U.S. Shipbuilding and Repair

National Security Assessment of the U.S. Shipbuilding and Repair Industry
(003-009-00719-4) May 2001 – Price $15

Executive Summary

The U.S. Department of Commerce, Bureau of Export Administration (BXA) performed this national security assessment of the U.S. shipbuilding and repair industry at the request and under the partial sponsorship of the Carderock Division, Naval Surface Warfare Center. BXA is delegated authority under Section 705 of the Defense Production Act of 1950, (50 U.S.C.§ 2061-2170) as amended, and by Executive Order 12656, to collect basic economic and industrial information to fulfill the Department's responsibilities regarding the health and competitiveness of defense-related sectors and technologies. The Office of Strategic Industries and Economic Security (SIES) is the operating unit within BXA with the responsibility for this data collection and analysis function.

This assessment of shipbuilding and repair was initiated in September 1999, and it is the first phase of a more extensive study of U.S. maritime activities. Additional assessments are planned for maritime related research and development, the shipbuilding supplier base, ocean resource recovery, and waterborne commerce. An initial goal of this effort was to characterize more fully the maritime sector in the United States. Additional objectives of these assessments are as follows:

- Illustrate the relationship between the maritime industry, national security, and the vitality of the U.S. economy.
- Identify opportunities for increased sharing of marine science and technology between public and private entities.
- Improve the use of public maritime capabilities toward advancing private industry competitiveness.
- Encourage cooperative efforts within the maritime industry among government, industry, and academia.

Over the course of the maritime industry assessment, SIES will utilize the expertise of various government agencies, universities, and private firms, including those listed below:

- Carderock Division, Naval Surface Warfare Center
- Maritime Administration
- Office of Naval Research
- U.S. Coast Guard
- National Oceanic and Atmospheric Administration
- Army Corps of Engineers
- Consortium for Oceanographic Research and Education
- American Shipbuilding Association
- Shipbuilders Council of America
- Massachusetts Institute of Technology
- Pennsylvania State University
- Trotta Associates, Inc.

The U.S. shipbuilding and repair industry is a strategic asset analogous to the aerospace, computer, and electronic industries. Frontline warships and support vessels are vital for maintaining America's national security and for protecting interests abroad. In emergency situations, America's cargo-carrying capacity is indispensable for moving troops and supplies to areas of conflict overseas. A domestic capability to produce and repair warships, support vessels, and commercial vessels is not only a strategic asset but also fundamental to national security. The U.S. government, through maritime legislation and the Department of the Navy, plays an essential role in the shipbuilding and repair industry's viability and long-term survival.

Assessment Findings

Industry Overview

1. Shipbuilding in the United States has historically been considered a strategic industry, supporting both military and commercial interests. Currently, the U.S. shipbuilding and repair industry consists of about 250 private companies and five publicly owned and operated repair yards. U.S. shipbuilding and repair revenues totaled $10.2 billion in 1998. About 10 percent of the companies accounted for 85 percent of these revenues. The shipyards on the Eastern and Gulf Coasts account for over 80 percent of the revenues for the entire industry.

2. The six largest shipbuilders, commonly referred to as the Big Six, account for two-thirds of the industry's total revenue (over $6.7 billion in 1998) and perform nearly 90 percent of all military work. Ninety-five percent of the revenues of these yards are defense-related. The Big Six accounted for about 11 percent of the industry's commercial revenues during the 1996-2000 period.

3. Corporately, the Big Six are structured as follows: Bath Iron Works (Maine), Electric Boat (Connecticut and Rhode Island), and NASSCO (San Diego) are part of General Dynamics' Marine Systems; Avondale (New Orleans) and Ingalls Shipbuilding (Mississippi) are part of Litton Ship Systems (which was recently purchased by Northrop Grumman); and Newport News Shipbuilding (Virginia), the largest of the Big Six, remains independent to date. On April 25, 2001, however, General Dynamics made a definitive agreement to acquire Newport News for $2.6 billion. Consummation of the deal may take several months pending Department of Defense (DoD) and other approvals.

4. Based on BXA survey data, the shipbuilding and repair industry employed nearly 89,000 private workers in 1998; another 23,000 people worked in publicly owned repair yards. Industry employment has dropped sharply since the early 1980s, when total private employment was close to 180,000 workers. Survey estimates indicated that employment would decline to about 83,500 in 2000. The Gulf Coast employs more shipyard workers (35 percent of the total) than any other region.

5. Production workers comprise about two-thirds of the total shipbuilding and repair workforce. The Big Six employ about 94 percent of the naval architects, engineers, and other marine professionals. Slightly less than 60 percent of their total workforce hours are attributed to production workers.

6. The industry has two market sectors: military and commercial. Ship construction and procurement methods in the two markets are quite different and generally incompatible.

7. The military share of industry revenues was about 70 percent in 1998; these revenues experienced modest growth (12 percent) in the 1996-2000 period, while commercial revenues, although much smaller, grew by more than 50 percent. (1999 and 2000 are based on shipyard estimates.)

8. The regions with the highest percentage of defense work are the Northeast (90.5 percent) and South Atlantic (81.2 percent). The regions with relatively higher percentages of commercial work are the Gulf Coast (49.5 percent), Pacific (34.2 percent), and Great Lakes (97.5 percent).

9. Significant consolidation in recent years has led to shipyard closings and mergers. Another recent development has been the creation of joint ventures between foreign and U.S. shipyards, primarily motivated by the desire to construct certain ship types within the United States and to compete in the U.S. market.

10. Orders for U.S. warships have declined 60 percent during the ten years since the end of the Cold War.

11. In recent years, ship repair revenues ranged between 30 and 40 percent of the industry's total revenues. This figure does not include repair expenditures by the U.S. Navy or Coast Guard at the five publicly owned repair yards.

Employment Concerns

1. Survey responses indicate that labor shortages have reduced profits, impacted construction costs, and delayed project completion for most shipyards. In addition, many shipyards subcontracted work normally done at the yard and turned away new business. A few yards also used contract labor. Labor shortages affected military and commercial yards about equally.

2. Due in part to job insecurity caused by uneven workload, harsh work environments, and a competitive labor market, labor turnover at some shipyards has been higher than in many other industries. Turnover is generally highest among production workers.

3. Both government and industry sources state that military procurement contracting practices can lead to overspecialization within the workforce. Narrowly defined job classifications (or titles) can cause idle time and reduce a shipyard's flexibility to utilize its workforce effectively. Also contributing to overspecialization are union activity and tradesmen certification requirements. In contrast, Kvaerner Philadelphia is applying the lean production business model used in Europe at its newly established commercial shipyard facility at the former Philadelphia Naval Shipyard. The company reported that it currently has only four job categories in

order to maximize the flexibility of its workforce and is creating subcontractors to do major subassembly work.

4. The skill base of the U.S. shipbuilding industry is eroding, notably for welders, pipe fitters, and ship fitters. Shipyards also cited shortages of machinists, electricians and marine engineers. Shipyards compete with other industries and with each other for skilled labor.

5. A common response to acute labor shortages by some U.S. shipyards is to hire and train unskilled workers. Training unskilled workers imposes additional costs with no guarantee the workers will stay long enough for the yard to recoup its investment. Some commercial yards reported that worker morale, substance abuse, and work-related accidents due to inexperience posed additional challenges.

Productivity and Competitiveness

1. Based on Department of Labor information, productivity in the U.S. shipbuilding industry has not significantly improved since the mid-1980s, although gains have occurred since 1995 (up 12 percent). Compared to productivity increases in aircraft manufacturing (up 84 percent), for example, shipbuilding productivity has not kept pace. Reliable measures of construction productivity, which in some ways are analogous to those in shipbuilding, are not available.

2. Interviews with Navy officials who had recently conducted site visits to several foreign shipyards revealed that U.S. shipbuilders' productivity is lagging behind that of international shipbuilders. Starting from a small production base, major Korean yards reportedly had gains in productivity of 15 percent annually in the last decade. The Japanese shipyards have a continuous improvement program and have already exploited the easier gains. Recent gains in these Japanese shipyards have, therefore, leveled to about 2-3 percent annually.

3. Productivity in the shipbuilding and repair industry was profoundly affected by the slowdown in defense production levels at the end of the Cold War. In addition, procurement practices, such as change orders, and the uncertainty of annual appropriations are known to adversely impact productivity and production schedules. Three of the Big Six reported productivity aggregate gains equal to or

greater than 15 percent in the past five years, while the other three reported gains of less than five percent.

4. Current U.S. DoD procurement policies do not adequately reward innovation in military ship construction practices, thereby indirectly encouraging shipbuilders to maximize labor hours.

5. Costs of maintaining excess capacity and underutilized capabilities (people and facilities) can be high for shipyards that focus on military work. Ship costs increase and competitiveness can be adversely impacted.

6. Based on Bureau of the Census data, U.S. shipbuilders subcontract about 40 percent of the value of their total revenues. The qualification procedure for military subcontractors is burdensome and expensive. Also, the reduced level of defense procurement has discouraged new subcontractors from entering the market (creating a sole-source environment), which can result in shipyards producing more items themselves.

7. In the five years between 1996-2000, capital outlays by the shipbuilding industry were $1.44 billion, including two new shipyards and several major upgrades. This outlay was about three percent of total industry revenues. The Big Six accounted for about half the capital expenditures and invested about 2.4 percent of their revenues. Four shipyards accounted for over half of the capital investment within the industry, and eight shipyards accounted for over 70 percent of the total.

8. Financial conditions and ample profitability highlight the shipbuilding industry as possessing a generally stable business base with low levels of debt. The receipt of progress payments from the Navy contributes to the industry's financial stability. Pre-tax profits for the U.S. shipbuilding industry averaged 6.75 percent of revenues for the period 1996-2000. Profits in the military sector exceeded 8 percent, while commercial profits were about 5.7 percent.

9. According to the survey, 81 percent of U.S. shipbuilders are optimistic that their competitive prospects will improve in the next five years.

Research and Development

1. U.S. warships are acknowledged to be the best in the world. Construction of these ships has advanced naval technology. Advancements include the integration of nuclear power and gas turbine propulsion, advanced weapons systems, state-of-the-art electronic communications, and stealth technologies.

2. A key reason for U.S. warship superiority has been the shipbuilding research and development (R&D) expertise that currently resides across the Enterprise, which is the term applied to the Navy's laboratories, acquisition commands, and certain shipbuilders and universities. Collectively, these organizations have conceived and designed most of the state-of-the-art hull, mechanical, electrical, power projection, air defense, and undersea warfare capabilities that are operational today. With reduced research and development budgets, some of that capability is now becoming fragmented. The shipbuilding industry's principal roles in the development process have been in the application of technology, detailed design, and manufacturing and system integration.

3. An existing effort to bolster the shipbuilding R&D infrastructure is the National Shipbuilding Research Project Advanced Shipbuilding Enterprise (NSRP ASE). This project is an industry/U.S. Navy partnership focused on improving the commercial competitiveness of the U.S. shipbuilding industry, thereby reducing the cost of Navy ships. NSRP ASE is the successor organization to the well-received MARITECH program that ended in 1998. The U.S. Navy and the 11 major shipbuilders that comprise NSRP are jointly funding R&D costs.

4. Based on survey information, less than one percent of industry employees are engaged in R&D at least part time; 25 percent of these employees have a four-year college degree.

5. U.S. shipyard R&D averaged about 1.23 percent of revenues from 1996-2000. Half of the R&D was company funded (0.64 percent of revenues), which compares with more than three percent for all U.S. manufacturing. The Big Six accounted for 80 percent of the R&D, averaging 1.49 percent of their revenues. The R&D range for the Big Six was from near zero to almost three percent. Slightly more than half their R&D was company-funded.

6. The U.S. Navy directly funded 42 percent of the R&D that took place in the shipbuilding industry. Most Navy R&D is devoted to the development of weapons and combat systems, which is not performed by shipyards.

7. While military technology is generally not exploited by the commercial shipbuilding sector, the Navy is attempting to exploit commercial off-the-shelf technologies for ship systems and hardware.

8. As part of recent DoD acquisition reform policies, the Navy is in the process of transferring its design and life cycle responsibilities to the shipbuilding industry. This transfer has been a part of an overall defense downsizing effort that began ten years ago.

9. Based on survey responses, shipyards expressed willingness to team with government, academia, and private entities. Larger companies were more in favor of teaming than were smaller companies.

Maritime Legislation

1. U.S. maritime legislation dates back to the late eighteenth century and has been enacted to preserve the industrial base and all facets of the maritime workforce. The shipbuilding industry is considered essential for national security, including wartime sealift operations.

2. U.S. shipbuilders must meet more stringent environmental standards and safety regulations than shipbuilders in most other nations.

3. The Merchant Marine Act of 1920 (the Jones Act) is the embodiment of government's relationship with the commercial shipbuilding industry. It limits the transport of cargo between U.S. ports to American made, owned, and crewed vessels.

4. The Merchant Marine Act of 1936, as amended, established the government's role in preserving a fleet of U.S. flag vessels, supporting commercial ship construction and providing operating subsidies. The construction and operating subsidies were withdrawn in the early 1980s, in part due to plans for construction of a 600-ship Navy. Withdrawal of the subsidies, however, accelerated a decline in industry employment and U.S. commercial shipbuilding revenues. (Based on U.S. Census

data and adjusted for inflation, industry revenues were over $17 billion in 1981 and down to just over $11 billion by 1987.)

5. The Merchant Marine Act of 1936 also established Title XI government loan financing; the program was amended and expanded with the signing (in 1993) of the National Defense Authorization Act of 1994, which contained the National Shipbuilding and Conversion Act of 1993. As of March 1, 2001, MARAD had pending loans worth over $4.7 billion. (Note: The President's 2001 budget proposals recommend lower appropriations for this program.)

6. Most commercial market opportunities for vessels over 1,000 tons, such as oceangoing cruise vessels and double-hulled oil tankers, were/are created by government legislation (Project America and the Oil Pollution Act of 1990).

U.S. Position in International Shipbuilding

1. The U.S. commercial shipbuilding industry is generally not internationally competitive, particularly in the construction of vessels over 1,000 gross tons. Various sources report several reasons for this lack of competitiveness, including foreign government subsidies and other unfair trade practices, exchange rates, and lagging U.S. productivity. In some niches, however, the United States currently has a significant world market share based mostly on domestic sales. These niches include offshore oil platforms, yachts, fast patrol boats, and recreational vessels.

2. The United States ranks tenth in the world with about a one percent share in the construction of new commercial vessels over 1,000 gross tons (as of June 2000). By this measure, the leading commercial shipbuilding nations are South Korea (43 percent of the market); Japan (26 percent); China (7 percent); and Germany, Italy, and Poland (each with 3 percent).

3. Exports accounted for less than 2 percent of the industry's 1998 revenues. The United States does not export any of its newly constructed front-line warships, but it does export selected combat systems that are installed on these warships.

4. The supply base for the shipbuilding industry is primarily domestic. Only about four percent of the items and materials purchased by shipbuilders are of foreign origin. The primary reasons for foreign sourcing are customer-directed suppliers, items not available domestically, and better prices. Survey data indicates that the

commercial sector is engaged in foreign sourcing to a somewhat higher degree than the military.

5. About 97 percent of U.S. international trade is carried on foreign-flagged vessels. Data from the U.S. Department of Transportation indicates that U.S. international trade is expected to double in 20 years. Waterborne commerce is the most energy efficient mode of transportation and the most environmentally friendly, factors that could increase market opportunities for U.S. shipbuilders.

6. An agreement to end most subsidies and supports in the international shipbuilding market was developed through the Organization for Economic Cooperation and Development (OECD). The U.S. Senate has yet to implement the agreement because of concerns that it will not achieve its intended goal.

7. The OECD predicted in late 2000 that overcapacity already existed in the international shipbuilding industry and that this overcapacity would approach 40 percent by 2005.

Shipbuilding Compared to Other Domestic Industries

1. Bureau of the Census data indicate that shipyard employment peaked at about 180,000 in 1981. Since then it has shrunk in two phases: first, after funding for the two commercial subsidies known as the Operating Differential Subsidy (ODS) and the Construction Differential Subsidy (CDS) ceased in 1982; and again after the collapse of the Soviet Union and subsequent defense downsizing. According to Census data, shipyard employment decreased to 95,000 in 1998.

2. As in the shipbuilding sector of the economy, employment declines were also experienced by the automobile and aircraft assembly sectors: the automobile sector decreased from about 360,000 to 240,000; the aircraft sector from 300,000 to 210,000 employees. Employment declines in the automobile and aircraft assembly sectors, however, were primarily due to increases in productivity, while employment declines in the shipbuilding sector were due to declines in the market.

3. U.S. shipbuilding is more labor intensive than other manufacturing industries. For example, in terms of the ratio of payroll to value added, the ratio for shipyards averaged about 63 percent in 1998, while auto assembly was only 28 percent and aircraft assembly was about 40 percent.

4. Production workers in the shipbuilding industry earn on average $15 an hour, excluding fringe benefits. Using the Gross National Product (GNP) deflator index to establish constant wage rates, real wages in the industry have actually declined in the last 20 years. Today, shipyard wages are barely above the national average for manufacturing. The average hourly wage for employees in aircraft ($24) and automobile assembly ($27) is significantly higher, and the gap is widening.

5. Output per employee in shipbuilding measured in constant dollars rose from about $83,000 in 1977 to $118,000 in 1998 (up 45 percent). Over the same period, auto assembly output per employee rose from about $452,000 to nearly $1 million (up 117 percent) and aircraft assembly output rose from $173,000 to about $326,000 (up 88 percent).

6. The aircraft and automobile manufacturing sectors outsource to a much greater extent than does the shipbuilding industry. Information gathered from site visits and interviews with knowledgeable sources indicates that some U.S. shipbuilders might benefit by expanding their use of second tier subcontractors.

7. As a ratio of value added (i.e., equals about 60 percent of shipbuilders' revenue), capital expenditures by the shipbuilding and repair industry (4.32 percent) averaged half that of all manufacturing (8.2 percent) from 1977-1998. (Note: The 4.32 percent figure is equivalent to about 2.59 percent of total revenues.)

Conclusions

1. Shipbuilding and repair is important to the national security of the United States. Frontline warships both enhance the national security and protect American interests abroad. It is essential that the capability and infrastructure needed to build these ships is resident in the United States because it provides added assurance that they can be built, repaired, and maintained during times of conflict.

2. The current U.S. commercial market for merchant vessels does not support the construction of the type of large sealift vessels needed in wartime. The projected market is unlikely to be any different.

3. The U.S. 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.

4. Current maritime related statutes are only marginally effective in achieving the intended goals of maintaining a professional maritime workforce and providing adequate numbers of commercially viable sealift vessels.

5. To achieve more substantial gains in productivity, the Navy procurement system will need to include greater incentives for investment in productivity-enhancing technologies and processes.

6. Many shipyards have difficulty attracting and retaining an adequate supply of qualified production workers. Shipyard productivity increases could potentially allow for higher pay scales, which could help alleviate this concern.

7. Extensive modernization of the commercial shipbuilding industry could improve productivity and thereby reduce the costs for purchasers of American-made vessels. The market for large vessels in the United States, however, is limited and may not provide an adequate return on this investment. Also, exports may not be a market-expanding option because world class foreign producers have a 15-20 year competitive lead on U.S. shipbuilders and have been accused of being heavily subsidized.

8. Commercial demand for vessels manufactured in the United States will be influenced by the following:

    a. The Oil Pollution Act of 1990 requires that all tankers entering U.S. ports be double-hulled by 2015.

    b. More U.S. residents are taking cruises, which is expected to increase the demand for small- and mid-sized cruise/gambling ships operating between U.S. ports.

    c. Traffic congestion, a growing problem in most major cities, is expected to increase the demand for fast ferries.

d. According to the Department of Transportation, maritime traffic on U.S. waterways is expected to double in the next twenty years, increasing the demand for barges, tugs, and bulk carriers.

e. During the 1990-91 conflict in the Persian Gulf, the military chartered foreign-flagged ships to transport logistics supplies to the Middle East. This action highlighted the need for Roll-On/Roll-Off sealift vessels, possibly including fast ferries.

Recommendations

1. The nation needs a unified strategy for developing and maintaining an infrastructure to produce world-class ships at more competitive prices. The U.S. Navy and the Maritime Administration can play an important role in developing such a strategy. In addition to its economic and military benefits, this strategy could help exploit the energy savings and environmentally friendly aspects of waterborne transportation.

2. The U.S. Navy and the Maritime Administration should work with industry executives to review current maritime legislation and recommend changes that effectively balance long-term national security needs with the nation's economic health. Unilateral removal of domestic procurement or other restrictions affecting the U.S. shipbuilding and repair industry is inadvisable without a comprehensive national maritime vision.

3. The U.S. Navy should consider reforming current procurement practices to reward major defense shipyards for increasing productivity and/or reducing costs. Concurrently, long-term stability and predictability in DoD ship procurement budgets are essential. A panel of experts from both the legislative and executive branches and the shipbuilding industry should be established to determine how to achieve this goal. This initiative could potentially provide substantial savings for the Department of Defense and U.S. taxpayers.

4. The U.S. Navy, the Maritime Administration, the shipbuilding industry, and institutions of higher learning should work together to develop a long-term R&D plan that supports the national maritime vision. The plan should address advanced ship concepts, platform efficiencies, improvements to manufacturing productivity, academic curricula to train the future workforce, and incentives to develop and maintain a world-class industry and associated R&D infrastructure.

The plan should build on the Maritime Technology program (MARITECH) and its successor venture, the National Shipbuilding Research Project Advanced Shipbuilding Enterprise, both of which have promoted joint cooperation between government and industry.

5. The progress of the Kvaerner Philadelphia Shipyard should be monitored to determine if modern European shipbuilding practices can effectively be applied in the United States for economic benefit. Elements to be monitored should include the following: 1) the utilization of the workforce in light of the great reduction in job titles; 2) the ability of the outside education environment to train entry level employees; 3) the development of major turnkey subcontractors; and 4) Kvaerner Philadelphia's productivity relative to other American and international shipyards.

6. Similarly, a number of recent joint ventures between U.S. and foreign shipbuilders should be monitored for potential industrial base benefits for both commercial and military applicability.

7. The U.S. Coast Guard's Deepwater Project has the potential to promote national economic interests such as vessel and sub-system exports, domestic and international partnering opportunities, and efficient shipbuilding. The U.S. Department of Commerce, Bureau of Export Administration is cooperating with the Coast Guard to help achieve these goals.