

# SHIPBUILDING INDUSTRY STUDY REPORT 1996

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Bethlehem Ship, Baltimore, MD  
USCG Yard, Baltimore, MD  
Avondale Shipyards, New  
Orleans, LA  
Bollinger Marine Shop & Shipyard,

Lockport, LA  
Halter Marine Shipyard,  
New Orleans, LA  
Textron Marine & Land Systems,  
New Orleans, LA  
Ingalls Shipyard, Pascagoula, MS

## **Places Visited (International):**

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Bruce' s Shipyard AB,  
Landskrona, Sweden  
Oresundsvaret AB, Landskrona,  
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## ABSTRACT

The shipbuilding industry is vital to the United States' s national security strategy. Recent cuts in Department of Defense procurement budgets have called into question the viability of an industry that has relied exclusively upon naval ship construction for the last two decades. If even a few U.S. shipyards are to remain in business, they must reenter the commercial shipbuilding market. To regain even a small percentage of that market, U.S. shipbuilding firms must learn to build ships competitively by streamlining their management structures, employing new manufacturing processes, and revitalizing their labor force.

## INTRODUCTION

The power of a nation, especially an island nation like the United States, to respond to global threats requires a maritime capability. Thus the capability and capacity to build large oceangoing vessels for U.S. power projection and sealift is important to the objectives of the U.S. national security strategy objectives.

When the Cold War ended in 1991, the U.S. military began to downsize and the U.S. Navy abandoned its goal of a 600-ship fleet. Orders for new ships were terminated, and long-range forecasts for new Navy ships grew dimmer and dimmer. As a result, many U.S. shipyards closed their doors or elected to focus solely upon ship repair instead of ship construction. Only *seven* privately owned yards were producing large vessels for the U.S. Navy as of March 1, 1996 (*U.S. Industrial Outlook 1996*).

The purpose of our study of the shipbuilding industry was to answer two questions. First, are the capacity and viability of the seven yards sufficient to meet national security needs for the production of both sealift assets and combatant vessels? Second, is it feasible for U.S. shipyards to compete in an international commercial market for oceangoing vessels as a means of preserving U.S. shipyard capacity, capability, and viability?

To answer these questions we visited several U.S. shipyards and spoke with corporate executives and union leaders. We also spoke to personnel from the U.S. Navy--the primary customer of the large U.S. shipyards. In

addition, we examined the commercial shipbuilding market to determine whether U.S. shipyards have the capability to compete in a fiercely competitive market in which foreign governments highly subsidize their home industries. As part of this investigation, we visited foreign shipyards, met with buyers of commercial ships, and examined the role of governments in the shipbuilding industry.

## **THE SHIPBUILDING INDUSTRY DEFINED**

Shipbuilding as an industry in the United States takes into account all of the labor, design, manufacturing processes, infrastructure, repair facilities, and suppliers involved in new construction, conversion, and repair of ships of various sizes and complexity--both military and commercial. The continuum of shipyards includes facilities ranging from huge industrial complexes located in major ports with cranes capable of lifting hundreds of tons to small, labor-intensive, family-owned businesses in remote locations.

The U.S. shipbuilding industry consists of publicly owned (government) shipyards, privately owned (commercial) shipyards, and key subcontract manufacturers engaged in design, manufacture, and/or maintenance of naval and commercial vessels and key shipboard systems. Publicly owned shipyards do not build new ships but only conduct ship repair operations.

There is a distinction between those elements of the industrial infrastructure that possess conventional capabilities and those that possess nuclear capabilities. Only two U.S. shipyards are capable of producing nuclear vessels, Newport News (aircraft carriers and submarines) and Electric Boat (submarines only).

Over 220 establishments in the United States are engaged in some form of shipbuilding and repair. The major shipbuilding base (MSB), as identified by the U.S. Maritime Administration (MARAD), comprises privately owned facilities that are open and have at least *one* shipbuilding position able to accommodate a vessel of 122 meters or more (*U.S. Industrial Outlook 1994*). Most of these yards are also major repair facilities with a dry-docking capability. As of January 1996, MARAD's Office of Ship Production identified 16 yards meeting MSB criteria. MSB yards employ roughly 70 percent of the total U.S. shipbuilding and repair labor force.

About 90 percent of these employees are engaged in U.S. Navy or Coast Guard ship production or repair (*U.S. Industrial Outlook 1996*).

U.S. shipyards are classified into first-tier shipyards, second-tier shipyards, and third-tier suppliers. First-tier yards include three major conglomerates in U.S. shipbuilding: the General Dynamics Corporation, which owns Electric Boat and Bath Iron Works; Litton Industries, which owns Ingalls Shipbuilding Company; and Tenneco, Incorporated, which owns Newport News Shipbuilding. In addition, 12 other yards make up the first tier (see Figure 1).

Second-tier yards include smaller yards, some with U.S. Navy contracts, that produce other than large oceangoing vessels exceeding 122 meters. These yards construct and repair smaller vessels for inland waterways and coastal carriers. Typical ship construction includes tugs, supply boats, ferries, fishing vessels, barges, drill rigs, small military vessels, and other government-owned vessels (e.g., Coast Guard cutters).

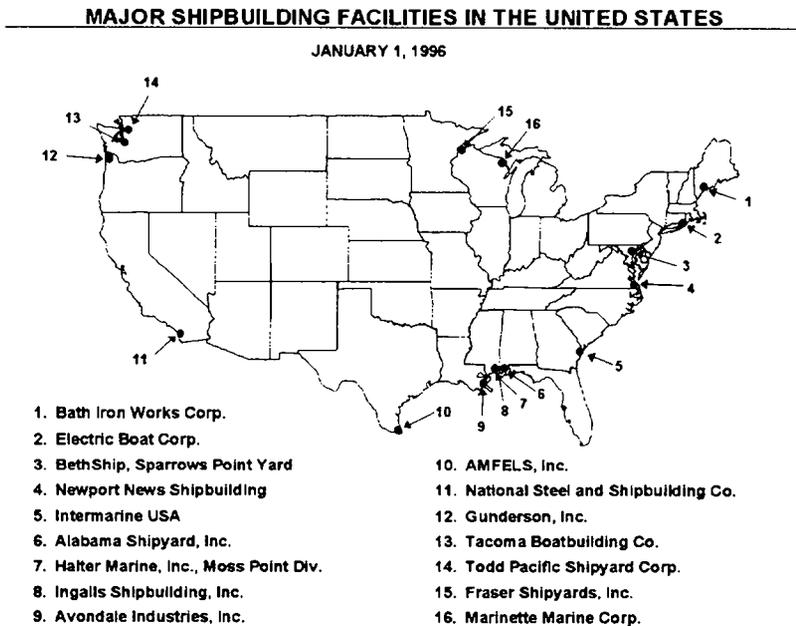


figure 1.

The third tier consists of hundreds of private sector and government-owned industrial facilities that design, develop, produce, and maintain subsystems and components required to support the shipbuilding industry.

## **CURRENT CONDITIONS**

The U.S. shipbuilding industry remains in a depressed state. The number of merchant and naval ships under construction and on order fell from approximately 150 each year in the mid-1970s to under 50 (projected) for 1996. This reduced construction of new ships has played havoc with the shipbuilding industry, resulting in "right sizing" of the labor force and the closing of several yards.

In 1990, 21 U.S. shipyards employed about 130,000 workers of all skill and pay levels. By the first quarter of 1996, only 16 yards employing 106,000 people remained. Some analysts project that by 2000 employment figures may drop to approximately one-half of the current level. Though this reduction may appear alarming, total employment in European, Japanese, and Korean shipyards is around 200,000, and those workers produce approximately 85-90 percent of the world's commercial ships.

### ***Commercial Shipbuilding Trends***

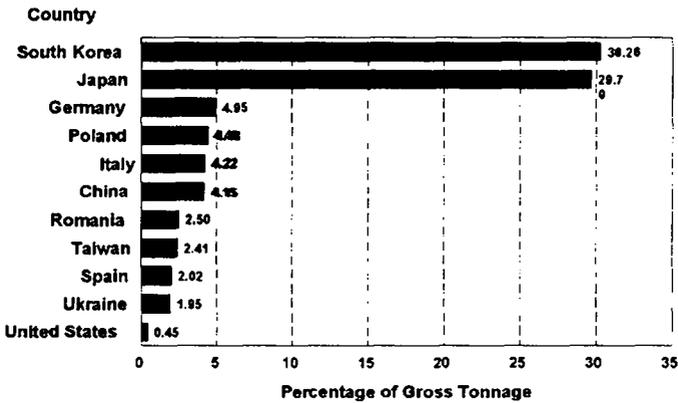
During 1995, the number of commercial ships on order or under construction in the world market rose 15 percent over the previous year. This increase followed an upward trend in new ship construction since 1991. The world order book for merchant vessels 1,000 gross tons (gt) and over consisted of 2,655 vessels totaling 48.5 million gt as of December 1995 (*U.S. Industrial Outlook 1996*).

Among the first-tier shipbuilding firms in the United States, two yards received commercial orders in 1995. The contract orders called for over one quarter million deadweight tons (dwt), including four new ships and four major conversions (eight product tankers). Also in 1995, a major second-tier shipyard received two product tanker orders, and during the first two months of 1996 a first-tier yard received an order for five product tankers. This encouraging news follows decades of declining

commercial market share: the low point was zero commercial ships of 1,000 gross tons and greater on order in 1987.

Firms in South Korea, Japan, and China, including Taiwan, hold nearly two-thirds of the commercial market share figured as a percentage of gross tonnage (Figure 2). Shipbuilding firms in Europe hold nearly 20 percent of the commercial market share, with Germany holding the largest percentage. The United States ranks 23rd among major shipbuilding nations, holding less than 1 percent of the world market share.

**Figure 2**  
**WORLD SHIPBUILDING ORDERBOOK**  
 as of December 31, 1995



Source: Lloyd's Register

### *Military Shipbuilding Trends*

U.S. military ship construction has steadily declined since the buildup of the early 1980s. In 1992, 10 Navy vessels were constructed, and by 1995 that number had declined to 6 ships. As of March 1, 1996, U.S. firms had 55 military ships of 1,000 dwt and greater on order or under construction for a total of just under 900,000 tons.

Most first-tier shipbuilding firms continue to rely exclusively on government contracts. Some industry leaders forecast that Navy shipbuilding will remain low for only a few more years and then will

increase by as much as 70 percent, but the shrinking U.S. defense budget and unprecedented pressure to balance the federal budget may mean that the anticipated increase is wishful thinking. The reduced threat to U.S. national security is more likely to translate into further reductions in naval combatants and military sealift requirements.

### *Current Capacity*

U.S. shipyards need to shed their considerable excess capacity. Shipbuilders in the United States would need to build 30-50 commercial ships per year to maintain the current capacity. In contrast, the average number of ships built per year over the last five years was only 3.8 (Snyder, 1996).

### *Subsidies*

Financial and fiscal policies remain crucial issues for the shipbuilding industry. The consequences of government intervention in the shipbuilding industry are contributing to excess production capacity and price cutting, especially in South Korea and Japan. The current commercial market continues to exhibit depressed prices influenced by price cutting (dumping) and tough international competition.

### *Productivity*

A National Shipbuilding Research Program (NSRP) project study on global shipbuilding competitiveness, completed in 1995, compared productivity and competitiveness in four U.S. shipbuilders and five foreign yards. The surveys, taken in 1978 and 1994, show that U.S. shipbuilders are losing ground to foreign competition in the overall level of technology used and specifically in the areas of shop construction, design and engineering, steel work, outfitting, and organization and operating systems (A&P Appledore, 1995).

While the differences in level of technology are very telling, the statistic that best frames the problem is the measure of competitiveness in man-hours (MH) expended per compensated gross ton (CGT). The study determined that the average MH/CGT was 184.4 for the U.S. yards

studied and 88.0 for all foreign yards, placing U.S. shipyard labor productivity at less than one-half that of all foreign competitors.

Another recent shipyard productivity study has put the U.S. relative productivity figure at one-third that of Japan, the recognized leader in shipyard productivity (Frankel, 1996). The findings common to all of the recent studies is that U.S. shipyards' labor productivity and relative level of applied technology are lagging foreign competition.

The answer to the competitiveness problem, then, should be a strong *determination to be competitive*, the acquisition and *application of the appropriate technology*, and the *integration of new technology* throughout the company, not just the haphazard add-on of technology, as is often the case. And, while the formula is simply stated, carrying it out involves a very difficult adjustment.

## CHALLENGES

With the end of the Cold War, the reduction in defense spending, and the downsizing of the U.S. Navy fleet to 340 ships, large, private U.S. shipyards face the major challenge of entering the worldwide commercial shipbuilding market. Their survival is at stake. The number of new U.S. Navy ship contracts in the foreseeable future will not sustain more than three or four large shipyards, so the rest must enter commercial shipbuilding as their primary source of revenue or go out of business.

No industry in a position similar to that of U.S. shipbuilders has become internationally competitive in less than 5-10 years. Foreign builders have captured the lion's share of new construction, but as the market grows, U.S. shipbuilders have a chance to regain some of the market share lost in the 1980s and early 1990s. U.S. shipbuilders would like to hold three to five percent of the world's market and can do so if they streamline their operations, make significant capital investments, and adopt process improvements to raise productivity. U.S. shipbuilders face challenges in the areas of finance, technology, labor, and management.

## *Finances*

If U.S. shipbuilders want to be competitive in the international commercial market, they must change their fiscal modus operandi. As a start, they will have to adopt a commercially oriented accounting system. Currently, government cost-accounting requirements are far more numerous, complicated, and manpower intensive than those required in commercial shipbuilding. To perform commercial work, the shipyards need to significantly reduce their large documentation and accounting teams.

The next fiscal step in helping U.S. shipbuilders make the transition to the commercial marketplace is to wean private shipyards from the generous financing and payment practices of U.S. Navy shipbuilding contracts. These practices are a major reason why U.S. shipyards are not competitive in the international commercial marketplace. For example, progress payments on Navy shipbuilding contracts are so favorable that private shipyards have little or no need to raise private financing for the working capital to fund their investment during ship construction. In all practicality, a Navy shipbuilding contract allows a company's cash outflows to be covered by biweekly cash inflows. Such practices are unheard of in the commercial shipbuilding market.

Those shipyards already in or planning to enter the commercial shipbuilding arena face another challenge: the loss of government subsidies. The Organization for Economic Cooperation and Development (OECD) agreement developed jointly in 1994 by the major shipbuilding nations seeks to remove unfair advantages and level the playing field for worldwide competition. Part of the agreement reduces financing limits on Title XI loan guarantees, a financial program that has recently helped U.S. shipyards to make sales in the commercial marketplace. Even though there is a great deal of controversy over its details and its impact on U.S. shipbuilders, the OECD agreement provides significant competitive advantages by eliminating extensive foreign government subsidies.

## *Technology*

In order to be profitable in the international commercial shipbuilding market, U.S. shipbuilders must overcome the technological advantage enjoyed by foreign competitors. *Their challenge is to choose the right new technologies to recapitalize the U.S. shipbuilding industry.*

Many of the shipyards we visited in Europe have developed construction/assembly techniques that use new technologies to modularize the shipbuilding process and have redesigned their shipyard infrastructures. The new technologies include state-of-the-art computer-assisted design and computer-assisted manufacturing systems for the design, installation, and future maintenance of ship hulls, modules, and systems.

Other European process technology studies netted improvements in sheet metal, furniture, electrical (conduits/cable), and communications installation operations. U.S. and European shipyards differ greatly in this area (Storch, Clark, and Lamb, 1995). Foreign shipbuilders concentrate on perfecting methods of ship design, steelwork, outfit drawing preparation, production design, and project planning before assessing the need for computers to support them. In particular, the Norwegians have significantly reduced their production times and costs by improving processes. They are considered to be "best-in-class" for modularization and other production processes.

In addition, Norwegian shipbuilders are particularly successful in ergonomically planning the yards themselves. They consider the space needs of the fabricators, installers, and assemblers involved in the production process and make significant investments in process improvement techniques. Their finely tuned yard layouts (infrastructure) are fully integrated with their production methods, which results in cost benefits in processes such as fabrication, welding, grinding, painting, and fit-up.

Another window of opportunity for the United States is advances in ship design. Applying new technologies to hull design and propulsion systems can lead to the higher speeds being demanded by the shipping industry. One U.S. firm, FASTSHIP, has developed an 850-foot fast freighter that

will cut in half the average time to cross the Atlantic. The competitive advantage that this new ship design can yield could be a major breakthrough for U.S. shipyards. Unfortunately, because of a lack of competitiveness among U.S. shipbuilders, the first ship of this type will most likely be built in Europe.

### *Management*

Astute action by management can bring success to the U.S. shipbuilding industry, and today's environment is ripe with opportunity. First, management must streamline the industry by removing burdensome layers within organizations and reducing engineering and administrative staffs. Most of the yards we visited in Europe employed very few people in administration and engineering. Excessive government administrative procedures need to be cut from Navy contracts. The industry must improve its processes and create a sleek industrial base that has the flexibility to quickly adapt to changes in technology.

Second, U.S. shipbuilders must refocus their attention on their labor force. Talented employees should be recruited, trained, nurtured, and given permanent positions in the organization. If the workers are productive and protected, they will work harder and be more willing to make recommendations on efficiency and alternative market opportunities. Finally, shipbuilders must aggressively market their companies. If prices can be made competitive, then success depends primarily on the aggressiveness of U.S. firms in pursuing new customers.

### *Labor*

Productivity is a critical element in the recovery of U.S. shipbuilders. No method used to compare foreign and U.S. shipyards yields pure results, but by any measure foreign shipbuilders certainly use fewer workers in the aggregate. Furthermore, foreign shipyard workers are capable of a greater variety of tasks than their counterparts in U.S. shipyards are. For example, most European welders can weld with multiple metals using multiple methods while U.S. welders tend to be more specialized and limited in scope.

In addition, foreign shipyards have developed a well-trained, motivated, and flexible labor force that communicates openly--from the lowest levels on the shop floor to the highest levels of management. The workers are also committed to an aggressive cross-training program that includes team-oriented assignments to improve process efficiency.

## **OUTLOOK**

### ***Military Shipbuilding***

The Navy recently accelerated its shipbuilding delivery schedule, but few if any ships are being added to new-order books. That cost is still the major driving factor is no surprise given the price tag of a major naval ship. The newest attack submarine, for example, will cost over \$1.5 billion.

The current and projected Navy requirements of six to seven ships per year will not be sufficient to keep the existing number of commercial Navy shipbuilders in business. Some yards will close or turn to the ship conversion and repair business only. For example, once the current backlog of TRIDENT and SEAWOLF submarines is finished, General Dynamics' s Electric Boat Division in Groton, Connecticut, can expect no new orders for submarines for several years until the next-generation attack submarine is designed and the contract(s) to build them are awarded.

### ***Commercial Shipbuilding***

The commercial shipbuilding forecast looks promising compared with that for naval shipbuilding. Estimates indicate that there will be a sizable demand for new commercial ships over the next three to five years because the commercial fleet is very old: by the mid-1990s, the average age of a commercial ship will be approximately 25 years.

The greatest need for ships will be in the tanker market. Additionally, while the trend is to build bigger ships, there is a strong market for handysize/handymax ships (between 20,000 and 50,000 dwt). Changes in environmental law, primarily in the United States, are affecting demand for new double-hull tankers. Other nations may follow suit--

especially in light of the recent supertanker grounding and oil spill off the coast of Wales.

Experts in the shipbuilding market forecasting business, such as A&P Appledore International of the United Kingdom and Drewry Shipping Consultants of London, agree that for the United States to have any hope of improving its share of the commercial market, it must enter a segment that complements its naval shipbuilding expertise, such as complex-type liquid natural gas (LNG) carriers and cruise ships. However, the overall world market for complex ships is small and dominated by European shipbuilders. Price, quality, and the ability to meet an agreed-upon delivery deadline will continue to be key factors in the award of shipbuilding contracts.

### *Labor*

Right sizing has meant massive layoffs for all U.S. shipyards, and the industry is becoming increasingly concerned that the pool of manpower with critical skills is aging, that workers are paid poorly, and that the industry is too unstable to attract new workers.

According to the U.S. Bureau of Labor Statistics, U.S. labor rates are extremely competitive compared with those in European countries (Figure 3).

**Figure 3**

### **Relative Shipyard Labor Rates in 1993 U.S. Dollar Equivalents Costs (incl. overhead & benefits)**

<b>South Korea</b>	<b>0.64</b>
<b>United States</b>	<b>1.00</b>
<b>Denmark</b>	<b>1.33</b>
<b>Japan</b>	<b>1.35</b>
<b>Germany</b>	<b>1.36</b>

However, the *productivity* shipbuilders receive for the labor rates still places U.S. shipyards at a distinct disadvantage. U.S. shipyard workers can compete globally if they are properly trained and supported with the right technology. Clearly, there must be more layoffs, aggressive outsourcing, and wholesale retraining for this work force to be effective. Shipbuilders in Europe and the Far East produce excellent ships, on time and on cost, with integrated technology that uses much smaller labor forces.

### *Is a High-Technology Yard Enough?*

In simple terms, absent the business commitment to become globally competitive on the commercial shipbuilding scene, no amount of technology will be enough. Assuming the commitment is there, obtaining and applying the appropriate process and hardware technology is necessary.

Globalization has the effect of flooding the shipbuilding industry with revolutionary advances in hardware and process, such as the use of robotics and unit-construction techniques. The pace of innovations and advances in engineering, design, hardware, and process is incessant--and certainly not advantageous to a U.S. industry that has not been a competitive player for the past 15 years and is not familiar with the potential of those advances.

### *Assessment*

The current U.S. capacity to build and repair ships can support the national security resource requirements for the short term (1-5 years) under the scenario that assumes two major regional conflicts. This capacity includes support for the construction of orders and projected orders for Navy combatants, auxiliaries, and strategic sealift vessels, both new construction and commercial ship conversion--a more cost-effective alternative. Current capacity can support full surge and sustainment as delineated in the latest *Mobility Requirements Study Bottom-Up Review Update*. In the long term (5-25 years), the projections indicate that even if the shipbuilding capacity further shrinks to five major building yards, capacity will be sufficient to produce the

number of new platforms necessary to replace the existing Navy fleet of more than 300 ships.

The greatest impediment to increasing the U.S. market share in commercial ship construction is that large U.S. shipyards are not globally competitive. To a large measure this has resulted from a conscious decision by the shipyards to dedicate their resources to the significantly more lucrative market of U.S. Navy work. The prospect of winning future government contracts has a paralyzing effect on the business decisions necessary for global, commercial competitiveness. And the current billion-dollar backlog of government ship orders with many of the first-tier shipyards only serves to bolster their reluctance to pursue global competitive status.

The current domestic political and economic climate will not tolerate significant new subsidies to support private shipyards that are not globally competitive. The U.S. market share of commercial vessel construction will increase only as a result of the competitive will and determination of individual shipyards. Competitiveness cannot be mandated by the government; it can be realized only through sound business decisions, determination, and patience.

## **GOVERNMENT GOALS AND ROLE**

Historically, different administrations and Congresses have tried to boost business in U.S. shipyards by providing everything from tariffs to direct subsidies. The purpose of their intervention was to lower overhead costs assigned to Navy ships and to ensure that a shipbuilding industrial base is maintained in the country.

### ***National Security Surge and Mobilization Requirements***

The nature of today's threat has changed from global challenges to more specific regional conflicts. Supporting conflicts of short duration with a "get-in-and-get-out" mentality is the only scenario that seems consistent with the limits of U.S. public resolve. If in the future the United States is faced with a national security threat that requires mobilization assets, the U.S. military will make use of the current active U.S. Navy fleet and the U.S. Maritime Administration's Ready Reserve

Fleet prior to trying to build new sealift vessels. In addition, the Department of Defense (DoD) and the Department of Transportation are investigating innovative methods of integrating the commercial maritime sector's vessels into sealift mobilization.

As a result of lessons learned during Desert Storm, the RRF has remained about the same size (95 ships), the number of roll-on/roll-off ships has increased modestly, and *the readiness of the entire fleet has increased significantly*. The RRF improved its readiness by placing minimal crews on high-value ships to expedite turnaround and by increasing funding for maintenance and repair. With the move toward come-as-you-are conflicts and the response capabilities of the RRF, *the limited abilities of U.S. yards to surge will not be significant* in real-time mobilization efforts.

### ***Survival of the Shipbuilding Industry—Government Efforts***

If the industry takes no progressive action, a minimum number of naval shipbuilders will remain viable, probably through mergers, joint ventures, or both. *The federal government should allow these consolidations to occur. In addition, naval shipyards in the ship repair, vice shipbuilding, business should be transferred to the private sector and operated as government-owned, contractor-operated (GOCO) facilities.* President Clinton and the U.S. Air Force used this strategy to reduce the number of aircraft repair depots when faced with the 1995 Base Realignment and Closure Commission proposed closings. By making the former naval yards available as GOCO facilities, the government would ensure that they will be available in times of extended national emergency, yet personnel and infrastructure costs during peacetime will be greatly reduced.

With the reduction in demand for U.S. military ships, large U.S. shipyards face a new challenge—transferring their skills and technologies from the military to the commercial market. *As long as U.S. shipbuilders can continue to construct high-technology replacement vessels to maintain the U.S. fleet at the required level, then encouragement, vice subsidized funding, is the desired means by which the U.S. government should contribute to the strengthening of shipbuilding in the United States.*

President Clinton's 1993 National Shipbuilding Initiative (*Strengthening America's Shipyards: A Plan for Competing in the International Market*) contains cooperative research and development (R&D) projects (MARITECH) that have assisted three of the largest U.S. shipbuilders in designing LNG carriers and cruise ships. This effort is entirely consistent with the niche markets the U.S. shipbuilders should enter and will help them compete with builders internationally. *The MARITECH program should be continued and expanded consistent with provisions of the OECD agreement and the industry's needs.*

The administration is using existing organizations (e.g., MARAD, the U.S. Foreign Commercial Service, and U.S. embassy personnel) to assist shipyards in their international marketing efforts and to facilitate cooperative arrangements and alliances between U.S. and foreign yards. MARAD, which is focusing on educating U.S. embassies on the needs of U.S. shipyards, is helping U.S. shipbuilders make contact with embassy personnel around the world who can provide information concerning potential international shipbuilding opportunities. MARAD is coordinating workshops, seminars, and trade exhibits with industry on marketing techniques and productivity improvements. *These efforts should be continued.*

In the Clinton plan, government agencies, including the DoD, the U.S. Coast Guard, and the Occupational Safety and Health Administration (OSHA), were assigned the task of eliminating unnecessary government regulations. Companies that do both commercial and government work are often forced to segregate military and commercial business to enable them to keep track of and ensure their compliance with government contract regulations. According to industry, the most important step the federal government could take is to remove requirements imposed only on federal contractors. Industries could then meld commercial business practices and projects with military-specific projects. The DoD has already taken steps to move away from military-unique specifications.

OSHA held extensive meetings and workshops with labor and industry representatives to develop streamlined regulations and "user-friendly" compliance instructions for commercial shipyards. The U.S. Coast Guard is working with the International Maritime Organization to

upgrade international standards to more closely match the stringent safety requirements enforced on U.S. vessels. In addition, the Coast Guard is working with U.S. carriers and standards bodies to revise or eliminate regulations that do not affect vessel safety yet add unnecessary costs. *The efforts toward regulatory streamlining and reform in all applicable federal agencies should be continued and expedited.*

Other actions that should be taken to support U.S. shipbuilding include (1) instituting tax reforms to promote commercial investment in production R&D and infrastructure improvements (an industrywide issue), (2) promoting technology sharing within and between industries, (3) using defense R&D to enhance productivity in naval construction (a cost-cutting measure), and (4) giving incentives for reducing the cost of naval construction by rewarding on-time, under-cost performances. Finally, the federal government should make every effort to pass the OECD agreement and, once it is in effect, diligently penalize signatory countries who do not comply with it.

## CONCLUSIONS

The United States is no longer a world-class commercial maritime nation, nor is it a leader in the building of oceangoing vessels. The periods of glory to which the United States points with pride were merely aberrations embarked upon to support the nation at war. Since World War II the U.S. shipbuilding industry has emphasized the building of warships for the military departments. The shipyards staked their futures on U.S. government business, and this affiliation proved to be costly.

Certainly, before the current military drawdown, there was adequate money to support numerous shipyards. Now, because of the drawdown, the United States is losing 10-15 percent of its "large-vessel-capable" yards annually. The loss will likely continue unchecked until what remains is only the number of first-tier yards that can survive under the minimum new-build scenario for the U.S. Navy now in effect. Repair shipyards and second-tier shipyards have fared much better and will continue to compete nationally and internationally.

U.S. shipyards' survival, therefore, depends on their viability in the global commercial market. U.S. shipyards are ill-suited for this competition for several reasons. First, although they retain more than adequate physical plants, the yards are old and have not been materially improved since World War II. In general, the only upgrades made to plant equipment have been government financed. By comparison, foreign yards have modernized and build with state-of-the-art equipment.

Second, U.S. shipyards have focused little engineering effort on the improvement of manufacturing processes. Shipbuilding productivity can be improved if the vast pool of engineering talent is applied to manufacturing operations.

Finally, to regain a dignified market share, U.S. shipyards must find the right niche in the commercial market to take full advantage of current opportunities and their own greatest talents. Cruise ships and special commodity carriers are examples of market niches to consider.

Most important, shipyards in the United States are still adequate to meet current and projected national security needs, but that is only part of the story. Tremendous amounts of capital are required to bring the yards back to cost-efficient production. Sources used in the past are no longer available, so improvements must come from profits generated in the global, commercial shipbuilding markets.

Succinctly, the first-tier shipbuilding industry in the United States is in significant trouble. Without a metamorphosis, large shipyards will die and leave the United States without any large shipbuilding capability except that protected for military purposes. Second-tier shipbuilders and repair yards will continue to compete successfully in both the domestic and international arenas.

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