

NOT FOR PUBLICATION UNTIL RELEASED BY THE  
HOUSE ARMED SERVICES COMMITTEE  
PROJECTION FORCES SUBCOMMITTEE

STATEMENT OF

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BEFORE THE

HOUSE ARMED SERVICES COMMITTEE

PROJECTION FORCES SUBCOMMITTEE

HEARING ON

THE U.S. SHIPBUILDING INDUSTRIAL BASE

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Chairman Bartlett, Representative Taylor, and distinguished members of the subcommittee, thank you for the opportunity to appear before you to discuss the shipbuilding industrial base. As requested, my testimony will focus on the following:

- The impact of the CNO's proposed 313 ship naval force on the shipbuilding industrial base;
- What the U.S. Navy has done in the past to incentivize the shipbuilding industry to make improvements that might increase their efficiency and reduce the cost of building and designing U.S. Navy ships; and
- What the Navy could do in the future to strengthen the shipbuilding industry and facilitate its continuous improvement.

Since 1998, I have worked with the Department of Defense and the U.S. shipbuilding industry in directing the National Shipbuilding Research Program (NSRP) to develop and execute an integrated national strategy to improve shipyard productivity. I'll focus my remarks on how industry and their Navy customers are collaborating effectively and efficiently to improve shipyard technology and processes to reduce costs to the nation's taxpayers.

**The first committee interest area regards the impact of the CNO's proposed 313 ship naval force on the shipbuilding industrial base.**

#### **Stability and Predictability**

The CNO's action to stabilize the shipbuilding program effectively addressed the single most important factor in improving the cost effectiveness of the program and in improving the health of the nation's shipbuilding infrastructure over the long term. The Congress' call last year for a definitive plan and the CNO's response were encouraging to the industrial base since these actions signaled an appreciation of the overwhelming influence of low, unstable ship orders on ship affordability and industrial base health. Stabilization of the shipbuilding budget will impact virtually every aspect of ship cost.

Stability and predictability are essential to future affordability and to preserving specific critical skills in an industry struggling to maintain skilled employees and capabilities in light of gaps in contract awards and low order quantities. A more stable and predictable funding environment in which DoD and Congress provide industry with definitive direction to develop strategic long-range plans will have substantial positive impact on costs and infrastructure vitality; specifically:

- Greater commitment from the government to define and stay on course with major programs can reasonably be expected to improve affordability and help preserve the infrastructure.
- The confidence that comes with this direction will allow for the major capital investments needed to improve productivity, allow for retention of skilled labor and advance the manufacturing process.
- A stable and reasonably predictable acquisition strategy will help maintain the ship design skill base and promote continuous performance improvement.
- The improved business environment will enable more effective outsourcing and sustain critical second and third tier suppliers.

## **Capability, Complexity and Low Build Rates**

The rising costs of ships can be attributed in large part to the increased capability of today's ships and the low build rate. Designs for both DD(X) and CVN 21 target substantial crew reductions coupled with greatly increased combat capability. The resulting design complexity drives acquisition costs up as a tradeoff to reduced lifetime cost. The new nine-ship San Antonio class of LPDs is designed to functionally replace four classes of ships (42 vessels) and carries a combat system comparable to an Aegis destroyer. These are wise choices, but they are reflected in per-hull acquisition cost increases on low volume production runs such that learning curve efficiencies have little opportunity to gain traction.

For example, having fewer naval ships in production increases the need to extend the designed service life of these vessels. Longer service life and combat conditions require strengthening critical structural components and compensatory weight reduction in less critical areas. This process further increases complexity. For example, in most commercial ships, plate metal thickness is limited to four to seven standard sizes to simplify procurement and production while boosting construction efficiency. By comparison, U.S. warships employ hundreds of different sizes of plate in order to meet service life and strength criteria. Whether the requirement is for increased capability, increased survivability, or longer service life, the end result is incrementally increased design complexity which negatively impacts shipbuilding productivity – presenting fewer opportunities for modularization and outsourcing, and increasing requirements for more experienced engineers, workers, and supervisors.

Reductions in ship procurements also create the additional burden of raising material costs for shipyard suppliers, and reducing the effectiveness of new efficiency initiatives. These factors tend to discourage new and innovative firms from entering the shipbuilding industry. By contrast, successful international commercial shipyards achieve the highest level of performance by maintaining steady production levels.

### **The second committee interest area regards what the U.S. Navy has done in the past to incentivize the shipbuilding industry to make improvements that might increase their efficiency and reduce the cost of building and designing U.S. Navy ships.**

Navy acquisition contracts provide a direct investment channel by which PEOs incentivize individual shipyards to improve efficiency and reduce costs. The incentives associated with Navy-shipyard contracts are likely to account for most industrial base investment either directly (contracts clauses) or indirectly (raising shipyard probability of winning a greater share of future business). Two aspects of these contracts, however, were frequently cited by industry in the late 1990s as problematic: change orders and cash flow. In recent benchmarking (2005), shipyards expressed the widespread opinion that the Navy had taken effective action on these issues. A noteworthy example is the 85% reduction in change orders seen in the VIRGINIA SSN program relative to the Seawolf program.

Another Navy vehicle for reducing ship construction cost is the Navy Manufacturing Technology (ManTech) Program. ManTech provides a mechanism for the development of enabling manufacturing technology for Navy weapon systems. The program is aimed at achieving affordability by inserting manufacturing process solutions early in the design phase to reduce life-cycle costs, improve schedules,

and ensure quality. Likewise, the Navy Small Business Programs (SBIR and STTR) contribute to shipbuilding efficiency to some degree.

### **National Shipbuilding Research Program**

The National Shipbuilding Research Program is an innovative means by which the Navy provides incentives for the industrial base to make improvements to lower the costs of ship design, construction and repair. In 1998, the Navy (ASN RDA and NAVSEA) challenged the shipbuilding industry to develop an integrated national strategy for shipbuilding cost reduction to be supported 50-50 by Navy and industry funding. The mission of the joint effort was to form an industry collaboration to manage and focus national shipbuilding funding on technologies to reduce the cost of warships to the U.S. Navy and provide a collaborative forum to improve business and acquisition processes. The Navy's logic was straightforward – and remains as compelling today as it was then:

- The Navy needs more capability per shipbuilding dollar.
- This requires modernization of shipbuilding technologies, best practices, processes and facilities.
- The Navy relies on the private sector for all warship construction and a large fraction of life-cycle repair, overhaul and conversion.
- The preponderance of U.S. shipbuilding revenue comes from Navy.
- Thus ...
  - o The Navy inevitably pays for improvements in this monopsony - or the cost of not improving
  - o The Navy needs industry to create and manage an efficient R&D vehicle for rapid and effective implementation of cost-saving processes and technologies across the public and private enterprise
  - o The Navy needs its industrial base to work together on common issues and share knowledge effectively and efficiently.

In response to the Navy challenge, 11 major U.S. shipyards manage a national collaboration focused on industry-wide implementation of solutions to reduce the cost of building and maintaining U.S. Navy warships. The National Shipbuilding Research Program is focused on reducing the cost of ships to the Navy and other national security customers by leveraging best commercial practices and improving the efficiency of the U.S. shipbuilding industry. NSRP receives funds from Naval Sea Systems Command via a Joint Funding Agreement (an 'Other Transaction' vehicle IAW 10 U.S.C. § 2371). Navy project funding is matched or exceeded by industry cost share to fund collaborative research. Solid return on investment potential is required of all funded projects as well as periodic measurement and reporting. In addition, results must be openly shared across the industry. Over 91 companies from 29 states collaborate on NSRP funded activities.

NSRP's Navy seed funds and associated industry cost share fund most of the R&D targeted on strategic investment requirements, but NSRP actively seeks to leverage other work and funding sources. The Office of Naval Research has been particularly effective in working with the industry collaboration to boost the ROI of its small business (SBIR, STTR) and Navy ManTech programs.

## Metrics of NSRP Effectiveness

NSRP reports a broad spectrum of metrics to the Navy. For brevity, only ROI is mentioned herein. Detailed accounting of payback proves that this investment saves federal money on Navy acquisition and repair contracts while improving the infrastructure. A detailed 2004 ROI analysis conducted by the shipbuilding industry using a Navy-defined methodology focused on a small subset of NSRP activities that reflected implementations that could be estimated with confidence in terms of cost reductions on existing Navy contracts. Specifically, the shipyards reported to PEOs that NSRP-generated cost savings and cost avoidance were projected to exceed \$373M through 2009, based on a government investment of \$74M. It is true, however, that despite the success of such efforts to reduce the rate of cost increases, factors such as low build rate and increasing warship complexity have resulting in rising bottom line costs.

An ultra-conservative ROI analysis validated 5:1 short-term return

The 2005 OSD-sponsored benchmarking study of shipyard efficiency provided another validation of the NSRP value proposition, in reporting that the rate of productivity improvement across the U.S. shipbuilding industrial base had demonstrably accelerated since the beginning of NSRP in 1999, narrowing the production process technology gap between U.S. yards and leading international yards that have much higher throughput. According to First Marine International (FMI), the benchmarking organization, improvements in many of the 50 areas evaluated are directly traceable to technology and process improvements brought about through NSRP.

DoD benchmarking documented rapid acceleration of industry improvements since 1999

A final indicator of this initiative's impact is found in an exhaustive implementation study directed by the Navy in 2004. NSRP's hallmark is the rapid, widespread implementation of R&D results on Navy programs: cross-yard and cross-tier, across varied technology areas, and long before projects complete – even at yards that were not on the project team. Over 65% of ASE projects have already been implemented in at LEAST one yard – most at multiple yards. Additionally, projects that would have been carried out by individual yards at a much slower pace and in isolation from other yards are accelerated by the multi-yard effort. The economic and other benefits gained from the projects are realized much sooner. Vendors and regulatory agencies are eager to engage through NSRP because they are afforded an efficient and effective avenue of access to the industry. The nationwide, real-time, on-going technology and knowledge transfer between geographically and market-separated yards coupled with subsequent widespread R&D implementation provides the Navy a large return on its seed funding.

CEOs asserted that NSRP enables them to make improvements for a fraction of the cost of going it alone.

## Rationale / Military Value Proposition / Business Case

A 2001 study done for NAVSEA reported that only 0.3% of Navy R&D goes to shipyard technologies and processes, yet shipyard productivity directly impacts total ownership cost (design, acquisition and life cycle costs) in every Navy ship program. NSRP was created to engage industry in developing and managing a cost-effective, cross-program vehicle for rapid and effective implementation of cost-avoidance processes and technologies – an innovative complement to stove-piped platform-specific R&D. NSRP was purpose-built as a highly leveraged program to drive industry-wide improvements applicable to ALL Navy ship programs on a scale and pace needed to impact Acquisition and Maintenance accounts.

The NSRP framework efficiently coordinates collaborative R&D among all segments of the ship construction and repair enterprise to reduce the cost and time required for both Navy and commercial ship construction, conversion, and repair.

Navy benefits accrue from direct payback to Navy programs and fleet maintenance PLUS the long-term payback from infrastructure and process improvements; a more robust commercial supply base; and the accelerated adoption of commercial practices in a defense-oriented enterprise. Since the Navy is the dominant customer for U.S. shipyards, Navy leaders who conceived of the current NSRP structure appropriately viewed sponsorship as a customer investment rather than federal subsidy.

Annual Navy seed funding acts as a catalyst, while NSRP organizational constructs provide the legal safeguards and efficient knowledge-sharing network that enable shipyards to collaborate extensively across corporate boundaries to accelerate cost-effective, reduced-risk R&D. In the aggregate, industry investment *more than doubles* the federal funds because large teams share in the initial costs of joint evaluation and experimentation. Each yard pays the more substantial costs of implementation and capital investment *after* the risk is reduced.

A key indicator of the program's impact is the independent business case analyses by shipyard executives across the country that led to increasing commitment of resources by their yards: cost-share over 50%, assignment of top people, sharing critical technology with competitors, and strong shipyard attendance at technology transfer events. NSRP has earned strong CEO-level support from across the industry because it is also aligned with economic reality from the shipyard perspective. The intense pressure on overhead rates brought about by the lowest Navy build rate in 50 years severely limits each organization's ability to tackle major challenges on its own. NSRP spreads financial risk by matching each yard's investment with funds from other yards, other private firms, and the Navy - such that individual risk is substantially reduced. In a business environment where defense R&D is not profitable and capital is scarce despite the anticipation of sharply increased demand during this decade, NSRP enables firms to make improvements for a fraction of the cost of going it alone.

### **NSRP Operations**

NSRP processes are set up to obtain rapid, widespread implementation on Navy construction and repair programs, by incentivizing broad, team-based projects vs. directing funding to a single yard. As a practical matter, the litmus test for NSRP awards is the extent of multi-shipyard demand and the project team's specific plans to share the results to a degree that facilitates real reduction of cost and risks by other yards who decide to implement the work. This tight alignment with both Navy priorities and industry business realities accounts for the success of this approach.

Transition from experiment to production use depends on decision-maker buy-in at the shipyards. These executives will implement only those ideas that have a compelling business case. Accordingly, the most significant implementation factor is to pick the right priorities to invest in, so that the results will address the demands of the shipyards. The NSRP Strategic Investment Plan and project proposal evaluation process are effective in this regard, in that NSRP investments are only made where eventual implementers demonstrate willingness to invest at least half the project costs on common priorities, then openly share the knowledge gained with interested U.S. shipyards. These critical features create a virtual learning

curve that helps compensate for the deleterious effects of the low volume of Navy shipbuilding on the yards' improvement rate.

Sustainable and pervasive collaboration requires active *ownership* by key stakeholders. The NSRP model lowers the 'transaction costs' of collaboration, accommodating stakeholder resource constraints by freeing them to focus on efficient, value-added communication. Building effective industry-wide collaboration is very difficult, and this one works.

### **National Consensus Strategic Investment Plan**

The NSRP Strategic Investment Plan (SIP) provides an integrated, prioritized, priced and readily executable plan of action based on mapping capability gaps to those solution paths with the greatest potential to systematically reduce the cost of naval shipbuilding programs. With a clear action plan and a mechanism to drive progress, the shipbuilding enterprise can focus on doing the right things (effectiveness) the right way (efficiency).

The detailed optimum ROI portfolio provided by this integrated national strategy answers the Navy's request for a cost-effective, cross-program vehicle for rapid and effective implementation of cost-reduction processes and technologies to address common cost drivers. The program targets solutions to consensus priority issues that exhibit a compelling business case – solutions that include both leverage of best commercial practices and creation of industry-wide initiatives with aggressive technology transfer to, and buy-in by, multiple U.S. shipyards.

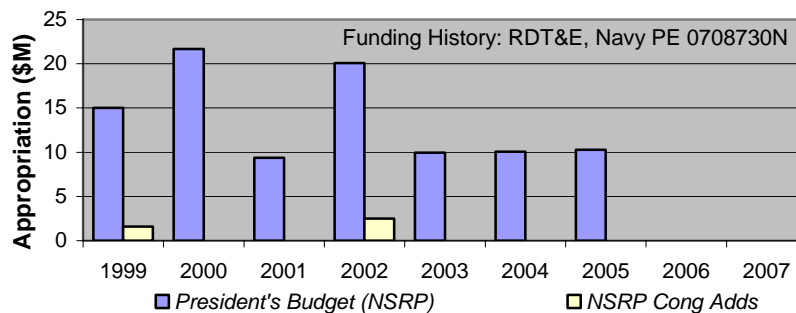
The SIP enables a disciplined, action-oriented approach to execution by laying out the order and logic of decisions and actions. Absent such a prescriptive model to guide actions, execution simply can't proceed in a logical way. The SIP also identifies the measurable critical success factors. The plan's structure and level of detail reflect its use as a working action plan to focus resources of the enterprise on a manageable solution path. The strategies within are business plans that map strategy definitions to an execution plan in the form of an investment portfolio – integrating capability advancements with a sound business plan. The approach is a logical progression for the integration and optimization of multi-disciplinary technologies. The SIP also provides a process, metrics and tools to periodically measure progress and adjust the plan accordingly.

The SIP is also used to focus other investment streams by providing a framework to guide collaborative R&D among all segments of the U.S. ship construction and repair industry, educational and research institutions, and government. This function helps align efforts from many sources and minimize redundant work. The plan aims to meet the nation's seapower needs at the lowest attainable cost, and provide a cost-effective, responsive industrial support base for maintaining in-service ships.

The SIP aggregates the wisdom of many experts with extensive shipbuilding experience from the diverse, complementary perspectives of shipyards, ship designers, academia and government. Its value was derived by distilling and framing this collective knowledge in a concise, coherent path forward. The plan is periodically updated to reflect progress to date, changes in the business environment, and consideration of all available benchmarking data. Rigorous quantitative analysis is also sometimes undertaken to validate or adjust investment priorities.

## NSRP Status /Funding Prognosis

Funding for NSRP from 1999 through 2005 was budgeted by the Navy under Navy RDT&E PE0708730N. The President's budget requests for FY06 and FY07 did not include funds for the program. PEO Ships and PEO Subs provided a total of \$3.5M for FY06 to sustain NSRP through a transition year during which the shipyard collaboration is working with the PEOs and NAVSEA on a future funding plan. As of today, the final Navy plans for post-2006 funding remain unclear. Absent funding on the order of \$10M for FY07 and beyond, the business case threshold for industry to provide resources and cost share will not be met and it will be necessary to downsize the program's structure, processes, shipyard executive involvement and ambition. While valuable work can be done for \$3.5M, attacking the major issues is simply not possible. While the results cited prove that NSRP has provided a substantial return on investment, the instability and unpredictability of program funding has restrained its considerable potential.



## Congressionally Directed Shipbuilding Studies

Section 1014 of the Ronald W. Reagan National Defense Authorization Act for Fiscal Year 2005 (Public Law 108-375; 118 Stat. 2041) directed SECDEF to conduct an independent study to assess cost effectiveness of the Navy ship construction program including “a variety of approaches by which, with a nationally integrated effort over the next decade, the United States shipbuilding industry might enhance its health and viability ... through a nationally integrated effort over the next decade.”

The language further specified that the study should “propose a plan incorporating a variety of approaches that would modernize the United States shipbuilding infrastructure within the next decade, resulting in a healthier and more viable shipbuilding industrial base; establish priorities for potential implementation of the approaches examined; estimate the resources required to implement each of the approaches examined; and consider the potential for using the NSRP to implement some of the various approaches.”

DUSD (IP) commissioned a global shipbuilding industrial base benchmarking survey by First Marine International to examine the shipyard component of vessel costs. Of note, the benchmarking scope did not include Government Furnished Equipment (e.g., combat systems) and materials costs that comprise an estimated 70% of Naval vessel cost. While the benchmarking firm included several high level recommendations, DUSD (IP) asked NSRP to develop and thoroughly document a consensus nationally integrated action plan that would meet the requirements of Sec 1014 to (1) propose a nationally integrated effort over the next decade that includes (2) priorities, (3) resource requirements and (4) the potential for



using NSRP to implement some of the various approaches. NSRP complied with this request and provided an 85-page detailed cost containment plan of attack to OSD.

The initial study published by OSD in May 2005 included NSRP's proposed action plan. The study provided to the defense committees by USD (AT&L) with his January 9, 2006 letter, however, included only the benchmarking survey conducted by First Marine International. Accordingly, this report to Congress appears to stop short of responding to all the requirements of Sec 1014 cited in the preceding paragraph. Additionally, USD(AT&L)'s stated expectation that shipyards will "use their own resources if they choose to pursue" the issues is problematic with regards to the nationally integrated effort mentioned in the Congressional language. While companies will invest in capital improvements and shipyard-unique issues if they can justify an appropriate ROI, the economics simply aren't there for individual investments on enterprise-wide challenges when shipbuilding sector margins hover at the risk free rate of return. To the degree that individual yards do elect to address common issues independently rather than as a team, this approach will be more costly to the taxpayer than the joint approach recommended by industry and originally chartered by the Navy.

### **SECNAV Shipbuilding Study**

Section 254 of the Fiscal Year 2006 Defense Authorization Act, Public Law 109-163, directed the Secretary of the Navy to conduct an assessment of the United States naval shipbuilding industry to determine how worldwide shipbuilding industry best practices for innovation, design, and production technologies, processes, and infrastructure could be adopted to improve efficiency in the following areas: program design, engineering, and production engineering, organization and operating systems, steelwork production, and ship construction and outfitting. Of note, these specific categories correspond 1-to-1 with the OSD benchmarking study.

The two principal actions identified in the resulting SECNAV report to Congress are indeed the most critical steps to achieve the goal – (1) Navy commitment to providing stability in future shipbuilding plans, programs, and budgets and (2) contracts that encourage and incentivize industry to make capital improvements. The Navy response also forwarded the industry's proposed action plan and cited the following examples of the business case for collaborative investments to complement other improvement avenues. Absent a joint R&D program, success in deploying industry solutions such as these would be highly improbable.

- Steelwork Production. NSRP's \$2M investment in precision laser-cutting technology was matched with an additional \$4M from Bender Shipbuilding and Caterpillar and resulted in a 30% reduction in steel cutting costs and 8% reduction in steel weight on a 3-ship series of Bender-built commercial vessels. Based on this pilot implementation in cutting steel more quickly with less distortion and with greater accuracy, Electric Boat invested capital in a new steel cutting facility. EB reported a resultant savings of over \$50M to the VIRGINIA-class submarine construction program, and expansion of the technology into Northrop Grumman Ship Systems' yards will recoup further benefit on DD(X) and other NGSS programs.
- Organization and Operating Systems. Another industry-wide NSRP initiative was the standardization and improvement of business processes between the yards and their suppliers. The adaptation of Internet technology to create a shipbuilding virtual enterprise replaces manual, labor-intensive, paper-

based, error-prone and long cycle interactions among yards, suppliers and the Navy. Annual realized cost reductions in this self-documenting system exceed \$2M per process implementation, per shipyard (75% cut in transaction cost and 66% reduction in cycle time). To date, a total of nine implementations are in production at four yards involved in combatant construction, with an additional 12 implementations in the planning stage. At \$2M annual cost reduction per process implemented, return on the \$8.4M Navy investment in this project could easily exceed \$40M per year. The technology is also being extended to mid-tier yards involved in LCS construction.

- Design, Engineering and Production Engineering. At the Navy's request, the NSRP collaboration salvaged a high ROI initiative that had been terminated due to the lack of a business case for individual shipyard investment. NSRP's collaborative structure enabled four first-tier shipyards to develop and implement a real-time, searchable inter-shipyard catalog to facilitate the reduction of the number of parts on warship designs through the ability to support formal part standardization programs for new designs. An example of the common parts catalog's impact is the reduction in unique parts from 92,000 in the SEAWOLF-class submarine to 18,000 in the VIRGINIA-class, and hundreds of millions of dollars in cost avoidance over the life of a major acquisition program. Implementation is complete on DD(X) and is continuing in additional shipyards, including mid-tier yards contracted to build the LCS. Annual cost savings/avoidance totaling \$22M have been estimated for the four Tier 1 yards that have implemented the common parts catalog – an accomplishment enabled by a \$4.5M NSRP investment. Additionally, the Navy logistics community is considering this approach for wide deployment across multiple Navy programs to exploit unquantified life cycle savings by the logistics community.

Navy support for industry collaborative teams enabled these results and many similar outcomes.

**The final topic regards what the Navy could do in the future to strengthen the shipbuilding industry and facilitate its continuous improvement.**

Numerous shipbuilding studies and war games have been conducted over the past decade. With few exceptions, they reached substantially identical conclusions:

1. The stability, predictability and volume of future demand are the pervasive drivers of non-value-added cost growth. The CNO's 313 ship plan was a bold step towards solving the stability and predictability issue. While low volume remains problematic, strategies such as the recent decision to build much of the future seabasing squadrons with variants of hot production line vessels reflect a keen appreciation of this factor by Navy leadership. Unfortunately, low build rates for ships such as submarines and DD(X) provide the other end of the spectrum.
2. The early stages of Naval ship programs (requirements definition and early stage design) drive the construction complexity and offer the highest leverage to control the cost of Naval Ships. These are largely the domain of DoD to address, and recent actions by the Navy in this regard are very encouraging. A July 25, 2005 CNO memo cited a short list of measures needed to recapitalize the fleet, including: reduce the number of ship classes, move towards modular, multi-purpose ship designs, manage requirements more closely, fence ship acquisition funds from being bill payers, and work on statutory and

regulatory barriers that impede effectiveness. It is my understanding that the Naval Sea Systems Command is actively assessing most of these issues.

3. The stability of the overall Navy shipbuilding plan should be matched with advance acquisition strategies such as multi-ship contracts to further incentivize cost reduction by the industry. Fixed price contracts are also frequently mentioned with the important qualifier that the ship design must be stable to accomplish this.

4. Industrial base investment is an area where opinions are more diverse.

- While some sectors of the industry are competitive in commercial markets, major combatant builders are not – and are unlikely to be in the future. As discussed in the benchmarking report, the demands of the federal customer for highly complex products coupled with detailed oversight of every step in the design and construction process creates a culture that is radically different than that found in shipyards that sell standard, simple designs as virtual commodities to a diversified customer base. Accordingly, their investment funding will inevitably be derived from business with federal customers.
- PEOs have and will undoubtedly continue to incentivize shipyards building their products to improve their capabilities. This should continue to be the principal channel for most federal investment.
- Aside from yard-by-yard investment, the logic of supporting a nationally integrated effort to attack common issues remains compelling. The opportunities are well-defined, the business case proven, and the execution vehicle is ready to act – but stability and predictability of support limits progress.

While the first three conclusions cited above are the most important necessities, they are insufficient to make the progress needed to afford a 313-ship Navy. The remainder of my statement focuses on the fourth conclusion.

### **A National Industrial Base Strategy**

Changes to the Navy's ship design and construction business model have decentralized roles and responsibilities across the public-private enterprise. The Navy inspired the NSRP collaboration in the late 1990s due to the absence of a cohesive plan to focus disparate improvement efforts and to improve enterprise goal congruence. This logic has been "re-discovered" repeatedly since then – here are just a few:

- The 2003, 2004, 2005 and 2006 Defense Authorization Bills each included language that encouraged this same concept. The 2005 bill, in particular, tasked OSD to report approaches for an integrated National Investment Strategy for shipbuilding.
- During the OSD benchmarking study, DUSD(IP) concluded that supplementing existing industrial base investment by individual DoD customers with a integrated national effort on common cost drivers was the most effective and cost-efficient means to address many of the study's findings.
- Your committee's 2006 authorization language expresses Congressional interest in taking advantage of NSRP as an execution vehicle for a prospective national, integrated effort to act on shipbuilding costs and infrastructure. "The committee is encouraged that the United States Shipbuilders have

embraced the National Shipbuilding Research Program as an effective and efficient means to collaborate on innovation in shipbuilding and ship repair. The committee believes that the Department can take advantage of this existing collaboration as an effective vehicle to address shipyard productivity issues related primarily to naval ship design practices.”

- VADM Munns wrote in a September 2005 Proceedings article that the nation should create a National Shipbuilding Strategy to protect and make the most effective use of our National Shipbuilding Industrial Base.
- In February 2006, the Defense Science Board submitted a report to the USD(AT&L) entitled "Defense Science Board Task Force on The Manufacturing Technology Program: A Key to Affordably Equipping the Future Force." In its report, the task force concluded that the DOD needs a more coherent manufacturing investment strategy.

NSRP has been executing exactly this kind of coherent enterprise strategy since 1999, although at a modest level of funding, and recently developed refinements to it in response to the OSD benchmarking. The latter was provided to the committee by the ASN RDA's Mar 27, 2006 letter that forwarded the Navy's report on an "Assessment of the Efficiency of Naval Shipbuilding." These plans provide a national consensus on a comprehensive set of integrated priorities – remedies for the shipbuilding enterprise can and will provide significant return on the taxpayer's investments in building ships to the Navy.

Numerous examples exist where achieving breakthrough improvement requires an Enterprise investment mentality and a critical mass of industry and government collaboration. The Navy Assessment cited three such examples and several others are listed below:

- Industry and government are leveraging each other's successes and lessons learned in Lean Manufacturing to further accelerate change across both private and public shipyards.
- Completing the development of and implementing end-to-end product data interoperability will provide major reductions in life cycle support costs. Because this capability relies on the development and deployment of industry-wide standards, this inherently collaborative activity moved slowly prior to NSRP support.
- Numerous safety, health and environmental requirements that are imposed on the shipbuilding industry. Joint industry teams facilitated by NSRP provide regulators with timely and valuable data and feedback that helps to avoid costly and/or ineffective solutions.
- NSRP has worked closely with ONR to focus some aspects of Small Business Programs (SBIR and STTR) and Navy ManTech on common issues that affect the industrial base. Since 1999, the value of these programs to shipbuilding has risen substantially as their contributions were linked to solving issues identified in the NSRP Strategic Investment Plan.

The shipbuilding industrial base knows the common issues and the most important solution paths – they have been repeatedly studied and reported. Most of the issues are undifferentiated between ship programs and shipyards, and a large fraction of the differences are attributable to hot production lines producing stable designs. The base has also demonstrated the willingness and ability to work across organization boundaries to tackle enterprise issues. The unsolved issue is the stability of resources to execute effective and efficient collaborative problem solving.

The NSRP action plan provided in response to OSD's request addressed the elements of Sec 1014 directly. It provides consolidated industry judgment on appropriate actions in response to findings in the OSD-sponsored benchmarking study. The consensus was achieved by engaging numerous experts with extensive experience in building and designing both warships and commercial ships across a diverse spectrum of U.S. shipyards.

The objectives of the proposed investment strategy are to:

- Frame a set of actionable approaches by which the Navy ship construction program could be made more efficient;
- Vet a set of implementable priorities for a nationally integrated effort over 5-10 years incorporating a variety of approaches that would modernize the U.S. shipbuilding infrastructure (physical facilities, critical processes, specialized labor pool and unique tools – including systems and processes), resulting in a healthier and more viable shipbuilding industrial base;
- Establish priorities for potential implementation of the approaches examined;
- Estimate the resources required to implement each of the approaches examined;
- Consider the potential for using NSRP to implement some of the various approaches;
- Identify DoD and Navy actions, policies and contract incentives to facilitate improvements to efficiency and modernization of the U.S. shipbuilding industrial base.

The recommended strategic framework focuses on the shipbuilding enterprise front-end processes highlighted by the benchmarking report as the biggest levers to effect improvement. Of note, many worthwhile recommendations considered were not included in the final prioritized recommendations due to an intentional focus on the highest leverage opportunities. The recommendations are defined at a level of detail that relies on a nationally-integrated effort to execute the framework provided. The strategy presented therefore assumes:

- An execution process that would employ a rigorous down-select process of specific, detailed and individually priced proposals that would address interdependencies among the issues;
- Leverage of the existing NSRP organizational structure & processes where appropriate;
- Provision for multi-year, multi-shipyard team projects where appropriate to the challenges;
- Provision for shipyard specific investment through appropriate channels and mechanisms;
- A flexible cost share structure that recognizes the barriers posed by a strict cost sharing requirement.

#### **A Framework of Five Strategic Thrust Areas**

The investment framework described provides a consensus integrated priority list to guide the cost-effective, goal-oriented investment of an estimated \$249M program. The framework contains five strategic thrust areas that provide focus for concentrating improvements - strategies that address the capabilities, concepts, and practices required to enhance the long-term infrastructure improvements needed by the Navy to build ships in the future. The five thrust areas, in investment priority order, are:

- Design, Engineering and Production Engineering
- Production Processes
- Navy / DoD / Industry Joint Action

- Shipyard Organization and Operations
- Shipyard Outsourcing and Supply Chain Integration.

These thrust areas compose a set of strategic focus areas to be managed and budgeted under a coordinated investment umbrella. Each is structured as a set of sub-elements that map the key areas of interest within a broad area of improvement. A detailed discussion of each of the 27 proposed sub-element investment areas is provided. These critical areas provide a roadmap for effective and efficient investment.

The table displays the 27 investment recommendations in priority order along with the recommended level of non-shipyard specific investment.

Priority	Investment Strategy	Joint Navy / OSD / Industry Action	Design, Engineering and Production Engineering	Production Processes	Outsourcing and Supply Chain Integration	Organization and Operating Systems	Shipyard Org & Operating Systems	Inv \$M
1	<b>Acquisition Strategy Stabilization</b>	X						-
2	Design for Production		X					\$20.0
3	Eliminate Non-Value Added Production Activity			X				\$8.0
4	Eliminate Disincentives & Improve Incentives	X						\$0.5
5	Consolidate & Streamline Production Management Info Systems					X		\$5.0
6	Improve Shipyard Planning & Scheduling Systems					X		\$5.0
7	Streamline Navy Technical Oversight	X						\$6.0
8	Improve the Naval Ship Design Process		X					\$8.0
9	Elevate Production Engineering		X					\$8.0
10	Apply Lean/Six Sigma Tools to Streamline Shipbuilding Supply Chains				X			\$6.0
11	Expand the use of Module Building (Outfitting Packages)			X				\$5.0
12	Balance the Use of Technology in Shipyards			X				\$2.0
13	Develop & Implement Advanced Material Handling			X				\$10.0
14	Develop Production Process Standards			X				\$2.0
15	Enable Enterprise Interoperability of Design & Production Data		X					\$20.0
16	Change Weight-based Cost Estimating Relationships	X						\$1.0
17	Manage Change Orders to Reduce Productivity Impact	X						\$1.5
18	Format Outfit Production Information		X					\$1.0
19	Improve Dimensional and Quality Control Tools and Practices		X					\$2.0
20	Optimize Manpower and Work Organization						X	\$3.0
21	Eliminate Outsourcing Disincentives				X			\$0.5
22	Improve Production Control Processes						X	\$5.0
23	Support Domestic Shipbuilding Volume other than Military Ships	X						-
24	Outsourcing Strategies, Including Regionalization and Process Consolidation of Shipyard Work				X			\$20.0
25	Enable Supply Chain Data Sharing				X			\$1.8
26	Rationalize Design Rule Methodologies on Naval Ships		X					\$5.0
27	Enable Resource Sharing Among Private / Public Shipyards	X						\$0.5

In addition to the industry-wide initiatives delineated above, highly focused, shipyard-specific initiatives would target infrastructure implementations to directly support planned Navy programs and/or strategic industrial base objectives.

This approach was developed by senior executives from U.S. shipyards. Through NSRP, they assembled a team of experts to lead the process of reviewing requirements and current investments, collecting enterprise-wide corporate knowledge, assessing gaps, and defining an action plan. A large cross-section of industry and government stakeholders assessed strengths, weaknesses, opportunities and challenges to

productivity and infrastructure modernization. Participants also identified and prioritized existing process and cultural challenges that limit introduction of new processes. The stakeholders then prioritized the benchmarking gaps and mapped them to an efficient, actionable investment portfolio. Each recommendation is described in terms of the issue addressed, actionable solutions, benefits of work to be expected, anticipated difficulties in pursuing the improvements, and an estimated cost of collaborative efforts that would precede individual shipyard implementation. There was solid consensus among U.S. shipyards on the highest priority actionable recommendations. Many worthwhile but lower priority recommendations from the benchmarking report were not included.

### **Executing the Plan**

The recommended investment strategy includes initiatives in each of the defined thrust areas that tie the strategic vision to one of two types of investments; 1) industry research through collaborative R&D or 2) shipyard-specific remedies. Additionally, several related recommendations are included for federal government action that may not be priced as an 'investment'.

To meet DoD goals, the proposed strategy exhibits the following attributes:

- Emphasizes solutions that can be impact the broad industrial base while providing for unique needs of Navy programs;
- Differentiates the attractiveness of solutions with applicability across multiple ship designs;
- Balances technology transition probability with the need for appropriate risks in innovation;
- Provides a technology portfolio in which diversification mitigates individual investment risks;
- Differentiates the appropriate roles for collaborative work versus subsequent platform-specific R&D funding;
- Recommends investments that shipyards who build naval vessels would employ on future Navy shipbuilding contracts.

### **Collaborative R&D**

The industry agreed with the HASC and DUSD(IP) that NSRP would be the logical vehicle to build on. NSRP operates under a Joint Funding Agreement (JFA) between NAVSEA and the shipyard collaboration that continues through 2009, subject to funding which is not yet defined for 2007 and beyond.

Much of the plan is consistent with execution via the existing NSRP structure with low risk and little difficulty. In fact, the plan was developed knowing that there was considerable overlap with the SIP. If Congress and DoD are ready to invest at such greater levels, NSRP's Executive Control Board (leadership from 11 shipyards) would be enabled to act on these areas much more vigorously.

The existing structure and process have a track record of flexibility, credibility and results to build on. While NSRP has operated at the \$10M level for the past few years, its structure was designed for a \$40M annual funding target, and it functioned very effectively at levels as high as \$22M. Industry leaders are confident that NSRP can readily adapt to \$30M as early as FY07, and ramp up as high as \$60M within 3 years while avoiding the overhead of duplication by adapting / expanding as needed rather than reinventing.

## **Shipyard-Specific Remedies**

If SECNAV and/or the PEOs determine that a technology, process, or infrastructure improvement developed using funds for collaborative projects will improve the productivity and cost-effectiveness of Naval vessel construction, they may elect to provide funds to a shipyard to facilitate the purchase of such technology, process, or infrastructure improvement. Since a process implemented in one yard is not necessarily applicable to another, the facility with less developed processes cannot simply copy the solution applied elsewhere. Similarly, a particular shipyard may not be able to apply the solutions of every industry-wide development due to unique limitations in their current processes and capital constraints. A specific process improvement may also include a change in hardware and infrastructure to support the process. The method and form of implementation of advanced processes will be unique to each yard and therefore require its own development path to at least some degree. These situations imply investments tailored to individual shipyards, whose improvement strategies are logically a mix of collaborative solutions and focused, shipyard-specific work. Initiatives regarding shipyard/program-specific projects and purchases of equipment and services are NOT suited to collaborative execution.

## **Summary**

In the last two Defense Authorization Bills, the HASC Force Projection subcommittee asked DoD for ideas for a nationally integrated effort over the next decade that includes priorities and resource requirements – including the potential for using NSRP to implement some of the various approaches. The consensus industry plan provided to DoD at their request responds in detail to the shipbuilding study findings and to each aspect of the 2005 Sec. 1014 tasking. While shipyards will continue to work with their PEO customers to improve productivity on each Navy program, sustained commitment to support a cross-program effort such as for efficient collaboration on industry-wide issues would accelerate the rate of improvement of the entire industrial base.

Thank you for the opportunity to testify before the Subcommittee regarding the nation's shipbuilding industrial base. I am honored to be here and ready to take your questions.



## References

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4. First Marine International findings for the global shipbuilding industrial base benchmarking study—Part 1: Major Shipyards, August 2005.
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6. U.S. Department of Defense [DUSD (Industrial Policy)] Global Shipbuilding Industrial Base Benchmarking Study—Part 1: Major Shipyards, May 2005.
7. Assistant Secretary of the Navy (Research, Development and Acquisition) letter of March 27, 2006 to Congress, transmitting an Assessment of the Efficiency of Naval Shipbuilding.