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Are Ships Different?

Policies and Procedures for the Acquisition of Ship Programs

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Summary

The management and oversight of a major defense acquisition program are exceedingly complex processes that must balance and reconcile diverse interests and differing perspectives and constituencies. Program Managers might focus more on near-term goals, including that of getting the new capability into the hands of operational users as quickly as possible. Others might place greater emphasis on minimizing risk by insisting on extensive testing before production starts. Still others are responsible for ensuring that all funds are expended in ways consistent with law and congressional intent and focus their efforts accordingly.

The U.S. Department of Defense has a well-established set of policies, procedures, and organizations for acquisition program management and oversight, described in the 5000 series of directives and instructions. These documents describe procedures and organizational responsibilities for program management, major milestones and key technical reviews, systems engineering, and test and evaluation.

Not all weapon systems fit comfortably within this framework. Indeed, every program is unique in one or more important ways. Some systems, including ships, have no dedicated full-scale test units; rather, every unit produced is expected to enter service. Ships also have several other characteristics that make them unique:

- length of time to design and build
- importance of industrial/political factors
- concurrency of design and build
- complexity
- low quantity/production rate
- high unit cost
- type of funding
- test and evaluation procedures.

The formal acquisition process is intended to be flexible enough to accommodate program differences through tailoring,[1] in which program management, program

[1] Tailoring is described in DoDI 5000.02 as how the MDA establishes "regulatory information requirements and acquisition process procedures . . . to achieve cost, schedule, and performance goals."

executive office, and Office of the Secretary of Defense (OSD) oversight officials craft a management and oversight approach that accommodates unique program characteristics but still satisfies statutory and regulatory constraints. Nevertheless, such flexibility requires considerable personal initiative to execute. Ship acquisition personnel for both the Navy and the OSD have become increasingly frustrated that the same acquisition strategy and program issues are addressed repeatedly, both within and across programs. At the request of the Navy and the OSD, RAND researchers therefore examined current policies, interviewed current personnel on current processes, documented the extent to which process tailoring is needed for shipbuilding programs but may not be accommodated, and developed suggestions for improvement.

Current Processes and Accommodations

The current generic acquisition process revolves around three milestones and associated life-cycle phases.

Milestone A is the decision point associated with entry into the technology development phase. It is typically reached once the Analysis of Alternatives is complete and a specific technical solution is proposed. At Milestone A, the MDA[2] approves the preferred material solution, approves the technology development strategy, and prepares a certification memo as required by statute.

Milestone B typically marks the formal initiation of a program and entry into the engineering and manufacturing development (EMD) phase. By this milestone, the program usually has had a preliminary design review, demonstrated relevant technologies and manufacturing processes, and determined its cost and schedule baseline. Here, too, the MDA must prepare a certification memo as required by statute.

Milestone C typically denotes entry into the production phase and authorizes a program to begin production at a low rate. By this point in the program, engineering and manufacturing development is complete and required testing and operational assessments have been successful.

Shipbuilding programs can differ from this generic process in several ways. Following Milestone A, acquisition programs typically have a technology development phase, with system design and development waiting until formal program initiation, which occurs at Milestone B. However, shipbuilding programs can be formally initiated at Milestone A (at the discretion of the MDA), thus beginning their formal pro-

[2] The MDA is the Department of Defense official responsible for making programmatic decisions during the acquisition process. The Under Secretary of Defense, Acquisition, Technology, and Logistics (AT&L) is generally the MDA for larger acquisition programs, acquisition category (ACAT) ID, and ACAT IAM. The head of a DoD component or Component Acquisition Executive is the MDA for the ACAT IC, ACAT II, and ACAT III programs.

gram activities earlier than other weapon systems. Ship programs tend to have somewhat more concurrency of technology development and system design activities.

Similarly, for shipbuilding programs, Milestone B rather than Milestone C essentially marks the start of initial production by authorizing lead ship construction. Unlike other programs, ship programs can begin manufacture during the engineering and manufacturing development phase that follows Milestone B in the form of the lead ship. For other programs, Milestone C authorizes low-rate initial production, something that has less meaning for ships because lead ship construction has already begun. For nonship programs, Milestone C is also intended to denote the completion of development and initial operational testing. Since the lead ship may not have been delivered and tested, Milestone C will necessarily have a different meaning for ship programs.

Despite variations in practice, DoDI 5000.02 is ambiguous or lacks specific language regarding how to tailor ship programs. For example, whereas Milestone B may authorize production of the lead ship, there is no corresponding language that defines when low-rate initial production occurs for ships if production begins at Milestone B. There is also no specific language for ships on full-rate production and Milestone C. The differing (and sometimes ambiguous) meaning of milestones for shipbuilding programs leads to confusion among various acquisition stakeholders. Furthermore, the Secretary of the Navy acquisition instruction is not always consistent with the DoD instruction. For example, the Navy instruction notes that Milestone B authorizes the lead ship and initial follow ships. The DoD instruction states that Milestone B typically authorizes the lead ship and that long lead[3] for follow ships may also be approved.

Stakeholder Views

To explore how the ambiguities of current guidance may affect shipbuilding programs and acquisition issues more generally, we conducted more than two dozen interviews with representatives from the Navy and from OSD.[4] These interviews covered questions on how ships differ from other major defense acquisition programs, what issues or problems arise from these differences in following the 5000 series of instructions, and what regulatory changes could facilitate the acquisition of ships.

Both OSD and Navy interviewees noted that the length of time to design and build a ship was the primary difference between ships and other acquisition programs. They also noted that politics and industrial base considerations played more prominent

[3] Long lead typically refers to the materials or services that must be procured in advance of construction, such as steel or propulsion equipment that is procured before the start of construction.

[4] We did not interview industry stakeholders in this study, although we have become a familiar with industry views from other research. The sponsors of this study wanted us to focus on government stakeholders. We believe that the breadth of interviews we conducted adequately covers the issues addressed in this study.

roles in shipbuilding than in other acquisition programs. Other areas in which interviewees said that shipbuilding programs are unique are the concurrency of design and build, greater complexity, high unit cost, and low production rate.

Some interviewees suggested that process tailoring[5] is sufficient to address the unique requirements of ships, with one even suggesting that all acquisition programs require tailoring. Others said that ambiguities in language made implementation of the 5000 process more difficult for ships. Among specific areas of difficulty that interviewees mentioned regarding ships were interpreting DoD instructions for ships (including initial and full-rate production), the content and timing of documentation requirements, testing and evaluation issues, statutory issues, and other policy and process issues.

Most interviewees did not think the 5000 process was irreparable, but many suggested ways to improve it to accommodate shipbuilding programs. Interviewees thought the 5000 process flexible, but many said that they found tailoring difficult. One claimed that tailoring resulted in more reviews and meetings, providing little incentive to seek it. Some said that improved guidance and less formalization of tailoring might make it more useful. Some felt that low-rate initial production and full-rate production distinctions should not apply to ships. OSD interviewees suggested more and earlier component or subsystem-level testing for ships, whereas Navy personnel suggested different language on technological development, recognizing that ships are a system of systems, and simplification of the system engineering process. Both OSD and Navy personnel felt that improving the ability to tailor, rethinking the meaning of currently ambiguous definitions (such as that for low-rate initial production and full-rate production) for ships, and rethinking the best way to test and evaluate ships would be helpful. One interviewee suggested that capturing these definitions in an annex to the 5000 process would be helpful.

Program Comparisons

To better evaluate the perceptions of stakeholders about the unique issues of shipbuilding programs, we gathered data on acquisition time lines and major program activities for several ship and nonship acquisitions.

The data confirmed that shipbuilding programs often have compressed early phases, contract awards that define program phases as well as the sequence of activities, relatively small total quantities, low annual production rates, a significant portion of the total quantity on contract before testing of the lead ship is complete, and a more significant role for the industrial base in influencing program structure and

[5] *Tailoring*, as used by interviewees, refers to the ability to alter various procedures and requirements of the acquisition process to accommodate the unique aspects of a program. This is consistent with how *tailoring* is defined in regulation.

contracting activity. Perhaps most important, the data confirm an apparent mismatch between major milestones and key program events, such as contract awards and testing. Ship program design and build events do not appear to align well with the intent, timing, scope, and content of some milestone reviews. Often, contract awards denote different design stages (e.g., system design, functional design, contract design) before Milestone B (or II) rather than technology development and demonstration. Milestone B tends to not only approve continued design activity (detail design) but also initial production (e.g., the lead ship). Under DoDI 5000.02, Milestone B is intended as the start of product development—integrating technologies and maturing concepts into a form intended for deployment to the warfighter—whereas ship programs tend to treat this milestone as a continuation of design activities. With some notable exceptions, system and subsystem demonstration through testing must wait for delivery and test of the lead ship, as opposed to the construction of developmental systems intended only for test. Ship programs also differed from each other, with the exact sequence, timing, and scope of contract awards varying by ship type, size, maturity of design and technology, the roles and responsibilities of government and industry, the preferred design tools, and the characteristics of the industrial base for each program.

We also identified differences between ship and other programs that appear to be real but do not have clear metrics. Milestone decisions and technical activities may require information at a level of detail not available until later stages of a ship program. Because the lead ship is intended as a deployable asset, live fire test activities may, because of the risk of damage, be inappropriate for ships, although this problem is becoming increasingly prevalent in programs with high unit costs. Although some major acquisition programs, such as satellites, may seem similar to ships in their long design and build time frame, deployed and operational first units, small quantities, and low production rates, they can also differ in ways, such as the workforce size and skill set needed to develop them and their operational environments. This underscores the need to tailor acquisition processes.

Yet care must be taken in tailoring programs. For example, because annual production rates for many complex ships are low and steady, the normal distinction between low-rate and full-rate production made by Milestone C is not relevant. Simply dropping Milestone C for ships, however, risks losing other attributes for it that are relevant to oversight, such as the completion of development and initial testing.

Designing the Ideal Ship Acquisition Process and Strategy

How might acquisition processes and milestones be best tailored for ship programs? To gain insight, RAND researchers considered two hypothetical possibilities: an unconstrained process in which constraints and requirements can be ignored to understand

the range of possible alternatives, and a constrained case in which constraints affect the timing and scope of oversight activities.

In the unconstrained case, Milestone A, as the start of major activity, is relatively fixed, but some latitude is available for technical and engineering activities and subsequent milestones and other oversight activities. Milestone B may be as early as the beginning of detail design work or as late as the start of construction for the lead ship. Milestone C could occur as early as the start of construction for the first ship or as late as the completion of initial operational test and evaluation.

This unconstrained case suggests a number of desirable "best" practices. The shipyards, weapon-system contractors, and Naval Sea Systems Command (NAVSEA) should collaborate, beginning with feasibility studies. Lead responsibility would shift, depending on activity, life-cycle phase, and relative competency. Prototyping (with or without competition) would be done to the maximum extent possible at the component and subsystem level. Early and continuous developmental and operational testing would be performed. Verification through inspection, analysis, modeling and simulation, similarity, and demonstration would all be acceptable practices. The gap between lead ship and follow ship would increase to reduce technical and operational risk; the follow ship would be built only after initial operational test and evaluation (IOT&E) is complete.

There is no "right" alternative; each has pros and cons. In a case with late milestones and little overlap of program phases, the technology and program baseline are more mature when decisions are made. Rework and redesign risks are minimized. However, longer program durations may lead to requirements "creep" and pose a significant challenge to the industrial base. Waiting to procure the follow ship until after the lead ship has completed IOT&E may be impractical, resulting in an excessive production gap, learning loss, higher material costs, and vendor base impacts. Where Milestone B can be aligned as needed and there is some concurrency in design and construction, the milestones can be aligned with the key functional activities of the ship design/build process. This option will require explicit process tailoring to define when Milestone B occurs for each ship program. An early milestone case with overlap of technology development, design, and construction phases would potentially allow mature technologies to be fielded more rapidly. These milestones mark the start of key functional activities in the ship design/build process. Nevertheless, satisfying the documentation requirements earlier in the process may be very challenging or might require a waiver. The concurrency of the process introduces risk of various kinds. The "optimal" program structure is thus very closely tied to the characteristics of a particular ship concept (e.g., technological maturity, design maturity, relevant industry capabilities) and an acceptable balancing of associated risks.

In the constrained case, however, the programmatic choices the Navy can make are influenced by a large set of factors, including technical and engineering activities, statutory and regulatory requirements, industrial base issues (workforce, financial

viability of shipyards), capital equipment requirements, force structure requirements, political factors, and overall fiscal constraints. As a result, the constrained oversight case looks like the nominal process for current ship programs. Milestone B denotes the start of detailed design and authorizes lead-ship construction, with an interim progress review authorizing initial follow ships. The role of Milestone C remains unclear, especially when few ships are to be built in a program. Milestone C might replace the interim progress review that authorizes follow ship construction. However, stakeholders had mixed opinions on this; some supported the idea, but others said that moving Milestone C would provide only limited oversight value because much information would remain unchanged after Milestone B.

Policy Options

There is a range of policy options for ship programs to reconcile the problems posed by unique characteristics of shipbuilding programs and ambiguities in DoD instructions. At one extreme, policymakers may choose to exempt ship programs from the DoD 5000 series. At another extreme, the DoD instructions might be rewritten to include language for each commodity type.

Exempt Ship Programs from the DoD Instructions

Exempting ship programs from the DoD instructions would give the Navy increased flexibility to design and manage ship programs. This would effectively shift program oversight to the Navy. Yet it would also shift many of the same problems to the Navy, given the ways shipbuilding programs can differ from each other.

Remove All References to Commodity Types in the DoD Instructions

A less extreme measure would remove all references to commodity types in the DoD instructions. Indeed, ships and satellite programs are the only weapon systems currently mentioned explicitly. Removing such explicit mention would leave just high-level guidance to tailor processes as appropriate. However, this option would not address the core issues that pose real challenges to ship programs. In particular, stakeholders would still debate what process tailoring is required for each ship program because of which characteristics, with no additional guidance on the range of acceptable options.

Clarify the Language and Interpretation for Ship Programs

Clarifying the language and interpretation for ship programs could help resolve ambiguities and conflicts in requirements. Additional guidance on how the process could be adjusted (tailored) for ship programs could ensure a more standardized interpretation of regulations and help coordinate the efforts of Program Managers and oversight officials. A policy memo could make explicit those parts of the acquisition process that

need to be tailored for ship programs as well as the range of tailoring options available. Each ship program would need to address each tailoring area as part of its acquisition strategy documentation.

Rewrite the Base Acquisition Regulation to Include Language for Each Weapon Type

Going beyond some clarifying language to rewrite the base acquisition regulation to include language for each weapon type could result in new problems rather than solving existing ones. Rewriting the base acquisition regulation could reduce program management flexibility and at the same time result in differing processes for ships, satellites, launch vehicles, armored vehicles, aircraft, and other programs, ultimately resulting in a number of completely different, independent acquisition processes. The result would be a highly complex set of acquisition regulations and processes adding to the burden of both Program Managers and oversight officials.

Conclusions and Recommendation

In the near term, we recommend clarifying the language and interpretation of existing regulations and guidance. This would involve making the language in DoD instructions more internally consistent and broader to mitigate the most critical ambiguities, aligning the language and intent of DoD instructions with those of the Secretary of the Navy, and providing more specific guidance on a standardized interpretation of policy and a standardized process for tailoring. This solution will require that oversight and program management officials agree to early and continuous interactions and capturing of tailoring decisions in the acquisition strategy approved at Milestone B (or in the technology development strategy approved at Milestone A).[6] Both communities must also follow the tailored strategy afterward, lest deviations cause the entire set of tailoring decisions to be revisited.

[6] A 2009 Government Accountability Office (GAO) report reaches a similar conclusion. See GAO, 2009b.