

# A question of cost

**BY REAR ADM. CHARLES "CHUCK" GODDARD, HOWARD FIREMAN AND CHRISTOPHER DEEGAN**

Chief of Naval Operations Adm. Michael Mullen has outlined the Navy's plan for constructing the next-generation fleet in the 30-year shipbuilding plan, which details the road to a 313-ship force structure required to support the National Security Strategy. The goal is a future fleet that balances capability with affordability.

Shipbuilding is a national security issue that will require an average annual shipbuilding investment of \$13.4 billion in fiscal 2005 dollars. The Congressional Budget Office has challenged the Navy's estimate and believes the required investment may be as much as \$19.5 billion per year. The question is not who is right or wrong, but rather how will the Navy and industry control historical cost behavior to recapitalize the fleet?

If the Navy and shipbuilding industry do not change our cost behavior, the country will be unable to afford the needed recapitalization of our fleet and the death spiral will accelerate. We cannot continue to perpetuate 29 models of ships, 16 surface-ship combat-system baselines and multiple configurations of shipboard hardware, such as 4,171 different pumps. The Navy cannot continue to add desirable attributes on top of our essential requirements. Industry cannot continue to overrun contracts and source material locally on a contract-by-contract basis. The bottom line: We must change our technical and business shipbuilding strategies.

The Navy is taking positive action to control costs and prevent requirements-creep. Controlling costs to achieve \$13.4 billion means building ships with capabilities that meet requirements, not objectives, and partnering with industry to explore alternative acquisition strategies, improve productivity and to source material strategically. This involves:

- Buying the right level of capability and preventing requirements-creep. The CNO created and empowered the Navy Capabilities Board (NCB) and the Resources, Requirements and Review Board (R3B) to review requirements that drive costs in ships, aircraft and weapons.
- The Navy has clearly delineated a long-range shipbuilding plan. We must now commit to and remain on track toward a 313-ship force structure so our shipbuilders can make appropriate long-term investments in skilled workers and infrastructure.
- Naval Sea Systems Command (NAVSEA) is exploring reduction of types and models of ships to reduce nonrecurring costs and increase learning benefits. This includes maximizing reuse of ship designs, components, use of open architecture and mission systems modularity.
- The acquisition community and industry are exploring alternative acquisition strategies where we segregate risk and purchase material strategically, increase leverage and reduce risk in contracting.

Mike Petters, president of Northrop Grumman Newport News, said stability is the key to success. If the Navy can avoid unnecessary changes and put a shipbuilding plan in place that is realistic and consistent from year to year, then industry will be willing to invest in people and facilities that enable them to build ships more efficiently. Navy Secretary Donald Winter forwarded the 30-year shipbuilding plan to Congress in February, and he and the CNO have repeatedly stated their commitment to the plan. Leadership has put the entire acquisition community on notice that this is the plan, and we must stick to it.

Naval ships are complex systems. They require design periods from concept to start of construction of five to 10 years, and construction time from two to seven years. They are procured in low rates and their service life is long: 25 years for smaller, less-complex ships and up to 50 years for aircraft carriers. As a result, 30 to 40 years are required to substantially change the Navy's force architecture. With this in mind, the Navy uses a planning methodology that incorporates three phases that reflect the appropriate focus of each period. These phases, as described in the 30-year plan, are:

- Near-term. This period includes the current budget year and future years defense plan (FYDP). During this phase, the Navy endeavors to minimize adjustments to the plan to balance the mix of ships, unit cost and resources available in the budget, while addressing industrial and vendor base concerns. Given known requirements, return costs on ships in construction and quantities, the cost estimates are reasonably accurate.
- Mid-term. This period is beyond the FYDP out to 10 to 15 years. Requirements are based on Defensewide planning scenarios and incorporate intelligence assessments of future threats and operating environments. Cost estimates are parametrically derived from analogies to current ship classes.
- Far-term. This period begins 15 or more years into the future. Because requirements are not fully recognized, the number and types of ships are rough targets based on joint and Navy analytical models and are focused on capability sufficiency and potential fleet architectures. Cost estimates are notional rough order of magnitude because of the uncertainties.

The plan establishes a force level of notionally 313 ships indexed to the 2020 threat (see table on Page 26). It provided the baseline for the president's 2007 budget submission. Overall, the plan reflects the Navy's commitment to stabilize the demand signal to the industrial base while achieving the appropriate balance of affordability and capability.

To provide stability and control costs in the near term, the CNO has established the NCB and R3B. The NCB is a one- and two-star board from the requirements and acquisition communities. The director of the Warfare Integration Division, Office of the Chief of Naval Operations (OPNAV), chairs the board. The NCB is chartered to review cost vs. capability trade-offs and is authorized to make cost avoidance changes to programs that do not require changes in approved requirements. Cost avoidance recommendations that require changes in approved requirements are referred to the R3B. The R3B is a three-star board that is authorized to make changes in key capability attributes if the cost trade-off warrants. It is chaired by the deputy chief of naval operations, integration of capabilities and resources. Cost avoidance recommendations that require changes to key performance parameters on shipbuilding programs are referred to the CNO executive board. A series of reviews have been conducted on the Littoral Combat Ship (LCS), the DDG 1000 Zumwalt-class destroyer, the CVN 78 Ford-class aircraft carrier and the SSN 774 Virginia-class submarine to understand the cost drivers, ensure that only needed capability is being procured and to examine opportunities for cost reduction. Program scope and capability reductions have been made where appropriate.

The mid- and far-term offer different opportunities to control costs. During these phases, the fleet will evolve through a round of recapitalizations. Each phase offers an opportunity to examine alternative fleet architectures that neck down the types and models of ships and introduce more modularity into designs. The goal is to provide approximately the same total numbers of ships but to look at alternatives for spreading capability and providing a more affordable mix compared with replacing like with like.

## EXPLORING ALTERNATIVES

As the CNO's shipbuilding plan was being developed, the commander of the Naval Sea Systems Command, Vice Adm. Paul Sullivan, tasked a team of experts in program management, systems engineering and cost engineering to lead a study to investigate technical and business strategies that will result in an affordable and executable 30-year shipbuilding plan. He specifically challenged the team to develop a fleet architecture with 10 or fewer ship types and explore alternative approaches to procuring the fleet.

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The team's approach began with creating alternative fleet architectures that reduced the types and models of ships, and exploited modularity while matching overall capability of the fleet. The broad-based team consisted of the revitalized future concepts design groups at NAVSEA; representatives from the Program Executive Offices for Ships, Carriers, Submarines, and Integrated Warfare Systems; engineers from Naval Surface Warfare Center Dahlgren and Carderock; and NAVSEA cost engineers. Options were developed along three broad themes:

- Maximum re-use of existing ship designs.
- Minimum number of ship types.
- Maximum modularity.

Concept designs were completed and build plans were created to match capabilities and numbers year-to-year to those of the 30-year plan. From these, a least-procurement-cost selection was made. The team's effort began with a search of fleet architecture studies that have been a topic of high interest over the past year. The Office of Force Transformation, the Center for Strategic Business Studies and the Congressional Research Service have all published recent studies. The team was briefed by the director of the OPNAV Assessment Division on the analysis that was done in support of the 30-year plan to understand what drove the baseline fleet. The team then developed more than 30 designs based on the three themes.

For example, to maximize re-use of existing designs to reduce nonrecurring engineering and take advantage of the learning curve, a potential strategy for surface combatants is to derive the planned CG(X) cruiser from DDG 1000 and the DDG 51 Arleigh Burke-class destroyer replacement from LCS. Upgrading the radar on DDG 1000, and replacing the Advanced Gun System with additional vertical launch cells to create CG(X) would be similar to how the CG-47 Ticonderoga-class Aegis cruiser was derived from the DD 963 Spruance-class destroyer. Similarly, installing the multifunction radar on one of the LCS variants and retaining the modular mission packages would provide a replacement for DDG 51s.

In addition, we can reduce the types and models of ships we have in the fleet and standardize their components, resulting in reduced logistic tails. For example, we can reduce the types of amphibious ships to one type vs. three. This would combine the landing ship dock and landing helicopter dock recapitalization in an LH(X) single type with two models, one optimized for short takeoff/vertical landing operations and the other for vertical takeoff and landing and surface movement.

The 2007 fleet has 21 types and 29 models of ships. The 30-year shipbuilding plan has 19 types and 27 models in 2020. The team found that we can potentially reduce the types to six with 10 models. The types and models in the alternative fleet are:

- CVN 78. Single type; we did not develop an alternative.
- LH(X). Single type; two models as explained above.
- Combat Logistics Force. Single type; two models: T-AKE and T-AO(X) variant.
- Common sub. Single type with modular mission sections.
- Surface combatants. Two types, a DDG and an LCS derivative.

The numbers of ships were about the same, with equivalent capacity (amphibious lift, D5 launchers, Vertical Launch System cells, etc.) but distributed differently across classes. This offers the potential to significantly reduce procurement cost as compared with the current long-range plan, because nonrecurring costs are reduced and there is more opportunity to extract production learning. To achieve such reductions in types and models, the Navy needs to develop a long-range fleet architecture. This architecture has the potential to achieve acquisition cost as well as significant life-cycle cost savings.

In addition to reducing ship types and models, we must implement open architecture, reduce our surface ship combat systems baselines from 16 to eight or fewer, and enforce more commonality and standardization in our components. The Office of the Assistant Secretary of the Navy (Research, Development and Acquisition) has executive committees in place to pave the road to open architecture and component standardization.

#### **ACQUISITION STRATEGIES**

In addition to studying alternative fleet architectures, NAVSEA and the program executive offices are also pursuing risk-based acquisition strategies based on benchmarking studies with the petroleum and automobile industries. Preliminary findings point to a profound change in the way the Navy can strategically source material in a sole source shipbuilding market. Although simple in concept, executing risk-based acquisition strategies will be complex in the ship construction market.

The first step is to quantify the amount of risk in any given portfolio. NAVSEA recently completed development of a probabilistic risk profile of the Navy's ship construction account. This assessment provides Navy leadership with the comparative, quantitative means to understand developmental and production risk inherent to any program. On a macro scale, this decision tool provides greater insight into balancing the risk in Defense Department investments, much in the manner private industry approaches investment decisions.

Understanding the degree of risk will present the ability to alter contractual behavior. Competitive industries aggressively isolate risk to leverage economies of scale, develop alternative sources and determine contract type. On a national scale, this can enhance the competitive supplier base and lower cost in a sole source market. Adopting this approach at the program level requires insight into the total cost equation of suppliers. In the end, increased commonality will enhance our potential to leverage greater economic order quantities, decrease the Navy's cost reimbursable contract behavior and lower costs.

The Navy is recapitalizing its fleet with significant contractual risk. This risk is largely owned by the Navy, based on cost-sharing relationships with five shipyards, which pass the risk to systems integrators, developers and production plants. Many of these activities share contracts with more than 100 Navy program offices. As we begin the ramp up to a \$13.4 billion ship construction account, nearly 90 percent of the near-term ship construction budget is targeted to sole-source shipbuilders (the LCS program is the sole exception). Of this 90 percent, only one-third is targeted at shipbuilder labor, and the remaining two-thirds represents material. Strategically sourcing this material through packaging commodity and equipment buys across contracts and introducing competition is where opportunity exists. More than 40 percent of ship material planned for the next four years is dedicated to warfare systems, and another 40 percent to complex engineered components such as power and auxiliary systems. War-fighting requirements, industry specialization, the burdens of government contracting, legislative restrictions, low volume buys and the lack of an integrated procurement strategy are fuel for aggressive strategic sourcing initiatives.

Fiscal 2007-08 provides an extraordinary opportunity for the Navy and industry to isolate risk, reduce cost and increase earnings. Strategically sourcing material within corporations, among industry partners and/or joined with the Navy can be a win-win proposition for all. Such a strategy will need to recognize the realities of a declining government workforce, corporate growth models and constituent influence. Above all, strategic sourcing demands the will of the Navy, industry and Congress to effect change.

By working together on a consistent plan, NAVSEA, OPNAV, industry, Congress, the secretariat and the program executive offices can:

- Procure the right level of capability and no more.

- Reduce the types and models of ships and components.
- Develop risk-based acquisition strategies that maximize fixed-priced contracts.
- Source material strategically to increase buying leverage.

We have a strategy and intend to make the CNO's shipbuilding plan a reality. Our Navy's future depends on it.