

**David K. Heebner**  
**Executive Vice President – Marine Systems**  
**General Dynamics Corporation**

---

Testimony before the  
House Armed Services Committee  
Seapower and Expeditionary Forces Subcommittee  
111<sup>th</sup> Congress, First Session

Improving Efficiency in Shipbuilding

Washington, D.C.

July 30, 2009

Chairman Taylor, Congressman Akin, members of the subcommittee, thank you for your invitation to testify today and for the committee's long history of support for United States shipbuilding.

My objective today is to provide an introduction to General Dynamics Marine Systems shipyards, followed by a brief discussion of factors driving efficiency gains. I will then discuss examples of challenges and successes we have experienced, and close with recommendations.

## **Introduction to General Dynamics Marine Shipyards**

General Dynamics Marine Systems business segment comprises Bath Iron Works, located in Bath, Maine; Electric Boat, located in Groton, Connecticut and Quonset Point, Rhode Island; and National Steel and Shipbuilding Company, or NASSCO, located in San Diego, California. Combined, these shipyards employ nearly 22,000 people. The group designs, builds and supports submarines, surface combatants, and auxiliary ships for the United States Navy, and commercial ships for U.S.-Flag customers.

### **BATH IRON WORKS**

Bath Iron Works, located on the Kennebec River in Bath, Maine, delivered its first ship to the United States Navy in 1893. Since then, BIW has delivered over 400 ships, including 242 military ships and more than 160 commercial vessels and private yachts. Today, 80% of the Navy's active surface combatant fleet was designed by BIW and is being sustained by BIW Planning Yard personnel. BIW plays a key economic role in Maine as it is Maine's largest single site private employer with over 5,500 highly skilled engineers, designers and shipbuilders having, on average, over 20 years of ship design and construction experience. BIW is currently building DDG 51 Class Destroyers, the DDG 1000 Class Destroyers and the Littoral Combat Ship (LCS).

### **ELECTRIC BOAT**

Electric Boat Corporation, headquartered in Groton, Connecticut, and with major facilities at Quonset Point, Rhode Island, has been designing and building submarines for the U.S. Navy since 1899. Starting with the first nuclear submarine, the USS NAUTILUS, Electric Boat has delivered 101 of the U.S. Navy's 198 nuclear submarines. Electric Boat designed and built the lead ship for 16 of the 19 classes of nuclear submarines, and has designed the propulsion plant for all but one class. Today at

Electric Boat there are over 10,000 engineers, designers, and craftsmen, focused on the design, construction, and life cycle support of nuclear submarines for the U.S. Navy and its allies. Almost 1000 more employees are engaged in various other shipbuilding work, including aircraft carrier propulsion plant design and naval combatant design and engineering. Electric Boat is currently building VIRGINIA Class submarines.

### NASSCO

NASSCO in San Diego has designed, built and delivered 135 new ocean-going vessels (Navy and commercial) over the last 50 years, and is the only remaining private shipyard on the West Coast capable of building large, ocean-going vessels. NASSCO includes 4,500 engineers, designers, and skilled shipbuilding craftspeople, plus 1,000 long-term on-site subcontractor partners supporting the shipyard. This makes NASSCO the largest industrial manufacturer in the San Diego area, and a strategic resource to both the Navy and Southern California. NASSCO personnel provide critical skills for the design and construction of US Navy Auxiliary ships as well as modern commercial ships for US domestic trade. In addition, NASSCO also provides important ship repair services – a vital role as San Diego has the largest US Navy fleet concentration on the West Coast. As a full service shipyard, NASSCO strives to reduce the cyclical nature of the ship construction and repair business by participating in several markets, an effort that greatly contributes to establishing continuity for the shipyard labor force. NASSCO is currently building the T-AKE Class dry cargo/ammunition ships, as well as commercial Product Carriers.

### **Factors Driving Efficiency Gains**

In line with the committee's interests, we in General Dynamics Marine Systems are continually focused on improving shipbuilding efficiency and affordability. Three key factors that have a direct and substantial impact on our shipyards are: Volume, Stability of Requirements, and Predictability in Funding and Scheduling.

Volume is the most obvious factor. Simply stated, the more ships we build, the more we can learn and improve our processes, leading to greater efficiency and lower cost. Just as important, increased volume affects thousands of suppliers who provide the components and commodities that comprise over half of ship construction costs. Economic order quantities, facilitated by Congressional support of multi-year procurements, improve vendor performance and lower shipbuilding costs. And with greater volume, there is increased incentive and latitude for making business decisions on capital investments and other facility improvements.

Stability of requirements is the second factor. Setting requirements early facilitates a more stable design before construction begins, and enables more effective production planning, design for producibility, risk reduction, and improved maintainability for reduced total ownership cost. Furthermore, with modern electronic modeling, simulation and planning tools at our disposal, a new design can be virtually built – even re-built many times -- before any construction actually commences.

The optimum scenario for reducing risk and cost on a shipbuilding program comes with the serial production of a mature design. In such an environment, more opportunities for cost and schedule reduction can be pursued and cost growth can be minimized. Major ship construction activity should not begin until a detailed design is substantially complete and critical equipment and material is available. With an integrated design-build approach, some prototype construction units can be manufactured and then incorporated into ship production units.

Once requirements are defined, “requirements churn” must be minimized. Otherwise, the flow of changing requirements will frequently result in various unforeseen and unintended costs. Stability of requirements, when supported by early involvement of industry in a ship design, maximizes the impact of design for producibility efforts. When risk is reduced, we are able to match investment decisions with program requirements in ways that improve our productivity and increase our efficiency.

The third factor is predictability in funding and scheduling. Ships are large, complex capital assets requiring years to design and build. Frequently, production plans must adapt to changing external factors. Minimizing these changes allows more effective cost control. Over the past few years, Congress has been most supportive in this respect, providing advanced funding and approving multi-year procurements, especially with mature programs. This is very helpful and should be continued to maximum extent possible.

We shipbuilders are responsible for the efficiency of our shipyards. We know that we must sustain our culture of continuous process improvement. I'll briefly address four areas that have significant impact on shipyard operating efficiency.

1. Early collaboration
2. Capital investment
3. Workforce training and,

#### 4. Applying lessons learned

First, by “early collaboration” I mean conduct an open and crisp selection process, either through direct competition or negotiation, then down-select and immediately begin collaboration between industry and Navy stakeholders. We support the fact that the government must preserve the benefits of competition. But we urge acceleration of the selection process, because early and continuous collaboration between the shipbuilder and customer that occurs after down-select is where substantial efficiency benefits are to be gained.

To elaborate, through Navy and industry collaboration we have developed a Design/Build approach to shipbuilding. The ship is designed with a focus on how a shipyard with a given set of facilities and equipment could most effectively and efficiently build the ship. Also, life cycle costs are addressed early in the development cycle for new ship design. Typically, sixty to seventy percent of the total cost for a Navy ship is associated with operations, support and disposal of the vessel. Thus, with early collaboration at the design stage, improvements and accommodations can be made to the design that will allow maintenance cost savings over the life of the ship. Early collaboration between the shipbuilder and the government customer also permits the shipbuilder to work with vendors to optimize the supply chain and further reduce costs. All together, this Design/Build/Maintain approach yields significant savings by reducing Total Ownership Costs.

Second, capital investment and facility improvements are a key enabler of cost reductions. These investments are more justifiable when there is reasonable assurance of a sustained and predictable workload that supports the business case for return on invested capital.

Third, workforce training and knowledge transfer highlight our most important asset – people. Many family generations have proudly worked in the same shipyard, and the average worker today has over 20 years of experience. Worker skills are learned and honed, often through “deck plate interaction”, and passed on to the next generation of shipbuilders. We also transfer knowledge using formal training, like our strong apprenticeship program, and we invest in other formal workforce training at every opportunity. At NASSCO, to just pick one example, we have invested an average of 280,000 hours per year in trade training over the last five years.

Fourth, we apply lessons learned from each ship we build. Continuous process improvement is now ingrained in our shipyard culture. We encourage our employees to

look for safer, better, faster, and less costly ways to build our ships. They take pride in the fact that their good ideas are valued and applied. We share lessons learned across General Dynamics' business units and work closely with our partners to promote improvement across all classes of ships. We also seek best practices through interaction with foreign shipyards, like the high-volume shipyards in South Korea.

## **Examples**

I think a few examples may be useful to illustrate our commitment to process improvement, increased efficiency and reduced shipbuilding costs.

First, regarding collaboration and predictable funding, Congress and the Navy have collaborated closely with us on the VIRGINIA class submarine program, and the results have been extremely positive. The Navy invested \$600 million dollars in the "Design for Affordability" program to develop design changes essential to price reduction. Congress provided advance funding and accelerated the production of two submarines per year. These collaborative efforts improved the design, increased the build rate, and reduced the total ownership cost of the program by nearly \$4 billion dollars.

Second, regarding the importance of facility modernization, we knew that the degree of ship completion before launch was a key factor to reducing ship costs. Work performed in a controlled outfitting shop environment is estimated to cost less than half than that of similar work done after a ship is waterborne. At BIW, the significant investment in the Land Level Transfer Facility and the Ultra Hall outfitting building has reduced direct labor hours by more than twenty percent compared to the last DDG 51s built on the inclined ways. When combined with the Design/Build approach and other advances in the modular construction process, these facilities have allowed us to build larger ship sections in a covered, controlled environment. This permits a much higher degree of completion prior to hull integration on the ways, and the ship becoming waterborne. The larger the ship module that can be constructed, the more efficient the assembly effort, meaning increased productivity, saved direct labor time, and reduced cost.

A final example is at NASSCO, where facility investments, workforce training, and lessons learned reduced T-AKE's labor hours by over 50%. Additionally, our partnership with South Korea's Daewoo shipbuilding increased efficiency and reduced cost on our commercial Product Carrier ships, and many of those improvements have carried over to our Navy programs.

## **Recommendations**

We are committed to increasing efficiency and removing cost from shipbuilding. We are improving every day, but we are also convinced that more can and will be done.

Mr. Chairman, your subcommittee's initiatives have contributed to more efficient and affordable shipbuilding, and to a more stable industrial base. Your support of multi-year procurement for mature programs, advanced procurement and advance construction authority will continue to reduce costs for both the government and for shipbuilders. Also, I want to thank you for your efforts with regard to Title XI loan guarantees. Every dollar of these loan guarantees can conceivably support \$20 of new American commercial shipbuilding. This sustains and modernizes the U.S.-flag merchant marine fleet making them more economically and environmentally efficient while simultaneously lowering the costs of Navy shipbuilding. Title XI is a win-win for American ship operators and shipbuilders, while allowing other positive benefits to American consumers.

Mr. Chairman, as you know, shipbuilding is a complex and dynamic process. Much has been done to improve efficiency, yet more can be done. We will work together with the Congress and the Navy to achieve this common objective.

I am proud of the high quality ships General Dynamics' shipbuilders are delivering to our Navy. I invite the committee to visit our shipyards so that our proud workers can show you the magnificent ships they build.

Thank you for the opportunity this opportunity to testify. I look forward to your questions.