

Recommendation 36: Transition from a program-centric execution model to a portfolio execution model.

Problem

The defense acquisition system (DAS) is beleaguered by a number of issues that challenge the United States ability to maintain military superiority. The following characteristics of the current DAS require immediate change:

- A compliance-heavy culture driven by fear of failure.
- A workforce belief that failures will be punished rather than celebrated, despite leadership pronouncements to take more risk and to *fail fast*.
- Until recently, a highly centralized organizational structure under which sequentially made decisions and a long *coordination* process led to unacceptable timelines, causing program delays and administrative inefficiencies.¹
- Milestone decisions that require excessive program documentation, multiple program reviews, and protracted coordination.
- Individual program-centric thinking and decision making versus mission and kill-chain-centric thinking.
- A rigid funding environment that stifles agility.
- Lack of decision authority commensurate with management responsibilities.

Background

DoD's acquisition process comprises three decision systems: the Joint Capabilities Integration and Development System (JCIDS) for identifying and validating user requirements; the Planning, Programming, Budgeting, and Execution (PPBE) System, for allocating resources and budgeting; and DAS, for developing and procuring the item. JCIDS, PPBE, and DAS—the defense acquisition Decision Support Systems (DSS)—together make up what is called *big A acquisition*, a system in which each of the three processes operates independently with separate chains of command.

Although there have been numerous acquisition reform efforts in recent decades, acquisition reforms in the 1980s that stemmed from the Goldwater–Nichols Act are most pertinent to the concerns listed above. It was among these reforms that the acquisition, requirements, and budgeting organizations were separated throughout DoD. “Goldwater–Nichols historically changed DoD acquisition by directing the establishment of the Office of the Under Secretary of Defense for Acquisition (USD[A]), and directing a similar structure of service component acquisition executives in authority over PEOs

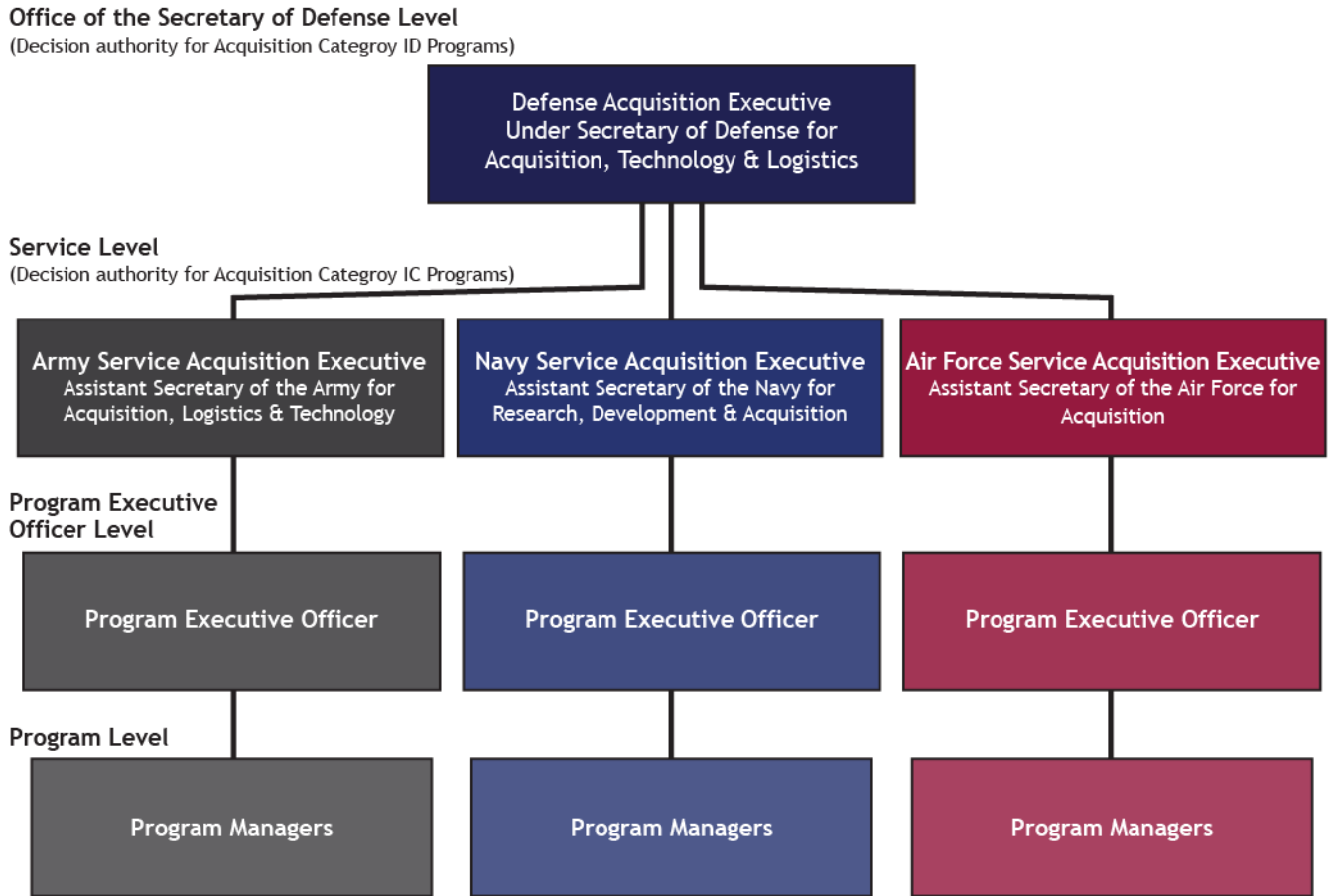
¹ GAO, *Best Practices: An Integrated Portfolio Management Approach to Weapon System Investments Could Improve DOD's Acquisition Outcomes*, GAO-07-388, March 2007, accessed November 26, 2018, <https://www.gao.gov/assets/260/258331.pdf>.

[program executive officers] and PMs [program managers].”² This reform came amidst damaging reports of overpriced spare parts and other forms of alleged waste and fraud that drew scrutiny from Congress in 1985. President Ronald Reagan appointed the Blue Ribbon Commission on Defense Management (commonly referred to as the Packard Commission) to identify issues in the defense acquisition process. Two of the key problems identified were fragmented responsibility for acquisition and no senior official at the Office of the Secretary of Defense (OSD) level to provide acquisition system supervision. The commission recommended establishing a USD(A), a comparable senior position for each of the Military Services, and PEOs to resolve gaps in major weapons systems acquisition. A key attribute of this organization structure was an acquisition chain of command through the Service Civilian Secretaries, not the uniformed military leadership, as illustrated in Figure 2-1 below.

The weapon systems organization and management framework established by Goldwater–Nichols is program centric: PMs report through PEOs to Service acquisition executives (SAEs) and then the defense acquisition executive (DAE) as required. The milestone decision authority (MDA) for major programs, typically the DAE or SAE, makes the key acquisition decisions for the program. These decisions include the overall strategy, contracting and acquisition approaches, entrance and exit criteria for key milestones, and the milestone decision itself. PEOs are often responsible for overseeing execution of multiple acquisition programs and can have acquisition authorities over smaller programs as delegated from the DAE–SAE chain of command. The PEO, as the executive manager of assigned programs, typically oversees one or more PMs. PMs are responsible for weapons systems development, production, and sometimes lifecycle sustainment. Classic program performance metrics are cost, schedule, and performance results as compared to the approved acquisition program baseline (APB).

² Dale P. Bond, Scott M. Davis, and Aaron D. Pearsall, *The Goldwater–Nichols Act of 1986: 30 Years of Acquisition Reform*, Naval Postgraduate School, MBA Professional Report, December 2016, accessed September 27, 2018, https://calhoun.nps.edu/bitstream/handle/10945/51649/16Dec_Bond_Davis_Pearsall.pdf?sequence=1&isAllowed=y.

Figure 2-1. Acquisition Decision-Making Structure



Discussion

The Section 809 Panel researched major defense acquisition programs and met with PEOs, PMs, and program personnel from programs that were identified as being successful. Key enablers common to these successful programs include the following:

- Requirements that are well developed and understood to the user and acquisition communities.
- Continuous and open communication across requirements, acquisition, and programming communities.
- Direct access to decision makers for timely decisions that cross the three communities.
- A tie to the warfighting mission and delivery to an operational cadence.
- Social rewards for risk taking and delivering *product-mission fit*, with all functionals—including ideally colocated contracting officers and supporting program management—believing they are accountable to program success.
- A culture of trust.

Lacking of trust continues to exist across the system in areas such as the following:

- PMs must navigate through an inefficient and time-consuming process to reach key acquisition decision makers.
- Delays in program decision making are costly, ineffective, and add undue risk and schedule to the program and ultimately the warfighter.
- Valuable talent and resources are wasted.
- Each individual in the coordination chain to the MDA has the potential to delay advancement of the signature package in return for some changes in the acquisition plan. Those individuals are not accountable for the program success.

Typically, overall requirements generation originates with the Combatant Commanders (CCDRs) in conjunction with the Military Service Chiefs. The process is to identify capability gaps that correlate to operational requirements and enter the requirements validation process. Ideally, candidate solutions are postulated, analyzed, and evaluated by OSD, the Joint Chiefs of Staff (JCS), and the Military Services and iterated with the acquisition community. In rare cases, requirements are monetized so decision makers can choose how much they want to spend for what capability. This ideal chain of events rarely happens because of the degree of collaboration and continuous work needed to get the requirement right. Further effort and collaboration is needed to assure the funding profile, which is owned by the PPBE community, is correct. If modifying a current system or developing a new system is required to meet a new threat, resources and requirements are passed to the acquisition system. Too often the acquisition community is brought in—after all the requirements and funding decisions have been made—to execute what has already been planned by the other two communities. Additionally, there is a need to ensure innovative capabilities for which there is no current requirement.

Because the PEO and PM must execute to requirements and budgets established outside their control, their ability to optimize efficiencies or interoperability across programs or a strategic enterprise vision is extremely limited. Although this process may have sufficed during previous eras of slower technological and threat advances, it is hampering acquisition agility today. As an extreme example, in modern iterative software development (such as Agile or DevOps) there are constant trade-offs on requirements, budget, and priorities per iteration (sometimes called sprints), as often as every 2 weeks. Such modern development techniques are extremely difficult to accomplish across the three separate authority areas, each of which has its own chain of command and decision-making processes.

The table below shows the limits per type of appropriation, which illustrate the current lack of budgetary flexibility allowed to the acquisition chain. The PEO is limited to a BTR of \$10 million or 20 percent (whichever is less) of RDT&E, or \$20 million or 20 percent (whichever is less) of Procurement funding. Anything above these thresholds requires congressional approval as ATR. Major defense acquisition program (MDAP) designation is baselined at \$480 million in FY 2014 dollars in RDT&E and \$2.79 billion in FY 2014 dollars in Procurement. BTR authority provides less than 2 percent flexibility for program execution. The current changes in operations, threats, and priorities warrant faster and greater fund shifting to optimize investments.

Table 2-1. Appropriation Limits

	PEO Authority	Congressional Approval	MDAP Baseline	% of MDAP Baseline
Appropriation	Below Threshold Reprogramming (BTR)	Above Threshold Reprogramming (ATR)		
Research, Development, Test and Evaluation (RDT&E)	\$10M or 20% (whichever is less)	Above \$10M or 20%	\$480M	2.0%
Procurement	\$20M or 20% (whichever is less)	Above \$20M or 20%	\$2,790M	0.7%

Congress recognized this overly centralized acquisition execution in DoD. In Section 825 of the FY 2016 NDAA, it designated MDAPs be managed at the SAE level or lower unless otherwise directed by the Secretary of Defense. SAEs have further delegated milestone decision authority (MDA) of Acquisition Category (ACAT) II Programs and below to PEOs. On the requirements, Section 802 of the FY 2016 NDAA designated Military Service Chiefs responsible for requirements. Despite this progress, more is required to increase agility, responsiveness, and efficiency within defense acquisition, specifically with requirements and budget. Both FY 2016 NDAA sections underscore the utility of moving to a portfolio approach.

Transitioning defense acquisition from a program-centric model to a portfolio model will enable the agile, flexible, and decentralized organization DoD needs. To reduce decision delay time, unnecessary workarounds, and inefficiencies seen in the current system, PAEs would be delegated a substantial level of acquisition, requirements, and budget decision authority. PAEs’ ability to integrate, manage, and execute programs within the portfolio would provide the flexibility, agility, and increased lethality required for responding to evolving threats and technology. The PAE would optimize cost reduction and schedule effectiveness and manage risks and opportunities, such as introduction of new technologies across the portfolio to maximize mission impact. To capitalize on the benefits of portfolio management, DAS must transition the current PEO role to a PAE role. The PAE role would replace the current Title 10 definition of the PEO with expanded roles and responsibilities as discussed below.

The PAE would be responsible for iteratively delivering capabilities based on technological maturity, cost, schedule, system performance, risks, and threat assessments. As seen in the success of the Air Force Rapid Capabilities Office, the PAE should have the authority to shape system requirements below key performance parameters (KPPs) within the portfolio to maximize the agility and flexibility required. Requirements organizations and operational commands currently invest substantial time on system requirements documents and collaboration with program offices with varying levels of success. Increased integration of the operational and acquisition communities is required to deliver mission capabilities with greater speed and agility.

One possible approach would be to apply mission engineering to map system capabilities to mission needs at the capability portfolio level. Mission engineering—which combines the structure of systems engineering with the tactical insights of operational planning—could provide a basis for the following:

- Assessing portfolio contributions to the delivery of capabilities against assigned kill chains and threads.
- Understanding the effects of investment decisions on operational priorities.
- Assessing the fighting capability of existing and planned weapon systems.
- Identifying capability gaps in light of existing and planned acquisitions.
- Providing a common mission picture to senior leaders and customer communities.

Although programs would still comply with JCIDS requirements documentation (approved at the Military Service level), the Military Services and Defense Agencies should develop a set of capstone requirements and related materials for each execution portfolio. These requirements would guide the iterative delivery of an integrated suite of capabilities to maximize operational impact. (See Recommendation 38).

The Military Service headquarters leadership, operational commands, and Joint Staff should collaborate to provide each execution portfolio with an integrated set of capstone requirements and threat assessments from the intelligence community. This approach would focus the Joint Staff and Military Service Chiefs on the strategic operational requirements, while enabling portfolios to manage speed and agility of capability requirements for specific systems/programs at lower levels. The PAE would require an embedded, empowered operational representative. This person would provide insight on operations and threats to shape portfolio priorities and capability roadmaps and provide rapid feedback and connections with operational end users. The capstone requirements document would provide flexibility for PAE's to make appropriate trade-offs between program capabilities and program cost, schedule, and performance. In cases for which substantial program changes require higher-level approval, Configuration Steering Boards should work with the PAE to ensure expedited decisions.

One of the biggest challenges to implementing a portfolio structure is allocation of program budgets. Most procurement programs today are funded and managed through budget line items, yet research and development (R&D) programs are funded and managed through accounts called program elements (PEs). A single weapon system is likely to include multiple budget items and PEs. The multiple programs included in the portfolio of a PAE could, unless modified, include hundreds of line items and PEs. Reallocating funds between budget items and PEs requires approvals by senior DoD officials (for BTR) and by Congress (for ATR). Such approvals can be time-consuming to obtain (and in some cases are denied), limiting the ability of PEOs and PMs to respond to changes in available technology and other portfolio and program developments.

In several cases, DoD has successfully developed and procured a system of systems within a single line item or PE. The Evolved Expendable Launch Vehicle (EELV) program, for example, provides for the

development of a range of domestic space launch systems and upgrades within a single PE. As another example, the Family of Medium Tactical Vehicles (FMTV) program provides for the procurement of a series of trucks and trailers that vary by mission and payload within a single line item. The budget structures of the missile defense program and the Stryker family of vehicles include examples of similarly broad line items and PEs. These more broadly structured budget items and PEs provide portfolio managers more flexible budgeting and enable them to make responsible decisions to move money within their portfolios in an agile manner. In these cases, transparency and accountability have been maintained by accounting for expenditures within the line item or PE through subaccounts—known variously as project codes, end items, cost elements, or budget program activity codes.

Congress and DoD should work together to increase acquisition system agility by building on these examples to provide greater funding flexibility at the portfolio level. The Military Services should review and rationalize the line item and PE structure for each major portfolio. This review should: (a) address cases in which programs or systems have been subdivided into multiple line items or PEs, making them more difficult to manage and (b) identify cases in which multiple programs or systems intended to provide a common capability could be combined into a single line item or PE (in the manner of the EELV or FMTV programs). Enhanced BTR authority could provide additional resource flexibility. Several proposed funding flexibility initiatives are described elsewhere in this report.

A pilot program should be established under which an entire portfolio in each Military Service would be funded under a single line item or PE. It is unlikely that Congress would be willing to grant such resource flexibility for a portfolio like the Navy PEO for Ships or the Army PEO for Ground Combat Systems, which includes multiple, highly visible major weapon systems. DoD may be able to build trust with Congress, however, if it shows that it can responsibly manage less visible portfolios. Examples of such portfolios include the portfolio of the Army PEO for Simulation, Training and Instrumentation or the Air Force PEO for Command, Control, Communications, Intelligence and Networks.

The PAE should be delegated MDA authority whenever appropriate. The PAE should have an assigned chief of contracting office (COCO) (see Recommendation 38), along with other senior functional staff with authority to allow the PAE to manage cost, schedule, and performance within the portfolio. As addressed more fully in Recommendation 41, the PAE should be responsible for sustainment management through sustainment program baselines (SPBs) managed by the PMs and product support managers (PSMs) throughout the process.

PAEs should have the authority, autonomy, and accountability to iteratively deliver an integrated suite of capabilities through empowered portfolio management. Enterprise capability portfolio managers should also be established and paired with existing functional capability boards (FCBs), at the OSD level. This shift would ensure an enterprise perspective on capability trade-offs and provide for the integration of requirements, acquisition, and resource decisions throughout the organization.

Conclusions

Transitioning defense acquisition from a program-centric model to a portfolio model will enable the agile, flexible, and decentralized organization DoD needs. To reduce decision delay time and unnecessary workarounds and inefficiencies seen in the current system, the PAE would be empowered

for an initial set of portfolios.³ As Congress and DoD gain trust in a more flexible resource allocation system, DoD should be able to delegate more and more authority to PAEs, enabling them to optimize acquisition outcomes.

PMs focus on executing the cost, schedule, and technical performance of the acquisition program; PAEs must look beyond the current state. The PAE must continually assess emerging threats, operational effectiveness, and the portfolio's capabilities and harness opportunities evolving from technologies and innovation. A key enabler of the portfolio management concept will be the requirement to develop and maintain a portfolio capability and technology roadmap as part of the 20-year portfolio strategy under Recommendation 38.

The PAE responsibilities should include the following:

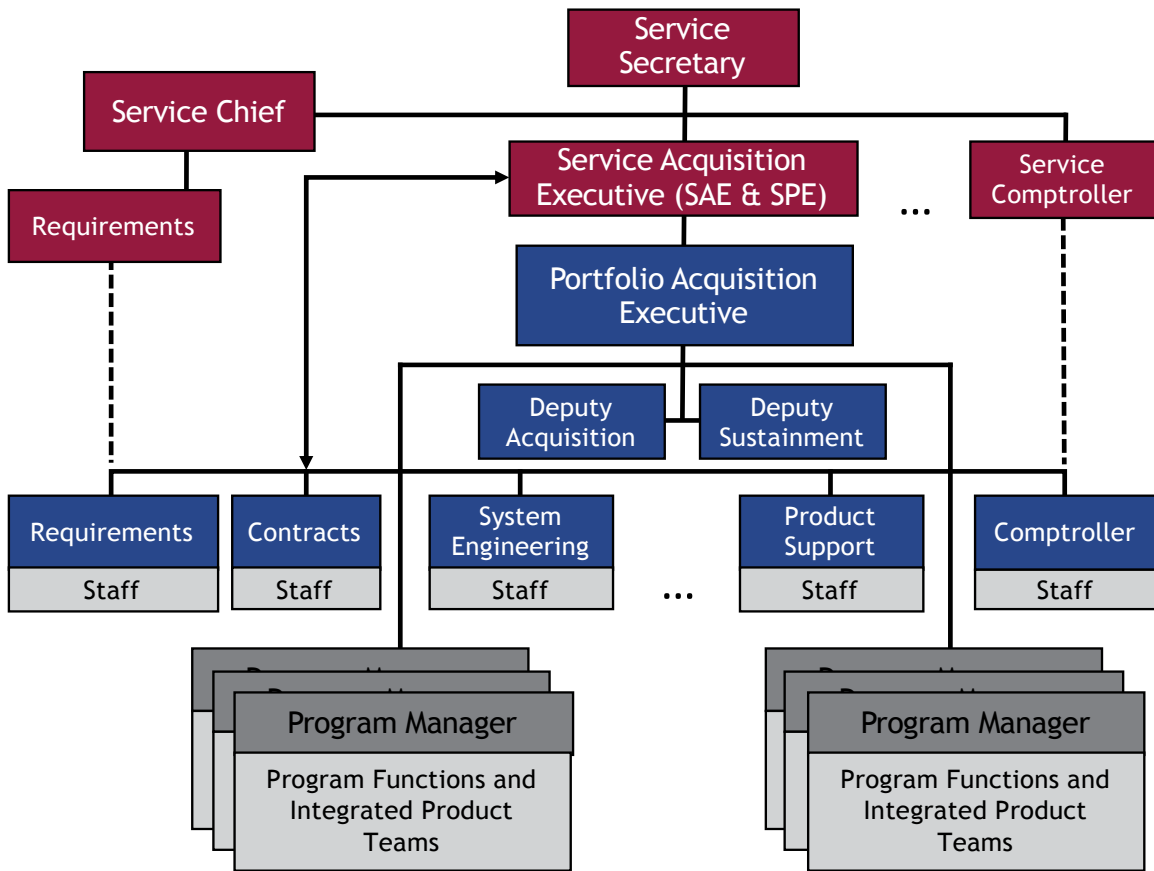
- Developing and maintaining portfolio roadmaps, including mission engineering plans, to strategically plan current and future program development and current program execution.
- Coordinating with Enterprise Capability Portfolio Managers to ensure a cross-cutting view of capability trade-offs.
- Ensuring interoperability is maintained with the enterprise capability architecture.
- Managing the full lifecycle, including acquisition and sustainment management via APBs and SPBs.
- Working with the science and technology (S&T) and R&D communities to prototype, experiment, and demonstrate solutions to shape new programs, increments, and capabilities.
- Shaping lower level requirements based on technology, cost, schedule, threat, and risk trade-offs, in active collaboration with key stakeholders within a Capstone Requirements Document.
- Managing and prioritizing resources across programs within the portfolio with budget transfer authority and other funding flexibility initiatives.

The PAE structure, notionally depicted in Figure 2-3, would enable the following:

- Increased responsiveness and mission impact.
- Greater system interoperability and system-of-systems designs/architectures.
- Increased cost efficiency.
- Reduced review and decision timelines.
- Reduced program documentation and reviews outside of the portfolio.
- Reduced reporting requirements to DAE, SAE, and Congress.

³ Mike Janiga and Pete Modigliani, "Think Portfolios, Not Programs," *Defense Acquisition Research Journal*, November–December 2014, accessed November 26, 2018, <http://dau.dodlive.mil/2014/12/19/think-portfolios-not-programs/#content>.

Figure 2-3. Portfolio Acquisition Executive (Notional)



SPE is Senior Procurement Executive

In a complex, integrated environment, the DAS can no longer rely on a structure based on individual systems but rather should embrace a capability-focused, portfolio-centric structure modeled on the commercial sector. Managing requirements, budgets, and staffs at the portfolio level would enable dynamic allocation to high-priority programs. Portfolio strategies, roadmaps, and architectures would guide program development.⁴ Establishing a management of portfolio capabilities would allow the Military Services to execute in a *speed to the fleet* environment in which requirements, resources, and acquisition decisions are made at the portfolio level instead of the individual program-level. Implementing a portfolio approach would require a substantial shift in authority and a shift in the culture from fear and mistrust to trust and empowerment.

To transition from a program-centric execution model to a portfolio execution model the following should take place:

- Establish the position of a portfolio acquisition executive (PAE) to manage portfolio execution. Title 10 change is required to enable PAEs to have enhanced responsibilities and authorities for optimal execution and integration of requirements, acquisition, and budgets to deliver mission

⁴ Ibid.

capabilities to warfighters. PAEs should have authority, autonomy, and accountability to iteratively deliver an integrated suite of capabilities through empowered portfolio management.

- Rationalize budget line item and PE structure within acquisition portfolios to maximize resource flexibility and responsiveness. Establish a pilot program under which each Military Service would designate an acquisition portfolio to be managed under a single line item or PE.
- Identify requirements at the portfolio level in a capstone requirements document.

Implementation

Legislative Branch

Note: Legislative implementation here are identified as subrecommendations to allow for better reference to them in the draft legislation text in the Implementation Details section that follows.

- Subrec. A: Direct DoD to establish a PAE structure using a portfolio-centric approach that integrates requirements, PPBE, and acquisition.
- Subrec. B: Direct DoD to conduct a comprehensive review of the existing budget line item and program element structure for acquisition programs, with the objective of (a) addressing cases in which programs or systems have been subdivided into multiple line items or PEs, making them more difficult to manage and (b) identifying cases in which multiple programs or systems intended to provide a common capability could be combined into a single line item or PE.
- Subrec. C: Authorize DoD to establish a pilot program, under which one acquisition portfolio for each Military Service would be managed under a single budget line item or PE, providing the portfolio manager with flexibility to move money in response to changes in technology and other program developments.

Executive Branch

- Revise procurement line items and R&D PEs in accordance with the findings of the comprehensive review; develop and submit new budget and program documents to Congress in accordance with the revised line item and PE structure.
- Identify acquisition portfolios in each Military Service to be managed under a single line item or PE, and submit to Congress for approval. The PAE responsibilities will include the following:
 - Direct development and maintenance of portfolio roadmaps, including mission engineering plans, to strategically plan current and future program development and current program execution.
 - Enable coordinating between execution and enterprise capability portfolio managers to ensure a cross-cutting view of capability trade-offs.
 - Ensure interoperability is maintained with the enterprise capability architecture.
 - Manage the full lifecycle, including acquisition and sustainment management via APBs and SPBs.

- Work with the S&T and R&D communities to prototype, experiment, and demonstrate solutions to shape new programs, increments, and capabilities;
 - Shape lower-level requirements based on technology, cost, schedule, threat, and risk trade-offs, in active collaboration with key stakeholders within a Capstone Requirements Document.
 - Manage and prioritize resources across programs within the portfolio
 - Implement process changes with empowered portfolio management experience
 - Reduce review and decision timelines.
 - Reduce documentation and reviews outside of the portfolio.
 - Reduce reporting requirements.
- Incorporate the above recommendations in a revision to DoDD 5000.01, The Defense Acquisition System and Operating Instructions. A revised DoDD 5000.01 has been developed and is attached in the Implementation Details for this section.

Note: Explanatory report language and draft legislative and regulatory text can be found in the Implementation Details subsection at the end of Section 2.

Implications for Other Agencies

- There are no cross-agency implications for this recommendation.

Recommendation 37: Implement a defensewide capability portfolio framework that provides an enterprise view of existing and planned capability, to ensure delivery of integrated and innovative solutions to meet strategic objectives.

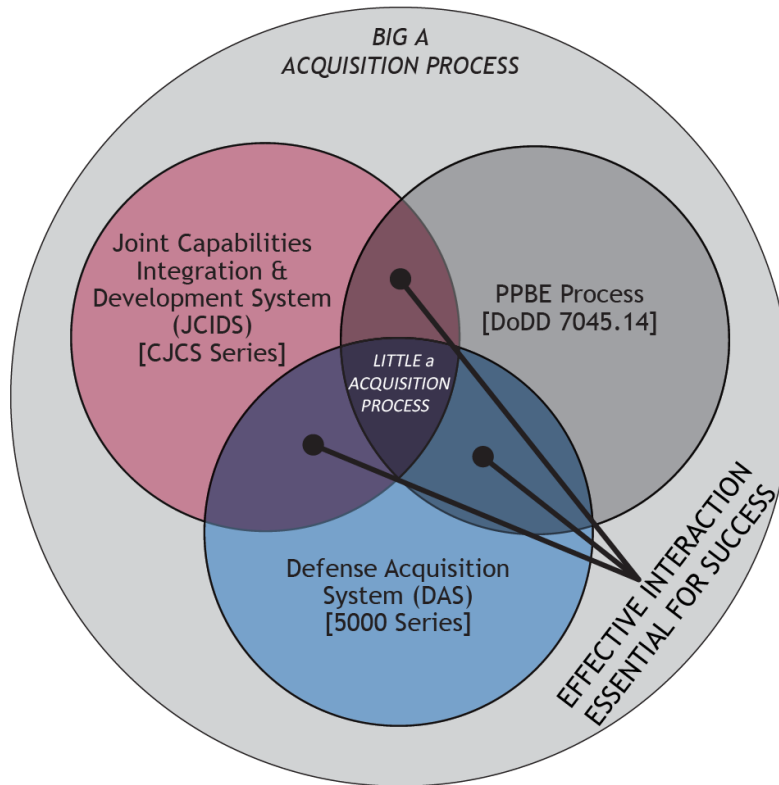
Problem

DoD's separate requirements, budgets, and acquisition decision-making processes fail to enable an enterprisewide view of existing and planned capabilities across Military Services and Defense Agencies to support timely and informed resource allocation decisions. The disjointed systems that make up the defense acquisition DSS (*big A acquisition* depicted in Figure 2-4), is one of the major inhibitors to achieving timeliness, flexibility, agility, and innovation.⁵ The second major inhibitor is lack of a DoD-wide capability view and awareness to inform resource allocation decisions at all levels.

The friction and lack of connectivity among the three systems can impede rapid response to priority needs and timely delivery of material solutions.

⁵ Section 809 Panel, *Report of the Advisory Panel on Streamlining and Codifying Acquisition Regulations: Volume 2 of 3*, 30–43 (2018).

Figure 2-4. Defense Acquisition Decision Support Systems (DSS – Big A Acquisition)



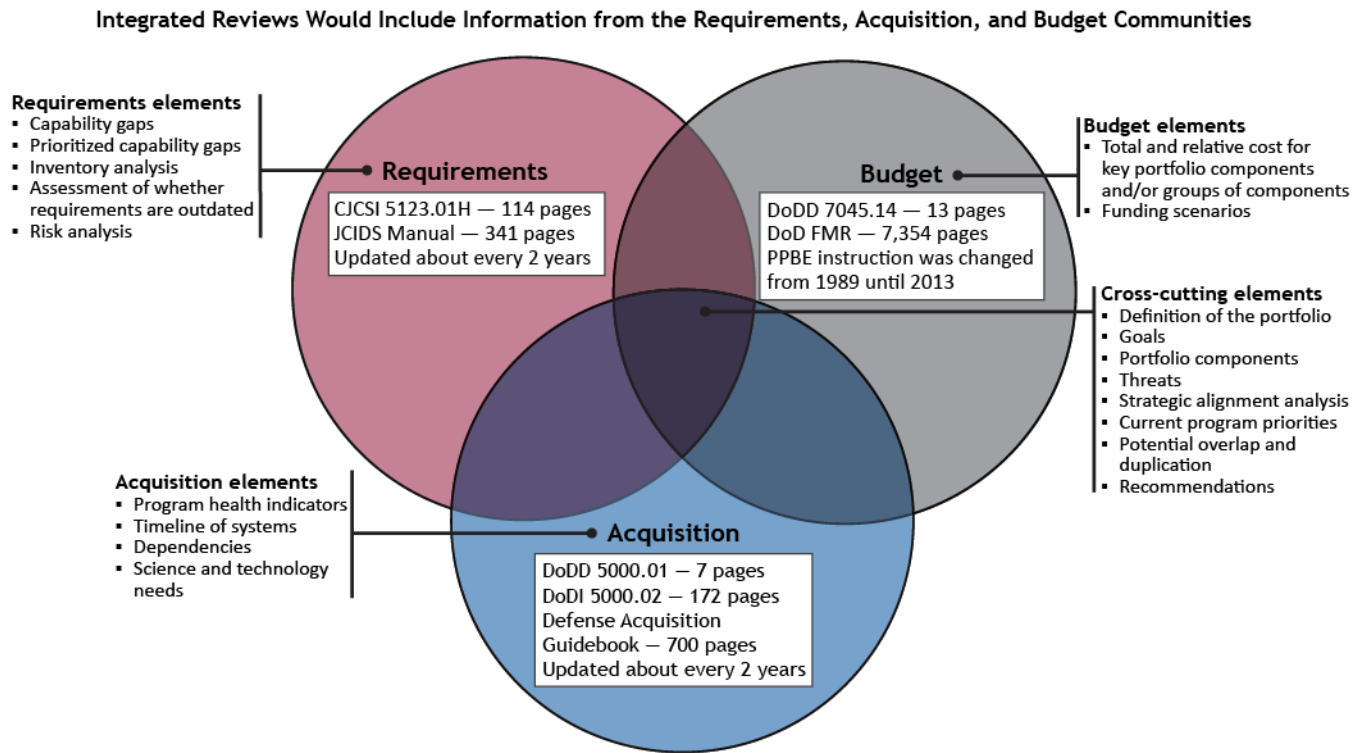
Background

DSS consists of three interrelated systems, with extensive, complex, and centralized decision-making processes driven by different timelines and system owners (see Figure 1-5).⁶

- The requirements system, known at the enterprise level as JCIDS, is administered by the Joint Staff and governed by the Chairman of the JCS Instruction (CJCSI) 5123.01H.
- The resourcing system, known as the PPBE system, is administered by the Director of Cost Assessment and Program Evaluation (D/CAPE) and the DoD Comptroller, and governed by DoDD 7045.14.
- DAS, is administered by acquisition personnel pursuant to guidance promulgated by the USD[A&S], including DoDD 5000.01 and DoDI 5000.02.

⁶ Ibid.

Figure 2-5. Description and Guidance for the DSS



Linkages between the DSS sub-systems are not sufficiently defined to enable the success of acquisition programs

Each of these systems is initiated by inputs at the Military Services working level and includes a series of hierarchical reviews at the Military Service and enterprise levels. The senior enterprise-level decision-making body for requirements is the Joint Requirements Oversight Council (JROC), and for resources is the Deputy Secretary’s Management Action Group (DMAG). Before the devolution of acquisition authority over the last 2 years, the Defense Acquisition Board (DAB) and the Under Secretary of Defense for Acquisition, Technology, and Logistics (USD(AT&L)) played parallel roles in the acquisition decision-making process.

The initiation and progress of an MDAP require successful navigation of all three systems. For example, an MDAP cannot be initiated without the development of an initial capabilities document (ICD) through the requirements process, an MDA through the acquisition process, and funding delivery through the PPBE process. Similarly, a substantial change in requirements for an ongoing program is likely to require separate approvals through the requirements chain, the resourcing chain, and the acquisition chain.

For DSS to be responsive, the individual PM must coordinate and synchronize the activities to deliver warfighter capabilities. Because these processes are stove-piped and have separate decision makers and timelines, they are often out of synch. The result can be substantial delays and even stop-go-stop sequences based on inconsistent decisions that inhibit rapid response to priority needs and timely delivery of material solutions, as evidenced by late capability deliveries, cost overruns, and deteriorating technical dominance.

DoD has tried to coordinate the three processes using integrated product teams and to provide for cross-functional membership on decision-making entities (for example, the designation of the Under Secretary of Defense (AT&L) (USD[AT&L]) as a statutory advisor to JROC and the designation of the Vice Chairman of the JCS (VCJCS) as a DAB member. Because requirements, budget, and acquisition officials exert the greatest control when they stay within their own stovepipes, efforts to coordinate the three processes have been less successful than hoped, and decision-making has remained largely a sequential process.

In another effort to overcome DoD's stove-piped decision-making structure and better coordinate the three acquisition components, DoDD 7045.20 (promulgated in 2008), called for the establishment of capability portfolio managers (CPMs) with military and civilian coleads. The directive expressly provided that CPMs "have no independent decision-making authority, shall not infringe on any existing statutory or regulatory authorities, and shall work within established coordination processes." Because of these limitations, the portfolio approach quickly proved to be unenforceable, and although the directive is still in effect, it has had no discernible effect on the defense acquisition DSS processes.

The utility and power of portfolio management constructs has been used to help inform investment decision makers in the Army's PEO Ground Combat Systems (GCS). PEO GCS, teaming with Sandia National Laboratories, adopted a portfolio management approach to optimally invest in ground combat modernization over a 25- to 35-year timeframe. Through tightly knit, cross-functional stakeholder collaboration and use of decision analysis tools (Capability Portfolio Analysis Tool [CPAT]), the team was able to provide decision makers with key alternatives and scenarios to "help shape decisions to continue modernization of the \$10 [billion] Stryker family of vehicles (originally slated for cancellation) and to strategically reallocate over \$20 [billion] to existing modernization programs by not pursuing the Ground Combat Vehicle program as originally envisioned."⁷ Ultimately, the Army estimated the decisions amounted to more than \$5 billion in cost avoidance and 30 percent greater fleet performance per dollar spent.⁸

In the *Volume 2 Report*, the Section 809 Panel concluded that structural change—from program-centric management to a more robust, multitiered portfolio management system at the execution and enterprise level—is needed to reduce the current organization's time and information challenges created by the centralized command structure and provide greater agility in the requirements, resourcing, and acquisition processes. There are four key elements of this proposed shift to a portfolio management framework:

- Replacing the traditional PEO role with that of the PAE, as described earlier in Recommendation 36.
- Establishing Enterprise Capability Portfolios (ECPs) with civilian and military coleads to conduct cross-cutting analysis and to identify needed capabilities and gaps in such capabilities.

⁷ Scott J. Davis et al., "Maximizing the US Army's Future Contribution to Global Security Using the Capability Portfolio Analysis Tool (CPAT)," *Inform Journal on Applied Analytics*, 46, no. 1 (2016): 91-108, <https://doi.org/10.1287/inte.2015.0824>.

⁸ Capability Portfolio Analysis Tool (CPAT) Overview, Stephen Henry, Sandia National Laboratories, presentation to Section 809 Panel, August 9, 2018.

- Improving the defense sustainment enterprise, including developing SPBs to improve sustainment planning and execution.
- Improving the current requirements process governed by JCIDS with a management structure that allows for tradeoffs within the multi-tiered portfolio structure.

Discussion

At the enterprise level, the proposed portfolio management approach has four major features, each of which would represent a substantial improvement in the operation of the defense acquisition DSS:

- The capability portfolio approach would enable DoD, when making capital investment and sustainment decisions, to break out of the current, program-centric and process-focused approach across the DSS and consider instead capabilities and desired outcomes for those key decisions.
- The capability portfolio approach, if resourced with a stable funding source through the Undersecretary of Defense (Research and Engineering) (USD[R&E]), would enable DoD to employ a more agile and coordinated approach to innovation, experimentation, demonstration, and rapid prototyping.
- As requirements, budget, and acquisition decision authority are delegated in the Military Services and Defense Agencies to empowered subordinates, the portfolio approach would bring together DoD's decision processes, establishing a collaborative process that presents a complementary view at the enterprise and execution level.
- The new portfolio system would bring the three systems together by bridging the gap between stove-piped decision-making systems through linked, collaborative processes, enabling DoD to field innovative solutions in a more timely and agile manner, moving the system from a serial decision-making process to a more concurrent process.

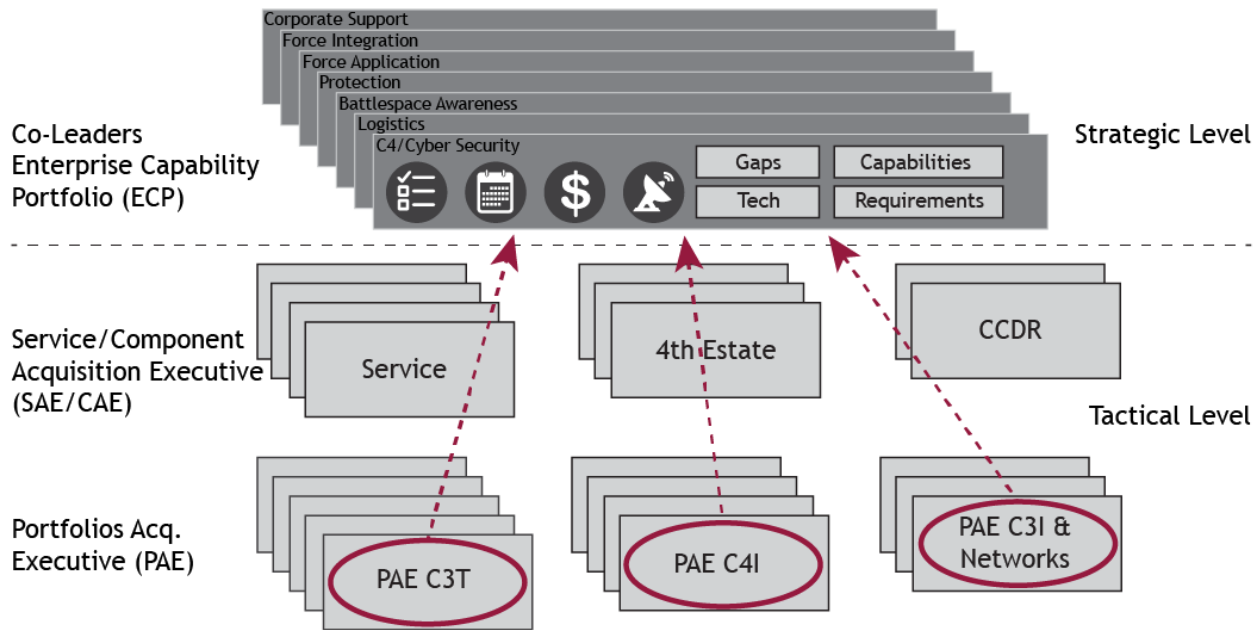
Implementation of capability portfolio management (CPM) at execution and enterprise levels is consistent with the current objective of the Combatant Command (CCMD), Military Service, and Defense Agency leadership: balancing investments in the future against today's requirements. With implementation of CPM, decision makers would consider capital investments differently—not as the latest in a series of weapons systems with enhanced capability but as an investment for which resources might better be applied to weapon systems modernizations or readiness in the same capability area. This portfolio structure would allow leadership to understand existing and planned capabilities across DoD.

Under the envisioned process, Military Service/Defense Agency-level portfolios—managed by newly-empowered PAEs (see Recommendation 36)—would be the primary vehicle for execution of the requirements, resources, and acquisition processes in the Military Services and Defense Agencies. The new PAEs would also provide portfolio information to ECPs, enabling the coleads to assess capabilities and identify critical gaps by using mission engineering and other appropriate analytic tools. This flow of portfolio information would also enable the coleads to present a common capability portfolio picture

to decision makers in the enterprise-level requirements, resources, and acquisition decision-making chains.

The intended flow of capability portfolio information from PAEs to enterprise-level ECP is shown in Figure 2-6, a version of which appeared in the Section 809 Panel’s *Volume 2 Report*. The graphic shows that a single enterprise-level capability portfolio is likely to include multiple execution-level portfolios – including portfolios from multiple Military Services, Defense Agencies, and from functional CCMDs with their own acquisition authority.⁹

Figure 2-6. Notional Enterprise Capability Portfolio Management



DoD should unite the defense acquisition DSS views at the DoD level by establishing civilian and military ECP coleads for each ECP. The military chairs of the six FCBs in the requirements process would be concurrently assigned by the VCJCS to serve as military coleads of the ECPs. Civilian coleads would be nominated and approved by the Under Secretary for Defense (Acquisition and Sustainment) (USD[A&S]) and/or Under Secretary for Defense Research and Engineering (USD(R&E)) and selected by the Deputy Secretary of Defense (DSD). The civilian coleads would also lead relevant issues teams for the D/CAPE and the Comptroller to support the enterprise-level resources process. The two coleads would work jointly with the Under Secretary of Defense for Policy (USD(P)) and other key players to support the enterprise-level strategic planning process.

The ECPs would operate much as Military Services, Defense Agencies, and OSD Integrated Product Teams (IPTs). Each of the ECPs would have committed representatives from cognizant Military Service, Defense Agency, and CCMD offices. ECP coleads would propose a work plan to the DMAG for review and approval. With resources assigned (government and contractor), they would execute the

⁹ Section 809 Panel, *Report of the Advisory Panel on Streamlining and Codifying Acquisition Regulations: Volume 2 of 3*, 42 (2018).

plan and present recommendations to the DMAG. ECPs would also respond as tasked by D/CAPE to lead specific issue teams.

Military Service-level PAEs—with delegated responsibility and authority for capability portfolio requirements, budgets, and acquisition—would bring together the three elements of the defense acquisition DSS in a single office, enabling rapid and comprehensive commitments. The PAEs would not only be responsible for acquisition execution, they would also have authority over requirements and budgets, feeding the Military Service- and enterprise-level requirements and programming processes. The new portfolio system would bring the three systems together through linked, collaborative processes, enabling DoD to field innovative solutions in a more timely and agile manner.

Existing Decision-Making Processes

Implementation of a new multilayered portfolio process would help address deficiencies in the existing DSS that cause DoD to do the following:

- Focus on large, traditional programs instead of smaller, more innovative programs.
- Provide inadequate attention to cross-functional gap analysis and nontraditional solutions.
- Lack the agility needed to adjust to new technologies and new threats.
- Focus too much on process and paperwork, rather than major strategy and risk decisions.

The NDS calls for DSS to “prioritize speed of delivery, continuous adaptation, and frequent modular upgrades.” As the NDS acknowledges, however, current processes are “over-optimized for exceptional performance at the expense of providing timely decisions, policies, and capabilities to the warfighter.”¹⁰

Because DSS decision-making processes are so burdensome, program advocates tend to focus their efforts on a few megaprograms that incorporate all available technologies in a single *big bang* acquisition. Recent examples include the Joint Strike Fighter, designed to meet the tactical aviation needs of three Military Services, and the acceleration of multiple advanced technologies onto the lead ship of a new class of aircraft carriers.

These megaprograms, which risk squeezing out available funding that could be used for rapid innovation and risk taking, too often fail to deliver as promised. When DoD tries to develop too many advanced capabilities within a single MDAP, delays in a single critical technology can slow down the entire program and cost billions of dollars. The resulting cost overruns can present funding difficulties for smaller, more innovative programs.

To overcome this problem, DoD needs the ability to rapidly develop less ambitious, more innovative programs. A more diverse portfolio—including smaller, more flexible investments—would enable DoD to adapt more quickly to emerging technology and respond more effectively to changes in the threat environment.

¹⁰ DoD, *A Summary of the 2018 National Defense Strategy of the United States of America: Sharpening the American Military's Competitive Edge*, 10, accessed December 30, 2018, <https://www.defense.gov/Portals/1/Documents/pubs/2018-National-Defense-Strategy-Summary.pdf>.

Providing multiple alternative vehicles for maturing technology should also reduce the temptation for larger programs to try to incorporate all available technologies in a single increment and make larger systems more agile and flexible. Some of the smaller investments may fail, but unlike the megaprogram failures dominating the defense budget today, such failures would be an acceptable cost of progress.

Cross-Functional Gap Analysis and Nontraditional Solutions

The NDS calls for increased use of nontraditional suppliers, new entrants, and small-scale vendors that can provide cutting-edge technologies. This approach, the NDS states, will “allow the Department to more quickly respond to changes in the security environment and make it harder for competitors to offset our systems.”¹¹ The current acquisition system relies on the traditional command organizational structure to develop new programs from the bottom up. Regardless of the problem, a tank and automotive command is likely to see a new land system as the appropriate solution, while a sea systems command is likely to identify a new surface combatant as the appropriate solution. As a result, the acquisition system tends to focus its energy on developing the *next generation* of existing systems, rather than identifying innovative new approaches. Gap analyses and analyses of alternatives are too often used to justify traditional programs, rather than seriously consider new technologies and new solutions.

To overcome this problem, DoD needs an approach that considers alternative approaches before focusing on a solution. A cross-cutting analysis of gaps and overlaps should take place *before*, not after, DoD settles on a particular material solution to a military problem. A portfolio-based acquisition approach should enable such cross-cutting analysis.

One possible approach would be to apply mission engineering. Mission engineering would provide leadership with tools to facilitate a view of current capabilities and future requirements, thus equipping decision makers with the information necessary to better prioritize limited resources. Successful mission engineering combines the structure of systems engineering with the tactical insights of operational planning. Mission engineering maps system capabilities to mission needs at the capability portfolio level.¹² Mission engineering emphasizes data driven, capability-based assessments to produce integrated warfighting capabilities that can be translated into specific programmatic guidance for strategic programs and can visually identify gaps.

The mission engineering analysis results are captured in effects/kill chains. These effects/kill chains identify operational needs based on the planned way to fight through mission threads captured in the CCMDs’ Operational Plans (OPLANs) and Contingency Plans (CONPLANs). The effects/kill chains may then be used to illuminate capability advantages and disadvantages of the alternatives; consider joint operational plans; examine sufficient feasible alternatives; characterize key assumptions, variables, and sensitivities; and assess technology risk and maturity. For example, the system’s ability to achieve the desired capability is assessed in terms of red, yellow, or green. Red would mean some significant degradation to mission; green would indicate the desired capability is being achieved. The analysis

¹¹ Ibid, 11.

¹² “Mission Engineering Integration and Interoperability (I&I),” James D. Moreland, Naval Sea Systems Command, accessed August 2, 2018, <https://www.navsea.navy.mil/Home/Warfare-Centers/NSWC-Dahlgren/Dahlgren-Resources/Leading-Edge/I-I-Leading-Edge/Moreland/>.

provides decision makers with a view of the system capabilities and how investment in resolving issues affects the overall mission and capability delivery.

Existing Decision-Making Processes Lack Sufficient Agility

The NDS calls for a “rapid, iterative approach to capability development” with rapidly evolving platform electronics and software instead of “static configurations that last more than a decade,” to reduce costs, technological obsolescence, and acquisition risk.¹³ The current, centralized DSS, with its three separate decision stovepipes, hinders speed and innovation. Not only are small, innovative programs disfavored, but large programs designed to meet future threats rely on locked-in baselines that limit their ability to respond to new threats and new technology developments.

Private-sector entities and some federal government elements (including the intelligence community) bring together requirements, resourcing, and acquisition decision-making processes to enable decision makers to promulgate needed changes at the speed of relevance. The DSS process, which separates these three processes, makes it extremely difficult to promulgate significant modifications after a program is underway. As a result, DoD adheres to existing requirements long after they clearly cannot be met at reasonable expense and defers critical and available new technologies to future upgrade programs that lie in the indefinite (and unfunded) future. To overcome this problem, DoD needs to create trade space in which reasonable decisions to trade cost, schedule, and performance against capability could be made in real time.

Existing Decision-Making Processes Focus Too Much on Process and Paperwork

The NDS notes that DoD’s management structure and processes “are not written in stone,” but are “a means to an end” —empowering warfighters with the knowledge, equipment, and support systems to fight and win.¹⁴

The current DoD organizational structure includes many separate stovepipes—each with its own bureaucracy and staff—that are empowered to say *no*, rather than work toward solutions to warfighter problems. The result is a system in which senior decision makers and their supporting staffs devote too much attention to process, procedure, and paperwork, rather than focusing on the major strategy and risk decisions that should be made at the enterprise level. Too often, innovative solutions are bogged down by a micromanaged process in which, as GAO found in a 2015 review, it takes an average of more than 2 years and 5,600 staff days to complete the 49 information requirements needed to support a single acquisition milestone decision.¹⁵

To overcome this problem, DoD needs a process by which senior decision makers make major strategy and risk decisions but leave the day-to-day management of individual portfolios and programs to

¹³ DoD, *A Summary of the 2018 National Defense Strategy of the United States of America: Sharpening the American Military’s Competitive Edge*, 11, accessed December 30, 2018, <https://www.defense.gov/Portals/1/Documents/pubs/2018-National-Defense-Strategy-Summary.pdf>.

¹⁴ *Ibid.*, 10.

¹⁵ GAO, *Acquisition Reform: DOD Should Streamline Its Decision-Making Process for Weapon Systems to Reduce Inefficiencies*, GAO-15-19, February 2015, accessed December 30, 2018, <https://www.gao.gov/assets/670/668629.pdf>.

hands-on managers. A multitiered portfolio approach should address this problem by assigning management responsibility to strong, new portfolio managers.

Conclusions

DoD needs a total lifecycle, multitiered, capability portfolio framework for capital investments that continuously seeks to integrate the separate requirements, resourcing, and acquisition decision stovepipes of the current DSS program-centric framework. DoD needs that framework for resource allocation at all management levels to compete in the 21st century where innovation, flexibility, and response time are critical. The multitiered portfolio framework under which authority is delegated can more effectively prioritize innovation and experimentation, consider nontraditional solutions, conduct more effective gap analysis, respond to new threats and rapidly integrate technologies in a more agile manner, and reduce the burdens of bureaucracy and micromanagement. Framework implementation would be facilitated by doing the following:

- Expand or adopt successful portfolio management models developed in DoD—such as FCB portfolios—and the private sector to the special imperatives and relationships in DoD organization. Private-sector portfolio management principles have been adopted in some parts of the government, as exemplified most recently by Office of Management and Budget (OMB) Memorandum M-18-19, and over the longer term by the portfolio standards incorporated into OMB Circular A-11. With some adjustment to accommodate requirements of the appropriations process and the Military Service-based DoD organizational structure, these standards might be incorporated into DoD's new capital investment system as well.
- Empower PAEs in the Military Services and Defense Agencies with delegated authority to collaborate with peers in requirements and resourcing within trade space provided and to present a common portfolio and program picture to Military Service-level and OSD/JCS leadership. This framework would minimize time to commitment, resulting in a more agile system that has the flexibility to respond to changing threats and emerging technologies.
- Designate senior DoD officials (military and civilian) as ECP coleads and charge them with integrating, synchronizing, and coordinating capability portfolio content to address capital investment alignment to strategic priorities and capability demand. ECP coleads would have no independent decision-making authority but would be responsible for providing cross-cutting analysis of capability portfolios and presenting a common capability portfolio picture to enterprise-level decision makers. ECPs will be aligned with the already-established FCBs initially; however, they may evolve together over time to provide as broad and segmented view of enterprise capabilities as possible to inform requirements, resourcing, and acquisition/sustainment decisions.¹⁶

¹⁶ There are currently six FCBs, with responsibility for C4/Cyber, Battlespace Awareness, Logistics, Force Integration, Protection, and Force Application, respectively. An additional Joint Capabilities Area (JCA), for Corporate Management and Support, does not have an FCB, and is included instead in a separate portfolio process led by the Chief Management Officer.

- Require ECP to develop strategic plans and roadmaps to provide a vision for the evolution of missions within their capability portfolios over time, help drive S&T investment and provide metrics for measuring capability portfolio performance.
 - Require a 20 year strategic plan which leverage the operational expertise of the CCMDs and the Senior Warfighter Forums – as well as scenario-based war games, mission engineering, and other strategic analysis that focus on desired outcomes rather than projected systems – to identify capability and resource mismatches, including gaps, shortfalls, and redundancies
 - Require adequate resourcing of ECPs to produce these plans, as well as other portfolio-level documents.
 - Require aligned execution portfolios and ECPs to share information continuously because both assess current and needed capabilities, including cross-cutting capabilities, for presentation with recommendations to the DoD decision makers at all levels.
 - The ECP military coleads will serve concurrently as FCB chairs. The civilian coleads can lead issue teams on behalf of the D/CAPE and the Comptroller. The two coleads would also work together to identify cross-cutting acquisition issues that should be raised through the USD(A&S) and the USD(R&E) and VCJCS to the DMAG and JROC.
- Approve a portion of the defensewide funding line for rapid development/prototyping (including the Rapid Prototyping Fund established pursuant to Section 804 of the FY 2016 NDAA) controlled by the USD(R&E), a portion of which will be allocated to the ECPs to provide seed money for key Execution and Enterprise portfolio priorities in accordance with strategic plans. Such a dedicated fund for emergent (within budget cycle) innovative and agile acquisition initiatives would provide a lever with which ECPs could address unfunded gaps or opportunities in Military Service execution strategic plans in support of programs.

Implementation

Legislative Branch

Note: Legislative implementation here are identified as subrecommendations to allow for better reference to them in the draft legislation text in the Implementation Details section that follows.

- Subrec. A: Direct DoD to transition the current DAS to a total lifecycle, multitiered (execution and enterprise), capability portfolio-centric framework that integrates requirements, budget, and acquisition/sustainment for capital investments/resource allocation. Incorporate above recommendations in a revision to DoDD 5000.01, The Defense Acquisition System Directive. A draft revised DoDD 5000.01 is attached in the Implementation Details for this section.
- Subrec. B: Direct DoD to establish ECPs to integrate, synchronize, and coordinate capability portfolio content to address capital investment alignment to strategic priorities and capability demand. ECP should be led by senior civilian and military personnel of SES/flag/general rank, pointed by DSD and VCJCS respectively. ECP coleads would have no independent decision-making authority but would be responsible for providing cross-cutting analysis of capability portfolios and presenting a common capability portfolio picture to enterprise-level decision makers.

- Subrec. C: Direct DoD to establish processes for ECPs to use a portion of defensewide funding for rapid development/prototyping funding controlled by the USD(R&E) to provide seed money for key portfolio priorities in accordance with strategic plans.
- Subrec. D: Provide increased flexibility in the appropriations and reprogramming processes, including the enhanced reprogramming authority discussed in Recommendations 46-48 of this report, to ensure that PAEs can provide timely responses to new threats, emerging technologies, and developments in portfolio performance.

Executive Branch

- Revise DoDD 5000.01, Defense Acquisition System, or cancel it and initiate a new directive that will be The Defense Capability Acquisition and Sustainment Framework that will:
 - Maintain and/or strengthen principles and policies in the existing DoDD 5000.01 while establishing a new model, Defense Capability Acquisition and Sustainment Framework (DCASF). The DCASF will be a through lifecycle, multitiered, capability portfolio acquisition and sustainment framework for capital investments that continuously seeks to integrate requirements, budget, acquisition/sustainment views of programs and services for more informed and collaborative decisions. Rescind DoDD 7045.20, Capability Portfolio Management, and include in revised DoDD 5000.01 or new Directive for Defense Capability Acquisition and Sustainment Framework and include its provisions for full-time civilian and military coleads to provide cross-cutting analysis and present a common capability portfolio picture to enterprise-level decision makers.
 - Provide for the DSD to appoint civilian ECP coleads who are experienced members of Senior Executive Service from a slate provided by USD(R&E) and USD(A&S). Nominees may come from any DoD acquisition activity or organization.
 - Provide for the military ECP colead to be a general or flag officer appointed by the VCJCS in consultation with Military Services and CCMDs. ECP military coleads will serve concurrently as chair of the relevant FCB in the JCIDS process.
- Require that ECPs have visibility on the full range of weapon systems and any evolving cross-cutting mission areas.
 - Note that the ECPs would not include business systems, because DoD is already developing separate business system portfolios under the Chief Management Officer's leadership.
- Require DSD and VCJCS to develop a DoD implementing directive for the operation of the ECPs that includes but are not limited to the following:
 - ECP coleads are jointly responsible for raising cross-cutting issues in the enterprise requirements, programming/budgeting, and acquisition review processes.
 - ECP coleads are responsible for identifying cross-cutting requirements, programming/budgeting, and acquisition/sustainment issues and raising them with the Military Services (and appropriate Defense Agencies).
 - ECP civilian colead leading issues teams through the 3-Star and DMAG review processes.

- ECP coleads are responsible for identifying cross-cutting acquisition issues, raising them to the Military Services (and appropriate Defense Agencies), and if necessary, working them through USD(A&S) and/or USD(R&E) to the DMAG.
- ECP coleads develop strategic plans and roadmaps to show a vision for the development of capability portfolios over time and to help drive S&T and rapid capability investments.
- ECP coleads establish positive relationships with PAEs, to include exchange of information, data, decisions, and planning, working toward a common view of every particular capability set.
- Establish a defensewide funding line for rapid development/prototyping funding (including the Rapid Prototyping Fund established pursuant to Section 804 of the FY 2016 NDAA) under control of the USD(R&E), with a portion available to ECP coleads to provide funding for use by Military Service/Defense Agency execution portfolio to address priority opportunities when Military Service/Defense Agency funding is unavailable.

Note: Explanatory report language and draft legislative and regulatory text can be found in the Implementation Details subsection at the end of Section 2.

Implications for Other Agencies

- There are no cross-agency implications for this recommendation.

Recommendation 38: Implement best practices for portfolio management.

Problem

In both *Volume 2* and *Volume 3* of the *Final Report*, the Section 809 Panel recommends DoD transition from program-centric to capability portfolio-centric acquisition management. Although implementation of a capability portfolio management framework is a best practice in itself, recognizing that the transition to portfolio management will not come easily nor without risk the best practices described below are put forth to help advance the transition and improve outcomes. Recommendations 36 and 37 provide detailed rationale for portfolio management and outline implementation actions to transition to a capability portfolio management framework for acquisition and sustainment of weapon systems. This recommendation identifies several specific approaches (creating critical questions, leveraging data, using analytical strategy modeling, and empowering the workforce) that serve as portfolio management best practices and would improve the likelihood of a positive transition to a multitiered portfolio framework that enables integration of requirements, budget, and acquisition/sustainment with decentralized decision authority.

The changes to acquisition and sustainment in Recommendations 36 and 37 are not totally unfamiliar to some aspects of DoD, but the key characteristics of portfolio management addressed within these recommendations have never been implemented as a comprehensive framework across DoD. The challenge is abandoning the deeply ingrained, stove-piped, program-based decision processes and procedures to adopt a new paradigm, while continuing to accomplish weapon systems development, testing, fielding, and sustainment. DoD, including OSD, JCS, Military Services and Defense Agencies have, over the decades, organized various collections of like capabilities into portfolios. An

infrastructure for capability portfolio management exists in the Military Services and Defense Agencies with PEOs who already supervise, if not manage, capability portfolios.

In 2008 DoDD 7045.20 was signed directing DoD “to use capability portfolio management to advise the Deputy Secretary of Defense and the Heads of the DoD Components on how to optimize capability investments across the defense enterprise (both materiel and non-materiel) and minimize risk in meeting the Department’s capability needs in support of strategy.”

Recommended implementation approaches, including enhancing PEO/PAE authority, establishing ECPs, rescinding both 5000.01 and DoDD 7045.20, and reissuing DoDD 5000.01 as the Defense Capabilities Acquisition and Sustainment Framework (DCASF), require commitment and leadership. Those activities, however, offer critical improvements to timeliness, flexibility, affordability, and technological innovation for weapon systems investments. It addresses and removes major challenges of the decades-old processes and procedures by focusing on managing by portfolio instead of program; by integrating requirements, budget, and acquisition/sustainment; and by delegating authority.

Background

Currently, the USD(P) coordinates two strategic plans that are developed within the planning phase of PPBE—the NSS and the NDS.¹⁷ Subsequently, D/CAPE publishes fiscal guidance and DoD reprogramming guidance in coordination with the DoD Comptroller. More than 10 years ago, DoDD 7045.20 called for CPM strategies and alignment of PEs (the structure for funding) to these portfolios; however, no substantial changes to the program approach have materialized.

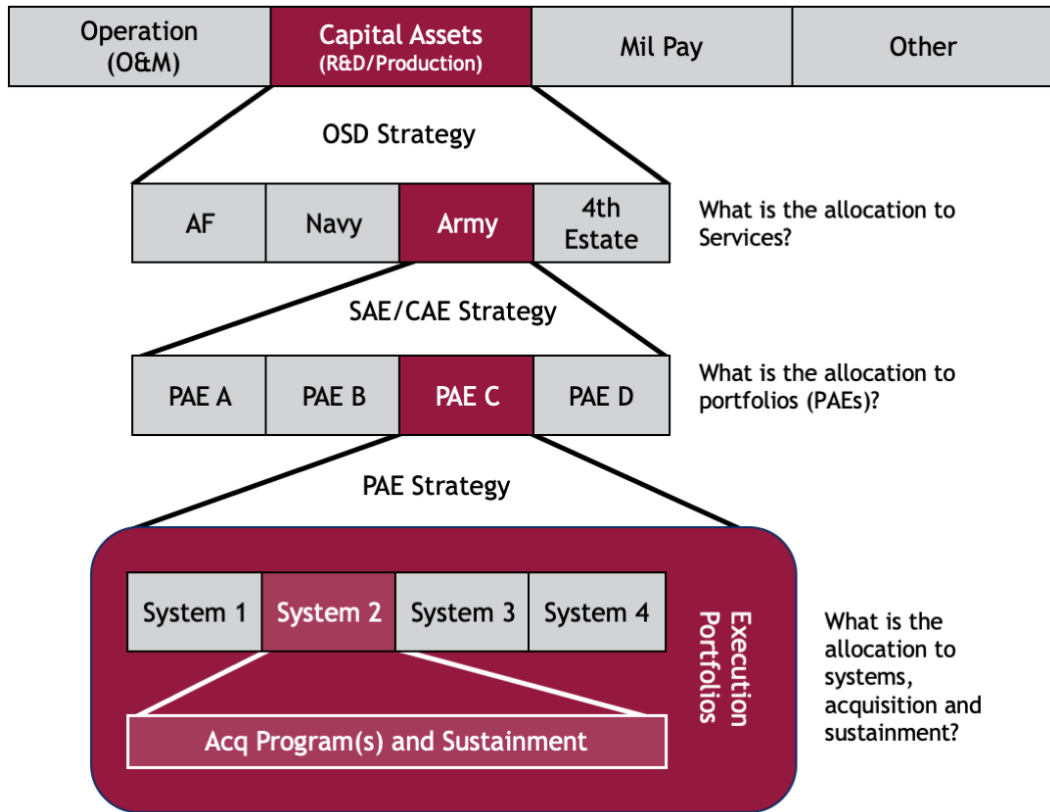
The current DSS structure—comprising JCIDS, PPBE, and DAS—is not well suited for portfolio-based management because integration across DSS for capital assets occurs through formal, designated acquisition programs. These programs are either MDAPs or nonmajor programs (non-MDAPS). DoD groups many, but not all, of these programs into portfolios managed by PEOs. Although PEOs were created in the 1990s to align programs into portfolios, the DSS process maintained a program-centric view. PEOs were not assigned any additional duties in statute or DoDD 5000.01 to accomplish portfolio management. Instead, they are midlevel managers between the PM and Component or OSD MDA. Often, though not always, non-MDAP programs have MDA delegated to PEOs by SAEs.

During the past 20 years, portfolio management has become widely accepted by industry as a best practice and has proven to offer many benefits. Organizations tend to perform best with centralized strategy and decentralized execution. The evolving industry methodology for managing capital assets in portfolios has shown increased efficiency and effectiveness “as portfolio management is the bridge between strategy and execution.”¹⁸ The Section 809 Panel’s recommendations regarding migration to a portfolio-based acquisition system move defense acquisition in this direction by establishing clear portfolio allocations from OSD to Military Services, then on to PAEs and PMs (see Figure 2-7). This decentralized structure both improves innovation and requires more coordination.

¹⁷ The Planning, Programming, Budgeting, and Execution (PPBE) Process, DoDD 7045.14 (2017).

¹⁸ Charles R. Mahon and John D. Driessnack, *Winning in the 21st Century: An Acquisition Point Paper to the Section 809 Panel*, September 2017, accessed June 7, 2018, <https://www.pmi.org/-/media/pmi/documents/public/pdf/white-papers/command-negation.pdf>.

Figure 2-7. Portfolio Allocation

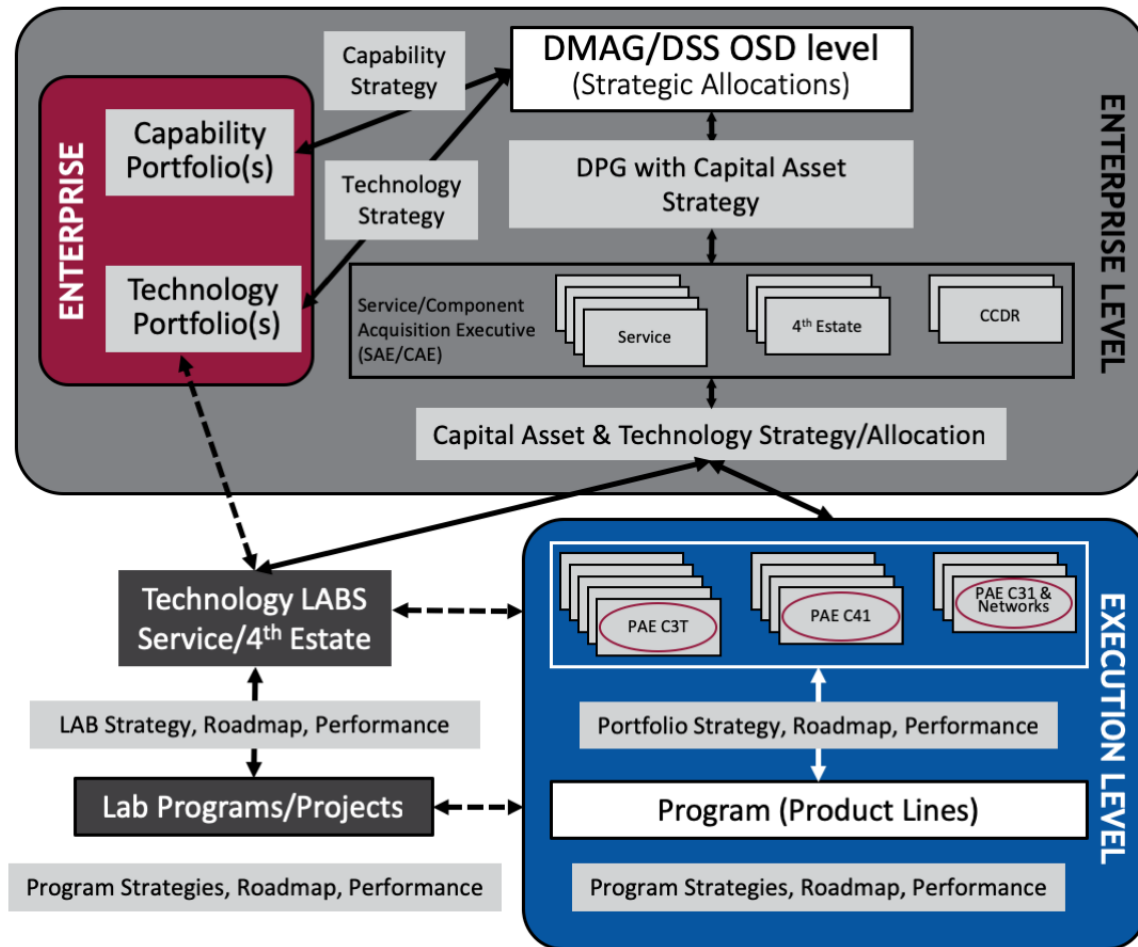


Industry guidance on project, program, and portfolio management has evolved since the 1960s, reflected in guidance published by the American National Standards Institute and the International Organization for Standardization.¹⁹ Many countries, including the United States, have adopted these evolving industry standards. OMB Circular A-11 and A-119 both encourage agencies to embrace industry standards.²⁰ To move to a portfolio management approach in the management of capital asset projects and programs, DoD should transition to a portfolio governance model that aligns strategy, risk tolerance, resource capacity, and evaluation results. Doing so would add an integrated, tiered capital asset view (OSD to Military Service to execution portfolio to program) across DSS with enterprise-level capability views cross-cutting the Military Service-oriented view. The enterprise and execution views form the multitiered portfolio management system (see Figure 2-8).

¹⁹ "The Standard for Portfolio Management, ANSI/PMI 08-003-2017," and "Guidance on Portfolio Management, ISO 21504:2015," International Organization for Standardization, accessed November 15, 2018, <https://www.iso.org/standard/61518.html>.

²⁰ Charles R. Mahon and John D. Driessnack, *Winning in the 21st Century: An Acquisition Point Paper to the Section 809 Panel*, September 2017, accessed June 7, 2018, <https://www.pmi.org/-/media/pmi/documents/public/pdf/white-papers/command-negation.pdf>.

Figure 2-8. Multitiered Portfolio Management System



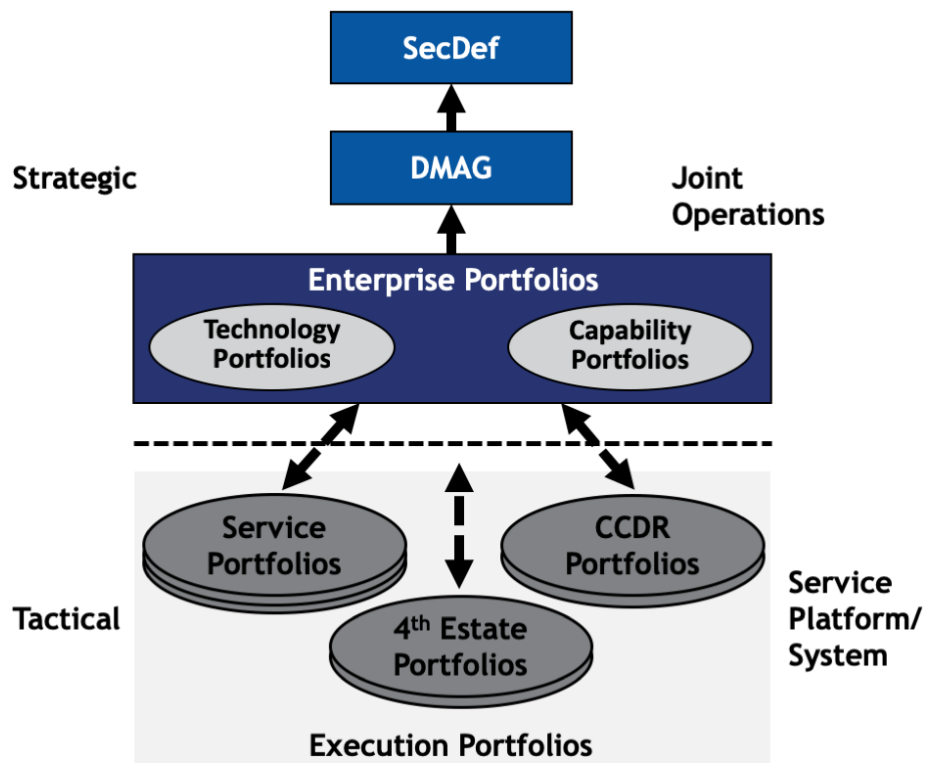
The ECP colead would provide senior decision makers views to resource allocation that would align objectives, capacity, and risk tolerance with execution portfolios managed by empowered and appropriately resourced PAEs. The PAEs could then optimize within their allocations down to PMs who have a lifecycle baseline (for both acquisition and sustainment).

Discussion

Taking a Portfolio View of Capital Asset Management

In its *Volume 2 Report*, the Section 809 Panel advocated for shifting from a program-centric DAS to one cemented around portfolio capabilities, with corresponding tools and resources that will support more effective program management. CPM would enable analysis and integration of cross-cutting data and create an enterprise view that would support better-informed decision making. This approach would provide new perspectives at both the strategic and tactical levels. The strategic enterprise level could view portfolios based on technology or capability. At the tactical execution level, portfolios would be viewed based on their organization (see Figure 2-9). In this model, the capability and execution views are tiered from the OSD to the Military Services and to the PAE. To maximize the ability of these new perspectives to enhance decision making in a portfolio-centric system, there are several best practices that should be considered.

Figure 2-9. Service Execution Portfolio and Enterprise Portfolio Information Flow



Moving from program-centric to portfolio-centric acquisition requires changing the primary view of how capital assets are managed. Portfolio management requires active management of the collection of programs/projects within the portfolio.²¹ Portfolio management does not require a change in the overall federal approach for capital budgeting, but it does incorporate aggregated product lines or product mixes that facilitates portfolio capability value assessments and resource allocation based on a broader capability view.

Industry portfolio management standards require portfolio-level strategic plans and roadmaps that enable strategic management. Included in these plans is value management, for which optimization is achieved by balancing benefits, risks, and resources. Additionally, a holistic, systems approach is needed given most portfolios are complex, adaptive systems.

Portfolio and program leaders should be transparent with the challenges (constraints, assumptions, issues, risks, and opportunities) within the portfolio of programs. The allocation to a portfolio and within a portfolio should be informed by the challenges. Points to consider include the following: *What is the challenge profile within the portfolio and the individual programs? Is the portfolio resilient enough to handle realized risks and lost opportunities that are historical within Defense Systems?* Armed with empowerment and flexibility in how resources are allocated, the PAE would craft a portfolio allocation that is robust enough to handle—at least in the near-term execution and budget years—cost, schedule,

²¹ Ibid.

and performance variations that are inherent in defense systems. The portfolio team, with improved stability in resource allocations and mission capability, should be able to anticipate the level of variation in the near term given credible data and clarity on the challenges.

Creating Critical Questions on Portfolio Value

A single approach or model for portfolio management would not be successful, as the 50-plus PEOs today represent a broad range of capital assets with various definitions of what would constitute portfolio capability value. DoD, through the tiered enterprise-execution portfolio concepts, should tailor capability value modeling to inform decisions relative to resource allocations from OSD to Components to portfolios to programs. The models can assist with optimizing portfolio effectiveness of capabilities while balancing short-term needs with long-term capabilities, especially for weapon and combat-oriented information systems and product lines. Each portfolio needs to develop its own set of *critical questions on portfolio value* that drive not a business case, but a missions/capability value case that informs strategy.

OMB Circular A-11, Preparation, Submission, and Execution of the Budget, outlines direction for capital investment, budgeting, and management. Additional guidance is captured in the Capital Programming Guide (CPG) supplement to Circular A-11, which asks agencies to answer three *critical questions*:

- Does the investment in a major capital asset support core/priority mission functions that need to be performed by the federal government?
- Does the investment need to be undertaken by the requesting agency because no alternative private-sector or government source can better support the function?
- Does the investment support work processes that have been simplified or otherwise redesigned to reduce cost, improve effectiveness, and make maximum use of commercial off-the-shelf (COTS) technology?²²

The CPG concept of having critical questions should be tailored to DoD. The recommended DoD enterprise- and execution-tiered approach necessitates tailored questions for each level of resource allocation. CPG, Section I.5.8, Portfolio Management, notes,

Capital assets should be compared against one another to create a prioritized portfolio of all major capital assets. ... While the benefits and costs of capital asset portfolios should be quantified in monetary terms when feasible, agencies also measure return on the basis of outputs and outcomes. ... Agencies should choose a portfolio of capital investment that maximize return to the taxpayer and the Government – at an acceptable level of risk.

²² Office of Management and Budget, *Capital Programming Guide, v3.0, Supplement to OMB Circular A-11: Planning, Budgeting and Acquisition of Capital Assets*, 2017, accessed November 9, 2018, https://www.whitehouse.gov/sites/whitehouse.gov/files/omb/assets/a11_current_year/a11_2017/capital_programming_guide.pdf.

Portfolio management theory and standards are readily available from commercial sources and academic literature. The theory is not repeated here. Agencies are encouraged to focus on the practical application of portfolio management theory. Most likely, the practical application will involve the tailoring of the principles to an agency's unique circumstances.

*All of the items in a portfolio must support strategic plans, goals, objectives and priorities. The strategy and goals drive the selection and prioritization. The selection process should eliminate unnecessary and poorly planned projects. In addition, the risks associated with each item should be evaluated and responses should be developed. The risk management process should reduce threats to the agency objectives. This should result in a portfolio that is balanced so that the mix of items maximizes the agency's ability to achieve strategic goals.*²³

The U.S. Army PEO for Ground Combat Systems, which manages the portfolio of tanks and other ground-based fighting vehicles, provides an example of this type of portfolio strategic planning linked to prioritization across product lines. The PEO, having the challenge of budget reductions, developed a tailored portfolio-level model (CPAT), to determine the optimal investment strategy for ground combat modernization over the next 25–35 years.²⁴ The model demonstrates the type of portfolio-level analytics that can be used. The model has been subsequently used in more than 40 studies applying operations research methods to optimally prioritize investments across acquisition and sustainment challenges.

This type of capability value modeling—which is not just focused on efficiency, but also effectiveness given the constraints and assumptions for the portfolio—is becoming the norm within portfolio management best practices. A recent paper from Massachusetts Institute of Technology, *Program and Portfolio Affordability Tradeoffs Under Uncertainty Using Epoch-Era Analysis*, “introduces a method to conduct portfolio design for affordability by leveraging Epoch-Era Analysis [EEA] with aspects of Modern Portfolio Theory.”²⁵ EEA “enables the conceptual design of systems that are resilient to potential change in context and needs (exogenous uncertainties) throughout the system lifecycle.”²⁶

Using Analytical Modeling of Strategy

An approach for addressing missions/capability is applying mission engineering approaches to map system capabilities to mission needs at the capability portfolio level. Mission engineering—which combines the structure of systems engineering with the tactical insights of operational planning—can provide a basis for assessing portfolio contributions to the delivery of capabilities against assigned kill chains and threads, understanding the effects of investment decisions on operational priorities, assessing the fighting capability of existing and planned weapon systems, identifying capability gaps in light of existing and planned acquisitions, and providing a common mission picture to senior leaders.

²³ Ibid.

²⁴ Scott J. Davis et al., “Maximizing the US Army’s Future Contribution to Global Security Using the Capability Portfolio Analysis Tool (CPAT),” *Inform Journal on Applied Analytics*, 46, no. 1 (2016): 91-108, <https://doi.org/10.1287/inte.2015.0824>.

²⁵ Parker D. Vasik, Adam M. Ross, and Donna H. Rhodes, “Program and Portfolio Affordability Tradeoffs Under Uncertainty Using Epoch-Era Analysis,” *INCOSE International Symposium*, September 13, 2016.

²⁶ Ibid.

Mission engineering maps system capabilities to mission needs at the capability portfolio level.²⁷ Mission engineering emphasizes data-driven, capability-based assessments to produce integrated warfighting capabilities that can be translated into specific programmatic guidance for programs and can visually identify gaps.

Leveraging Data

The transition to portfolio management will allow program-level data to be leveraged and leaner as programs are managed within a portfolio structure. When appropriate, PAEs and functional leaders can reduce program-level instruction (DoDI 5000.02) and statutory documentation requirements through the use of portfolio approaches. Portfolio-level documentation should not be additive, but instead enable program-level documentation and reporting to be consolidated as appropriate. A holistic system approach to data and documentation should evolve with the goal of improved transparency. As portfolio management matures, the Select Acquisition Report (SAR) and Defense Acquisition Executive Summary (DAES) should transition to portfolio level.

Empowering Workforce

Prior to the Packard Commission, material and/or systems commands, which could best be described at the time as functional matrix organizations, held responsibility for acquisition and sustainment. One of the major findings of the Packard Commission was that individuals in the functional organization (today, often referred to as competencies) had decision authority on matters that affected a program's cost, performance, and/or schedule. Implementation of the Packard Commission's recommendations was an attempt to remedy this situation by better unifying programmatic decisional authority. The Packard Commission, and the advent of integrated program teams in the 1990s, shifted the balance of power in the direction of PMs and PEOs. In the intervening years, the influence PEOs and PMs has declined, as evidenced by the current situation in which process too often eclipses the mission of product development and delivery. Recommendations 36 and 37 in this report work to restore line management authority and rebalance the emphasis of product over process, in particular by designating the SAE/PAE as the top of the chain of command responsible for managing the system from initiation to disposal.

A prime reason processes have overpowered products has been the resistance of the functional competencies to colocate their personnel with program teams, especially within the contracting and comptroller competencies. To the maximum extent practicable, functional competency personnel should be colocated with PMs and PAEs. Functional competency personnel should support PMs and PAEs by doing the following:

- Providing competent, qualified personnel.
- Operating and sustaining efficient and effective infrastructure.
- Establishing consistent policies and technical guidelines.

²⁷ "Mission Engineering Integration and Interoperability (I&I)," James D. Moreland, Naval Sea Systems Command, accessed August 2, 2018, <https://www.navsea.navy.mil/Home/Warfare-Centers/NSWC-Dahlgren/Dahlgren-Resources/Leading-Edge/I-I-Leading-Edge/Moreland/>.

- Streamlining processes.
- Incorporating advanced technology and operating and support lessons into design.

Colocating competency personnel should include competencies charged with maintaining clearance certification (e.g., flight clearance and submarine safe) which must function as a check-and-balance to ensure safety and good functional practice. The purposeful tension between the PM's and PAE's directive authority, functional competencies, technical guidelines, and consistent policy charters should not impede progress. That tension is intended to further programmatic efficiency while maintaining standards and safety. When conflicts between the entities cannot be resolved, they must be expeditiously elevated to senior leadership for adjudication.

Although collocation would be quite helpful, it is not the only approach to help facilitate portfolio management. To actively manage portfolio challenges, PAEs need a more empowered workforce than most current PEOs have. For PAEs to be agile, the workforce also needs to be agile within the organization. Thus, the individuals assigned to the PAE execution organization by the enterprise, whether they are program managers, contracting officers, financial managers, system engineers, or other functional members, should be empowered by their system command or parent organization when assigned to the PAE organization. Individuals should be assigned, to the maximum extent practical, as full-time employees to PAE organizations, allowing PAEs and their senior acquisition functional matrix leaders the necessary agility in balancing resource needs. The workforce members assigned full time to the PAE organization should be rated within the PAE organization by their respective senior matrix leaders, who are also assigned full time. Senior matrix leaders should be rated by the PAE or deputy PAE as appropriate. Missile Defense Agency (MDA) provides a current example. In addition to overseeing the programs within the MDA portfolio, the MDA director, unlike most PEOs, has a more active management role in the portfolio, with increased contracting, financial systems engineering, and other functional authorities. Although rated by the PAE, common sense checks and balances are required for certain functional experts with specific decision-making authority of their own, such as warranted contracting officers. Such functional experts should have a concurrent rater within their specific functional area to support their independent decision-making role.

Conclusion

Moving defense acquisition from a highly centralized, program-centric model with stovepipe-driven requirements, budget, and acquisition processes to a collaborative, decentralized, portfolio-centric framework entails nothing more than implementing management best practices. The move would yield timely, flexible, agile, cost-effective, and technologically innovative weapon systems acquisition and sustainment. Portfolio management is no longer in its infancy; there are standards and best practices that DoD can use while implementing the recommended multitiered capability portfolio framework. DoD could start with using critical questions to drive a long-term portfolio investment strategy that supports meeting capability needs, implementing analytical modeling of strategy to apply mission engineering approaches to map system capabilities to mission needs at the capability portfolio level, leveraging data that allow the MDAs (DAE, SAE, PAE, PM) and functional leaders to reduce program level instruction (DoDI 5000.02) and statutory documentation requirements, and empowering the workforce to make decisions.

Creating Critical Questions on Portfolio Value

Portfolio managers need to devise *critical questions on portfolio value* that support development of capital-asset-focused strategies, roadmaps, and analytical models. The portfolio manager should ask critical question that cut across DSS to tease out strategies that drive an optimized portfolio. Each portfolio leader should establish a set of criteria that sets the key questions for determining portfolio capability value allocation decisions at each enterprise and execution portfolio tier. With more than 50 current PEOs migrated to being PAEs, the execution portfolios will cover a broad set of defense systems, and each portfolio would have a unique set of criteria to help determine for the portfolio what value means, allowing for tailored approaches.

Using Analytical Modeling of Strategy

All portfolio levels, whether OSD ECP portfolios or Military Service and PAE execution portfolios, need to use models to support allocation recommendations and decisions. All DoD-level ECPs should develop a 20-year capital asset strategy, aligned and linked to the NDS, which addresses their assigned functional capabilities. The goal of these strategies is to inform the discussion (through critical questions) on how defense resources should be allocated at the enterprise level across the services and execution portfolios to optimize capability in accordance with the NDS. Each strategy should focus on and recommend potential paths for changes to current Military Service and Defense Agency allocations relative to missions and resources with a focus on which changes have the best potential for an optimized capability across the next 20 years. The strategies should be supported by operations research (OR) modeling that considers both current and future (out to 20 years) capacity/mission planning needs.

Leveraging Data

Current program-oriented documentation can be transitioned to include a portfolio view to assist management and communication of the portfolio strategy and roadmap. Portfolio leadership should leverage and update current program-centric data sets to support creation of portfolio data sets and information needed to identify and document portfolio capability value decisions and allocations to portfolios/programs. A lean approach should be taken to consolidate the current program-centric planning/resource/reporting documentation to a more holistic system approach for portfolio-centric documentation. The portfolio strategy, roadmap, and periodic assessment reporting should provide transparency to stakeholders. Documentations, as appropriate, would be approved by negotiation. As portfolio strategies are created and overall portfolio management reporting matures, the program-oriented and DAES reporting would transition to a portfolio strategy annual and quarterly reporting.

Empowering Workforce

Workforce responsibility, authority, and accountability of the workforce should be fully aligned to the objectives of the PAE organizational mission. The operational chain of command runs from SAE to PAE (replaced PEO) to senior portfolio staff, including PMs and functional leaders. Senior functional leaders from the enterprise should be assigned full time to the portfolio organization and be rated in the portfolio organization on their contribution to successful achievement of the portfolio's objectives. Colocating competency personnel should include competencies charged with maintaining clearance certification (e.g., flight clearance and submarine safe), which must function as a check-and-balance system to ensure safety and good functional practice. Tension will occur between PM's and PAE's

directive authority and functional competencies. That tension is to further programmatic efficiency while maintaining standards and safety but needs to be elevated if it is affecting execution. The senior functional leaders within the PAE organization should also rate the full-time functional workforce assigned to the PAE as appropriate.

Implementation

Legislative Branch

- There are no statutory changes required for this recommendation.

Executive Branch

- Revise DoDD 5000.01, The Defense Acquisition System, as The Defense Capability Acquisitions and Sustainment Framework (a recommended draft is attached in the Implementation Details for this section) and incorporate applicable Section 809 Panel recommendations including the following
 - Implement best practices for portfolio management.
- Direct development of an implementing DoDI for the Defense Capability Acquisition and Sustainment Framework, which should include the following among other best practices:
 - Establish key questions for determining portfolio capability value relative to resources efficiency and effectiveness.
 - Use a combination of models to support resource allocation and capability delivery effectiveness decisions at each portfolio tier (PAE, Service, OSD).
 - Leverage and update current program-centric data set to support the creation of portfolio sets of data and information to document portfolio capability value and resource allocations to portfolios/programs. Aggressively lean documentation requirements. Address required reporting transition from program to portfolio as portfolio management matures.
 - Fully align responsibility, authority, and accountability of the workforce to the objectives of the PAE organizational mission. Delegate functional authority to individuals assigned to the PAE execution organization by the enterprise to execute the PAE organization's objectives. Rate these individual within the PAE organization on their contributions to the success of those objectives. Plan for tension between program and functional leadership that will positively affect outcomes so leaders learn to work together to achieve the PAE organizational mission objectives.

Note: Draft regulatory changes can be found in the Implementation Details subsection at the end of Section 2.

Implications for Other Agencies

- There are no cross-agency implications for this recommendation.

Recommendation 39: Leverage a portfolio structure for requirements.

Problem

DoD's requirements system is under-resourced and lacks the speed, agility, and innovative approaches needed to effectively exploit leading technologies for military advantage. DoD's requirements processes, including implementation of JCIDS policies, contribute to lengthy development timelines, limited flexibility, and stove-piped systems. Although this process is important for CCMDs to provide joint warfighting priorities, the lengthy series of system-centric analyses, requirements documents, and reviews can limit innovation and interoperability by prematurely defining and constraining requirements.

Software is a driving force for most weapon system advancements, yet the requirements structure inhibits adoption of leading software development practices (e.g., Agile and DevOps). While offering some flexibility for software, programs are expected to define requirements at the start and obtain approvals from senior leaders. Agile and related methodologies dispel the myth that software programs must define requirements upfront, when the program has the least knowledge about user needs and the target solution. Commercial organizations develop software iteratively, with dynamic scope and requirements based on user feedback, interim performance, and shifting priorities.

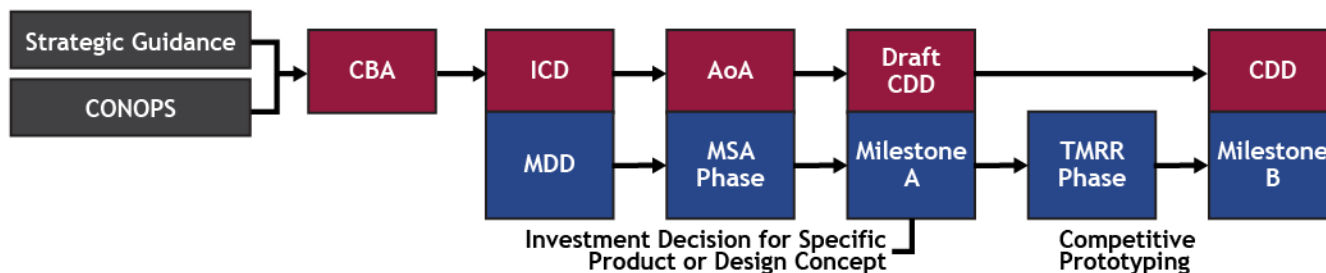
Recent DoD reform efforts have focused on streamlining coordination timelines for JCIDS requirements documents. These reforms fail to address the bigger issue of breaking down large, stove-piped programs from the start. DoD needs many small and mid-sized capabilities to complement and connect the major systems.

Background

JCIDS provides a critical and systematic process for incorporating CCMD inputs on capability gaps, operational requirements and funding priorities within constrained budgets. It has a portfolio structure based on functional capability areas, each with an FCB. JCS reviews ensure cross-Military Service issues are adequately addressed and limit duplicative requirements among the Military Services. JCS further validates requirements for critical areas to include communications, logistics, and cybersecurity. JCIDS also ensures nonmateriel aspects (e.g., doctrine, training, personnel) are aligned to maximize mission impact.

As shown in Figure 2-10, DoD strategic guidance and CONOPs for the operational mission area drive a capabilities-based assessment (CBA). CONOPs often reflect a culture that identifies traditional, Military Service-specific capabilities. When a CONOP outlines a to-be state, it often lacks sufficient evidence-based analysis. These issues can preordain a biased Military Service solution or a technologically infeasible solution. Initial analysis takes place during the CBA and leads to development of one or more ICDs. The ICD serves as a key entrance criterion to the acquisition process at the materiel development decision.

Figure 2-10. Interaction of JCIDS Documents and Early Acquisition Lifecycle



Programs conduct an analysis of alternatives (AoA) and related analyses during the Materiel Solution Analysis (MSA) Phase to prepare for Milestone A, which, as outlined in DoDI 5000.02, is an “investment decision to pursue specific product or design concepts.” Even at this early stage, programs will already have made some crucial decisions about the nature of the solution.²⁸ Many of these decisions are very important for ensuring joint warfighting success, but some may be unnecessarily restrictive. A draft Capability Development Document (CDD), with several mandatory and program-unique KPPs, is required for Milestone A approval.²⁹ KPPs can help constrain program costs and limit requirements creep in later phases, yet they can also restrict the solution trade space. Milestone A authorizes the program to advance to the Technology Maturation and Risk Reduction (TMRR) Phase: the point at which the procuring agency can engage industry and contract for competitive prototyping to reduce risk in the selected materiel solution. Typically, the Request for Proposal (RFP) for technology maturation or risk reduction either suggests or clearly identifies the preferred solution with detailed specifications and technical requirements. Because programs perceive urgency to complete the CDD and enter the development phase, the insights gained from risk reduction prototypes often come too late to effectively shape the CDD. These early commitments to a solution may serve to overly constrain innovative options.

The JROC or the Military Services’ requirements council must approve the final CDD before a program can release the RFP for system development. A 2015 GAO report indicated that completing a CDD takes, on average, 24 months—the longest timeframe of all the program documentation the GAO reviewed.³⁰ Lengthy AoAs, conducted in parallel with the CDD development, contribute to these timelines. The CDD sets the scope of a major program for a decade or longer of development, testing, and production. During this timeframe, changes occur constantly across operations, threats, priorities, budgets, technologies, and related systems; however, unless the Military Service wants to use the update process, the requirements remain fixed. Updates are reviewed and approved by a configuration steering board (CSB) chaired by the SAE, with membership consisting of executives from the relevant

²⁸ “Failures of Imagination: The Military’s Biggest Acquisition Challenge,” Jarrett Lane and Michelle Johnson, *War on the Rocks*, April 3, 2018, accessed December 30, 2018, <https://warontherocks.com/2018/04/failures-of-imagination-the-militarys-biggest-acquisition-challenge/>.

²⁹ “Key Performance Parameters (KPPs),” DAU Acquipedia, accessed December 30, 2018, <https://www.dau.mil/acquipedia/pages/article/details.aspx#1346>.

³⁰ GAO, *Acquisition Reform: DOD Should Streamline Its Decision-Making Process for Weapon Systems to Reduce Inefficiencies*, GAO-15-192, February 2015, accessed December 30, 2018, <https://www.gao.gov/assets/670/668629.pdf>.

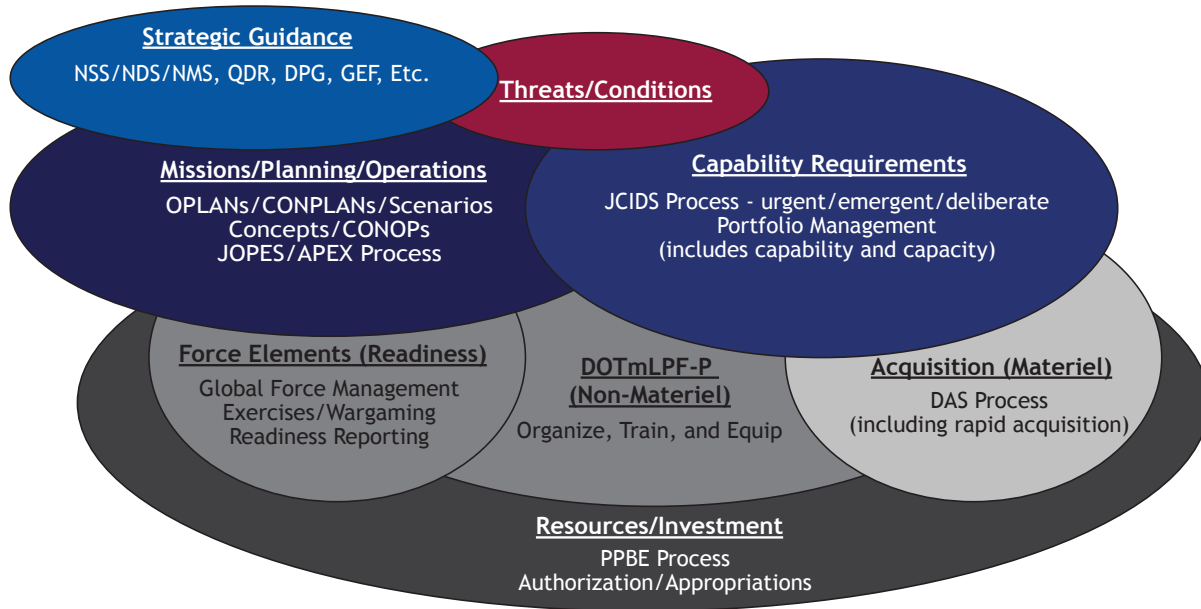
Military Service, OSD, and JCS. Often, the lack of knowledge about requirements processes hinders and lengthens each step's completion.

Realizing that subsequent increments or programs may follow many years later, operational sponsors are incentivized to include most known requirements in the current CDD. This practice compounds risk by expanding the program scope, the number of critical technologies to mature, and variances in estimates. These compounded risks drive longer timelines and higher costs to achieve the target system's initial operational capability (IOC). JCIDS does have fast track lanes for urgent operational needs (UONs) that affect an ongoing contingency operation and Joint emergent operational needs (JEONs) that affect an anticipated contingency operation. The CCMDs, the CJCS, and the VCJCS identify joint UONs and JEONs, while the Military Services may also identify UONs. The JCIDS manual outlines staffing timelines of 15 days for UONs and 31 days for JEONs, whereas the traditional deliberate planning timeline is 97 days. DoDI 5000.02 states these capabilities must be fielded in less than 2 years.

During development, PMs may discover that the program has experienced major operational and threat changes, technology maturity or performance issues, budget changes, or other disruptive factors. ACAT I and IA programs must convene a CSB at least annually to review all requirements changes, significant technical configuration changes, and descoping options to reduce costs or respond to emerging threats. The CSB reviews and may recommend changes to the requirements authority.

As highlighted in Figure 2-11, the JCIDS process of coordinating the major capability requirements documents is just one part of the broader DoD requirements processes. Strategic guidance (e.g., NSS and NDS) provides DoD an overarching framework of objectives and priorities to shape operations, requirements, and investments. The missions, planning, and operations function includes operational plans and CONOPS that articulate operational capabilities and how an organization plans to accomplish its missions. In force elements, the Military Services and Combat Support Agencies organize, train, and equip materiel and nonmateriel solutions to provide forces to the CCMDs. Although DoD's requirements processes interface with the acquisition and budgeting processes, tighter alignment is critically needed for more efficient and effective solution deliveries. DoD needs to examine the requirements processes holistically, beyond JCIDS boards and documentation reviews (along with aligning with budget, acquisition, and sustainment) for greater speed, agility, and innovation for mission impact.

Figure 2-11. Requirements Process Interactions³¹



Discussion

Problems with DoD's Requirements Processes

The lengthy analysis and documentation procedures involved in JCIDS are designed to set requirements for billion-dollar platforms that will operate for several decades. Three to 5 years may elapse from the time an operational commander initially identifies a capability need to when a CDD is approved. The only other pathway currently available is an *express lane* for meeting urgent or emerging operational needs. Military Services' implementation of Middle Tier Acquisition outlined in Section 804 of the 2016 NDAA includes the Service Chief approving requirements, which appears excessive for a rapid prototyping project. DoD needs many intermediate pathways to provide *just enough* analysis and requirements documentation for midsized systems, with lifespans under a decade, that can be iteratively upgraded by subsequent releases. This situation calls for a set of processes that can exploit mature, leading technologies for military capabilities today by establishing an architecture that can integrate emerging technologies tomorrow. For example, a fifth-generation fighter requires different rigor in documentation than a small, command-and-control IT solution. F-35 software upgrades (and fixes to critical safety or operational issues) require a different approach than the initial CDD for the program. A program that relies heavily on COTS solution requires a different approach than a new development program with maturing technologies. Acquiring IT as a service is different from tailoring a COTS solution or developing new software development.

The Requirements System Inhibits Contemporary Software Development Practices

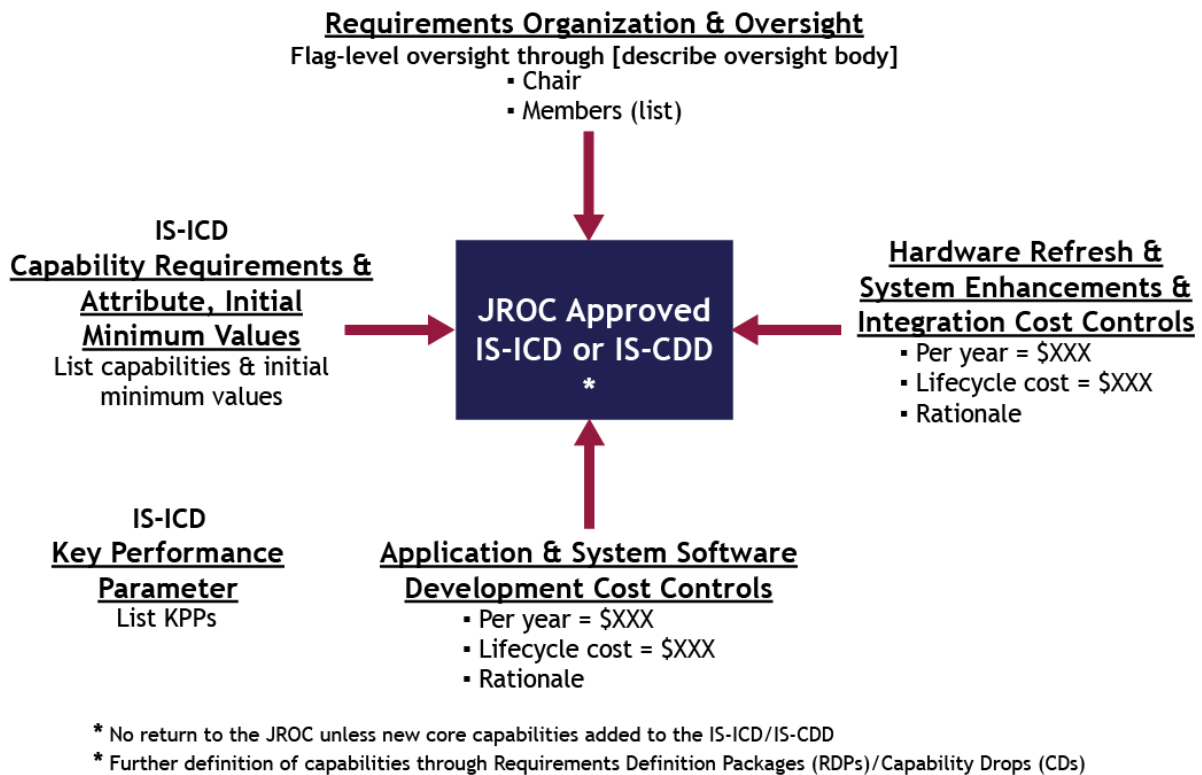
As shown in Figure 2-12, the IT Box model in the JCIDS manual was designed to enable flexibility in requirements for software development costing more than \$15 million. The four sides of the IT Box

³¹ Source: Joint Capabilities Integration and Development System (JCIDS) Manual of Operations.

represent a flag-level oversight requirements board, validated capabilities and initial measures of effectiveness, estimated software development and integration costs and estimated sustainment costs. JROC approves an information system variant of the ICD or CDD that defines these boundaries. Provided the program *stays within the box*, it does not require subsequent JROC approval or JCIDS documents. The program can iteratively define smaller requirements documents for approval by its flag-level requirements board.

Although the IT Box originally required programs to generate a high-level IS-ICD for the JROC to approve, the JROC has since designated the IS-CDD as the guiding document. Per discussions with JCS/J8, IS-CDDs can average 40 pages and require 2.5 months of staffing by the JCS (in addition to Military Service-level staffing) to receive JROC approval. The JCS envisions that programs will generate IS-CDDs for each major incremental development, not for an entire major system.

Figure 2-12. IT Box Primer



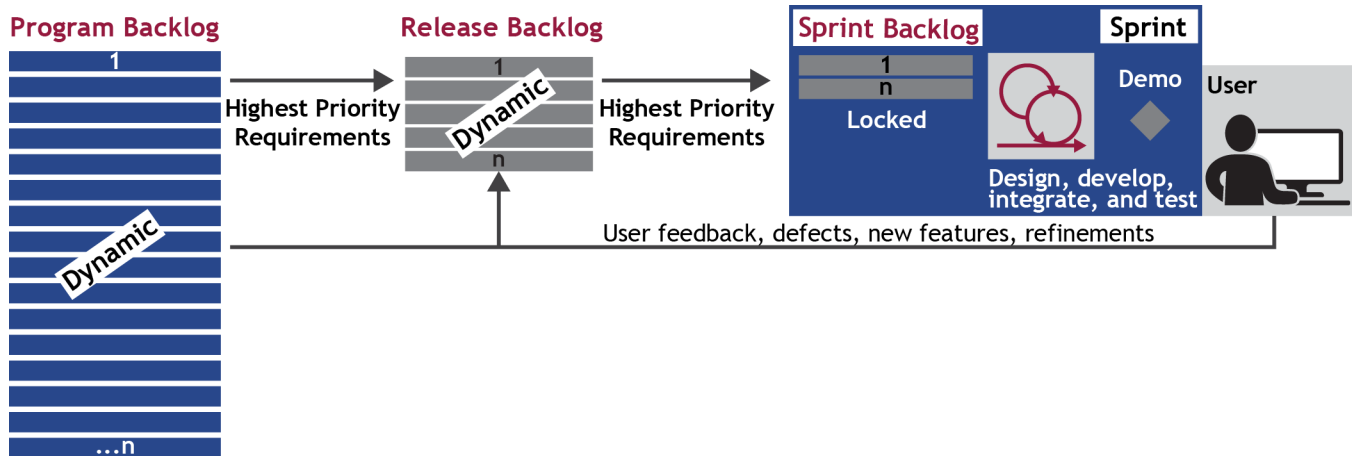
Source: Adapted from DAU graphic.

This approach is based on the fallacy that programs can effectively define the scope and requirements for a major software development effort upfront and bound the program by the estimated development and sustainment costs. By contrast, as noted previously, in leading software development practices—such as Agile and DevOps—users, acquirers, developers, and other stakeholders iteratively define, prioritize, and change program scope and requirements. They begin with a hypothesis of the desired functionality and iteratively build, test, and demonstrate capabilities in close coordination with users. Users and engineers provide feedback on interim developments to shape future iterations. A growing number of DoD software programs are embracing this model, with some notable successes achieved by

programs such as the Air Force’s Air Operations Center Pathfinder program, which delivers higher-quality, lower-risk, secure software on a weekly release schedule to warfighters.³²

Leading commercial corporations and start-ups apply Agile practices to manage software requirements via dynamic, prioritized backlogs of user stories. User stories capture the functionality the end users expect the software to deliver, often with a clear *definition of done* that serves as the acceptance criterion. A product owner collaborates with the stakeholders to prioritize the user stories on the product backlogs—the set of features for which software must be developed (see Figure 2-13). The highest priority features determine the scope of the next time-boxed release backlog. The development team commits to design, develop, integrate, test, and demonstrate working software for each sprint backlog to users and testers. Based on software performance and user feedback, product owners may make changes to the release and program backlogs to shape user stories and priorities.

Figure 2-13. Example of Agile Backlogs



Conclusions

Develop a Capstone Set of Requirements for Each Portfolio

Instead of producing a large set of system-centric requirements documents, the Military Services and Defense Agencies should develop a set of capstone requirements and related materials for each execution portfolio. These items would guide the iterative delivery of an integrated suite of capabilities to maximize operational impact.

The Military Service headquarters leadership, in collaboration with their respective Military Service Chiefs, operational commands, and JCS, should work to provide each execution portfolio with an integrated, capstone set of requirements and threat assessments (from the intelligence community). This approach would focus the JCS and Military Service Chiefs on the strategic operational

³² “AOC Pathfinder is Saving USAF Big Money, and It Wants More of It,” Air Force Magazine, February 22, 2018, accessed December 30, 2018, <http://www.airforcemag.com/Features/Pages/2018/February%202018/AOC-Pathfinder-is-Saving-USAF-Big-Money-And-It-Wants-More-of-It.aspx>.

requirements, while enabling portfolios to manage speed and agility of capability requirements for specific systems/programs at lower levels.

The capstone documents would include:

- **Enduring Enterprise Requirements (EERs):** Current and future operational requirements of the Military Services and CCMDs based on the relevant CONOPs. These would not be written at the system level or allocated to individual systems; ideally, they would be constrained to a few strategic themes to provide strategic direction.
- **Measures of Force Effectiveness (MOFEs):** Specific measures of how a force mix (a system of systems consisting of elements such as sensors, weapons, and communications systems) performs against the EERs. MOFEs represent the culmination of the Measures of Effect and Measures of Performance currently captured in ICDs and CDDs. This would impel the PAE to iteratively deliver capabilities to maximize performance against MOFEs, focusing investment on the highest mission impact.
- **Mission Threads, Kill/Effects Chains:** Representative vignettes that illustrate specific operational scenarios. The vignettes would expand upon the Mission Engineering work within OSD, JCS, and the Services to identify a series of effects chains and would focus investments to strengthen any *weak links* in the chain, holistic integration, and strategic outcomes.

The capstone requirements provide the PAE direction for shaping prototypes and experiments, the trade space for program requirements, and resources to maximize mission impact. Ideally, capability requirement documents for programs would be iteratively developed and approved at lower levels (within the Military Services' corporate structure) to focus on more detailed, specific needs. KPPs for MDAPs would still be validated by Military Service Chiefs and/or Service Headquarters Staff, and (if the program is of JCS interest), by the JROC.

Empower PAEs with Flexibility to Shape and Shift Program Scope and Requirements

Replicating the success of the Air Force Rapid Capabilities Office, the PAE should be empowered to shape program requirements below a KPP. The PAE would be responsible for iteratively delivering capabilities based on their capstone portfolio requirements, technological maturity, cost/budget, schedule, system performance, risks, threats, and other such considerations. PAEs would allocate capability requirements to different elements of the portfolio based on analytics to maximize MOFEs and mission impact. As programs progress, operations, threats, and priorities change. PAEs would shift requirements across programs/projects to maximize the effect of each investment in close coordination with operational commanders, empowered operational representatives within the portfolio, and other key stakeholders. This approach would not require CSBs with senior DoD officials or extensive documentation coordination across DoD. Instead, it would potentially enable programs to provide capabilities to operational commands years sooner at lower costs than if they waited to mature all technologies and develop and test all functionality to meet 100 percent of the requirements defined a decade earlier.

Assign Empowered Operational Representatives to Each Portfolio

Tighter integration of the operational and acquisition communities is critical to delivering mission impactful capabilities. Requirements organizations and operational commands currently invest time in authoring system requirements documents and collaborate with program offices with varying levels of success. A better approach would be to embed empowered operational representatives within each portfolio.

The empowered operational representatives would help shape the vision for key capability areas within the portfolio. They could provide insights on current operations and threats to help acquisition professionals and contractors shape capability developments. These representatives could provide rapid feedback on interim developments and connect programs with operational commanders and end users; assist in establishing portfolio priorities; and define, shape, and prioritize lower-level capability requirements. Requirements would be constrained by available portfolio budget and strategic direction. The operational representatives could also advise the PAE on shaping lower-level program requirements and senior leaders on strategic, long-term priorities, capability needs, and investments. These operational representatives would serve as key linchpins to shape a portfolio/mission area; therefore, portfolios should competitively staff these billets with experienced operators who have strengths in strategic planning, collaboration, and systems engineering. While the operational community faces resource constraints, embedding the right representatives to shape a portfolio's acquisitions is a critical investment to ensure timely delivery of capabilities that maximize mission impact.

As Congress has authorized new acquisition pathways and greater flexibilities, DoD has a prime opportunity to develop a tighter collaborative relationship between technologists and warfighters to iterate and identify innovative new means and ways to shape the environment. It is important not to constrict the opportunity space by biasing capability development through the lens of yesterday's and today's operations. In some cases, where an operational community is fixed on a known means and ways, there will be value to let the CONOPS drive requirements and solutions. In other cases, however, CONOPS should result from a deeper, objective understanding of technologies and their military applications, which would enable innovation achievement in the means and ways.

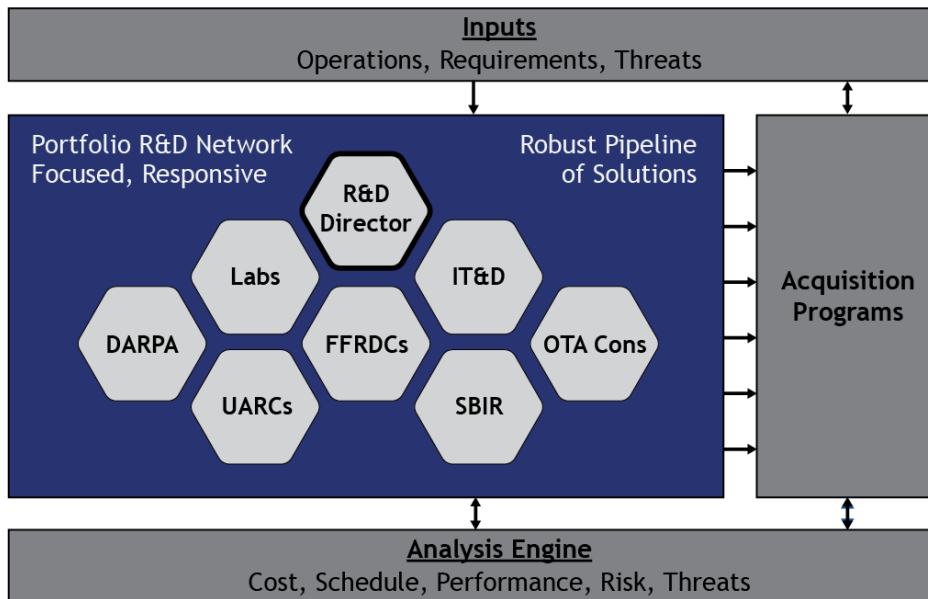
Maximize Use of Prototyping, Experimentation, and Minimum Viable Products

Execution portfolios should maximize use of prototyping, experimentation, demonstrations, and minimum viable products (MVPs) independent of specific programs as well as in the early stages of a given program's acquisition lifecycle. Congress and DoD, over the last few years, established a series of initiatives, funds, organizations, and pathways to increase use of these practices. DoD has begun implementing middle-tier acquisition via rapid acquisition and rapid fielding pathways per Section 804 of the FY 2016 NDAA. These pathways can prototype innovative technologies, demonstrate them in an operational environment, and produce mature capabilities without having to go through JCIDS and DoDD 5000 acquisition processes. A prototype or MVP in the hands of operators and engineers would accelerate learning and design of solutions beyond a team conducting a CBA or AoA. Portfolios should use the multiple prototyping pathways to the maximum extent before establishing a formal program or follow-on increment to shape scope and requirements. Iterative prototypes and MVPs would improve opportunities to exploit leading technologies and the chances of delivering high-value capabilities to

warfighters. Prototypes provide valuable inputs to mission engineering efforts by demonstrating how strengthening individual elements of a mission thread generate holistic impact.

As highlighted in Figure 2-14, each portfolio should collaborate with a robust R&D network, including the Defense Advanced Research Projects Agency, government laboratories, federally funded research and development centers, university affiliated research centers, and industry. Industry R&D can come from a variety of sources that include the Small Business Innovation Research program, Other Transaction Authority Consortia, and DoD-industry liaison programs such as DIU, SOFWERX, AFWERX, partnership intermediary agreements, technology investment agreements, grants, and cooperative agreements. Each portfolio’s network could collaborate and compete on research to exploit leading technologies for military advantage. This network should focus on ensuring a robust pipeline of innovative solutions to shape the scope of new programs and modernize existing systems. Each portfolio could establish an S&T/R&D director to coordinate research activities and investments with the portfolio’s network, Military Service leadership, and the USD(R&E). The directors would develop an S&T/R&D strategy and roadmap to align research with portfolio priority needs and opportunities. They could shape R&D investments as a diverse portfolio of many seedling efforts with stage funding from multiple DoD sources, technology agreements, and industry R&D funds. The S&T/R&D strategy should include *technology push* opportunities to apply leading technologies to military needs. The portfolio S&T/R&D director would be responsible for ensuring the most promising S&T/R&D projects cross the *valley of death* to be integrated into programs of record and fielded. This effort would include use of transition confidence levels to proactively connect, shape, plan, and fund the technology transitions.³³

Figure 2-14. Interplay of Portfolio R&D, Requirements, and Analysis



³³ Anthony Davis and Tom Ballenger, “Bridging the ‘Valley of Death’,” *Defense AT&L Magazine*, January–February 2017, 13-17, accessed December 30, 2018, https://www.dau.mil/library/defense-atl/DATLFiles/Jan-Feb2017/Davis_Ballenger2.pdf.

Develop Portfolio Analysis Engines and Model-Based Enterprise Architectures

Portfolios could also develop analysis engines for continual integrated analysis of capabilities, requirements, threats, cost, schedule, performance, risks, and other factors. Instead of a linear, serial, program-centric model of CBAs and AoAs, a portfolio team (with staff augmentation from operational, acquisition, and sustainment commands) could expand that analysis across a suite of capabilities.

As captured in Recommendation 36 of this report, each portfolio should have an enterprise architecture lead/group that uses model-based engineering. These enterprise models, with related portfolio analysis, would help shape portfolio priorities, capability scope, and requirements, which would help ensure capabilities are designed and developed to maximize interoperability within and across portfolios. Enterprise architects would work with their peers in other execution portfolios, Military Service headquarters, and ECPs.

Tight integration with cost analysts, systems engineers, users, and financial managers helps to assess the cost-performance trade space to scope affordable solutions. Prior to the 1996 DoDI 5000.2-R establishing AoAs, DoD conducted cost and operational effectiveness analyses (COEAs).³⁴ The COEAs emphasized quantitative cost analysis in program formulation. Although the current policies dictate program affordability targets and caps, and cost is part of AoAs, more comprehensive cost analysis could be used to shape program scope and requirements. Adopting more portfolio management practices as outlined in this report, along with revisiting some of the COEA practices, would help ensure programs are bounded by realistic affordability constraints, based on available portfolio budgets.

Manage IT Requirements Using Dynamic Portfolio Backlogs

A software requirements model should be timely, iterative, dynamic, and user-centric. Execution portfolios should manage their capability requirements via a series of dynamic backlogs rather than large static documents. As mentioned earlier, a dynamic backlog is a prioritized list of required functions written from an operational user's perspective but can also include technical requirements such as cybersecurity. The highest priority items on the backlog drive the next capability development or research (if greater technology maturity is needed). The requirements to shape a new capability development could be iteratively captured and approved via a tailored document, depending on the size, scope, cost, and risk. Managing requirements via backlogs is easier for software and IT given their dynamic and severable traits, but portfolios could also employ this approach beyond IT programs with smaller, iterative developments.

The portfolio's operational representative should be empowered to dynamically reprioritize, add or delete, and shape capability requirements based on operational needs, threats, technical performance, systems engineering, security, feedback from earlier releases, and other factors. These representatives would actively collaborate with operational commanders, end users, organizations providing threat assessments, and enterprise architects to curate the portfolio backlog. During portfolio reviews with Military Service leadership and operational commands, PAEs and their operational representatives

³⁴ Defense Acquisition Management Documentation and Reports, DOD 5000.2-M, February 1991, Part 8: Cost and Operational Effectiveness Analysis, accessed December 30, 2018, <http://www.whs.mil/library/mildoc/DOD%205000.2-M,%20February%201991%20Part%201.pdf>.

could present the requirements backlog to ensure alignment with Military Service and CCMD operational priorities and outcomes.

Each program or increment could also manage its requirements via dynamic backlogs. As interim developments are demonstrated or fielded, user feedback and system performance might generate new capability requirements or shift priorities for the backlog. The goal should be to ensure that each successive iteration addresses the users' highest priority needs and strengthens force effectiveness.

Consider Breaking Large Programs Down into Smaller Efforts to Iteratively Deliver Capabilities

As DoD establishes execution portfolios or adopts related practices within the portfolios, PAEs should consider opportunities to decompose large programs currently in the planning and development phases into multiple smaller efforts. Each program would need to balance the pros and cons of restructuring to include timing and system-of-systems integration, which may require revisiting the CDD and acquisition strategy structure of programs in development. The VCJCS should update the JCIDS manual to enable a more iterative structure in CDDs in future programs by adopting the proposed CDD annex approach in the new JCIDS manual and effectively implementing it.

This approach would enable PAEs to comply with the direction for rapid, iterative development in the NDS, DoDD 5000.01, and FAR Part 39. For example, instead of spending a decade to deliver all the functionality required in a CDD, the program could be structured to deliver functionality years sooner and iteratively deliver capabilities and new technologies via future releases, manage common subsystems (e.g., communications or sensors) via a single group within the portfolio, and integrate across platforms. If a technology or performance parameter proves more difficult to implement than planned, the functionality could be deferred to a subsequent release to allow mature capabilities to be fielded near-term.

Implementation

Legislative Branch

- Include language in the next NDAA authorizing Military Services and Defense Agencies to pilot a portfolio requirements approach within one or more of their current PEOs or via the proposed execution portfolio structure.

Executive Branch

- Charter teams to develop a set of capstone requirements for each execution portfolio. These capstone requirements should include EERs, MOFEs, and mission threads/effect chains/mission engineering. They should provide an umbrella set of requirements to shape capability research, planning, and developments.
- Update the JCIDS manual, CJCS Instruction (CJCSI) 5123.01, and DoDI 5000.02 to empower PAEs to shape and defer lower-level requirements, below a KPP, for programs in development.
- Determine a reasonable level of delegated authority based on the size of the program, changes, risks, and other factors. The PAE should be empowered to make changes to approve requirements on ACAT II–IV programs and lower-level requirements for ACAT I programs, in

collaboration with key stakeholders. *Major* changes (e.g., KPPs for ACAT I programs) will require senior approval via the CSBs and/or related processes as defined in current acquisition and requirements policies.

- Assign one or more operational representatives to each execution portfolio. These representatives would report directly to the PAE and may have dual reporting to an operational command or headquarters staff.
- Update DoDI 5000.02 to prioritize prototyping, experimentation, and delivery of MVPs before the start of a program and in the early phases of the acquisition lifecycle. PAEs should be empowered to work with the R&D community to rapidly fund prototyping efforts to shape the scope and requirements of new programs, upgrades to existing programs, projects to improve interoperability between systems, or initiatives to improve the readiness of fielded systems.
- Charter a team to iterate on the IT Box model or develop a new approach for meeting software requirements. The team lead and team members must have experience with or a deep understanding of Agile development practices. The chosen approach should enable adoption of software development practices to include Agile and DevOps through use of dynamic, prioritized backlogs managed by product owners rather than large, static documents. Authorize iterative release approvals at the lowest level commensurate with program scope, cost, and risk.
- Outline multiple requirements pathways for DoD to follow. The pathways may include Middle Tier Acquisition rapid prototyping and rapid fielding; technology insertion and iterative upgrades to existing systems; software intensive systems; business systems; commercial solutions with little to no development; formalizing a government R&D program; IT services, cyber acquisition, and limited lifespan capabilities with little to no sustainment needs.

Note: Explanatory report language and draft legislative and regulatory text can be found in the Implementation Details subsection at the end of Section 2.

Implications for Other Agencies

- There are no cross-agency implications for this recommendation.

Recommendation 40: Professionalize the requirements management workforce.

Problem

DoD's RM workforce is responsible for executing JCIDS and component requirements development and management processes. The RM workforce is not a professional career like the professional career fields that enable the PPBE system and DAS.

Capability requirements executives have expressed concern over the lack of an identified, trained, experienced, managed, and resourced RM workforce. Acquisition professionals receive extensive training and follow different, professional growth and career development paths providing years of experience in each successive job role. They often require a decade of experience to become proficient in their fields. RM organizations frequently have military operators who take a few Defense

Acquisition University (DAU) and Military Service-unique training classes with little to no prior experience in the field. Operators typically serve in requirements jobs on short assignments of 18-24 months with little to no prospect of returning to RM jobs in the future.

DoD has taken steps in compliance with statute to develop and provide professional training to the RM workforce by DAU and individual components. DoD has not provided the structure to motivate recruitment, growth, and retention of RM professionals as key enablers to effectively identify the capabilities needed for operational success.

The short, one-time assignments and lack of successive job roles to provide professional growth and experience prevent incumbents from gaining the proficiency necessary to understand the complex environment and effectively capture and shape system requirements. Further exacerbating the challenge, Military Services have been left to develop their own unique definitions of RM job roles, certification standards, personnel identification, and personnel management as RM personnel.

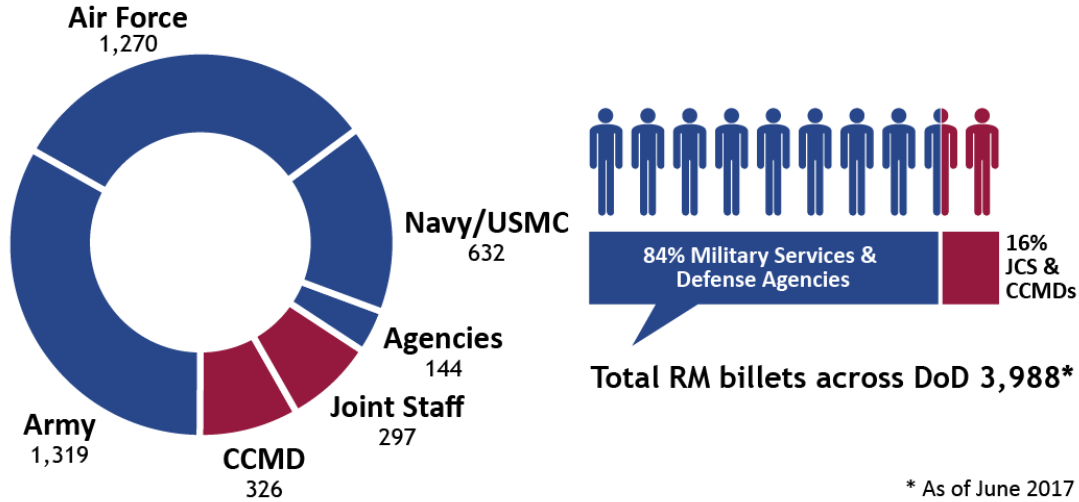
The RM workforce lacks a career path with roles and responsibilities and progressive experience. Each Military Service has unique RM definitions and lacks rigor in managing the manpower and career path standards. Undermanning and a dearth of RM professional skills and experience exacerbate the problems. RM requires a professional workforce capable of doing more than developing and staffing program requirements documents to assess the strategic and portfolio perspectives. More can be done to align the strategic guidance (e.g., NDS), CCMD priorities, capability gaps, threats, mission engineering, and capability roadmaps.

Background

As of June 2017, there were 3,988 RM billets across DoD. The JCS and CCMDs accounted for 16 percent, and the remaining 84 percent were in the Military Services and Defense Agencies (see Figure 2-15). In the FY 2007 NDAA, Congress directed the USD(AT&L), in consultation with DAU, to develop a training program for DoD personnel responsible for generating requirements. USD(AT&L)—working with Joint Staff J-8 and codified in the JCIDS manual—established and mandated the Requirements Management Certification Training framework comprising four different groups of RM personnel requiring completion of five courses for certification. These groups include requirements originators and support, writers and developers, core expertise, and senior-level validators and prioritizers. DAU has the authority and responsibility to develop and provide training. Departments and agencies have the authority and responsibility to identify personnel who need training, send personnel to training, and certify RM personnel. As of June 2017, 66 percent of the billets were filled by trained personnel, 21 percent were filled by untrained personnel, and 13 percent of billets were unfilled.³⁵ DAU provides the training and has worked with the requirements community to iteratively update the RM training curriculum provided by DAU and has provided development assistance to Military Service-unique training. In 2018, DAU began a major review and restructure of the RMCT curriculum to provide experiential learning and job support tools. These tools would be essential to rapidly develop timely and relevant capability requirements and better prepare RM personnel for the more rapid and agile emerging acquisition environment.

³⁵ J8 2017 Requirements Management Certification Team, Joint Staff Action Process Report to Functional IPT.

Figure 2-15. DoD RM Billets



Discussion

DoD RM cannot be done effectively by having warfighters serving in ad-hoc roles for a short tour before returning to operations. The RM community must have strong ties to the operational community. A warfighting operational perspective—preferably from top warfighting performers with recent operational experience—is essential to inform the front end of capability requirements development and management. Military Services should consider how top warfighters can play a more active role in RM. Military RM professionals with relevant operational experience, when coupled with their civilian RM counterparts who remain in their jobs longer, could form a highly skilled and experienced team as part of a common professional career path.

Some executives believe the loss of systems engineering support for JCIDS damaged the RM process.³⁶ Broad agreement exists regarding the importance of systems engineering analysis early in the process to develop requirements, CBA, and enterprise architectures. Early systems engineering would help ensure capability requirements are realistic given technology maturity, testability, affordability, and interoperability. Executives disagree as to how much systems engineering should be performed by the JCS, OSD, and Military Services. Although JCS and OSD benefit by having greater systems engineering and technical expertise from an enterprise requirements and architecture perspective, defining capability requirements and robust analysis should be done within the Military Services’ and Defense Agencies’ operational, R&D, and acquisition commands.

Conclusions

DoD requires a centralized definition of a RM profession and career for both military and civilians—and their combination as a force multiplier. It could be modeled on those for the acquisition workforce (see Section 5)—featuring career paths and the associated training and experience with increasing responsibilities and a growth track of roles—to strengthen and expand a cadre of capable RM professionals. RM professionals should act as warfighter partners, and the PM should provide the connections between operations and acquisition. They understand the strategic guidance, OPLANs,

³⁶ Information gathered during Section 809 Panel Sustainment Workshops, February–March 2018.

and CONOPs to interpret the capability requirements and the business language for funding and resourcing the solutions. JCS/J8, Military Service requirements headquarters, and operational commands—with the advice of DAU—should collaboratively define a common DoD RM profession including:

- **Growth-Defined Job Roles:** Job roles, based on tasks to be performed, should provide professional growth when coupled with defined job experience. DoD should define a common set of RM job roles for military and civilian members.
- **Experience-Defined Career Paths:** Career paths, with the potential for upward mobility, should be defined and incentivized for growth within and across Military Services for the civilian workforce.
- **Professional Training and Job Support Tools:** This is the most developed component of the career professional model across DoD. Professional training and job support tools should be based on tasks to be performed.
- **Standards:** Professional training and experience standards are essential for each job role across a career.
- **Selection Criteria/Targeted Recruiting:** To grow a cadre with operational warfighting experience and requirements process, resourcing process, and acquisition process experience, including systems engineering, S&T, or R&D experience section criteria and targeted recruiting are essential.
- **Incentivized Workforce:** To grow and sustain an RM profession that is agile and focused on the delivery of timely and relevant capability to warfighters, the workforce must be incentivized.
- **Accountability:** Accountability is essential to meet professional standards and ensure delivery of timely, relevant capabilities in partnership with the acquisition workforce and ultimately the warfighter.

JCS/J8, Military Service requirements headquarters, and operational commands—with the support of DAU—should also examine military and civilian billets, opportunities for common job roles, development of military and civilian job performance duties leveraging skills and experience brought to the table by both communities, work experience opportunities, both military and civilian career progression paths, and the balance of military and civilian billets to provide relevant and timely capability. To increase continuity and effect, while reducing turnover, DoD should consider allocating more billets to civilian personnel (ideally with operational, systems engineering, and/or acquisition experience) who will remain in the organization longer than Military Service members. JCS/J8, Military Service requirements headquarters, operational commands, and DAU should mature the training and education by creating subsequent iterations of the RM curriculum and adding more just-in-time training. These stakeholders should also explore a facilitated approach similar to the Services

Acquisition Workshop (SAW) with an integrated team embarking on capabilities analysis and requirements for a major system.³⁷

Implementation

Legislative Branch

- There are no statutory changes required for this recommendation.

Executive Branch

- Develop a strategy for a more formalized RM profession. This strategy should include the RM billets; education, training, and certification; targeted recruiting; career paths; and engagements with the R&D community, industry, and innovation organizations across the defense community.
- Allocate additional resources to RM to include extending military tours in RM positions and increasing the number of civilian billets. This ensures DoD is investing in the right capabilities and effectively laying the groundwork to develop and produce capabilities that have the greatest mission impact.

Note: There are no Implementation Details for this recommendation.

Implications for Other Agencies

- There are no cross-agency implications for this recommendation.

Recommendation 41: Establish a sustainment program baseline, implement key enablers of sustainment, elevate sustainment to equal standing with development and procurement, and improve the defense materiel enterprise focus on weapon system readiness.

Problem

Defense sustainment is a highly complex system of systems operating without fully coordinated requirements, under multiple commands and departments, receiving separate funding streams, often yielding disconnected decisions on total weapon system readiness, operating without sufficient data intelligence, with success graded on disconnected measures. The current state of readiness is driven by structure and strategy implications of decisions that focus on business concepts rather than the required outcome or customer measure of success or failure. Accountability is diffused to the point that no single authority is responsible for material readiness to meet operational requirements.

³⁷ A SAW is a facilitated workshop built around a specific acquisition and its team to mentors and guides them in developing their contract plans, research, requirements, request for proposal, source selection, and contractor assessments.

DSS suffers from shortcomings that inhibit its performance:

- There is no single document that governs sustainment costs, schedule, and performance throughout the lifecycle of a program (weapon system).
- Sustainment leadership expertise on SAE staffs is not given the same credence as acquisition and procurement.
- Issues in cost estimation, contracting, *color of money*, intellectual property (IP) and data rights, and metrics and data analytics impede sound sustainment decisions and timely actions.
- The Defense Materiel Enterprise (DME) is not sufficiently focused on weapon system readiness.

Lack of Governance for Sustainment

During development and production, the APB constrains a program's cost, schedule, and technical performance in terms of objectives and thresholds, but the APB provides little governance over the sustainment phase of a program's lifecycle. The APB is the governing document from program start (Milestone B) through full-rate production (FRP), yet this critical document pertains to less than one-third of the program's lifecycle costs and an even smaller portion of its life.³⁸ The PM reports program progress toward the thresholds in the APB to the MDA, the SAE, and Congress. Exceeding APB thresholds can cause a statutory Nunn–McCurdy breach and possible program cancellation. The APB, with its consequences for failure, has proven to be a strong motivator for the DAS. There is no equivalent governing document for programs in sustainment. Once fielded, a weapon system is supported by multiple individual sustainment organizations, each providing singular product support elements. Because there is no coordinated and constrained governance for program sustainment, weapon system readiness has become the unpredictable outcome of an unconstrained and unfocused defense sustainment system. As a result, PMs can find their programs affected by external budgetary and policy decisions with little opportunity to recover in a timely manner.

By DoD policy (DoDI 5000.2), PMs are responsible for cost, schedule, and performance management of their programs throughout the lifecycle. Although PMs can appropriately manage development and procurement during acquisition, they do not have the authority or capability to manage weapon system sustainment that delivers readiness. Instead, readiness is controlled by the sustainment *silos* providing the product support elements within the DoD sustainment system.

Standing of Sustainment

Sustainment does not stand on equal footing with development and procurement during the acquisition phase of a program. Responsibility and accountability for sustainment management do not converge on any single organization or individual focused on weapon system readiness. Sustainment costs are born out of design trades and decisions made during a program's development and procurement. Sustainment funding has often been used as the PM's *management reserve* (MR) to meet unplanned program issues during development and production, likely because deferment of product

³⁸ O&S costs are estimated to make up as much as 70 percent of the total lifecycle cost of DOD's major weapon systems. S. Report 112-26, *Report to Accompany the National Defense Authorization Act for Fiscal Year 2012*, June 22, 2011, 136.

support activities is believed to be recoverable later in the program. Delays in planned product support investments affect reliability and maintainability and substantially increase support costs and affect readiness. Requirements officials tend to focus more on traditional operational performance factors (i.e., speed, range, firepower) and less on sustainability (i.e., availability, reliability, maintainability, ownership costs). As a result, the latter often are subsumed by design trades and unforeseen cost increases during acquisition.

Sustainment Activities Lack Modern Enablers

Planning and investments for sustainment activities are further inhibited by issues with funding types and obligation rates, procurement restrictions, cost modeling, IP and data rights, and lack of knowledge sharing across the enterprise. Cost estimating tools for total lifecycle costs have not evolved as much as those used to calculate development and production costs. As a result, models used to determine lifecycle costs do not produce reliable calculations. Unlike commercial counterparts, military systems in general lack sufficient data to support use of data analytics. Commercial entities warehouse system performance data and constantly analyze it looking for trends that can help predict when preventive maintenance can be done to avoid costly, sometimes catastrophic repairs. This same data can be used to support effective decision making throughout the system's lifecycle.

Defense Materiel Enterprise Lacks Alignment

Readiness shortfalls can be seen in every Military Service. GAO reports for several years have documented critical readiness issues. Factors such as 17 years of war and the effects of the Budget Control Act of 2011 (resulting in sequestration) have led to the readiness state decried by the Service Vice Chiefs in their recent testimony before Congress.³⁹

Sustainment issues were highlighted by USD(A&S) Ellen Lord when she said, "sustainment costs for the F-35 are unaffordable."⁴⁰

In implementing the Goldwater–Nichols Act of 1986, development and procurement were separated from sustainment within DoD. One of the principle intents of this legislation was to clearly reassert civilian control of the military. An unintended consequence, however, was a disenfranchisement of the sustainment community.

Background

DoD must be able to immediately counter multipronged, sustained threats, yet the current logistics and sustainment system lacks the agility needed to do so. For decades, product support and sustainment

³⁹ Statement of General Stephen W. Wilson, Vice Chief of Staff, U.S. Air Force, before the Senate Armed Services Subcommittee on Readiness and Management Support, February 14, 2018, accessed January 4, 2019, https://www.armed-services.senate.gov/imo/media/doc/Wilson_02-14-18.pdf.

³⁹ Statement of Admiral William F. Moran, Vice Chief of Naval Operations, U.S. Navy, before the Senate Armed Services Subcommittee on Readiness, accessed January 4, 2019, https://www.armed-services.senate.gov/imo/media/doc/Moran_02-14-18.pdf.

³⁹ Statement of General James C. McConville, Vice Chief of Staff, U.S. Army, before the Senate Armed Services Subcommittee on Readiness, accessed January 4, 2019, https://www.armed-services.senate.gov/imo/media/doc/McConville_02-14-18.pdf.

³⁹ Statement of General Glen M. Walters, Assistant Commandant, U.S. Marine Corps, before the Senate Armed Services Subcommittee on Readiness, accessed January 4, 2019, https://www.armed-services.senate.gov/imo/media/doc/Walters_02-14-18.pdf.

⁴⁰ "Pentagon 'can't afford the sustainment costs' on F-35, Lord says," Aaron Mehta, *Defense News*, accessed March 29, 2018, <https://www.defensenews.com/air/2018/02/01/pentagon-cant-afford-the-sustainment-costs-on-f-35-lord-says/>.

management have been secondary to development and procurement within the DAS. Military systems have remained in service far longer than originally planned. Maintaining required spares for postproduction systems has been challenging as the government and industry have placed higher priority on new acquisitions. This lack of attention to product support and sustainment management has led to degraded weapon system readiness, rising sustainment costs, and insufficient supply support, and in parallel created suboptimal conditions in maintenance training, maintenance publications, provisioning, and repair capability.

DAS is focused on program development and procurement and is governed by the APB. Weapon systems sustainment is funded and managed by the operational side of DoD. Separation of sustainment from development and procurement yields an approach to acquisition that focuses on technical solutions for a program, at the expense of balanced weapon systems sustainment throughout the lifecycle.

Existing regulations and policies establish reviews at each program milestone to ensure adherence to all aspects of defense acquisition. These reviews are supported by senior level staffs with expertise regarding the operational environment, requirements, and defense acquisition. Senior officials at levels equivalent to those for development and procurement—with the requisite expertise for product support management—are less represented. The system’s focus on development and procurement, with an attendant lack of appreciation, expertise, and accountability for weapon systems sustainment can preclude needed discussion on the supportability aspects of a system at these milestone reviews.

Program funding flows from Congress to the Military Services through a variety of appropriations and is channeled not only to the program but also to siloed organizations that will ultimately support the product. This partitioning of program sustainment funding leads to an incomplete accounting of critical resources such as manpower, training, spares, engineering, depot repair, and support equipment.

With each element of the sustainment organization devising, constructing, and implementing its own data and metrics, contradictory objectives can arise. The result is an incomplete set of metrics and an inability to use shared data visible to all stakeholders and to provide a reliable indication of sustainment health for weapon systems or the overall condition of the capability portfolio within which the platforms reside.

The DME consists of the materiel systems and supply commands and the DoD industrial base that comprise product support and sustainment management for DoD. Membership in this enterprise is not officially designated but is understood to mean everything and everyone associated with developing, procuring, storing, distributing, repairing, and supporting DoD’s warfighting capability. It includes contracted support but, historically, industrial base assessments have not included the contractor element. This approach presents an incomplete picture of the DME’s capacity.

Discussion

Several key shortcomings exist regarding sustainment management:

- There is a lack of alignment and governance of program sustainment cost, schedule, and performance over the entire lifecycle.

- The SAE staffs do not include sustainment professionals at an equivalent level of authority to the development and procurement senior staff and leadership.
- Key enablers for modern sustainment are missing across the enterprise.

Establish a Sustainment Program Baseline

The PM's focus during development and production is on meeting the APB's cost, schedule, and performance thresholds. The effects of these shortfalls and trade-offs are not generally realized until years later, after the successful milestone decision and following the tenure of the PM who made the decision. The DAS focuses more on ensuring the program is meeting the requirements of the APB and less on the ability to sustain the system in the future.

Warfighters receive weapon systems as a product of the DAS and depend on the sustainment system to provide the product support required for operational readiness of the weapon system. On average, approximately 72 percent of weapon systems lifecycle costs are in sustainment, yet there is no mechanism for coordinated governance of this critical operational program phase. The Section 809 Panel researched major defense programs and found the APB to be an effective tool for guiding, governing, and constraining the development and production of major weapon systems.

During design, alternatives are weighed for performance and affordability. The PM must balance these factors and make decisions that will affect supportability and sustainment costs, both of which are outside the APB constraints. Small design trade-offs rarely affect total lifecycle costs enough to cause a program cost breach. Programs typically do not fail a milestone or breach the APB because of underfunded or delayed product support.

During development and procurement, PSMs are planning for and engaged in activities that will provide for the effective sustainment of the system after fielding. Critical product support milestones occur after the APB's final milestone review: the FRP decision. Critical sustainment milestones such as the material support date (MSD) and depot stand-up require planning, coordination, and funding years in advance of fielding, but they fall victim to design trades and budget reallocations to meet performance needs. Accordingly, early funding for sustainment investments is at risk because it is used as a source to fund development cost growth.

Despite efforts to increase visibility of design decisions affecting product support requirements, when technical or budgetary challenges arise during development and procurement, PMs have at times been forced to trade off programs' future (outside the APB) to solve a current problem (inside the APB). The consequences of these deferrals and trade-offs are not realized until years later, after weapon systems are fielded and milestones completed. Decisions on program requirements, performance, and configurations made early in the acquisition process will largely determine a system's Operating and Support (O&S) costs, and opportunities to reduce or avoid O&S costs diminish as a program advances through the lifecycle.

KPPs and key system attributes (KSAs) for system lifecycle management are being included in program APBs; however, once a program has passed Operational Test and the FRP milestone decision, the APB is no longer a strong motivator for the PM or RM (A8/G8/N8).

PMs are responsible for the program's development and procurement and have the authority, autonomy, tools, and funding to manage to the parameters specified in the program's APB, which is approved by the resource manager, MDA, and the PM. DAS is program-focused with the following characteristics:

- It is a highly complex system of systems with one primary governing program document: the APB.
- There are clearly defined and accountable officials: the PM, the MDA, and the resource manager.
- Funding streams are directed to the program per APB thresholds.
- Programs are *strongly* managed, funded, and measured to specific outcomes: Operational Test and Evaluation and FRP.
- Program success is measured by meeting APB thresholds and achieving milestone approval.
- The organizations' objectives, metrics, and funding are focused on program success.

In post-production, the PM and PSM are responsible for sustainment, but do not have sufficient authority, requirement, or funding to successfully manage the independent product support elements amongst the sustainment silos. With rare exception, there is actually no one individual truly responsible or empowered to manage a program's sustainment for operational readiness; no single official is held accountable for readiness shortcomings. Some of the challenges within the sustainment system include the following:

- The system includes process-focused sustainment silos that are *not* program-focused.
- It is a system that is *not* managed, funded, or measured by the outcome: program readiness.
- There are multiple funding streams to independent organizations without regard for program readiness requirements.
- Organization objectives, metrics, and funding are self-reflecting.
- It is a highly complex system of systems consisting of disconnected sustainment silos.
- There is no accountable official for programs' readiness.

The following are significant challenges in the acquisition and sustainment systems:⁴¹

- Product support is a low priority and often becomes the funding source for unplanned program shortfalls, because there are no consequences for the PM or the program under the APB.

⁴¹ Information gathered during Section 809 Panel Sustainment Workshops, February–March 2018.

- Supportability KPPs and KSAs are not well used during weapon system design and are not measured or evaluated during the sustainment phase.
- The sustainment system is a collection of independent and specialized organizations that lack governance and accountability for the weapon systems readiness it supports.
- The acquisition system is program focused and governed by the APB.

Program offices lack appreciation of the effects of delaying sustainment planning. Issues that were consistently expressed by subject matter experts (SMEs) include the following:

- Resources for product support and sustainment planning were not allocated and controlled early in the development process.
- Funding requirements for minimum capability for product support and maintenance were ill defined.
- Warfighters were not sufficiently engaged to address product support and sustainment requirements.
- Government and industry were not aligned regarding product support planning, incentives to improve reliability and maintainability, and sustainment.

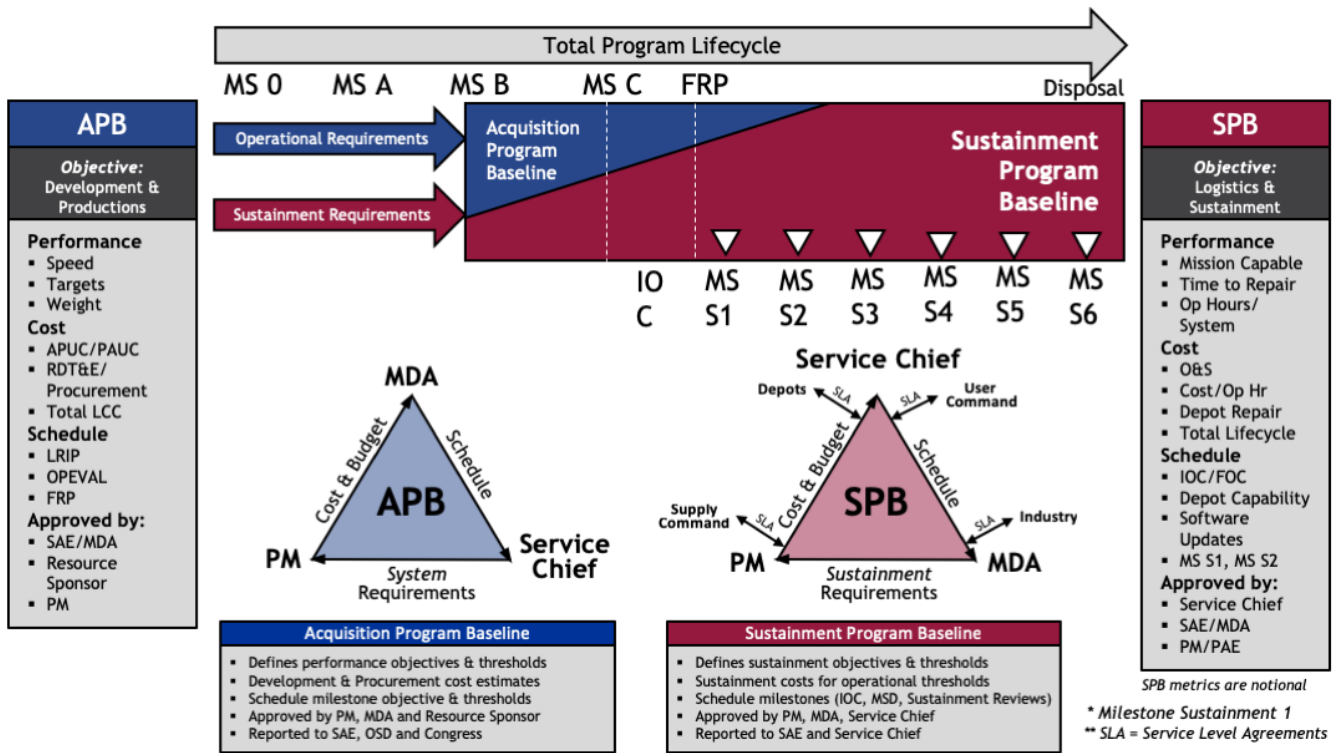
SPB would improve the current shortcomings outlined in both the acquisition and sustainment systems that are affecting both operational costs and readiness. The SPB would be the governing document for product support and sustainment over the entire program lifecycle. The SPB would have the same three stakeholders as the APB: the PM, the resource sponsor, and the MDA—facilitating a long-term commitment that will enhance readiness.

The SPB in Development and Procurement

The SPB would be generated during concept exploration and consider the key cost and readiness drivers that would influence trade-off considerations. During this early phase, sustainment goals could include annual operating costs, security, maintainability, transportability, mobility, availability, personnel, and the support and repair concepts. The APB would remain the key document during development and production. The importance of the SPB would increase over time. The relationship between SPB and APB is depicted notionally in Figure 2-16.

The SPB would mature with the program and product development. Sustainment performance requirements would start out as estimates and be further refined through the course of a program. As the strategy, costs, and performance parameters of the program's plan for sustainment evolve, the SPB would capture the critical parameters to govern the program's sustainment strategy after FRP. The budget and funding for *all* product support requirements and lifecycle costs would be identified in the SPB to reflect the strategy, plans, and milestones outlined in the lifecycle sustainment plan (LCSP). The critical product support milestones from the LCSP would be reflected in the SPB. The APB and SPB would be reviewed and approved at program acquisition milestones.

Figure 2-16. Sustainment Program Baseline in the Acquisition Lifecycle



The SPB During Sustainment and Disposal

As the program support concept matures, the SPB would provide the PM and PSM with the authority to govern the product support requirements, funding, and performance of the program in the sustainment system. As shown in the diagram above, the PM would develop service-level agreements (SLAs) with the product support providers. SLAs would be binding agreements between the organizations outlining requirements, funding, and performance outcomes to achieve the thresholds in the SPB. SLAs should be updated annually with 5-year forecasts.

After FRP, the SPB would be updated, reviewed, and approved biennially for the remainder of the program’s lifecycle by the PM, MDA, and resource sponsor at the sustainment program milestone. A breach to the SPB thresholds for cost, schedule, or performance would be reported to one level above the stakeholders within 30 days.

The SPB would capitalize the value of early sustainment planning, devise budgets to support the necessary planning, and integrate the cost, performance, and accountability of a program throughout the lifecycle.

Incorporating both the APB and SPB into program development and production provides the needed transparency, outcome-based results, and full accountability for the PM to manage the program across the entire lifecycle. This approach is applicable in the current PEO structure as well as the portfolio management construct.

Although creation of this document adds to the program office workload, the value it adds in establishing early sustainment performance goals and protecting sustainment funding offsets the additional effort. Because sustainment funds are often used as a source of MR, the SPB may also be viewed as limiting the PM's flexibility to move funding to address emerging issues. The document would force a contract with the key program stakeholders that would prevent outside agencies from raiding program funding. By ensuring the stakeholder network is involved in funding allocation, the program would also benefit from added influence and support to replace reallocated sustainment funding should it be necessary to move those funds to address an emergent development or production need.

Establishing and maintaining the SPB would improve governance and management of programs' product support and sustainment by doing the following:

- Developing sustainment performance requirements that influence design.
- Balancing trade-offs between development, production, and sustainment.
- Protecting requirements and funding that impact future readiness and sustainment costs
- Empowering the PM to manage sustainment to the SPB cost, schedule, and performance thresholds through SLAs with product support providers.
- Enabling and instituting governance and accountability of weapon system sustainment and readiness.

Elevate Sustainment

Better management of product support should start with mandating that the PSM be a direct report to the PM. Establishing a PSM position was intended to bring product support and sustainment experience and expertise to the upper management levels of the program office. Although the PSM roles and responsibilities are clearly defined, no specific resources are identified to support these efforts. Having the PSM as a direct report to the PM would signal to the entire program office the importance placed on sustainment management.

Elevating sustainment would also require a larger and more experienced staff within the PAE organization. The deputy PAE for sustainment would lead a team of product support experts who would provide guidance for individual programs and oversight of the entire portfolio. They would be the first level advisors for the PAE making trade-off decisions to achieve portfolio objectives.

At the SAE level, a deputy for sustainment would lead senior product support and sustainment experts who would be advocates for successful sustainment decisions throughout the acquisition process. The sustainment deputy would guide the Military Services' strategy and governance of sustainment and also advise the SAE on sustainment. They would also provide inputs for both the PAE and ECP regarding sustainment.

Key Enablers for Modern Sustainment are Missing

A number of key enablers are absent from the sustainment system:

- There is no stable funding for sustainment planning and execution that is budgeted at the program level and then directly controlled by the PSM.
- Contractual vehicles do not incentivize key partners to meet long-term sustainment goals.
- IP and data rights are not appropriately addressed.
- O&S cost modeling is inadequate.

PMs have historically been forced to make design trades-offs, favoring operational requirements early in a program's lifecycle and consuming resources that would otherwise have been used to cover sustainment needs. PMs favor technical requirements over sustainment planning in the early stages of a program. Technical issues are not clearly understood until design work can be completed and sustainment planning impacts will not be seen until years later. There are no sustainment requirements in either the APB or the acquisition strategy that must be fulfilled prior to each milestone decision.

The PSM must compete for program funding to achieve appropriate levels of sustainment planning and performance. Funding is often provided only in the year of execution, further hampering the PSM's ability to establish long-term strategies to improve sustainment performance or incentivize lifecycle cost reductions.

Sustainment Funding

Sustainment is often allocated Operations and Maintenance (O&M) funding that expires each year. Solving obsolescence issues, particularly for avionics parts, is constrained by real or perceived regulations or policies that govern the funding source. With rapid technology advances, the capability of replacement avionics, as well as other categories of components, usually exceeds that of the item it is replacing. Because replacement technology typically increases speed, throughput, or some other aspect of performance, it is perceived as adding functionality. This perception often drives procuring agencies to determine that R&D funds are required to counter the obsolescence, adding unnecessary time and complexity to the sustainment process. Without budgeted resources, identifying funding to correct obsolescence becomes exacerbated by short response time.

Interpretation of the regulations and policies governing obsolescence has been incorrect.⁴² A research project initiated by DAU, in conjunction with Hacking 4 Defense (H4D), showed that procurement activities were using an interpretation fostered by an incorrect application of the Financial Accounting Regulation regarding *capability improvements* resulting from redesigns due to obsolescence issues. Interviews with more than 100 individuals throughout the acquisition community revealed that an incorrect interpretation had been circulated throughout DoD. DAU and H4D investigated the

⁴² Information gathered during Section 809 Panel Sustainment Workshops, February–March 2018.

regulations and policies, finding them essentially silent on this matter, and recommended a new training element quickly disseminate the correct information and updates to the regulation.

The variety of funding sources (commonly called color of money issues) and expiration periods applied create sustainment issues as well. An example of why the potential for confusion exists can be found in funding for spare parts. Spare parts may be considered provisioning, replenishment, depot-level repair, or obsolescence. Spares for provisioning may be purchased through a program office with procurement funds for initial sparing. Replenishment may constitute additional purchase of spares or depot-level repair may be executed to support replacement of worn or damaged parts. Obsolescence may result from failure in reliability or diminishing manufacturing sources. Each of these possibilities could require funding by a different appropriation, with each funding source governed by a different expiration period.

Financial Management Regulations (FMRs) can be confusing, arcane, and subject to interpretation, as in the obsolescence example above. The result is delayed decision making and lack of agile support to warfighters. Asset visibility is also affected. Long-term contracting is impeded, which inhibits depot maintenance organizations (both organic and commercial) from developing well established relationships with suppliers.

IP and Data Rights

Program management has not addressed the IP issue in sustainment adequately.⁴³ PMs and PSMs share responsibility for ensuring weapon systems receive appropriate and competitive component repair. To maintain competition throughout the lifecycle, data rights and IP—as applicable to both hardware and software—must be addressed up front. Obtaining IP and data rights has become a complex issue for most major programs, resulting in dissatisfaction within both the organic and commercial depot organizations. Data rights and IP should be made available when needed, where needed, and for the specific purpose needed while also protecting the IP and data rights of industry partners.

Software Sustainment

Organic software sustainment is determined by platform requirements. There is no organic software sustainment strategy today, and considering the rapidly evolving nature of software development and maintenance tools, the government needs to increase attention here. The complexity of acquiring data and data rights regarding commercial products, incorporated into either purpose-built or hybrid platforms, requires development of policy, regulations, and statutes. The government should leverage the strengths of both organic and commercial software organizations in this effort.

Depot Maintenance

Little knowledge sharing occurs among the Military Services and between organic depot organizations and commercial maintenance, repair and operations (MRO) facilities. Differences in execution of sustainment support among the Military Services do not promote active sharing of ideas, methods, and technologies. The degree of sharing is driven by personal relationships. Organic depots and

⁴³ Richard Van Atta et al., *Department of Defense Access to Intellectual Property for Weapon Systems Sustainment*, IDA Paper P-8266, May 2017, Institute for Defense Analysis (IDA), accessed May 30, 2018, https://www.ida.org/idamedia/Corporate/Files/Publications/IDA_Documents/SFRD/2017/P-8266.pdf.

commercial MRO facilities consider themselves competitors; consequently, knowledge sharing regarding repair methods, tooling concepts, and processes is rare. Successful programs find ways to overcome these obstacles, but responsiveness was forced by the program office rather than incentivized through appropriate contract vehicles. An example of this is the F-22 program for which specific expertise to support depot level repair at an organic depot is supported by manpower detailed by the original equipment manufacturer (OEM).

Metrics and Data Analytics

SMEs have identified several shortfalls in metrics:⁴⁴

- Tools to enable model-based engineering for sustainment are needed.
- Total lifecycle analysis tools are needed, such as better tools to model reliability and maintainability, determine optimum product support, forecast demand profile, and perform predictive manpower analysis.
- Model-based engineering is used extensively during development. Modeling of sustainment to include such items as transportation, deployed repair capability, and manpower are seldom used.

Reliability estimates are calculated during proposal development and are measured during technical maturation. Actual reliability seen in combat operations is often substantially different from the early estimates or even measurements taken in a laboratory environment. Maintainability is judged during technical evaluation through a maintenance demonstration. Results may not be representative of the final delivered product. Tools that allow modeling of reliability and maintainability characteristics would allow identification of the effects of early development decisions. For example, a model that included the required maintenance-free operation time following deployment would drive reliability and provide assessment of the time required to deliver deployed repair capability to a combat theater of operations. Predictive manpower analysis tools, applied early in the development phase, would provide lead time for training and documentation requirements to be established and appropriate planning, budgeting, and forecasting applied.

Demand signals provided to repair activities (whether organic or commercial) drive investments in training, tooling, manpower, and spare parts availability. SMEs from both organic facilities and industry spoke about the demand signal quality, which can impede execution of depot-level repairable (DLR) actions.⁴⁵ Tools providing visibility of demand signal to all stakeholders are not in place. Reports regarding metrics within the organic industrial base are replete with recommendations and suggestions for improvements. Although some recommendations and suggestions have been adopted, the current readiness state indicates that more can be done.

Use of predictive analytic tools is in its infancy within DoD but widely used by industry. Data from each Military Service is controlled, stored, and manipulated internally. Each DME element has its own

⁴⁴ Information gathered during Section 809 Panel Sustainment Workshops, February–March 2018.

⁴⁵ Ibid.

information technology department, but there has not been a requirement for them to be interoperable or for the data to be collectively warehoused. Efforts to compile all the data, collectively analyze it, and make decisions at the DoD level requires numerous data calls, manual information transmission, and considerable time.

O&S costs equate to 42 percent of the FY 2019 DoD budget request, more than double the investment in research and procurement. Whether funding is being applied correctly must often go unanswered for lack of effective data analytics.

Improve Focus of Defense Materiel Enterprise on Weapon System Readiness

The DME's lack of focus regarding weapon system readiness is manifested in four key areas:⁴⁶

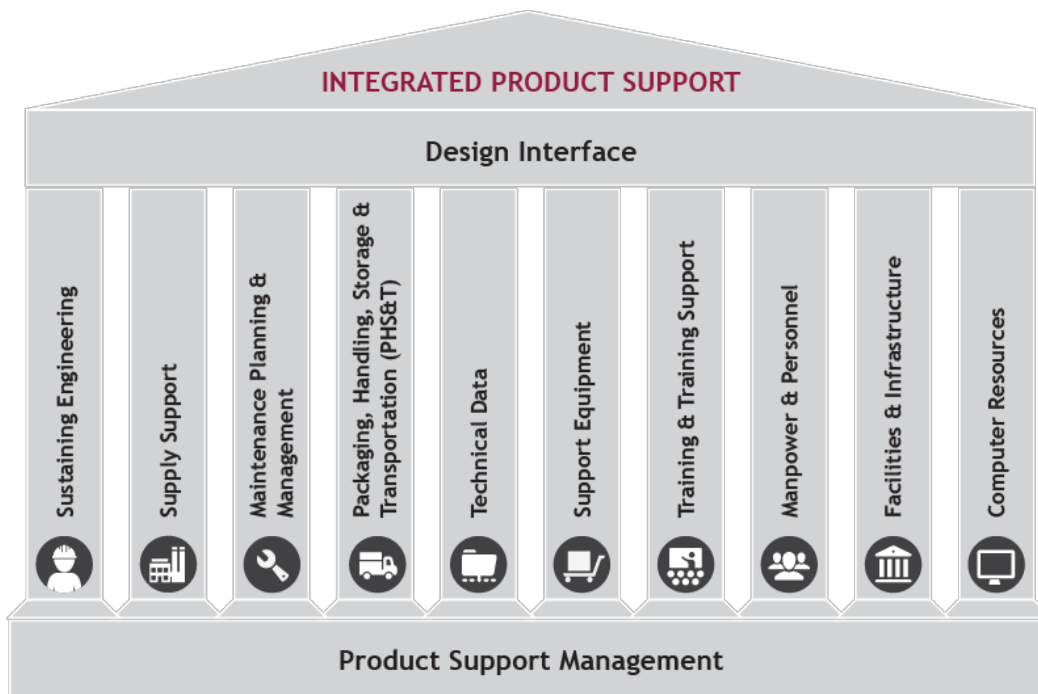
- Product support provided by individual, internally focused organizations in the DME to weapon system readiness does not receive the attention or visibility needed.
- PMs have little insight regarding decisions made by suppliers of the various product support elements and have little opportunity to influence these decisions or to assess the impacts in a timely manner.
- Total industrial capacity and capability has not been assessed in many years.
- Overall depot maintenance strategy is not aligned to the NDS.

Product Support

Product support organizations in DoD are focused on single elements such as manpower, training, systems engineering, mission software, depot repair, spares and consumables, or technical publications, as shown below (see Figure 2-17). Operating in sustainment silos, these organizations tend to make independent decisions based on anticipated outcomes beneficial to the organization without regard for requirements, budgets, funding levels, or readiness effects. The system lacks a controlling mechanism for the required output—weapon system readiness. When isolated mandates, such as military end strength, are issued, the down-stream effects of such decisions are felt throughout the defense sustainment system for years. Weapon system sustainment requires a system-of-systems approach to plan, manage, and control the interdependencies of the product support elements contributing to a program readiness. Figure 2-17 depicts the product support elements, each of which is funded differently, operates on metrics with little or no direct correlation to readiness, and is internally focused rather than outcome focused.

⁴⁶ Ibid.

Figure 2-17. Product Support Elements



SMEs repeatedly described situations in which organizations within the integrated product support elements either executed or failed to execute decisions based solely on their own internal policies, direction, or even personal biases without regard for the effect on readiness.⁴⁷ An example is the anecdotal information provided by one PSM who stated that a supply-chain element failed to initiate a contract for replacement spares for an item that was rendering a number of his platforms non-mission capable (NMC).⁴⁸ When he investigated, he determined that a key contract was being withheld over a negotiation on allowable profit regarding a 1 percent difference in price for a piece-part worth less than \$1,000. Further research found a number of platforms had been declared NMC awaiting resolution of a price difference measured in tens of dollars. This put weapon system readiness in jeopardy when a premium to a contractor or supplier could have quickly resolved the problem and met warfighter needs. (See the panel’s recommendation on value analysis in Recommendation 38.)

Program Manager Insight Regarding Product Support

One stakeholder held up the USAF model as a positive example of product support.⁴⁹ This model depicted a feedback mechanism from the sustainment enterprise to the Program Management Office (PMO). The USAF model resulted from a reorganization that provides periodic program reviews by all levels of the acquisition system—from the SAE, PEO, PMO, Systems Commands, and warfighters. Other stakeholders indicated the USAF model should be replicated in the other Military Services.⁵⁰

⁴⁷ Ibid.
⁴⁸ Ibid.
⁴⁹ Ibid.
⁵⁰ Ibid.

A governance process that is inclusive of stakeholders, is transparent in intent and purpose, and allows for Military Service-level redistribution of funds to address emerging needs while ensuring program needs are considered would be a step toward better sustainment management. Failure to better manage and invest in product support has a two-fold effect: It increases future operations costs and reduces funds available to invest in new capabilities and recapitalization.

Total Industrial Capacity and Capability

With respect to maintenance, total industrial capacity of the United States has not been accurately assessed in many years. Depot maintenance capacity, to include both commercial and organic organizations, is not aligned to the NDS because there has been no requirement to do so. Organic depot maintenance organizations are generally aligned to the needs of the Military Service they support, except in rare cases in which Military Services have agreed to satisfy joint needs. Commercial depot maintenance organizations are profit motivated but have more flexibility to respond to changing requirements. Lack of a complete industrial capability and capacity assessment and determination of overall required capacity has resulted in duplication of capability in some areas and gaps in others. For example, each Military Service addresses the issue of diminishing manufacturing sources and material shortages (DMSMS). The Army and Air Force their own respective unique software tools. The Navy has distributed capability across five different organizations.

Depot Maintenance Strategy

10 U.S.C. § 2464 requires DoD to maintain core depot capabilities for key weapon systems sufficient to support expansion for wartime operations. 10 U.S.C. § 2466 places a 50 percent limitation on the funds made available to Military Services or Defense Agencies that can be used to contract for performance by nongovernment personnel, commonly known as the *50/50 rule*. Up to 50 percent of the total depot maintenance budget is thus an entitlement for the government maintenance organizations. Throughout its history, 10 U.S.C. § 2466 has been changed several times to ensure a balance between organic depot funding and contracted performance to optimize efficiency of the overall repair network.

Organic depot maintenance remains an important capability. During World War II, IP developed by one company was often handed over to another company to enable increased production rates. Modern weapons systems have become so complex that rapidly increasing productions rates in this manner would be nearly impossible for many reasons, including time. International conflicts are now more often a *come as you are* evolution. Organic depot maintenance has evolved from a manufacturing capability to MRO capability. Title 10 requires an organic depot capability to provide surge capacity but primarily for component repair to support already fielded equipment.

Some older industrial capabilities are not available through industry or are sufficiently critical that a government source must be maintained. For example, the major producer of gun tubes for cannons, mortars, and tanks for the Army is Watervliet Arsenal. Similarly, the primary producer of arresting gear for use aboard Navy aircraft carriers is at Lakehurst, NJ.

Conclusions

DAS is focused on the development and production of weapon systems and governed by the APB. This system has governance and controls to manage the cost, schedule, and performance required. The sustainment of DoD's weapon systems, which accounts for more than 70 percent of weapon system

lifecycle costs, lacks the required governance and accountability, and is a system of independently operated silos that compete for limited dollars. DoD's sustainment system lacks the alignment of investments, enablers, data, metrics, and management to enable affordable and effective weapon system readiness.

Implement a Sustainment Program Baseline

Improving weapon system readiness will require implementing the alignment, governance, and visibility of the sustainment costs, requirements, and funding over the entire lifecycle, to enable the development, execution, and support of the system's operational readiness, directly managed by the PM and the PSM as approved by the SPB. The PM must be aware of and able to directly influence decisions regarding the program by other elements of the Defense Materiel Enterprise. To address this issue, the following should occur:

- Establish the PM as the single responsible authority for ensuring material readiness to the established requirements in the SPB.
- Require the SPB for all program acquisition milestones and biannually after Milestone C.
- Align funding, requirements and expectations for provider organizations to execute the sustainment strategy to improve, obtain, and monitor weapon system readiness through service provider agreements.

Elevate Sustainment to an Equal Standing with Development and Procurement

Changes in the existing organizational structures are needed throughout DAS to enable sustainment to gain the visibility and stature afforded to development and procurement. Such change will require strengthening the authority of sustainment officials from the SAE to the program office.

The PSM needs to be a direct report to the PM and part of the PAE's organization. Empowerment and appropriate incentives for the PM and the PSM can be accomplished by making changes that provide stable funding and having the PSM become a direct report to the PM. This action would highlight the importance of sustainment management to the entire program office.

Equally important is having sufficient expertise and authority in the PAE and SAE organizations to ensure implications of program and enterprise decisions that will affect sustainment of a program going through decision reviews will be understood. To address this concern, the following should occur:

- Establish sufficient expertise on the PAE staff to facilitate and govern product support and sustainment decisions across the portfolio.
- Establish expertise on the SAE staffs with the necessary knowledge and sufficient authority to provide inputs for both portfolio- and enterprise-level decisions regarding sustainment within the Military Services and across DoD.

Key Enablers are Required to Improve Sustainment Management

Enablers for sustainment management are needed to improve the information, modeling, and metrics used across the defense enterprise to manage this extremely complex and costly system. To address this concern, the following should occur:

- Implement improvements in cost modeling for sustainment. Decisions made within the first 30 percent of development and procurement determine 70 percent of the lifecycle cost. Establishing a SPB early and allowing the PSM to drive sustainment costs through reliability and maintainability improvements during design will create long-term benefits.
- Prescribe and allow programs to budget for obsolescence. Tools for predicting obsolescence, particularly in electronic components, are readily available. Ensuring programs have properly estimated and budgeted for obsolescence management will enable proactive planning and response to this issue faced by all programs.
- Promote knowledge sharing among organic depot maintenance activities and commercial MRO activities.
- Clarify statutes, regulations, and policies regarding sustainment funding. Training related to such clarifications will be needed to improve standardization, promote flexibility in interpretation, and provide more agile sustainment response to warfighters.
- Develop and use sustainment metrics and data analytics for cost estimating, modeling, and performance.

Align the DME to Strategic Weapon System Readiness

Current material readiness and sustainment costs are driven by the DME's structure and strategy decisions without established responsibility and accountability for desired outcome tied to readiness requirements. Changes to both the structure and strategy should be focused on increasing agility and flexibility of the system to provide better warfighter support. To address this concern, the following should occur:

- Develop an integrated national industrial-base strategy, encompassing both organic and commercial organizations, aligned with current NDS.
- Conduct an end-to-end material readiness process assessment to provide alternatives to improve the effectiveness, efficiency, and affordability of the overall system.
- Make organic depot determinations within the industrial base (organic and commercial), focused on warfighting requirements.
- Develop a DoD vision for the industrial base regarding organic and commercial technology to take best advantage of all capabilities.
- Develop a strategy for organic software engineering capability and requirements.

Implementation

Legislative Branch

- Direct DoD to implement an SPB to govern product support cost, schedule, and performance of the weapon system throughout the lifecycle. Require the development of an SPB—concurrent with the development of the APB—that is updated and approved at each program acquisition milestone and then biennially following FRP at the sustainment milestone reviews.
- Direct DoD to update and strengthen lifecycle cost estimating methodologies to support development of the SPB. Obsolescence affects all programs; proactive planning and requiring programs to budget for obsolescence would improve readiness.
- Direct DoD to propose specific changes to statutes to clarify sustainment funding that are needed to improve standardization, promote flexibility in interpretation, and provide more agile sustainment response to warfighters. Congress should also direct DoD to implement changes to update regulations and policies and conduct training related to the changes to statutes.
- Direct DoD to conduct and report to the congressional defense committees, an assessment of the defense sustainment enterprise to include balance of leadership attention among acquisition and sustainment, organizational structures, national industrial base, and alignment of DME to weapon system readiness and support of the NDS. The assessment should include the following: end-to-end material readiness process assessment to provide alternatives to improve the effectiveness, efficiency, and affordability of the overall system. The industrial base strategy should do the following:
 - Encompass both organic and commercial organizations in the national industrial base.
 - Right size and composition of the industrial base regarding organic and commercial technology to take best advantage of all capabilities in view of the NDS.
 - Focus depot determinations within the industrial base (organic and commercial) on warfighting requirements.
 - Tie accountability for outcome to readiness requirements.
 - Maintain DME agility and flexibility for warfighter support.
 - Include other activities and/or entities as identified to provide a full and accurate assessment of the defense sustainment enterprise.

Executive Branch

- Elevate sustainment to an equal standing with development and procurement by adequately funding, manning, and overseeing sustainment in accordance with the recommendations of the panel.
- Improve sustainment management through key enablers.

- Improve the data and information, modeling, and metrics across the defense sustainment enterprise to manage this extremely complex and costly capability. To address this concern, the following focus areas require attention:
 - Employ cost modeling for sustainment being mindful of the fact that decisions made within the first 30 percent of development and procurement determine 70 percent of the lifecycle cost.
 - Develop a strategy for organic software engineering capability and requirements.
 - Create long-term benefits by ensuring the PSM drives sustainment costs through reliability and maintainability improvements during design.
 - Establish an SPB early.
 - Share knowledge promptly among organic depot maintenance activities and commercial MRO activities.
 - Maintain sustainment metrics and data analytics for cost estimating, modeling, and performance.
- Address the following in DoD and Military Service/Agency directives and instructions:
 - Policies and processes to implement enhanced sustainment management per statutory requirements.
 - SPB as the baseline requirements document for funding and staffing sustainment activities.
 - Sustainment billet structures across DoD appropriate to challenges of the sustainment enterprise.
 - Sufficient expertise on the PAE staff for product support and sustainment.
 - Management of programs to the thresholds in the SPB and development of service provider agreements with major stakeholders.
 - Empowerment of the PM, with direct input from the PSM, to manage the sustainment of the program from cradle to grave, through the SPB.
 - Situating the PSM as a direct report to the PM.
- Empower the PSM to develop and execute the lifecycle sustainment plan to meet the cost, schedule, and performance requirements of the SPB.
- Incorporate above Executive Implementation recommendations in revision to DoDD 5000.01, The Defense Acquisition System and operating instructions.

Note: Explanatory report language and draft legislative and regulatory text can be found in the Implementation Details subsection at the end of Section 2.

Implications for Other Agencies

- There are no cross-agency implications for this recommendation.

Recommendation 42: Reduce budgetary uncertainty, increase funding flexibility, and enhance the ability to effectively execute sustainment plans and address emergent sustainment requirements.

Problem

Budgetary uncertainty and limited funding flexibility have hampered the ability to effectively execute sustainment plans and address emergent sustainment requirements. DoD sustainment suffers for the following reasons:

- Sustainment is underemphasized in the lifecycle cost estimate (LCCE) during program planning.
- Trades are made during early phases of development that could negatively affect the program in the sustainment phase.
- Sustainment receives inadequate attention in the early acquisition phases.
- The sustainment phase lacks adequate planning, programming, and budgeting.
- Decisions are made by higher authority in response to emergent requirements.
- Ambiguity in DoD financial regulations causes sustainment requirements to be budgeted in the wrong appropriation account.
- Programs cannot be supported because funding in the correct appropriation is not available during execution years.
- Sustainment requirements budgeted in an O&M appropriation are affected by the availability of funding when they are needed in execution year.

Background

In the defense acquisition community, several terms are used to refer to the costs associated with maintaining weapons systems. It is a common mistake that the acquisition community believes that O&S and the appropriation O&M are interchangeable, but they are not. There is also a misperception that all O&S activities are only funded with the O&M appropriation and that is not true either.

O&M is a category of appropriations accounts enacted by Congress each year as part of the annual defense appropriations law. O&M funds *some* of O&S functions but not all of them. O&M appropriations also provides funding for some civilian employee salaries; military base operations to include utilities, security, and building maintenance and repairs; medical care; IT infrastructure; recruitment activities; training; and other needs.

O&S refers to the category of *costs* that are used for program sustainment. O&S is not a standard part of appropriations law, but is referenced in law and DoD policy. DoD is explicitly required to collect data

on O&S costs, but there is no reference to operating and sustainment in 10 U.S.C. § 101, Definitions.⁵¹ The DoD D/CAPE defines O&S costs as those for “personnel, equipment, supplies, software, and services associated with operating, modifying, maintaining, supplying, and otherwise supporting a weapon system in the DoD inventory.”⁵² These costs can be funded with O&M, Research, Development, Testing, and Evaluation (RDT&E), or Procurement appropriations.

Sustainment refers generically to the process of keeping a weapons system or other technology in good working condition. For many complex or technologically advanced systems, sustainment represents the largest single portion of the total cost over the life of the system. Again, these activities can be funded with O&M, RDT&E, or Procurement appropriations.

Cost Categories

The total cost of a DoD acquisition program varies depending on the definition of *cost*. The *procurement cost* of a program refers to the amount expended from the procurement appropriation account for prime mission equipment, support items, and initial spares. *Program acquisition cost* refers to the combined procurement cost; research, development, and testing cost; and military construction costs. Program acquisition cost can also include some O&M costs, referred to as *acquisition O&M*. The *lifecycle cost* consists of the program acquisition cost, operating and support costs, and disposal cost. The operating and support cost and disposal cost are generally funded from the O&M appropriation accounts.

Former USD(AT&L) Frank Kendall includes lowering lifecycle cost among 10 principles for achieving better buying power in DoD. Kendall wrote that “controlling life-cycle cost is one of our jobs; staying on budget isn’t enough,” and warned against “poor decisions that result in short-term savings at the expense of high long-term costs.”⁵³

Underemphasis on Lifecycle Cost

With respect to the cost thresholds, these different definitions are important because they affect whether or not programs experience Nunn–McCurdy breaches.⁵⁴ If a program’s per-unit procurement cost or program acquisition cost exceeds certain thresholds, the program faces termination.⁵⁵

The fate of programs can depend on both procurement cost and program acquisition cost—but not lifecycle cost. Although deferring costs into the longer term may in some cases be the most effective way of managing initial investment costs and enabling the program to continue, by keeping the program within cost thresholds, that decision may push costs out of the developmental and production phases and into the sustainment and disposal phases of a program’s lifecycle.

⁵¹ Guidance on Life-Cycle Management, 10 U.S.C. § 2337a.

⁵² Office of the Secretary of Defense – Cost Assessment and Program Evaluation, *Operating and Support Cost-Estimating Guide*, March 2014, 2-3, accessed September 10, 2018, https://www.cape.osd.mil/files/OS_Guide_v9_March_2014.pdf.

⁵³ Frank Kendall, “Better Buying Power Principles: What Are They?”, *Defense AT&L*, January-February 2016, Principle 4, accessed November 6, 2018, <http://www.dtic.mil/dtic/tr/fulltext/u2/1016057.pdf>.

⁵⁴ *Nunn–McCurdy breach* refers to 10 U.S.C. §§ 2433 and 2433a, which specify that if a program’s unit costs exceed certain thresholds, the program in question must be terminated unless the Secretary of Defense certifies that it is essential to national security.

⁵⁵ Percentage growth thresholds are based on both cost definition and time period in which projections were made.

Literature on Lifecycle Cost

Several organizations have published documents assessing the possibility of making total lifecycle costs—particularly sustainment costs—a greater factor in program decision making. MDAPs are already required to provide a *full lifecycle cost analysis* in their Selected Acquisition Reports to Congress, but this analysis does not factor into Nunn–McCurdy cost breaches.⁵⁶

GAO last updated its *Cost Estimating and Assessment Guide* in 2009, so its conclusions may be somewhat outdated. The document notes that:

“DOD starts more weapons programs than it can afford, creating competition for funding that encourages low-cost estimating and optimistic scheduling, overpromising, suppressing bad news, and for space programs, forsaking the opportunity to identify and assess potentially better alternatives. Programs focus on advocacy at the expense of realism and sound management.”⁵⁷

A 2011 paper from the Software Engineering Institute decried the problems with accurately projecting the O&S costs of weapons systems. The paper noted that “the difficulty of accurate cost estimation is compounded by the fact that estimates are now prepared much earlier in the acquisition lifecycle, well before there is concrete technical information available.”⁵⁸

A 2014 MIT paper by an Air Force program manager showed that historically, actual lifecycle cost estimates for MDAPs exceeded their initially projected lifecycle costs by 20 to 506 percent. The paper’s “Recommendations” section appeared to suggest incentives for analysts to adopt the rosier-possible assumptions to justify low cost projections: “Department-wide assumptions should be set above the DoD Component level to ensure fairness in quantifying systemic cost risk for MDAPs.”⁵⁹

In 2014, DoD’s CAPE office published a detailed analysis of the cost elements and estimation methodologies for program O&S costs. The analysis emphasized the difficulty of projecting O&S costs in their entirety, noting that for items such as indirect support and depot maintenance it was “difficult, if not impossible, to compare these costs to available funding.”⁶⁰

Lifecycle Cost Data

Past analyses suggest that for most major types of MDAP, O&S costs make up a large percentage of the lifecycle cost. According to the 2014 CAPE analysis, space systems are the only exception (see Figure 2-18).

⁵⁶ Selected Acquisition Reports, 10 U.S.C. § 2432(c)(3).

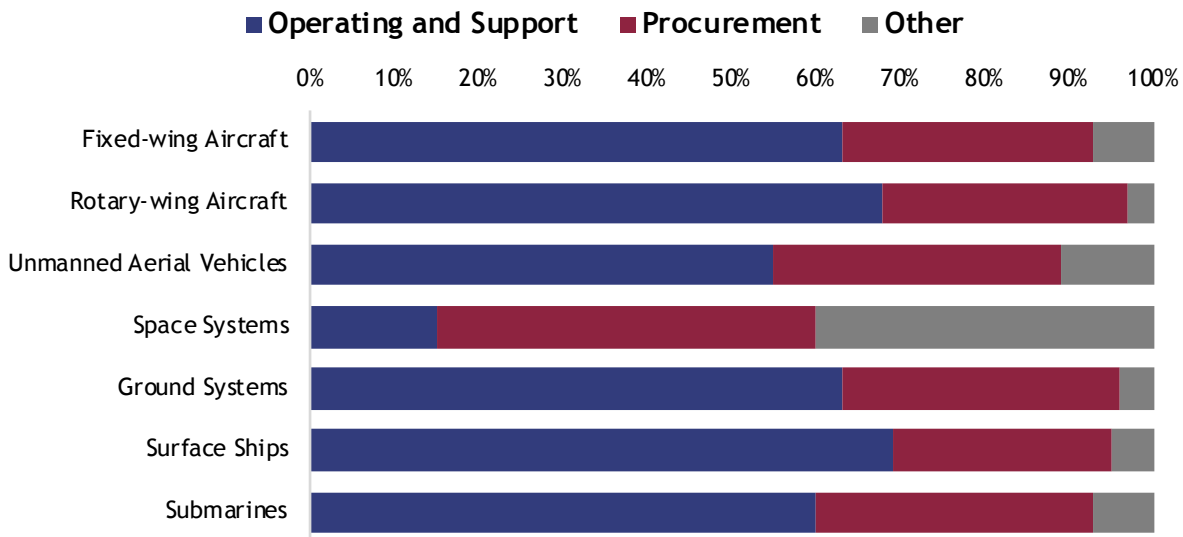
⁵⁷ GAO, *GAO Cost Estimating and Assessment Guide: Best Practices for Developing and Managing Capital Program Costs*, GAO-09-3SP, March 2009, 42, accessed June 29, 2017, <http://www.gao.gov/assets/80/77175.pdf>.

⁵⁸ Robert Ferguson et al., *Quantifying Uncertainty in Early Lifecycle Cost Estimation (QUELCE)*, Software Engineering Institute, December 2011, accessed November 5, 2018, https://resources.sei.cmu.edu/asset_files/TechnicalReport/2011_005_001_15419.pdf.

⁵⁹ David Petrucci, *Improved Affordability in DoD Acquisitions through Strategic Management of Systemic Cost Risk*, Massachusetts Institute of Technology, February 2014, 90, accessed June 29, 2017, http://seari.mit.edu/documents/theses/SDM_PETRUCCI.pdf.

⁶⁰ Office of the Secretary of Defense – Cost Assessment and Program Evaluation, *Operating and Support Cost-Estimating Guide*, March 2014, accessed September 10, 2018, https://www.cape.osd.mil/files/OS_Guide_v9_March_2014.pdf.

Figure 2-18. Percentage of Program Lifecycle Cost Average for MDAP Categories⁶¹



For individual programs, O&S as a share of total costs can be even higher. According to an independent analysis prepared for the Marine Corps Deputy Commandant for Aviation, O&S accounted for roughly 80 percent of total H-1 helicopter upgrade program costs.⁶² The high O&S costs associated with major programs suggest that if Congress and DoD wish to apply useful metrics to program review, those metrics must incorporate sustainment in some way.

Programs may also benefit from making the same stakeholders responsible for decisions and costs throughout each phase of a program’s lifecycle. If a program office is responsible for initial acquisition costs but not sustainment costs, the office may face disincentives to increase up-front investment as a way of reducing long-term costs. DoD programs do not generally have a single stakeholder responsible for managing all O&S costs. There is no single source of O&S funding; this authority is fragmented among multiple organizations and appropriation line items.

Discussion

DoD spends billions of dollars annually to operate and sustain weapon systems. With the amount of dollars at stake, DoD has placed more attention on controlling total lifecycle costs with initiatives aimed at ensuring that weapon systems are not only affordable but effective over the long term. These costs include, among other things, repair parts, maintenance, and personnel. They have historically accounted for about 70 percent of total weapon system costs.⁶³

⁶¹ Ibid, 2-3. “Other” category consists of RDT&E and Military Construction funding.

⁶² Joseph Dyer and Peter Williams, “Marine Light Attack Helicopter Independent Readiness Review,” April 12, 2017, provided to Section 809 Panel.

⁶³ O&S costs are estimated to make up as much as 70 percent of the total lifecycle cost of DoD’s major weapon systems. FY 2012 NDAA, Report 112-26 to accompany S. 1253, June 22, 2011.

Sustainment Programming, Planning and Budgeting

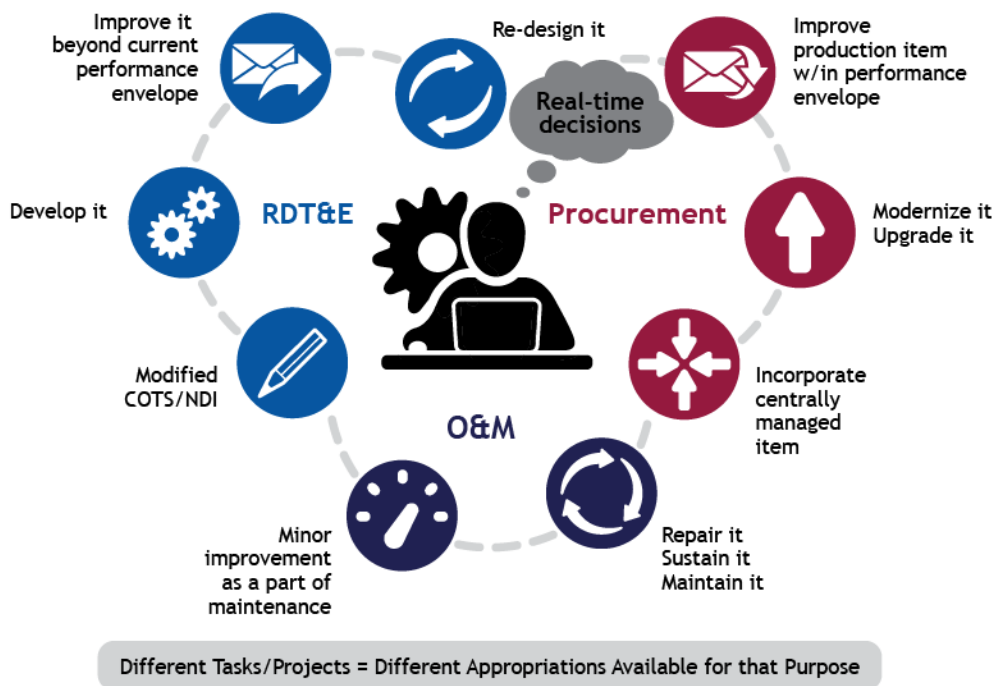
At present, programs do not always have sufficient funding flexibility for sustainment. Estimating sustainment costs frequently, budgeting for sustainment within appropriations will help address recurring sustainment issues. Sustainment requires a combination of RDT&E, procurement, and O&M funding to successfully execute the full range of lifecycle sustainment actions. Stable funding is key to successful execution and having funding of the correct type in place at the right time requires program offices to forecast, program, and budget accurately for sustainment.

Establishing an SPB, aligned with the APB, will enable the level of planning, programming, budgeting, and cost estimation necessary to enable DoD prioritization for funding. The sustainment cost estimate should be as definitive as possible, based on the information available at the time that it is made, and should be regularly refined and improved as more and better information becomes available. An SPB initiated during program development and matured and reviewed prior to each milestone decision would provide for the necessary forecast and oversight of sustainment funds, and also provide valuable insight into the effects on lifecycle costs of decisions made at the program, portfolio, and Military Service or operational employment level. Transparency of budget allocations would also allow program offices to establish long-term relationships with both commercial and organic depot facilities, enabling more efficient planning/execution of depot work and should lead to lower sustainment costs. These long-term relationships with suppliers will provide benefits to warfighters and the DoD.

Unclear Guidance on Appropriation Funding

Programming and budgeting for sustainment activities are further inhibited by issues with funding types, procurement restrictions and obligation expiration periods (commonly called *color of money* issues). Uncertainty about funding rules can inhibit programs by not adequately projecting funding requirements. There are three types of sustainment activities: product improvements, technical refresh and DMSMS, which includes obsolescence that have resource implications that affect what type of appropriation is used, driven by a determination of whether the cost is an expense or an investment. The DoD FMR describes several conditional circumstances on whether or not a cost is an expense or an investment. To further complicate the resource decision, an expense can be funded with O&M or RDT&E appropriations and an investment can be funded with Procurement, MILCON or RDT&E appropriations. Expense/investment thresholds also affect this determination. As depicted in Figure 2-19, the resource decision criteria described in the FMR leads to much confusion which impacts proper programming, budgeting and execution of sustainment activities.

Figure 2-19. Complexity of Product Support Strategy Funding⁶⁴



Realizing the confusion depicted in the graphic above and the product improvement graphic below, the Section 809 Panel reached out to DAU to use the Hacking for Defense methodology with a team of students to “develop a way for product support managers and program managers to budget and plan for obsolescence of parts and components of a weapon system.”⁶⁵ “Through their discovery interviews and hypothesis testing, the team reframed the problem to be: “There is no clear DoD guidance on obsolescence.”⁶⁶ The team specifically found that program managers and financial managers are misinterpreting the FMR with regard to obsolescence. Figure 2-20 was presented by DAU and has been used as a guideline by resource managers to help clarify FMR product improvement appropriation selection criteria, but has been applied for obsolescence and tech refresh requirements, too. The research team found situations in which a required component had gone out of production and a replacement component was available but also happened to provide a capability enhancement. In such cases, program managers and financial managers were asserting that the capability enhancement required RDT&E funding to finance the replacement component. This assertion may be a misinterpretation of the FMR. The misinterpretation causes program managers and financial managers to perform unnecessary workarounds to obtain RDT&E funding that the program has not been appropriated and could cause delays in delivering capability to warfighters. These costs and delays

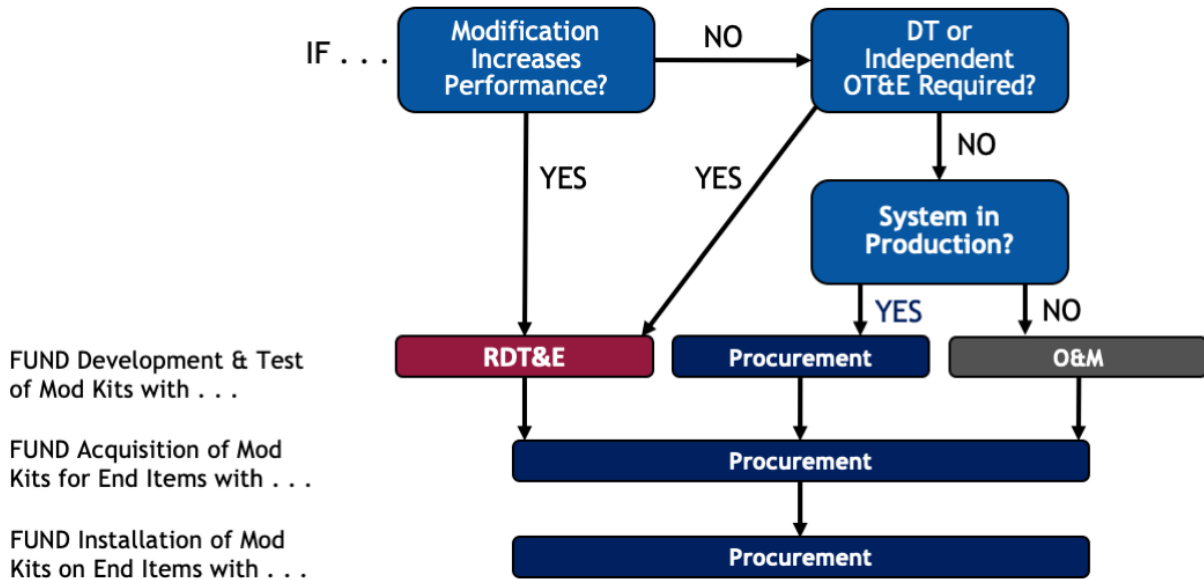
⁶⁴ Figure adapted from “Department of Defense Product Support Manager Guidebook,” release 2011, DAU, figure 12, accessed September 12, 2018, <https://www.dau.mil/guidebooks/Shared%20Documents%20HTML/PSM%20Guidebook.aspx>.

⁶⁵ David L. Gallop, PhD, *Defense Acquisition University (DAU) Hacking for Defense/Leading Innovation (H4D/LI) Pilot-2 Info Paper*, May 21, 2018, provided to Section 809 Panel, September 20, 2018. David L. Gallop, PhD, “In Innovation Insurgency: Hacking for Defense at DAU,” *Defense AT&L Magazine*, May-June 2018, 2-7, accessed September 12, 2018, <https://www.dau.mil/library/defense-atl/DATLFiles/May-Jun2018/DATL%20MayJune2018b.pdf>.

⁶⁶ David L. Gallop, PhD, *Defense Acquisition University (DAU) Hacking for Defense/Leading Innovation (H4D/LI) Pilot-2 Info Paper*, May 21, 2018, provided to Section 809 Panel, September 20, 2018.

could be avoided with clarifying language in the FMR.⁶⁷ The team proposed that clarifying language be added to the FMR and job aides be developed for the PM and business communities.

Figure 2-20. Current Product Improvement Funding Policy⁶⁸



Funding for spare parts serves as another example of why confusion frequently arises. Spare parts may be funded differently based on whether they are considered provisioning spares, replenishment spares, depot level repairs, or obsolescence. The FMR states that initial spares (provisioning spares) and repair parts will be procured along with procurement of the end item and funding will be budgeted based on a first-year obligation rate of 92 percent. The O&M accounts will finance the purchase of depot-level reparables and consumable repair parts, primarily through the Defense Working Capital Fund, for maintenance of all Class IX equipment (excluding medical-peculiar repair parts). Each of these examples may be funded by a different appropriation type and each funding source may face a different year of expiration.

The DoD FMR can often be confusing and subject to interpretation, as in the obsolescence and spares examples above. This confusion results in delayed decision making and lack of agile support to warfighters. The resource decision criteria require simplification, and solutions such as the one depicted in Figure 2-21 need to replace the product-improvement funding policy depicted in the graphic above. Three of the sustainment activities—product improvement, technical refresh, and DMSMS should follow one decision flow chart called product investment because ultimately all of these activities are an investment in the end item.

- The RDT&E appropriation should be applied for the analytical nonrecurring cost to find a solution for obsolescence or product improvements. When there is an emergent, unexpected

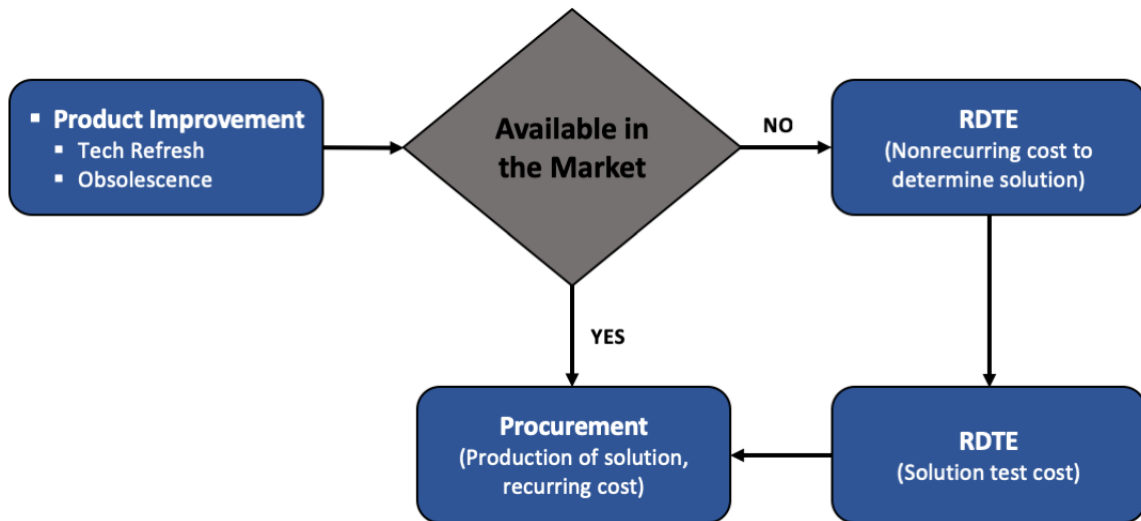
⁶⁷ Ibid.

⁶⁸ Figure adapted from presentation by Dana Stewart, *Color of Money: Funding Policies and Fiscal Law*, May 20, 2015, Defense Acquisition University, 19, accessed September 12, 2018 http://ndiatvc.org/images/downloads/DAU_Training/dau_color_of_money.pdf.

obsolescence or DMS, the program office can pursue reprogramming or use of O&M (form, fit, function item replacement), whichever addresses the situation most appropriately.

- The procurement appropriation should be applied for the recurring cost of the investment of the end item, such as scheduled tech refresh and modification kits. This concept still meets the original intent of the FMR that all costs are either an investment or an expense.

Figure 2-21. Proposed Product Investment Decision Tree



Most importantly, it is critical for PMs to recognize that the SPB is dynamic and forecast risk when establishing the SPB cost estimate and plan for RDT&E and procurement postproduction requirements. The investments (Procurement and RDT&E appropriations) are the costs that result in the acquisition of, or addition to, end items. These costs benefit future periods and generally are long term.⁶⁹ The O&M appropriation is an expense, and expenses are the costs incurred to operate and maintain the organization and system. That is why an investment account and an expense account should be used for sustainment activities. Because investment accounts will be used for the three types of sustainment activities—product improvements, technical refresh, and DMSMS—these activities can be tied to budget line numbers (BLINs) and PEs. This connection offers more traceability and transparency of costs for these sustainment activities, as well as the total capital investment. Being able to trace program trades of funding for sustainment requirements can be further expanded by establishing separate budget projects and cost categories within the PEs and BLINs. Having this traceability also offers the cost estimating community historical data to improve on and address the sustainment cost estimating weakness described by CAPE.

Sustainment Underfunded/Emergent Requirements Affect Resources Available

Sustainment requirements can be underfunded for a variety of reasons. Too many categories of appropriations accounts, as just described, can lead to situations in which sustainment professionals are unsure which appropriation account to use to cover a given type of cost. Competing requirements among different stakeholders can also lead to chronic underfunding. During the year of execution,

⁶⁹ DoD Financial Management Regulation, Volume 2A, Chapter 1, Section 01021 - Funding Policies.

situations can occur as mishaps, material shortages, and emergent requirements such as operational contingencies that affect both needed and available resources.

Acquisition program funding flows from Congress to the Military Services through a variety of appropriations and is channeled to organizations that will ultimately support the product. Examples of program funding include manpower, training, spares, engineering, depot repair, and support equipment. Sustainment funding has often served as the program manager's *bill payer* to meet unplanned program issues during development and production. This results in inaccurate program and budget estimates for sustainment requirements leading to underfunding in the year of execution. The establishment of the SPB should help establish an improved cost estimate and give accountability from the PM through the PAE to report any budget variances to the baseline.

Conclusions

It is critical to establish financial enablers that reduce budgetary uncertainty, increase funding flexibility, enhance the ability to effectively execute sustainment plans, and address emergent sustainment requirements.

DoD should establish an SPB in conjunction with the APB to monitor system requirements through acquisition and O&S. Currently, after IOC there are no formal milestones or events to measure system sustainment/readiness goals tied to the PEO/PM. Currently, sustainment trades are being made without clearly understanding or communicating the overall effect to system readiness and the lifecycle cost of the program. This issue can be mitigated with improved cost estimating methodologies and models for programming and budgeting sustainment funding. PMs should program for system sustainment risk and always establish an RDT&E line for postproduction analytical requirements and program for procurement to address possible obsolescence and product improvements. Doing so will allow PMs to establish long-term strategies to improve sustainment performance or incentivize lifecycle cost reductions.

Planning and investments for sustainment activities are often complicated by complex and ambiguous guidance on funding types. DoD can remedy this problem by clarifying statutes, regulations, and policies regarding funding, and redefining appropriation criteria in the FMR to provide more flexibility. As described above, sustainment planning should be aligned to maximize use of RDT&E and procurement appropriations. O&M may be used for maintenance, repair, and operations.

Once the program enters the execution year, the PEO (or under the proposed portfolio management structure PAE) and PMs need the financial agility to rapidly address emergent sustainment requirements. As described in *Volume 3*, Section 4, budget flexibility can be achieved by the following:

- Increasing the Procurement and RDT&E BTR thresholds, which will permit leadership to more easily move funding as needed within appropriations accounts.
- Delegating BTR authority to the lowest practical level (PEO/PM) with the most knowledge of the program.

Requiring programs to budget for the postproduction phases of their lifecycles will enable leadership to more accurately forecast required future resources via the SPB, reducing the degree to which expanded reprogramming authorities are needed.

Moving some of the sustainment activities to the investment accounts versus annual funding allows PMs to negotiate long-term supplier agreements that can reap savings on contractor supported systems, or performance-based logistics contracts. Although, for those activities still funded by O&M, the PM needs the increased flexibility to fund those requirements affected by continuing resolutions and O&M appropriations accounts should be allowed a 1-year, 5 percent carryover authority.

Extending the period of availability for sustainment funding with the carryover proposal, will reduce pressure to spend money for the sake of spending money driven by obligation end-period spending. In addition to addressing the effects of continuing resolutions, it could also eliminate the pressure driven by appropriation execution performance metrics. This carryover authority in the O&M appropriation accounts would give the sustainment community more time to acquire needed capabilities in years when funding is released late and permit sustainment acquisition professionals to smooth out the end-period surges in contract spending that occur each year.

As described, these recommended financial enablers should provide improved planning, programming, and execution of sustainment activities, which would improve the development, implementation, and tracking of the overall lifecycle cost of a program.

Implementation

Legislative Branch

- Congressional changes to implement sustainment funding recommendations are included in the Section 809 Panel's *Volume 3, Recommendations 46 through 49*.
 - Recommendations 46 through 48 includes a recommendation that FMR rules be modified to allow for more flexible reprogramming of funds at the portfolio level. These modifications would have to be approved by the congressional defense committees. This would allow for more efficient management of acquisition portfolios in general.
 - Recommendation 49 includes a recommendation that defense O&M appropriations accounts be granted a 1-year, 5 percent carryover authority. This would allow for a smoothing across time periods in the funding for many of DoD's sustainment needs.

Executive Branch

- Clarify the definitions of appropriations account categories in the FMR to provide more flexibility for sustainment activities. In particular, clarify the distinction between expenses and investments.
 - Update FMR Volume 2A, Chapter 1, Section 010201(B)(1) to allow O&M appropriations to be used to purchase supplies, services, or solutions that are necessary to address these

expense needs. Expenses are the costs incurred to operate and maintain the organization and systems, such as services, supplies, and utilities.

- Update FMR Volume 2A, Chapter 1, Section 010201(B)(2) to make the R&D investment cost category provide new and innovative technologies and allow Procurement appropriations and RDT&E appropriations to be used for purchasing supplies, services, or solutions necessary to address these nonrecurrent investment needs. Investments are the costs that result in the acquisition of, modification or addition to, end items. These costs benefit future periods and generally are of a long-term character such as real property and personal property.
- Other Executive Branch changes to implement sustainment funding recommendations are included in the Section 809 Panel’s *Volume 3* Recommendations 41 and 46 through 49.
 - Recommendation 41 includes a recommendation to establish a Sustainment Program Baseline (SPB) in conjunction with the APB to report system requirements through acquisition and O&S. APBs and SPBs would together constitute cost estimates for the total lifecycle cost of programs. This change would provide a more transparent and accurate assessment of the true costs of program sustainment.
 - Recommendations 46 through 48 include a recommendation that portfolio managers be given approval to make decisions on below-threshold reprogramming actions in cases for which a viable funding offset has been identified within the same portfolio. This flow down of decision authority should be accompanied by increased reprogramming thresholds and adjustment of the 20 percent rule for reprogramming within Procurement or RDT&E appropriations accounts, allowing for more efficient management of acquisition portfolios in general.
 - Recommendation 49 includes a recommendation that defense O&M appropriations accounts be granted a 1-year, 5 percent carryover authority, to be implemented by the DoD Comptroller and other comptroller authorities in DoD. This carryover authority would allow for a smoothing across time periods in the funding for many of DoD’s sustainment needs.

Implications for Other Agencies

- There are no cross-agency implications for this recommendation.