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The Transformation of the European Defense Industry

Emerging Trends and Prospects for Future U.S.-European Competition and Collaboration

James B. Steinberg

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James B. Steinberg

Prepared for the
Under Secretary of Defense for Acquisition

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PREFACE

This report examines the structure and evolution of the European defense industry and its prospects for future development. It is designed to help readers understand the strategies and objectives of the principal European industrial and government officials and to lead to an assessment of the possibilities for future collaboration and competition with the U.S. defense industry. It should be of interest to policymakers concerned with transatlantic defense cooperation, arms export policies, NATO issues, and the U.S. industrial base.

The research was conducted under the Acquisition and Support Policy Program of RAND's National Defense Research Institute (NDRI) for the Deputy Under Secretary of Defense for Acquisition (International Programs). NDRI is a federally funded research and development center sponsored by the Office of the Secretary of Defense and the Joint Staff.

A companion study by Rachel Kaganoff at RAND will examine the policies and attitudes of the United States government and industry toward transatlantic collaboration.

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SUMMARY

In the years following World War II, the United States was the NATO defense market's principal supplier. This arrangement served both U.S. and NATO interests in rapid European rearmament, interoperability and standardization of weapon systems, and efficient production. The European market was also a source of profit for U.S. firms. Over time, Europe rebuilt its own design and production capability, first through licensed production of U.S. systems and offsets, then gradually, under growing nationalist sentiments and a strengthening European economy, through the rebuilding of an indigenous industry. Today, the larger NATO European allies rely primarily on domestic or European systems, while the smaller countries are still heavily dependent on U.S.-designed systems.

National independence brought Europeans such benefits as security of supply, access to leading-edge technology, improved balance of payments, and increased employment, but at a price: higher unit costs, duplicative research and manufacturing capabilities, and declining standardization in NATO. In the late 1970s and early 1980s there was an effort to overcome some of these problems through an emphasis on transatlantic collaborative programs, but many of the more visible efforts, such as NFR-90, MSOW, and APGM, have now been abandoned. Increasingly, Europeans have turned to European collaboration as an answer to the limitations of national defense markets.

BACKGROUND: CHARACTERISTICS OF THE EUROPEAN DEFENSE MARKET

The Europewide Market

Taken as a whole, the European market is about half the size of the U.S. market, whether viewed from the perspective of European procurement or the European defense firms' sales. R&D is a particularly significant problem for European defense firms, since European government funding for defense R&D is only about one-third of U.S. government expenditures. Europeans depend more on export sales, which make up a somewhat larger percentage of defense sales in key industries, and the additional sales offered by exports help compensate for the lower domestic demand. European exports have

fallen considerably in the late 1980s. Productivity in European aerospace is lower than its U.S. counterpart.

Although Europeans on the whole have had greater state ownership in the defense industrial sector, there is a distinct trend toward privatization, not only in the UK (where privatization is most advanced), but also in the more heavily state-sector-dominated countries such as France and Italy. European firms are increasingly concentrating on diversifying their activities into the civil sector, to protect against declining European defense budgets and the uncertainties of the defense market.

Europe on the whole lags the United States in defense-related technologies, although the U.S. government's assessment of European technological strengths is more pessimistic than those made by European and private sources.

The Major National Markets

European defense markets fall into three tiers: France, Germany, and the UK, which are essentially self-sufficient and have technologically advanced firms in most sectors; a second tier (dominated by Italy and Spain and trailed by Belgium, the Netherlands, and Norway) that has considerable indigenous capability and some advanced firms but also depends heavily on collaboration; and Greece, Turkey, Portugal, and Denmark, which mostly rely on imports and licensed production.

France, Germany, and the UK have annual defense budgets in the range of \$33–\$36 billion. Procurement expenditures range from \$8 billion (Germany), \$12.8 billion (France), to \$14 billion (UK). Defense R&D spending is around \$5.5 billion in France, \$4.1 billion in the UK, and \$2.1 billion in Germany. Defense sales for France and the UK are around \$20 billion, for Germany around \$12 billion. France is the dominant defense exporting country in Europe, followed by the UK and Germany.

Italy is spending about \$15 billion on defense in total, \$4.3 billion on procurement, and \$510 million on research. Defense sales amount to some \$4.5 billion. Spain trails by a considerable margin: \$7.3 billion total defense spending, \$2.6 billion procurement, and \$320 million R&D. Spain's defense sales in 1987 were \$1.8 billion.

THE CHANGING ECONOMIC, POLITICAL, AND SECURITY ENVIRONMENT IN EUROPE AND ITS IMPACT ON THE EUROPEAN DEFENSE INDUSTRY

Stagnant or declining defense budgets in Europe in the late 1980s and early 1990s are an important factor in shaping the European defense market because lower budgets lead to less procurement. Declining export sales (brought on by lower demand from developing countries and competition from firms in the United States and developing countries themselves) contribute to shrinking the potential market for European firms. Rising unit costs (a result of higher R&D costs) as well as inflation and intergeneration price increases further exacerbate the industry's problem. Rising R&D costs are a particularly important concern: since European governments are financing less and less of European firms' R&D, there is considerable R&D duplication as a result of national fragmentation, and there are fewer unit sales over which firms can spread R&D costs. Taken together, these economic factors have produced considerable overcapacity in Europe's defense sector.

Political factors, too, have shaped the movement toward greater industrial consolidation and a more transnational approach to weapons system development and manufacture. Institutional armaments cooperation has been promoted in Europe through the Independent European Program Group (IEPG) and more recently through its nascent research component, EUCLID. The IEPG has focused in recent years on developing a more open, competitive European arms market, but it retains a fundamental concern for protecting national industrial bases through its continuing commitment (at least on a transitional basis) to *juste retour* (matching a nation's share of the work on a collaborative project to its financial contribution). EUCLID offers Europeans an opportunity to collaborate on upstream, "precompetitive" research, but the scale of the proposed effort is very modest. Europeans have also looked to the Western European Union (WEU) as a forum for armaments collaboration, although the WEU role in this area has declined in favor of the IEPG.

In NATO, transatlantic arms collaboration has found a focus in the Conference of National Armaments Directors (CNAD), which provides both a forum for NATO nations that wish to develop joint projects and a common planning framework through its Conventional Armaments Planning System (CAPS), which seeks to facilitate early identification of cooperative opportunities. More recently, CNAD has turned its attention to more open transatlantic arms trade under the aegis of the Task Force on Defense Trade.

Much of the political impetus to collaborate has come from bilateral or multilateral relationships within NATO. Franco-German cooperation has been particularly important, and it has received a considerable boost from political agreements such as the Élysée Agreement of 1963 and the revived commitment to collaborate between President Mitterrand and Chancellor Kohl in 1983. France and Germany have also been the principal proponents of a greater security role for the European Community (EC). These political agreements have helped spawn a number of collaborative programs, including the Hot, Milan, and Roland missiles, the Alpha-Jet and Transall aircraft in the 1960s and 1970s, and the joint Tiger helicopter program in the 1980s. The close Franco-German relationship helped create longstanding industrial ties between France's Aerospatiale and Germany's MBB (now part of the defense conglomerate, Deutsche Aerospace (DASA)).

Franco-British relationships have also had an impact on arms collaboration. Some of the early joint programs, such as the Jaguar fighter, the Lynx, Puma, and Gazelle helicopters, and the Martel missile, are examples of Franco-British collaborations. Although the pace of Anglo-French cooperation slowed in the 1980s, there is renewed interest in collaborating on a frigate and a standoff air-delivered nuclear weapon. French and British arms cooperation has also centered around the 1987 Anglo-French Reciprocal Purchase Arrangement, designed to facilitate more open competition in each other's procurement and to facilitate opportunities for collaboration.

The multinational European aircraft consortia are highly visible cases of multilateral collaboration. Both the Tornado aircraft consortium (Panavia) and the collaborative European Fighter Aircraft (EFA) have brought together governments and industry (Germany, Italy, and the UK for Tornado, with Spain added for EFA) to design, develop, and manufacture a common aircraft. An even broader collaboration may develop for transport aircraft through the Future Large Aircraft Group (FLAG), which also includes France.

Much of U.S.-European collaboration and defense trade comes under the framework of a series of bilateral memoranda of understanding (MOUs) between the United States and its NATO allies. These MOUs contain provisions to waive "buy national" restrictions, protect classified information and intellectual property rights, and generally set the terms for bilateral defense cooperation.

The broad trend toward European political and economic integration also has an impact on industrial consolidation and transnational collaboration. The current efforts to create a European Political Union could result in a greater role for the European Community in security

matters, including armaments. To date, that role has been limited by Article 223(b) of the EC's Rome Treaty, which allows individual EC nations to develop their own procurement policy, although some argue that Article 30 of the Single European Act (1987) gives the EC a role in defense industrial base matters. The EC Commission has expressed growing interest in playing a role in defense trade issues, but so far this has been resisted by defense ministers, who prefer the IEPG as the forum for promoting more open defense trade.

The drive to complete the internal European market ("EC-1992") is also having an impact on the defense sector. EC-1992 has led European industry officials to take a more European outlook in their business decisions, and this affects defense because many firms produce dual-use equipment (items that have both military and civilian applications) or have activities in both civil and military markets. EC regulations governing competition (including limits on government subsidies that distort the market and merger and monopoly provisions) also affect dual-use and diversified military/civil firms. Although the EC does not directly regulate defense items, it does assert jurisdiction over dual-use items under its public procurement regulations, even if they are acquired by ministries of defense. The EC also considered a proposal to extend the Common Customs Tariff to dual-use imports, but this proposal has been put aside (at least for the time).

Another area of EC involvement that indirectly affects defense is in technology R&D, primarily through the EC Framework program, jointly financed by government and industry, designed to promote the competitiveness of European technology in key areas such as information technology, industrial technology, and communications. Other European (non-EC) technology research programs that have a spillover impact on defense are EUREKA (applied technologies) and the European Space Agency (ESA).

Changes in the strategic environment also affect the future of European defense industries. As military planning moves away from a single contingency based on defending against a massive Soviet invasion, requirements are increasingly focusing on mobility, flexibility, and the ability to project forces, with premiums on surveillance and early warning and projecting firepower at a distance. This will affect the mix of systems to be acquired, place new emphasis on R&D, and perhaps facilitate collaboration. Reduced budgets as a result of the declining European threat will shrink markets, but instability in the Persian Gulf and Middle East could offer new export opportunities,

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and the development of a European security identity through the WEU or EC would also promote collaboration.

Conventional arms control will also have an impact, by reducing demand for treaty-limited equipment while stimulating investment and modernization in areas not covered by agreements. It places a premium on technological hedging against breakdowns in the arms control process. It could also accelerate the trend toward greater diversification into civil applications and products.

PATTERNS OF INDUSTRIAL ADAPTATION: CONSOLIDATION THROUGH NATIONAL CHAMPIONS AND TRANSNATIONAL TIES

The development of national champions (monopoly suppliers in individual European countries) and proliferating transnational ties were the two dominant trends in the European defense industry in the 1980s.

The small size of national markets made it impossible to sustain much competition in individual countries, so in many key sectors a single national firm emerged out of industry consolidation. But the emergence of national champions was only a partial solution to the problem posed by fragmented European markets; increasingly, these firms sought transnational (primarily European) ties to extend their access to additional markets and hedge against the vagaries of individual nations' procurement plans. The consequence of the two trends was to increase considerably the size of the major European firms; today, four European firms rank in the top twelve worldwide.

In the drive to expand the size and scope of operations needed to meet economic and technological competition ("critical mass"), European firms followed three principal strategies: horizontal integration of common product lines, sectoral consolidation, and complementary groupings. Horizontal consolidation offers the clearest economic benefits: longer production runs, less R&D duplication, and fewer competitors. Sectoral consolidation allows greater R&D synergies between related technologies and more rational product development from a technology-oriented organization. Complementary groupings can offer enhanced opportunities for systems integration, although in some cases the activities of the conglomerate are so loosely associated that the principal benefit appears to be a financial hedge against downturns in one of the company's sectors.

European firms used a number of techniques to implement these strategies, ranging from ad hoc, one-time collaboration to full merger

or acquisition. These techniques were used both for national consolidation and the development of transnational (European or transatlantic) links. Some of the more innovative developments included the increasing use of Economic Interest Groups (EIGs) as a way of combining firms' activities from two or more countries without the legal complications of merger, and the exchange of equity, which gives firms inside access to each other's corporate plans and can establish a pattern of preferred collaborative partners.

THE CORPORATE RESPONSE: TRANSNATIONAL CLUSTERS AND INDEPENDENT FIRMS

By the beginning of the 1990s, a pattern began to emerge in the organization of the European defense industry: three principal transnational defense clusters that dominated the market (particularly in aerospace and electronics) and a group of smaller niche firms, particularly in engines, land warfare systems, and shipbuilding. The three principal clusters are DASA and Aerospatiale; GEC, Siemens, and Matra; and British Aerospace (BAe) and Thomson-CSF.

The first cluster is DASA/Aerospatiale, growing out of one of the oldest collaborations in Europe, MBB/Aerospatiale. DASA is the third-largest defense firm in Europe; Aerospatiale is seventh. The DASA/Aerospatiale cluster is centered around two principal defense activities, missiles (Euromissile) and helicopters (Eurocopter). Their collaboration extends to civil aviation (through Airbus, with BAe) and space programs.

The second cluster is GEC/Siemens/Matra. GEC is fourth largest in defense sales in Europe. Siemens has a small percentage of its activities in defense, while Matra specializes in missiles and space. This cluster has two poles: GEC/Siemens, brought about by their joint bid to acquire portions of Plessey, and GEC/Matra, centered around their joint subsidiary Matra-Marconi Space and collaboration on air-to-air missiles.

British Aerospace is the largest defense firm in Europe, and Thomson-CSF is the second largest, first in European electronics. The BAe/Thomson-CSF cluster is built around missiles, with ad hoc programs such as the Active Sky Flash air-to-air missile, their involvement in air defense systems in the multinational Future Air-to-Air Missile (FAAMS) program, and a proposed merger of their missile programs in a new entity, Eurodynamics. But the two firms' recent decision to postpone indefinitely the Eurodynamics project, coupled with Thomson's decision to collaborate with DASA/Aerospatiale on an

air defense missile system, casts some doubt on their long-term relationship.

These clusters are not discrete blocs; there are many examples of collaborations between firms from different clusters. Matra is a particular case in point: both GEC and DASA own Matra shares, and Matra is looking to collaborate with BAe, GEC, and DASA in its standoff antitank weapon, Apache. Some of the firms in the clusters also have significant transatlantic ties as well.

There are also a number of important defense firms not as directly involved in the European clusters. Engine manufacturers are a special case in point: two of the firms have major transatlantic ties (SNECMA with GE; DASA-MTU with Pratt-Whitney) as well as relations with each other. Other important independents include the French firms Dassault (aircraft), Dassault Electronique (seekers and missile/aircraft electronics), and GIAT (land warfare systems and munitions); the UK's Westland (helicopters), Racal and Thorn-EMI (electronics), and Vickers (tanks); Germany's Rheinmetall (artillery), Krupp-Mak (tanks and armored vehicles), and Krauss-Maffei (tanks); and Italy's two large public holding companies: IRI-Finmeccanica, which includes the new giant Alenia, a merger of Aeritalia (aircraft) and Selenia (electronics), and EFIM, embracing Agusta (helicopters) and Finbreda/Otomelara (missiles). The shipbuilding sector remains highly national, with each country retaining national champions who have few transnational links.

PROSPECTS FOR THE FUTURE

There are seven emerging trends in the European defense sector. Four are structural: further consolidation, but at a slower pace; more extensive "strategic" alliances; hollowing out of the national defense conglomerates in favor of more sectoral EIGs; and privatizing and the lessening of state control. Three trends affect the substance of firms' activities: diversification (both within the defense sector and into civil activities); greater focus on versatile defense technologies; and increased attention to systems integration.

One of the principal question marks for the future is the conflict between competition and consolidation in the European market. Declining defense budgets have intensified the tradeoff between affordability and protecting the industrial base. Although competition offers clear economic benefits, economic and political pressures are pushing European firms toward greater consolidation, at the expense of competition. Europe will still reap economic benefits from greater

rationalization, less overcapacity and duplication, and more technologically competitive R&D, but this will come at the price of increasing monopoly of supply, at least for high-technology systems and major platforms and subsystems.

A system of de facto *juste retour* is developing. Most large programs will be collaborative, but each national champion will be guaranteed a share. There are two alternatives to this scenario. One is direct competition with U.S. firms—which is unlikely, given European concerns about defense industrial base. The second is the development of complementary competing consortia (teaming firms with complementary rather than common capabilities, such as a missile body manufacturer with a seeker/radar firm). This would permit competition while still providing national *juste retour*. There are already a few examples of this approach, but in the future, pursuing this strategy may require U.S. firms to participate in the competing consortia.

Whether U.S. firms can play such a role will depend on government and industry attitudes on both sides of the Atlantic. Some in Europe advocate an explicit European preference in acquisition to protect European firms and the European technology/industrial base from the inherent market advantages of U.S. firms. They are also skeptical that the United States will allow fair European access to its market. Even many of those who advocate a more open transatlantic market in the long run believe Europe must build up its capabilities before fair transatlantic competition can take place. U.S. corporate officials are also ambivalent about whether they would be prepared to open up the U.S. market in return for greater access to Europe. The looming competition over exports to the Gulf and Middle East could further complicate the prospects for more openness on the two sides of the Atlantic.

To break this deadlock, the United States and European governments might agree on formal provisions to assure openness, along the lines of a defense GATT. Short of such a sweeping step, greater transatlantic trade and cooperation might come about as a result of U.S. firms developing a greater interest in European markets and more willingness to share technology, and government taking a more active role in reducing trade and collaboration barriers, through greater cross-purchases of off-the-shelf equipment, a focus on affordability rather than state-of-the-art performance, and a higher political priority on collaborative programs. Growing concerns about competition from Japan could also help bring about closer defense trade relations between the United States and Europe.

The prospects for these changes in attitude and approach are highly uncertain. In the long run, progress will be affected by factors not directly related to defense trade, such as the nature of U.S.-European security cooperation and transatlantic trade and economic relations. Although the road to improved defense industrial transatlantic cooperation is rocky, a genuine commitment from government and industry officials could surmount some of the hurdles and resist inherent pressures for protectionism.

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1. INTRODUCTION

In the decades since the end of World War II and the creation of NATO, the West European¹ defense market has been an important focus of interest for the U.S. government and the American defense industry. In the early postwar years, U.S. policy focused on European rearmament. Since European industry was decimated by war, the United States became the dominant supplier of Europe's defense needs (initially through outright grants, over time increasingly through arms sales).²

These transatlantic arms transfers served several important U.S. interests. From a security perspective, direct arms transfers to Western Europe provided a rapid means of rearming European allies, a concern that became increasingly important as the Cold War intensified between 1948 and 1951. Introducing U.S. equipment into European inventories also promoted a key operational goal, enhanced rationalization, standardization, and interoperability (RSI) of NATO military systems, thus improving the effectiveness of NATO's diverse military forces. From the U.S. perspective, European purchases of U.S. military equipment or licensed manufacture of U.S.-designed systems was the preferred route to achieving RSI.

U.S. equipment sales also advanced U.S. (and NATO) economic interests. More users meant longer production runs, which in turn meant lower unit costs and more capability for a given expenditure level.

From the U.S. defense industry's standpoint, the European market was an important—though secondary—source of profit, and foreign sales offered an opportunity to spread overhead costs over a larger number of units, improving firms' competitive position in bidding for U.S. sales.

¹Throughout this report, "West European" will be used synonymously with "NATO Europe" (or simply Europe) unless specifically noted. Neutrals (such as Sweden and Switzerland, both of which have several important defense firms) are outside the scope of this study. "Germany" refers to reunification West Germany.

²Simon Webb, *NATO and 1992: Defense Acquisition and Free Markets*, 1989, pp. 7-13; William D. Bajusz and David Louscher, *Arms Sales and the U.S. Economy*, 1988, pp. 38-40; Ethan Kaptein, "Corporate Alliances and Military Alliances: The Political Economy of NATO Arms Collaboration," 1989, pp. 14-17. U.S. arms deliveries (primarily grants) to Europe peaked in 1953/54, at \$13 billion (1985 dollars). Today, grants are confined almost exclusively to NATO's Southern Region countries, with equipment assistance in the mid-1980s averaging around \$500 million/year.

For several decades, the United States dominated the so-called "two-way street" in defense trade, essentially a superhighway from the United States to Europe and a footpath from Europe back to the United States.³ While estimates vary, the ratio of U.S. to European arms sales within NATO reached as high as 9:1 or 10:1.⁴ Modest European defense budgets, the relatively small size of European defense manufacturers, limited European government financial support for sophisticated defense research and development (R&D), and the overall U.S. technological edge contributed to keeping Europe in a subordinate role.

Over time, the U.S.-European relationship in defense equipment trade has become more balanced. European direct purchase of U.S. systems has fallen dramatically as a result of arrangements such as licensed coproduction of U.S. equipment, and offset arrangements (coupled with some U.S. purchases of European equipment) have further reduced the imbalance in the U.S.-European two-way street.⁵ The dramatic postwar economic revival in Europe, combined with national policies to build and support domestic defense industries, spawned increasingly capable European defense firms. Europeans sought greater independence from the United States, most notably in France, adopting a "buy national" philosophy in military procurement. Today, for most of the major European allies, two-way defense trade has come closer to equilibrium.⁶

³See, for example, *Jane's Defence Weekly*, June 2, 1990, p. 1101.

⁴See, for example, Webb, p. 112 (10:1); *Armed Forces Journal International*, December 1989, p. 54, and December 1990, p. 37 (9:1 in 1980, 2:1 by 1989). A recent study by the Defense Systems Management College Research Fellows, *Europe 1992: Catalyst for Change in Defense Acquisition*, September 1990, p. 82, put the figure at 1.7:1 in FY 1987. The North Atlantic Assembly Subcommittee on Defense Cooperation (November 1984) estimated the ratio as 6.7:1 in FY 1983. See the appendix for a discussion of data sources and methodology.

⁵For a list of major licensed production and coproduction programs involving U.S. equipment in Europe, see Webb, Table 1, p. 15.

⁶Two-way street ratios can vary considerably over a short period as a result of one or two large contracts. For example, the U.S.-France ratio approached equilibrium when the United States acquired the French-designed RITA battlefield communication system in 1985, but it swung back in favor of the United States when France purchased U.S. AWACS and C-130s. See M. Thevenin, "France's Role in U.S.-Allied Defense Cooperation," *NATO's Sixteen Nations, Special Edition, Common Defense*, October 1989, p. 23. In 1988, the Defense Department reported that France imported \$171 million in U.S. defense goods, while the U.S. imported \$53.6 million from France. *Defense News*, December 3, 1990, p. 10. (Arms Control and Disarmament Agency (ACDA) data.) Germany assesses its two-way street balance at 24:1 in 1978, 4:1 in 1982, and 2:1 in 1987. Wolfgang Ruppelt, "Aspects of German-U.S. Cooperation," *NATO's Sixteen Nations, Special Edition, Common Defense*, October 1989, p. 32.

The United States devotes only a small fraction of its procurement budget to European equipment.⁷ A few large programs stand out: the U.S.-licensed manufacture of British Aerospace's (BAe) Hawk and Harrier aircraft and the U.S. Army's acquisition of the GTE/Thomson-CSF Mobile Subscriber Equipment (MSE).⁸ Growing European self-sufficiency in equipment design and manufacturing is a far more important factor in the more balanced two-way street. The larger European allies have almost completely ended their dependence on the United States, while smaller, less technologically sophisticated nations such as Turkey or Greece rely to a much greater extent on U.S. systems. A recent study found that in 1988, 89 percent of the military equipment operated by Turkey was of U.S. design, 78 percent in Greece, and 77 percent in Denmark, compared with 17 percent in France and 7 percent in the United Kingdom. Belgium and Germany were in the middle, with 32 percent and 33 percent U.S.-designed equipment, respectively. The study also suggested that for small countries, dependence on the United States is not limited to high-value, high-technology systems.⁹

France made national independence in defense equipment a preeminent goal in the early 1960s under President de Gaulle, an effort that took on increasing importance with France's withdrawal from NATO's unified military command.¹⁰ In the United Kingdom, ties with the United States remained strong, but interest in national independence has grown over time.¹¹ The German defense sector, hobbled by postwar reconstruction, grew more slowly.

⁷It is difficult to assess how much U.S. procurement goes to foreign contractors. In 1989, DoD reported that 4.6 percent of all prime contracts (\$6.4 billion) went for work outside the United States, but this includes U.S. firms abroad and excludes European subsidiaries in the United States. *Defense and Economy World Report*, November 21, 1990, p. 180. Webb, pp. 11 and 23, reports that the United States imported just over 1 percent of total defense equipment spending in complete equipment imports from Europe in the mid-1980s and an additional 1.25 percent on subcontracts from NATO countries, including Canada.

⁸The United States is currently acquiring several European systems, including the C-23 Sherpa, light howitzer, and Harrier (UK); C-27 (Italy-U.S.); Popeye missile (Israel); Arrow missile system (U.S.-Israel); Penguin missile (Norway); squad automatic weapon (Belgium); Fox NBC reconnaissance vehicle (Germany); and 9mm pistol (Italy). Overall, the value of non-U.S.-designed equipment that the United States plans to acquire in FY 1992 is scheduled to decrease from \$1.5 billion to \$1.1 billion. *Armed Forces Journal International*, March 1991, p. 24.

⁹Grupos des Estudios Estrategicos (1988), in *El Pais*, p. 6, October 8, 1988.

¹⁰For a comprehensive account of France's development of a national defense industrial base, see Edward A. Kolodziej, *Making and Marketing Arms: The French Experience and Its Implications for the International System*, 1987.

¹¹Two developments in the 1980s stand out. First was the effort by the British defense secretary, Michael Heseltine, to loosen U.S.-UK ties in favor of a more

National independence provided several important benefits: security of supply, access to leading edge technology, improvement in the national balance of payments, and employment. But independence also carried a considerable price: higher unit costs,¹² duplicative research and development, and more noninteroperable systems throughout NATO.¹³ In addition, the relatively modest size of individual European defense budgets meant that European defense firms, limited almost exclusively to their own domestic markets (plus developing nation sales), could never achieve the size of their U.S. counterparts.

The adverse impact of "buy national" procurement policies became increasingly evident during the period of the "Second Cold War" (late 1970s—early 1980s), as growing concerns about the East-West military balance in Europe led NATO planners to seek more effective use of limited NATO defense resources, especially through procurement harmonization and enhanced collaboration.¹⁴ Limited collaboration efforts in the late 1950s and early 1960s were succeeded by a sustained political effort to promote a more transnational approach as the earlier drive toward national independence in arms manufacture

European approach to the defense industrial base in the mid-1980s. Second was the United Kingdom's greater openness to the possibility of UK-French nuclear collaboration, primarily the exclusive province of U.S.-UK collaboration.

¹²Webb, p. 16, cites a Dutch Defense Ministry study suggesting that the F-16 licensed manufacture arrangement added 35 percent to the cost of direct purchase. See also Michael Rich et al., *Multinational Coproduction of Military Aerospace Systems*, 1981, pp. 114-120.

¹³For example, the number of types of fighter aircraft in NATO inventories increased from 15 in the 1960s to 22 in 1988. In 1978, three types accounted for 60 percent of NATO squadrons; by 1988 the top three represented only 40 percent. Similar trends can be seen for tanks (7 types in the 1960s and 1970s; 10 in the 1980s) and naval SAMs (7 types in the 1960s, 12 by 1977). Webb, Chapter 3.

¹⁴The effort to harmonize and standardize NATO equipment dates back to the NATO Defense Production Committee (established in 1954, renamed the Armaments Committee in 1958). Some of the initiatives in the later 1970s and mid-1980s included the Callaghan Report (1974), identifying the economic and military costs of nonstandardization and duplication in NATO; the Long-Term Defense Program (LTDP) of 1978, which was designed to remedy deficiencies in NATO's conventional capability; the Phased Armament Planning System of 1980 (PAPS), designed to enhance early arms cooperation; the NATO Standardization Group (1983); the Nunn Amendment (1985), which provided dedicated funding for collaborative NATO projects; the Conventional Defense Initiative of 1985, to strengthen NATO's conventional forces and enhance NATO-wide collaboration; and the Conventional Armaments Planning System (CAPS), inaugurated in 1987, to improve arms cooperation. See Webb, Appendix A; James B. Steinberg, "Rethinking the Debate on Burden Sharing," *Survival*, January-February 1987, pp. 64-70; and Michael Moodie and Brenton Fischmann, "Allied Armaments Cooperation," 1989, pp. 27-32.

proved unsustainable.¹⁵ Under the prodding of the Nunn Amendment and NATO-sponsored initiatives, NATO nations developed a number of high-visibility transatlantic collaborative programs, such as the NATO Frigate (NFR-90), the Medium Stand-Off Weapon (MSOW), the Autonomous Precision-Guided Munition (APGM), and the Multiple Launch Rocket System (MLRS).¹⁶ But the initial enthusiasm for heightened U.S.-European collaboration, manifest in large multinational programs, has faded in the face of such practical realities as differing requirements, cumbersome project management, unrealistic expectations, mutual misunderstanding, and questionable commitment. NFR-90, MSOW, and APGM have all now been cancelled;¹⁷ funding for NATO cooperative R&D programs from the United States fell from \$115.6 million in FY 1990 to \$85.8 million in FY 1991.¹⁸

European interest in intra-European collaboration grew in parallel with the U.S.-led drive for cooperation and collaboration in NATO. Although the 1960s witnessed a flurry of so-called European cooperative programs, France dominated most of them, and there was little real collaboration.¹⁹ By the early 1980s even those modest efforts had slowed to a trickle, in part due to declining procurement budgets, although the collaborative fighter program, Tornado (begun in the 1960s), went forward. But the mid-1980s saw increased interest in European collaboration, spurred on by the efforts of the British defense minister Michael Heseltine to revitalize the Independent European Program Group (IEPG). These efforts received a further boost with the publication of the influential European Defense Industry Study Team report *Towards a Stronger Europe* (1986). During this same period, Europeans initiated a number of important

¹⁵In the 1960s there were no NATO collaboration programs; by the 1970s there were only five, including Rolling Airframe Missile (RAM, U.S.-Germany) and MLRS. *International Defense Review*, November 1990, p. 1285.

¹⁶In addition, there were some 25 Nunn Amendment programs by 1990. For a list of Nunn Amendment programs, see *Jane's NATO Handbook*, 1989-1990, p. 258.

¹⁷The terminally guided warhead for MLRS (a collaborative U.S.-France-Germany-UK program) may also be in trouble as the U.S. Congress undertakes a review of duplicative smart antiarmor submunitions. *Defense News*, May 13, 1991, p. 51.

¹⁸*Armed Forces Journal International*, December 1990, p. 44. The FY 1992 budget calls for a further cut, to \$41 million. *Armed Forces Journal International*, March 1991, p. 24. This falls far short of the target 25 percent of all U.S. R&D established by Defense Secretary Carlucci in 1987.

¹⁹The earliest collaborative projects involved France and Germany in Transall (1959) and the Hot, Milan, and Roland missiles (1964). Others included Atlantique (1959) (France, UK, Germany, Italy, and Belgium); Jaguar (1964) and Martel (1963) (France-UK); Alpha-Jet (1969) (France-Germany); FH-70 howitzer (1970s) (Germany-Italy-UK); and Scorpion AFV (1970s) (Belgium-UK).

collaborative programs, including the European Fighter Aircraft (EFA), the Franco-German helicopter Tiger, the Franco-Italian Family of Anti-Air Missiles (FAAMS), the Franco-German-Italian-Dutch NH-90 helicopter, and scores of others. To a growing extent, European industry itself has pushed for collaboration.

With the end of the Cold War, the impetus to transnational collaboration stemming from the need for greater RSI to counter the Soviet threat has faded. But other strategic, political, and economic factors continue to lead Europeans to expand their horizons beyond national procurement and to consider broader forms of collaboration, both within Europe and with the United States.

This report examines the inner workings of the European defense market,²⁰ primarily from the "supply side," the European defense industry and its component firms.²¹ Understanding the European defense market's evolution and prospects will assist in assessing the future of U.S.-European arms collaboration (or competition) and in understanding the implications for U.S.-European political and security cooperation.²²

The study begins by describing the structure of the European market, first from a pan-European perspective and then moving to the individual major national markets. It then examines the forces—economic, political, and strategic—shaping the evolution of the European defense industry, particularly as they affect the prospects for consolidation and European or transatlantic collaboration (Sec. 3). Section 4 analyzes the two dominant trends that have shaped the industry in

²⁰Although this report focuses on the "defense" industry, it is important to keep in mind the important areas of synergy and overlap between military and civil high-technology industries, particularly in electronics, aviation, and space. Although developments in the civil sector are touched on throughout this study, they are not addressed systematically. Nor does this study attempt to provide a comprehensive portrait of the European defense industrial base; rather, it concentrates on the largest prime contractors, system integrators, and technology leaders. The focus is on national consolidation and transnational collaboration; much of the domestic-only segment of the market is discussed only insofar as it is relevant to ongoing international industry consolidation. There has been no attempt to analyze second- and third-tier firms; their small role in collaboration is the basis for the omission, although consolidation and transnational collaboration will undoubtedly have an impact on them as well.

²¹This report focuses on the supply side, but it also addresses the demand side (including defense budgets, export markets, and national and transatlantic government policies that affect the industry), since demand is a crucial factor in shaping the industry's strategies.

²²The interrelationship of defense industrial policy, arms acquisition, and overall U.S.-European relations is discussed in J. B. Steinberg and C. Cooper, "The Evolution of the European Economy: Implications for Transatlantic Relations," *International Spectator*, Spring 1991.

the past decade: the development of national champions and increasing transnational ties. Section 5 summarizes the key developments of the last decade for the three principal defense industry "clusters" and the major independent European defense firms. Section 6 discusses the European defense industry's likely future, including key trends and their impact on transatlantic collaboration and cooperation.

2. BACKGROUND: CHARACTERISTICS OF THE EUROPEAN DEFENSE MARKET

For the most part, the NATO Europe defense equipment market consists of thirteen individual markets, each with its own demand, requirements, and in many cases its own national suppliers. But there is a growing European dimension to acquiring and supplying arms. This section looks at the structure of the European defense sector, beginning by comparing the U.S. and pan-European markets and then describing the major European countries.

THE EUROPEAN DEFENSE MARKET

Size

There are many ways to measure the size of the NATO Europe defense market and to compare it with the U.S. market. No single method is fully satisfactory; but all demonstrate that the European defense market is considerably smaller than its U.S. counterpart.¹

One measure, on the "demand" side, is the size of defense budgets. The combined defense expenditures for the thirteen European NATO allies² in 1990 was \$147 billion, about half the size of the U.S. budget (\$289 billion).³ The ratio has remained roughly constant over recent years (see Fig. 1).⁴ A second measure, of greater relevance for assessing defense industrial implications, is the size of military equipment expenditures. Using the definitions used by the European ministries of defense (MoDs), procurement expenditures for 1990 will be around \$46-\$48 billion, compared with \$81.3 billion for the United

¹For a discussion of different methods of measuring and comparing scale, see Rich et al., pp. 8-15.

²Iceland has no military forces.

³Author's calculations. Official NATO data, using NATO definitions of defense spending, gives \$304 billion in 1989 U.S. defense outlays, \$155 billion for Europe. *Defense and Economy World Report*, January 9-16, 1991, p. 265.

⁴Changes in the ratio are in part a product of fluctuating exchange rates; the high dollar in the period 1982-1986 accounts for some of the difference in U.S. spending as compared with NATO Europe. As a percentage of GNP, the gap between the U.S. and European defense budgets is smaller, and in the case of several of the so-called developing defense industry (DDI) countries such as Greece and Turkey, the percentage of GNP spent on defense actually exceeds the U.S. figure.

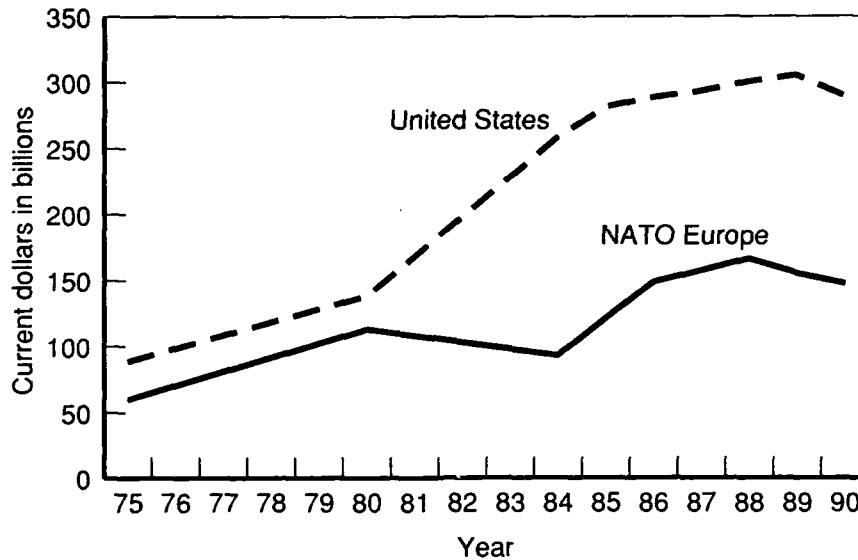


Fig. 1—Total Defense Expenditures

States in FY 1990.⁵ A narrower measure, major military equipment purchases, gives European procurement of \$32.4 billion in 1989 (1988 dollars) compared with \$71.8 billion for the United States (see Fig. 2).⁶

Comparing the size of U.S. and European arms sales gives a similar result. Europe's top five arms-producing countries had arms sales in 1988–1989 totalling around \$60 billion, compared with approximately \$90–\$100 billion in the United States (see Fig. 3).⁷

⁵Author's calculations based on individual ministry of defense data. This is consistent with NATO data ("Financial and Economic Data Relating to NATO Defense," NATO Press Service, 1989) and the Williams de Broe estimate of \$43 billion (*Guardian*, August 7, 1990). It includes spare parts, repairs, etc.

⁶ACDA; Ian Anthony et al., *West European Arms Production*, October 1990, published by Stockholm International Peace Research Institute and hereafter cited as *SIPRI*; and *SIPRI Yearbook 1990*, p. 153.

⁷Author's calculations, multiple sources (see discussion of individual countries below). This is consistent with *SIPRI*, which puts sales for the top 84 NATO Europe firms at \$61 billion in 1988 (the top 100 West European firms had sales of \$66 billion; 14 of those firms are in Sweden, Switzerland, and Austria). EC unpublished data estimate EC defense turnover at 56 billion ecu in 1989 (\$67 billion). UK industry accounted for about 18 billion ecu (\$21.5 billion), 34 percent of the EC total; France, 17

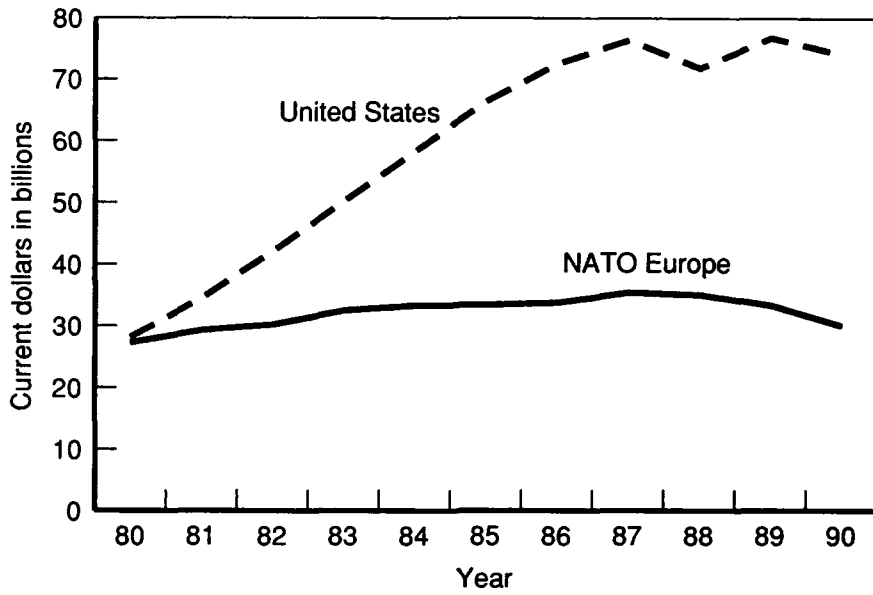


Fig. 2—Major Military Equipment Expenditures

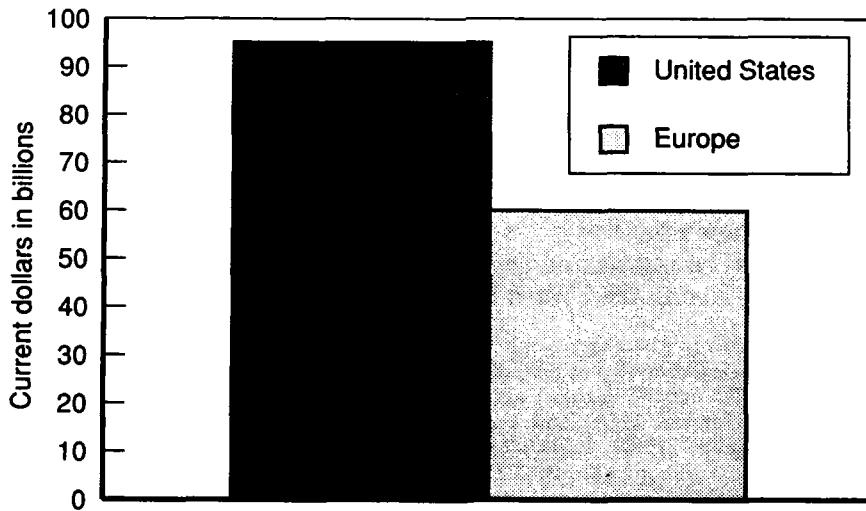


Fig. 3—Arms Sales: United States vs. Top Five European Countries, 1988-1989

billion ecu (\$20.3 billion), 30 percent of the total; and Germany 10 billion ecu (\$12 billion), 10 percent of total EC sales.

In aerospace (civil and military), the U.S. lead is somewhat larger. In 1990, the U.S. aerospace industry had sales of around \$130 billion,⁸ compared with around \$55 billion in Europe.⁹ Slightly less than half of U.S. aerospace sales were in the defense sector (some \$60–\$65 billion), while somewhat more than half of European aerospace sales are in defense (\$30–\$35 billion) (see Fig. 4).¹⁰ The importance of the aerospace sector must be placed in context; although critical to European technological competitiveness, the aerospace sector ranks 14th in size in Europe.¹¹ The smaller size of European defense markets, combined with the traditional European proclivity to favor national suppliers, has produced a European industry composed of a larger number of firms, but of smaller size, compared with the United States (see Table 1).¹²

Research and Development

Another important area of comparison is R&D spending. In FY 1990, U.S. government spending for defense-related research was approximately \$37 billion, while European R&D approached \$12.5 billion (see Figs. 5 and 6).¹³ Although the gap is large, European defense

⁸*Aviation Week and Space Technology*, January 21, 1991, p. 11; March 18, 1991, pp. 38–39.

⁹Author's calculation based on multiple sources. See below for individual countries. France and the UK had similar aerospace sales (around \$18.5 billion), two-thirds of the European total.

¹⁰EC data suggest that 60–63 percent of all aerospace sales are in defense. Eurostat and Euroconsult/CEC, *Compétitivité Aeronautique Civile Européenne*, 1989. Calculations based on individual country data put this somewhat lower, around 55 percent.

¹¹EC Commission, *Panorama of EC Industry*, 1989.

¹²Data for this table are from Webb, p. 62, who contrasted U.S. firms' output with European firms in five key sectors in the mid-1980s. For combat jet aircraft, six U.S. firms produced an average annual output of 600 units (100/firm) compared with eight Europeans generating 300 units (37.5/firm). For main battle tanks (MBTs), two U.S. firms produced 600 units (300/firm), compared with five firms and 500 units in Europe (100/firm). There were similar ratios in major warships and submarines (ten U.S. firms averaging 1.2/firm compared with 23 European averaging 0.6/firm) and surface-to-air missiles (SAMs) (four U.S. companies, 2500/firm, seven Europeans, 1000/firm). Average output was similar only for antitank weapons (five firms in both the United States and Europe, with 5000 units/firm in the United States, 4000 in Europe).

Longer production runs contribute substantially to enhancing price competitiveness, although the precise extent is difficult to measure. One study using cost/performance ratios measured the cost differences attributable to length of production runs between European and U.S. fighter aircraft at 25–50 percent. Andrew Moravcsik, "1992 and the Future of the European Armaments Industry," 1989, p. 16.

¹³Author's calculation based on national sources. D. Hobbs, "Research and Development in NATO: The European View," *NATO's Sixteen Nations*, December 1989–January 1990, p. 27, gives U.S. R&D as \$40 billion in 1987, Europe, \$10 billion. The

Table 1
Average Annual Volume per Firm, United States vs. Europe
(mid-1980s)

	Aircraft	Tanks	Ships	SAMs	ATGMs
United States	100 (6)	300 (2)	1.2 (10)	2500 (4)	5000 (5)
Europe	37.5 (8)	100 (5)	0.6 (23)	1000 (7)	4000 (5)
U.S.-Europe ratio	2.7:1	3:1	2:1	2.5:1	1.25:1

NOTE: Number of firms in parentheses.

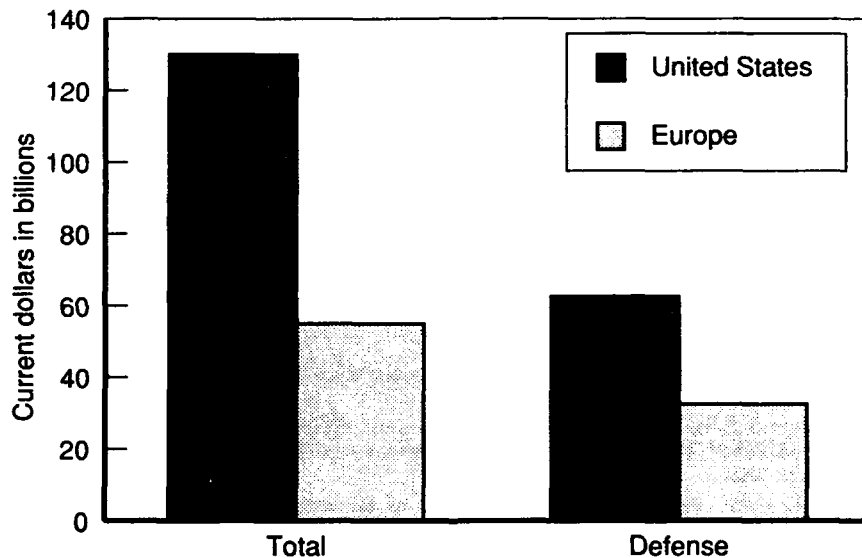


Fig. 4—Aerospace Sales, 1990

R&D support is growing, while in the United States it is declining slightly. In the United States, about 57–70 percent of government R&D is for defense, while in the UK it is around 50 percent, 30 per-

3:1 ratio for R&D compares with only a 2:1 difference between the United States and NATO Europe in procurement. In part, this difference is a product of greater European focus on government support for civil R&D. Total DoD RDT&E in FY 1991 is \$35 billion. R&D alone (without operational system development) is \$26 billion (both down slightly from FY 1990). To this, nuclear weapons R&D should be added, amounting to some \$2 billion.

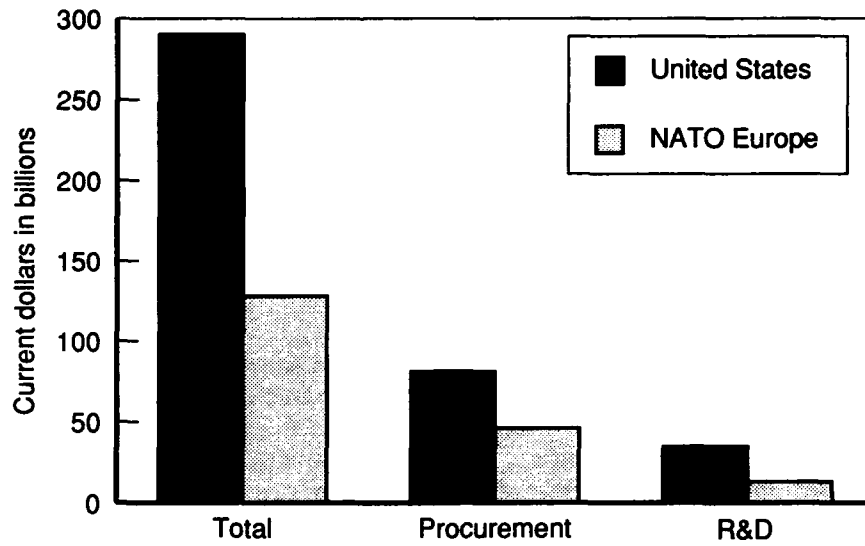


Fig. 5—Defense Expenditures, 1990

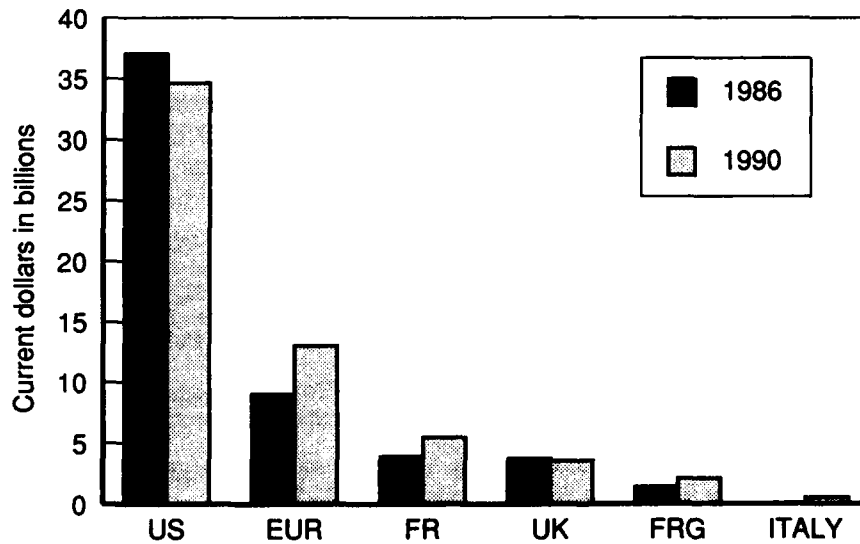


Fig. 6—Government-Financed Military R&D, 1986 and 1990

cent in France, and 15 percent in the FRG.¹⁴ The United States spends about 14 percent of its defense budget on R&D; UK R&D spending is about 10 percent of the total defense budget;¹⁵ France, 15 percent; and Germany, 6.5 percent.¹⁶ Looked at more broadly, the U.S. government support for R&D makes up about 50 percent of total U.S. R&D expenditures,¹⁷ compared with 60–65 percent in France, 50–55 percent in the UK, and 38 percent in the FRG. Overall, European governments spend about \$90 billion on public- and private-sector R&D, compared with approximately \$150 billion in the United States.

Over time, European firms are being forced to spend high proportions of corporate revenues for R&D. This is a product of two factors: the need for increased R&D investment in light of the growing technological sophistication of modern weaponry, and declining government support for industry's research costs.¹⁸ For example, according to Thomson-CSF, government support for R&D has declined from 50 percent of the firm's R&D costs to 25 percent in the last decade.

Exports

Historically, export sales have played an important role in augmenting domestic national and European sales for many of the major European defense contractors. Indeed, many European defense programs, including such complex and expensive systems as fighters, have been designed with the export market in mind. This has been especially true for French systems, where export sales have been a

¹⁴Author's calculations. U.S. data are based on a study by Battelle Memorial Institute (*Defense News*, February 18, 1991, p. 9) and DoD. European data are from national sources. See also *Les Echos*, March 5, 1990 (FBIS-WEU-90-108, p. 14). A recent study by the Council on Competitiveness put U.S. defense R&D spending at about 65 percent of federal R&D expenditures in 1988, and Germany's at 12.5 percent. *Los Angeles Times*, March 21, 1991, p. D-3.

¹⁵About £2 billion in 1989, down £200 million from 1988. Altogether, the UK government provides about £4.5 billion for research, while the private sector provides £4.8 billion. *Times* (London), July 26, 1990.

¹⁶*Jane's Defence Weekly*, November 25, 1989, p. 1155, and author's calculations. Japan spends only 2.2 percent of its defense budget on R&D.

¹⁷The Battelle Memorial Institute projects total U.S. R&D spending for 1991 at \$155 billion: \$72.2 billion government, \$75.9 billion industry, \$6.9 billion other. Total U.S. R&D spending was 2.6 percent of GNP in 1987, compared with 2.8 percent in Germany. Defense R&D spending was 0.8 percent of GNP, compared with 0.2 percent in Germany.

¹⁸Andrew Latham and Michael Slack, *The Evolving European Defense Sector: Implications for Europe and North America* (no date), p. 5.

key element of sustaining the domestic technological and manufacturing base.¹⁹

Comparing U.S. and European exports is particularly difficult because of definitional differences and the difficulties of capturing trade in components and subsystems. According to one study, between 1980 and 1986, European defense firms exported 36 percent of their products, compared to 13 percent for U. S. firms.²⁰ In aerospace, European exports were 61 percent, compared with 24 percent for the United States (see Fig. 7).²¹ In France, exports in 1990 accounted for 57 percent of all aerospace sales (civil and military), compared with 24 percent in the United States; 45 percent of French electronics turnover is exported.

Using data from a variety of sources, U.S. defense exports were on the order of \$12 billion in 1989, compared with \$6.6–\$7 billion in Europe. According to ACDA, U.S. 1988 arms exports were \$14.3 billion, compared with \$4 billion for Europe. *SIPRI* gives U.S. exports as \$10.5 billion and Europe's as around \$7 billion for the same year. (For 1989, U.S. exports were \$10.8 billion, Europe \$6.2 billion). National European data place European dependence on arms exports much higher.²²

The smaller size of production runs in Europe enhances the importance of marginal additional sales as a means to recoup fixed costs.

¹⁹See Kolodziej, *Making and Marketing Arms*, Chapter 3.

²⁰The U.S. figure is consistent with an analysis by the U.S. Aerospace Industries Association, which puts U.S. defense exports at 15 percent of production (expected to rise to as much as 25 percent over the next decade). *Dallas Morning News*, July 9, 1991, p. 10.

²¹*Defense News*, January 22, 1990. European figures are from the Groupe de Recherche et d'Information sur la Paix; the U.S. data are from the Electronic Industries Association. According to the Aerospace Industry Association (AIA), total U.S. aerospace exports in 1990 were \$39.1 billion, of which 19 percent (\$7.6 billion) were defense related. With the rapid decline in European defense exports in the past three years, U.S. and European defense export rates (civil and military) are becoming more equal.

²²Martin Bittleston, "Cooperation or Competition? Defense Procurement Options for the 1990s," *Adelphi Papers*, 250, Spring 1990, p. 25, relying on UK MoD data, states that French exports represented 45 percent of total production on average in 1984–1989; the UK, 33 percent; the FRG and United States, 10 percent. In French aerospace (civil and military), exports account for around 60 percent of all sales, the largest net export sector. *Aviation Magazine International*, March 15, 1990.

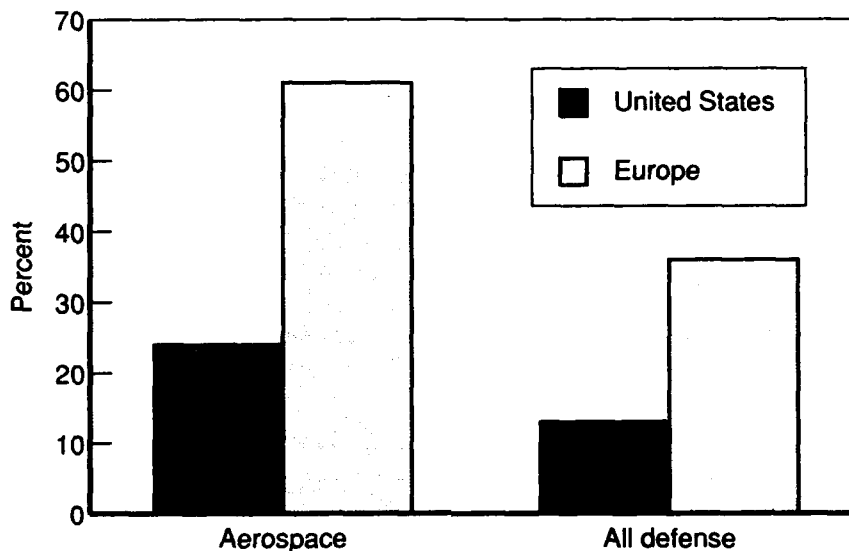


Fig. 7—Defense Exports, 1980-1986
(average annual percent exported)

Cost savings for France, Germany, and the United Kingdom from lowered unit costs due to exports can amount to as much as \$844 million to \$1 billion per year.²³

Declining export sales could have a profound impact on European firms. Most of the major firms derive a substantial portion of their revenues from exports: BAe (73 percent, half of which was from the Middle and Far East); Thomson-CSF (60 percent, with 31 percent of all exports to the Middle East); DASA (slightly more than half from foreign sales); and Aerospatiale (60 percent foreign sales).

Sales to the United States are a final potential market for European defense manufacturers, although for the most part this market has indeed remained "potential."²⁴ In a few cases the United States has adopted a European-designed system, but it has rarely bought off

²³Bajusz and Louscher, p. 13, reporting on a study by Lewis Snider.

²⁴UK sales to the United States are a partial exception; in 1989 the UK sold \$918 million in defense equipment to the United States and bought \$1849 million. Intra-European "sales" are much rarer; most intra-European activity comes through collaboration.

the European shelf,²⁵ preferring instead licensed production or joint programs, with the lion's share of spending remaining in the United States with U.S. firms.²⁶

In the wake of the Gulf War, there is growing interest in developing an international, or at least pan-EC, regime to govern arms sales. German defense manufacturers in particular have urged harmonizing European export rules through the EC.²⁷

Productivity

The smaller size of the European defense markets may help account in part for the lower productivity of European aerospace workers. In a study conducted for the European Community over the period 1980-1987, the added value per worker in the UK in aerospace was 30,000 ecu/year, while in the FRG and Italy it was 35,000, in France 44,000, and in the United States 50,000.²⁸ A survey of U.S. and European aerospace companies, along with UK and NATO officials, in 1977-1980 revealed that Europeans most often cited lower productivity as the reason for the comparative inefficiency of European firms. The respondents identified several factors, including labor hoarding, lack of worker mobility, less capital per worker, and government emphasis on job preservation rather than production.²⁹ Although it seems likely that the gap has been narrowing over time as a result of European investment in technology and capital, larger U.S.

²⁵The U.S. acquisition of Roland is a case in point; although the United States manufactured Roland on license from France and Germany, it spent more on modifications than the total original development cost. See Kolodziej, *Making and Marketing Arms*, p. 164; Rich et al., pp. 57-60. The EC has claimed that European governments now procure up to 50 percent of their military equipment from the United States, while the United States in turn buys only 2 percent of its equipment in Europe, although these figures are subject to considerable doubt. *Defense News*, July 16, 1990, p. 8. Henri Matre, president of Aerospatiale, put the ratio of U.S.-Europe vs. Europe-U.S. sales at 7:1. *Le Figaro*, June 11, 1990. This is more consistent with ACDA data.

²⁶The U.S. Army's acquisition of the Mobile Subscription Equipment (MSE) tactical communications system is a case in point. Although acquired as a nondevelopmental item (NDI) based on the French (Thomson-CSF) RITA system, more than 70 percent of the contract is likely to go to a U.S. firm (GTE).

²⁷*Le Monde*, June 20, 1991, p. 34; *Defense News*, May 27, 1991, p. 38 (interview with the French state secretary for defense Gerard Renon). Martin Bangemann, EC Industrial Affairs Commission, has proposed an EC scheme that would cover both dual-use and defense equipment. *Jane's Defence Weekly*, June 8, 1991, p. 987.

²⁸Euroconsult and Gelman Research Association, 1988.

²⁹Keith Hartley, "Efficiency, Industry and Alternative Weapons Procurement Policies," 1987, pp. 254-285. The author found some empirical support for these views, although data limitations precluded conclusive results.

production runs and greater economies of scale give the United States a significant advantage.³⁰

State vs. Private

Traditionally, a substantial part of the European defense sector was public or quasi-public,³¹ most notably in France, Italy, and Spain. Government ownership has facilitated direct and indirect subsidies, an important element of the Europeans' strategy to sustain their defense industrial and technological base and to maintain government control over the defense industrial base. But in recent years there has been a distinct trend away from state ownership in Europe.

The United Kingdom led the way on privatizing major defense-sector firms. Over the past decade or so, the British government has privatized British Aerospace, Rolls-Royce, Royal Ordnance, British Shipbuilders, Shorts Brothers, and the management of Royal Dockyards.³² In France, privatizing is a more recent development.³³ In the past several years a number of steps have been taken, including fully privatizing (Matra), partially privatizing (Sextant Avionics), and converting a government-operated manufacturer (*regie directe*) to a "public sector" company (GIAT).³⁴ Overall, on the order of 80 percent of the French defense industry can still be considered to be "public sector," although the degree of control varies.

³⁰The U.S. advantage is partially limited by technology transfer restrictions, which cut into potential U.S. export sales and foreign collaboration.

³¹Government involvement can take many forms: direct government operation (e.g., DCN in France for shipbuilding); 100 percent ownership through state holding companies (IRI and EFIM in Italy) or direct government shareholding (Aerospatiale); partial government ownership with voting control (Dassault); and restrictions on certain corporate activities or a right to veto (the UK government's "golden shares" in BAe). Even when the firm is 100 percent state owned, management may retain considerable independence although it depends on the state for investment capital (Aerospatiale).

³²Even with privatization, the UK government retains certain control through restrictions retained at the time of privatization (including limits on foreign ownership and a right to veto some corporate actions by using the government's "golden share"). See *Guardian*, December 14, 1984, p. 11.

³³In the early years of President Mitterrand's administration, France actually increased the degree of state control over defense industries, including Matra and Dassault. Kolodziej, *Making and Marketing Arms*, p. 185. This trend has reversed in recent years with the privatization of Matra and the transformation of GIAT to a public-sector company.

³⁴The conversion of GIAT (discussed below), and its subsequent involvement in a flurry of transnational arrangements, demonstrates the importance of privatizing to facilitate transnational collaboration.

Italy, which has a mix of public- and private-sector firms, has taken some steps toward private control. While the two dominant state holding companies have acquired at least partial ownership in several formerly private companies (most notably Selenia), the firms within the holding companies are increasingly acting as independent entities, with the prospect of expanded nongovernment shareholding. Some 60 percent of Italy's defense sales are attributable to firms wholly or partially owned by the two public-sector holding companies.

In Germany, direct government ownership is rare. Nonetheless, privatizing has had an impact on the shape of industry; Daimler-Benz/DASA's agreement to accelerate its takeover of the government's Airbus holding was an important factor in the German government decision to allow Daimler-Benz to acquire MBB, the crucial step in creating the defense giant Deutsche Aerospace (DASA).

Although the U.S. defense industry is typically considered to be a private-sector activity, in fact there are segments with significant public ownership. Almost all final assembly operations in the munitions industry are in the public sector (U.S. government arsenals), and approximately one-third of the aircraft industry's plant and equipment is government owned.³⁵

Military vs. Commercial

One important development is the changing mix of military and civil sales for European defense contractors.³⁶ In Europe, in the last decade the trend toward increased civil sales has grown. In the French aerospace industry, for example, civil revenues (including space) accounted for only 27-30 percent of the total in 1980, but they reached an estimated 48% in 1989, similar to the United States (around 50 percent in 1990). Moreover, this trend is likely to continue; in 1990 civil new orders accounted for over 55 percent of the total.³⁷

³⁵Jacques Gansler, *Affording Defense*, 1989, p. 240. Moreover, government and government-controlled labs remain an important element of the defense research and production complex, not only in nuclear weapons but in conventional systems (China Lake, Wright-Patterson, etc.). In an interview, one German manufacturer has pointed to the United States' continued use of public-sector arsenals as an important barrier to access to the U.S. market.

³⁶Determining the percentage of a company's sales in the military sector can be difficult. Many firms do not account for their revenues in this way, and there are problems with items that are made for both civil and military use ("dual use"). See *Defense and Foreign Affairs*, January/February 1990, p. 17.

³⁷*Defense News*, March 11, 1991, p. 35; *Aviation Magazine International*, March 15, 1990.

Virtually every European corporate official stresses the long-term goal of further diversifying into the civil sector. For example, BAe recently acquired Rover, a British automotive firm; Ballast Nedour, a Dutch construction group; and Analytic Servitec, a property development firm.³⁸ DASA management projects an increase in civil sales from 52 percent of revenues to 75 percent by the end of the decade. Aerospatiale, which had more than half its sales in defense in 1988, had 56 percent civil sales in 1989 and projects that figure to increase to as much as 67 percent. Even Dassault, which has been one of the more defense-oriented firms (more than 70 percent defense), has established a goal of 45 percent civil sales by the end of the decade.

According to an official of the Society of British Aerospace Companies, the changing mix from 70 percent defense to near equality "is not through any real downturn in military orders, but due to enormous increased demand of the airlines." Nonetheless, there remain significant barriers to shifting defense activities to the civil sector. In the words of a joint report of the UK Department of Trade and Industry and the MoD, "Many of the difficulties of transferring technology from defense to civil markets are not primarily of a technical nature. The difficulties often reflect a culture gap between companies' marketing and other activities for the defense and civil markets."³⁹ Up until now, there has been little government interest in fostering the process of "conversion," with the possible exception of Germany.⁴⁰

Technological Competitiveness

Assessing the European defense industry's technological strengths compared with the United States is difficult and somewhat subjective. The U.S. government periodically attempts such a comparison for 20 critical technologies. As Fig. 8 shows, DoD believes that Europe does not "significantly lead" the United States in any sector but is "capable of making major contributions" in seven sectors (machine intelligence and robotics, simulation and modeling, weapon system environment, air-breathing propulsion, high-energy density materials, composite materials, and biotechnology).⁴¹

³⁸*Financial Times*, July 7, 1990.

³⁹*Ibid.*

⁴⁰The UK minister of defense procurement said that "British industry is perfectly capable of determining its own product range without government assistance." *Financial Times*, July 7, 1990.

⁴¹The DoD assessment for 1990 is reproduced in Office of Technology Assessment, *Arming Our Allies: Cooperation and Competition in Defense Technology*, 1990. An earlier assessment, using a somewhat different list of 22 critical technologies, found

Critical technologies	Dual-use	NATO allies
1. Semiconductor materials and microelectronic circuits	√	**
2. Software producibility	√	**
3. Parallel computer architectures	√	**
4. Machine intelligence and robotics	√	***
5. Simulation and modeling	√	***
6. Photonics	√	**
7. Sensitive radars	√	**
8. Passive sensors		**
9. Signal processing	√	**
10. Signature control		**
11. Weapon system environment	√	***
12. Data fusion	√	**
13. Computational fluid dynamics	√	**
14. Air-breathing propulsion	√	***
15. Pulsed power		**
16. Hypervelocity projectiles		**
17. High-energy density materials		***
18. Composite materials	√	***
19. Superconductivity	√	**
20. Biotechnology materials and processes	√	***
Capability to contribute to the technology:		
**** Significantly ahead in some niches of technology		
*** Capable of making major contributions		
** Capable of making some contributions		
* Unlikely to make any immediate contribution		

SOURCE: Adapted from Office of Technology Assessment, 1990.

Fig. 8—European Technological Competitiveness

A recent study by York University's Centre for International and Strategic Studies⁴² attempted a more detailed assessment of European and North American technological capabilities in key armaments sectors. Overall, the study found a considerable degree of European competitiveness in a number of areas. In military vehicles, the study concludes that European capabilities are "very close to ca-

Europe with a lead in three areas (integrated optics, high power microwaves, kinetic kill energy) and parity in two others (hypervelocity projectiles and biotechnology). *Soviet Military Power*, 1989.

⁴²Latham and Slack, p. A-67.

pabilities available in the United States," equal to the United States in all areas except propulsion system design, development, and technology.⁴³ For conventional weapons, the authors judge that Europe has "excellent capabilities," with a European lead in small arms and single/twin system rocket launchers, equality in medium and large caliber weapons, and a U.S. lead in multiple rocket launch systems.⁴⁴ For aerospace, the U.S. has a significant lead in combat and transport aircraft and medium/heavy helicopters, with roughly equal capabilities in training aircraft, RPVs, and simulators, as well as aircraft subsystems. In shipbuilding, European capability is "impressive," with European advantages in diesel engines for surface ships, conventional submarines, and mine warfare vessels, and equality in all other areas except gas turbine engine propulsion, navigation systems, and nuclear-powered submarines.⁴⁵

The key European deficiency identified in the study is electronics, where the American lead is "very high" (Europe is equal to the United States only in acoustic systems, battlefield communications, and a few niches of optoelectronics).⁴⁶ The European shortcoming in electronics is an important impetus behind the move to consolidate the European electronics industry and thereby reduce duplicative R&D and amass the resources necessary to improve Europe's competitive position.⁴⁷

The European Defense Industry Study Team also examined European technological competitiveness in its report *Towards a Stronger Europe*. The report concluded that "Europe's technology base, taken overall and including space, is encouragingly competitive, but shows some critical areas of weakness, particularly in electronics and new materials. . . . In development and production, Europe is less compet-

⁴³Latham and Slack, p. A-70.

⁴⁴Latham and Slack, p. A-74. The authors point to European collaboration in both civil and military fields as a factor in the increasing European competitiveness in this sector.

⁴⁵Latham and Slack, p. A-83.

⁴⁶Latham and Slack, p. A-85.

⁴⁷A Department of Commerce study, *Emerging Technologies: A Survey of Technical and Economic Opportunities* (1990), identified 12 key sectors (advanced materials, superconductors, advanced semiconductors, digital imagery, high-density data storage, high-performance computing, optoelectronics, artificial intelligence, flexible computer-integrated manufacturing, sensor technology, biotechnology and medical devices, and diagnostics). The study concluded that Europe leads the United States in two areas (digital imagery and computer-integrated manufacturing) and is closing in on the United States in all but artificial intelligence, biotechnology, and high-performance computing. Cited in *Aerospace Daily*, May 26, 1990, p. 311.

itive than her technology base would suggest, primarily because of her fragmented markets."⁴⁸

THE MAJOR NATIONAL EUROPEAN DEFENSE MARKETS

The European arms market consists of three groups. The top group comprises France, Germany, and the UK, which account for 70 percent of NATO Europe's defense budgets. These three countries have a comprehensive defense industrial base, with capability in virtually every important sector. Seventy percent of the top 100 firms in Western Europe in 1989 were located in these three countries; they produced 80 percent of the group's total arms sales (domestic and export).⁴⁹ The second group consists of Italy, Spain, Belgium, Norway, and the Netherlands. Each has significant defense industrial capacity but also depends on collaboration and imports. In this group, Italy and Spain have the most extensive defense industrial base, and they will be discussed individually. In the third group are Greece, Turkey, Denmark, and Portugal, which have few sophisticated defense industrial firms and are highly dependent on licensed manufacture and direct imports.

France

France has arguably the largest and most self-sufficient defense industrial base of the West European nations, although in employment it lags the UK slightly (300,000 to 325,000).⁵⁰ Total arms sales in France are around FF 100–120 billion (\$18.4–\$22 billion).⁵¹ Its aerospace sector (civil and military) is Europe's largest, with about 36 percent of the EC total. In 1990, total aerospace turnover was FF 98.7 billion (\$18.7 billion),⁵² with slightly more than half (52 percent) in military sales, FF 58.4 billion (\$10.7 billion) (see Fig. 9). Aerospace

⁴⁸European Defense Industry Study Team, *Towards a Stronger Europe*, Vol. 1, p. 2.

⁴⁹SIPRI, p. 6.

⁵⁰*Le Monde Diplomatique*, November 1990; *Le Point*, February 11, 1991, pp. 34–35. The French government in a June 1990 report put the figure somewhat lower, at 261,000 employees (approximately 1 percent of the work force), with a 1988 defense turnover of FF 116 billion (\$19.5 billion), 2.3 percent of France's GDP and about one-third of that exported. *Defense News*, December 3, 1990, p. 16.

⁵¹*Le Figaro*, January 18, 1991, p. 43; *L'Usine Nouvelle*, December 6, 1990.

⁵²The 1990 results represent a 2 percent real increase (6 percent nominal) over 1989 (FF 93.2 billion), which in turn was up 5 percent (real growth, 11.8 percent nominal) over 1988. *Defense News*, March 11, 1991, p. 35.

exports amounted to FF 56.3 billion (\$10.3 billion), 57 percent of turnover.⁵³

The future of the French aerospace industry in the near term is uncertain, as a result of declining orders and the franc's strength against the dollar. New orders fell 9.6 percent to FF 132 billion from their record performance of FF 147 billion in 1989, due primarily to a decline in export orders (down 16 percent from FF 76.1 billion in 1989 to FF 63.8 billion in 1990).⁵⁴ The percentage of new military orders recovered slightly, to 44.7 percent in 1990 from 38.7 percent in 1989, though below the 1988 level of 50 percent.⁵⁵

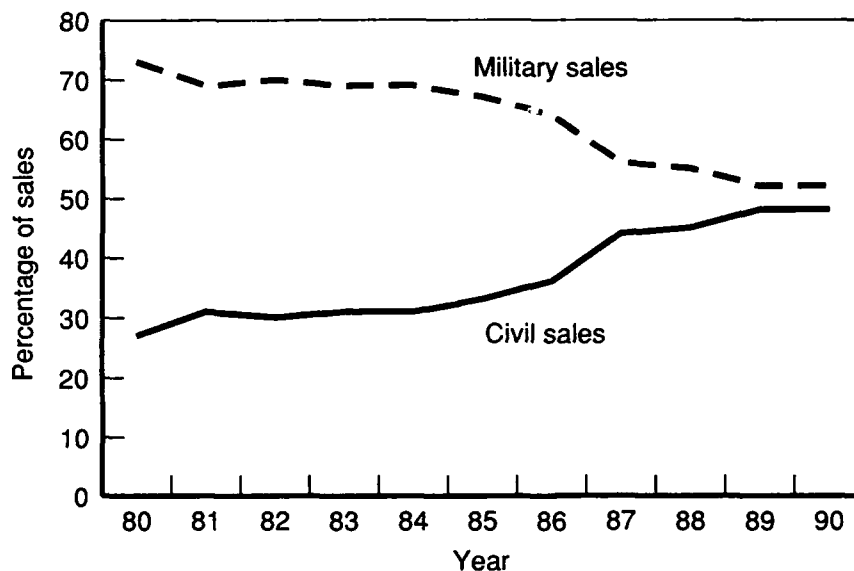


Fig. 9—French Aerospace Sales: Civil vs. Military

⁵³In 1989, 33.4 percent of aerospace sales went to government (34.1 percent in 1988); 7.5 percent other France (6.7 percent); 59 percent export (59.2 percent). Airframes and missiles made up 52.5 percent; propulsion 22.1 percent; equipment and subsystems 25.4 percent in 1990. *Idem*.

⁵⁴Total sales for 1989 were 22 percent above the previous year. The dollar value of aerospace sales actually increased slightly from 1989 (\$23 billion) to 1990 (\$24 billion) due to the rise in the franc. The dollar value of exports was virtually even (\$11.8 billion in 1989, \$11.7 billion in 1990). *Defense News*, March 11, 1991, p. 35; *Aviation Magazine International*, October 1, 1990, p. 14.

⁵⁵*Defense News*, March 11, 1991, p. 35; *Aviation International*, October 1-15, 1990, p. 14.

France expects to spend around FF 196–200 billion (\$36–\$37 billion) on defense in 1991 (not including retirement pay), roughly level with the two previous years.⁵⁶ Investment expenditures represent around FF 100 billion (\$19 billion), slightly over half the total.⁵⁷ Procurement represents about 70 percent of the investment budget, FF 70 billion (\$12.8 billion), of which about 10 percent goes to cooperative programs.⁵⁸ Defense research accounts for about 30 percent of the total investment budget (FF 30 billion, or \$5.5 billion).⁵⁹ About 30 percent of all government research funding in France goes for defense activities.⁶⁰

Exports play a critical role in France's strategy to maintain a nearly self-sufficient industrial base while holding down equipment cost to the French MoD. France was the world's third-largest arms exporter from 1985 to 1989, shipping \$16 billion in arms, three-fourths of which went to developing nations.⁶¹ Export orders reached a peak of FF 62 billion (\$7.1 billion) in 1984, dropped sharply to a low of around FF 20 billion in 1989 (\$3.1 billion), but rebounded to FF 33.4 billion (\$6.1 billion) in 1990 (see Fig. 10).⁶² The actual trade balance has declined less precipitously, from FF 34 billion (\$4.9 billion) in 1986 to around FF 28 billion (\$5.2 billion) in 1990,⁶³ partially as a result of the backlog of orders from previous years. From 1987 to 1988 the share of French exports accounted for by defense fell from 42

⁵⁶*Aviation Magazine International*, October 1, 1990, p. 21. A study by the British consulting firm BDMI/Lancashire Enterprises projects French defense spending to rise 15 percent in real terms by 1995, from \$30.2 billion to \$34.8 billion. *Financial Times*, December 17, 1990, p. 6.

⁵⁷The proposed budget is FF 103 billion, up 1 percent over 1990 (which in turn was 5.8 percent higher than 1988). This figure is about FF 6–7 billion below earlier projections. Budget cuts will come primarily in army systems. See *Les Echos*, January 24, 1991, p. 3; *Nouvelle Economiste*, March 3, 1989; *Aviation Magazine International*, October 1, 1990, p. 21; *International Defense Review*, October 1990, p. 1085. The share for investment has risen slightly in recent years (from around 46 percent in 1983).

⁵⁸Thevenin, *NATO's Sixteen Nations*, p. 23. Webb, p. 21, gives 25 percent.

⁵⁹*Les Echos*, March 5, 1990, p. 14. SIPRI puts this figure much lower, at FF 16 billion in 1990.

⁶⁰*Les Echos*, May 3, 1990, p. 10.

⁶¹SIPRI. According to the Congressional Research Service, in 1990 France was fourth in the value of new arms agreements with the Third World, with transfers worth \$2.2 billion (compared to \$2.6 billion for China). Richard F. Grimmett, *Conventional Arms Transfers to the Third World, 1983–1990*, August 2, 1991.

⁶²*Le Monde*, November 11, 1990; *Le Quotidien de Paris*, November 9, 1990, p. 32 (FBIS-WEU-90-239, December 12, 1990, p. 18).

⁶³*Liberation*, December 26, 1990, p. 5. The dollar increase represents appreciation of the franc against the dollar.

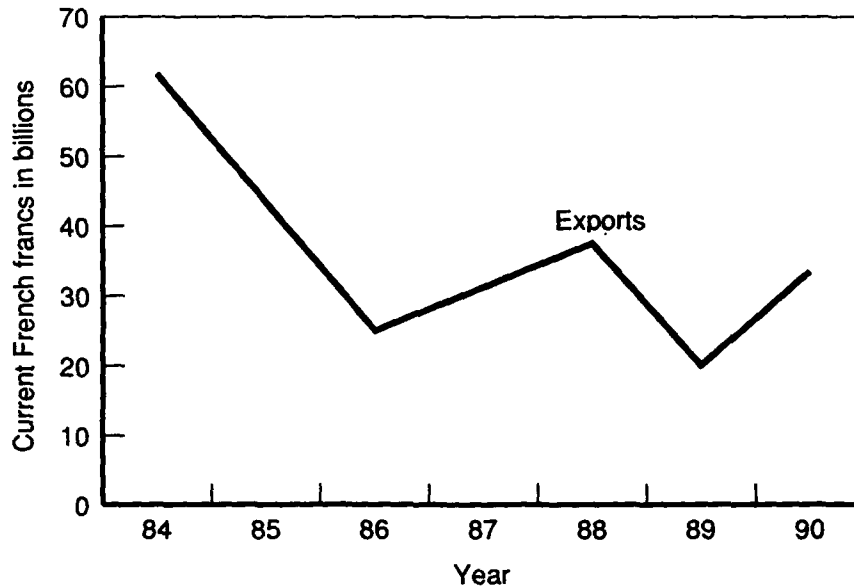


Fig. 10—French Defense Export Orders, 1984–1990

percent to 33 percent.⁶⁴ It remains to be seen whether the recent surge in export sales in the wake of Iraq's invasion of Kuwait will continue (the Middle East has been the most important customer for French exports).⁶⁵

⁶⁴*Armed Forces Journal International*, June 1989, p. 62.

⁶⁵Middle East/Mahgreb export orders (FF 20 billion, or \$3.4 billion) accounted for around half of all orders in 1988 (they averaged 58 percent of defense equipment export orders over the past decade). *Defense News*, September 17, 1990, p. 3. In 1989, with a 75 percent decline, they fell to only 25 percent of the total (FF 5.5 billion). *Le Figaro*, January 18, 1991, p. 43. The North America/West Europe market held steady, with orders of FF 9 billion (\$1.4 billion) both years. Thomson-CSF estimates that its Middle East orders declined 36 percent in 1989 and a further 28 percent in the first quarter of 1990. *Liberation*, January 17, 1991, p. 15. No large new orders were received from the Gulf in the first half of 1990, but sales picked up in the last quarter. *Le Monde*, November 9, 1990; *Liberation*, December 26, 1990. In December, Thomson-CSF announced a contract worth FF 3.4 billion (\$625 million) with Saudi Arabia for the Crotale short-range air defense system. *Le Figaro*, January 10, 1991, p. 43. Nonetheless, most French observers remain pessimistic, believing that the United States will reap the lion's share of any new orders from the Gulf region. See, e.g., the statement of the National Assembly's Defense Committee rapporteur, Jean-Guy Branger, in *Le Quotidien de Paris*, November 9, 1990: "[France and the UK] will get only the leftovers from the major contracts our transatlantic allies amass." See also *Defense News*, September 17, 1990, p. 3; *Le Point*, February 11, 1991, pp. 34–35.

Since the early 1960s, France has pursued a strategy of independence in developing its defense industrial base. Perhaps the most dramatic symbols of the French strategy of self-sufficiency are the French nuclear forces and the new Rafale fighter (France declined to participate in the collaborative EFA program).⁶⁶ But strict French independence may be ending even in traditionally national sectors: France and the United Kingdom are actively exploring collaboration on a new frigate and an air-delivered standoff nuclear weapon, and on an industrial level, several French firms are involved in pan-European programs related to a next-generation fighter.⁶⁷ In a statement accompanying the 1991 defense budget, France's former defense secretary, Jean-Pierre Chevenement, has acknowledged the need to emerge from isolation: "France cannot continue to manufacture 96 percent of its weapons" and will "have to develop cooperation or resolve itself to off-the-shelf buys from overseas."⁶⁸

France has been somewhat less enthusiastic than the UK about an open-competition approach to procurement policy. This stems in part from the long history of close French state involvement in the defense industries and its concern over the problem of technological competition with the United States.⁶⁹ But the Anglo-French Reciprocal Purchase Arrangement of 1987⁷⁰ and France's active involvement in the IEPG reflect at least partial acceptance of greater openness in procurement.

Although France remains concerned about protecting its defense industrial base, this does not necessarily mean that it is opposed to collaboration; on the contrary, France is involved in a number of gov-

⁶⁶France explored a possible trans-European fighter collaboration with the four EFA countries but was unwilling to show much flexibility in order to achieve agreement.

⁶⁷For example, the Thomson-GEC collaboration on radar and the SNECMA proposal to collaborate with Rolls-Royce on an engine. *Les Echos*, April 6, 1990, p. 10.

⁶⁸*Defense News*, September 17, 1990, p4. This view was strongly echoed in a study prepared by the French Foreign Ministry's Center for Analysis and Planning: "France today no longer has the financial means to maintain complete technological independence. Some of the elements of our defense capability which thus far have been deemed significant will be among the battlements that must be abandoned." *Liberation*, March 9, 1990, pp. 10-11. The report called for a more open and international perspective in key areas such as fighters, artillery and munitions, and naval construction and equipment.

⁶⁹William Walker and Philip Gummett, "Britain and the European Armaments Market," *International Affairs*, 1989, p. 425.

⁷⁰See below, p. 50.

ernment-sponsored collaboration programs,⁷¹ some of them going back to the late 1950s. France has a memorandum of understanding on defense trade and collaboration with the United States, originally signed in 1963,⁷² although there have been few concrete collaborative programs.⁷³

United Kingdom

Like France, the United Kingdom has a large and diverse defense industry. It employs some 325,000–340,000,⁷⁴ accounting for 3 percent of the labor force and 3 percent of the UK's GDP (one-fourth of which is exported).⁷⁵ In 1986 this represented around £12 billion (\$17.6 billion), of which £9 billion was in MoD contracts (\$13.2 billion) and £3 billion in exports (\$4.4 billion), with an additional £400 million (\$510 million) imported (95 percent of which was from the United States).⁷⁶ While the UK MoD identifies about 10,000 firms that benefit from its contracts, a smaller number (about 100) make equipment specifically

⁷¹According to the French defense cooperation attaché in Washington, these cooperative programs receive about 10 percent of the French equipment budget, a proportion that has been relatively constant over the last decade. Thevenin, p. 23.

⁷²The memorandum was renewed in June 1990. *Defense News*, December 3, 1990, p. 10.

⁷³France has participated in few of the NATO-directed collaboration programs (the Hawk SAM in the early 1960s is the principal exception). On a bilateral basis, the most successful transatlantic collaborations have been the GEC/Thomson-CSF battle-field communication system and the GE/SNECMA collaboration on the KC-135 re-engineing. A third collaboration, on Roland, caused considerable friction between the United States and France. Kolodziej, *Making and Marketing Arms*, p. 164; Andrew Moravcsik, "Defense Cooperation: The European Armaments Industry at the Crossroads," *Survival*, January–February 1990, p. 73, note 29. France is a member of the four-nation transatlantic collaboration developing a terminally guided submunition for MLRS.

⁷⁴Some estimates put this figure slightly higher, at 225,000 for UK MoD contracts, 120,000 for defense exports (a total of 345,000), and an additional 170,000 indirectly involved in defense activities. Trevor Taylor and Keith Hayward, *The UK Defense Industrial Base: Development and Future Policy Options*, 1989 (hereafter, "UK DIB"). Keith Hartley et al., "The Economics of UK Defense Policy in the 1990s," *RUSI Journal*, Summer 1990, gives the figure as 340,000 direct, 280,000 indirect for 1987–1988. The UK Trades Union Congress puts the figure at 1 million. The UK Defense Manufacturers' Association has forecast that defense employment will decline from 618,000 to 495,000 by the mid-1990s. *Defense News*, February 11, 1991, p. 6.

⁷⁵UK DIB, pp. 34–35. This, as the authors of the study acknowledge, understates the value of imports; they quote the UK MoD as saying that in 1982, 7 percent of defense equipment expenditures (more than £600 million, or \$1.1 billion) went to the United States alone.

⁷⁶UK DIB, p. 13. Half of the UK's exports go to the Middle East and North Africa. Bittleston, p. 37.

for military use. From 1974 to 1983, defense procurement rose from 6.3 percent to 12.2 percent of manufacturing GDP.⁷⁷

Defense plays a critical role in UK high-technology activities. In aerospace, for example, around 55 percent of the total £11 billion (\$18.5 billion) in turnover in 1989 was attributable to defense.⁷⁸ Twenty percent of the UK electronics industry is directly attributable to defense activities. Exports are critical in this sector; defense electronics exports accounted for £5.4 billion (\$7.9 billion) in turnover in 1986, 47 percent of all defense sales.⁷⁹

The UK defense budget peaked in real terms at around £21 billion (\$36 billion) (in 1988/1989 pounds) in 1987, and has declined about 10 percent since then.⁸⁰ A further 6–9 percent real decline is expected over the next three years.⁸¹ UK defense spending has also been squeezed by higher than expected inflation, which led the MoD to cut £1.8 billion last summer.

Procurement accounts for about £8 billion/year (\$14 billion) and has declined from 46 percent of the budget in 1984–1985 to 39 percent in the proposed 1990–1991 budget. Seventy-five percent is spent in the UK on national programs, 15 percent to UK firms on collaborative projects, and 10 percent to foreign firms, up from 5 percent in the mid-1980s.⁸² Research and development account for another £2.45

⁷⁷Walker and Gummert, p. 423. The UK Defense Manufacturers' Association said that defense industrial share of production was up to 11 percent in 1980, suggesting that the principal change took place from 1974 to 1983. *Defense News*, February 11, 1991, p. 6. Some analysts now believe that defense has once again declined to 11 percent of manufacturing output. Dr. Trevor Taylor, personal communication.

⁷⁸*Guardian*, September 30, 1990; *Interavia Aerospace Review*, August 1990, p. 664. The UK accounts for 34 percent of total West European aerospace revenues, compared with 31 percent for France, 24 percent for Germany, and 9 percent for Italy.

⁷⁹*UK DIB*, p. 48. See also *Defense News*, January 8, 1990.

⁸⁰Hartley, p. 50. *Defense News* puts the 1990 budget at \$33.4 billion, 1988 exports at \$725 million, and 1988 imports at \$625 million.

⁸¹*Financial Times*, December 17, 1990, p. 6. Spending for 1991 is expected to be £21.58 billion (\$38.5 billion) (including an extra £253 for the Gulf War). *Jane's Defence Weekly*, November 17, 1990, p. 970.

⁸²Hartley, p. 51; *UK DIB*, p. 80; *NATO's Sixteen Nations*, December 1989–January 1990, p. 20. The UK National Audit Office similarly concluded that collaboration represents 15 percent of defense equipment expenditures (\$2.6 billion). However, the NAO raised some questions concerning the impact of collaboration; it concluded that in six of ten programs examined, collaboration had caused delay or cancellation. These were NFR-90, ASRAAM, EH-101, MLRS, Trigat antitank missile, and the Cobra radar. *Defense News*, March 11, 1991, p. 31. Spending for collaborative programs in 1989–1990 amounted to £2.37 billion, 15 percent of the total spent on equipment. *Defense News*, May 13, 1991, p. 13.

billion (\$4.1 billion), slightly over 10 percent of the MoD budget.⁸³ Of the defense R&D spending, about £1.5 billion (\$2.5 billion) goes to private industry, while £800 million (\$1.4 billion) goes to government labs and the remainder to universities. This represents 50 percent of the total UK government support for research and development, and 25 percent of all R&D spending in the UK.⁸⁴

Productivity remains a concern for the UK defense industry, with output per worker at £21,575 in 1985, below U.S. and European competitors.⁸⁵ But there appears to be considerable improvement in recent years. Aerospace gross revenues have nearly doubled (from £5.5 billion to £9 billion, 1979–1989), with employment dropping from 230,000 to 200,000.⁸⁶

Two important trends in the British defense industry in the past decade have been privatization and consolidation. During the 1980s the Thatcher government sold off most of the state-held firms (including British Aerospace (1985), Royal Ordnance (1987), British Shipbuilders (1986), Shorts Brothers (1989)⁸⁷ and Rolls-Royce⁸⁸), as well as the management of the Royal Dockyards. Over the same period, two defense industrial giants emerged, British Aerospace (which acquired Hawker Siddeley, much of Royal Ordnance, and Sperry UK) and GEC (which acquired all or parts of Marconi Electronics, Ferranti, and Plessey). These firms will be discussed in detail below.

The UK, under the leadership of Sir Peter Levene, has been a forceful advocate for more competitive, open defense procurement, consistent with the Thatcher government's commitment to free market economics.⁸⁹ However, the government's attitude toward mergers (with

⁸³*Financial Times*, January 17, 1990; SIPRI gives a similar figure of £2.5 billion in 1989–1990. SIPRI, p. 11. In the 1990–1991 budget, equipment spending is proposed at £8.3 billion (\$14.8 billion), R&D at £2.5 billion (\$4.5 billion). Hartley, p. 49. The budget earmarks £2.61 billion (\$4.7 billion) for aerospace equipment, £1.7 billion (\$3 billion) for electronics, £723 million (\$1.3 billion) for ordnance, and £680 million (\$1.2 billion) for shipbuilding and repair.

⁸⁴*Financial Times*, January 17, 1990.

⁸⁵UK DIB, p. 35. Output per employee nearly doubled from 1980 to 1985.

⁸⁶*Interavia Aerospace Review*, August 1990, p. 664.

⁸⁷Shorts was acquired in 1989 by the Canadian firm Bombardier.

⁸⁸Gavin Kennedy, "Strains and Prospects in Defense Procurement," *RUSI Journal*, Summer 1989, p. 45. In some cases, there are limitations on these firms' privatization. The UK government retains so-called "golden shares" in BAe and Rolls, and it has limited to 15 percent the amount of shares that can be held by foreign interests. Walker and Gummett, p. 435.

⁸⁹The UK has long taken the view that, if we are to get maximum return from defense resources, our procurement policy must be centered around competition wherever practicable. Competition can relieve the financial bonds restricting us, yielding better

their possible anticompetitive consequences) has been more ambivalent, reluctantly accepting that competition cannot always be sustained in the face of market pressures for consolidation.⁹⁰ The Gulf War has raised some concern that the contraction of UK capacity limits the ability to surge production for wartime needs or replace equipment used in the coverage of the Gulf, although government officials have downplayed the extent of the problem.⁹¹ Some have argued that, of the major European nations, the United Kingdom is the least enthusiastic about European collaboration, in part as a result of the U.S.-UK tie.⁹²

Germany

Germany has the third-largest defense industry in NATO Europe with total turnover of approximately DM 23 billion (\$12.1 billion), 3.5 percent of Germany's (preunification) industrial production. Approximately 250,000 individuals are employed in defense production, working in some 10,000 firms (about 1 percent of the workforce).⁹³ The German aerospace industry (military and civil) had a similar turnover of approximately DM 23 billion (\$12.1 billion) in 1989, slightly less than half of which came from defense (down from 60 percent in the early 1980s).⁹⁴ Aerospace is growing at about 14

value for money, which in turn releases funds for research, development, and procurement itself." Sir Peter Levens, "European Defense Research and Procurement After 1992," *NATO's Sixteen Nations*, December 1989, p. 75. Walker and Gummett, p. 420. Interest in competition was also stimulated by the prospect of declining defense budgets after a surge in equipment spending in the first half of the 1980s. The procompetition policy was based on three principles: competitive tendering, fixed-price contracts to shift the risk of overruns and reward efficiency, and relating payments to progress. This has been termed a more "commercial" approach to procurement. James Moray Stewart, "Future Defense Needs: The Challenge for the Defense Industry," *RUSI Journal*, Summer 1990, p. 44. James Heitz Jackson, "Reshaping of the Defense Industry," *Jane's Defence Weekly*, November 25, 1990, p. 1154.

⁹⁰The UK's acquiescence in the GEC/Siemens acquisition of Plessey, after the original bid was turned down by the Mergers and Monopolies Commission, and the support for GEC's purchase of Ferranti Defense Systems are evidence of the UK's pragmatic attitude.

⁹¹*The Economist*, January 26, 1991, p. 49. The article pointed to Royal Ordnance's inability to increase production of 155mm shells, and the difficulty of obtaining the ammunition from alternative European services.

⁹²Latham and Slack, pp. 39-40; *Aviation Week and Space Technology*, Special Supplement, June 12, 1989, p. 15. *UK DIB*, p. 109, notes that "under the conservative government, American defense industrial interests have been welcomed to Britain." The United States took 28 percent of the UK's defense exports in 1986. *UK DIB*, p. 36.

⁹³*Le Monde Diplomatique*, November 1990; Regina Karp, "The German Defense Industry in a Changing Europe," 1990, p. 6; *Aviation Week and Space Technology*, May 14, 1990.

⁹⁴*Aviation Week and Space Technology*, May 14, 1990, p. 82.

percent a year, three times faster than in France and four times the UK.⁹⁵

In 1990, Germany spent some DM 53–54 billion (\$33–\$33.5 billion) on defense, putting it roughly on par with France and the UK.⁹⁶ The German government has proposed a DM 52.6 billion (\$32.8 billion) defense budget for 1991, with DM 12.9 billion (\$8 billion) in procurement (20 percent) and DM 3.4 billion (\$2.1 billion) in R&D (6.5 percent).⁹⁷ Larger cuts in total defense spending are likely in the future.⁹⁸

Over the period 1983–1987, German arms exports amounted to approximately \$7.6 billion, fifth in the world (after the United States, USSR, France, and the UK).⁹⁹

The German defense industry was the slowest to develop of the principal three European allies, in part due to postwar restrictions on the German military.¹⁰⁰ In the early years of rearmament, Germany depended heavily on military equipment acquired or produced under license from the United States.¹⁰¹ Beginning in the late 1950s and early 1960s (with aircraft such as the Alpha-Jet and Transall and missile systems such as Hot, Milan, and Roland), Franco-German cooperation became increasingly important, symbolized in the Élysée Accord of 1963.¹⁰²

⁹⁵Philip Butterworth Hayes, "The European Aerospace Industry Report," *Interavia Aerospace Review*, December 1990, p. 1099. Hayes was citing the November 1990 report by the UK Industry Research Group. For a thorough, though somewhat dated, analysis of the impact of the defense sector on the German economy, see Bernard Huebner, "The Importance of Arms Exports and Armament Cooperation for the West German Industrial Base," 1989.

⁹⁶*Defense and Economy World Report*, January 30, 1991, p. 272. A figure of \$31 billion is given in *Defense News*, February 18, 1991, p. 15.

⁹⁷*Wehrdienst*, March 11, 1991, p. 1. R&D for 1990 was also DM 3.4 billion, up from DM 3 billion in 1989. But spending is expected to fall by 15 percent (to DM 2.7 billion) by 1994. *Wehrdienst*, March 18, 1991, p. 1.

⁹⁸BDMI/Lancashire projects a decline of 19 percent from \$32.1 billion in 1990 to \$26 billion in 1995 (in 1990 dollars and exchange rates). *Financial Times*, December 17, 1990, p. 6.

⁹⁹Germany's exports are much more oriented toward the United States and Europe; Germany ranks sixth in exports to developing nations and third in exports to developed countries. ACDA.

¹⁰⁰Many of these restrictions were lifted in the Paris Treaty of 1954. Germany's indigenous armaments program received a boost with the creation of the Bundesamt für Wehrtechnik und Beschaffung in 1957. *Le Monde Diplomatique*, November 1990.

¹⁰¹In the decade after the 1955 Mutual Defense Agreement between Germany and the United States, Germany received \$5 billion in military equipment from the United States. *Le Monde Diplomatique*, November 1990; Ruppelt, p. 31.

¹⁰²See below, pp. 48–49.

Collaboration remains a focus of Germany's defense industrial strategy, with some 60–70 percent of all programs today in international collaboration (primarily European).¹⁰³ Germany has not sought a high degree of industrial self-sufficiency in defense (in marked contrast to France and the UK), but it is increasingly concerned with maintaining access to technology through defense research and development and has sought to use collaboration to achieve that access.¹⁰⁴

German defense industrial consolidation under Daimler-Benz (DASA) has dramatically reshaped Germany's defense industrial base. Today, DASA accounts for as much as 40–50 percent of German MoD contracts.¹⁰⁵

Italy

Italy is Europe's fourth-largest defense market, with defense sales of \$4.5 billion, 8000 firms (200 principal firms), and some 50,000–80,000 employees.¹⁰⁶ Italy's 1989 aerospace sales were approximately \$4.8 billion (\$4.6 billion in 1988), also the fourth largest in NATO Europe.¹⁰⁷ Aircraft is the most important sector, accounting for over half (51 percent) of all sales.¹⁰⁸

Like Germany, Italy in the postwar period rearmed initially with U.S. equipment, moving on in the 1960's to licensed production of U.S. designs.¹⁰⁹ For Italy, like its European counterparts, the decline of the export market (from 70 percent of Italy's defense production in 1980 to 35 percent at the end of the decade),¹¹⁰ coupled with the prospect of a declining national defense budget, has created new pressures to

¹⁰³*Le Monde Diplomatique*, November 1990; Ruppelt, p. 31; and Karl Helmut Schnell, "The German-American Two-Way Street," *NATO's Sixteen Nations*, October 1987, p. 35.

¹⁰⁴See the comments of Juergen Schrempp in *NATO's Sixteen Nations*, December 1989. Germany continued to rely on U.S. foreign military sales (FMS) for about \$4.3 billion in the 1980s. Ruppelt, p. 31.

¹⁰⁵Karp, p. 7; *Le Monde Diplomatique*, November 1990. DASA is discussed in Sec. 5.

¹⁰⁶*Interavia Aerospace Review*, January 1990, p. 43; *DAH*, February 1990, p. 32. *Mondo Economico*, September 1, 1990, pp. 25–26 (FBIS-WEU-90-203, October 19, 1990, pp. 28–29).

¹⁰⁷*Interavia Aerospace Review*, January 1990, p. 43; *Guardian*, August 7, 1990.

¹⁰⁸*Interavia Aerospace Review*, January 1990, p. 43.

¹⁰⁹Luigi Stefani, "Present and Future Italian-U.S. Cooperation in Defense Procurement," *NATO's Sixteen Nations*, 1989, pp. 53–54.

¹¹⁰Italy's falling exports are due not only to declining demand and increased competition, but also from new government restrictions on exports, which stem in part from controversy surrounding arms sales to Iran in 1987–1988.

consolidate the Italian industry and eliminate duplication and overcapacity. Italy's low level of research funding also provides an impetus to consolidation in order to reduce research duplication and fund high-cost projects: Italy is said to devote only 1.5 percent of its GDP (L 15 trillion, or \$11 billion) to research.¹¹¹

Italy's planned defense budget for 1990 was L 18 trillion (\$15 billion) (it is L 23.5 trillion if one counts *carabinieri* and pensions). Investment accounts for 28 percent of defense spending, L 5.1 trillion (\$4.3 billion). L 3.8 trillion (\$3.2 billion) goes for equipment, L 610 billion (\$510 million) for research, and L 669 billion (\$559 million) for infrastructure.¹¹²

The structure of the Italian industry is unique; it is dominated by two large state holding companies (*enti pubblici economi*): IRI-Finmeccanica¹¹³ (with ties to the Christian Democratic Party) and EFIM¹¹⁴ (traditionally associated with the Socialist Party),¹¹⁵ both of which are responsible to the Ministry for State Holdings. Together they control about 60 percent of Italy's defense turnover (37 percent IRI, 23 percent EFIM).¹¹⁶ Yet Italy too is influenced by the trend toward privatization. This can be seen in the merger of Selenia and Aeritalia, where part of the new company, Alenia, will be in private hands. Before the merger, Aeritalia's CEO, Fausto Cereti, predicted that Aeritalia's private-sector share could go from 16 percent to as much as 49 percent.¹¹⁷

Because its defense equipment budget is relatively small, Italy is heavily committed to cooperative programs, ranging from aircraft (Tornado, EFA), to helicopters (EH-101, NH-90), radar (Euroradar for EFA), and missiles (FAAMS as part of Eurosam and Otomat). These arrangements allow Italy to meet its armament requirements with

¹¹¹DAH, February 1990, p. 33.

¹¹²Defense News, May 1990, pp. 281-282.

¹¹³IRI stands for Istituto per la Ricostruzione Industriale.

¹¹⁴Ente Partecipazioni e Finanziamento Industria Manifatturiera.

¹¹⁵Until the fall of 1990 EFIM was actually headed by a Social Democrat, who was replaced by a former Socialist senator, Gaetano Mancini. *La Repubblica*, October 5, 1990, p. 9 (FBIS-WEU-90-230, November 29, 1990, p. 32).

¹¹⁶DAH, February 1990, p. 33.

¹¹⁷*Interavia Aerospace Review*, January 1990, p. 14. Although a recent study commissioned by the Italian treasury identified a number of state-owned firms that were candidates for privatizing, IRI and EFIM were not likely to be privatized immediately, but subsequent efforts to shift their activities to the private sector were not ruled out. *Mondo Economico*, October 20, 1990, pp. 28-30 (FBIS-WEU-90-244, December 19, 1990, p. 25).

indigenously produced equipment¹¹⁸ while maintaining a reasonable level of technological sophistication in its military forces.

Spain

In contrast with the leading defense producing nations, Spain's industry is quite small, with 240 suppliers, 37,744 employees, and a turnover in 1987 of 228 billion pesetas (\$1.8 billion).¹¹⁹ Spain's defense industry has a large public-sector component, with 52 percent of defense equipment spending going to public-sector companies in 1987, 35 percent to private enterprise, and 13 percent for imports (by 1989, imports were around 18 percent). The main sectors are armaments and ammunition (28 percent of turnover), naval (20.2 percent), electronics (18.8 percent) and aerospace (13 percent).

In 1990, Spain's defense budget was 870 billion pesetas (\$7.3 billion), 36 percent (310 billion pesetas, or \$2.6 billion) of which went for equipment (including R&D), fifth largest in NATO Europe.¹²⁰ It is expected to decline by 20 percent in 1991.¹²¹

R&D spending by the government has increased dramatically in the last five years, from 2 billion pesetas (\$16 million) in 1985 to 40 billion pesetas (\$320 million) in 1990 (down slightly from 1989). A major portion of the R&D spending (some 18 billion pesetas, or \$150 million in 1989) is attributable to EFA.

Spain's Dirección General de Armamento y Material (DGAM) hopes to develop the Spanish defense industrial base by coordinating the armed services' demand and promoting collaborative programs to give Spanish industry access to foreign technology. Much of this effort centers around the two major aircraft projects: the 1983 agreement to acquire 72 U.S. F-18s, which has generated almost \$1.2 billion in offsets, one-third of which has been in defense and Spain's 13 percent share of EFA.

Spain's defense industry is organized around four components of the state-owned National Industrial Institute (INI): Construcciones Aeronauticas S.A. (CASA), aircraft; Empresa Nacional Bazan de Construcciones Navales Militares, shipbuilding; Santa Barbara, ord-

¹¹⁸One source estimates that Italian firms produce 90 percent of the country's military equipment. *DAH*, February 1990, p. 33.

¹¹⁹*Defence*, November 1990, p. 724.

¹²⁰*Guardian*, August 7, 1990; *Defense News/IISS* puts the defense budget figure at \$7.9 billion.

¹²¹*Jane's Defence Weekly*, December 1, 1990, pp. 1107-1109.

nance; and INISEL, electronics. There are two important private firms: Union Española de Explosivos (a division of Rio Tinto Explosivos), and CESELSA (electronics).¹²²

These sketches of individual defense markets show vividly the difficulty of sustaining a defense industrial base organized on purely national terms. Europe's largest countries spend less than one-sixth as much as the United States on defense; procurement budgets and R&D spending are comparably small. The supply side (defense and aerospace sales) shows a similar pattern. By the mid-1980s, European governments and industry began to realize that they needed new strategies to overcome these limitations and maintain the economic and technological competitiveness needed to respond to the changing economic, political, and security environment.

¹²²Ibid.

3. THE CHANGING ECONOMIC, POLITICAL, AND SECURITY ENVIRONMENT IN EUROPE AND ITS IMPACT ON THE EUROPEAN DEFENSE INDUSTRY

In recent years, several important developments have accelerated the trend away from national defense procurement to a broader European-wide market. This trend was well under way before the political events of 1989-1991, but it has received further boosts from both the end of the Cold War military confrontation in Europe and the Gulf War. Although no one factor alone can account for this change, the economic, political, and strategic developments discussed in this section all point in a common direction: away from national self-sufficiency and toward a more European market in military equipment.

ECONOMIC FACTORS

Declining Defense Budgets

Economic constraints have played a major role in promoting European consolidation and collaboration in defense procurement. Although European defense budgets (like the U.S. budget) increased to some extent during the period of NATO's commitment to increase military spending by 3 percent and the era of the "second Cold War" (from about 1979 to the mid-1980s), total defense spending in Europe began to flatten and, in some cases, tail off toward the end of the 1980s.¹ According to SIPRI, defense procurement spending in NATO Europe peaked in 1987 (at around \$33 billion in 1988 dollars) and has declined slightly since then. Using the broader definitions of procurement from individual MoDs, spending for the top five European NATO countries will be around \$42 billion in 1990.²

¹Overall, NATO Europe defense spending rose slightly from \$133 billion in 1985 to \$143 billion in 1990 (constant 1987 dollars). See *Business Week*, February 19, 1990. Real defense spending by NATO European countries (including France) fell from about \$150 billion in 1985 to an estimated \$125 billion in 1990. Spending also fell during this period as a percentage of GNP from about 3.5 percent to 3 percent. The largest cuts in percentage terms have come from NATO's smaller European members, notably the Netherlands, Denmark, and Belgium.

Using NATO definitions, European defense spending fell from \$157 billion to \$155 billion from 1988 to 1989 (current dollars).

²SIPRI, pp. 8-9. EC data put total EC procurement at approximately \$45 billion in 1989, a figure that should roughly equal NATO Europe procurement. This estimate is

The political changes in Eastern and Central Europe, the ongoing withdrawal of Soviet forces into the USSR, and the implementation of the CFE conventional arms control agreement will lead to even greater reductions in NATO defense budgets in the future. SIPRI's analysis projects an 18 percent real annual decline in NATO Europe's procurement spending over the next five years. Even if export sales remain constant, major defense equipment sales would slide below \$30 billion by 1995.³ A study conducted for the European Community concluded that NATO Europe's military spending would decline slightly in real terms from \$147 billion in 1990 to \$145 billion in 1995.⁴

European governments will implement some of the spending cuts through reduced force structures. But it is already clear that European defense ministries must sacrifice some procurement programs, perhaps even cancel major new starts. In the UK, for example, the defense secretary has cancelled the planned procurement of an additional 33 Tornado fighters and has cut major surface combat vessels from 48 to 40, submarines from 27 to 16, and RAF squadrons from 15 to approximately 9.⁵ The UK has reduced its planned purchases of the new Challenger 2 tank from 600 to as few as 140, and other army programs have been cut or delayed.⁶ While France has not formally amended its *loi de programmation* for 1986-1991, defense equipment spending for 1991 will fall FF 6-7 billion (\$1.1-\$1.3 billion) below previous projections, and deeper cuts are anticipated for the next programming period, 1992-1997. France has reduced its planned acquisition of the Leclerc tank from 1400 to 1000 and has delayed deliveries; France has also delayed deliveries or schedule for the de Gaulle aircraft carrier, Mirage 2000 aircraft, Mirage F-1 upgrades, and the Rafale.⁷ The Netherlands has cancelled its plans to procure

supported by a private study by Williams de Broe, which found that nominal defense equipment spending in NATO Europe increased 3 percent from 1989 to 1990, from \$41.6 billion to \$43 billion. *Guardian*, August 7, 1990.

³SIPRI, pp. 60-61, projects a one-sixth cut for European arms sales (including exports) from 1989 to 1995: from \$34.8 billion to \$29.3 billion in constant 1988 dollars in its more optimistic scenario, and a one-third reduction in its more pessimistic case. The more optimistic projection assumes exports stay constant.

⁴The study is by BDMI and Lancashire Enterprises for the EC, reported in *Financial Times*, December 17, 1990, p. 4. The Williams de Broe study projected an overall 5 percent increase in NATO Europe military equipment spending, rising from \$43 billion in 1990 to \$51 billion in 1995. *Guardian*, August 7, 1990.

⁵*Options for Change*, U.K. Ministry of Defense, July 1990; *Defense News*, May 13, 1991, p. 16.

⁶*Jane's Defence Weekly*, November 10, 1990, p. 925.

⁷*Jane's Defence Weekly*, October 13, 1990, p. 681; *International Defense Review*, March 1990, p. 324.

the Light Attack Helicopter (LAH) and to modernize its Leopard I-V tanks.⁸

Although the Gulf War may help put a floor under declining defense budgets, it is unlikely that European governments will substantially alter their planned total defense expenditures in response.

Declining Export Sales

For many years, European governments and manufacturers sought to alleviate the problems of short production runs, overcapacity, and high overhead by promoting export sales, primarily to developing countries. Export sales offer not only the prospect of longer production runs for spreading development costs, but also an opportunity to smooth out potential peaks and valleys in production schedules and employment.⁹ Exports can produce lower unit costs for governments and increased productivity for firms. But a combination of declining arms exports to the Third World and competition from new sources (including developing countries themselves) cut substantially into many European nations' arms exports until the outbreak of the Gulf crisis. France, for example, had only around FF 20 billion (\$3.7 billion) in foreign orders in 1990, 40 percent below the 1988 level of FF 37.5 billion (\$5.8 billion), and sharply below the 1984 peak of FF 61.8 billion (\$9.6 billion).¹⁰

In the short run, the Gulf War's aftermath has provided relief from the secular trend of declining export sales. France had a dramatic foreign sales upturn (67 percent) in 1990, primarily as a result of selling air defense equipment to Saudi Arabia and Kuwait,¹¹ but it remains to be seen whether European or American firms will be the principal beneficiaries of new foreign sales.¹² In the longer term, concern about proliferating high-technology conventional weapons to the Middle East and other volatile regions may create pressure for

⁸*Jane's Defence Weekly*, February 16, 1991, p. 210.

⁹Edward Kolodziej, "Re-Evaluating Economic and Technological Variables to Explain Global Arms Production and Sales," 1987, p. 314.

¹⁰*Le Monde*, March 4, 1990, and November 11, 1990.

¹¹*Le Monde*, July 3, 1991, p. 8.

¹²U.S. Third World arms transfer agreements surged in 1990, more than doubling from \$7.8 billion in 1989 to \$18.5 billion, according to a congressional study. The increase was "directly attributable to very costly new orders from Saudi Arabia," according to the report. Grimmert, *Conventional Arms Transfers to the Third World*, p. 6. In contrast, European Third World arms agreements declined in 1990, according to the same study: France from \$3.7 billion in 1989 to \$2.2 billion in 1990; the UK from \$2.7 billion to \$1.6 billion; Germany from \$886 million to \$190 million; and Italy from \$268 million to \$230 million (all in constant 1990 dollars). Grimmert, p. 9.

new export control arrangements, perhaps modeled on the Missile Technology Control Regime (MTCR). This could cut further into potential export sales.¹³

Rising Unit Costs

Rising unit costs for defense equipment have compounded the problem of declining resources. To some extent, rising unit costs are a direct result of declining budgets. Fewer pounds, deutschemarks, and francs for defense procurement mean shorter production runs; in turn, shorter production runs mean a higher ratio of fixed to variable costs (including the need to spread costly R&D over a smaller number of units) as well as lost economies of scale and benefits of the learning curve.¹⁴

Other factors also contribute to rising unit costs. Inflation in the defense sector has an impact, as can be seen from the U.S. experience, where defense prices increased 19.9 percent from 1982 to 1989, although this was less than the rate of increase for other government purchases.¹⁵ Intergenerational price increases (above inflation) have been dramatic (on the order of 5 percent a year),¹⁶ primarily as a result of modern military systems' increased technological sophistication, with research and development costs assuming a growing share of overall program costs.¹⁷

This growing R&D component is a particularly important factor shaping the European defense industry, since direct government funding of military research and development as a share of overall program

¹³The MTCR was publicly announced in April 1987 by the United States, Canada, France, Germany, Italy, Japan, and UK. It is designed to control the transfer of technology that could contribute to nuclear-capable missiles. See Martin Navias, "Ballistic Missile Proliferation in the Third World," *Adelphi Papers*, 252, Summer 1990, Chapter 3.

¹⁴One study argues, based on research on the aerospace industry, that for every doubling of output, labor costs are reduced by 20 percent and unit costs fall by one-half the reduction of labor costs. Latham and Slack, p. 12. An EC study found a 20 percent reduction in unit costs with doubled production in the aerospace industry and a 30 percent reduction from doubled production in electronics and microcomputer products. EC, *Europe Without Frontiers—Completing the Internal Market*, 1989, p. 58.

¹⁵The inflation figure is for U.S. defense purchases. *Economic Report of the President*, 1990. Inflation for nondefense government purchases was 33.4 percent over the same period.

¹⁶*Towards a Stronger Europe*, p. 1.

¹⁷One study suggests that for fighter aircraft, R&D as a percentage of overall project cost has gone from 15 percent in the 1960s to 30 percent for EFA. Pauline Creesey and Simon May (eds.), *The European Armaments Market and Procurement Cooperation*, 1988, p. 17.

cost is declining in Europe.¹⁸ Many European defense firms report that they are allocating a growing percentage of corporate revenues to R&D.¹⁹ European firms must increasingly look to equipment sales to recoup corporate expenditure on R&D. The problem of high R&D costs is exacerbated by the considerable degree of duplication in national European efforts.²⁰

Overcapacity

Shrinking budgets and rising unit costs will further exacerbate the already serious problem of systemic overcapacity in most European defense industries. Even before the recent round of cutbacks in procurement programs, most sectors of the European defense industry had considerable overcapacity. While the precise extent of overcapacity is difficult to calculate,²¹ senior European procurement officials have estimated that, on the whole, capacity is as much as three times what is required to meet European defense requirements.²² Overcapacity is a product of several factors. The most important is European nations' desire to develop their indigenous defense manufacturing sector. In some cases (at least in the past), overcapacity is a product of nations' efforts to maintain intranational competition, even at the cost of considerable economic inefficiency. While some overcapacity is useful to provide a wartime surge capability and to allow for competition,²³ the current surplus is costly for European taxpayers,

¹⁸In France, government financing of military R&D declined from 72 percent to 46 percent in 1978-1986. *Interavia Aerospace Review*, May 1989, p. 391. See Moravcsik, p. 68.

¹⁹For example, in France, Thomson-CSF reports that government funding for the firms' R&D fell from 50 percent to 25 percent in the last decade.

²⁰Hobbs, p. 27, estimates that European unit costs for military equipment are 12 percent higher than in the United States by virtue of R&D duplication alone. Lack of open competition and small production runs are said to add a further 30-47 percent (citing K. Freeman, "Defence Procurement Policy in Europe," *RUSI Journal*, December 1987). While these precise figures are open to dispute, it seems clear that there is considerable costly duplication caused by a lack of division of labor or specialization in European defense research efforts.

²¹Bittleston, p. 28, attempted to address the extent of overcapacity by measuring the value (in defense revenues) of European defense firms put up for sale, arguing that this represented capacity "on which . . . it is no longer possible to earn a profit." But the fact that a firm wishes to sell assets does not, in itself, reflect the degree of overcapacity.

²²In the vivid language of the chairman of Westland, Sir John Cuckney, the status of the European helicopter industry is characterized by "overmanning, overproduction, and lack of profitability." Anthony et al., p. 38.

²³The tradeoff between overcapacity and competition is an important question for the future of the European defense industry. Sir Peter Levene has remarked that "there is much more that can be done to reduce duplication without threatening an

who must subsidize the resulting inefficiencies either through direct government payments or higher prices for military equipment.

Declining budgets and export sales, rising unit costs, and overcapacity all add up to reduced demand (in number of systems and quantities of individual systems). Many European firms have announced job cuts in recent months.²⁴

POLITICAL FACTORS

The economic factors just described give government and industry powerful incentives to pursue greater industrial consolidation and a more transnational approach toward European defense procurement. But the pace of efforts in this direction has accelerated substantially from European governments' deliberate policy choices favoring a more collaborative outlook. These "demand side" effects fall into several categories: institutional arms cooperation (through organizations such as the IEPG, WEU, and NATO), bilateral and multilateral agreements, and the indirect impact on defense cooperation from broader governmental policies promoting European political and economic integration (EC 1992, European Political and Economic Union, EC Technology and R&D programs).

Institutional Armaments Cooperation

The IEPG/EUCLID. The Independent European Program Group (IEPG) was founded in 1976 to provide a forum for coordinating the armaments policy of the European NATO members.²⁵ Until 1984, the IEPG was a relatively dormant and low-level organization. In November 1984, under the prodding of UK defense secretary Michael Heseltine, the European defense ministers decided to raise the IEPG's profile and meet for the first time at the ministerial level.

adequate degree of competition or essential national interests." Levene, "European Defense Research and Procurement After 1992," *NATO's Sixteen Nations*, December 1989, p. 77. Whether the two goals can in fact be pursued simultaneously is discussed below; see Sec. 6.

²⁴For example, BAe has announced plans to eliminate nearly 10,000 jobs (7200 in defense), Royal Ordnance 460 (*Independent*, June 7, 1991, p. 20), MBB as many as 1000, Rheinmetall 1000 (*Wall Street Journal*, April 23, 1991, p. A-12; *New York Times*, March 22, 1991, p. D-4; *L'Usine Nouvelle*, December 6, 1990; *Jane's Defence Weekly*, December 8, 1990, p. 1182), VSEL 500 (*Jane's Defence Weekly*, August 11, 1990, p. 182), and GEC-Ferranti 500 (*Jane's Defence Weekly*, June 30, 1990, p. 1315).

²⁵Of the 14 European members of NATO, only Iceland, which has no military, does not participate in IEPG.

The decision to "revitalize" the IEPG was followed by preparation of the IEPG Action Plan, based on the European Defense Industry Study Team's publication *Towards a Stronger Europe* (December 1986).²⁶ The overriding objective of the Action Plan was to promote competition within Europe through an open arms market (although the degree of enthusiasm for this goal varies among the member states). The commitment to open competition received a boost from the fact that the United Kingdom chaired the IEPG from 1988 to 1990. On the operational level, the IEPG nations agreed to move toward open bidding on a nondiscriminatory basis to any contractor in an IEPG nation. But the IEPG countries accepted that in some cases (especially involving developing defense industry (DDI) nations),²⁷ a sudden move to open competition might damage or destroy a nation's defense industrial base. Therefore the Action Plan continued to support some use of the principle of *juste retour*.²⁸ The Action Plan also advocated better coordination of research and technology development, which has culminated in the creation of EUCLID (European Cooperative Long-Term Initiative in Defense), an intergovernmental program for coordinating defense technology research.²⁹

Overall, the IEPG's stated objectives are to (1) enhance procurement and R&D efficiency, (2) increase standardization and interoperability, (3) strengthen the European defense industrial base, and (4) facilitate improvements in the transatlantic two-way street in defense procurement.³⁰

²⁶The study was chaired by Mr. Henk Vredeling, the former Dutch defense minister, and is sometimes known as the "Vredeling Report." The Action Plan was approved at the IEPG meeting in Luxembourg in November 1988.

²⁷The DDI nations are Greece, Portugal, and Turkey.

²⁸*Juste retour* (literally, "fair return") can have several different meanings. In some usages it means that in a collaborative program, each nation will receive an industrial work share equal to its government's financial contribution to the project. *Juste retour* may be component-specific (as in EFA, where each participating nation's contractors receive a proportional share of each of the major elements (airframe, engine, radar)), or project-specific (permitting national specialization, as in the Eurosam consortium, where France is developing the missile, Italy the radar). Sometimes the term is used even more broadly, to include an overall balance in a nation's contribution/work share, across several projects. This is the IEPG definition. From an economic standpoint, the first form of *juste retour* is the least efficient, leading to duplicate capabilities in all participating countries. The insistence by each of the EFA countries on its own aircraft assembly lines is a prime example, although the EFA consortium has let many sub-contracts through competition.

²⁹In 1989 the IEPG also implemented the Vredeling Report's recommendation to establish a small permanent secretariat, now based in Lisbon.

³⁰*Defence*, September 1989.

The IEPG now has three committees. Panel I (chaired by Norway), Operational Requirements and Programmes, focuses on requirements harmonization and translation into programs.³¹ Panel II (chaired by France), Research and Technology, is responsible for research cooperation, including EUCLID. Panel III (chaired by Germany), Procedural and Economic Matters, is oriented toward opening the European weapons market with the goal of creating a common market in weapons for the members of the IEPG.³² As a practical matter, harmonizing requirements and translating them into collaborative programs have taken a back seat in recent years to the drive for a more open market. This is attributable in part to the priorities and viewpoint of the United Kingdom, which chaired the IEPG from 1988 to 1990 (now succeeded by Belgium).

Current IEPG efforts focus on implementing the commitment to open bidding. At its November 16, 1990, meeting in Copenhagen, the IEPG adopted the Coherent Policy Document, which sets forth the basic principles for opening the European defense market, covering cross-border competition, *juste retour*, technology transfer, and support for DDI countries. The document also gives guidelines on the nature of the required national procurement contract bulletins and the "focal point" of contact within the procurement bureaucracy for all potential bidders.³³ But important issues remain unresolved. Despite Germany's prodding, the IEPG ministers declined to adopt a legally binding commitment to open bidding, preferring to depend on a political commitment. This enhances the importance of monitoring and dispute adjudication procedures to assure that the political commitment is being carried out in good faith. These procedures are still in negotiation under the auspices of Panel III.

³¹Panel I was created by bringing together the old Panel I (requirements) and Panel II (projects) in an effort to improve the translation of European Staff Targets (EST) and Outline European Staff Targets (OEST) into actual military programs. See Levene, "European Defense Research," p. 86.

³²In addition, three ad hoc working groups report to Panel III: Competition, *Juste Retour*, and Technology Transfer. There is also a working group on Cooperation in Research and Technology, which reports to Panel II. Other subgroups include Research Policy and Developing Defense Industries. The IEPG also created a working group to consider the effects of 1992 on defense procurement. For a more complete description of the various panel and group activities, see "IEPG-EDIG—For an 'Open' European Defence Market?" *Defence*, September 1989; Rt. Hon. Tom King, "Strengthening the European Pillar: The Work of the IEPG," *Jane's NATO Handbook*, 1989-1990, pp. 222-224.

³³IEPG/Min/D-14, November 16, 1990. As of autumn 1990, all 13 IEPG nations had appointed focal points, and 11 have produced a contract bulletin. There is considerable variation in the degree of detail and compliance with the guidelines on criteria for contract selection.

Although the IEPG has set open markets as its central theme, the political realities of European collaboration are reflected in the need to deal with the problem of *juste retour* and the DDI nations. The Coherent Policy Document retains a commitment to *juste retour* for all IEPG countries, at least for a transitional period. Although openness advocates such as Sir Peter Levene (until recently, UK chief of defense procurement) have argued that a more open market can benefit DDI nations,³⁴ most of those nations believe that unfettered openness would devastate their smaller, less technologically advanced industries.

EUCLID, launched at the June 1989 IEPG Ministerial, is a major new effort to coordinate defense research activities throughout NATO Europe.³⁵ EUCLID will focus on upstream (emerging) technologies rather than those related to producing systems.³⁶ Cooperative research is organized into Common European Priority Areas (CEPAs),³⁷ each of which contains several cooperative Research Technology Projects (RTPs);³⁸ these are funded on a voluntary basis by any IEPG government with an interest in the projects,³⁹ augmented by research funds from participating industry.⁴⁰ Proposed first-year funding for

³⁴"DDIs can benefit from the open market in defense equipment. . . . I have been struck by the capability that DDI industries already possess in certain fields, capitalizing on natural advantages, for instance in labor costs. I am sure that these countries could win more business given the right climate: a more open market will provide this." Levene, "European Defense Research," p. 77.

³⁵For a detailed description of EUCLID's structure and progress to date, see Carol Reed, "EUCLID: The Future of European Defence Technology," *Defence*, June 1990, pp. 344-348. Before it established EUCLID, the IEPG was involved in coordinating defense research through ad hoc Cooperative Technology Projects (CTPs).

³⁶Interview with Yves Sillard, *Defense News*, October 16, 1989, p. 94.

³⁷Thus far, 11 CEPAs have been identified: modern radar technology, silicon micro-electronics, composite structures, modular avionics, electric gun, artificial intelligence, signature manipulation, optoelectronic devices, satellite surveillance technology, underwater detection and related technologies, and human factors.

³⁸As of the November 1990 Ministerial, 26 RTPs had been identified. For a discussion of individual RTPs, as well as the nations and industries participating, see *Defence*, June 1990.

³⁹Normally, each participating country would contribute equal shares, though the rule can be modified by agreement, especially to facilitate participation by DDIs. Each project will be managed by a lead nation through a single lead contractor, selected by the lead nation through competition. *Defence*, June 1990, p. 344.

⁴⁰Industry is also given a role in proposing RTPs. For some firms, this is an opportunity to get government funding for research that would otherwise be funded solely out of corporate resources.

1990 was about \$135 million,⁴¹ although no contracts have yet been awarded.

EUCLID is likely to prove an important forum for industrial collaboration. Five of the major European aerospace firms (BAe, MBB, Aerospatiale, CASA, and Aeritalia) have signed an agreement to cooperate on all EUCLID program activities except undersea acoustic systems.⁴² Although the IEPG nations have reached an agreement on technology transfer and intellectual property rights, this may nonetheless pose a problem in carrying out EUCLID programs, as many firms worry that they will lose the commercial benefits of innovative ideas and technology if they participate in transnational or multifirm research.⁴³ Another important area of concern is whether EUCLID will simply "relabel" research programs that would otherwise be funded by national governments, as opposed to real Europewide coordination and strategic direction.⁴⁴

According to many industry and government officials, one important benefit of EUCLID collaborative research programs is that they will expose European researchers, engineers, and designers to one another's methods and approaches. Despite the broad range of collaborative programs over the years, there are still differences in national corporate cultures that have proved to be systemic barriers to effective cooperation. Even though the funds allocated to EUCLID are modest and the prospects for major substantive research breakthrough limited, many see collaboration at the research level as a way of breaking down these barriers and enhancing the prospects for more joint development at the precompetitive stage. Advocates of EUCLID point to civil research collaboration under the EC's Framework Program as a model.

WEU. The Western European Union (WEU) had its origins in the July 1947 defensive alliance between the United Kingdom and France, and it was expanded by the Brussels Treaty of 1948 to include the Benelux nations. Germany and Italy joined the WEU in the Paris Treaty of 1954 after the failure of the European Defense Community. In 1988 Spain and Portugal joined the WEU. The WEU had fallen into dormancy in the late 1950s and 1960s, only to be revived in the mid-1980s as a forum for the European pillar of NATO, to consider

⁴¹Hobbs, p. 30. The small size of the EUCLID program is evidence that EUCLID is a long way from becoming a European equivalent of the U.S. Defense Advanced Research Projects Agency (DARPA), which has a budget of \$1.5 billion in FY 1991.

⁴²*Armées d'Aujourd'hui*, No. 150, April 1990, p. 47.

⁴³*Defence*, September 1989.

⁴⁴Hobbs, p. 30.

security questions that fell outside the ambit of the EC. The WEU's more notable accomplishments since its revival include the Platform on European Security Interests in 1987, coordinating European participation in the Persian Gulf in 1987, and response to the Iraqi invasion of Kuwait in 1990.

Until July 1990, one of three principal "agencies" of the WEU was "Armaments Cooperation," responsible for promoting requirements harmonization and collaboration among WEU members. In October 1989, the WEU's foreign and defense ministers called for using the WEU "to provide a political impetus to institutions of cooperation in the field of armaments."⁴⁵ But with the rise of the IEPG, and the shift in WEU focus toward operational coordination of members' military activities (especially out-of-area), the armaments cooperation effort seemed increasingly redundant and has been eliminated as a separate activity of the WEU.⁴⁶ This could change, however, if the member states decide to expand the WEU's role in connection with developing a European security identity.

CNAD. The NATO Conference of National Armaments Directors (CNAD) was created in 1966, bringing together the chief procurement officials from NATO nations with the object of enhancing armaments cooperation and RSI. The CNAD has played an important role in most NATO-centered arms cooperation efforts, including the LTDP and Conventional Defense Initiative, and it has been the forum for organizing collaborative programs among two or more NATO members.⁴⁷ In recent years, the CNAD has focused on improving opportunities for defense collaboration through a coordinated NATO-wide planning process, NATO's Conventional Armaments Planning System (CAPS), which is being implemented by the CNAD after a two-year trial. The purpose of CAPS is to provide a centralized common format for nations to project their procurement plans, which will improve the prospects of identifying opportunities for collaboration or requirements harmonization early in the procurement process. To date CAPS has produced few concrete accomplishments, but the effort is still in its early stages.

The latest CNAD initiative in arms collaboration is the Task Force on Defense Trade, established on October 24, 1990. The Task Force's goal was to identify barriers to intra-Alliance defense trade (including

⁴⁵Webb, p. 103.

⁴⁶See interview with Willem van Eekelen, secretary general of the WEU, in *International Defense Review*, March 1990, p. 261.

⁴⁷Bittleston, p. 13.

protectionism, technology transfer restrictions, and limits on foreign ownership) and propose steps to reduce or eliminate them.⁴⁸ The Task Force presented its report to the CNAD at its April 25, 1991, meeting and forwarded the report to the North Atlantic Council, which authorized further study. The Task Force has caused controversy. At least one NATO country, Belgium, refused to participate, countries have disagreed over the scope of the mandate, and the initial goal of the Task Force (to provide concrete recommendations for improvements in trans-NATO defense trade) has been scaled back.⁴⁹ In its report, the Task Force proposed further NATO-wide steps to develop a "code of conduct" in defense procurement to promote greater opportunities for transnational collaboration and competition, drawing on the experience of the IEPG, GATT, and bilateral or multilateral MOUs.⁵⁰

Bilateral and Multilateral Armaments Cooperation

Special bilateral and multilateral relationships have been the main-spring of European collaborative defense programs. These political relationships have raised the visibility of cooperative programs and given them a political significance that transcends purely operational military considerations governing development and procurement decisions. High-visibility European cooperative programs have become partially insulated from the normal national defense budgeting process, as the political costs associated with cancelling or even delaying cooperative projects often outweigh traditional operational and fiscal considerations.⁵¹

Franco-German Cooperation. Franco-German armaments cooperation has its roots in the late 1950s, blossoming in the relationship developed between Charles de Gaulle and Konrad Adenauer in the

⁴⁸*NATO's Sixteen Nations*, November 1990, pp. 54-55.

⁴⁹*Defense News*, February 4, 1991, p. 3.

⁵⁰The report concludes that increased competition could stimulate efficiency, maintain downward pressure on costs, help rationalize the defense industrial base through reduced overcapacity and larger economies of scale, and foster Alliance cohesion. But it also recognizes competition's potential pitfalls, including creating new monopolies and reducing security of supply and national independence. It considers four possible solutions: (1) a Code of Conduct, setting forth fundamental principles to govern industrial nations' acquisition policies and practice; (2) a NATO defense trade agreement; (3) extending bilateral cross purchasing; and (4) a NATO purchasing agency. The Task Force suggests the creation of a NATO committee to direct and monitor trade activities and to undertake any further action authorized by the North Atlantic Council.

⁵¹This obviously is not true for transatlantic collaboration, as evidenced by the failure of NFR-90, MSOW, and ASRAAM.

early 1960s.⁵² The Élysée Treaty of 1963 committed the two countries to broad-ranging coordination on security policies, including armaments planning and cooperation. One of the most enduring bilateral cooperative relationships, between the French firm Aerospatiale and Germany's MBB, developed in parallel with this first flowering of Franco-German security cooperation.⁵³ But implementing the Élysée agreement's ambitious goals proved harder to achieve. In January 1983, President Mitterrand of France and Chancellor Kohl of the FRG committed to reactivate the treaty. Implementation has included creating a Franco-German Defense and Security Council chaired by the French president and German chancellor, and the Franco-German brigade.⁵⁴ France and Germany are also leading the effort to enhance the European Community's security dimension.⁵⁵

Although several Franco-German cooperative armament programs preceded the Élysée Treaty's reactivation,⁵⁶ the two leaders' political emphasis on the bilateral relationship gave new importance to these efforts. This political commitment has helped the bilateral cooperative Tiger helicopter program survive continuing conflicts between France and Germany over priorities and requirements. Today, the Aerospatiale/MBB (now DASA) relationship forms one of the three principal axes for a number of European cooperative programs in defense and aerospace.⁵⁷

Despite the two governments' continued stress on the Franco-German "couple," some difficulties remain on both government and industrial

⁵²France and Germany created a joint military research institute in Saint-Louis, France in 1959.

⁵³Philippe Cothier, "Industries Européennes de Défense: De la Coopération Traditionnelle à l'Émergence d'une Europe de l'Armement," 1989, p. 5.

⁵⁴International Institute for Strategic Studies, *Strategic Survey 1987-1988*, p. 83.

⁵⁵Chancellor Kohl and President Mitterrand stimulated new attention on EC security policy in their joint proposal to the Dublin summit in April 1990 and in their joint letter on the eve of the EC Intergovernmental Conference on Political Union in Rome in December 1990. The letter urged that "political union should include a real security policy which would eventually lead to a common defense." *Le Monde*, December 9-10, 1990, p. 4.

⁵⁶For example, the Transall (1959) and Alpha-Jet (1969) aircraft, antitank missiles Hot and Milan (1964), and surface-to-air missile Roland (1964). *Armées d'Aujourd'hui*, No. 150, p. 46; Thevenin, p. 23. Transall teamed Nord Aviation, MBB, and Fokker; Alpha-Jet teamed Dassault-Breguet and Dornier, with SNECMA, Turbomeca, MTU, and KHD on the engines. The missile programs were developed by Aerospatiale/MBB's Euromissile. Kolodziej, *Making and Marketing Arms*, 1987, pp. 320-321.

⁵⁷See Sec. 5.

levels, particularly in light of declining defense budgets. One French industry representative recently observed, "We are concerned about the possibility to cooperate in the future with West Germany. . . . If there is declining activity in Germany, it could prompt an increase in activity with America and other European countries."⁵⁸

Franco-British Cooperation. France and the United Kingdom in recent years have attempted to strengthen their bilateral armaments collaboration. Like the Franco-German relationship, this effort has its roots in geopolitical considerations. The United Kingdom seeks to balance the Franco-German relationship, while France hopes to strengthen British ties to the Continent. Proposals for developing the strategic relationship have always included an important element of arms collaboration. Some of the earliest collaborative programs were Franco-British.⁵⁹ More recently, Prime Minister Thatcher of Britain and President Mitterrand of France agreed to work toward "enhanced cooperation" in defense, including the possible codevelopment of nuclear-capable standoff air-to-surface launchers.⁶⁰ France and the UK are also working to develop an AAW Frigate to replace the now cancelled NFR-90.⁶¹

Recent Franco-British efforts have focused on coordinating arms acquisition policies to facilitate cross-national arms purchases. The most important product of this effort is the 1987 Anglo-French Reciprocal Purchase Arrangement (a model for the IEPG's open bidding effort, although initial IEPG efforts preceded the Franco-British agreement). The agreement provides for opening arms acquisition bids to each other's nationals (with some exceptions on the basis of national security) and for advertising opportunities to bid to each

⁵⁸Robert Dubost, head of cooperation for Dassault, *Armed Forces Journal International*, July 1990, p. 22.

⁵⁹For example, the Jaguar fighter (1964), Puma, Gazelle, and Lynx helicopters (1967), and the Martel missile (1963). The collaborative relationship declined in the 1970s and 1980s. Kolodziej, *Making and Marketing Arms*, pp. 153-155. Jaguar involved collaboration between Breguet Aviation (now part of Dassault) and British Aircraft (now BAe); the helicopters teamed Aerospatiale and Westland (with Turbomeca and Rolls-Royce on the engines); Martel was a Matra/Hawker-Siddeley collaboration.

⁶⁰*Guardian*, May 5, 1990; *Times*, October 24, 1990, p. 10. The collaboration would be to build a longer-range variant of France's ASMP, called the ASLP (Air-Sol Longue Portée). GEC and Aerospatiale have discussed industrial collaboration on the project. *Jane's Defence Weekly*, January 5, 1991, p. 5.

⁶¹*Defense News*, March 4, 1991; *Aviation Week and Space Technology*, March 11, 1991, p. 11. The frigate will carry the multinational LAMS air defense system, which involves British Aerospace and France's Thomson and Aerospatiale. See p. 84 below.

other's nationals.⁶² Other elements of the cooperative relationship in acquisition include equipment conferences for government and industry representatives concerning land, air, and sea systems and a joint commission to monitor implementation of the agreement.⁶³

To date, the direct results of this open bidding arrangement appear modest, and claims of success are based primarily on anecdotal evidence.⁶⁴ Cross-national purchases are highly concentrated in dual-use, general purpose, and off-the-shelf items, rather than sophisticated hardware. To achieve the target of 10 percent foreign purchase, French procurement officials estimate that virtually all contracts would have to be made available for open bid.⁶⁵ One important barrier is the lack of standard procedures for bid preparation and evaluation, as well as the different roles played by the Délégation Générale d'Armement (DGA) in France and the Procurement Executive in the UK.⁶⁶ But the arrangement has had a significant impact on building Franco-British industrial links.

⁶²The agreement contains several points: (1) open bidding on all production contracts valued between £1 million and £50 million (between £1 million and £10 million for development and project definition contracts); (2) primes must allow open bidding for subassemblies, components, and raw materials; (3) nondiscriminatory treatment of each other's nationals; (4) each country will simultaneously publish contract bulletins about bid opportunities for both primes and subs; (5) possibilities for cooperative arrangements for research should be explored. The two countries have also agreed to respect each other's qualified contractors' list. A joint committee, chaired by principal deputies to the two national armament directors, meets quarterly to assure the fair and smooth implementation of the agreement, and there are periodic meetings of technical officials from the two MoDs. Carol Reed, "The Anglo-French Connection: The Reciprocal Purchasing Agreement," *Defence*, November 1989. See also *NATO's Sixteen Nations*, December 1989–January 1990, p. 20; Walker and Gummett, p. 429; Latham and Slack, p. 13; Marcel Benichou, "The Development of Anglo-French Relations in Defense Equipment," *RUSI Journal*, Winter 1989, pp. 55–57.

⁶³*NATO's Sixteen Nations*, December 1989–January 1990, p. 20.

⁶⁴One study stated that there has been "significant expansion in cross-channel purchases," although it presented no data to support the claim. Latham and Slack, p. 13. According to Sir Peter Levene's Parliamentary testimony in March 1991, the United Kingdom had bought £100 million (\$160 million) from France since 1988, and France bought £90 million from the UK. *Defense News*, May 13, 1991, p. 12; see also Stewart, "Future Defense Needs," p. 47. The medium-term aim is for cross-purchases on the order of FF 1–2 billion (\$150–\$300 million). Benichou, p. 57; interview with Yves Sillard, *International Defense Review*, March 1990, p. 324. Recent transactions include UK purchase of French mine disposal equipment, sonars, and mortar shells (Thomson-Brandt, Thomson-Sintra, and Ruggieri); and French acquisition of naval radars and laser range finders (Racal, Plessey, and USH).

⁶⁵UK officials now estimate that 10–15 percent by value of the equipment purchased comes from outside the UK. *NATO's Sixteen Nations*, December 1989–January 1990, p. 20; *Defense News*, March 11, 1991, p. 31.

⁶⁶See Reed, "The Anglo-French Connection." In France the DGA not only develops requirements and chooses contractors, it is directly involved in managing research and

The Aircraft Consortia. A highly visible instance of multilateral collaboration involves the three nations (UK, Germany, and Italy) that together built the Tornado fighter under the framework of the Panavia consortium, and that are now (with the addition of Spain) undertaking the European Fighter Aircraft (EFA) project under the aegis of Eurofighter.⁶⁷

An even broader effort (including France) in the field of transport aircraft is also under way, with the creation of Euroflag—the European Future Large Aircraft Group,⁶⁸ a new industrial collaboration involving Aeritalia, Aerospatiale, BAe, CASA, and MBB.⁶⁹ The future of this effort is uncertain; it may depend on the degree of European interest in developing greater European force projection capability. Cost is a major factor, and Europeans may turn to acquiring U.S. transport aircraft if they decide to proceed with this requirement.

The experience of fighter collaboration has spawned some efforts to assess the costs and benefits of government-directed collaboration.⁷⁰ Both government and industry officials argue that the experience demonstrates the advantages of leaving the design of collaborative projects in large measure to industry.⁷¹ It is important to note, however, that the political impetus behind the fighter collaborations has thus far allowed EFA to survive in an uncertain strategic and budgetary environment. Moreover, the importance of harmonizing national requirements on multinational programs suggests the necessity of some form of high-level government involvement from the early stages of collaboration. Nonetheless, in many sectors, Europe is moving away from traditional collaborative programs based on government-created consortia composed of nationally nominated contractors to carry out the work on a noncompetitive basis.

in some cases production activities. The UK Procurement Executive is much more limited in scope.

⁶⁷The participants are British Aerospace, MBB/Dornier, Aeritalia, and Construcciones Aeronauticas SA (CASA). Parallel consortia are developing EFA's radar (Euroradar) and engine (Eurojet). *Aviation Week and Space Technology*, February 19, 1990. Britain and Germany each have one-third shares, while Italy has 21 percent and Spain 13 percent.

⁶⁸Euroflag is a Europe-only successor to FIMA (Future International Military Airlifter), which also included Lockheed. *Defense News*, June 12, 1989, p. 3.

⁶⁹*NATO's Sixteen Nations*, August 1989, p. 108.

⁷⁰See Rich et al., Chapter 4, and Mark Lorell, *Multinational Development of Large Aircraft: The European Experience*, 1980.

⁷¹See, for example, James Moray Stewart, "The European Defence Market," *NATO's Sixteen Nations*, January 1990, p. 19.

Bilateral U.S.-European MOUs. A series of bilateral memoranda of understanding (MOUs) between the United States and its NATO allies form the framework for transatlantic arms trade and collaboration. Although some agreements date back to the early 1960s, a number of MOUs were signed in the 1970s, governing bilateral defense trade, encouraging off-the-shelf purchases, and providing for nondiscriminatory treatment of foreign bids, as well as measures to protect classified information and intellectual property rights.⁷² The U.S. secretary of defense, pursuant to authority granted him by the 1976 and 1977 Defense Authorization Acts, waived the provisions of the Buy America Act for defense trade pursuant to the MOUs.⁷³ The MOUs have provided some benefits to Europeans seeking access to the U.S. market. But many European procurement officials detect an element of "divide and conquer" in the U.S. bilateral approach, and they profess some confusion as the United States pursues the bilateral and NATO-wide tracks simultaneously. Some officials in both Europe and the United States would prefer to see more direct negotiations between Europe as a whole (perhaps through the IEPG) and the United States to establish common rules for transatlantic defense trade and collaboration.

European Political and Economic Integration

European Political Union. Deeper political integration among EC nations could enhance the prospects for European arms collaboration and for developing a single European defense market. A more united Community is likely to take on a broader security dimension. In implementing security cooperation, member countries may make greater efforts to coordinate (perhaps even combine) military planning, strategy, and operations, which would increase the likelihood of cooperatively defined procurement requirements. This in turn could lead at some later date to more joint procurement, perhaps even culminating in a single European defense procurement agency. Even without joint procurement or combined military activities, political union could stimulate further European cooperation in armaments policy and procurement if it led to the amendment or even the repeal of Article 223(b) of the Rome Treaty (the basic charter of the Community),

⁷²The 1975 MOU with the UK was the first of these MOUs to be signed with a European country. Sir Peter Levene, "Maintaining the Two-Way Street: UK/US Defense Procurement," *NATO's Sixteen Nations*, 1989, p. 80.

⁷³Webb, pp. 10-11.

which authorizes, but does not require, EC countries to favor national manufacturers in defense procurement.⁷⁴

Precisely how far Europe will evolve in this direction is difficult to forecast. The results of the Intergovernmental Conference on Political Union, launched in December 1990, will indicate how far the Community is prepared to go in the security sphere in the near future. The EC's Rome 1990 Communiqué demonstrates the Community's intention to play a more active role in the security domain, including arms cooperation.⁷⁵

Even if Article 223(b) is not repealed, Article 30 of the Single European Act (SEA) (1987) may give the Commission another basis for asserting jurisdiction over the European defense market. Article 30(6)(a) is a general exhortation to work together more closely on the "political and economic aspects of security,"⁷⁶ while Article 30(6)(b) is more specific: "The High Contracting Parties are determined to maintain the technological and industrial conditions necessary for their security. They shall work to that end both at national level and, where appropriate, within the framework of the competent institutions and bodies." Some Commission staff and other analysts argue that the Commission itself is one such competent body (by virtue of its involvement in such technology programs such as ESPRIT and its other industrial-base responsibilities), but this interpretation is stoutly resisted by those who believe that the IEPG and WEU are the relevant forums.⁷⁷

The Commission has cautiously begun to explore how it might use Article 30(6)(b) to increase its involvement in defense industrial pol-

⁷⁴Article 223(b) provides: "Any member state may take such measures as it considers necessary for the protection of the essential interests of its security which are connected with the production of or trade in arms, munitions, and war material."

⁷⁵The Rome Communiqué (December 14-15, 1990), Presidency Conclusions, noted that the European Council had agreed "as regards *common security*, the gradual extension of the Union's role in this area should be considered, in particular with reference initially to . . . economic and technological cooperation in the armaments field; coordination of armaments export policy" (emphasis in original).

⁷⁶Article 30(6)(a) provides: "The High Contracting Parties consider that closer cooperation on questions of European security would contribute in an essential way to the development of a European identity in external policy matters. They are ready to coordinate their positions more closely on the political and economic aspects of security." Within the Community, this process of coordination is known as European Political Cooperation (EPC).

⁷⁷See Rainer Rupp, "Europe 1992: Potential Implications for the North Atlantic Alliance," *NATO's Sixteen Nations*, December 1989-January 1990; C. Reed, "Defence and the European Community," *Defence*, No. 3, 1990, pp. 192-193, quoting the report of WEU's Jean-Marie Caro on why the WEU should be the forum for coordinating issues relating to defense industrial economics.

icy. The Commission has stated its intention to address "as a matter of priority, the question of defense procurement in light of provisions of both the EC Treaty and the European Cooperation provisions of the SEA."⁷⁸ In addition, the Commission has initiated several studies to examine defense industries and the relationship between dual use and the EC regulatory jurisdiction. The Commission is also considering financial aid to defense companies affected by defense budget cuts to support R&D in dual-use technologies.⁷⁹

European governments have been reluctant to cede jurisdiction over defense procurement to Brussels, largely due to the security implications of defense acquisition policies and concerns about the impact of supranational decisions on their industrial base. But the recent agreement to give the Commission jurisdiction over public procurement policy in some of the sensitive areas of "excepted" procurement under GATT and the Rome Treaty suggests that sectors once thought sacrosanct might some day come under the EC's competence.

Initially, under both GATT and the Rome Treaty, other important "excepted" categories of procurement included water, energy, transport, and communications.⁸⁰ But the impetus toward completing the internal market led the EC in early 1990 to open these previously exempted areas to Community-wide competition. Under rules recently adopted by the EC, all EC nations must open for competitive bidding projects involving water, energy, transport, and telecommunications by January 1, 1993.⁸¹ This sector is enormous in comparison with the defense procurement sector (as much as \$300-400 billion annually, as compared with \$40 billion for EC weapons procurement).⁸² Open

⁷⁸EC COM(88)376 Final, November 10, 1988, quoted in Latham and Slack, p. 17; Bittleston, p. 22.

⁷⁹*Financial Times*, February 27, 1991, p. 18; Latham and Slack, p. 18.

⁸⁰For GATT, the Tokyo Round established a public procurement code to open up public bidding, but Article VIII of that code specifically allows nations to deny national treatment on national security grounds. Further implementation of the Tokyo Round provisions on public procurement have been caught up in the collapse of the Uruguay Round (though technically they are separate negotiations).

⁸¹Portugal, Spain, and Greece have been allowed to delay implementation of the so-called Utilities Directive.

⁸²See Rupp, p. 24; *Financial Times*, January 17, 1991, p. 8. Only about 2 percent of Europe's public procurement contracts now go to foreign firms. *Financial Times*, May 7, 1990. The public procurement rules have raised considerable disquiet in the United States, because they explicitly authorized discrimination against non-Community bidders (by either dismissing bids with less than 50 percent EC content or requiring them to offer at least a 3 percent cost advantage). This has even led some in the U.S. Congress to call for retaliation. The EC said that it would drop this provision of the new public procurement rules if broader open competition in public procurement is adopted in GATT.

competition in these sectors could foreshadow similar developments in defense procurement.

Until now, European defense officials have been particularly determined to maintain the dividing line separating EC and national competence, preferring IEPG as the vehicle for developing a common European acquisition policy.⁸³ This could change if the IEPG fails to deliver on its promises, or if the EC (in conjunction with the WEU) becomes more directly involved in defense policy.

EC-1992. There has been considerable speculation concerning the effect of the EC's drive to complete the internal European market (commonly known as "EC-1992") on European defense industry.⁸⁴ Even without a repeal of Article 223(b), there are several reasons to believe that EC-1992 and other Commission initiatives will further break down national barriers in the defense industry, and thus contribute to a "single" defense market.

The impact of EC-1992 on the defense sector is a product of a new European corporate orientation that leads industrial managers to make decisions in terms of a European rather than a national market. This has an important impact on defense firms, many of which are engaged in manufacturing dual-use items or who simultaneously produce both civil and military products. To the extent that there are civil as well as military markets for a company's products, firms will increasingly orient their strategy for sales, distribution, and manufacturing sites toward the Community-wide market. The impact on the "defense side of the house" will grow as more and more European defense firms diversify into civil operations.⁸⁵

⁸³See, for example, Levene, "European Defense Research and Procurement After 1992," p. 75. In the words of Sir Peter Levene, "By Article 223 of the [Rome] treaty, matters concerned with the production of, or trade in, defense equipment generally fall outside the Commission's competence, and we believe that is right." According to senior UK and French officials, a practical agreement has been reached between the IEPG and the EC; the IEPG will keep the EC "informed" of its activities, if the EC will refrain from asserting jurisdiction over defense procurement.

The latent conflict between the competence of IEPG and the EC rose to the surface in 1989 as a result of the Commission's staff proposal, now in administrative limbo, for a "Common Customs Tariff" on dual-use items. See below, p. 58.

⁸⁴The goal of EC-1992 is to achieve the "four freedoms" in the EC market: freedom of trade in goods, services, and capital, and free movement of peoples.

⁸⁵"It is true that EC-1992 will have substantial indirect effects on defense procurement, most particularly by its implication for industrial restructuring. These will affect defense contractors under Article 223, because many of them also operate in the civil sphere." Sir Peter Levene, "European Defense Research and Procurement After 1992," p. 75. "European defense industries are caught up in the powerful dynamics surrounding the Single European Act, not least because most defense contractors are substantial players in civil high technology markets and because

The EC directives and regulations may also impose legal constraints on companies that manufacture dual-use items or for firms with close connections between their military and civil products. In order to assure fair competition (a "level playing field"), the Commission, in implementing EC-1992, is moving to prohibit state subsidies or other discriminatory measures that would unfairly advantage one Community member's products. To the extent that dual-use items are a part of commercial trade within the Community, and thus subject to the Commission's jurisdiction, the Commission could argue that it has the authority to regulate subsidies to dual-use or mixed civil/military firms if these subsidies, under the guise of defense programs, give a company an unfair commercial advantage.⁸⁶ Although the Commission has moved cautiously in this area thus far, there is considerable room for expansion should the Commission so choose (and should it receive backing from the European Council).⁸⁷

Merger and antimonopoly regulations are another aspect of EC competition policy that could affect the future of European defense industry. The Commission could apply Article 85 of the Rome Treaty (prohibiting anticompetitive groups and formations) and Article 86 (limiting "abusive" practices by firms with dominant market position) to civil operations of firms that operate in both civil and military sectors in a way that might limit the degree of industrial consolidation or collaboration.⁸⁸

boundaries between civil and military technology are becoming harder to draw." Walker and Gummert, p. 419.

⁸⁶Article 223(b) specifically contemplates this EC role.

⁸⁷The problem of state subsidies is endemic in the European aerospace industry. See Philip Butterworth Hayes, "Europe's Single Market Will Bring Radical Changes," *Interavia Aerospace Review*, December 1990, pp. 1099-1102. The forms of subsidy include direct, unrepayable investments, repayable capital, government R&D support, tax advantages, export aid, and direct government and government-guaranteed loans.

⁸⁸Carol Reed, "1992: A Minefield for the European Defence Industry," *Defence*, June 1989; *Guardian*, September 21, 1990. The EC has exclusive jurisdiction over mergers and acquisitions of companies whose combined turnover exceeds 5 billion ecu, and where at least two of the companies have 250 million ecu turnover, unless each of the companies generates two-thirds of its turnover in a single member state. Council Regulation (EEC) No. 4064/89, December 21, 1989, Article I. Although the Commission's jurisdiction is exclusive for mergers that meet the threshold test, it is "without prejudice to Article 223 of the Treaty." Preamble, paragraph 28. The Commission has already asserted jurisdiction over combinations that involve firms engaged in both military and civil activities, for example in the Aerospatiale/DASA proposal to create Eurocopter, which the Commission approved in February 1991. The Commission also asserted jurisdiction over the GEC/Siemens acquisition of Plessey, insofar as it affected Plessey's telecommunications activities. Mergers may be permitted where greater efficiency is needed to avoid massive import penetration from non-EC producers. The Commission has identified electronics, aerospace, and computer/telecommunications as sectors where that principle might apply. "Horizontal Mergers

The EC also asserts jurisdiction over dual-use items as an aspect of its public procurement regulations. In its general guidelines on public procurement, the Commission has stated: "The position of defense procurement is more complicated and the rules more often have not been properly applied to this sector. Most procurement by defense agencies is, in fact, subject to the rules. The only defense procurement contracts not covered are those concerning products for specifically military purposes, i.e., arms, munitions and war material."⁸⁹

The Commission has also explored asserting jurisdiction over dual-use items in the area of imports. In 1988, the Commission proposed to the European Council that the Community impose a Common Customs Tariff (CCT) on dual-use items, whether or not the end use was military or civil. The Commission argued this was the only way to harmonize different national treatment of dual-use imports, to avoid cheating or manipulation of the tariff system. "Purely" military equipment (such as tanks) would be given a zero percent tariff,⁹⁰ and other items would fall under the Community's general variable rate scheme, for tariffs up to 14 percent. As a practical matter, the Commission's proposal appeared to imply that items ranging from small arms and ammunition to radars and communication systems would be subject to an EC tariff.⁹¹

European military and procurement officials criticized this proposal, arguing that the tariff violated Article 223(b) and intruded on the jurisdiction of national governments and the IEPG.⁹² Many in the United States pointed to the tariff as proof that the Europeans were indeed constructing "Fortress Europe." As a result of the outcry, the Commission indefinitely postponed action on the proposal in April 1990.⁹³

and Competition Policy in the European Community," *European Economy*, 40, May 1989, cited in *SIPRI*, pp. 50-51.

⁸⁹*Public Procurement and Construction: Towards an Integrated Market*, European Documentation, Office of the Official Publications of the European Community, Luxembourg, 1989, p. 23, quoted in Anthony et al., pp. 48-49.

⁹⁰This is required under Articles 223 and 28. Latham and Slack, p. 17.

⁹¹For a general discussion of the CCT proposal on dual-use items, see Rupp, "Europe 1992," pp. 23-26; Webb, pp. 118-121.

⁹²The North Atlantic Assembly, at its meeting in Hamburg in the fall of 1988, adopted a resolution "noting that the proposal to terminate the existing tariff concessions for imports of defense equipment from countries which are not members of the EEC, if adopted, would amount to protectionist measures harmful to intra-Alliance trade in defense components." See Carol Reed, "Europe 1992 and the Future of Transatlantic Defence Cooperation," *Defence*, July 1989, p. 508; *Defence News*, October 16, 1989, p. 1.

⁹³*Defence News*, April 30, 1990, p. 14.

European Economic and Monetary Union (EMU). The European Community launched a renewed effort to establish an Economic Monetary Union in December 1990, in parallel with the Intra-governmental Conference on Political Union. For at least some European nations, EMU's goal is to create a single EC currency and promote convergence of national fiscal policies.⁹⁴ EMU could facilitate European collaboration, as establishing a single currency would eliminate transaction costs and financial risks caused by currency fluctuations.

European Research and Technology Cooperation

Other than EUCLID, pan-European support for technology research is concentrated on the civil sector.⁹⁵ In part this reflects a belief (especially in the field of aerospace and electronics) that the innovation potential—as well as economic growth and employment prospects—are greater on the civil side.⁹⁶ To a growing extent, European governments are focusing on collaborative research efforts as a way to eliminate duplication and achieve technological competitiveness with the United States and Japan.

The EC Framework Program. The EC "Framework Program" provides an umbrella for most of the Community's important cooperative research programs.⁹⁷ These include ESPRIT (European Strategic Program for Research in Information Technology), 3.1 billion ecu (\$4 billion, 1984–1994);⁹⁸ BRITE (Basic Research in Industrial Technologies for Europe), 125 million ecu (\$160 million over four years); and RACE (Research in Advanced Communications Technology in Europe), 1.1 billion ecu (\$1.3 billion, 1987–1991).⁹⁹ Framework

⁹⁴This goal is shared to varying degrees. The United Kingdom is most skeptical, while others, especially the less developed nations, have expressed concern over timing.

⁹⁵Hobbs, p. 27. Overall, European governments spend around \$32 billion on public- and private-sector civil R&D and around \$12–13 billion on military (author's calculations).

⁹⁶Hobbs, p. 28.

⁹⁷The current effort is the Third Framework Program (1990–1999), with three priority areas: (1) information technology, telecommunications, industrial manufacturing technology, and new materials; (2) natural resources; and (3) human resources. The total EC budget for the Third Framework Program is 7.9 billion ecu. Latham and Slack, p. 19.

⁹⁸ESPRIT, first created in 1984, predates the formal Framework Program, which was launched by the 1987 Single European Act.

⁹⁹Other activities include Euram (advanced materials research, 30 million ecu over four years); Biotechnology (75 million ecu over five years); Cost (scientific and technical cooperation, 2 million ecu); and Science (chemistry, biocommunications, optics, instrumentation, artificial intelligence, 227 million ecu). Latham and Slack, p. 22.

programs typically are funded on a matching basis, with half the funds coming from companies or industries participating in the program and half from a government-contributed central pool that currently amounts to 3 percent of the Community budget.¹⁰⁰

EUREKA. EUREKA was created in 1986, stimulated by European fears of a growing technological gap with the United States as a result of the substantial U.S. technology investment in the SDI program. Unlike the EC Framework Program, which is oriented toward basic research, EUREKA is directly concerned with applications. Today, 19 nations¹⁰¹ participate in EUREKA, and over 500 projects (worth \$9 billion) in the fields of HDTV, biotechnology, aerospace, communications, automated assembly, and supercomputers have been funded.¹⁰² On June 1, 1990, EUREKA ministers approved 91 new projects, of which 9 were in information technology and 22 in robotics and production automation, such as computer-aided design and manufacture for aircraft assembly. The budget for these new programs is 964 million ecu (\$1.2 billion). Funding for projects runs at about 1 billion ecu/year (\$1.2 billion); one-third comes from governments and the remainder comes from participating companies.¹⁰³

JESSI (Joint European Submicron Silicon) is the largest EUREKA program. Budgeted at \$4 billion over eight years, it is designed to produce the next generation of integrated circuits and reduce European dependence on the United States and Japan. Industrial participation is centered around the big three European chipmakers: Siemens, Philips, and SGS-Thomson (a joint Franco-Italian consortium).¹⁰⁴

ESA. The European Space Agency (ESA), with an annual budget of \$1.2 billion ecu (\$1.4 billion), is another focal point of European collaboration in both research and system production.¹⁰⁵ ESA originally developed Ariane (now run by a private consortium); it operates on

¹⁰⁰The Commission would like to double this, to 6 percent. See Hobbs, p. 28.

¹⁰¹The EC-12 plus Austria, Finland, Iceland, Norway, Sweden, Switzerland, and Turkey.

¹⁰²Hobbs, p. 28; Agence Europe, June 1, 1990; *Economist*, June 22, 1991, p. 73.

¹⁰³Hobbs, p. 28.

¹⁰⁴*Defense News*, July 16, 1990, p. 8. There has been some suggestion that JESSI participants might seek to collaborate with the United States, especially Semitech. *Defense News*, July 17, 1989, p. 1. IBM and Texas Instruments have expressed interest in joining JESSI.

¹⁰⁵ESA was created in 1975. It now includes 9 of the 12 EC countries (minus Portugal, Greece, and Luxembourg), five of the EFTA nations (Sweden, Switzerland, Austria, Norway, with Finland as an associate). Canada is also an associate member. Hobbs, p. 28.

obligatory contributions from members (based on wealth) for basic scientific research and voluntary participation in applied projects. ESA incorporates the *juste retour* concept to assure that funds are spent on industries in contributing countries.¹⁰⁶

STRATEGIC ENVIRONMENT

The international strategic environment plays a crucial role in shaping the demand for defense goods and services. Changes in the perceived threat affect both the size of defense budgets and the types of military equipment needed. As the likelihood of a direct military threat from the republics of the former Soviet Union recedes, European nations have begun to reassess their future military requirements. Significant defense spending cuts are likely in the short term. At the same time, instability in the Middle East and Persian Gulf may offer new opportunities for arms sales outside the region.

These international developments will also shape operational requirements. The drawdown of military forces in the European theater will lead nations to develop a new mix of military capabilities, subject to affordability. Some in industry and government believe that the new environment will create more common military requirements and thus enhance prospects for collaboration. As Europeans broaden their contingency planning beyond its previous focus on a massive Soviet invasion, all nations will find an increased need for mobility, flexibility, and the capability to operate at a distance, regardless of their geographical location in Europe. This will lead to a new premium on surveillance and early warning, light, mobile forces, and the ability to project effective firepower over great distance.¹⁰⁷ These systems will require considerable technological sophistication, and the high costs of R&D needed to maintain technological competitiveness will provide additional impetus for collaboration.¹⁰⁸ The movement toward multinational forces in NATO could also increase incentives for common equipment.¹⁰⁹

¹⁰⁶Although civil space activities are not considered directly in this report, it is interesting to note the Europeanization of major programs in that sector; the French firms Aerospatiale and Dassault have recently agreed to permit DASA and Aeritalia to become partners in the Hermes space shuttle program under ESA. *L'Usine Nouvelle*, November 15, 1990, p. 32.

¹⁰⁷See, for example, *Armed Forces Journal International*, January 1990, p. 27; Anthony et al., pp. 29-30.

¹⁰⁸These same factors could also lead to greater transatlantic collaboration. A recent study sponsored by U.S. CREST and the Hudson Institute identified four areas for collaboration that the authors believed would have significant relevance in the new

The Gulf War has stimulated European interest in an independent European defense capability, operating through the WEU and EC. If the European involvement in the recent Gulf War foreshadows a more active military role out-of-area, there could be a further convergence of military requirements and a greater emphasis on reducing operational dependence on the United States. This in turn could lead to efforts to develop European designed and manufactured systems.¹¹⁰ France, in particular, has highlighted the need for European capabilities in surveillance and lift.¹¹¹

The changing strategic environment will not affect all defense industrial sectors in the same way. As budgets shrink, governments will emphasize upgrading existing platforms instead of building new ones. This will further enhance the importance of defense electronics, a leading sector in intra-European consolidation. Cost constraints and political restrictions on training in Europe will lead to a greater emphasis on simulation.¹¹² Nations will emphasize R&D as a technological hedge against new threats, rather than acquiring and fielding costly new systems. This will affect European defense firms' financial health, since they depend heavily on production runs to cover R&D costs. To compensate, firms will place additional emphasis on export sales, increasing the competition for export markets.

strategic environment: distributed surveillance, tactical ballistic missile defense, hypersonic technology, and simulation and wargaming. U.S. CREST-Hudson Institute, *Cooperative Strategies*, 1991.

¹⁰⁹See William A. Taft IV, "Standing Together: Defense Security and Industrial Cooperation in the New NATO," *NATO's Sixteen Nations*, November 1990, p. 15. "We used to argue for arms cooperation on the grounds that common equipment would eventually lead to common tactical doctrine. With the arrival of NATO multinational forces, the requirements of tactical formations will lead us to buy common equipment."

¹¹⁰This is a particularly important question for Germany, which, as a matter of both political practice and constitutional doctrine, has limited its deployment of troops out of NATO's Central Region. A more active role for Germany would lead to a new emphasis on mobile forces, which could lead to a greater cooperation with the other principal NATO European weapons-developing nations: France, the UK, and Italy. See *Wehrtechnik*, June 1991 (FBIS-WEU-91-132, July 10, 1991, p. 16).

¹¹¹See *Armed Forces Journal International*, June 1991, pp. 58-60. In an interview, Defense Minister Pierre Joxe of France stated, "Without allied intelligence, we were nearly blind. [It] was the United States that provided, when and how it wanted, the essential information necessary for the conduct of the conflict." *Defense News*, May 13, 1991, p. 50.

¹¹²This point was made by Siemens officials in a survey of the future of the German defense industry in the post-Cold War environment. Chris Jenkins, "Even More Uncertainty in the German Defence Industry," *Defence*, No. 3, 1990, p. 196.

Conventional arms control in the CFE Treaty and beyond will have a parallel impact on defense industries.¹¹³ First, by constraining the military threat, CFE will lead generally to smaller force structures and reduced requirements in many areas. Second, treaty-imposed numerical limits on certain equipment categories (aircraft, tanks, helicopters, AFVs, and artillery) will tend to shift procurement toward items not limited by the treaty and upgrades and modernization of treaty-limited items. This in turn will increase the importance of electronics, munitions, and command and control. Third, the process of cascading (transferring modern equipment in excess of the treaty ceilings to the forces of less modern NATO militaries) will reduce the procurement requirements of DDI countries, intensifying export competition.¹¹⁴ Finally, treaty verification and compliance will create new requirements, especially for technologies related to surveillance and intelligence gathering.¹¹⁵ Growing concern over the proliferation of sophisticated defense systems and technology could cut into export markets, although most arms control efforts to date are oriented toward a small class of weapons and technologies (medium- to long-range missiles, nuclear, chemical, and biological weapons). For most conventional systems, the focus is on a *system of registering rather than controlling arms*. In the short run, arms sales to the Middle East are likely to remain an important outlet for European firms, although the loss of the Iraqi market will have an impact, especially for France (which estimates that it has lost nearly \$10 billion in potential business with Iraq over the next five years).

As defense markets shrink and requirements become more uncertain, many European defense firms are focusing on developing commercial applications for defense systems and shifting their mix of activities toward civil products. This adaptation will permit European firms to

¹¹³For a more extended discussion of the impact of arms control on the European defense industry, see Anthony et al., Chapter 4; Stewart, "Future Defense Needs," pp. 45-47.

¹¹⁴Under current NATO plans, most of the equipment items proposed for transfer are tanks and armored personnel carriers. Turkey, Greece, Spain, and Portugal are the principal beneficiaries; most of the equipment will come from the United States and Germany. *Jane's Defence Weekly*, June 1, 1991, p. 915.

¹¹⁵At least one senior European defense executive, the president of MBB, has had second thoughts on the business potential in this area: "Verification doesn't seem to be a business that holds too much prospect." *Aviation Week and Space Technology*, June 17, 1991, pp. 76-77.

CFE will also directly constrain the size of German forces, and future agreements may limit the sizes of all European forces. This could reduce procurement demand, but smaller force sizes will reduce personnel and operating costs, thus freeing up some funds for R&D and procurement.

maintain technological skills while hedging against the vagaries of the defense market.

Rapid changes in the European economic, political, and strategic environment mean considerable short-run uncertainty for the European defense market. Firms and governments must respond rapidly to the new realities, a process already well under way. The next section examines European firms' principal strategies for adapting.

4. PATTERNS OF INDUSTRIAL ADAPTATION: CONSOLIDATION THROUGH NATIONAL CHAMPIONS AND TRANSNATIONAL TIES

In response to the changing economic and political environment, European defense firms embarked in the late 1980s on a dramatic wave of industrial consolidation which carried through 1990. This section examines the various techniques used to increase the size and scope of the firms' activities and the underlying strategies and rationales for consolidation.

NATIONAL CHAMPIONS AND TRANSNATIONAL TIES

Two dominant and complementary themes characterize the European defense industry's strategy in the late 1980s and early 1990s: create large, national champions and expand transnational relationships.

National Champions

Until the mid-1980s, the European defense market was characterized by a large number of comparatively small firms in most product sectors. The autarchic nature of defense procurement assured that each major country had at least one participant in each sector; in many cases there was more than one competitor.

This structure was ill-suited to the realities of the evolving defense market: stagnant domestic defense budgets, declining export sales, and reduced order quantities. European firms on the whole were too small to compete in technology or price with their U.S. counterparts. In many key sectors, firms' average production volume was around half of U.S. firms' output.¹ Although some governments hoped to maintain multiple suppliers to retain an element of competition, the resulting inefficiencies from low production runs and a high ratio of fixed to variable costs created considerable inefficiency that was implicitly subsidized by the governments (in the form of higher unit costs).² Moreover, as replacement costs for equipment increased between generations, the period between generations lengthened. Since

¹Webb, p. 62.

²"The main reason why unit costs of equipment in Europe are high is because nations buy in increasingly uneconomic quantities from their own industries in order to protect them." *Towards a Stronger Europe*, p. 2.

orders were often too small to split between several manufacturers, a firm that lost a procurement competition might be forced to wait a decade or more before a new contract opportunity arose. Contract competitions became virtually a do-or-die proposition for many manufacturers, particularly those that specialized in relatively narrow lines of work.³ High entry barriers blocked new firms from competing.

At the same time, as a matter of national policy, most European governments remained committed to retaining at least some national capability in most key defense sectors. While few governments were willing to support the costs of multiple national suppliers, they seemed to accept a certain level of inefficiency in order to sustain their defense industrial base, assure security of supply, maintain national technological capability, reduce pressure on balance of payments, promote industrial employment, and enhance national prestige.

The combination of economic forces and explicit government policies led to the emergence of "national champions" at the major system and subsystem level—monopoly or near-monopoly suppliers created through the merger and acquisition of competitors within national boundaries. A firm that became a national champion was virtually assured participation in any national or collaborative program within its sphere of competence.

Two types of national champions have emerged in Europe: sectoral and diversified. There are many examples of sectoral national champions: in electronics, GEC in the UK and Thomson-CSF in France; in tanks, Vickers in the UK, GIAT in France, and Krauss-Maffei in the FRG. Diversified national champions include British Aerospace (BAe), which acts as the UK national champion in military aircraft, missiles, and land systems; France's Aerospatiale (helicopters and missiles); and DASA, a highly diverse conglomerate that unites Germany's principal aerospace, electronics, and engine activities. In a few cases there remains some intranational competition, but this is relatively rare.⁴ In many of these cases, companies are developing intranational collaborative arrangements that will likely prove a way station to full integration in a single entity (for example, the collabo-

³Given that major economies of scale are available, the tendency is for losers in unregulated competitions to be driven from competing in that field in the future so that, in the end, only one firm, and no domestic competition, remains." Taylor and Hayward, "The UK DIB: Issues and Options," *RUSI Journal*, Summer 1989, p. 52.

⁴In the UK, for example, both Yarrow and Swan build the Type 23 frigate.

ration between GIAT, RVI, and Creusot-Loiret in tracked and wheeled vehicles).

The emergence of national champions provided a partial response to the competitive disadvantages suffered by European firms. But these efficiency gains are inherently limited by the size of the national markets, which, in most cases of expensive military systems, are too small to achieve needed efficiencies.

Transnational Ties

In an effort to expand the size of their potential market, and to achieve greater predictability of demand, many European firms have turned to forging transnational corporate links. Transnational ties expand the size of the accessible market, since transnational partners are positioned to compete for the procurement requirements of several countries instead of being limited to a single nation's acquisition program. This offers a twin advantage: the possibility of longer production runs if a system is acquired by multiple countries, and a hedge against being shut out of the market entirely, since multiple potential customers means that the firm has multiple opportunities to sell a given system.⁵ Transnational links also offer an opportunity to share R&D costs, thus reducing duplication, lowering fixed to variable cost ratios, and enhancing the firms' ability to maintain access to costly leading-edge technologies.

The second half of the 1980s saw an explosion in the number of transnational links, primarily within Europe. Although intra-European collaboration dates back to the 1950s, early efforts at collaboration took place primarily as a result of agreements between governments to develop and procure common equipment, with the industrial arrangement patched together to carry out an ad hoc project. Increasingly through the 1980s, industry itself initiated transnational links that extended beyond individual projects to more comprehensive and enduring relationships.

⁵Truly open competition is, in theory, an alternative to transnational links as a way of expanding the potential market for a firm's product—an approach that is at the heart of the current IEPG efforts to create a single European defense market. However, most firms believe that the political realities in Europe are such that no nation would award a contract for a major system to a foreign national. Thus, transnational ties offer a way of accessing foreign markets while recognizing the practical limitations posed by "buy national" policies.

Achieving Critical Mass

Taken together, the evolution toward national champions and the increase in transnational links have reshaped the face of the European defense industry. The two developments are complementary: parallel responses to the economic constraints posed by the contemporary defense market.⁶ The consequence of these two trends is a dramatic increase in the size and scale of operations of the major European defense firms and a reduction in the number of competitors. Lord Weinstock, the chief executive of GEC, predicted that by the end of the 1990s there will be at most four giant electronics firms in Europe.⁷

The concept of critical mass (called *taille critique* by the French) has become increasingly important to aerospace and defense electronics activities.⁸ In the words of a Thomson executive, "Everything we do is done to reach a critical mass in each of our core businesses, through both national concentrations and Europeanization."⁹ The question is whether such consolidation will enhance the prospects for technological and price competition within Europe or stifle it.¹⁰

Increased size offers many potential advantages, including abilities to raise adequate capital or self-finance,¹¹ support costly R&D establishments and self-initiated product development, absorb cost overruns or failed or cancelled projects, and weather periods of slack demand. When increased size comes about by horizontal consolidation, it offers the prospect of longer production runs and a more assured stream of orders.

This focus on increased size and scale has already had a dramatic impact on the European defense industry. By 1989-1990, four European firms were in the top twelve worldwide (see Figs. 11 and 12).

⁶In the words of BAe chairman Roland Smith, "It would not be difficult to forecast a situation in which the European defense equipment industry will be forced to move quickly into complementary alliances, mergers and acquisitions so as to gain the economies of scale and afford the research programs to sustain advancing technology without too substantial a contribution from European governments." *Armed Forces Journal International*, December 1989, p. 24.

⁷*Guardian*, September 30, 1990.

⁸*Jane's Defence Weekly*, November 25, 1989, p. 1154.

⁹*Defense News*, December 3, 1990, p. 10.

¹⁰*Jane's Defence Weekly*, November 25, 1989, p. 1154. See Sec. 6.

¹¹In an interview, DGA's engineer general Jean-Benoit Rome observed: "It is often said that, to remain competitive, armament industries must reach a minimum critical size. . . . In practice, the right size for a company is that which enables it to achieve a self-financing capability sufficient to develop its new products and guarantee its future." *DAH*, November 28, 1989, p. 44.

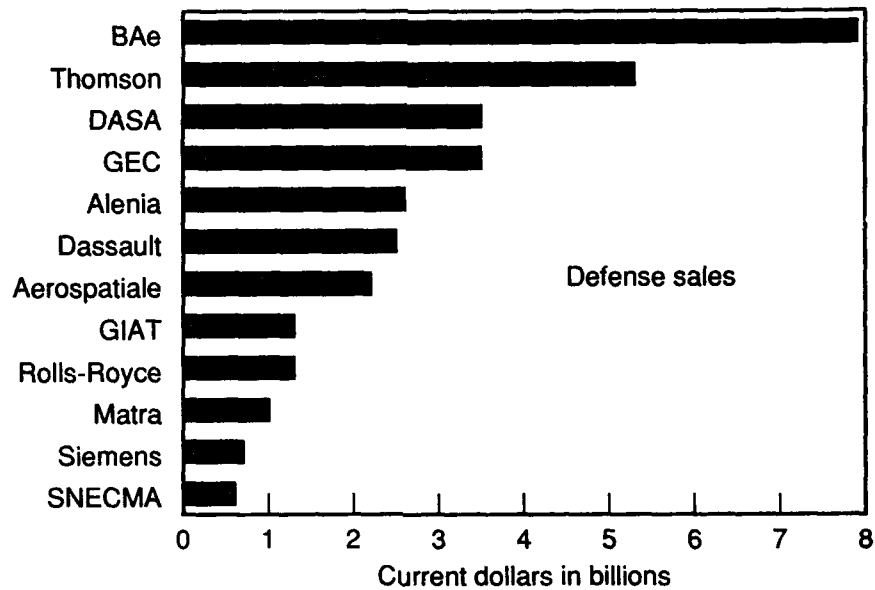


Fig. 11—Top Twelve European Defense Manufacturers, 1990

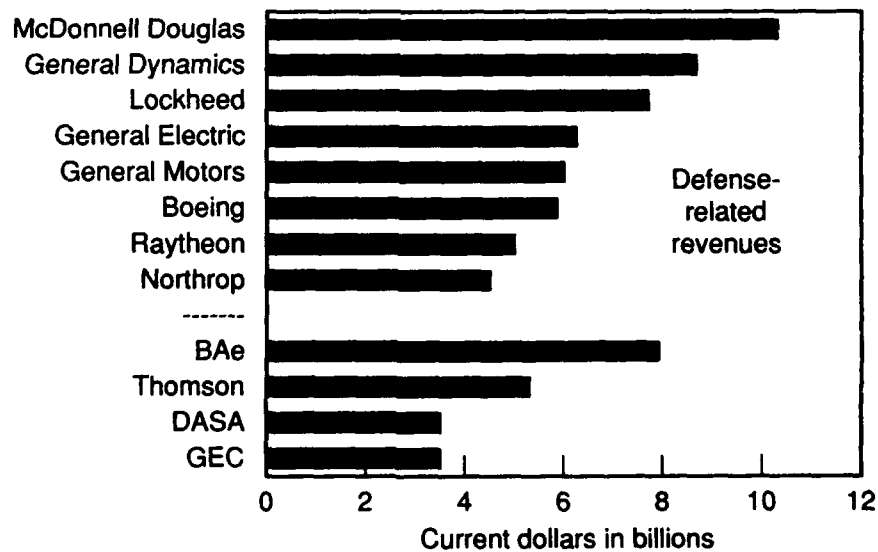


Fig. 12—Top Twelve Defense Manufacturers, United States and Europe, 1989-1990

The creation of Eurocopter will place this Franco-German helicopter collaboration second only to Sikorsky in helicopter sales, while Thomson's acquisitions and joint ventures place it second in the world in electronics and in simulators, fourth in optronics. The joint Thomson/Aerospatiale subsidiary Sextant Avionics is fourth internationally in avionics, while the Aerospatiale/SNPE combination on missile motors is second in the world. Some national firms are major international actors in their own right: Rolls-Royce is the world's third-largest engine manufacturer, and SNECMA is fourth.

STRATEGIES FOR CONSOLIDATION

European firms have adopted similar strategies in pursuing their twin goals of consolidating into "national champions" and expanding transnational links. Broadly, these strategies fall into three categories: horizontal integration of common product lines, sectoral consolidation, and aggregating complementary activities.

Horizontal consolidation is the most straightforward of these strategies, with obvious economic benefits for firms in the form of longer production runs, less duplication in research, design, and manufacturing, and fewer competitors. Many national champions emerged through horizontal consolidation. For example, GEC became the UK's national champion in radar by acquiring Marconi and Ferranti Defense Systems; Sextant Avionics combined virtually all of France's avionics capability; Aerospatiale and SNPE have agreed to join their missile propulsion activities; and DASA grouped MBB and Dornier civil and military aircraft programs under a single umbrella. This strategy also applies to transnational relationships: for example, French (Aerospatiale) and German (MBB) helicopter programs are joined in Eurocopter, and Matra-Marconi Space links the space activities of France's Matra and the UK's GEC-Marconi. The approach has deep roots in the history of European collaboration, beginning with MBB and Aerospatiale in Euromissile, the French-German cooperative framework for surface-to-air and surface-to-surface missile programs since the early 1960s.

Sectoral consolidation is a somewhat broader grouping of activities, transcending individual product lines. Sectoral consolidation offers the benefit of tapping R&D synergies in related technologies and rationalizing product development through a more technology-oriented approach to firm organization. Much sectoral consolidation has taken place within individual countries, including the grouping in France of virtually all major ordnance and army weapon activities under GIAT, Germany's Rheinmetall and Krupp-Mak creating a joint venture in

land warfare systems, and a consolidation of a broad range of electronics activities under Thomson-CSF in France and GEC in the UK.¹² Sectoral consolidation has also occurred in the transnational dimension: GIAT's acquisition of Belgium's FN Herstal and Poudreries Réunies de Belgique (PRB), Thomson's purchase of Philips's Dutch military electronics subsidiaries, and GEC's and DASA's equity investment in Matra.

The third strategy, complementary groupings, is the broadest and most varied approach, ranging from groupings of closely associated and highly complementary activities to diversified conglomerates of loosely related defense industrial activities. One important impetus to this strategy is the growing importance of systems integration in modern military equipment, which implies the need to integrate subsystems and related components as early as the research and design stage.¹³ But for firms in which the consolidated activities are only loosely associated, the principal benefit would appear to be a financial hedge against a downturn in sales from one of the conglomerate's component elements.

Firms have used this strategy on both the national and transnational levels. The most dramatic example is the creation of DASA, grouping together virtually all of the German military aerospace and electronics industry. British Aerospace is another, somewhat less broad case, created in part by BAe's acquiring the recently privatized Royal Ordnance. An example of transnational complementary groupings is Eurosam, grouping French and Italian radar, missile electronics, and missile body capabilities.¹⁴

To implement each of these strategies, European firms have developed a broad variety of relationships, ranging from ad hoc, one-time collaboration to full merger or acquisition. In a recent study, Latham and Slack characterized the nature of these relationships along several parameters: organizational form (consortium, alliance, joint ven-

¹²In many cases this process of sectoral consolidation is incomplete: France retains a second important military electronics firm, Dassault Electronique; Thorn-EMI and Racal are smaller, but important, electronics firms in the UK. The prospects for further national sectoral consolidation are discussed in Sec. 6.

¹³Modern missile systems and conformal radar are two examples of this high degree of system interdependence.

¹⁴The proposed Eurodynamics, joining Thomson-CSF's missile electronics capabilities with BAe's missile design and manufacture activities, would also have created a broad-based complementary grouping. Instead, Thomson-CSF has reached an agreement with Euromissile (DASA and AeroSpatiale) to produce an upgraded version of the Crotaie air defense missile.

ture); genesis (industry or government initiated); focus (R&D, production, servicing); and purpose (ad hoc, strategic alliance).¹⁵

Ad hoc collaboration is the oldest technique, dating to the earliest years of European collaboration. On the whole, these efforts typically are government initiated: each firm is assigned a specific work share and retains its own identity, and the collaboration is restricted to a single system or product. Most European aircraft collaborations (Alpha-Jet, Transall, Tornado, EFA) have followed this pattern. Parallel consortia cover the key associated systems, grouping the "national champion" fighter engine and radar firms (e.g., Euroengine and Euro radar) of the participating countries. Although these collaborations are designed as one-time arrangements, they have the prospect of growing into more enduring relationships, like, for example, the evolution of Franco-German missile collaboration under the aegis of Aerospatiale/MBB's Euromissile.

The use of ad hoc collaboration is not limited to transnational programs; the recent agreement between GIAT, RVI, and Creusot-Loire to design and manufacture armored fighting vehicles is an example of ad hoc collaboration within a single country. This technique is typically used for horizontal consolidation, grouping manufacturers with similar capabilities to develop a common product.

At the other end of the consolidation spectrum is merger and acquisition. European defense firms have used this technique for each of the three strategies outlined above: to achieve horizontal consolidation (Sextant, GEC-Marconi-Ferranti), for sectoral consolidation (GIAT), and for complementary grouping (BAe-Royal Ordnance, DASA).

Between these two extremes lie a variety of techniques to create a more enduring relationship than ad hoc collaboration, but less integration than merger or acquisition. The loosest form of arrangement in this middle category is a longstanding association between firms across a number of projects, without any formal structure or agreement. This is most typical within individual countries (such as the long-term partnership between Matra and Thomson on missiles, Thomson and Dassault on fighters, or Vickers and Royal Ordnance on tank manufacture).

More recently (and especially in the transnational context), firms have sought to give a more formal or institutional dimension to their relationships by creating "strategic alliances": agreements to collaborate on a range of systems and technologies over an extended period.

¹⁵Latham and Slack, p. 43.

Sometimes a strategic alliance agreement includes a commitment to work on particular projects; in other cases it is simply an undertaking to look on the allied firm as a "preferred partner" when choosing project collaborators. Companies may choose to cement these alliances by a formal written agreement or (with increasing frequency) through exchanging equity. Equity exchanges take place on several levels: exchanges between holding companies (typically designed to give the investing firm a seat on the board, an inside perspective on long-run corporate strategy that could facilitate collaboration) or between operating companies, where the purpose is to facilitate direct collaboration on projects. Matra's relationship with its European partners demonstrates both types of equity exchange: DASA's and GEC's 5 percent holdings in the Matra group fall in the "boardroom" category, while the planned 20 percent exchange between Matra Defense and Space and MBB is an operating-level relationship.

Another important evolving technique is the Economic Interest Group (EIG).¹⁶ This technique was developed to circumvent some of the legal difficulties associated with full merger on the transnational level and the problems posed by conflicting national laws. Although the form is quite flexible, typically the partners create a new entity (an EIG) to manage the common activities of participating firms, with a formal division of economic shares in the activities and profits. The assets that contribute to the combined activities of the participating firms remain in the hands of the individual firms. The use of EIGs is becoming increasingly important in Europe in the civil as well as the defense sector, although it offers particular advantages when one or more of the participants is wholly or partially state owned.¹⁷ Eurosam, the French-Italian grouping developing a range of surface-to-air defense systems, is a classic example of a well-developed EIG.

These examples are drawn from recent European transnational relationships, to date the most fertile area for European defense firms' transnational ties. To a lesser extent, however, companies have used several of the techniques described above to develop transatlantic ties. Many NATO-sponsored programs (NFR-90, MSOW) are examples of ad hoc collaboration, although these highly visible efforts have encountered considerable difficulty in recent years. Transatlantic mergers and acquisitions are rare, but not unheard of; several European aerospace firms have acquired U.S. entities, although often

¹⁶Groupement d'Intérêt Économique (GIE) in France, where the concept was originally developed. It became part of European Community law in 1989. It bears many similarities to a joint venture.

¹⁷See *Financial Times*, July 30, 1990; *Towards a Stronger Europe*, Vol. 1, p. 8.

the U.S. firms are not primarily in the defense sector (e.g., Matra's acquisition of Fairchild Space).¹⁸ U.S. and European firms have developed strategic alliances; this has happened most dramatically in the field of jet engines, where SNECMA has a longstanding relationship with GE, and DASA-MTU has agreed on a broad collaboration with United Technologies/Pratt-Whitney.¹⁹ Recently, BAe and General Dynamics have agreed to join in a "strategic alliance."

A NEW LANDSCAPE

A new landscape is forming in the European defense sector as a result of the interplay of consolidation into national champions and the proliferating transnational links: it has three axes or defense giants—DASA/Aerospatiale, GEC/Siemens/Matra, and BAe/Thomson-CSF—and a shrinking number of smaller firms or sectoral champions that increasingly are tying their fates to one or more of the three principal axes. The next section summarizes the key developments in this process.

¹⁸There are major barriers to European acquisition of U.S. defense firms, including the limits imposed by the Exxon-Florio Amendment to the 1988 Trade Act, which requires executive branch review of mergers and acquisitions involving foreign entities that could have an impact on national security, and the requirement of special security arrangements to protect information from foreign disclosure. In one highly publicized case—Ferranti's acquisition of the U.S. firm ISC—the limitations placed on the British owners' oversight of the firm's activities were blamed for the massive fraud committed by ISC's former owners. Such constraints have inhibited European interest in acquiring U.S. defense firms.

¹⁹Transatlantic engine collaboration has focused on civil rather than military projects, although the GE/SNECMA partnership to re-engine the U.S. KC-135 has an explicitly military dimension.

5. THE CORPORATE RESPONSE: TRANSNATIONAL CLUSTERS AND INDEPENDENT FIRMS

THE THREE PRINCIPAL INDUSTRIAL CLUSTERS

As a result of both ad hoc arrangements and more deliberate corporate strategies, Europe appears to be moving toward three principal defense "giants" or industrial "clusters," especially in the aerospace industry.¹ The first is Deutsche Aerospace (DASA)/Aerospatiale, centered around Germany's large national defense conglomerate and its principal European partner, Aerospatiale. The second cluster, GEC/Siemens/Matra, is focused on defense electronics and space. The third is British Aerospace (BAe)/Thomson-CSF, an Anglo-French pairing, with particular emphasis on missiles and avionics.² Although the lines dividing these clusters are blurred, and there is considerable collaboration across two or more of the groupings, the clusters represent the development of preferred partner arrangements.

DASA/Aerospatiale

The first major European cluster involves Germany's DASA and France's Aerospatiale. The consolidation of most of Germany's aerospace industry under the umbrella of Daimler-Benz was one of the most dramatic developments in the restructuring of the European defense sector in the late 1980s. Over a period of several years Daimler-Benz acquired all of, or a majority of shares in, four major German firms: MTU³ (the principal military engine manufacturer), TST⁴ (electronics and radar), Dornier (space and aviation), and MBB

¹Roland Smith, chairman of British Aerospace, has observed that the European defense industries' current wave of merger and consolidation would lead to the domination of three or four "major players" unless "individual European governments take it upon themselves to interfere with the progression of market forces." *Armed Forces Journal International*, December 1989, p. 24. Another executive said the market would be limited to very large companies with a few "smaller niche players," but "no room for the medium-size firms."

²See the appendix for a note on sources for the data in this section.

³Motoren und Turbinen Union.

⁴Telefunken Systemtechnik. TST was originally part of the German electronics firm AEG, which Daimler acquired in 1982 and spun its military electronics activities off into a separate entity, now under the wing of DASA.

(aircraft and helicopters, missiles).⁵ In 1989, Daimler consolidated its defense activities under the broad umbrella of DASA and reorganized along four functional lines: aircraft, space, defense, and propulsion systems.⁶

DASA is now the third-largest defense firm in Europe, with total revenues of DM 12.5 billion (\$7.2 billion) in 1990. Overall, defense makes up about 48 percent of DASA's turnover (\$3.5 billion),⁷ while export sales account for half (DM 6.2 billion) of DASA's business. DASA has a commanding role as a national champion in Germany: some 40 percent of the German MoD's procurement expenditures go to elements of DASA.

The overall strategy behind consolidating four leading defense and electronics firms under DASA was to allow German industry to meet international competition and adapt to the modern defense market.⁸ But it appears that this phase of consolidation has essentially reached an end. DASA's chairman recently observed, "We have no intention of buying more German companies." Instead, DASA intends to concentrate on "extended partnerships" with European and U.S. firms.

Aerospatiale is the seventh-largest defense firm in Europe, with total revenues of FF 32 billion (\$5 billion) in 1990. It is 100 percent state

⁵Daimler's acquisition of MBB was highly controversial and raised concerns at the German Cartel Office over its anticompetitive consequences. The German economics minister ultimately overrode the Cartel Office's opposition but required as a condition of the merger that Daimler agree to assume the government's remaining 20 percent share of Airbus by 1996; Daimler was also required to sell off parts of MBB's naval and remotely piloted vehicle (RPV) activities.

⁶Despite the reorganization, each of the components kept an element of independence, owing to legal complications associated with the fact that Daimler owns different shares of equity in the component firms, ranging from 58 percent of Dornier to 100 percent of TST.

⁷This is expected to fall to 45 percent in 1991.

⁸DASA summarized its strategy in its 1989 annual report:

As the example of our European partner-countries shows, their national aviation and space capacities have in several cases already been integrated for some time. While the aerospace industry in the Federal Republic of Germany was efficient, it was too small and fragmented overall; in the long run, it was therefore not capable of managing entire projects and systems and its international competitiveness was therefore not assured.

The transformation into a larger, powerful unit is therefore a necessary, logical and internationally inevitable step. Now that we have secured the capability to manage entire systems, our mastery of key areas of technology together with highly qualified personnel and, not least of all, a structure which has been adapted to market requirements, Deutsche Aerospace will be a competent and reliable partner in the international market.

owned, with principal defense activities in the fields of missiles and helicopters. Forty-four percent of Aerospatiale's 1990 revenues came from defense activities (FF 14.7 billion, \$2.2 billion), although the firm expects this to decline to 33-40 percent.⁹ Sixty percent of Aerospatiale's sales are export.

Aerospatiale's management has vocally advocated greater consolidation (*une grande cohesion*) of the French aerospace industry. In addition to forming the joint Sextant Avionics with Thomson and a joint subsidiary with SNPE for missile motors, Aerospatiale has promoted consolidating French missile programs (through a combination of Aerospatiale and Matra) and aircraft manufacture (Aerospatiale and Dassault). Both Matra and Dassault, however, have thus far fought to maintain their independence, in part out of reluctance to join forces with a state-owned firm.¹⁰

The DASA/Aerospatiale nexus is one of the oldest cooperative relationships in Europe, dating back to the early 1960s collaboration between Aerospatiale and MBB in antitank and surface-to-air missiles (Hot, Milan, and Roland).¹¹ The cooperation in missile design and manufacture, which took place under the umbrella of Euromissile, continues today with the recent agreement to produce the missile body for Thomson's short-range surface-to-air missile, the VT-1. The new missile will be used with Thomson's Crotale and Euromissile's Roland air defense systems. The increased intensity of Aerospatiale's collaboration with DASA on missiles may in part be a reaction to BAE and Thomson's proposal (now indefinitely postponed) to consolidate their missile activities in Eurodynamics, establishing a competing transnational consortium in this sector.¹²

⁹Aerospatiale's involvement with Airbus is its principal civil activity, accounting for 40 percent of its revenues. Aerospatiale is also heavily involved in European space programs.

¹⁰Matra is a private company, and the French government owns a minority interest (though a voting majority) in Dassault. There are reports that at least some in the French government favor the two consolidations.

¹¹Aerospatiale is also a shareholder in MBB (7.5 percent).

¹²The growing ties between Matra and GEC offer a third competitor in missile manufacture (along with the German firm BGT, in which Matra recently acquired a 20 percent share), although the GEC-Matra effort is focused on air-to-air missiles. Their principal area of competition is antiship missiles: Euromissile is developing a follow-on to the Exocet, the ANS, and Matra is teamed with Italy's Otomelara on the Otomat. This is an example of blurred lines between the major cluster, since DASA/MBB owns 5 percent of Matra. Another Matra-Euromissile tie was recently cinched with the decision to end development of the RM-5 surface-to-air missile in favor of the Thomson-CSF VT-1. It is possible that this new development may presage weaker ties between Matra and DASA.

The second major axis of DASA/Aerospatiale collaboration concerns helicopters. The relationship originally formed as an ad hoc industrial collaboration to develop the joint Franco-German Tiger/PAH-2 helicopter (for antitank, escort, and support roles). The two firms decided to deepen the relationship by creating an EIG, Eurocopter, which will be a joint holding with at least 60 percent held by Aerospatiale.¹³ The new entity will be the world's second-largest helicopter manufacturer, after Sikorsky.¹⁴ In addition to the Tiger, the new enterprise will be responsible for the French and German participation in the NH-90 program, the P-120 (a replacement for the Gazelle and Puma), and in the future, a joint replacement for the now competing Aerospatiale Ecureuil and MBB BO-105.

The DASA/Aerospatiale combination in Eurocopter may foreshadow an even grander consolidation of the European helicopter industry, to include Britain's Westland, the Netherlands' Fokker, and Italy's Agusta. Eurocopter is teamed with Westland to offer the Tiger in the UK's army attack/support helicopter competition, while the NH-90 program involves Fokker and Agusta as well as Eurocopter.¹⁵ But there is also a transatlantic dimension to the European helicopter industry: Sikorsky owns a share of Westland,¹⁶ which will produce the Black Hawk under license; MBB has joined the Boeing/Sikorsky team for the U.S. LH program, and Agusta has a number of licensed manufacture relationships with U.S. firms. U.S. Army Secretary Michael Stone has proposed establishing links between the LH and Tiger programs.

Aerospatiale and DASA also have close links in the civil sector, through their involvement in the Airbus consortium and space programs such as Hermes. But DASA's collaborative activities are not limited to Aerospatiale; indeed, as much as 50 percent of DASA's turnover comes from European cooperation, two-thirds of which is with France. In the past, this has primarily taken the form of ad hoc collaboration, such as the Panavia (Tornado) and Eurofighter (EFA)

¹³The two firms thus far have formed a joint marketing company, with production assets still held separately. Over time, each plans to convert its helicopter divisions into autonomous companies, which will be held by the joint Eurocopter. But it seems likely that both national groups will retain their identity within Eurocopter.

¹⁴Currently, Aerospatiale is fourth and MBB eighth in the world. The expected turnover for Eurocopter is around \$2.3 billion.

¹⁵Under the current arrangement, France and Italy each have a 36.3 percent share, Germany 21.7 percent, and the Netherlands 5.7 percent. There are reports that Italy is considering reducing its share, with the difference to be assumed by Aerospatiale.

¹⁶Westland is teamed with IBM for the UK's EH-101 program.

consortia;¹⁷ but increasingly, DASA is developing more "strategic" alliances. Notable examples in the civil sector are the broad-ranging agreement between DASA-MTU and United Technologies/Pratt-Whitney on aircraft engines¹⁸ and the recently announced agreement between Daimler and Mitsubishi.¹⁹

In defense, DASA has pursued creating strategic alliances through cross-purchases of equity; it has a 5 percent shareholding in Matra and plans a 20 percent equity exchange between their subsidiaries, MBB and Matra Defense Space.

Aerospatiale's cooperative relationships are not limited to DASA, even in the area of missiles. Aerospatiale is collaborating with both DASA and BAe on third-generation antitank missiles and with BAe and GEC through Eurosam in the Family of Anti-Air Missiles (FAAMS) program and with Thomson on the VT-1,²⁰ a further indication that the dividing line between the three principal clusters is highly permeable.

GEC/Siemens/Matra

The second principal industrial cluster is the UK's General Electric Corporation (GEC), Germany's Siemens, and France's Matra. There are two poles to this grouping: GEC/Siemens in defense electronics and GEC/Matra in missiles and space.

Both GEC and Siemens are electronics giants, with most of their activity outside the defense sector. GEC receives about one-third (\$3.5 billion) of its \$11 billion in revenues from defense (concentrated in its subsidiary, GEC-Marconi),²¹ Siemens less than 10 percent (approx-

¹⁷The EFA collaboration is not limited to MBB as the airframe manufacturer; DASA-MTU participates in the companion Eurojet engine development and DASA-TST has a role in the radar consortium, Euroradar.

¹⁸Pratt-Whitney tied the decision to exclude military engines, at least for the present, to concerns about U.S. restrictions on technology transfer. *Aviation Week and Space Technology*, March 18, 1991, p. 29. The strategic alliance with Pratt supersedes an existing ad hoc collaboration with GE on the GE90 engine. Despite the new agreement, DASA-MTU will continue to collaborate with GE on the CF680 engine. DASA also plans an equity exchange with Pratt-Whitney to cement that strategic alliance.

¹⁹Although talks began in March 1990, as of June 1991, few concrete projects had emerged. *Wall Street Journal*, June 14, 1991.

²⁰Eurosam is discussed in connection with the Thomson/BAe grouping below.

²¹GEC-Marconi is the defense sector arm of GEC. Created in 1987, it now includes Marconi (radar and communications), Elliott Brothers (aircraft automation), Yarrow Shipbuilders, and the acquired military activities of Plessey and Ferranti Defense

imately \$700 million). GEC is a much more significant actor in the defense industry, ranking fourth in Europe. It is a true national champion in British electronics, accounting for 70 percent of the UK MoD's electronics contracts and some 16 percent of the total UK defense budget. With its acquisition of Ferranti Defense Systems in 1990, GEC became the sole supplier of aircraft radar in the UK.

By contrast, Siemens plays a secondary role in German defense electronics after DASA-TST. Nonetheless, Siemens ranks just below the top ten in Europe in defense revenues, and with its acquisition of Nixdorf in January 1990, Siemens became the second-largest computer company in the world, after IBM.

Matra is one of two premier French missile firms (along with Aerospatiale) and a major actor in civil and military space. Matra is a rarity among French defense firms, one of the few that is wholly private. Matra ranks tenth in Europe in defense revenues, with about \$1 billion in defense revenues and slightly more in space activities.²²

GEC and Siemens established their link through a joint bid to acquire a large portion of Plessey Co., a British avionics and defense firm, in September 1989. After the British government had turned down an earlier bid by the two firms in 1986, GEC and Siemens won approval for a proposal to acquire separately some portions of Plessey²³ while jointly owning and managing the remainder.²⁴ Nevertheless, the two firms viewed their arrangement as a long-term relationship. They put particular emphasis on the joint R&D effort, which, in the words of a GEC spokesman, would permit the two companies "to 'grow' joint venture programs from the ground up."

Systems. Dexter Jerome Smith, "GEC: A Dynamic Force in a Global Market," *RUSI Journal*, Autumn 1990, pp. 45-50.

²²This includes both Matra's share of Matra-Marconi Space and Matra's U.S. acquisition, Fairchild.

²³GEC acquired 100 percent of Plessey's crypto, naval, and avionics activities as well as Plessey Semiconductors, while Siemens gained all of Plessey's radar, defense systems, and traffic control activities.

²⁴Under the approved agreement, shared activities were to include equal shares in aerospace microelectronics, microwave, and central R&D; a 75 percent GEC share in Plessey Telecommunications; and a 75 percent Siemens share in electronic systems. Since that time, the two companies have divided up some of the proposed shared activities, with GEC assuming full control of Plessey Aerospace, Materials, and Semiconductors. The principal joint activity now is GPT (telecommunications). *Financial Times*, July 3, 1990, p. 16.

Another connection developed when GEC acquired Ferranti's radar activities, since Siemens was paired with Ferranti²⁵ in offering the ECR-90 radar for EFA (the system ultimately chosen by the participating governments). But some observers doubt the long-term viability of the relationship: one GEC official has observed, "The GEC-Siemens relationship has been a disaster. It is a very embittered relationship and there is something seriously wrong. The divorce was already underway when they bought Plessey."²⁶

The GEC/Matra connection has both strategic and ad hoc project dimensions. When France privatized Matra in 1988, GEC acquired a shareholding in the parent company,²⁷ and in 1989, GEC and Matra agreed to a joint venture combining the two firms' space activities, called Matra-Marconi Space.²⁸ They have also agreed to a major ad hoc program cooperation, with GEC joining to offer the Matra-designed MICA air-to-air missile for the Royal Air Force in competition with the Hughes/BAe ASRAAM.²⁹ GEC is also a potential partner (along with BAe, DASA, and CASA) for Matra's standoff antitank weapon, the Apache, now that MSOW has been cancelled.

Like the other principal European clusters, GEC/Siemens/Matra has extensive transnational ties beyond the cluster itself. GEC has worked with France's Dassault Electronique to develop antiship missile decoys. GEC will participate in developing the naval version of FAAMS with Eurosam and BAe, and it hopes to collaborate with Thomson on the next-generation fighter radar. Through Plessey, GEC has acquired teaming relationships with Rockwell-Collins, GE, and Honeywell in the United States. Siemens's transnational efforts are more modest, but it is a partner in the three-nation Trigat program.

²⁵The other participants are Italy's FIAR and Spain's INISEL. In a move that is typical of the strategy of firms in second-tier countries, FIAR and INISEL were also paired with the losing consortium (which included GEC-Marconi, and TST in offering the Hughes radar). FIAR and INISEL were essential partners, since they are national champions and it was apparent that the Italian and Spanish governments would insist on a share of the radar work in proportion to their participation in the EFA as a whole.

²⁶*Financial Times*, July 3, 1990, p. 16.

²⁷Originally 4 percent, the shareholding was raised to 5 percent in 1989. As noted above, DASA also owns 5 percent of Matra, and a further equity exchange between Matra Defense and MBB is planned. These two connections vividly illustrate Matra's strategy to form links "in two strong directions"; but, at least to date, the connection with GEC is more developed, thus explaining its inclusion in the GEC/Siemens cluster for the purpose of this study.

²⁸The venture will have annual sales of around \$550 million. Planned activities include European satellite programs, Ariane, and the European Space Station.

²⁹Matra has also agreed to cooperate with Alenia on future air-to-air missiles.

Matra has been very active in international collaboration, in ad hoc programs such as the arrangement for Italy to produce Matra's Mistral under license, joint development with Italy's Otomelara of the Otomat (antiship) and Milas (antisub) missiles, as well as with Germany's MST on the Brevel RPV.³⁰

Matra and Italy's Finbreda/Otomelara have agreed to extend their relationship beyond ad hoc joint programs (Otomat and Milas) to more long-term cooperation. In another example of a structural alliance (in addition to shareholdings with GEC and DASA), Matra recently acquired 20 percent of Germany's BGT,³¹ and it agreed to work with BGT to develop a short-range version of Matra's MICA missile.

Matra is eager to develop transatlantic ties as well. In the words of Matra's Jean-Louis Gergorin: "We are totally opposed to the concept of a 'Fortress Europe.' We consider Europe as our interior market, but by no means will this prevent us from being active internationally, especially in the U.S. We therefore are seeking partnerships in the U.S., either through investment or joint ventures."³² Pursuing this strategy, Matra acquired Fairchild Defense and Space Corporation and hopes to develop a relationship with Hughes, the premier U.S. missile firm. Matra is also working with both General Dynamics and McDonnell Douglas to promote the sale of its air-to-air missiles for use with export versions of the F-16 and F-18 fighters.

BAe/Thomson

The third of Europe's three principal defense industrial clusters centers around British Aerospace and France's Thomson-CSF.

British Aerospace is Europe's largest defense manufacturer, and the seventh largest in the world, with defense revenues around £4.4 billion (\$7.9 billion) in 1990 (about 44 percent of BAe's total revenues). The principal defense components of BAe are military aircraft, BAe Dynamics (primarily missiles), and Royal Ordnance (guns, ammunition, rocket motors, control systems, and fuses).

³⁰The Brevel was originally an MBB/Matra program, but the German government required DASA to spin off MBB's RPV activities as a condition of approving DASA's acquiring MBB.

³¹Bodenseewerk Gerätetechnik.

³²*Aviation Week and Space Technology*, June 12, 1989, p. 104.

Thomson-CSF, the defense subsidiary of Thomson SA,³³ is the second-largest defense firm in Europe, with 1990 total sales of FF 37 billion (\$6.8 billion). Seventy-nine percent of Thomson-CSF's sales were in defense; this gives Thomson 1990 defense revenues of around \$5.3 billion. Thomson is a partially state-owned firm, with activities concentrated in electronics (radar, sonar, guidance, simulators, and avionics). It is the largest defense electronics group in Europe and second (to Hughes) worldwide.

Both BAe and Thomson-CSF are national champions in most sectors of their activities and have substantially increased the scale of their domestic activities in recent years. BAe acquired Royal Ordnance when it was privatized in 1987. Thomson-CSF has been extremely active in domestic consolidation: it has formed a joint avionics subsidiary, Sextant (with France's Aerospatiale), consolidating virtually all French avionics capabilities. The new firm ranks first in Europe in avionics (fourth worldwide).³⁴

The core of the BAe/Thomson cluster was to center around their proposed joint venture, Eurodynamics, combining the missile systems activities of the two firms (primarily the Electronic Systems and Missile Electronics Division of Thomson-CSF with most of BAe Dynamics).³⁵ Although there is some overlap between their activities, this would be primarily a complementary grouping, with Thomson contributing the missile electronics and BAe the missile body and propulsion capabilities. Among the programs that would fall within the purview of Eurodynamics are the Active Sky Flash medium air-to-air missile and the Crotale and Shahine air defense systems.³⁶

The two firms recently announced that they had shelved the proposed merger, even though both the French and British governments had approved the plan.³⁷ Thomson-CSF president Alain Gomez said that the two firms needed to reassess the plan in light of the changing

³³Thomson SA owns 60 percent of Thomson-CSF; 40 percent is publicly traded. In 1990, Thomson accounted for 49 percent of Thomson SA's turnover.

³⁴Sextant itself is a private-sector firm, although its parents are public-sector entities.

³⁵The combined revenues of the firms' activities within the scope of Eurodynamics are around \$2.2-\$2.7 billion.

³⁶At present there is some competition between the two firms, particularly between Thomson's Crotale and BAe's Rapier.

³⁷Eurodynamics' creation faced a number of hurdles from the British government, which was concerned about the competitive consequences of a merger between a private-sector British firm and a partially state-owned French firm. But in January 1991, the British Monopolies and Merger Commission approved the proposed joint venture.

strategic environment and that the two firms would continue to cooperate on specific programs.³⁸ Instead, Thomson has reached agreement with DASA and Aerospatiale to produce the missile body for Thomson's VT-1, replacing Thomson's former partner, the U.S. firm LTV. Whether this move reflects a reorientation of Thomson's approach to collaboration remains to be seen.³⁹

Another key link between BAe and Thomson is emerging out of the Franco-Italian EIG, Eurosam, which is developing a family of air defense systems for naval and land-based applications.⁴⁰ The original partners in Eurosam were Thomson-CSF (which contributes its Arabel radar system), Aerospatiale (the Aster 15 and 30 missiles), and Italy's Selenia (the Empar radar). The British government's decision in December 1989 to adopt FAAMS for its naval anti-air requirement (called LAMS) cleared the way for BAe to join the Eurosam effort, though initially not as a full participant in the EIG.⁴¹ Spain joined the Eurosam project for both the surface-to-air and naval programs (working through INISEL and Ibermissil).

A third, potentially far-reaching link between the two firms never came to fruition: their joint bid to acquire Ferranti Defense Systems, one of the UK's two principal radar manufacturers.⁴²

Both BAe and Thomson also have other transnational ties, many of which predate the BAe/Thomson link. BAe has developed transnational relationships in both Europe and the United States and has utilized a variety of the techniques identified in Sec. 4. For example, BAe licensed the production of its Hawk and Harrier aircraft to

³⁸At the same time that the two firms announced plans to shelve Eurodynamics, Thomson-CSF revealed its plan to acquire a 50 percent share in the UK's Pilkington Optronics. M. Gomez contrasted the two decisions, arguing that while missile programs had become increasingly uncertain in the evolving strategic environment, optronics would likely prove useful across a wide variety of defense systems.

³⁹Thomson's management stressed that the agreement was limited to the VT-1 program, but that it was prepared to increase cooperation with Euromissile on a "pragmatic basis." *Financial Times*, September 6, 1991, p. 1.

⁴⁰The program is known as the Future Surface to Air Family (FSAF). It is part of a broader Franco-Italian cooperation in air defense, the Family of Anti-Air Missiles (FAAMS).

⁴¹The three governments signed an agreement in February 1991 to initiate project definition work. GEC will also have a major role in this effort, illustrating the blurred lines separating the major clusters. The Netherlands is also exploring joining the project.

⁴²Ferranti was acquired instead by GEC (see above). There is speculation that the British government actively opposed the Thomson/BAe bid, for reasons similar to its opposition to Eurodynamics. Eventually, BAe bowed out of the joint offer, and Thomson then withdrew its bid. Thomson and BAe also have a few other cooperative efforts, including cooperation in the area of active towed array sonar.

McDonnell Douglas, built the Tornado with Germany's MBB and Italy's Aeritalia in the Panavia consortium, and is developing EFA with DASA/MBB, Aeritalia, and Spain's CASA. BAe has recently concluded an agreement for a strategic alliance with General Dynamics (GD), to give BAe "a U.S. dimension." The two companies sought to give the strategic alliance a concrete dimension through an agreement by Royal Ordnance to provide the gun for the U.S. M1A2 tank, in GD's failed bid to sell the M1A2 tanks to the United Kingdom.⁴³ It will also team with Raytheon to offer the Patriot air defense system to the United Kingdom,⁴⁴ and has signed a framework agreement with Boeing to explore future cooperation.⁴⁵

BAe has also pursued the acquisition technique in building transnational links: it is set to buy the German firm Heckler and Koch, a small arms manufacturer. When merged with BAe's Royal Ordnance, BAe will control more than half the European market in military small arms.

There has been persistent speculation that BAe is interested in establishing some kind of strategic relationship with Germany's DASA, though DASA publicly denies that such a move is in the works.⁴⁶

Thomson, too, has expanded its international links through a variety of techniques. Perhaps the most dramatic was acquiring most of the defense electronic activities of the Dutch firm Philips in January 1990, which increased Thomson-CSF sales by FF 5 billion (\$780 million).⁴⁷ Other acquisitions include the UK-based simulator firm Link-Miles (making the new combined entity the second-largest simulator manufacturer in the world); a 50 percent share of the sonar activities of UK's Ferranti International, which, when combined with Thomson's own sonar subsidiary, will make Thomson a key European player in that sector and fourth worldwide in undersea detection; and a proposed agreement to acquire 50 percent of UK's Pilkington

⁴³Acting as a national champion in tank gun development, Royal Ordnance also teamed with the British firm Vickers to produce the gun for Vickers's successful entry into the competition, the Challenger 2, and with Rheinmetall for Germany's Leopard 2 (another failed competitor).

⁴⁴*Defense News*, May 27, 1991, p. 35.

⁴⁵*Defense News*, March 25, 1991, p. 2.

⁴⁶As noted above, BAe already collaborates with DASA's MBB on the Tornado and EFA; the two also have extensive ties through the Airbus civil aircraft program.

⁴⁷This acquisition had both a transnational and a domestic component: Thomson acquired Philips's Dutch (HSA), Belgian (MBLE), and French (TRT) subsidiaries. Thomson was also reported to be interested in acquiring Philips's British subsidiary, MEL, but MEL was ultimately acquired by the UK's Thorn-EMI.

Optronics subsidiary, making Thomson Europe's largest optronics firm (fourth internationally).

One of Thomson's most important ad hoc, transnational collaborative programs involved teaming with GTE to build a battlefield communication system for the Army based on Thomson's RITA; Thomson hopes to expand its relationship with GTE in the future. Thomson has also agreed to cooperate with GEC on a radar for the next-generation (i.e., post-EFA/Rafale) fighter. This could bring about a convergence of all three principal axes in Europe in radar, since DASA-TST is linked with GEC on the EFA radar.

Thomson's management is very clear about its overall strategy: "We very much need to expand our industrial capacities, and the large cost of research and development is leading us to think of all sorts of solutions (alliances, cooperation programs, etc.) to make the most out of that investment. No country, no manufacturer can continue to cover the whole spectrum of defense activities by itself, so it has become indispensable to consider link-ups with others."⁴⁸ It has also been explicit on the focus of its efforts: "Our number one priority is to consolidate the Thomson position in Europe; after that comes becoming more active in the U.S. market."⁴⁹

Both BAe and Thomson have depended heavily on export sales. BAe receives 73 percent of its turnover from exports (although a considerable portion of that is from civil aircraft); 50 percent of its foreign sales are to the Middle East and Far East. Sixty percent of Thomson's sales were exports in 1989 (31 percent of total sales went to the Middle East). Lost sales in the Middle East have hit Thomson (like most French firms) very hard, although the firm recently won a new contract to supply air defense systems to Saudi Arabia.⁵⁰

To hedge against the uncertainties of the defense market, both firms have concentrated on expanding civil activities. Since neither firm has a majority of its revenues from defense,⁵¹ they are already well diversified: recent activities include BAe's acquiring the auto maker Rover, and Thomson's purchases of foreign civil electronics firms (Telefunken in Germany, GE/RCA Commercial Products and Wilcox

⁴⁸Thomson's general manager, Jean-Francois Briand, in *Aviation Magazine International*, July 1, 1990, p. 12.

⁴⁹*Le Figaro*, September 18, 1989.

⁵⁰The order was for Crotale, worth \$670 million. *Jane's Defence Weekly*, December 15, 1990, p. 1205.

⁵¹BAe derives 42 percent of its revenues from defense activities, while Thomson-CSF (the defense unit of Thomson SA), although heavily oriented to defense (78 percent of sales), makes up only about 44 percent of the parent firm's sales.

in the United States, and Ferguson in the UK) as well as adapting its Aster radar for civil air traffic control.

EUROPEAN ENGINE MANUFACTURERS

The principal European military engine manufacturers, as a result of their extensive transatlantic ties as well as European cooperation, present an unusual case within the European defense industry. This field is dominated by national champions: Rolls-Royce in the United Kingdom (Europe's largest and the world's third-largest engine manufacturer, involved in both jet and rotary engine programs),⁵² France's SNECMA (fourth in the world, second in Europe, jet engines) and Turbomeca (Europe's premier rotary engine firm); and, somewhat smaller, Germany's MTU (jet and rotary engines).⁵³

In the past, the European axis of jet engine collaboration has centered around engines for the Tornado and EFA fighters, uniting Rolls, MTU, and FIAT Avio on Tornado, and adding Spain's Industria de Turbo Propulsors/Sener in Eurojet, the engine consortium associated with EFA. SNECMA was not involved in either project, since France did not participate in either consortium. However, a grand alliance for the future may be in the offing: SNECMA and Rolls have agreed to explore a collaboration to develop jointly an engine for the next-generation (post-EFA/Rafale) fighter.⁵⁴

On the transatlantic level, collaboration has focused on civil jet engines, although there is considerable prospect for these activities to spill over to military efforts. The most well-developed relationship is between GE and SNECMA, which has worked together for eleven years to develop and manufacture the CFM56 engine. This relationship does have an explicit military dimension: GE and SNECMA created a joint venture, CFM International, to undertake the re-engining of U.S. KC-135 tankers.⁵⁵ Rolls-Royce is proposing to collaborate with Lockheed on the engine for a new U.S. Air Force/Navy trainer, and,

⁵²Rolls-Royce, with military sales in 1989 of around £740 million (\$1.3 billion), is the ninth largest in defense sales in Europe.

⁵³Italy has two principal engine firms, FIAT Avio and Piaggio; in Spain, Sener acts as the national champion.

⁵⁴Rolls-Royce and SNECMA have collaborated on the civil side, in the engine for the Concorde. Other European ties include SNECMA's acquisition of the engine activities of Belgium's FN Herstal, and an agreement between Rolls and Germany's BMW to develop a civil jet engine (to compete with the GE/SNECMA GE-90 and the Pratt-Whitney/MTU PW 4000).

⁵⁵GE and SNECMA are expecting further military collaboration on the infrared suppressor for the CFM56 and engine development for trainer aircraft.

as noted earlier, DASA-MTU has recently announced plans to build a strategic alliance with United Technologies/Pratt-Whitney, although they have agreed (at least for now) to exclude military engine programs.

These arrangements illustrate two alternative directions for the European defense industry as a whole: consolidation into one or two European suppliers based on long-term intra-European corporate links (Eurojet plus SNECMA), or competing transnational consortia involving both U.S. and European firms (GE/SNECMA, Pratt-Whitney/MTU, Rolls/BMW). The implications and prospects for these two alternatives are examined in Sec. 6.

The European rotary aircraft engine market is dominated by France's Turbomeca, a firm with FF 1.6 billion (\$250 million) in defense revenues in 1989. Turbomeca has developed engines not only for French helicopters, but also the RTM-322 for the UK and Canadian versions of the EH-101 and the four-nation NH-90.⁵⁶ Turbomeca is the lead firm on the engine for the Tiger, teaming with Rolls-Royce and MTU.

KEY DEFENSE FIRMS OUTSIDE THE CLUSTERS

Most of Europe's top defense manufacturers now fall within the three principal clusters or the engine groupings. There are several important firms that are not closely tied to any of the clusters: France's Dassault Aviation, GIAT, and Dassault Electronique; the UK's Westland, electronics firms Thorn-EMI and Racal,⁵⁷ and Vickers, the UK tank manufacturer; Italy's two state-controlled conglomerates, IRI-Finmeccanica and EFIM; Spain's state-owned aeronautics firm CASA;⁵⁸ and Germany's land warfare companies, Rheinmetall, Krupp-Mak, and Krauss-Maffei.

Dassault Aviation. Dassault is the symbol of the "old style" in European defense, a national champion concentrating almost exclusively on national defense programs and export sales.⁵⁹ Dassault has

⁵⁶The engine competition for the Italian EH-101 is another example of competing transnational consortia involving the United States: Turbomeca/Rolls/Piaggio (Italy) were competing against GE/FIAT Avio/Alfa Romeo Avio (which was recently chosen by the Italian MoD). Both are also competing for the NH-90.

⁵⁷Plessey and Ferranti are still engaged in defense manufacture, although the scale of their activities has shrunk dramatically since most of their defense activities were acquired by competitors in 1989-1990.

⁵⁸CASA is described in Sec. 3.

⁵⁹As previously noted, France has a second major aircraft firm, Aerospatiale, but Aerospatiale is not involved in fighter development and manufacture. Nonetheless, there has been pressure to consolidate the two firms.

developed all the major French fighters, from Alpha-Jet through Mirage and Super-Etendard, and now Rafale. Some FF 13.4 billion (\$2.5 billion) in sales come from defense (it is the sixth-largest defense firm in Europe), 78 percent of the firm's total. Sixty-three percent of revenues are from export sales (military and civil).⁶⁰ The principal exception to Dassault's national orientation was the Atlantique maritime patrol aircraft, which was developed jointly by Dassault and British, Dutch, Italian, German, and Belgian firms. Dassault now seeks to involve its former partners in the Atlantique 2 follow-on aircraft.⁶¹

GIAT. GIAT⁶² presents a vivid contrast with Dassault. Until recently GIAT was a true relic of the old system, not only state owned but state operated, concentrating on meeting the needs of the French MoD in army vehicles and munitions. With the decision to convert GIAT to a public-sector company (100 percent state owned but privately managed), implemented in July 1990, GIAT "came to life," with extensive efforts both to consolidate the fragmented French market in vehicles and munitions and to build transnational links.⁶³

On the national level, GIAT is in the process of consolidating most of the French army munitions activities through its acquisition (planned or implemented) of Luchaire (heavy caliber munitions), Matra Manurhin Defense (medium caliber), and the French Munitions Company (small caliber). For armored vehicles, GIAT entered into an agreement with two of its principal French competitors, Creusot-Loire and Renault Véhicules Industriels (RVI), to create a jointly owned company to manage current and future tracked and wheeled vehicle programs. GIAT also began talks with Usinor Salicor (Creusot-Loire's parent) about a possible link-up in the area of light armored cars and tank turrets, and it plans joint development of non-terminally-guided munitions with Aerospatiale.

⁶⁰For the first half of 1990, Dassault's sales stayed flat (FF 7.99 billion compared with FF 7.91 billion over the comparable 1989 period). The share of sales from defense dropped slightly to 74 percent, while exports rose to 68 percent.

⁶¹Collaboration on Atlantique was facilitated by the fact that several European nations planned to acquire it. For Atlantique 2, there are as yet no other European countries planning to purchase the aircraft, although Dassault is hopeful that the U.S. decision to cancel the Lockheed P-7A may create an opening. This explains in part Dassault's eagerness to maintain European partners in developing Atlantique 2; it may improve the prospects for procurement by the governments of its collaborators.

⁶²Groupement Industriel des Armements Terrestres.

⁶³It is difficult to calculate precisely the current size of GIAT, given the flurry of recent acquisitions. Putting together 1989 revenues from recently acquired elements would give the consolidated firm revenues in excess of FF 8.4 billion (\$1.3 billion).

On the transnational level, GIAT has acquired two Belgian munitions firms, PRB⁶⁴ and FN Herstal.⁶⁵ It has developed an offset arrangement with the UK's Vickers as part of its effort to sell the Leclerc tank to the British army, reached an agreement with Royal Ordnance and Germany's Rheinmetall to collaborate on the next generation of tank guns, and is teaming with the UK's Hunting and two German firms (Honeywell Regelsystem and Dynamit Nobel) on an antitank mine. GIAT has teamed with the UK's GKN to study future medium armored vehicles, to complement its intra-France arrangements with RVI and Creusot-Loire. There is also a transatlantic dimension to GIAT's new orientation: teaming with GE to develop a turreted gun system for light helicopters such as the U.S. LH.

Dassault Electronique. Dassault Electronique (DE) is an example of a European niche firm that has focused primarily on the domestic market but has in recent years sought transnational links.⁶⁶ In France, DE has worked for many years with Matra and Aerospatiale on missile seekers and with Thomson-CSF on aircraft radar and EW systems, and it has developed computers, jammers, and digital buses for Dassault aircraft. On the European level, DE has recently signed agreements with DASA-TST for the ANS antiship missile seeker, with Italy's Selenia for the Aster seeker, and a broad agreement with GEC to collaborate on active seekers for air-to-air missiles, including the joint GEC/Matra effort on MICA. DE has developed a significant transatlantic link in its collaboration with Westinghouse to develop an onboard Air Force computer based on DE's macrohybrid military processor, a cooperation now extending to mass memories and high-speed digital buses.

British Electronic Independents: Thorn-EMI and Racal. Both Thorn-EMI and Racal are niche electronics firms with an uncertain future in the defense sector. Both have less than 10 percent of their sales in defense, and both had recently sought to sell off their military activities. Recently, however, Thorn-EMI acquired Philips's UK defense electronics subsidiary, MEL. Thorn has a broad marketing and R&D agreement in electronics and optronics with France's SAT.

Vickers. Vickers is a British automotive and engineering firm, with its principal defense activities in tanks and marine engineering.

⁶⁴Poudreries Réunies de Belgique.

⁶⁵The engine activities of FN Herstal had been acquired by SNECMA.

⁶⁶DE has slightly over FF 3 billion (approximately \$500 million) in defense sales, putting it near the bottom of Europe's top 20 firms. Seventy-seven percent of DE's 1989 turnover was military, 28 percent export (civil and military).

Thirty-one percent of Vickers's 1990 sales were in defense (\$465 million out of \$1.5 billion total). Defense sales increased 56 percent in 1990 from the 1989 level, when defense made up only 20 percent of the total, and should receive a boost from the UK's decision to acquire the Vickers Challenger 2 tank.⁶⁷

German Land Warfare Firms. Rheinmetall is Germany's leading producer of artillery and is also involved in a number of land warfare systems. In 1990, Rheinmetall had DM 1.2 billion in defense sales (\$740 million), about a third of the company's total turnover, and a 27 percent increase over 1989.⁶⁸ Rheinmetall is involved in several collaborative ventures: with BAe/Royal Ordnance to develop a 140mm smooth-bore gun for the next UK tank, and a broader cooperation with Royal Ordnance and GIAT on the next-generation tank gun. It is teamed with GE in the United States on a single-barrel gun for the Marder armored personnel carrier.

In another example of sectoral consolidation, Rheinmetall acquired a 60 percent share of Krupp-Mak in October 1990, creating a new joint venture (to be called Mak System Gesellschaft). The new entity (with projected turnover of DM 350 million) will include all of Krupp-Mak's tank and armored vehicle programs⁶⁹ but not Krupp's naval activities (which were recently augmented by acquiring MBB's naval programs).⁷⁰ The new firm will have a European collaborative dimension, as a result of Krupp's joint development of the AV-90 armored vehicle with Italy's Otomelara.

Italy's State Holding Companies: IRI-Finmeccanica and EFIM.⁷¹ Although the Italian defense industry had already achieved considerable financial consolidation under the state's two principal defense-oriented holding companies, the component firms have recently engaged in an effort to rationalize their management and organization. The most notable example is the merger in December 1990 of Aeritalia, Italy's largest aerospace firm (around \$1.8 billion in turnover, \$1.2 billion in defense), with Selenia, a radar, electronics, and missile company (which forecasts \$400 million in defense

⁶⁷*Defense News*, March 11, 1991, p. 41; April 4, 1991, p. 11.

⁶⁸About half the increase comes from last year's acquisition of 60 percent of Krupp.

⁶⁹This will not bring about a total consolidation of German tank and armored vehicle activities, since Krauss-Maffei (developer of the Leopard 2 MBT) remains independent. Rheinmetall's management has indicated that it is open to cooperation with Krauss-Maffei in the future. *Jane's Defence Weekly*, November 24, 1990.

⁷⁰The German government required MBB to sell off its naval programs as a condition of its acquisition by DASA.

⁷¹IRI and EFIM are also discussed in Sec. 2.

revenues in 1989), into a new entity, Alenia.⁷² The new firm will retain ties to IRI-Finmeccanica (which will hold 77 percent of the shares) but will achieve a certain degree of independence. Alenia's 1990 turnover was L 4.9 trillion (\$3.9 billion).⁷³ The aircraft sector had L 2 billion in turnover, slightly less than half of it (L 804 million) in defense. Twenty-eight percent of the defense sales were for export.⁷⁴ Other elements of Italian consolidation include Finmeccanica's acquiring 47 percent of Elletronica, formerly a private firm involved in electronic warfare, software, and microwave/infrared systems (which will be folded into Alenia), and Aeritalia's 25 percent shareholding in Aermacchi, which develops combat and training aircraft.

IRI-Finmeccanica's component firms have been deeply involved in transnational collaboration. On the aircraft side, Aeritalia has participated in most major European collaborative programs, including Tornado (BAe, MBB), EFA (BAe, MBB, CASA), and Atlantique 2 (Dassault).⁷⁵ It is a partner with Aermacchi and Brazil's Embraer in the AMX program. Aermacchi is teaming with DASA/Dornier in developing an advanced training system for future combat aircraft and with Hughes and Lockheed for a future U.S. Air Force trainer. On the electronics side, Alenia will participate, through Selenia, in Eurosam and in a broad long-term cooperative relationship with Aerospatiale on missile systems and satellites.

EFIM's two principal components, Agusta and Finbreda, are also deeply involved in collaboration; Agusta participates in several European helicopter programs (including the NH-90 and EH-101), while Finbreda (through its Otomelara missile division) has a broad arrangement with Matra on antiship and torpedo programs.⁷⁶

⁷²Both Aeritalia and Selenia were already part of IRI. When consolidated, Alenia is expected to have revenues over \$4 billion (around \$2.6 billion in defense-related activities), moving it into the top five European defense firms.

⁷³*Defense News*, April 22, 1991, p. 25.

⁷⁴*Defense News*, June 10, 1991, p. 40.

⁷⁵It also has collaborative relationships in civil aviation with the Airbus 321 (though Aeritalia is not a member of the Airbus consortium) and the ATR regional aircraft (with Aerospatiale). Aeritalia also has ties in civil aviation with Boeing and McDonnell Douglas.

⁷⁶Italy's independent defense firms also have significant transnational ties. FIAR, Italy's principal aircraft radar firm, represents Italy on the Tornado and EFA radar collaborations and is also teamed with Thorn-EMI and Germany's Eltro to develop the search and track system for EFA. FIAT Avio is Italy's main aircraft engine manufacturer, participating in the Tornado and EFA engine projects, and it has built several other engines under license from Rolls and GE. It is collaborating with GE and Alfa Romeo Avio on an engine for the EH-101 helicopter, in competition with the Rolls/Turbomeca/Piaggio RTM-322.

Shipbuilding. Shipbuilding remains the most national of all European defense sectors, with limited collaborative or export programs either within Europe or abroad. Although a number of countries have several shipbuilders, there is almost no competition among individual classes of ships.⁷⁷ The low rate of replacement for most ships has put considerable strain on firms in the industry. Some of the firms are diversifying into heavy engineering and civil construction.⁷⁸

In France, the state-operated DCN is responsible for all major warship construction, while several smaller firms produce minor ships and export models. DCN hopes to expand its import and collaborative efforts through its newly created private-sector firm, DCN International.

In the United Kingdom, the shipbuilding industry, once highly nationalized, is now private. Vickers Shipbuilding and Engineering Ltd. (VSEL) builds submarines (along with its subsidiary, Cammell Laird, which VSEL recently put up for sale). Yarrow is the lead design yard for frigates, and Vosper Thornycroft has that distinction for mine countermeasure ships. Swan Hunter, which builds the Type 23 frigate as well as auxiliaries, is another firm hard hit by defense spending reductions, and it is threatening layoffs.

In Germany, Bremer Vulkan builds frigates and tankers, while Blomm and Voss, which is controlled by Thyssen Nordseewerke, is responsible for the successful MEKO frigate, used by Germany and a number of other countries, including Portugal and Turkey. Both Italy and Spain have highly concentrated warship industries; most Italian construction is carried out by the component firms of Cantieri Navali Italiana Finconteri, while Bazan in Spain handles most of that country's major military shipbuilding.

With the collapse of the eight-nation NFR-90 program,⁷⁹ Europeans are now exploring a European collaboration for a next-generation frigate. The principal discussions involve France and the United

⁷⁷One exception is Type 23 frigates for the Royal Navy, which are built by both Swan and Yarrow, and VSEL may bid in the future.

⁷⁸*Jane's Defence Weekly*, November 3, 1990.

⁷⁹Canada, France, Germany, Italy, the Netherlands, Spain, United States, and United Kingdom.

Kingdom; other potential participants include Germany, the Netherlands, and Spain.⁸⁰

⁸⁰*Jane's Defence Weekly*, December 1, 1990. Germany has signed agreements with the Netherlands and Spain to explore collaboration on surface combatants. *Jane's Defence Weekly*, February 2, 1991, p. 214.

6. EMERGING TRENDS IN THE EUROPEAN DEFENSE SECTOR

From the preceding survey of the European defense industry, it is possible to see a number of trends that are likely to shape the European defense industry in the coming decade. Four of these trends are structural, concerning the nature of corporate organization and relationships with other firms and the state:

- Further consolidation, but at a slower pace
- More extensive strategic alliances
- Hollowing out of national champions through the proliferation of sectoral EIGs
- Privatizing and the lessening of state control.

Three trends are substantive, focusing on the kinds of activities that will dominate corporate strategy:

- Diversification
- Focusing on versatile technologies
- Greater attention to systems integration.

The two sets of trends are, however, closely linked; for example, greater attention to systems integration tends to promote the consolidation of firms with complementary capabilities.

STRUCTURAL TRENDS

Further Consolidation, but a Slower Pace

It seems likely that the frenzy of industrial consolidation in Europe has peaked. But further concentration is still possible where several national competitors remain in the same product line or sector (especially if some of the firms are small). In the United Kingdom, where GEC is established as the principal electronics firm, the remaining firms (Thorn, Racal, and Ferranti) have been struggling and are ambivalent about their long-term future in the defense sector. In the coming years they are likely to consolidate or to be absorbed by GEC (or perhaps even by a foreign giant such as Thomson). In France, despite considerable resistance from Dassault management,

there are building pressures to consolidate the airframe industry in a single entity, most likely under Aerospatiale's leadership.

Consolidation is also possible through acquiring firms in smaller European countries, along the lines of Thomson's acquisition of Philips and GIAT's acquisition of FN and PRB. But these opportunities are limited, since some European countries (notably Italy and Spain) seem determined to protect their national defense industrial base even at the cost of considerable inefficiency. Since the firms in these countries typically are already monopoly suppliers, the principal trend will be to rationalize the activities of the larger, state-dominated conglomerates. The merger of Selenia and Aeritalia is an example of this process.

More Extensive Strategic Alliances

With fewer opportunities to consolidate through merger or acquisition, firms will pay increasing attention to less complete forms of consolidation, especially strategic alliances. The jury is still out on the long-term value of strategic alliances; although they are much discussed, it remains uncertain to what degree they will enhance European companies' competitiveness or efficiency. Many doubt the viability of strategic alliances in the absence of concrete collaborative programs. However, strategic alliances may prove useful as an interim step toward developing additional transnational EIGs, which could emerge from closer working relationships and information exchange among alliance partners.

Hollowing Out the National Defense Conglomerates: Proliferating Transnational EIGs

As we have seen, national consolidation has produced a number of large national firms, many of whose activities are only partially (if at all) related. From an economic standpoint, highly diversified defense conglomerates offer relatively modest benefits beyond those relating to size.¹ To achieve needed economies of scale, access to multiple national markets, and reduced R&D duplication, the subelements of these conglomerates have sought out horizontal or complementary partners, typically from other European countries.

¹These include access to capital, ability to weather failed or cancelled projects or shifts in procurement priorities, and financial diversification (see Sec. 4).

This process has led to a "hollowing out" of the diversified giants, in which whole sectors are carved out and consolidated in transnational EIGs. Perhaps the most dramatic examples of this phenomenon are the creation of Eurocopter and the now postponed plan to create Eurodynamics. Although each of the national giants (Aerospatiale and DASA for Eurocopter, Thomson-CSF and BAe for Eurodynamics) retain financial control of the new entities, quasi-independent management assumes control of program and day-to-day activities, with the prospect that the links with the parent firms will become more and more attenuated over time. Other examples include Matra-Marconi Space, Eurosam, and Euromissile,² and, on a purely national level, Sextant Avionics.

The indefinite postponement of BAe/Thomson-CSF's plans to create Eurodynamics raises some questions about the nature and extent of this trend. Although the companies blamed the halt on uncertainties in the post-Cold War, post-Gulf War environment, some have speculated that the complementary merger approach was unbalanced; it offered too little synergy or cost savings. This suggests that horizontal efforts, like Euromissile and Eurocopter, may prove the more common pattern, although Eurosam, a complementary EIG, is proceeding.

Intensified export competition may also impede the trend toward transnational horizontal groupings. With the Gulf War's end, many firms may see opportunities for expanded sales and may wish to compete for them on a national basis. It is perhaps noteworthy that the Eurodynamics negotiations broke down at the same time Thomson-CSF received a large order from Saudi Arabia for the Crotale air defense system (a program that would have fallen within Eurodynamics); Thomson may have wished to keep its improving export prospects to itself.

If this trend does continue, however, over time it could transform the European defense industrial landscape from one centered around national champions (monopoly suppliers to their own governments) to one of Europewide monopoly suppliers in each sector. This development is already advanced in some sectors (fighter aircraft, with EFA,

²These arrangements differ considerably from collaborations such as Euroengine, in which the various participants collaborate on an individual project but long-term product development and management remains outside the consortium. The case of the Eurofighter consortium falls between these two extremes; although a strong national component remains, the successive collaboration of BAe, MBB, and Aeritalia on two generations of fighter aircraft suggests that any future European fighter collaboration will include these three at a minimum.

and helicopters, with Westland and Agusta joining Eurocopter on several helicopter projects).

Privatizing and the Lessening of State Control

There is a long tradition of state ownership in the defense industrial sector in Europe, particularly as compared with the United States. Over recent years, however, several European governments have moved to privatize all or part of important sectors. The United Kingdom, under Margaret Thatcher, led the way by privatizing giants such as BAe, Rolls-Royce, and Royal Ordnance, as well as smaller firms such as Shorts. More recently, France has lessened its direct state control, completely privatizing Matra, creating Sextant Avionics as a private-sector company (though controlled by public-sector firms, Aerospatiale and Thomson), and converting GIAT from a government-operated entity to a public-sector (though 100 percent government-owned) firm. Even DCN, the state-run naval manufacturer, now has a private-sector international marketing firm to facilitate its export activities. There is also a move toward privatizing major sectors of government-controlled industry in Italy, although the troubled financial condition of the two large defense holding companies IRI-Finmeccanica and EFIM means that privatizing them will only come after further privatization in the civil sector.

Private or partially private firms have several advantages, including access to private capital, greater corporate flexibility, and improved opportunities to collaborate, both in Europe and with the United States.³ EC-1992 and the EC's focus on competition policy could spur further privatizing (or lessening of state control/subsidies), particularly for firms active in the civil sector, as the Commission comes to focus on state-controlled firms' potential unfair competitive advantages over private entities. This trend offers benefits to European governments as well by reducing the drain on national treasuries in a time of economic stringency.⁴ Many of the firms under state control

³In one respect the public-sector firms have an advantage in the debt market, since their borrowing is, in effect, government guaranteed. In recent months, credit ratings of European defense firms (both private and public sector) have been stable or improving, while those of U.S. firms are falling. *Defense News*, February 18, 1991, p. 10.

⁴This was an important impetus to the transformation of GIAT into a public-sector company. "Before our change of status, we were isolated from the industrial world. Now we are obliged to make a profit for the first time since Colbert." Jacques Gentjen, interviewed in *Financial Times*, February 6, 1991, p. 21.

were unprofitable.⁵ But privatization carries associated costs in potential lost employment and a greater risk that the firms will fail.

SUBSTANTIVE TRENDS

Diversification

One of the clearest priorities of European defense manufacturers is to diversify product lines and activities, as a hedge against the declining defense market (domestic and export) and the uncertainties over national procurement priorities and programs. This strategy can take many forms, including diversifying within the defense sector or into either related or unrelated civil activities. As noted above, diversifying within the defense sector offers only marginal economic benefits (particularly where there is little or no synergy between the activities of the component elements). Although some defense sectors will do better than others in the coming years, declining budgets will have an impact on most.

By contrast, diversifying into civil activities seems more promising, and this is clearly a dominant priority for European corporate managers. Virtually every major firm has established targets for reducing its dependence on defense contracts.

Whether this approach will succeed in the long run remains an open question. There is considerable literature and debate on the prospects for spinning military technology off to the civil sector—and spinning civil technology “on” to defense. Clearly there are some areas of high synergy and overlap, such as Thomson-CSF’s involvement in civil air traffic control radar. More generally, a number of European defense firms have made a major commitment to civil space activities (Matra/GEC, Aerospatiale, DASA); and most of the major airframe manufacturers are increasing their focus on civil aviation. These are two of the most promising high-growth, high-technology civil sectors. But the benefit and long-run viability of diversifying into unrelated activities is more questionable; BAe’s acquisition of Rover is an interesting test case.

⁵The French government’s scope to support state industry today looks very limited, unless it is prepared further to open government owned companies’ capital to private shareholders.” *Financial Times*, February 12, 1991, p. 5.

Focus on Versatile Defense Technologies

As European firms seek to hedge against the uncertainties of the post-Cold War defense market, one promising strategy is to focus on versatile defense technologies. These are technologies with broad application to a variety of systems that may be required on the modern battlefield. European industrialists have identified several areas with growth potential: C³I, surveillance, composite materials, and stealth technology. By shifting attention to versatile technologies, European firms can adapt to changing procurement requirements and participate in a broad range of programs, instead of depending on a specific platform or system.⁶ This approach also allows firms to increase their R&D spending to remain technologically competitive while lessening the risk that they will fail to recoup their expenditures because of abbreviated or cancelled production orders. In addition, focusing on versatile technologies allows European firms to adapt to the growing trend toward extending the life of platforms and systems through product and subsystem upgrades.

Another business advantage of versatile defense technologies is that, unlike platforms, they are unaffected by arms control agreements; indeed, some of the technologies will be in greater demand for use in arms control compliance and verification.⁷

Increased Attention to Systems Integration

The complexity of modern military equipment places a premium on systems integration. Not only are there growing synergies between subcomponents, in many cases (such as conformal radar) integration must begin at the design and research phase. For an increasing number of systems, it is no longer adequate simply to subcontract for a plug-in black box; firms must collaborate from the research and design phase.⁸

⁶It is interesting to note Thomson-CSF's rationale for beginning a new partnership with Pilkington at the same time it shelved Eurodynamics. According to Thomson-CSF president Alain Gomez, although missile programs were subject to change in the new strategic environment, optronics were likely to have broad applications across an array of systems.

⁷Anthony et al., p. 15.

⁸Electronic systems can radically alter the performance characteristics of weapons and surveillance platforms, and the increasing modularity of modern electronics systems makes retrofit a more attractive option, though clearly even more benefits can be derived by designing and developing together new platforms and new fully integrated electronics, taking a total systems approach." Smith, p. 48. The joint GEC/BAe bid to become prime contractor for the UK's EH-101 helicopter is an illustration of this trend; neither of the partners is directly engaged in helicopter

The greater need to integrate systems has contributed to consolidating the European defense sector, particularly among firms engaged in complementary activities. Eurosam is a vivid example: a commitment by a missile body manufacturer and missile electronics and radar firms to pool their efforts. DASA represents an alternative approach: the grouping together within a single firm propulsion, electronics, and missile frame suppliers.

design and manufacture, but the increasing importance of electronics opens the possibility of a prime who subcontracts for the platform itself. BAe/GEC is competing against bids from IBM/Westland and Westland alone, with the IBM/Westland bid favored.

7. CONCLUSION: COMPETITION VERSUS CONSOLIDATION AND THE PROSPECTS FOR TRANSATLANTIC COLLABORATION

THE CONFLICT BETWEEN COMPETITION AND CONSOLIDATION

National and transnational industrial consolidation has helped reduce overcapacity and allowed European firms to operate on a scale that is more self-sustaining and suited to the peculiar characteristics of the defense market. But for governments this trend has produced a dilemma, because consolidation has substantially reduced competition for high-technology and complex systems, not just on national levels¹ but increasingly Europewide.² Policymakers have sought to counter the trend toward monopoly by pushing open competition, primarily through the IEPG Action Plan.

Much of the policy debate over defense acquisition stems from the conflict over how much priority to give economic efficiency (affordability) and concerns about maintaining a defense industrial base. This conflict has become more acute as NATO defense budgets decline. Proponents of increased competition through greater access to markets argue that the resulting efficiencies will help stretch tight defense budgets, while others contend that smaller budgets require more determined effort to protect the shrinking defense industrial base.

The case for favoring industrial base over efficiency is rather weak in the NATO context; it is difficult to imagine that the interests of NATO partners could diverge so sharply that they would deny each other access to needed equipment and technology. Indeed, it is possible to argue the opposite—interdependence of industrial base will help cement the link between allies. This was the strategy pursued

¹One of the most striking examples of the inability to maintain competition on the national level was GEC's acquisition of Ferranti Defense Systems. Even though the UK MoD and Department of Trade and Industry (DTI) are the most frequent advocates of competition in defense procurement, they were forced to bow to the reality that the UK could not support more than one radar firm. See *Financial Times*, January 25, 1990, p. 12.

²Cutting overcapacity has other costs, including reduced surge capacity and dependence on less reliable foreign sources of supply. This problem became clear during the Gulf War: Britain's Royal Ordnance was unable to increase production for 155mm artillery shells, and the British met resistance when they tried to acquire additional ordnance from Belgium. *Economist*, January 26, 1991, p. 49.

by the founders of the European Coal and Steel Community in 1951, who promoted Franco-German interdependence in those key sectors as a way to reduce the risk of conflict between those two historical rivals. Although domestic political imperatives in favor of industrial base strategies are stronger with declining budgets, in the long run the resulting inefficiencies will harm national output and employment.

The economics of defense may, however, preclude the choice of an effective competitive strategy. The process of consolidation is likely to frustrate efforts to maintain competition in Europe (especially for major systems and principal subcomponents) for two central reasons. First, European firms are hedging against the risks of competition through transnational horizontal consolidation, thus limiting the number of competitors in Europe. At the extreme, in many sectors this process is creating a European monopoly supplier, albeit in the form of a consortium with multiple national participants.³ Second, it is doubtful that the major European governments would permit competition to drive out key elements of the national defense industrial base, a likely consequence of eliminating national preference in the win-or-die context of defense acquisition.⁴

These developments apply primarily to the high end of defense procurement. For dual-use or low-technology items, multiple suppliers are more common, and governments will be less concerned about the impact of a foreign award on the national defense or technology base.⁵

Thus, despite the efforts of European governments to limit the application of *juste retour*, it is likely that a system of de facto national work shares will persist into the future. Most large programs will be collaborative, but each nation's national champion is virtually guaranteed participation in the project. This, in some respects, is prefer-

³The helicopter industry is a case in point. Jean-François Bigay, director of Aerospatiale's helicopter division, recently observed, "No more than two [helicopter companies] will be left in the United States, possibly only one. In Europe, the same thing will happen, whether it comes about by the establishment of a consortium of the four existing builders or by some other means." *Aviation Magazine International*, August 15-31, 1990, p. 22.

⁴Kapstein argues that developing corporate alliances is a second-best choice after open competition, which is impracticable given governments' commitment to maintaining industrial and technology base. Kapstein, pp. 6-14.

⁵It is difficult to measure what percentage of European defense budgets are affected by these trends toward monopoly. In the UK, for example, nondual defense electronics (a sector undergoing substantial consolidation) accounted for about 12 percent of the UK defense budget in 1987 (£ 2.4 billion). *UK DIB*, p. 47. According to the United Kingdom, 63 percent of the value of defense contracts for FY 1990-91 was let by competition or other market-oriented approaches (e.g., price lists).

able to the autarchic procurement universe of the past, but it means that the potential gains in efficiency are limited.

The new approach does offer several advantages over the more traditional government-directed, ad hoc project consortium.⁶ Since the teaming arrangements will be developed by the firms themselves, they will offer considerable flexibility to make use of comparative advantage and specialization.⁷ Second, the more enduring relationships between European firms will allow greater industry-directed product innovation and development, as well as reduced R&D duplication. Third, R&D collaboration will permit European firms to achieve a greater degree of technological competitiveness with U.S. firms.

There are two possible ways out of this dilemma. The first is to permit direct competition from U.S. firms, the only entities that can compete economically and technologically with the emerging transnational European giants and clusters. The prospects for this seem dim, however. If European governments are reluctant to subordinate their own national independence to a Europewide defense industrial base, *a fortiori* they are unlikely to award important contracts to U.S. firms without European partners at the risk of driving national firms out of business and increasing their reliance on the United States. A broader scheme of reciprocal off-the-shelf purchases would help assure a better overall balance of defense trade, but it would not solve the industrial and technology base problem.⁸

The second alternative is the growth of complementary alliances, either intra-European or transatlantic, rather than horizontal consolidation. The creation of complementary alliances would permit competition between consortia while retaining enough national participa-

⁶Webb, p. 19, identifies a number of factors that have caused inefficiency in government-directed work-sharing arrangements, including costs associated with additional bureaucracy, inability to capitalize on firms' technical or production advantages, duplicative production lines, and disruption caused by the need to reallocate work shares based on fluctuating exchange rates. These factors have led to an increase in overall project costs on the order of 50-150 percent. But others dispute this assessment. See Moravcsik, p. 75.

⁷This will be limited by the insistence of second-tier countries such as Italy and Spain that their firms participate in the high-technology end of product development and manufacture, even though they may be at a competitive or technological disadvantage compared with the larger, more sophisticated first-tier firms of France, Germany, and the UK.

⁸A variant of this approach is the "family of weapons" concept, when the United States and European firms develop complementary systems. The failure of the AMRAAM-ASRAAM family of weapons effort, however, casts some doubt on the viability of this approach.

tion to satisfy national defense industrial base concerns.⁹ There are a few existing examples of such competing consortia. A consortium consisting of Siemens, Thomson-CSF, Thorn-EMI, and the United States' General Electric was chosen to develop the COBRA counter-radar battery to meet the requirements of France, Germany, and the United Kingdom, in competition against two other, strictly European consortia.¹⁰ In the competition for the UK's new air-to-air missile, the UK-France team of GEC/Matra is offering its Micasraam missile in competition against the BAe/Hughes ASRAAM. Similarly, in the UK tank competition, the foreign entrants (GD's M1A2, Krauss-Maffei's Leopard 2, and GIAT's Leclerc) all teamed with UK manufacturers to ensure a domestic component to their bid.¹¹ New possibilities for this type of competition may arise in medium surface-to-air missiles with the BAe/Raytheon team (perhaps with the addition of DASA)¹² offering the Patriot against Eurosam's FSAF.

⁹As the *Financial Times* observed in an editorial, "Faced with the growing pressure on British suppliers to consolidate, the MoD has sought to maintain competition by promoting the notion of trans-European defense consortia, which would bid for work in several countries. . . . But the prospects for such ventures remain uncertain and will depend vitally on whether European governments are prepared to open their markets to them." *Financial Times*, January 25, 1990, p. 12. The Vredeling Report also advocated competing consortia as a means of honoring the political realities of *juste retour* while capturing some of the benefits of competition. *Towards a Stronger Europe*, Vol. 1, p. 7.

Moravcsik, p. 76, suggests that the competing consortia approach works best "where each European government is willing to finance more than one firm or design team." But, as the BAe/Hughes ASRAAM vs. GEC/Matra MICA competition shows, competing consortia based on complementary alliance does not require competing firms from the same sector in each country to achieve the politically required degree of *juste retour*.

¹⁰*Jane's Radar Systems*, p. 83. In February 1990, the consortium received an initial \$170 million contract. It is noteworthy that the three consortia were not fully competitive; Thomson-CSF was the French partner for all three proposals.

¹¹An interesting example of competing consortia (albeit in a small program) is the field vying for the joint French-German-UK requirement for an off-route mine. The common military requirement was developed through NATO, and development cooperation was agreed upon in an MOU finalized in 1989, with France as the lead nation and the government agency Direction des Armements Terrestres (part of DGA) the executive agent. Four consortia responded to the request for proposals: Aerospatiale (lead-France) and MBB (Germany), with small British subcontractors; GIAT (lead-France), Nobel and Honeywell (FRG), and Hunting (UK); Matra-Manurhin Defense (lead-France), Serat (France), BAe (UK), and Rheinmetall (FRG); and TRT (lead-France, now part of Thomson), Diehl (FRG), and Plessey (UK). The first two consortia passed the initial test/validation. See Michel Coisplet, "Stopping the Tank—A European Project," *NATO's Sixteen Nations*, November 1990, pp. 36–39; *Le Figaro*, November 8, 1990.

¹²Raytheon and DASA have formed a joint venture for programs on existing and future surface-to-air missiles. *Aviation Week and Space Technology*, July 1, 1991, p. 25.

These examples demonstrate the value of a transatlantic dimension to the viability of the competing consortia approach. A transatlantic tie might prove particularly effective when there are two competing U.S. manufacturers looking for international outlets for their products—the GE/SNECMA vs. Pratt-Whitney/MTU competition the clearest case in point. In rarer cases, this approach will succeed when the European firm has a specific technology or capability absent in the United States.¹³

The success of this approach depends on whether Europeans are willing to share some of their market with U.S. firms, and the parallel acceptance by U.S. government and industry of an at least partially open U.S. market.¹⁴ But this effort faces important barriers.

There are many in Europe who believe that Europe must protect its economic and political interests by limiting the larger U.S. manufacturers' access to Europe. Their view is colored by a belief that the United States already practices substantial protectionism.¹⁵ Henri Matre of Aerospatiale has called for a "European preference" in weapons acquisition, to be accompanied by negotiated rules of reciprocity between the United States and Europe. "As long as the U.S. has a preference for U.S. products, we should have a preference for European products in Europe."¹⁶ Europeans believe that U.S. firms' inherent competitive advantages, including a long history of a protected market affording significant scale economies and generous government R&D support, would monopolize European demand if the European market were suddenly open to free transatlantic competition.¹⁷ This view is most prevalent in the larger European nations; many of the smaller countries already depend heavily on U.S.-designed equipment. But even the poorer countries resist off-the-shelf

¹³The Matra/Westinghouse collaboration is a case in point.

¹⁴This happened in the case of GE/SNECMA; their joint venture CFM won the contract for re-engining the KC-135.

¹⁵*Le Monde*, June 18, 1990; *Le Figaro*, June 11, 1990.

¹⁶*Financial Times*, September 5, 1990; *Armed Forces Journal International*, October 1990, p. 42. Matre has made other comments in this vein: "The European arms market is open to the United States. U.S. and European competition is played off against each other. This is not the case in the U.S.A." *Jane's Defence Weekly*, September 11, 1990, p. 486. He has also suggested that the United States would not open its market to the Europeans until Europe readdressed the imbalance in two-way trade (which he frequently describes as "7:1") by establishing a Europe-wide market with a European preference. *Le Monde*, June 18, 1990. "Our industry forces cooperation—European cooperation first of all." *Armed Forces Journal International*, October 1990, p. 42.

¹⁷Moravcsik, p. 73.

purchases of U.S. equipment, preferring coproduction to build national industrial base.

Many Americans fear that European defense industrial consolidation, combined with declining defense budgets, will in fact lead to a strong preference to "buy European." Robert O'Rourke, a vice president for international activities at Hughes, recently observed that "the conventional thinking today is that the European defense market is going to become more restrictive to U.S. companies operating from back in the United States." Gene Harwell, a Texas Instruments vice president, stated that "the market in Europe is going to be increasingly fenced for the Europeans. It will not be an obvious fence but an invisible curtain. . . . The Europeans will be careful not to try to raise protectionist issues." To overcome this barrier, Harwell said, the most common strategy pursued by U.S. firms is teaming. "In a national competition, you cannot go in with any reasonable expectation of beating the national champion. The answer is to have European partners and joint venture relationships."¹⁸ But Americans disagree over whether to focus on project-by-project links or broader strategic alliances. Many believe that strategic alliances are preferable because building transatlantic relationships requires investing too much effort for just a single collaboration. Most also recognize that to get access to the European market, U.S. firms will have to share some of their domestic business.

Some Europeans are skeptical about partnerships between U.S. and European firms. Rolf Roesler, U.S. marketing director for Siemens defense electronics, has suggested that by the end of 1991, most European firms would have all their teaming arrangements in place—with other Europeans.¹⁹ He also argues that cultural and business style factors will lead to Europe-only arrangements. "The European countries do not need to tout a 'Fortress Europe.' . . . To a certain degree, it could establish itself by means of practical and daily cooperation."²⁰

Competition for export sales has intensified in recent years, as demand dropped with the end of the Iran-Iraq war, financial constraints in developing countries caused by declining oil revenues and increasing debt, and growing insistence on offsets or coproduction. The

¹⁸*Defense News*, January 22, 1990, p. 17.

¹⁹A U.S. industry official, Hughes president D. Kenneth Richardson, has expressed concern over how open the European consortia will be, criticizing the "exclusiveness" of many of them. *Aerospac Daily*, November 29, 1990, pp. 346-347.

²⁰*Armed Forces Journal International*, September 1989, p. 50.

number of competitors has risen, not only in NATO, but also in Israel, Brazil, South Korea, and China. Europeans fear that the United States will take advantage of its role in the Gulf to lock up Middle Eastern markets. "The United States' crucial role in the Gulf War will give American exporters a trump card for the next large Middle East arms sales."²¹

BREAKING THE DEADLOCK: AN APPROACH TO ENHANCING TRANSATLANTIC COLLABORATION

Most Europeans contend, at least publicly, that strengthening the European market is consistent with improved transatlantic ties. The director of the French DGA, Yves Sillard, observed that "a stronger European industry will be a stronger pillar for the alliance and will also be able to speak from a stronger position with its U.S. counterparts. It's entirely wrong, I think, to imagine that this reinforcement of European industry is aimed against U.S. industry; it is a necessity per se, and will create more favorable conditions for joint programs between Europe and the United States."²² Yet each side is reluctant to open its own market first, fearing that the other will take advantage without reciprocating. Many Europeans, such as German procurement chief Wolfgang Ruppelt, believe that there must be further integration of the European market before there can be improved transatlantic collaboration and more open trade. This view has been echoed in industry: "Before we put our own European house in order, it will be difficult to improve fundamentally our transatlantic cooperation."²³ Ruppelt has criticized what he sees as "the unabated

²¹*Le Monde*, February 1, 1991, p. 21. U.S. plans to sell some \$18 billion in military equipment to Middle East and Gulf states and a recent U.S. Administration proposal to allow the Export-Import Bank to guarantee up to \$1 billion in loans for arms purchases to NATO, Japan, Israel, Australia, and other countries (if the president determines it is in the national interest) have heightened European concerns. Aerospatiale recently criticized U.S. Ex-Im loan guarantees for Sikorsky's proposed Blackhawk sale to Turkey, a competition in which Aerospatiale is offering the Super Puma without government financial support. *Defense News*, May 13, 1991, p. 4. The future of the Administration's proposal is uncertain, given strong congressional opposition and lukewarm industry support.

²²*Defense News*, October 16, 1989, p. 94. Sir Peter Levene has expressed similar sentiments: "What could be more shortsighted than to break down—with all the effort it will require—barriers of national protection in Europe, only to erect still more damaging barriers to the rest of the world? The IEPG nations share a common concern to avoid measures which might be construed as protectionist on either side of the Atlantic." *NATO's Sixteen Nations*, December 1989, p. 86.

²³P.G. Willekens, chairman of the Belgian Defense Industry Group, in *Defense News*, February 4, 1991, p. 45. This was also a major theme in the IEPG's Vredeling Report: "There will be many practical benefits if Europe's defense industries can organize themselves to remain strong against the growing competition. With such au-

American trend toward more trade restrictions which are frequently interlinked with mobilization base demands. The problem is not so much one of erecting barriers around Europe to keep the United States out; what is rather more critical is the reverse problem: opening the U.S. market to European industry."²⁴

One approach to promoting transatlantic collaboration (advocated by U.S. NATO ambassador Taft) is the idea of a transatlantic defense GATT, to eliminate national preference and other trade barriers in defense procurement among NATO countries.²⁵ Although this approach appears to offer considerable economic benefits in theory, in practice it will prove extremely difficult to implement, at least in its purest form. Given U.S. firms' advantage in size and technology, most Europeans believe that European firms would be at a hopeless disadvantage in a straight-up competition. U.S. domination would have profound consequences for the European defense industrial base, technological competitiveness in both defense and civil sectors, balance of payments, and industrial employment. Moreover, as demonstrated by GATT itself and the continuing transatlantic controversy over subsidized export sales of aircraft, it is difficult to develop unambiguous criteria for "fair competition," particularly where the determinants are subjective, such as for specialized military procurement. For these reasons, European governments are unlikely to accept truly open transatlantic defense competition.

Short of a defense GATT, there are several ways that Europeans and the United States might promote access to each other's markets. If U.S. firms conclude that the potential value of European sales outweighs the cost of sharing access to the hitherto highly national U.S. market, they are more likely to develop teaming relations with Europeans and could become advocates for a less protectionist U.S. policy.²⁶ Given the relative size of the two markets and the substantial U.S. advantage in many technologies, however, the advan-

thority, Europe will be more able to cooperate in sophisticated programs with the U.S. She will be better placed to introduce European products to the U.S. market." *Towards a Stronger Europe*, p. 1.

²⁴Ruppelt, pp. 32, 36.

²⁵See Taft, pp. 14-26. Taft suggested that the process should begin by making existing barriers more transparent, then working to eliminate them.

²⁶In the words of Ambassador Taft, "What needs to be grasped is that access to the European market is worth the price of opening up our own." *Financial Times*, February 20, 1991, p. 3.

tage of such a tradeoff is not self-evident.²⁷ U.S. attitudes on this issue vary considerably. Some senior corporate officials are prepared to move toward mutually open markets, while others prefer assured demand from a closed market to open two-way transatlantic procurement.

If they wish to move toward greater transatlantic collaboration and trade, U.S. firms must overcome their reluctance to share technology. Francis Cevasco, formerly a senior DoD official in charge of transatlantic collaboration, recently stated that U.S. firms "don't want to get serious about technology sharing, but they must if the alliance is to work."²⁸ Europeans cite technology transfer restrictions and limits on third-party exports as the most serious barriers to transatlantic collaboration. Conversely, greater willingness to share U.S. technology will help promote developing transatlantic consortia, and it will offer European governments and industry a benefit that will partly balance the cost of opening their markets to U.S. firms.

Governments can play an important role in fostering transatlantic industrial ties. At a minimum, this means reducing barriers to foreign access on both sides of the Atlantic to facilitate transatlantic collaboration when firms themselves see a financial incentive.²⁹ In addition, governments could play a more active role. They could purchase more off-the-shelf (or modified off-the-shelf) equipment instead of preferring to acquire systems that meet highly specific national needs.³⁰ More government commitment to requirements harmonization (including a willingness to show flexibility in setting requirements), which would allow firms to offer a single equipment item for markets on both sides of the Atlantic, is another way to achieve this goal.

Placing greater emphasis on affordability than on state-of-the-art performance would also facilitate transatlantic trade by allowing European firms to exploit price advantages associated with additional sales of in-production equipment, a compensation for possible technological advantages held by U.S. firms.

²⁷Where Europeans have technology that U.S. firms (or the U.S. government) want, the prospects for collaboration are brightest. The Dassault Electronique/Westinghouse collaboration is a case in point.

²⁸*International Defense Review*, November 1990, p. 1286.

²⁹U.S. policy on transatlantic collaboration is analyzed in a forthcoming RAND Note by Rachel Kaganoff.

³⁰This factor was critical to the French (Thomson-CSF) participation in the U.S. Army Mobile Subscriber Equipment (MSE) program, which was a nondevelopment item (NDI) procurement.

Finally, governments could make a political commitment to favor cooperatively developed projects, even if this entailed additional costs, program delays, or modification in requirements, at least in the short term. To be successful, this would involve favoring transatlantic industry collaboration both in source selection and in long-term commitment. To some extent, this has occurred through the Nunn programs, although many in the United States question placing priority on Nunn programs at the expense of more important national efforts.³¹ The most realistic means of implementing this approach (and the one favored by U.S. industry) is to give priority to industry-initiated teaming. Industry-initiated teaming is more likely to reflect a corporate belief that the arrangement contains adequate financial rewards, a factor often missing from forced government marriages.³² This process could be enhanced by supporting transatlantic collaboration at the early research stages of system development.³³

The impetus to greater transatlantic collaboration could come from growing Japanese competition in the defense and dual-use sectors. At least one European commentator has suggested that the United States and Europe will need to collaborate to meet the Japanese technological challenge.³⁴ But this view is less widely shared in the United States, due in part to U.S. firms' skepticism about the quality of Europeans' technological contribution. This assessment could change over time, however, as European industry consolidates and its high-technology market expands (especially in dual-use technologies) and as financial support for European R&D programs grows (through the EC Framework Program, EUREKA, ESA, and others).

A forthcoming study in this project will address U.S. corporate and government attitudes toward transatlantic collaboration. For the purposes of this study, a few general observations are in order. First,

³¹Many Europeans have the opposite perspective: they believe that Congress and the DoD give a lower funding priority to Nunn and other transnational collaborative programs.

³²A senior Martin Marietta official recently expressed this view: "Industry is a better leader of cooperation development than governments are." An LTV official observed, "Industry-to-industry arrangements are better. Governments should get the hell out of the way." *International Defense Review*, November 1990, p. 1285.

³³This is the principal recommendation of the U.S. CREST-Hudson Institute report.

³⁴Henri Conze, "Prospects for Armament Industry," unpublished paper, August 22, 1990, p. 9. Although Japan's arms sales have been limited by law and practice to its own market (and to collaboration with the United States), a few Japanese firms are approaching the size of the larger U.S. and European firms. For example, Mitsubishi Heavy Industries had ¥ 364 billion in defense sales in 1989 (\$2.6 billion), and Kawasaki Heavy Industries had ¥ 175 billion (\$1.3 billion). *Economist*, February 2, 1991, p. 67.

it is clear that powerful political forces in the United States favor maintaining "buy American" preferences, to retain a strong U.S. industrial base, protect against unwanted technology transfer, and secure U.S. jobs.³⁵ Although the Administration continues to have strong advocates for a more open approach, the importance of the transatlantic dimension is not well integrated into overall acquisition and technology transfer policy. On the industry side, some firms are ignorant of, or indifferent to, opportunities for collaborating with European firms.³⁶ Others are now pursuing transatlantic collaboration and strategic alliances, although they would become even more active if changes in U.S. government policy made these relationships easier to implement.

The overall tenor of U.S.-European political, economic, and security relations will have an important but unquantifiable impact on the future of U.S.-European relationships. To the extent that ties remain close and common security interests are in the forefront, a climate for cooperation will flourish. But if the United States and Europe begin to see their security interests diverge, the likelihood of cooperation will diminish. Perhaps the most dangerous area is trade and economic relations. If U.S.-European relations move toward freer trade and more economic cooperation, industry on both sides will be more likely to collaborate in the defense and high-technology sectors. By contrast, a move toward two competing but closed trade blocs will inevitably dim the prospects for collaboration in these highly sensitive sectors.

In conclusion, it seems fair to say that the road to improved defense industrial transatlantic cooperation is rocky, but not impassable. It

³⁵In commenting on the failure to develop a relationship between Aerospatiale and Sikorsky, Aerospatiale's Jean-François Bigay reflected some of the prevailing pessimism: "It is obvious that the American armed services are not prepared to finance a development that would put profit in the hands of a European partner. Indeed, we operate under completely different economic concepts. And I am convinced that cooperation with the United States today is possible only in the field of ideas." *Aviation Magazine International*, August 15-31, 1990, p. 28. It should be noted, however, that both Westland and Agusta have licensed manufacturer agreements with U.S. helicopter firms, and MBB has become a member of the Boeing/Sikorsky team for the Army LH program. *Aviation Week and Space Technology*, September 17, 1990, p. 121.

³⁶A recent article quoted an anonymous U.S. defense industry official on the subject of U.S.-European alliances: "We don't think that anyone has anything to teach us." *International Defense Review*, November 1990, p. 1285.

will take considerable commitment from government and industry officials on both sides of the Atlantic to surmount the many hurdles and to resist the inherent political tendencies toward protectionism.

Appendix

NOTE ON METHODOLOGY

Data on military expenditures, sales, and exports are notoriously imprecise, and when one attempts to make cross-national comparisons the problems are compounded because of differences in definitions, methods of accounting, and the need to find a common unit of comparison. Frank Blackaby and Thomas Ohlson, in their essay "Military Expenditure and the Arms Trade: Problems of the Data," identified a number of the problems that arise in the efforts of the Stockholm International Peace Research Institute (SIPRI) to calculate international arms production and trade. SIPRI's data are limited to major conventional weapons and therefore exclude some subsystems and small arms. It collects data from a variety of published sources, raising problems of completeness, accuracy, and interpretation. Transactions must be valued¹ and reduced to a common unit of account, thereby raising issues of inflation (to achieve constant currency figures) and currency conversion.

SIPRI's methodology differs considerably from that used by the Arms Control and Disarmament Agency (ACDA) in its *World Military Expenditures and Arms Transfers* series, both in scope (ACDA includes electronic equipment and small arms, as well as defense industrial production equipment) and source (ACDA uses U.S. government sources for foreign arms sales, without specifying the specific source or methodology). ACDA, too, uses its own valuation method, rather than sales price. These differences can be significant: for example, ACDA gives a lower share of Third World arms sales to France, the UK, and Italy and a higher share to Germany than does SIPRI for the period 1975-1979.²

Although calculating government expenditures for defense (including procurement and R&D) is somewhat more straightforward (at least for the NATO nations discussed in this report) as a result of the availability of government budget documents, problems of comparability remain in definitions, exchange rates, and price indices. Blackaby and Ohlson note that in 1981, NATO figures for France and Germany gave military expenditures 24 percent higher than those

¹SIPRI does not use actual sales price; instead, it has created an elaborate weapons valuation algorithm that takes into account the relative capability of the equipment.

²Blackaby and Ohlson, p. 12.

reported by national sources. ACDA itself has acknowledged limitations in its data, and Webb has identified additional problems in calculating "two-way street" trade flows.³

In this report, data have been compiled from a variety of sources. Wherever possible, national sources are used (official data for government expenditures and company or industry association sources for private-sector data on sales, exports, and the like). In some cases this has been supplemented by secondary sources when national data are lacking or when there are discrepancies in the data from different sources. In a number of instances the principal figure given is the author's estimate, based on examining multiple sources, and it is identified as such.

Allocating revenue between military and civil activities poses particularly difficult problems. This report accepts companies' attribution of sales to one sector or the other. Space is treated as civil, except where there is a specific breakout of civil and military space sales.

Currency conversion is a particular problem in transnational comparisons, since relative movements (as measured in the national currency) are often masked or exaggerated when expressed in dollars by currency fluctuations unrelated to changes in the variable being examined.⁴ Yet there is no reliable purchasing power parity (PPP) standard to use for military equipment, although Eurostat does have an overall PPP index for EC countries. Values are presented in current currencies except where noted. Wherever possible, the value is given in the national currency; a dollar value is given parenthetically (based on Federal Reserve data, and IMF data for the ecu, for the year's average dollar exchange rate) to assist the reader in understanding orders of magnitude and to permit rough comparison with the United States. The impact of fluctuating exchange rates should be kept in mind: the appreciation of European currencies against the dollar in the past several years can often produce a result that is distorted in dollar terms. For example, some 15 percent of the large increase in BAe defense revenues from 1989 to 1990 is a product of the

³Webb, p. 112, and Kolodziej, "Re-Evaluating Economic and Technical Variables," p. 318, found that French national data on exports exceeded ACDA figures by 3:1 in the late 1970s; in the United Kingdom, the ratio was about 2:1.

⁴Jacques Fontanel, "A Note on the International Comparison of Military Expenditures," p. 29, identifies a number of the problems in using currency conversion to compare military expenditures, sales, etc., including the relative independence of domestic defense consumption from currency fluctuations and the impact of interest rate differentials, capital flows, and trade balances on exchange rates.

appreciation of the pound; the French arms trade surplus, which declined nearly 18 percent from 1986 to 1990 (in current francs), shows modest growth when valued in dollars based on average 1986 and 1990 exchange rates.

Much of the information in this report is derived from interviews with senior government procurement officials, NATO, EC, and WEU staff, industry representatives, and private analysts in Europe. To facilitate the candid expression of views, information is not attributed to sources by name, except where it has come from public sources.

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