- Patrol Frigates (PF) (Figure I-9)
- Amphibious assault ship (LHA)
- Mark 48 torpedo
- The Harpoon missile system (Frontispiece and Figure I-10)
- SSN-688 class attack submarine
- Nuclear powered guided missile frigate (DLGN)
- Fleet satellite communications system spacecraft (Figure I-11).

This broad diversity significantly complicates the problem of managing weapon system acquisition in the Navy and sets it apart from other DOD components.

(3) Project Management in the Navy

There are currently 56 project management organizations in the Navy. Seven of these organizations report directly to the Chief of Naval Material either in recognition of the size and importance of the programs involved, e.g., Polaris/Poseidon and Trident weapon systems, or because the hardware is associated with multiple programs. The remaining 49 project management offices report organizationally to the commanders of the three hardware-oriented Systems Commands. While most project management offices have been formed for the purpose of managing the acquisition of a specific weapon system, such as

FIGURE I-5
Fighter Aircraft (F-14)

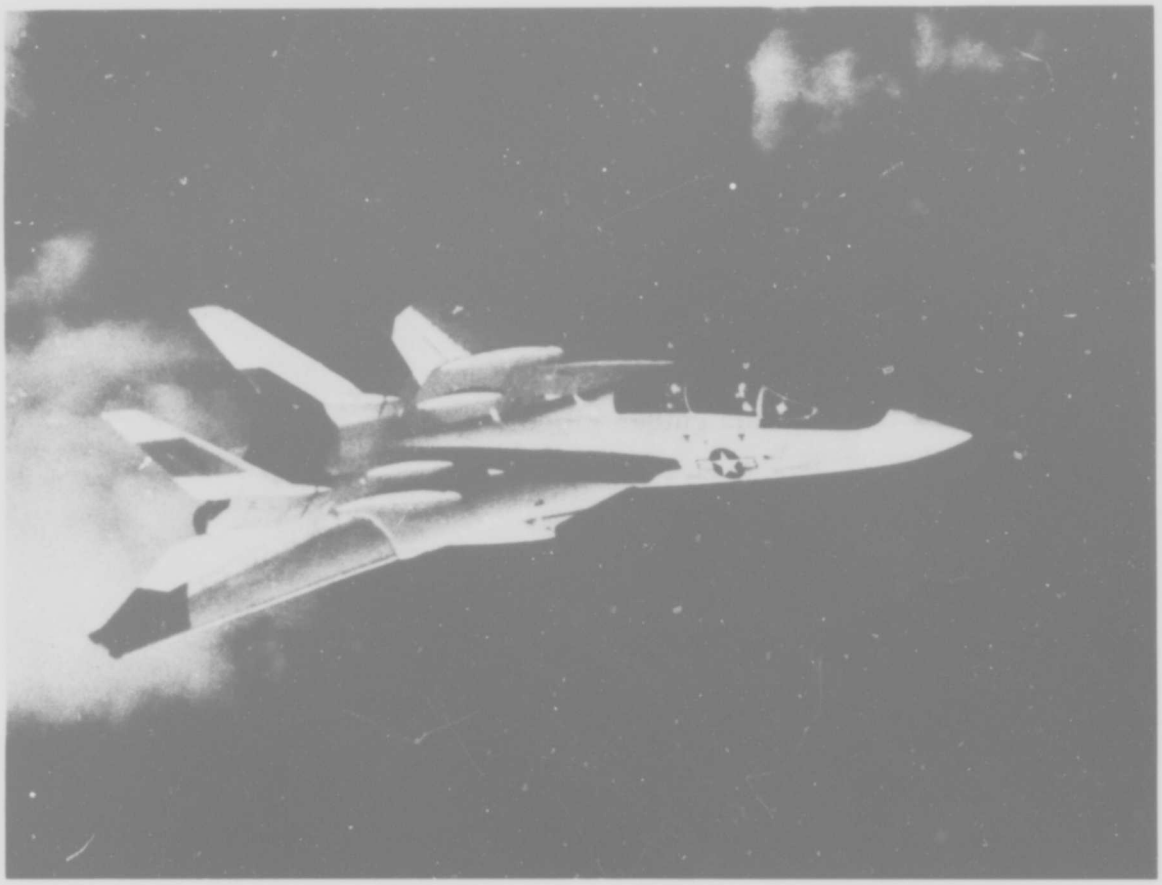


FIGURE I-6
Phantom Aircraft (F-4)

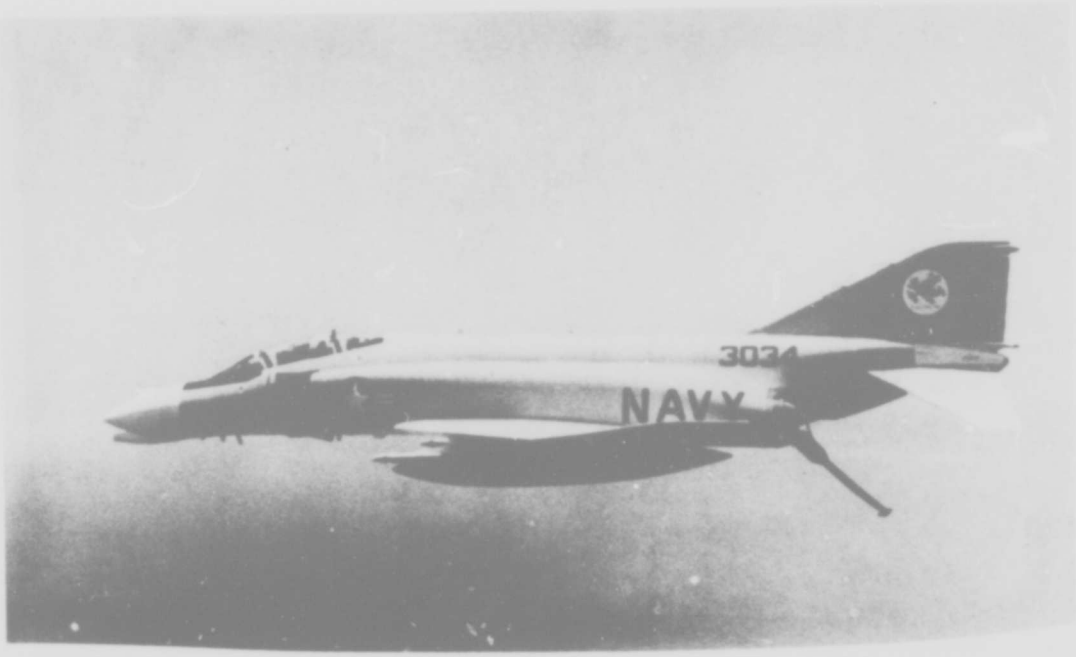
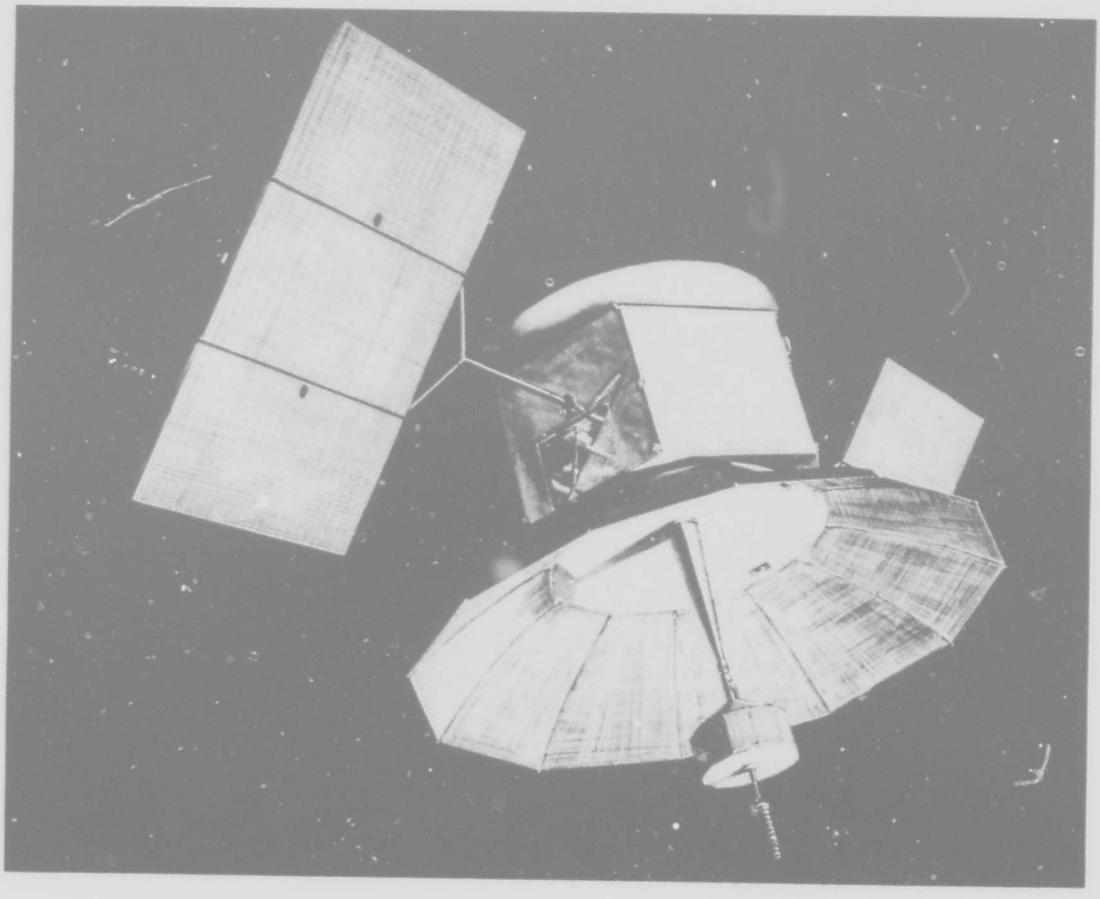


FIGURE I-7
Antisubmarine Aircraft
(S-3)

FIGURE I-8
Trident Nuclear Powered
Missile Submarine

FIGURE I-9
Patrol Frigate (PF)



the F-14 aircraft, the responsibilities of several project managers are oriented to a special subject area, e.g., the Spanish Ship Support Project Office. The NMARC study has tended to concern itself principally with hardware acquisition managers, although many of its findings and recommendations will apply equally to some of the smaller, special-purpose project offices as well.

The Navy employs the project management concept in both of its common forms:

- The vertical project organization, which is virtually self-contained in terms of functional capabilities
- The matrix organization, which receives specific functional support on an as-required basis from shared resource pools.

The matrix form is by far the more common in the Navy, principally because of its lower total resource requirement, although there may be some loss of responsiveness and effectiveness. This reduction in effectiveness has been aggravated in the past two to three years by economy-driven reductions in the size of the functional organizations available to support the project managers.

The vertical project organization is used by two major program managers in the Navy:

- The Strategic Systems Project Office, which manages the navigational, fire control, and missile subsystems used in the fleet ballistic missile system
- The Naval Reactors Office, responsible for the acquisition and operation of nuclear propulsion plants used in Navy ships.

Both of these program offices possess extensive in-house technical resources, although the systems managed by these organizations must be integrated with ship subsystems acquired by the Naval Sea Systems Command.

(4) Program Performance

The criteria for successful management of a weapon system acquisition are generally considered to consist of the following:

- Adherence to budgeted acquisition cost
- Meeting planned delivery schedules
- Meeting technical performance requirements.

In terms of those criteria, the Navy has experienced both notable success and some noteworthy problems. Among the more significant successful programs are the following:

- The Polaris/Poseidon programs, which are among the highest in national defense priorities
- The nuclear propulsion program, under the direction of Admiral Hyman G. Rickover
- The F-4 fighter aircraft, employed successfully under combat conditions by the Navy, the U.S. Air Force, and the Israeli Air Force, and an important asset to a score of other allied countries.

The Navy has also had its share of programs that have experienced difficulties with respect to some of the conventional criteria for success, including the following programs:

- The LHA (helicopter assault ship) and the Spruance class destroyer (DD-963) (see Figure I-3) programs, which are both behind schedule and, in the case of the LHA, far above budgeted cost
- The F-14 fighter aircraft program, which has experienced major cost growth and serious financial difficulties for its prime contractor, Grumman Aircraft (see Figure I-5).

Some of the underlying causes of such difficulties in major programs are discussed in the body of this report.

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The next chapter presents an overview of the NMARC studies and is followed by five chapters dealing with the work of the five functional panels comprising the NMARC.

II. OVERVIEW OF THE NMARC STUDIES

This chapter offers an integrated overview of the major issues and conclusions from the studies carried out by the Navy and Marine Corps Acquisition Review Committee (NMARC) and its five component panels, Research and Development, Test and Evaluation, Procurement, Production, and Cost. While the NMARC finds potential for significant improvement in a number of aspects of Navy systems acquisition practices, it concludes that, for the most part, the Navy and Marine Corps do a good job of acquiring weapons systems, despite an environment of complexity and turbulence. Most Marine Corps systems are developed by the Navy and the Army; hence, overall acquisition process improvements within the Navy will accrue to the Marine Corps as well.

It is the opinion of the NMARC that the acquisition process for surface ships offers the most significant potential for improvement. On the other hand, the strategic missile system and the Navy's nuclear power programs have consistently been regarded as highly successful programs, and, through those combined efforts, this country remains preeminent in these fields among the world powers. Similarly, most Navy aircraft and missile systems are highly regarded, and several are in use by the Air Force and numerous foreign countries.

The Navy currently manages 53 programs that fall under the major system criteria established in DOD Directive 5000.1, with a total value of $91 billion. Such systems require formal processing through the Defense System Acquisition Review Council (DSARC) process, and to a lesser extent are also subject to formal quarterly status reporting to Congress via the Selected Acquisition Report (SAR) system. The magnitude of Navy major system acquisition effort roughly equals the combined level of Army and Air Force efforts.

The Navy is well aware of the problems inherent in managing weapons acquisition programs of such magnitude in the current climate of economic uncertainty, severe inflation, Defense budgetary constraints, staff layering, and personnel turbulence. Significantly increased naval capability of potential world adversaries induces

further stresses to the acquisition process. Shipbuilding claims, program cost growth, shortcomings in project management, deficiencies in contract administration, and deteriorating relations with industry are indicative of more fundamental problems that stem from an inability on the part of Government in general and DOD and the Navy in particular to balance needs with current projected available resources. The NMARC concludes that many Navy acquisition difficulties stem from this general inability.

The policy set forth in the Secretary of the Navy's (SECNAV) basic acquisition instruction, SECNAV Instruction 5000.1, is basically sound; however, the NMARC does see numerous areas where significant improvement, in both policy and practice, is not only possible but absolutely necessary if the Navy is to improve its ability to live within its means and yet carry out its assigned mission in a creditable manner. Of particular concern is the extensive and often detailed involvement of the Office of the Secretary of Defense (OSD) in the execution of weapon system acquisition programs.

The findings and recommendations of the five panels that conducted the bulk of the NMARC study strongly indicate that several major factors or problem areas underlie many of the individual problems being encountered in Navy material acquisition. These major factors include the following:

- Program and funding turbulence
- Difficulties of contracting in an inflationary environment
- Inadequate definition and interpretation of the acquisition management roles of OSD, the Office of the Chief of Naval Operations (OPNAV), and the Naval Material Command resulting in excessive and counterproductive involvement of higher staff levels in the direct management of weapon systems acquisition programs
- The proliferation and expansion of organizations having review and approval authority but contributing little to work performance.
- The erosion of the credibility of Navy program cost estimates and budgets with both OSD and the Congress

- A need to strengthen both the authority and the staffing of Navy project management organizations
- The need for increased cost consciousness and cost management
- The need for improved capability to integrate surface-ship combat systems successfully and efficiently
- Failure to test the performance of new weapons in a combat-type environment.

In defining and examining acquisition issues, the NMARC made extensive use, particularly in areas related to requirements and the identification of acquisition strategies and alternatives, of the work completed by the Commission on Government Procurement, the Blue Ribbon report, several industry advisory group studies, and other similar studies.

The thrust of the major findings and recommendations developed viewed against the factors cited above and with special emphasis on ship acquisition, are further summarized in the following sections of this chapter.

1. Preprogram Management Activities—including program identification based on mission deficiencies and examination of alternatives, research and development activities, and acquisition and long-range planning
2. Program Management Phase Activities—addressing the role, authority, and staffing support of the project manager; the problem of layering, aspects of procurement; contract administration; cost and financial management; and test and evaluation
3. Shipbuilding—an overview of aspects of the study related to current Navy shipbuilding problems
4. Government-Industry Relations—a recap of what both parties can do to assure a constructive acquisition environment

This chapter thus draws from the work of the five NMARC panels.

Chapter VIII contains a consolidated listing of all of the recommendations of the NMARC.

1. PREPROGRAM MANAGEMENT ACTIVITIES

Since the principal tool of system acquisition in DOD is the project manager concept, the NMARC studied the Navy acquisition process recognizing the importance of the Navy project manager. This section, however, addresses three aspects of activity that influence the outcome of a program but occur partly or wholly before the assignment of a project manager.

(1) Program Initiation

Instability of requirements after commitment to a major program is a prime weakness in the acquisition process. Soft or changing requirements have led to prolonged development, cost growth, and criticism by the General Accounting Office (GAO) and the Congress. Such instability can be attributed largely to poor definition of roles within OSD and the Navy, funding inadequacies, layering and personnel turbulence in key positions, and failure to respect program decisions and commitments.

An acquisition program should not be formally undertaken until the major participants involved have an agreed understanding of what is achievable and usable. For systems that do not evolve from existing weapon systems, such agreement normally should follow completion of an advanced development program; thus, when the program is formally established, it can be well defined, costed, and supported. Formally establishing the program earlier is to invite disaster by denying freedom of investigation, the pursuit of alternatives, and necessary development iterations.

Effective pursuit of alternatives should normally involve an early industry/service dialogue, with emphasis on a set of mission objectives that establish the minimum capability being sought. The system acquisition recommendations advanced by the Commission on Government Procurement (COGP) were used by the NMARC for reference in reviewing the Navy process

for initiating and pursuing a system acquisition effort. Such recommendations essentially call for increased industry involvement and responsibility in developing a broader range of alternatives and early agreement among the military services, the Office of the Secretary of Defense (OSD), and the Congress concerning mission goals. The Navy is moving in this direction through the Chief of Naval Operations' Program Analysis Memorandum (CPAM) process (which translates DOD planning and programming guidance into Navy mission area summaries and forms the basis for annual Navy posture statements to the Congress) and subsequent formal budget submission. Discussion and timely agreement as to the purpose for new programs, as opposed to prematurely debated and defined specific system choices, would permit much more rational funding of related effort and associated development and would also permit exploration by the Navy of a broader range of alternatives from which to select and pursue a preferred system solution.

Within the Navy, the Chief of Naval Operations (CNO) and his immediate staff are clearly responsible for planning future forces and, together with the Secretariat, for approving acquisition plans that are consistent with budget and other resource constraints both internal and external. A key role of the Chief of Naval Material (CNM) is to interact with the CNO during the generation of the plan and then be responsible for its execution. Unfortunately, however, the Naval Material Command is observed to defer frequently to strong OSD and OPNAV staff efforts to control the details of choice, substance, and schedule in connection with various acquisition efforts.

These staff actions are particularly disruptive during the research and development (R&D) phases of an acquisition. In response to budget pressure, decisions are frequently made based upon OPNAV staff recommendations without recourse to the Material Command. As programs get into further budgetary difficulty, even higher level staff reviews result. This leads to juggling of resources rather than informed planning and generates a climate of instability and a preoccupation with day-to-day survival on the part of R&D program managers. A more balanced effort is necessary to stimulate exploration and pursuit of a broader range of alternatives within an improved "mission area" context. Recent

action has been initiated to achieve such balance;* however, the procedures have not been in use long enough to permit observation of results.

Restitution of the proper balance between user (OPNAV) and supplier (NAVMAT) will require the cessation or diminution of many OSD and OPNAV functions in the acquisition process and the assumption of a more responsible role by the Material Command. The NMARC believes that an enhanced partnership role for the Material Command should produce improved management of acquisition. To this end, the NMARC recommends that the Navy take the following actions:

- Strengthen Material Command technical and cost planning capability. (Parallel and complementary groups in OPNAV and NAVMAT should work in close collaboration, the OPNAV group concentrating on mission goals and deficiencies, setting relative mission area priorities, and the examination of the allocation of resources to those deficiencies, and the NAVMAT group concentrating on the optimal set of technological methods for satisfying the requirements within expected resources.)

- Redefine a proper balance of authority and responsibility for the acquisition process between OPNAV and NAVMAT.

- Establish as fundamental Navy policy that commitments to concepts and decisions in the acquisition process by the Navy Secretariat, OPNAV, and NAVMAT will be binding for extended periods, thus restoring some measure of program stability.

- Design and implement a method for continuing self-evaluation of the acquisition process, as differentiated from systems acquisition programs per se.

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* OPNAV Instruction 5000.42, 1 June 1974.

(2) Management of Research and Development

The quality of management and direction of the R&D process determines (1) the degree to which technical alternatives and cost tradeoffs will be available for final system definition and (2) the adequacy of the technology base upon which new programs will draw.

Effective R&D requires a combination of control to preclude redundancies and relative freedom (within reasonable bounds) to explore varied alternatives. Some amount of funding flexibility, including use of appropriate management reserves, is a necessary ingredient in such a process. The R&D process is one of management of change and requires that risk must be taken to produce a useful product.

Currently deficiencies exist in the Navy R&D process with respect to these attributes. These deficiencies cannot be corrected entirely within the Navy itself. Before real improvement can result, certain changes must occur at higher levels. The present system within the DOD places a premium on adhering to a plan generated some years earlier and justified as being accurate in detail. In addition, Congress restricts reprogramming authority to under $2 million without prior approval of the committees concerned. These constraints require management to fine-tune multi-million-dollar plans, often starting 3 years in advance of funding authorization.

An improved process should be established that would provide for a graduated hierarchy of reprogramming authority for RDT&E funds. It is apparent that the present economic environment alone dictates significantly raising the congressionally imposed limit, and it should be raised to a level that would permit the successive establishment of graduated reprogramming thresholds at OSD and military service levels.

As a corollary to an improved system of reprogramming authorities, the NMARC also believes that fund administration for the Navy RDT&E appropriation requires more coherent management. The appropriation, which consists of several parts, is substantially managed by the Material Command and/or the Office of Naval Research (ONR) with the notable exception of the advanced development portion of the appropriation, which

is managed by OPNAV. OPNAV direction and control of advanced development effort is appropriate to the extent that the R&D community requires coherent direction regarding the relative priorities of effort that should be undertaken within each of the several broad mission areas.

It is generally observed that OPNAV involvement surpasses that required to establish relative mission area priorities properly. The overly detailed OPNAV involvement is partially attributable to the similarly detailed overinvolvement of the OSD staff. Nevertheless, OPNAV involvement in detailed administration of the advanced development account should be reduced and a more balanced partnership relationship established between OPNAV and the Material Command relative to R&D fund administration. Such balance should provide for strong setting of mission area priorities by OPNAV, coupled with strong Material Command efforts to explore broad ranges of options within available funds to permit improved tradeoff decisions between such options.

To improve funding flexibility and to promote more coherent control of R&D effort, the NMARC recommends that the Navy take the following actions:

- The classical user-supplier roles of OPNAV and the Naval Material Command should be reaffirmed, and appropriate balance between the two entities should be established.

- The Chief of Naval Material (CNM) should be charged with full responsibility and authority for management of development funding under the supervision of the Assistant Secretary of the Navy (Research and Development) (ASN(R&D)) and within overall priorities established by the CNO.

Opportunities were identified by NMARC for more effective use of the Navy's in-house laboratory complex. Several measures were recommended, including the following:

- Reaffirm and strengthen CNM authority and control of development funding and retain management of the eight NAVMAT laboratories under the Deputy

Chief of Naval Material (Development). If such strengthening is not achieved, reassign management of the eight NAVMAT laboratories to their primary client Systems Commanders. The Naval Research Laboratory should remain under the command and management of the Chief of Naval Research.

- Review laboratory missions and functions to eliminate unnecessary redundancies. Consideration should be given to further consolidation of the laboratory base.

- Develop a capability for management of systems integration of ship combat system/command and control interfaces using expertise available in the laboratories, Navy programming centers, and certain test and evaluation (T&E) facilities. This capability should provide for adequate feedback from test and evaluation and fleet operational experience to design and development activities. This capability should be located and managed so that it can be applied both to the conceptual phase of appropriate Navy programs and to the later development and update phases.

(3) Acquisition Strategy and Long-Range Planning

Preprogram management and R&D management deficiencies discussed in the preceding sections are compounded by the fact that systems acquisition planning is not effectively integrated with the planning, programming, and budgeting system (PPBS). High-level commitment, funding support, and assistance in program execution are often lacking. As opposed to such commitment, support, and assistance, an inordinate amount of effort is directed toward review and readjustment of programs by staff elements not in a position to make positive contributions.

An improved forum is needed to provide balanced, timely, and positive high-level involvement in the integration of the many individual requirements decisions and accomplishments within the budget constraints of the total annual Navy development and

acquisition program. The CNO's Program Analysis Memorandum process and associated CNO Executive Board (CEB) deliberations constitute a positive effort in this direction.

The CNO Executive Board provides top OPNAV-level involvement and review, but it does not include the Secretariat or assure the necessary continuity of review and commitment. There is a tendency for personnel at the highest level to limit specific program reviews to pre-Defense-Systems-Acquisition-Review-Council (DSARC) actions or for various members of the Secretariat or CNO organizations to review the programs individually on certain occasions, such as budget formulation. This situation could be improved if the presently constituted Navy Systems Acquisition Review Council (NSARC) were to meet at least quarterly, to provide advice collectively to the Secretary of the Navy concurrently with the recommendations advanced by the CNO relative to any given issue.

The NSARC should focus on reviewing and developing a top-level commitment to an overall acquisition strategy or "blueprint" applicable to each major system acquisition undertaking. The blueprint for action should comprise a series of interrelated, mutually supporting plans or actions upon which the acquisition and logistical support of that system can be accomplished.

Overall goals must be well defined in relation to OSD guidance and projected resources in order that OSD top-level commitment can be secured similarly through DSARC and PPBS processes.

Wherever possible, early and continuing agreement between the Navy and OSD relative to broad mission goals should be secured in advance of pursuing specific programs in support of those goals. The NSARC should comprise the sole top-level forum within the Navy to approve initiation and to review progress of major acquisition efforts. It should meet as necessary to approve program initiation plans and actions.

Such action should engender a more coherent total Navy acquisition program in relation to available projected resources and permit the Navy to demonstrate improved acquisition management and program success to higher authority. A heightened

confidence in Navy management should permit a relaxation of involvement by higher authority, including the Congress, in program details. Evidence suggests that many decisions reflect undue influence of OSD staff personnel who have individually tended to assume the role of final authority. Paradoxically, detailed OSD staff review of Navy conceptual efforts is likely to suppress rather than stimulate the exploration of alternatives due to the tendency of the military services to push for OSD concurrence with what may appear to be the best choice at a given juncture with given individuals.

To explore alternatives adequately, service authority is required to pursue diverse efforts in an unconstrained fashion until sufficient information is generated upon which to base intelligent decisions as to which efforts to continue, shelve, or abandon. OSD review should not occur until the data that the effort in question is designed to produce become available. The more practical means of achieving this operation is for the Navy to evaluate choices, not undigested information, with the choices having been developed in a relatively unconstrained fashion, and a specific recommendation made to OSD as to the desirable alternatives to be pursued further.

Similarly strong service action should be taken to better identify the relative priorities of various elements of the total annual acquisition program. The Navy should identify certain core programs, lay out long-term funding requirements, and give sufficient support planning to enable the authorization of multiyear programs.

Such action may result in identifying other areas that are susceptible to budget adjustment; thus overall improvement must stem from sincere collateral efforts on the part of all concerned to structure a long-term total Navy acquisition program, including commitment of the necessary resources in an orderly manner. Improved accommodation must be reached between OSD and Navy views as to the appropriate balance to be struck between OSD/Navy responsibilities, interests, and prerogatives.

The relative responsibilities of OSD and the Navy are appropriately established in a policy sense by DOD Directive 5000.1. Unfortunately, contrary to such stated policy, the NMARC

perceives a tendency of the OSD staff to become more deeply involved in what should be armed service responsibilities in the acquisition process.

It is the clear conviction of the NMARC that sound management would call for a substantial withdrawal of OSD from specific participation in individual weapons system acquisition programs and a dedication instead to policy formulation and monitoring in matters of total DOD objectives, force levels, budget, and overall management philosophy. It will be necessary for the Navy, by emphasis on NSARC-type reviews, to demonstrate a degree of excellence in system acquisition management sufficient to justify the confidence the Secretary of Defense (SECDEF) will need to change OSD's management philosophy and practices and reverse the trend toward increasingly heavy OSD involvement in military service acquisition program detail.

The NMARC recommends that the Navy take the following actions:

- A comprehensive acquisition strategy or blueprint should be developed for each major acquisition program. The plan should be developed in the context of current and projected resources, should be prioritized within the total annual Navy program, and should bear the approval of all concerned including the Secretary of the Navy, the CNO, the CNM, and the Commandant of the Marine Corps (CMC), where appropriate.

- The project manager, when designated, should be charged with responsibility for carrying out the plan, and should be provided with sufficient continuing resources and support, including essential technical and management full-time staff, to maximize the potential for program success. He should have the authority to request a meeting of the NSARC and should be the prime point of contact between OPNAV, the Secretariat, and the Naval Material Command regarding his project.

- The key participants in the early development of a program should continue in positions of responsibility as the program is carried out.

- Major deviations from the plan should require approval by the NSARC.

- The NSARC should be more fully utilized to provide formal advice to the Secretary of the Navy. Where possible, a single briefing by the project manager concerned should be made to a joint gathering of NSARC and CEB members, following which, separate NSARC and CEB deliberations could be held as desired. Each NSARC should address timely questions for which it is covened and should not unnecessarily reopen issues upon which decisions have previously been made.

- The Navy should identify certain "core" programs that should not be altered short of major changes in the world situation. The Navy should present a long-range plan for these programs to the Congress and should justify the need for long-term funding.

The NMARC recommends that the SECDEF reinforce the principles established by DOD Directive 5000.1 as follows:

- OSD staff review of service study of alternatives prior to a service's requesting a program initiation DSARC should be substantially reduced.

- DSARC recommendations and SECDEF decisions should be altered only if absolutely necessary and then only as the result of a further DSARC meeting and subsequent SECDEF decision.

- Relative to shipbuilding programs, the thresholds established in the original Development Concept Paper (DCP) should operate to control the construction program (reverse the current trend toward requiring upwards of ten separate DSARCs, with all the attendant prebriefings, etc., in connection with a new ship class development and construction program).

- The frequent use of the DSARC process to approve annual procurements of hardware for programs previously approved for production should be eliminated.

In connection with the question involving the trend toward increased OSD staff involvement in all aspects of the acquisition process, the NMARC considers, for example, that the proposed revision of the charter of the Assistant Secretary of Defense (Installations and Logistics) and his apparently intended increased involvement in system acquisition activities contradicts previous SECDEF policy intentions.

The NMARC is confident that the Navy will demonstrate its capability to manage acquisitions with less OSD participation and suggests that this proposed charter revision and implied increased OSD staff involvement and other similar incursions on military service responsibility be seriously questioned.

2. PROGRAM MANAGEMENT PHASE ACTIVITIES

The success of an acquisition program is heavily dependent upon the effectiveness of the project manager (PM) and his staff, the management systems and techniques employed to acquire the product, and the extent to which the project manager is able to exercise authority over and focus his attention upon his program and resource deployment.

(1) The Project Manager and His Staff

Planning support and top-level involvement in major system acquisition efforts discussed in the preceding sections converge upon the project manager and his staff in their task of accomplishing program objectives. With certain notable exceptions, the Navy project manager's assigned responsibility has not been matched with the freedom to exercise his authority without intensive participation and review from a proliferating number of higher review authorities. Project managers' decisions once made have not always received adequate backing from OSD and higher Navy authorities.

Proper policy currently exists relative to the project manager's role, i.e.:

> "Successful development, production and deployment of major weapon systems require competent people, rational priorities, and clearly defined responsibilities. The program manager should be the single individual who is given requisite authority, resources and responsibility to totally manage a major program."*

In practice, this sound policy is often diluted by the well intentioned efforts of individuals in the Defense and naval hierarchies and staffs, each driven by his own perception of the task at hand.

The NMARC is convinced that the Navy principles of project management organization are sound but that the usable authority of the individual project managers must be strengthened. In the face of continuing personnel reductions and budget restraints, such strengthening probably cannot be accomplished by adding people in total; rather, it must occur through reallocation and consolidation of existing assets, improved training, reassignment of existing personnel, and possibly consolidation in the number of projects that are presently separately identified and managed. Change must come from a well coordinated, understood, and supported total Navy effort to improve the many functions of project management. The project management task is of such importance, and bears the focus of so many recommended actions in this entire report, that the NMARC believes a major implementation effort must be undertaken and centered around the recommendations contained in this section on program management activities.

The Navy and Marine Corps have the largest number and greatest diversity of major program efforts of any of the armed services. In view of this management workload and the limited number of personnel, the NMARC supports the Navy's matrix approach to project management. The fully integrated and staffed project organization is, however, supported for high-value, top-priority acquisitions, such as the fleet ballistic missile program.

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* DOD Directive 5000.1.

Although the matrix approach is working well in most areas of acquisition, one of the key elements susceptible to improvement is that of functional staff support. NMARC observed that, while numerous functional support personnel devote full or nearly full time effort to certain projects, their responsibility to the project manager is tenuous and they often are physically collocated. In particular, on major programs the location of the procuring contracting officer (PCO) and his supporting staff is of principal importance. Accordingly, the NMARC recommends that, for major projects, the PCO or his representative be located on the staff of the project manager.

Supporting technical management personnel are, of course, vital to the project manager and should be collocated with him. Since technical assistance is often obtained from naval activities remote from the project manager, functions and relationships must be clearly defined. Major contractual, financial, and legal problems are being experienced by some project managers. There is a definite need to strengthen the business management capability within each major project office. Where feasible, project managers should have some business management training or experience in addition to the technical qualifications.

In any event, a suitably qualified business/financial manager should be assigned to assist the project manager. Action should be taken to reassign billets to project management organizations from OPNAV, the Naval Material Command (NAVMAT), and Systems Command (SYSCOM) staffs where such reassigned personnel could make a positive contribution to the acquisition process. This action would thus reduce current organizational layering and operational impediments imposed upon the project offices and would at the same time place the business/financial management expertise in the individual project offices where it is now lacking. It is considered that such action would facilitate reduction in the administrative lead times involved in many actions and would improve management of program resources and relations with both industry and higher authority.

Other key areas needing attention include the following:

2. Career Development, Training, and Assignment

The NMARC observes the need for a strong, centrally managed career development, training, and assignment program to support the project management objectives of the Navy. The recently established weapons system acquisition manager (WSAM) program is a commendable step. It needs strong, continued application and support. The WSAM program should be expanded to include and address strongly the business/financial management aspects of systems acquisition as well as the technical aspects.

2. Foreign Military Sales

Increased government-to-government programs to sell military equipment to foreign countries have severely impacted several project offices. Foreign military sales (FMS) workload has increased significantly with little or no accompanying increase in staff.

Although most FMS agreements provide a surcharge to cover estimated administrative costs, various policies preclude using these funds for direct reimbursement of the appropriation used to pay the administrative costs attributable to the foreign sale. Further, DOD personnel ceilings have severely limited the number of positions available for assignment to project offices. These constraints should be examined by both OSD and Navy with the objective of providing adequate numbers of project office personnel in order to avoid further impact on U.S. Navy programs.

The NMARC recommends that the Navy take the following actions:

- Implement the intent of DOD Directive 5000.1. Project managers should have requisite responsibility and authority to direct their projects except for specifically named items that are outside their purview.

- Retain project/functional matrix organization staffing of most project management offices.

- Grant the project manager authority and control over all project funds to the maximum extent practicable.

- Require the project manager to report excessive staff reviews and other hindrances caused by staff layering to higher authority during his quarterly program review.

- For major projects, locate the PCO or a designated contracting officer on the staff of the project manager.

- Collocate project managers and key technical support personnel with their principal functional support organizations. As an example, move the Navy Ship Engineering Center (NAVSEC) into close proximity with the Naval Sea Systems Command (NAVSEA) project offices.

- Establish project manager selection procedures similar to those set forth in OPNAV Instruction 1211.8 for less than major programs. Ensure project managers have an adequate combination of formal education, training, and experience prior to assignment as a project manager.

- Assign a strong business and financial management assistant reporting directly to the project manager to all major project management offices.

- Intensify management attention and support to the WSAM program to provide for the development and training of business/financial managers to be assigned to project managers.

- Augment project staffing to support major government-to-government foreign military sales programs; manpower ceiling supplements or use of support contractors are among the ways this could be accomplished.

(2) Layering

Layering and short tenure at Navy and OSD headquarters staff levels places a heavy nonproductive burden on project managers in achieving program objectives and substantially increases the total time and effort needed to carry out an acquisition program.

The prevalence of layering observed by the NMARC offers one of the most significant opportunities for simplifying the acquisition problem. The phenomenon is both a matter of organizational structure and a matter of procedures and systems that invite multiple reviews, redirections, inquiries, and serial approvals. Thus, it can be ameliorated through procedural changes, establishment of concurrent reviews, decentralization, and revisions in management philosophy.

While discussed in this subsection for emphasis, layering is not a separable subject but permeates nearly all aspects of acquisition and was a concern of each NMARC panel. The discussion of the proposed use of the NSARC in Section 1, Subsection (3) of this chapter, "Acquisition Strategy and Long-Range Planning," addressed the need to reduce OSD activity in program details. The previous subsection on strengthening the project manager's ability to use his authority also addresses layering. In short, a need exists for critically reviewing functions performed and for rebalancing authority at many interfaces, among which are the following:

- OSD/Navy
- Navy secretariat/OPNAV
- OPNAV/NAVMAT
- SYSCOM/project managers
- Within the R&D community.

Increasing interest in details of specific acquisitions at the congressional level constitutes yet another interface layer.

The NMARC ascribes the problem to the following two principal causes:

- Duplicative OSD-level staff functions relative to systems acquisition, which are mirrored in the Navy (and other services as well)

- The short average tenure of senior civilians and military personnel (approximately 2 years) at the staff review level, which creates an extensive need for learning and information presentation.

The NMARC believes that positive action to bring about a major reduction in the layering situation at all levels is essential. As noted in an earlier section, the current trend observed in OSD toward even greater centralization will cause continued duplication of functional staff involvement in system acquisition program detail. Some unilateral actions the Navy can take to reduce layering include the following:

1. Clarify roles and responsibilities of OPNAV and NAVMAT and eliminate staff duplications

2. Give greater responsibility to SYSCOMs for establishing product acquisition policies and monitoring performance

3. Utilize a strong, active NSARC to preclude the need for requests for information from OSD.

Further, in order to reduce layering and procurement lead time, the CNM should restrict review emphasis to presolicitation reviews (i.e., Advanced Procurement Plans, Source Selection Plans, Requests for Proposals, etc.) by both the SYSCOMs and NAVMAT. These reviews should include an examination of both business strategy and technical aspects.

The NMARC recommends that the Navy take the following additional actions:

- Continue joint NAVMAT and ASN(I&L) review of Advanced Procurement Plans (APP) with the objective of upgrading APPs to a master acquisition strategy plan thereby permitting expeditious Secretarial approval of Requests for Authority to Negotiate (RAN) and Determinations and Findings (D&F).

- CNM increase emphasis on presolicitation reviews by both NAVMAT and the SYSCOMs. These reviews should include an examination of both business strategy and technical aspects.

- Consider eliminating duplicate review and approval chains and procedures between the Assistant Secretary of the Navy (Installations and Logistics) and the Assistant Secretary of the Navy (Research and Development) (ASN(I&L)/ASN(R&D)) and the Deputy Chief of Naval Material (Development) and the Deputy Chief of Naval Material (Plans and Programs) (DCNM(D)/DCNM(P&P)).

- Ensure that all acquisition review level billets have at least a planned 4-year tenure.

(3) Aspects of Cost and Financial Management

Extensive program cost growth has caused significant loss of credibility relative to the Navy's ability to manage its major acquisition programs. The loss of cost credibility is a significant part of the Navy's total credibility problem. This overall credibility problem has led to overmanagement by higher authority and restriction on the use of funds to the point that effective management and execution of programs is further adversely affected.

The NMARC concludes that the cost growth that has been one of the contributing causes of the loss of credibility has resulted from unrealistically low levels of initial funding of major programs. Limited defense budgets, inflation, and mounting weapon systems costs in the face of growing requirements cause tremendous pressure at all levels to reduce cost estimates and budgets to the minimum for which the program can possibly be accomplished. Understandably, this leads to the structuring of success-oriented programs in which risks are depressed, plans are overly optimistic, and the schedule, official cost estimate, and resulting budgets are the absolute minimum for which it may be possible to accomplish the program if every step is fully successful.

Existing Navy cost estimating staffs are professionally competent and produce better estimates than they are generally given credit for. However, they are understaffed in relation to their workload and are frequently required to develop estimates to a very tight schedule on the basis of very limited data. To

ensure the integrity, completeness, and currency of cost estimates, it is necessary that the cost estimating groups in the naval Systems Commands be given adequate manpower and improved information, and that the cost data be provided to the NSARC.

Due to prematurity and the short time available, the Navy's analysis of technical, schedule, and economic risks is frequently inadequate. As a result, cost estimates, budgets, and schedules fail to include provisions for risks. The emphasis on minimizing cost estimates and budgets prevents the inclusion of management reserves in budgets as a prudent provision for unanticipated problems and risks and a basis for management flexibility in solving difficulties. The result is a high potential for cost growth aggravated by delays and the lack of resources to deal with problems as they arise.

The pressures that lead to understatement of official program cost estimates and initial budgets also create an atmosphere conducive to contractor buy-ins and inevitability lead to contract cost growth. The avoidance of this condition and the restoration of Navy cost credibility requires vigorous action to eliminate the practices that facilitate buy-ins.

Design to (unit production/flyaway) Cost and Life-Cycle Cost management are being implemented by DOD as techniques to control and reduce costs. While the NMARC was impressed with some Navy implementations of the former, it is concerned by what appears to be a DOD-wide emphasis on formal Design-to-Cost procedures and detailed reports. This could reduce the laudatory aspects of Design to Cost to an essentially ineffective ritual. Design to Cost must be implemented with judgment and flexibility if it is to be effective.

Current efforts to implement Life-Cycle Cost management place excessive emphasis on the development of total Life-Cycle Cost models and estimates based on the largely inaccurate and incomplete data on current operating and support costs. There is a failure to recognize that only a portion of these costs, as they relate to weapon systems, are sensitive. A more productive approach is to emphasize the selection of design alternatives that make the greatest contribution to reducing ownership costs (e.g., increase reliability, provide ease of maintenance, etc.)

There is a need for the Navy to achieve the same consciousness of weapon systems costs that it has traditionally shown regarding weapon system performance. The Navy's record in the achievement of weapon system performance objectives has been generally good, but its record of achievement of cost objectives is less laudable. Properly used, Design to Cost and Life-Cycle Cost management can promote both cost consciousness and cost goal achievement. However, other measures are required. Design and other requirements included in Requests for Proposals should be rigorously evaluated in terms of cost-effectiveness.

There is a need to upgrade the monitoring, tracking, and anticipation of contractor costs. This can be done through improvements in reporting of contractor costs, better use of contractor reports, improved on-site review and analysis of project status, and increased direct dialogue between the Navy project office and the contractor.

The recommendation for improvement in cost reporting should not be interpreted as urging an increase in the scope or detail of reports. In fact, the reverse can be achieved in many cases by better planned and more sophisticated definition of Navy needs for cost data. The NMARC perceived a general need for the simplification, consolidation, and introduction of flexibility into DOD cost reporting systems. Accordingly, the NMARC recommended the development of a single cost reporting system primarily geared to serve the needs of program management and extended as necessary to obtain data for cost estimating, but at all times subject to the Navy's continuing realistic surveillance of contractor cost and performance status.

Cost credibility and management problems at the acquisition program level are aggravated by the lack of integration of the major internal DOD and Navy planning, decision-formulation, and reporting systems, i.e., PPBS, DCP, DSARC, and SAR. These systems are sound in concept; however, the coordination and operation of these systems are often poor and lead to weapon system program instability. These systems were conceived at different times to serve the needs of different Assistant Secretaries of Defense, and program plans developed in one system may not be accepted in another. This contributes to the counterproductive overinvolvement in program management by the

higher echelons responsible for the systems as decisions are reopened and previously approved plans are questioned. It also causes instability in program plans and resultant inefficiencies in program execution. There is a need for a study of these systems to develop an integrated approach to DOD and Navy program planning and decision formulation.

The Selected Acquisition Report (SAR), the DOD means of reporting quarterly the status of major programs to the Congress, is a special situation. It has been revised so frequently that both traceability from one report to the next and comparability with program plans have been lost. Because of this, the SAR itself has become a contributor to the cost credibility problem. The NMARC has identified some problems with the current SAR. Congress has identified others. These defects should be corrected and then the SAR content and format stabilized so that it can serve the functions of an accurate report of program status and projections and a traceable record of these matters.

The NMARC found that in some instances program cost risks have been exacerbated by the use of acquisition strategies and contracting methods that were ill-suited to the conditions of the program and/or the current inflationary and unstable economic conditions. Of particular concern are the treatment of escalation (in program cost estimates, budgets, and SARs, as well as contracts) and the policies and provisions affecting contract financing requirements and finance costs.

The major need in the area of escalation is to utilize the best and most realistic projections available of the effects of inflation on program costs and, for the longer performance period contracts, to provide contract provisions that give the contractor reasonable protection against cost growth due solely to inflation. Also it is necessary to eliminate the imposition of unrealistically low forecasts of inflation by fiat from the Office of Management and Budget (OMB) and OSD and artificial restrictions on providing for escalation in budgets. The use of contract provisions geared to the economic conditions of the 1950's and 1960's should be required to reflect current conditions.

There is a need to allow a flow of escalation forecasts upward from the Systems Command level constrained only by expert opinion of realistic expectations for each industry and the need for a visible and consistent treatment of inflation in budgets, contracts, and SARs.

The treatment of the time period of escalation coverage in shipbuilding contracts has been particularly deficient and is the subject of a CNM study to develop more suitable contract provisions. However, escalation provisions unsuited to the current economic environment are not unique to shipbuilding. It should be noted that inadequate escalation identification and unrealistic projections have contributed to an unwarranted appearance of cost overruns in some programs and have been a significant factor in the deterioration of DOD and Navy cost credibility.

The NMARC considers that current procurement policies regarding progress payments, allowability of the costs of contract financing, and profit levels result in the imposition of undue financing requirements and resulting unreimbursed financing costs on Defense contractors. These conditions risk making Defense business unattractive to current participants and potential investors. Again the situation is most serious in the shipbuilding industry, and a CNM study directly addressing progress payment inadequacies in that area is underway.

There also should be a DOD evaluation of the adequacy of current progress payment (contractor investment in work) guidelines for the current economic environment. Consideration should be given to the possible recognition and reimbursement of the cost of contractor financing of work, either through direct allowance of the costs of interest or imputed interest or through revision of profit guidelines to allow proportionally greater increases in profit when higher investment is required.

The NMARC considers that both Navy cost and financial management and contracting problems could be reduced by greater stability of program plans. Congressional multiyear authorizations for major programs would contribute significantly to this stability.

Key NMARC recommendations regarding the cost and financial management area include the following:

- Strengthen cost estimating capabilities of the naval Systems Commands by providing for adequate staffing, flow of estimating data, and command support.

- Take action to protect the integrity of cost estimates, including the use of a single Navy organization, insulated from program and budget pressures, to review SYSCOM cost estimates and prepare independent cost estimates.

- Ensure that changes to program scope and requirements are accompanied by corresponding adjustments to cost estimate baselines and budgets.

- Reinforce policies requiring quantitative risk assessment, including the most probable cost and schedule effects.

- Provide for more judicious implementation of Design to (production) Cost and Life-Cycle Cost management. DOD and Navy guidance for both areas should be revised to emphasize the basic principles, management flexibility, and practicability. To maximize its effectiveness, Design to Cost should be applied in the early development phases.

- Emphasize Navy project management responsibility to track and project the costs of contractors and to take appropriate action to control them.

- Integrate and simplify contractor cost reporting requirements and allow flexibility to fit management needs.

- Revise OSD and Navy internal planning and reporting systems (PPBS, DCP, DSARC, and SAR) as necessary to provide for integrated program plans, decisions, and status reports.

- Obtain agreement with OMB and OSD to utilize only the most realistic projections of economic escalation. Escalation should be clearly identified in cost estimates, budgets, and reports.

- Complete CNM studies of shipbuilding contract escalation and progress payment provisions and use their findings and recommendations to formulate revised policies and guidance.

- Request OSD to consider remedial action concerning the excessive contract financing requirements and costs imposed by current progress payment, cost allowability, and profit policies.

- Undertake studies to devise and obtain OSD and congressional agreement to practical means of including prudent management reserves in acquisition budgets.

- Navy and OSD urge that Congress approve multiyear program authorizations.

(4) Procurement and Contract Administration

Request for Proposal (RFP) preparation and proposal evaluation, source selection, business clearance processing, negotiation techniques, selection of contract type, increasing attractiveness of DOD business, and field contract administration were examined extensively by the Procurement and Production Panels. Because of the vast amount of material to be examined in a short time, only limited attention was directed to logistics support and maintenance considerations. The NMARC did not go beyond examining basic policies and forming the perception that, although such policies appear to be sound, the Navy lacks the internal logistics discipline to integrate the logistics support of new weapon systems into the Navy's existing logistics systems.

The NMARC recommends that the Navy take the following actions:

- NAVMAT and the Systems Commands should give increased attention to presolicitation review of RFPs with special attention to technical specifications.

- Navy procurement policy and procedures should be reexamined with a view toward increasing the attractiveness of doing business with DOD. In addition to equitable provisions for escalation and progress payments previously mentioned, the review should include factors bearing on profitability.

- To improve communications with the contract administration office (CAO), the project manager of every major project should be represented by a dedicated project officer on the staff of each CAO administering significant portions of the project's efforts.

- The Navy's capability to analyze and verify contractor cost projections should be strengthened.

- The concept of "a single Government face to the contractor" should be reemphasized.

- CAOs should participate in contract negotiations and, to the extent practicable, in evaluation of proposals, in order to enhance the CAO's knowledge of contractual intent.

- The CAO should be free of responsibility for settlement of claims, to minimize deterioration of the working environment.

- Navy industrially funded activities' manpower levels should be determined by their financial controls; separately imposed personnel ceilings, which are almost never in phase with the requirements of the customer-funded workload, should be eliminated.

- A decision to undertake formally a major system acquisition effort should include an explicit decision as to the level of logistic support upon which design and development of the intended system is to be predicated and how it fits into the existing Navy family of weapon systems.

- The Navy requires a project manager, during the conceptual phase of the weapons acquisition process, to develop an integrated logistic support plan that contains a detailed resource analysis. Once this plan is completed, an explicit decision should be made by the users and producers to determine and fund the appropriate level of support for the weapon system.

- Integrated logistic support plans are typically not subjected to a Navy internal quality assessment and are commonly examined critically only at DSARC. A Navy internal quality control over integrated logistic support plans should be established.

- The Navy should develop more effective means to motivate contractors to give appropriate consideration to supportability in the design of weapons systems.

Additional and more specific observations and recommendations regarding major system procurement actions are addressed in Section 3, "Shipbuilding."

(5) Test and Evaluation

Test and evaluation (T&E) is the necessary continuum of actions to insure quality, reliability, and good performance in material acquired. Testing is an integral part of the engineering process and is essential to proper design. It begins in the earliest conceptual stage of material development and lasts throughout the service life of a system. It reaches a climax in operational testing, when the system's intended performance is demonstrated under as near combat conditions as can be devised. Operational testing is done in the Navy by the Operational Test and Evaluation Force (OPTEVFOR), which reports directly to the CNO.

The Marine Corps, which acquires its equipment largely from the Army and Navy, participates in testing through liaison with the other military services. The Marine Corps also conducts its own OT&E at the Marine Corps Development and Education Center at Quantico, Virginia.

The NMARC found that the Navy Department has an active program for T&E, not, however, without some generic problems, including the following:

- Organizations without resources to accomplish tasks

- Avoidance or circumvention of policies and procedures

- The pervasive problem that T&E is low man on the totem pole when schedule or funding is tight.

NMARC recommendations in the area of test and evaluation fall in four categories:

- Realistic operational evaluation
- Test and evaluation planning
- Test resources
- Combat systems integration.

1. Realistic Operational Evaluation

There is a correlation between Navy readiness and its recent combat experience. Thus evaluation of new weapon systems and the decision to proceed, redesign, or cancel should be based on tests conducted under the best possible simulation of combat conditions.

- The Navy should establish a strong, centralized office, at the OPNAV level, that is responsible to insure the "combat effectiveness" of new acquisitions. The following functions are needed:

  - An intelligence function to identify deficiencies in meeting existing and forecasted threats

  - An independent, in-house audit of requirements and a continuing overview of requirement modifications

  - A sponsor for the development of threat simulation capabilities and an operational coordinator for Navy forces engaged in opposition techniques

  - A home, divorced from the research and development process, for the operational

test force, to insure that COMOPTEVFOR is fully engaged in early systems planning.

- A coordinated approach to the development of tactics that are abreast the threat and new capabilities

- A fleet readiness function that can gauge current and projected effectiveness of the active fleet.

NMARC finds some of these functions being done in OPNAV but in various offices. Hence, the following actions are recommended:

. These existing personnel assets be regrouped or restructured to the single purpose of ensuring combat effectiveness

. The Navy take steps to establish a prioritized budget for implementation of overall threat simulation requirements.

2. Test and Evaluation Planning

Navy T&E directives correctly reflect OSD policy and the concerns of Congress, but procedures can be further refined and improved in the following manner:

. Levels of approval for test and evaluation should be established consistent with program classifications; i.e., Major and Less-Than-Major. The Navy lacks a well established process for approval of test planning in most cases. This is particularly relevant to Less-Than-Major programs where visibility is reduced, but the need is not lessened for coordination of test resources, reliability and maintainability goals, and integrated logistics support aspects.

- Further, it is recommended that an annual review be made of T&E planning for all programs not currently subjected to a DSARC, SAR, or similar process. This T&E review is necessary to ensure that:

  (1) The requirement remains valid

  (2) Program technical progress is consistent with the funding and schedule plan

  (3) Subsystems can meet the schedule for Approval for Service Use

  (4) The program plan allows sufficient time and funding for correction of discrepancies uncovered during test.

- The Navy needs to increase the timeliness of test reporting and to insure prompt distribution of evaluations to cognizant engineering communities within the military service.

- The Navy also needs to improve its awareness that overtesting is as great an ill as undertesting. A deliberate focus on this aspect of T&E—during the approval process—is necessary. In a similar vein, the Navy, when it decides to buy commercial, off-the-shelf equipment, must avoid superimposing unnecessary military directives and specifications on the procurement.

3. Test Resources

The Navy T&E facilities and ranges are varied in management cognizance, have a degree of overlapping capabilities, and lack a coordinated approach to budget and military construction (MILCON) planning and execution. Similarly, there is no focal point for the development and allocation of target resources or for threat simulation facilities. There is no strong "single voice" to interface with OSD on matters relative to the Test and Evaluation Facility Base. NMARC, therefore, recommends the following actions:

- A position should be established in the Naval Material Command for a test facilities manager of flag rank to manage and coordinate range, facility, and target matters. This manager, regardless of specific command alignment of facilities, could—if strongly staffed and chartered—serve two necessary functions.

  - First, to coordinate the capacity and workload of the various test activities, to coordinate the funding allocated to the activities, and to manage the development and utilization of target and threat simulation hardware. He should overview the planning of development programs for test resources.

  - Second, this test facilities manager should provide a coordinated view for test facility requirements, workload projection, and capability/capacity assessments in the Navy-OSD interface.

- NMARC also found that the Navy lacks a realistic environment to do ship-borne developmental testing. A test ship for realistic testing is recommended, and appropriate action to fund this requirement should be undertaken.

4. Combat Systems Integration

The technical complexity of the fully digitized combat system, whether aboard ship or in an aircraft, has brought a new dimension to system acquisition management. The proper interfaces between weapons subsystems and command and control subsystems and between subsystem hardware and software must be established early in a program. Problems have been most prevalent in shipboard systems. NMARC recommends the following:

That the Navy should develop improved internal techniques to assist in the ship conceptualization

and synthesis process by appropriate feedback of T&E results, and to upgrade system description and specification procedures to accomodate modern technology.

- That combat system integration test facilities be used for complex digital systems, and be placed at Government sites, where practical, and scheduled for life cycle use in configuration control and training.

- That the Navy, on major complex programs and especially those with lengthy acquisition phases, such as ships, should select and employ a skilled systems integrator.

3. SHIPBUILDING

The Navy's shipbuilding program has encountered serious difficulties in recent years. As naval ships have grown larger, more complex, and more expensive and their weapon systems increasingly sophisticated, problems have been experienced by the Navy in obtaining on-time ship deliveries from shipbuilders; in acquiring delivered ships on which all systems are integrated, combat-ready, and perform their designed functions; in keeping available an adequate number of shipbuilders and ship-repair contractors with the capability and drydock capacity to construct and maintain the Navy's large, complex combatant ships; in maintaining a stable, well trained workforce in naval and private shipyards; and in maintaining sound, businesslike working relationships with the nation's shipbuilders. The most critical impact of these influences is reflected in the substantial increase in the cost of individual ship acquisiton programs, and the corresponding loss of credibility with the Congress and the Defense Secretariat.

The increased size and complexity of naval ships have served to concentrate most Navy shipbuilding programs in only a few of the larger private shipyards in recent years. These yards, in addition to their heavy Navy shipbuilding workloads, have undertaken an increasing volume of commercial shipbuilding work since 1970, which has placed a strain on their present plant capacities to handle cur-

rent and projected Navy work. While the commercial shipyards have invested in major plant expansion, they are reluctant to expand these investments because of the uncertainty of the levels of future Navy workload.

The problem of the adequacy of plant capacity is compounded by the impact on shipbuilders' capability of the extremely high labor turnover rates they are experiencing. Ship-repair contractors have been similarly affected by high turnover and by the size of modern naval warships, which restrict their overhaul assignments to those shipyards with drydocks large enough to accommodate them.

The high turnover rates have necessitated massive investments, in both naval and private shipyards, in training programs to equip newly acquired personnel with basic shipbuilding and ship-repair craft skills. The heavy overhead burden of these training programs could be alleviated by Federal subsidization of shipyard workers' training from such sources as the Comprehensive Employment and Training Act of 1973.

Nuclear shipbuilding capacity is a special case, because of the exacting quality and safety standards that must be maintained and because of the considerable investment required in special tooling, facilities, and training. Only two private shipyards are currently actively engaged in nclear ship construction. The introduction of additional contractors into Navy nuclear shipbuilding programs would involve significant capital investment.

One means that has been proposed for partially alleviating some of these problems of shipyard capacity and capability has been the assignment of limited amounts of new-construction work to one or more naval shipyards. The eight naval shipyards have been dedicated, for the last several years, exclusively to ship repair and modernization work. The ability of naval shipyards to adhere to cost and schedule parameters in new construction projects would be jeopardized by the probable disruptive impact of conflicting ship-repair work unless priority is accorded over new construction work.

Shortcomings have been noted in the Navy's in-house engineering capability, particularly with respect to systems engineering required in support of preliminary design, contract design and specification, system integration, and test planning. Engineering resources in naval shipyards have decreased substantially with the termination of ship-

building in these yards, and these resources would require significant upgrading to support assignment of a lead-ship design. The NMARC recommends that systems engineering capabilities be reexamined and consolidated.

Systems engineering problems are particularly evident with respect to the integration of shipboard combat systems. The combat systems in some major combatant ships have not been adequately integrated for the achievement of satisfactory systems effectiveness. Steps taken by the Navy to attack this problem have included the designation of combat-systems integrators or integrating contractors for some ship acquisition projects, and the use of land-based test sites in system development, software validation, testing, checkout of hardware and software design changes, and training of fleet operating personnel.

Another approach taken by the Navy to improve ship-systems design has involved increasing the participation of potential builders of a ship in its design development. This approach, which was employed for the Patrol Frigate (PF) acquisition, shows promise of improving the overall accuracy of ship designs and specifications. In addition, this approach will serve to reduce the incidence of engineering change proposals during a ship's construction.

NMARC recommendations applicable to shipbuilding were developed during the deliberations of the five functional panels. NMARC recommends that the Navy take the following actions:

- Seek congressional authorization for a 5-year shipbuilding program.
- Disclose long-range shipbuilding and ship overhaul plans to interested and qualified contractors.
- Improve production performance and reduce the need for changes; improve product definition before award of shipbuilding contracts.
- Continue and expand the use of lead and follow shipyards in ship design procurements, such as in the PF and SCS ship acquisitions.

- Select the appropriate contractual form; e.g., lead ships should normally be procured under cost-reimbursable contracts and follow ships under fixed-price-incentive-fee contracts.

- Ensure that the Supervisor of Shipbuilding (SUPSHIP) is made fully knowledgeable, in advance, as to the terms, conditions, and intent of each ship acquisition contract through appropriate involvement in proposal evaluation and contract negotiation.

- Assign responsibility for settlement of major shipbuilding claims to higher authority. Assign a claims team reporting to higher authority to negotiate each major claim, thus freeing the SUPSHIP for focus on administering current programs.

- Because of the critical value of nuclear propulsion to the U.S. Defense posture, involve at least three shipbuilders in nuclear submarine construction and at least two shipbuilders in nuclear surface ship construction.

- The Navy retain title to portions of the recently closed Boston Naval Shipyard and explore leasing facilities at Boston and Hunters Point (San Francisco) to private contractors with options to assure access for naval ship repair and drydocking.

- New construction should not be assigned to naval shipyards except under certain narrowly defined conditions.

- Control manpower levels at Navy Industrial Fund (NIF) activities by workload and customer funding; personnel ceiling controls should be removed.

- Use ship overhaul advanced planning, as exemplified by the submarine Planning and Engineering for Repairs and Alterations (PERA) system, for all combatant ship types.

- Assign a dedicated project officer on the SUPSHIP staff to represent major ship acquisition project managers.

- Support public and private shipyard training programs with funds from such sources as the Comprehensive Employment and Training Act of 1973.

- Designate a combat-systems integrator or integrating contractor for every major combatant ship acquisition program. The combat-systems integrator should participate in contract design, development, software validation, construction, testing, and trials phases for the lead ship of a class.

- Establish land-based test sites for use in system development, software validation, and production assistance for every major combatant ship class. These sites should be located on Government property if practical and available during the life of the class for checkout of hardware and software design changes and for training of fleet personnel.

NMARC found that the Navy has made substantial progress in settling its major backlog of shipbuilding claims. Settlements for the year ending 31 December 1974 totaled $480 million, leaving a balance of $636 million. The $480 million claimed, which included $111 million appealed to the Armed Services Board of Contract Appeals (ASBCA) and was settled out of court, was settled for $207 million. The significance of this progress is apparent when compared to the previous 2 years during which the Navy settled only five claims totalling $53 million for a total of $23 million. The Navy reports it expects to settle a substantial number of the remaining claims during 1975. The NMARC noted that the Navy has taken a number of specific actions regarding claims prevention, including the retention of the claim team concept, in order to settle potential claim problems in the early stages.

The concerns that have been addressed regarding Navy shipbuilding should be viewed within the perspective of what Secretary of the Navy Middendorf has called "the clear and impressively positive record that has been compiled." In his testimony before the House Seapower Subcommittee in September 1974, he noted the size of the shipbuilding program ($3.4 billion in fiscal year 1974), the labor intensity of the industry, and the long time it takes to build a capital ship—7 years in the case of the nuclear-powered aircraft carrier Nimitz, for example.

4. GOVERNMENT/INDUSTRY RELATIONS

Recent years have witnessed some deterioration between the Navy (and, in fact, all DOD component services) and industry. The NMARC directed its attention to this situation, and finds that improvement in the interface environment, which would clearly benefit the objectives of system acquisition, can be brought about by both parties. NMARC believes this improvement will be found in the direction of the following:

- Better two-way communications between the Navy and industry
- Candor in dealings on the part of both parties
- Equity.

(1) Navy Actions

The directive governing Navy acquisition, SECNAV Instruction 5000.1, addresses relations with industry only to a limited extent. It provides for coordination of the Development Concept Paper (DCP), when appropriate, with personnel in industrial or scientific communities; iteration of acceptable initial technical or conceptual proposals to foster innovation and a more complete understanding of the Navy's desires; communication to promote industry understanding of the Navy's desires and true attitudes with respect to evaluation criteria prior to RFP issuance; and incentives to industry to promote economy.

The NMARC offers the following recommendations for further improvement on the Navy's part:

- More effective communications should be established with industry regarding the Navy's long-range acquisition and maintenance contracting plans.
- Attention should be paid to the completeness and clarity of RFPs, especially the technical areas.
- Technical leveling should be prohibited.

- Parallel negotiations should be used only to the point where a source selection decision can be made.

- The prohibition against using auction techniques should be reaffirmed.

- Current limitations on the use of the Contractor-Weighted Average Share (CWAS) concept should be relaxed, thereby allowing auditors more time for direct cost analysis and evaluation and imposing fewer requirements on those contractors involved.

- In light of current economic conditions, weighted guidelines should be reevaluated with a view toward permitting adequate profit and fee levels.

- The need for the CAO to be the single point of contact for a contractor on contractual matters should be reaffirmed.

- The CAO should participate in contract negotiations to the extent possible to make certain the CAO is aware of the intent of a contract as well as the terms and conditions.

- The responsibility for claim settlement should be removed from the CAO.

- Major efforts should be made to minimize causes for contract changes and to adjudicate valid changes promptly and equitably.

- Measures should be taken to install in all Government personnel engaged in acquisition activities an awareness of and sensitivity to opportunities for improving the acquisition environment at the interface where the Navy's interests are served.

- Effort to improve military specifications on a scheduled basis should be continued.

(2) Initiatives for Industry

NMARC is firmly convinced that the realization of improved Navy acquisition will depend in large part on the share of responsibility industry must bear for interface problems, and acceptance by industry of the need to improve its own practices and procedures in the following areas:

- Avoiding the "buy-in" or overoptimistic commitment to cost, schedule, and technical performance by resisting Government suggestions or encouragement to participate in such overoptimism, resisting the urge to initiate such positions, and communicating concerns regarding realism to the Navy.

- Instilling in key industry management the dedication to restore credibility to the basic principles of the acquisition process.

- Facilitating change adjudication by provision of full and factual relevant data and more vigorous, cooperative, and timely participation in the Navy's efforts to reach agreement on the cost, technical, and schedule impact of changes.

- Prosecuting measures to improve industry productivity and effectiveness in the development and production of systems to meet Navy needs.

- Improvement in industry cost schedule control systems as a means to overall cost consciousness and reliability in both development and production cost estimates.

- Continuing to seek ways and offer constructive suggestions to the Navy on improving the effectiveness of acquisition-related activities and the environment in which they are carried out.

Industry's excellent cooperation with the NMARC study effort appears to indicate a receptiveness to the intent of these suggestions.

Considering the complexity of modern warfare technology and the economic environment in which systems must be acquired,

it is more important than ever for industry and the Navy to work together to achieve a constructive, productive relationship.

5. SUMMARY

In summary, it can be said that the NMARC reached several overall conclusions regarding the problems of Navy and Marine Corps acquisition management and the actions necessary to solve them. None of the problems are simple, and they do not admit to simplistic or quick solutions. In fact, the solution to many of these problems is a continuous process, requiring changes to policies, attitudes, and actions at all levels of Government. The NMARC summary conclusions regarding acquisition problems are the following:

- The instability or turbulence of program plans and budgets is a major cause of inefficiency in DOD and Navy acquisition management. Once a program enters the acquisition phase, almost any change costs money. Whether it be to increase or decrease quantities, to extend or accelerate schedule, costs are increased over those required if a stable plan were followed. The principal causes of instability are unintegrated and unrealistic plans and budgets and the failure to make sound decisions based on all relevant factors and then stick with them. Improvements in DOD and Navy planning, budgeting, and decisionmaking should be given high priority.

- Contracting policies and practices that may have been well founded have become obsolete in the current inflationary and unstable economy. This condition has contributed to contract cost growth (or an appearance of growth) and a worsening of Navy-contractor working relationships, particularly in shipbuilding. A general review of these policies is in order and was already underway in some areas prior to the NMARC study.

- Perhaps the most pervasive, disruptive influence on Navy project management is the inadequate and improper definition of the roles of OSD, OPNAV, and the Naval Material Command in acquisition management. The NMARC found that the policies of DOD Directive 5000.1 are being widely ignored, with the result that there is excessive and counter-

productive involvement of higher level staffs in the direct management of major programs. This involvement comes from both OSD and OPNAV. It undercuts the position of the project manager, obscures the lines of authority and responsibility, and destroys accountability for program management.

- A related problem is the proliferation of higher level staffs. A standard reaction to program management problems appears to be the addition of more layers of review rather than strengthening the quality and quantity of personnel directly responsible for the management of programs. Authority and responsibility should be clearly defined, and, more importantly, the organizations in OSD, OPNAV, NAVMAT, and the Systems Commands that are involved in the acquisition process should be made to limit themselves to their defined areas of responsibility. As much authority as practical should be decentralized and located in the program management organization. Within the Navy program management matrix, the project office should be strengthened to include full line responsibility and adequate staffing for technical, financial, and contract management.

- The credibility of Navy acquisition management cost estimates and budgets with both Congress and OSD has seriously eroded in the past decade. Cost growth of major programs has been a major cause of this, and this, in turn, has its roots in overly optimistic and inadequate initial official cost estimates and budgets. A range of actions and a period of time will be required to overcome this situation. However, the key elements are realistic planning and budgeting, emphasis on the quality and integrity of cost estimates, clear lines of authority and accountability for project management, a general atmosphere of candor, and timely and open communications regarding cost and financial problems from the bottom of the Navy organization to the very top.

- In line with the strengthening of Navy project management offices, these offices must be made cost conscious and fully aware of their responsibilities to track and project the costs of their contractors, report them accurately, and take appropriate actions to control costs and avoid cost growth. Such an attitude is essential to successful management decentralization and the restoration of Navy cost credibility.

- The Navy has not yet demonstrated that it has solved its problems in integrating complex surface-ship combat systems. However, a number of actions have been initiated to correct this situation, including the hiring of integration contractors and the construction of test and integration facilities. The full resolution of these problems and the effective use of integration contractors and facilities requires that the Navy develop a high technical capability in this area. A coordinated program to achieve this should be undertaken.

- Finally, the development and deployment of combat-capable weapons can be assured only if new weapons are tested in the environment and against the best feasible simulations of the threats that they are expected to encounter in actual use. This type of testing should be made a matter of Navy policy and adequate resources made available for its performance.

Implementation of these recommendations and the recommendations detailed in the following chapters should assist the Navy in improving its weapon system acquisition management.

6. OVERVIEW RECOMMENDATIONS

Of the recommendations developed in the five Panel chapters that follow, the most significant have been summarized in this overview. In addition, certain recommendations have been stated in this chapter that were developed as a result of the integrated review of the aggregate work of the five NMARC Panels and their interactions. These recommendations are supported by the total effort and are listed here for convenience.

Recommendation OVRVW-1: Establish as fundamental Navy policy that commitments to concepts and decisions in the acquisition process by the Navy Secretariat, OPNAV, and NAVMAT will be binding for extended periods, thus restoring some measure of program stability.

Recommendation OVRVW-2: Design and implement a method for continuing self-evaluation of the acquisition process, as differentiated from systems acquisition per se.

Recommendation OVRVW-3: OSD should withdraw substantially from specific participation in individual weapon system acquisition programs and dedicate its energies instead to policy formulation and monitoring in matters of total DOD objectives, force levels, budgets, and overall management philosophy. The proposed expanded charter of the Assistant Secretary of Defense (Installations and Logistics) should be seriously questioned.

Recommendation OVRVW-4: The usable authority of the individual project managers should be strengthened, primarily by constraining extraneous demands, reallocating and consolidating assets, improving training, reassigning existing personnel, and possibly consolidating the number of projects that are presently separately identified and managed.

Recommendation OVRVW-5: Constraint should be exercised in the total number of projects formally designated.

Recommendation OVRVW-6: Positive action should be taken to bring about a major reduction in layering at all levels by clarifying OPNAV and NAVMAT roles, assigning greater responsibilities to SYSCOMs for establishing product acquisition policy and monitoring performance, and utilizing NSARC to reduce information demands and duplicative reviews.

Recommendation OVRVW-7: Positive measures should be taken by OPNAV to ensure that changes to program scope and requirements are accompanied by corresponding adjustments to cost estimate baselines and budgets.

Recommendation OVRVW-8: A decision to undertake formally a major system acquisition effort should include an explicit decision as to the level of logistic support upon which design and development of the intended system is to be predicated and how it fits into the existing Navy family of weapon systems and existing logistic capabilities.

Recommendation OVRVW-9: The Navy requires a project manager during the conceptual phase of the weapons acquisition process to develop an integrated logistic support plan that contains a detailed resource analysis. Once this plan is completed, an explicit decision should be made by the users and producers to determine and fund the appropriate level of support for the weapon system.

Recommendation OVRVW-10: Integrated logistic support plans are typically not subjected to a Navy internal quality assessment and are critically examined only at DSARC. A Navy internal quality control over integrated logistic support plans should be established.

III. RESEARCH AND DEVELOPMENT PANEL

At the outset of the NMARC study, the R&D Panel was impressed with the number, depth, and pertinence of previous studies of the acquisition process in general and of the role and missions of the Navy's research and development (R&D) establishments in particular.

An early decision made was to take maximum advantage of the insights obtained by eminently qualified people during some of these detailed investigations in recent years. This led to a recognition of the validity of the principles enunciated in the Blue Ribbon study of 1970, of the overwhelming need for providing the decisionmakers with better alternatives and options in the full range of the requirements-to-cost environment described in the 1972 report of the Congressional Committee on Government Procurement, and of the validity of the observations on Navy laboratory assignments and performances by the more recent Hazen and Hollingsworth reports (references 1, 2).

The NMARC R&D Panel was composed of one corporate research director from industry, one executive with systems engineering background, two division general managers with broad Navy experience, and one missile systems executive with a strong background in program management. This diversity of experience was complemented by an equally diverse Navy staff with broad experience in the administrative, planning, and execution phases of R&D management. In its fact finding efforts, this group was soon driven to a close examination of the Navy's initial requirements-setting process, wherein decisions are made that are of far-reaching consequence for the acquisition process, as it uncoils from exploratory developments to prototype evaluation and production in today's limited-budget environment. More than ever before, these decisions involve tradeoffs that must be based on technical and cost information, which, as we now know, cannot be provided by analysis alone but requires interaction with the R&D community. This then sets the theme for the entire NMARC R&D Panel report: how to establish conditions that are optimal for

realistic, risk-conscious requirements setting and technology utilization. The R&D Panel report thus deals with issues in the following broad areas of interest:

- R&D planning and execution roles of OPNAV and NAVMAT
- Use and interaction of NRL and the eight CNM laboratories
- Use of systems engineering disciplines
- Potential benefits of commercial practices in implementing a design-to-cost philosophy.

There is a great deal of interdependence of these study areas, and generally each Panel member contributed to all of the areas. The Panel's recommendations are directed at a focusing of responsibilities in the first three areas and simplification of practices in the last area. It should also be noted here that it was the unanimous feeling of the R&D Panel that the Navy should reconvene at least the R&D Panel of the NMARC approximately 1 year after the issuance of this report to hear an accounting of the Navy's progress in implementing the recommendations contained herein.

1. BACKGROUND

(1) History, Previous Studies, and Lessons Learned

The study of naval history shows that whenever organizational imbalances are perceived, the number of studies increases and reorganization follows. A brief historical perspective of Government research and development (R&D) is included as Appendix R&D-A to this report.

After the War of 1812, in 1842, and again during the Civil War, the Navy was studied and reorganized to accommodate growth and redistribution of authority. Then the late 1800's saw the emergence of the Bureau of Navigation to a preeminent position, followed by a great period of adjustment, indecision, and readjustment. This period lasted until the establishment of the Chief of Naval Operations (CNO) in 1915 which, coupled with a world war, stabilized the relationship between "operators" and the "bureaus."

Between wars, the debate over the role of naval aviation occupied much of the energies of the naval establishment. Then after World War II, a continuing series of studies, studies of studies, reorganizations, and studies of reorganizations were undertaken from which evolved the structure that exists today. The latest major result of these events has been the elimination of the bilinear relationship within the Department of the Navy, which occurred in 1966. Appendix R&D-B traces the studies of Government R&D from the 1947 report of the Steelman Committee on Science and Public Policy to the 1972 report of the Commission on Government Procurement.

The various findings of the R&D Panel and their conclusions and recommendations were strongly guided by the lessons learned and recorded in previous studies and by the experiences gained from previously implemented recommendations.

(2) Organization for RDT&E

The Secretary of the Navy has delegated to the Assistant Secretary of the Navy (R&D) management of the appropriation "Research, Development, Test and Evaluation, Navy" (RDT&E, N) (reference 3). This responsibility gives him far more control over the Navy's program in this area of responsibility than has, in the past, normally been exercised by officials at the secretariat level. He is the only civilian executive assistant to the Secretary with control of an appropriation.

Within the Department of the Navy ASN(R&D) functions as a counterpart and principal point of contact for Director of Defense Research and Engineering (DDR&E). He also serves as Chairman of the Research and Development Committee and is responsible for supervision of the Office of Naval Research.

The ASN(R&D) has a small personal technical staff made up of military and civilian RDT&E professionals. For assistance in fulfillment of his Departmentwide responsibility for policy supervision of all research, development, test, and evaluation effort within the Department of the Navy, the ASN(R&D) looks to his principal advisors: the Director, RDT&E (OP-098); the Deputy Chief of Staff (RD&S), Marine Corps; the Chief of Naval Development; the Chief of Naval Research; the Oceanographer of the Navy; and the Director of Navy Laboratories (reference 4).

The Director of Research, Development, Test, and Evaluation (OP-098) has a primary responsibility to the Chief of Naval Operations and collateral duty to the ASN(R&D). For the former, the DRDT&E implements the CNO's responsibility for planning, programming, and appraising RDT&E. He also provides staff support and executes at the OPNAV level the Secretary's responsibilities for planning, programming, and budgeting of RDT&E.

The Chief of Naval Development (CND) also acts as the Deputy Chief of Naval Material for Development (DCNM(D)) in the Naval Material Command. As CND he plans, coordinates, and directs the Navy's Exploratory Development Program (6.2)* for the ASN(R&D). In his position as DCNM(D) he assists the Chief of Naval Material in the implementation of his RDT&E responsibilities. In general, he supervises the planning, execution, and appraisal of development, test, and evaluation programs and provides overall supervision of, and develops management policies concerning, the facilities resources available within the Navy Material Command for execution of the RDT&E program. DCNM(D) also serves as Assistant Oceanographer of the Navy for Ocean Engineering and Development (reference 5).

The Chief of Naval Research (CNR) coordinates the Naval Research Program (6.1)* and provides budgeting, accounting, and related reporting services for ASN(R&D). CNR also heads the Office of Naval Research, which was established as a separate activity within the Executive Office of the Secretary of the Navy by Public Law 588, 79th Congress (10 U.S.C. 5150) of 1 August 1946. Responsibilities of the CNR include, in addition to his coordination assignment, conduct of research for the Navy, consolidation and summarization of the annual RDT&E budget submittals of the development agencies, and supervision, administration, and control of all activities within or on behalf of the Department of the Navy relating to patents, inventions, trademarks, copyrights, royalty payments, and similar matters. The CNR also serves as Assistant Oceanographer of the Navy for Ocean Science.

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* See Appendix R&D-C, Section 7, for definitions of RDT&E program categories.

ASN(R&D)'s responsibility for the Navy laboratories is exercised through his Director of Naval Laboratories (DNL) who reports via the Chief of Naval Development. DNL provides the focus on matters relating to the health and development of all Navy laboratories. In addition the DNL serves as Director of Laboratory Programs (DLP) on the staff of the DCNM(D) and is concerned with NMC laboratory matters and directs the management of the RDT&E field activities complex within NMC.

Other principal active players in the RDT&E community include the Deputy Chief of Staff (RD&S), Marine Corps, the representative of the Commandant for RDT&E matters; appropriate agents from the Bureau of Naval Personnel and the Bureau of Medicine and Surgery; and senior officials of the Systems Commands (SYSCOM 03s) who represent the Commands in research and technology matters. These and other officials are noted in Appendix R&D-C.

2. MAJOR ISSUES EXAMINED

The R&D Panel assignment encompassed the R&D process from the invention, innovation, and generation of requirements through the transition to production. Thus it became necessary early in the study to ascertain those areas that were fundamental to material acquisition and to which the Panel could expect to make meaningful contributions. With this in mind, the Panel selected and then concentrated its efforts upon a few areas: the generation of requirements, the use of the laboratories, the use of industry, the use of personnel, and the management of funds. Then during the course of the study, the major themes of the report emerged. They are discussed in detail in the sections that follow.

The study of the first area, requirements, quickly led to the illumination of an organizational imbalance within the Navy. The Panel concluded that a fundamental shift in authority has occurred and has had a major impact on the way the Navy does business. This subject is discussed in Section 3, "The Navy User-Supplier Relationship." The use of the laboratories was found to be a complex issue and is discussed in several sections, although the main study of mission assignments, laboratory functions, and scope of the laboratory complex is contained in Section 4, "Support by the Navy Laboratories." The laboratories were found to be essentially sound, with further progress in consolidation deemed to be appropriate.

Fully aware that the preeminent tool of authority in the Navy acquisition community is control of funds, the Panel addressed the issue of funding separately as well as in relation to other issues. A discussion of this subject, included as Section 5, addresses the need for a balance in funding authority similar to the balance called for in Section 3, as well as the need for proper delegation of that authority.

Three issues felt to be of extreme importance yet not so broad as the other issues are discussed in Section 6. Subsection (1) of Section 6 deals with the better use of specifications by the Navy, including the simplification of the Navy process, the use of commercial specifications, and the use of the warranty method of maintenance. Subsection (2) deals with long-range planning in the conduct of R&D including the necessity for distinction between planning for requirements and planning for technology. Subsection (3) deals with the utilization of personnel in the conduct of R&D.

3. THE NAVY USER-SUPPLIER RELATIONSHIP

(1) Statement of the Issue

The Panel's review of the role of R&D in support of Navy and Marine Corps material acquisition confirms that the Department of Navy's tasks are complex and multidisciplinary since they involve the development, test, production, and support of complex air, land, sea, and subsurface weapon systems. The Navy requirement to operate in so many environments (surface, subsurface, land, and air) creates a more severe acquisition challenge than faced by any of the other services, hence, the need for a strong organization that is capable of meeting the technology needs as required to support the fleet.

The R&D role of the Navy Material Command was a prime focus of the Panel's inquiry. It became quite clear early in the course of the study that interfaces with higher authority, such as OPNAV, ASN(R&D), Director of Defense Research and Engineering (DDR&E), Office of Management and Budget (OMB), General Accounting Office (GAO), and the Congress, could not be ignored as a major consideration in problem identification and recommendations of potential solutions thereto.

It is apparent that the number of organizational interfaces involved in the management of RDT&E activities creates indecision and lack of discipline. Of these interfaces, that with OPNAV is considered most dominant in assessing the current situation regarding R&D in the Navy. More specifically, the central issue identified by the Panel is that of the proper balance between the operations community and the supplier community within the Navy (commonly referred to as the "user-producer" relationship). Elements of this central issue include the need for clarification of line and staff roles and authority; the mismatch of authority, responsibility, and accountability in the control of R&D funding; and the generation of requirements.

It is the Panel's conviction that no completely productive assessment of means to improve the effectiveness of the R&D process within the Material Command can be made without at least recognizing the ramifications and impacts of key interfaces with higher organizational echelons. It is to this end, therefore, that this section is directed with a recognition of the dangers of oversimplification of a very complex organism, the problems of turf protection and politics, and an appreciation for the difficulties in effecting meaningful changes to the status quo.

(2) Background

General Order Number 5 of October 1964 (replaced by SECNAV Instruction 5400.13 of August 1971 enunciated the user-supplier management doctrine that was intended to govern the relations between the CNO and CNM as user and supplier and diagramed the flow of their dialogue.

The principal purpose behind General Order Number 5 was to establish a reasonable balance between two principal functions—recognition and establishment of requirements and response to requirements via the R&D/acquisition process. The user is primarily responsible for determining what needs to be done while the supplier is primarily responsible for presenting options and determining how objectives and needs can be achieved. Together, through an active dialogue in which the user is spokesman for "demand" and the supplier for "supply," they evolve the best compromise between what is desirable to have and what is possible to get.

The Navy bilinear system was subsumed under the CNO in the reorganization of March 1966, and since then it has frequently been held that the user-supplier dialogue of the RDT&E process is obsolete; this idea is unfounded. Having OPNAV as user and NAVMAT as supplier is a sound management principle and has been tacitly espoused (although not effectively detailed) in the series of OPNAV directives on the conduct of RDT&E currently issued under OPNAV Instruction 5000.42. Figure III-1, based on a figure drawn from that document, illustrates the roles of SECDEF, CNO, and CNM.

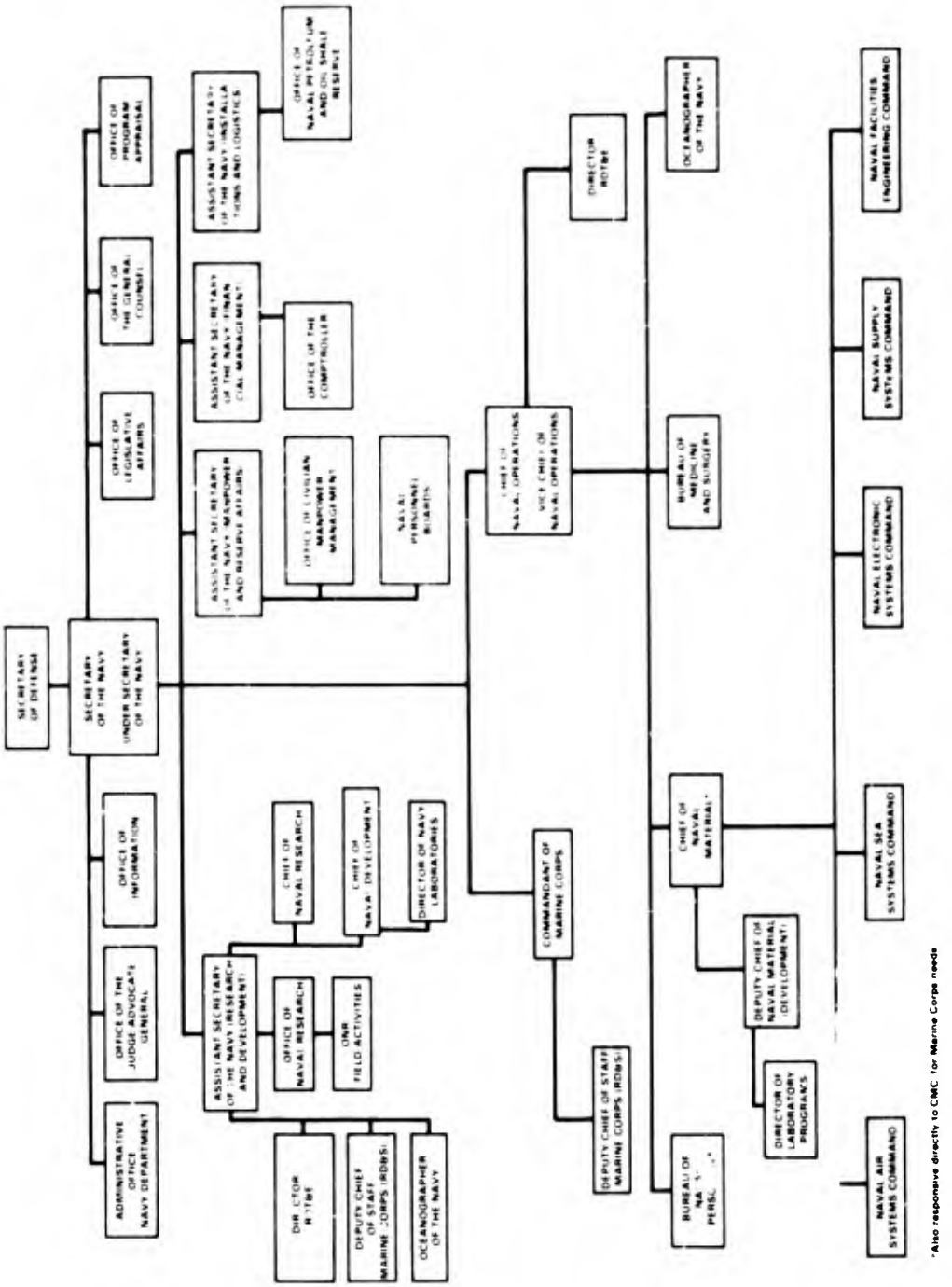
In 1964, SECNAV Instruction 5430.67 identified the specific responsibilities of the principal managers in the Navy/Marine Corps RDT&E community. The document was based on the user-supplier dialogue and is still active today although some organizational names have been changed. The principal representatives of the participants in the dialogue were originally intended to be the Director, RDT&E (OP-098), and the Deputy Chief of Naval Material (Development) (MAT-03). However, there have been so many additions to the list of principal participants, both line and staff, during the intervening years that successful managers have been forced to find their own critical paths through the bureaucratic complex (see Appendices R&D-D, -E, and -F).

The responsibilities of the Chief of Naval Material revolve about his principal assignment for material support as indicated in paragraph 2b of OPNAV Instruction 5450.176:

> The basic concept of the Naval Material Command is that of a single, integrated material support agency under the Chief of Naval Operations with central responsibility and accountability for total weapon/support systems development, procurement, production, and support, including human operator integration, depot maintenance, supply management facility support, and integrated logistic support planning.

The CNO and his immediate staff, OPNAV, are clearly responsible for planning for future forces and for approving an acquisition plan that is consistent with budget constraints and various political and other external constraints. A key role of the CNM is to interact with the CNO during the generation of

FIGURE III-1
Principal Department of the Navy
Headquarters Organization for RDT&E



the plan and then be clearly responsible for its execution. The presently observed practice, however, is for the OPNAV staff, with its various approval mechanisms, to make strong efforts to control the details of choice, substance, and schedule in the R&D/acquisition process, even though the principal responsibility of the Chief of Naval Material in the unilinear organization under the CNO is to manage the integrated material support agency.

Within both OPNAV and NAVMAT there have been major deviations from the intent and the words in existing instructions with resulting poor management practices. Representative examples of the involvement of higher decision levels in the conduct of development programs (under RDT&E funding) are drawn from the 1973 Beaumont study (reference 6), the SES project, and the NAVSEA CIWS project. These are included as Appendices R&D-D, -E, and -F, respectively. Study of the Beaumont and SES examples illustrates the heavy involvement of OPNAV, SECNAV, and OSD with the detailed affairs of the projects, and the last example (CIWS) shows the heavy staffing and layering in the Systems Commands that results from such involvement.

(3) Findings and Conclusions

From the contents of SECNAV Instruction 5430.67 of 29 June 1964 and OPNAV Instruction 5000.42 of 1 June 1974, it would appear that an adequate basis has been established for defining the role and functions of OPNAV and NAVMAT. For various reasons, there continues, however, to be an inadequate demarcation between the requirements role of OPNAV and the execution or supplier role of NAVMAT.

It is the conclusion of the R&D Panel that without actions to bring about a better balance between the roles of NAVMAT and OPNAV, there is a serious doubt regarding the effectiveness of changes within the Material Command that might offer potential for improvement in the R&D/acquisition process. The Beaumont study (reference 6) points out in strong language the need for extensive realignments in OPNAV. The Panel does not concur in the scope of such recommendations but is convinced that achievable and much needed chages of a much less extensive nature are in order.

It is felt that the CNO, in making R&D resource commitments, does not make adequate use of NAVMAT. In response to budget pressures, decisions are frequently made based upon OPNAV staff recommendations without participation by the Material Command. As programs get into further budgetary difficulty even higher level staff review results. This leads to juggling of resources rather than informed planning and generates a climate of instability and a preoccupation with day-to-day survival on the part of R&D project managers (PMs).

The evidence strongly suggests that senior Navy officials permit their staff organizations to usurp the power necessary for effective project management. This mode of indirect supervision and control is a poor and costly substitute for the assignment of qualified and highly motivated PMs with freedom to carry out assignments. The preferred approach is to strengthen the authority of PMs, as called for by the Commission on Government Procurement, and hold them accountable for the results. The Panel does note significant Navy progress since the issuance of DOD Directive 5000.1 in the training and selection of qualified PMs, but, if the PMs are not given the necessary freedom, flexibility, and authority to carry out their responsibilities, there will be a poor return on this investment.

The most commonly voiced complaint heard throughout the R&D/acquisition community is the widespread decoupling of accountability, responsibility, and authority. In other words, those who are accountable have insufficient authority, and those who either have authority or are in positions to influence strongly the successful prosecution of R&D/acquisition programs (staffs) have no accountability for success or failure.

Within the Naval Material Command establishment, most of the project and program managers come under the Systems Commands, an arrangement that is judged to be essentially sound. However, the panel has observed that the ability of the Systems Commanders to truly oversee their project and program managers is often preempted by the detailed management roles assumed by OPNAV and OSD staffs. R&D/acquisition managers tend to go to the principal source of their funding and to the highest level of management they are permitted to approach for support without seriously concerning

themselves with the intermediate management echelons. Although a few strong managers may be able to perform successfully in this arena, the majority of projects suffers from funding instability and decision delays.

Another aspect of this picture is that of requirements. This is a principal area wherein reform was advocated by the Commission on Government Procurement. OPNAV Instruction 5000.42 addresses weapon system selection and planning and represents the Navy's latest thinking on requirements determination. It is also represented as incorporating the thrust of the recommendations of the Commission on Government Procurement. There is still concern that this document may not sufficiently encourage proper prosecution of alternatives or system options at the advanced development stage prior to an acquisition decision. The wording of paragraph 7.d.(2) of OPNAV Instruction 5000.42 in particular leads to this concern. The Advanced Development Objective (ADO), one of the requirements documents replaced by the Operational Requirement (OR), appears to have offered considerably more latitude in the examination of potential mission applications.

It has also been asserted that, in spite of the Blue Ribbon Panel's enunciation of the Design-to-Cost principle (reduce cost and increase reliability while preserving necessary performance), requirements are still driven by a desire for maximum performance at minimum schedule without proper development of alternatives that would permit tradeoff of performance against cost (see for example paragraph 7.g of OPNAV Instruction 5000.42: ". . . . the CNO will establish a preferred alternative. . . . "). The prospect of technological advances still persuades planners and decisionmakers to seek increased performance, greater precision, added function capability, and thus more complexity, all of which tend to increase cost and reduce reliability (see enclosure 2, section 3, to OPNAV Instruction 5000.42). Such courses are frequently followed without proper regard to realistic operational needs. Also, there is often a misconception at technically naive management levels that the promise of a new (or better) system can be validated solely through analysis, without recourse to actual experimental hardware or software. This has often proved to be an invalid assumption. As a result, budgets are

often formulated without adequate provision for funds to permit realistic evaluation of alternatives or, even when budgeted, such funds are cut prematurely in favor of a "preferred" approach advanced by an articulate system advocate.

Since the demand for weapon systems greatly exceeds available funds, the various OPNAV mission sponsors strongly vie for their share of the budget. To satisfy as many needs as possible, there often is reluctance to fund for contingencies or to support alternative options. This creates pressure to forge ahead with a preferred approach, often without adequate accounting of the risks involved. Overoptimism or salesmanship on the part of the R&D community is a contributory factor in many cases, and is aggravated by tieing R&D activities too rigidly to a need for early introduction of fleet hardware.

These and many other considerations have led the Panel to conclude there needs to be a better dialogue, mutual respect, and common purpose developed between the operational and material communities in the evolution of realistic requirements. There must be an intensive and continuous interchange between the "needed" and the "desirable" on the one hand and the "possible" and the "probable" on the other.

At the same time there must be adequate provision for technology "push" in contrast to requirements "pull." If R&D is completely constrained to respond only to specific requirements, the current trend toward guaranteed success as a criterion for initiating development programs will grow to the detriment of invention and innovation. There must be suitable provision of a reasonable share of R&D funds to foster threat-productive as well as threat-reactive systems, i.e. we must create threats for the enemy to face.

(4) Recommendations

Recommendation R&D-1: A proper balance should be established between OPNAV and NAVMAT in consonance with their respective primary roles of user and supplier.

Comment: SECNAV Instruction 5430.67 of 29 June 1964 and supplementary OPNAV directives have established a proper setting for the roles of OPNAV and NAVMAT. There has been a lack of necessary management to maintain an effective demarcation between the requirements role of OPNAV and the execution role of NAVMAT. Inherent in this relationship must be the maintenance of adequate communication to assure a necessary dialogue.

Recommendation R&D-2: The authority of the Chief of Naval Material to control the RDT&E program funding, in categories 6.2 through 6.6, * under management supervision of ASN(R&D) should be clearly specified.

Comment: Gradual erosion of the technology base effort has occurred under the present arrangement of funding authority, evidenced by the recent growth of a pseudo-category, 6.3A. Without effective control of the development program at a single point within the supplier community, organizational barriers to the smooth progression of development will persist.

Recommendation R&D-3: The number of personnel in OPNAV devoted to the acquisition process should be reduced, thereby assuring staff concentration on the requirements role with the concomitant responsibilities for frequent evaluation of program responsiveness to fleet needs.

Comment: Too many members of OPNAV devote much of their time following specific projects in detail and in essence managing the NAVMAT PMs. Although program and development coordinators serve valuable functions in many projects, their position represents a "layer" as well as a mechanism for overmanagement by the mission and platform desks.

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* See Appendix R&D-C, Section 7, for definitions of RDT&E program categories.

Recommendation R&D-4: Billets saved as a result of implementing recommendation R&D-3 should be reassigned to the Naval Material Command.

Recommendation R&D-5: The role of the Naval Material Command in the decisionmaking process should be emphasized, e.g., by increasing representation on the Chief of Naval Operations' Executive Board (CEB).

Comment: The most significant portion of the Navy budget falls under the responsibility of the Material Command, yet the CEB as presently constituted has only one regular NAVMAT member. The main body of the Board consists of various members of the other portion of the CNO's staff, OPNAV.

Recommendation R&D-6: To effect redress of the existing imbalance in organizational structure, serious consideration should be given to the placement of the position of CNM at the same level as the Vice Chief of Naval Operations (VCNO), reporting directly to the CNO.

Comment: The effectiveness of the unilinear system could be strengthened by the recreation of the essential aspects of bilinearity, while retaining the effective single control of the CNO.

4. SUPPORT BY THE NAVY LABORATORIES

(1) Statement of Issue

How can the effectiveness and productivity of Navy laboratories and related organizations in the performance of material acquisition for the Navy be improved?

(2) Study Approach

At the beginning, the panel members had individual criteria as to what a research and development laboratory should be and how it should operate. During their deliberations, there emerged

collective criteria, based essentially on commercial practice, by which the Panel undertook to evaluate these activities, reach certain conclusions, and formulate recommendations. In so doing, there was recognition of the previously stated caveats regarding certain unique features of Navy laboratories.

The Panel conducted extensive interviews of key laboratory personnel and industrial contractors and thoroughly reviewed a number of recent studies already made of the laboratories. They sought to establish the state and health of their organizations, people, facilities, products, and funding with the objective of identifying actions that might offer potential for their more effective utilization.

(3) Role of the Navy Laboratories

The technical organizations identified as laboratories reporting to the Chief of Naval Material exist at the intersection of several technical functions, not all of which are directly related to material acquisition. Likewise, they exist at the intersection of several sources of funds, not all of which are from the RDT&EN account. Existing at these intersections the laboratories play a variety of roles, e.g., acting variously at the interface between the Systems Commands and industry, and at other times between the Systems Commands and the operating forces afloat.

The management objectives appropriate to the various laboratory roles are not necessarily the same, and the importance and value of these organizations is perceived differently by each segment of the material and operating communities interacting with the laboratories. The complexity of the laboratory situation is such that recommendations for their improvement in either performance or management coming from a particular segment of the DOD community are quite likely to upset facets of their function that are important to other segments. That being the case, some care must be taken in examining proposals for change.

Approximately one quarter of the Navy's RDT&E funds is spent in or by the Navy laboratories. Most of the remainder is

spent in various industrial establishments in support of relatively few major programs. The laboratories are thus substantial, albeit minority, claimants in the Navy RDT&E program, and their principal importance to that program lies in their generation and utilization of technical ideas and knowledge and in their support of major programs.

About 50 percent of the Navy laboratories' funds derive from RDT&EN, the balance coming from various procurement and operating accounts. Thus, in addition to their contribution to the development of new concepts, they play a substantial role in the acquisition of certain types of equipment and in the in-service engineering support and product-improvement activities that are necessary throughout the lifetime of any deployed equipment.

It must be understood that the in-house laboratories are not analogs of industrial laboratories who develop new products so that their parent organizations will be able to market new items. Nor are they like commercial technical organizations whose saleable product is developmental engineering in aid of whatever client hires them. The new technology utilized or created by the Navy laboratories normally will find its way to the fleet only when it has been handed over to the industrial producer. The technical sophistication that comes from thorough involvement on the forefront of technological progress will be of use in making the Navy an informed customer for new equipment only as the laboratories are called on to perform their proper role in the acquisition process.

To succeed as a source of technical knowledge for the Navy, the laboratories must be used in that role by headquarters, and they must be high-quality organizations. To maintain the quality, it is essential that the laboratories be directly in the business of creating or adapting newly discovered technology. Thus, they must be flexible and innovative—the kind of organization that is capable of fresh technical approaches to practical problems, either newly perceived or of such familiarity as to be taken as part of Navy tradition. The classic management problem is thus how to establish conditions that will promote the conduct of an inventive, free-thinking, and wide-ranging technical activity, while at the same time maximizing the direct payoff to the Navy's interests. It is not immediately clear that the two desiderata are compatible.

There are three additional facets of the laboratory function that merit notice here. First, the laboratory community is a massive reservoir of technical experience, in touch both with the latest in science and technology and with the actual operating problems of the fleet. As such, it is the most important single source of technical input to consideration of new requirements for equipment that will enhance the Navy's operational capability.

Second, the laboratories must be in the business of testing and experimentation to carry out their technical programs. Thus, they represent a resource of facilities and skill that can be used in aid of high-technology T&E activities when those test resources are not being used for development work.

Finally, in those areas where the laboratories have been active in direct support to the fleet and in-service engineering, they represent a body of continuous experience with Navy problems that is the foundation of our technical ability to respond immediately to operating problems in crisis situations.

In particular, it is this last feature that makes an essential difference between the Government laboratories and other means of conducting the Navy's technical business. During the entire organizational existence of some of these laboratories, however, there has been no call for full wartime mobilization; only a small fraction of the existing workforce was technically active during World War II. Yet the laboratories have demonstrated repeatedly during periods of open hostility since World War II that the capability to respond is there. Thus, in considering ways to improve the efficiency and the utilization of the Navy's laboratories, it must be remembered that the management and the methods must not be so tightly structured for peacetime operation that the flexibility to respond quickly in time of emergency is degraded.

In 1964 the principal R&D laboratories were established under management of the CNM with responsibility delegated to DCNM(D) (MAT-03). The main purposes for this change to corporate status were to:

- Make sure the technical competence is available to all bureaus and commands rather than only to the former parent organization

- Permit broader use of facilities
- Bring about common policies for management
- Give laboratory directors greater flexibility in program management.

Appendix R&D-G provides a list of the Navy laboratories, their missions, FY74 total budget, FY74 RDT&E budget, and number of employees.

(4) Discussion and Findings

The in-house laboratories of the DOD, including those of the Navy, have been regularly studied at intervals rarely longer than a year for at least the last decade. Such studies have usually emphasized the efficiency and performance of laboratories as operating organizations, with recommendations aimed at improving the laboratories per se. The R&D Panel has attempted to consider the laboratories as one set of performers in the context of the Navy's total R&D and acquisition activities.

1. Products and Functions

As has already been noted, the products of each of the laboratory organizations cover a broader range of activity, from basic research to various kinds of in-service support directly to the operating fleet elements, than is common in either university or industrial organizations. The restructuring of the Navy laboratories begun in 1966 included the coalescence of several of the existing laboratories and the closure of three of them in an effort to reduce manpower and clarify missions.

A major thrust of the coalescence was to organize the laboratories so that they could cover warfare areas with available technical assets. That effort resulted in fostering technical competence at a given laboratory or center in all of the technologies contributory to a given warfare area, with the consequence that they tend to have activities in common areas of technology, even though their assigned missions are different.

Laboratory performance in the development of technologies of importance to the Navy, i.e., in exploratory development and portions of advanced development, is judged to be generally competent and, in some technical areas, excellent. A relatively small portion of such work is carried out with funds that are at the discretion of laboratory management, and most of the balance is programmed through negotiations with the client Systems Commands or direct laboratory funding from NAVMAT.

There is a close relationship with the program and planning operations in the SYSCOM-03 and further improvements in examining program plans at higher levels in the laboratories and the SYSCOMs are being worked out. Some of the SYSCOMs have actually delegated effective planning control for specific technical areas to a laboratory. On the other hand, mechanisms for working with MAT-03 in ensuring balance in technical areas that encompass more than one laboratory and more than one SYSCOM have recently been severely damaged by the retirement of key MAT-03 personnel.

In working the technology areas of interest, the Navy laboratories have played an important role in on-site reviews of industrial independent research and development (IR&D) programs, thus allowing the laboratories to profit by knowledge of what industry is doing and allowing industry to profit from the advice and knowledge of Navy programs. However, the mechanisms by which new technology generated in the in-house laboratories finds its way to industrial developers are not at all obvious. Some of this knowledge gets to industry during the fabrication by industry of feasibility models of Navy concepts, and some is imparted through laboratory monitorship or technical direction of full-scale development programs.

In a similar vein, the success with which new technological opportunities are passed from the SYSCOM-03s to the acquisition community has been marginal, despite efforts by the 03 community to call attention to technological possibilities that have not yet been reduced to fully worked out hardware concepts. It is noted that in one SYSCOM there is a formal mechanism to get the acquisition directorate involved in the formalation of the 6.2 program and also all advanced system projects.

The laboratory function in many mature advanced development programs and in most engineering development projects tends to be in response to the needs of program and project managers, who are generally not in the research and technology directorates. The actual functions range from in-house work and test to various forms of technical authority over the work of industrial contractors. It is rare that a Navy laboratory is given a position of real technical cognizance over a major engineering development project, since the PMs have usually opted to retain that governmental function within their immediate staffs. Characteristically, arguments develop over the degree of technical independence that the laboratory should exercise in carrying out what it considers a technically professional job. PMs who are driven by a combination of performance, cost, and schedule constraints often cannot afford to consider new technical variations in a defined project. On the other hand, the laboratories tend to push what they consider the best and latest technical paths to quality equipment for the Navy without due regard for meeting schedules.

Another product of the laboratories is technical staff support to headquarters, whether that be a SYSCOM, NAVMAT, OPNAV, or on occasion DDR&E. One area with which the Panel has been particularly concerned is the provision of systems engineering services. "Systems engineering" has a variety of connotations, and great care is necessary to avoid a misunderstanding in terminology. Given the diversity of the technical elements that make up what the Navy tends to regard as systems, few laboratories have been in a position to perform a full range of systems engineering on things larger than, say, a weapon with its associated sensors and fire control. There is evidence, however, of some progress, as attested by the following:*

> The entire Navy laboratory community has always played an important role in formulating RDT&E program plans by cooperative planning with program

* Dr. C.E. Bergman, Navy Electronics Laboratory Center, writing in the May-June 1974 issue of Naval Research Reviews.

> managers and administrators in Washington .... we believe our influence in this regard has been strengthened further through the recent formation of a group to provide systems engineering studies related to overall naval communications and command system.

There is also ample evidence that the Navy has had difficulty with the complex problems of combat system integration of ships. The present problems have been recognized by the Navy, and attempts are being made to solve them. It is not clear, however, that there is adequate development of a cadre of experienced technical people who can be counted on to assist in this function. The problems will become more acute as more and more ships are fitted with digital equipment and demands for improved performance dictate the need for more and more functions aboard the ship to work in an integrated fashion. The Panel believes that the problem is of sufficient severity to call for special organizational measures in the technical community of the Navy and has addressed this in a separate section, which follows.

Yet another type of technical staff support to the headquarters function is technical input to long-range plans. This function also includes technical input to the formulation of operational requirements. The Panel perceives present laboratory contributions to such functions as somewhat haphazard. In the realm of technology base planning, individuals from the laboratories have served as contributors and advisors to the SYSCOMs and NAVMAT for years, and, as noted earlier, some of the laboratories have been delegated major responsibility for planning particular areas. More recently, laboratory personnel have been key participants in the development of Technology Coordinating Papers (TCPs) under DDR&E auspices. However, the positions developed during such exercises are often without any laboratory institutional concurrence or, for that matter, the detailed concurrence of the various echelons of Navy management that might desire to attempt a balance of these views with ongoing program interests. There is also a source of major confusion in the planning process in the occasional use of experts from the same laboratory to support competitive advocacy positions among various parts of a SYSCOM or offices in OPNAV.

It has not been apparent to the Panel that there is a corporate mechanism for the Navy to receive and systematically assess the inputs from planning staffs in the laboratories in the sense that such a system commonly operates in the industrial sector. The converse observation is that when there are so-called planning staffs in the laboratories, they are in some laboratories more occupied with assisting a headquarters client than they are with serving their parent organizations in local planning. The Panel particularly sought some evidence of systematic laboratory input of technical details and analysis of tradeoff options during the decision process for major weapon systems and ship configurations. Although such details are available at the SYSCOM level, their appearance seems to be variable at the OPNAV level, where the major program decisions are made under the present system.

During the introduction of new equipment to the fleet, in providing in-service engineering support, and in directly supporting operating elements when there are special problems with deployed equipment, the laboratories provide excellent service. This offers the additional benefit of keeping the laboratories involved with actual operating problems. The running contact of the Navy laboratories with actual operations is thought to be superior to that of laboratories of the other services and allows the Navy's organizations to develop the corporate technical memory that is one of their prime assets.

There are other functions of the R&D community that support acquisition, such as technical advice on production problems, consultative service to procurement through analysis and comment on the appropriateness of schedules and type of contract, cost estimation, and the validation of production and maintenance cost estimates and what industry would call market analysis. The last involves detailed knowledge of size of buy, replacement schedule, relative cost of improved design and maintenance, and some estimate of operational worth as compared with existing equipment. In addition to the use of SYSCOM personnel the Navy should make greater use of the CNM laboratories in support of such functions.

2. Financing

The fundamental feature of the Navy's method of funding its laboratories derives from its method of presenting and justifying its budget to OSD and the Congress, i.e., in terms of RDT&E work to be accomplished, not in terms of organizations to be supported. This philosophy extends to the technology base work as well as throughout the engineering projects. Thus, in theory, no Navy laboratory is assured of any funding, and each year it must sell the services of its entire work force.

In practice, the Independent Research and Independent Exploratory Development (IR/IED) work under the discretion of the technical director is the most stable fraction of the laboratory RDT&E budget. However, this amounts to a trivial fraction of the total, and the mainstay of most of the Navy laboratories is their exploratory development work, which is negotiated in detail with clients and with MAT-03 for the direct laboratory funding program. Most of the elements of the exploratory development work last for several years, once agreed upon, and laboratory management can generally count on certain levels of funds. However, inflation has seriously reduced the amount of such funding, and the total size of the Navy's 6.1 and 6.2 programs* has not kept pace with the rise in prices and the Federal pay scales. The most serious practical problems arise in 6.3 and 6.4 programs* since this constitutes a substantial part of laboratory funding, and these programs are subject to frequent and large dollar adjustments as a result of high-level changes in the Navy's RDT&E program. These are particularly serious when they occur late in the fiscal year. Such problems are hardly unique to the Navy laboratories, however, for such fluctuations in program funding have exactly the same type of impact on industrial contractors. On the other hand, industrial firms can attempt to deal with the fluctuations by getting other business, by using corporate funds to maintain the work force during the transition

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* See Appendix R&D-C, Section 7, for definitions of RDT&E program categories.

period, or by reducing the work force. Navy laboratories can only reduce the work force through the relatively cumbersome procedures of the civil service, with attendant political displeasure, and there are no corporate funds that can be used to smooth out the transition. That leaves only the path of seeking other business, which tends to mean shifting the work force to other tasks in a backlog that the laboratory may have been fortunate enough to have built up in the face of impatience from its SYSCOM clients.

The laboratories operate under an accounting system called Navy Industrial Funding (NIF). Under this system, there is a corpus of operating funds, and costs are allocated to various cost centers with overhead charges assigned according to a set of specified rules. The system differs from industrial financial management in that there is no profit, laboratories are not allowed to accumulate capital, and there is no amortization of capital facilities.

The name of this accounting system suggests that the style of management of the laboratories is industrial; however, it is not. Laboratory management does not have control over salaries, or the ability to make tradeoff decisions between using income for work force or the acquisition of capital facilities. What is industrial is the entrepreneurial method of establishing the program of work in the institution.

Clearly, the accounting system does not require the entrepreneurial style that is now associated with NIF. But given this mode of operation, it can only be expected that the laboratories will be competing for work in the areas of greatest significance to the Navy. They will attempt to develop the most complete expertise that will permit them to seek work more effectively, and they will branch out from their central mission areas as far as reasonable extensions of their competence can take them in order to broaden their business base. In a system where profit cannot be a measure of success, organizations will seek instead some combination of increased responsibility, increased work in areas of critical significance to the Navy, and increased business volume. Of these, only business volume is easily quantified. But without other controls the desire to increase business

volume serves to stimulate free-wheeling competition and give incentive to a diffusion of product specialization.

The other facet of laboratory financing that is subject to constant discussion is the detail of the work tasking in the technology base. This is often confused with the flow of money to the laboratories, while in reality the detail is not one of cash availability, but rather of statements of work to be done with that money. It is the Panel's opinion that substantial progress can be made in the near future in negotiating laboratory tasks in larger blocks than has been customary. This will require adjustment in the procedures of both laboratory and client, for on both sides it has been customary to negotiate the program at the level of the smallest aggregate of work used by either laboratory or client for any management purpose. The widespread use and broad dissemination of DD Forms 1498 is a prime example. This practice tends to obscure the main technical thrust of the program and invites misunderstanding and detailed adjustments by higher authority, whether that be in the Navy or in DDR&E.

3. Organization and Management

A particular strength of the CNM laboratories has been their organization along major function, warfare, or platform lines, rather than along lines of technologies or commodities. This has allowed the laboratories to interact with the fleet with superior knowledge of working systems, to accept more responsible functions in technical direction during the acquisition of major systems, and to act as the common factor in dealing with more than one SYSCOM when the technical job requires such joint attention. In short, this organization has been of significant value in coupling these technical organizations to the practical purposes of the Navy. In concert with the value of the organizational structure has been the existence of a central reporting point in NAVMAT that could set and implement general laboratory policy and, in principle, could control program balance in the laboratories from a Navy-wide point of view.

During the years since this organizational pattern was set up, several problems have become apparent, some of which have been discussed above. The client commands

have shown some reluctance to make full use of the laboratories' capabilities, or to trust them to do a quality job. The laboratory functions, although reviewed regularly in principle, are more diffuse and apparently overlapping than is considered desirable. The central laboratory management has been unable to do as effective a job of adjusting and balancing the program across all of the laboratories as was originally envisioned. The increasing stringency of the budget argues that the Navy may no longer be able to afford as broad a spectrum of technological activity at each of the laboratories as we have had during the past decade. The laboratories do not appear to be providing the kind of input to corporate planning that good industrial practice would expect, nor do they appear to be prepared to carry out the sort of systems engineering the Navy will need increasingly in the future.

It was with some hesitation that the Panel resolved the question of whether or not some or all of the CNM laboratories should be returned from the command and management of the CNM to the SYSCOMs. A significant change since 1966, when CNM assumed command of the laboratories, is the reorganization of the SYSCOMs in a way that allows more unified treatment of technical and engineering problems within a single SYSCOM. That is, the number of projects that require active collaboration of two or more SYSCOMs is much smaller particularly since the recent creation of NAVSEA. Similarly most of the NAVMAT designated projects have been assigned to one or another of the SYSCOMs and of those remaining with CNM, only PM-4 makes extensive use of the Navy laboratories.

Benefits of reporting to the SYSCOMs might include greater willingness of the clients to use the laboratories for responsible functions through delegation, thus effecting tighter coupling of the laboratories to the acquisition process; ability to control unequivocally, through their control of funds, the work put into the laboratories, thus reducing the tendency to diffusion of mission; ability to coordinate more effectively the use of laboratory test assets with those of the test activities under SYSCOM control; and the ability to make direct adjustments of laboratory manpower and funding by adjustments involving other SYSCOM field activities, should the need arise.

Disadvantages include the possibility that the bulk of the laboratory effort will be consumed by near-term problems to the detriment of work that is necessary for the long-range interest of the Navy; greatly increased difficulty in producing a program that is balanced across the needs of the entire Navy rather than those of one SYSCOM, with concomitant difficulty in presenting the Navy's program to higher authority; difficulty in making a rational plan for the acquisition of facilities for the entire Navy RDT&E community when the outlook is very dubious for the satisfaction of more than a small fraction of the facilities requirements of all claimants; and lack of a central focal point to present a firm Navy position on the total in-house laboratory effort, particularly during a period when very difficult decisions will have to be made on how to reduce the in-house work force in a way that will leave a well balanced effort.

In theory, all of the potential disadvantages attendant on return of the laboratories to the SYSCOMs would be avoided by their retention under the command and management of the CNM, and suitable steps by that management could provide a large measure of the potential benefits listed for such transfer. In practice, however, the powers presently possessed by the DNL have not been used, or perhaps are unuseable, and the putative advantages of central management have not been realized. Thus, the proper decision on whether to transfer the laboratories depends on the determination of the DNL and the CND to use the authority they have to carry out the central management function.

The Panel feels that retention of the central laboratory management system will have greater potential benefit to the Navy only if NAVMAT is strengthened in accordance with recommendations R&D-1 and R&D-2 and if the CNM fully exercises that authority. If this is not achieved, the Panel feels that the Navy will be better served by returning laboratory command and management to the Systems Commands.

(5) Ship Combat Systems Integration

This subsection deals with one particularly important aspect of ship acquisition, namely combat systems design, integration, checkout, and acquisition management as it impacts the

R&D community. The combat system deserves this special empasis because it is by far the most technically complex part of the ship acquisition process, and the one that has changed most during the last decade. Vice Admiral Eli T. Reich states part of the issue very appropriately (reference 7).

> It cannot be achieved by assigning responsibility to a contractor who lacks experience in the functions, tactics, strategies and implementation of Naval warfare, and we cannot accomplish it 'in-house' because of the way we are organized.

Improvement of the Navy's ability to handle the combat system (including weapon system) design, integration, test, and evaluation, therefore, is an appropriate focus of special attention. Reference 8 provides an excellent detailed exposition of the nature of this task and the Navy's present situation.

In a positive sense, there are many appropriate actions underway:

- Shore-based test sites associated with DD-963, LHA, and PF programs have been of such benefit as to become essential to these programs.

- In many areas of the Navy and DOD, there is an increasing emphasis upon improving the capability to handle the software used in modern combat systems.

It must be noted, however, that these test sites, while essential for each ship program, do not serve a present and growing long-term need for a Navy owned and operated activity that could become the focus of the in-house technical competence and experience in combat systems integration. Such an activity, ideally, could become the place where practical operating experience with the present generation of digitally equipped ships feeds back to the technical community for both immediate solutions of critical problems and long-term improvement in the specification and acquisition of new systems.

The activity of such an operation would be complementary to the skills and interests of the present shipbuilding industry.

It is needed now to work on today's ship acquisition problems, and will be needed more each year as the inventory of ships with modern digitally equipped combat systems increases.

(6) Conclusions

The Panel generally agreed there exists a lack of adequate involvement of the laboratories in the requirements setting process, i.e., making available to requirements planning timely inputs of available technology, systems, components, and related risks based on the state of development. This not only makes it difficult to match that which needs to be done with that which can be done, but it tends to isolate the supplier community from the user community and loses the opportunity to obtain early direction and commitment of the laboratory community in both its planning for and its implementation of the technology base.

A discernable need was found for better coordination of technology programs across laboratories and centers and industrial activities. The responsibility for this coordination currently lies in several places, within the 03 areas of the SYSCOMS and CNM and through various mechanisms set up within the laboratory community, e.g., program offices and laboratories exercising a lead role. From a variety of sources the Panel learned that a lack of coherence is felt to exist among these programs for various reasons including micromanagement, proliferation of tasks, and diffusion of goals and objectives. Some sort of new mechanism is needed to focus these efforts and couple them closer to the development programs addressing the Navy's most urgent needs.

It was generally agreed by the Panel that although there are several instances of excellent basic resource coupling between NRL and the CNM laboratory community, there is considerable room for improvement. It is felt that this improvement can probably be achieved by a review of NRL mission statements and a rededication to and a better understanding of the CNM laboratory/center roles and missions. There is already evidence this is occurring; however, encouragement is needed to achieve the desired results.

In general, within the NIF funding constraints and NAVMAT policies under which laboratory directors are constrained to function, there is too little authority over and flexibility of action within exploratory development tasks. Current program efforts are not so much limited by micromanagement as they are by lack of flexibility that the technical director can use to plan and implement exploratory development programs that should be responsive to long-range Navy needs. The Panel concluded that further agglomeration of funding in so-called "blocks" would be useful particularly if these blocks were made to coincide with clearly defined, nonoverlapping mission statements.

Perhaps one of the most serious shortcomings perceived by the R&D Panel was the general lack of coupling that was found to exist among SYSCOMS, NAVMAT, project and program managers, and the laboratory community. Obviously, this is not a problem that can be easily resolved, but it is one which the panel feels can be substantially ameliorated. A most significant improvement could occur if the laboratory community were guided by long range planning within NAVMAT. Again, this accomplishes many important things including matching capabilities to needs, commitment of the producer's best effort to meet the users' long-range needs, and a much-needed coherence among programs.

Although there were many evidences of a systems approach within the laboratory community, it is generally felt that the systems engineering capability and efforts within the laboratory community are inadequate. In addition to the establishment of largely unique and independent missions among the laboratories and centers, the systems engineering and integration functions within the engineering development process would be improved by:

- Closer coupling with the headquarters' organization concerned with R&D management and planning

- Greater mutual involvement in the planning process by the user and the supplier.

A new mechanism is needed to assure the appropriate level and quality of effort in this vital systems engineering function.

The need is greater in the area of ship combat systems integration where the Navy's in-house capabilities are fragmented. Digital data handling is central to most of these systems with

inherent interface problems between sensor subsystems, fire-control subsystems, and general command and control systems and displays. Often the hardware/software integration tasks needed to conform with the combat doctrine essential for a ship are of such complexity that special land-based test and simulation installations are needed (as in DD-963, PF, Trident, Aegis). To plan, develop, and manage these major integration efforts, a cadre of highly capable and experienced systems engineers will have to be formed.

Regarding the effectiveness and efficiency of laboratories in performing their tasks within current mission statements, an important factor that degrades the quality of the results has been an apparently inherent instability within their programming structure. This instability is affected by all of the factors that have been presented heretofore under the NIF funding system. Only minimal flexibility exists to compensate for performance difficulties that always arise in research and development programs requiring enlightened tradeoff decisions. All too frequently, program fluctuations can occur sometimes late in the fiscal year. Even though laboratories have authority to reprogram up to 25 percent of the funds, reprogramming actions necessitated by inadequate allowance for contingencies elsewhere in the development establishment can cause a sudden curtailment of program support, necessitating frequent realignment of programs accompanied by increases in program risk. This situation is worsened by the current reduction in support, which in some programs can create a level of instability that makes program success highly improbable. In addition, competition among laboratories is increased as necessitated by short-term survival, reducing the general esprit of the community to relatively ineffective levels.

The Panel concluded the following are proper primary functions of laboratories and related activities:

1. Naval Research Laboratory

   (1) Basic research
   (2) Selected areas of technology
   (3) Technical consultation
   (4) Development of special systems
   (5) Corporate memory

2. NAVMAT laboratories

   (1) Technology base
   (2) Systems engineering
   (3) Development and demonstration of feasibility
   (4) Technical consultation
   (5) Support for other activities
   (6) DT&E feedback and analysis

3. Other activities

   (1) Test and evaluation
   (2) Fleet service engineering
   (3) Specific development and design.

Within this framework, the technical areas in which the laboratories function need to be clarified and the missions need to be restated so that there is no confusion about what the laboratory specialties are to be at the end of a planned period of adjustment. In keeping with this clarifying realignment, each laboratory will have to engage in a narrower spectrum of technological support activities, depending more on its sister laboratories or industry for technological backup, when that is needed.

Research and development in torpedos is underway at five laboratories—Naval Surface Weapons Center, White Oak (NSWC/WO); Naval Undersea Systems Center, Newport (NUSC/Newport); Applied Research Laboratory, Pennsylvania State University (ARL/Penn State); Naval Undersea Center, San Diego (NUC/San Diego); and Naval Ship Reserach and Development Center, Carderock (NSRDC/Carderock). Most of these organizations spend $5 million or more per year with emphasis on a different aspect of the system. Direction is generated from the Systems Command with the respective laboratory responding as requested. As a result, the laboratories are not partners in the total process and therefore do not channel their technical expertise into solving the total problem but remain somewhat fractionated.

The surface-based fire control systems located at four laboratories—Naval Air Development Center, Warminster, (NADC/War); Naval Ship Weapons Center (NSWC); Naval Weapons Center at China Lake (NWC); and Applied Physics Laboratory, Johns Hopkins University (APL/JH)—have some overlap with the

three aircraft-based fire control system laboratories—NADC, NWC, and NSWC. In each case the current laboratory mission statements permit this redundancy, and the sponsors seek out those organizations considered to be most responsive to the headquarters' managers needs. The result is a proliferation of responsibilities among several laboratories that in turn, are not operating as a cohesive entity except as determined by headquarters.

There is an appreciable degree of redundancy among NADC; NUC/San Diego; NRL; and Naval Undersea Systems Center, New London (NUSC) in the area of acoustic sensors. NADC deals with the aircraft platform and NUC, NRL, and NUSC with the surface platform. However, much of the technology is similar or even identical, because the aircraft searches with an ocean-borne device (buoy or towed or dipped sonar). Efforts should be made to focus the acoustic sensor programs with visible strength and utilize technical expertise where it exists in supporting roles.

The Navy is to be commended for the recent laboratory consolidations that have been carried out, but detailed study of possible further consolidations, reassignment, or closures needs to be made. These studies should be carried out and implemented by Navy personnel rather than by outside study groups. As an example, the Panel sees merit in considering the assignment of the Naval Coastal Systems Laboratory (NCSL) as a dedicated activity in support of the operational test and evaluation force. Laboratory facilities such as the Ocean Simulation Facility, computers, and tracking ranges are important assets in carrying out the test and evaluation (T&E) function. Furthermore, with some appropriate reductions, the staff appears well oriented and qualified to perform many of the needed functions. These factors coupled with waterfront facilities and location, including proximity to the climatic test chamber at Eglin Air Force Base, all add to the attractiveness of such a proposal. Finally, it would appear to be a politically acceptable move.

While it is necessary to improve the quality of corporate planning of work carried out in the laboratories, thus ensuring an adequate response to a perceived threat, it is essential that measures be taken to ensure the existence of technology "push" as a counter balance to requirements "pull." For this reason,

it is felt that the Naval Research Laboratory should continue to report to CNR and function as the Navy's corporate research laboratory. In keeping with this function, its involvement with mature development tasks should be carefully restricted to areas in which it is uniquely competent among the Navy's laboratories. Although NRL has been known for many years as the corporate research laboratory, it has not been adequately carrying out that function as it is understood in industry. In particular, it is incumbent on a corporate research laboratory to undertake as part of its basic program work that is expected to be of assistance to the development laboratories in the corporate system. That is the price it pays for the freedom to generate its own technology push. Thus NRL should make greater efforts to know and understand the research needs of the other Navy laboratories and within available resources attempt to broaden the spectrum of its basic work into areas needed by the other laboratories. Effective transfer of scientific expertise and knowledge acquired by NRL will depend on the development of mutually cooperative interactions with the other laboratories.

(7) Recommendations

Recommendation R&D-7: The eight NAVMAT laboratories should continue to operate under the DCNM(D) only if NAVMAT is strengthened in accordance with recommendations R&D-1 and R&D-2. If the strengthening implied in these changes is not achieved, these laboratories should be transferred to Systems Commands. NRL should be retained under the command and management of CNR and the engineering, T&E, and service organizations under the SYSCOMs.

Recommendation R&D-8: A central point of guidance should be established under DCNM(D) for coordinating the systems engineering efforts at the Navy laboratories and for expanding the systems engineering discipline within the Navy laboratory community. The objective of this new function shall be to broaden the Navy's capabilities for developing the alternatives and tradeoffs in platform and combat systems that are a prerequisite for the design-to-cost type of acquisition mode.

Recommendation R&D-9: A determination of which areas of future technology should be prosecuted by NRL in preparation for further exploitation by the CNM laboratories should be included in ASN(R&D) planning of the technology base.

Recommendation R&D-10: The definition and elimination of undesirably duplicative efforts at two or more laboratories, as traced in the 1974 Hollingsworth report should be completed. Extraneous (non-mission-essential) product lines should be transferred to other CNM laboratories or NRL with the objective of further laboratory consolidation.

Recommendation R&D-11: Building on the skills available from RDT&E activities and Navy Programming Centers, a capability should be established to provide for systems integration of ship weapon system/command and control interfaces for the conceptual pnases of a program and the late evolutionary phases.

Recommendation R&D-12: The most appropriate location and organizational arrangement for activities that provide the core of technical support for combat system design, integration, and test should be determined. This should provide for adequate feedback from test and evaluation and fleet operational experience to design and development activities.

Recommendation R&D-13: The development of practical means to negotiate the program of technology base work in the NAVMAT laboratories in major blocks so as to promote the clear assignment of product area responsibilities and expand the funding flexibility available to laboratory management should be accelerated.

Recommendation R&D-14: A discipline should be established that will ensure serious attention by laboratory management to providing technical input to the Navy's corporate technical planning process in their areas of product responsibility, matched by serious consideration of those inputs at the corporate level (CNM).

5. FUNDING

(1) Statement of the Issue

What steps should be taken to correct deficiencies in RDT&EN funding policy, procedures, and practices to improve effectiveness of the R&D/acquisition process?

(2) Background

The Department of the Navy is unique within the Department of Defense in that the ASN(R&D) can exercise powerful control through his managership of the RDT&EN appropriation. Responsibilities for the other appropriations reside in OPNAV, specifically in OP-090. The CNO designates OP-098, the Director, RDT&E, to serve as his RDT&EN appropriation sponsor within OPNAV.

As already noted the Assistant Secretary (R&D) has a small staff of professional assistants to remain abreast of items of most critical interest to him, including program budget and financial matters. However, his ability to be personally involved is very limited, so he uses two principal sources of assistance, OP-098 and the Comptroller of ONR. OP-098 is charged to support ASN(R&D) in all related matters, which include maintaining a staff capability to prepare the program budget, keeping detailed fiscal records of all RDT&E programs, and preparing necessary financial displays for ASN(R&D). The Comptroller of ONR serves also as Special Assistant (Financial Management) to the ASN(R&D) and uses the ONR financial organization to provide the Assistant Secretary with all necessary financial management assistance for RDT&EN.

(3) Discussion

Although the line of financial management authority appears to be clearly defined for RDT&EN, the system continues to be plagued by several serious problems of turbulence arising from both external and internal sources. With the Program Objective

Memorandum (POM) exercise in January, a series of events is initiated to establish the planning base for the next 3 years. However, OPNAV is so heavily involved in manipulating the details of ongoing acquisition programs that guidance for the POM tends to be late, fails to focus on the general objectives of the program, and commonly deals with fiscal solutions to incompletely stated problems.

During this POM period, the CNM staff is generally not a part of the deliberations because of haste and a general desire to deal directly with sources of detailed information at low levels in the Systems Commands. This practice results in little attention to coordination among the Systems Commands and represents another example of the lack of balance between OPNAV and NAVMAT in achieving a satisfactory R&D/acquisition program.

Lack of discipline in budget formulation is encouraged by the large number of participants and the number of documentary actions required. Appendix R&D-J is an example and shows all the steps required to prosecute only the PM-4 portion of the POM-76 program, along with a number of actions that do not contribute to a productive program and must therefore hinder the process.

Financial management is inevitably intertwined with program planning. Errors in the initial planning engendered by haste and incomplete knowledge will be perpetuated throughout the POM process and the follow-up budget and apportionment actions. The activities of DDR&E in adjusting program planning through the use of threats of funding deferrals, coupled with the lateness of congressional actions, help create an atmosphere of uncertainty and indecision that percolates down to the lowest program levels. The resultant confusion and instability wastes both money and the energy of key management personnel.

Adjustments in the program in response to fluctuations in either funding or management guidance must be reviewed at each level above the Systems Command out of context with the rest of the total plan as established in the POM, the budget, or the apportionment. Further, the Request for Authority to Negotiate (RAN) and the accompanying Determination and

Findings (D&F) are a potential source of abrupt modulation in program and budget plant. Current procedures require that all proposed RDT&E procurements under exception 11, Title 10, U.S.C. 2304, that exceed a cumulative total of $100,000 as identified in ASPR 3-302 over the history of the project must be submitted for approval to ASN(I&L) in the format of a RAN/DF. The process requires a Systems Command to submit the document to MAT-02, who in turn obtains an endorsement from DCNM(D) before transmitting it to ASN(I&L) via ASN(R&D). At each stage of this chain, staffs have an opportunity to ask questions, require amplifying statements, and indeed exert technical modulation of the program. The $100,000 threshold has remained in spite of the severe cost escalation in recent years.

The ability of responsible management to make adjustments in the RDT&E program without undue delay because of successive reviews and approvals is central to the RDT&E process. At best, RDT&E planning has many unknowns because the investigators are in new territory, even at the engineering end of the process. In recognition of this, management procedures should include sufficient flexibility so those responsible can take appropriate action quickly. The present system within the DOD places a premium on adhering to a plan generated 3 years earlier and justified as being accurate to the last detail, when the program manager knows from experience that, as the program is pursued, unanticipated problems will arise and new technological solutions will have to be invoked.

Without approval of the concerned committees, at present Congress restricts to $2 million any increase of an approved project and prohibits any increase in an item of special congressional interest. This constraint requires management to fine-tune a multi-billion-dollar plan starting 3 years in advance of appearing before Congress. In order that the project manager have maximum flexibility, and because of the imbalance between OPNAV and NAVMAT, neither the Chief of Naval Material nor the Systems Commander has any residual flexibility. A project manager with a multi-million-dollar project has far more useable flexibility than has the CNM.

The result of this situation is that management cannot fulfill its assigned responsibility. Each senior management level is restricted by the $2 million limit and therefore cannot use

its resources in the most cost-effective manner. The alternative to following the original plan is to process a series of reprogramming requests through channels and thereby consume an inordinate amount of time. Good management is therefore not encouraged, with resulting frustrations and complaints by OSD and Congress.

Another problem area is the existence of a major barrier at the transition of projects from one funding category to another. Such problems are due to many factors, including those of organizational prerogatives and management attitudes. For each case of transition, management must initiate particular techniques to attack the basic problems inhibiting that case. A dominant class of such problems is the transition from exploratory development (6.2) to advanced development (6.3).

SECNAV Instruction 5430.67 assigned responsibility for 6.2 to the CND in order to build a fence around exploratory development, thereby preserving a strong technological capacity in the Navy. Implementation management of 6.3 was assigned to the CNM while responsibility for planning of the total RDT&E appropriation was assigned to CNO. With the CND and DCNM(D) positions filled by the same individual, the transition between 6.2 and 6.3 should not be inhibited by any organizational barrier. However, this is not the case, for OPNAV has retained the implementation management phase of 6.3 to itself and created this barrier. In addition, the definition of 6.3 has been distorted to where it is almost equivalent to 6.4 rather than being the category where the options are identified and explored for effective decisionmaking.

The current system does not permit a careful exploration of the options so that reasonable tradeoffs can be examined. Decisions are made too soon concerning a proper solution for a problem, and the various advocates take early, firm stands thereby placing decisions in concrete prematurely. Furthermore, OPNAV's desire to direct the development phase of the acquisition process inhibits their proper attention to the establishment of requirements and generates problems with management and utilization of resources.

(4) Recommendations

Recommendation R&D-15: A hierarchy of reprogramming authority for RDT&EN funds, such as $25 million for OSD, $10 million for CNM, and $5 million for Systems Commanders, should be established.

Recommendation R&D-16: A discipline of authority and responsibility for the program/budget planning processes consistent with the required balance between OPNAV (requirements) and NAVMAT (acquisition) should be established.

Recommendation R&D-17: A mechanism should be initiated for establishing firm guidelines to reduce the high degree of RDT&E funding instability that currently exists.

Recommendation R&D-18: CNO should assign management responsibility for 6.3 to the CNM in the same manner as CND/DCNM(D) currently controls 6.2 programs in order to better integrate the exploratory and advanced development efforts.

Recommendation R&D-19: Budget execution procedures should be changed as proposed in CNM memos to ASN(R&D) dated 21 March 1966 and 14 April 1966. In the interim, the authority delegated to the CNM by ASN(R&D) memo dated 10 May 1966 concerning allocation of RDT&E funds to the Naval Material Command to direct below-threshold changes for DOD categories 6.2 through 6.6 should be implemented. (These memos are contained in Appendix R&D-K.)

Recommendation R&D-20: The threshold requirement for RDT&E RAN/D&Fs under exception 11 (Title 10, U.S.C. 2304) should be increased from $100,000 as called for in ASPR 3-302 to $1 million.

Recommendation R&D-21: The ASN(R&D) staff should be involved early in the planning of an R&D project when a RAN/D&F will be required, thus avoiding unexpected delay.

6. RDT&E MANAGEMENT PRACTICES

(1) Role of Industry

1. Statement of the Issue

Should the Navy change its design philosophy, specification procedures, and acquisition practices to increase the use of commercially available equipment and to take advantage of techniques, components, or repair principles that have proven effective and profitable in industry?

2. Background

In examining the factors contributing to cost growth in military procurements, previous studies have identified the inappropriate use of standards or specifications as a fruitful area. As early as 1935 this was recognized by the Secretary of the Navy.* More recently the topic has been given new emphasis in conjunction with attempts to apply the design-to-cost principles advocated by the Blue Ribbon Panel.

The most significant facets of the issue are exposed by the following questions:

- Does the Navy's method of applying military specifications and standards to specific programs through the entire acquisition process permit a realistic application of design-to-cost practices by the supplier and customer?

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* Navy Department General Order No. 2, May 13, 1935.

- Do the Navy's current procedures as practically applied to the creation, change, review, and approval of military specifications and standards produce the appropriate response to cost-effective changes taking place in manufacturing technology of components and equipments?

The Navy's design philosophy and acquisition practices as currently exercised do not exploit fully the cost savings inherent in using commercially available equipment as the preferred choice, and selective ruggedization rather than complete militarization where possible. It is particularly important to recognize powerful biases against this approach built into the present procurement system. The boilerplate approach to listing all possible applicable military specifications and standards in procurement documents is one example.

The design of new equipment should take advantage of techniques, components, or repair principles that have proven cost-effective in commercial products. Worthwhile innovations are inherent in recent developments in solid-state microelectronics (chips, cards, and microprocessors) as detailed in the Electronics-X report.* Here such issues as the future use of standard electronics modules, the Navy's position on software languages, and the decentralization of future shipboard computer systems are involved.

It has been observed both in shipbuilding and in microelectronics that industry, the Navy's ultimate producer of hardware, is showing decreasing enthusiasm in conforming to rules for design and inspection that do not reflect recent changes in technology and in maintenance philosophies such as the ARINC** approach, particularly in those fields where

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* Electronics-X report, AD-783007, prepared for the Advanced Research Projects Agency (ARPA), January 1974.

** Aeronautical Radio Inc., which provides communication specifications and hardware and operates and maintains a worldwide network for the air transport industry.

military equipment is already a small part of their business base. This situation is not likely to improve. The fraction of the Gross National Product going into military equipment is on a long-term decline, and the industrial uses of technologically advanced hardware exhibit a long-term growth trend. In the long run, either the acquisition of military equipment will have to accommodate to these constraints, or sufficiently high prices will have to be accepted to keep the military specification suppliers as specialty houses.

Under the present system, waivers are often granted after lengthy and costly representation. Despite the existence of a value engineering program, there are presently no effective incentives built into Requests for Proposals (RFPs) or contracts to elicit industry's ideas as to how the best use can be made of commercial practices without jeopardizing needed military reliability and maintainability.

RFPs should insist that tradeoffs be presented showing advantages or disadvantages and possible cost savings accruing due to use of best commercial practices versus military specifications (MILSPECs). These tradeoffs should be included as an item in the source selection criteria and continued refinement should be incorporated in the contract. Emphasis should be changed from "why" to "why not" use best commercial practices.

Obviously, any change from current rigorous applications of military specifications and standards would have an effect on the Navy integrated logistic support (ILS) practices and procedures. Great care must be taken in examining these effects to avoid overstatement of the benefits or costs. Not only is the determination difficult to make, but it involves well established organizations, their historical way of doing things, and their anticipated workload.

The use of warranty contracts with industry has been suggested and should be considered for future acquisitions. Trial efforts in this area seem to be underway, but it would be well to pursue these on a broader front with increased emphasis on a plan and with a schedule for attainment of the end objective and a system for tracking the costs.

3. Study Approach

To investigate the role of industry in the acquisition process, the R&D Panel first examined the Electronics-X study recommendations and the Army Materiel Acquisition Review Committee (AMARC) contractual innovations for consideration by NMARC and possible adoption by the Navy. The Panel then identified areas where new technology trends might warrant setting up new rules and solicited inputs from the ILS community on new ways of involving industry in repair and maintenance. They also examined the recommendations of the Cost Study of Unreasonable Contract Requirements for possible adoption by the Navy. The Panel then generated recommendations appropriate to the NMARC study.

4. Conclusions

The R&D Panel has reached the following conclusions:

- The costs for new equipment of all types are being inflated by an acquisition system that does not, in practice, select only those military specifications and standards that are essential to the acquisition of a product that performs the basic requirements at a minimum total cost.

- The Navy (and all of DOD) has a large and elaborate system for the creation, change, review, and approval of military specifications and standards. This system has grown steadily in size, and its product—military specifications and standards—as used in the acquisition of equipment has grown to some 40,000 items. These items are cross-referenced, and interrelated, often in conflicting ways, such that perhaps no one individual or even a group of individuals can comprehend their full impact on relatively simple equipments. These documents also contain very substantial amounts of "how to" detail, which does not belong in a contract. It is not likely that the system, left on its own, will correct the problems created by these characteristics of present military specifications and standards.

- Particular attention should be paid to changes required in military specifications and their application in relation to the use of large-scale integrated circuits and other similar advanced-technology solid-state devices.

- Warranties should be pushed when economical, where the equipment is suitable, and when an appropriate supplier base is available.

- Greater use should be made of ruggedized (versus militarized by MILSPECs) commercial equipment.

- Current contractual modes for small equipment development do not appear to offer enough flexibility to enhance the use of best commercial practice in product design.

5. Examples of Cost Bias Introducted by Military Specifications

Most military specifications are written to provide general requirements meeting a wide variety of needs. As a consequence, they always require some interpretation for the specific area in which they are to be used. It is usually this latter characteristic that has the greatest effect on costs. In many cases insufficient thought is given to the specification before it is made part of a larger systems specification and applied across the board without noting exceptions to those portions that are not applicable to the specific system under consideration. Misapplication is one of the major shortcomings of military specifications. When military specifications are substituted for good design and systems engineering, the cost to the Government increases.

The specifications indicated below are representative of typical specification problems that have been encountered on recent shipbuilding programs.

(1) MIL-STD-901C, Shock Test High-Impact (HI) Shipboard Machinery, Equipment and Systems Requirements for

In general this specification does not relate appropriately to modern techniques for structural design and analysis. The methods currently used in the aircraft industry for specifications of structural loads and design criteria should be adapted to the shipboard equipment problems. The modern specification and design of high-rise structures or nuclear power plants in seismically active zones is an example of a similar transfer of technique.

(2) MIL-STD-740B, Airborne and Structureborne Noise Measurements and Acceptance Criteria of Shipboard Equipments

For most machinery, the testing defined by this specification will not verify whether the noise requirements will be met in the ship installation. Noise measurements can only be made effectively in the final installed environment. A component or subsystem contractor may be required to perform this test to satisfy the design specification only to find later that, once installed in the ship, the equipment does not meet the requirements. This type of problem is generally the result of a misapplication of the specification.

(3) MILSPEC MIL-E-16400F, Electronic Equipment. Naval Ship and Shore: General Specification

This specification is basically for electronic equipment. However, many times it is imposed in a contract in toto including the mechanical equipment, in which case Defense Contract Administration Services (DCAS) people require compliance with every detail. This is costly and either unnecessary or not applicable in the case of mechanical equipment.

(4) MIL-STD-108, Definitions of Basic Requirements for Enclosures for Electric and Electronic Equipment

The section of this specification on drip-proof enclosures is ambiguous. In essence, it requires there be no water found within the cabinet after the test. However, in some cases, water may accumulate in areas that are not relevant to performance. Nonetheless, corrective action and retest are required by the specification. Since electronic equipments on warships are located in controlled inside spaces, it would follow that use of commercial practices in lieu of MILSPEC design would reduce cost without jeopardizing performance.

(5) MIL-STD-454C, Standard General Requirements for Electronic Equipment (Requirement 12, Paragraph 12, Screw Lengths)

This section sets a minimum for the exposed portion of a screw above its nut of 1-1/2 threads. Tolerance buildup within bolted sections can cause this minimum not to be met, requiring that several screw sizes be kept on hand during assembly. A minimum or maximum exposed thread length should be determined by the specific application. Additionally, Military Standard (MIL-STD) bolts and nuts are called out in MILSPECS that are in most cases identical to commercial grade and much more expensive due to the requirement for vendor qualification and screening.

The draft specification, MIL-E-28900 (Navy), General Specification for Naval Multiplatform Electronic Equipment, illustrates the tendency of military specifications to drive the design toward the high end of the cost spectrum. This bias is introduced most commonly by use of the phrase, "Unless otherwise specified in the individual equipment specification this equipment shall ...," followed by a specification requirement that safely covers the severest class of service. Thus the specifications are written to encourage

overspecification unless the PM specifically arranges for a detailed, paragraph-by-paragraph, review and revision of the military specification's applicability to his program.

Industrial firms, while competing for a program, are very reluctant to conduct this careful determination of minimum requirements and to request the appropriate waivers. They do not have enough time and they fear their proposal will be deemed unresponsive or given a low score by the customer's specialists in charge of the area in question, unless tradeoffs are required by the RFP and/or included in the source selection criteria.

The industry review process for military specifications, in draft form, should be intensified to provide a more realistic cost-sensitive feedback to the Government agency responsible for the specification.

Reviews are ordinarily conducted by specialty groups, both in Government and in industry, who work almost exclusively with military specifications rather than hardware design or manufacturing in the broadest sense. Their orientation toward cost-sensitive aspects of the specification is not always as good as it might be, especially because they are conditioned by repeated exposure to the MILSPEC way of doing business. Also, the time allowed for the review is often too short. In the case of MIL-E-28900 (Navy) cited here, the net time allowed for the individual actually performing the review was 10 calendar days. Even a specialist in the specification side of the business can make only a cursory contribution in such a short time.

It has been held that the Department of Defense agencies responsible for specification are not receptive to changes proposed by industry that may increase the risks in meeting a requirement. Although this is quite understandable, the creation of the lowest cost design for a given requirement calls for assumption of some risk provided that rewards or penalties to both Navy and vendor are well understood.

MILSPECs, and MIL-E-28900 is no exception, have far too many paragraphs devoted to material that either belongs

in a design guideline handbook or is better left completely out. These guideline paragraphs eventually become part of the contract. As such, they must be interpreted by the contractor's design and production engineering activities and the Government's source inspectors. At each step of this process, a subjective judgment must be made concerning what is acceptable. The safe, and usual, course is to avoid the new and potentially controversial design or manufacturing process. Thus we have a system that tends to continue costly features or processes in situations where they are really not necessary.

Appendix R&D-H, entitled "Cost Savings Through Commercial Practices," summarizes portions of the Electronics-X report that the Panel wishes to highlight.

6. Recommendations

Recommendation R&D-22: RFPs and ensuing contracts should require cost-reducing tradeoffs where feasible between the use of best commercial practice and MILSPEC requirements, and such tradeoffs should be considered in the source selection criteria.

Recommendation R&D-23: Mechanical, electrical, and environmental interface standards for each unit should be included (or prime contractors should be required to include them) as a part of military electronic equipment specifications. This will facilitate future design and price competition and provide for replacement of old designs by new-generation equipment through interchangeability of similar equipment intended for similar applications.

Recommendation R&D-24: A policy should be promulgated requiring that the Navy take steps toward assuring that new electronic equipments that are likely to replace older equipments in aircraft, ground vehicles, and other platforms will be made with form, fit, and function interchangeable with the older equipments without costly modification unless the life-cycle cost benefits of a different new equipment clearly outweigh the cost of such modifications.

Recommendation R&D-25: Tradeoffs should be made between providing a more benign standard environment of humidity and temperature control and shock and vibration isolation to facilitate use of cheaper and more readily available devices compared with full compliance with current MILSPECs. Strict military environmental requirements imposed on equipment and systems cause great increases in cost.

Recommendation R&D-26: Multiple developments of equipments conforming to interface specifications should be obtained. Where the potential market for the equipment is large enough, industry-financed development should be encouraged; otherwise, multiple developments should be procured under Government contracts, giving due regard to unique Navy logistic problems.

Recommendation R&D-27: A specification review task force should be established to design a technique for effective specification scrubbing and tailoring to specific procurements. The task force should be principally drawn from outside the specifications organizations. The end product of the task force would be a simple, unambiguous procedure for scheduling, staffing, and executing contract specification tailoring and removing superfluous and other unwarranted features found to increase costs.

The R&D Panel sees merit in an extension of the use of commercial warranties on military equipments where feasible and economical. This would be a next logical step beyond the current trial use of reliability warranties.* To this end, the Panel makes the following additional recommendation:

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* Joint Memo, DDR&E Currie and ASD(I&L) Mendolia, dated 14 August 1974; subject: Trial Use of Reliability Improvement Warranties in the Acquisition Process of Electronic Systems/Equipments—action memo.

Recommendation R&D-28: Initially, long-term contractor maintenance warranties should be applied, where economically practical, to equipment in which failed units can logically be replaced in the field and conveniently returned to the contractor's plant or base for repair without compounding logistic problems or to which the contractor can have ready access for field repair, such as: airborne communication, navigation, and identification equipment; modular radars and vehicle communication sets; complex manpack equipment such as LORAN C/D; forward-looking infrared (FLIR) systems; and domestic communication, data processing, and radar installations.

(2) Long-Range R&D Planning

1. Statement of the Issue

The necessity for planning for the Navy in both the near and long range as expressed in the CNO Planning and Programming Guidance (CPPG) and the CNO Program Analysis Memoranda (CPAM) process is strongly reaffirmed. The question is the balance between requirements pull and technology push. Statements such as the one in OPNAV Instruction 5000.42, paragraph 6.d., that "the R&D plan consists of science and technology objectives and approved operational requirements" do not reveal the desired balance, nor do they specify how the information on both technical threat and technological leadership opportunity is considered in the requirements process. There is also evidence that the planning is disproportionately spread between OPNAV and NAVMAT and, for some missions, is not integrated into a comprehensive long-range plan. Balance is needed such that OPNAV sets objectives for both requirements and costs and that NAVMAT plans the technical and financial means needed to fill those requirements.

2. Analysis and Discussion

The R&D Panel has observed that, while the Navy's planning process is detailed in a number of instructions and

planning guidance memoranda, it is not being adequately implemented and there is a lack of technical strength in the groups dedicated to long-range planning both in OPNAV and in NAVMAT.

The Panel welcomes the recent establishment of the so-called extended planning guidance (EPG) process that is to provide guidance for refining CNO long-range planning with regard to projections of future research and development and affordability of desired acquisitions. Its objective is that several Navy organizations (fleet users, systems analysts, and technology and acquisition experts) must be involved in this type of planning function, but there is concern that these inputs are not now synthesized in a sufficiently balanced and cohesive manner. This is apparent in such crucial technology areas as digital data systems and cruise missile defense.

The Navy cannot improve the acquisition process of weapons or data systems with the development time of 8 to 10 years unless its tools and experts in long-range technology, threat analysis, and budget forecast are greatly improved. This will include taking stock of its current assets, extrapolating into the future a variety of ultimate acquisition strategies, and examining both the financial positions and the military capabilities. For example, in introducing new acquisition concepts such as the high-low mix for combatant ships, the Navy must be able to demonstrate full awareness of the consequences projected through the useful life (10 to 30 years) of a major asset, both material and personnel.

Long-range planning can be logically divided into two generically different types, and it is appropriate to affiliate one type with the OPNAV and the other type with the NAVMAT organization. Thus, two separate long-range planning groups are visualized, organizationally separate but working together in a balanced, complementary fashion. And indeed, the give-and-take that should occur between the two long-range planning groups in exchanging information on requirements and potential solutions is precisely the user-supplier principle at work in the long-range planning area.

The functions of CNO and CNM under General Order Number 5, prior to its revision in 1968, are highlighted below as related to planning. The CNO is required to express the material needs of the operating forces of the Navy to the CNM. The CNM is required to advise the CNO as to the economic and technological feasibility of meeting such needs. The CNM is also required to keep CNO informed of new capabilities to meet needs that may not have been expressed. CNO will select the work to be done to satisfy the needs of the operating forces based on feasibility data and their current estimates of military worth of a particular need in relation to other desirable needs. Selection of the work to be done includes the curtailment or cancellation of work already in progress in favor of work that offers greater promise or greater military worth.

As stated in Section 3, the principal purpose behind General Order Number 5 was to establish a reasonable balance between two principal functions—the establishment of requirements, and responses to these requirements via the acquisition process. The R&D Panel concluded there is a need to reestablish this balance because the OPNAV side of the house has expanded beyond the establishment of requirements into specifying how work necessary and appropriate for meeting the requirements shall be accomplished. There is a concomitant need to ensure that OPNAV, specifically OP-090, Director, Navy Program Planning, is performing long-range planning and restricting itself to requirement areas, such as, for example:

- Survey of Navy capital assets and manpower levels
- Catalog of Navy time-phased operational needs; this should include near term and extend out 30 years (the life of ships in the fleet)
- Correlation of planning results with long-range funding implications.

3. Findings and Conclusions

The R&D Panel finds extensive planning activities in various parts of the Naval Material Command and in OPNAV, but the sort of planning done is not constrained in a way that is consistent with the NMARC recommendations concerning proper balance between user and supplier. Thus, for example, there are staff planning activities in OP-095, Director, ASW and Ocean Surveillance Programs, and in OP-098, Director, RDT&E, that deal with the sort of technical assessment and planning that the Panel feels should be more appropriately a central part of the NAVMAT planning function.

Further, the Panel did not find evidence in either user or supplier communities of what it would consider adequate attention to corporate-level planning. This finding must not be construed as a Panel desire to have absolutely firm and very detailed plans out to the end of the suggested 30-year time period; indeed it is typical of corporate-level planning to allow for many alternatives, both technological and economic. Broad planning must allow for changes in operational conditions on the one hand, and technological opportunity on the other, combined with factors of national economics and DOD interservice balances and limitations.

4. Recommendations

Recommendation R&D-29: Parallel, long-range planning groups should be established in OPNAV and in NAVMAT.

Comment: The planning group in OPNAV would develop and maintain (1) a survey of capital assets and manpower, (2) a catalog of Navy time-phased operational needs, and (3) correlation of planning results with long-range funding implications. The planning group in CNM should develop profiles of importance for R&D compounded from

analysis and balancing of assets, needs, and estimates of probability of technological advance and innovation, and related matters. These two planning groups would operate in parallel. The OPNAV planning group would determine and state the requirements. The NAVMAT planning group would offer the acquisition alternatives based on known technology available for fulfillment of the requirements. The functions performed now in OPNAV that are beyond requirements and involve acquisition planning should be transferred to the CNM. These functions are currently being performed in OP-095 and OP-098.

(3) Personnel

1. Statement of the Issue

Proper utilization of personnel is of utmost importance to the conduct of R&D. In this regard the Panel was obliged to consider whether improvements could be made in current military or civilian personnel policies.

2. Study Approach

The subject of technical personnel arose at each discussion with field personnel during the visits with laboratories and center management. As a part of each interview and question period following briefings, the level of technical competence required to maintain a superior Navy was discussed. Each paper reviewed by the R&D Panel was specifically analyzed to determine technical personnel needs, existing capability, and ideas for maintaining high-level technical competence in the Navy R&D community.

3. Discussion

Without the employment of sound management principles in the selection, training, motivation, and direction of high-quality personnel, the best of organizations and intentions can, and probably will, fail to achieve their goals. In an R&D organization there must be an assurance of continued technical competence through training and career development of onboard personnel and proper staffing of technical billets as vacancies occur. The R&D Panel paid particular attention to the recent capability analysis and plans made by the Director of Navy Laboratories (DNL), and a review was made of present management policy guidelines. DNL strategies pertaining to laboratory personnel are:

- Identify top performers; give them key jobs
- Identify marginal performers; move out of key positions into jobs structured to match their abilities; offer opportunities for change, growth, and renewal
- Develop a plan for career development, personnel assignments, and advancement for professional civilians.

Present policies must be formulated in light of current realities. These include decline in headquarters technical personnel, aging, some job dissatisfaction in middle-management levels, difficulty of reassigning poor producers in civil service, absence of a well developed professional career pattern, and insufficient attention devoted at headquarters level to civilian personnel development and utilization.

Presently proposed actions concern removal of constraints on salaries of top people and the development, on a pilot basis, of a means for improved rotation of civilians within laboratores, within Systems Commands, and between laboratories and Systems Commands.

Two items of interest continued to arise in each discussion of personnel management. First, the lack of flexibility that the laboratory manager has in control of his

personnel ceilings is a serious problem. Although mechanisms exist for the increase or decrease of personnel in response to job demand, the presently imposed ceiling restrictions are inflexible, and no laboratory director can afford to release billets, since he knows they can only rarely be regained. This issue is intimately involved with the shrinking size of DOD, of course, but stands by itself as a separate problem. It is insufficient to ascribe this condition simply to the overall DOD policy of force reduction.

Second, the ability of the naval technical community, laboratories, and headquarters to attract high-quality personnel is somewhat coupled to the ratio between industry and Government pay scales. The principal problem for Navy laboratory management appears to lie at the upper end of the pay spectrum. The commercial equivalent to the Navy laboratories' technical directors, for example, is often compensated at 150 to 200 percent of the Government salary rate.

The Panel was favorably impressed with the general dedication and quality of the personnel in the Navy system, especially in view of the circumstances. It is clear, however, that continued salary inequity of the present magnitude cannot long continue without highly adverse effects upon the capability of the Navy RDT&E system.

The Panel concurs with the findings of the Blue Ribbon Defense Panel Report concerning officer rotation and career plans as quoted:

> From the point of view of the position to be filled, as well as in the best interests of the officer himself, his job assignments should be of sufficient duration, so that he can become thoroughly involved in the work and be fully responsible for results.
>
> There is merit in giving to officers opportunities in a broad spectrum of military responsibilities. Nevertheless, under existing conditions in which technical or professional training in areas other

than commanding men have become of increasing importance, the Services' current rotation policies and rates are counterproductive.

One solution is to change the rules for career advancement, rather than try to conform the requirements of the job to an arbitrary set of rotation and promotion rules. This is particularly true in the technical and professional areas.

Specialist careers should be established for officers in such staff, technical and professional fields as research, development, intelligence, communications, automatic data processing, and procurement.

The duration of assignments should be increased, and should be as responsive to the requirements of the job as to the career plan of the officer. Officers continued on an assignment for these reasons should not be disadvantaged in opportunity for promotion.

Military career development includes a variety of career plan options, each with a set of desired assignments. This pattern has grown rather rigid in recent years, however, to the point that each Navy job has an unidentified, but generally well known "career enhancing" value. Troublesome to the Panel are indications that assignments within the supplier side of the Navy are frequently considered "second team" duty by the regular line naval officers.

4. Findings and Conclusions

The civil service system tends to discourage mobility, with a great tendency for poor performers to remain in an organization for a long time. As a result, these individuals gain seniority and tend to be elevated to senior positions without having demonstrated the necessary capabilities. This is not a new finding, but the R&D Panel cannot resist noting the personnel problems created thereby in the Navy scientific and technical community. Navy management, particularly in R&D, must recognize this problem and utilize initiative to move top performers, both civilian and military, to the key jobs whenever appropriate.

The Department of Navy has several official programs labeled "Career Development" that send individuals to formal courses at universities, Civil Service Commission (CSC) schools, and special sessions, for instance the NAVAIR Executive and Management Development Program, a description of which is included as Appendix R&D-I.

However, the Panel finds such assignments are not consistently part of organizational or individual career development programs. For example, people sent to the Industrial College of the Armed Forces, Harvard Business School, and Federal Executive Institute are often inspired and broadened by the curriculum and their exposure to other senior personnel. However, they are then returned to their old positions with little opportunity for using their newly acquired capabilities. Another aspect of the present practice is an insufficient emphasis on grooming sufficient "heirs apparent" for senior civilian positions, as is done in industry. If this were to be done, top performers could regularly be trained to step into advanced positions with better competence and continuity. The problem appears to be related to a degree of insecurity on the part of the senior officials on the one hand, and requirements of the "merit" promotion system on the other.

The Panel did not find it appropriate to study the question of matching the size of the laboratory work force to the Navy's needs. The Panel believes that the general ills of the RDT&E process, as discussed elsewhere, cause inefficiencies in laboratories as well as in headquarters and, therefore, that an improvement in output and/or a reduction in manpower is theoretically possible. In general, however, the Panel concurs with the Hazen Committee that reductions in manning of the laboratories offers no guarantee of money savings to the RDT&E function of the Navy. Any conclusion about reduction in the size of the work force must rest on a detailed analysis under the DNL, function by function, of each laboratory with consequent decisions about what functions can either be terminated or transferred elsewhere.

The R&D Panel finds the policies for planning and use of laboratory resources being pursued within the existing constraints by the Director of Navy Laboratories to be of significant potential value.

The Panel finds that the Navy practice of joint military/civilian management of its laboratories is an essential feature in promoting the necessary coupling of the laboratories to the fleet and the material community. It has worked to the Navy's advantage in the past and should be continued. The assignment of officers with recent operational experience to the laboratories is in theory valuable, but care is necessary in making sure that their duties in the laboratories are well matched to their interests and abilities. The number of technically trained officers assigned to the laboratories is felt to be too small, and the Panel viewed with concern the apparent lack of attractiveness of such assignments and the unfavorable promotion pattern of officers so assigned.

The number of recent retirements from the laboratory work force has been very large, with a consequent loss of corporate experience. Although the replacement of the retirees with younger scientists and engineers has distinct advantages in terms of making sure that the laboratories remain abreast of the latest technology, there will be practical problems in developing in these younger people the depth of understanding and loyalty to the Navy that was characteristic of those who have been retiring. Further, recent policy decisions forcing an artificial reduction in the number of GS-13 through GS-15 employees will be counterproductive in recruitment and maintenance of quality in the work force.

Finally, the R&D Panel finds a need for increased discipline in the execution of ongoing programs and compliance with previous recommendations in the personnel area.

5. Recommendations

Recommendation R&D-30: The practice of joint military/civilian management of Navy laboratories embodied in the concept of a commanding officer and a civilian technical director should be continued.

Recommendation R&D-31: Top military and civilian performers should be matched to the key jobs in the R&D management structures of ONR, NAVMAT

headquarters, SYSCOMs, and the laboratories. Military jobs must be identified and treated as career-enhancing billets in the naval personnel selection process. Care must be taken to remove the artificial penalties that have become attached to the R&D functional billets (that are not project management) of the laboratories and headquarters, since these penalties undermine the important matrix support of Navy projects.

Recommendation R&D-32: Revision of military assignment/tour lengths to provide substantially longer terms, where appropriate to professional specializations, should be continued. Long tours should not be considered detrimental to officer promotion.

Recommendation R&D-33: Plans for career development, particularly for professional civilians, should be further developed and supported and should include increased utilization of lateral job mobility, as typified by the NAVAIR Executive and Management Development Programs. Utilization of "job-grooming" placements for top performing civilians from middle management should be increased.

Recommendation R&D-34: Immediate efforts should be made to remove currently imposed congressional restrictions on top-level Government executive salaries.

7. SUMMARY OF RECOMMENDATIONS

(1) Major Recommendations

Recommendation R&D-1: A proper balance should be established between OPNAV and NAVMAT in consonance with their respective primary roles of user and supplier.

Recommendation R&D-2: The authority of the Chief of Naval Material to control the RDT&E program funding, in categories 6.2 through 6.6,* under management supervision of ASN(R&D) should be clearly specified.

Recommendation R&D-7: The eight NAVMAT laboratories should continue to operate under the DCNM(D) only if NAVMAT is strengthened in accordance with recommendations R&D-1 and R&D-2. If the strengthening implied in these changes is not achieved, these laboratories should be transferred to Systems Commands. NRL should be retained under the command and management of CNR and the engineering, T&E, and service organizations under the SYSCOMs.

Recommendation R&D-10: The definition and elimination of undesirably duplicative efforts at two or more laboratories, as traced in the 1974 Hollingsworth report should be completed. Extraneous (non-mission-essential) product lines should be transferred to other CNM laboratories or NRL with the objective of further laboratory consolidation.

Recommendation R&D-11: Building on the skills available from RDT&E activities and Navy Programming Centers, a capability should be established to provide for systems integration of ship weapon system/command and control interfaces for the conceptual phases of a program and the late evolutionary phases.

Recommendation R&D-22: RFPs and ensuing contracts should require cost-reducing tradeoffs where feasible between the use of best commercial practice and MILSPEC requirements, and such tradeoffs should be considered in the source selection criteria.

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* See Appendix R&D-C, Section 7 for definitions of RDT&E program categories.

Recommendation R&D-27: A specification review task force should be established to design a technique for effective specification scrubbing and tailoring to specific procurements. The task force should be principally drawn from outside the specifications organizations. The end product of the task force would be a simple, unambiguous procedure for scheduling, staffing, and executing contract specification tailoring and removing superfluous and other unwarranted features found to increase costs

Recommendation R&D-29: Parallel, long-range planning groups should be established in OPNAV and in NAVMAT.

Comment

The R&D Panel emphasizes the need for action in several major areas. Primary is the need to reestablish proper balance between OPNAV and NAVMAT in terms of the user/supplier relationship.

SECNAV Instruction 5430.67 of 29 June 1964 and supplementary OPNAV directives have established a proper setting for the roles of OPNAV and NAVMAT. There has been a lack of exercise of the necessary discipline by management to maintain an effective demarcation between the requirements role of OPNAV and the execution role of NAVMAT. Inherent in this relationship must be the maintenance of adequate communication to assure a necessary dialogue.

Gradual erosion of the technology base effort has occurred under the present arrangement of funding authority, evidenced by the recent growth of a pseudo-category, 6.3A. Without effective control of the development program at a single point within the producer community, organizational barriers to the smooth progression of development will persist.

Long-range planning can be logically divided into two generically different types, and it is appropriate to affiliate one type with the OPNAV, and the other type with the NAVMAT organization. Thus, two separate long-range planning groups

are visualized, organizationally separate but working together in a balanced, complementary fashion. And indeed, the give and take that should occur between the two long-range planning groups in exchanging information on requirements and potential solutions is precisely the user-supplier principle at work in the long-range planning area.

(2) Other Recommendations

Recommendation R&D-3: The number of personnel in OPNAV devoted to the acquisition process should be reduced, thereby assuring staff concentration on the requirements role with the concomitant responsibilities for frequent evaluation of program responsiveness to fleet needs.

Recommendation R&D-4: Billets saved as a result of implementing recommendation R&D-3 should be reassigned to the Naval Material Command.

Recommendation R&D-5: The role of the Naval Material Command in the decisionmaking process should be emphasized, e.g., by increasing representation on the Chief of Naval Operations' Executive Board (CEB).

Recommendation R&D-6: To effect redress of the existing imbalance in organizational structure, serious consideration should be given to the placement of the position of CNM at the same level as the Vice Chief of Naval Operations (VCNO), reporting directly to the CNO.

Recommendation R&D-8: A central point of guidance should be established under DCNM(D) for coordinating the systems engineering efforts at the Navy laboratories and for expanding the systems engineering discipline within the Navy laboratory community. The objective of this new function shall be to broaden the Navy's capabilities for developing the alternatives and tradeoffs in platform and combat systems that are a prerequisite for the design-to-cost type of acquisition mode.

Recommendation R&D-9: A determination of which areas of future technology should be prosecuted by NRL in preparation for further exploitation by the CNM laboratories should be included in ASN(R&D) planning of the technology base.

Recommendation R&D-12: The most appropriate location and organizational arrangement for activities that provide the core of technical support for combat system design, integration, and test should be determined. This should provide for adequate feedback from test and evaluation and fleet operational experience to design and development activities.

Recommendation R&D-13: The development of practical means to negotiate the program of technology base work in the NAVMAT laboratories in major blocks so as to promote the clear assignment of product area responsibilities and expand the funding flexibility available to laboratory management should be accelerated.

Recommendation R&D-14: A discipline should be established that will ensure serious attention by laboratory management to providing technical input to the Navy's corporate technical planning process in their areas of product responsibility, matched by serious consideration of those inputs at the corporate level (CNM).

Recommendation R&D-15: A hierarchy of reprogramming authority for RDT&EN funds, such as $25 million for OSD, $10 million for CNM, and $5 million for Systems Commanders, should be established.

Recommendation R&D-16: A discipline of authority and responsibility for the program/budget planning processes consistent with the required balance between OPNAV (requirements) and NAVMAT (acquisition) should be established.

Recommendation R&D-17: A mechanism should be initiated for establishing firm guidelines to reduce the high degree of RDT&E funding instability that currently exists.

Recommendation R&D-18: CNO should assign management responsibility for 6.3 to the CNM in the same manner as CND/DCNM(D) currently controls 6.2 programs in order to better integrate the exploratory and advanced development efforts.

Recommendation R&D-19: Budget execution procedures should be changed as proposed in CNM memos to ASN(R&D) dated 21 March 1966 and 14 April 1966. In the interim, the authority delegated to the CNM by ASN(R&D) memo dated 10 May 1966 concerning allocation of RDT&E funds to the Naval Material Command to direct below-threshold changes for DOD categories 6.2 through 6.6 should be implemented. (These memos are contained in Appendix R&D-K.)

Recommendation R&D-20: The threshold requirement for RDT&E RAN/D&Fs under exception 11 (Title 10, U.S.C. 2304) should be increased from $100,000 as called for in ASPR 3-302 to $1 million.

Recommendation R&D-21: The ASN(R&D) staff should be involved early in the planning of an R&D project when a RAN/D&F will be required, thus avoiding unexpected delay.

Recommendation R&D-23: Mechanical, electrical, and environmental interface standards for each unit should be included (or prime contractors should be required to include them) as a part of military electronic equipment specifications. This will facilitate future design and price competition and provide for replacement of old designs by new-generation equipment through interchangeability of similar equipment intended for similar applications.

Recommendation R&D-24: A policy should be promulgated requiring that the Navy take steps toward assuring that new electronic equipments that are likely to replace older equipments in aircraft, ground vehicles, and other platforms will be made with form, fit, and function interchangeable with the older equipments without costly modification unless the life-cycle cost benefits of a different new equipment clearly outweigh the cost of such modifications.

Recommendation R&D-25: Tradeoffs should be made between providing a more benign standard environment of humidity and temperature control and shock and vibration isolation to facilitate use of cheaper and more readily available devices compared with full compliance with current MILSPECs. Strict military environmental requirements imposed on equipment and systems cause great increases in cost.

Recommendation R&D-26: Multiple developments of equipments conforming to interface specifications should be obtained. Where the potential market for the equipment is large enough, industry-financed development should be encouraged; otherwise, multiple developments should be procured under Government contracts, giving due regard to unique Navy logistic problems.

Recommendation R&D-28: Initially, long-term contractor maintenance warranties should be applied, where economically practical, to equipment in which failed units can logically be replaced in the field and conveniently returned to the contractor's plant or base for repair without compounding logistic problems or to which the contractor can have ready access for field repair, such as: airborne communication, navigation, and identification equipment; modular radars and vehicular communication sets; complex manpack equipment such as LORAN C/D; forward-looking infrared (FLIR) systems; and domestic communication, data processing, and radar installations.

Recommendation R&D-30: The practice of joint military/civilian management of Navy laboratories embodied in the concept of a commanding officer and a civilian technical director should be continued.

Recommendations R&D-31: Top military and civilian performers should be matched to the key jobs in the R&D management structures of ONR, NAVMAT headquarters, SYSCOMs, and the laboratories. Military jobs must be identified and treated as career-enhancing billets in the naval personnel selection process. Care must be taken to remove the artificial penalties that have become attached to the R&D functional billets (that are not project management)

of the laboratories and headquarters, since these penalties undermine the important matrix support of Navy projects.

Recommendation R&D-32: Revision of military assignment/tour lengths to provide substantially longer terms, where appropriate to professional specializations, should be continued. Long tours should not be considered detrimental to officer promotion.

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Recommendation R&D-34: Immediate efforts should be made to remove currently imposed congressional restrictions on top-level Government executive salaries.

Comment

The recommendations summarized in this section are considered to be necessary details to be addressed in implementation of the major recommendations. The reestablishment of the user/supplier balance would involve shifts of both billets and expertise between OPNAV and the Naval Material Command.

In addition to shifts of planning, financial, and technical analysis billets, the technical engineering and scientific personnel performing R&D work in the Naval Material Command need constructive modifications in their mode of operation.

The R&D Panel addressed in some detail the problem of MILSPECs, applicability of warranties, and ways and means to take advantage of good commercial practice. The electronics industry was chosen as the best example to make inroads into the excessive costs for hardware and software due to the inappropriateness of specifications applied.

Laboratory personnel needs are being addressed by DNL who is pursuing actions dictated by regulations, instructions, and directives now in being. The Panel placed emphasis on discipline required to carry out existing policy in a constructive manner that will improve career patterns.

The funding recommendations represent the R&D Panel's position on the problem of responsibility and authority (funding) being disassociated. The R&D Panel believes implementation of detailed funding recommendations is necessary to accomplish the needed improvements indicated by the major recommendations listed in subsection (1) of this section.

REFERENCES

1. Hazen, David C., Chairman, Report of the Naval Research Advisory Committee, "Ad Hoc Sub Committee for the Study of Navy Laboratory Utilization," August 1974.

2. Hollingworth, G. L., Chairman, "A Review of Laboratory Missions and Functions," for the Office of the Chief of Naval Material, August 1974.

3. NAVMAT Instruction 5040.2A, "Project Management Reviews," 11 April 1972.

4. DOD Directive 5100.1, "Functions of the Department of Defense and Its Major Components," 31 December 1958.

5. OPNAV Instruction 5450.165, "Tasks and Functions of the Oceanographer of the Navy," 26 August 1966.

6. Major Organizational Considerations for the Chief of Naval Operations, Organization Resources Counselors. Inc., May 1973.

7. Reich, Vice Admiral Eli T., USN (Ret.), "A Survey of the Navy Shipbuilding Claims Problem," report to the Deputy Secretary of Defense, July 1974.

8. Travel Report Regarding DD 963 Composite Integration Test of Command and Control Shore Station, memo for Rear Admiral C.M. Hart, 4 November 1974.

IV. TEST AND EVALUATION PANEL

The Test and Evaluation Panel undertook to review and assess the policies, practices, and procedures utilized by the Navy and Marine Corps for conducting the test and evaluation (T&E) of systems, equipment, and material during all phases of the acquisition process. In establishing a course of investigative action, a few precepts were identified to provide a basis for measurement.

T&E is obviously a necessity to insure receipt of the best possible military equipment. However, it is evident that quality cannot be tested or evaluated into a product. Reliability, or quality, must be built in by sound and appropriate concepts, requirements, and design; by proper execution of the concept through good engineering and testing; and finally by the use of the most appropriate materials, equipment, and production methods. Experience has shown that to develop well engineered systems it becomes necessary to test and evaluate throughout the entire acquisition process, essentially in five basic areas:

- Prior to final selection of materials and equipment and their applications
- During the engineering design phase
- During the component or subsystem assembly
- During trials or inspections that are conducted to determine specification compliance
- And finally, operationally to determine performance, limitations, and effectiveness against the threat which generated the requirement.

T&E, then, is a continuum from concept through development, production, and service life until the equipment is finally surveyed from use.

In the Panel's contacts and briefings, one thing became abundantly clear; the Systems Commands, the "doers" in the acquisition chain, have been denuded of talent to feed the layers of supervision which in recent years have been superimposed above them. Some way must be found in the Defense organization to decentralize, to get lines of authority, responsibility, and accountability clearly established; and to restore talent to the ranks of the providers of material.

1. BACKGROUND

(1) History

Past Navy test and evaluation precepts, as part of its acquisition process, have included most of the presently stated policies of the Office of the Secretary of Defense (OSD). The Board of Inspection and Survey (INSURV) began formally inspecting ships and their weapons systems about 1840 and became a legal body in 1882.

Two decades ago approval for service use (ASU) was directed by OPNAV Instruction 4720.9 of March 1955. This directive called for prototyping and evaluation by an independent agency where military characteristics or performance of ships and aircraft were affected. The criteria for approval for service use were defined in several revisions to this instruction, the latest dated 23 August 1974 (OPNAV Instruction 4720.9D).

Historically, acquisition was through a "class desk" or "type desk" in the Bureaus. This "class desk" provided for life-cycle (cradle-to-grave) support in one office. Development testing was under the material Bureaus which were responsible for demonstrating, through technical evaluation, a high probability that the system would perform to specification in its intended operating environment.

An independent test agency (currently titled the Operational Test and Evaluation Force (OPTEVFOR) and reporting directly to the head of the Service, the Chief of Naval Operations (CNO)) has been conducting operational testing since WW II. Tactically oriented at first, OPTEVFOR has for the past 20 years conducted operational evaluations of new systems as a part of the Navy's acquisition process.

DOD Directive 5000.1 (July 1971), which establishes policy for weapon systems acquisition program management, turns away from the total package procurement approach established by a previous Administration. It emphasizes responsible program management, which is regulated by overt decision milestones. Navy compliance is directed in SECNAV Instruction 5000.1, which implements the general OSD policy within the Navy. DOD Directive 5000.3 (January 1973) deals with test and evaluation.

(2) Current Status

With respect to Navy T&E policy, DOD Directives 5000.1 and 5000.3 had minor impact. OPTEVFOR was named the Navy's "independent test agency" and its Commander was assigned additional duty to the CNO as an Operational Test and Evaluation (OT&E) advisor. A secondary function of the OT&E advisor is to coordinate the demands for test resources (ranges, fleet services, targets, etc.) and to aggregate long-range requirements so that rational planning can be accomplished. This is intended to facilitate the use of development testing facilities to serve operational evaluation needs.

Although Navy T&E policy was thus established, the Panel finds that the Navy does not consistently adhere to directed practice. For example, because of waning budget or firmly prescribed Initial Operational Capability (IOC) dates, tests and evaluations have been postponed, partially performed, or cancelled.

2. MAJOR ISSUES EXAMINED

The Panel was impressed with the breadth of the Navy's mission. Its complexity is great. To fulfill that mission, expertise is required on the surface, under the sea, in the sky over the sea, in space, and with the amphibious Marine Corps, across the beaches of the world.

In judging the quality of operational testing, the Panel finds the Fleet Ballistic Missile Strategic Force (the Polaris and Poseidon submarines) to be the most thorough in planning, scheduling, and execution. The mobility of the seagoing strategic force allows a Polaris/Poseidon submarine to be ordered in to a tender or base to replace tactical warheads with instrumented warheads of any of her missiles.

These missiles are chosen by lot. She is then ordered to proceed to a particular spot in the ocean and directed over tactical communications circuits to fire into an instrumented target area where accuracy of impact can be measured in feet. Here is operational testing at its best.

The aviation arm of the Fleet, in the opinion of the Panel, is considered next best to the strategic force in terms of quality of testing. Here one finds that recent battle experience in the skies over Vietnam has left a sense of urgency. There is a commendable effort to get the best possible equipment, airplanes of performance adequate to ensure local air superiority over a fleet at sea, and to give a fleet that great striking power which is the hallmark of carrier aviation. Testing facilities are good at Naval Air Test Center (NATC), at Pacific Missile Range (PMR), and in other locations under the purview of the Naval Air Systems Command (NAVAIR). The peculiarities of arrested landings and catapult takeoff, as well as the entire envelope of airplane performance, can be tested by thorough professionals graduated from the Test Pilot Training School at Patuxent River—an institution which enjoys a worldwide reputation for excellence and which has provided training for eleven of our astronauts.

Lagging the submarine and air forces and therefore in need of the most attention are the surface ship and surface ship weapon systems. The Panel believes that this is an outgrowth of operations conducted during two past wars (Korea and Vietnam) in a comparatively benign surface and subsurface environment.

The Panel reviewed a wide range of T&E-related issues and considers that increased emphasis should be placed in the following categories of the Navy test and evaluation continuum:

- Realistic Operational Evaluation
- Test and Evaluation Planning
- Test Resources
- Combat Systems Integration.

In researching these topical areas, the T&E Panel reviewed pertinent directives, received presentations from concerned personnel, and made several visits to test and evaluation activities to gain an insight into current problems. Appendix T&E-A summarizes the Panel's activities. The T&E Panel has no specific recommendations relative to the Marine Corps or to Marine Corps peculiar

equipment. Except for a very few equipments, such as the amphibious LVTP-7, the Marine Corps obtains its equipment from the other Services and places a liaison officer with the Project Manager to ensure that suitability for Marine Corps use is achieved. The independent agency for Marine Corps operational testing is the Marine Corps Development and Education Center (MCDEC) with headquarters at Quantico, Virginia.

3. REALISTIC OPERATIONAL EVALUATION

As stated above, the Navy's readiness is directly related to recent combat experience. The Panel considers that material testing, as well as the development of tactical procedures, should be done in a threat environment. Further, the Panel is concerned with the difficulty of conducting Navy business under the significant burden of DOD and congressional over-management which may be a factor in diverting attention from addressing the real threat.

(1) Statement of the Issue

The Navy must first recognize the threat (existing and forecast) and, secondly, subject new requirements, engineering decisions, and testing requirements to careful scrutiny in evaluations under hostile-like conditions. Likewise, the most beneficial training which the Navy can undertake in peacetime is test and evaluation under the best possible threat simulation.

(2) Study Approach

In the study of cases, discussions concerning the Operational Evaluation of the MK86 Gun Fire Control System revealed that despite the fact that the system was highly susceptible to a threat environment, the Navy (to avoid a ship delay) procured the system. Alternative modes, however, are in development as a result of the reported deficiency. Similarly, basic communications data systems, upon which the Navy bases training, tactics, and concepts of group common defense, are also susceptible to a threat environment. There are cases, however, where the Navy is improving the realism of testing. Examples are in the planned tests for the Close-In-Weapons System (CIWS),

the amphibious assault ship (LHA) operational evaluations utilizing Marine Corps forces, and the "Six-on-Six" demonstration of the F-14 weapon system. Certain joint tests currently planned under the direction of the OSD Deputy Director (Test and Evaluation) (DEPDIR(T&E)) will also test multiple force actions in threat environments. The Navy's own Operational Test and Evaluation Force, however, has not been fully supported in its attempt to evaluate systems against realistic combat situations.

(3) Findings and Conclusions

It is the consensus of the T&E Panel, based upon this part of the study, that the Navy test and evaluation program requires improvement in the following areas:

- The Navy is not structured to facilitate a playoff of the requirements process, the engineering development, and the test programming against the best simulation of the hostile threat

- The Navy has only a limited means to create a realistic seaborne threat environment for use by ship and air units.

The initiative of DEPDIR(T&E) to provide realistic joint test operations is endorsed. For example, the programmed Electronic Warfare Joint Test will determine the best tactics and aircraft/electronic countermeasures (ECM) mix for penetration of a heavy surface-to-air missile defense.

(4) Recommendations

The T&E Panel recommends that the Navy take the following actions:

Recommendation T&E-1: The organization within the office of the Chief of Naval Operations which is responsible for "Combat Effectiveness" of naval systems should be strengthened. Resources for analysis, operational testing, combat simulation, intelligence liaison, requirements auditing, tactical development and evaluation, and monitoring Fleet readiness should be included in the "Combat Effectiveness" office.

Recommendation T&E-2: The capability for seaborne simulation should be developed further in such a manner that future test and evaluation is accomplished in a simulated hostile environment. The operational training of personnel should also be realized in such an environment.

Recommendation T&E-3: Test and evaluation planning should be reviewed to insure that threat requirements and test plans are both identified and addressed by the Developing Agency and OPTEVFOR during system design, engineering, and development testing. An auditable trail of requirements versus performance should be maintained. (It is notable that OPTEVFOR was not included in the early planning for the VFAX or S3A COD (Carrier on Board Delivery) aircraft.)

Recommendation T&E-4: In-service evaluations of active fleet units, specifically those combatants with advanced missile weapons systems, should be strengthened in order to provide the CNO with documented reports on combat effectiveness of Fleet systems. This procedure would ensure timely feedback of engineering and support problems to Developing Agencies. (The Panel considers that evaluations similar in nature to those managed by the Strategic Systems Project Manager could become the blueprint for Fleet performance and effectiveness evaluations.)

Recommendation T&E-5: A prioritized budget for implementation of overall threat simulation requirements in support of all T&E programs from development through Fleet exercises should be established.

Recommendation T&E-6: A truly expert evaluation force should be provided by elevating the overall knowledge and expertise of the Navy officer corps engaged in T&E through higher formal education in peacetime. (The continuing education program under the Naval Postgraduate School would assist in achieving this.)

4. TEST AND EVALUATION PLANNING

As previously stated, the Navy T&E policy effort has been satisfactory and its directives do reflect the policy of the Department of Defense and the concerns of the Congress. During the past three years, as the new T&E policies and procedures evolved, some program turbulence was experienced in the Navy as the not-previously-required Test and Evaluation Master Plans (TEMPs) and other actions were formulated.

(1) Statement of the Issue

In the area of test and evaluation planning, the Navy has made good progress in achieving a balanced program. However, policy and procedural areas can be further improved.

(2) Study Approach

The Panel reviewed TEMPs for several of the major programs, such as LHA (amphibious assault ship), PF (Patrol Frigate), and PHM (NATO hydrofoil). In addition, discussions with program personnel, INSURV, and field activities provided an in-depth insight to planning problems. The Panel also counselled with Dr. Eugene Fubini concerning his recent study of test and evaluation for the Director of Defense Research and Engineering. This study addressed multiservice problems in test planning and execution.

(3) Findings and Conclusions

Based on the review of T&E planning, the following conclusions were reached:

1. The Navy lacks a definitive chain of accountability for both test planning and test execution. It is recognized that the Program Manager has the ultimate responsibility; however, his program is reviewed at various levels up through DOD by offices with little or no accountability.

Hence, he can be "second guessed" by all concerned, yet he is the specific individual who must assign his assets in the most effective manner to execute the overall program. While a program overview is required for integration with budget planning, the line of authority should be explicit. Levels of approval (one office at each echelon) should be established, and any perturbations to the Program Manager's test plan should be considered in light of total program time and funding constraints. It was noted in all programs investigated that provision of time and funding for corrections of deficiencies developed as a result of T&E was largely absent.

2. As compared to non-Government contractural relationships, the Navy is found to be in an adversary relationship with contractors. This attitude is not the particular result of test and evaluation programs, but does serve to inhibit the establishment of contractor relationships which permit a meaningful test program. The Navy has tended to become overly involved with aspects of production acceptance testing that are traditionally the contractor's responsibility. For instance, implementation of complex directives such as "Manual for Control of Testing and Ship Conditions" (NAVSHIPS 0905-485-6010) may be counterproductive.

3. The Approval for Service Use (ASU) procedures, recently updated by OPNAV Instruction 4720.9D (23 August 1974) provide a positive checkpoint for material acceptance. The tendency to provide additional layers and checks and balances to these procedures should be carefully avoided. As opposed to the TEMP approach, the ASU approval system is clearly defined with definite responsibilities assigned. However, the complexity and time involved can lead to circumvention of ASU requirements. For instance, major modifications to the AN/SPS-49 and AN/SPS-55 radars were not processed in accordance with the basic directive.

4. Integrated Logistics Support (ILS) aspects of any program should be tested along with characteristics such as technical performance and reliability. The Navy is including ILS aspects in TEMPS; however, it would appear that more attention could be given to this area. It was particularly noted that in the F-14 program a lack of spare parts significantly hindered the initial operational evaluation (OPEVAL) conducted prior to the aircraft's first deployment.

(4) Recommendations

It is recommended that the following actions be taken:

Recommendation T&E-7: A specific approval authority should be designated for TEMPs in each program category. This aspect is particularly pertinent to the Less-than-Major programs which are not subjected to Major program monitoring. Further, an annual review process for Less-than-Major programs should be established.

Recommendation T&E-8: The need for the "Manual for Control of Testing and Ship Conditions" (NAVSHIPS 0905-485-6010) should be reviewed to determine if the level of detailed involvement with the contractor during production testing is warranted in both a technical and a business sense. Additionally, the Navy should review the requirements of the "Total Ship Test Program for Ship Production" (NAVSHIPS 0900-077-3010) with a view toward removing an expensive overinvolvement with the contractor's test program (e.g., Stage 3 testing and testing sequence requirements).

Recommendation T&E-9: It should be ensured that discrepancies brought out in tests are brought to the attention of all concerned in a timely fashion and that time and funding are available for correction of deficiencies. The Panel further recommends that the use of the "yellow sheet" format, as used in the aircraft acceptance process, be adopted by OPTEVFOR.

Recommendation T&E-10: Test and evaluation documentation should be ensured that adequately describes test goals for reliability, maintainability, supportability (ILS), and survivability.

Recommendation T&E-11: The T&E planning effort and the program review process should be used to ensure that a properly balanced program is formulated which provides for sufficient testing to achieve a desired level of confidence in projected system performance. It should be recognized that systems can be overtested to the point of being uneconomical. Testing beyond the maximum capability of the item, where failures are expected due to design limits, should not be conducted unless the purpose of the testing is specifically to examine the failure mode. Additionally, with due regard for the budget cycle, program schedule and funding plans which allow sufficient reserve to permit correction of deficiencies uncovered during test execution should be ensured.

5. TEST RESOURCES

The Test and Evaluation Facility Base has been reviewed several times in recent years; however, the Base is still loosely knit and without central coordination. The T&E facilities and ranges in the Navy are varied in management cognizance, have overlapping capabilities, and have no coordinated approach to budget and military construction (MILCON) planning. Of the eight "T&E facilities" specified to be under the cognizance of the DEPDIR(T&E), two are National Ranges (Pacific Missile Range and National Parachute Test Range), two are administered by Navy laboratories (Atlantic Undersea Test and Evaluation Center and Naval Weapons Center), one is under Fleet cognizance (Atlantic Fleet Weapons Range), and the remaining three are under the cognizance of NAVAIR (Naval Air Test Center, Naval Air Propulsion Test Center, and Naval Air Test Facility, Lakehurst).

(1) Statement of the Issue

The Blue Ribbon Defense Panel Staff Report of Operational Test and Evaluation (July 1970) stated that "there is a requirement

for a DOD organization at higher-than-Service level which would have broad responsibilities and authority for OT&E throughout the DOD." DEPSECDEF Memorandum of Feburary 1971 established a Deputy to the Director of Defense, Research and Engineering (DDR&E) for T&E to have "across-the-board responsibility for OSD in test and evaluation matters." In August 1971 the Secretary of Defense (SECDEF) directed, inter alia, that the DEPDIR(T&E) "insure an adequate base of test and evaluation ranges and other major facilities." DEPSECDEF Memorandum of October 1971 requires a "strong focal point for T&E facility base to coordinate planning and actions." The bases specified at that time for the Navy were the Pacific Missile Range, the Naval Air Propulsion Test Center, the Atlantic Undersea Test and Evaluation Center, the Atlantic Fleet Weapons Range, and the Naval Air Recovery Facility/Joint Parachute Test Facility, now the National Parachute Test Range.

Initially, OPNAV (OP-983) was designated the focal point but had no direct inputs to coordination of T&E base planning.

In addition to these major facilities the Navy has a multitude of technical activities which contribute to the overall test and evaluation continuum as shown in Appendix T&E-B. The primary issue is the question of the Navy's ability to coordinate the overall management of these activities to the betterment of the material acquisition process.

(2) Study Approach

The Panel discussed at length the coordination of test resources with DEPDIR(T&E) and various facility Commanders as indicated in Appendix T&E-A. Interpanel discussions with the Research and Development Panel of the NMARC were also held on an ad hoc basis. Although not every one of the facilities could be visited or heard from, a picture of irresolute control, compounded by the multimission, multimanagement of the test resource complex was evident. A "single voice" speaking for Navy test resources, one who has management control, has not been clearly established to perform as an interface with DEPDIR (T&E).

In addition to interviews at several of the Commands comprising the Navy T&E Base, the Panel was permitted to review

a recent study chaired by Dr. Donaldson for the Naval Air Systems Command that analyzed in detail the management of test resources within that Command.

(3) Findings and Conclusions

The T&E Panel considers the following findings and conclusions most pertinent to the clarification of responsibilities for the Navy T&E Facility Base:

1. Because of the multimission nature of most field activities engaged (to some degree) in test and evaluation matters, it is necessary to establish clear lines of authority for resources coordination.

2. The Navy has not established a strong focal point for test resources management in order to provide a good working interface relationship with DOD.

3. The Panel endorses the concept of resource management analysis performed in the Donaldson study as a valid effort to establish order among the test resources within the Naval Air Systems Command.

4. Test resources for realistic testing of major propulsion units in an at-sea environment have not been established. Hence, for systems such as the Controllable Reversible Pitch (CRP) propellers, it was necessary to devote active fleet units to development testing. Additionally, the test propellers were, although functionally similar, not the same propellers destined for the Patrol Frigate and DD-963 programs.

(4) Recommendations

The T&E Panel recommends the following actions to improve the coordination and utilization of test resources:

Recommendation T&E-12: A flag officer should be designated as Test Facilities Manager in the Naval Material Command to manage directly or through Systems Commands,

as appropriate, all test and evaluation related facilities, ranges, and centers assigned to the Naval Material Command. This officer could be assigned additional duty on the OPNAV staff as the Navy's Development Facilities Manager to provide the single point of contact with DEP-DIR(T&E) on facilities and resources coordination.

Recommendation T&E-13: The CNM Test Facilities Manager's office should be staffed and supported to perform the following tasks:

- Assess capacity and monitor work assignment.
- Coordinate military construction and procurement funds; e.g., make facilities improvement consistent with workload projection. The Pacific Missile Range is currently experiencing difficulty in coordinating a MILCON funded building to house an approved and funded computer with delivery scheduled.
- Develop and manage Navy targets and threat simulation assets through appropriate field activities and in coordination with operational commanders.

Recommendation T&E-14: The Naval Sea Systems Command should sponsor an analysis of assigned facilities, similar to that documented in the NAVAIR Donaldson study, to assess existing capabilities, possible redundancy of effort, and areas susceptible to management refinement.

Recommendation T&E-15: A dedicated ship platform, new or old, with a multitest mission (i.e., weapons, machinery, electronics, etc.) should be developed. Certain major propulsion equipments, such as gas turbines and controllable pitch propellers, cannot be tested during development in a true environment at existing shore sites.

6. COMBAT SYSTEMS INTEGRATION

The integration of the modern weapons suite with the platform, be it a ship or an aircraft, presents a complex problem for the designer, the engineer, the project manager, and the test planner. With the advent of full digital Command and Control systems interfacing with digital sensor and weapons management, the Navy has experienced difficulty in assuring that the hardware/software interface is properly established and maintained through the acquisition process. Additionally, the Navy is faced with life-cycle interface and configuration control management for which there are no established procedures.

(1) Statement of the Issue

The delivery of USS California (DLGN-36) during the past year was marred by poor and deficient performance of its fully digitized weapons system. The problems were foreseen before delivery, and a deliberate decision was made to accept the ship with the problem to be solved later. This situation is indicative of a broader problem within the Navy which was not fully appreciated at the initiation of the DLGN-36 program during the 1960s. That is, the Navy has accepted the technical complexity of modern systems for installation without the advances in management methods and resource dedication to coordinate the assembly, test, configuration, changes, evaluation, and validation of complex systems as ready for service use. The DLGN-36 system is an example of inadequate system integration and configuration control which should serve as a lesson learned for future systems. Fortunately, the Panel sees the Navy taking positive steps—in specific programs—to close the integration management gap.

(2) Study Approach

In addition to reviewing the DLGN-36 delivery problems (as related to combat systems integration), the Panel investigated other programs in which digital systems are primary contributors to weapon systems performance.

A briefing on the Trident Command and Control digital system integration planning was provided for the Panel. It was

noteworthy that in this program an integrating contractor (IBM) has been tasked as a subcontractor of General Dynamics' Electric Boat Company (the Trident submarine prime contractor) to ensure system interface compatibility. Additionally, a complete Land-Based Evaluation Facility is planned for proofing the system hardware/software interfaces, maintenance of configuration control, and for equipment checkout prior to shipboard installation. A similar facility to be used as a training site is planned for Bangor, Washington.

In the Patrol Frigate program, a Combat System Land-Based Test Site has been established under direct Government contract with the Sperry Company which is tasked with overall integration responsibility. In addition to equipment checkout, this site will provide training.

The combat systems in the DD-963 and LHA programs are under a total package procurement contract and hence are the responsibility of Litton Industries. The results of this type of integration program are yet to be seen. However, Litton has established Land-Based Test Sites as management tools for systems development.

In the case of the DLGN-38 program, a land-based test site has been established at Mare Island, California. This site has test installations of various components of the total system to ensure compatibility, but it is not currently programmed as a permanent installation to support life cycle configuration management.

Looking into air systems, the Panel visited the System Integration Test Site (SITS) at the Naval Missile Center, which played an important role in system integration during development of the F-14A.

Additionally, the Panel reviewed the closely related subject of management control of the Fleet Combat Direction System Support Activity (FCDSSA) and the Material Command interfaces with OPNAV in this area. The FCDSSAs are tasked to provide maintenance of existing Fleet digital programs, to update Command and Control programs, and to assist OPNAV in NATO tactical system interfaces. The FCDSSAs provide support to the acquisition process based upon arrangements made between

OPNAV and NAVMAT. Currently the FCDSSAs report directly to an OPNAV office tasked with Combat Direction System management.

(3) Findings and Conclusions

Based upon the investigation by the Panel, the following conclusions were reached:

1. The integration of digital systems in strategic systems is well conceived and properly planned and is being executed in a manner which maximizes the probability of success.

2. In other programs, specifically in ship systems, the Panel notes a lesser commitment to combat system integration.

3. The establishment of land-based test and evaluation sites for digital combat system engineering development, software validation, configuration management, and operator/maintenance training is an effective way to ensure proper system integration management.

4. The use of a skilled integrator, by contract or subcontract, is necessary to insure subsystem compatability.

5. There is no compelling evidence which would require changes to the current organizational structure relative to the management of the FCDSSAs.

6. There is no specific policy for assignment of responsibility for life-cycle management of the interfaces between the combat subsystems and the Command and Control system.

(4) Recommendations

The Panel recommends that:

Recommendation T&E-16: The Navy should use combat integration test sites for all new major systems.

Recommendation T&E-17: Wherever practicable, the Navy should locate future combat systems test sites on Navy-owned property to provide permanence for life-cycle configuration control and training facilities.

Recommendation T&E-18: All programs involving digital weapons system/command and control interfaces should have a selected, skilled integrating agent accountable for the proper integration of the system.

Recommendation T&E-19: The FCDSSAs should remain under the control of OPNAV, but improved procedures and processes, within a formal framework, should be established for the Material Command's interface with the FCDSSAs. Because of operational aspects, the responsibility for life-cycle management of the system interface specifications (Weapons to Command and Control) should specifically reside in the CNO offices.

7. COLLATERAL OBSERVATIONS

As with any study, the review process invariably uncovers subjects which are broader in scope than that provided for in the basic charter. However, in many cases, these subjects are closely related or strongly impact on the subject under review. One such subject is "concurrency" as opposed to "fly before buy."

In recent years, "fly before buy" became a buzz word that attempted, without definition, to describe serial development. More recently this method has been entitled "prototyping." Either term indicates the desire to have a system fully tested at each phase before proceeding to the next phase, particularly leading up to the production decision. Interpreted literally, the instructions governing the Defense Systems Acquisition Review Council (DSARC) process attempt to impose such doctrine. Actually, in most major programs a certain amount

of concurrency is allowed in the form of limited production before completion of all testing. This form of concurrency is endorsed by Mr. Packard in his report on T&E (Appendix T&E-C).

The T&E Panel considers that concurrency in a program may be quite necessary if certain systems are to be fielded in reasonable time to avoid obsolescence. Intelligent use of concurrency must be allowed after proper selection of materials, maximum use of existing technology, and adequate testing of new technology before full commitment. In reviewing the commercial Boeing 747 T&E program with the contractor, it was noted that a great deal of concurrency was used. The resulting compressed program allowed Boeing to deliver to a commercial customer a production 747 airplane in three and one-half years from program start—a start which involved building a new plant in which to build the airplane.

The 747 program was chosen for review in order to examine the T&E program of a successful "Major" civilian project which was generated and carried out without the support of DOD or Congress. Interestingly, there were several familiar similarities with military programs. For example, the aircraft experienced a weight growth problem during development. Secondly, the schedule was driven by an initial operational capability (IOC) date—an IOC date which had to be slipped three months because of development problems. Some additional highlights of this program which bear on the NMARC review are:

- Firm agreements on contract price
- Solid guarantees
- No meddling by either side
- Simple, forthright contracts
- Mutual agreement on escalation clauses
- Lack of contractor management layering
- Rapid decision-making ability by program personnel
- Responsibility with authority in contractor's organization
- Uncomplicated lines of communication between parties
- Informality and person-to-person contact.

By comparison, military purchases of commercial versons of this and other Boeing aircraft added several management layering problems plus additional costs to the taxpayer because of military directives and specifications. For example, the strict imposition of a Government directive on a recent commercial aircraft procurement program placed such additional requirements on contractor flight test personnel

that the Government was required to pay approximately $65,000 extra for this previously tested commercial aircraft. In addition, the Government-imposed requirement of approving test plans, sometimes up to 90 days in advance of scheduled tests and with no provision for last-minute modifications due to weather conditions or equipment availability, severely restricted the flexibility and efficiency of the test program.

Government business is hedged by regulations and specifications so numerous and so restrictive as to connote distrust and to engender an unwholesome adversary relationship between government and contractor.

Recommendation T&E-20: Military purchases of commercial products, particularly successful off-the-shelf systems, should be examined especially for cost savings through simplification of contract requirements.

Concluding the T&E Panel report, the Panel Chairman would like to officially recognize the cogent comments of one of the Panel members, attached as Appendix T&E-D. These comments describe first order problems facing the acquisition programs of the DOD in the present and coming years unless some positive and enlightened efforts are undertaken.

8. SUMMARY OF TEST AND EVALUATION PANEL RECOMMENDATIONS

The summary of T&E Panel recommendations which follow group the recommendations as "major" and "other," but the recommendations in each group are not necessarily in any order of rank.

(1) Major Recommendations

Recommendation T&E-1: The organization within the office of the Chief of Naval Operations which is responsible for "Combat Effectiveness" of naval systems should be strengthened. Resources for analysis, operational testing, combat simulation, intelligence liaison, requirements auditing, tactical development and evaluation, and monitoring Fleet readiness should be included in the "Combat Effectiveness" office.

Recommendation T&E-7: A specific approval authority should be designated for TEMPs in each program category. This aspect is particularly pert nent to the Less-than-Major programs which are not subjected to Major program monitoring. Further, an annual review process for Less-than-Major programs should be established.

Recommendation T&E-12: A flag officer should be designated as Test Facilities Manager in the Naval Material Command to manage directly or through Systems Commands, as appropriate, all test and evaluation related facilities, ranges, and centers assigned to the Naval Material Command. This officer could be assigned additional duty in OPNAV as the Navy's Development Facilities Manager to provide the single point of contact with DEPDIR(T&E) on facilities and resources coordination.

Recommendation T&E-15: A dedicated ship platform, new or old, with a multitest mission (i.e., weapons, machinery, electronics, etc.) should be developed.

Recommendation T&E-16: The Navy should use combat integration test sites for all new major systems.

Recommendation T&E-18: All programs involving digital weapons system/command and control interfaces should have a selected, skilled integrating agent accountable for the proper integration of the system.

(2) Other Recommendations

Recommendation T&E-2: The capability for seaborne simulation should be developed further in such a manner that future test and evaluation is accomplished in a simulated hostile environment. The operational training of personnel should also be realized in such an environment.

Recommendation T&E-3: Test and evaluation planning should be reviewed to insure that threat requirements and test plans are both identified and addressed by the Developing Agency and OPTEVFOR during system design, engineering, and development testing. An auditable trail of requirements versus performance should be maintained.

Recommendation T&E-4: In-service evaluations of active fleet units, specifically those combatants with advanced missile weapons systems, should be strengthened in order to provide the CNO with documented reports on combat effectiveness of Fleet systems. This procedure would ensure timely feedback of engineering and support problems to Developing Agencies.

Recommendation T&E-5: A prioritized budget for implementation of overall threat simulation requirements in support of all T&E programs from development through Fleet exercises should be established.

Recommendation T&E-6: A truly expert evaluation force should be provided by elevating the overall knowledge and expertise of the Navy officer corps engaged in T&E through higher formal education in peacetime. (The continuing education program under the Naval Postgraduate School would assist in achieving this.)

Recommendation T&E-8: The need for the "Manual for Control of Testing and Ship Conditions" (NAVSHIPS 0905-485-6010) should be reviewed to determine if the level of detailed involvement with the contractor during production testing is warranted in both a technical and a business sense. Additionally, the Navy should review the requirements of the "Total Ship Test Program for Ship Production" (NAVSHIPS 0900-077-3010) with a view toward removing an expensive overinvolvement with the contractor's test program (e.g., Stage 3 testing and testing sequence requirements).

Recommendation T&E-9: It should be ensured that discrepancies brought out in tests are brought to the attention of all concerned in a timely fashion and that time and funding are available for correction of deficiencies. The Panel further recommends that the use of the "yellow sheet" format, as used in the aircraft acceptance process, be adopted by OPTEVFOR.

Recommendation T&E-10: Test and evaluation documentation should be ensured that adequately describes test goals for reliability, maintainability, supportability (ILS), and survivability.

Recommendation T&E-11: The T&E planning effort and the program review process should be used to ensure that a properly balanced program is formulated which provides for sufficient testing to achieve a desired level of confidence in projected system performance. It should be recognized that systems can be overtested to the point of being uneconomical. Testing beyond the maximum capability of the item, where failures are expected due to design limits, should not be conducted unless the purpose of the testing is specifically to examine the failure mode. Additionally, with due regard for the budget cycle, program schedule and funding plans which allow sufficient reserve to permit correction of deficiencies uncovered during test execution should be ensured.

Recommendation T&E-13: The CNM Test Facilities Manager's office should be staffed and supported to perform the following tasks:

- Assess capacity and monitor work assignment
- Coordinate military construction and procurement funds; e.g., make facilities improvement consistent with workload projection
- Develop and manage Navy targets and threat simulation assets through appropriate field activities and in coordination with operational commanders.

Recommendation T&E-14: The Naval Sea Systems Command should sponsor an analysis of assigned facilities, similar to that documented in the NAVAIR Donaldson study, to assess existing capabilities, possible redundancy of effort, and areas susceptible to management refinement.

Recommendation T&E-17: Wherever practicable, the Navy should locate future combat systems test sites on Navy-owned property to provide permanence for life-cycle configuration control and training facilities.

Recommendation T&E-19: The FCDSSAs should remain under the control of OPNAV, but improved procedures and processes, within a formal framework, should be

established for the Material Command's interface with the FCDSSA. Because of operational aspects, the responsibility for life-cycle management of the system interface specifications (weapons to Command and Control) should specifically reside in the CNO offices.

Recommendation T&E-20: Military purchases of commercial products, particularly successful off-the-shelf systems, should be examined especially for cost savings through simplification of contract requirements.

In summary, the T&E Panel finds the Navy making good progress in test and evaluation matters. The material area in need of the most attention is in surface warfare systems, which is addressed specifically in several of the Panel's recommendations. However, the most important consideration the Panel found is that the Navy should restructure its acquisition management approach to ensure that the acquisition of material is totally relevant to the projected threat. The lead recommendation concerns this finding and is supported by several other recommendations.

V. PROCUREMENT PANEL

The Procurement Panel report, which is presented in this chapter, embraces more than just procurement—the formal act of buying a product—since the understanding of the procurement function itself is dependent on a clear understanding of the total acquisition process from definition of requirement to operational use. In the short time of this study, addressing all of the problems that were raised by both Government and industry personnel would have been impossible; thus, only the most important and those that the Panel felt offered the highest payoff have been discussed.

In the course of its review the Procurement Panel was faced on several occasions with an issue that was considered to be beyond the scope of the Panel's charter during the limited time available for the study but that nevertheless should be identified as a subject for further study. This issue is the question of the need for reorganization of the Navy structure. Many comments were offered regarding the need to change the Navy organizational structure; specifically, these comments favored a return to the bilinear organization of the 1950s. The Panel believes that the Navy organization is complex and recommends that it be studied by the Navy to determine if simplification and reduction of overlapping responsibilities are possible.

1. BACKGROUND

Historically, the U. S. Navy has nearly always enjoyed the overwhelming support of the people, the Congress, and the President. It was the symbol since early days of the courage, fighting spirit, and determination that most Americans feel to be the hallmark of the nation. It has been widely used as a valuable adjunct to diplomatic endeavors, and its presence around the world has given confidence and hope to many. Yet today it suffers from lack of support in the Congress; it no longer commands the general public's traditional respect as the finest fighting force afloat; it is beset by critics from all sides.

Part of this is the natural result of changing times, the advent of long-range missilery, the disenchantment with an unpopular war,

and the desire in the Congress to sponsor more politically acceptable social-benefit programs. But some of the problem can also be traced to the lack of communication of a sense of mission and purpose by the Navy itself and by its inability to maintain a steady course with clearly defined goals, fiscal integrity, and a constructive business relationship with its shipbuilders. In its study the Procurement Panel made a special effort to probe the basis for this erosion of the Navy's stature and has made recommendations that it feels will substantially improve the Navy's credibility with the Congress and its relationships with industry and, through more efficient use of resources, will lead to a more effective fighting force.

The study approach taken consisted of interviews with key personnel within the Navy and industry. Visits were made to three shipyards and one major aircraft plant. In addition to these formalized briefings and visits, many interviews were conducted on a person-to-person basis by members of the Panel and the staff. The consulting firms of Cresap, McCormick and Paget Inc. and Logistics Management Institute conducted interviews with the Navy program offices and have submitted an extensive supplementary report on the program management function.

2. MAJOR ISSUES EXAMINED

This report addresses four main areas of the total acquisition problem: systems acquisition, procurement practices, program management, and finally, a specific section for ship acquisition.

Regarding systems acquisition, the Panel reviewed the problems associated with requirements definition, planning, and funding of major programs. Such problems as the diffusion of authority, the subversion of the Defense Systems Acquisition Review Council (DSARC) process, "layering," the dilution of authority, and the resultant instability of program requirements have been examined. In addition, issues relating to major system acquisition planning, programming, and budgeting have been reviewed. Recommended improvements are proposed.

Regarding procurement practices, the Panel has addressed the procurement process, pertinent regulations, source selection, the selection of contract types, and associated contractor problems. Specific problems concerning internal Navy and OSD program funding, negotiation review procedures, and delegation of authority to contract

administration personnel were considered. Problems associated with the Navy/contractor relationship were studied including deficiencies in the source selection/evaluation process, such as technical transfusion, auctions, buy-ins, and the selection of contract types. The "engagement" policy, escalation, and cash flow problems were also reviewed. Recommendations have been presented.

Relative to program management the Panel has dealt primarily with the day-to-day working relationships of the project manager (PM) and his associates. The primary emphasis has been placed on those factors that either enhance or inhibit the project manager's ability to carry out his responsibilities. Specific findings and conclusions regarding the matrix form of organization, the PM's control of funds, the effect of layering, the PM's role in procurement, and foreign military sales are discussed. Recommendations on the PM's authority and interrelationships with other Navy and Office of the Secretary of Defense (OSD) organizations are presented. In addition, a study of the Navy's program management organization was undertaken by Cresap, McCormick and Paget Inc., management consultants; the report of that study * is included as an annex to this report.

The final section of the Procurement Panel report covers specific problems associated with ship acquisition. The shipbuilding industry has changed radically in the last few years from an industry that had a great amount of available capacity to one that is now very busy. Many yards that formerly were dependent on Navy work are now preoccupied with more profitable commercial work. The availability of shipyards to fulfill Navy requirements, particularly those with nuclear capacity, has decreased significantly. The Navy did not recognize this situation early enough and through its policy of engagement has made Navy work unattractive to many yards. The Panel examined the problems that the Navy has that are peculiar to the shipbuilding industry. Many of the common problems found in the prior three sections have been included for the sake of continuity.

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* A Study of Project Management for the Navy's Major Weapons Systems Acquisitions Process, Cresap, McCormick and Paget, Inc., Management Consultants, December 1974.

Many studies have been conducted in recent years dealing with the problems of Government procurement, and very few of the recommendations made in this report are being made for the first time. The Panel feels that the specific recommendations made in this report are current, sound, and worthy of serious consideration for implementation.

3. SYSTEMS ACQUISITION

In the early and mid 1960's, the Navy and other armed services saw a gradual but increasing erosion of their decisionmaking prerogatives as increasingly greater control of all aspects of the weapons acquisition process was assumed by a very small group operating within the Office of the Secretary of Defense (OSD). The Navy quite properly felt that basic decisions affecting its operational capability were being made by analysts with little or no exposure to national defense exigencies.

Under Deputy Secretary of Defense Packard, this policy was renounced and a new policy of restoring responsibility and authority to the armed service components was enunciated with the issuance of DOD Directive 5000.1. This top-level policy clearly establishes within OSD the prerogative of policy formulation, assuring that programs are pursued in response to valid needs and evaluation of policy implementation on approved programs. It just as clearly assigns to the armed service components the prerogatives of need identification, definition, and development and production of systems to satisy those needs. The Panel found that, while DOD Directive 5000.1 is very clear in its policy direction, the implementation of this policy within the Navy and the OSD is not being carried out in the manner intended.

(1) Statement of the Issue

A problem of the Navy's material acquisition system has been the inability of the Navy to formulate and implement a realistic long-term plan to meet its major systems acquisition objectives. This has led to criticism by the OSD, the Office of Management and Budget (OMB), and the Congress. The Panel believes that the reason for this situation stems in good part from the fact that the concept of DOD Directive 5000.1 has not been implemented, for which OSD must bear a share of the responsibility. The heavy OSD staff involvement throughout a system's life cycle, from concept formulation through

production and deployment, contributes to the Navy's problems in developing long-term plans. Such a situation tends to stultify effective Navy management initiatives because of the diffusion of accountability and responsibility.

In this issue the Panel has explored specific areas of the acquisition process and found that in nearly every case the reasons for poor performance could be traced to a lack of coordination between organizational elements of the Navy and OSD, an incredible amount of organizational layering (i.e., duplicative functions usually exercised by staff personnel), and a clear lack of delegation of sufficient authority and responsibility at all levels. The following specific subissues were examined:

- Requirements definition and determination of system alternatives
- Acquisition planning and strategy
- Resources and budget management
- Program control and DSARC implementation
- Organizational layering.

(2) Study Approach

This issue was examined by the Procurement Panel by means of personal conversations with and briefings by project managers of the Navy's major programs and their staffs; by on-site visits to three major shipbuilders' facilities and one major aircraft contractor; by review of recent testimony before the Seapower Subcommittee of the House Armed Services Committee; by discussions with others of the Navy's experienced officials including contracting officers and with their counterparts in industry, and by analysis of papers that relate to the subject.

(3) Findings, Conclusions, and Recommendations

1. Requirements Definition and Determination of Systems Alternatives

The Navy is inhibited, by heavy OSD staff involvement, from exercising its prerogatives in the generation, evaluation, and selection of system alternatives. To explore alternatives adequately, the armed services require the authority to pursue diverse efforts in an unconstrained fashion until sufficient information is generated upon which to base intelligent decisions as to which efforts to continue, shelve, or abort. In practice, however, the OSD staff has interjected itself into the exploratory process, looking for justification and review before the Navy has had an opportunity to examine the alternatives. Paradoxically such detailed review is likely to suppress rather than stimulate the exploration of alternatives since the service is forced to justify its analysis and in the process pushes for OSD concurrence as to what may appear to be the best choice at that given point in time. OSD review generally should not occur until the data that the effort in question is designed to produce become available. The only really practical means of operation is for the armed services to furnish choices, not undigested information, with the choices having been developed in a relatively unconstratined fashion. Although informal OSD staff involvement is appropriate, formalization thereof may be expected to force premature reliance on unrefined data.

Recommendation PROC-1: The Secretary of Defense (SECDEF) or the Deputy Secretary of Defense (DEPSECDEF) should reinforce the decentralization principles of DOD Directive 5000.1 and its derivative policies by preventing OSD staff involvement in and constraint of the Navy's studies of alternatives prior to the Navy's requesting the program initiation Defense Systems Acquisition Review Council (DSARC) (#1).

Recommendation PROC-2: The Secretary of the Navy (SECNAV) should assure that SECNAV Instruction 5000.1 provides for comparable elimination of premature Navy staff involvement and constraint to assure the project manager's control over management of conceptual and exploratory development programs.

2. Acquisition Planning and Strategy

The Navy's proposed system for developing acquisition strategy and program plans via the Decision Coordinating Paper (DCP) provisions of DOD Directive 5000.2 for a major weapons system is in need of amplification and perfection. There seems to be no substantial evidence or assurance that such strategy and plans are developed by a PM supported by experts knowledgeable in all functional areas including operations, requirements, procurement, production, costing, logistical support, equipment technology, or industrial inputs. Most important of all, program instability over the entire life cycle seems to result from a lack of total and continuous dedication to achievement of the objectives of a plan on the part of all concerned. Thus there seems to be no assurance that the approved plans and strategy can ever survive the inevitable changes of command at the secretariat and top military policy-making levels.

With a perpetuation of this philosophy and approach, Navy program management will continue to be subject to unwarranted OSD and congressional intervention into its affairs. Also, any accommodation to be reached between the Department of Navy and OSD with respect to the decentralization concepts of DOD Directive 5000.1 is dependent on the need for the Navy to amplify and perfect its present system for development and execution of program plans and strategy.

Recommendation PROC-3: The Secretary of the Navy (SECNAV), the Chief of Naval Operations (CNO), and the Chief of Naval Material (CNM) should take steps to improve specific system

development and acquisition programs. In particular, strategy and plans should be developed by experts professionally knowledgeable in all functional areas involved with benefit from contacts with knowledgeable industry personnel. These professionals should have long-term continuity. Such strategy should be developed with firm consideration given to existing POM-projected resources. The strategy should establish guidance within which the affected PM can perform tradeoffs. Key participants in the development of such a plan or strategy should continue in positions of responsibility in the program. The PM must play an integral role if not actually lead the planning effort.

3. Resource and Budget Management

The Navy has been severely criticized by the Congress for major perturbations in its acquisition program. This has lead not only to unfortunate reductions in funding requests, but also to a seeming lack of confidence in the Navy's planning and programming capabilities.

The annual budget process forces reappraisal of programs that in reality probably do not need annual review. The counterproductivity of such actions should be reviewed and corrective steps taken to lengthen the interval of program budget review. Unfortunately, contrary to stated OSD and Navy policy, the Panel perceives a tendency to require more frequent review at all levels throughout the acquisition process. So many are reviewing the very justification for major programs at such frequent intervals that the result has been a serious negative impact on the efficient acquisition of such programs. This annual budgetary process, moreover, coupled with continuous reappraisal of the military threat and changes in management philosophy, leads to program turbulence, which generally results in higher unit costs and stretched schedules.

There are conflicts in armed service/OSD responsibilities, interest, and prerogatives in the area of

resource allocation and budgeting. For example, the OSD desires zero-based total program budget reviews; however, the budget is so large and programs so numerous as to preclude annual total program review by the OSD staff. Therefore, of necessity, OSD review must deal mainly with incremental changes, which in turn translate to detailed OSD monitoring, create more rules and thresholds governing substitutions, and add new categories among which resources cannot be transferred. In turn, pressure is created for shredding out more and more program elements to provide "visibility" for staff members charged with keeping track of various costs. In the long run this often increases the cost of exploring alternatives.

Thus, one original aim of program budgeting—getting the services to look at the full costs of alternative choices—may be frustrated by the very action intended to stimulate examination of the full cost of alternatives. The lack of a coordinated OSD/service approach to resource requirement planning hinders the Navy's ability to support its programs to the Congress.

The Navy has been faced in recent years with massive claims, primarily from shipbuilders. While no single factor creates these claims, the Panel noted during its investigation a consistent story of underbudgeting on major programs. The Panel believes that a major factor contributing to this situation has been the tendency on the part of the Navy, under pressure from Congress, to eliminate all contingency funding that would normally be expected to cover unforeseeable technical difficulties and the like.

The Panel feels that such contingencies are necessary and suggests that the Navy conduct its internal budget exercises on a conservative basis, such as budgeting for management reserves. In addition to the need for realistic budgets, the Navy can strengthen its position by identifying certain inviolate programs and laying out long-term require-requirements.

Recommendation PROC-4: SECNAV and CNM should take immediate, positive steps to improve

major system planning, programming, budgeting, and acquisition data for presentation to appropriate key congressional committee and professional staff members. SECNAV, CNO, and CNM should also take steps to better acquaint such persons with Navy mission deficiencies, programs, and requirements.

Recommendation PROC-5: Major acquisition programs should be budgeted on a multiyear basis and include a management reserve, which should be under the control of the Navy.

Recommendation PROC-6: The Navy should identify certain "core" programs that should be regarded by all concerned as inviolate short of major change in the threat assessment. The Navy should present a long-range plan for these programs to the Congress and justify the need for multiyear authorization.

Recommendation PROC-7: OSD and the Navy should develop a coordinated approach to resource requirement planning aimed at reduction in the levels and types of detailed OSD monitoring, rules and thresholds of governing substitutions among various resource categories, and the multiple shredouts of program elements.

Recommendation PROC-8: The Navy should closely examine the problems associated with downward pressures on program estimates with a view to formulating policies aimed at elimination of such practices, which are the genesis of cost growth and claims and ultimately of congressional antipathy.

4. Program Control and DSARC Implementation

The DSARC process seems to be well conceived; DOD Directive 5000.1 provides for an appropriate balance between OSD policy and direction and delegation of authority and responsibility to the DOD components. In practice, however, the delegation of responsibility by the OSD to the Navy, indeed by Congress to OSD and the Navy, for the management of programs is insufficient.

The repetitive reviews of extreme detail lead to a lessening of confidence and negatively impact the management of programs.

Viewed from the perspective of Navy PMs, the basic thrust of DOD Directive 5000.1—to incentivize the armed services and PMs to seek more responsibility and authority—has been blunted by a continuance of heavy OSD staff involvement. The complaints focus on the DSARC process for the following reasons:

- After scrubbing all alternatives and firming up the Development Concept Paper (DCP), the Navy often finds alternatives added by the OSD staff that frequently carry greater weight than the Navy position.

- DSARCs are scheduled too frequently, creating funding, contractual, and schedule turbulence. The numerous prebriefings for each DSARC are primarily for the benefit of staff and result in the dilution of the PM's time out of proportion to the value of such exercises.

- The DCP decisions, as drafted by the OSD staff, are frequently delayed in issuance and may not reflect the verbal discussion at the actual DSARC meeting.

Some improved accommodation must be reached as to the appropriate balance to be struck between Navy/OSD responsibilities, interests, and prerogatives.

Recommendation PROC-9: The Secretary of Defense (SECDEF), DEPSECDEF, and SECNAV must effect improved accommodation between OSD and Navy views as to the appropriate balance to be struck between OSD/Navy responsibilities, interests, and prerogatives as intended by the principles of DOD Directive 5000.1. Some specific examples are the following:

- Eliminate OSD staff constraint of Navy studies of alternatives prior to Navy's requesting the first DSARC.

- Extend the half life of DSARC decisions. Once the SECDEF/DEPSECDEF and SECNAV agree on a signed DCP, stick with the decision longer than is currently the case—i.e., purposefully reduce program turbulence, which is generated internally by OSD/Navy.

- Adopt a practice of hearing Navy positions firsthand before making negative decisions regarding the Navy's DSARC proposals.

- Retreat from the practice of using the DSARC process to approve annual production buys of hardware programs already approved for production

- Relative to shipbuilding programs, adopt a practice of letting the thresholds established in the original DCP operate to control the construction program (i.e., the current trend is toward requiring as many as ten separate DSARCs, with all the attendant prebriefings, briefings, etc. in connection with a new ship class development and construction program).

Recommendation PROC-10: SECNAV should convene the NSARC upon the recommendation of the CNO or the CNM, to review major weapons systems acquisition at key junctures where DSARC meetings are now required. CEB meetings now conducted as pre-DSARC meetings should be conducted in joint sessions with the NSARC, to assure that all senior Navy principals consider program issues concurrently and jointly, and to reduce review activity for the PM.

5. Organizational Layering

The problems related to generation/selection of alternatives and resource allocation previously discussed generally manifest themselves through layering of people throughout the OSD staff and Navy headquarters-level organizations. Contrary to the original intent of the DSARC process (to facilitate major program decisions and to obtain commitment and support from the main parties concerned), the process has become overinstitutionalized. Whereas it was originally intended that a major program would be reviewed by the DSARC at three junctures, the trend now is toward as many as six or seven reviews per program. Such multiple review cycles create major problems for the PM due to (1) prebriefings/ancillary DOD Cost Analysis Improvement Group (CAIG) and T&E efforts and (2) the overlying budget process operating to invalidate Development Concept Paper (DCP) thresholds almost before the ink drys on an approved DCP.

It is perceived that real improvement in the generation, selection of alternatives, and resource allocation phases of the acquisition process can only be achieved through a reduction in staff involvement in line operations at all levels. The heavy layering at Navy headquarters levels largely is a function of the extensive demands placed on them by the OSD staff. Any quantum reduction in layering must begin and be maintained with a significant reduction in both the numbers of OSD staff personnel and the degree of remaining involvement in armed service program detail.

> Recommendation PROC-11: SECDEF, DEPSECDEF, and SECNAV should evaluate staff needs, functions, and responsibility/authority assignments in the context of DOD Directive 5000.1 emphasis on streamlined decisionmaking and strong, relatively autonomous PMs. Specific policy should be promulgated that delineates authority and responsibility limits of staff specialists. The billets eliminated by the reduction of excessive layering should be utilized by reassigning them to the operational functions including augmentation of the PMs.

4. PROCUREMENT PRACTICES

(1) Statement of the Issue

Problems that fall within this issue are considered in two broad categories: (1) those that relate to internal Navy and OSD practices, such as program funding, and (2) those that pertain to the Navy/contractor relationship, such as type and source selection procedures and selection of contract. Within these broad categories the Panel examined in detail six major subissues that have been identified as problems by both Navy and contractor personnel. These are:

- Program budgeting and funding
- The need for improvements in procedures
- Deficiencies in the source selection process
- Selection of contract type
- Government/contractor relationships
- Special economic considerations.

(2) Study Approach

The issue was examined by the Procurement Panel by means of personal conversations with and briefings by several project managers of the Navy's major programs and their staffs; by on-site visits to three major shipbuilders' facilities and one major aircraft contractor; by review of recent testimony before the Seapower Subcommittee of the House Armed Services Committee; by discussions with others of the Navy's experienced officials including contracting officers and with their counterparts in industry· and by analysis of other papers that relate to the subject.

(3) Findings, Conclusions, and Recommendations

1. Program Budgeting and Funding

Budget estimates presented to Congress for major programs often appear to be unrealistic. The underlying cause is not believed to rest upon the inadequacy of the basic estimating system in use nor upon any lack of competence or diligence of the personnel involved (in fact, the contrary appears to be the case). It does appear, however, that the quality of the overall cost estimates has been degraded by a downward estimating bias in the preparation and processing of major weapon system cost estimates. This downward bias stems from either conscious or unconscious attempts to portray optimistically the expected program costs, in spite of uncertainties associated with economic conditions technical difficulties, and program changes.

The natural pressures of competitive systems, the desire to sell the program, and optimism have all contributed towards a reduction in estimated budget requirements from the baseline estimate by the time the request finally gets to the Congress. This forced reduction could come from within the Navy, the DOD, OMB, or finally even Congress itself, but the end result is the same: underfunded programs that generally run into trouble.

The Navy should have the capacity in its Systems Commands (SYSCOMs) to develop reasonable program cost estimates with associated rationale. The Panel feels that if such estimates, made at the outset of a program funding cycle, were maintained as a record throughout program life, then the ultimate funding would more closely approximate actual requirements. Higher level reviewing authorities within the Navy or OSD should not direct or approve changes to any baseline cost estimate without substantiating evidence of change in scope.

Recommendation PROC-12: The Navy should improve the reliability of estimated program costs it presents to Congress. The responsibility for

the preparation of baseline cost estimates should be assigned to the SYSCOMs. Detailed baseline estimates with associated rationale should be developed for each major program. The baseline estimate should be made a matter of record and should not be changed except when justified by modifications to scope and then only when completely substantiated in writing. (See further discussion in Chapter VII, Cost Panel).

2. The Need for Improvements in Procedures

The Panel found considerable dissatisfaction with the manner in which approvals for major programs are processed. The Advance Procurement Planning (APP) document details a complete acquisition plan covering such things as quantities, potential sources, and funding requirements. This document forms the basis for business strategy decisions and is approved at all levels up to and including the Chief of Naval Material.

APPs should be prepared on a timely basis. Statutory documents such as the Request for Authority to Negotiate (RAN) and the Determination and Findings (D&F) could be processed expeditiously merely by referring to the already approved APP. With such an in-depth review at the beginning of the business cycle, the pricing aspects of the present business clearance review could then be performed within the SYSCOMs and a considerable amount of time could be saved.

The Panel also found considerable dissatisfaction with the level of authority granted to field personnel. While requirements vary, the Panel feels that the assignment of competent contracting personnel with commensurate authority within Supervisor of Shipbuilding (SUPSHIP) offices and Naval Plant Representative Offices (NAVPROs) could greatly speed up the negotiation of changes and forestall potential claims. The present practice of restricting administrative contracting officers (ACOs) to very minor actions without going back to headquarters for approval is self-defeating.

Recommendation PROC-13: The Navy should emphasize the review of proposed acquisitions at the beginning of the business cycle, utilizing the APP document to delineate clearly all facets and considerations of the proposed procurement. Review should be accomplished through the command chain including a representative of the Assistant Secretary of the Navy for Installations and Logistics (ASN(I&L)). RANs and D&Fs should reference the approved APP and should be expedited through the system.

Recommendation PROC-14: NAVMAT should assess SYSCOM capacity to approve its own business clearances and increase their approval levels as appropriate. NAVMAT should periodically audit the SYSCOMs' performance of the business clearance function and, if that audit reveals serious deficiencies, the business clearance authority can be returned to NAVMAT until the deficiencies are remedied.

Additional billets should be provided to the SYSCOMs' contracts directorates for specialists in advanced pricing techniques.

Recommendation PROC-15: Reliability and maintainability requirements should be eliminated from the business clearance. These requirements have nothing to do with the business aspects of procurement and have substantially increased procurement lead times.

3. Deficiencies in the Source Selection Process

The Navy, along with the rest of DOD, has been criticized for its source selection policies and practices. This criticism generally involves the following areas:

- Clarity of Requests for Proposals (RFPs)
- Technical transfusion
- Buy-ins
- Parallel negotations (auction techniques)
- Best and final offers.

Taken together these techniques cover the significant steps and problem areas that are generally considered to be part of the administrative process leading to the award of a major program. While each of these alone can be justified in certain cases, it is the combination of all taken together and the manner in which they have been utilized that has led to the numerous complaints and general dissatisfaction with Navy selection and award practices.

Lack of clarity in RFPs is a major complaint of Navy contractors, other than shipbuilders. This is unfair to contractors who may discuss issues that they feel are significant in a technical dissertation only to find out later that the Navy considers them unimportant, while issues that the Navy believes to be vital have been ignored. Evaluation criteria have been alleged to be so vague as to be misleading. There is a direct relation between the clarity of the RFP and the quality of proposals received; therefore, care should be taken to insure that all significant requirements are precisely set forth and that optional requirements are clearly labeled.

Technical transfusion occurs when the best elements of a proposal are revealed to other offerors. This is encouraged under SECNAV Instruction 5000.1 where it would not confer a competitive advantage. A serious injustice can result, however, when a number of offerors are equalized technically. Price or estimated cost alone then determines the successful contractor.

Technical transfusion would appear to be appropriate only when the Navy is paying for the proposal, such as in the contract definition phase. This distinction is not made clearly in SECNAV Instruction 5000.1. The topic is treated briefly but well in NAVMAT Note 4255 of September 23, 1974, which states:

> ....strengths, weaknesses, or overall evaluation of any offeror's proposal with respect to other proposals must not be divulged either directly or indirectly. The conduct of discussions must avoid leveling proposals to the point where technical discrimination

necessary for source selection is destroyed and cost however weighted, assumes disproportionate importance.

The term "buy-in" is commonly used to describe the tactic of submitting an unrealistically low cost proposal as a means of winning a competitive procurement. It can often result however, from actions generated by the Navy, either by "leaking" the amount of money available for a particular procurement, which is below a reasonable bid, or by setting one contractor against another in an attempt to gain price reductions. In either event, the result is the same—the award is made at a price below reasonable expectation, and either the contractor or the Government ends up paying the final bill, depending upon the type of contract employed. The unfortunate part of such a situation, however, is that the contractor is under undue pressure from the very outset of the contract and his actions are geared toward minimum expenditures, which nearly always works to the detriment of the program.

Both the Navy and the contractor must share the blame for this situation. The Navy has the capability to provide its own estimate of program cost and should not openly encourage or accept unrealistically low prices from contractors. The contractors, for their part, are well aware of the consequences of a buy-in yet continue the practice "just to keep the plant busy" or "to keep the workforce intact." DOD Directive 5000.1 clearly calls for downgrading any proposal that carries an unrealistically low price, and it would be well for the Navy to avail itself of this practice.

Parallel negotiation, which can occur with or without technical leveling, is a practice that has seen wider use in recent years as budget pressures have increased. The persistence of these practices probably represents the dedication of people to the idea that the intensification of competitive pressure prior to source selection must produce the best deal for the Government. Unfortunately, this tactic, when used in the extreme, constitutes an unwarranted exercise of the Government's monopsonistic position, forces contractors into unrealistic cost cutting, and eventually works to the detriment of the Navy.

The best and final offer technique is also a relatively recent innovation that was initiated by the General Accounting Office (GAO). While DOD Directive 5000.1 does not require competitive price negoation, the Navy's implementing instruction, SECNAV Instruction 5000.1 dated March 13, 1972, and the Armed Services Procurement Regulation (ASPR) both clearly require competitive negotiations leading to each contender's best and final offer. Many contractors have objected strenuously to this approach considering it to be nothing more than an auction.

Recommendation PROC-16: While the regulations with respect to the source selection and negotiation procedures presently exist, more definitive explanation of the intent and purpose of these procedures should be included in applicable instructions and more training undertaken at various levels to assure proper implementations.

Recommendation PROC-17: Requests for Proposals (RFPs) should be carefully reviewed for clarity of requirements. Where it is desirable to allow a contractor freedom to develop an individual technical approach, this fact should also be clearly delineated.

Recommendation PROC-18: Policy statements should continue to be developed that emphasize a desire to prevent erosion of the spirit and intention of the ground rules and to avoid selection practices that lead to auction techniques, excessive technical transfusions, and undue pressures upon contractors through best and final offer techniques

Recommendation PROC-19: Buy-ins should be discouraged by downgrading proposals that appear to be priced unrealistically low.

4. Selection of Contract Type

The information furnished to the Panel indicates that there is a lack of consistency in selection of type of contract for what appear to be like procurement situations. In some instances selection of the wrong contract type has led to disastrous consequences from a procurement standpoint. One reason that such errors have been made is that the directives and regulations permit wide latitude of choice without specific direction as to the use of particular types for certain situations.

In several instances, the Navy has utilized a fixed-price form of contract for development work and for follow ships before the prototype has been completed and without the benefit of a proven design. Premature use of fixed-price contracts appears to have been justified on the basis that the Navy must use this vehicle because it is fund-limited and needs to know the maximum it will have to pay. Unfortunately, this practice has had just the reverse effect. It has inhibited good working relationships, prevented the incorporation of worthwhile improvements, and led to the submission of claims resulting in final costs probably higher than those that would have been experienced under a cost-reimbursement contract.

The Navy should direct all procurement activities to avoid using contractual formats and clauses that shift unreasonable risk to the contractor, particularly when incomplete technical specifications or uncertainties as to the ultimate cost of the product are evident. If schedule requirements dictate the need to place follow-on production prior to prototype completion, then a form of cost-type contract should be employed.

Recommendation PROC-20: A clear-cut policy is needed to define the contract type to be used at various stages of program development. To accomplish this, SECNAV Instruction 5000.1,

Naval Procurement Directive (NPD) III-4 and ASPR Section 3, Part 4, should be rewritten to describe the options available and the recommended criteria upon which contract selection should be based. The acquisition strategy should then provide for enforcing these instructions in every case.

5. Government/Contractor Adversary Relationships

Adversary business relationships between the Government and its Defense contractors are detrimental to the interests of both parties and to the national interest. In such an environment, both parties lose—the rightful economic needs of industry are ill served and the cost to Government grows. Although the Panel believes that to some extent industry has overemphasized the magnitude of these adversary relationships and the resulting impact on contractors' business affairs, there is substantial evidence that the problem exists. While there are undoubtedly a number of underlying causes for this situation, the two most frequently identified to the Panel were the erosion in the profit being realized under Government contracts and the continuous interference by resident Navy personnel in what contractors consider to be management prerogatives.

A well reasoned and equitable solution to reverse the trend toward adversary relationships between Government and industry is needed. There must be a return to the traditional situation in which the interests of both parties are better served and in which the elements of mutual good faith, trust, confidence, and integrity are restored.

A factor contributing to the deterioration of satisfactory relationships between contractors and Government has been the implementation of the so-called "engagement" policy. Broadly defined, the engagement policy encourages the active participation by Government contract administrators, auditors, and PMs at various organization levels in the day-to-day management

direction and decision processes nominally the prerogative of the contractor. The result of such engagement, if carried to the extreme, is obviously the creation of an environment of friction and a substantial increase in administrative burden caused by redundant inquiries and requests for additional reports and substantiation detail beyond reasonable levels.

The industry recognizes the need for a system of checks and balances in the Government procurement procedure. However, the application of policies, regulations, or procedures designed to maintain proper checks and balances must not be allowed to create an adversary relationship between the parties involved. The Panel believes that a major factor contributing to the problems of engagement is the zeal with which personnel in SUPSHIP or NAVPRO organizations implement the policy. As in most situations, a reasonable approach will generate cooperation, but an unreasonable one will most certainly create antagonism.

Several other factors observed to contribute to the adversary relationship problem involve the characteristics of the contract that has been established for a particular program. In some cases through inadequate specifications, lack of cost realism, improper contract type, or payment schedule, certain technical and financial risks have consciously or unconsciously been transferred from the Government to the contractor and, with the consequent reduction in the profit factor, have created an imbalance in the desired procurement relationship.

Although it has been stated from the Government's viewpoint that contractors may have entered into contracts with full knowledge of the inherent risks involved and that the contractor could have refused such contracts, such a view must be considered shortsighted with respect to achieving a desirable Government/industry team relationship.

Recommendation PROC-21: The CNM should clearly enunciate the aims of the engagement concept by setting forth a posture and attitude calculated to

motivate personnel at all levels, both Government and contractor, to produce the kind of effort the national interest requires. Management training within the Navy and industry program and functional organizations should emphasize this philosophy.

6. Special Economic Considerations

Many defense contracts are of such magnitude that their financing during production requires large sums of money. This burden has increased proportionally with the increase in the rate of inflation and other economic factors. The thrust of this subissue is that the contractor should not be unfairly affected financially by events or situations over which he has no control and that Government payment provisions should recognize such cases by arranging for equitable and prompt progress payments where warranted and by adjusting contract escalation provisions to reflect current experience in inflation rates. Recognition should also be given to the capital investment needs of the contractor, his working capital requirements under Government contracts, and the cost of interest charges.

During periods of abnormal economic conditions involving accelerated increases in rates of inflation, it is reasonable to expect that the Government should, in its future contracts, revise the escalation provisions to reflect such trends adequately.

The Navy makes provisions for progress payments in its long-term contracts; however, industry has indicated that the basis for computation of allowable progress payments should be revised. Many contractors state that, in shipbuilding contracts in particular, such payments made on the basis of cost incurred or physical progress accomplished (whichever is less), adjusted by substantial contractual withholdings, have resulted in a situation that has increased working capital requirements for ships under construction and caused a concomitant increase in contractor costs in the form of interest on borrowed capital. In the long run, it is said, this situation will result in increases

in contract prices or a further reduction in the industry's opportunity for earning a fair return. This situation again leads to the industry's position urging that the Government should take action to recognize the cost of borrowed funds as an allowable expense.

Recommendation PROC-22: Contract provisions with respect to payment should be reviewed with recognition of the cash-flow problems incident to present inflation, high interest rates, and other economic problems.

Recommendation PROC-23: In future contracts, escalation provisions should be revised to reflect the impact on contractor costs attributable to abnormal general economic conditions. If indices are used, they should be a reasonable reflection of the variations in cost for labor and materials utilized by the contractor in performance of the specific Government contract and should be applied in recognition of a mutual problem without unreasonable restrictions.

5. PROGRAM MANAGEMENT

The Navy program management system is, with very few exceptions, based upon a matrix form of organization wherein the project manager (PM) maintains a relatively small staff and relies upon headquarters organizations to provide necessary support in the functional disciplines. This has worked reasonably well for the Navy, but the Panel believes that a strengthening of the program management function as contemplated by DOD Directive 5000.1 would enhance a PM's ability to conduct his program and in turn restore some measure of confidence in the Navy's capability for systems acquisition.

(1) Statement of the Issue

The Panel examined the role of the PM within the Navy from the standpoint of his organizational relationships and his authority to perform his function. In this process it was evident

that the delegation of authority to the PM contemplated by DOD Directive 5000.1 was being subverted by excessive staff interference at all levels.

Mr. Packard's intent, at the time of promulgation of DOD Directive 5000.1, was very clear when, in testimony before the Holifield Committee on September 22, 1970, he stated in part (emphasis supplied):

> I consider the present Defense Systems Acquisition Review Council (DSARC) structure and policy to be an interim one on new weapons programs. The OSD office should make or approve policy, and monitor performance against approved policy. These offices should not have to make implementing decisions except to authorize a program and release funding when they are satisfied the services have brought the program far enough along to be ready for the next step. This is what the Development Concept Paper (DCP) and the DSARC program are all about. As the services demonstrate an improved capability, these controls should be relaxed.
>
> If this approach is to work, several things need to be done. A good manager must be assigned to the job by the responsible service, and he must be given authority to make decisions about his program. It may be difficult for the services to do this, but it must be done. There are two reasons why it is not done now. Too many higher ranking officers want to get in on the act. It is generally agreed that they don't know very much about the project in the sense that they make no positive contribution, but they can and do say "No." And they have to be briefed often and in great detail. We have a similar problem with higher ranking officials in the OSD offices in exactly the same way.
>
> In summary, I would like to reemphasize that procurement in Defense is complex—we need many different policies and different procedures. We will make improvements only to the extent we can get more good people into the business, and structure the organization so that they can use their intelligence, judgment, and energy effectively. We don't need more high level staff involvement in the services. We don't need more GAO types making decisions for us, and we don't need more legislation to

> spell out how to do this job. All we need is more capable people really managing these new weapons programs, working in an organizational structure in the services, and an attitude at all levels that will enable us to say, "This is the project manager's job—if he can't do the job right, we will find another project manager who can."

This policy was instituted by Mr. Packard, but its implementation has not taken place and indeed may have gone in the opposite direction. The problem is now to invest in the PM the necessary authority to perform his assigned mission

(2) Study Approach

Data on this issue were gathered from discussions with PMs and personnel assigned in their offices and through examination of the Cresap, McCormick and Paget report, "A Study of Project Management for the Navy's Major Weapon System Acquisition Process," which is included in the Project Management Annex, in Volume 2.

(3) Findings, Conclusions, and Recommendations

1. Advantages and Disadvantages of the Matrix Organization

The Navy uses the matrix organization approach in project management (i.e., a small project office supported by a large functional organization as opposed to a large integrated project office). The Panel believes that the Navy should continue to use this form of organization, but with certain changes that enhance the authority and responsibility of the PM.

The matrix form of organization has some distinct advantages and disadvantages. It is more economical for overall support of all the programs in the Navy but is generally less efficient with respect to any one program. On the other hand, programs that were organized vertically with all the contributors on the project payroll historically have had the best record of success. These programs had

a high priority, wide technical span, and high-level funding. However, the progess of these projects came at the expense of the functional organizations and at the expense of laboratories that had the mission to generate technology for future projects. There is a practical limit to the number of projects that the Navy can manage vertically since there is a finite number of qualified technical people in the Navy.

The matrix organization is more flexible than the vertical organization. It can be more quickly staffed and more easily dissolved. It can react more rapidly to changes in requirements gen rated by a change in the threat since new technologies can be integrated. It also allows more projects to be intensively managed than could be done with the vertical approach since the functional organization provides the reservoir of technology on which each of the PMs can draw.

There are some disadvantages, however. The unity of command of the PM is violated since the people who furnish his support do not actually work for him. This impairs the authority of the PM in the true organizational sense. The PM and his staff in the matrix organization must have a high level of both management and technical acumen in order to deal with the ambiguities of this form of organization. Intensive training is required to provision personnel to manage programs using the matrix approach.

A PM operating in a matrix management scheme has only that authority he obtains through the use of influence and the backing of that level of management supervising both the PM and the matrix organizational elements. To obtain support he must have some device that assures that the functional manager will be responsive to him. The primary way he obtains the services he needs is through control of all the funds required for his project. Personnel in the functional organization must be placed in the position of being responsive to the PM or else their funding will be cut off.

This concept has a dual advantage. First, the PM has the freedom to buy support from those who are

responsive to his needs, either from contractors or in-house organizations. Second, the functional organization is forced to examine the program in order to obtain the dollars needed to survive; thus it is able to point out to the PM areas where he needs support that he may not have recognized. If the PM is to be held accountable for a specific job in a matrix organization, he must have control over all funds involved in his project because this is his only real source of power.

The Panel believes that in many cases the PM's staff was too small to be truly effective. While the Panel would not advocate the large-PM-staff approach found in the Air Force for the reasons noted above, the PM should have sufficient technical and managerial capability on his staff to run a program effectively both within the Navy organization and at contractors' plants.

The PM function within the Navy has not yet achieved the stature it deserves. Even though the weapon system acquisition manager (WSAM) program has been established, the Panel found that many PMs did not even know it existed. It is believed that greater emphasis on the career opportunities within the project manager function coupled with a firm policy to hand pick PMs of sufficient rank (i.e., flag rank for major programs) would be beneficial to the Navy.

Recommendation PROC-24: The authority of the PM should be increased by giving him control of funds to the extent practical for his project. Support provided to the PM by the functional organizations should be handled in much the same manner by the PM as he handles his contractors. Performance of the in-house support supplied to the PM should be measured by the same techniques that are used to measure the performance of industry. The PM should have considerable latitude in regard to how much work he assigns in-house and how much work he contracts for outside.

Recommendation PROC-25: The number of personnel on the direct staff of the PM should be increased in order to allow him to manage both the in-house

and contractor efforts. The exact number of personnel in the program management organization is a function of the complexity of the program, the level of competence and training of the personnel, and the point in the life cycle of the system. As a very minimum, the PM must have sufficient personnel to determine cost, schedule, and technical conditions. He must have sufficient personnel to act as an effective transfer function.

Recommendation PROC-26: The Navy should stress the career opportunities of the PM function and recognize the increase in the responsibilities of the PMs. The grade assigned should reflect this change. The Navy should assign dynamic rising officers to PM billets to demonstrate the importance of the job. Promotional reviews should be conducted by people in the management chain and not by those who have no knowledge of a PM's effectiveness.

2. Excessive Layering

On the occasion of his departure as CNO, Admiral Zumwalt wrote to Secretary of Defense Schlesinger this opinion on the implementation of DOD Directive 5000.1:

> ....The move toward decentralization of acquisition responsibility while retaining major decision authority at the Secretary of Defense level was a significant change. I wholeheartedly endorse this change to participatory management. However, during the several years that we have been operating under the aegis of 5000.1, I have observed an erosion of the principles and concepts basic to that directive....

In their study on project management, Cresap, McCormick and Paget (CMP) found that a PM's contact with personnel in the Pentagon was five times greater than his contact with the contractor he was supervising (p. III-10). This indicates that the PM is spending more time answering questions than he spends managing the work he was appointed to manage. PMs, for example, spent an average of 17.6 percent of their time preparing

briefings (CMP Exhibit III-13). The PM could be much more effective if he were free to perform the day-to-day management functions of running his project. The necessity to continuously brief higher headquarters must be recognized as a major source of lost time for the PM.

PMs have an inordinate number of organizational layers and offices to satisfy before they are permitted to carry out their assigned missions. This layering of organization hinders and delays the decision process in the weapons acquisition life cycle. Organizational layers above the PMs do not generally contribute to reducing the workload of the PM and in many instances generate work for him. The PM must go through at least five organizational layers, i.e., SYSCOM, NAVMAT, OPNAV, SECNAV, and SECDEF (CMP Exhibit III-8) before he gets his program approved. This in itself does not seem out of line; however, each level contains several major components to satisfy, each component has numerous subordinate offices, and each office has specialists in a very narrow field. Each of these people must have his cut at major actions with the net result that getting a program going and keeping it going becomes a long, drawn-out process. Most of these staff personnel perform a "no" function while making only minor contributions to the actual work to be performed.

Recommendation PROC-27: Every effort should be exerted by OSD, CNO, and CNM and their staffs to strip out those organizational elements that have become operational beyond their assigned responsibilities.

Recommendation PROC-28. Each headquarters should examine every exercise it puts the PM through to determine if that task is really necessary and if the office can answer the questions with data already available to it.

Recommendation PROC-29: Each headquarters should do its best to answer inquiries from higher headquarters without making waves in the next lower headquarters. Particular attention should be paid to each headquarters' elaborating on the request of the one above as it passes to the one below.

3. Funding Constraints

The PM is not always given control of all the funds used in support of his project, which results in loss of support from some areas. In addition, he is constrained from budgeting for risk adequately, which is what he is managing in a development program.

The PM normally recognizes risk in his estimates, but as he goes through the chain, each level tends to eliminate this contingency from the proposed cost. Consequently, the PM is left with what amounts to a fixed-price development program that involves unfunded risk factors. Since he is responsible, he must at least be given the authority to display his risks at all levels without fear of having his program canceled. Unless this is recognized, overoptimistic estimates will remain the order of the day.

A PM has no certainty of receiving funds programmed year to year without repeated justification exercises. Yet several times each year he is involved in detailed justifications of his funding requirements in the normal budget cycle. Added to this, he must respond to "what if" exercises from numerous sources. This occurs when a request is made that the PM assess the impact if the budget and/or schedule and/or scope of work are changed. Many of these "what if" exercises appear to be started by personnel with no real authority for making these types of inquiries.

Once a PM has gone through the NSARC/DSARC process, he should have a reasonable assurance that the programmed funds approved will be forthcoming. Funding should become a routine matter unless a major shift in priorities occurs, and that should be a rare occurrence.

> Recommendation PROC-30: The PM should be given the authority to run his program. This authority can be exercised only if the PM is given control to the maximum extent practical over all funds allocated to his project. The PM should be allocated funds to buy support from whereever he needs it, including support from SYSCOMs.

Recommendation PROC-31: The SECDEF and the Department of the Navy should take immediate steps to implement the letter and intent of DOD Directive 5000.1

4. PM Relationships with the Contracting Officer

The Panel examined the present role of the procuring contracting officer (PCO) and his relationships with the project manager in the matrix environment. The Panel believes that the PCO should act as a functional element of the PM's staff and be colocated with him where possible, but that his job can best be performed if he is free to play the role of devil's advocate. In this respect, it is important that there is a clear identification of his authority with the SYSCOM procurement organization.

The mission assigned to the PM is such that his involvement in procurement activities should be held to a minimum. The role of the contracting officer is fraught with rules, regulations, laws, and paperwork that must be handled by those expert in that field. The job of PM should be kept separate from the PCO functions purely on a checks and balances basis. If the PM were also the PCO, any discussion he held with contractors could be construed as a legitimate change to the contract from the contracting officer resulting in a plethora of claims and changes to contracts. The day-to-day technical interchange required in any major program would become inhibited, and the best thinking available could not be brought to bear on significant problems.

The Panel found that, wherever warranted on the basis of workload, the PCO was dedicated to the program he served. The Panel supports this approach and further believes that colocation of the PM and PCO permits better understanding of their mutual roles and enhances program objectives.

Recommendation PROC-32: The functions of the PCO or his representative should be kept separate and distinct from those of the PM. The PCO or his

representative should be a dedicated member to the PM staff and should be collocated with his staff. PMs should not have warrants.

5. Foreign Military Sales

The Panel found that many PMs were being forced to accept the added burdens of assisting foreign governments in the government-to-government procurement of hardware without any increase in staff. This occurred despite the fact that the customer was quite willing to pay for additional support.

This practice creates a substantial additional burden on the PM. With the typically small Navy program office and the time it takes for foreign travel, the PM cannot afford to be away from his program without seriously jeopardizing its own progress.

In addition to the manpower problem, the PM frequently finds himself in the position of allying himself with the foreign government in negotiations with the U.S. supplier. Frequently contracting officers will minimize or disallow costs that should be recoverable on foreign military sales (FMS). This practice appears to result from either a lack of understanding of the additional costs and risks incurred in foreign sales and operations or a zeal to demonstrate an ability to reduce the contractor's price to an absolute minimum. This is a prime example of the use of the U.S. Government's bargaining power to benefit a foreign buyer to the detriment of a U.S. contractor.

Recommendation PROC-33: On those projects handling large FMS cases, adequate staffing should be provided to the PM to handle the additional workload.

Recommendation PROC-34: The Navy and OSD should examine the present policy of negotiating

FMS cases to insure equitable treatment of U.S. contractors for those costs associated with the foreign procurement.

6. SHIP ACQUISITION

Navy combatant vessels are very complex weapons systems requiring acquisition lead times of 4 to 8 years or more. This issue addresses acquisition problems that are unique to Navy shipbuilding. These are mostly in addition to those problems of a more general nature that have been identified in previous sections of this report, although there will be some overlaps with topics already covered.

(1) Statement of the Issue

The ship acquisition process has been going on for many years under peacetime, wartime, and cold war situations. Many of the ship acquisition programs have had very successful results in meeting stated performance goals and being delivered on schedule and within budgeted funds. Starting in the mid 1960's, some of the Navy's ship acquisition programs began to experience serious schedule slippages and/or cost growth. A number of general conditions and practices have had an adverse effect on the ship acquisition process during this period, including the following:

- The generally low level of commercial and Navy shipbuilding activity prevalent in the 1960s and until 1972. This buyer's market led to a very competitive environment, optimistically low prices, and a policy of attempting to recoup from underestimates via the changes article. In the mid to late 1960s, the pace of these actions increased, resulting in substantial claims against the Government by the shipyards.

- Increasingly complex and often inappropriate procurement practices.

- Funding limitations due to the inflationary environment.

- Rapid inflation. While naval ship construction contracts have included escalation provisions, they generally were inadequate to cover the increases incurred by shipbuilders.

The NMARC Procurement Panel has identified a number of specific factors in ship acquisition that are significant to program success. The most important of these are the following:

- Definition and stability of the performance requirements for a ship system
- Adequacy of program funding
- Acquisition approach
- Adequacy of the data package on which shipbuilders base their cost proposals
- Realistic contract pricing
- Concurrency in combatant ship procurement
- Economic considerations in ship procurement
- Shipbuilder/Government business relationships
- Integration of combat systems.

Each of these subissues is addressed in the following pages. While the actions that the Navy has already taken toward improvement of the procurement process have been noted, the principal focus has been on the additional steps that should be taken to increase the effectiveness of ship procurement and to minimize future contractual problems.

(2) Study Approach

The Procurement Panel held discussions and received briefings from several ship acquisition project managers, three shipbuilders, three Supervisors of Shipbuilding, contracting personnel of the Naval Sea Systems Command (NAVSEA),

preliminary design and contract design personnel at the Naval Ship Engineering Center (NAVSEC), the OPNAV sponsor of surface ship programs, and the OPNAV sponsor of submarine programs. The approach also included study of the testimony given to the Seapower Subcommittee of the House Armed Services Committee and Vice Admiral Eli T. Reich's report on claims.

(3) Findings, Conclusions, and Recommendations

Discussion of the issues together with Panel findings and conclusions are organized in accordance with the nine factors identified in the statement of the issue.

1. Definition and Stability of Performance Requirements

Two factors that exert a major influence on the design, construction, schedule, and cost of ship systems are (1) the completeness and adequacy of defined performance requirements and (2) the stability of these requirements through the acquisition cycle.

The acquisition of a ship will be most efficiently accomplished if the performance requirements remain stable throughout the procurement cycle; however, since the design and construction time for a new class of ship may run from 4 to 8 years, significant changes in the original threat and hence the operational role of the ship may occur. Likewise, advances in technological capability to one or more subsystems may offer improved or less costly performance. Tradeoffs must be continuously performed against the originally defined requirements to weigh benefits of design change versus adverse cost or schedule impacts on the overall program.

The manner in which ship requirements have been stated varies greatly among programs. Although OPNAV Instruction 9010.300 recently issued by the Navy defines procedures for developing top-level requirements and specifications, it should be supplemented by strict policy

and further procedures to maintain OPNAV and Naval Material Command (NAVMAT) disciplines throughout the ship's program life. DOD should establish practices consistent with this policy.

Recommendation PROC-35: Rigorous attention should be placed on the operational analysis leading up to the statement of requirements for new ship classes. Conscientious effort should be made to achieve the objectives of OPNAV Instruction 9010.300. The results of this effort should be scrutinized carefully at the program initiation DSARC.

2. Adequacy of Funding

Adequate funding is generally recognized as a prerequisite for achieving the stated goals of a program and minimizing perturbations in program planning. Funding programs properly has become increasingly difficult in the current inflationary environment.

There is convincing evidence that several of the ship acquisition programs have been underfunded. Some of the underfunding has resulted from the rapid inflation, but a substantial contributor has been overoptimism on the part of program sponsors as well as others in DOD who tried to present a program in the best possible light by minimizing estimates of program costs. The problem has been exacerbated by overoptimistic contractor estimates. The results of this underfunding have been large claims, inordinate cash flow requirements, and deterioration of sound working relationships with shipbuilders. Some of these problems would be alleviated if the Congress were to provide multiyear authorization for Navy ships.

Recommendation PROC-36: The policy of allowing only one estimating authority for ship acquisition programs should be continued. Baseline estimates should not be changed without sufficient cause. Any change should be documented.

Recommendation PROC-37: If a program is not funded at a level that supports the NAVSEA-approved estimate, the scope of the program should be reduced if that is feasible, or the program should be stopped.

Recommendation PROC-38: Every effort should be made to convince the OMB and the Congress of the desirability of multiyear authorization for ship acquisition programs. This authorization should allow flexibility in the timing of expenditures within the period authorized.

3. Acquisition Approach

The acquisition approach adopted for a program can contribute to the minimization of contractual problems over the life of the program or can be an underlying cause of problems. A number of different acquisition approaches have been used over the past 5 years. Two of these were selected for close examination. The DD-963 was selected because it is a total-package-type procurement, and the Patrol Frigate was selected because it represents one of the principal approaches now being used for multiship procurement programs.

The DD-963 procurement was carried out under the contract definition-total package procurement approach now prohibited in DOD largely because of the risk it imposed on the contractor. Despite the many negative aspects of a total package procurement, there are a number of desirable features in the DD-963 approach that are appropriate for consideration in future procurements. The most important of these are the following:

- Requirements definition receives close attention and system design tends to be optimized.

- The contractor has responsibility for and control over most of the major subsystems

and components of the ship, resulting in the clear-cut assignment of responsibility and generally more efficient procurement and integration of subsystems.

- Government-furnished equipment (GFE) and Government-furnished information (GFI) are reduced, thereby minimizing the Government's responsibility for program delay and exposure to claims.

- Intraclass standardization of equipment is maximized with attendant improvement in logistic support.

In the Patrol Frigate acquisition program, several advantages as well as some potential disadvantages arise from the policies that have been employed. This approach is more conservative for the lead ship since it utilizes a cost-type contract based on a more comprehensive data package, reducing the risk to the contractor. The Navy's risk however, is increased since the Navy retains responsibility for the suitability of the design package for the follow yards.

No single approach has universal application. Care must be taken to adopt the proper approach for each situation keeping in mind the basic policy that the type of contract used must be consistent with the selected acquisition method.

Recommendation PROC-39: Criteria for judging acquisition approaches should be developed and used in selecting the approach that is best suited for a given program.

4. Adequacy of the Data Package on Which Shipbuilders Base Their Cost Proposals

It is most difficult for the Navy to provide a data package that describes the design of the desired ship in sufficient detail to permit preparation of an estimate that will have an acceptable level of accuracy. In the case

of most shipbuilding programs, shipbuilders have prepared their cost proposals on the contract plans and specifications. In the past, the contract plans package has consisted of about 40 drawing typically covering the following characteristics:

- General arrangements of the compartments including the machinery spaces
- Profile of the ship
- Key structural features
- Diagrams of key piping and electrical systems
- Heat balances
- Electrical power requirements.

In addition, prospective shipbuilders have been furnished a list of the components and technical data to be provided by the Government. In recent programs increased effort has been placed on the amount of data provided in the contract plans and specifications, although, for most programs, the detailed working drawings are not available at the time the shipbuilders prepare their cost proposals.

While shipbuilders have traditionally prepared cost proposals from contract plans and specifications and may have to do so in the future, the limited degree of detail available introduces significant uncertainties. This in turn necessitates a more careful consideration on the part of the Navy regarding the selection of the proper form of contract to preclude contracting on a fixed-price basis before the details of the design are firm.

> Recommendation PROC-40: NAVSEA should continue the present emphasis on increasing the scope of the design effort going into the contract plans and specifications to provide greater assurance that a valid estimate can be made, a fully responsive design developed, and the resultant ship built at reasonable cost.

Recommendation PROC-41: On programs involving significant numbers of production ships or ships of high unit cost, NAVSEA should defer solicitation of the follow ships until the majority of the detailed design drawings for the lead ship have been issued. If the program is critical to national defense needs and proceeding with procurement of follow ships prior to this point is necessary, the higher risk involved should be recognized. Provisions should be made for the higher risk in the budget and in the terms of the contract used for the early follow ships.

5. Realistic Contract Pricing

In view of the extent of the reported growth of Navy shipbuilding and the resultant losses or limited profits, equitable pricing of shipbuilding contracts becomes very significant. Executives in the shipbuilding industry report that they develop what they believe to be realistic costs and reasonable profit levels and submit them to the Government in their proposals. They further state that during the several iterations in their contract negotiations, they may be negotiated down to unrealistic prices and low target profit levels and are in a "take it or leave it" situation. They note that in a number of cases the ceiling on the price they could negotiate was fixed by funding limitations. They further report that faced with the need for work and the desire to maintain good relationships with their prime customer, they reluctantly accepted contracts priced below levels they judged to be sound. They report that the combination of delays, extraordinary inflation, high cost of money, and manpower constraints lead to major overruns instead of the marginal profits they had hoped for.

Discussions with Government personnel tend to support the fact that on some programs the shipbuilder's prices had to be negotiated down to meet approved budget levels and that in some cases the budget level was too low. In the case of competitive programs several shipbuilders complain of the auction atmosphere that exists in the best and final offer approach.

In view of the difficulty of earning a reasonable profit, shipbuilders are finding it difficult to obtain capital for facility modernization or expansion to support Navy programs. With the advent of large commercial shipbuilding programs, the Navy needs to recognize that the buyer's market situation has changed and that it can no longer maintain a capability for Navy ship construction if it persists in the selection of inappropriate contract vehicles in an attempt to counter funding deficiencies.

Emphasis in contract negotiations needs to be shifted from getting the lowest possible price to getting a price that is reasonable for both parties. This includes setting target cost and profit goals at levels commensurate with baseline cost estimates in order to provide greater probability of achieving performance within cost and a reasonable rate of return on investment.

Recommendation PROC-42: In negotiated procurements, realistic target cost levels should be set that are fully supported by sound baseline cost estimates.

Recommendation PROC-43: The type of contract for the lead ship should be tailored to the degree of risk. Some type of cost-reimbursement contract should be used when significant risk is present. A fixed price contract should be used only when the data package is sufficiently complete to permit realistic pricing.

Recommendation PROC-44: When competitive procurements are used, action that could lead to an auction-type environment should be avoided. The feasibility of using two-step negotiated procurements should be examined. Emphasis in the first step should be put on identifying the offeror(s) fully qualified for the particular shipbuilding program; then cost proposals should be solicited once from the qualified shipbuilders.

6. Concurrency in Combatant Ship Procurement

One of the most difficult tasks facing Navy planners is the determination of the amount of concurrency that is appropriate in the procurement of naval combatants such as destroyers, frigates, and attack submarines that are built in classes. Developing the detailed design and building the first ship of a class of naval combatants takes about 3 to 5 years, depending upon the complexity of the ship and the urgency of the program. Since the design phase occupies 1 to 2 years of this period, the construction time required for subsequent ships is less, but still much longer than for other weapon systems.

If the procurement of the follow ships in a class were deferred until the lead ship had been delivered and tested, the first follow ship would not be delivered until 8 or 9 years after the contract had been placed for the lead ship. Subsequent follow ships would have deliveries extending beyond that. Literal application of "fly-before-buy," which would mean delivery and test of the lead ship before contracting for follow ships, is not appropriate.

In most programs, selection of components and subsystems is generally limited to those that have been fully tested and approved for fleet use. Therefore, the technology applicable to the systems installed in the ships of the class would be approximately 10 years old at the time the ships were delivered. Thus the problem becomes one of tradeoff between delivery of obsolete ships or unacceptable risk from early follow-on contracting.

The Navy's approach to ship design and shipbuilding is generally conservative. The principal problems in recent years have been related to combat system integration. Special efforts have been taken in the recent programs to avoid these problems through use of land-based prototype test sites.

Considering the long lead time required for construction of ships, it appears to be sound to schedule follow ships in a class with some concurrency to avoid

obsolescence in the later ships of a series. Risk can be minimized if the preparation of the detailed working plans has been completed before follow ships are contracted for, and in any event before fixed prices are requested. These data should provide prospective shipbuilders with sufficient information to prepare a proposal with acceptable limits of confidence. In order to make this approach work most effectively, it will be necessary to undertake procurement of long-lead-time items, including weapons system elements, well in advance of the time at which the contract is placed with shipbuilders for the follow ships.

Recommendation PROC-45: When the PF procurement approach is to be the ship acquisition model and when concurrency is necessary, the following considerations should be given special attention:

- Contract for the lead ship on a cost type basis. Contract with the lead yard for some of the first lot of follow ships.

- Contract for the follow ships from other yards on a fixed-price basis only after effort on the lead ship has produced a stable design. The first follow ship from the lead shipyard should be scheduled for completion at least 12 months after delivery of the lead ship. The first follow ship from a follow shipyard should be scheduled for completion at least 18 months after delivery of the lead ship.

- Include sufficient funds in the program budget to cover possible costs stemming from the Government's warranting the detailed design package.

7. Economic Considerations in Ship Procurement

Because most shipbuilding contracts cover periods of 3 to 8 years, the cumulative effect of changes in the

economic environment become very significant. The rapid inflation of the last several years has had an adverse impact on many shipbuilders. While shipbuilders working on Navy contracts have had included in their contracts escalation provisions designed to protect them from inflation, these provisions in shipbuilding contracts have varied considerably and are deemed inadequate by most shipbuilders.

The two most significant problems reported by the shipbuilders relate to shipbuilding delays and the validity of the indices. Ships experience delays for a number of reasons attributable to both the Government and the Contractor. The abrupt cutoff of the application of escalation provisions is inequitable. Some shipbuilders have reported that the mechanics of the escalation provision are not working properly in the recent period of rampant inflation. They note that the Bureau of Labor Statistics figures used as a base for calculating escalation do not adequately reflect shipbuilding cost elements.

Many shipbuilders have also complained that the revised Navy procedure for progress payment reimbursement is inequitable and creates severe cash flow problems. The Panel agrees that the present practice is unduly restrictive and deters shipbuilders' willingness to invest in new facilities that would tend to reduce shipbuilding costs through greater efficiency; thus the restrictive progress payment provisions appear to be self-defeating.

Recommendation PROC-46: NAVSEA and the Shipbuilder's Council should undertake a study to develop indices that are adequate to reflect shipbuilding cost escalation.

Recommendation PROC-47: NAVSEA and the shipbuilders should schedule ships more realistically and/or NAVSEA should provide that the escalation would apply to some reasonable period of excusable delay (possibly 1 year) in the completion of each ship in a series.

Recommendation PROC-48: In order to make its shipbuilding programs more attractive to industry, the Navy should minimize the shipbuilders' cost problems either with more adequate and timely progress payments or allowance of interest as a valid item of cost or both.

8. Improved Shipbuilder/Government Business Relationships

Over the period from World War II to 1972, the Navy has been the major customer of the U.S. shipbuilding community. For much of this period, generally good working relationships have existed between the shipbuilders and the Navy. This relationship could be categorized as a team relationship as much as the more usual supplier/customer relationship. The team has had some outstanding achievements. Unfortunately, in recent years, the team spirit has been replaced in some instances by an adversary position between the Navy and its shipbuilders, particularly in the nuclear yards. This climate has stemmed from the increasing incidence of claims coupled with the Navy's directed policy of engagement (i.e., the direct participation by resident Navy personnel in the management decisions and practices of its shipbuilders).

The intent of the engagement philosophy was to encourage resident Navy personnel (SUPSHIPs) to play a more active role in understanding and evaluating shipbuilders' management and operational practices, particularly in cost-reimbursement environments. Unfortunately, engagement implementation by Navy personnel combined in some instances with poor judgment has led to a marked deterioration of relationships at several major shipbuilders.

The problem has been accentuated in those yards where substantial claims have resulted, many of which are founded on the premise of constructive changes that the shipbuilders attribute to direction by Navy personnel. Another contributing factor has been the failure on the part of Navy personnel to recognize the difference between fixed-price (including fixed-price-incentive) and cost-type

effort, with the result that requests that might be readily complied with on cost-type contracts are strongly resisted under fixed-price arrangements. This leads to a further straining of relationships.

The number of claims, their value, and the rate of adjudication varies significantly from shipbuilder to shipbuilder as well as from contract to contract with a given shipbuilder. It is fair to state that the responsibility for the claims backlog does not rest solely with the Navy. In fact, during the last year or more the Navy has undertaken a concerted effort to adjudicate outstanding claims and has significantly reduced the number and estimated value of the claims.

There appears to be a relationship between a contractor's cost experience and the level of claims. When a contractor experiences cost growth, he has a greater tendency to press for contract changes, which may result in claims. The best means of avoiding claims is to avoid situations where contractors will experience major cost growth resulting in losses. Better definition of requirements, tight control of engineering changes, delivery of GFE and GFI on schedule (and without flaws), and avoidance of underpricing will all contribute to reduced claims. Over the past 5 years, early attention to negotiation of contract changes has helped to prevent the buildup of unsettled change orders.

Recommendation PROC-49: Toward the objective of reestablishing a cooperative relationship with its shipbuilders, the Government (NAVSEA, SUPSHIPs, and the Defense Contract Audit Agency (DCAA) should limit requests for data regarding the operation of a shipyard to that which the Navy actually needs to fulfill its responsibilities for ship acquisition. The type and extent of data requested should be commensurate with the type of contract(s) used. NAVSEA should set forth a moderate policy on the engagement concept and insure that the service philosophy is clearly understood at all echelons.

9. Integration of Combat Systems

Some of the combatant ship acquisition programs have experienced difficulties and delays in achieving operational effectiveness of the total combat system. The need is to identify an acquisition approach that will avoid these problems and achieve a fully integrated combat system in a timely and cost-effective manner. The difficulty results primarily from the complexity of a ship and its many subsystems including navigation, communications, sensors, weapons, and command and control.

In order to achieve effective combat system integration, early attention must be given to total system design. Historically, ship design has been approached primarily by specialists in the various subsystems and components. Only recently has the responsibility for the platform and the weapon system been brought together under a single Command. While the roots of the integration problem are at the beginning of a program, the problems have manifested themselves at the time the systems are being tested. Computer programs for command and control systems may not have been completely debugged or they may be incompatible with each other.

To alleviate these problems, increased attention is being focused on the engagement of a combat system integration contractor and the use of a land-based combat test system. Greater emphasis is needed on total system design starting in preliminary design and during the preparation of the contract plans and specifications. The design concept for the total system together with the key interface requirements for the principal subsystems should be completed before the contract plans and specifications are completed. They should reflect the integrated design concept.

The approach taken on the Trident program of assigning responsibility for integrating and testing subsystems to an integration contractor appears to hold substantial benefits. This practice permits identification and resolution of subsystem problems at the land-based test site before installation onboard ship.

Recommendation PROC-50: For each major combatant acquisition program, an integrator should be engaged to concentrate on systems integration and to test the system at a land-based test site. The Navy should continue to utilize a land-based test site of the weapon/command and control system in all ship acquisition programs involving new designs to test fully as much of the system as is practicable prior to installation of the first system in a ship. The test site should be placed where it can be used most effectively by the engineers responsible for system design and test.

Recommendation PROC-51: In programs involving a sizable number of ships, an extra ship set of equipment should be procured for use in the land-based prototype throughout the shipbuilding program for testing and training.

7. SUMMARY OF PROCUREMENT PANEL RECOMMENDATIONS

(3) Systems Acquisition

1. Requirements Definition and Determination of Systems Alternatives

Requirements definition and determination of systems alternatives by the Navy are inhibited by premature intervention by OSD staff, which restricts the Navy's management of conceptual and exploratory development phases.

Recommendation PROC-1: The Secretary of Defense (SECDEF) or the Deputy Secretary of Defense (DEPSECDEF) should reinforce the decentralization principles of DOD Directive 5000.1 and its derivative policies by preventing OSD staff involvement in and constraint of the Navy's studies of alternatives prior to the Navy's requesting the program initiation Defense Systems Acquisition Review Council (DSARC) (#1).

Recommendation PROC-2: The Secretary of the Navy (SECNAV) should assure that SECNAV Instruction 5000.1 provides for comparable elimination of premature Navy staff involvement and constraint to assure the project manager's control over management of conceptual and exploratory development programs.

2. Acquisition Planning and Strategy

Acquisition planning and strategy formulation, as presently performed by the Navy, is in need of a major reorientation. This is a fundamental prerequisite to reversal or amelioration of the problem of unwarranted OSD and congressional intervention into Navy affairs.

Recommendation PROC-3: The Secretary of the Navy (SECNAV), the Chief of Naval Operations (CNO), and the Chief of Naval Material (CNM) should take steps to improve specific system development and acquisition programs. In particular, strategy and plans should be developed by experts professionally knowledgeable in all functional areas involved with benefit from contacts with knowledgeable industry personnel. These professionals should have long-term continuity. Such strategy should be developed with firm consideration given to existing POM-projected resources. The strategy should establish guidance within which the affected PM can perform tradeoffs. Key participants in the development of such a plan or strategy should continue in positions of responsibility in the program. The PM must play an integral role if not actually lead the planning effort.

3. Resource and Budget Management

The lack of a coordinated OSD/Navy approach to resource and budget management inhibits the Navy's ability to support its programs to the Congress.

A variety of pressures exist that tend to force the estimated costs downward.

Recommendation PROC-4: SECNAV, CNO, and CNM should take immediate, positive steps to improve major system planning, programming, budgeting, and acquisition data for presentation to appropriate key congressional committee and professional staff members. SECNAV, CNO, and CNM should also take steps to better acquaint such persons with Navy mission deficiencies, programs, and requirements.

Recommendation PROC-5: Major acquisition programs should be budgeted on a multiyear basis and include a management reserve, which should be under the control of the Navy.

Recommendation PROC-6: The Navy should identify certain "core" programs that should be regarded by all concerned as inviolate short of major change in the threat assessment. The Navy should present a long-range plan for these programs to the Congress and justify the need for multiyear authorization.

Recommendation PROC-7: OSD and the Navy should develop a coordinated approach to resource requirement planning aimed at reduction in the levels and types of detailed OSD monitoring, rules and thresholds of governing substitutions among various resource categories, and the multiple shredouts of program elements.

Recommendation PROC-8: The Navy should closely examine the problems associated with downward pressures on program estimates with a view to formulating policies aimed at elimination of such practices, which are the genesis of cost growth and claims and ultimately of congressional antipathy.

4. Program Control and DSARC Implementation

Program control by the Navy is frustrated by OSD misimplementation of the DSARC process, as originally conceived by Mr. Packard and described in DOD Directive 5000.1 and its derivative policies.

Recommendation PROC-9: The Secretary of Defense (SECDEF), DEPSECDEF, and SECNAV must effect improved accommodation between OSD and Navy views as to the appropriate balance to be struck between OSD/Navy responsibilities, interests, and prerogatives as intended by the principles of DOD Directive 5000.1. Some specific examples are the following:

- Eliminate OSD staff constraint of Navy studies of alternatives prior to Navy's requesting the first DSARC.

- Extend the half life of DSARC decisions. Once the SECDEF/DEPSECDEF and SECNAV agree on a signed DCP, stick with the decision longer than is currently the case—i.e., purposefully reduce program turbulence, which is generated internally by OSD/Navy.

- Adopt a practice of hearing Navy positions firsthand before making negative decisions regarding the Navy's DSARC proposals.

- Retreat from the practice of using the DSARC process to approve annual production buys of hardware programs already approved for production.

- Relative to shipbuilding programs, adopt a practice of letting the thresholds established in the original DCP operate to control the construction program (i.e., the current trend is toward requiring as many as ten separate DSARCs, with all the attendant prebriefings, briefings, etc. in connection with a new ship class development and construction program).

Recommendation PROC-10: SECNAV should convene the NSARC upon the recommendation of the CNO or the CNM, to review major weapons systems acquisition at key junctures where DSARC meetings are now required. CEB meetings now conducted as pre-DSARC meetings should be conducted in joint sessions with the NSARC, to assure that all senior Navy principals consider program issues concurrently and jointly, and to reduce review activity for the PM.

5. Organizational Layering

The existence of large, redundant staffs of specialists, interspersed between SECNAV and the program manager and between SECNAV and SECDEF, all of which are chartered to exercise review functions, inhibits the efficient functioning of Navy systems acquisition management.

Recommendation PROC-11: SECDEF, DEPSECDEF, and SECNAV should evaluate staff needs, functions, and responsibility/authority assignments in the context of DOD Directive 5000.1 emphasis on streamlined decisionmaking and strong, relatively autonomous PMs. Specific policy should be promulgated that delineates authority and responsibility limits of staff specialists. The billets eliminated by the reduction of excessive layering should be utilized by reassigning them to the staffs of the PMs.

(4) Procurement Practices

1. Program Budgeting and Funding

The Navy has the capability to prepare sound baseline cost estimates, but the original estimate is frequently reduced by a downward bias before the budget requirement is sent to Congress.

Recommendation PROC-12: The Navy should improve the reliability of estimated program costs it presents to Congress. The responsibility for the preparation of baseline cost estimates should be assigned to the SYSCOMs. Detailed baseline estimates with associated rationale should be developed for each major program. The baseline estimate should be made a matter of record and should not be changed except when justified by modifications to scope and then only when completely substantiated in writing.

2. The Need for Improvements in Procedures

Internal processing of procurement documents within the Navy is redundant and time-consuming. The procurement cycle could be shortened considerably by streamlining procedures and delegating greater authority to the SYSCOMs and to field personnel.

Recommendation PROC-13: The Navy should emphasize the review of proposed acquisitions at the beginning of the business cycle utilizing the APP document to delineate clearly all facets and considerations of the proposed procurement Review should be accomplished through the command chain including a representative of the Assistant Secretary of the Navy for Installations and Logistics (ASN(I&L)). RANs and D&Fs should reference the approved APP and should be expedited through the system.

Recommendation PROC-14: NAVMAT should assess SYSCOM capacity to approve its own business clearances and increase their approval levels as appropriate. NAVMAT should periodically audit the SYSCOMs' performance of the business clearance function and, if that audit reveals serious deficiencies, the business clearance authority can be returned to NAVMAT until the deficiencies are remedied.

Additional billets should be provided to the SYSCOMSs' contracts directorates for specialists in advanced pricing techniques.

Recommendation PROC-15: Reliability and maintainability requirements should be eliminated from the business clearance. These requirements have nothing to do with the business aspects of procurement and have substantially increased procurement lead times.

3. Deficiencies in the Source Selection Process

Contractors frequently complain that the Navy's source selection procedures are not clearly spelled out with the result that there is a considerable amount of inconsistency among SYSCOMs. These complaints cover evaluation criteria, competitive negotiations, encouragement of "buy-ins," etc.

Recommendation PROC-16: While the regulations with respect to the source selection and negotiation procedures presently exist, more definitive explanation of the intent and purpose of these procedures should be included in applicable instructions and more training undertaken at various levels to assure proper implementations.

Recommendation PROC-17: Requests for Proposals (RFPs) should be carefully reviewed for clarity of requirements. Where it is desirable to allow a contractor freedom to develop an individual technical approach, this fact should also be clearly delineated.

Recommendation PROC-18: Policy statements should continue to be developed that emphasize a desire to prevent erosion of the spirit and intention of the ground rules and to avoid selection practices that lead to auction techniques, excessive technical transfusions, and undue pressures upon contractors through best and final offer techniques.

Recommendation PROC-19: Buy-ins should be discouraged by downgrading proposals that appear to be priced unrealistically low.

4. Selection of Contract Type

The Navy has frequently utilized contract types that are inappropriate for the status of the program being placed under contract. Such action seems to have resulted from a desire to shift a greater risk to the contractor, but unfortunately it has backfired in the form of large claims.

Recommendation PROC-20: A clear-cut policy is needed to define the contract type to be used at various stages of program development. To accomplish this, SECNAV Instruction 5000.1, Naval Procurement Directive (NPD) III-4, and ASPR Section 3, Part 4, should be rewritten to describe the options available and the recommended criteria upon which contract selection should be based. The acquisition strategy should then provide for enforcing these instructions in every case.

5. Government/Contractor Adversary Relationships

With the reduction in contractor profit margins brought about by the "risk-shifting" philosophy and the increasing efforts on the part of resident Navy personnel to enter into the management decisionmaking process, Government/contractor relations have deteriorated to what can truly be considered an adversary position.

Recommendation PROC-21: The CNM should clearly enunciate the aims of the engagement concept by setting forth a posture and attitude calculated to motivate personnel at all levels, both Government and contractor, to produce the kind of effort the national interest requires. Management training

within the Navy and industry program and functional organizations should emphasize this philosphy.

6. Special Economic Considerations

The present rapid rate of inflation has caused severe cash-flow problems for contractors. Progress payment clauses require revision, and more equitable escalation clauses are also required.

Recommendation PROC-22: Contract provisions with respect to payment should be reviewed with recognition of the cash-flow problems incident to present inflation, high interest rates, and other economic problems.

Recommendation PROC-23: In future contracts, escalation provisions should be revised to reflect the impact on contractor costs attributable to abnormal general economic conditions. If indices are used, they should be a reasonable reflection of the variations in cost for labor and materials utilized by the contractor in performance of the specific Government contract and should be applied in recognition of a mutual problem without unreasonable restrictions.

(5) Program Management

1. Advantages and Disadvantages of the Matrix Organization

The Navy's use of the matrix form of organization is probably a good compromise with limited resources available. Certain improvements are needed, however, to improve the operating efficiency of the project manager.

Greater career opportunities should be stressed for the PM function. Careful selection of well qualified

PMs of sufficient rank would tend to forestall much of the existing staff interference.

Recommendation PROC-24: The authority of the PM should be increased by giving him control of funds to the extent practical for his project. Support provided to the PM by the functional organizations should be handled in much the same manner by the PM as he handles his contractors. Performance of the in-house support supplied to the PM should be measured by the same techniques that are used to measure the performance of industry. The PM should have considerable latitude in regard to how much work he assigns in-house and how much work he contracts for outside.

Recommendation PROC-25: The number of personnel on the direct staff of the PM should be increased in order to allow him to manage both the in-house and contractor efforts. The exact number of personnel in the program management organization is a function of the complexity of the program, the level of competence and training of the personnel, and the point in the life cycle of the system. As a very minimum, the PM must have sufficient personnel to determine cost, schedule, and technical conditions. He must have sufficient personnel to act as an effective transfer function.

Recommendation PROC-26: The Navy should stress the career opportunities of the PM function and recognize the increase in the responsibilities of the PMs. The grade assigned should reflect this change. The Navy should assign dynamic rising officers to PM billets to demonstrate the importance of the job. Promotional reviews should be conducted by people in the management chain and not by those who have no knowledge of a PM's effectiveness.

2. Excessive Layering

PMs have an inordinate number of reviewing authorities to answer to. Many of these are outside the chain of command, have no approval authority, and contribute nothing to the program.

Recommendation PROC-27: Every effort should be exerted by OSD, CNO, and CNM and their staffs to strip out those organizational elements that have become operational beyond their assigned responsibilities.

Recommendation PROC-28: Each headquarters should examine every exercise it puts the PM through to determine if that task is really necessary and if the office can answer the questions with data already available to it.

Recommendation PROC-29: Each headquarters should do its best to answer inquiries from higher headquarters without making waves in the next lower headquarters. Particular attention should be paid to each headquarters' elaborating on the request of the one above as it passes to the one below.

3. Funding Constraints

Funding for approved programs is not given to the PM charged with program responsibility. Frequently the PM is not given the full authority of a DSARC approval but is frequently required to rejustify his program between DSARCS.

Recommendation PROC-30: The PM should be given the authority to run his program. This authority can be exercised only if the PM is given control over all funds allocated to his project. The PM should be allocated funds to buy support from wherever he needs it, including support from SYSCOMs.

Recommendation PROC-31: The SECDEF and the Department of the Navy should take immediate steps to implement the letter and intent of DOD Directive 5000.1.

4. PM Relationships with the Contracting Officer

The present relationship between PMs and contracting officers appears to be working well. On major programs, the PCO is a dedicated member of the PM staff, but the PM has not been delegated contracting officer authority. Colocation is most important.

Recommendation PROC-32: The functions of the PCO or his representative should be kept separate and distinct from those of the PM. The PCO or his representative should be a dedicated member of the PM staff and should be collocated with his staff. PMs should not have warrants.

5. Foreign Military Sales

The FMS case workload is frequently added to the workload of already understaffed program offices. This adds to administrative workload, more reviews, and further detraction from the ability of the PM to function properly. Present FMS case procurement practices work to the disadvantage of the U.S. contractor.

Recommendation PROC-33: On those projects handling large FMS cases, adequate staffing should be provided to the PM to handle the additional workload.

Recommendation PROC-34: The Navy and OSD should examine the present policy of negotiating FMS cases to insure equitable treatment of U.S. contractors for those costs associated with the foreign procurement.

(6) Ship Acquisition

1. Definition and Stability of Performance Requirements

Lack of requirements stability caused by involving too many people in the acquisition process creates real problems for the Navy and has caused its credibility to be suspect.

Recommendation PROC-35: Rigorous attention should be placed on the operational analysis leading up to the statement of requirements for new ship classes. Conscientious effort should be made to achieve the objectives of OPNAV Instruction 9010.300. The results of this effort should be scrutinized carefully at the program initiation DSARC.

2. Adequacy of Funding

Baseline cost estimates tend to be changed in reviews by higher echelons resulting in program underfunding and claims. Multiyear funding for ship acquisition would result in overall reduction in ship costs.

Recommendation PROC-36: The policy of allowing only one estimating authority for ship acquisition programs (NAVSEA 052) should be continued. Baseline estimates should not be changed without sufficient cause. Any change should be documented.

Recommendation PROC-37: If a program is not funded at a level that supports the NAVSEA-approved estimate, the scope of the program should be reduced if that is feasible, or the program should be stopped.

Recommendation PROC-38: Every effort should be made to convince the OMB and the Congress of the desirability of multiyear authorization for ship acquisition programs. Some flexibility should be requested for the project manager in timing of expenditures.

3. Acquisition Approach

The Navy has used a variety of acquisition approaches that seem to vary without a great deal of logic. Clearly defined requirements are necessary, accompanied by instructions to working personnel to prevent use of approaches that are inappropriate.

Recommendation PROC-39: Criteria for judging acquisition approaches should be developed and used in selecting the approach that is best suited for a given program.

4. Adequacy of the Data Package on Which Shipbuilders Base Their Cost Proposals

Shipbuilding by its very nature requires that initial estimates be made on the basis of broad design criteria. Follow ships are also priced on the basis of a "contract design" that has not been proven in construction and thus contains many uncertainties or errors.

Recommendation PROC-40: NAVSEA should continue the present emphasis on increasing the scope of the design effort going into the contract plans and specifications to provide greater assurance that a valid estimate can be made, a fully responsive design developed, and the resultant ship built at reasonable cost.

Recommendation PROC-41: On programs involving significant numbers of production ships or ships of high unit cost, NAVSEA should defer solicitation of the follow ships until the majority of the detailed design drawings for the lead ship have been issued. If the program is critical to national defense needs and proceeding with procurement of follow ships prior to this point is necessary, the higher risk involved should be recognized. Provisions should be made for the higher risk in the budget and in the terms of the contract used for the early follow ships.

5. Realistic Contract Pricing

Realistic pricing is essential if future claims are to be avoided. Downward pressures resulting from budgetary limitations, technical leveling, best and final offers, etc. eventually lead to underpriced contracts, schedule slips, and claims.

Recommendation PROC-42: In negotiated procurements, realistic target cost levels should be set (ensuring that adequate amounts are included for labor, material, and other valid cost elements) supported by sound baseline cost estimates.

Recommendation PROC-43: The type of contract for the lead ship should be tailored to the degree of risk. Some type of cost-reimbursement contract should be used when significant risk is present. A fixed price contract should be used only when the data package is sufficiently complete to permit realistic pricing.

Recommendation PROC-44: When competitive procurements are used, action that could lead to an auction-type environment should be avoided. The feasibility of using two-step negotiated procurements should be examined. Emphasis in the first step should be put on identifying the offeror(s) fully qualified for the particular shipbuilding program; then cost proposals should be solicited once from the qualified shipbuilders.

6. Concurrency in Combatant Ship Procurement

Proper planning of follow ship procurement is essential if the Navy is to deliver ships to the fleet with up-to-date weapons systems. Because of the length of time required to build a lead ship of a class, the Navy is almost forced to initiate procurement action on follow ships before the lead ship is delivered. Under these circumstances it is imperative that consideration be given to long-lead funding of weapon system elements well in advance of follow ship procurement.

Recommendation PROC-45: When the PF procurement approach is to be the ship acquisition model and when concurrency is necessary, the following considerations should be given special attention:

- Contract for the lead ship on a cost type basis. Contract with the lead yard for some of the first lot of follow ships.

- Contract for the follow ships from other yards on a fixed-price basis only after effort on the lead ship has produced a stable design. The first follow ship from the lead shipyard should be scheduled for completion at least 12 months after delivery of the lead ship. The first follow ship from a follow shipyard should be scheduled for completion at least 18 months after delivery of the lead ship.

- Include sufficient funds in the program budget to cover possible costs stemming from the Government's warranting the detailed design package.

7. Economic Considerations in Ship Procurement

The present escalation provisions and clauses used by the Navy are considered inadequate. The present complicated method of determining progress payments is inequitable and self-defeating since it deters investment in new facilities that could provide greater efficiency.

Recommendation PROC-46: NAVSEA and the Shipbuilders' Council should undertake a study to develop indices that are adequate to reflect shipbuilding cost escalation.

Recommendation PROC-47: NAVSEA and the shipbuilders should schedule ships more realistically and/or NAVSEA should provide that the escalation would apply to some reasonable period of delay (possibly 1 year) in the completion of each ship in a series.

Recommendation PROC-48: In order to make its shipbuilding programs more attractive to industry, the Navy should minimize the shipbuilders' cost problems either with more adequate and timely progress payments or allowance of interest as a valid item of cost or both.

8. Improved Shipbuilder/Government Business Relationships

The Navy presently finds itself in an "adversary" type of situation with its major shipbuilders. This has been brought on by a continuous erosion of profit factors and aggressive implementation at some levels of the so-called "engagement" policy.

Recommendation PROC-49: Toward the objective of reestablishing a cooperative relationship with its shipbuilders, the Government (NAVSEA, SUPSHIPs, and the Defense Contract Audit Agency (DCAA) should limit requests for data regarding the operation of a shipyard to that which the Navy actually needs to fulfill its responsibilities for ship acquisition. The type and extent of data requested should be commensurate with the type of contract(s) used. NAVSEA should set forth a moderate policy on the engagement concept and insure that the service philosophy is clearly understood at all echelons.

9. Integration of Combat Systems

In complex ships the use of a subsystem integrator would greatly enhance the Navy's and contractor's ability to meet schedule and performance requirements.

Recommendation PROC-50: For each major combatant acquisition program, an integrator should be engaged to concentrate on systems integration and to test the system at a land-based test site. The Navy should continue to utilize a land-based test site of the weapon/command and control system in all

ship acquisition programs involving new designs to test fully as much of the system as is practicable prior to installation of the first system in a ship. The test site should be placed where it can be used most effectively by the engineers responsible for system design and test.

Recommendation PROC-51: In programs involving a sizable number of ships, an extra ship set of equipment should be procured for use in the land-based prototype throughout the shipbuilding program for testing and training.

VI. PRODUCTION PANEL

The NMARC Production Panel has found that the principal problems in producing and delivering defense material are not caused primarily by difficulties in the physical jobs of manufacture and assembly but are related, rather, to earlier decisions in research and development, cost and schedule commitments, contracting methods, and Government/producer relationships. The panel found that, in successful programs, the Navy and its contractors had maintained a healthy and cooperative relationship; where adversary positions had developed, however, programs were in trouble. The key, as the NMARC Production Panel sees it, is creating and maintaining an atmosphere of joint and timely resolution of problems as they occur--and they invariably will in any program.

Rear Admiral Levering Smith, USN, has described the partnership between Government and industry on the Polaris program as: "...a partnership in the sense of being a continuing relationship with indefinitely continuing responsibilities of each member of the military-industrial team to each other member and to the common objective." The NMARC Production Panel has found that not all Navy programs are being managed in accordance with this principle and that shipbuilding specifically seems to be approached, in a number of cases, with an almost directly contrary philosophy. Much of the content of this report, therefore, relates to how the buyer/seller relationship might be improved.

1. BACKGROUND

The charter for the NMARC Production Panel identified the areas to be studied, with particular emphasis on shipbuilding. Major areas of study included the acquisition environment, with emphasis on industrial capacity, both private and public; policies and procedures in acquisition planning and procurement; staffing and management of contract administration field offices; and claims prevention. In addition, the general subject of program management was assigned to all panels, and some facets thereof were examined by the NMARC Production Panel.

(1) Study Approach

The NMARC Production Panel was composed of executives of two shipbuilding firms, two missile development/manufacturing companies, and one airframe manufacturer. With this diversity of backgrounds, the Panel decided that its fact-finding efforts should include visits to major ship, aircraft, missile, and electronics producers to acquaint the Panel members with the techniques employed in each of those special fields and their unique aspects. A comprehensive schedule of trips and briefings was therefore established, with concentration on shipbuilding and shipbuilders, both naval and private.

Early in the study, it was decided that the Panel and staff would function as a unit rather than subdividing and making separate trips. This was carried out except that, because of schedule conflicts, some Panel members were unable to make all stops on every trip. However, several executive sessions were held during the course of the study during which information received, impressions and opinions formed, and problems noted were discussed with the Panel as a whole.

Panel visits are shown in Appendix PROD-B. It is apparent that the Panel concentrated in the shipbuilding areas but did not neglect aircraft, missile, and electronics producers. The Panel also met with representatives of several operational commands, such as Commander in Chief, U.S. Atlantic Fleet (CINCLANTFLT), and Commander, Naval Air Force, U.S. Pacific Fleet (COMNAVAIRPAC), to learn views of the Navy's "users," particularly with respect to ship repair and overhaul.

The discussions with field offices concentrated on views of their responsibilities, relationships with higher authority, field contract administration, and staffing adequacy. The visit to the Naval Weapons Center, China Lake, focused on the laboratory interface with material producers and the laboratories' role in project technical management. Not shown are the numerous visits, interviews, and briefings held in the Washington area, primarily with Chief of Naval Material (CNM), systems commands (SYSCOM), and project management personnel.

(2) Additional Tasks Assigned

During the course of the study, additional tasks were assigned the Panel. These were: (1) a review of the study on claims conducted by Vice Admiral Eli T. Reich, USN (Ret.), for the Deputy Secretary of Defense (DEPSECDEF); (2) an examination of the effects of Title VIII of the 1975 Defense Appropriation Authorization Bill, which states that all future major strike-force combatant ships shall be nuclear powered; and (3) "should-cost" studies. The Panel's comments on the Reich report and Title VIII are included in discussions of the issues in subsequent sections of this chapter.

In response to the request to examine should-cost, a preliminary examination led to the conclusion that it was a less important issue than others assigned to the Panel. There is a wide divergence of opinion among the services and the Office of the Secretary of Defense (OSD) on the definition of should-cost and how it should be applied. A Department of Defense (DOD) should-cost coordinating committee has been formed. The committee has not yet resolved the basic question of what should-cost is. Consequently, the NMARC Production Panel did not pursue the issue in any detail and has no specific recommendations on it.

2. MAJOR ISSUES EXAMINED

The NMARC Production Panel concentrated its efforts in four main study areas:

- Utilization of personnel and organization, particularly in project management
- The acquisition environment
- The production impact of planning and procurement strategy
- Field contract administration.

These study areas are mutually interdependent. For example, there is an obvious interrelationship between project management and field contract administration. In the following pages, therefore, different aspects of some of the same problems are treated in several places.

The report is organized by study areas, each of which covers several major subjects. Each of these major subjects is developed in

some detail, with recommendations categorized as "major" and "other." The distinction between the two levels of recommendations is largely judgmental, but the intent was to identify as major the recommendations that appeared to have the highest potential payoff and that appeared to have the best chances of being implemented.

Although a large number of issues was examined, the major points that this Panel wishes to emphasize are:

- Industrial capacity--and the special issue of new construction in naval shipyards
- Strengthening of project management
- Improved product definition prior to firm production contracting
- Increased flexibility in shipbuilding contracting
- Combat systems integration in shipbuilding.

The following four sections of this panel report address the four study areas in which most of the NMARC Production Panel's efforts were concentrated.

3. PERSONNEL AND ORGANIZATION

(1) Project Management

1. Statement of the Issue

The role of the project manager (PM) in the acquisition process was examined in detail by the NMARC Production Panel. It was considered necessary to examine the PM's role both from the standpoint of how effectively responsibilities were being discharged and how effective was the basic project/functional matrix organization that is generally characteristic of Navy acquisition organizations.

2. Findings and Conclusions

The NMARC Production Panel spent much time and effort examining the project/functional matrix organization devoted to the acquisition of weapon systems. Comparisons were made with project management in private industry and in the U.S. Air Force. Project management offices and techniques were evaluated in terms of the success of the projects.

Project management of major programs in the U.S. Air Force is characterized by vertical organizations wherein all necessary functions are assigned to the PM and the project office is staffed accordingly. In the Navy acquisition organization, the Strategic Systems Project Office (PM-1) comes the closest to being a truly "vertical" organization. PM-1 is responsible for the development, production, and support of the Navy's submarine-launched, ballistic missile weapons systems, the Polaris, Poseidon, and now Trident missile programs.

The ballistic missile project has been very successful. In addition to the advantages of the concentration of management functions and personnel within the PM's staff, it should be recognized that the project through the years has also enjoyed the highest priorities and adequate funding to do what was needed when it was needed. These additional considerations must be acknowledged as being of great significance in assessing the success of the project. For any future Navy project of comparable national significance, however, PM-1 would serve as the undisputed model of how such new projects should be organized, managed, and staffed.

Not all of the Navy's acquisition projects can be accorded the highest priority. Furthermore, when the number of Navy projects that meet the DOD criteria for major projects worthy of intensified management is considered, it is not possible to staff all of these projects vertically within present headcount restraints. (The Naval Air Systems Command (NAVAIR) has 22 projects; the Naval Sea Systems Command (NAVSEA) has 21. The Navy has a total of 53 major weapon system acquisition projects that qualify for intensified management techniques under the DOD criteria.) In addition, functional staffs are required for support of the myriad minor Navy programs and projects that would never warrant vertical staffing, just as the Air Force maintains its Air Force Systems Command,

Air Force Logistics Command, Aeronautical Systems Division, and other functional organizations.

It is unrealistic to plan to augment the existing Navy staff to be able to staff project offices as essentially self-contained organizations. The impossibility of this is further emphasized when it is remembered that further reductions of 6,000 to 8,000 Navy civilian personnel in FY75 have been ordered by OSD in response to direction by the Congress.

There is general agreement among both Navy personnel and contractors that the matrix form of project management has served the Navy well in most areas of acquisition. One prime example of this is aircraft procurement. The Navy has been eminently successful in recent years in acquiring first-rate aircraft, some of which are used by the U.S. Air Force and foreign governments as well as by the U.S. Navy.

Airframe manufacturers have told the NMARC Production Panel that they are able to work well with Navy PMs. The same manufacturers sometimes question the need for the large Air Force systems project office (SPO) staffs. One airframe manufacturer told the NMARC Production Panel:

> Our experience has...shown that our most successful programs have been characterized by a close synergistic association between our own competent technical manager and a broad gage Navy Technical Manager who was an integral part of the SYSCOM Project Office, backed up by a small staff of subsystem assistant managers.... A competent Navy Technical Manager with a small high quality staff knows when additional technical help is needed, where to find it and has authority to get it.

NAVSEA's project offices do not vary significantly from those in NAVAIR with respect to overall approach or staffing levels. The NMARC Production Panel, therefore, concluded that recent problems in naval ship acquisition might be attributable to primary causes other than the use of matrix-type project management.

Responsible observers noted that successful matrix-type project management is dependent to a large degree on the

closeness of the working relationship of the PM and his small staff with those who provide the project with technical support and technical support management. The NMARC Production Panel observed one case in which, because of geographic separation and the attitudes and approaches of technical support personnel, the PM had lost control of his technical support management.

Where, as in this case, remotely located technical assistance has been allowed to evolve into something called "technical management," separate and distinct from project management, problems were observed. Although instances could be cited of projects that have successfully hurdled this roadblock, it was apparent to the Panel that chances of success are greatly increased where program/project management and technical management are collocated in concept, as well as physically; the PM's key technical personnel should support him and should be located close enough to him to do it effectively. When it is essential that some technical support functions be performed by remotely located naval activities, their relative authorities and relationships must be clearly and specifically delineated. Such activities should never be placed in the chain of command between a PM and his contractors. Delays, confusion, and claims result from such an arrangement.

NAVSEA's ship acquisition project managers (SHAPMs), for example, located in Arlington, Virginia, are physically separated from their primary source of technical assistance, the Naval Ship Engineering Center (NAVSEC), in Hyattsville, Maryland. Although the offices are only a relatively few miles apart, personnel consume many hours in round-trip travel between the two locations; work that should be accomplished face to face is attempted over the telephone; and some communication that should take place, does not. Communication difficulties are further magnified when technical assistance is provided by a laboratory more than 2,000 miles from the PM's office.

The NMARC Production Panel recognizes that it is not realistic to expect that all technical support personnel for every project can be located with the PM in the Washington area. The point the Panel wishes to make is that the PM must retain control of the management of technical support for his project and that technical direction to the contractor

should come from the PM, not from technical support personnel acting independently of the PM.

The NMARC Production Panel concluded that certain other support must also be collocated with the PM and, even in a matrix-type project management office, should be directly assigned to the PM. The most significant direct support required is contracting support. Two of the thorniest problems confronting PMs are:

- The length of time required to process procurement documents (e.g., Procurement Requests (PRs), Requests for Authority to Negotiate (RANs), and Determinations and Findings (D&Fs)
- The length of time required to effect contractual changes.

Lack of timely response from procurement support personnel contributed to cost growth on contracts by delaying production, put the Navy in an unfavorable light as a customer, and appears to have contributed to claims. One way of ensuring improved response by procurement personnel would be to assign the procuring contracting officer (PCO) to the PM's staff, including all necessary support staff (i.e. contract negotiators, contract administrators, and clerks). Policy guidance for these people would continue to be the responsibility of the SYSCOM's deputy commander for contracts, but they should be assigned full time to, and be physically located in, the offices of the PM. Location on the PM's staff should serve to reinforce the identification of the PCO with that project. Collocation of the PCO and those giving technical guidance to the contractor should minimize the chances of inconsistencies in technical and contractual actions.

The optimum location of the PM's office itself came under the review of the NMARC Production Panel. It had been suggested that perhaps a PM should be located at the contractor's plant, rather than in Washington. However as was discussed in foregoing paragraphs, a prime requisite is for the PM to be located with his key technical support management personnel and with his procurement staff. In the case of NAVSEA PMs this means near NAVSEA (Arlington, Virginia), NAVSEC (Hyattsville, Maryland), and the Naval Ship Research and Development Center (NSRDC) (Carderock, Maryland).

This, in the Navy, is comparable to the Air Force's collocation of its major aircraft systems PMs with its Aeronautical Systems Division and close to the Air Force Logistics Command, and is done for the same reasons.

It should also be noted that PMs spend a considerable portion of their time delivering Pentagon briefings, defending their budgets, and testifying to congressional committees. Location of the PM in (or in close proximity to) Washington would appear to save considerable travel time and money.

On-site response to the PM and to the exclusive needs of the project at the contractor's plant is increasingly being provided by assignment of a dedicated project officer to the Contract Administration Office (CAO) staff. Such a project officer reports to the head of the CAO (e.g., the Supervisor of Shipbuilding, Conversion, and Repair, USN (SUPSHIP), or the Naval Plant Representative Office (NAVPRO)), but has collateral reporting responsibility to the PM in Washington for whose project he is locally responsible. This ensures full-time exclusive attention to a project at the contractor's plant and provides the PM with a responsive point of contact. Assignment of such dedicated project officers onsite is done by all SYSCOMs for some projects, but is not yet universal.

An additional issue that has had a significant impact on project management is that of government-to-government foreign military sales of Navy weapon systems. Foreign military sales (FMS) and grants have been made for many years. However, in recent years, the level of this activity has increased tremendously. NAVAIR, for example, in FY74 had foreign military sales funds of $2.4 billion are in addition to its $3.6 billion of regular procurement funds. Thus, the dollar level of foreign military sales has escalated to the point where FMS represents one-third of the total dollars spent in acquisition. A similar impact is being experienced in varying degrees by the other systems commands.

The situation is complicated further when foreign governments desire certain changes in the weapon systems being purchased to meet their own specific needs. The foreign government recognizes the impact of its unique requirements and is willing to pay for the services of personnel in excess of

the numbers approved in the Federal budget to accomplish authorized work for the U.S. Navy. The NMARC Production Panel concluded that it was increasingly important to staff the Navy's foreign military sales support effort properly. Mistakes in administration of the foreign military sales program can have an immediate and adverse effect on our national prestige, position in the free world community, and balance of payments.

The Panel further concluded that it is inappropriate to plan and budget for a certain level of personnel resources to meet an approved Navy program and then to dilute that effort through application of a portion of those resources to other reimbursable programs. If the costs, including personnel costs, of a foreign military sales program or any other program, are being reimbursed by a customer, the need for, and desirability of, application of personnel ceilings to such a program is questioned. The question is particularly worthy of attention when it is recognized that the foreign military sales program has now grown to such a level that its staffing requirements are having a significant impact on approved Navy programs, and will continue to do so for the foreseeable future.

3. Major Recommendations

Recommendation PROD-1: The Navy should retain the project/functional matrix organization staffing of most of its project management offices. The vertical organization is, however, supported for high-value, top-priority programs for which the number of people required full time warrants it.

Recommendation PROD-2: The Navy should collocate project management and key technical support management personnel. When additional technical assistance is obtained from naval activities remote from the PM, functions and relationships must be clearly defined. In particular, technical personnel remote from the PM should serve in an advisory capacity and should not function in the chain of command between the PM and the contractor.

Recommendation PROD-3: For major projects, the Navy should locate the PCO on the staff of the PM. Necessary

procurement support staff should also be assigned to the staff of each major weapon system acquisition project manager. The PCO and the PCO's supporting staff should be physically located in the project management office. Collateral reporting responsibility for policy guidance to other elements of the parent organization may be retained as appropriate.

4. Other Recommendations

Recommendation PROD-4: The Navy should continue to seek support for the collocation of NAVSEC with NAVSEA.

Recommendation PROD-5: Personnel ceiling controls (or any other management device that has similar effects) should be removed from programs for which the personnel and other support costs are reimbursable. For foreign military sales programs, the number of people hired could simply be the number that the customer is willing to pay for. For other reimbursable programs, compensating ceiling authorization could be provided between the executive agencies involved, inasmuch as the total work would still be within the bounds of an approved and budgeted program.

(2) Layering

1. Statement of the Issue

Probably the most universal complaint heard by the NMARC Production Panel related to "layering." Layering refers to excessive numbers of echelons of authority, with concomitant diffusion of responsibility, authority, and accountability.

2. Findings and Conclusions

Although a PM is properly charged to manage his project, many distractions were highlighted in the course of this study. Probably the most consistent and pervasive demand on the PM concerns the many briefings that he must make. It was noted that many briefings were for information only and were made

to officials who had little or no authority to affect the progress of a project but who could, through misunderstanding, neglect, or bias, negate an action. The practice of multiple briefings primarily for information only is counterproductive in that it detracts from the PM's ability to manage his project. Not only is the number of briefings great, the time span over which the briefings are given is inordinately long.

As one example of a result of layering, various Navy PMs decried the excessive numbers of briefings that they were required to make prior to having their projects reviewed by the Defense Systems Acquisition Review Council (DSARC). The numbers of discrete briefings required range up to 13 for some DSARC presentations, with additional briefings required if the PM is to appear before a congressional committee. Furthermore, the prebriefings started as many as 70 working days prior to the scheduled date of the DSARC presentation.

Another effect of layering, with its multiplicity of staff organizations' duplicating one another at successive echelons, is the inordinate difficulty and time involved in securing approval of technical and contract changes and procurement requests. For example, a procurement request involving a Request for Authority to Negotiate (RAN) and a Determination and Findings (D&F) typically must be reviewed and approved by 60 different people in 25 separate offices in the originating SYSCOM and Naval Material Command (NAVMAT) headquarters. "Simpler" procurements may involve only half as many approvals, but even that is an excessive number. As a result, the average procurement administrative lead time for negotiated contracts in excess of $1 million is approximately 240 days.

The time required to reach contractual agreement or effect a contract change is lengthened by the many reviews that are made by people with concern for a relatively limited aspect of the procurement. The needs of other Government personnel, who are primarily checking the procurement documentation to determine whether it complies with established policy within their spheres of concern, could be satisfied by merely providing them with a copy of the procurement documentation. They then would have an opportunity to raise timely objections without delaying the processing of the documentation through the entire approval cycle.

It was clear to the NMARC Production Panel that delays in processing changes and procurement and contractual documents were adversely affecting production by delaying effective application of production resources, contributing to the generation of claims by contractors. As an example of delays in contractual authorization to proceed with Class I engineering changes (as defined by MIL-STD-480), one company reported that on a recent contract an average of 336 days was required to obtain contractual authorization on of 39 Class I engineering change proposals (ECPs) that had been submitted. This compares with the target approval times in MIL-STD-480 of 24 hours for emergency, 15 days for urgent, and 45 days for routine ECPs. Other companies report many instances of 1 year or more for contractual authorizations.

The discrepancy between target and actual approval times for contractual authorization is due primarily to three factors:

- Processing for technical approval is slow and cumbersome.
- Layering involved in converting the technical approval of a PM or configuration control board (CCB) into a contract change order is excessive.
- NAVMAT requires that all changes having an estimated cost of over $10,000 be priced before being ordered.

After change requests finally reach a contract negotiator, he still must negotiate the change order. Other delays occur in mailing and reproduction of copies. The NMARC Production Panel concluded that the excessive delay in converting a change request or procurement request issued by a CCB or PM into a change order signed by both the contractor and the contracting officer may be reduced both by assigning the PCO to the staff of each major weapon system PM and by assigning, in each SYSCOM, contract negotiators whose first priority task is to convert CCB directives approving Class I ECPs into official contractual authorizations.

The delay in pricing before ordering was introduced to reduce claims and to prevent a large accumulation of Government-ordered changes that may be in excess of budgeted funds. However, these undesirable effects may be avoided by issuing change orders based on a maximum or ceiling price, with the firm price to be negotiated downward from the ceiling when sufficient cost data are available. It is realized that the contractor normally will provide a sufficient contingency factor if his change is to be maximum priced and that funds reserved for authorized but not finally priced change orders will soon be exhausted under this system. However, excess funds covering the balance between ceiling price and negotiated price can be released if the backlog of nonnegotiated change orders is held to the practicable minimum. This would act to encourage early negotiation of change orders to release any excess funds for other project applications.

The excessive delays (such as 1 year) in contractual authorization of changes result either in work being held up or in the contractor's proceeding at his own risk. The Navy thus loses many opportunities for reduced costs or incorporation of needed performance, reliability, or safety improvements. Incorporation of needed changes by retrofit creates additional costs that could have been avoided had the change been incorporated during production. Major efforts should be taken to streamline both the technical and the contractual approval of ECPs.

The NMARC Production Panel also observed that the roles of the Office of the Chief of Naval Operations (OPNAV) and subordinate fleet staffs relative to those of the SYSCOMs have in practice, become somewhat confused in recent years. OPNAV and fleet-staff personnel have become increasingly involved in technical matters that were formerly in the exclusive province of the SYSCOMs. This has had at least two adverse impacts. Whereas the responsibility for technical decisions with respect to weapon-system acquisition should be that of the SYSCOM commander, OPNAV personnel have participated increasingly in these technical decisions in recent years. Further aggravating the situation, authority to make most major policy decisions on weapon-system acquisition has escalated in recent years to the OSD.

As a general rule, officials in the chain of command between OSD and a SYSCOM commander seldom have authority to make significant decisions relative to a weapon-system acquisition. If a matter is beyond the authority of a SYSCOM commander to decide, it usually must ultimately be decided in OSD. However, those in the chain of command between the SYSCOM commander and OSD have the ability--which they exercise all too frequently--to delay, deflect, and halt progress.

Furthermore, the situation also exists within the SYSCOM where, as at higher echelons, there is a plethora of staff personnel, each having an interest in some portion of a project, and each contributing to the large number of staff approvals a project manager is required to obtain on even relatively minor matters before a decision can be made.

3. Major Recommendations

Recommendations PROD-6: The Navy should eliminate unnecessary reviews and approvals of technical and contract changes and procurement requests; wherever possible, approval of procurement documents should be limited to those people whose decisions with respect to that procurement are essential. To facilitate the entire acquisition process, reviews should be concurrent or parallel, rather than sequential, whenever possible.

4. Other Recommendations

Recommendation PROD-7: The Navy should seek a better balance between the authority of the Chief of Naval Operations (the user) and that of the Chief of Naval Material (the producer) in the acquisition of weapon systems. It is considered that the role of OPNAV should be focused on mission requirement determination and the role of NAVMAT and the SYSCOMs should be focused on the acquisition of weapon systems to meet OPNAV's stated requirements.

Recommendation PROD-8: The Navy should better define the role of NAVMAT headquarters. Those headquarters functions that contribute positively to the weapon-system

acquisition and logistic support processes should be retained. Any resources identified as excess could be effectively applied within the SYSCOMs.

Recommendation PROD-9: The number of briefings required to be made by PMs should be reviewed, reduced, and consolidated. Opportunities for reduction exist in eliminating those briefings that are for information only and in substituting written communications for some formal briefings. It would be beneficial if briefings to be made were limited to those people who actually must make a decision as a result of the briefing.

Recommendation PROD-10: The Navy policy requiring negotiation of price before an engineering change is contractually authorized should be continued, and in those cases where a time-consuming cost evaluation of the change is required, the Navy and the contractor should attempt to maximum-price the change to forestall any adverse impact on production.

Recommendation PROD-11: The Navy should place major emphasis on achieving both technical approval and contractual authorization of Class I ECPs within existing approval time targets.

Recommendation PROD-12: In each SYSCOM certain contract negotiators in each major weapons area should be designated to process contract change orders implementing CCB directives as their task of first priority. To make such an assignment meaningful, the processing of paper between the CCB, project manager, and contract negotiator must be streamlined.

(3) Ship Repair and Overhaul Planning and Resources

1. Statement of the Issue

Current Navy distribution of authority and responsibility is generating difficulties in orderly accomplishment of scheduled ship repair and overhaul availabilities according to defined plans and schedules.

2. Findings and Conclusions

Overhaul and modernization of ships of the U.S. Navy are planned according to schedules published by OPNAV. With advice from NAVSEA and other elements of NAVMAT, OPNAV sets overhaul cycles for all ship types.

At the time a ship is overhauled, which means that repairs are accomplished that have become necessary since the ship's last overhaul and certain rehabilitation and other preventive maintenance actions are performed, alterations are also made to ship systems. These alterations, which upgrade or replace shipboard systems and components, are also planned well in advance and are scheduled for progressive, systematic installation in ships in the OPNAV-published Fleet Modernization Program (FMP). The fleet type commanders prepare budgets for the repair work that the ships scheduled for overhaul will require and for certain minor alterations they are authorized to have made; NAVSEA and the other SYSCOMs budget for the major alterations (e.g., ship alterations (SHIPALTs) and ordnance alterations (ORDALTs)) for which they have technical responsiblity.

The actual accomplishment of these repairs and alterations is also supposed to take place according to well defined plans. Both the type commander's list of repair requirements and the SYSCOMs' alterations lists should be provided to the naval shipyard or the Supervisor of Shipbuilding, Conversion, and Repair, USN (SUPSHIP), as much as 240 days prior to the date a ship is scheduled to commence overhaul.

Traditionally, the SUPSHIP's or naval shipyard's planning for the availability begins at that point. At the time of receipt of the "240-day letter," the SUPSHIP or naval shipyard begins ordering long-lead-time Government-furnished material (GFM), assembling drawings, and writing work specifications to be followed by the ship repair contractor or the naval shipyard production department. Thus, theoretically, by the time the ship actually arrives for its overhaul, production personnel have been provided with complete packages of documentation required for every repair or alteration to be performed, personnel from the SUPSHIP or naval shipyard having visited the deployed ship and "ship-checked" the systems and components identified by the ship's force via the type commander as needing repair; all required material is in place, either in the shops or in the

supply department ready for issue; and the only jobs remaining to be planned in detail are "open-and-inspect" jobs--i.e., repairs that cannot be fully defined until an equipment can be removed to the shop and its internal components inspected.

Departures from this overhaul planning system have been effected in recent years for submarines and other complex ship types. Planning and Engineering for Repairs and Alterations (PERA) organizations have been established for the purpose of preplanning overhauls as much as a year in advance. When a PERA preplans an overhaul, installation of scheduled alterations is given detailed attention. Material for alterations planned for an entire class of ships may be ordered by the PERA long in advance and prepositioned where each overhaul is to be performed. Some equipments are identified as rotatable pool material, meaning that they will be installed during early overhauls, and the equipments they replaced will be repaired later for installation during subsequent overhauls, thus reducing the number of jobs on any given overhaul that control the duration of the availability. All required drawings, standards, and work specifications are assembled, produced, and delivered to the cognizant SUPSHIPs and naval shipyards.

For a PERA-planned overhaul, the ship's force is relieved of responsibility for generating the original list of repairs required; instead, agents of the PERA (usually naval shipyard planners and estimators and design division and combat systems office engineers) go aboard the ship a full year in advance of the overhaul and ship-check the ship from stem to stern. The resulting repair work list, generated by expert personnel, is then integrated with the alterations list, at which time repairs, the need for which is obviated by the identification of alterations to the same systems, are dropped out.

The result is an integrated work package (variously called Overhaul Work Package (OWP) for submarines and Ship Alterations and Repair Package (SARP) for cruisers and destroyers). The integrated work package is presented for approval to the type commander, and changes in recommended priorities of repair jobs are negotiated between the type commander and the SUPSHIP or naval shipyard.

The approved OWP or SARP is delivered to the SUPSHIP or naval shipyard well in advance of the overhaul start date, and the local naval activity's planning personnel are supposed to have little to do except to keep abreast of equipment breakdowns and other material deficiencies that occur between completion of the integrated work package and commencement of the overhaul, and to plan the open-and-inspect jobs. These techniques are most fully advanced in the planning of nuclear submarine overhauls but are gradually being extended, in successively greater depth, to the overhaul of all ship types. Personnel and funding limitations, however, are slowing progress to some extent.

Unfortunately, neither of these overhaul planning systems works in reality as described. One reason is that ceilings on the number of SUPSHIP and naval shipyard personnel allowed have prevented the SUPSHIPs and naval shipyards from fully performing all of the early, systematic planning they would like to be able to do and have put them in a reaction-to-crisis mode. Not only are work specifications not routinely produced 30 days prior to an overhaul start date; in many cases, individual jobs are still being written after an overhaul is well underway.

A second reason that overhaul planning does not function smoothly is that local contracting authority at the naval shipyards is inadequate. The local contracting authority at naval shipyards should be raised to permit reasonable freedom to purchase needed industrial material and to reduce the current dependence on the local Navy purchasing office. The level of contracting authority granted to naval shipyards should be reviewed periodically to keep the level consistent with the impact of inflation on the prices of industrial material.

The most important reason the overhaul planning system breaks down, however, is instability in the work package. This occurs when work-package changes are ordered well after deadline dates for doing so have already passed. These changes cause 240-day letters to be issued late almost invariably, which compounds the SUPSHIP/naval shipyard planning problem. Alterations that have been in the FMP for years will suddenly be ordered delayed or modified, or alterations scheduled for a subsequent availability will, at the last minute, be ordered to be accomplished during the present overhaul.

These changes, of course, disrupt work packages, negating the value of early planning efforts, and require substantial additional planning on a crash basis with a significant impact in terms of cost, schedule adherence, and orderly work accomplishment.

Repair lists are subject to similar instability. Type commanders order changes, additions, and deletions in repair lists throughout the course of an availability. These changes impact on prior overhaul plans and on work progress. In the business of ship repair, in which the sequence of work performance plays such a predominant role in the cost and duration of an overhaul, the disruptive effect of such practices is significant.

SUPSHIPs are particularly hard hit by late arrival of alteration and repair packages and late changes thereto because they can only issue work to contractors on a fixed-price basis. They and ship repair contractors would benefit if SUPSHIPs were permitted to issue insufficiently defined work orders on a cost-reimbursable basis.

Instability of repair and alteration work packages tends to reflect undue discredit on the performance of the naval shipyards, SUPSHIPs, and ship-repair contractors. When an availability fails to meet its scheduled completion date or exceeds its budgeted cost, the blame is normally laid on the performing shipyard and its naval supervision. Yet the naval shipyards' and SUPSHIPs' efforts to get overhauls accomplished according to early, comprehensive, and systematic plans are frequently frustrated by their lack of authority and control over those plans and adherence to them. Also, since they do not control the repair dollars, SUPSHIPs and naval shipyards can get accomplished only those jobs a type commander has decided to fund, regardless of whether the type commander's judgment coincides with the engineering and logistic judgment of the personnel who have performed the detailed analyses of the work that needs to be performed.

The NMARC Production Panel recognizes that ship overhaul work planning is dynamic, and that some late changes to the best defined work packages are inevitable. The Panel further recognizes that operational requirements and changes in

enemy threat characteristics will sometimes make advancing the date of an alteration highly desirable, even at substantial additional cost. But the degree of change that does occur in naval ship overhaul work packages far exceeds what would be permitted in a well disciplined system.

The Navy has given NAVMAT and its subordinate systems commands the responsibility for the execution of depot-level maintenance of the ships of the fleet. But the Navy has not provided NAVMAT with effective authority to get that job done. Most of the control over what gets done and when it is done is in the hands of operational personnel in OPNAV and the fleet.

Attention is invited to a comparison of the management of ship overhauls with that of naval aircraft reworks. Aircraft reworks are planned and funded by NAVAIR (based, of course, on data and recommendations from the fleet); the aircraft are flown to a Naval Air Rework Facility (NARF) on the appointed date and are left there by their crews, who depart the premises; the NARF reworks the aircraft according to NAVAIR's planning, under NAVAIR direction, and is paid by NAVAIR. Despite the fact that naval aircraft maintenance is seriously underfunded, NAVAIR appears to be providing much more satisfactory service to the fleet under this system than NAVSEA is able to provide for ships under a system in which NAVSEA does not maintain management and financial control over the work performed.

The Operating Forces of the Navy are the users of what the producers--the SYSCOMs--produce. As a rule, the users should be responsible for identifying their operational requirements and for expressing those requirements to the Navy's producer organizations. The producers should, in turn, be responsible for responding to those requirements and should have adequate authority to be able to provide the required products with a minimum of interference. It is incumbent on the user to make his demands on the producer reasonable and attainable; it is incumbent on the producer to inform the user promptly of any difficulties encountered in attaining the user's objectives; and it is incumbent on both of them to engage in a dialogue that will permit early resolution of conflicts between user objectives and producer capabilities. It is not questioned that the needs of the operating forces must always be paramount; but the balance between user objectives and producer capabilities seems to have become tenuous.

Action by the Navy is therefore required to restore a balance between operator needs and SYSCOM capabilities, a balance that will bring needed discipline to the planning and accomplishment of naval ship overhaul and repair.

3. Major Recommendations

Recommendation PROD-13: The Navy should continue and expand the application of early and detailed advance planning of ship overhauls such as is accomplished by the PERA organizations, particularly for nuclear submarine overhauls. To this end, the Navy should give priority to identification and allocation of the personnel and financial resources necessary to extend PERA-type planning techniques fully to all major combatant ship overhauls.

Recommendation PROD-14: The Navy should devise means of improving planning discipline for ship maintenance and modernization so that late changes to alterations and repairs in overhaul work packages are minimized. In order to achieve this, the Navy should find ways to ensure that technical, logistical, and production considerations carry adequate weight relative to military requirements in the Navy's decisionmaking processes, and that those responsible for the execution of depot-level maintenance of ships may be permitted to carry out their responsibilities according to plan.

Recommendation PROD-15: The Navy should give priority to identifying and allocating additional personnel and financial resources requisite for extended PERA-type planning and improved ship overhaul planning generally. Additional resources for PERAs, naval shipyard planning departments, and SUPSHIPs will be required. In particular, if greater overhaul work-package stability cannot be achieved, additional personnel will be required by SUPSHIPs engaged primarily in administration of ship overhaul and repair work.

4. Other Recommendations

Recommendation PROD-16: The local contracting authority at naval shipyards should be increased.

Recommendation PROD-17: Authority should be granted to SUPSHIPs to issue ship repair and alteration work to Master Ship Repair (MSR) Contract contractors on a cost-reimbursable basis, to the extent that the adequacy of the contractors' accounting systems will permit when work is insufficiently described to permit soundly based fixed pricing. The bulk of ship repair and alteration work should continue to be issued by SUPSHIPs on a fixed-price basis, but issuance of appropriate work on a cost-reimbursable basis will eliminate delays in work acceptance and reduce potential claims arising from work, whose scope could not be sufficiently forecast.

4. THE ACQUISITION ENVIRONMENT

(1) Industrial Capacity in the Aerospace, Shipbuilding, and Ship Repair Industries

1. Statement of the Issue

(1) The dwindling number of defense dollars has had a particularly adverse impact on the aerospace industry. Procurement of new types of aircraft has been curtailed, and the planned production of existing aircraft and aerospace products has been reduced. It is considered axiomatic that a viable aerospace design and manufacturing industry must continue to function and to meet our defense needs.

(3) The Navy is considering resuming ship construction in naval shipyards, which for the last several years have been restricted to ship conversion, alteration, and repair work.

(3) Private-shipyard drydock capacity for the repair and overhaul of larger naval ships is limited on both the east coast and the west coast of the United States.

(4) Application of the "homeport rule" causes workload imbalances among shipyards and fails to take advantage of idle industrial capacity.

(5) Only two shipyards are currently being employed to build nuclear surface ships and submarines for the Navy.

2. Findings and Conclusions

(1) Idle Aerospace Capacity

With the broad reduction of dollars for aircraft procurement, the prime aircraft manufacturers are facing increasingly difficult problems that must be solved for them to remain competitive and viable. An aircraft weapons system manufacturer must possess a wide range of skills. These skills have been generally available to the manufacturer in the past, even though the employment pattern in the aerospace industry has been characteristically cyclical. It is questionable whether needed skills will be available in the future if they are once lost.

The matter of maintaining a viable aerospace capability was of concern to the NMARC Production Panel. Although the NARFs properly have a wide range of capabilities for depot-level rework of aircraft, engines, and components, only the contractors have the capability to build new, complex aircraft. The private sector also has established capability for the total range and scope of aircraft major modifications and conversions.

For both the manufacture of new aircraft and major modification of existing aircraft, it is valuable to the Navy for the manufacturer to warrant his product. Recognizing that there will always be an interface between the respective capabilities of doing work at an aircraft manufacturer's plant and at a NARF, the NMARC Production Panel concluded that this interface should be examined in the light of maintaining a viable aircraft industry, although still retaining the capability of the Government to respond rapidly to emergency circumstances.

In reviewing conditions in this area, it was noted that current directives with respect to the allocation of work between the private and public sectors for conversion, alteration, and repair were being observed and met. A large part of the work done by the private sector was, however, being performed by firms other than the large, prime aircraft manufacturers. Many of these firms are classified as small business. The migration of this level of work to small business firms does not contribute to the maintenance of a viable aerospace mobilization base.

(2) New Construction in Naval Shipyards

A number of factors, including the size and complexity of modern warships, their nuclear-propulsion plants, and their series production in large numbers to promote economies in their acquisition cost, have combined in recent years to limit major warship construction contracts to only a handful of the nation's largest shipbuilders. Size, complexity, and nuclear power have also worked to limit the number of private shipyards capable of overhauling naval vessels.

These factors are compounded by the greatly increased amounts of commercial shipbuilding work being performed in private American shipyards; commercial ship construction now accounts for an estimated 56 percent of the dollar value of all shipbuilding work currently

currently on order in U.S. yards, the first time since World War II that Navy new construction has not accounted for the preponderance of U.S. shipbuilding. This further limits the private shipbuilding capacity that will be available for Navy new construction programs.

In partial response to this situation, the Navy has called for assignment, under certain conditions, of limited amounts of naval new construction work to one or more naval shipyards. No new construction has been assigned to naval shipyards since the FY68 program. The Navy has stated that a primary motive for wanting new construction assignments is the workload-leveling effect that a properly scheduled new construction project could bring to a naval shipyard, permitting more efficient utilization of manpower and reducing fleet repair prices by spreading fixed costs over a broader workload base.

Representatives of the shipbuilding industry have objected, citing the higher cost of new construction in naval shipyards. (The Navy estimates the cost of new construction in a naval shipyard to be roughly 30 percent higher than the cost of having the same work performed by a private shipyard. This estimate compares only the relative costs of the construction work and does not take into account the cost benefits that accrue to the naval shipyard's overhaul and repair business as a result of manpower utilization efficiencies that are made possible by the inclusion of new construction work in its total workload.)

As a result of study and discussions with both Navy officials and private shipbuilders, the NMARC Production Panel has concluded that assignment of new ship construction work to naval shipyards is not presently in the Navy's overall best interest. The Navy has, quite correctly, indicated that certain preconditions need to be met before new construction assignments to naval shipyards would be a prudent move to make, even in the Navy's own viewpoint.

First among those preconditions is that at least the initial naval shipyard shipbuilding assignment should be for a series (i.e., more than two) of relatively less

complex ships, conventionally powered auxiliaries such as destroyer or submarine tenders. Such an assignment would permit the orderly buildup of the requisite manpower and experience that would be essential if the naval shipyard involved were to endeavor to deliver the ships at a cost anywhere near comparable to that of a private shipyard or to advance to construction of more complex, nuclear powered ships. However, no such series of auxiliary ships is currently programmed in the Navy's Five-year Defense Plan (FYDP). The entire question thus becomes somewhat academic.

If such a series of ships should suddenly appear on the Navy's shipbuilding horizon, however, there are other preconditions of equal importance. Relief from employment ceilings (or mandated employment reductions) would have to be granted to the affected naval shipyard(s), to enable it (them) to build up a work force to meet the demands of the new construction assignment without impinging on repair capability.

The new construction project would also have to be protected from disruption and delay by emergent repair projects. The Navy has had bitter experience with excessive costs of naval-shipyard-built ships whose construction was continually interrupted as personnel were borrowed for use on higher priority repair work. While the Navy has doubtlessly learned enough that it would not again permit uncontrolled raids on shipbuilding projects, some system would nevertheless be necessary that would accord a naval shipyard and its parent command, NAVSEA, a forum in which relative priorities and costs could be weighed and argued before a repair job would be permitted to delay or disrupt a new construction ship. At the same time, a gateless fence should not be built around a naval shipyard's new construction work force; a shipyard commander should have controlled flexibility to move personnel between and among shipbuilding and ship repair projects for maximized efficiency in manpower/trade-skill utilization.

A naval shipyard should not be assigned to build the lead ship in a class. The buildup of the requisite engineering talent would be a long and expensive process

and would be worthwhile only if the shipyard had prospects of continuing lead-ship design assignments.

Because of these many constraints, the NMARC Production Panel sees no advantage to the Navy in embarking on a program of new ship construction in naval shipyards at this time.

(3) Limited Drydock Capacity

The reduction in fleet size in recent years with the older, smaller, and less complex auxiliary ships virtually disappearing from the Operating Forces, has served to reduce significantly the amount of naval ship repair work available to be performed by the smaller U.S. private shipyards. As a result, representatives of the U.S. private shipyards have called for an increase from 30 or 35 percent to 50 percent of the Navy ship conversion, alteration, and repair funds that are allocated annually to the private sector. The Navy has objected to this proposal, citing the reduced flexibility in its workload assignments that would result, and pointing out that few of the smaller private shipyards would benefit from the proposed increase, because most of the additional work would, due to ship size and complexity, inevitably go to the already overloaded large private yards.

The NMARC Production Panel has found that a significant shift in conversion, alteration, and repair funds to the private sector could not be accomplished without either (1) a significant increase in the number of large, private drydocks or (2) significant and expensive increases in the number of split availabilities, wherein drydocking is performed at one shipyard and other repair work is performed at another yard. Although the allocation of conversion, alteration, and repair funds between public and private yards has been in compliance over the last 5 years with the DOD requirement that a minimum of 30 percent of mission-essential work be assigned to private facilities, the allocation has been governed primarily by relative capacities and capabilities, fleet operating schedules, and homeport considerations; the absence of a DOD directive on Navy/ private workload allocation

would have made little or no difference in where the work was assigned. The smaller private shipyards with small drydocks (or, in some cases, no drydocks at all) would thus derive little or no benefit from a reallocation of conversion, alteration, and repair funds, unless a significant additional number of availabilities could be split between two shipyards.

Splitting availabilities between two yards is currently done only as a last resort. Split availabilities are expensive, inefficient, and difficult to schedule and manage, and they remove a ship from the fleet for an unacceptable length of time. The Navy is thus understandably reluctant to increase split availabilities, particularly since it is unable to fund overhauls adequately that are scheduled for more efficient accomplishment.

Evidence of the fact that, without additional split availabilities, smaller shipyards would not benefit greatly from a reallocation of repair funds can be found in the effect on workload distribution of the recent closures of two naval shipyards. On the east coast, as a result of the closure of the Boston Naval Shipyard, the workload imposed by the Atlantic Fleet is handled by the remaining three east coast naval shipyards and by eight of the larger private shipyards with drydocks adequate to handle the larger auxiliary and support ships of the fleet. Scheduling of ship repair work and placing of emergent ship repairs has been rendered extremely difficult by this restriction in the number of available drydocks.

The closing of the naval shipyard at Boston raises a serious question relative to the capability of both Navy and private east coast repair yards to meet all of the repair and overhaul requirements of the Navy and commercial sector. A list of the shipyards and an estimate of the number of drydocks capable of serving the larger naval auxiliary fleet is presented in Table VI-1.

Table VI-1
East Coast Repair Yards Capable of
Servicing Large Navy Surface Ships*

Shipyard	Number of Large Drydocks
Philadelphia Naval Shipyard	7
Norfolk Naval Shipyard	9**
Charleston Naval Shipyard	10**
Bethlehem, East Boston	3
Bethlehem, Hoboken	4
Todd, Brooklyn	4
Bethlehem, Key Highway, Baltimore	5
Maryland Shipbuilding and Drydock	4
Norfolk Shipbuilding and Dry Dock	1
Savannah Machine and Shipyard Company	1
Jacksonville Shipyards, Inc.	6 (Floating)
Total	54

* This table lists only shipyards currently engaged, or with recent experience, in naval surface ship repair work. Other east coast yards with large drydocking facilities include General Dynamics' Quincy, Massachusetts, and Groton, Connecticut, yards; Bethlehem Steel's Sparrows Point, Maryland, yard; Newport News Shipbuilding and Dry Dock Company, Newport News, Virginia; Sun Shipbuilding Company, Chester, Pennsylvania; and Seatrain Shipbuilding Corporation, Brooklyn, New York. These shipyards' drydocks, however, are occupied with commercial new construction or naval nuclear submarine construction and repair, or both, and are thus not generally available for naval surface ship repair work.

** One-half of the drydocks reserved for submarine work.

The overhaul schedule for Navy surface ships larger than destroyer escorts indicates that approximately 240 drydock-months of overhaul, restricted availability, and post-shakedown-availability work will be required for the Atlantic Fleet in FY75 and 248 in FY76. This would

require from 45 to 50 percent of the capacity of these shipyards. The availability of tnis capacity would depend on the following factors:

- The commercial repair workload in the eight private shipyards
- The dedication of certain facilities in the eight private yards to new construction
- The other types of shipwork required of the three naval shipyards.

It is estimated that, while the total demand for repair facilities on the east coast did not justify keeping the Boston Naval Shipyard open on an active, full-time basis, it could be in excess of the drydock capacity of the other eleven major repair yards.

The Boston Naval Shipyard facilities are located at two sites: Charlestown, at which the bulk of the shipyard's industrial activity took place; and an annex in South Boston, which contains a graving dock large enough to accommodate Midway-class aircraft carriers. If these facilities could be leased to one or more private operators under an arrangement that would accord priority to emergent Navy ship repair work, it would provide the Navy with needed surge drydock capacity on the east coast.

In San Diego, California, the Navy owns a large drydock that was part of the former naval ship repair facility that was closed in 1964. San Diego-area contractors now bid for use of that drydock and may use it for commercial work if it is not needed for Navy work. Dependent upon the degree of interest shown by New England contractors, a similar arrangement would be desirable for use ob the Boston Naval Shipyard facilities.

It is understood by the NMARC Production Panel that efforts are currently underway to pass title of the Boston Naval Shipyard from the Federal Government to the city of Boston or any one of a number of other potential new

owners. However, if the facilities are needed for emergent Navy ship repair work, it will be necessary for the Navy to retain title to the shipyard. It is therefore appropriate for the Navy, in addition to its current participation in efforts to secure non-Navy reuse of the Boston Naval Shipyard, to confirm the need for east coast ship repair surge drydock capacity, and to determine the feasibility of granting a firm or firms the rights to operate the shipyard (less that portion of the property that has been reserved, by recent congressional legislation, for a national park to house the USS Constitution) under an arrangement by which they would grant first priority to accomplishment of any emergent Navy ship repair work requiring use of the Boston Naval Shipyard facilities. Early action will be required, however, to prevent loss of Navy title to the property.

At Hunters Point in San Francisco, the situation is somewhat simpler, in that the Navy is retaining title to the closed naval shipyard property and facilities for mobilization purposes. The need for ship repair surge drydock capacity is equally acute on the west coast, and the Navy is currently actively engaged in trying to arrange for contractor operation of the facilities with a view toward maintaining capacity and capability in the San Francisco area for repair of aircraft carriers.

(4) Application of the Homeport Rule

As the homeport rule is presently applied, a Navy ship must be overhauled in the shipyard nearest its homeport. When available capacity does not permit this, an effort is made to place the ship in the next nearest shipyard. This policy makes sense in terms of crew morale and personnel retention rates if the facilities involved are within reasonable commuting distance of the ship's homeport (i.e., within a 50- to 60-mile radius). However, the rule carries little logic when it forces a ship into an already heavily loaded shipyard 500 miles from its homeport, when another yard 800 or 1,000 miles from the homeport has idle capacity and needs the work.

If the location of the overhaul yard nearest a ship's homeport is such that the crew members cannot commute daily to their homes and families, the Navy's needs would be better served if it were to place the ship for overhaul where present and projected industrial capacity and capability will be best utilized. For example, if a ship homeported in Mayport, Florida, cannot be overhauled in the Mayport/Jacksonville area and idle capacity exists at Bath, Maine, the ship should be overhauled at Bath, Maine, rather than being force-fit into a shipyard at Charleston, South Carolina, or Norfolk, Virginia, if yards at those locations are well loaded.

It is true that sailors can drive to Mayport on weekends from Charlestown or even from Norfolk. Crew member of ships being overhauled at considerable distances from their homeports, however, can take advantage of Navy programs that have been established to get them to and from their families. (It should also be noted that when a ship's overhaul is scheduled for six or more months' duration, the ship's homeport is officially changed to the overhaul location, and the crew and families are moved there at the Navy's expense.)

(5) Nuclear Shipbuilding Capacity

The NMARC Production Panel has examined the Navy's projected shipbuiding programs and concludes that the requirement of Title VIV of the 1975 Defense Appropriation Authorization Bill that all major combatant ships to be built henceforth must be nuclear powered is feasible within existing nuclear shipbuilding capacity, and that neither new capital investment nor AEC qualification of any additional shipbuilders will be essential to the successful accomplishment of these programs. The pressure on currently qualified nuclear shipbuilders results from the large numbers of nuclear ships presently under contract; those presently planned but not yet authorized or funded could be accommodated by those shipbuilders already licensed to do nuclear shipwork. However, the NMARC Production Panel is concerned that present and projected nuclear shipbuilding is concentrated in only two shipyards.

The two shipyards that are currently engaged in the construction of nuclear ships for the Navy are the Newport News Shipbuilding and Drydock Company and General Dynamics' Electric Boat Division. Both yards are heavily loaded with both nuclear shipbuilding and nuclear ship repair work. Further, only one shipyard (Newport News) has an active capability to construct nuclear surface ships.

Both Electric Boat (EB) and Newport News are currently performing nuclear submarine overhauls. Newport News is building the lead boat and four others of the SSN-688 class. Newport News is also building two nuclear aircraft carriers (with one more under contract, but for which the keel has not yet been laid) and four nuclear guided-missile frigates, converting four nuclear ballistic-missile submarines, and building two other nuclear attack submarines. These are in addition to contracts for the construction of six large commercial vessels.

EB is building the lead Trident submarine, with options for three follow Trident boats. In addition, EB has 19 SSN constructions and two SSBN conversions under contract, including construction of 18 SSN-688-class submarines.

Both yards will be hard pressed to meet all of their schedules for delivery of such massive numbers of the Navy's most complex and difficult-to-build ships. These assignments are taxing the physical capacities of both shipyards, and both companies are experiencing difficulties in recruiting and training personnel in the numbers required to accomplish their huge workloads.

Also worthy of note is the fact that the nation's nuclear shipbuilding eggs have been concentrated in only two baskets, both on the east coast.

In the meantime, two naval and two private shipyards with extensive nuclear shipbuilding experience have no present or projected nuclear ship construction work assigned. Both the Portsmouth, New Hampshire, and the Mare Island (Vallejo, California) Naval Shipyards have built numerous nuclear submarines. (However, resumption of new construction at these or other naval shipyards is subject to certain constraints. See subsection (1) of this section.)

General Dynamics' shipyard in Quincy, Massachusetts, has built one nuclear guided missile cruiser, one nuclear guided missile frigate, and two nuclear attack submarines, and has completed construction of two nuclear attack submarines, which were started by EB. Litton Industries' Ingalls Shipbuilding Division has built several nuclear submarines. Although Ingalls is overhauling two nuclear submarines at the present time, it has no projected assignments of additional nuclear new construction or repair work.

The NMARC Production Panel considers this a dangerous situation. Sabotage to, or default by, either or both of the only two shipbuilders currently engaged in nuclear ship construction would deal a crippling blow to the Navy's nuclear shipbuilding program and would have an extremely adverse effect on national security. It would be much healthier if additional shipyards were engaged in nuclear ship construction for the Navy.

3. Major Recommendations

Recommendation PROD-18: The Navy, with the assistance of the Office of the Secretary of Defense, should take immediate action to retain title to the Boston Naval Shipyard (less the 28 acres reserved for the USS Constitution National Park), in order that surge drydock capacity for the repair of large, complex naval ships may be maintained on the east coast.

Recommendation PROD-19: The Navy should study the need for and feasibility of leasing to private contractors the Hunters Point Naval Shipyard facilities and the Charlestown portion of the Boston Naval Shipyard facilities, and request options for Navy use of the large South Boston drydock as required. The Navy should seek an out-leasing arrangement similar to that employed for the large Navy floating drydock at San Diego, whereby contractors bid for use of the facility, and Navy ship repair work is accorded priority. These actions should be taken to assure the maintenance of a capability for repair of naval ships in the Boston and San Francisco areas in order that the naval shipyard drydocks there may be used for emergent Navy repair work when required.

Recommendation PROD-20: The Navy should not assign new construction work to naval shipyards until and unless (1) a series of three or more follow-ship auxiliaries can be assigned to a single yard; (2) the new-construction work can be assured of protection from excessive disruption by emergent repair work; and (3) ceiling relief can be provided to the performing naval shipyard so as to provide for orderly buildup of a shipbuilding work force in such a way that the shipyard's repair capability is not deleteriously affected.

Recommendation PROD-21: The Navy should take steps to acquire and maintain an active capability among at least three shipyards for construction of nuclear submarines, and between at least two shipyards for the construction of nuclear surface ships, in order that nuclear shipbuilding capability may be spread among an industrial base sufficiently large to protect national security interests. To do so, the Navy will find it necessary to seek to create an environment that will attract private capital investment in nuclear shipbuilding for the Navy.

4. Other Recommendations

Recommendation PROD-22: The Naval Air Systems Command should reevaluate the aircraft industrial base in the light of today's situation, considering viability, mobilization, and overall capability in the aerospace industry.

Recommendation PROD-23: The Naval Air Systems Command should make visible a firm plan that delineates work to be done in the private sector and work to be done by Government agencies, and should allocate work in accordance with that plan.

5. Observation

The Navy's present application of its homeport rule does not permit taking full advantage of present and projected

industrial capacity and capability on each coast, particularly where such capacity and capability are located remote from homeport areas. To the extent that it can be done without jeopardizing Navy personnel retention rates, the Navy might wish to modify its application of the homeport rule to take better advantage of available industrial resources.

(2) Work force Skill and Stability

1. Statement of the Issues

(1) High turnover in naval and private shipyards is causing moderate to severe shortages of critical shipwork craft skills in shipyards in most parts of the country. Due to the unavailability of fully trained shipyard workers in the labor market, private and naval shipyards are faced with the necessity for costly training programs to develop the skills required to cope with present and projected workloads of individual shipyards.

(2) Industrially funded naval activities, such as naval shipyards and NARFs, are subjected to ceilings (or quasi-ceilings) on employment that conflict with the financial controls on their employment that are generated by their customer-funded mode of operation.

2. Findings and Conclusions

(1) Personnel Turnover

The turnover rates in both naval and private shipyards should be a matter of serious concern to both the Navy and the shipbuilding industry. One major shipbuilder has a rate of turnover that approximates 60 percent a year. Another hired over 12,000 people in 1973 and increased his end-year total employment by only 650

men. A third shipbuilder hired 8,000 people in 1 year and suffered a net loss in employment. As a result of these high turnover rates, which have been aggravated by loss of skilled personnel in recent years as a result of past layoffs, reductions in force (RIFs), and shipyard closures that resulted from previous decreases in workload, critical shipbuilding and ship repair craft skills are in short supply in almost every area in which there are shipyards.

The NMARC Production Panel has no quick and total solution for this turnover problem, which is rooted in many causes, some of which are sociological. Both the naval and the private shipyards, however, should intensify their efforts to alleviate the turnover problem by such means as intensified and more systematic efforts to organize shipwork so as to facilitate its performance by unskilled and semiskilled personnel; close examination of relative wage rates in public versus private shipyards and in shipyards versus other industries; and increased use of the results of motivational research to increase job stability.

Varying wage rates have contributed to the personnel turnover problem. The NMARC Production Panel noted that wages in naval shipyards are higher than those in private yards. In testimony to the Seapower Subcommittee of the Committee on Armed Services of the U.S. House of Representatives on 9 July 1974, Vice Admiral (then Rear Admiral) R.C. Gooding, USN, estimated that naval shipyard wage rates average approximately 15 percent higher than private yard wage rates. Causes of the differential were attributed by other Navy officials to mechanisms in the Government's pay-setting scheme for blue-collar workers, changes to which would require congressional legislation. Complaints were also heard from private shipbuilders that they were losing large numbers of workers to the construction industry because of higher wages in the construction trades. While no reliable data on the extent of migration from shipyards to construction appear to have been developed, Bureau of Labor Statistics figures do not indicate that construction workers' average hourly wages, which were only

$.25 higher than shipyard rates in 1954, are now a full $1.86 an hour higher than shipyard workers' average hourly wages.

Early correction of these conditions is not likely. However, it behooves the Navy to make an effort to ensure that there is a full understanding throughout the Department of Defense, in the private shipbuilding and ship repair industry, and in the Congress of the several factors that exert upward pressures on Navy civilian labor costs.

In addressing the turnover problem, which results in shortages in such craft skills as electronics mechanic, welder, shipfitter, and others, the shipyards have invested heavily in 3- to 4-year apprentice-training programs. For example, approximately 5,000 apprentices are now in 4-year training programs in the eight naval shipyards. The cost of such massive training efforts necessarily increases the prices charged by naval shipyards to their fleet customers.

Private shipyards that had never before conducted their own apprentice training are now finding such programs their only way of acquiring skilled workers. Most private shipyards traditionally have concentrated more on short-term training designed for rapid acquisition of a limited range of skills in an individual to meet immediate specific skill demands of the workload. Because of the present heavy turnover (which is considered by most shipbuilders to be primarily a function of the higher wages paid in other industries), investment in such short-term, entry-level training has been forced upward to the point that it constitutes a significant overhead burden.

The Navy has recommended (to the House Armed Services Committee's Seapower Subcommittee, among others) that funds be obtained from such sources as the Comprehensive Employment and Training Act of 1973 to subsidize the costs of apprentice programs in naval and private shipyards. In the Navy's proposal, up to one-half of the cost of a 4-year apprenticeship would be paid for with these funds, with the employing shipyard paying for the last 2 years of training.

The NMARC Production Panel endorses the Navy's proposal and concludes that benefits would be gained if coverage were also extended to short-term (e.g., 6-week to 6-month) entry-level training in private shipyards, as well as in those naval shipyards that might find it profitable to engage in this type of training. The NMARC Production Panel further considers that control of the training funds acquired should be lodged with NAVSEA; distributing these funds via state and local governments would serve only to delay their receipt by the applying shipyards and to add unnecessary administrative expenses, which would reduce the amounts of the funds that those shipyards would eventually receive.

The Comprehensive Employment and Training Act (CETA) provides Federal funding support for employment and training. CETA money is controlled by the Department of Labor to solve special employment problems throughout the nation. The shipbuilding industry presents just such a special problem that might, however, be handled more easily through new and separate legislation. The specific source of the Federal funding is less important than the need to take effective action to recognize that the labor force requirements of the shipbuilding industry are an employment problem that could become a job solution for thousands of unemployed workers.

A second means considered by the NMARC Production Panel of alleviating shipyards' skill shortage and training-cost problems involves coordination with the Federal Government's announced efforts to create government jobs to reduce unemployment. During the course of this study, it was reported by the news media that the President intended to create 85,000 public service jobs and to establish 40,000 Government jobs for Vietnam veterans.

These actions would be taken at a time when the Navy is being subjected to an estimated 6,000- to 8,000-men cut in employment, of which the naval shipyards' share will be approximately 4,000, and when private shipyards are experiencing extreme difficulties in acquiring even trainable unskilled manpower. It seems only logical and prudent to the NMARC Production Panel

that the President's programs to combat unemployment should be applied to those segments of the economy that are experiencing manpower deficiencies, and that jobs created by the President's programs should be located where there is productive work that needs to be done, rather than establishing "make-work" positions.

It became evident to the NMARC Production Panel that the training of naval- and private-shipyard professional-engineering personnel has not kept pace with the significant increases in complexity in naval ship electronics and weapon systems. That combat systems integration is a problem (addressed in detail elsewhere in this report) results in part from the unavailability, during critical phases of ship construction and overhaul projects, of shipyard engineers trained to the state-of-the-art in the advanced technologies involved in making the several subsystems of a complex combat system function together as a cohesive unit. While it may never be possible for most shipbuilders to develop and maintain within their shipyards an independent capability in the field of combat systems integration, they should have at hand selected personnel who have had multidisciplinary training and thus are capable of monitoring a combat systems integrator's efforts.

(2) Personnel Ceiling Controls

Naval shipyards, NARFs, and certain other naval activities operate financially under the Navy Industrial Fund (NIF). For these activities, work done for a customer is paid for by that customer. Concurrent financial control and personnel ceiling controls for NIF activities are therefore philosophically contrary to the premise of NIF.

Workload should be assigned and accomplished within the bounds of resources available. The industrial manager must balance work force, facilities, and time in accomplishing his assigned workload. Through control of financial resources, the industrial manager should be able to staff his organization to meet both planned and emergency workload as circumstances dictate. He can

retain a certain degree of flexibility through the judicious use of overtime to meet work overloads existing for relatively short periods of time. Considering the fluctuating workload and work skill requirements that are endemic to naval shipyards and NARFs, a certain degree of flexibility must be available to the industrial manager both to use his resources effectively and to remain responsive to the fleet.

To attempt to overlay all of the foregoing with additional controls in the form of personnel ceiling controls (or any other devices that tend to have the same effect as ceilings) is generally doomed to failure. Workload and externally imposed ceiling controls are almost never in phase, and the imposition of such controls inevitably leads to ineffective use of total resources. The problem is compounded if the industrial manager is forced to reduce the number of people on the payroll to meet an arbitrary year-end limitation, regardless of workload and work/skill balance, and then follow this with a period of accelerated hiring at the beginning of the following fiscal year to meet his funded workload requirements.

The only danger to be avoided, should employment ceilings be removed from industrially funded naval activities, is the possibility that attempts might be made to reallocate work from the private sector to those naval activities to support increased employment levels. However, since guidance with respect to the allocation of work between the public and private sectors is given by the Office of the Secretary of Defense and since it is largely controlled by such factors as relative capacity and capability, it is not considered that this is a very immediate danger. Nevertheless, should ceiling controls be lifted, some protections against any such tendency should be established.

A related problem for the naval industrial manager is the length of time required under civil service regulations to separate employees in order to either stay in phase with a declining workload or to balance work skills. Planning for a reduction in force (RIF) must begin some 5 to 6 months in advance of the actual date that employees are to be off the payroll. This poses a significant management challenge to the industrial

manager. It would be most helpful if there were some alternative ways, such as short-term furloughs, that would permit relatively short-term release of employees without following the complicated, time-consuming procedures required for a formal RIF, while also protecting the long-term job rights of the employees.

An ancillary, although quite significant, impact of current RIF procedures is the extensive skill balance disruption that occurs when employees "bump" other employees with lower retention rights. It is generally agreed that, for every employee removed from the payroll as a result of a RIF, three or more employees will move from one job to another as bumping occurs.

(3) Major Recommendations

Recommendation PROD-24: The Navy should intensify its efforts to acquire Federal funds, through of the Comprehensive Employment and Training Act of 1973 or other similar programs, to support training programs in public and private shipyards. Funds so acquired should be applied to support of both long-term (3- to 4-year) apprentice training and short-term (up to 6-month) entry-level training. Distribution of the training funds should be from the Department of Labor NAVSEA, and from NAVSEA directly to the naval and private shipyards whose training programs have been qualified for such funding support.

Recommendation PROD-25: Navy Industrial Fund (NIF) activities should operate with financial controls; personnel ceiling (or quasi-ceiling) controls should be removed from NIF activities.

Recommendation PROD-26: U.S. Civil Service regulations with respect to reductions-in-force (RIF) for NIF activities should be reexamined to attempt to reduce the time period between the decision date that a RIF is required and the date when employees are off the payroll. Alternative means of rapidly reducing the number of employees for relatively short periods of time with more streamlined administrative procedures to effect this would be highly desirable in

giving the industrial manager the flexibility needed to meet a changing workload, while also protecting the long-term job rights of the employee.

Recommendation PROD-27: The Navy should ensure that the absence of personnel ceiling controls does not affect the distribution of industrial work between the public and private sectors to the detriment of private industrial capacity and capability.

4. Other Recommendations

Recommendation PROD-28: Through the Office of the Secretary of Defense, the Navy should request that priority be given in the President's programs to combat unemployment to creating jobs in those segments of the defense industry experiencing manpower shortages. Specifically, rather than naval-shipyard employment's being reduced below the levels demanded by assigned and projected workload, the "public service" and "Vietnam-veteran" jobs to be established in the President's unemployment-reduction programs should be assigned to those shipyards. Similar priority should be given to support of additional productive jobs in private shipyards doing naval or commercial shipwork in the national interest in depressed-employment areas.

5. Observations

The inordinately high turnover rates plaguing both naval and private shipyards deserve attention at the highest levels of the Navy and the Department of Defense. They seriously jeopardize the continued capability of the U.S. shipbuilding and ship repair industry and the naval shipyards to construct and maintain the large, complex warships of today's Navy. That total solutions to the turnover problem are not available should not deter the Navy and DOD from making every effort to alleviate the problem to the extent possible.

Efforts should not be limited to traditional civilian personnel administration approaches to such problems, but should encompass recognition of the fact that greater stability of workload would help; that examination should be made of the effect of differences between the wage rates in naval and private shipyards on work force stability; that greater efforts should be made to organize work in such ways that it can be performed by other than comprehensively trained journeymen; that stabilizing work planning and then accomplishing the work according to plan would have a beneficial impact on job satisfaction at the worker level; and that some of the findings of behavioral scientists in recent years with respect to motivation and job satisfaction might have potential for profitable application to the shipyard turnover problem.

(3) Long-Range Planning in Naval Shipbuilding and Ship Repair

1. Statement of the Issue

Congressional funding of naval ship construction programs for only a year at a time makes it difficult for shipbuilders to plan and schedule their workloads, acquire and train personnel, and acquire required materials. The problem is compounded by the Navy's reluctance to release its internal plans for projected shipbuilding programs and ship repair and overhaul programs.

2. Findings and Conclusions

A universal complaint among U.S. private shipbuilders has been the uncertainty of naval procurement, never knowing from one year to the next how many ships of what types they may hope to get awarded. It is likewise difficult for the Navy to plan long-term shipbuilding programs that are subject to annual perturbations as a result of congressional actions.

Last summer, the House Armed Services Committee's Seapower Subcommittee proposed that the Congress approve and authorize a 5-year Navy shipbuilding and conversion program. The Navy has endorsed this proposal. Such a plan would render the shipbuilding industry more capable of committing facilities, expansion and modernization, manpower recruiting and training

efforts, and financial resources, and of performing on a more timely and economical basis in response to Navy demands. Further, subcontractors and equipment suppliers supporting the Navy shipbuilding program would be better able to plan and allocate their requisite output to support Navy new construction and conversion.

With or without congressional authorization of a multi-year shipbuilding program, the Navy could provide more assistance to its shipbuilding contractors from within Navy in-house resources. For example, the outlines of the shipbuilding program contained in the Five-Year Defense Plan (FYDP) could be made available to interested and qualified members of the shipbuilding industry. Even with knowledge that the FYDP shipbuilding program is subject to significant change by the Congress, shipbuilders' planning efforts would be assisted by the sharing of such information.

A similar sharing of planning data could be instituted for ship overhaul and repair programs. Periodic conferences between the Naval Sea Systems Command's workload and work scheduling officials and ship repair contractors, outlining the shipwork projected for the ensuing quarter or biennium, would greatly assist those contractors in their labor and facilities planning and might result in the availability of additional ship repair capacity to the Navy.

Such efforts to make planning data available to industry could, in addition, help to encourage capital investment in shipbuilding and ship-repair facilities and to maintain an adequate industrial base for competitive procurements.

3. Major Recomendations

Recommendation PROD-29: The Navy and Department of Defense should continue and intensify their efforts to obtain congressional authorization of a 5-year Navy shipbuilding program.

Recommendation PROD-30: The Navy should provide interested and qualified members of the shipbuilding and ship repair industry the outlines of the shipbuilding program contained in the Department of Defense's FYDP

and of scheduled ship repair and overhaul work. The information should be made available as part of periodic conferences or joint planning sessions, giving contractors opportunities to comment on the Navy's shipwork plans.

5. THE PRODUCTION IMPACT OF PLANNING AND PROCUREMENT STRATEGY

(1) Product Definition

1. Statement of the Issue

Inadequate definition of the product required and subsequent contracting for it in an improper manner impact heavily on the timeliness, quality, and cost of the product delivered. Facets of the issue that received particular attention by the NMARC Production Panel included:

- Adequacy of technical documentation
- Appropriateness of the contractual instrument
- Evaluation of offerors
- The procurement approach.

2. Findings and Conclusions

(1) Technical Documentation

The quality and specificity of technical documentation provided to Navy contractors vary widely. Contractual responsibilities for to the accuracy or adequacy of these technical data also vary widely. These variances create problems for the Navy and its contractors when the adequacy (or lack thereof) of technical data has not been considered in procurement planning.

Technical documentation cannot be given by a designer to a manufacturing department for production, even

within the same company, without allowing and planning for a certain level of engineering support to permit manufacture of a product to meet the intended use. This being the case, it would seem unrealistic to expect that technical documentation will always be so error free and complete that it can be furnished to any qualified producer and be adequate to permit manufacture of a product without any further interpretive or corrective action.

In Navy shipbuilding procurements, the lack of discipline that pervades the entire process of product definition has permitted contracts to be let for construction of ships whose systems have been insufficiently specified and whose characteristics have been ordered changed while the ship was under construction. This situation has forced shipbuilders into the position of having to request changes constantly as a ship is being constructed and has required the Navy to continue to make decisions concerning ship characteristics throughout the construction period.

One cause of this problem can be traced to late changes in ship missions and characteristics without adequate regard for their impact on construction time and cost. When this occurs, serious disruptions ensue in NAVSEA and NAVSEC. In order to meet deadline dates for the letting of shipbuilding contracts, NAVSEA and NAVSEC are forced to seek proposals on incomplete and obsolescent data packages. Shipbuilders then find themselves building to specifications and drawings they know they cannot trust.

Rather than concentrate on who is right in resolving the inevitable differences that arise in the use of such technical documentation, effort should be devoted to ensuring that an adequate administrative and contractual procedure exists and is operative to resolve such differences, and to organizing the production of the data package in such a way that those who will have to use it have an opportunity either to participate in its development or to comment on it before it is finalized. Much can be done, for example, within NAVSEA to correct and alleviate facets of this problem.

The approach taken to the design of the Patrol Frigate (PF) and Sea Control Ships (SCS) is a promising first step. In this approach, two potential builders of the ship to be procured participate in its design and comment on one another's design contributions from a producibility viewpoint. While the returns on the success of this technique are not yet in, it appears inevitable to the NMARC Production Panel that improvements in the adequacy of the technical data package will result from it.

Data package adequacy could also be improved by placing some controls on the making of conceptual changes that alter the currency and coverage of the data. The Navy would be well advised to explore the desirability of identifying points of time in the acquisition process at which data packages could be frozen, with any significant changes in design characteristics requiring high-level review and approval, and requests therefor accompanied by justifications that include cost/benefit analyses of the impact of the proposed change as weighed against its military or technical necessity.

Further improvements in technical-data adequacy could be achieved through more systematic determination of the kind and quality of specifications to be employed in each procurement of aircraft and shipboard components. For example, performance specifications have been used successfully for many years for procurement of avionics, but when used by the Naval Ship Systems Command (NAVSHIPS) (now incorporated in NAVSEA) for procurement of sonars, three very different designs of one major sonar resulted, causing NAVSHIPS to change to detailed design specifications for reprocurements.

Similarly, detailed design specifications have been used by some naval commands as mandatory requirements, while others have provided drawings as informational supplements to performance specifications; results of both techniques have been mixed, depending on specific circumstances, quality of the specifications, and contract administration factors.

The NMARC Production Panel considers that, on the one hand, detailed design specifications should be made mandatory only after an evaluation has concluded that the specifications are "buildable", (i.e., that a contractor could build to the specifications without requiring significant changes as production progressed), but that, on the other hand, use of performance specifications must be tempered by consideration of the need for replacement parts and interchangeability. As a general rule, it appears that use of performance specifications for procurement of prototypes should usually be followed by use of mandatory detailed design specifications, based on the tested prototype's design, for follow-on buys to assure uniformity and interchangeability.

(2) The Contractual Instrument

The Navy has demonstrated apparent inconsistencies in its use of different types of contracts, particularly as related to shipbuilding contracts. Relatively less complex ships are being bought under cost-reimbursable contracts while complex ships are being built under fixed-price contracts.

The NMARC Production Panel has concluded that too many variables exist, particularly those related to today's economy, to permit fixed-price contracts to be reasonable instruments for acquiring prototype or lead ships. Lead ships should normally be bought under cost-plus-incentive-fee (CPIF) contracts and so, in some cases, should early follow ships, particularly when a follow ship is the first ship of its class to be built by a given shipbuilder. When a second contractor is brought in to construct follow ships of a given class, his first ship should be treated as a lead ship, i.e., it should be on a cost-reimbursable-type contract, and sufficient time should be allowed in the schedule for the second contractor to proof his production on his first follow ship before completing significant work on his second.

Fixed-price-plus-incentive-fee contracts are appropriate for follow-ship procurements if adequate escalation provisions are included.

(3) Evaluation of Offerors

NAVSEA has had mixed success in recent years in the evaluation of offerors on shipbuilding procurements. On the one hand, all of the anticipated offerors have not always submitted proposals as expected; on the other, it has not been possible in some cases to disqualify the proposals of shipbuilders who lack adequate facilities and capabilities for construction or conversion of the ships being procured.

The NMARC Production Panel considers that evaluations of offerors could be enhanced by improving the adequacy and conciseness of the requests for proposals (RFPs) to which they are asked to respond, and by publishing in each RFP the criteria and order of importance that will be applied to evaluation of their proposals. It is further considered that NAVSEA's practice of using headquarters personnel to conduct preaward surveys is sound and should be continued because it moderates the possibility of bias by a SUPSHIP for or against a shipbuilder because of past relationships or because SUPSHIP personnel may feel that they need a new award to enhance job security.

(4) The Procurement Approach

A reasoned approach to each procurement is essential to ensure that both the product desired and the method of its procurement have been sufficiently defined and are compatible.

For example, to assure adequate competition and fair evaluation of proposals, the Navy should determine a means of restricting the physical size and length of proposals so that they are concise enough to be read and understood thoroughly and so that offerors are not forced to expend undue overhead expense on proposal formulation. Data requested in an RFP should be limited to what is actually required for fair evaluation of the proposal.

Another approach that has merit in some instances is the use of presolicitation notices and conferences. Such procedures not only reduce the costs of preparing proposals but also permit prospective offerors an opportunity to review specifications for completeness, submit questions, and point out potential discrepencies before formal procurement action is initiated.

Award of a contract for pilot production of one or more units by a second source to the detailed design used by the first source is another approach that can be used to demonstrate the ability or inability of a contractor to build to a given design and to prove the producibility of the data package. Two proven sources can then compete for the next contract.

As was stated earlier in this chapter, the approach employed by NAVSEA in procurement of the PF and SCS is a step forward. However, the NMARC Production Panel considers that the two shipbuilders involved in the design phase of a procurement using this approach should both be allotted some of the ships to be built when sufficient numbers of ships are to be bought. As presently practiced, "Shipyard B" participates only on speculation, with no sure expectation that anyone but "Shipyard A" will be given any ships to build. Both shipbuilders should participate in construction as well as design, with the number of units built by each determined by cost/price comparisons made when the contracts are negotiated.

The NMARC Production Panel also considers that, in ship procurements using the PF/SCS approach, the lead-ship designer (Shipbuilder A) should normally be awarded the lead-ship construction contract, with an adequate number of follow ships also awarded to permit unit-cost reductions to result from production efficiencies made possible thereby.

The NMARC Production Panel has observed that the best-and-final-offer procedure has been improperly employed in some cases, resulting in inflated early proposals, on the one hand, and forced buy-ins on the

other. The only legitimate reason for employment of the best-and-final-offer procedure is an actual change in contract scope; in such instances, the Panel considers that resolicitation to all responsive offerors is preferable.

Finally, the Panel considers that delivery dates in initial requests for proposals (RFPs) should be made more realistic and flexible as a means of opening up competition to builders whose workloads, production forces, or other factors might otherwise prevent them from responding.

3. Major Recommendations

Recommendation PROD-31: The Navy should continue and broaden its use of lead and follow yards in ship design procurements as was done in the Patrol Frigate (PF) and Sea Control Ship procurements, as a means of improving the adequacy of the technical data packages used in ship acquisitions.

Recommendation PROD-32: The Navy should assure that delivery schedules stated in requests for proposals (RFPs) are both realistic and flexible, in order to secure maximum competition.

Recommendation PROD-33: The Navy should award cost reimbursable contracts for lead ships; follow ships, except for the first follow ship built by a second source, should normally be procured under fixed-price-plus-incentive-fee contracts with adequate provisions for escalation.

4. Other Recommendations

Recommendation PROD-34: The Navy should eliminate misuse of best-and-final-offer procedures.

Recommendation PROD-35: The Navy and industry should recognize that technical documentation represents a best effort to describe what is intended. Correction of errors

in technical documentation should be the goal in resolving any differences between Government and industry. Administrative and contractual procedures should focus on achieving this goal.

Recommendation PROD-36: The Navy should consult industry in advance of changing or modifying specifications that have a significant impact on industry. If this practice were followed, the Navy would be advised of the impact on producibility, cost, schedule, and utility that would result from such a specification change. This could then be considered within the overall framework of what is intended by the change and what would be the relative impact of that change.

Recommendation PROD-37: The Navy should assure sufficient time for a second shipbuilder building his first follow ship to "proof" his production prior to proceeding with the rest of a series of follow ships.

Recommendation PROD-38: The Navy should place limits on the volume of paper permissible in contractors' proposals to facilitate the evaluation process and to reduce the cost to a contractor of proposal preparation.

Recommendation PROD-39: The Navy should advise offerors as to what criteria and order of importance will be applied to evaluation of their proposals.

5. Observation

NAVSEA's practice of having preaward surveys for all major procurements performed by headquarters personnel is sound and should be continued.

(2) Claims

1. Statement of the Issue

Shipbuilding claims result from many causes, and these causes must be treated if shipbuilding claims are to be eliminated. The Navy and its contractors can further relieve the

claims situation by cooperating to process the current backlog of claims expeditiously.

2. Findings and Conclusions

Every shipbuilding contract ever administered by the Navy has undoubtedly engendered some circumstances by virtue of which a shipbuilder became entitled to additional compensation. Formal and constructive changes, Navy-caused delays and suspensions, defective specifications, and late and defective Government-furnished material and information have all occurred, providing valid bases for requesting more money, more performance time, or both.

Since 1968, the Navy has recognized the size and gravity of the shipbuilding claims problem. The Todd settlement of $96.5 million in 1969 for the $114-million DE-1052-class claim received critical scrutiny from the Congress and the General Accounting Office (GAO) that led to charges of "give-away." Following this, a virtual moratorium existed in the settlement of claims. A marked adversary relationship arose between the Government and shipbuilding contractors. Within the Navy, there was little motivation to settle claims.

Beginning in January 1973, the Navy appears to have adopted a more comprehensive and objective approach toward resolving the large backlog of shipbuilding claims. The leadership in the Navy secretariat, NAVMAT, and NAVSEA has definitely changed the so-called "disincentive" environment toward claims processing, which existed from 1968 to 1973, to one of aggressive review of claims against planned milestones, aiming at expeditious and equitable settlements or at giving the contractor the opportunity to make a prompt appeal to the Armed Services Board of Contract Appeals (ASBCA).

The claims problem touched almost all of the shipbuilding industry; it was not limited to certain contracts or contractors. Virtually every shipbuilder engaged in building major naval vessels in the past 10 years has resorted to claims in quest of equitable price adjustments for contractual actions or inactions of the Government. It has also been suggested that, at least to some extent, the claims grew out of potential "loss contracts" that were spawned by the shift in the early 1960's from negotiated contracts to formally advertised, firm fixed-price contracts.

It is not appropriate for the NMARC Production Panel to offer recommendations for claims now in process. However, one observation that was repeatedly noted by the Panel at briefings by both shipbuilding contractors and the Navy's own field contract-administration offices (CAOs) was that placing claims evaluations under the administrative control or direct supervision of the CAO inevitably leads to an adversary position between the contractor and the CAO. This adversary position makes it much more difficult for the CAO to pursue his primary task of administration of current contracts as well as to fulfill his responsibility to obtain data from the contractor for use in the claims evaluations. The NMARC Production Panel believes that claims evaluation and preparations for claims trials before the ASBCA are SYSCOM headquarters responsibilities that should not be delegated to the CAO. Further, if the magnitude of a claim evaluation requires an onsite team, this team should not be collocated with the CAO, so that the CAO does not become connected in anyone's mind with the claim evaluation team.

The Panel has also found that one of the major contributing factors to existing claims was failure on the part of the contractor and/or the Navy to resolve the cost or schedule impact of changes to the contract in a timely manner.

The NMARC Production Panel considers that SYSCOM PMs should give high priority to evaluation and determination of the cost and schedule impact of all changes, including those identified by the contractors as constructive changes. It is the Panel's consensus that, in order to ensure that adequate resources are applied in an expeditious manner in the evaluation of changes, it is essential that the Navy impose target time constraints for the evaluation and review process to arrive at either an equitable settlement or a contracting officer's decision. To minimize the possible impact on production during the evaluation of a change, the Navy and the contractor should endeavor to "maximum price" the change; i.e., to negotiate a ceiling cost for the change until a thorough cost evaluation can be accomplished.

The NMARC Production Panel also acknowledges that to evaluate and resolve the impact of changes to the contract will require the complete cooperation of both the contractor and

the Navy. If, during this process, an impasse or dispute becomes apparent and cannot be resolved at the local level, the issue should be reported to the next higher level in the Department of the Navy for the purpose of proposing a course of action to resolve the issue or to recognize that the issue in question may be submitted as a claim by the contractor.

The NMARC Production Panel has found that NAVSEA has been successful in decreasing the backlog of shipbuilding claims and in stemming the flow of new claims. The reduction from a total of 110 shipbuilding claims in 1971 to the present backlog of only 25 is attributable in large measure to the intensive effort throughout the Naval Material Command to settle these claims as equitably and expeditiously as possible. During the period from calendar year 1971 to the present, approximately 53 shipbuilding claims have been settled or withdrawn, with a total value of approximately $630 million. NAVSEA responded to the report of Vice Admiral Eli T. Reich, USN (Ret.), "A Survey of the Navy Shipbuilding Claims Problem," by concurring or partially concurring in 36 percent of the report's recommendations, with a point-by-point comment to the CNM on those recommendations in which it did not concur.

3. Major Recommendations

Recommendation PROD-40: The Navy should continue to make claims evaluation and processing a headquarters responsibility and relieve the CAOs of any responsibility in the claims evaluation process in order to allow the CAOs to pursue their major task of administering current contracts.

Recommendation PROD-41: The Navy should continue its emphases on expeditious claims processing and on claims prevention.

Recommendation PROD-42: The Navy should process all changes to a contract on a priority basis and should try to use maximum pricing of changes whenever feasible in order to minimize the possible impact on production while a cost evaluation is in process.

4. Other Recommendations

Recommendation PROD-43: The Navy should attempt to locate claims teams at offices other than CAOs in order to prevent the growth of adversary relationships between contractors and the CAOs.

5. Observations

The Panel commented on the report of Vice Admiral E.T. Reich, USN, (Ret.), "A Survey of the Navy Shipbuilding Claims Problem." In general, the NMARC Production Panel considers the report to be excellent. It appears to be the product of an indepth analysis and very objectively illuminates the problems. The recommendations are sufficiently broad to enable accomplishment by a variety of actions. There are, however, several recommendations in the report with which the NMARC Production Panel does not fully agree. Specific comments by the NMARC Production Panel on the report's individual recommendations are provided in Appendix PROD-A to this report.

(3) Commonality Among Ships of a Class

1. Statement of the Issue

The purpose of achieving commonality within ships of a class (or, in its broader scope, commonality of all like machinery in the Navy) is to standardize machinery and equipment in order to simplify maintenance and logistic support. At issue is the practicality of commonality when two or more shipbuilders are building the same class of ships, when construction of the class proceeds over a period of years, or when the class contains only one or two ships.

2. Findings and Conclusions

The conventional approach to ship acquisition from two or more shipbuilders for each class, which results in different

ship designs and nonstandard equipment, has the following disadvantages: (1) the Navy has to pay for the different designs; (2) separate test procedures are required; (3) the operating and maintenance manuals and procedures differ; and (4) many different sets of spare parts are required. Lack of commonality thus causes severe problems in the fleet, in that personnel are hampered in operation and maintenance of different equipments serving the same basic purposes because they do not have training and experience with each design. Delays in obtaining, and costs of stocking, maintenance parts are also major problems with diverse designs.

Commonality among ships of a class when there are two or more shipbuilders for the class includes the following factors:

- Commonality in <u>design</u>, which requires:
  - One design organization, the lead yard
  - One configuration- and change-control system
  - Establishment of a product baseline for the class by the lead yard and close control of nonconformances
- <u>Equipment</u> commonality, which may be achieved by one of the following options:
  - Central procurement: Government buy and furnish; and lead yard buy and furnish non-GFE
  - Negotiation of options by lead yard to be exercised by follow yard or Government
  - Development by Government or lead yard of detailed drawings and specifications for procurement and adherence to such detailed designs
  - Acquisition of reprocurement data packages by the Government and their use by all yards.

In the conventional approach to ship acquisitions involving a large number of ships of the same class, a contract design is prepared by a design agent under the direction of NAVSEC. Based on the contract design and the remainder of the bid package, several shipbuilders submit proposals. Contracts are awarded to two or more shipyards for construction of the lead and follow ships. As a result, two or more detailed designs are prepared, one for each successful bidder. Each item of machinery and other contractor-furnished equipment (CFE) may be procured from several vendors by each shipbuilder, because of competitive pricing or because of the inability of original vendors to continue to supply the item.

In the approach being used on the PF and SCS, which is termed "In-house Ship-System Design with Shipbuilder Assistance," the ship-system design is started by NAVSEC and completed by a competitively selected lead shipbuilder. The lead shipbuilder completes the ship-system design, prepares the detailed design, and constructs the lead ship. A tentative follow yard has a contract to provide comments on the design to ensure that it is not biased in favor of the lead yard's production facilities. The follow yard or yards will be required to fabricate to the same detailed design as used by the lead yard. In any case in which a follow yard must change the design because of incompatibility with its facilities, the yard then must assume performance responsibility for the changed features of the design. To standardize major equipments, the lead yard is required to procure major items for the lead ship competitively and to secure options for follow ships. The options are to be exercisable by the lead yard, a stated follow yard, or the Government. When exercised, the options will call for delivery on a fixed-price basis with escalation provisions.

The NMARC Production Panel noted that, at present, some vendors are refusing to honor options in contracts because the prices provided in the options do not fully cover escalation. Thus, although the PF/SCS concept is a constructive approach to achieving commonality in a class involving a large number of ships, in practice, the provisions of the options must be made to cover escalation fully if the options are to achieve any beneficial results.

Each of the means of achieving greater commonality has its disadvantages and problems as well as its benefits. If the means chosen for equipment commonality is the option described above of central procurement with Government buy and furnish, then the ultimate application of this method would involve procurement of all of a given item needed for the ship class in one purchase order. One factor limiting such action is that Congress usually does not authorize funds for procurement of all such equipment for all the ships of a class at one time. Another factor is that a contractor can usually mate machinery and hull (both hardware and schedules) more easily when items are CFE rather than GFE.

When the ships of a class are few in number and sometimes separated from one another by several years of construction time, little commonality of machinery and equipment may be feasible. Vendors usually will have improved, or at least changed, designs in the years intervening between purchase orders. The cost of tooling up to build one unit of an obsolete design would be exorbitant. Nevertheless, commonality is a desirable goal and should be achieved whenever practicable in all ship classes, including those involving only a few ships.

3. Major Recommendations

Recommendation PROD-44: As a major step in achieving commonality, the PF/SCS approach (requiring the lead yard to procure major items competitively for the lead ship and to secure options, with escalation provisions, for additional units for follow ships) should be used in acquisitions involving several ships of a class to be built by two or more shipbuilders. The contractual provisions must provide coverage for all known escalation factors in order to make options viable.

4. Observation

Commonality is a desirable goal for all ship classes; however, only a minimal degree of commonality may be feasible for those classes that involve a limited number of ships with one or more years intervening between completion dates of successive ships (such as CVANs).

(4) Combat Systems Integration

1. Statement of the Issue

The combat systems in some major combatant ships have not been properly integrated to achieve satisfactory systems effectiveness. Steps have been taken to introduce improvements, such as the use of land-based test sites (LBTSs) and the designation of combat systems integrators for some ship acquisitions. The major questions examined by the NMARC Production Panel concerned the degree of necessity for combat systems integrators, the use and locations of LBTSs, and whether the combat systems integrator should be an associate of the prime shipbuilder or should be a subcontractor.

2. Findings and Conclusions

The majority of shipyards lack capability for combat-systems integration. Smaller yards have little or no expertise in development and testing of computer programs, optimum use of computers, arrangement of displays for optimum control of the various weapons in combat, or even in fault isolation and test of electronic equipment. These same yards have no desire to engage in building up electronics and weapon-systems staffs at times of peak workload only to have to reduce these staffs drastically a short time later, due to the normal workload fluctuations in ship-system design and testing.

Even the major shipyards lack in-house computer programming and combat-systems integration capabilities, although the requisite expertise sometimes may be found in another division of the corporate structure.

Currently, combat-systems integration contractors are participating to varying degrees in the design, development, or ship installation and testing of combat systems in such ship classes as the PF, Trident, SSN-688, and DD-963. In some instances, the participation of the integrating contractor is limited to operation of the LBTS and to development and checkout of the computer programs for the lead ship of the class. Most current LBTSs are remote from the shipyards, which

reduces the feasibility of assembling and testing subsystem assemblies at the LBTS before installation in the ship.

The NMARC Production Panel has concluded that the sophistication and complexity of modern combat systems hardware and software dictate that a combat systems integrator or integrating contractor be acquired for each major combatant ship class acquisition.

The integrator may be either a subcontractor to the prime shipbuilder or an associate. If the combat systems integrating contractor is a subcontractor, the shipbuilder is responsible for coordination with his subcontractor and retains overall responsibility for making all ship systems function effectively. If the integrator is an associate of the prime shipbuilder, then the task of coordination and the overall systems responsibility belong to the ship-acquisition project manager (SHAPM). In the latter case, the SHAPM and his staff must have a strong capability in management of combat-systems integration. Regardless of whether the integrator is a subcontractor or an associate, however, the division of work, the interfaces between the integrator and shipbuilder, and the schedules for each must be established in detail as soon as possible after the integrator is designated.

In the broadest application of the concept, the combat-systems integrator would be responsible for performance of the following functions:

- Participate with NAVSEC (and anyone else involved) in preliminary design
- Participate with the lead yard in commenting on and influencing the contract design; in this capacity, the integrating contractor would optimize design for the use of computers and the arrangement of displays, and, to some degree, would participate in the selection of combat systems components
- Participate with the lead yard in detailed design as it relates to the combat systems

- Define and document the interfaces between command and control and all weapons, equipments, and subsystems comprising the total combat systems of the ship
- Operate the LBTS
- Develop and "proof" the combat systems' operational computer programs
- Take delivery of the GFE and CFE components of the combat systems at the LBTS
- Palletize (as appropriate) selected and designated combat-systems subassemblies; perform preliminary tests of such subassemblies at the LBTS
- Assist the shipyard in testing the combat systems aboard ship
- Assist the shipyard in builder's trials; such assistance would include adjustment, calibration, and replacement of failed parts in combat systems equipments prior to and following final acceptance trials (FATs)
- Maintain configuration management functions.

The combat-systems integrating contractor should not be put in the position of conflict of interest on hardware selection. A hardware exclusion clause in his contract may be required. If equipments or weapons he is producing are chosen for the ship class, either such choice must be made by the PM and announced prior to designation of the integrating contractor, or the contractor must not be given any role in hardware selection.

The LBTS may be operated by the integrator (either at the plant of the integrating contractor, at the shipyard, or at a Navy site) or by the shipyard with guidance and participation by the combat-systems integrator. If the PF concept (in which a lead yard and follow yard participate with NAVSEC in contract design and the follow yard comments on the detailed

design developed by the lead yard) is used in construction of a ship class, the combat systems integrating contractor for the lead yard should be selected prior to contract design. The integrating contractor then should participate in influencing the contract design and should perform assigned portions of the detailed design, construction, and testing. The main function of the integrating contractor is to develop and proof the computer programs in conjuction with the hardware of the combat systems. However, when designated at the beginning of design, the integrating contractor should be utilized to perform the other facets of combat-systems integration.

The use of LBTSs to proof computer programs and hardware compatibilities and to aid in other facets of combat-systems integration is essential. LBTSs may serve the following purposes:

- To aid in design, development, integration, and test of the combat systems, including proofing of the maintenance and operational computer programs
- To serve as a production tool to aid in the test and checkout of equipments for the lead and follow ships
- To serve as a training aid for fleet personnel
- For use in configuration management, to test proposed design changes in hardware and computer programs.

To perform the second of the foregoing functions, the LBTS should be located at, or in close proximity to, the yard of the shipbuilder. For the third and fourth functions, location at a Navy facility may be desirable. For the first function, the scope of the LBTS should be as complete as possible, including launching devices for weapons. For the second function, the LBTS need only be capable of performing those operations necessary for the desired off-ship testing and assembly of equipments and subsystems. If sufficient

funds are available and the choice of prime and integrating contractors so dictates, the solution may lie in the establishment of two LBTSs, one for development, training, and configuration control, and the other as a production aid to the shipbuilder.

3. Major Recommendations

Recommendation PROD-45: A combat-systems integrator or integrating contractor should be required in the development and construction of every major combatant ship class.

Recommendation PROD-46: An LBTS should be required for system development and software validation for each major combatant ship class.

Recommendation PROD-47: The combat systems integrator should participate, as a minimum, in the contract design, development, software validation, construction, test, and trials phases of the lead ship.

4. Other Recommendations

Recommendation PROD-48: If location permits, an LBTS should be used as a production aid during construction of all ships of a class.

Recommendation PROD-49: After construction of the lead ship, an LBTS should be retained for training fleet personnel and for checkout of design changes in hardware and software.

5. Observation

The establishment of two LBTSs may be the solution to providing facilities suitable for accomplishment of all of the four major functions cited herein.

6. FIELD CONTRACT ADMINISTRATION

(1) Staffing

1. Statement of the Issue

Navy contractors have complained of unresponsiveness, lack of competence, and disruption of the orderly progress of production on the part of field contract-administration offices (CAOs). At the same time that contractors are saying they must deal with too many personnel in CAOs and are objecting to the depth of involvement of CAO personnel in the contractor's operations, SUPSHIPs and Naval Plant Representative Offices (NAVPROs) are claiming that employment ceilings and other restrictions prevent the hiring of adequate numbers of personnel with sufficient expertise to do a fully capable job of contract surveillance.

Personnel shortages are one reason given by SUPSHIPs for inconsistent handling of change orders, which is a problem often cited by shipbuilders as a source of shipbuilding claims. Other SUPSHIPs involved mainly in ship overhaul and repair believe that increased personnel levels could permit more timely issue of overhaul and repair work packages.

2. Findings and Conclusions

The term contract administration office (CAO) as used herein applies to:

- SUPSHIPs
- NAVPROs
- AFPROs
- Defense Contract Administration Services Offices and Districts (DCASOs and DCASDs).

At present, although SUPSHIPs have a target calling for issue of ship overhaul and repair work packages no later than 30 days in advance of an availability's start date, they are often still issuing sections of the work package at the time of a ship's arrival, when the overhaul is scheduled to begin. Such tardy issuance of work packages does not give a ship-repair contractor sufficient time to plan his work or acquire needed materials prior to beginning work. Correction of the present situation requires increased stability in ship overhaul and repair planning. Stability improvements required include the following:

- Closer adherence to the alterations scheduled in the Fleet Modernization Program (FMP) so that preparation of the alterations portion of the work package well in advance of the overhaul date will serve a useful purpose

- Increased management of advanced preparation of work packages by PERA offices

- Fewer late changes in the work package introduced by actions taken by the type commander, particularly changes ordered after the availability has commenced

- Authority granted to the SUPSHIP to issue work specifications under a master ship repair contract on either a fixed-price or cost-plus basis, depending on the degree of definition of the work package.

At present, in order to permit completion of overhaul work packages on a more timely basis, the NMARC Production Panel considers that the improvements described above should be instituted; otherwise, needed improvement in overhaul planning can only be obtained through an increase in billets allotted to those SUPSHIPs concentrating on ship overhaul and repair.

At some private shipyards, a large backlog of unnegotiated change orders exists. However, the NMARC Production Panel found that concentration on negotiation of these change

orders by the contracts department of a SUPSHIP can result in a drastic reduction in the backlog. An industrious and knowledgeable officer at one SUPSHIP not only negotiated in about 1 year's time, all change orders older than 6 months, but also closed out several contracts on which work had been completed several years earlier. These successful techniques should be applied at other CAOs where insufficient progress has been achieved in reducing the number of outstanding undefined and unpriced change orders.

A close working relationship between the PM and the CAO is necessary if the results sought by the PM are to be achieved under the terms of the contracts. However, the following policies of DOD regarding contract administration services (CAS) tend to blur the lines of contact between the PM and the CAO:

- CAS in a given plant must be performed by a single DOD component.
- CAS in certain plants may be assigned to a single military department.
- Regardless of whether CAS are performed by a military department or by a DCAS component, the CAO is supposed to be responsive to the technical direction exercised by cognizant PMs.
- The number of PM personnel attached to a CAO is supposed to be kept to a minimum.
- CAS for several SYSCOMs or military departments are to be provided on a common basis.

Application of these policies effectively limits the practical authority that any individual PM may have over a specific CAO. Lines of authority are clearer when the majority of the work administered by a CAO is done for a single project manager, or when construction in a shipyard is administered by a SUPSHIP for one class of ships under a single NAVSEA PM. In the more usual case, however, of CAS performed for several PMs and for more than one military department, special

arrangements or agreements may be required to provide a specific PM with requisite technical control over the CAO and the necessary degree of frequent communication regarding progress or problems.

A PM can achieve a better agreement with the CAO on a major contract as to the relative emphases to be placed on various administrative and technical matters by means of a "memorandum of understanding." In addition, service to the PM can be improved by establishment on the staff of the CAO of a dedicated project officer for each major project assigned. Although the dedicated project officer should report directly to the CAO, he also should be regarded as a special representative of the PM in that shipyard or plant. The project officer at the CAO will communicate directly with the PM by telephone and letter and will carry out the PM's instructions to the extent they are consistent with the contract and with the administrative direction received from the CAO. Dedicated project officers functioning in this manner are already assigned to many CAOs, but the practice needs to be extended so that every major Navy project is represented by a dedicated project officer on the staff of each CAO supervising substantial work for that project.

The capability of the CAO has often been supplemented for specific projects by assignment to the CAO of a technical representative supporting the PM. However, to maintain a "single Government face to the contractor," the technical representative should either be the same person as the CAO's project officer for the project or he should be made a subordinate of the CAO project officer.

Personnel in the offices of PMs often have had little experience in contract administrative functions. Thus, they sometimes lack appreciation the work of CAOs and may not be familiar with manufacturing procedures and technique. With this experience gap, such personnel cannot be fully effective in their project-management functions. Prior duty in a CAO would thus provide junior officers and civilians with valuable training for many project management tasks.

3. Major Recommendations

Recommendation PROD-50: The techniques that have proven successful in drastically reducing the backlog of undefined and unpriced change orders and in closing out contracts should be applied at those CAOs that have been making inadequate progress in this area.

Recommendation PROD-51: For each major project, a dedicated project officer acting as a representative of the PM should be assigned to the staff of each CAO exercising field contract-administration functions for contracts that cover significant portions of the project's efforts.

4. Other Recommendations

Recommendation PROD-52: If improved planning stability such as is described herein cannot be instituted, the number of billets allocated to those SUPSHIPs primarily engaged in overhaul and repair work should be increased.

5. Observation

CAOs are good training grounds for junior officers in anticipation of future project-management assignments.

(2) Responsibilities

1. Statement of the Issue

The functions normally assigned to and performed by CAOs are stated in the Armed Services Procurement Regulation (ASPR) Insofar as an individual PM is concerned, the CAO assists the PM in ensuring that the contractor achieves the intended result under a contract assigned to a specific CAO for performance of contract administration functions.

The CAO is hampered in providing maximum assistance to the PM by organizational complexities that tend to isolate him from the PM, by lack of sufficient authority in some instances, and by interference from other activities in the performance of his functions. The NMARC Production Panel has found several areas in which changes could be made that would enable the CAO to do a more effective job and would help to improve his relationship with both the contractor and the PM.

2. Findings and Conclusions

Clarification of the responsibilities of the CAO and his relationship with the contractor would be improved by greater conformance to the concept known as "a single Government face to the contractor." CAO and contractor personnel both report problems because of conflicting instructions and guidance given to the contractor by diverse Government personnel. Contractors state that they do not know who is in charge when, on the same contract, they are given direction by laboratory liaison personnel, the PM (or his personnel), a technical representative acting independently of the CAO, and CAO personnel. Such direction often is given to the contractor without the knowledge of the CAO. Confusion and constructive changes result.

Technical-liaison personnel from a laboratory assigned technical-assistance responsibilities (or any similar functions) must be made to deal with a contractor within the bounds prescribed by the contract and with the full knowledge of the CAO. When instructions from laboratory liaison personnel or from personnel assigned to the PM are such that compliance would result in breach of contract, appropriate contract modification is necessary prior to implementation of the instructions. The CAO must be kept informed of all discussions with the contractor so that the CAO is the activity that presents the "single Government face."

Another violation of the principle of a "single Government face" results from interpretations of the overlapping missions of the CAO and the Defense Contract Audit Agency (DCAA). Various Government agencies have varying concerns

with different phases of a contractor's operations. In the past, this type of problem has been addressed by assigning plant cognizance to a single agency. This agency then has acted as the agent for any military service or other executive department for contracts being performed within that plant.

This identification of authority has become diffused in recent years, particularly with respect to the interface between the Defense Contract Audit Agency (DCAA) and the CAO, with the advent of the "total audit concept" embraced by the DCAA. The overlap and duplication of functions of the DCAA and the CAO is causing confusion. To reduce confusion, duplication of functions performed by the DCAA and the CAO should be eliminated both from their official charters and from their individual interpretations of their respective responsibilities and authorities.

The NMARC Production Panel believes that performance by CAOs of claims-administration functions leads to lack of mutual trust and respect between the CAO and the contractor. Assignment of such functions hampers the CAO in administering the contracts on which claims do not exist, as well as in achieving performance on unfinished portions of the contracts to which the claims apply. Also, where the CAO is charged with claims administration, he often must assign his most highly skilled technical personnel to claims resolution, thereby reducing his effectiveness in acccomplishing other important functions. The panel considers that the CAO should provide appropriate inputs to claims resolution but should not be responsible for claims administration.

The NMARC Production Panel found numerous instances in which local CAOs were neither privy to, nor participants in, competitions leading to contracts or in negotiation of the contracts they were administering. It has long been recognized that in addition to the specific terms and conditions of the contract, the contractual intent is of great importance. Without having participated in the events leading to a contract, the CAO is at a great disadvantage in interpreting the contractual requirements. The problem is compounded by the fact that the key contractor personnel associated with the contract are usually well aware of the contractual intent.

It is realized that dozens of CAOs cannot be invited to participate in the early phases of advertised procurement involving large numbers of potential bidders. However, CAOs can be brought in (1) if the contract is being negotiated with a single source; (2) when only two competent sources are involved; or (3) after the list of bidders or sources has been reduced to the single contractor chosen by the Government source-selection authority and the PCO. Whenever feasible within these limitations, the CAO (or CAOs) should (1) participate in conferences between the PCO, PM, and prospective contractor(s); (2) assist in review of proposals; and (3) aid in the evaluation of proposals. CAO personnel then would have a proper background for performance of their assigned functions in greater conformance with objectives of the PM. The disadvantage of the CAO vis-a-vis the contractor in discussions of contractual intent would thus be considerably reduced.

Optimum relationships between NAVAIRSYSCOM NAVPROs and NAVAIR PMs are impeded by the NAVAIRSYSCOM organizational structure. Significant features are as follows:

- The Naval Air Systems Command Representative, Atlantic (NAVAIRSYSCOMREPLANT), has been assigned command responsibility for NAVAIRSYSCOM NAVPROs, including personnel requirements and workloads.

- NAVAIR's Material Acquisition Group performs CAO management coordination, including preparation of budgets and issuance of policy concerning CAO functions.

- NAVAIR's Contracts Group provides guidance on contractual matters.

- The NAVAIR PMs, who are supported by the NAVAIR Plans and Programs Group, give technical guidance for their respective projects to the NAVPROs, who report through NAVAIRSYSCOMREPLANT to the Material Acquisition Group.

It can be seen from the foregoing discussion that the organizational structure is cumbersome and does not enhance the objectives of having the CAO perform his functions as a member of the PM's team. If the necessary and minimum number of billets required to administer the NAVAIR NAVPROs could be absorbed by NAVAIR headquarters, confusion in supervision would be reduced by relieving NAVAIRSYSCOMREPLANT of command responsibility for NAVAIR NAVPROs and by having this function exercised directly by NAVAIR headquarters.

CAOs perform important functions in regard to all contractual changes. In the area of constructive changes, it is important that the CAO aid in defining such changes promptly. The NMARC Production Panel found instances in which Class I engineering change proposals (ECPs) were not being contractually ordered and/or the cost negotiated for over a year after submittal.

CAOs cannot control delays caused by the SYSCOMs, but a CAO can reduce the time required for negotiating a firm price by emphasizing this function. In cases in which authority for Class II engineering change approval (or concurrence in classification) is currently either retained in a SYSCOM or delegated to a laboratory, such authority should instead be delegated to the local CAO whenever feasible in order to expedite Government action. In particular, such delegation to the CAO should be made when unreasonable delays are frequent and usual and the contractor is the only current manufacturer of the product. Delays in the final Government action on changes of any kind usually result in increased cost.

3. Major Recommendations

Recommendation PROD-53: NAVPROs and SUPSHIPs should be relieved of responsibility for administration of claims. Contractors must also agree to pursue claims outside of those parts of their organizations that conduct day-to-day business with the Government.

Recommendation PROD-54: The policy of "a single Governmment face to the contractor" should be reaffirmed and practiced. The cognizant CAO should be clearly

identified as the Government team leader in the Government interface with the contractor. He should coordinate, schedule, and resolve any differences stemming from the activities of varying Government offices or agencies with respect to the contractor. Any problems that cannot be satisfactorily resolved at the local level should be taken promptly through the chain of command to whatever level is necessary for resolution.

Recommendation PROD-55: The CAO should participate in negotiation of contracts so that CAO personnel will be knowledgeable in the intent of the contracts as well as in their terms and conditions; to the extent practicable, the CAO should participate in the evaluation of proposals or in competitions leading to contracts; where practicable, these premises should apply to DCASOs and Air Force Plant Representative Offices (AFPROs) as well as NAVPROs and SUPSHIPs.

4. Other Recommendations

Recommendation PROD-56: The missions and charters of SUPSHIPs, NAVPROs, and DCAA should be reviewed to eliminate overlapping functions; in particular, duplication of authority in both financial and industrial areas should be eliminated.

Recommendation PROD-57: The command responsibilities of NAVAIRSYSCOMREPLANT for NAVAIR NAVPROs should be deleted from the NAVAIRSYSCOMREPLANT charter and should be exercised by NAVAIR headquarters.

5. Observation

Responsibility for Class II engineering change approval should be delegated to the CAO whenever feasible. High priority should be given to making all changes definitive and to negotiating their cost promptly.

7. SUMMARY OF PRODUCTION PANEL RECOMMENDATIONS

(1) Major Recommendations

Recommendation PROD-1: The Navy should retain the project/functional matrix organization staffing of most of its project management offices. The vertical organization is, however, supported for high-value, top-priority programs for which the number of people required full time warrants it.

Recommendation PROD-2: The Navy should collocate project management and key technical support management personnel. When additional technical assistance is obtained from naval activities remote from the PM, functions and relationships must be clearly defined. In particular, technical personnel remote from the PM should serve in an advisory capacity and should not function in the chain of command between the PM and the contractor.

Recommendation PROD-3: For major projects, the Navy should locate the PCO on the staff of the PM. Necessary procurement support staff should also be assigned to the staff of each major weapon system acquisition project manager. The PCO and the PCO's supporting staff should be physically located in the project management office. Collateral reporting responsibility for policy guidance to other elements of the parent organization may be retained as appropriate.

Recommendation PROD-6: The Navy should eliminate unnecessary reviews and approvals of technical and contract changes and procurement requests; wherever possible, approval of procurement documents should be limited to those people whose decisions with respect to that procurement are essential. To facilitate the entire acquisition process, reviews should be concurrent or parallel, rather than sequential, whenever possible.

Recommendation PROD-13: The Navy should continue and expand the application of early and detailed advance planning of ship overhauls such as is accomplished by the PERA organizations, particularly for nuclear submarine overhauls. To this end, the Navy should give priority to identification

and allocation of the personnel and financial resources necessary to extend PERA-type planning techniques fully to all major combatant ship overhauls.

Recommendation PROD-14: The Navy should devise means of improving planning discipline for ship maintenance and modernization so that late changes to alterations and repairs in overhaul work packages are minimized. In order to achieve this, the Navy should find ways to ensure that technical, logistical, and production considerations carry adequate weight relative to military requirements in the Navy's decisionmaking processes, and that those responsible for the execution of depot-level maintenance of ships may be permitted to carry out their responsibilities according to plan.

Recommendation PROD-15: The Navy should give priority to identifying and allocating additional personnel and financial resources requisite for extended PERA-type planning and improved ship overhaul planning generally. Additional resources for PERAs, naval shipyard planning departments, and SUPSHIPs will be required. In particular, if greater overhaul work-package stability cannot be achieved, additional personnel will be required by SUPSHIPs engaged primarily in administration of ship overhaul and repair work.

Recommendation PROD-18: The Navy, with the assistance of the Office of the Secretary of Defense, should take immediate action to retain title to the Boston Naval Shipyard (less the 28 acres reserved for the USS Constitution National Park), in order that surge drydock capacity for the repair of large, complex naval ships may be maintained on the east coast.

Recommendation PROD-19: The Navy should study the need for and feasibility of leasing to private contractors the Hunters Point Naval Shipyard facilities and the Charlestown portion of the Boston Naval Shipyard facilities, and request options for Navy use of the large South Boston drydock as required. The Navy should seek an out-leasing arrangement similar to that employed for the large Navy floating drydock at San Diego, whereby contractors bid for use of the facility, and Navy ship-repair work is accorded priority. These actions should be taken to assure the maintenance of a capability

for repair of naval ships in the Boston and San Francisco areas in order that the naval-shipyard drydocks there may be used for emergent Navy repair work when required.

Recommendation PROD-20: The Navy should not assign new-construction work to naval shipyards until and unless (1) a series of three or more follow-ship auxiliaries can be assigned to a single yard; (2) the new-construction work can be assured of protection from excessive disruption by emergent repair work; and (3) ceiling relief can be provided to the performing naval shipyard so as to provide for orderly buildup of a shipbuilding workforce in such a way that the shipyard's repair capability is not deleteriously affected.

Recommendation PROD-21: The Navy should take steps to acquire and maintain an active capability among at least three shipyards for construction of nuclear submarines, and among at least two shipyards for the construction of nuclear surface ships, in order that nuclear shipbuilding capability may be spread among an industrial base sufficiently large to protect national security interests. To do so, the Navy will find it necessary to seek to create an environment that will attract private capital investment in nuclear shipbuilding for the Navy.

Recommendation PROD-24: The Navy should intensify its efforts to acquire Federal funds, through the Comprehensive Employment and Training Act of 1973 or other similar program, to support training programs in public and private shipyards. Funds so acquired should be applied to support of both long-term (3- to 4-year) apprentice training and short-term (up to 6-month) entry-level training. Distribution of the training funds should be from the Department of Labor to NAVSEA, and from NAVSEA directly to the naval and private shipyards whose training programs have been qualified for such funding support.

Recommendation PROD-25: Navy Industrial Fund (NIF) activities should operate with financial controls; personnel ceiling (or quasi-ceiling) controls should be removed from NIF activities.

Recommendation PROD-26: U.S. Civil Service regulations with respect to reductions-in-force (RIF) for NIF activities should be reexamined to attempt to reduce the time period between the decision date that a RIF is required and the date when employees are off the payroll. Alternative means of rapidly reducing the number of employees for relatively short periods of time with more streamlined administrative procedures to effect this would be highly desirable in giving the industrial manager the flexibility needed to meet a changing workload, while also protecting the long-term job rights of the employee.

Recommendation PROD-27: The Navy should ensure that the absence of personnel ceiling controls does not affect the distribution of industrial work between the public and private sectors to the detriment of private industrial capacity and capability.

Recommendation PROD-29: The Navy and Department of Defense should continue and intensify their efforts to obtain congressional authorization of a 5-year Navy shipbuilding program.

Recommendation PROD-30: The Navy should provide interested and qualified members of the shipbuilding and ship repair industry the outlines of the shipbuilding program contained in the Department of Defense's Five-Year Defense Plan (FYDP) and of scheduled ship-repair and overhaul work. The information should be made available as part of periodic conferences or joint planning sessions, giving contractors opportunities to comment on the Navy's shipwork plans.

Recommendation PROD-31: The Navy should continue and broaden its use of lead and follow yards in ship design procurements as was done in the Patrol Frigate and Sea Control Ship procurements, as a means of improving the adequacy of the technical-data packages used in ship acquisitions.

Recommendation PROD-32: The Navy should assure that delivery schedules stated in requests for proposals (RFPs) are both realistic and flexible, in order to secure maximum competition.

Recommendation PROD-33: The Navy should award cost-reimbursable contracts for lead ships; follow ships, except for the first follow ship built by a second source, should normally be procured under fixed-price-plus-incentive-fee contracts with adequate provisions for escalation.

Recommendation PROD-40: The Navy should continue to make claims evaluation and processing a headquarters responsibility and relieve the CAOs of any responsibility in the claims evaluation process, in order to allow the CAOs to pursue their major task of administering current contracts.

Recommendation PROD-41: The Navy should continue its emphases on expeditious claims processing and on claims prevention.

Recommendation PROD-42: The Navy should process all changes to a contract on a priority basis and should try to use maximum pricing of changes whenever feasible in order to minimize the possible impact on production while a cost evaluation is in process.

Recommendation PROD-44: As a major step in achieving commonality, the PF/SCS approach (requiring the lead yard to procure major items competitively for the lead ship and to secure options, with escalation provisions, for additional units for follow ships) should be used in acquisitions involving several ships of a class to be built by two or more shipbuilders. The contractual provisions must provide coverage for all known escalation factors in order to make options viable.

Recommendation PROD-45: A combat-systems integrator or integrating contractor should be required in the development and construction of every major combatant ship class.

Recommendation PROD-46: An LBTS should be required for system development and software validation for each major combatant ship class.

Recommendation PROD-47: The combat sytems integrator should participate, as a minimum, in the contract design, development, software validation, construction, test, and trials phases of the lead ship.

Recommendation PROD-50: The techniques that have proved successful in drastically reducing the backlog of undefined and unpriced change orders and in closing out contracts should be applied at those CAOs that have been making inadequate progress in this area.

Recommendation PROD-51: For each major project, a dedicated project officer acting as a representative of the PM should be assigned to the staff of each CAO exercising field contract-administration functions for contracts that cover significant portions of the project's efforts.

Recommendation PROD-53: NAVPROs and SUPSHIPs should be relieved of responsibility for administration of claims. Contractors must also agree to pursue claims outside of those parts of their organizations that conduct day-to-day business with the Government.

Recommendation PROD-54: The policy of "a single Government face to the contractor" should be reaffirmed and practiced. The cognizant CAO should be clearly identified as the Government team leader in the Government interface with the contractor. He should coordinate, schedule, and resolve any differences stemming from the activities of varying Government offices or agencies with respect to the contractor. Any problems that cannot be satisfactorily resolved at the local level should be taken promptly through the chain of command to whatever level is necessary for resolution.

Recommendation PROD-55: The CAO should participate in negotiation of contracts so that CAO personnel will be knowledgeable in the intent of the contracts as well as in their terms and conditions; to the extent practicable, the CAO should participate in the evaluation of proposals or in competitions leading to contracts; where practicable, these premises should apply to DCASOs and Air Force Plant Representative Offices (AFPROs) as well as NAVPROs and SUPSHIPs.

(2) Other Recommendations

Recommendation PROD-4: The Navy should continue to seek support for the collocation of NAVSEC with NAVSEA.

Recommendation PROD-5: Personnel ceiling controls (or any other managment device that has similar effects) should be removed from programs for which the personnel and other support costs are reimbursable. For foreign military sales programs, the number of people hired could simply be the number that the customer is willing to pay for. For other reimbursable programs, compensating ceiling authorization could be provided between the executive agencies involved, inasmuch as the total work would still be within the bounds of an approved and budgeted program.

Recommendation PROD-7: The Navy should seek a better balance between the authority of the Chief of Naval Operations (the user) and that of the Chief of Naval Material (the producer) in the acquisition of weapon systems. It is considered that the role of OPNAV should be focused on mission requirement determination and the role of NAVMAT and the SYSCOMs should be focused on the acquisition of weapon systems to meet OPNAV's stated requirements.

Recommendation PROD-8: The Navy should better define the role of NAVMAT headquarters. Those headquarters functions that contribute positively to the weapon-system acquisition and logistic support processes should be retained. Any resources identified as excess could be effectively applied within the SYSCOMs.

Recommendation PROD-9: The number of briefings required to be made by PMs should be reviewed, reduced, and consolidated. Opportunities for reduction exist in eliminating those briefings that are for information only and in substituting written communications for some formal briefings. It would be beneficial if briefings to be made were limited to those people who actually must make a decision as a result of the briefing.

Recommendation PROD-10: The Navy policy requiring negotiation of price before an engineering change is contractually authorized should be continued, and in those cases where

a time-consuming cost evaluation of the change is required, the Navy and the contractor should attempt to maximum-price the change to forestall any adverse impact on production.

Recommendation PROD-11: The Navy should place major emphasis on achieving both technical approval and contractual authorization of Class I ECPs within existing approval time targets.

Recommendation PROD-12: In each SYSCOM certain contract negotiators in each major weapons area should be designated to process contract change orders implementing CCB directives as their task of first priority. To make such an assignment meaningful, the processing of paper between the CCB, project manager, and contract negotiator must be streamlined.

Recommendation PROD-16: The local contracting authority at naval shipyards should be increased.

Recommendation PROD-17: Authority should be granted to SUPSHIPs to issue ship repair and alteration work to Master Ship Repair (MSR) Contract contractors on a cost-reimbursable basis to the extent that the adequacy of the contractors' accounting systems will permit, when work is insufficiently described to permit soundly based fixed pricing. The bulk of ship repair and alteration work should continue to be issued by SUPSHIPs on a fixed-price basis, but issuance of appropriate work on a cost-reimbursable basis will eliminate delays in work acceptance and reduce potential claims arising from work whose scope could not be sufficiently forecast.

Recommendation PROD-22: The Naval Air Systems Command should reevaluate the aircraft industrial base in the light of today's situation, considering viability, mobilization, and overall capability in the aerospace industry.

Recommendation PROD-23: The Naval Air Systems Command should make visible a firm plan that delineates work to be done in the private sector and work to be done by Government agencies, and should allocate work in accordance with that plan.

Recommendation PROD-28: Through the Office of the Secretary of Defense, the Navy should request that priority be given in the President's programs to combat unemployment to creating jobs in those segments of the defense industry experiencing manpower shortages. Specifically, rather than naval-shipyard employment's being reduced below the levels demanded by assigned and projected workload, "public-service" and "Vietnam-veteran" jobs to be established in the President's unemployment-reduction programs should be assigned to those shipyards. Similar priority should be given to support of additional productive jobs in private shipyards doing naval or commercial shipwork in the national interest in depressed-employment areas.

Recommendation PROD-34: The Navy should eliminate misuse of best-and-final-offer procedures.

Recommendation PROD-35: The Navy and industry should recognize that technical documentation represents a best effort to describe what is intended. Correction of errors in technical documentation should be the goal in resolving any differences between Government and industry. Administrative and contractual procedures should focus on achieving this goal.

Recommendation PROD-36: The Navy should consult industry in advance of changing or modifying specifications that have a significant impact on industry. If this practice were followed, the Navy would be advised of the impact on producibility, cost, schedule, and utility that would result from such a specification change. This could then be considered within the overall framework of what is intended by the change and what would be the relative impact of that change.

Recommendation PROD-37: The Navy should assure sufficient time for a second shipbuilder building his first follow ship to "proof" his production prior to proceeding with the rest of a series of follow ships.

Recommendation PROD-38: The Navy should place limits on the volume of paper permissible in contractors' proposals to facilitate the evaluation process and to reduce the cost to a contractor of proposal preparation.

Recommendation PROD-39: The Navy should advise offerors as to what criteria and order of importance will be applied to evaluation of their proposals.

Recommendation PROD-43: The Navy should attempt to locate claims teams at offices other than CAOs in order to prevent the growth of adversary relationships between contractors and the CAOs.

Recommendation PROD-48: If location permits, an LBTS should be used as a production aid during construction of all ships of a class.

Recommendation PROD-49: After construction of the lead ship, an LBTS should be retained for training fleet personnel and for checkout of design changes in hardware and software.

Recommendation PROD-52: If improved planning stability such as is described herein cannot be instituted, the number of billets allocated to those SUPSHIPs primarily engaged in administration of ship overhaul and repair work should be increased.

Recommendation PROD-56: The missions and charters of SUPSHIPs, NAVPROs, and DCAA should be reviewed to eliminate overlapping functions; in particular, duplications of authority in both financial and industrial areas should be eliminated.

Recommendation PROD-57: The command responsibilities of NAVAIRSYSCOMREPLANT for NAVAIR NAVPROs should be deleted from the NAVAIRSYSCOMREPLANT charter and should be exercised by NAVAIR headquarters.

VII. COST PANEL

For many years, the Department of the Navy and the Department of Defense had great credibility with the American people regarding the acquisition of their weapon systems. The public and the Congress placed a high degree of confidence and trust in the integrity and competence of the military services. As a nation, we were willing to pay the high costs for weapon systems as long as we believed we were receiving high quality in acquisition management and weapon performance. This credibility was shattered in the mid-1960's by the Vietnam war, the surfacing of the C-5A problems, and large cost overruns on many weapon programs.

A basic assumption, implicit in all of the Cost Panel deliberations and recommendations, is that a significant part of the total credibility problem is the declining confidence in the Navy's ability to estimate, manage, and report costs. Recent and continuing cost overruns in certain of the Navy's major acquisition programs have contributed to the Navy's "cost credibility gap." Some of these overruns have come as unpleasant surprises to the Congress. The decline of congressional confidence has resulted in an increase in fencing or restriction of funds that now limits the Navy's capability to deal with the unexpected in weapon systems acquisition. One cannot factually demonstrate that the Navy and the nation have fewer ships or aircraft because of this alleged cost credibility gap, but it must be assumed implicitly that the seeds of such a negative outcome have been planted.

The cost credibility gap has also impacted the Office of the Secretary of Defense (OSD), the Navy, and the other military services. It has resulted in a proliferation of reviews and of layers of management dedicated primarily to the review and checking of the actions of the lower levels of management because the upper levels of management do not have the requisite trust and confidence in the management capability of the lower levels.

Overruns occur, management layers are added, new checkers are checking the old checkers, funding fences are developed, and the downward spiral in management efficiency and effectiveness accelerates.

The Cost Panel has concluded that several factors impact the Navy's ability to prevent such cost overruns. Of particular concern are those that contribute to establishing initial program funding at an unrealistically low level. When programs are funded unrealistically, cost overruns are almost certain.

The limited Defense budget and mounting weapon systems cost cause tremendous pressure at all levels of program and budget review to reduce official cost estimates and budgets to the absolute minimum for which the program can possibly be accomplished. It is argued that anything greater than that amount either will be an unacceptably large cost figure that will jeopardize the initial approval of the program or will lead to wasteful "gold-plating" on that program. This leads to the structuring of totally success-oriented programs in which the planned schedule, the official cost estimate, and the resulting budgets may not give proper recognition to the risks involved in program accomplishment. Unless the program is 100 percent successful at each milestone of development and acquisition, more funds will be required and an overrun will occur. This approach to initial funding requests has eliminated the management reserve or funding flexibility so necessary in all programs for those unknowns that may be expected due to the impreciseness of any prediction or estimate.

The potential for cost overruns due to unrealistic funding requests is compounded when overall departmental budget cuts occur. Very few programs are ever eliminated completely in this process. Rather, the remaining resources are spread over all the programs. Schedules are extended and delivery dates deferred. The funding surprises are simply put off until some future date, when even greater assurance exists that they will be more disastrous.

External influences have also compounded the problem of underfunding. Inflation that began in the late 1960's in the Defense/construction industry has had a major impact on weapon system funding. This high rate of economic escalation coupled with certain shortages of materials and production capabilities has resulted in significant increase in costs.

. Until the Navy and the Department of Defense (DOD) begin to estimate and fund their programs realistically, the necessary credibility of the military services with the American public will not be reestablished. The management layers and other changes have been made to treat the symptoms and not the cause. The Navy must make

some very hard and agonizing choices as to just what it wants in its weapons inventory and when it wants it, then proceed to buy only what it can afford by fully funding the programs through all phases.

In addition, there is a need for the Navy to develop an increased "cost consciousness" in the management of its acquisition programs. Monitoring and use of the cost reports from contractors and laboratories should be improved, as should the ability to obtain, understand, and utilize cost information available through progress reviews, direct inquiries, and other less formal means. The analysis and projection of contractor costs is an area particularly in need of upgrading. Also, the communications about any possible cost increases, major change orders, claims, or financial problems must be timely and open from the bottom of the Navy organization to the very top. Recent surprise cost increases on two of the Navy's major weapon programs emphasize that this communication problem has not yet been overcome. The Navy must increase its ability to estimate, manage, and report costs. The recommendations contained in this chapter are directed principally at these objectives.

1. BACKGROUND

The historical background of the financial management function in the Navy is, of course, closely aligned with the historic evolution of the overall Navy organization and specifically with the post-World-War-II period. Therefore, the Cost Panel believes it is appropriate to outline some of the more significant changes that have taken place during the last three decades. These are discussed in the following subsections.

(1) History of the Navy Organization

The Navy had a bilinear-type organization for about a hundred years. The main feature of this organization was that the senior naval officer, the Chief of Naval Operations, commanded the naval operating forces. The material side of the Navy (weapon systems acquisition) was accomplished by the old bureau system, which reported to the Secretary of the Navy. The bureaus were primarily responsible for the budget formulation and execution of the weapon systems programs up until the mid-1960's. Although history is full of writings about

problems with the old bureau system in the bilinear organization, that organization did have certain strengths. The bureau chiefs felt a very personal responsibility for the cost estimates and budget figures, the development and performance of the weapons, and the overall weapon acquisition program. The Congress, the Secretary of the Navy, and the Chief of Naval Operations knew who was responsible.

This was changed in the mid-1960's when the Navy adopted the unilinear system, which is similar to the organization structure of the Army and the Air Force. It put the material side of the Navy under the Chief of Naval Operations (CNO). A Chief of Naval Material (CNM) was created to coordinate the new material systems commands.

(2) History of the Financial Management Function in the Department of the Navy

During World War II, Secretary Forrestal organized and staffed a much stronger comptrollership organization and financial management function than had previously existed in the Navy. The Comptroller of the Navy (NAVCOMPT) organization evolved out of this effort, and the Office of Assistant Secretary of the Navy for Financial Management (ASN(FM)) was created. By statute, the ASN(FM) was also designated the Comptroller of the Navy. A senior military officer served as Deputy Comptroller. The NAVCOMPT organization served as the only budget and accounting office for both the Secretary and the CNO for many years. In the early 1960's the Secretary of Defense introduced a new Planning, Programming and Budgeting System (PPBS). It was decided that the CNO staff would have the responsibility for programs but NAVCOMPT would continue to have primary responsibility for the budget. In late 1971, the CNO decided that he needed his own budget group and, therefore, OP-92 was created, reporting to the CNO through OP-090. MAT-01, the NAVMAT financial management office, was created during the mid-1960's when the CNM office was formed.

(3) History of Weapon Systems Acquisition Programs

The post-World-War-II trend for Navy and Marine Corps weapon systems has been toward ever increasing technical complexity, with a resulting rapid increase in cost. The complexities of the weapon systems have led to much greater interrelationships between the various systems commands and also the various budget appropriations. Consequently, the Navy has done much reorganizing within the overall material commands, and today there is a real mixture of project offices and Systems Command structure.

With some weapon systems programs, the Navy has developed a full project office, such as the Strategic Program Office for Polaris, Poseidon, and Trident. In this program, the project management approach proved to be very successful. The program was staffed with very able people, was adequately funded, selected able contractors, and monitored and reported the progress of its program in an outstanding manner. The Navy has had other successful weapon systems programs and has the knowledge and experience to manage the acquisition process properly.

During the 1960's, many changes were made in the DOD management systems, the procurement procedures, and the budgetary process. These changes all came during the same period when the Navy was experiencing major organizational changes.

The trend in the procurement procedures was toward total-package procurement and, in general, much tighter procedures and controls. Even where programs were not put out on a total package procurement basis, such as the DE-1052 program, procurement procedures were used that obtained lower initial competitive bids and contract prices. Generally, the savings were then reprogrammed to other weapon systems requirements. At the same time, the cost of the Vietnam War continued to soar, and many funds had to be reprogrammed from weapon systems to meet the current operating costs of the war.

One of the resulting consequences of all these changes was that cost overruns began to appear in the late 1960's on

many of the weapon systems. These were reported to Congress in more detail than ever before and, subsequently, reported in the national press. This was the beginning of the "credibility gap" on the major weapon systems programs.

Others would also point out that possibly the weapon systems programs of the 1950's and earlier had major cost problems and technical problems too, but that they were never reported to the degree that the 1960 programs were controlled and reported upon. Also, during those earlier years, it has been alleged that the more flexible procurement policy with the contractors and budget relationships with the Congress allowed some of the program problems to be successfully resolved by additional funds.

Beginning about 1970, the Department of Defense again made substantial changes in such areas as procurement policies and procedures and internal management systems. There was a turn away from total-package procurement and much more emphasis on "fly before buy" and prototype development programs. New cost and management information systems were introduced, such as the Development Concept Paper (DCP), Selected Acquisition Report (SAR) and Defense Systems Acquisition Review Council (DSARC) systems.

The Navy and Marine Corps Acquisition Review Committee (NMARC) study group was formed to examine the Navy and Marine Corps weapon systems acquisition programs. The NMARC Cost Panel was assigned the responsibility to examine the Navy's and Marine Corps' capacity to discharge financial and cost management responsibilities throughout the acquisition process, including cost risk analysis and organization for cost control.

In order to carry out this responsibility, the Cost Panel read most of the pertinent DOD and Navy directives, past studies, and other appropriate material. The Panel also met and discussed the issues with many Navy, DOD, and Defense industry officials. The Cost Panel concentrated on six programs—TRIDENT, SSN-688 Class submarines, Patrol Frigate (PF), S-3A, PHOENIX missile and the HARPOON missile. The Panel also looked at many other programs for specific points of interest.

2. MAJOR ISSUES EXAMINED

The Cost Panel of the NMARC study group has studied 17 major issue areas and has made recommendations in each area for consideration by the appropriate Navy and OSD officials.

Eight of the major issues may be grouped under the overall caption of "Cost Credibility." These are:

- Cost Estimating and the Use of Cost Estimates
- Assessment of Financial Impact of Risk
- Design to Cost and Life Cycle Cost
- Proper Interface of DOD and Navy Internal Systems
- Contractor Reporting
- Navy Laboratory Reporting
- Navy/DOD Cost Reporting—Selected Acquisition Reports (SAR)
- The "Buy-In" Problem.

The Cost Panel believes that the Department of the Navy needs to strengthen the overall financial management function in its Systems Commands and its weapon systems project offices. The Panel believes that the quality of financial management personnel must be enhanced so they can adequately monitor the cost and financial aspects of each project. Four issues have been grouped under the caption of "Financial Management Organization/Personnel."

- Financial Management Capability in the Project Management Offices
- Selection and Career Development of Project Office Business/Financial Management Personnel
- Foreign Military Sales
- Layering—Financial Management Function.

The remaining five issues are more independent and are therefore, presented under the caption of "Key Financial/Cost Policy Issues." These are the following:

- Economic Escalation
- Imputed Interest
- Cash Flow/Progress Payments
- Availability and Use of Management Reserves
- Multiyear Authorization of Major Weapon Systems.

Each of these 17 issues is treated in one of the following major sections of this chapter. A summary of recommendations is presented in section 20.

The Cost Panel attempted to eliminate duplication with other Panel reports and their recommendations. However, the Cost Panel members recognize that problems in the research and development, test and evaluation, procurement, and production areas often result in major financial problems. Therefore, the recommendations of the other Panels must be given careful consideration by the Navy and the Office of the Secretary of Defense if the cost credibility problem is to be overcome.

The Cost Panel fully recognizes that many of the issues and recommendations contained in this report have been previously studied and discussed by the Department of the Navy. The Panel also recognizes that the day-to-day management of the Navy's multibillion-dollar weapon acquisition program is one of the world's toughest management challenges. Therefore, the observations and recommendations presented in this chapter were developed in a constructive manner for consideration by the Navy and OSD. There was no intent to be unduly critical of past performance.

3. COST ESTIMATING AND THE USE OF COST ESTIMATES

Cost estimates are a vital factor in the decisionmaking process of all major acquisition programs. The quality of the cost estimates, and the manner in which they are used, play a crucial role in the Navy's planning and acquisition process.

(1) Statement of the Issue

The ability of the Navy to prepare good cost estimates has been repeatedly questioned. Thus, the issues are the following:

- Is the quality (accuracy, timeliness, and comprehensiveness) of Navy cost estimates adequate for effective acquisition management?
- Does the Navy have the cost estimating resources, including the availability of cost data, to prepare good cost estimates?

- Are the available cost estimates properly used in acquisition program planning, budgeting, decision-making, and management?

(2) Study Approach

The Cost Panel read the following documents:

- DOD Directive 5000.1
- SECNAV Instruction 5000.1
- OPNAV Instruction 5000.42
- Cost Estimating Classification Systems, Naval Ship Systems Command, December 1971
- Ships Work Breakdown Structure (SWBS), Naval Sea Systems Command
- NAVELEX Instruction 7720.4, 2 July 1973
- MIL-STD-881, Work Breakdown Structure
- Contractor Cost Data Reporting (CCDR), 5 November 1973
- Evaluation Report on SCIP, July 1972
- Cost Estimating—A Crucial Function, NAVSEC 6110
- SECNAV Instruction 7000.19A, dated September 19, 1973
- SCN Pricing and Cost Control Study Summary Report, April 1969
- NAVSHIPS Cost Estimating Capabilities, June 1969
- Shipbuilding and Conversion Improvement Program (SCIP)

- Influences on Naval Ship Cost Estimating for Budget Purposes, DOD Cost Research Symposium, March 1970
- Report of the Pricing Subcommittee on a Review of Cost Estimating Techniques within DOD, September 1970
- NAVELEX Estimating Guide
- GAO Report on Theory and Practice of Cost Estimating for Major Acquisitions, July 1972
- Booz, Allen Report on Government and Industry Cost Estimating and Cost Control, April 10, 1969
- NAVSEA Inflation Escalation Indices
- Compilation of Recent Shipbuilding Cost Information: Vol. II, June 1974
- Hearings Before the Subcommittee of the Committee on Appropriations, House of Representatives, 1969-1974
- Pricing and Contracting for Inflation, Harold E. Sharp, ACO Air Force Office, McDonnell Douglas, NSIA South Bay Chapter, Spring 1971
- DOD Directive 5000.4, dated June 13, 1973
- OPNAV Instruction 4700.12C, dated April 20, 1970
- OPNAV Instruction 7720.2A, dated May 21, 1971.

The Cost Panel met and discussed the issues with personnel in the following functional areas:

- SYSCOM Estimating Groups
- OP-96D
- CAIG
- NAVCOMPT
- MAT-02.

The Cost Panel examined the following programs:

- CVANs
- DLGN-36 and -37
- DLGN-38 Class
- PF
- HARM
- Sea Launched Cruise Missile (SLCM)
- SSN-688 Class
- TRIDENT.

(3) Findings and Conclusions

Previous studies of cost estimating and the use of cost estimates during the years 1969 to 1970 identified problem areas in the Navy's estimating capability, in the adequacy of the Navy's cost data banks, and in the Navy's use of cost estimates in the planning, budgeting, and acquisition process. Since that time, the Navy has improved in these areas, but more improvement is required if the Navy's cost estimating is to be of superior quality and credibility with DOD and the Congress.

Existing estimating staffs are professionally competent and produce better estimates than they are sometimes given credit for. However, staffing continues to be a problem in all three Naval Systems Commands (SYSCOMs). Despite repeated efforts, the Naval Electronic Systems Command has been unable to obtain the funds and billets to form a cost estimating and analysis group. The Naval Ordnance Systems Command (NAVORD) did obtain one man in 1972 and two more in 1973 to start the nucleus of a professional staff. The Naval Ship Systems Command (NAVSHIPS) has lost eight people since October of 1971, going from 25 to 17. It recently gained the three from NAVORD upon becoming the Naval Sea Systems Command (NAVSEA). The Naval Air Systems Command (NAVAIR) has added nine people since 1970 for a total of 27. Aircraft pricing has increased from 11 to 12, Government-Furnished Equipment (GFE) pricing from 0 to 2, cost analysis for 2 to 7, and missile pricing from 5 to 6. With the cost of avionics becoming a much larger portion of the total cost of aircraft and missile systems, a need exists to strengthen NAVAIR's capability in this area, both for GFE and contractor-furnished equipment (CFE).

Because of the staffing problems, NAVELEX and NAVORD have had to continue to rely on contractor quotations for estimates. NAVELEX, NAVAIR, and NAVSEA 06H have made use of outside consulting firms for estimating assistance. This has been helpful, but, in the long run, the Navy would benefit most by developing its own internal capability.

Functional responsibilities have been added to the established cost-estimating groups without added resources to carry out the functions. Functions such as economic forecasting, economic analysis, and support for life cycle cost and design to cost, all of them important, have been added during periods when staff increases have been virtually unobtainable and, in the instance of NAVSEA, when staffs have been actually reduced. This work dilutes the effort required to perform the basic acquisition cost estimating responsibility and reinforces the need for additional staffing.

The production of quality estimates requires that the estimating function operate in an environment where it has the independence to exercise its best professional judgment and expertise without pressure to provide a predetermined result. The production of quality estimates also requires the senior management support necessary to ensure that the best available data are provided to the estimating function by the various sources within the SYSCOMs. Inadequate and/or late definition of weapon systems, inadequate risk assessment, and program changes with late feedback to estimating staffs still occur and hinder the development of quality estimates.

The late receipt and/or inadequate definition of weapon systems continues to be a major problem in the development of quality estimates. This problem has been and continues to be particularly acute in Navy Shipbuilding and Conversion (SCN) programs. OPNAV Instruction 4700.12C, dated 20 April 1970, contains instructions that, if followed, would provide the necessary information on Shipbuilding and Conversion programs to the estimating function in a timely manner for producing budget-quality estimates. As of December 10, 1974, NAVSEA had not yet received from the Office of the Chief of Naval Operations (OPNAV) any single-sheet characteristics so that estimating could be started for the 1977 Program Objectives Memorandum (POM). This information should have been sent to NAVSEA by October 1, 1974.

Development of an improved cost data base requires continued attention. While lack of adequate staffing contributes to this problem, cost estimators are not always given access to the detailed cost estimating data and contractor cost reports presently available in other areas of the Commands. There also has been, on occasion, a reluctance on the part of Procurement Contracting Officers (PCOs) to require ship contractors to submit their detailed estimating bid data in accordance with paragraph (b) of the "Price Breakdown and Bid Estimating Data" Article of Invitations for Bid.

For Navy estimates of weapon system costs to become fully adequate and have the maximum credibility with DOD and Congress, the Navy, from the top down, must devote more attention, emphasis, education, and personnel resources to this subject in each of the SYSCOMs.

The system suffers from too much layering of estimating and cost estimate review and analysis today. While recognizing the reasons for the formation in the same time frame, of both OP-96D and ASD (PA&E) Cost Analysis Improvement Group (CAIG), plus the need for both NAVCOMPT and ASD (Comptroller) review and cost analyses, the preparation of one Independent Parametric Cost Estimate (IPCE) and one review and analysis by OP-96D would be sufficient. The responsibility and accountability for cost estimating should rest on the Navy with SYSCOM estimating staffs as the focal points and an organization such as OP-96D preparing IPCEs and monitoring the SYSCOM estimates.

(4) Recommendations

As a result of the analysis summarized above, the Cost Panel makes the following recommendations regarding cost estimating and the use of cost estimates·

Recommendation COST-1: Emphasize the importance of the cost estimating function throughout the command chain.

Recommendation COST-2: Provide adequate staffing, training, and career patterns in the cost estimating and cost analysis function.

Recommendation COST-3: Establish a central cost estimating and analysis group in NAVELEX.

Recommendation COST-4: Provide the three SYSCOM estimating groups (NAVSEA and NAVAIR now exist; NAVELEX is proposed) with the independence and top management support necessary for the preparation of quality estimates by having these groups report at an appropriate level in the SYSCOM that will ensure this support and independence.

Recommendation COST-5: Instill in all areas of command the importance of cooperating with and providing, in a disciplined and timely fashion, to the estimating function the most complete information available concerning the technical definition, risk assessment, quantity requirements and schedule parameters on which to base estimates.

Recommendation COST-6: Enforce OPNAV Instruction 4700.12C. Provide for greater discipline in the planning phase and during the complete budget cycle to ensure that late changes to programs are minimized and that the number of programs for which budget quality estimates are required are held to the prime candidates to diminish the use of less than Class C estimates in budgets.

Recommendation COST-7: Make it a firm policy in each SYSCOM to provide the cost estimators and cost analysts with access to the detailed cost data supplied by contractors in support of proposals and with the contract costs reported in accordance with the criteria established by DOD Instruction 7000.2 or other contract cost reporting requirements.

Recommendation COST-8: Include a contingency in the estimate whenever a less-than-budget-quality cost estimate is to be included in the budget.

Recommendation COST-9: Directed cost estimates that modify those prepared by the responsible cost estimating functions should be identified as such. This identification must include the identity of the person or authority responsible for the directed cost estimate.

Recommendation COST-10: Reduce layering of cost estimating and layering of the review and analysis of cost estimates. Detailed review and analysis of estimates by NAVCOMPT and ASD (Comptroller) except for their normal budget review, should be eliminated. Modify the charter for the ASD (PA&E) Cost Analysis Improvement Group (CAIG) to limit their function to that of establishing criteria and guidelines concerning the preparation and presentation of cost estimates on Defense systems to DSARC and to that of monitoring the armed services' cost estimating procedures, methodology, and accuracy to assure OSD that the services are performing their responsibilities. Place OP-96D's staff, augmented as necessary, and its present function of preparing Independent Parametric Cost Estimates (IPCEs) and making detailed reviews and analyses of SYSCOM estimates in an area insulated from program or budget bias or outside influence. The Office of the Assistant Secretary of the Navy (Financial Management) appears to be a logical choice, although all possible choices should be evaluated. The detailed cost estimating review results should be available to all levels of management in the Navy and OSD. Presentations to DSARC on the review of weapon system costs would then be made by the ASN (FM) or his designee. The main thrust of this recommendation is that DOD should place responsibility and accountability for cost estimating on the Navy.

4. ASSESSMENT OF FINANCIAL IMPACT OF RISK

The Navy has made progress in technical risk assessment for its newer research and development (R&D) programs; however, the need exists to recognize and fund technical and schedule risk in programs at later stages of development or production and to design risk provisions into the contracts.

(1) Statement of the Issue

In every program, at every phase of its execution, risks are encountered and resolved. The risks may be in technical achievement or schedule performance or may be related to the cost estimate. Cost, schedule, and technical requirements

are the three interrelated elements of every program: they behave like the sides of a triangle, and the triangle is always closed. So, the resolution of technical risks can cause a schedule slip or a cost growth or both. Similar results can be expected when schedules slip: a different statement of work and/or a cost change. The risk assessment issues are the following:

- Recognizing and planning for risk
- Using risk assessment in management decisions concerning "how much risk to take"
- Contracting in such a way as to minimize the financial impact of risk.

(2) Study Approach

In approaching the study of this issue, the Cost Panel read previous studies and the pertinent DOD Directive and Navy Instruction on the issue. These included:

- DOD Directive 5000.1
- SECNAV Instruction 5000.1
- "Fiscal and Life Cycles of Defense Systems," August 1974, GDP
- AMARC Summaries
- Summaries of Testimony before the Sea Power Subcommittee
- Electronics-X Study, March, 1974
- Report of the Commission on Government Procurement (1972)
- "Industry View of Defense Department Material Acquisition Proces," L.W. Mullane, President, Aerojet Manufacturing Company, at Industrial College Armed Forces Alumni Meeting in September 1974

- "Discussion and Application of Cost Risk Analysis," Hughes Aircraft Company Internal Study, R. E. Clapp, January 1973.

The Cost Panel met and discussed the issue with personnel in the following functional areas:

- OP-96
- OP-92
- CAIG
- NCB
- MAT-02
- NAVAIR
- NAVSEA
- NWC
- ODDRE
- NAVSEC.

The Cost Panel examined the following programs:

- HARPOON
- S-3A
- PHOENIX AIM-54A
- TRIDENT
- SSN-688/700
- PF
- HARM
- Sea Launched Cruise Missile (SLCM).

(3) Findings and Conclusions

Cost risk analysis techniques are in widespread use throughout industry and within the Defense Department. By carefully examining the technical uncertainties and schedule uncertainties fairly well down in the work breakdown structure and pricing the alternatives, confidence in achieving a task can be related to cost. One form of this relationship, illustrated below, is the cumulative probability that the task can be done for a given number of dollars or less. Two curves are shown, Figure VII-1 for an early development program where risk is high, and Figure VII-2 for a mature production program where risk is low.

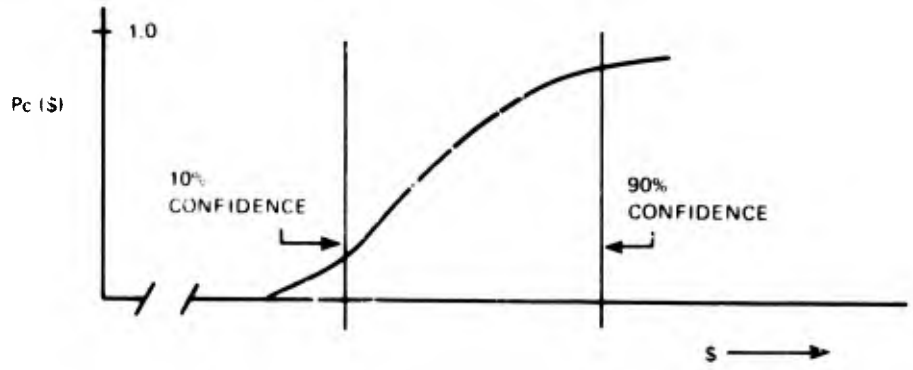

FIGURE VII-1
Early Development, High Risk

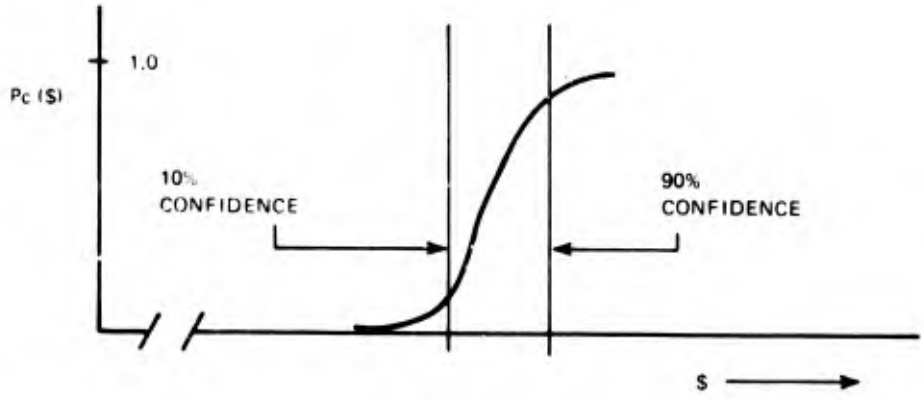

FIGURE VII-2
Mature Production, Low Risk

In early development, the "S" curve shown in Figure VII-1 will be relatively flat; technical uncertainties are high and neither labor nor material requirements are well defined. As the program progresses and some hardware has been built and tested, the uncertainties are less in material, engineering, and labor. As a consequence, the "S" is steeper, and the 10 percent and 90 percent points move closer together. Finally, when an equipment has been in production, the risks are low and the curve is quite steep as shown in Figure VII-2. The slope of the "S" curve is really a measure of the risk—flat is high risk and steep is low risk.

1. Technical Risk

There is a good awareness of technical risk in many areas, and, in most of the new programs, as described in the following examples, steps have been taken to plan for it.

(1) HARPOON

The Naval Air Systems Command assigned a group of estimators to work for 6 months to arrive at a good cost estimate. This group was provided the technical support from the Navy laboratories to identify technical uncertainties and plan for them. When contractor proposals were received, cost credibility was tested against these estimates, and this test weighed heavily in contractor selection.

(2) SSN-688/700

To minimize the risk, an "off the shelf" sonar was chosen that "nearly" met the requirements. At the same time, however, an upgraded, interchangeable design was undertaken that met all the requirements. The new design proved successful.

(3) PF, DD-963, and TRIDENT

Land-based test sites are planned to minimize weapon system and power plant technical risks. The TRIDENT program had an excellent risk identification and resolution plan; this ranged from submarine mockups to land-based test sites to alternate courses in missile development.

(4) SEA LAUNCHED CRUISE MISSILE

This program is making extensive use of design-to-cost and risk analysis. The Navy project manager has made maximum use of the NAVAIR staff, the Navy laboratories, and the contractors to identify and plan for the expected technical risks and to set design to cost objectives. Of particular importance from a cost risk viewpoint was the emphasis placed on cost credibility and cost traceability in the source evaluation and selection process. This appears to verify the importance of cost understanding in advanced engineering development programs as contrasted to emphasis on a low target price. Since this program is still early in advanced development, it is not possible to assess the ultimate effectiveness of these management actions.

The need for engineering to identify and resolve potential technical risks is clear. If suppliers are changed or processes are modified, engineering verification is necessary. The Cost Panel's investigation indicated that in production shipbuilding programs, the level of engineering support funded by the Navy is marginal. In aerospace programs, this is significantly less of a problem.

A serious production, technical, and schedule risk can be associated with the difficulties being experienced by specialty product second tier suppliers. These suppliers are finding it unattractive to do business on Government contracts because of excessive documentation requirements, interrupted and delayed procurements, high investment costs, and delays in payments after delivery of parts. Many specialty suppliers are seeking other than Navy work. If these specialty vendors are not avilable to the Navy, alternate components will have to be used. This creates the need for additional engineering on the prime contractor's part or added costs in developing new subcontract sources. This places a potential schedule lien against a production program.

Based on its investigation, the Cost Panel concluded that:

- Good understanding of technical risk is being developed.

- It is possible to involve the Navy laboratories and contractors in technical risk identification.

- Advanced development and engineering development can be funded to account for some risk. However, retaining these funds until all risks are resolved will sometimes be difficult because in some cases these funds are identified as "reserves" and tend to be eliminated in budget reductions or reprogramming.

- Good working relationships between SYSCOMs, plant representatives, and contractors can be developed. As expected, the quality of this working relationship was best where the program funding was adequate and the contracting officers participated in program decisions where all concerned understood the resolution of technical risk.

- Support engineering is required during production at sufficient levels to resolve problems before they disrupt or delay the program.

- The Navy and prime contractors must take the necessary steps to preserve and encourage second tier specialty vendors to continue with Government work. The procedures the Navy requires from these small suppliers appear to be inconsistent with their ability to perform and the paper work requirement appears to be delaying payment of these critical vendors.

2. Schedule Risk

The risk in schedule is generally understood, but provisions for its resolution were in general not as clearly defined. Research and development contracts were found to have schedules that were worked out between the activities, the sponsors, the estimators, and the procuring Navy laboratories. In the newer programs, HARPOON and SLCM, the contractor inputs were available prior to Request for Proposal (RFP).

When the Panel visited Lockheed-California in connection with the S-3A program, the schedule risks in production programs due to increasing lead times for materials and components were highlighted in the discussions. Procurement lead times were also of concern at Hughes Aircraft where the AIM-54A Phoenix missile was studied. During visits to Electric Boat and Newport News, the Panel was told that the lead times required for materials used in shipbuilding were also increasing, causing a schedule risk in their programs.

Schedule risks in shipbuilding appear to be quite high. Several ship programs are experiencing significant schedule delays. In some instances shipbuilding schedule risks appear to have been exacerbated by the use of unrealistically optimistic schedules in acquisition plans and contracts. Of particular concern is the failure in some shipbuilding programs to allow a sufficient interval between the lead ship and follow ships to complete the detailed design and incorporate the lessons learned during lead ship construction.

The panel also found that the schedule risk in ships is further compounded by a lack of firmness in ship acquisition planning. "Last minute" changes in the procurement plan require the NAVSEA estimators to provide "instant estimates" of cost and schedule (see also Issue 3, Cost Estimating). This increases both cost and schedule risk through the failure to provide adequate time (and, in many cases, data) for a valid estimate of either.

The Navy briefings on adjustments to prices made/claimed for late GFE or design data highlights the problems the Navy is experiencing in resolving (painfully) this aspect of schedule risk. It appears that better GFE planning and/or greater use of contractor furnished equipment (CFE) could relieve the Navy of some of this class of schedule risk.

The Cost Panel concluded that schedule risk is not adequately accounted for in program planning. Several actions appear necessary, including the following:

- For R&D programs, examine schedules on a continuing basis in the same way that technical performance is evaluated and consider R&D "desired" and required schedules.

- For production programs, the lead time required to procure critical materials is increasing. The Navy has long recognized the need for long lead funding for these critical materials. However, with the difficulties currently being encountered, the lead times are growing. It may be necessary to revise the long lead funding profile upwards and provide the funding sooner for most production programs.

- For ship programs, examine the schedule risk for the lead ship very carefully, using current experiences on submarines, carriers, and destroyers. For new programs, establish more realistic lead ship schedules and allow a sufficient time interval for the follow ship. Stabilize acquisition plans and, where possible, make schedule allowances for potential changes.

- For Government Furnished Equipment (GFE) and data schedule risk, the Navy should assure that the schedule risk in the GFE is understood before being committed to a date. Alternatively, contractor furnished equipment (CFE) procurements should be considered.

3. Risks and Management Decisions

Risk assessment is being used in many management decisions. The understanding, however, is qualitative at best. As one manager put it, "Risk, like beauty, is in the eyes of the beholder!" It appears that in the newer programs and in those where open communications exist, this qualitative understanding works. The disciplines described in the design to cost and life cycle cost issue (Section 5 of this chapter) are examples of the way risk assessment, in this case related to production unit cost, can be used to improve management decisions. More quantitative assessments of technical and schedule risk can be made using existing data.

4. Risks and Contracting

The contracting policy presently in use by the Navy is generally consistent with program risk. For programs where risk is high, such as R&D and lead ships, cost-type contracts are normally used. Early production where risk is "medium" is contracted for on a fixed-price-incentive basis. Late production contracts are fixed price, and here the risk is low. (The contracting approach to account for economic inflation is discussed in the Cost Panel escalation issue, Section 15 of this chapter.)

The ultimate success of a weapon system depends heavily on how well the research and development is carried out. Consequently, the approach the Navy used in preparing the RFP, soliciting contractor response, and evaluating proposals for advanced development was investigated for two current programs in NAVAIR, HARPOON and SLCM.

In both cases, the preliminary design devised by the Navy prior to the RFP was a composite of what "could be done" in the eyes of NAVAIR and the Navy laboratories. The technology for both missiles was essentially within the state of the art. High-risk items, such as the HARPOON engine and the SLCM guidance, were designated for parallel development. Contractor consultation in the preliminary design was encouraged and, in the case of SLCM, pre-RFP contracts were let to the five qualified contractors for design studies.

In both programs, the Navy had made careful estimates of development cost. The proposals for SLCM in the technical area were evaluated relative to a range of acceptable technical parameters. In both programs, the proposed target costs were evaluated for credibility and compared to estimates. Low proposed prices were downweighted. In light of the cost-risk curve shown earlier in Figure VII-1, this is proper, because if a program is contracted for at a target price where the chances of success are in the 10 to 20 percent region, trouble is almost certain to develop.

In the case of SLCM, the final four competing contractors were aware that two would be chosen and knew the available budget. During proposal evaluation, the Navy asked questions about cost and technical content. At the end of this period, each of the four contractors was given the opportunity to revise his cost proposal. Two increased cost; two decreased cost. The changes were evaluated for credibility and traceability. In the final selection, one who increased his price was chosen and one who decreased his price also won. This demonstrates that the selection criteria had cost in its proper relationship to program objectives.

Based on its review, the Panel reached the following conclusions:

- The present use of contract types generally fits program risk.
- In writing RFPs for R&D programs, Navy laboratory and contractor support is most valuable. It helps to identify risk and provides a basis for good cost estimates.
- Low target prices for R&D contracts have little meaning by themselves. Credibility, traceability, and relationship to risk are most important.

- Detailed understanding of proposed R&D costs by the Navy is invaluable. The classic "best and final" auction is worthless, particularly when risk exists. (This point is discussed in the Cost Panel issue in Section 10 of this chapter.) The final price revision based on hard, traceable cost data, on the other hand, is very useful. It allows the Navy to understand the risks and the proposed plan for resolution.

(4) Recommendations

Based on the analysis summarized above, the Cost Panel makes the following recommendations regarding the assessment of the financial impact of risk:

Recommendation COST-11: Continue to place emphasis on risk assessment. Make risk assessments in quantitative terms and use them in decisionmaking, especially in budgeting and contracting.

Recommendation COST-12: Choose contract type, target-ceiling spread, and incentives that prevent the assumption of undue risk by either the contractor or the Government.

Recommendation COST-13: Recognize the need for engineering support during production; buy it and use it to minimize risk.

Recommendation COST-14: Modify planning and contract provisions for long-lead material to reflect current material procurement lead-times and uncertainties.

Recommendation COST-15: Set realistic schedules and recognize schedule risk in prime contracts. Plan for schedule risk in GFE delivery and/or, if this is not feasible, consider CFE procurement.

Recommendation COST-16: Investigate the problems in data requirements and payment delay being experienced by small, second-tier specialty subcontractors and take action to keep them viable and available to the Navy.

Recommendation COST-17: For new research and development programs:

- Use Navy laboratories to identify risk early in preliminary design.
- Use the entire applicable Navy estimating capability to price the program.
- Approve a bidders list prior to RFP formulation and use contractor support in cost estimating, risk assessment, and RFP preparation.
- Recognize the uncertainty of proposed cost at completion and evaluate proposed target price on the basis of traceability, credibility, and risk planning.
- Ask questions of the proposers as necessary to obtain understanding of the proposals. Make provision for the proposers to make a final price adjustment accounting for this dialogue. Evaluate this final price on the basis of traceability and credibility.

5. DESIGN TO COST AND LIFE CYCLE COST

The acquisition and operation of weapon systems under existing and presently foreseen budget constraints require that the full cost of ownership (not simply the initial acquisition cost) be assessed, since they are major determining factors in force composition and total defense capability.

(1) Statement of the Issue

Design to cost requires the establishment of cost goals early in the development process and the management and control of future acquisition, operating and support costs to these goals by the conduct of practical trade-offs between system capabilities, cost, and schedule. The design-to-cost goal is "A specific cost number, in constant dollars, based upon a

specified production quantity and rate, established early during system development as a management objective and design parameter for subsequent phases of the acquisition cycle.

Life cycle costing addresses the whole cost of ownership: the initial acquisition cost and the postdeployment cost, including the cost of support equipment, manning, training, overhaul, maintenance, and the like.

The major issues include the following:

- The definition and application of life cycle cost, the use of models for measurement and estimating of life cycle costs, and the availability of data for modeling and evaluation
- The relationship of design to cost to life cycle cost
- Techniques to make design to cost effective.

(2) Study Approach

The Cost Panel read appropriate Navy and DOD directives and related papers. These included:

- Joint Design to Cost Guide, NAVMAT P5242
- Design to Cost, CNM PPM 13
- Changing Fashions in Procurement, J. K. Daniels, Army, September 1974
- Design to Cost of Naval Ships, Leopold, Jons, Drewry, 1974, SNAME
- The Patrol Frigate Program, A New Approach to Ship Design and Acquisition, Newcomb and DiTrapani, Naval Engineers Journal, August 1973

- Design to Cost, Defense Management Journal, September 1974
- A Return to Basics: Implementing Design-to-Cost, AIA, March 1974
- Life Cycle Cost (LCC), NAVMAT 0232 RCG, April 1974
- Problems in Life Cycle Support Cost Estimation, A. S. Goldman, Naval Research Logistics Quarterly, March 1969
- LCC Arrives for Major Systems, William F. Finan, LMI, Defense Management Journal, Winter 1968-1969
- DOD Directive 3200.9, Initiation of Engineering and Operational Systems Development
- Life Cycle Costing Procurement Guide (Interim), July 1970
- Ways to Make Greater Use of the Life Cycle Costing Acquisition Technique in DOD, GAO, 21 May 1973
- DTC Briefing Charts, November 1974, ODDRE.

The Cost Panel met and discussed the issues with:

- MAT-0232
- Systems Acquisition Management Division ODDRE
- NAVSEC
- SYSCOM estimating groups.

The Cost Panel reviewed the following programs:

- LHA
- DD 963
- PF
- Sea Launched Cruise Missile (SLCM).

(3) Findings and Conclusions

1. Life Cycle Cost

Confusion exists over the definitions of life cycle costs and the models used to measure them. It has been estimated that about half the cost of ownership of a weapon system is insensitive to system design. Administrative, procurement, and other Navy "overhead" logistic costs vary much more slowly than the flyaway cost of weapon systems. This type of fixed cost tends to confuse design to life cycle cost efforts. Further confusion results because the Navy data banks do not contain sufficient low-level cost data to permit detailed quantitative tradeoffs in life cycle cost elements to be made during design and development.

However, the key parameters that drive costs after initial weapon system acquisition generally are well known in a qualitative sense. For example, if one design is more reliable than another by a substantial amount, clearly fewer maintenance personnel will be needed, and this cost impact can be evaluated without knowing the precise number of people involved. If an automated design is quite complex, it may, when it is working, save manpower, but the question of fallback position requires analysis in a qualitative sense, and a design to life cycle cost judgment can be made based on qualitative data and experience. Cases will develop where quantitative assessments of some significant part of life cycle cost can be made, and these data can be used in the process of design. For example, the cost of automatic test equipment and its maintenance can be estimated and traded off for more maintenance manpower and manual test equipment.

It is concluded, therefore, that designing prime equipment to cost is not at all inconsistent with designing to minimum life cycle cost. The overriding life cycle cost influencing parameters, even though some are known only qualitatively, can guide the equipment design to cost and life cycle cost. The acquisition management approach should concentrate on those known portions of post deployment

cost that can be controlled or influenced, and in the large sense minimize life cycle costs.

2. Design to Cost

Design to cost is being applied to all programs that had not passed DSARC III by August 1973. Cost is defined as "flyaway cost" for a given quantity produced at a given rate, expressed in constant dollars. Design to cost is most effective when it is part of a program from the preliminary design phases through production. The process when applied late in design more nearly becomes value engineering.

The effectiveness of the process of design to cost depends on the sensitivity of cost to design as well as the competiton that exists in the early phases of a program. Electronics, aircraft, and missile costs are very sensitive to design and to relatively small differences in performance requirements. Ships' costs, on the other hand, are less sensitive to design and more dependent on producibility. The allowable range of performance parameters for ships, such as speed, is generally less than for aerospace equipment. Costs in any design are very sensitive to the environment in which the design is done. A highly competitive environment will normally generate more innovation and better design to cost.

Since there are as many designers of aerospace and electronics products as there are contractors, design to cost will, indeed, be competitive. The contractor motivation is to win the production contract. For ships, on the other hand, the Navy makes virtually all the basic design decisions. With few exceptions, the shipyards do not influence the design; they build to specification. Consequently, the shipbuilders compete and capture Navy business on the basis of production cost rather than design cost or life cycle cost. However, most of the elements of the ships' weapon systems fall into the same category as aircraft, missiles, and electronics—there are competing contractors who have complete design capability.

(1) Case Study—Sea Launched Cruise Missile

Design to cost is being applied to the Sea-Launched Cruise Missile program in what appears to be a most effective way. This program is still early in advanced development, and the ultimate success of design to cost is unknown. However, since many of the techniques of management, contracting, reporting, and control are applicable in a general way, the design-to-cost features of the program are enumerated here. They include the following:

- The program office staff was well qualified and had previous experience on other missile programs

- The program was started with production cost as a key design parameter

- Prior to preparing the RFP for development, the Navy prepared the bidders list and awarded study contracts to each of the five qualified contractors. The purpose of the study was to force the issues prior to the RFP and source selection. The pre-RFP environment was an open arena between Government and contractor. Cost was a design parameter; production people from the contractor played key roles in design tradeoffs. NAVAIR separately estimated cost in this open environment. The Navy thus developed a substantial understanding not only of production cost but also of the development costs and their relationship to performance. When the RFP was released, the Navy was able to provide a ranking of performace parameters and state acceptable performance ranges. This was combined with a design to cost ceiling to give the contractors flexibility in design alternatives, an essential element of designing to a cost goal. The proposer was to provide a design within this range and

have clearly stated below-ceiling cost goals that were credible. This approach established a sound, viable basis for the implementation of the design to cost concept.

- The four contractors who submitted proposals were aware that two awards for development would be made. Each proposal contained the specific design-to-cost baseline and its rationale.

- Now that two contracts have been awarded and development is underway, emphasis on design to cost is continuing in what appears to be an effective way. Primary communication between contractor and Government is through quarterly meetings at the contractors' plants. The contracting officer is a key member of the reviewing team. The reviewing team (contractor and Navy) is thus able to authorize changes to the baseline design, virtually "on the spot" to continue design to cost. To control the direction given to the contractors, the Navy program manager controls access to the contractors' engineering and estimating personnel as well as cost data.

- Formal design-to-cost reports are few and simple. They consist of four to five pages that describe changes around the baseline contained in the contractor's proposal. These are contractor pre-established and Navy-reviewed cost targets for the fabrication of development prototypes. Meeting these targets will be considered a demonstration of satisfactory progress toward the ultimate design to cost goal.

- The contractors have broken down the SLCM into major parts and subsystems. A single individual has been assigned responsibility for each of these elements.

Design to cost for a ship is necessarily a complex task because the cost estimate for the ship encompasses a wide variety of equipment types and sizes. The interface and integration requirements are complex, and the work takes a long time to perform. Furthermore, the total ship cost includes systems that have had separate, prior development. The typical life span of a ship is over 20 years and that of the payload (combat systems) is 7 to 10 years. Therefore, there will be about three payload life cycles in the life of a ship. This disparity between platform and payload life necessitates periodic modernization and conversion of naval ships.

Design to cost for a ship can be considered in three parts: the whole ship, the platform, and the payload. For a new class of ship, the general approach to all three parts is set in preliminary design. Therefore, design to cost for new ships is primarily the responsibility of the Naval Ship Engineering Center (NAVSEC), since at this time they are the only preliminary designers of the Navy ships. Even though ship design to cost will always be different in its application from that of aircraft, missiles, or electronic systems, it may be possible to generate an efficacious environment in preliminary design by bringing industrial teams into ship design at the formative stages. Electric Boat and Newport News possess some ship preliminary design capability. In addition, there are a few independent design agents in the United States. With time, this capability might be expanded to complement and compete with NAVSEC.

Both the LHA and the DD 963 were procured under total-package procurement. The contractor was responsible for design and construction of the ships. In addition, life cycle costing was invoked

during contract definition. The results of these efforts to minimize design cost and life cycle cost cannot be determined because the programs are still underway. The degree of success will probably always be clouded because of the overwhelming problems the contractor has encountered with these programs.

The PF program is proceeding with a strong emphasis on minimum production cost. The key features of this program include the following:

- Navy preliminary design is followed by ship system design (SSD) and the development of the Navy's preliminary design to a level of detail suitable for bid purposes for lead ships. SSD also includes development of plans for integrated logistics and support, data management, configuration management, and long-lead procurement.

- Two ship system design contracts were let, one to Bath Iron Works (the lead shipbuilder) and one to Todd Shipyards (a potential follow yard). The involvement of Todd, the second contractor, provides checks and balances on producibility and assures a competitive follow-on environment.

- Extensive plans have been developed for the use of land-based test facilities for both propulsion and combat systems.

3. Conclusions

The current directives on design to cost are heavily procedure oriented, with an attendant demand for specific detailed reports and contracting procedures. In addition, great emphasis is placed on very low cost goals. As long

as these goals and budgets are set on realistic estimates, the design to cost process can work well.

However, there is a real danger that the budgeting and funding procedures of the Navy (and DOD) will inhibit the use of life cycle cost management in the acquisition process. Life cycle cost reductions might increase the initial acquisition cost of major weapon systems as reflected in the annual acquisition budget. The reduced costs in the operations and maintenance (O&M) accounts will only show up as smaller incremental reductions in follow-on yearly funding for these accounts.

Additional observations of the Cost Panel on design to cost and life cycle cost include the following:

- Design to cost and life cycle cost begin with preliminary design, and preliminary design decisions have a profound impact on production costs.

- The impact of design features on life cycle cost, especially those related to design to cost, can be understood and acted upon even when the life cycle cost impact is only known qualitatively.

- Life cycle cost consideration will improve the decisionmaking process. Better data on post-deployment cost need to be developed to provide a more quantitative basis for those life cycle cost elements that can be measured.

- Design to cost will be more difficult to achieve in ships than other naval weapon acquisitions because of the absence of competition in preliminary design.

- Simple documentation of design to cost, such as that used on SLCM, is effective and provides the program manager with the data he needs to communicate effectively with the contractor, NAVAIR, OPNAV, CAIG, etc.

(4) Recommendations

The Cost Panel makes the following recommendations regarding design to cost and life-cycle cost:

Recommendation COST-18: Continue to apply design to cost principles, especially in preliminary design. Understand where the cost really is: emphasize the quality of the estimate which sets the cost goal.

Recommendation COST-19: Competition and alternate designs are the touchstones of design to cost. The Navy should provide adequate time and money in the early design phases to assure the success of design to cost by taking the following measures:

- Have the qualified contractors participate with the Navy laboratories and the SYSCOMs to provide data needed to issue a meaningful RFP.
- Establish a prioritized or weighted set of performance characteristics with either an acceptable range or a minimum value specified for each characteristic. These should be coupled with a design-to-cost ceiling representing the maximum average unit cost figure acceptable to the Navy. These requirements should be the basis of the RFP. This approach provides the contractors with flexibility necessary for alternate design concepts and performance/cost tradeoffs.
- Wherever feasible, use two contractors through the engineering development phase. A competitive advanced development phase is particularly crucial.
- Increase the R&D effort emphasizing design to cost in the areas of materials, processes, components, systems, and subsystems to improve the cost of these elements.

Recommendation COST-20: Since shipbuilding is a special case of design to cost, it is recommended that the Navy undertake a special study to determine:

- The benefits that could derive from competitive preliminary designs for ships
- The feasibility of expanding this capability in private shipyards
- The benefits of competition through the preliminary design and prototype phases of combat weapon systems.

Recommendation COST-21: Life cycle cost should be considered as only one of the many disciplines in the weapon system design, acquisition, and operational cycle. It must not be allowed to become the sole driver. It is also doubtful if a total life cycle cost figure, derived through a large computer printout, is of any value, given the weaknesses in the current data banks and basic cost information. However, life cycle cost can be used in acquisition management by concentrating on those portions or determinants of post-deployment cost that are design sensitive and/or influenced by the acquisition manager and contractor action, such as, reliability and maintainability, manning (numbers and skills), training, and support equipment.

Recommendation COST-22: Reexamine and simplify the instructions issued relative to design to cost and life cycle cost. Use every possible precaution to prevent design to cost and life cycle cost from becoming another "ility." Provide guidelines to Navy program managers and their contracting officers.

6. PROPER INTERFACE OF DOD AND NAVY INTERNAL SYSTEMS

The internal planning, budgeting, and reporting systems of the Navy and Department of Defense have a major impact on the success (or lack of success) of major weapon systems programs. The major systems that are referred to are: the Planning, Programming, and Budgeting System (PPBS), the Decision Coordinating Paper (DCP), the Defense Systems Acquisition Review Council (DSARC), and the Selected Acquisition Reports (SAR). These systems were developed at different times to bring about a more orderly management decision process in the Department of Defense. However, the lack of coordination between the systems has resulted in program instability for many major weapon systems.

(1) Statement of the Issue

The major issues are:

- Are the internal DOD and Navy systems giving management adequate (too little/too much) information for decisionmaking?
- Are the individual systems properly coordinated to facilitate and sustain management decisions with the greatest possible efficiency?
- Are the individual management decisions resulting in program stability and continuity that contributes (or not) to the success of the weapon systems programs?

(2) Study Approach

The Cost Panel approach to studying this issue was first to read all the pertinent DOD and Navy Directives and other appropriate material. These included:

- DOD Directive 5000.1
- SECNAV Instruction 5000.1
- OPNAV Instruction 5000.42
- DOD Directive 7000.3
- DOD Directive 5000.2 (draft)

- DOD Directive 5000.4
- DOD Instruction 7045.7
- DOD Instruction 7045.10
- DOD/Navy Programming Manuals.

The Cost Panel discussed the issues with all present and some former incumbents who held responsibility in the following functional organizations:

- ASD (Comptroller)
- ASN (FM)
- ASN (I&L)
- OP-090
- OP-90
- OP-92
- NCD
- MAT-02.

The Cost Panel reviewed the following programs:

- F-14
- S-3A
- LHA
- DLGN
- CVAN
- PF
- CONDOR
- PHOENIX
- HARPOON.

(3) Findings and Conclusions

The major internal systems of the Department of Defense and the Navy appear to be sound and generally give management adequate information for decisionmaking, provided the base data are correct. The systems were implemented at various periods of time and under different Secretaries of Defense. Most of the systems have originated in the Office of the Secretary of Defense. Secretary McNamara installed the PPBS system in order to foster a more logical and orderly decisionmaking process in the program and budget allocation cycle.

The DCP system was installed under Dr. Foster when he was Director of Defense Research and Engineering (DDR&E). The main object of this system is to develop a contract between the Office of the Secretary of Defense and the military services regarding the main features of a weapon system from a technical, schedule, and cost basis.

The Selected Acquisition Reporting (SAR) system was fully implemented by Secretary Packard in the late 1960's so that he would have a periodic status report on the major weapon systems. He recognized that the annual program and budget review process did not necessarily focus on the status of the total program at any given point in time. The C-5A difficulties and the cost overruns on other major weapon systems that were reported in the 1968 period were the catalysts for developing the reporting system.

The DSARC process was initiated by Secretary Packard so that top defense officials could review the weapon systems program and make the necessary decisions at the crucial milestone points in their development.

It is the Cost Panel's opinion that all of these systems are necessary. However, it is disappointing to find that many of these systems do not function to expectation years after implementation. It also appears that the coordination and integration of these systems have not been accomplished to the degree that is necessary to achieve program stability.

One of the problems is that each system is somewhat oriented to the particular information needs of an individual Assistant Secretary of Defense function. The staffs of these individual Assistant Secretary of Defense functions often do not recognize the decisions that have been made previously in the other decisionmaking cycles. For example, it is not uncommon for the program analysis staff to attack the decisions that have been made during the budget cycle and vice versa.

Many program staff papers are written without regard to some of the decisions made and the issues resolved in the budget, DCP, and DSARC processes. Consequently, much time and effort is expended in recycling issues and decisions regarding many of the major weapon systems programs. More important, it often leads to program instability and increased costs.

Changes in programs that have gone to contract generally lead to a cost growth situation. Either an increase or decrease in the program will cost the Department of Defense money. Therefore, when program changes are made to solve a program or budget problem, such changes invariably lead to increased costs being reported on the SAR some time later.

Some examples of these problems include the following:

- The SAR report must show the latest quantity approved in the Five-Year Defense Plan (FYDP), although a subsequent Program Objectives Memorandum (POM) or Program Decision Memorandum (PDM) decision might have changed that quantity.

- The classic decision was made in the Navy to approve a nine ship LHA program within the framework of the PPBS system and contracting with Litton. Then, within the first year of contract, the Navy reduced the program to five ships.

- The off-and-on program decisions regarding the CONDOR missile over the last 5 years were compounded by the problem of writing a DCP long after the program was well launched.

- Reportedly the effectiveness of the DSARC process has declined recently. Many program managers are complaining about untimely decisions, recycling old issues, and general harassment from the various staffs in the OSD layers of management.

The new Congressional Budget Office and the information needs and procedures that will evolve from creation of this new group will impose new demands on the present DOD and Navy internal management system. This must be carefully considered in developing plans for more integration and coordination between the systems.

The officials in OSD should recognize that these management information and planning systems were basically designed to achieve a more orderly process of decisionmaking and program stability. It is questionable that this can be achieved without greater effort to coordinate and integrate these systems.

(4) Recommendations

As a result of the analysis summarized above, the NMARC Cost Panel makes the following recommendations regarding the interface of DOD and Navy internal systems:

Recommendation COST-23: The major DOD and Navy internal systems are sound in concept and should be continued. However, the coordination and the operation of the systems are often poor and lead to weapon system program instability.

Recommendation COST-24: Develop a plan of action to achieve better coordination and integration of the individual systems so that good continuity and stability can be achieved in the major weapon programs. It should be noted that this recommendation will not be accomplished just by calling for proper integration in the various DOD and Navy directives. It will require a serious effort in the Office of the Secretary of Defense, and will require that the Deputy Secretary of Defense make sure that the staffs of the various Assistant Secretaries of Defense are willing to abide by prior decisions reached during the other internal decisionmaking cycles. It will also require a commitment by top Defense and Navy officials to achieve program stability in the major weapon systems programs.

Recommendation COST-25: Where applicable, individual systems should be updated and streamlined. For example, the detailed procedures of the PPBS system have not been modernized since about 1965. There is much effort put into the detailed recapping of the January update for the FYDP that possibly could be improved. Recommendations are provided in Section 9 regarding the SAR reporting system. The Cost Panel believes that some features of the DSARC/DCP system need review and change if it is to be a more effective management system. There appears to be a need to improve the timeliness and accuracy of the decisionmaking documents. The DSARC/DCP process is addressed by other Panel reports.

Recommendation COST-26: In order to properly stabilize the execution of major weapons system programs in the interests of increased efficiency, it is recommended that the Navy adopt a policy of stable planning and fully adequate funding of selected priority major weapons acquisition programs, probably those designated for reporting on the SAR. This will entail the development of realistic quantity and performance requirements based on the best analysis of defense needs, a realistic acquisition plan and schedule, and initial funding (and estimates of future funding requirements) of an amount sufficient to execute the program as planned. Once this planning is established in the applicable systems and documents, changes to any of these programs should be made only to reflect changes in operational requirements, unanticipated events within the program, or direction of higher authority over the Navy. Program and budgeting modifications should be avoided if the program is proceeding according to technical milestones, on schedule, and within cost estimates.

7. CONTRACTOR REPORTING

Contractor cost and management reports have been characterized over the years as being, on the one hand, excessively costly and institutionalized, and, on the other hand, inadequate for program management and control, visibility, and data collection. It is important to both the Navy and contractors that cost and management reports provided by contractors be adequate for the needs of the Navy at minimum cost.

(1) Statement of the Issue

The major issues discussed are the following:

- Are contractor cost reports adequate (accurate, timely, and comprehensive) to meet Navy needs for program management information, cost projections, and cost estimating data?

- Do contractor cost reports provide the data necessary for reporting within the Navy, to OSD, and to the Congress?

- Are DOD standard cost system requirements and reports that are levied on contractors a satisfactory value in terms of management utility versus cost?

- Do redundancy and unnecessary procedural detail exist in DOD/Navy reporting requirements imposed on contractors, and are reporting requirements limited to the minimum needed to satisfy legitimate management and cost estimating requirements?

(2) Study Approach

The Cost Panel approach to studying this issue was first to read pertinent DOD and Navy Directives and other appropriate material. These included:

- DOD Directive 5000.1
- DOD Instruction 5000.2
- DOD Instruction 7000.2
- DOD Instruction 7000.10
- DOD Instruction 7000.11
- NAVMAT Instruction P-5241
- OPNAV Instruction 5000.42.

The Panel met and discussed the issue with personnel in the following areas:

- AIR-5011
- AIR-50114
- SEA-052
- OP-96.

The Cost Panel examined the following programs through discussions with contractor and/or Navy Project Office personnel:

- TRIDENT Submarine
- TRIDENT Missile
- SSN-688 CLASS
- Patrol Frigate
- CVAN
- HARPOON
- S-3A

- SPARROW
- HARM
- AEGIS
- SLCM.

(3) Findings and Conclusions

The policy of DOD Directive 5000.1 is widely accepted as being appropriate to the acquisition of major defense systems and, as related to this issue, provides a reasonable policy concerning management information/program control requirements.

Contract requirements for the reporting of cost and other management information were found to vary widely. This was true even in the case of different contracts placed with the same contractor organization. Variations in reporting requirements are proper and should be a function of such factors as contract type, program risks, and contractor and DOD/Navy management systems and organizations involved in the program. However, there were strong indications that a significant part of the variations were the result of unstable reporting and informatic requirements external to specific Navy program management needs and the failure (on the part of the Navy) to use uniform criteria or existing contractor data. It was also noted that the Navy was moving to improve this situation with policies that emphasized the use of both uniform criteria and, where suitable, the contractor's internal work breakdown and management structure and internal cost systems.

The Navy perceives the cost planning and control of shipbuilders as being generally in need of significant improvements and is attempting to stimulate these improvements, primarily by requiring major shipbuilders to have cost control systems that satisfy the criteria of DOD Instruction 7000.2. All three of the shipbuilders visited by the Cost Panel were taking some action in the direction of meeting the DOD Instruction 7000.2 criteria. In the case of one shipbuilder, this was limited to a test implementation of revised management control systems on a single contract. The other two shipbuilders stated their intention to comply with DOD Instruction 7000.2 on all Navy new construction and had made significant progress in bringing their internal control systems into compliance with the criteria.

At each of the shipbuilders visited, the Supervisor of Shipbuilding and his staff strongly supported the concept of improving shipbuilder management through the application of DOD Instruction 7000.2 and the need for the greater access to shipbuilder cost plans and performance data, which they expected to be another result of the application.

The Navy approach to the implementation of DOD Instruction 7000.2 is generally considered to be reasonable by both Navy and contractor personnel. Problems of inflexible and detailed interpretation of the DOD Instruction 7000.2 criteria, excessive requirements for changes to contractor cost and management systems, and rigid requirements for detailed planning and problem analysis, which have characterized some past applications of DOD Instruction 7000.2, are being avoided. The resulting systems and cost data are generally satisfactory to both Navy and contractor management. This implementation approach is in keeping with the policy of DOD Directive 5000.1 and the intent of DOD Instruction 7000.2. Of the 24 major Navy programs required to submit the DOD Selected Acquisition Report, DOD Instruction 7000.2 is implemented in or in the process of being implemented on 12 of the more recent programs.

The use of the cost information made available by the implementation of DOD Instruction 7000.2 and the assessment of the benefits of DOD Instruction 7000.2 varied fairly widely among both Navy and contractor personnel. Totally negative opinions were very rare in both groups. The most serious expressions of concern came from the shipbuilders, who did not disagree with the objectives of DOD Instruction 7000.2 and the Navy approach to its implementation, but expressed apprehension that the resulting reporting requirements may be excessive, e.g., as many as 1,100 items of data in a single report. It appeared that these reporting requirements were the result of an attempt by the Naval Sea Systems Command to combine cost reporting for program management needs and for cost estimating into a single report. (See the discussion of these two types of reporting requirements below.) The concern expressed was in regard to the possible need to provide formal explanations of variances from plans and problem analysis for such a large number of items.

Both contractor and Navy personnel agree that effective program management and early identification and resolution of

problems is dependent on frequent direct communication between the Navy and contractor managers. This is developed through person-to-person contact achieved by frequent Navy visits to contractor facilities and reviews of performance and problems. The reporting in connection with DOD Instruction 7000.2 is not a primary means of initial identification and notification of problems. However, it provides a source of backup information on the cost impact of problems and a form of insurance against program surprises. The implementation of DOD Instruction 7000.2 also establishes the framework for cost planning and control, which facilitates subsequent direct communication regarding cost status and provides detailed supporting data.

While DOD Instruction 7000.2 establishes criteria for contractor internal systems for cost and schedule management and for the data generated by these systems, it does not include any requirements for reporting to the Government. Cost reporting requirements applied in conjunction with DOD Instruction 7000.2 are normally those defined in DOD Instruction 7000.10, which provides the following three separate reports:

- The Cost Performance Report (CPR), intended primarily for use with DOD Instruction 7000.2 as a means of obtaining comprehensive reports of contract cost status and outlook for program management use

- The Contract Funds Status Report (CFSR), which addresses contract fund status and funding requirements

- The Cost/Schedule Status Report (C/SSR), a reduced CPR for use on smaller contracts and not requiring a DOD Instruction 7000.2 systems base.

DOD Instruction 7000.10 provides means to collect summary-level cost and schedule performance data from contractors for program management purposes pursuant to DOD Directives 7000.1 and 5000.1 and for responding to requests for program status information on major defense systems, primarily by means of DOD Instruction 7000.3 (SAR). In defining the scope of DOD Instruction 7000.10, the following points are stated:

- In concert with the policies of DOD Directive 5000.1, utilization of CPR, CFSR, and C/SSR shall be limited by program managers to that necessary to achieve essential management control

- Contractors are encouraged to substitute internal reports for CPR, CFSR, and C/SSR provided that data elements and definitions used in the reports are comparable to CPR, CFSR, and C/SSR requirements and that the reports are in forms suitable for management use.

Another cost report required on major programs is the Contractor Cost Data Report (CCDR) specified by DOD Instruction 7000.11 and NAVMAT P5241. The main thrust of CCDR as stated in the OSD Assistant Secretaries' Memorandum for Joint Logistics Commanders, dated 24 October 1973, is to assist all DOD components in the following tasks:

- Preparing cost estimates for major system acquisitions reviewed by DSARC at each program decision milestone

- Developing independent Government cost estimates in support of cost and price analyses and contract negotiations

- Tracking contractors' negotiated cost.

Some redundancy of purpose between DOD Instruction 7000.10 and CCDR is apparent. Substantial redundancies also exist in the data required by CCDR and that required in the reports specified in DOD Instruction 7000.10. In addition, extensive internal redundancies exist in CCDR, which is actually an array of four separate reports, three of which require quite detailed data on contractor actual costs and cost projections.

CCDR and its predecessor, Cost Information Reporting (CIR), appear to require more rigid adherence to a standardized work breakdown structure and definitions than required by DOD Instruction 7000.2. This can and, in fact, has resulted in at least one program's (HARPOON) having a cost work breakdown structure for CCDR that differs from the program management work breakdown structure (WBS) implemented with DOD Instruction 7000.2.

Industry is particularly concerned by the CCDR requirement for plantwide indirect cost data and projections in accordance with standard breakdowns that are not compatible with many industry indirect cost structures. Concern also exists regarding the requirement for detailed business projections.

The apparent CCDR emphasis on the need for standard breakdowns and definitions in order to provide adequate data for future parametric cost estimating appears to be misguided since it overlooks the fact that schedules, management strategy, manufacturing techniques, contractor efficiency, technology base, and other factors, which will always be nonstandard, cause work scope and cost to deviate from "standard" in each program and its elements, regardless of efforts to standardize cost data breakdowns and definitions.

DOD is currently proceeding with activities leading to the establishment of a centralized, automated, computer-terminal-accessible cost estimating data base. Contractors are concerned with the integrity of their cost data that may be enetered into this computerized data repository. Navy cost estimators are highly skeptical that sufficient program information and technical data to make the cost data meaningful can be included in the data base. It appears that the efforts and funds being directed toward the establishment of the computerized cost data base could probably have more immediate benefit if spent on upgrading the existing cost data bases and insuring properly controlled access to them by all DOD personnel who have a legitimate need for cost estimating data.

At this point, it appears appropriate to review applicable policy statements of DOD Directive 5000.1 concerning management information/program control requirements. They include the following:

- Information shall be provided which is essential to effective management control
- Such information should be generated from data actually utilized by contractor operating personnel and provided in summary form for successively higher level management and monitoring requirements

- A single, realistic work breakdown structure shall be developed for each program to provide a consistent framework for the following:
  - Planning and assignment of responsibilities
  - Control and reporting of progress
  - Establishing a data base for estimating the future cost of defense systems.
- Documentation shall be generated in the minimum amount to satisfy necessary and specific management needs.

The Cost Panel concluded that the requirements of CCDR conflict with the policies of DOD Directive 5000.1 in the following areas:

- Redundancy of purpose and data requirements between DOD Instruction 7000.10 and CCDR resulting in the generation of documentation in excess to the need
- Internal redundancies within CCDR data requirements resulting in documentation in excess to the need
- Rigidized/standardized work breakdown structure and definitions resulting in possible (actual) generation of more than a single WBS, generation of data not utilized by contractor personnel, and generation of excessive documentation.

It is believed that essential data to establish a data base for estimating the future cost of defense systems is either currently available in contractor report submittals or can be obtained within the policies of DOD Directive 5000.1 and implementation of a single integrated cost reporting system based on DOD Instructions 7000.2 and 7000.10. This will require adherence to the policy of flexible implementation of criteria and utilization of existing contractor data in order to minimize generation of documentation.

(4) Recommendations

The NMARC Cost Panel makes the following recommendations regarding contractor reporting:

Recommendation COST-27: The Navy should continue its policy of implementing DOD Instruction 7000.2 on major acquisition programs.

Recommendation COST-28: The Navy should continue its present approach to the implementation of DOD Instruction 7000.2 of avoiding interpretations of criteria that would require unnecessary or unrealistic changes to contractor internal cost and management systems.

Recommendation COST-29: Only a single work breakdown structure or cost reporting structure should be imposed in any one contract. This is in concert with DOD Directive 5000.1, and the structure should be established by the Navy project manager in accordance with the applicable guidance. However, this guidance should be interpreted with sufficient flexibility to satisfy the unique management, technical, contract, and organizational needs of each phase of the program.

Recommendation COST-30: The CPR of DOD Instruction 7000.10 should be taken as the basic contractor cost report, with additions and/or changes to this base made as necessary (1) to satisfy program peculiar management needs, (2) to utilize fully and economically contractor internal cost systems and reports that provide equivalent data, and (3) to obtain any additional data needed for cost estimating purposes.

Recommendation COST-31: DOD cost data reporting requirements should be integrated into a single basic system to eliminate redundancy, inconsistent procedures, and multiple breakdowns and formats. Cost reporting requirements also should clearly provide flexibility for tailoring to fit program management needs and to avoid collection of non-essential data. The program management reports of DOD Instruction 7000.10 should be the basis for all contractor cost reporting to DOD. The needs for and benefits of any

additional data beyond that available from these reports should be examined. If additional data are necessary, criteria should be established to permit them to be obtained as a logical extension of the DOD Instruction 7000.10 series of reports. Cost data reporting requirements should be in criteria form to the maximum feasible extent and should follow the guidelines of DOD Directive 5000.1. CCDR (DOD Instruction 7000.11) should be cancelled as a separate reporting system.

Recommendation COST-32. Integrity of any data bank resulting from contractor cost data reporting should be maintained with respect to accuracy, completeness (of data), and limiting access to those with a legitimate need to use the data to develop cost estimates. This should be done to prevent compromise, misuse, or misapplication of the data.

8. NAVY LABORATORY REPORTING

Navy laboratories perform essential functions in the research and development of naval weapon systems and, accordingly, contribute to the cost of these systems. As a result, it is important that cost and management reporting by Navy laboratories be adequate to the task of managing the weapon system program.

(1) Statement of the Issue

This issue concerns the adequacy of Navy laboratory reports to meet program needs and the subsequent utilization of this information, including the reporting activity within the Navy and the Department of Defense and to Congress.

(2) Study Approach

The Cost Panel approached the study of this issue by reading the appropriate DOD and Navy Directives/Instructions:

- DOD Directive 5000.1
- DOD Instruction 7000.2
- DOD Instruction 7000.10
- DOD Instruction 5000.2
- OPNAV Instruction 5000.42.

The Panel met with Navy program personnel on the following specific programs:

- TRIDENT
- SPARROW
- HARM
- Sea Launched Cruise Missile (SLCM).

The Panel discussed the issue with personnel at the following Navy laboratories:

- Naval Weapons Center, China Lake, California
- Naval Ship Research and Development Center, Carderock, Md.

The Panel reviewed laboratory cost reports on:

- SPARROW
- HARM
- TRIDENT Submarine.

(3) Findings and Conclusions

Reporting varies among laboratories and within a single laboratory on different programs or projects. As in the case of contractor reporting, this is to be expected and will be a function of program considerations. It was not evident that new "systems" or reporting requirements had been introduced into Navy laboratories by external organizations as has sometimes been the case in past contractor reporting requirements. Navy laboratory reporting requirements appear to originate from internal Navy organizations and their needs as they perceive them.

Laboratory cost reports varied from a gross summary of expenditures and funding status reports on one program involving substantial dollars, to a detailed accounting of expenditures by task or work element and a forecast of expenditures on a task involving a small amount of dollars on another program. Some activities in Navy laboratories are burdened with excessive reporting requirements, while reports on some others do not provide adequate information for program management.

No evidence was found indicating that DOD Instruction 7000.2 was implemented in Navy laboratories. However, certain reports essentially met the intent of DOD Instructions 7000.2 and 7000.10. No evidence was found indicating that DOD Instruction 7000.11, Contractor Cost Data Reporting, or NAVMAT Instruction P-5241, also CCDR, were implemented in Navy laboratories.

Concern existed in some program offices over the control and reporting of costs on activities performed by the laboratories. As a result, certain program offices authorize and fund laboratory efforts for a number of relatively small, but separate, work packages or tasks.

Emphasis is being placed on better financial management of activities in the laboratories including cost and management reports, both internal and external to the laboratories.

As in the case of contractor/Navy program management, the program offices and laboratories concur that management of program activities performed by the laboratories is primarily through communication outside of the documented report submittals. Many of these communication channels appeared to be good.

Laboratory efforts at resource planning and financial management have at times been frustrated by uncertainty of and abrupt changes in the level of funding and changes in scope of program tasks assigned. As in all other areas of program management, valid, stable plans and budgets are a great aid to economy and efficient management.

(4) Recommendations

As a result of the analysis summarized above, the NMARC Cost Panel makes the following recommendations regarding Navy laboratory reporting:

Recommendation COST-33: Efforts to improve laboratory financial and resource management should be encouraged.

Recommendation COST-34: In improving and extending laboratory management capabilities, care should be taken

to avoid layering of management functions and activities that are being performed effectively by other activities.

Recommendation COST-35: Guidelines should be developed to guide Navy project managers in determining the cost planning and reporting requirements that they wish to levy on tasks they assign to laboratories. Program management responsibility and authority in this area should be emphasized.

Recommendation COST-36: On the basis that the implementation of DOD Instruction 7000.2 provides the foundation for satisfactory cost control and cost reporting to project offices (conclusion of the Cost Panel issue discussed in Section 7), it is recommended that major program tasks assigned to laboratories be reviewed for selective application of the intent of this instruction, and that application be made where appropriate. Further, the Navy should develop an appropriately modified DOD Instruction 7000.2 type of criteria for the planning and control of costs in major laboratory programs.

9. NAVY/DOD REPORTING—SELECTED ACQUISITION REPORTS

Effective program management requires periodic reviews and reports of technical, schedule, and cost status. These reviews and reports are necessary for the program manager and other organization elements charged with the responsibilities of program monitoring, approval, and/or authorization.

(1) Statement of the Issue

The Selected Acquisition Reports (SARs) were established to serve as program progress reports within the Department of Defense. Subsequently, they have become a primary communication vehicle in reporting to the Congress. However, the SARs have often been criticized as lacking credibility or usefulness. The major issues are the following:

Do the SARs adequately reflect program status?

- Are the SARs prepared and submitted on a timely basis and in a meaningful format?

(2) Study Approach

The NMARC Cost Panel approach to studying this issue was first to read the pertinent DOD instructions and other appropriate material. These included:

- DOD Instruction 7000.3
- Draft revision of DOD Instruction 7000.3, forwarded for comment on November 21, 1974
- Recent House Appropriations Committee Reports discussing SARs
- Reports of the Senate Committee on Appropriations discussing SARs
- Recent GAO reports on SARs and on cost growth in major weapon systems.

The Panel discussed the issue with personnel in the following functional areas:

- NCD
- OP-090
- OP-92
- MAT-02.

The Cost Panel discussed the issue with personnel in the following program offices and reviewed their recent SARs:

- PF
- HARPOON
- S-3A
- SSN-688
- TRIDENT.

Also, the Panel discussed the issue with the following contractors:

- Bath Iron Works
- General Dynamics, Electric Boat Division
- Newport News Shipbuilding and Dry Dock Company
- McDonnell Douglas Aircraft Company
- Lockheed-California Company
- Lockheed Missiles and Space Company.

(3) Findings and Conclusions

The SARs represent a prime communication vehicle between the Department of the Navy, DOD, and the Congress for reporting major weapon systems program status. The reports are similar in concept to the quarterly financial reports of the American business community to their stockholders and creditors. However, the SAR system goes much farther than simply providing program information. In concept, it forces a periodic review and evaluation of the weapon systems programs in a consistent format. Many problems have arisen in initiating this system because it is a rather complex reporting structure. But much progress has been made in implementing the SAR system, as can be readily seen in comparing current SARs with earlier reports.

However, the SAR system has come under increasing criticism, particularly from Congress. In the House Appropriations Committee Report of September 11, 1972, the Committee criticized the SARs in the following respects:

- The SARs are untimely
- No "audit trail" exists to explain differences between development and planning estimates
- There are no firm guidelines against which to measure additional procurement costs
- A summary statement is necessary to discuss the probability of the weapon system's achieving its primary mission or meeting original contract specifications

- Performance characteristics should be tailored to the specific key points of the weapon system, not to uniform characteristics of a class of weapon systems

- SARs do not show total weapon system costs.

The Senate Committee on Appropriations in August 1974 (2 years later) had other criticisms and suggestions for improvement:

- The criteria for adding and deleting programs from the SAR system requires improvement

- Changes between planning and development estimates should be visible in the SARs

- The format for comparison of costs incurred, schedule attainment, and technical performance against original projection requires improvement

- Performance characteristics should be directly related to the weapon systems' planned requirements and an assessment provided as to whether the system is expected to attain the plan.

These criticisms and suggestions for improvement appear valid. In part, due to this congressional concern, the SAR Review Group developed a draft revision to DOD Instruction 7000.3. The draft was amended by agreements with the congressional committees and forwarded for comment on November 21, 1974. As they affect the points raised by the Congress, the revisions appear desirable and should be implemented. However, the draft also seeks to address criticisms from others.

Navy personnel have raised serious questions regarding the validity of the program data reported in the SARs. This is primarily due to the question of what constitutes the program on which current estimates will be based. In response to requests for guidance, the Assistant Secretary of Defense (Controller) issued a memorandum on July 17, 1973, which stated that the current estimate should be made on the program as approved in the current FYDP, as amended by DCP, DSARC, or budget

reprogramming. This guidance is incorporated in the draft revision to DOD Instruction 7000.3, which further states:

> Other proposed major program changes being reviewed exclusively within the POM/PDM process will not be considered to be amendments to the currently approved program until the POM/PDM/OSD Budget Review Cycle is completed.

For the December 31 and March 31 SARs, the use of the approved program in the current FYDP for pricing out the current estimate makes sense. However, to prepare the June 30 and, in particular, the September 30 SARs on this basis may not result in correct program status reporting. If the POM or PDM cycles have changed program quantities, phasing or other features, and these have not been reflected in revisions to the current FYDP, the SAR would be prepared on a program base that is out of date from a Navy and OSD point of view.

In view of the changing nature of fiscal constraints during this program planning and budgeting time period, the Panel understands the rationale of not basing the SARs on the POM/PDM process results. Such results could be misleading in relation to the subsequent December 31 SARs, which reflect the final budget and FYDP actions. However, to continue preparation of the SARs on the present basis can be equally misleading and can contribute to a widening credibility problem.

Recognizing the logic on both sides of this argument, the questions is raised as to the necessity of the September 30 SARs or, in fact, for quarterly SAR reporting. As a matter of practicality, significant changes in current estimates of the status of major weapon programs could probably be as effectively portrayed on a semiannual basis as on the present quarterly basis. If major changes occur, a quarterly report could be prepared on an exception basis.

The draft revision of DOD Instruction 7000.3 also presents the current thinking regarding presentation of escalation cost in SARs. The Panel believes that as presently stated, the draft instructions will result in confusing and possibly misleading the readers of SAR reports as to the total estimated impact of escalation on the program. The baseline (planning or development)

escalation assumption and revisions to that assumption are clearly highlighted in the Program Acquisition Cost report section of the SAR as "Provision for Economic Change." However, escalation applicable to approved program changes is included with the estimated cost of the change on this report. Such escalation is only visible in the "Remarks" column of the cost variance analysis report section of the SAR.

The September 30, 1974, SAR for the Patrol Frigate program demonstrates this problem. Total program changes of $187.4 million to the development estimate are presented in the Program Acquisition Cost section. Upon examination of the Cost Variance section, $45.3 million of this total is a result of projected escalation. It seems more appropriate and meaningful to make the total estimated impact of escalation visible rather than segregating the components in different sections of the SAR. Escalation practices as they impact the SARs are also discussed in a separate Panel issue presented in Section 15 of this chapter.

Personnel within the Navy program offices and other organizational elements have expressed frustration in dealing with the seemingly continuous changes in format and guidelines generated by DOD. Such changes often occur after a quarterly SAR is nearing completion and require at least one (if not more) substantial revision to the SARs. For example, in the last week in July and as late as August 13, 1974, several memoranda "augmenting and clarifying" prior guidelines on escalation treatment in June 30, 1974, SARs were forwarded to program offices.

The Panel recognizes that refinements and guidance will, of necessity, change. However, the timing of such instructions has led to additional work (or rework) requirements on the program offices and Navy Comptroller's staff and have resulted in SAR submissions at dates later than desired. This problem is further compounded when one considers the impact on the reader of a report that is in a continual state of change. The continuity of understanding is broken, the ability to compare information (and the basis for its presentation) from one report to another is hampered, and the credibility of the data is questioned.

The majority of the Navy contractors visited had never seem SAR information on programs in which they are participating.

The Panel recognizes that certain data in the reports is proprietary to the Navy. However, an informal (or formal) review with major contractors of their contract's technical, schedule, and cost status information would serve a useful purpose in focusing any discussions of program status by the contractors, DOD, and the Navy on the same base of information, the SAR document. In discussions with the public, the press, or the Congress, the interested parties would be informed of what each is thinking and this would, the Panel believes, enhance credibility of the discussions.

(4) Recommendations

As a result of the analysis summarized above, the NMARC Cost Panel makes the following recommendations regarding the SAR:

Recommendation COST-37: The Navy and DOD should consider changing the SAR reporting frequency to semi-annual. Consideration of congressional requirements is necessary, and the flexibility to require interim reports where significant changes occur should be maintained.

Recommendation COST-38: Critical reviews of the current draft revision of DOD Instruction 7000.3 should be made by Navy and DOD personnel to determine that it addresses the major problems and criticisms leveled against the SAR system. The majority of the revisions appear justified. However, the Panel recommends that the draft and formats be revised to present escalation costs for program changes along with the Provision for Economic Change so that impact of escalation may be seen. Related recommendations of escalation practices in SAR reporting are included in the Cost Panel issue discussed in Section 15.

Recommendation COST-39: It is doubtful (and questionable) that the Navy and DOD can obtain billions of dollars in the future for major weapon programs without giving a report on technical, schedule, and cost status. Therefore, the system must work to provide the most meaningful information possible and to tell the complete story about each program.

Once the revised DOD Instruction 7000.3 is issued, any further changes should be kept to an absolute minimum for a period of several years so that the integrity and comparability of the system can be developed and proven.

Recommendation COST-40: Pertinent sections of the SAR concerning technical, schedule, and cost status of major contracts should be reviewed with the applicable contractor to assure that interested parties may speak from one authoritative document among themselves and with the public, the press, or the Congress. This should not require disclosure of proprietary data (contractor or Navy).

10. THE BUY-IN PROBLEM

A key ingredient in any successful weapon program development and procurement is a contract price that includes realistic costs in relation to the work to be accomplished. When acquisition practices do not foster an environment for such realism in cost or pricing, the result can be a program with cost growth and/or failure to produce the desired weapon system. Either result is undesirable in procurement of weapons for this country's defense.

(1) Statement of the Issue

Buy-ins occur when unrealistically low bids are submitted in order to secure a contract in a competitive procurement environment or to "sell" or obtain approval for program initiation or continuance. The major issues are:

What are the factors that encourage buy-in?

- Are present Navy acquisition practices effective in preventing buy-ins?

(2) Study Approach

The Cost Panel approach to studying this issue was first to read all the pertinent DOD Directives and Navy Instructions and other appropriate material. These included:

- DOD Directive 4105.62
- DPC 110
- CNM PPM Number 16
- DOD Directive 5000.1
- SECNAVINST 5000.1
- AMARC Cost Panel Report
- Excerpts from Commission on Government Procurement Report
- National Security Industrial Association's letter of September 6, 1974, presenting NSIA views on issues and problems undertaken by NMARC
- Aerospace Industries Association of America, Inc. letter of September 27, 1974 presenting AIA views on issues and problems undertaken by NMARC
- NASA PRD 70-15.

The Panel then discussed the issue with personnel in the MAT-02 functional areas.

The Panel also discussed the issue with eight major Navy contractors.

(3) Findings and Conclusions

A number of factors contribute, either independently or in concert, to the buy-in problem. The first is that procurement opportunities are generally limited in relation to available defense industry capacity. This can lead to a "win-at-any-price" philosophy as contractors struggle to maintain technological capabilities and adequate work backlogs.

To prevent this factor from leading to buy-ins, a number of elements must be present in the acquisition process. Adequate independent estimates developed by the Navy are necessary for comparison with contractor proposals to detect unrealistic bids. (The Navy's cost estimating capabilities are discussed in the Cost Panel issue addressed in Section 3 of this chapter). The requirements for realistic and substantiated costs in proposals must be emphasized to contractors at the outset of the procurement process. When unrealistic or unsubstantiated cost proposals are detected, they should be challenged and penalized in the evaluation process.

The second factor that contributes to the buy-in problem is the downward bias created by the desire of the military service and/or contractors to sell a program to OSD, OMB, or the Congress. This bias may result in a more optimistic view of final program cost than is warranted, or it may lead to pressure on contractors to submit low bids with the assurance that future funds will be available to cover the real costs.

Given the limited financial resources available for competing programs, the pressure to sell is understandable. However, it must not lead to the point of encouraging contractors to submit estimates that are less than realistic (given the risks involved) or in anticipating additional funding in future budgets. Adequate independent estimates and visibility of such estimates in the decisionmaking cycles are required to counter this downward bias.

This factor is also somewhat self-adjusting. Contractors are perhaps more aware of what over-optimism or the downward bias has caused in the last decade and are more resistant to such pressures. In addition, the Navy has also seen the results and is facing the problem of funding this "bow-wave" of costs coupled with the rapid inflation of costs that is occurring.

The final factor contributing to buy-ins is acquisition practices that allow or encourage an undue focus on the lowest cost in final selection. This can tend to institutionalize the buy-in strategy as necessary for contractors to maintain their competitive position. SECNAV Instruction 5000.1 specifies the following steps in selecting the winning contractor:

> ....a series of iterations...with each offeror following initial proposal submission, to continue for a reasonable period of time until each proposal is deemed either technically acceptable or unsuitable.... Such optimization frequently implies technical transfusion between competing proposals.... The companies involved should be encouraged to incorporate those facets of each proposal which would combine to form the technically superior proposal... following technical evaluation and ranking of proposals with respect to technical excellence...and management... complete pricing should...then be obtained from contending contractors and negotiations undertaken for the purpose of arriving at each contender's best and final offer.

In the discussion held with Navy contractors and in reviewing industry memoranda and studies, the Cost Panel found almost uniform objections to these practices. The "ratcheting effect" of technical transfusion and leveling, parallel negotiations, and multiple "best and final" offers in the procurement cycle tend to focus improperly on obtaining lowest cost and to perpetuate the buy-in strategy as a requirement for successful contract award. There is strong industry resentment against these practices, and several contractors have stated that they will no longer be involved in contract discussions where a best and final offer "auction" is used, with the award going to the lowest bidder.

The Cost Panel does not believe that the use of a best and final offer to close negotiations is in itself detrimental. It is the misuse of the practice that is believed to contribute to a buy-in environment.

It is interesting to note that in the report of the U.S. Air Force Academy's Risk Analysis Study Team (August 2, 1971), the "technical transfusion" concept was severely criticized:

> ....whatever actual technical transfusion...tends to be superficial and is not sufficient to make all proposals...technically equal because the technical capabilities of the contractor are not the same. The results are to transfer the emphasis in source selection away from technical uncertainty issues on to lowest cost bids. We suggest that the DOD reinforce current policies to prohibit the Government from assisting in technical transfusion before the source selection decision. (Emphasis added.)

Some advocates of the technical transfusion, parallel negotiation, and best-and-final offer techniques maintain that their use is essential to eliminate award protests. The experience of NASA acquisitions indicates that such techniques are not required. NASA's source selection directive, PRD 70-15, as revised in 1972, does not require a best and final offer. In fact, it prescribes that the normal practice in cost-type development contracting is to finalize source selection first and then to proceed to the process of technical transfusion and price negotiation with the selected source. The NASA procedures have been reviewed and upheld in various General Accounting Office (GAO) award protest decisions.

The Commission on Government Procurement shared the concerns expressed by industry as they pertain to R&D contracting:

> .... discussion in R&D procurements have been used to achieve the comparability between competing "products" which one expects in formal advertising. This tends to bring the offer of each preparer to a common level of technical excellence. Such "technical leveling" can foster a Government practice of "auctioning" the contract to the preparer who bids the lowest price.

The Commission recognized recent Comptroller General decisions and NASA's PRD 70-15 prohibiting "transfusion" and parallel cost negotiations and went on to state:

> Recent changes in procurement law suggest that agencies now are devoting much attention to this matter and that these problems may not continue to be considered acute... In view of the recent attempts... we have concluded it would be inappropriate at this time to recommend detailed statutory revisions.

However, the Navy and DOD have not followed the lead taken by others, and the potential for buy-ins continues to exist.

(4) Recommendations

The NMARC Cost Panel makes the following recommendations regarding the buy-in problem:

Recommendation COST-41: Technical transfusion or leveling of proposals and parallel negotiations leading to best and final offer "auctions" should be prohibited. In making this recommendation, the Cost Panel does not intend to preclude oral and written discussion with contractors that are oriented toward assuring an understanding of the proposal by both parties, nor does the Panel desire to preclude adjustments to proposals (which are substantiated and traceable to the original estimate) based on such discussions.

Recommendation COST-42: Cost, schedule, and technical realism should be the primary considerations in cost estimating, proposal evaluation, and source selection. Offerors should be instructed to submit their best cost and technical proposals at the outset. Unrealistic or unsubstantiated proposals should be downgraded or rejected in the evaluation cycle.

Recommendation COST-43: The Cost Panel believes that a memorandum from the Secretary of Defense to the military services addressing the need for cost realism in acquisition practices and setting forth guidelines similar to those above would be appropriate to focus attention on eliminating the factors that may lead to buy-ins.

11. FINANCIAL MANAGEMENT CAPABILITY IN THE PROGRAM MANAGEMENT OFFICE

The business/financial management capability of the program office should be improved.

(1) Statement of the Issues

Critical to the project management office's ability to carry out its responsibilities successfully is the capacity of the office itself in terms of the adequacy of resources assigned in areas of

business and financial management (B/FM) such as cost estimating, budget development, procurement planning and programming, report preparation and analysis, and funds/cost control and accounting. The adequacy of resources is in turn, governed in part by the following factors:

- The technical and business management proficiency of the individuals assigned to the business/financial management positions in the project offices
- The degree to which business/financial management responsibilities of the individual are adequately defined and clearly understood by all individuals involved
- The adequacy of the number, scope, and organizational location of business/financial management billets within the project office as they affect successful execution of these responsibilities.

(2) Study Approach

The Cost Panel approach to studying this issue was to read pertinent DOD and Navy Directives and other appropriate material. These included:

- DOD Directive 5000.XX (Draft: Systems Acquisition Management Careers)
- DOD Manual 5010.16C
- SECNAV Instruction 12950.11
- SECNAV Instruction 12950.9
- OPNAV Instruction 5311.5
- OPNAV Instruction 1211.8
- NAVMAT Instruction 0231/TI.M (Draft: Weapon System Acquisition Management Career Program)

- NAVMAT Instruction 5000.5B
- BUPERS Instruction 1040.2
- NAVSHIPS Handbook (Ch. 5) 0900-070-1010
- NAVMAT Project Management Handbook 1973-74
- Various memoranda written between 1970 and the present dealing with the need for improved "business management" in program offices and at SUPSHIPs organizations
- Various memoranda written between 1970 and the present dealing with selection and development of Navy Project Managers and dealing with the military and civilian Weapon System Acquisition Manager (WSAM) Program
- Various training course descriptions
- Various Project Office Charters
- Cresap, McCormick and Paget (CMP) Study dealing with Financial Management in the Navy (Phases I and II)
- A Study of Project Management for the Navy's Major Weapons Systems Acquisition Process, Cresap, McCormick and Paget Inc., December 1974.

The Cost Panel met and discussed the issue with

- ASD (I&L)
- ASD Comptroller
- ASAF (FM)
- NCB
- OP-21
- OP-92
- PERS-41A
- MAT-92
- NAVSEA 00V
- NAVSEA 02

- NAVSEA 09B
- NAVAIR 01B
- NWC China Lake
- SUPSHIP Bath, Maine
- SUPSHIP Groton, Connecticut
- Commander AFSC
- Chief of Staff AFSC
- Comptroller AFSC
- Director of Personnel AFSC
- Rockwell International Corp.
- General Electric Co.
- McDonnell Douglas Astronautics Co.
- Bath Iron Works
- Electric Boat Division of General Dynamics
- Lockheed Missiles and Space Co.

The Panel met with representatives of the following project offices:

- PM-1
- PM-2
- PMS 393
- PMS 396
- PMS 399
- PMS 403
- PMA 242
- PMA 244
- PMA 258
- PMA 262
- PMA 263.

(3) Findings and Conclusions

Since the end of World War II, the acquisition process has been marked by successively more sophisticated systems that cost more and require greater lead time for development and production. Historically, the emphasis of the armed services has been on the performance characteristics of new weapons with considerably less emphasis on schedule or cost considerations. The Cost Panel recognizes the critical importance of technical performance but suggests that considerably more emphasis must be placed on cost and schedule factors than has historically been true.

During the course of the study it became apparent to the Cost Panel that although the various program charters provide general guidance with respect to the business/financial management responsibilities of the project office, a current, comprehensive, well defined, approved definition of these responsibilities in the program office does not exist. Although the emphasis of the B/FM definition will (and should) vary from project to project and within the project as it moves through the various acquisition life cycle phases, the basic elements of such a definition should remain relatively constant. Such items as cost estimate analysis, planning and programming, budget development, oversight of the contract administration function, management systems utilization and analysis, cost control, accounting and reporting, and the development of SAR and such other reports as may be required by the Congress or the DOD offer themselves as likely candidates for inclusion on a list of B/FM elements for which the project office is primarily responsible.

It is clear that achieving acceptable system performance must continue to be the overriding objective of the Project Manager (PM). It is equally clear, however, that sound business planning and related financial functions such as contracting and cost control will assume increasing importance. To date, the Navy has been slow in developing an adequate B/FM capability in many project management offices. The Logistics Management Institute (LMI)* study completed for the NMARC states that a consensus is emerging with respect to the desirability of the Project Manager's having: "Business management training reflected in the MBA degree or comparable training in systems management," and having attended "... the 20-week course in program management ... (at) the Defense Systems Management School (DSMS)." The Cresap, McCormick and Paget Inc. (CMP) study** of project management completed for the NMARC, however, reflects the following facts regarding

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* As quoted on page II-11 of the December draft of the Cresap, McCormick and Paget Inc. study of project management completed for the NMARC (See Volume 2).

** See statistical appendix of the CMP study entitled "Background and Experience of Current Project Managers and Deputies."

the 100 Project Managers and their deputies who responded to the CMP survey dealing with their background:

- All but five considered themselves to be well founded technically
- Only eight had been to the DSMS 20-week course
- Only 17 had been awarded graduate degrees in business management fields
- Eighty-two (of 98 who reported on this question) had had previous weapons system acquisition experience.

The clear implication of the above is that the Navy considers a technical background combined with prior weapon system acquisition experience to be an overriding consideration with respect to the capability of project managers and their deputies. Prior weapon system acquisition experience and attendance at various short courses can provide insight into project management problems and the decisions a PM must make. Such experience cannot, in most cases, however, provide the in-depth foundation essential to adequate development and analysis of interrelated business and financial management alternatives in diverse areas ranging across cost estimation, procurement planning, contract definition and negotiation, cost report analysis, SAR development, etc. Therefore, there is a strong need for B/FM capability in the project offices to properly support the PM and his deputy.

The need to upgrade B/FM capabilities in project offices and Supervisor of Shipbuilding organizations was recognized as early as 1970 by the Assistant Secretary of the Navy (I&L). Although each of the then SYSCOM Commanders and the Chief of Naval Material concurred with the intent of the Secretary's guidance, to date few (one-third or less) of the 24 SAR project offices appear to be adequately staffed in this regard. Slow realization of the intent of the Secretary's guidance may be traced in part to NAVMAT's and the SYSCOMs' hesitance, given recent manpower ceilings and reduction efforts, to define the B/FM role and to man the necessary billets; however, the factors that

originally generated the need (i.e., the need for better business planning and cost control) have, if anything, become more pronounced.

Most PMs recognize their overall responsibility in the B/FM area. Therefore, the following discoveries were surprising:

- In 15 of the 24 SAR programs, the PM did not have an assistant who served as the B/FM counterpart to the assistant for technical matters.

- Only eight of the 49 Navy programs reviewed in the CMP study contained adequate numbers of people within the project management office to carry out the B/FM oversight responsibilities outlined above.

- Whether for parochial reasons, or because of the PMs' conviction that other areas of project responsibility have greater priority, many project office personnel, including some PMs, are hesitant to recognize the value of an adequately defined and staffed B/FM function within the project management office.

It is not the Panel's intent to argue against the matrix approach to project management employed by the Navy but to argue for an expanded B/FM capability within the project office. In order to fulfill his overall responsibilities in the B/FM area the PM must possess the following capabilities:

- Have a degree of visibility into each of the functional areas that the press of business seldom allows him to gain personally on a continuing basis

- Be able to coordinate inputs to, and outputs from, the functional groups with the technical and fleet support elements of the project office, with other parts of the SYSCOMs and NAVMAT, OPNAV, Navy Secretariat, DOD, and Congress, among others.

It is difficult to accomplish such coordination effectively and meet other PM demands without knowledgeable assistance in the B/FM area of competence.

Similarly, it is not the Panel's intent to create the impression that the financial management personnel in most project offices are not doing their jobs. Traditionally, the PMO financial management function has been perceived as encompassing the buildup of budget submissions, requesting funds apportionments, accounting for funds, and reporting basic cost information. Each of these functions is important to successful business and financial management, and each has generally been well performed with varying degrees of sophistication. However, as described above, the complexities of the B/FM issues that presently must be routinely faced and resolved by the project office require a much broader definition of the function with concurrent development of appropriate position descriptions and the allocation/reallocation of billets as necessary.

(4) Recommendations

The Navy matrix/functional approach to project office support in the business/financial management should be continued. However, the B/FM capability within the project office should be materially strengthened by implementing the following recommendations:

Recommendation COST-44: Develop and implement criteria and guidance designed to govern the establishment and continuing maintenance of the B/FM capability and responsibility in project offices. The objective of such an effort should ultimately be the allocation of adequate resources to the project office on a continuing basis to ensure that, as a minimum, the following business/financial management oversight responsibilities can be effectively carried out: budget planning and development; utilization of cost/schedule planning and control systems; cost estimate analysis (including input reports such as proposals) and cost control, accounting, and reporting (including output reports such as SARs); funding and payment planning and control; and procurement/contract planning, programming, execution, and administration functions.

Recommendation COST-45: Develop position descriptions for an assistant program manager having major business/financial management responsibilities in support

of the Project Manager to be assigned to the major projects. In carrying out these responsibilities, adequate support staff billets should also be provided in the project office. Depending upon the life-cycle phase of the program, its size, and how the project is organized, personnel assigned to the project office should vary. However, between two and five well qualified professional business/financial management personnel would be an appropriate rule-of-thumb target number for each SAR program.

Recommendation COST-46: Create the billets and fill them with an appropriate mix of qualified officers and civilians. The definition of those billets should be developed such that a hierarchy and a ladder for career progression (both civilian and military) is created as discussed in Section 12 of this chapter.

12. SELECTION AND CAREER DEVELOPMENT OF PROJECT MANAGEMENT OFFICE BUSINESS/FINANCIAL MANAGEMENT PERSONNEL

The Navy requires a more clearly defined approach to the selection and career development of military officers and civilians who serve in project office business and financial management billets.

(1) Statement of the Issue

Recognizing the need for development of, and the benefits to be derived from, enhancing the business and financial management function (B/F M) of project management offices through better definition and the allocation of additional billets (as addressed in the issue presented in Section 11 of this chapter) is not sufficient without concurrent and continuing attention to:

- The manner in which individuals (civilian and military) are selected for and assigned to these billets so that effective execution of the business/financial management function is ensured while the career development of individuals involved is enhanced

- The adequacy of civilian and military career development policies (specially designated billets, relationship to the Weapons System Acquisition Manager (WSAM) program, etc.) and opportunities (personnel training, subspecialization, counselling, job assignment, etc.) with respect to ensuring the future availability of highly qualified individuals for positions as assistant project managers for business and financial management.

(2) Study Approach

The Cost Panel approach to studying this issue was to read pertinent DOD and Navy Directives and other appropriate material. These included:

- DOD Directive 5000.XX (Draft: Systems Acquisition Management Careers)
- DOD Manual 5010.16C
- SECNAV Instruction 12950.11
- SECNAV Instruction 12950.9
- OPNAV Instruction 5311.5
- OPNAV Instruction 1211.8
- NAVMAT Instruction 0231/TLM (Draft: Weapon System Acquisition Management Career Program)
- NAVMAT Instruction 5000.5B
- BUPERS Instruction 1040.2
- NAVSHIPS Handbook (Ch. 5) 0900-070-1010
- NAVMAT Project Management Handbook 1973-74
- Various memoranda written between 1970 and the present dealing with the need for improved "business management" in program offices and at SUPSHIP organizations

- Various memoranda written between 1970 and the present dealing with selection and development of Navy Project Managers and dealing with the military and civilian Weapon System Acquisition Manager (WSAM) Program

- Various training course descriptions

- Various Project Office charters

- Cresap, McCormick and Paget (CMP) Study dealing with Financial Management in the Navy (Phases I and II)

- A Study of Project Management for the Navy's Major Weapons Systems Acquisition Process, Cresap, McCormick and Paget Inc., December 1974..

The Panel discussed the issue with the following:

- ASD (I&L)
- ADS Comptroller
- ASN (FM)
- ASAF/FM
- NCB
- OP 21
- OP 92
- PERS 41A
- MAT-92
- NAVSEA 00V
- NAVSEA 02
- NAVSEA 09B
- NAVAIR 01B
- NWC China Lake
- SUPSHIPS Bath, Maine
- SUPSHIPS Groton, Connecticut
- Commander AFSC
- Chief of Staff AFSC
- The Comptroller AFSC
- Director of Personnel AFSC
- Rockwell International Corp.
- General Electric Co.
- McDonnell Douglas Astronautics Co.

- Bath Iron Works
- Electric Boat Division of General Dynamics
- Lockheed Missiles and Space Co.

The Cost Panel examined the following programs through contractor and/or Navy Project Office personnel:

- PM-1
- PM-2
- PMS 393
- PMS 396
- PMS 399
- PMS 403
- PMA 242
- PMA 244
- PMA 258
- PMA 262
- PMA 263.

(3) Findings and Conclusions

As developed earlier in the discussion relating to the need for improved business and financial management (B/FM) capability in the project management office (Section 11 of this chapter), the armed forces have historically devoted most of the emphasis in systems acquisition to achievement of performance parameters. As a result, until comparatively recently, cost parameters received considerably less attention, almost to the point of being ignored except for funds management.

Given the need to develop an expanded B/FM capability in the project office and the availability of an adequate number of appropriately defined billets (as discussed in Section 11), the questions then become the following:

- What are the Navy's options for expanding project management office B/FM capability in the short run?
- What should be done to motivate qualified personnel to enter and pursue careers in B/FM?

- What should be done to ensure an adequate future supply of well qualified personnel to serve as assistant project managers for business and financial management?

The Supply Corps seems to offer the greatest reservoir of officers trained in B/FM-related skills. Of 1,949 officers in the Supply Corps between the rank of Lieutenant Commander and Captain (inclusive), 729 or 37.4 percent possess master's degrees in fields aligned to systems acquisition.* Yet, less than half of the 24 SAR programs have Supply Corps officers assigned to the project management office in Washington. Important but tangential issues related to billet definition and ceiling point relief are often raised when installation of an improved B/FM capability in the project office by introduction of Supply Corps officers is discussed. It is the Panel's firm belief, however, that whatever the source of the billets (SYSCOM, Supply Corps, or other), improving project office business and financial management capability is of such urgency as to require immediate resolution of the billet related issues.

This is not to say that a sudden influx of Supply Corps officers to project offices is in order without a careful screening, selection, and training process, because most of the 729 officers referred to above are not well versed in the complexities of the weapon system acquisition. Failing identification and assignment of qualified Supply Corps officers, the short-run solution seems to require additional outside help either in the form of new hires or selected line officers if they are available and properly trained.

The Navy recognized the need to foster the training and selection of highly qualified project managers when it initiated the Weapon System Acquisition Manager (WSAM) subspecialty program in 1970. The WSAM program was designed to identify potential project managers; therefore, it has primarily emphasized technical competence in awarding the subspecialty

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* Extracted from data developed by NAVSUP at the request of the Cost Panel.

designation. The most highly qualified project managers should have fairly detailed insight into the B/FM function; it would therefore seem appropriate to include some B/FM-related criteria in the WSAM selection process. If the WSAM program is to be employed as a primary tool in the selection of personnel to fill B/FM positions — and the Cost Panel feels it eventually should be — then addition of B/FM criteria to the WSAM selection process becomes mandatory. If the WSAM is not to be the vehicle for selection of B/FM personnel, a new subspecialty designator should be introduced.

BUPERS Instruction 1040.2 dealing with the mechanics of application for WSAM subspecialty consideration by naval officers does not adequately treat the need for highly qualified B/FM personnel in systems acquisition. While it may not be practical to develop the personalized screening and selection process that some industrial firms employ in the recruiting and selection of B/FM personnel, it would seem advisable to improve the quality of information on B/FM sent to the fleet so that interested and qualified officers will apply. A business and financially oriented WSAM selection board might also be convened, and qualified business and financial managers might be included on all future WSAM boards.

In concert with proven screening and selection processes, improved career patterns and ladders for officers choosing B/FM in weapon system programs must be developed. Whatever the mechanics of such development, it is axiomatic that few qualified officers (line or staff) will be attracted unless an equivalent potential for advancement compared to other opportunities exists.

Historically, the unrestricted line has placed a premium on operational experience, the restricted line has placed its emphasis on technical experience, and the Supply Corps has not viewed tours in systems acquisition as particularly beneficial; therefore, positive action to make B/FM in systems acquisition attractive will be required. As one senior Supply Corps officer stated, in order for the proposed B/FM concept to work, at least so far as the Supply Corps officers are to be involved, the Navy will have to insist on assignment of the Corps' better talent and ensure that the individuals assigned are promoted with or ahead of their contemporaries.

To achieve an appropriate career path in the B/FM area, the officers involved must not only be assured of promotional opportunities to flag rank, but must be offered a hierarchy of systems acquisition-related billets, which will allow experience to be gained at the various stages of the officer's career as well. Opportunities for postgraduate education in B/FM-related fields must be opened up and qualified officers of all designators encouraged to apply. For many of the reasons discussed above, establishing appropriate career development opportunities may require initiation of a new subspecialty.

In a somewhat different manner, the existing civil service system has failed to develop a cadre of individuals who are prepared to complement the naval service in overseeing the full range of B/FM functions in the PMO. The civil service position series, as it is currently structured, generally precludes the capable entry level individual from gaining sufficient insight into the functions of other series, thereby preparing him to manage activities adequately in several related series (e.g., an individual may be qualified in budget development or contract administration, but is seldom sufficiently proficient in budget development, contract administration, and other related functions to be charged with oversight responsibilities). A way must be found to hurdle the artificial barriers imposed by the current system and develop a civil service career path leading from entry level to supergrade that is marked by opportunities for a variety of assignments, including postgraduate education in a broad range of business-related fields.

In order for individuals (both civilian and military) who have chosen careers in business and financial management to take full advantage of the opportunities available, well defined career ladders must be accompanied by adequate preparation to assume each step on the ladder. Courses such as the 2-week course in corporate finance offered by the DSMS at Fort Belvoir, the 6-week course addressing cost control offered by the Postgraduate School (PGS) at Monterey, or even the 20-week course in systems acquisition management offered at DSMS cannot be expected to provide more than an overview of, and general insight into, some of the problems to be addressed in a typical program office.

The Cost Panel believes that a well rounded training program should combine an understanding of the theory of business and financial management with on-the-job experience and the opportunity to observe industry without having to assume an adversarial role or to operate in support of the Navy or DOD position. The Panel also believes that the well qualified B/FM should have had the following training:

- At least 3 years' experience in a subordinate position in the B/FM function in a project office

- A postgraduate degree in either business administration or one of the business-related disciplines and a 1-year (or longer) training-with-industry tour conducted along the lines of the Air Force program.

The Panel recognizes that in order to realize the benefits of a training path such as the one outlined above, a significant commitment to the individual in both time and money must be made early in his career. It is also recognized that, for many officers, a greater degree of specialization must be accepted. It is the Panel's conviction, however, that both the specialization necessary and any temporary inconvenience or expense caused by sending individuals to school or to a 1-year exchange program with industry will be far outweighed by the ultimate benefits that will be derived by the service.

NAVMAT and DOD Instructions currently in draft form speak to improving WSAM selection and career development (both civilian and military) by establishing a "steering committee" within NAVMAT to provide general direction to the effort. Because the development of capable B/FM personnel will require difficult and unpopular decisions and, as such, committees tend to operate by consensus (particularly over the long run if they remain operative), the committee approach is felt to be inappropriate. Rather, a permanent oversight group organizationally located where it can monitor and direct progress on billet definition, personnel selection, career guidance, and career development seems to hold greater promise for long-term success.

(4) Recommendations

The selection and career development of civilian and military business and financial management (B/FM) should be improved by:

Recommendation COST-47: Develop appropriate B/FM billets in the major program management offices as discussed earlier in conjunction with issues presented in Section 11. The first step in this effort should be the internal resolution as to the source of these billets in relation to personnel ceilings.

Recommendation COST-48: Investigate the feasibility of either dividing the WSAM subspecialty designator system into subordinate parts (business/financial management, technical direction, and fleet integration and support), or establishing a new subspecialty for business/financial managers in systems acquisition; and implement the results of the investigation.

Recommendation COST-49: Revise BUPERS Instruction 1040.2 to encourage financially oriented officers to seek careers associated with the WSAM subspecialty.

Recommendation COST-50: Investigate the feasibility of establishing a new career civil service series (entry level GS-9 or 11) designed to develop individuals for key project office positions who are versed in all aspects of B/FM as related to systems acquisition and establish such a series if feasible.

Recommendation COST-51: Develop and implement guidance and procedures designed to result in comprehensive and tailored training programs for civilians and military officers who choose a career in B/FM.

Recommendation COST-52: Establish a permanent oversight group under the ASN/FM to develop, implement, and monitor progress on civilian and military career progression opportunities and patterns, assignments, training provisions, etc. of individuals involved in the acquisition of weapon systems and other finance-related careers in the Navy.

Recommendation COST-53: Establish procedures to ensure that only the better qualified individuals are selected for B/FM assignments and, if officers, their careers are enhanced by such assignment (assuming, of course, adequate performance).

13. FOREIGN MILITARY SALES

The sale of U.S. Navy weapon systems internationally has increased substantially in recent years, and the potential for continued high sales remains good. The Navy must be able to manage effectively programs for international customers dealing with the U.S. Government in the purchase of Navy weapon systems.

(1) Statement of the Issue

Foreign military sales (FMS) of U.S. defense systems can be accomplished on a commercial or direct sale basis between a U.S. contractor and a foreign customer, in which case, the U.S. contractor has the responsibility for management of the program. On foreign military sales that require a government-to-government procurement, it is necessary that the responsible military service be able to manage effectively the programs for international customers.

Foreign military sales have been managed effectively by the Navy for many years and do not represent a new problem area. Programs such as the F-4, A-4, and SPARROW are examples of successful FMS programs carried out by the Navy. However, the recent increase of FMS sales and the future potential coupled with the reduction in Navy personnel gives rise to the question whether current FMS programs will be managed effectively.

This issue concerns the adequacy of the financial management organization and personnel necessary to FMS activities of U.S. Navy defense systems procured through the U.S. Government.

(2) Study Approach

The Cost Panel met and discussed the issue with personnel in OSD-ISA, OP-63, PM-21, and NAVAIR and reviewed the F-4, S-3A, PF, HARPOON, and SPARROW programs. The Panel also discussed the issues with various industry people.

(3) Findings and Conclusions

Organizationally, the DOD/Navy interface is considered satisfactory. A single point of contact between DOD and the Navy for foreign military sales is essential, and the role of OP-63 in this area appears to be adequate.

Timeliness and accuracy of cost estimates for Letter of Offer (LOO) proposals for international customers generally are in need of improvement. Timeliness of response is important to the U.S. Government in relation to the competition with systems offered by other countries. Reasonableness of cost estimates provided in LOO by the U.S. Government in relation to the actual cost of systems procured by international customers is important in maintaining a credible image in the international market place. The Cost Panel noted that:

- Recent experience indicates that estimates used in LOO are generally lower than ultimately contracted, causing U.S. credibility to suffer in the international market. Recent inflationary factors are the principal cause for these low estimates and are not necessarily unique to the Navy.

- Response time to requests for LOO exceed that desired by the foreign customer in some cases.

Navy SYSCOM/Project Management Offices have the responsibility to manage the acquisition of the Navy weapon systems for foreign customers procured through the U.S. Government. In NAVAIR, which accounts for nearly two-thirds ($2.4 billion) of Navy FMS funding, this responsibility is carried out on major systems through a combination of the appropriate project management office and NAVAIR-01A4, which provides the continuity and coordinating functions concerning

FMS. For smaller FMS cases, NAVAIR-01A4 performs the acquisition and coordination functions. The increase in FMS sales, coupled with the general reduction in Navy personnel, places a substantially increased burden on these organizations. There is need to adjust personnel ceiling restrictions in order to manage certain FMS programs adequately, and actions recognizing this need are underway.

Letters of Offer negotiated between the U.S. Government and foreign governments normally contain an administrative charge that includes the U.S. Government's cost to manage and administer the weapon system acquisition on behalf of the foreign customer. Therefore, U.S. Navy costs to manage foreign programs are, to a degree, reimbursable, and to that extent an increase in personnel above present ceiling restrictions appears appropriate when required to manage FMS programs adequately.

The Security Assistance Programs (SAP) or foreign military sales organization within NAVMAT is now PM-21 (formerly MAT-045). The charter for this organization and the responsibilities of the SYSCOMs appear to represent a "layering." PM-21 does represent a single point of contact with OP-63 and provides a monitoring function to CNM and to that extent may be desirable. However, in view of the number of individual FMS cases active within the Navy, it does not appear to be appropriate or desirable to have FMS actions flow through this organization on their way to or from OP-63 and the SYSCOM action organization.

Financial aspects of systems sold to foreign customers vary considerably, but generally financial management of individual cases defined in the LOO is required and periodic reports must be provided to the customer. In some cases, resident customer personnel in the financial management area are assigned to the United States in Washington, D.C., and/or the contractor's plant. It is important in these instances that the Navy have competent financial management personnel assigned to the program.

In addition to the financial aspects of FMS cases, other requirements of various customers differ from each other considerably. As an example, the number of foreign representatives who reside in the United States for a specific program can vary between zero and upwards of 50 located in Washington, D.C., and the

contractor's plant. These foreign representatives, in addition to financial management personnel, can include program managers, technical personnel, logistics support personnel, and operational personnel.

(4) Recommendations

As a result of the findings and conclusions summarized above, the NMARC Cost Panel makes the following recommendations regarding foreign military sales:

Recommendation COST-54: It is recommended that the program office organization be strengthened in those cases where it is essential that Navy systems for foreign customers be procured through the U.S. Government. This should include the addition of a strong program management type of person, as well as a financial manager and appropriate personnel in other functions, to serve as an active focal point in the program office to assist in the marketing and management aspects of these specific foreign military sales.

Recommendation COST-55: Recognizing the reimbursable nature of management/administrative costs of FMS programs, an increase in personnel above present ceilings should be permitted when required to manage these government-to-government programs adequately. However, industry capability to perform and manage these efforts should be utilized wherever feasible.

Recommendation COST-56: The Navy should review organizational elements between the marketing organization (OP-63) and the acquisition organization (SYSCOM/project office) to reduce or eliminate the layering of intermediate functions.

14. LAYERING—FINANCIAL MANAGEMENT FUNCTION

In recent years, layers have built up in the financial management function just as they have in about every other functional area within the Department of Defense. It is questionable if these additional layers have assisted the weapon acquisition process, and consideration should now be given to eliminating one or more layers in the financial management function.

(1) Statement of the Issue

The major issue is whether the Navy can reduce the number of organizational layers in the financial management chain of command by the following actions:

- Consolidating OP-92 with the Navy Comptroller's Budget Office (NCB)
- Merging MAT-01 of the CNM organization into the consolidated NCB group.

(2) Study Approach

The NMARC Cost Panel's approach to studying this issue was first to read and review all major studies on this issue. These included:

- Recent SECNAV, CNO papers on the NCB/OP-92 Consolidation issue
- House Appropriations Committee Reports, 1973 and 1974
- Cresap, McCormick and Paget Study dealing with financial management in the Navy (Phases I and II)
- SECNAV Financial Management Study
- Previous NAVCOMPT Study
- Previous CNO Studies.

The Panel also discussed this issue with present and former incumbents who held responsibility in the following positions:

- ASN (FM)
- NCD
- NCB
- OP-090
- OP-92
- CNM
- MAT-01
- MAT-02
- Systems Commanders
- Various Program Managers
- Fiscal Director, Marine Corps.

(3) Findings and Conclusions

The following chart is a simplified historic portrayal of the Navy chain of command for financial management. It should be noted that the Navy has added two layers of management review during the past decade.

1921	1959	1963	1971
President	President	President	President
	SECDEF	SECDEF	SECDEF
SECNAV	SECNAV	SECNAV	SECNAV
		CNM	CNO
Bureaus	Bureaus	Bureaus	CNM
			SYSCOMs

The House Appropriations Committee has never been happy with the OP-92/NCB split and has repeatedly urged the Navy to do something about it. The following is a quote from last year's committee report:

The committee concluded that there is an unnecessary split of the financial management/comptrollership function within the Navy. The Navy currently, and for the past 3 years has operated separate budget offices within the Office of the Assistant Secretary of the Navy for Financial Management and the Office of the Chief of Naval Operations. Despite previous criticism on this subject, the Navy has done little but repeatedly study the problem using in-house study teams and paid consultants. About all that has resulted from the studies to date is the use of a new term within the Navy called 'Integrated Fiscal Management Improvement System' (IFMIS). The Committee fails to see how the financial management system can be integrated when the proposal encompasses the retention of split responsibilities at the top.

The time for action has arrived. Thus, the committee requests that as a first step in its integrated fiscal management improvement system the Navy consolidate its budget offices.

The CNO/CMC/SECNAV organizations have basically agreed to the consolidation of OP-92 and NCB under one Navy budget officer. The remaining question is the reporting line of responsibility and authority for the budget officer and the consolidated budget office. The Secretary of the Navy has requested a plan for combining the budget offices on 1 February 1975.

The other layer of financial management review that should be addressed is the MAT-01 organization, which is the financial agent for the Chief of Naval Material (CNM). The MAT-01 organization serves the CNM and the Navy Material Command in all areas of planning and programming, budget formulation, and budget execution. During the past year, this organization has experienced a 50 percent reduction in personnel. The group is presently organized as follows:

ONM Appropriation	3 professionals*
	1 vacant military position
	1 clerical

OPN Appropriation	5 professionals* 2 clerical
Procurement Appropriations	7 professionals* 2 clerical
Program Policy and Special Projects	4 professionals* 1 vacant military position 2 clerical
Financial Management Systems	3 professionals* 2 clerical

Deputy Chief of Naval Material (Programs and Financial Management) (RADM); Associate Director, (GS-17): Deputy (Captain), plus clerical support

The capability of MAT-01 appears to have been reduced through personnel reductions to the point that its function could and should be accomplished by the consolidated OP-92/NCB group. The Chief of Naval Material might wish to retain a few financial experts as part of his personal staff, but this would probably be not more than five or six individuals.

(4) Recommendations

The NMARC Cost Panel offers the following recommendations regarding financial management layering:

Recommendation COST-57: The Secretary of the Navy should determine how best to consolidate OP-92 and NCB, after fully considering the views of the CNO and CMC. The Panel recommends that the primary responsibility be assigned to the Assistant Secretary of the Navy (Financial Management) with the necessary reporting

* Military and civilian

alignment to serve properly the Chief of Naval Operations and the Commandant of the Marine Corps. It is very important that the consolidation of the budget functions be accomplished in a manner that does not result in any dilution of the ability of the Comptroller of the Navy to exercise his statutory responsibilities relative to the budget process.

Recommendation COST-58: In order to assist with the current personnel cutbacks and to reduce layering, consideration should be given to merging MAT-01 into the new consolidated NCB budget office (see Recommendation COST-57). This recommendation is put forth with the full recognition that most Chiefs of Naval Material would want a MAT-01 organization to run the budget program for them and to allocate funds between the various systems commands and project offices. Most CNMs would feel that they have lost a significant part of their command and organization if they gave up the MAT-01 organization with its control over the budget dollars. However, it is questionable if many major weapon systems were ever significantly aided by this additional layer in the financial management chain. The NMARC Cost Panel believes that the CNM should exert his command influence and allocation decisions (between systems commands/program offices) on budgetary matters through the new consolidated NCB organization. It is suggested that consideration be given this recommendation about 6 to 12 months after the OP-92/NCB consolidation has been effected.

15. ECONOMIC ESCALATION

The proper budgeting, funding, and reporting of major weapon systems programs requires the prediction and inclusion in the estimating, budgeting, and reporting process of the best projections available for the costs of economic escalation.

(1) Statement of the Issue

Except during extended periods of economic stability, economic projections are difficult to make, and some uncertainty as to their ultimate accuracy will exist. When, for

various political or budgetary reasons, the most accurate economic projections available are subjected to downward bias and these lower projections are included in the budgeting and funding process, the problem of program underfunding is greatly magnified. Failure to provide adequate protection to contractors against unforeseen financial risks caused by economic escalation can likewise adversely impact weapon programs. The major issues are the following:

- Does the Navy have the capability to predict and estimate inflationary trends adequately?
- Are inflationary trends included and identified in the estimating and budgeting process?
- Does a consistent and realistic policy dealing with economic inflation exist?
- Do the escalation clauses in contracts provide reasonable protection to contractors?

(2) Study Approach

The Cost Panel approached the study of this issue by reading pertinent prior studies and reports. These included:

- SCN Pricing and Cost Control Study Summary Report, April 1969
- NAVSHIPS Cost Estimating Capabilities, June 1969
- Shipbuilding and Conversion Improvement Program (SCIP)
- Influences on Naval Ship Cost Estimating for Budget Purposes, DOD Cost Research Symposium, March 1970
- Report of the Pricing Subcommittee on a Review of Cost Estimating Techniques within DOD, Sept. 1970
- NAVELEX Estimating Guide

- GAO Report on Theory and Practice of Cost Estimating for Major Acquisitions, July 1972
- Booz, Allen Report on Government and Industry Cost Estimating and Cost Control, April 10, 1969
- NAVSEA Inflation Escalation Indices
- Compilation of Recent Shipbuilding Cost Information: Vol. II, June 1974
- Hearings Before the Subcommittee of the Committee on Appropriations, House of Representatives, 1969-1974
- Pricing and Contracting for Inflation, Harold E. Sharp, ACO Air Force Office, McDonnell Douglas, NCMA South Bay Chapter, Spring 1971
- MAT-02 Studies on this Issue
- Bureau of Labor Statistics, Material and Labor Indices
- Conference Board Economic Studies and Projections, Rinfret Boston Associates, Inc.

The Panel also discussed the issues with personnel in the following functional areas:

- SYSCOM estimating groups
- OP-096D
- CAIG
- NAVCOMPT
- MAT-02.

The Panel reviewed the contract escalation clauses for the following ship construction programs:

- CVAN-68 and -69
- DLGN-36 and -37
- SSN-688 Class
- TRIDENT SSBN
- DLGN-38 Class.

(3) Findings and Conclusions

The effect of economic escalation has been generally understated in the Navy's weapon systems program budgets, with the result that major cost growth has been reported (for example, the September 30, 1974, SARs). Part of this cost growth is the result of the present uncertain and highly inflationary state of the economy. This could not have been foreseen when prior-year programs were budgeted, but indications of an accelerating inflation were evident at the time of the formulation of the POM-76. The remainder of this economic cost growth is primarily the result of:

- The use of OSD/OMB-projected escalation indices that have been lower than published economic indications
- OSD's approving and requiring the use of indices lower than those projected by SYSCOMs
- Lack of consistent and realistic overall internal Navy policy guidance for the prediction and estimation of economic escalation
- Lack of capability within some of the SYSCOMs (NAVELEX and old NAVORD) to address and predict economic escalation adequately.

OMB Directive CIR A-11 does not permit budgeting for anticipated inflation in annual accounts; therefore, these accounts are being underfunded.

Until recently, the factors used and the dollar amounts included for economic escalation were not always separately and clearly identified in the estimating and program budgeting process, making difficult the tracking and explanation of this cost growth to the Congress and the public.

Policy guidelines do not exist that would provide for consistency and uniformity of treatment for the reporting of escalation in the budgeting and SAR cycles. Projections for escalation in the SARs for out-years do not necessarily use the same indices as those used for program budgeting during the same periods.

The escalation clauses in Navy ship construction contracts fail to provide the protection needed by contractors under the present rate of inflation. The primary reason for this lack of protection is the failure to provide for escalation protection beyond target cost and target schedule in the manner that incentive contracting contemplates on base dollar costs and schedule.

The economic price adjustment provisions in the Armed Services Procurement Regulations (ASPR) are too restrictive to provide adequate protection for economic escalation. ASPR 3-404.3 restricts its use to fixed-price contracts at the option of the contracting officer. The clauses in ASPR 7-106 limit escalation adjustments to 110 percent of the original contract price.

The use of option provisions in new procurement and the exercise of option provisions in existing contracts under the present economic escalation conditions will result in undue financial risks as contemplated in ASPR 1-1503.

(4) Recommendations

As the result of the analysis summarized above, the NMARC Cost Panel makes the following recommendations regarding economic escalation:

> Recommendation COST-59: The Navy should obtain agreement with DOD and OMB for the elimination of the use of other than the most realistic projections of economic escalation in estimating and budgeting for major weapon systems.
>
> Recommendation COST-60: The Navy should improve its in-house capability to forecast the effect of economic escalation. At the present time, NAVSEA (SHIPS) has the most proven capability. Except in NAVSEA and NAVAIR, this ability does not exist to any marked degree. Overall policy guidance must be developed, and the capability of each SYSCOM and PM-1 must be strengthened. Overall DOD direction should be provided by ASD (Comptroller) and OMB's approval should be obtained.

Recommendation COST-61: The Navy should adopt one of the following approaches to identifying and funding economic escalation:

- Include in the budgeting and programming process the best estimate of inflation that can be predicted. Set forth these amounts separately in the funding requests to Congress and clearly show the basis for the predictions. Gain congressional recognition that these projections may be subject to change either up or down depending on economic trends over which the Navy has no control.

- Include in the budgeting and programming process the best estimates of inflation that can be predicted to provide Congress with some guidance as to possible total end cost of each major weapon system. Obtain congressional concurrence to agree to fund only the base year dollar end costs plus one out-year's projection of inflation. In each succeeding year's budget include one more year of inflation projections until no more out-year projections are required.

Recommendation COST-62: The Navy should improve its major weapon system scheduling. The projection of realistic schedules, taking into account the best available information on lead times for material acquisition and taking into account the time required to accomplish the scope of work, is necessary if the provisions for economic escalation are to bear a reasonable relationship to actual experience.

Recommendation COST-63: The Navy should obtain permission to include economic escalation in annual accounts and keep visible the amounts included.

Recommendation COST-64: The Navy should continue to improve the present policy of using base-year dollar estimates with economic escalation shown as a separate identified cost.

Recommendation COST-65: The Navy should provide policy guidance to insure that the amounts included for

economic escalation in the programming, budgeting, and SAR cycles for the out-years are reported consistently and uniformly.

Recommendation COST-66: The Navy should complete MAT-02's effort to develop escalation clauses for shipbuilding contracts that will provide protection to contractors for economic escalation. Recognition must be given to the fact that these clauses must have the basic flexibility to be modified as required to suit the particular circumstances of various types of procurements. These clauses should provide for divorcing the effect of escalation from the basic risk-sharing arrangements of fixed-price-incentive-fee (FPIF) contracts by providing protection to ceiling. They should also consider extending the application to cost-type contracts. In addition, it would appear necessary for the Navy to encourage the flowdown of escalation provisions to subcontractors when the prime contractor has such protection.

Recommendation COST-67: In conjunction with the other services, the Navy should recommend to DOD a revision to ASPR 3-404.3 and ASPR 7-106 to broaden the ASPR coverage for economic price adjustments.

Recommendation COST-68: The Navy should not include option provisions in new long-term procurements under the current economic environment without making adequate provision to protect the contractor against the effects of economic escalation.

Recommendation COST-69: DOD and the Navy should continue their efforts to develop and apply equitable adjustments to existing contracts to minimize the effect of economic escalation.

16. INTEREST

Interest is a true economic cost that must be recognized in prices if U.S. Defense contractors are to remain viable suppliers of goods and services for defense and for the nation.

(1) Statement of the Issue

In recent years, interest (or the time cost of money)—both interest on borrowings and imputed interest on equity capital—has become a significant cost in the performance of Defense contracts. The major issues with respect to interest as a cost are:

- Is contractor investment important in Defense work?
- Is interest on investment a cost?
- Is imputed interest a good measure of the time cost of money?
- Is the concept of imputed interest too difficult to manage administratively?
- If the contractor is to receive imputed interest, how should it be calculated?

(2) Study Approach

To study the issue of interest, the NMARC Cost Panel first read and reviewed all major studies on this issue. These included:

- DIAC Working Group Report ("Charles Report"), May 15, 1965
- IAC Subcommittee Report ("Fox Report"), June 11, 1971
- Joel Dean Associates, "Reconnaissance of Military Pricing," November 9, 1962
- Joint Industry Conference Meeting (October 1958)
- LMI "Study of Profit or Fee Policy"
- Trueger, Paul M., Accounting Guide for Defense Contractors (6th ed., 1971)

- Williston on Contracts (3rd ed., 1961)

- Wright, Howard M., Accounting for Defense Contracts, 1961.

The Panel reviewed the following statutes and regulations: (1) Uniform Commercial Code, (2) ASPR Section 15, 1949 Edition, (3) ASPR Section 15, 1959 Edition, (4) ASPR Section 3 and ASPR Section 7, (5) DPC 5, (6) DPC 79, (7) DPC 96, (8) DPC 107, (9) Treasury Decision 5,000 and (10) "Green Book."

The Panel reviewed the recent board and court decisions concerning interest. These included:

- Aerojet-General Corporation, ASBCA No. 17171.

- Joseph Bell, et al. v. United States, 186 Ct. Cl. 189, 494 F2d 975 (1963)

- Drexel Dynamics Corporation, ASBCA Nos. 9502, 9617, 9793 and 10608

- Dworshak Dam Constructors, Eng. BCA 3240, 73-2 BCA

- Dynamics Corp. of America v. United States, 182 Ct. Cl. 62 (1968)

- Dynaport Electronics, Inc., ASBCA No. 17895, 74-1 BCA

- Fairchild Industries, ASBCA No. 15272, 74-1 BCA

- Foster Construction C.A. v. United States, 20 CCF para. 83,036 (Ct. Cl., Trial Judge Schwartz, 10 May 1974)

- General Dynamics Corporation, ASBCA No. 13825, 73-2 BCA

- Gibbs Shipyard, Inc., ASBCA No. 9998, 67-2 BCA

- J. D. Hedin Construction Co. v. United States, 197 Ct. Cl. 782 (1972)

- Kaman Aircraft Corporation, ASBCA No. 10141, 66-1
- Keco Industries, Inc., ASBCA Nos. 15061 and 15131, 71-1 BCA
- Keco Industries, Inc., ASBCA No. 12729, 71-1-BCA
- Lake State Manufacturing Corporation, ASBCA No. 17286, 73-2 BCA
- Lieb Brothers, Inc., ASBCA Nos. 10007 and 10008, 74-1 BCA
- Newport News Shpbldg. & D. D. Co. V. United States, 179 Ct. Cl. 97 (1967)
- Newport News Shpbldg. & D. D. Co., ASBCA 71-1 BCA
- Oxford Corporation, ASBCA Nos. 12298 and 12299, 69-2 BCA
- Phillips Construction Co., Inc. v. United States, 179 Ct. Cl. 54 (1967)
- Rainier Company, Inc., ASBCA No. 3565, 57-1 BCA para. 1231, 59-2 BCA
- Rainier v. United States, 137 Ct. Cl. 210 (1957)
- Roscoe-Ajax Construction Company, Inc., ASBCA No. 12110, 71-1 BCA
- Sanders Associates, Inc., ASBCA No. 8481, 65-2 BCA
- Singer-General Precision, Inc.—Librascope Group, ASBCA No. 13241, 73-2 BCA
- Sun Electric Corporation, ASBCA No. 13031, 70-2 BCA
- Wichita Engineering Co., ASBCA No. 2522, 6 CCF (1955).

The Cost Panel also discussed this issue with various lawyers, people in the Department of Defense, and members of industry.

(3) Findings and Conclusions

The economic history of interest on Defense contracts indicates that a distinct and major change occurred in the Defense contract industry investment in the early 1960's.

Prior to 1959, the Department of Defense furnished nearly all of the capital required for Defense contract work. The Department of Defense provided contractors' capital through cost-reimbursable contracts, through large government-owned, contractor-operated (GOCO) facilities, and through tooling and equipment, which was furnished or loaned to contractors under the Government-Furnished Property clauses. During this earlier time, Defense contractors needed and made only a minimum investment in plant and working capital for contract performance. Capital turnover was high; therefore, contractors and Government procurement personnel were not concerned with interest in a major way.

In the 1960's the Defense investment picture changed dramatically. The Department of Defense began to require contractors to invest more and more capital in plant and working capital for their Defense business. At the same time, the Government increased the use of fixed-price contracts, reduced the number of GOCO facilities, and reduced the amount of Government-furnished tooling and equipment. Also, reimbursement for changed work has not been accomplished on a timely basis. Contractor investment and interest costs have increased significantly.

A major problem has arisen for contractors and the Department of Defense because interest costs on contractor investment are now higher than in earlier years, thereby making proper cost determination for interest necessary (collecting all cost in prices), and the Department of Defense has not given adequate consideration to the increased contractor investment in Defense work and does not give recognition to contractors for the increased interest cost that such an increased investment bears.

This second notion is often referred to as the "disallowance of interest"; it was continued and extended further by the Department of Defense through application of the Armed Services Procurement Regulations (ASPR) provisions for fixed-price contracts. The concepts reflected in the ASPR provisions denying interest on borrowings were designed in an era when major procurement was done through cost-reimbursable contracts, when contractors' investment was much lower, and when interest was of much less real economic concern. With the advent of the requirement for substantially increased contractor investment, the problem of proper cost determination for interest cannot be avoided any longer.

The Cost Panel recognizes that there are necessarily two elements to the problem of interest and its cost to Defense contractors. Both require resolution. One, addressed in this section, is the need to compensate contractors for the legitimate costs of their investment in work-in-process. The other element involves the use of progress payments to limit contractor investment in work-in-process (and hence interest costs) to an economically supportable, equitable, and efficient level. This element is addressed in Section 17 of this chapter.

It is essential that contractors recover all their legitimate cost in Defense contract pricing. Interest, or the time cost of money, is a true economic cost. This is a fact, regardless of whether the interest in question represents actual payments for interest on borrowings or whether it represents imputed interest arising from the use of a contractor's own equity capital. Interest on borrowings as a real cost has been recognized in recent years by appeal boards and courts in the area of changed work under Defense contracts. Recently, imputed interest—just as much a cost as interest on borrowings—has been recognized by the Armed Services Board of Contract Appeals as an appropriate cost in a major appeal by Aerojet General Corporation (ASBCA No. 17171). If all investments are properly recognized and treated equally in Defense contract pricing, a new law need not be made for the recognition of interest as a cost. Interest can simply be imputed to investment.

The Armed Services Procurement Regulation does not disallow imputed interest that is applied to investment. The Armed Services Procurement Regulation only makes interest on

"borrowings" not allowable. Therefore, imputed interest could be introduced as an appropriate and proper cost in all Defense procurement pricing, although it should be done through the ASPR.

The imputing of costs in general is not a new concept in accounting or in regulatory pricing. Even imputing of interest is not a new concept. Interest, imputed or on borrowed funds, is well recognized as a cost in the accounting and pricing of public utilities.

The Accounting Principles Board regularly imputes cost. For example, imputing of cost is found in Accounting Principles Board Opinions Number 7, "Accounting for Leases in Financial Statements of Lessors," number 8, "Accounting for the Cost of Pension Plans," number 11, "Accounting for Income Taxes," number 16, "Business Combinations," and number 25, "Accounting for Stock Issued to Employees." Moreover, costs are regularly imputed in public utility ratemaking—for example, in establishment of fair value rate bases. Finally, the Department of Defense and the Navy regularly impute costs, other than interest costs, in pricing of the following:

- Changed work
- Salaries for proprietors and partners
- Construction contract costs based on Associated General Contractors' (AGC) rates
- Unfunded past service pension costs
- State and local income taxes and tax credits.

Appeal boards and courts have recognized imputed costs for the pricing of Defense contracts; this has been done in the appeals of Bruce Construction, ASBCA No. 5932; Sperry-Univac, ASBCA No. 13588, 70-2 BCA 9 8555; and Western Electric, 68-2 BCA 9 7275.

The imputing of interest is also a fairly common practice. Accountants impute interest when they use Accounting Principles Board Opinion No. 21, "Interest on Receivables and Payables,"

or when accountants use Accounting Principles Board Opinion No. 5, "Reporting of Leases in Financial Statements of Lessee." The regulated industries, such as public utilities, regularly impute interest on funds required for construction of facilities for accounting or pricing (ratemaking). This imputing of interest is often called "interest during construction" or "an allowance for funds used during construction." The Department of Defense and the Navy impute interest in their application of the Armed Services Procurement Regulation, Appendix E-528, (when a progress payment clause is added to a contract) and the payment of interest on claims through ASPR provision 7-104.39.

Imputing interest would not be administratively difficult to manage. Boards of contract appeals, courts, accountants, economists, and many persons in Government have been imputing interest for years. The concept is simple. When the Department of Defense uses a contractor's money (without regard to the source of that money, whether it be borrowed or equity capital), the Department of Defense must recognize the capital investment and pay for the use of the money.

If a contractor is overpaid today, he must refund the overpayment to the Department of Defense and Navy, and he must reimburse the Department of Defense and Navy for the use of their money through an interest allowance. It is only fair also to give recognition of interest in the opposite situation, that is where the Government uses the contractor's investment.

Interest can be defined to be the payment for the time cost of money. It is calculated using the simple formula:

Principal x Rate x Time

The principal amount is the amount of money invested or due from the Government. A practical interest rate can be settled on and might include one of the following rates:

- Contractors' short-term interest rate plus allowances for such things as compensating balances
- The prime rate plus some percentage to give recognition to the risk of the lender to the defense contractor, plus some allowance for such things as compensating balances (for example, 150 percent of the prime rate)

- The rate set by the Secretary of the Treasury adjusted upward for such things as compensating balances

- Other rates that measure fairly the time cost of money.

The length of time involved in an interest calculation could essentially be established as the date from the time the money was used until the time the money was paid.

Two questions do arise from time to time concerning interest on investment. Often the question is raised as to whether interest cannot be just left as a part of profit. It was tried in DPC-107 and did not succeeed. The reason that such an interest-in-profit system does not succeeed is the failure to have true accountability unless interest is dealt with as a cost.

Another question arises as to why interest must be dealt with as a cost rather than as a profit. This has to do with the capability, training, and expense of Government procurement personnel to handle the matter of investment. The Cost Panel believes that Government procurement personnel can handle the matter of investment and of insuring that interest is paid fairly from contract to contract, if interest is dealt with as a cost, and if it is subject to proposal amount presentation and Government audit. To bury interest together with profit is to allow some contractors to be paid some interest and others not to be paid an equivalent amount under equal circumstances.

(4) Recommendations

The NMARC Cost Panel offers the following recommendations for consideration:

Recommendation COST-70: DOD and the Navy should recognize imputed interest as a cost under all Government contracts.

Recommendation COST-71: DOD and the Navy should form a committee that includes industry representatives to draft an ASPR clause and to determine the mechanics of calculating the investment and cost. This recognition of investment should be done on a two-stage basis. At first, rough or approximate calculations should be sufficient. Later, as experience in this matter is gained, more guidance can be given Government and contractor personnel.

Recommendation COST-72: If ASPR revision is considered necessary, DOD and the Navy should revise the ASPR to recognize imputed interest as a cost.

17. CASH FLOW/PROGRESS PAYMENTS

Navy and the DOD have recognized that progress payments are required in certain procurements since total reliance on private financing could result in greatly increased weapon system costs and perhaps would exceed the commercial credit available to finance Defense work.

(1) Statement of the Issue

Recent studies of contract financing have led to changes in progress payment practices for shipbuilding contracts. The major issues are:

- Do present progress payment practices contribute to undesirable cash flow difficulties for contractors?
- Do contributing factors exist that affect the progress payment practices and impact contractor cash flow adversely?

(2) Study Approach

The Cost Panel approach to studying this issue was first to read recent studies and the pertinent Navy Instruction on the issue. These included:

- Report of the Industry Advisory Council Subcommittee to Consider Defense Industry Contract Financing, June 1971
- Defense Industry Profit Review by Logistics Management Institute, November 1967
- SECNAV Instruction 7810.11
- Report of Task Group to Study Shipbuilding Progress Payments, July 1972.

The Panel discussed the issues with personnel in the following functional areas:

- MAT-02
- NCB.

These issues were also discussed with several major shipbuilding contractors.

(4) Findings and Conclusions

The recent Industry Advisory Council (IAC) study, "Defense Industry Contract Financing" (the Fox Report), was prompted by the following three factors:

- The growth in demand for Government contract financing
- The growth in outstanding progress payments
- Concern that Government financing policies were causing inequities among contractors.

The report focused on cost-based progress payments. In general, the report recommended a more restrictive definition of cost incurred, a more uniform approach to progress payment frequency, and the allowance of imputed interest in calculating profit on capital for contract profit determination. As a general conclusion, the report reinforces the concept of contractor investment in contract work-in-progress and encourages the use of more private capital on a short-term basis

to cover this investment. The report also recommended an in-depth study of progress payments based on a percentage of stage-of-completion basis.

The Task Group to Study Shipbuilding Progress Payments was established in response to that recommendation, and its report was delivered on July 31, 1972. SECNAV Instruction 7810.11 was issued on March 13, 1973, to implement the recommendations of the task group.

This instruction set out a dual payment scheme. Progress payments were to be continued to be paid in accordance with the provisions of ASPR, Appendix E, Part 5. Progress payments based on costs were to be made at the rate of 80 percent for non-small-business concerns. For non-small-business concerns, seven interim payments are to be made based on increments of 10 percent in the relationship of progress payments incurred to contract price. However, certain physical completion percentages must be attained prior to the interim payment.

The instruction includes the more restrictive definition of cost incurred as suggested by the Fox Report. The mechanics of the dual payment technique assure that contractors will have an investment in contract work-in-progress. In application, the technique would require additional private financing over prior progress payment practices, particularly during the periods between the interim payments.

This step-level approach to contract financing/Government progress payments came at an unfortunate time, as both shipbuilding contractors and Navy personnel have stated to the NMARC Cost Panel. The requirement for additional private financing of work-in-progress and the severe tightening in commercial credit markets and subequent increases in interest costs combined to raise serious problems in implementing this Instruction.

As a result, only one minor contract has been signed incorporating this Instruction since its issuarce. The Panel believes a major difficulty in the dual-payment technique is that it attempts to place a universal solution on a nonuniform situation. The ability of contractors to sustain investment in work-in-progress varies in relation to a number of factors; among them are:

- The amount of investment required before the delivery of a contract end item and the length of time which that investment is accumulated

- The contractor's financial base and working capital situation that must furnish the funds for investment, if funded internally

- The contractor's access to commercial credit markets or other debt or equity sources for externally generated funds for investment

- The contractor's ability to incur the cost of providing or acquiring the required funds for investment in contract work.

The Cost Panel is not convinced that the progress payment procedures included in SECNAV Instruction 7810.11 adequately consider these problems.

Contracts signed since April 1, 1973, that do not incorporate SECNAV Instruction 7810.11 have required a waiver of that Instruction and have generally included a modification of the previous progress payment method. There are concerns regarding this modified method also. Briefly, the previous method was generally based on a percentage of the result of multiplying the billing base, less a holdback, by the physical completion percent. The sum of payments was limited to the lesser of physical progress or 105 percent of costs incurred. The present modification reduces the cost incurred limitation to 100 percent. As a result, there is now little potential for realizing any profit on costs incurred until an end item is delivered or the contract completed.

But, just as important, perhaps, is the problem of base. The difficulty expressed by contractors has been one of obtaining adjustments to the billing base to reflect the following:

- Contract changes (both formal and constructive)

- Overruns of target cost on fixed-price-incentive-type contracts.

If changes are not identified, negotiated, priced, and adjudicated on a current basis, or if an adjustment to some point between target and ceiling is not made when costs exceed target, the contractor faces the prospect of incurring costs that will not be covered by progress payments.

A compounding problem affecting cash flow is the liquidation of progress payments upon delivery of contract end items. In multiship contracts, the "price" of each ship for liquidation purposes may be specified or may be an average unit price for the total contract. Liquidation of progress payments upon delivery of the first ships can result in an unrealistic cash flow to the contractor in relation to incurred costs during the first part of the contract period if an "average" price is used.

Normally the first ship will cost more than the second, which costs more than the third, etc. Failure to recognize this in establishing the liquidation method and in setting ship prices for billing purposes may result in the contractor's failing to receive profit on, or reimbursement for, costs associated with the delivered ship. With the normally long time periods between ship deliveries, this adds to the contractor's cash flow difficulties.

The Navy is well aware of the problems discussed above. The ASN (I&L) and DCNM (Procurement and Production) have commenced a Naval Material Command review of these problems and evaluation of alternatives for their solution. While the study is not in a stage of completion that would allow the Panel to comment specifically, the Panel believes that the effort is necessary and should be completed.

(5) Recommendations

As a result of the analysis summarized above, the NMARC Cost Panel makes the following recommendations regarding cash flow/progress payments:

Recommendation COST-73: The effectiveness of SECNAV Instruction 7810.11 in its present form is questionable in the judgment of the Panel. The current Navy study should be completed; policies for financing, contractor investment,

and profit should be defined; and modification of SECNAV Instruction 7810.11 should be effected to achieve practices that are equitable and realistic in view of the current economic environment.

Recommendation COST-74: The Panel recognizes that the Navy should not adopt any practice that would result in "windfall" and undeserved cash payments to contractors. However, in structuring new progress payment practices, the Panel believes the Navy should consider allowing contractor receipt of some amount of earned profit on costs incurred (with appropriate limits on recovery over costs incurred) for contracts with long procurement and construction phases.

Recommendation COST-75: The Navy should consider establishing a policy requiring that a contract price that recognizes variation in costs between ships in a production run be specified for purposes of liquidating progress payments.

Recommendation COST-76: Adjustments to the billing base should be made in a timely manner. Other Panels have addressed required improvements in the adjudication of changes to contracts.

18. AVAILABILITY AND USE OF MANAGEMENT RESERVES

Navy project managers should be provided additional flexibility in the form of a "management reserve" in order for Navy systems acquisition projects to proceed with as little disruption as possible and so that maximum advantage may be taken during system development of opportunities to realize production or life cycle cost economies.

(1) Statement of the Issue

One of the basic principles of project management planning and estimating is the need for a fund of unassigned dollars, commonly designated as a "management reserve." This management reserve is utilized to accommodate demands for

funds created by risks and unforeseen events that materialize during the course of the project. Affecting the creation and utilization of management reserves in the Navy are the following questions:

- Through what procedures should such reserves be generated?
- What amount is adequate?
- Should the reserves be identified and visible to others than the project manager?

(2) Study Approach

The Cost Panel approach to studying this issue was to read pertinent DOD and Navy Directives and other appropriate material. These included:

- HR 16243
- OMB Circular A-11
- DOD Instruction 7000.2
- NAVMAT Instruction 7000.14B.

The Panel met and discussed the issue with the following:

- ASD-(I&L)
- ASD-(Comptroller)
- NCB
- NCD
- OP-03
- OP-21
- OP-22
- OP-43
- OP-92
- NAVSEA-02
- NAVSEA-04
- NWC China Lake
- SUPSHIP Bath, Maine
- SUPSHIP Groton, Connecticut
- Bath Iron Works
- Electric Boat Division of General Dynamics
- Lockheed Missiles and Space Company.

The Panel examined the following programs:

- TRIDENT
- TRIDENT Missile
- TRIDENT Submarine
- SSN-688/700
- PF
- AEGIS
- HARM
- S-3A
- HARPOON
- SPARROW.

(3) Findings and Conclusions

Although all industry and Government project managers who have some flexibility in the application of funds are not successful, virtually all who are successful have enjoyed some flexibility with respect to fund application. Some would argue that if management reserves are openly provided, the manager will inevitably consume those reserves. Often, the argument goes, the reserves will be expanded in a manner such that more "gadgetry" or nonessential system technical performance is procured without significantly improving system development or achieving savings in either life cycle or production costs.

Clearly, dissipation of reserves in this manner is inappropriate. However, proper selection and continued orientation of key project management office personnel to the importance of Defense system cost goals combined with adequate controls on reserve fund utilization should go a long way toward solving the problem of reserve dissipation. In fact it could be argued that any program that does not have a reserve to deal with risks is foredoomed to significant cost problems.

The Congress has historically been wary of management reserves. However, the issue should be reopened with the congressional committee members and staff, because they may wish to take the initiative in requiring more realistic estimates, including the necessary reserves.

At present, rather than having reserves to dissipate, most project managers (PMs) find themselves with insufficient funds to cover the normal risks that are realized during the course of the project. One reason is that funds are frequently redirected to other efforts because of budgetary pressures. The PM also is continually faced with pressure to reduce cost or budget estimates.

It has not been the Navy's policy or practice to eliminate whole projects when budget cuts or other actions force reexaminations of project priorities but to reorient the projects affected. Reorienting projects by stretching out or reducing procurement quantities may help in terms of "this-year" dollars, but usually it results in significant reduction of any flexibility that may exist, thereby laying the groundwork for an out-year overrun.

Generally speaking, PMs have not openly identified many of their reserves earmarked for minimizing the impact of anticipated or unanticipated risks. A variety of methods have been developed by PMs for dealing with the need for reserves without openly identifying them. The most frequent means is the conscious or subconscious development of "invisible" reserves adequate to supplement "visible" reserves sufficiently in an attempt to minimize the impact of risks that materialize.

"Visible" reserves are currently built into the various budget appropriations, although they may not be labelled as such (e.g., approximately 8 percent of the current SCN appropriation is money for "future characteristics changes," "cost growth," "escalation," and "change orders").

Some "invisible" reserves are inherent in the estimating process. Other invisible reserves are developed by such means as estimating liberally the number of test engines, spares, or other items or factors necessary to program success. Invisible reserves are rarely identified outside the project office or to a level above the PM. Thus, there is little opportunity to tell how large these invisible reserves are, whether they are adequate, or how well they are employed in improving system development or reducing production or life cycle costs.

If one of the purposes of having a reserve is to allow the manager sufficient flexibility to avoid many of the pitfalls that

lead to overruns, then recent Navy overruns may be attributed, at least in part, to either inadequate provision of (visible and/or invisible) reserve funds to deal with project risk, or to ineffective employment of those reserves. Whatever the cause, congressional reaction to the overrun has been clear. Navy flexibility (in the utilization of visible or invisible management reserves) has been severely constrained through special provisions in legislation and by building fences within and between the various appropriations. The problem tends to grow as more controls by the DOD and the Congress lead to less flexibility in financial management and to smaller management reserves at the PM's level.

Adequate development and funding of reserve accounts will not solve all of the Navy's system acquisition cost problems. However, recognition of the need for such reserves, independent of escalation and characteristic changes, should materially assist PMs in effectively managing risk, improve Navy cost credibility in the long run, and ultimately achieve production and life cycle cost economies.

(4) Recommendations

In order to partially reduce cost fluctuations in systems acquisition by providing the Program Manager greater flexibility in dealing with known and unknown risks and in order to encourage him to foster development of the system such that production and life cycle economies will be realized, the NMARC Cost Panel recommends that the Navy:

Recommendation COST-77: Undertake a full study to determine the extent of reserve requirements and to make specific recommendations as to the manner in which they should be developed, controlled, and applied. The study should be conducted so as to provide for OSD, OMB, and congressional input/participation to ensure appropriate perspective and to facilitate implementation of study results.

Recommendation COST-78: Attempt to eliminate artificial constraints inherent in the budgeting process such as those imposed by OMB Circular A-11 (e.g., with respect

to escalation) and the Congress (e.g., with respect to legislative provisions that preclude changing funds obligation authority from one year to the next for the same line item within the same appropriation).

Recommendation COST-79: Encourage the development of budgets that both recognize risks (Cost Panel Section 4) and request funding more toward contract ceiling (including reserves) in order to fund probable system costs.

Recommendation COST-80: Utilize system cost estimates developed in the SYSCOM that include a certain percentage (e.g., 5 to 15 percent) of the base estimate as a management reserve.

19. MULTIYEAR AUTHORIZATION OF MAJOR WEAPON SYSTEMS

The history of weapon systems acquisition reflects the impact made on programs due to changes of a technical, schedule, or cost nature. The acquisition process would benefit if greater stability were introduced by the removal of certain variables in the process. One such area is the requirement of annual authorization from the Congress, because the life of most weapon systems programs extends over a number of years.

(1) Statement of the Issue

Can the Navy attain improved stability in long-lead-time weapon system acquisition through a multiyear authorization process?

(2) Study Approach

The Cost Panel approach to studying this issue was first to read all the pertinent DOD and Navy Directives and other appropriate material. These included:

- Hearings of the Sea Power Subcommittee of the House Armed Services Committee, 1974
- Budget and Impoundment Act of 1974

- Vinson-Trammel Act of 1934
- Navy Department Programming Manual
- SECNAV Instruction 5000.1
- OPNAV Instruction 5000.42.

The Panel discussed the issue with present and former incumbents who held responsibility in the following areas:

- ASD(Comptroller)
- ASN(FM)
- OP-92
- NCD
- NCB
- MAT-02
- NAVAIR
- NAVSEA.

Additionally, representatives of several Navy contractors were consulted.

(3) Findings and Conclusions

The program plans for almost all major weapon system acquisitions have undergone changes. The resulting program instability has contributed to the cost growth and other problems.

Congressman Vinson, in hearings that resulted in the passage of the Vinson-Trammell Act of 1934, addressed the problem of instability in shipbuilding when he stated:

> The adoption of a definite naval policy will permit an orderly building program in the future. Such a building program will not only be more economical but also it will contribute to better designs, better workmanship, less disruption of industry, and will keep the national defense on a higher level than is possible under old wasteful methods of building a navy by alternate spasms of intense activity and practically complete idleness.

In recent years the experience in shipbuilding and aircraft acquisition reflects this problem. In the early 1960's, ship construction was at a low ebb but rose to high levels in the early 1970's. Conversely, aircraft procurement was at high levels in the early 1960's and declined in the early 1970's. These fluctuations reflect the characteristics of naval weapon systems acquisition.

Both the Navy and contractors suffer the effects of this process. Contractors are subjected to problems of maintaining a workforce large enough and with competent skills to fulfill the requirements of the Navy. Examples of this are evident in aircraft and shipbuilding programs. Contractors are reluctant to make capital commitments in a climate lacking program stability.

To facilitate the management of weapon systems acquisition, DOD and the Navy have provided the Congress with planning information primarily in the form of the Five Year Defense Plan (FYDP). Supplemented by other reports to the Congress, such as the SAR, a management partnership has existed in the procurement of weapon systems.

A valuable adjunct would be multiyear authorizations such as have been proposed for shipbuilding. A multiyear approach to authorization would commit Congress to taking a longer range view of weapon systems acquisition resulting in a better understanding of the Navy's requirements. This longer commitment would provide the depth of understanding necessary to evaluate the impact of program changes. Multiyear authorization from the Congress would assist the Navy to achieve a higher degree of stability so important to the control of costs.

Multiyear authorization by the Congress would also assist the Defense industry in evaluating the potential market for the out-years. This should lead to a greater willingness of the Defense industry to invest in facilities and other capabilities if they know where Congress stands on the individual weapon system programs. One of the advantages of total-package procurement was that it gave an added dimension of stability to the individual programs. With the swing away from total-package procurement, a multiyear authorization by Congress might be a big assist to the Defense industry for planning purposes.

As witnessed over the years, the Congress has become more involved in the acquisition process. The Armed Services Committees have increased their scope of review, as seen in recent years with R&D and military personnel authorizations. Additional involvement will result from the Budget and Impoundment Act of 1974 with its Congressional Budget Office (CBO) and Budget Committees in each body. To foster the management partnership between Congress and the Navy, the Navy should be able to provide all the information necessary to contribute toward the stability of weapon systems acquisition.

(4) Recommendations

The NMARC Cost Panel presents the following recommendations for consideration:

Recommendation COST-81: The Cost Panel supports the intent of multiyear authorizations. Selected weapon systems programs in shipbuilding and modern aircraft and missiles, with their long lead times, could benefit most from multiyear authorizations.

Recommendation COST-82: An open working relationship with Congress is most important. A large portion of the information on which Congress formulates its course of action is the reporting submitted by DOD and the Navy. It is necessary that this information be clear, concise, timely, and accurate.

20. SUMMARY OF COST PANEL RECOMMENDATIONS

(3) Cost Estimating and the Use of Cost Estimates

Recommendation COST-1: Emphasize the importance of the cost estimating function throughout the command chain.

Recommendation COST-2: Provide adequate staffing, training, and career patterns in the cost estimating and cost analysis function.

Recommendation COST-3: Establish a central cost estimating and analysis group in NAVELEX.

Recommendation COST-4: Provide the three SYSCOM estimating groups (NAVSEA and NAVAIR now exist; NAVELEX is proposed) with the independence and top management support necessary for the preparation of quality estimates by having these groups report at an appropriate level in the SYSCOM that will insure this support and independence.

Recommendation COST-5: Instill in all areas of command the importance of cooperating with and providing, in a disciplined and timely fashion, to the estimating function the most complete information available concerning the technical definition, risk assessment, quantity requirements and schedule parameters on which to base estimates.

Recommendation COST-6: Enforce OPNAV Instruction 4700.12C. Provide for greater discipline in the planning phase and during the complete budget cycle to insure that late changes to programs are minimized and that the number of programs for which budget quality estimates are required are held to the prime candidates to diminish the use of less than Class C estimates in budgets.

Recommendation COST-7: Make it a firm policy in each SYSCOM to provide the cost estimators and cost analysts with access to the detailed cost data supplied by contractors in support of proposals and with the contract costs reported in accordance with the criteria established by DOD Instruction 7000.2 or other contract cost reporting requirements.

Recommendation COST-8: Include a contingency in the estimate whenever a less-than-budget-quality cost estimate is to be included in the budget.

Recommendation COST-9: Directed cost estimates that modify those prepared by the responsible cost estimating functions should be identified as such. This identification must include the identity of the person or authority responsible for the directed cost estimate.

Recommendation COST-10: Reduce layering of cost estimating and layering of the review and analysis of cost estimates. Detailed review and analysis of estimates by NAVCOMPT and ASD (Comptroller) except for their normal budget review, should be eliminated. Modify the charter for the ASD (PA&E) Cost Analysis Improvement Group (CAIG) to limit their function to that of establishing criteria and guidelines concerning the preparation and presentation of cost estimates on Defense systems to DSARC and to that of monitoring the armed services' cost estimating procedures, methodology, and accuracy to assure OSD that the services are performing their responsibilities. Place OP-96D's staff, augmented as necessary, and its present function of preparing Independent Parametric Cost Estimates (IPCEs) and making detailed reviews and analyses of SYSCOM estimates in an area insulated from program or budget bias or outside influence. The Office of the Assistant Secretary of the Navy (Financial Management) appears to be a logical choice, although all possible choices should be evaluated. The detailed cost estimating review results should be available to all levels of management in the Navy and OSD. Presentations to DSARC on the review of weapon system costs would then be made by the ASN (FM) or his designee. The main thrust of this recommendation is that DOD should place responsibility and accountability for cost estimating on the Navy.

(4) Assessment of Financial Impact of Risk

Recommendation COST-11: Continue to place emphasis on risk assessment. Make risk assessments in quantitative terms and use them in decisionmaking, especially in budgeting and contracting.

Recommendation COST-12: Choose contract type, target-ceiling spread, and incentives that prevent the assumption of undue risk by either the contractor or the Government.

Recommendation COST-13: Recognize the need for engineering support during production; buy it and use it to minimize risk.

Recommendation COST-14: Modify planning and contract provisions for long-lead material to reflect current material procurement lead-times and uncertainties.

Recommendation COST-15: Set realistic schedules and recognize schedule risk in prime contracts. Plan for schedule risk in GFE delivery and/or, if this is not feasible, consider CFE procurement.

Recommendation COST-16: Investigate the problems in data requirements and payment delay being experienced by small, second-tier specialty subcontractors and take action to keep them viable and available to the Navy.

Recommendation COST-17: For new research and development programs:

- Use Navy laboratories to identify risk early in preliminary design.
- Use the entire applicable Navy estimating capability to price the program.
- Approve a bidders list prior to RFP formulation and use contractor support in cost estimating, risk assessment, and RFP preparation.
- Recognize the uncertainty of proposed cost at completion and evaluate proposed target price on the basis of traceability, credibility, and risk planning.
- Ask questions of the proposers as necessary to obtain understanding of the proposals. Make provision for the proposers to make a final price adjustment accounting for this dialogue. Evaluate this final price on the basis of traceability and credibility.

(5) Design to Cost and Life Cycle Cost

Recommendation COST-18: Continue to apply design to cost principles, especially in preliminary design. Understand

where the cost really is: emphasize the quality of the estimate which sets the cost goal.

Recommendation COST-19: Competition and alternate designs are the touchstones of design to cost. The Navy should provide adequate time and money in the early design phases to assure the success of design to cost by taking the following measures:

- Have the qualified contractors participate with the Navy laboratories and the SYSCOMS to provide the data needed to issue a meaningful RFP.

- Establish a prioritized or weighted set of performance characteristics with either an acceptable range or a minimum value specified for each characteristic. These should be coupled with a design-to-cost ceiling representing the maximum average unit cost figure acceptable to the Navy. These requirements should be the basis of the RFP. This approach provides the contractors with flexibility necessary for alternate design concepts and performance/cost tradeoffs.

- Wherever feasible, use two contractors through the engineering development phase. A competitive advanced development phase is particularly crucial.

- Increase the R&D effort emphasizing design to cost in the areas of materials, processes, components, systems, and subsystems to improve the cost of these elements.

Recommendation COST-20: Since shipbuilding is a special case of design to cost, it is recommended that the Navy undertake a special study to determine:

- The benefits that could derive from competitive preliminary designs for ships

- Tne feasibility of expanding this capability in private shipyards

- The benefits of competition through the preliminary design and prototype phases of combat weapon systems.

Recommendation COST-21: Life cycle cost should be considered as only one of the many disciplines in the weapon system design, acquisition, and operational cycle. It must not be allowed to become the sole driver. It is also doubtful if a total life cycle cost figure, derived through a large computer printout, is of any value, given the weaknesses in the current data banks and basic cost information. However, life cycle cost can be used in acquisition management by concentrating on those portions or determinants of post-deployment cost that are design sensitive and/or influenced by the acquisition manager and contractor action, such as reliability and maintainability, manning (numbers and skills), training, and support equipment.

Recommendation COST-22: Reexamine and simplify the instructions issued relative to design to cost and life cycle cost. Use every possible precaution to prevent design to cost and life cycle cost from becoming another "ility." Provide guidelines to Navy program managers and their contracting officers.

(6) Proper Interface of DOD and Navy Internal Systems

Recommendation COST-23: The major DOD and Navy internal systems are sound in concept and should be continued. However, the coordination and the operation of the systems are often poor and lead to weapon system program instability.

Recommendation COST-24: Develop a plan of action to achieve better coordination and integration of the individual systems so that good continuity and stability can be achieved in the major weapon programs. It should be noted that this recommendation will not be accomplished just by calling for proper integration in the various DOD and Navy directives. It will require a serious effort in the Office of the Secretary of Defense, and will require that the Deputy Secretary of Defense make sure that the

staffs of the various Assistant Secretaries of Defense are willing to abide by prior decisions reached during the other internal decisionmaking cycles. It will also require a commitment by top Defense and Navy officials to achieve program stability in the major weapon systems programs.

Recommendation COST-25: Where applicable, individual systems should be updated and streamlined. For example, the detailed procedures of the PPBS system have not been modernized since about 1965. There is much effort put into the detailed recapping of the January update for the FYDP that possibly could be improved. Recommendations are provided in Section 9 regarding the SAR reporting system. The Cost Panel believes that some features of the DSARC/DCP system need review and change if it is to be a more effective management system. There appears to be a need to improve the timeliness and accuracy of the decisionmaking documents. The DSARC/DCP process is addressed by other Panel reports.

Recommendation COST-26: In order to properly stabilize the execution of major weapons system programs in the interests of increased efficiency, it is recommended that the Navy adopt a policy of stable planning and fully adequate funding of selected priority major weapons acquisition programs, probably those designated for reporting on the SAR. This will entail the development of realistic quantity and performance requirements based on the best analysis of defense needs, a realistic acquisition plan and schedule, and initial funding (and estimates of future funding requirements) of an amount sufficient to execute the program as planned. Once this planning is established in the applicable systems and documents, changes to any of these programs should be made only to reflect changes in operational requirements, unanticipated events within the program, or direction of higher authority over the Navy. Program and budgeting modifications should be avoided if the program is proceeding according to technical milestones, on schedule and within cost estimates.

(7) Contractor Reporting

Recommendation COST-27: The Navy should continue its policy of implementing DOD Instruction 7000.2 on major acquisition programs.

Recommendation COST-28: The Navy should continue its present approach to the implementation of DOD Instruction 7000.2 of avoiding interpretations of criteria that would require unnecessary or unrealistic changes to contractor internal cost and management systems.

Recommendation COST-29: Only a single work breakdown structure or cost reporting structure should be imposed in any one contract. This is in concert with DOD Directive 5000.1, and the structure should be established by the Navy project manager in accordance with the applicable guidance. However, this guidance should be interpreted with sufficient flexibility to satisfy the unique management, technical, contract, and organizational needs of each phase of the program.

Recommendation COST-30: The CPR of DOD Instruction 7000.10 should be taken as the basic contractor cost report with additions and/or changes to this base made as necessary (1) to satisfy program peculiar management needs, (2) to utilize fully and economically contractor internal cost systems and reports that provide equivalent data, and (3) to obtain any additional data needed for cost estimating purposes.

Recommendation COST-31: DOD cost data reporting requirements should be integrated into a single basic system to eliminate redundancy, inconsistent procedures, and multiple breakdowns and formats. Cost reporting requirements also should clearly provide flexibility for tailoring to fit program management needs and to avoid collection of nonessential data. The program management reports of DOD Instruction 7000.10 should be the basis for all contractor cost reporting to DOD. The needs for and benefits of any additional data beyond that available from these reports should be examined. If additional data are necessary, criteria should be established to permit them to be obtained as a logical extension of the DOD Instruction 7000.10 series of reports. Cost data reporting requirements should be in criteria form to the maximum feasible extent and should follow the guidelines of DOD Directive 5000.1. CCDR (DOD Instruction 7000.11) should be cancelled as a separate reporting system.

Recommendation COST-32: Integrity of any data bank resulting from contractor cost data reporting should be maintained with respect to accuracy, completeness (of data), and limiting access to those with a legitimate need to use the data to develop cost estimates. This should be done to prevent compromise, misuse, or misapplication of the data.

(8) Navy Laboratory Reporting

Recommendation COST-33: Efforts to improve laboratory financial and resource management should be encouraged.

Recommendation COST-34: In improving and extending laboratory management capabilities, care should be taken to avoid layering of management functions and activities that are being performed effectively by other activities.

Recommendation COST-35: Guidelines should be developed to guide Navy project managers in determining the cost planning and reporting requirements that they wish to levy on tasks they assign to laboratories. Program management responsibility and authority in this area should be emphasized.

Recommendation COST-36: On the basis that the implementation of DOD Instruction 7000.2 provides the foundation for satisfactory cost control and cost reporting to project offices (conclusion of the Cost Panel issue discussed in Section 7), it is recommended that major program tasks assigned to laboratories be reviewed for selective application of the intent of this instruction, and that application be made where appropriate. Further, the Navy should develop an appropriately modified DOD Instruction 7000.2 type of criteria for the planning and control of costs in major laboratory programs.

(9) Navy/DOD Reporting—Selected Acquisition Reports

Recommendation COST-37: The Navy and DOD should consider changing the SAR reporting frequency to semi-annual. Consideration of congressional requirements is necessary, and the flexibility to require interim reports where significant changes occur should be maintained.

Recommendation COST-38: Critical reviews of the current draft revision of DOD Instruction 7000.3 should be made by Navy and DOD personnel to determine that it addresses the major problems and criticisms leveled against the SAR system. The majority of the revisions appear justified. However, the Panel recommended that the draft and formats be revised to present escalation costs for program changes along with the Provision for Economic Change so that impact of escalation may be seen. Related recommendations of escalation practices in SAR reporting are included in the Cost Panel issue discussed in Section 15.

Recommendation COST-39: It is doubtful (and questionable) that the Navy and DOD can obtain billions of dollars in the future for major weapon programs without giving a report on technical, schedule, and cost status. Therefore, the system must work to provide the most meaningful information possible and to tell the complete story about each program. Once the revised DOD Instruction 7000.3 is issued, any further changes should be kept to an absolute minimum for a period of several years so that the integrity and comparability of the system can be developed and proven.

Recommendation COST-40: Pertinent sections of the SAR concerning technical, schedule, and cost status of major contracts should be reviewed with the applicable contractor to assure that interested parties may speak from one authoritative document among themselves and with the public, the press, or the Congress. This should not require disclosure of proprietary data (contractor or Navy).

(10) The Buy-in Problem

Recommendation COST-41: Technical transfusion or leveling of proposals and parallel negotiations leading to best and final offer "auctions" should be prohibited. In making this recommendation, the Cost Panel does not intend to preclude oral and written discussion with contractors that are oriented toward assuring an understanding of the proposal by both parties, nor does the Panel desire to preclude adjustments to proposals (which are substantiated and traceable to the original estimate) based on such discussions.

Recommendation COST-42: Cost, schedule, and technical realism should be the primary considerations in cost estimating, proposal evaluation, and source selection. Offerors should be instructed to submit their best cost and technical proposals at the outset. Unrealistic or unsubstantiated proposals should be downgraded or rejected in the evaluation cycle.

Recommendation COST-43: The Cost Panel believes that a memorandum from the Secretary of Defense to the military services addressing the need for cost realism in acquisition practices and setting forth guidelines similar to those above would be appropriate to focus attention on eliminating the factors that may lead to buy-ins.

(11) Financial Management Capability in the Program Management Office

Recommendation COST-44: Develop and implement criteria and guidance designed to govern the establishment and continuing maintenance of the B/FM capability and responsibility in project offices. The objective of such an effort should ultimately be the allocation of adequate resources to the project office on a continuing basis to ensure that, as a minimum, the following business/financial management oversight responsibilities can be effectively carried out: budget planning and development; utilization of cost/schedule planning and control systems; cost estimate analysis (including input reports such as proposals) and cost control, accounting, and reporting (including output reports such as SARs); funding and payment planning and control; and procurement/contract planning, programming, execution, and administration functions.

Recommendation COST-45: Develop position descriptions for an assistant program manager having major business/financial management responsibilities in support of the Project Manager to be assigned to the major projects. In carrying out these responsibilities, adequate support staff billets should also be provided in the project office. Depending upon the life-cycle phase of the program, its size, and how the project is organized, personnel assigned to the project office should vary. However,

between two and five well qualified professional business/financial management personnel would be an appropriate rule-of-thumb target number for each SAR program.

Recommendation COST-46: Create the billets and fill them with an appropriate mix of qualified officers and civilians. The definition of those billets should be developed such that a hierarchy and a ladder for career progression (both civilian and military) is created as discussed in Section 12 of this chapter.

(12) Selection and Career Development of Project Management Office Business/Financial Management Personnel

Recommendation COST-47: Develop appropriate B/FM billets in the major program management offices as discussed earlier in conjunction with issues presented in Section 11. The first step in this effort should be the internal resolution as to the source of these billets in relation to personnel ceilings.

Recommendation COST-48: Investigate the feasibility of either dividing the WSAM subspecialty designator system into subordinate parts (business/financial management, technical direction, and fleet integration and support), or establishing a new subspecialty for business/financial managers in systems acquisition; and implement the results of the investigation.

Recommendation COST-49: Revise BUPERS Instruction 1040.2 to encourage financially oriented officers to seek careers associated with the WSAM subspecialty.

Recommendation COST-50: Investigate the feasibility of establishing a new career civil service series (entry level GS-9 or 11) designed to develop individuals for key project office positions who are versed in all aspects of B/FM as related to systems acquisition and establish such a series if feasible.

Recommendation COST-51: Develop and implement guidance and procedures designed to result in comprehensive and tailored training programs for civilians and military officers who choose a career in B/FM.

Recommendation COST-52: Establish a permanent oversight group under the ASN/FM to develop, implement, and monitor progress on civilian and military career progression opportunities and patterns, assignments, training provisions, etc. of individuals involved in the acquisition of weapon systems and other finance-related careers in the Navy.

Recommendation COST-53: Establish procedures to ensure that only the better qualified individuals are selected for B/FM assignments and, if officers, their careers are enhanced by such assignment (assuming, of course, adequate performance).

(13) Foreign Military Sales

Recommendation COST-54: It is recommended that the program office organization be strengthened in those cases where it is essential that Navy systems for foreign customers be procured through the U.S. Government. This should include the addition of a strong program management type of person, as well as a financial manager and appropriate personnel in other functions, to serve as an active focal point in the program office to assist in the marketing and management aspects of these specific foreign military sales.

Recommendation COST-55: Recognizing the reimbursable nature of management/administrative costs of FMS programs, an increase in personnel above present ceilings should be permitted when required to manage these government-to-government programs adequately. However, industry capability to perform and manage these efforts should be utilized wherever feasible.

Recommendation COST-56: The Navy should review organizational elements between the marketing organization (OP-63) and the acquisition organization (SYSCOM/project office) to reduce or eliminate the layering of intermediate functions.

(14) Layering—Financial Management Function

Recommendation COST-57: The Secretary of the Navy should determine how best to consolidate OP-92 and NCB, after fully considering the views of the CNO and CMC. The Panel recommends that the primary responsibility be assigned to the Assistant Secretary of the Navy (Financial Management) with the necessary reporting alignment to serve properly the Chief of Naval Operations and the Commandant of the Marine Corps. It is very important that the consolidation of the budget functions be accomplished in a manner that does not result in any dilution of the ability of the Comptroller of the Navy to exercise his statutory responsibilities relative to the budget process.

Recommendation COST-58: In order to assist with the current personnel cutbacks and to reduce layering, consideration should be given to merging MAT-01 into the new consolidated NCB budget office (see Recommendation COST-57). This recommendation is put forth with the full recognition that most Chiefs of Naval Material would want a MAT-01 organization to run the budget program for them and to allocate funds between the various systems commands and project offices. Most CNMs would feel that they have lost a significant part of their command and organization if they gave up the MAT-01 organization with its control over the budget dollars. However, it is questionable if many major weapon systems were ever significantly aided by this additional layer in the financial management chain. The NMARC Cost Panel believes that the CNM should exert his command influence and allocation decisions (between systems commands/program offices) on budgetary matters through the new consolidated NCB organization. It is suggested that consideration be given this recommendation about 6 to 12 months after the OP-92/NCB consolidation has been effected.

(15) Economic Escalation

Recommendation COST-59: The Navy should obtain agreement with DOD and OMB for the elimination of the use of other than the most realistic projections of economic escalation in estimating and budgeting for major weapon systems.

Recommendation COST-60: The Navy should improve its in-house capability to forecast the effect of economic escalation. At the present time, NAVSEA (SHIPS) has the most proven capability. Except in NAVSEA and NAVAIR, this ability does not exist to any marked degree. Overall policy guidance must be developed, and the capability of each SYSCOM and PM-1 must be strengthened. Overall DOD direction should be provided by ASD (Comptroller) and OMB's approval should be obtained.

Recommendation COST-61: The Navy should adopt one of the following approaches to identifying and funding economic escalation:

- Include in the budgeting and programming process the best estimate of inflation that can be predicted. Set forth these amounts separately in the funding requests to Congress and clearly show the basis for the predictions. Gain congressional recognition that these projections may be subject to change either up or down depending on economic trends over which the Navy has no control.

- Include in the budgeting and programming process the best estimates of inflation that can be predicted to provide Congress with some guidance as to possible total end cost of each major weapon system. Obtain congressional concurrence to agree to fund only the base year dollar end costs plus one out-year's projection of inflation. In each succeeding year's budget include one more year of inflation projections until no more out-year projections are required.

Recommendation COST-62: The Navy should improve its major weapon system scheduling. The projection of realistic schedules, taking into account the best available information on lead times for material acquisition and taking into account the time required to accomplish the scope of work, is necessary if the provisions for economic escalation are to bear a reasonable relationship to actual experience.

Recommendation COST-63: The Navy should obtain permission to include economic escalation in annual accounts and keep visible the amounts included.

Recommendation COST-64: The Navy should continue to improve the present policy of using base-year dollar estimates with economic escalation shown as a separate identified cost.

Recommendation COST-65: The Navy should provide policy guidance to insure that the amounts included for economic escalation in the programming, budgeting, and SAR cycles for the out-years are reported consistently and uniformly.

Recommendation COST-66: The Navy should complete NAT-02's effort to develop escalation clauses for shipbuilding contracts that will provide protection to contractors for economic escalation. Recognition must be given to the fact that these clauses must have the basic flexibility to be modified as required to suit the particular circumstances of various types of procurements. These clauses should provide for divorcing the effect of escalation from the basic risk-sharing arrangements of fixed-price-incentive-fee (FPIF) contracts by providing protection to ceiling. They should also consider extending the application to cost-type contracts. In addition, it would appear necessary for the Navy to encourage the flowdown of escalation provisions to subcontractors when the prime contractor has such protection.

Recommendation COST-67: In conjunction with the other services, the Navy should recommend to DOD a revision to ASPR 3-404.3 and ASPR 7-106 to broaden the ASPR coverage for economic price adjustments.

Recommendation COST-68: The Navy should not include option provisions in new long-term procurements under the current economic environment without making adequate provision to protect the contractor against the effects of economic escalation.

Recommendation COST-69: DOD and the Navy should continue their efforts to develop and apply equitable adjustments to existing contracts to minimize the effect of economic escalation.

(16) Interest

Recommendation COST-70: DOD and the Navy should recognize imputed interest as a cost under all Government contracts.

Recommendation COST-71: DOD and the Navy should form a committee that includes industry representatives to draft an ASPR clause and to determine the mechanics of calculating the investment and cost. This recognition of investment should be done on a two-stage basis. At first, rough or approximate calculations should be sufficient. Later, as experience in this matter is gained, more guidance can be given Government and contractor personnel.

Recommendation COST-72: If ASPR revision is considered necessary, DOD and the Navy should revise the ASPR to recognize imputed interest as a cost.

(17) Cash Flow/Progress Payments

Recommendation COST-73: The effectiveness of SECNAV Instruction 7810.11 in its present form is questionable in the judgment of the Panel. The current Navy study should be completed; policies for financing, contractor investment, and profit should be defined; and modification of SECNAV Instruction 7810.11 should be effected to achieve practices that are equitable and realistic in view of the current economic environment.

Recommendation COST-74: The Panel recognizes that the Navy should not adopt any practice that would result in "windfall" and undeserved cash payments to contractors. However, in structuring new progress payment practices, the Panel believes the Navy should consider allowing contractor receipt of some amount of earned profit on costs incurred (with appropriate limits on recovery over costs incurred) for contracts with long procurement and construction phases.

Recommendation COST-75: The Navy should consider establishing a policy requiring that a contract price that recognizes variation in costs between ships in a production run be specified for purposes of liquidating progress payments.

Recommendation COST-76: Adjustments to the billing base should be made in a timely manner. Other Panels have addressed required improvements in the adjudication of changes to contracts.

(18) Availability and Use of Management Reserves

Recommendation COST-77: Undertake a full study to determine the extent of reserve requirements and to make specific recommendations as to the manner in which they should be developed, controlled, and applied. The study should be conducted so as to provide for OSD, OMB, and congressional input/participation to insure appropriate perspective and to facilitate implementation of study results.

Recommendation COST-78: Attempt to eliminate artificial constraints inherent in the budgeting process such as those imposed by OMB Circular A-11 (e.g., with respect to escalation) and the Congress (e.g., with respect to legislative provisions that preclude changing funds obligation authority from one year to the next for the same line item within the same appropriation).

Recommendation COST-79: Encourage the development of budgets that both recognize risks (Cost Panel Section 4)

and request funding more toward contract ceiling (including reserves) in order to fund probable system costs.

Recommendation COST-80: Utilize system cost estimates developed in the SYSCOMs that include a certain percentage (e.g., 5 to 15 percent) of the base estimate as a management reserve.

(19) Multiyear Authorization of Major Weapon Systems

Recommendation COST-81: The Cost Panel supports the intent of multiyear authorizations. Selected weapon systems programs in shipbuilding and modern aircraft and missiles, with their long lead times, could benefit most from multiyear authorizations.

Recommendation COST-82: An open working relationship with Congress is most important. A large portion of the information on which Congress formulates its course of action is the reporting submitted by DOD and the Navy. It is necessary that this information be clear, concise, timely, and accurate.

VIII. SUMMARY OF RECOMMENDATIONS

This chapter provides a convenient summary of the recommendation developed in the overview (Chapter II) and the five panel chapters (Chapters III through VII).

1. OVERVIEW RECOMMENDATIONS

Recommendation OVRVW-1: Establish as fundamental Navy policy that commitments to concepts and decisions in the acquisition process by the Navy Secretariat, OPNAV, and NAVMAT will be binding for extended periods, thus restoring some measure of program stability.

Recommendation OVRVW-2: Design and implement a method for continuing self-evaluation of the acquisition process, as differentiated from systems acquisition per se.

Recommendation OVRVW-3: OSD should withdraw substantially from specific participation in individual weapon system acquisition programs and dedicate its energies instead to policy formulation and monitoring in matters of total DOD objectives, force levels, budgets, and overall management philosophy. The proposed expanded charter of the Assistant Secretary of Defense (Installations and Logistics) should be seriously questioned.

Recommendation OVRVW-4: The usable authority of the individual project managers should be strengthened, primarily by constraining extraneous demands, reallocating and consolidating assets, improving training, reassigning existing personnel, and possibly consolidating the number of projects that are presently separately identified and managed.

Recommendation OVRVW-5: Constraint should be exercised in the total number of projects formally designated.

Recommendation OVRVW-6: Positive action should be taken to bring about a major reduction in layering at all levels by clarifying OPNAV and NAVMAT roles, assigning greater responsibilities to SYSCOMs for establishing product acquisition policy and monitoring performance, and utilizing NSARC to reduce information demands and duplicative reviews.

Recommendation OVRVW-7: Positive measures should be taken by OPNAV to ensure that changes to program scope and requirements are accompanied by corresponding adjustments to cost estimate baselines and budgets.

Recommendation OVRVW-8: A decision to undertake formally a major system acquisition effort should include an explicit decision as to the level of logistic support upon which design and development of the intended system is to be predicated and how it fits into the existing Navy family of weapon systems and logistic capabilities.

Recommendation OVRVW-9: The Navy requires a project manager during the conceptual phase of the weapons acquisition process to develop an integrated logistic support plan that contains a detailed resource analysis. Once this plan is completed, an explicit decision should be made by the users and producers to determine and fund the appropriate level of support for the weapon system.

Recommendation OVRVW-10: Integrated logistic support plans are typically not subjected to a Navy internal quality assessment and are critically examined only at DSARC. A Navy internal quality control over integrated logistic support plans should be established.

2. RESEARCH AND DEVELOPMENT PANEL

(1) Major Recommendations

Recommendation R&D-1: A proper balance should be established between OPNAV and NAVMAT in consonance with their respective primary roles of user and supplier.

Recommendation R&D-2: The authority of the Chief of Naval Material to control the RDT&E program funding, in categories 6.2 through 6.6,* under management supervision of ASN(R&D) should be clearly specified.

Recommendation R&D-7: The eight NAVMAT laboratories should continue to operate under the DCNM(D) only if NAVMAT is strengthened in accordance with recommendations R&D-1 and R&D-2. If the strengthening implied in these changes is not achieved, these laboratories should be transferred to Systems Commands. NRL should be retained under the command and management of CNR and the engineering, T&E, and service organizations under the SYSCOMs.

Recommendation R&D-10: The definition and elimination of undersirably duplicative efforts at two or more laboratories, as traced in the 1974 Hollingsworth report should be completed. Extraneous (non-mission-essential) product lines should be transferred to other CNM laboratories or NRL with the objective of further laboratory consolidation.

Recommendation R&D-11: Building on the skills available from RDT&E activities and Navy Programming Centers, a capability should be established to provide for systems integration of ship weapon system/command and control interfaces for the conceptual phases of a program and the late evolutionary phases.

Recommendation R&D-22: RFPs and ensuing contracts should require cost-reducing tradeoffs where feasible between the use of best commercial practice and MILSPEC requirements, and such tradeoffs should be considered in the source selection criteria.

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* See Appendix R&D-C, Section 7, for definition of RDT&E program categories.

Recommendation R&D-27: A specification review task force should be established to design a technique for effective specification scrubbing and tailoring to specific procurements. The task force should be principally drawn from outside the specifications organizations. The end product of the task force would be a simple, unambiguous procedure for scheduling, staffing, and executing contract specification tailoring and removing superfluous and other unwarranted features found to increase costs.

Recommendation R&D-29: Parallel, long-range planning groups should be established in OPNAV and in NAVMAT.

(2) Other Recommendations

Recommendation R&D-3: The number of personnel in OPNAV devoted to the acquisition process should be reduced, thereby assuring staff concentration on the requirements role with the concomitant responsibilities for frequent evaluation of program responsiveness to fleet needs.

Recommendation R&D-4: Billets saved as a result of implementing recommendation R&D-3 should be reassigned to the Naval Material Command.

Recommendation R&D-5: The role of the Naval Material Command in the decisionmaking process should be emphasized, e.g., by increasing representation on the Chief of Naval Operations' Executive Board (CEB).

Recommendation R&D-6: To effect redress of the existing imbalance in organizational structure, serious consideration should be given to the placement of the position of CNM at the same level as the Vice Chief of Naval Operations (VCNO), reporting directly to the CNO.

Recommendation R&D-8: A central point of guidance should be established under DCNM(D) for coordinating the systems engineering efforts at the Navy laboratories and for expanding the systems engineering discipline within the Navy laboratory community. The objective of this new function shall be to broaden the Navy's capabilities for developing the alternatives and tradeoffs in platform and combat systems that are a prerequisite for the design-to-cost type of acquisition mode.

Recommendation R&D-9: A determination of which areas of future technology should be prosecuted by NRL in preparation for further exploitation by the CNM laboratories should be included in ASN(R&D) planning of the technology base.

Recommendation R&D-12: The most appropriate location and organizational arrangement for activities that provide the core of technical support for combat system design, integration, and test should be determined. This should provide for adequate feedback from test and evaluation and fleet operational experience to design and development activities.

Recommendation R&D-13: The development of practical means to negotiate the program of technology base work in the NAVMAT laboratories in major blocks so as to promote the clear assignment of product area responsibilities and expand the funding flexibility available to laboratory management should be accelerated.

Recommendation R&D-14: A discipline should be established that will ensure serious attention by laboratory management to providing technical input to the Navy's corporate technical planning process in their areas of product responsibility, matched by serious consideration of those inputs at the corporate level (CNM).

Recommendation R&D-15: A hierarchy of reprogramming authority for RDT&EN funds, such as $25 million for OSD, $10 million for CNM, and $5 million for Systems Commanders, should be established.

Recommendation R&D-16: A discipline of authority and responsibility for the program/budget planning processes consistent with the required balance between OPNAV (requirements) and NAVMAT (acquisition) should be established.

Recommendation R&D-17: A mechanism should be initiated for establishing firm guidelines to reduce the high degree of RDT&E funding instability that currently exists.

Recommendation R&D-18: CNO should assign management responsibility for 6.3 to the CNM in the same manner as CND/DCNM(D) currently controls 6.2 programs in order to better integrate the exploratory and advanced development efforts.

Recommendation R&D-19: Budget execution procedures should be changed as proposed in CNM memos to ASN(R&D) dated 21 March 1966 and 14 April 1966. In the interim, the authority delegated to the CNM by ASN(R&D) memo dated 10 May 1966 concerning allocation of RDT&E funds to the Naval Material Command to direct below-threshold changes for DOD categories 6.2 through 6.6 should be implemented. (These memos are contained in Appendix R&D-K.)

Recommendation R&D-20: The threshold requirement for RDT&E RAN/D&Fs under exception 11 (Title 10, U.S.C. 2304) should be increased from $100,00 as called for in ASPR 3-302 to $1 million.

Recommendation R&D-21: The ASN(R&D) staff should be involved early in the planning of an R&D project when a RAN/D&F will be required, thus avoiding unexpected delay.

Recommendation R&D-23: Mechanical, electrical, and environmental interface standards for each unit should be included (or prime contractors should be required to include them) as part of military electronic equipment specifications. This will facilitate future design and price competition and provide for replacement of old designs by new-generation equipment through interchangeability of similar equipment intended for similar applications.

Recommendation R&D-24: A policy should be promulgated requiring that the Navy take steps toward assuring that new electronic equipments that are likely to replace older equipments in aircraft, ground vehicles, and other platforms will be made with form, fit, and function interchangeable with the older equipments without costly modification unless the life-cycle cost benefits of a different new equipment clearly outweigh the cost of such modifications.

Recommendation R&D-25: Tradeoffs should be made between providing a more benign standard environment of humidity and temperature control and shock and vibration isolation to facilitate use of cheaper and more readily available devices compared with full compliance with current MILSPECs. Strict military environmental requirements imposed on equipment and systems cause great increases in cost.

Recommendation R&D-26: Multiple developments of equipments conforming to interface specifications should be obtained. Where the potential market for the equipment is large enough, industry-financed development should be encouraged; otherwise, multiple developments should be procured under Government contracts, giving due regard to unique Navy logistic problems.

Recommendation R&D-28: Initially, long-term contractor maintenance warranties should be applied, where economically practical, to equipment in which failed units can logically be replaced in the field and conveniently returned to the contractor's plant or base for repair without compounding logistic problems or to which the contractor can have ready access for field repair, such as: airborne communication, navigation, and identification equipment; modular radars and vehicular communication sets; complex man-pack equipment such as LORAN C/D; forward-looking infrared (FLIR) systems; and domestic communication, data processing, and radar installations.

Recommendation R&D-30: The practice of joint military/civilian management of Navy laboratories embodied in the concept of a commanding officer and a civilian technical director should be continued.

Recommendation R&D-31: Top military and civilian performers should be matched to the key jobs in the R&D management structures of ONR, NAVMAT headquarters, SYSCOMs, and the laboratories. Military jobs must be identified and treated as career-enhancing billets in the naval personnel selection process. Care must be taken to remove the artificial penalities that have become attached to the R&D functional billets (they are not project management in the laboratories and headquarters, since these penalties undermine the important matrix support of Navy projects.

Recommendation R&D-32: Revision of military assignment/tour lengths to provide substantially longer terms, where appropriate to professional specializations, should be continued. Long tours should not be considered detrimental to officer promotion.

Recommendation R&D-33: Plans for career development, particularly for professional civilians, should be further developed and supported and should include increased utilization of lateral job mobility, as typified by the NAVAIR Executive and Management Development Programs. Utilization of "job-grooming" placements for top performing civilians from middle management should be increased.

Recommendation R&D-34: Immediate efforts should be made to remove currently imposed congressional restrictions on top-level Government executives salaries.

3. TEST AND EVALUATION PANEL RECOMMENDATIONS

(1) Major Recommendations

Recommendation T&E-1: The organization within the office of the Chief of Naval Operations which is responsible for "Combat Effectiveness" of naval systems should be strengthened. Resources for analysis, operational testing, combat simulation, intelligence liaison, requirements auditing, tactical development and evaluation, and monitoring Fleet readiness should be included in the "Combat Effectiveness" office.

Recommendation T&E-7: A specific approval authority should be designated for TEMPs in each program category. This aspect is particularly pertinent to the Less-than-Major programs which are not subjected to Major program monitoring. Further, an annual review process for Less-than-Major programs should be established.

Recommendation T&E-12: A flag officer should be designated as Test Facilities Manager in the Naval Material Command to manage directly or through Systems Commands, as appropriate, all test and evaluation related facilities, ranges, and centers assigned to the Naval Material Command. This officer could be assigned additional duty in OPNAV as the Navy's Development Facilities Manager to provide the single point of contract with DEPDIR(T&E) on facilities and resources coordination.

Recommendation T&E-15: A dedicated ship platform, new or old, with a multitest mission (i.e., weapons, machinery, electronics, etc.) should be developed. Certain major propulsion equipments, such as gas turgines and controllable-pitch propellers, cannot be tested during development in a true environment at existing shore sites.

Recommendation T&E-16: The Navy should use combat integration test sites for all new major systems.

Recommendation T&E-18: All programs involving digital weapons system/command and control interfaces should have a selected, skilled integrating agent accountable for the proper integration of the system.

(2) Other Recommendations

Recommendation T&E-2: The capability for seaborne simulation should be developed further in such a manner that future test and evaluation is accomplished in a simulated hostile environment. The operational training of personnel should also be realized in such an environment.

Recommendation T&E-3: Test and evaluation planning should be reviewed to insure that threat requirements and test plans are both identified and addressed by the Developing Agency and OPTEVFOR during system design, engineering, and development testing. An auditable trail of requirements versus performance should be maintained.

Recommendation T&E-4: In-service evaluations of active fleet units, specifically those combatants with advanced missile weapons systems, should be strengthened in order to provide the CNO with documented reports on combat effectiveness of Fleet systems. This procedure would ensure timely feedback of engineering and support problems to Developing Agencies.

Recommendation T&E-5: A prioritized budget for implementation of overall threat simulation requirements in support of all T&E programs from development through Fleet exercises should be established.

Recommendation T&E-6: A truly expert evaluation force should be provided by elevating the overall knowledge and expertise of the Navy officer corps engaged in T&E through higher formal education in peacetime. (The continuing education program under the Naval Postgraduate School would assist in achieving this.)

Recommendation T&E-8: The need for the "Manual for Control of Testing and Ship Conditions" (NAVSHIPS 0905-485-6010) should be reviewed to determine if the level of detailed involvement with the contractor during production testing is warranted in both a technical and a business sense. Additionally, the Navy should review the requirements of the "Total Ship Test Program for Ship Production" (NAVSHIPS 0900-077-3010) with a view toward removing an expensive overinvolvement with the contractor's test program (e.g., Stage 3 testing and testing sequence requirements).

Recommendation T&E-9: It should be ensured that discrepancies brought out in tests are brought to the attention of all concerned in a timely fashion and that time and funding are available for correction of deficiencies. The Panel further recommends that the use of the "yellow sheet" format, as used in the aircraft acceptance process, be adopted by OPTEVFOR.

Recommendation T&E-10: Test and evaluation documentation should be ensured that adequately describes test goals for reliability, maintainability, supportability (ILS), and survivability.

Recommendation T&E-11: The T&E planning effort and the program review process should be used to ensure that a properly balanced program is formulated which provides for sufficient testing to achieve a desired level of confidence in projected system performance. It should be recognized that systems can be overtested to the point of being uneconomical. Testing beyond the maximum capability of the item, where failures are expected due to design limits, should not be conducted unless the purpose of the testing is specifically to examine the failure mode. Additionally, with due regard for the budget cycle, program schedule and funding plans which allow sufficient reserve to permit correction of deficiencies uncovered during test execution should be ensured.

Recommendation T&E-13: The CNM Test Facilities Manager's office should be staffed and support to perform the following tasks:

- Assess capacity and monitor work assignment
- Coordinate military construction and procurement funds; e.g., make facilities improvement consistent with workload projection
- Develop and manage Navy targets and threat simulation assets through appropriate field activities and in coordination with operational commanders.

Recommendation T&E-14: The Naval Sea Systems Command should sponsor an an analysis of assigned facilities, similar to that documented in the NAVAIR Donaldson study, to assess existing capabilities, possible redundancy of effort, and areas susceptible to management refinement.

Recommendation T&E-17: Wherever practicable, the Navy should locate future combat systems test sites on Navy-owned property to provide permanence for life-cycle configuration control and training facilities.

Recommendation T&E-19: The FCDSSAs should remain under control of OPNAV, but improved procedures and processes, within a formal framework, should be established for the Material Command's interface with the FCDSSA. Because of operational aspects, the responsibility for life-cycle management of the system interface specifications (weapons to Command and Control) should specifically reside in the CNO offices.

Recommendation T&E-20: Military purchases of commercial products, particularly successful off-the-shelf systems, should be examined especially for cost savings through simplification of contract requirements.

4. PROCUREMENT PANEL RECOMMENDATIONS

(3) Systems Acquisition

Recommendation PROC-1: The Secretary of Defense (SECDEF) or the Deputy Secretary of Defense (DEPSECDEF) should reinforce the decentralization principles of DOD Directive 5000.1 and its derivative policies by preventing OSD staff involvement in and constraint of the Navy's studies of alternatives prior to the Navy's requesting the program initiation Defense Systems Acquisition Review Council (DSARC) (#1).

Recommendation PROC-2: The Secretary of the Navy (SECNAV) should assure that SECNAV Instruction 5000.1 provides for comparable elimination of premature Navy staff involvement and constraint to assure the project manager's control over management of conceptual and exploratory development programs.

Recommendation PROC-3: The Secretary of the Navy (SECNAV), the Chief of Naval Operations (CNO), and the Chief of Naval Material (CNM) should take steps to improve specific system development and acquisition programs. In particular, strategy and plans should be developed by experts professionally knowledgeable in all functional areas involved with benefit from contacts with knowledgeable industry personnel. These professionals should have long-term continuity. Such strategy should be developed with firm consideration given to existing POM-projected resources. The strategy should establish guidance within which the affected PM can perform tradeoffs. Key participants in the development of such a plan or strategy should continue in positions of responsibility in the program. The PM must play an integral role if not actually lead the planning effort.

Recommendation PROC-4: SECNAV, CNO, and CNM should take immediate, positive steps to improve major system planning, programming, budgeting, acquisition data for presentation to appropriate key congressional committee and professional staff members. SECNAV, CNO, and CNM should also take steps to better acquaint such persons with Navy mission deficiencies, programs, and requirements.

Recommendation PROC-5: Major acquisition programs should be budgeted on a multiyear basis and include a management reserve, which should be under the control of the Navy.

Recommendation PROC-6: The Navy should identify certain "core" programs that should be regarded by all concerned as inviolate short of major change in the threat assessment. The Navy should present a long-range plan for these programs to the Congress and justify the need for multiyear authorization.

Recommendation PROC-7: OSD and the Navy should develop a coordinated approach to resource requirement planning aimed at reduction in the levels and types of detailed OSD monitoring, rules and thresholds of governing substitutions among various resource categories, and the multiple shredouts of program elements.

Recommendation PROC-8: The Navy should closely examine the problems associated with downward pressures on program estimates with a view to formulating policies aimed at elimination of such practices, which are the genesis of cost growth and claims and ultimately of congressional antipathy.

Recommendation PROC-9: The Secretary of Defense (SECDEF), DEPSECDEF, and SECNAV must effect improved accommodation between OSD and Navy views as to the appropriate balance to be struck between OSD/Navy responsibilities, interests, and prerogatives as intended by the principles of DOD Directive 5000.1. Some specific examples are the following:

- Eliminate OSD staff constraint of Navy studies of alternatives prior to Navy's requesting the first DSARC.

- Extend the half life of DSARC decisions. Once the SECDEF/DEPSECDEF and SECNAV agree on a signed DCP, stick with the decision longer than is currently the case—i.e., purposefully reduce program turbulence, which is generated internally by OSD/Navy.

- Adopt a practice of hearing Navy positions firsthand before making negative decisions regarding the Navy's DSARC proposals.

- Retreat from the practice of using the DSARC process to approve annual production buys of hardware programs already approved for production.

- Relative to shipbuilding programs, adopt a practice of letting the thresholds established in the original DCP operate to control the construction program (i.e., the current trend is toward requiring as many as ten separate DSARCs, with all the attendant prebriefings, briefings, etc. in connection with a new ship class development and construction program).

Recommendation PROC-10: SECNAV should convene the NSARC upon the recommendation of the CNO or the CNM, to review major weapons systems acquisition at key junctures where DSARC meetings are now required. CEB meetings now conducted as pre-DSARC meetings should be conducted in joint sessions with the NSARC, to assure that all senior Navy principals consider program issues concurrently and jointly, and to reduce review activity for the PM.

Recommendation PROC-11: SECDEF, DEPSECDEF, and SECNAV should evaluate staff needs, functions, and responsibility/authority assignments in the context of the emphasis in streamlined decisionmaking and strong, relatively autonomous PMs. Specific policy should be promulgated that delineates authority and responsibility limits of staff specialists. The billets eliminated by the reduction of excessive layering should be utilized by reassigning them to the staffs of PMs.

(4) Procurement Practices

Recommendation PROC-12: The Navy should improve the reliability of estimated program costs it presents to Congress. The responsibility for the preparation of baseline cost estimates should be assigned to the SYSCOMs. Detailed baseline estimates with associated rationale should be developed for each major program. The baseline estimate should be made a matter of record and should not be changed except when justified by modifications to scope and then only when completely substantiated in writing.

Recommendation PROC-13: The Navy should emphasize the review of proposed acquisitions at the beginning of the business cycle utilizing the APP document to delineate clearly all facets and considerations of the proposed procurement. Review should be accomplished through the command chain including a representative of the Assistant Secretary of the Navy for Installations and Logistics (ASN(I&L)). RANs and D&Fs should reference the approved APP and should be expedited through the system

Recommendation PROC-14: NAVMAT should assess SYSCOM capacity to approve its own business clearances and increase their approval levels as appropriate. NAVMAT should periodically audit the SYSCOMs' performance of the business clearance function and, if that audit reveals serious deficiencies, the business clearance authority can be returned to NAVMAT until the deficiencies are remedied.

Additional billets should be provided to the SYSCOMs' contracts directorates for specialists in advanced pricing techniques.

Recommendation PROC-15: Reliability and maintainability requirements should be eliminated from the business clearance. These requirements have nothing to do with the business aspects of procurement and have substantially increased procurement lead times.

Recommendation PROC-16: While the regulations with respect to the source selection and negotiation procedures presently exist, more definitive explanation of the intent and purpose of these procedures should be included in applicable instructions and more training undertaken at various levels to assure proper implementations.

Recommendation PROC-17: Requests for Proposals (RFPs) should be carefully reviewed for clarity of requirements. Where it is desirable to allow a contractor freedom to develop an individual technical approach, this fact should also be clearly delineated.

Recommendation PROC-18: Policy statements should continue to be developed that emphasize a desire to prevent erosion of the spirit and intention of the ground rules and to avoid selection practices that lead to auction techniques, excessive technical transfusions, and undue pressures upon contractors through best and final offer techniques.

Recommendation PROC-19: Buy-ins should be discouraged by downgrading proposals that appear to be priced unrealistically low.

Recommendation PROC-20: A clear-cut policy is needed to define the contract type to be used at various stages of program development. To accomplish this, SECNAV Instruction 5000.1, Naval Procurement Directive (NPD) II-4, and ASPR Section 3, Part 4, should be rewritten to describe the options available and the recommended criteria upon which contract selection should be based. The acquisition strategy should be provided for enforcing these instructions in every case.

Recommendation PROC-21: The CNM should clearly enunciate the aims of the engagement concept by setting forth a posture and attitude calculated to motivate personnel at all levels, both Government and contractor, to produce the kind of effort the national interest requires. Management training within the Navy and industry program and functional organizations should emphasize this philosophy.

Recommendation PROC-22: Contract provisions with respect to payment should be reviewed with recognition of the cash-flow problems incident to present inflation, high interest rates, and other economic problems.

Recommendation PROC-23: In future contracts, escalation provisions should be revised to reflect the impact on contractor costs attributable to abnormal general economic conditions. If indices are used, they should be a reasonable reflection of the variations in cost for labor and materials utilized by the contractor in performance of the specific Government contract and should be applied in recognition of a mutual problem without unreasonable restrictions.

(5) Program Management

Recommendation PROC-24: The authority of the PM should be increased by giving him control of funds to the extent practical for his project. Support provided to the PM by the functional organizations should be handled in much the same manner by the PM as he handles his contractors. Performance of the in-house support supplied to the PM should be measured by the same techniques that are used to measure the performance of industry. The PM should have considerable latitude in regard to how much work he assigns in-house and how much work he contracts for outside.

Recommendation PROC-25: The number of personnel on the direct staff of the PM should be increased in order to allow him to manage both the in-house and contractor efforts. The exact number of personnel in the program management organization is a function of the complexity of the program, the level of competence and training of the personnel, and the point in the life cycle of the system. As a very minimum, the PM must have sufficient personnel to determine cost, schedule, and technical conditions. He must have sufficient personnel to act as an effective transfer function.

Recommendation PROC-26: The Navy should stress the career opportunities of the PM function and recognize the increase in the responsibilities of the PMs. The grade assigned should reflect this change. The Navy should assign dynamic rising officers to PM billets to demonstrate the importance of the job. Promotional reviews should be conducted by people in the management chain and not by those who have no knowledge of a PM's effectiveness.

Recommendation PROC-27: Every effort should be exerted by OSD, CNO, and CNM and their staffs to strip out those organizational elements that have become operational beyond their assigned responsibilities.

Recommendation PROC-28: Each headquarters should examine every exercise it puts the PM through to determine if that task is really necessary and if the office can answer the questions with data already available to it.

Recommendation PROC-29: Each headquarters should do its best to answer inquiries from higher headquarters without making waves in the next lower headquarters. Particular attention should be paid to each headquarters' elaborating on the request of the one above as it passes to the one below.

Recommendation PROC-30: The PM should be given the authority to run his program. This authority can be exercised only if the PM is given control over all funds allocated to his project. The PM should be allocated funds to buy support from wherever he needs it, including support from SYSCOMs.

Recommendation PROC-31: The SECDEF and the Department of the Navy should take immediate steps to implement the letter and intent of DOD Directive 5000.1.

Recommendation PROC-32: The functions of the PCO or his representative should be kept separate and distinct from those of the PM. The PCO or his representative should be a dedicated member of the PM staff and should be collocated with his staff. PM's should not have warrants.

Recommendation PROC-33: On those projects handling large FMS cases, adequate staffing should be provided to the PM to handle the additional workload.

Recommendation PROC-34: The Navy and OSD should examine the present policy of negotiating FMS cases to insure equitable treatment of U. S. contractors for those costs associated with the foreign procurement.

(6) Ship Acquisition

Recommendation PROC-35: Rigorous attention should be placed on the operational analysis leading up to the statement of requirements for new ship classes. Conscientious effort should be made to achieve the objectives of OPNAV Instruction 9010.300. The results of this effort should be scrutinized carefully at the program initiation DSARC.

Recommendation PROC-36: The policy of allowing only one estimating authority for ship acquisition programs (NAVSEA 052) should be continued. Baseline estimates should not be changed without sufficient cause. Any change should be documented.

Recommendation PROC-37: If a program is not funded at a level that supports the NAVSEA-approved estimate, the scope of the program should be reduced if that is feasible, or the program should be stopped.

Recommendation PROC-38: Every effort should be made to convince the OMB and the Congress of the desirability of multiyear authorization for ship acquisition programs. Some flexibility should be requested for the project manager in timing of expenditures.

Recommendation PROC-39: Criteria for judging acquisition approaches should be developed and used in selecting the approach that is best suited for a given program.

Recommendation PROC-40: NAVSEA should continue the present emphasis on increasing the scope of the design effort going into the contract plans and specifications to provide greater assurance that a valid estimate can be made, a fully responsive design developed, and the resultant ship built at reasonable cost.

Recommendation PROC-41: On programs involving significant numbers of production ships or ships of high unit cost, NAVSEA should defer solicitation of the follow ships until the majority of the detailed design drawings for the lead ship have been issued. If the program is critical to national defense needs and proceeding with procurement of follow ships prior to this point is necessary, the higher risk involved should be recognized. Provisions should be made for the higher risk in the budget and in the terms of the contract used for the early follow ships.

Recommendation PROC-42: In negotiated procurements, realistic target cost levels should be set (ensuring that adequate amounts are included for labor, material, and other valid cost elements) supported by sound baseline cost estimates.

Recommendation PROC-43: The type of contract for the lead ship should be tailored to the degree of risk. Some type of cost-reimbursement contract should be used when significant risk is present. A fixed price contract should be used only when the data package is sufficiently complete to permit realistic pricing.

Recommendation PROC-44: When competitive procurements are used, action that could lead to an auction-type environment should be avoided. The feasibility of using two-step negotiated procurements should be examined. Emphasis in the first step should be put on identifying the offeror(s) fully qualified for the particular shipbuilding program; then cost proposals should be solicited once from the qualified shipbuilders.

Recommendation PROC-45: When the PF procurement approach is to be the ship acquisition model and when concurrency is necessary, the following considerations should be given special attention:

> Contract for the lead ship on a cost-type basis.
> Contract with the lead yard for some of the first lot of follow ships.

- Contract for the follow ships from other yards on a fixed-price basis only after effort on the lead ship has produced a stable design. The first follow ship from the lead shipyard should be scheduled for completion at least 12 months after delivery of the lead ship. The first follow ship from a follow shipyard should be scheduled for completion at least 18 months after delivery of the lead ship.

- Include sufficient funds in the program budget to cover possible costs stemming from the Government's warranting the detailed design package.

Recommendation PROC-46: NAVSEA and the Shipbuilders Council should undertake a study to develop indices that are adequate to reflect shipbuilding cost escalation.

Recommendation PROC-47: NAVSEA and the shipbuilders should schedule ships more realistically and/or NAVSEA should provide that the escalation would apply to some reasonable period of delay (possibly 1 year) in the completion of each ship in a series.

Recommendation PROC-48: In order to make its shipbuilding programs more attractive to industry, the Navy should minimize the shipbuilders' cost problems either with more adequate and timely progress payments or allowance of interest as a valid item of cost or both.

Recommendation PROC-49: Toward the objective of reestablishing a cooperative relationship with its shipbuilders, the Government (NAVSEA, SUPSHIPs, and the Defense Contract Audit Agency (DCAA) should limit requests for data regarding the operation of a shipyard to that which the Navy actually needs to fulfill its responsibilities for ship acquisition. The type and extent of data requested should be commensurate with the type of contract(s) used. NAVSEA should set forth a moderate policy on the engagement concept and insure that the service philosophy is clearly understood at all echelons.

Recommendation PROC-50: For each major combatant acquisition program, an integrator should be engaged to concentrate on systems integration and to test the system at a land-based test site. The Navy should continue to utilize a land-based test site of the weapon/command and control system in all ship acquisition programs involving new designs to test fully as much of the system as is practicable prior to installation of the first system in a ship. The test site should be placed where it can be used most effectively by the engineers responsible for system design and test.

Recommendation PROC-51: In programs involving a sizeable number of ships, an extra ship set of equipment should be procured for use in the land-based prototype throughout the shipbuilding program for testing and training.

5. PRODUCTION PANEL RECOMMENDATIONS

(1) Major Recommendations

Recommendation PROD-1: The Navy should retain the project/functional matrix organization staffing of most of its project management offices. The vertical organization is, however, supported for high-value, top-priority programs for which the number of people required full time warrants it.

Recommendation PROD-3: For major projects, the Navy should locate the PCO on the staff of the PM. Necessary procurement support staff should also be assigned to the staff of each major weapon system acquisition project manager. The PCO and the PCO's supporting staff should be physically located in the project management office. Collateral reporting responsibility for policy guidance to other elements of the parent organization may be retained as appropriate.

Recommendation PROD-6: The Navy should eliminate unnecessary reviews and approvals of technical and contract changes and procurement requests; wherever possible, approval of procurement documents should be limited to those people whose decisions with respect to that procurement are essential. To facilitate the entire acquisition process, reviews should be concurrent or parallel, rather than sequential, whenever possible.

Recommendation PROD-13: The Navy should continue and expand the application of early and detailed advance planning of ship overhauls such as is accomplished by the PERA organizations, particularly for nuclear submarine overhauls. To this end, the Navy should give priority to identification and allocation of the personnel and financial resources necessary to extend PERA-type planning techniques fully to all major combatant ship overhauls.

Recommendation PROD-14: The Navy should devise menas of improving planning discipline for ship maintenance and modernization so that late changes to alterations and repairs in overhaul work packages are minimized. In order to achieve this, the Navy should find ways to ensure that technical, logistical, and production considerations carry adequate weight relative to military requirements in the Navy's decisionmaking processes, and that those responsible for the execution of depot-level maintenance of ships may be permitted to carry out their responsibilities according to plan.

Recommendation PROD-15: The Navy should give priority to identifying and allocating additional personnel and financial resources requisite for extended PERA-type planning and improved ship overhaul planning generally. Additonal resources for PERAs, naval shipyard planning departments, and SUPSHIPs will be required. In particular, if greater overhaul work-package stability cannot be achieved, additional personnel will be required by SUPSHIPs engaged primarily in administration of ship overhaul and repair work.

Recommendation PROD-18: The Navy, with the assistance of the Office of the Secretary of Defense, should take immediate action to retain title to the Boston Naval Shipyard (less the 28 acres reserved for the USS Constitution National Park), in order that surge drydock capacity for the repair of large, complex naval ships may be maintained on the east coast.

Recommendation PROD-19: The Navy should study the need for, and feasibility of, leasing to private contractors the Hunters Point Naval Shipyard facilities and the Charlestown portion of the Boston Naval Shipyard facilities, and request options for Navy use of the large South Boston drydock as required. The Navy should seek an out-leasing arrangement similar to that employed for the large Navy floating drydock at San Diego, whereby contractors bid for use of the facility, and the Navy ship-repair work is accorded priority. These actions should be taken to assure the maintenance of a capability for repair of naval ships in the Boston and San Francisco areas in order that the naval-shipyard drydocks there may be used for emergent Navy repair work when required.

Recommendation PROD-20: The Navy should not assign new-construction work to naval shipyards until and unless (1) a series of three or more follow-ship auxiliaries can be assigned to a single yard; (2) the new-construction work can be assured of protection from excessive disruption by emergent repair work; and (3) ceiling relief can be provided to the performing naval shipyard so as to provide for orderly buildup of a shipbuilding workforce in such a way that the shipyard's repair capability is not deleteriously affected.

Recommendation PROD-21: The Navy should take steps to acquire and maintain an active capability among at least three shipyards for construction of nuclear submarines, and among at least two shipyards for the construction of nuclear surface ships, in order that nuclear shipbuilding capabilitity may be spread among an industrial base sufficiently large to protect national security interests. To do so, the Navy will find it necessary to seek to create an environment that will attract private capital investment in nuclear shipbuilding for the Navy.

Recommendation PROD-24: The Navy should intensify its efforts to acquire Federal funds, through the Comprehensive Employment and Training Act of 1973 or other similar program, to support training programs in public and private shipyards. Funds so acquired should be applied to support of both long-term (3- to 4-year) apprentice training and short-term (up to 6-month) entry-level training. Distribution of the training funds should be from the Department of Labor to NAVSEA, and from NAVSEA directly to the naval and private shipyards whose training programs have been qualified for such funding support.

Recommendation PROD-25: Navy Industrial Fund (NIF) activities should operate with financial controls; personnel ceiling (or quasi-ceiling) controls should be removed from NIF activities.

Recommendation PROD-26: U. S. Civil Service regulations with respect to reductions-in-force (RIF) for NIF activities should be reexamined to attempt to reduce the time period between the decision date that a RIF is required and the date when employees are off the payroll. Alternative means of rapidly reducing the number of employees for relatively short periods of time with more streamlined administrative procedures to effect this would be highly desirable in giving the industrial manager the flexibility needed to meet a changing workload, while also protecting the long-term job rights of the employee.

Recommendation PROD-27: The Navy should ensure that the absence of personnel ceiling controls does not affect the distribution of industrial work between the public and private sectors to the detriment of private industrial capacity and capability.

Recommendation PROD-29: The Navy and Department of Defense should continue and intensify their efforts to obtain congressional authorization of a 5-year Navy shipbuilding program.

Recommendation PROD-30: The Navy should provide interested and qualified members of the shipbuilding and ship repair industry the outlines of the shipbuilding program contained in the Department of Defense's Five-Year Defense Plan (FYDP) and of scheduled ship-repair and overhaul work. The information should be made available as part of periodic conferences or joint planning sessions, giving contractors opportunities to comment on the Navy's ship-work plans.

Recommendation PROD-31: The Navy should continue and broaden its use of lead and follow yards in ship design procurements as was done in the Patrol Frigate and Sea Control Ship procurements, as a means of improving the adequacy of the technical-data packages used in ship acquisitions.

Recommendation PROD-32: The Navy should assure that delivery schedules stated in requests for proposals (RFPs) are both realistic and flexible, in order to secure maximum competition.

Recommendation PROD-33: The Navy should award cost-reimbursable contracts for lead ships; follow ships, except for the first follow ship built by a second source, should normally be procured under fixed-price-plus-incentive-fee contracts with adequate provisions for escalation.

Recommendation PROD-40: The Navy should continue to make claims evaluation and processing a headquarters responsibility and relieve the CAOs of any responsibility in the claims evaluation process, in order to allow the CAOs to pursue their major task of administering current contracts.

Recommendation PROD-41: The Navy should continue its emphasis on expeditious claims processing and on claims prevention.

Recommendation PROD-42: The Navy should process all changes to a contract on a priority basis and should try to use maximum pricing of changes whenever feasible in order to minimize the possible impact on production while a cost evaluation is in process.

Recommendation PROD-44: As a major step in achieving commonality, the PF/SCS approach (requiring the lead yard to procure major items competitively for the lead ship and to secure options, with escalation provisions, for additional units for follow ships) should be used in acquisitions involving several ships of a class to be built by two or more shipbuilders. The contractual provisions must provide coverage for all known escalation factors in order to make options viable.

Recommendation PROD-45: A combat-systems integrator or integrating contractor should be required in the development and construction of every major combatant ship class.

Recommendation PROD-46: An LBTS should be required for system development and software validation for each major combatant ship class.

Recommendation PROD-47: The combat systems integrator should participate, as a minimum, in the contract design, development, software validation, construction, test, and trials phases of the lead ship.

Recommendation PROD-50: The techniques that have proven successful in drastically reducing the backlog of undefined and unpriced change orders and in closing out contracts should be applied at those CAOs that have been making inadequate progress in this area.

Recommendation PROD-51: For each major project, a dedicated project officer acting as a representative of the PM should be assigned to the staff of each CAO exercising field contract-administration functions for contracts that cover significant portions of the project's efforts.

Recommendation PROD-53: NAVPROs and SUPSHIPs should be relieved of responsibility for administration of claims. Contractors must also agree to pursue claims outside of those parts of their organizations that conduct day-to-day business with the Government.

Recommendation PROD-54: The policy of "a single Government face to the contractor" should be reaffirmed and practiced. The cognizant CAO should be clearly identified as the Government team leader in the Government interface with the contractor. He should coordinate, schedule, and resolve any differences stemming from the activities of varying Government offices or agencies with respect to the contractor. Any problems that cannot be satisfactorily resolved at the local level should be taken promptly through the chain of command to whatever level is necessary for resolution.

Recommendation PROD-55: The CAO should participate in negotiation of contracts so that CAO personnel will be knowledgeable in the intent of the contracts as well as in their terms and conditions; to the extent practicable, the CAO should participate in the evaluation of proposals or in competitions leading to contracts; where practicable, these premises should apply to DCASOs and Air Force Plant Representative Offices (AFPROs) as well as NAVPROs and SUPSHIPs.

(2) Other Recommendations

Recommendation PROD-4: The Navy should continue to seek support for the collocation of NAVSEC with NAVSEA.

Recommendation PROD-5: Personnel ceiling controls (or any other management device that has similar effects) should be removed from programs for which the personnel and other support costs are reimbursable. For foreign military sales programs, the number of people hired could simply be the number that the customer is willing to pay for. For other reimbursable programs, compensating ceiling authorization could be provided between the executive agencies involved, inasmuch as the total work would still be within the bounds of an approved and budgeted program.

Recommendation PROD-7: The Navy should seek a better balance between the authority of the Chief of Naval Operations (the user) and that of the Chief of Naval Material

(the producer) in the acquisition of weapon systems. It is considered that the role of OPNAV should be focused on mission requirement determination and the role of NAVMAT and the SYSCOMs should be focused on the acquisition of weapon systems to meet OPNAV's stated requirements.

Recommendation PROD-8: The Navy should better define the role of NAVMAT headquarters. Those headquarters functions that contribute positively to the weapon-system acquisition and logistic support processes should be retained. Any resources identified as excess could be effectively applied within the SYSCOMs.

Recommendation PROD-9: The number of briefings required to be made by PMs should be reviewed, reduced, and consolidated. Opportunities for reduction exist in eliminating those briefings that are for information only and in substituting written communications for some formal briefings. It would be beneficial if briefings to be made were limited to those people who actually must make a decision as a result of the briefing.

Recommendation PROD-10: The Navy policy requiring negotiation of price before an engineering change is contractually authorized should be continued, and in those cases where a time-consuming cost evaluation of the change is required, the Navy and the contractor should attempt to maximum-price the change to forestall any adverse impact on production.

Recommendation PROD-11: The Navy should place major emphasis on achieving both technical approval and contractual authorization of Class I ECPs within existing approval time targets.

Recommendation PROD-12: In each SYSCOM certain contract negotiators in each major weapons area should be designated to process contract change orders implementing CCB directives as their task of first priority. To make such an assignment meaningful, the processing of paper between the CCB, project manager, and contract negotiator must be streamlined.

Recommendation PROD-16: The local contracting authority at naval shipyards should be increased.

Recommendation PROD-17: Authority should be granted to SUPSHIPs to issue ship repair and alteration work to Master Ship Repair (MSR) Contract contractors on a cost-reimbursable basis to the extent that the adequacy of the contractors' accounting system will permit, when work is insufficiently described to permit soundly based fixed pricing. The bulk of ship repair and alteration work should continue to be issued by SUPSHIPs on a fixed-price basis, but issuance of appropriate work on a cost-reimbursable basis will eliminate delays in work acceptance and reduce potential claims arising from work whose scope could not be sufficiently forecast.

Recommendation PROD-22: The Naval Air Systems Command should reevaluate the aircraft industrial base in the light of today's situation, considering viability, mobilization, and overall capability in the aerospace industry.

Recommendation PROD-23: The Naval Air Systems Command should make visible a firm plan that delineates work to be done in the private sector and work to be done by Government agencies, and should allocate work in accordance with that plan.

Recommendation PROD-28: Through the Office of the Secretary of Defense, the Navy should request that priority be given to the President's program to combat unemployment to creating jobs in those segments of the defense industry experiencing manpower shortages. Specifically, rather than naval shipyard employment being reduced below the levels demanded by assigned and projected workload, "public-service" and "Vietnam-veteran" jobs to be established in the President's unemployment-reduction programs should be assigned to those shipyards. Similar priority should be given to support of additional productive jobs in private shipyards doing naval or commercial shipwork in the national interest in depressed-employment areas.

Recommendation PROD-34: The Navy should eliminate misuse of best-and-final-offer procedures.

Recommendation PROD-35: The Navy and industry should recognize that technical documentation represents a best effort to describe what is intended. Correction of errors in technical documentation should be the goal in resolving any differences between Government and industry. Administrative and contractual procedures should focus on achieving this goal.

Recommendation PROD-36: The Navy should consult industry in advance of changing or modifying specifications that have a significant impact on industry. If this practice were followed, the Navy would be advised of the impact on producibility, cost, schedule, and utility that would result from such a specification change. This could then be considered within the overall framework of what is intended by the change and what would be the relative impact of that change.

Recommendation PROD-37: The Navy should assure sufficient time for a second shipbuilder building his first follow ship to "proof" his production prior to proceeding with the rest of a series of follow ships.

Recommendation PROD-38: The Navy should place limits on the volume of paper permissible in contractors' proposals to facilitate the evaluation process and to reduce the cost to a contractor of proposal preparation.

Recommendation PROD-39: The Navy should advise offerors as to what criteria and order of importance will be applied to evaluation of their proposals.

Recommendation PROD-43: The Navy should attempt to locate claims teams at offices other than CAOs in order to prevent the growth of adversary relationships between contractors and the CAOs.

Recommendation PROD 48: If location permits, an LBTS should be used as a production aid during construction of all ships of a class.

Recommendation PROD-49: After construction of the lead ship, an LBTS should be retained for training fleet personnel and for checkout of design changes in hardware and software.

Recommendation PROD-52: If improved planning stability such as is described herein cannot be instituted, the number of billets allocated to those SUPSHIPs primarily engaged in administration of ship overhaul and repair work should be increased.

Recommendation PROD-56: The missions and charters of SUPSHIPs, NAVPROs, and DCAA should be reviewed to eliminate overlapping functions; in particular, duplications of authority in both financial and industrial areas should be eliminated.

Recommendation PROD-57: The command responsibilities of NAVAIRSYSCOMREPLANT for NAVAIR NAVPROs should be deleted from the NAVAIRSYSCOMREPLANT charter and should be exercised by NAVAIR headquarters.

6. COST PANEL RECOMMENDATIONS

(1) Cost Estimating and the Use of Cost Estimates

Recommendation COST-1: Emphasize the importance of the cost estimating function throughout the command chain.

Recommendation COST-2: Provide adequate staffing, training, and career patterns in the cost estimating and cost analysis function.

Recommendation COST-3: Establish a central cost estimating and analysis group in NAVELEX.

Recommendation COST-4: Provide the three SYSCOM estimating groups (NAVSEA and NAVAIR now exist; NAVELEX is proposed) with the independence and top management support necessary for the preparation

of quality estimates by having these groups report at an appropriate level in the SYSCOM that will insure this support and independence.

Recommendation COST-5: Instill in all areas of command the importance of cooperating with and providing, in a disciplined and timely fashion, to the estimating function the most complete information available concerning the technical definition, risk assessment, quantity requirements and schedule parameters on which to base estimates.

Recommendation COST-6: Enforce OPNAV Instruction 4700.12C. Provide for greater discipline in the planning phase and during the complete budget cycle to insure that late changes to programs are minimized and that the number of programs for which budget quality estimates are required are held to the prime candidates to diminish the use of less than Class C estimates in budgets.

Recommendation COST-7: Make it a firm policy in each SYSCOM to provide the cost estimators and cost analysts with access to the detailed cost data supplied by contractors in support of proposals and with the contract costs reported in accordance with the criteria established by DOD Instruction 7000.2 or other contract cost reporting requirements.

Recommendation COST-8: Include a contingency in the estimate whenever a less-than-budget-quality cost estimate is to be included in the budget.

Recommendation COST-9: Directed cost estimates that modify those prepared by the responsible cost estimating functions should be identified as such. This identification must include the identity of the person or authority responsible for the directed cost estimate.

Recommendation COST-10: Reduce layering of cost estimating and layering of the review and analysis of cost estimates. Detailed review and analysis of estimates by NAVCOMPT and ASD(Comptroller) except for their normal budget review, should be eliminated. Modify the charter for the ASD (PA&E) Cost Analysis Improvement Group (CRAIG) to limit their function to

that of establishing criteria and guidelines concerning the preparation and presentation of cost estimates on defense systems to DSARC and to that of monitoring the armed services' cost estimating procedures, methodology, and accuracy to assure OSD that the services are performing their responsibilities. Place OP-96D's staff, augmented as necessary, and its present function of preparing Independent Parametric Cost Estimates (IPCEs) and making detailed reviews and analyses of SYSCOM estimates, in an area insulated from program or budget bias or outside influence. The Office of the Assistant Secretary of the Navy (Financial Management) appears to be a logical choice, although all possible choices should be evaluated. The detailed cost estimating review results should be available to all levels of management in the Navy and OSD. Presentations to DSARC on the review of weapon system costs would then be made by the ASN (FM) or his designee. The main thrust of this recommendation is that DOD should place responsibility and accountability for cost estimating on the Navy.

(2) Assessment of the Financial Impact of Risk

Recommendation COST-11: Continue to place emphasis on risk assessment. Make risk assessments in quantitative terms and use them in decisionmaking, especially in budgeting and contracting.

Recommendation COST-12: Choose contract type, target-ceiling spread, and incentives that prevent the assumption of undue risk by either the contractor or the Government.

Recommendation COST-13: Recognize the need for engineering support during production; buy it and use it to minimize risk.

Recommendation COST-14: Modify current production contract long-lead provisions to reflect material procurement lead-time risks.

Recommendation COST-15: Set realistic schedules and recognize schedule risk in prime contracts. Plan for schedule risk in GFE delivery and/or, if this is not feasible, consider CFE procurement.

Recommendation COST-16: Investigate the problems in data requirements and payment delay being experienced

Recommendation COST-17: For new research and development programs:

- Use Navy laboratories to identify risk early in preliminary design.
- Use the entire applicable Navy estimating capability to price the program.
- Approve a bidders list prior to RFP formulation and use contractor support in cost estimating, risk assessment, and RFP preparation.
- Recognize the uncertainty of proposed cost at completion and evaluate proposed target price on the basis of traceability, credibility, and risk planning.
- Ask questions of the proposers as necessary to obtain understanding of the proposals. Make provision for the proposers to make a final price adjustment accounting for this dialogue. Evaluate this final price on the basis of traceability and credibility.

(3) Design to Cost and Life-Cycle Cost

Recommendation COST-18: Continue to apply design to cost principles, especially in preliminary design. Understand where the cost really is: emphasize the quality of the estimate which sets the cost goal.

Recommendation COST-19: Competition and alternate designs are the touchstones of design to cost. The Navy should provide adequate time and money in the early design phases to assure the success of design to cost by taking the following measures:

- Have the qualified contractors participate with the Navy laboratories and the SYSCOMs to provide the data needed to issue a meaningful RFP.

- Establish a prioritized or weighted set of performance characteristics with either an acceptable range or a minimum value specified for each characteristic. These should be coupled with a design-to-cost ceiling representing the maximum average unit cost figure acceptable to the Navy.

- These requirements should be the basis of the RFP. This approach provides the contractors with flexibility necessary for alternate design concepts and performance/cost tradeoffs.

- Wherever feasible, use two contractors through the engineering development phase. A competitive advanced development phase is particularly crucial.

- Increase the R&D effort emphasizing design to cost in the areas of materials, processes, components, systems, and subsystems to improve the cost of these elements.

Recommendation COST-20: Since shipbuilding is a special case of design to cost, it is recommended that the Navy undertake a special study to determine:

- The benefits that could derive from competitive preliminary designs for ships

- The feasibility of expanding this capability in private shipyards

- The benefits of competition through the preliminary design and prototype phases of combat weapons systems.

Recommendation COST-21: Life cycle cost should be considered as only one of the many disciplines in the weapon system design, acquisition, and operational cycle. It must not be allowed to become the sole driver. It is also doubtful if a total life cycle cost figure, derived through a large computer printout, is of any value, given the weaknesses in the current data banks and basic cost information. However, life cycle cost can be used in acquisition management by concentrating on those portions or determinants of post-deployment cost that are design sensitive and/or influenced by the acquisition manager and contractor action, such as reliability and maintainability, manning (numbers and skills), training, and support equipment.

Recommendation COST-22: Reexamine and simplify the instructions issued relative to design to cost and life cycle cost. Use every possible precaution to prevent design to cost and life cycle cost from becoming another "ility." Provide guidelines to Navy program managers and their contracting officers.

(4) Proper Interface of DOD and Navy Industrial Systems

Recommendation COST-23: The major DOD and Navy internal systems are sound in concept and should be continued. However, the coordination and the operation of the systems are often poor and lead to weapon system program instability.

Recommendation COST-24: Develop a plan of action to achieve better coordination and integration of the individual systems so that good continuity and stability can be achieved in the major weapon programs. It should be noted that this recommendation will not be accomplished just by calling for proper integration in the various DOD and Navy directives. It will require a serious effort in the Office of the Secretary of Defense, and will require that the Deputy Secretary of Defense make sure that the staffs of the various Assistant Secretaries of Defense are willing to abide by prior decisions

reached during the other internal decisionmaking cycles. It will also require a commitment by top Defense and Navy officials to achieve program stability in the major weapon systems programs.

Recommendation COST-25: Where applicable, individual systems should be updated and streamlined. For example, the detailed procedures of the PPBS system have not been modernized since about 1965. There is much effort put into the detailed recapping of the January update for the FYDP that possibly could be improved. Recommendations are provided in Section 9 regarding the SAR reporting system. The Cost Panel believes that some features of the DSARC/DCP system need review and change if it is to be a more effective management system. There appears to be a need to improve the timeliness and accuracy of the decisionmaking documents. The DSARC/DCP process is addressed by other Panel reports.

Recommendation COST-26: In order to properly stabilize the execution of major weapons system programs in the interests of increased efficiency, it is recommended that the Navy adopt a policy of stable planning and fully adequate funding of selected priority major weapons acquisition programs, probably those designated for reporting on the SAR. This will entail the development of realistic quantity and performance requirements based on the best analysis of defense needs, a realistic acquisition plan and schedule and initial funding (and estimates of future funding requirements) of an amount sufficient to execute the program as planned. Once this planning is established in the applicable systems and documents, changes in operational requirements, unanticipated events within the program, or direction of higher authority over the Navy. Program and budgeting modifications should be avoided if the program is proceeding according to technical milestones, on schedule and within cost estimates.

(5) Contractor Reporting

Recommendation COST-27: The Navy should continue its policy of implementing DOD Instruction 7000.2 on major acquisition programs.

Recommendation COST-28: The Navy should continue its present approach to the implementation of DOD Instruction 7000.2 of avoiding interpretations of criteria that would require unnecessary or unrealistic changes to contractor internal cost and management systems.

Recommendation COST-29: Only a single work breakdown structure or cost reporting structure should be imposed in any one contract. This is in concert with DOD Directive 5000.1, and the structure should be established by the Navy project manager in accordance with the applicable guidance. However, this guidance should be interpreted with sufficient flexibility to satisfy the unique management, technical, contract, and organizational needs of each phase of the program.

Recommendation COST-30: The CPR of DOD Instruction 7000.10 should be taken as the basic contractor cost report with additions and/or changes to this base made as necessary (1) to satisfy program peculiar management needs, (2) to utilize fully and economically contractor internal cost systems and reports that provide equivalent data, and (3) to obtain any additional data needed for cost estimating purposes.

Recommendation COST-31: DOD cost data reporting requirements should be integrated into a single basic system to eliminate redundancy, inconsistent procedures, and multiple breakdowns and formats. Cost reporting requirements also should clearly provide flexibility for tailoring to fit program management needs and to avoid collection of nonessential data. The program management reports of DOD Instruction 7000.10 should be the basis for all contractor cost reporting to DOD. The needs for and benefits of any additional data beyond that available from these reports should be examined. If additional data are necessary, criteria should be established to permit them to be obtained as a logical extension of the DOD Instruction 7000.10 series of reports. Cost data reporting requirements should be in criteria form to the maximum feasible extent and should follow the guidelines of DOD Directive 5000.1. CCDR (DOD Instruction 7000.11) should be cancelled as a separate reporting system.

Recommendation COST-32: Integrity of any data bank resulting from contractor cost data reporting should be maintained with respect to accuracy, completeness (of data), and limiting access to those with a legitimate need to use the data to develop cost estimates. This should be done to prevent compromise, misuse, or misapplication of the data.

(6) Navy Laboratory Reporting

Recommendation COST-33: Efforts to improve laboratory financial and resource management should be encouraged.

Recommendation COST-34: In improving and extending laboratory management capabilities, care should be taken to avoid layering of management functions and activities that are being performed effectively by other activities.

Recommendation COST-35: Guidelines should be developed to guide Navy project managers in determining the cost planning and reporting requirements that they wish to levy on tasks they assign to laboratories. Program management responsibility and authority in this area should be emphasized.

Recommendation COST-36: On the basis that the implementation of DOD Instruction 7000.2 provides the foundation for satisfactory cost control and cost reporting to project offices (conclusion of the Cost Panel issue discussed in Section 7), it is recommended that major program tasks assigned to laboratories be reviewed for selective application of the intent of this instruction, and that application be made where appropriate. Further, the Navy should develop an appropriately modified DOD Instruction 7000.2 type of criteria for the planning and control of costs in major laboratory programs.

(7) Navy/DOD Cost Reporting—Selected Acquisition Reports

Recommendation COST-37: The Navy and DOD should consider changing the SAR reporting frequency to semi-annual. Consideration of congressional requirements is necessary, and the flexibility to require interim reports where significant changes occur should be maintained.

Recommendation COST-38: Critical reviews of the current draft revision of DOD Instruction 7000.3 should be made by Navy and DOD personnel to determine that it addresses the major problems and criticisms leveled against the SAR system. The majority of the revisions appear justified. However, the Panel recommended that the draft and formats be revised to present escalation costs for program changes along with the Provision for Economic Change so that impact of escalation may be seen. Related recommendations of escalation practices in SAR reporting are included in the Cost Panel issue discussed in Section 15.

Recommendation COST-39: It is doubtful (and questionable) that the Navy and DOD can obtain billions of dollars in the future for major weapon programs without giving a report on technical, schedule, and cost status. Therefore, the system must work to provide the most meaningful information possible and to tell the complete story about each program. Once the revised DOD Instruction 7000.3 is issued, any further changes should be kept to an absolute minimum for a period of several years so that the integrity and comparability of the system can be developed and proven.

Recommendation COST-40: Pertinent sections of the SAR concerning technical, schedule, and cost status of major contracts should be reviewed with the applicable contractor to assure that interested parties may speak from one authoritative document among themselves and with the public, the press, or the Congress. This should not require disclosure of proprietary data (contractor or Navy).

(8) The "Buy-in" Problem

Recommendation COST-41: Technical transfusion or leveling of proposals and parallel negotiations leading to best and final offer "auctions" should be prohibited. In making this recommendation, the Cost Panel does not intend to preclude oral and written discussion with contractors that are oriented toward assuring an understanding of the proposal by both parties, nor does the Panel desire to preclude adjustments to proposals (which are substantiated and traceable to the original estimate) based on such discussions.

Recommendation COST-42: Cost, schedule, and technical realism should be the primary considerations in cost estimating, proposal evaluation, and source selection. Offerors should be instructed to submit their best cost and technical proposals at the outset. Unrealistic or unsubstantiated proposals should be downgraded or rejected in the evaluation cycle.

Recommendation COST-43: The Cost Panel believes that a memorandum from the Secretary of Defense to the military services addressing the need for cost realism in acquisition practices and setting forth guidelines similar to those above would be appropriate to focus attention on eliminating the factors that may lead to buy-ins.

(9) Financial Management Capability in the Program Management Office

Recommendation COST-44: Develop and implement criteria and guidance designed to govern the establishment and continuing maintenance of the B/FM capability and responsibility in project offices. The objective of such effort should ultimately be the allocation of adequate resources to the project office on a continuing basis to ensure that, as a minimum, the following business/financial management oversight responsibilities can be effectively carried out: budget planning and development; utilization of cost/schedule planning and

control systems; cost estimate analysis (including input reports such as proposals) and cost control, accounting, and reporting (including output reports such as SARs); funding and payment planning and control; and procurement/contract planning, programming, execution, and administration functions.

Recommendation COST-45: Develop position descriptions for an assistant program manager having major business/financial management responsibilities in support of the Project Manager to be assigned to the major projects. In carrying out these responsibilities, adequate support staff billets should also be provided in the project office. Depending upon the life-cycle phase of the program, its size, and how the project is organized, personnel assigned to the project office should vary. However, between two and five well qualified professional business/financial management personnel would be an appropriate rule-of-thumb target number for each SAR program.

Recommendation COST-46: Create the billets and fill them with an appropriate mix of qualified officers and civilians. The definition of those billets should be developed such that a hierarchy had a ladder for career progression (both civilian and military) is created as discussed in Section 12 of this chapter.

(10) Selection and Career Development of Project Management Office/Financial Management Personnel

Recommendation COST-47: Develop appropriate B/FM billets in the major program management offices as discussed earlier in conjunction with issues presented in Section 11. The first step in this effort should be the internal resolution as to the source of these billets in relation to personnel ceilings.

Recommendation COST-48: Investigate the feasibility of either dividing the WSAM subspecialty designator system into subordinate parts (business/financial management, technical direction, and fleet integration and support), or establishing a new subspecialty for business/financial managers in systems acquisition; and implement the results of the investigation.

Recommendation COST-49: Revise BUPERS Instruction 1040.2 to encourage financially oriented officers to seek careers associated with the WSAM subspecialty.

Recommendation COST-50: Investigate the feasibility of establishing a new career civil service series (entry level GS-9 or 11) designed to develop individuals for key project office positions who are versed in all aspects of B/FM as related to systems acquisition and establish such a series if feasible.

Recommendation COST-51: Develop and implement guidance and procedures designed to result in comprehensive and tailored training programs for civilians and military officers who choose a career in B/FM.

Recommendation COST-52: Establish a permanent oversight group under the ASN/FM to develop, implement, and monitor progress on civilian and military career progression opportunities and patterns, assignments, training provisions, etc. of individuals involved in the acquisition of weapon systems and other finance-related careers in the Navy.

Recommendation COST-53: Establish procedures to ensure that only the better qualified individuals are selected for B/FM assignments and, if officers, their careers are enhanced by such assignment (assuming, of course, adequate performance).

(11) Foreign Military Sales

Recommendation COST-54: It is recommended that the program office organization be strengthened in those

cases where it is essential that Navy systems for foreign customers be procured through the U. S. Government. This should include the addition of a strong program management type of person, as well as a financial manager and appropriate personnel in other functions, to serve as an active focal point in the program office to assist in the marketing and management aspects of these specific foreign military sales.

Recommendation COST-55: Recognizing the reimbursable nature of management/administrative costs of FMS programs, an increase in personnel above present ceilings should be permitted when required to manage these government-to-government programs adequately. However, industry capability to perform and manage these efforts should be utilized wherever feasible.

Recommendation COST-56: The Navy should review organizational elements between the marketing organization (OP-63) and the acquisition organization (SYSCOM/project office) to reduce or eliminate the layering of intermediate functions.

(12) Layering—Financial Management Function

Recommendation COST-57: The Secretary of the Navy should determine how best to consolidate OP-92 and NCB, after fully considering the views of CNO and CMC. The Panel recommends that the primary responsibility be assigned to the Assistant Secretary of the Navy (Financial Management) with the necessary reporting alignment to serve properly the Chief of Naval Operations and the Commandant of the Marine Corps. It is very important that the consolidation of the budget functions be accomplished in a manner that does not result in any dilution of the ability of the Comptroller of the Navy to exercise his statutory responsibilities relative to the budget process.

Recommendation COST-58: In order to assist with the current personnel cutbacks and to reduce layering, consideration should be given to merging MAT-01 into the

new consolidated NCB budget office (see Recommendation COST-57). This recommendation is put forth with the full recognition that most Chiefs of Naval Material would want a MAT-01 organization to run the budget program for them and to allocate funds between the various systems commands and project offices. Most CNMs would feel that they have lost a significant part of their command and organization if they gave up the MAT-01 organization with its control over the budget dollars. However, it is questionable if many major weapon systems were ever significantly aided by this additional layer in the financial management chain. The NMARC Cost Panel believes that the CNM should exert his command influence and allocation decisions (between systems commands/program offices) on budgetary matters through the new consolidated NCB organization. It is suggested that consideration be given this recommendation about 6 to 12 months after the OP-92/NCB consolidation has been effected.

(13) Economic Escalation

Recommendation COST-59: The Navy should obtain agreement with DOD and OMB for the elimination of the use of other than the most realistic projections of economic escalation in estimating and budgeting for major weapon systems.

Recommendation COST-60: The Navy should improve its in-house capability to forecast the effect of economic escalation. At the present time, NAVSEA (SHIPS) has the most proven capability. Except in NAVSEA and NAVAIR, this ability does not exist to any marked degree. Overall policy guidance must be developed, and the capability of each SYSCOM and PM-1 must be strengthened. Overall DOD direction should be provided by ASD (Comptroller) and OMB's approval should be obtained.

Recommendation COST-61: The Navy should adopt one of the following approaches to identifying and funding economic escalation:

- Include in the budgeting and programming process the best estimate of inflation that can be predicted. Set forth these amounts separately in the funding requests to Congress and clearly show the basis for the predictions. Gain congressional recognition that these projections may be subject to change either up or down depending on economic trends over which the Navy has no control.

- Include in the budgeting and programming process the best estimates of inflation that can be predicted to provide Congress with some guidance as to possible total end cost of each major weapon system. Obtain congressional concurrence to agree to fund only the base year dollar end costs plus one out-year's projection of inflation. In each succeeding year's budget include one more year of inflation projections until no more out-year projections are required.

Recommendation COST-62: The Navy should improve its major weapon system scheduling. The projection of realistic schedules, taking into account the best available information on lead times for material acquisition and taking into account the time required to accomplish the scope of work, is necessary if the provisions for economic escalation are to bear a reasonable relationship to actual experience.

Recommendation COST-63: The Navy should obtain permission to include economic escalation in annual accounts and keep visible the amounts included.

Recommendation COST-64: The Navy should continue to improve the present policy of using base-year dollar estimates with economic escalation shown as a separate identified cost.

Recommendation COST-65: The Navy should provide policy guidance to insure that the amounts included for economic escalation in the programming, budgeting, and SAR cycles for the out-years are reported consistently and uniformly.

Recommendation COST-66: The Navy should complete MAT-02's effort to develop escalation clauses for shipbuilding contracts that will provide protection to contractors for economic escalation. Recognition must be given to the fact that these clauses must have the basic flexibility to be modified as required to suit the particular circumstances of various types of procurements. These clauses should provide for divorcing the effect of escalation from the basic risk-sharing arrangements of fixed-price-incentive-fee (FPIF) contracts by providing protection to ceiling. They should also consider extending the application to cost-type contracts. In addition, it would appear necessary for the Navy to encourage the flowdown of escalation provisions to subcontractors when the prime contractor has such protection.

Recommendation COST-67: In conjunction with the other services, the Navy should recommend to DOD a revision to ASPR 3-404.3 and ASPR 7-106 to broaden the ASPR coverage for economic price adjustments.

Recommendation COST-68: The Navy should not include option provisions in new long-term procurements under the current economic environment without making adequate provision to protect the contractor against the effects of economic escalation.

Recommendation COST-69: DOD and the Navy should continue their efforts to develop and apply equitable adjustments to existing contracts to minimize the effect of economic escalation.

(14) Interest

Recommendation COST-70: DOD and the Navy should recognize imputed interest as a cost under all Government contracts.

Recommendation COST-71: DOD and the Navy should form a committee that includes industry representatives to draft an ASPR clause and to determine the mechanics of calculating the investment and cost. This

recognition of investment should be done on a two-stage basis. At first, rough or approximate calculations should be sufficient. Later, as experience in this matter is gained, more guidance can be given Government and contractor personnel.

Recommendation COST-72: If ASPR revision is considered necessary, DOD and the Navy should revise the ASPR to recognize imputed interest as a cost.

(15) Cash Flow/Progress Payments

Recommendation COST-73: The effectiveness of SECNAV Instruction 7810.11 in its present form is questionable in the judgment of the Panel. The current Navy study should be completed; policies for financing, contractor investment and profit should be defined; and modification of SECNAV Instruction 7810.11 should be effected to achieve practices that are equitable and realistic in view of the current economic environment.

Recommendation COST-74: The Panel recognizes that the Navy should not adopt any practice that would result in "windfall" and undeserved cash payments to contractors. However, in structuring new progress payment practices, the Panel believes the Navy should consider allowing contractor receipt of some amount of earned profit on costs incurred (with appropriate limits on recovery over costs incurred) for contracts with long procurement and construction phases.

Recommendation COST-75: The Navy should consider establishing a policy requiring that a contract price that recognizes variation in costs between ships in a production run be specified for purposes of liquidating progress payments.

Recommendation COST-76: Adjustments to the billing base should be made in a timely manner. Other Panels have addressed required improvements in the adjudication of changes to contracts.

(16) Availability and Use of Management Reserves

Recommendation COST-77: Undertake a full study to determine the extent of reserve requirements and to make specific recommendations as to the manner in which they should be developed, controlled, and applied. The study should be conducted so as to provide for OSD, OMB, and congressional input/participation to insure appropriate perspective and to facilitate implementation of study results.

Recommendation COST-78: Attempt to eliminate artificial constraints inherent in the budgeting process such as those imposed by OMB Circular A-11 (e.g., with respect to escalation) and the Congress (e.g., with respect to legislative provisions that preclude changing funds obligation authority from one year to the next for the same line item within the same appropriation).

Recommendation COST-79: Encourage development of budgets that both recognize risks (Cost Panel Section 4) and request funding more toward contract ceiling (including reserves) in order to fund probable system costs.

Recommendation COST-80: Utilize system cost estimates developed in the SYSCOM that include a certain percentage (e.g., 5 to 15 percent) of the base estimate as a management reserve.

(17) Multiyear Authorization of Major Weapon Systems

Recommendation COST-81: The Cost Panel supports the intent of multiyear authorizations. Selected weapon systems programs in shipbuilding and modern aircraft and missiles, with their long lead times, could benefit most from multiyear authorizations.

Recommendation COST-82: An open working relationship with Congress is most important. A large portion of the information on which Congress formulates its course of action is the reporting submitted by DOD and the Navy. It is necessary that this information be clear, concise, timely and accurate.

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GLOSSARY(1)

ABBREVIATIONS AND ACRONYMS

ACO	Administrative Contracting Officer
ACV	Air cushion vehicle
ADO	Advanced Development Objective
AEDO	Aeronautical Engineering Duty Officer
AFPRO	Air Force Plant Representative Office
AGC	Associated General Contractors
AMARC	Army Materiel Acquisition Review Committee
APP	Advance Procurement Plan
ARPA	Advanced Research Projects Agency
ASBCA	Armed Services Board of Contract Appeals
ASD(I&L)	Assistant Secretary of Defense (Installations and Logistics)
ASN(AIR)	Assistant Secretary of the Navy (Air)
ASNE	American Society of Naval Engineers
ASN(R&D)	Assistant Secretary of the Navy for Research and Development
ASN(I&L)	Assistant Secretary of the Navy (Installation and Logistics)
ASPR	Armed Services Procurement Regulation
ASU	Approval for service use
ASW	Antisubmarine warfare

B/FM	Business and financial management
BOB	Bureau of the Budget
BRDP	Blue Ribbon Defense Panel
BUAER	Bureau of Aeronautics
BUDOCKS	Bureau of Yards and Docks
BUMED	Bureau of Medicine and Surgery
BUORD	Bureau of Ordnance
BUPERS	Bureau of Naval Personnel
BUSHIPS	Bureau of Ships
BUWEPS	Bureau of Weapons
CAB	Civil Aeronautics Board
CAIG	Cost Analysis Improvement Group
CAO	Contract Administration Office
CAS	Contract Administration Services
CCB	Configuration Control Board
CCDR	Contractor Cost Data Reporting
CEB	CNO Executive Board
CETA	Comprehensive Employment and Training Act
CG	Comm nding General
CINCLANTFLT	Commander in Chief, U.S. Atlantic Fleet
CIWS	Close-in Weapons System
CMC	Commandant of the Marine Corps

CMP	Cresap, McCormick and Paget Inc.
CNA	Center of Naval Analyses
CND	Chief of Naval Development
CNM	Chief of Naval Material
CNO	Chief of Naval Operations
CNR	Chief of Naval Research
CNS	Chief of Naval Support
COD	Carrier Onboard Delivery
COGP	Commission on Government Procurement
COMNAVAIR-PAC	Commander, Naval Air Force, U.S. Pacific Fleet
CPAM	CNO's Program Analysis Memorandum
CPIF	Cost Plus Incentive Fee
CPPG	CNO Planning and Programming Guidance
CPR	Contract Performance Report
CRP	Controllable reversible pitch
CSC	Civil Service Commission
CWAS	Contractor-weighted average share
D&F	Determination and Findings
DC	Development Coordinator
DCAA	Defense Contract Audit Agency
DCAS	Defense Contract Administration Services

DCASD	Defense Contract Administration Services District
DCASO	Defense Contract Administration Services Office
DCG	Deputy Commanding General
DCNM(D)	Deputy Chief of Naval Material (Development)
DCNM(P&P)	Deputy Chief of Naval Material (Plans and Programs)
DCNO	Deputy Chief of Naval Operations
DCNO(AIR)	Deputy Chief of Naval Operations (Air)
DCNO(D)	Deputy Chief of Naval Operations (Development)
DCP	Development Concept Paper
DCS(RD&S)	Deputy Chief of Staff (Research, Development, and Studies)
DDC	Defense Documentation Center
DDR&E	Director of Defense Research and Engineering
DEPDIR(T&E)	Deputy Director (Test and Evaluation)
DEPSECDEF	Deputy Secretary of Defense
DLP	Director of Laboratory Programs
DMSO	Defense Materials Systems Office
DNL	Director of Navy Laboratories
DNP	Director of Navy Programs
DOD	Department of Defense
DON	Department of the Navy
DP	Development Proposal

DRDT&E	Director of Research, Development, Test, and Evaluation
DSARC	Defense System Acquisition Review Council
DSB	Defense Science Board
DSRV	Deep-submergence rescue vehicle
DTC	Design to Cost
DTMB	David Taylor Model Basin
ECM	Electronic Countermeasure
ECP	Engineering Change Proposal
ED	Exploratory development
ED	Engineering Duty
EPA	Extended Planning Annex
EPG	Extended Planning Guidance
FAT	Final Acceptance Trial
FCDSSA	Fleet Combat Direction System Support Activity
FLIR	Forward-looking infrared
FMP	Fleet Modernization Program
FMS	Foreign military sales
FPR	Federal Procurement Regulation
FYDP	Five-year Defense Plan
GAO	General Accounting Office
GFE	Government-furnished equipment

GFI	Government-furnished information
GFM	Government-furnished material
GOCO	Government-owned, contractor-operated
GSA	General Services Administration
IDA	Institute for Defense Analysis
ILS	Integrated Logistic Support
INSURV	Board of Inspection and Survey
IOC	Initial Operational Capability
IR&D	Independant Research and Development
IR/IED	Independent Research/Independent Exploratory Development
JCS	Joint Chiefs of Staff
JSESPO	Joint Surface Effect Ship Program Office
LBTS	Land-based Test Site
LHA	Amphibious Assault Ship
LORAN	Long-range aid to navigation
LRU	Line replaceable unit
MARAD	Maritime Administration
MCDEC	Marine Corps Development and Education Center
MEL	Marine Engineering Laboratory
MILCON	Military Construction
MILSPEC	Military Specification
MIL-STD	Military Standard

MSR	Master Ship Repair
NADC	Naval Air Development Center
NAEI	Naval Aviation Executive Institute
NAFI	Naval Avionics Facility, Indianapolis
NARDC	Naval Research and Development Information Center
NARDIC	Navy R&D Information Center
NARF	Naval Air Rework Facility
NATC	Naval Air Test Center
NAVAIR	Naval Air Systems Command
NAVAIRSYS-COMREPLANT	Naval Air Systems Command Representative, Atlantic
NAVCOMPT	Comptroller of the Navy
NAVELEX	Naval Electronic Systems Command
NAVMAT	Naval Material Command
NAVORD	Naval Ordnance Systems Command
NAVPRO	Naval Plant Representative Office
NAVSEA	Naval Sea Systems Command
NAVSEC	Naval Ship Engineering Center
NAVSHIPS	Naval Ship Systems Command
NDCP	Naval Development Concept Paper
NELC	Naval Electronics Laboratory Center
NIF	Navy Industrial Fund

NMARC	Navy and Marine Corps Acquisition Review Committee
NMC	Naval Material Command
NOL	Naval Ordnance Laboratory
NPD	Naval Procurement Directive
NRAC	National Research Advisory Council
NRL	Naval Research Laboratory
NSARC	Navy Systems Acquisition Review Council
NSF	National Science Foundation
NSRDC	Naval Ship Research and Development Center
NSWC	Naval Surface Weapons Center
NUC	Naval Undersea Center
NUSC	Naval Underwater Systems Center
NWC	Naval Weapons Center, China Lake
NWL	Naval Weapons Laboratory
OCEANAV	Oceanographer of the Navy
ODDR&E	Office of Defense Research and Engineering
OMB	Office of Management and Budget
ONR	Office of Naval Research
OPEVAL	Operational Evaluation
OPNAV	Office of the Chief of Naval Operations
OPTEVFOR	Operational Test and Evaluation Force
OR	Operational Requirement

ORDALT	Ordnance Alteration
OSD	Office of the Secretary of Defense
OST	Office of Science and Technology
OT&E	Operational Test and Evaluation
OWP	Overhaul Work Package
PC	Program Coordinator
PCO	Procuring Contracting Officer
PERA	Planning and Engineering for Repairs and Alteration
PF	Patrol Frigate
PHM	NATO Patrol Hydrofoil, Guided Missile
PM	Program memorandum
PM	Project Manager
PMA	Project Manager, NAVAIR
PMO	Project Management Officer
PMR	Pacific Missile Range
POM	Program Objective Memorandum
PMS	Project Manager, NAVSHIPS (NAVSEA)
PPBS	Planning, programming, and budgeting system
PR	Procurement Request
PSAC	President's Science Advisory Council
PTA	Proposed Technical Approach
RAN	Request for Authority to Negotiate

R&D	Research and Development
RD&S	Research, Development, and Studies
RDT&E	Research, Development, Test, and Evaluation
RDT&EN	Research, Development, Test, and Evaluation, Navy
RFP	Request for Proposal
RIF	Reduction in Force
R&T	Research and Technology
SAP	Security Assistance Program
SAR	Selected Acquisition Report
SARP	Ship Alterations and Repair Package
SCN	Shipbuilding and Conversion, Navy
SCS	Sea Control Ship
SECDEF	Secretary of Defense
SECNAV	Secretary of the Navy
SES	Surface effect ship
SESOC	Surface Effect Ships for Ocean Commerce
SHAPM	Ship Acquisition Project Manager
SHIPALT	Ship Alteration
SITS	System Integration Test Site
SPO	Systems Project Officer
SSP	Source Selection Plan
STO	Science and Technology Objective

SUPSHIP	Supervisor of Shipbuilding, Conversion, and Repair
SYSCOM	Systems Command
TCP	Technology Coordinating Paper
T&E	Test and Evaluation
TEMP	Test and Evaluation Master Plan
TLR	Top-level Requirement
TLS	Top-level Specification
USMC	U.S. Marine Corps
VCNO	Vice Chief of Naval Operations
WRA	Weapons replacement assembly
WSAM	Weapons System Acquisition Manager

DEFINITIONS

Acceptance for Service Use: The result of an INSURV or BIS acceptance trial is a report that includes a statement or finding that the ship or aircraft model is recommended for acceptance or rejection. Specific conditions for acceptance are also identified in the report.

Acceptance Trials: The trials conducted by the Board of Inspection and Survey to determine contractual compliance with Navy specifications for new ships and new model aircraft and conformance with mission requirements established by CNO.

Active Participation: Refers to OPTEVFOR involvement in DT&E efforts for the purpose of securing IOT&E information.

Advanced Development: Includes all projects that have moved into the development of hardware for experimental or operational test.

Advanced Development Objective (ADO): Outlines a development that is not yet assured as to military usefulness, technical feasibility, and financial acceptability. It calls for development effort to supply the missing information. (obsolete)

Appropriation Sponsor: DCNO or a Director of a Major Staff Office charged with supervisory control over an appropriation.

Approval for Service Use: SECNAV Instruction 5000.2 states "where a system/equipment is approved by the SECDEF for production, such decision may be considered as constituting approval for service use. This approval does not in any way relieve the Chief of Naval Operations of his responsibility for determining the service acceptability for systems and equipments." For programs not subject to DSARC review, the production decision and approval for service use shall be rendered by CNO.

Board of Inspection and Survey (BIS or INSURV): A board established by law, reporting to SECNAV and CNO, that is responsible for the conduct of service acceptance trials of new ships and model aircraft for the purpose of determining "whether or not the contract and authorized changes thereto have been satisfactorily fulfilled." The findings of the Board and its recommendations relating thereto form the basis upon which SECNAV makes his determination of "final acceptance (or rejection) for naval service." Historically the term "BIS" has been applied to the acceptance tests of aircraft. "INSURV" is also an abbreviated title for Board of Inspection and Survey but with historical application to the acceptance tests of ships.

Certification: The act of attesting, by report, letter or certificate, that the performance of an equipment or system meets prescribed performance criteria. The work carries the connotation of a guarantee.

Combat System: The Command and Control, Communications, Weapon, and other electronic systems used directly for target surveillance, target recognition, target acquisition, electronic countermeasures, and weapon delivery.

Dedicated Services: The utilization of fleet services wherein support of the project is the assigned mission for the designated fleet units.

Defense System Acquisition Review Council (DSARC): A body at the DOD level that reviews DCPs at appropriate times and makes recommendations to SECDEF for his decision.

Deficiency Correction Testing (DCT): The group of continuing but individually scheduled test and evaluation efforts sponsored by the developing agency for purposes of determining the suitability and acceptability of the corrective action taken to eliminate or otherwise resolve deficiencies reported during the Board of Inspection and Survey Trials, OPEVAL, and fleet use.

Department of the Navy Five-Year Program (DNFYP): The Navy's official programming document commonly referred to as the Blue Streak. This publication consists of volumes or booklets and displays the Navy's portion of the Five-Year Defense Program (FYDP). SECDEF-approved forces, manpower, and financial data are given for each Navy program element for the current, budget, and program year.

Developing Agency (DA): The Systems Command assigned responsibility for the development, test, and evaluation of the weapon system, subsystem, or item of equipment.

Development Concept Paper (DCP): Memorandum from the Secretary of Defense expressing his decisions on the initiation of, or changes to, major R&D programs. The draft is prepared by the individual service; the final approved version is in effect a contract between the service and SECDEF.

Development Coordinator: The single individual within the Office of Director RDT&E (OP-098) who is charged with the coordination of both development test and evaluation and initial operational test and evaluation for a particular development project.

Developmental Test and Evaluation (DT&E): All test and evaluation effort undertaken by the developing agency for the purpose of obtaining development information or a combination of development and operational information on a system, subsystem, equipment, or component involved in the defense system acquisition process. Such tests proceed under the direction of the developing agency and may be performed by the developing agency or for the developing agency by OPTEVFOR (Operational Test and Evaluation Force), e.g., development or operational assist and TECHEVAL projects. In order to

assure the generation of information considered essential for IOT&E purposes, the developing agency shall jointly plan the development test program with OPTEVFOR who, if not performing the test, shall participate therein and submit its independent assessment of the expected operational effectiveness and service suitability of the emerging design to CNO. DT&E includes engineering and development tests, laboratory/contractor demonstration, NPEs (Naval Preliminary Evaluations), NTEs (Naval Technical Evaluations), and the follow-on Deficiency Correction Tests.

Engineering Development: Includes those development programs that are being engineered for service use but have not yet been approved for procurement or operation.

Engineering Tests: The test program sponsored by the developing agency using developmental and early production prototype hardware for purposes of demonstrating the nature and extent of the technical, operational, and economic feasibility and the utility of the engineering approaches mechanized in the candidate system(s) selected for validation in the Milestone I Program Decision. Such tests are performed by the participating laboratories and contractors and are tailored to explore the engineering alternatives available for consideration in high-risk areas and to select the specific mechanizations to be employed in the product design.

Evaluation: The review and analysis of qualitative or quantitative data produced during current or previous testing or operational usage, or combinations thereof to determine the worth of the item tested.

Exploratory Development: Includes all effort directed toward the solution of specific military problems, short of major development projects.

Five-Year Defense Program (FYDP): The official OSD publication that summarizes the approved plans and programs of the Department of Defense components.

Follow-On Operational Test and Evaluation (FOT&E): Any operational test and evaluation of a system, subsystem, equipment, or component conducted under fleet conditions by OPTEVFOR or other operational commands designated by CNO, subsequent to the major production decision (Milestone III) for purposes of further verifying

system performance capabilities and limitations, refining tactical employment doctrine and requirements for personnel and training, and validating the correction of deficiencies previously identified. Such tests may be initiated using prototype hardware until production systems become available.

Full-Scale Development Decision: The DSARC II decision to proceed with the full-scale development phase of the weapons system acquisition life cycle.

General Operational Requirement (GOR): Forecasts of operational capabilities that will be required in major warfare or support areas to counter predicted threats or to satisfy anticipated operational objectives that will be needed during the timeframe 10 to 20 years in the future. (obsolete)

Initial Operational Test and Evaluation (IOT&E): Any operational test and evaluation effort participated in or undertaken by OPTEVFOR prior to the major production decision (Milestone III) for purposes of assessing the operational effectiveness and suitability (including reliability, maintainability, safety, and supportability) of a system, subsystem, equipment, or component involved in the defense system acquisition process prior to the major production decision. The test programs involved in the IOT&E effort include those sponsored by the developing agency for development purposes (DT&E) and the formal OPEVAL sponsored by CNO. The latter test program is conducted by OPTEVFOR using production (pilot or early) systems unless authorization is received from CNO to employ production prototype equipment.

Integrated Logistic Support: A composite of all the support considerations necessary to assure the effective and economical support of a system for its life cycle. It is an integral part of all other aspects of system acquisition and operation. Integrated logistic support is characterized by harmony and coherence among all the logistic elements.

Major Production Decision: The DSARC III decision to authorize full production on a new system.

Naval Preliminary Evaluation (NPE): A series of technically oriented tests sponsored by the developing agency and conducted by Navy test activity personnel using production prototype hardware for the purpose of initiating and carrying forward the performance characteristics and operational suitability assessments required during the full-scale development period. This test program is generally associated with aircraft weapons system programs and their associated major non-expendable subsystems. The results constitute the basis of a developing agency determination of readiness for Board of Inspection and Survey Trials and formal OPTEVAL, when required.

Naval Technical Evaluation (NTE): The intermittent but continuing technically oriented test program on aircraft systems sponsored by the developing agency and performed by government test agencies for purposes of validating the operational constraints (envelopes, safety, etc.) within which subsequent tests and evaluations will proceed, evaluating changes dictated by the results of ongoing test and evaluation programs, determining carrier suitability and performance characteristics not scheduled for demonstration by the laboratory or contractor and determining readiness for formal OPEVAL. For weapons, both free-fall and guided, these tests are formalized in a developing activity sponsored test program called NTE using late production prototype or pilot production hardware, which is performed by a naval test activity other than the cognizant design agent or by OPTEVFOR under a CNO authorized technical evaluation (TECHEVAL) project (see OPNAV Instruction 3930.8 series). The results constitute the basis for developing agency certification of readiness for formal OPEVAL.

Not-To-Interfere Basis (NIB): A basis for obtaining fleet services whereby the unit conducts its normal type training or other assigned mission, and project testing is conducted simultaneously as long as it does not interfere with the assigned mission.

Operational Effectiveness: How well the system meets its defined operational requirements in its intended operation environment, including effects of countermeasures and tactics.

Operational Evaluation (OPEVAL): The evaluation program conducted by the independent (not responsible to the developing agency) test activity (Operational Test and Evaluation Force) for the purpose of completing the assessment of operational suitability of a system and making an authoritative determination of its capabilities and limitations when operated and maintained in the operational environment

in accordance with the constraints previously established by the developing agency. The results of this evaluation program and the COMOPTEVFOR recommendation relating thereto form the basis for the DSARC or equivalent body's decision relative to Milestone III and the associated approval for service use. This program constitutes the concluding phase of IOT&E and is conducted on production (pilot or initial) hardware unless the use of production prototype hardware is specifically authorized by CNO.

Operational Suitability: The determination made by COMOPTEVFOR prior to the major production decision. It involves quantitative and qualitative assessments of the following design attributes:

- Reliability: Demonstrated, satisfactory, and effective performance in accordance with program objectives in a realistic operational environment, for stated periods of time without failure or performance degradation below specified limits.

- Maintainability: Demonstrated capability to be effectively maintained by the level of personnel skill anticipated to be available under service conditions.

- Supportability: Reasonable indication that logistic support in a deployed status is feasible.

- Operability: Demonstrated effective operation by qualified fleet personnel.

Operational Test and Evaluation (OT&E): Tests and evaluations participated in or performed by operational personnel focusing on operational effectiveness and suitability (including reliability, compatibility, interoperability, maintainability, and supportability). It also includes the development of optimum operational tactics for systems and equipment being developed for service use. Operational evaluations undertaken for the specific purpose of obtaining operational information proceed under the direction of COMOPTEVFOR (Commander, Operational Test and Evaluation Force) and will be performed by agents or activities under his direct control. Such tests are intended to supplement rather than duplicate the operational test results obtained during the DT&E (Development Test and Evaluation) programs under the developing agency and shall be reported directly to CNO.

Pilot Production: The controlled manufacture of limited numbers of an item for services test and evaluation purposes using manufacturing drawings and specifications that have been developed for quantity production and with tooling that is representative of that to be used in unlimited production.

Planning/Programming/Budgeting System (PPBS): An integrated system for the establishment, maintenance, and revision of the FYDP and the DOD budget.

Principal Development Activity (PDA): The Principal Development Activity is the agency assigned by the Chief of Naval Material to undertake the management and technical responsibility for prosecution of the development effort, including timely budgeting for and allocation of resources within the approved plan.

Production Decision: A generic term used in the defense system acquisition business to denote any of a series of production decisions rendered by competent authority authorizing the procurement of hardware items or systems for either OT&E (Operational Test and Evaluation) purposes or service use, employing production (hard) tools, processes, and procedures in their manufacture. Such decisions involve the use of funds made available under the production appropriation.

Program Coordinator: The invididual within OPNAV who is responsible for the formulation and administration of a program.

Program Decisions:

- Program Initiation Decision: The DSARC I decision to proceed with the validation phase of the acquisition life cycle.
- Full-Scale Development Decision: The DSARC II decision to proceed with the full-scale development phase of the weapons system acquisition life cycle.
- Major Production Decision: The DSARC III decision to authorize full production on a new system.

Program Element: The basic building block of the Five-Year Defense Program which is a description of the mission to be undertaken and a collection of the organizational entities identified to perform the mission assignment. Elements may consist of forces, manpower, materials (both real and personal property), services, and associated costs as applicable.

Program Element Sponsor: The DCNO or Director of a major staff office who is responsible for force composition, funding support, and programmed manpower for a specific program element. He is responsible for objectives and planned programs for the out years, as well as for the development of program change requests (PCRs).

Program Initiation Decision: The DSARC I decision to proceed with the validation phase of the acquisition life cycle.

Program Memorandum (PM): A document resembling an abbreviated DCP, intended for use for those programs below DSARC cost thresholds but for which DSARC review is desired.

Program Sponsor: The DCNO or Director of a major staff office.

Programming: The process of preparing a program, especially in terms of quantitative, physical requirements of manpower, material, and facilities.

Programming Budgeting System: The procedures for the establishment, maintenance, and revision of the Five-Year Defense Program and the DOD budget.

Project Manager (PM): The single individual responsible for a particular weapon system acquisition project. The project manager is the representative of the development agency and derives his authority from a charter issued by such agency.

Project Operations (POPS): The actual conduct of operations by fleet units in support of a CNO-assigned project.

Prototype: A generic term used in the Defense system acquisition business to denote any of a series of preproduction models of a system, subsystem, equipment, or building block component constructed for the purpose of demonstrating its attributes of technic operational, and economic feasibility; its utility; its producibility; or any combination thereof.

Required Operational Capabilities Statement (ROC): A composite listing of all required operational capabilities for a class of ship or types of aircraft squadrons as assigned by the Chief of Naval Operations. A ROC, together with a statement of Projected Operational Environment (POE), provides the necessary detail and criteria to establish manning requirements. (Published as OPNAV Instruction 3500 series.)

Research, Development, Test, and Evaluation (RDT&E): A multistage process that has as its objective the development of an operational capability. The function performed by RDT&E is the production of knowledge required to achieve such capabilities.

Ship Acquisition Project Manager (SHAPM): A SHAPM is a NAVSEA project manager who manages the development, design, construction, and conversion of assigned ship types. He operates under a charter from Commander, Naval Sea Systems Command, as approved by the Chief of Naval Material. A SHAPM's chartered responsibilities normally include "coordinating authority" functions for ship type assigned to him.

Specific Operational Requirement (SOR): The document that authorizes the conduct of an engineering development or an operational systems development project, and as such is the formal document in which the Chief of Naval Operations states a need for development of new or improved capabilities to counter a specific threat or to satisfy an operational deficiency. The SOR normally follows and is based on information contained in the Proposed Technical Approach (PTA). (obsolete)

Ship Design Manager: The agent responsible to the SHAPM for the production of the complete ship design, including the test specifications.

SUPSHIP T&E Program Coordinator: The manager within the office of the Supervisor of Shipbuilding who is designated to monitor T&E program progress at the shipbuilding site and to coordinate the T&E activities of special test groups with the testing activities of the shipbuilder. He has the principal responsibility for effective liaison between the Supervisor of Shipbuilding and the total ship test director (TSTD).

Task Group Manager (TGM): A manager responsible to the Ship Design Manager for coordinating the activities related to the total-ship design process, e.g., the Mobility System TGM, the Combat System TGM, and the T&E TGM.

Technical Development Plan (TDP): The primary vehicle of the Principal Development Activity (PDA) for conveying the details of development necessary for effective management review. It is prepared in response to an Advanced Development Objective (ADO) or a Specific Operational Requirement (SOR). (obsolete)

Test: Any program or procedure that is designed to obtain, verify, or provide data for the evaluation of: research and development; progress in accomplishing development objectives; or performance and operational capability of systems, subsystems, components, and equipment items.

Test Development Activity (TDA): An agency, government, or contractor normally responsible to a TDM for preparing technical test documentation.

Test Development Director (TDD): The director responsible to the TSTD for development of test documentation and for supporting execution of the test program for one of the three major systems in a ship, i.e., combat, mobility, and support.

Test Development Manager (TDM): A manager responsible to a TDD for development of test documentation for subsystems of the major ship system, e.g., command and control, AAW, and ASW under the TDD for combat system.

Test and Evaluation (T&E): The process of measurement and analysis to validate a component/system/ship's compliance with specified technical and operational performance requirements.

Test and Evaluation Master Plan (TEMP): A management document prepared by the project manager that describes how and when developmental and operational test objectives will be met.

Total Ship Testing: Testing of a ship in accordance with a predetermined specific plan devised to assure progressive equipment and intrasystem and intersystem testing in sufficient depth to validate that the ship as a system meets performance criteria that demonstrate that it is capable of fulfilling its mission requirements.

Total Ship Test Director (TSTD): The manager responsible to the SHAPM for development and execution of the total-ship test program including direction of the program TDDs and overall analysis and evaluation of T&E program progress and effectiveness.

User: The fleet, in the user/producer dialogue of product acquisition. The fleet is represented by COMOPTEVFOR with respect to operational test and evaluation conducted by an independent "user" activity.

Validation: The act of confirming that design specifications and contractual commitments have been met and that operational capabilities of the ship/systems have been demonstrated to be satisfactory.