

# SHIPBUILDING

## ABSTRACT

The United States Shipbuilding Industry is a dichotomy. The US builds the world's most technologically advanced warships but remains non-competitive in the large commercial vessel international market. High labor and material costs and low productivity have essentially erased the global market share for large US-built commercial ships. On the other hand, cheap labor and materials, smart business practices, and heavy government investment have led to substantial market shares for the Asian rim. Fortunately, the lack of a viable commercial market doesn't negatively impact US national security, but keeping the industry afloat does affect the nation's economy.

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Mr. Chris Vuxton, Dept of the Army

Dr. Mark Montroll, Faculty  
CAPT Mike Brown, US Coast Guard, Faculty  
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## **PLACES VISITED**

### **Domestic:**

Newport News Shipbuilding, Northrop Grumman Ship Systems, Newport News, VA  
Kvaerner Philadelphia Shipyard, Philadelphia, PA  
National Steel and Shipbuilding Company, General Dynamics, San Diego, CA  
Bollinger Shipyard, Lockport, LA  
Central Gulf Lines, New Orleans, LA  
Textron Marine and Land Systems, New Orleans, LA  
Seemann Composites, Gulfport, MS  
Northrop Grumman Ship Systems, Gulfport, MS  
Northrop Grumman Ship Systems, Pascagoula, MS  
Austal, Mobile, AL

### **International:**

Kawasaki Heavy Industries Shipyard, Sakaide, Japan  
US Consulate General, Osaka, Japan  
Ishikawajima-Harima Heavy Industries Shipyard, Aioi, Japan  
Mitsubishi Heavy Industries Shipyard, Kobe, Japan  
Kvaerner-Masa Shipyard, Helsinki, Finland  
Kvaerner-Masa Shipyard, Turku, Finland  
Aker Finnyards, Rauma, Finland  
US Embassy, Tallinn, Estonia  
US Embassy, Helsinki, Finland  
Presentation by Wartsila Corporation, Helsinki, Finland

*America's shipbuilding industrial base is a critical element of our defense, economy, and world influence.*  
*Senator Trent Lott<sup>1</sup>*

## **INTRODUCTION**

Since the United States is a maritime nation and the world's dominant superpower, the mastery of the seas is vital to US national interests. By the sea, the US carries its goods to foreign markets. By the sea, America brings foreign goods to her shores. By the sea, the US projects its military instrument of national power. Continued US success depends on the availability of military and commercial vessels to meet current and future requirements. Consequently, an understanding of global shipbuilding capability is fundamental to ensuring US national interests.

Although the worldwide shipbuilding industry has declined over the past two decades, the US shipbuilding industry remains postured to support the nation's requirements for the 21<sup>st</sup> Century. Since the September 11<sup>th</sup> attacks, the US has become immersed in transforming its military and homeland security forces. The US government and shipbuilding industry are therefore inextricably linked. This relationship survives, in part, on its ability to preserve national security and promote global economic stability.

Using core materials, independent research, guest lecturers, and domestic and international site visits, our study group analyzed the major facets of the shipbuilding industry. Our purpose was to determine if the global industry satisfies the requirements for US national security and economic stability today and for the foreseeable future. In forming our conclusions and recommendations, we reviewed the current condition of the global and domestic shipbuilding industry. We looked at its past and present performance, challenges, future outlook, international competition and trends, and the US government's role within the industry. While divergent views exist across the spectrum of policy enactments and long-term industry goals, our stated conclusions and recommendations are based on this synthesized, in-depth analysis.

## **THE SHIPBUILDING INDUSTRY DEFINED**

The shipbuilding industry is a worldwide business enterprise. Although approximately three quarters of all new construction is centered in Asia between South Korea, Japan, and China, repair and maintenance facilities exist worldwide. The industry is a mix of public and private yards that include facilities ranging from huge industrial complexes located in major ports to small, family-owned businesses in remote parts of the globe. Shipbuilding includes all the labor, design, manufacturing processes, infrastructure, and suppliers needed to construct new ships ranging from simple cargo carriers to complex warships, cruise vessels, and modern tankers.

The US has five public naval shipyards located in Portsmouth, Norfolk, Pearl Harbor, Puget Sound, and Curtis Bay. Northrop Grumman and General Dynamics own the six major private yards, known as the "Big Six." Northrop Grumman has shipyards in New Orleans, LA; Pascagoula, MS; and Newport News, VA. General Dynamics owns

Bath Iron Works in Bath, ME; Electric Boat Corporation in Groton, CT; and the National Steel and Shipbuilding Company in San Diego, CA. The Big Six shipyards form the first tier of the US shipbuilding industry, specializing in the construction of large military and commercial vessels. The industry's second tier includes facilities such as Bollinger Shipyards in Lockport, LA; Textron Marine and Land Systems in New Orleans, LA; and Austal USA in Mobile, AL. These yards construct and repair smaller vessels such as tug boats, supply boats, ferries, fishing vessels, barges, small military vessels, and Coast Guard cutters. Shipbuilding's third and fourth tiers consist of subcontractors and suppliers who provide subsystems such as command and control, propulsion, and fire control for military and commercial vessels.

## CURRENT INDUSTRY CONDITION

### Market Trends

The US shipbuilding industry is not competitive in the global commercial market. Asia provides the preponderance of the world's oceangoing vessels. South Korea, Japan, and China have approximately 75 percent of this market.<sup>2</sup> European nations capture another 15 percent, leaving the remainder of the world's nations to compete for less than 10 percent of the global marketplace.<sup>3</sup> The US share of the global commercial market is less than one percent, and America ranks tenth in the world in terms of new tonnage built (see Figure 1).<sup>4</sup>

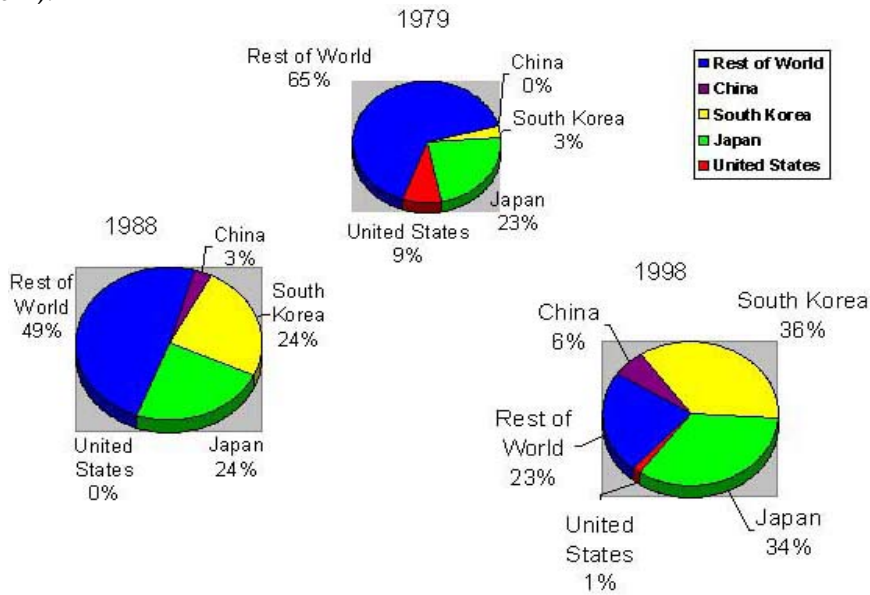


FIGURE 1: WORLD COMMERCIAL TONNAGE CONSTRUCTION

Asian nations achieved comparative advantage in the global marketplace by minimizing costs, thereby enabling them to become the preeminent commercial shipbuilders during the last quarter of the twentieth century. Asia's industry is heavily automated, allowing it to efficiently produce commercial vessels at internationally

competitive prices. Automation also reduces labor costs, permitting countries like South Korea and China to build commercial ships much cheaper than other nations.

The Asian shipbuilding industry further mitigates costs by producing tankers and container ships from standard designs. Adopting this technique provides workers with a steep production learning curve, saving time and effort and enhancing the company's profitability. Although Asia is the world's commercial shipbuilding leader, there is still stiff competition between South Korea, Japan, and China for global market share.

European shipbuilders couldn't compete with Asia in building container ships and tankers, so they found their niche in the international cruise liner market. The Europeans build the world's most luxurious and sophisticated cruise ships, and although they build fewer ships, the cruise liners range from two to five times the cost of simple tankers and container ships. The Europeans therefore generate enough profit on each ship for their industry to remain solvent. Recently, European shipbuilders have used their technological expertise to produce other sophisticated vessels, such as liquefied natural gas carriers, in a bid to render some of the market share away from the Japanese.

As noted, the Asians and Europeans together have nearly ninety percent of the international commercial shipbuilding market. Innovation and high productivity are key in helping them maintain a stranglehold on the global market. The US can't compete without a major overhaul of its own infrastructure and shipbuilding processes.

### **Subsidies and Protectionism**

According to the US Department of Commerce, "The US shipbuilding and repair industry is dependent on government policy for its long-term survival. Shipbuilding and repair is an important component not only of the nation's defense but also of America's transportation infrastructure."<sup>5</sup> Currently, the financial viability of the industry rests in two markets: the domestic market which is enhanced by protectionist legislation such as the Merchant Marine Act of 1920 (the Jones Act), and the national defense market, which is sustained by the demand for naval combatants. Most shipbuilders prefer building naval and Coast Guard vessels because of their profitability and the reliability of government contracts. Defense work also enables the shipyards to maintain a cadre of skilled labor, tremendously enhancing any future national mobilization effort. While the US Navy is the industry's largest customer for strategic national defense assets, there are proponents within the industry that advocate a greater need for subsidies and protectionist legislation that would stimulate commercial shipbuilding.

One factor contributing to US commercial shipbuilding's demise is the heavy subsidies that foreign governments provide to their shipbuilding corporations. Some foreign governments not only underwrite companies who sell commercial tankers and container ships below cost, they also pour billions of dollars of capital investment into the industry. The Japanese relied heavily on this strategy; however, the South Koreans replicated it and have since dethroned the Japanese as the world's leaders in large commercial vessel production. Congress dealt the US international commercial

shipbuilding industry the coup de grace by canceling the Construction Differential Subsidy (CDS) program in 1981. The Roosevelt administration, under the Merchant Marine Act of 1936, established the program to:

Provide for a subsidy of up to 50 percent of the construction costs of a commercial vessel built in the US to offset the lower foreign construction costs. The subsidy was paid to the US-flagged ship owner rather than the shipbuilder, and it was only available for those ships built in the United States that were to be registered under the laws of the US and operated in international trades.<sup>6</sup>

The US government paid the subsidy to the American ship owner to buttress the domestic market. Once the subsidy was removed, US ship owners purchased less expensive vessels overseas. Although other subsidies such as the Maritime Security Program still exist, the cancellation of the CDS program in the face of heavily subsidized foreign competition significantly reduced the commercial segment of US shipbuilding.

Another piece of the US commercial shipbuilding jigsaw puzzle is the political nature of the industry itself. For example, Northrop Grumman's Newport News Shipyard employs approximately 18,000 people and is the largest single private employer in Virginia.<sup>7</sup> If the government were to invest in automation and upgrade the facility, then Northrop Grumman could employ fewer workers. However, few politicians are going to vote for legislation to improve a facility that in the end puts constituents out of work. Furthermore, Northrop Grumman makes its money based on the number of man-hours it takes to build a vessel. A modern, automated shipyard would significantly reduce that number of man-hours, thereby decreasing corporate profits. As a result, both the politicians and shipyard owners have a vested interest in maintaining the status quo.

## **Productivity**

US shipbuilding productivity does not compare favorably with that of other nations. In the early 1990s, productivity in US shipyards was about one-fourth that of the Japanese and forty percent that of the Europeans.<sup>8</sup> In other words, it took the US nearly four times as many man-hours as the Japanese to build the same vessel. US shipyard productivity still lags today. During our international studies, one Finnish host briefed that his company builds in twelve months what takes the US nearly 3½ years. Clearly, if the US is to have any competitive chance in the global commercial market, it must make huge strides to improve its productivity levels.

Increases in productivity in the US are not unprecedented. In fact, between 1987 and 1998, the US shipbuilding industry experienced a modest 12 percent productivity growth. By way of comparison, US auto industry productivity increased 45 percent during the same time period, while the aircraft industry enjoyed a whopping 84 percent increase!<sup>9</sup> However, improved productivity is not the end all. A demand for US-built ships would have to exist. Freight prices would have to be high enough to encourage ship owners to add new tonnage or replace older vessels. And ship prices would have to

be high enough to generate profits for builders. In other words, increased productivity by itself would not guarantee success for US yards in the commercial market.

### **International Competitiveness**

There was a time when US shipbuilders *were* competitive in the global commercial market. US shipbuilding reached its apex in World War II, producing more vessels than any other nation. Reduced requirements for US ships following the war caused a significant demobilization in US yards. During the ensuing production slowdown, US shipbuilders progressively lost global market share because they could not compete on a cost basis with their European or Japanese rivals. To compensate for these losses, the US government provided construction subsidies that considerably improved sales. In the mid-1970s, the US built an average of 20 large commercial vessels per year. In 1981, however, the cancellation of the CDS program caused a dramatic decrease in the US share of the commercial market. In fact, by the mid-1990s, US shipyards averaged less than two large commercial vessels per year.<sup>10</sup>

US shipbuilders have essentially ignored the commercial market for the past decade. This, coupled with the diminished demand for Navy ships since the end of the Cold War, threatens the industry's ability to compete in the global commercial shipbuilding market and its capability to build the most cost-effective naval combatants.

In 1993, the US government established the MARITECH Program to improve US shipbuilding's global commercial competitiveness. This five-year program, which has since been transferred to the US Navy, strives to identify and share industry-wide best practices such as computer-aided design and computer-aided manufacturing (CAD/CAM). However, the program's future funding levels are in question. Regardless, global competitiveness is not a static condition. Any strides US shipbuilders make to improve their commercial competitiveness will likely see similar, if not equal improvements in the yards of global competitors.

### **Information Technology (IT)**

Shipbuilders are incorporating information technology into their business processes, just as the aircraft and automobile industries did a few decades ago. CAD/CAM is one example, ranging from two-dimensional (2D) modeling to derive the general arrangement drawings and functional schematics of a ship, to three-dimensional (3D) modeling used for structural design. However, it is during outfitting design that 3D modeling offers its most powerful capabilities by providing detailed arrangements of all the ship's compartments, piping, and ventilation geometry. CAD/CAM is not the only IT application in shipbuilding. Technical databases known as Product Data Management (PDM) tools provide an essential capability by identifying all the necessary elements that must be procured by producing bills of materials, by managing the design configuration, and by conducting Logistics Support Analyses.



In the past, CAD/CAM has focused mainly on the improvement and optimization of the design and build processes. However, today's software companies are trying to expand the use of computerized integrated systems into the areas of customer relations and supply chain management. This effort has resulted in the Product Lifecycle Management (PLM) tool, a single computerized tracking system that integrates a ship's development, production, customer relations, and supply chain.

Despite the difficult development of these systems, tremendous benefits have been gained through the use of IT products by the shipbuilding industry. Improvements in design quality have led to productivity gains and increased effectiveness and efficiency in the production phase of shipbuilding. However, the development of integrated computerization is still ongoing. The shipbuilding industry envisions further benefits from the use of PLM and the creation of a web-based framework between all participants in the shipbuilding process (i.e. government, shipyards, suppliers, and customers).

In addition to enhancing design and production capabilities, shipbuilders are turning to information technology to enhance business processes and supply chain management. However, a 1999 study concluded US shipbuilding still lags other industry groups in supply chain management and the use of electronic commerce technologies.<sup>11</sup>

Since 1999, shipyards have been investing in revolutionary technologies. The Shipbuilding Partners and Suppliers (SPARS) Consortium, a National Shipbuilding Research Program-sponsored partnership, proposes deploying Supply Chain Virtual Enterprises to integrate the shipbuilding supply chain linking customers, partners, subcontractors, and suppliers. Virtual Enterprises enables sourcing and supply chain integration to provide business process interactions among shipyards and suppliers.<sup>12</sup> Continued advancements within electronic commerce and supply chain management will help the shipbuilding industry achieve greater efficiencies.

### **Global Overcapacity**

Global shipbuilding capacity exceeds near-term needs by approximately thirty percent, with estimates that the figure may reach forty percent by 2005.<sup>13</sup> This number could grow even larger as China continues to construct major shipyards on her own and with the infusion of corporate investments from South Korea, Singapore, and Japan.<sup>14</sup> China's goal is to "account for 25 percent of the world shipbuilding market by 2010."<sup>15</sup> In the US, the Big Six shipyards collectively have an overcapacity for military ship construction estimated at between forty and fifty percent.<sup>16</sup>

The good news for US shipbuilding is that the recent Asian economic downturn and current OECD initiatives might reduce international subsidies and cause South Korea and China to decrease their shipbuilding overcapacity. Furthermore, the world fleet is aging while international seaborne trade is growing. New building demand is therefore projected to be significant through 2010, which would fill some of this overcapacity.

## CHALLENGES

According to the National Shipbuilding Research Program, the US industry faces six key challenges:

- 1) Preserving critical defense infrastructure;
- 2) Reducing the cost to the commercial and military customer;
- 3) Shrinking the technology gap;
- 4) Establishing a presence in the global market;
- 5) Improving productivity; and
- 6) Reducing the cost of materials.<sup>17</sup>

Our group added two other challenges to this list: the difficulty of achieving innovation without real competition, and the need to improve the DoD acquisition process.

According to an industry labor expert, the key challenge facing US shipbuilding is simply keeping it in the US.<sup>18</sup> And according to Miss Cynthia Brown, from the American Shipbuilding Association, the top three challenges facing the industry are “Survival, survival, and SURVIVAL!”<sup>19</sup>

The shipbuilding industrial base is a critical component of our defense infrastructure, supporting both current and future readiness. While the quality of US warships is arguably the best in the world, there are serious questions about the efficiency of US shipyards. This lack of efficiency not only influences the cost of US warships, but also the viability of the shipyards, particularly the Big Six, in competing globally in commercial or military markets.

Globalization is shrinking the technology gap between shipyards around the world. The heavily industrialized nations no longer enjoy unique competitive advantages against less industrialized nations that pay lower wages. Because of the relatively high costs of US-built ships, US shipyards will continue to struggle to increase their share of the global shipbuilding market.

Our research indicates that lagging productivity is not the only cause of the inefficiency of US shipyards. This inefficiency is also due to an inability to achieve material savings, which typically represent approximately sixty percent of a ship’s costs.

Lack of competition in the military shipbuilding market has produced monopolistic deficits in innovation and efficiency. In seeking transformation of the military services, this absence of innovation is particularly troubling and may drive the military customer to alternative suppliers.

Finally, the DoD acquisition process is designed for effectiveness, not efficiency. The result is the world’s best warships, but at an extremely high cost. Shipbuilding also has a significant political component. As a result, there is momentum to “keep the production line going” in filling the order book.

## **OUTLOOK**

The future of the global shipbuilding industry is uncertain. Both domestic and international builders are facing underutilized yard capacity and infrequent new construction orders. Leading international shipbuilders are heavily subsidized in some way by their governments and are more interested in capturing a larger share of the global market than fair and open competition. The mercantilist philosophy that is so pervasive in the commercial industry will continue in the foreseeable future. It is in this zero-sum game that the miniscule US commercial shipbuilding industry has to compete.

Some industry analysts estimate that world trade will continue to increase at the rate of approximately three percent per year for the next ten years.<sup>20</sup> Moreover, the international tanker fleet is over twenty years old, and the majority of these ships will have to be replaced during the next decade.<sup>21</sup> If these predictions are correct, the current US shipbuilding industry is not positioned to compete on the recapitalization of the international commercial tanker fleet. High labor and material costs, production inefficiencies, and lack of commercial building experience are the primary reasons why the US industry will remain non-competitive in the commercial market. As long as the Jones Act remains in effect, US shipyards will continue to build a small number of tanker and container ships for the domestic market. US shipbuilders recognize these facts and will continue to rely on the defense industry for their financial solvency.

American shipyards may be able to recapture some of the market as composite materials become more prevalent in future ship design. The US is a world leader in the use of composite materials in the shipbuilding industry. Currently, composite technology is directed toward the defense industry and naval combatants. Several small companies, such as Seemann Composites in Gulfport, MS, are on the cutting edge of technology and are exploring commercial applications.<sup>22</sup> However, South Korea, Japan, and China will continue to dominate the tanker and container ship market, and European countries will remain the leaders in the luxury cruise ship market for the foreseeable future. Composites, combined with fast ferry technology, are possible niche markets that US yards may exploit in order to increase their global share of the commercial market.

The US retains the strategic shipbuilding capacity to source its national security strategy by dividing defense contracts between shipyards and using subsidies such as the Voluntary Intermodal Sealift Agreement (VISA) to supplement organic lift capacity in times of national emergency.<sup>23</sup> Shipbuilding is a strategic industry and the US will somehow always maintain sufficient building capacity. America is the only nation on earth that ensures its strategic shipbuilding capacity with defense contracts while others accomplish this task through commercial subsidies. We believe the current policy will remain in effect for the foreseeable future.

## **GOVERNMENT GOALS AND ROLES**

The US government's primary goal in the shipbuilding industry is to retain an indigenous capability to build ships in support of its national security strategy. In doing

so, the US must maintain a sufficient number of shipyards, skilled workers, and capital equipment to sustain the world's most technically superior naval combatants. Additionally, the US government must maintain the ability to surge ship production in the event of potential or actual hostilities.

Subordinate to this goal, the US government desires to sustain production such that shipyard jobs are maintained at relatively stable levels without jeopardizing political support. Furthermore, the US government wishes to sustain a shipbuilding industry with a minimum amount of government subsidies and legislative protection in order to not invite retaliatory trade protections and unfair claims from trading partners.

A cooperative monopsony exists between the US government and the shipbuilding industry that endeavors to ensure the preservation and sustainment of capabilities and core competencies essential to the survival of both. Neither component can survive without the other. The government requires ships for its navy and national security requirements, while the shipbuilders require government intervention to exist as an industry. As the two entities are inextricably linked, the US government must play a key role in effectively shaping the shipbuilding industry for years to come.

The most prevalent means of government intervention resides in legislative enactments, the majority of which are protectionist or subsidy-based programs. Continuation of these enactments, namely the Jones Act, the Title XI Loan Guarantee Program, and the Maritime Security Program (MSP), will buttress the domestic commercial market and provide legislators the impetus to debate their usefulness.

Government intervention directly impacts both the defense and the domestic maritime trade markets. These two markets preserve national security and promote US and global economic stability through employment and productivity. The Jones Act alone guarantees more than 124,000 jobs. Elimination of this key legislation would directly impact employment stability within local communities. Some ship owners, however, advocate elimination of the Jones Act primarily for the opportunity to maximize their returns on investment by use of foreign hires. Opposition viewpoints also suggest that the Jones Act unfairly prevents free markets.

The counter arguments cite domestic trade preservation and the rise of asymmetric threats fueling the Global War on Terrorism as reasons to retain legislative subsidies such as the Jones Act. In the case of the MSP, the government retains a supplemental sealift capability for strategic defense missions. The \$100 million used to fund the MSP is money well spent for a capability we can ill afford to lose.

Given the declining global market and the small market share currently held by US shipbuilders, commercial shipbuilding would not be adversely impacted in the short term by the elimination of this legislation. However, over the long term, commercial shipbuilders would likely lose the incentive to explore innovative business practices and technological advances that would ultimately lead to lower production costs. Without

any type of government intervention, commercial shipbuilders would be left to rely on government defense contracts to generate any profitable returns.

Although US commercial shipbuilding is not competitive in the global market, the government should enact policies that offer incentives for commercial innovation and technological developments. Cost-saving initiatives can be applied throughout the industry to reduce production costs or create economic advantages and should be rewarded through government incentives. These incentives could include such things as tax cuts, grants, and loan guarantees.

## **ESSAYS ON MAJOR ISSUES**

### **ESSAY ONE: MILITARY TRANSFORMATION AND THE BIG SIX**

In an effort to accelerate military transformation, the Navy is fast-tracking several innovative concepts for future ship programs including Littoral Combatant Ship (LCS) and High Speed Vessel (HSV). It is not clear at this time if this new direction is an opportunity or a threat for the Big Six shipbuilders.

The core competency of the Big Six is building large, complex military ships to Navy requirements. The production of these ships is, for a variety of legitimate reasons, time consuming, costly, and technically evolutionary. However, with LCS and HSV, the Navy is seeking the exact opposite. What the Navy wants are ships they can field quickly, at relatively low cost, and with revolutionary capabilities. Are the Big Six ready to execute transformation's themes of rapid development, low cost, and innovation? There are a number of challenges.

Rapid development is severely constrained by the ship acquisition process. The Navy and DoD have made ship acquisition a slow, structured march. The ships the Navy builds today are vast systems-of-systems that simply cannot be conceptualized, integrated, and built quickly. In this environment, there are no prototypes and no second chances, so the development schedule is a careful sequence of events that ultimately ensures technical performance. Consequently, the rapid rate of development sought in these new transformation efforts is unheard of in ship acquisition.

Reducing costs is also difficult for the Navy and the Big Six. The acquisition process invests a great deal of energy in tracking and controlling costs, but actually reducing ship costs presents a troublesome paradox. For example, by reducing the labor going in to a ship through production improvements such as automation, the shipyard can indeed reduce the cost of building that ship, but because the Navy determines allowable profit as a percent of the cost of building a ship, shipyard profitability is also reduced. So by performing better for the Navy and the taxpayers, the shipyards actually perform worse for their shareholders. This system may not overtly keep the yards from improving productivity, but it clearly does not provide incentives for productivity improvements.

The biggest challenge to innovation is the risk-intolerant nature of Navy shipbuilding. By seeking to carefully control cost and schedule while ensuring technical success, Navy ship acquisition compresses innovation into the margins. Cost and schedule inevitably require management in the real world of finite resources. However, a new balance between risk and reward is necessary to transform the Navy and its supporting shipbuilding industrial base in any significant way.

To navigate through these unfamiliar waters, the Navy and the Big Six must consider several questions. For the Navy, the first question is obviously, “What kind of ships will I need in the future?” The second question is, “How can we produce these ships?” The answers involve the role of the shipbuilding industrial base, how to integrate the research and development component, and to what extent to implement acquisition reform initiatives. The third question is, “What kind of industrial base do I need to preserve to support surge requirements?”

For the Big Six, the questions are similar. The first question is, of course, “What is the future market?” The second question is, “What segment of the future market should I target?” Business strategy depends on several interrelated factors including opportunity costs, entry costs, and profitability. Also important are strategies for identifying and obtaining new competencies through partnerships, corporate acquisitions, or self-development. The third question is, “How much of the target market can I expect?” Obviously, none of these questions can be answered with certainty.

In the near term, the Navy and the Big Six will continue their current relationship, and together they will continue to produce the world’s most advanced warships. The impending change in sea state spurred by transformation, however, will necessarily take both the Navy and the Big Six on a different course. The real question is, “To where?” By exploring the implications of transformation and answering key questions of mutual interest, the two can plan for a disciplined journey from where they are today to where they need to be in the future.

Mr. Ron Davis, Dept of the Navy

## **ESSAY TWO: REVIVING COMMERCIAL SHIPBUILDING**

The United States shipbuilding and merchant marine industries have been on the decline since the end of World War II. Several cabotage laws have been enacted to protect both industries, but with little success. With or without these laws, the simple fact remains that US shipyards are not competitive in the world market. This essay takes a brief look at the history of the major US commercial shipbuilding industry, factors that contributed to its decline, and potential solutions to revive it.

### **Discussion**

In support of World War I, US shipyards built 1,774 major commercial ships (over 2,000 gross tons) between 1917 and 1921.<sup>24</sup> The end of the war created a huge surplus of commercial ships, resulting in far fewer vessels being built during the interwar period and subsequent downsizing of many shipyards. This pattern was repeated for

World War II, and the industry has not been able to recover from that downturn. In fact, delivery of major merchant ships fluctuated in the double digits from 1947, but generally declined from fifty ships to only two in 2001. The shipbuilding industry employed over 1.4 million workers in 1943 and 1944. That number has also been on the decline, with just over 90,000 workers employed in 2001.<sup>25</sup> Major shipbuilding yards, repair yards, and topside repair yards have undergone several mergers, downsizings, and closures. In 1977, they totaled 169 (excluding public yards). That number stood at 92 in 2001.<sup>26</sup>

Two major reasons account for US commercial shipbuilding's situation: predatory pricing practices (especially in Japan, South Korea, and China), and lack of innovation on the part of US shipbuilders to create a demand push for ships.

### **The Asian Factor**

Japan entered the shipbuilding business in the 1960s when the government identified shipbuilding as essential to economic growth. Shipbuilding is capital intensive and investors were reluctant to invest in an industry that had been dominated by the US and Europe. As a result, the Japanese government heavily subsidized the industry to get it through its infancy and continues to do so even today. South Korea embarked on the same path in the 1970s, as did China in the 1980s.<sup>27</sup>

### **Innovation**

Another cause of the US shipbuilding industry's demise is the slow pace of innovation. US shipbuilders have not taken steps to implement modern processes to reduce construction costs and delivery times. With the exception of naval vessels, the only vehicle that is sustaining the major US shipbuilding industry is the Merchant Marine Act of 1920, commonly known as the Jones Act. If the Jones Act is repealed or watered down, the major commercial shipbuilding industry, or what is left of it, will collapse. Positive steps must be taken to avoid this situation. The US is a maritime nation with over 95,000 miles of coastline (including inland waterways), making the marine industry vital to our economy and security strategy.

### **Demand Push Strategy**

The time is right for the US shipbuilding industry to reinvent itself by creating a demand for ships. The Oil Pollution Act of 1990 (OPA 90) offers one opportunity. Per OPA 90, only double-hulled tankers will be allowed to operate in US waters as of 1 January 2015. Additionally, the law requires the gradual phase out of US-flagged tankers based on age, tonnage, and configuration. The number of US tankers subject to OPA 90 varies with sources of information. Best estimates put the number at 66 tankers, of which 31 should have been removed from service between 2000 and 2002.<sup>28</sup> The 35 remaining single-hulled ships will have to either be replaced or removed from service by the deadline. This establishes a demand for tankers, but it is not conceivable to expect a one-for-one replacement. The shipbuilding industry must drive the needs by teaming

with ship owners and shipping companies to identify cargo-carrying needs and design families of tankers to economically fulfill those needs.

Another potential area for ship employment is using coastal container ships to relieve road congestion on the nation's major highways. Interstate 95 along the east coast and Interstate 5 along the west coast are two prime examples. In 1998, the US transportation system carried over 15 billion tons of freight valued at over \$9 trillion. That year, trucks moved 71 percent of the total tonnage and 80 percent of the total value of US shipments, while only eight percent of the tonnage and 1.75 percent of the total value was moved by water (see Table 1). The projection for movement of freight as indicated by Table 1 is a recipe for congestion on our highways if the trend continues unabated. Domestic freight volume is predicted to increase by more than 65 percent from 1998 to 2020. Trucks will move the lion's share of the freight increase over that period, increasing highway freight volume by more than 73 percent. Waterborne domestic freight volume will increase by 37 percent. Expansion of highways has not kept up with the traffic increase. Vehicle-miles traveled increased by 80 percent while lane-miles increased by only two percent between 1980 and 2000.<sup>29</sup> The result is congestion and bottlenecks when demand for roads exceeds supply, which will in turn significantly affect the speed and reliability of the road system.

Table 1. US Freight Shipment by Tons and Value

| Mode                       | Tons (millions) |               |               | Value (billion \$) |               |               |
|----------------------------|-----------------|---------------|---------------|--------------------|---------------|---------------|
|                            | 1998            | 2010          | 2020          | 1998               | 2010          | 2020          |
| <b>Domestic</b>            |                 |               |               |                    |               |               |
| Air                        | 9               | 18            | 26            | 545                | 1,308         | 2,246         |
| Highway                    | 10,439          | 14,930        | 18,130        | 6,656              | 12,746        | 20,241        |
| Rail                       | 1,954           | 2,528         | 2,894         | 530                | 848           | 1,230         |
| Water                      | 1,082           | 1,345         | 1,487         | 146                | 250           | 358           |
| <b>Total, Domestic</b>     | <b>13,484</b>   | <b>18,821</b> | <b>22,537</b> | <b>7,877</b>       | <b>15,152</b> | <b>24,075</b> |
| <b>International</b>       |                 |               |               |                    |               |               |
| Air                        | 9               | 16            | 24            | 538                | 1,198         | 2,284         |
| Highway                    | 419             | 733           | 1,069         | 772                | 1,724         | 3,131         |
| Rail                       | 358             | 518           | 699           | 116                | 248           | 432           |
| Water                      | 136             | 199           | 260           | 17                 | 34            | 57            |
| Other                      | 864             | 1,090         | 1,259         | n/a                | n/a           | n/a           |
| <b>Total International</b> | <b>1,786</b>    | <b>2,556</b>  | <b>3,311</b>  | <b>1,443</b>       | <b>3,204</b>  | <b>5,904</b>  |
| <b>Grand Total</b>         | <b>15,270</b>   | <b>21,377</b> | <b>25,848</b> | <b>9,320</b>       | <b>18,356</b> | <b>29,979</b> |

Source: "The Freight Analysis;" Federal Highway Administration; October 2002.

The shipbuilding industry must again team with shippers to develop a strategy to gain the lion's share of projected increase in domestic freight movement. The strategy



must demonstrate that it is more economical for shipping companies to focus on movement of freight by water than over highways. The strategy must also demonstrate to the Department of Transportation that it is more economical to subsidize construction of ships to move freight than invest in a never-ending quest to ease traffic congestion. Safety will also increase on the nation's highways with fewer trucks on the roads.

### **New Age Shipbuilding Techniques**

As the shipbuilding industry creates demand for ships, it must also develop new and innovative ways of building ships to reduce construction, operating, and maintenance costs. Modular construction and sub-contracting must be leveraged to maximum advantage. Shipyards must migrate to assembly facilities, with several modules and sub-modules constructed and delivered by sub-contractors. State-of-the-market technology must be installed in the pilothouse and engine room to reduce staffing. The Coast Guard must be involved in developing these new features to approve reduced staffing levels.

### **Conclusion**

The US commercial shipbuilding industry is struggling to survive, being kept alive in part by the Jones Act. Some argue that the Jones Act is protectionist in nature, while others believe it is not only necessary, but also vital to US national security strategy. Every major maritime or shipbuilding country has some form of cabotage law. US shipbuilding is at a disadvantage in the international market because it lacks subsidies provided to foreign shipbuilding industries by their governments. Nevertheless, this is not a reason to be complacent. The industry must become proactive in creating a demand push for ships subject to OPA 90, creating a market for new generations of watercraft such as coastal container ships, and leveraging technology to reduce lifecycle costs. The industry cannot rely on hope and keep crying foul. It must clutch in and set the wheels of a vital industrial base in motion.

CDR Eku Faux, USCG

## **ESSAY THREE: WORKFORCE ISSUES**

The number of US shipyards that construct large naval vessels has contracted from a World War II high of 300 down to six. Likewise, employment has shrunk from a wartime high of well over one million people down to less than 100,000.<sup>30</sup> The skilled workforce has declined more than fifty percent over the past twenty years. The cyclical and unpredictable nature of the industry has caused companies to frequently lay off workers. In a predominately union environment, younger, less-experienced workers are typically the first to be let go, causing skilled employee average ages to be very high. The average skilled employee in US shipyards is between 41 and 50 years old. The national average for skilled labor production workers is 42.1 years.<sup>31</sup> The number of skilled workers available to the industry is expected to continue to decrease, forcing many shipyards to hire – and thus train – unskilled workers.<sup>32</sup>

In 2002, the US Shipbuilding and Repair Industry reported shortages in skilled labor for all groups of the workforce.<sup>33</sup> Considerable shortages were reported for welders

and pipe fitters. Shortages in electricians, machinists, and painters also exist. Low pay and tough working conditions pose significant limitations to recruiting and retention. Average hourly pay is approximately \$14.54, not a very attractive amount for the physically demanding and dangerous work required of most skilled laborers.<sup>34</sup>

## **The Challenges**

**Declining Military Build Rates.** At current rates of replenishment, one source estimates the US Navy fleet may decline to as few as 200 ships.<sup>35</sup> The Navy's ship program has decreased 60.5 percent since the 1980s, dropping to an average annual procurement of 7.5 ships compared to 19 two decades ago. Forced to look to the domestic and global commercial markets for business, most shipyards had little success. Labor was affected in companies that couldn't successfully transition from military to commercial vessels.<sup>36</sup>

**Poor Commercial Markets.** The US is extremely "uncompetitive in the commercial shipbuilding market."<sup>37</sup> Other nations' advantageous shipbuilding policies, lower labor costs, and greater efficiencies have left the major American shipbuilders with no opportunity and little incentive to compete. Expensive materials, low productivity, and high wages will continue to keep US shipbuilders out of the upper tier markets.<sup>38</sup>

**Overcapacity.** Due to US Navy requirements, the Big Six currently operate at as little as fifty percent of their capacity.<sup>39</sup> While having the capability may be good if it is ever needed, it forces the employer into unproductive practices such as stretching out construction projects to keep skilled labor on-board.<sup>40</sup>

**Poor Productivity.** United States shipbuilding productivity is close to the bottom among international shipbuilders. US shipbuilding has "high labor, material, and overhead costs" as compared to international shipbuilders. Higher costs of US ships is caused by lower productivity and not higher wages. American shipyards are not internationally competitive and the domestic market for large commercial vessels can't sustain a high production rate. Efficiency and increased productivity is gained through building large numbers of ships, thereby realizing the benefits of economies of scale.<sup>41</sup>

**Unions.** US shipbuilders find resistance to improvements in employee productivity. The Europeans, for example, are trying to become more efficient through outsourcing. The majority of highly specialized American workers are unionized in an entrenched system that requires much more supervision and planning to manage the division of labor. Resistance to necessary changes in American practices may be very difficult from the existing unionized labor force.<sup>42</sup>

**Recruiting and Training Programs.** The Big Six employ the largest percent of the skilled workforce and accounted for approximately 80 percent of all training hours in 2000. Newport News, for example, offers apprentice programs in 18 crafts ranging from heavy metal fabrication to welding equipment and repair.<sup>43</sup> However, these training programs are not without problems. Poor entry-level worker education, work ethic,

motivation, and the ability to stay “drug free” are concerns of the industry.<sup>44</sup> Shipyards like Bollinger and Newport News must recruit heavily to find qualified workers.<sup>45</sup>

Several states are concerned with the health of their shipyards and are making efforts to assist them. Alabama, for example, recruits potential workers right out of high school with offers of apprenticeships and craft training programs.<sup>46</sup> Louisiana is working closely with Bollinger and other neighboring shipyards to tailor community and technical college courses to meet industry needs.<sup>47</sup>

## **The Way Ahead**

**Increase and Sustain Naval Vessel Build Rates.** Increasing and sustaining the naval build rate would make the shipyards that produce naval vessels more stable by removing the cyclic nature of government business. Creating a schedule and budget for naval shipbuilding over a 15-20 year period – independent of the current PPBS cycle – would allow industry to know exactly what would be built, by whom it would be built, and add confidence that government funds would be available to complete all work. Additionally, foreign military sales of US-built naval vessels should be examined as a method of increasing the build rate of US shipyards. US industry currently does this with combat aircraft and other military systems, so there is no reason why US shipbuilders shouldn't be able to capitalize on this international market.

**Gain Global Commercial Market Share.** The US government must find ways to encourage and assist US shipbuilders in gaining a bigger share of the global commercial market. A one-percent share of the world market is unacceptable by any measure. First, the government should establish a goal to capture ten percent of the world market within the next ten to fifteen years. Second, government funds are necessary for capital investment (subsidies) to modernize shipyards so they can increase efficiency and productivity in order to compete in the global market. Lastly, once the capital investment has been made, the government should contract a significant number (10-15 per shipyard) of large ships (tanker/cargo) to be built on speculation. Modernization and economies of scale would significantly reduce the cost per vessel, giving US shipbuilders a chance to compete in the global market.

## **Conclusion**

Creating a steady work environment will encourage qualified workers to come back to US shipyards. A major contributor to the high costs of US ships is the low numbers being built. Finding ways to increase build rates would improve recruiting and retention of skilled workers. Sustaining the long-term build rates would reduce the historic cyclic nature of US shipbuilding, keeping skilled labor in the industry. Improved build rates would also lead to more job openings due to the simple fact that more ships would be being built. Lastly, improved build rates would improve productivity and competitiveness, making shipbuilding a more attractive career. Lt Col Joe Harrison, USMC

## **ESSAY FOUR: MERCHANT MARINES**

“I present to the Congress the question of whether or not the United States should have an adequate merchant marine. To me there are three reasons for answering this question in the affirmative. The first is that in time of peace, subsidies granted by other nations, shipping combines, and other restrictive or rebating methods may well be used to the detriment of American shippers. Second, in the event of a major war in which the United States is not involved, our commerce, in the absence of an adequate merchant marine, might find itself crippled because of its inability to secure bottoms. Third, in the event of a war in which the United States itself might be engaged, American-flagged ships are obviously needed not only for naval auxiliaries, but also for the maintenance of reasonable and necessary commercial intercourse with other nations.”

President Franklin Delano Roosevelt, 4 March 1943

The question President Roosevelt asked Congress in 1943 concerning the need for an adequate merchant marine still haunts the US today. Even as early as the Jones Act of 1920 and the Merchant Marine Act of 1936, the merchant marine was declared a means of economic and military power. Although this country has seen time and time again the need for the service of the merchant marine, this much-needed asset has weakened because the industry is too expensive to sustain in peacetime. Corporate income tax on the revenue from trade shipping, income tax on mariners’ overseas wages, expensive design criteria set by the US Coast Guard (USCG), and a lack of insurance compensation for US seafarers have driven US merchant shipping to foreign ownership. Foreign-flagged vessels and crews control almost 95 percent of import and export cargo for the US. Is the US merchant marine ready to help provide for the economic and military aspects of national security? How will the shortfalls be resolved? Is there even a need for the US merchant marine?

### **Economic State of the Merchant Marine**

The merchant marine competes less today in the international trade market but is regulated to move all domestic shipping. Privately owned, US-flagged ships that create revenue for the nation’s economy decreased to a low of 239 just since Desert Storm (1991), of which 102 operate in international trade, 105 operate in domestic trade, and 32 work only for the US government. The US is the world’s largest trading nation, accounting for almost 20 percent of world ocean trade, and yet in 1999 it carried only nine percent of the cargo. By April 2000, the US ranked 12<sup>th</sup> in the world’s merchant shipping fleet, sliding from 5<sup>th</sup> in 1970. According to the Maritime Administration (MARAD), international trade will triple and 90 percent of that will move by sea by 2020. That increase will be a loss to the US economy. The lack of US competitiveness in international trade shipping degrades America’s opportunity for increased revenue and the availability of US-flagged, militarily useful ships and skilled US mariners.

Domestic shipping has played a significant part in maintaining the viability of the US merchant marine. According to MARAD, the total direct economic activity associated with the domestic trade is approximately \$10 billion per year, which equates to more than \$4 billion in direct wages to the ship owners. On top of that, domestic shipping is expected to increase due to a shift in dry cargo shipments from clogged

highway and rail networks to inland waterways. Also, the government has subsidized merchant shipping by making it the benefactor of cargo preference laws that generate revenue. For instance, the US Department of Agriculture and US Agency for International Development annually administer \$1 billion in food aid that is guaranteed to move by merchant shipping.

US participation in the movement of international trade is minimal, which means that the merchant shipping industry will not provide as much as it has in the past to the growth of the economy. On the other hand, the US merchant marine is the sole provider of shipping revenues in domestic trade, but the government has made it that way so that the merchant marine is available for the national defense.

### **Military State of the Merchant Marine**

National defense depends on the strategic sealift capability that is provided by the merchant marine to maximize defense logistics capability and minimize its cost. Because the merchant marine had been so unpredictable in terms of availability, the US instituted programs to maintain some capability. These programs include the National Defense Reserve Fleet (NDRF), Ready Reserve Force (RRF), Voluntary Intermodal Sealift Agreement (VISA), and the Maritime Security Program (MSP).

The Transportation Institute reported as of February 2001, the NDRF is made up of 317 inactive dry cargo vessels, tankers, military auxiliaries, and other ship types. MARAD put 91 of these vessels in its subordinate program, the RRF.

The RRF was specifically structured to move Army and Marine Corps unit equipment and sustainment supplies for all services. It is now made up of 76 militarily functional ships. The force is located throughout the country and is maintained in a reserve status in the event of a crisis. The ships are managed by commercial companies and crewed by civilian merchant mariners.

VISA is a defense program that enables “assured access” to commercial ships in order to move sustainment cargo during crises. Activation of this program is done on a time-phased basis. Commercial operators can volunteer capacity in the first two stages of VISA; however, in Stage III, participants must commit at least fifty percent of their capacity. Quite often, ships participating in the VISA program are also enrolled in MSP.

MSP is a ten-year program that is designed to provide funding for ship owners who are willing to commit 100 percent of enrolled vessels to DoD during war or a national emergency. Currently there are 47 US-flagged vessels registered in the program.

Mariners present the biggest challenge to ensuring the merchant marine can meet the national defense requirements. Captain William G. Schubert, head of MARAD, believes that the US is capable of crewing the ships necessary to meet surge sealift requirements in a wartime environment. Fifty-one of the ships in RRF have about nine or ten crewmembers already onboard. Schubert said, “The mariners needed to augment

these existing crews are expected to be derived, in large part, from members of the commercial mariner labor pool that are currently ashore.”<sup>48</sup> The problem is retention. The number of mariners decreased from a peak of 166,000 working after WWII down to 15,000. During the 1991 Gulf War, crewing the 200 ships used was almost impossible.

There is a readiness problem with the US merchant marine. Although high costs to US-flagged ship owners, an aging fleet, limited defense programs, and unskilled and unavailable mariners explain why this is the case, there is still a need to fix it. By doing so, the US would be able to prosper from international trade and ready itself for times of war and national emergencies.

### **Resolving the Shortfalls**

The number one problem is the cost to operate a US-flagged vessel. One initiative to cut the cost of US shipping is the Merchant Marine Cost Parity Act. This legislation would accomplish at least four initiatives: (1) replace the corporate income tax on US-flagged shipping revenue with a flat tonnage tax which falls in line with other countries; (2) exempt up to \$80,000 of US mariners’ overseas wages from federal taxes; (3) limit design and building criteria to those of the International Maritime Organization over the more stringent USCG standards; and (4) reduce lawsuits by allowing for insurance compensation when mariners are injured or killed aboard ship.

The second largest problem has been the availability of qualified mariners to operate the ships, particularly some of the older vessels. Technology changes like containerization have increased the carrying capacity and hence the economic potential of some vessels, but not necessarily their military usefulness. Consequently, MARAD continues to hold the old break bulk ships, which are much more practical to the military. With that in mind, there are some human resource initiatives taking place to deal with the issue of not having enough mariners. The maritime community is addressing licensing and documentation issues in order to ensure accessibility of mariners. An agreement between labor unions to crew ships across union lines is being worked. A tracking database of merchant mariners and their qualification records is being established and should be completed by the fall of 2003. A merchant mariner reserve was proposed by MARAD and is up for study by DoD.

### **Conclusion: Is There a Need for the Merchant Marine?**

By reviewing the government policies already instituted and the industry initiatives to generate stability amongst mariners, it becomes evident that the nation’s efforts, thus far, barely sustain the merchant marine. The best possibilities seem to be in capturing a significant share of the international trade market. This can be accomplished by enacting legislation such as the Cost Parity Act and possibly through a mariner recruitment program that would include human resource incentives such as free education. The point is that the US needs merchant shipping for national defense, which despite Roosevelt’s statements in 1943, has been evident since the Jones Act of 1920.

COL Debbie Bazemore, US Army

## CONCLUSION

Shipbuilding is almost as old as mankind itself. For centuries, nations have built wealth and power using the world's oceans as highways for commerce. The United States is a maritime nation whose vitality and survival are tied to its use and control of the world's waterways.

Our industry study group was tasked with answering the question, "Does the shipbuilding industry support US national strategic goals?" The short answer is yes; however, efficiency is not an overriding factor in the current system. America has conscientiously abandoned the international commercial shipbuilding marketplace. Instead, she has chosen to maintain strategic shipbuilding capacity through defense contracts.

America's Asian neighbors have taken an opposite approach and have geared their industry toward the commercial market. Hefty government subsidies coupled with innovative management and manufacturing processes have made Asia the preeminent commercial shipbuilding region in the world. Their European counterparts have been forced to specialize in technologically advanced vessels and cruise liners to remain competitive. The new Asian shipbuilding tiger is China, and some analysts predict they will wrestle significant market share away from their cousins within the next decade. Asian and European worker productivity and state financing are substantial barriers that US shipbuilders will not overcome without significant government assistance.

America must find a niche in the global marketplace to have any hope of regaining international market share. US expertise in composite technology and fast sealift offers hope to future commercial builders. Moreover, protectionist legislation may provide a hedge against foreign competition in the domestic marketplace, allowing time to mature fledgling technologies. New domestic markets such as an east coast seaborne freight service have the potential to provide not only domestic builders with a new untapped market, but also carries the possibility of revitalizing the Merchant Marine Force which heretofore has been allowed to atrophy. If the US chooses to do nothing, then commercial domestic builders will continue to barely survive. Fortunately, adopting this course of action will not jeopardize US national security. However, national pride and prestige demand that the government, along with the US shipbuilding industry, implement policies that begin to redress this international commercial shipbuilding mismatch.

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