SHIPBUILDING

ABSTRACT: The U.S. shipbuilding industry designs and builds the most advanced military vessels in the world, yet remains uncompetitive in the commercial shipbuilding market. The major yards are unable to compete internationally due to the dedicated industrial policies, greater efficiency, and lower labor rates in other countries. However, the absence of a robust commercial counterpart to the military shipbuilding sector does not have a negative impact on national security. "Second-" and "third-tier" yards that produce the majority of the "Jones Act" ships have been more innovative, more efficient, and therefore, more successful. However, all shipbuilders must apply modern business practices, processes, and enabling technologies to become more cost-effective and competitive.

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PLACES VISITED

Domestic:

Bath Iron Works, Bath, ME

Bird Johnson, Walpole, MA

Bollinger Shipyards, Lockport, LA

Central Gulf Shipping Lines, New Orleans, LA

Electric Boat, Quonset Point, RI

Friede Goldman Halter Marine Group, Pascagoula, MS

Ingalls Shipbuilding, Pascagoula, MS

Knight and Carver, San Diego, CA

Military Sealift Command, Washington, DC

National Steel and Shipbuilding Company, San Diego, CA

Naval Sea Systems Command, Crystal City, VA

Naval Surface Warfare Center, Carderock Division, Carderock, MD

Newport News Shipbuilding, Newport News, VA

North American Shipbuilding Company, Lockport, LA

Portsmouth Naval Shipyard, Kittery, ME

Swift Ships, Morgan City, LA

Textron Marine & Land Systems, New Orleans, LA

U.S. Navy Supervisors of Shipbuilding: New Orleans, LA; Bath, ME; Pascagoula, MS; and Newport News, VA

International:

Direction des Constructions Navales (DCN), Paris, France

DCN Indret, La Montage, France

DCN Lorient Naval Yard, Lorient, France

Hitachi Shipyard, Singapore

International Maritime Defense Exposition Asia, Singapore

Ishikiwajima Heavy Industries, Aioi, Japan

Jurong Shipyard, Singapore

Kawasaki Heavy Industries, Sakaide, Japan

Keppel Shipyard, Singapore

Mitsubishi Heavy Industries, Kobe, Japan

Sembawang Shipyard, Singapore

U.S. Consulate, Osaka, Japan

U.S. Embassy, Paris, France

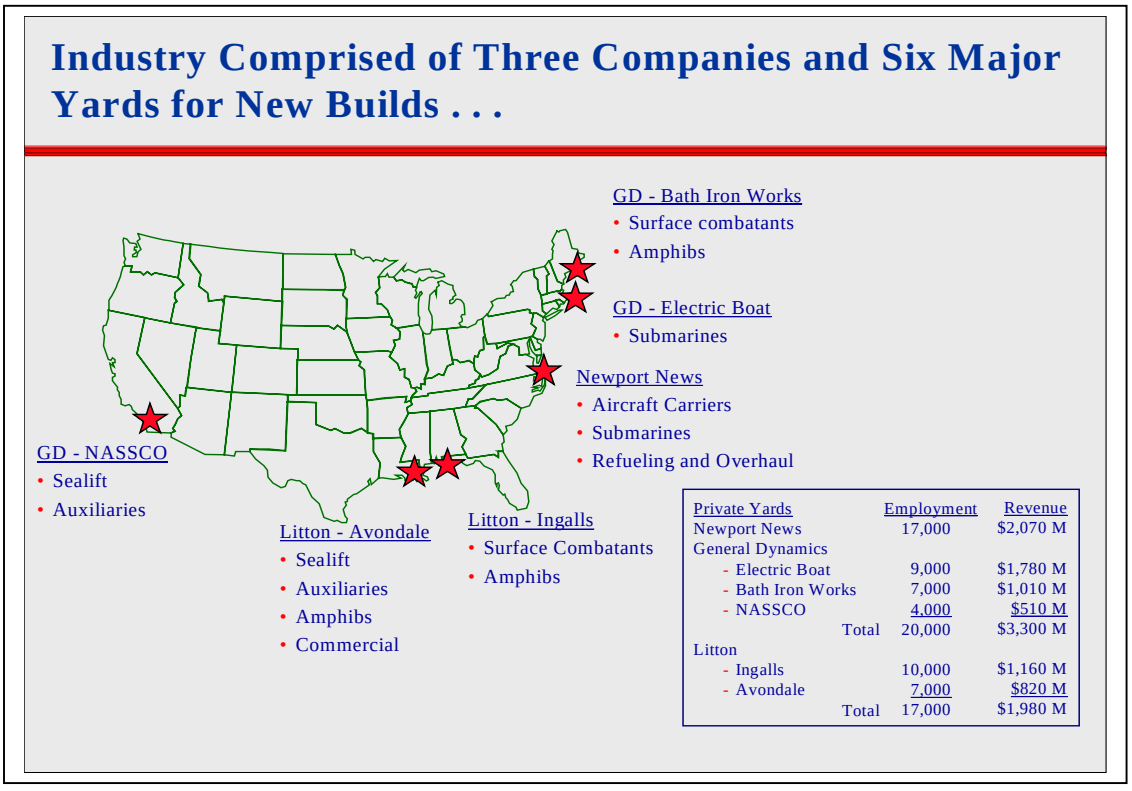
Introduction

The United States is the world's sole remaining superpower. Our status as an "island nation" provides distinct advantages to trade and national security. Over 95% of our imports and exports are transported by sea. This requires a strong Navy to ensure our sea lines of communication remain open. Our national military strategy relies heavily on power projection by sea and use of our maritime boundaries for defense. Our reliance on the sea demands that we maintain a world-class shipbuilding industry to support our national security interests and economic well-being. This paper provides a description of the industry, a broad overview of the status of the U.S. shipbuilding industry, a review of some of the major challenges facing the industry today, and makes recommendations.

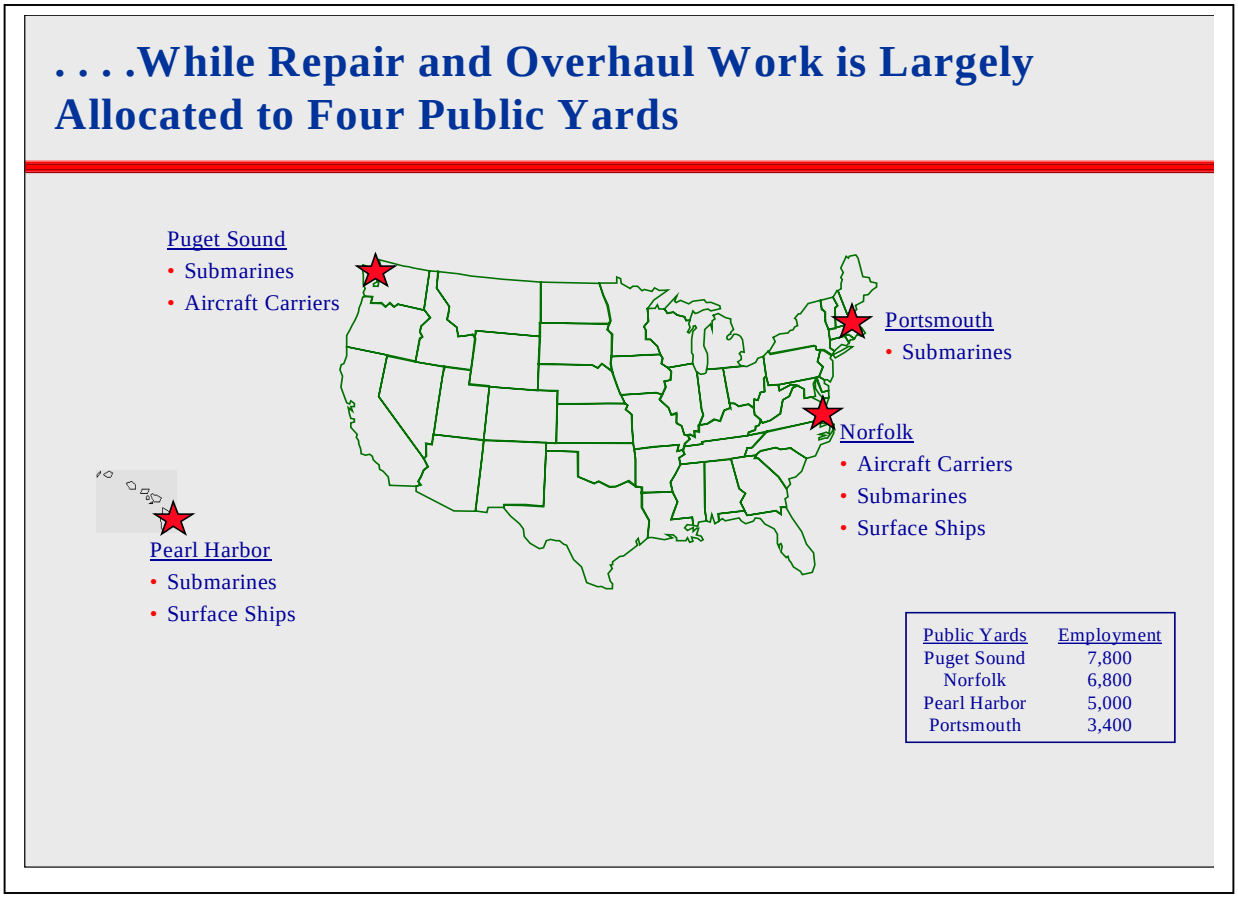
Industry Description

The U.S. shipbuilding and repair industry is a strategic asset critical to our nation's defense and viability. At over $10 billion in annual revenues and nearly 100,000 employees, the industry plays a significant role in the U.S. economy.[i] Department of Defense (read U.S. Navy) procurement accounts for about 70 percent of the industry's revenue. The commercial side of the industry is less than half the size of the military but has grown at a faster rate in the last five years. International business plays a very minor role for the U.S. shipbuilding industry and accounts for only about 1 or 2 percent of total revenues. However, the survival of the industry is hinged on improving production and management practices as well as increasing foreign sales.

Approximately 250 companies comprise the U.S. shipbuilding and repair industry. However, 10 percent of these firms account for 85 percent of the business.[ii] The six largest companies, grossing over a billion dollars annually are often referred to as the "Big Six", represent two-thirds of the overall shipbuilding/repair business and 90 percent of the defense work. More than 100 of the smaller firms have annual revenues of less than $5 million and represent less than 2 percent of the industry's total revenues.



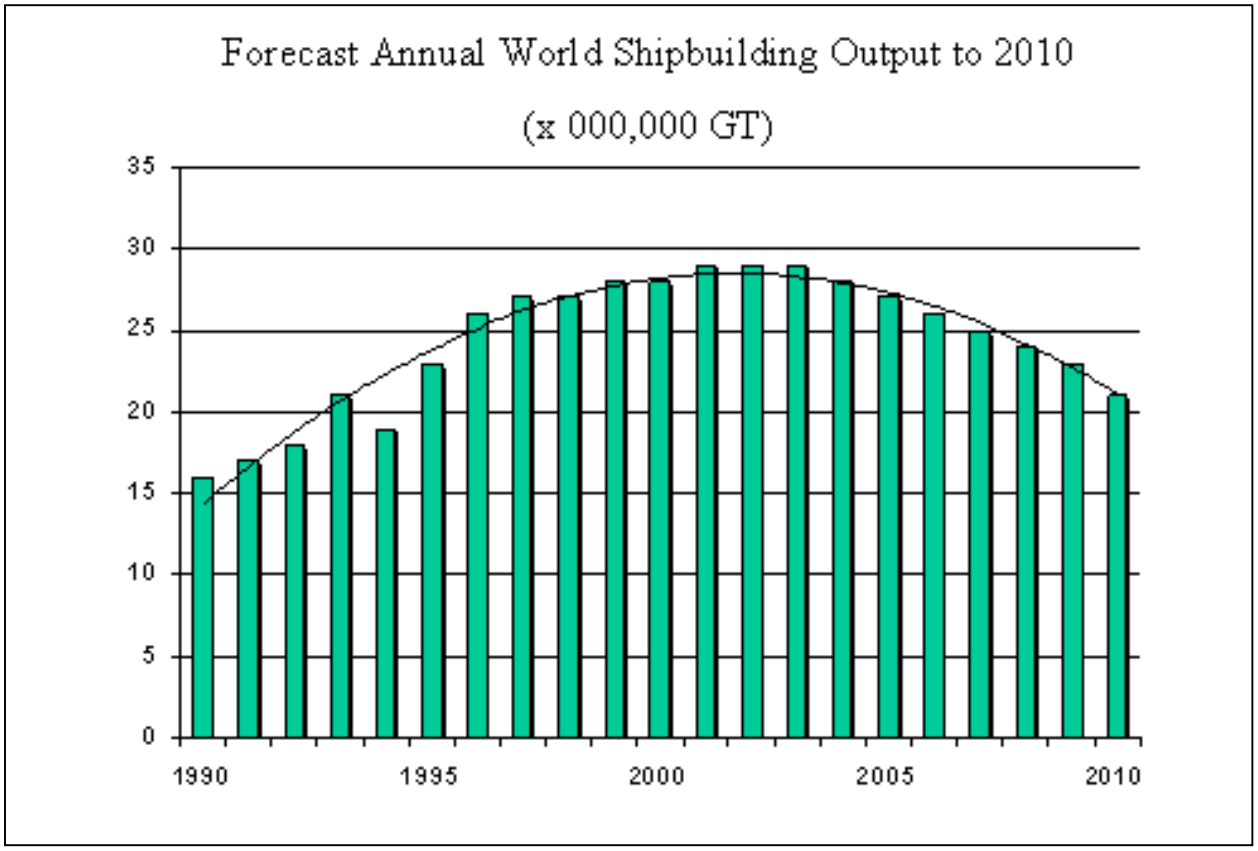
The Congress appropriates Naval ship repair money each year to private shipyards and four publicly owned naval shipyards. Typically, naval repair yards are used for more challenging repair functions. These four shipyards are administered by the Navy and the Naval Sea Systems Command (NAVSEA) and accounted for $1.4 billion of the $2.1 billion appropriated for repair work in FY 1998, up from the $871 million appropriated the year before.[iii] A recent U.S. Department of Commerce report describes the public yards as follows: "The Norfolk Naval Shipyard, located in Portsmouth, Virginia, employs over 6,700 people while the yard in Pearl Harbor employs about 5,000. The Portsmouth Naval Shipyard, which specializes in repair work for the Los Angeles class nuclear submarine, is located between Boston and southern Maine and employs over 3,300 workers annually. The Puget Sound Naval Shipyard located in Washington State employs 7,700 workers, giving it the status as the largest shipyard on the West Coast. In total, Navy repair yards currently employ about 22,700 workers, which combines both U.S. Navy personnel and civilian employees. The U.S. Coast Guard also has access to its own public facility for ship repair and construction. The Coast Guard yard at Curtis Bay near Baltimore, Maryland has $60 million available for internal revenue and is a full service shipyard."[iv]



Source: Newport News Shipbuilding

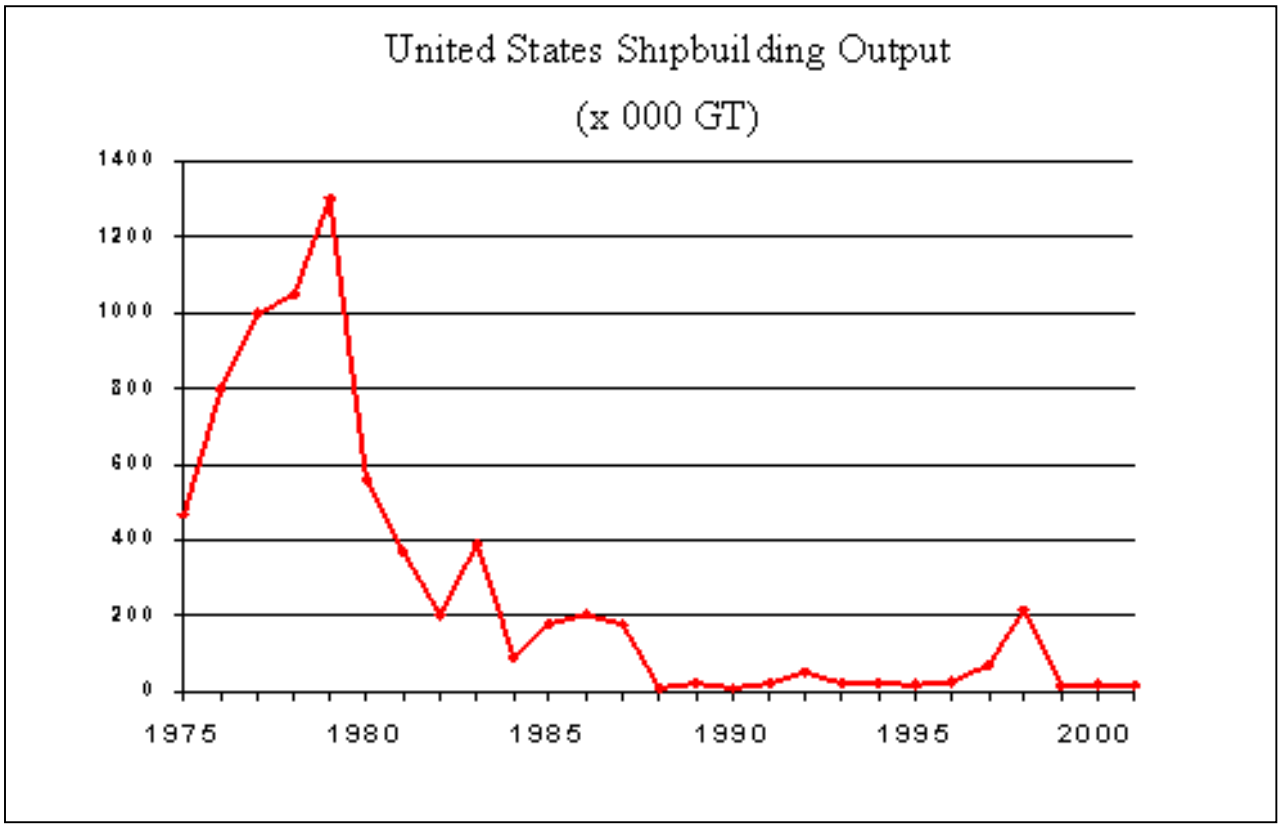
Current Condition

Even the most cursory review of world shipbuilding statistics and forecasts reveals a major cause of concern for the survivability of America's shipbuilding industry. During the last two decades, world trade by sea has continually increased: 3.3 billion tons of cargo in 1980, to 4.3 billion tons in 1995, to a projected 5.5 billion tons in 2010.[v] At the same time, world shipbuilding output has generally kept pace with the increases and declines resulting from significant events such as world conflicts, major changes in oil prices, and recessions.



Source: ABS

Current levels of ship construction for the past few years and forecasts through 2010 are at 1500 to 2000 ships for a total of 20 to 27m gt (for ships of 100 gt and over).[vi] During the period indicated above, America's shipbuilding activity declined from a high of approximately 205 vessels at .56m gt and 4.1% of the world total to an average of 30 vessels at .06m gt and .2% of the world fleet.[vii]



The building of ships worldwide has increased every year for the last ten years, or 137% from 1988 to 1998.[viii] At the same time, cargo vessel market shares have changed dramatically. Western Europe has declined from 33% to 18% while South Korea has increased from 1% to 29%. The largest share of the world total has been held by Japan at over 39%. Together, Japan and Korea hold two-thirds of the total world production.[ix]

As of October 3, 2000, American shipbuilders had 149 commercial vessels on order with an estimated value of almost $4 billion.[x] The Commerce Department summarizes the major orders as "two cruise ships priced at $440 million each are on order from Ingalls, while Avondale will gross almost $500 million from the three tankers on its books. NASSCO will be constructing three $210 million tankers and two $150 million RO/RO ships over the next five years. Friede Goldman Offshore has landed six semi-submersible orders worth about $700 million, and AMFELS is committed to build two construction vessels, each priced at over $100 million."[xi]

Continued facility modernization and improved labor force productivity are required to compete. The results of increased productivity is readily apparent in Japan where market share has been preserved, even though their $57 per hour wage rate far exceeds that of a $25 per hour in Europe and $15 per hour in Korea.[xii] The United States suffers from high labor rates caused by low rates of productivity. Overseas shipyards build ships more efficiently and are able to keep material costs low due to volume production and efficient production processes.

Analysts forecast that in approximately 5 to 10 years, 60 percent of domestic oil supplies and 27 percent of gas supplies will come from deepwater areas of the Gulf of

Mexico. Floating production supply and offloading units (FPSO's) and shuttle tankers will be required to transport these resources to refineries. FPSO's are utilized in all deepwater facilities worldwide – except the Gulf of Mexico where use decisions depend on the completion of an environmental impact study. The Coast Guard is already on record stipulating to the Mineral Management Service (MMS) that FPSO's for the Gulf of Mexico are required to meet Oil Pollution Act (OPA) 90 double hull requirements. Fifty two floating production systems are planned or under study for this area as of August 1999. The Gulf of Mexico offshore market comprises 30 percent of deepwater worldwide capital expenditure for the next five years.[xiii]

Industry Challenges

The U.S. shipbuilding industry faces a number of challenges including: a shrinking U.S. Navy fleet, excess capacity, increased competition from non-traditional players, increased pace of technology insertion, funding fluctuations that challenge workforce retention, industry shortage of qualified technical resources, and an aging workforce. Some of the important areas are examined as follows:

Shrinking Navy Fleet

The United States Navy shipbuilding budget -- the lifeblood of our major yards -- is insufficient to meet the goals of a 305 ship navy as called for by the last Quadrennial Defense Review (QDR). The present situation indicates that shipbuilding requirements critical to national security are not being met. The Navy acquisition budget for the past eight years has been insufficient to meet fleet replacement schedules. The build rate needs to double (12 ships per year) to sustain fleet size at 305 vessels.

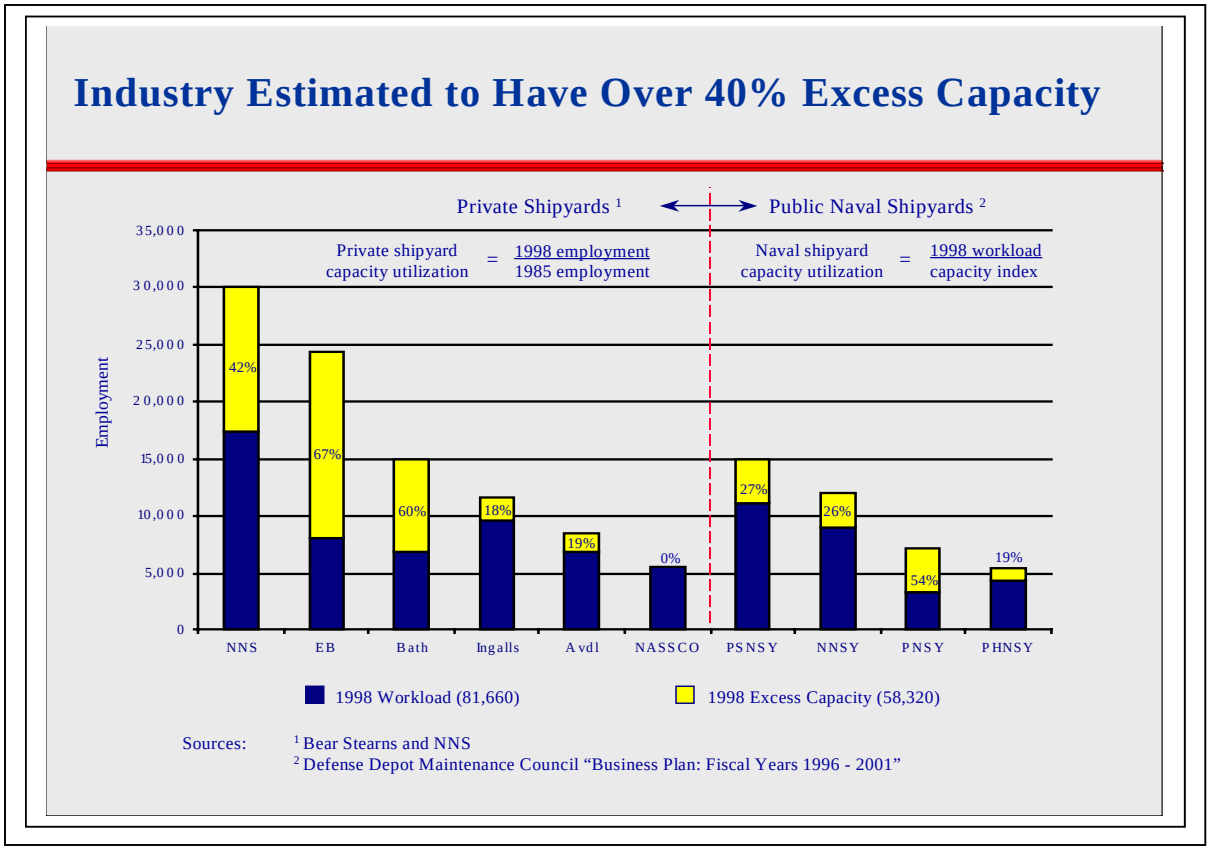
The Deepwater acquisition program of the U. S. Coast Guard is on schedule to begin production in 2003. This visionary program could include as many as 40 new vessels and service life extensions of others representing significant work for the industry. While design is proceeding on schedule, construction funding has yet to be appropriated.

Funds should be allocated in projected federal budget surpluses to rebuild our national security fleet including a 10 to 12 naval vessel build rate to reach the 305 ship QDR fleet, meet the Coast Guard integrated deepwater system and Sealift requirements.[xiv] Budget efficiencies can be achieved with stable, high rates of production using multiyear procurement appropriations.

Excess Capacity

Worldwide shipbuilding prices are at historically low levels. Despite this fact, China is increasing its capacity. Attempts to strike a balance between excess capacity and preservation of the industrial base will be the focal point of discussion should a new round of Base Realignment and Closure (BRAC) be authorized by Congress. Many of the requirements for America's new production could come due at the same time causing a potential inefficient shift from overcapacity to undercapacity rather than steady production levels with manageable orders. Examples include schedules for DD-21; Coast Guard deepwater system; cruise vessels; Jones Act replacement vessels; FPSO's and

shuttle tankers; deferred major repairs due to previous low oil prices and special orders such as Fast Ship.[xv]



Funding spikes challenge workforce retention

Unsteady and unpredictable government procurement practices are forcing shipyards to compete based on short-term initiatives. The resultant unwillingness to take on long term investments and improvements reduces overall market competiveness. Funding uncertainty creates an unsteady work environment that causes skilled labor to seek employment in other industries. Continued reliance on a shrinking workforce causes erosion in the number of skilled workers, leading to an increasing dependence on hiring less skilled and motivated workers with poor work ethics.

Aging workforce

Most of the companies visited voiced a concern about the age of their workforce. The current nationwide average age of shipyard production workers is 42.1 years; maritime professionals 43.5 years, and administrative workers 45.1 years.[xvi] This trend indicates that the shipbuilding industry is quickly reaching a crisis situation, as replacements are not readily available. The revolution in business affairs and information technologies are providing more attractive alternatives to both engineering and production workers alike. Furthermore, financed education and training programs do not have sufficient throughput to meet the demand.

International Dimension

The down turn in commercial shipbuilding orders, and the dwindling U.S. Navy fleet and orders, have led to very significant reductions in the shipbuilding industry workforce. The pressure to further reduce the workforce through the strategies of merger and downsizing of the shipyards is being mounted in the hope that the industry will adopt policies that would make it competitive internationally. This approach may not yield the desired results without considering the requirements of the international customers. Because of this posture, the policy of restrictions on technology transfer to potential customers is implemented with the negative effect of driving such customers to European and Asian shipyards where the technologies are made available to them. The restrictions on this type of technology transfer are inconsistent with globalization trends and the prevailing revolution in business affairs.

The shipbuilding industry is dependent on experienced and skilled workers whose expertise has been developed over long periods. The average age of the U.S. shipbuilding industry workforce indicates that a new generation of workers would have to undergo on-the-job training if the industry is to be competitive internationally and meet U.S. strategic demands in the first two decades of the 21st century. This entails a significant rise in shipbuilding orders to engage the workforce and provide the opportunities for them to practice their art.

The options available to the U.S. shipbuilding industry include utilization of the opportunities available in the emerging markets, such as in Africa, to engage the excess design and construction expertise, and the relaxation of restrictions on technology transfer in order to attract foreign acquisitions. In addition, U.S. ship designers would have to consider giving some priority attention to designs that meet foreign requirements rather than focusing on meeting U.S. requirements for which there will be no customers outside the shores of the U.S..

Options are also available for US shipbuilders taking on life-cycle support of naval ships to partner with repair facilities overseas. For example, the major shipyards in Singapore are world-class facilities with a robust skilled workforce. Their port infrastructure and 3rd tier supplier base is highly developed, making replacement parts easy to obtain. Although the US government is not able to form long-term relationships with specific contractors due to contracting restrictions, US shipyards with responsibility for life-cycle maintenance of naval ships may be able to enter into strategic partnerships with these yards, especially for ships deployed in the Pacific for very long periods.

Outlook

The capabilities and capacity of the “Big Six” shipyards are sufficient to meet our National Security requirements, but have to be maintained with sufficient workload. Government investment to establish a competitive, commercial, ocean-going shipbuilding capability is not required to meet sealift requirements or preserve the industrial base. The maritime strategy of the United States now focuses on power projection and regional engagement. As such, Naval force structure, construction requirements, and budgetary needs are easy to forecast. This strategy depends on resolving conflicts with available,

vice mobilized, assets. Given the complexity of modern naval combatants, large-scale, World War II-type mobilization efforts in U.S. shipyards are no longer feasible. Efforts to maintain an extensive "just-in-case" infrastructure, with its attendant bloated workforce are undesirable and retard necessary investments in production efficiency. It is necessary, however, to maintain a core of skilled workforce to sustain current U.S. capabilities. The government and private shipyards should join in developing repair facilities and forward basing to maintain current fleet assets.

Excess capacity continues to cause industry instability. In particular, redundant capabilities in public and private shipyards warrant further consolidation or BRAC consideration. Near exclusive reliance on Department of Defense contracts by private shipyards has stifled the required investment and innovation necessary to compete in the commercial markets. However, with increased government support of foreign military sales, shipyards could make profitable use of their current excess capacity while simultaneously strengthening our support to friends and allies.

The U.S. shipbuilding industry represents just one percent of the world market for ocean-going commercial vessels, a substantial portion of which is due to the Jones Act. The commercial outlook for the "Big Six" shipbuilders is bleak. They are unable to compete on the global commercial market due to high material and labor costs as well as lower productivity. Labor costs are kept artificially high by continued Union resistance to employee cross-training and shipyard reluctance to invest in automated production tooling. However, the second and third tier shipyards continue to compete effectively in niche markets on both the domestic and global market.

Government Roles and Policies

The primary goal of the U.S. government is to ensure that sufficient capacity exists to meet national security requirements. In shipbuilding, this translates to fostering the world's premier naval force and reserve shipping capacity for times of national emergency. Towards that end, two agencies have leading roles within the shipbuilding industry: the U.S. Navy for military vessels and the Maritime Administration (MARAD) for commercial interests. The programs employed by these two entities to meet their respective national security objectives may differ, yet their focus must be singular and clear. In particular, MARAD needs to be committed to capitalizing on existing niches, vice attempting to salvage an entire industry replete with inefficiencies and inabilities to compete on a global scale.

The quality of naval vessels produced in the United States is unparalleled. The U.S. government should take advantage of this fact to bring large shipyards to capacity, and in turn, drive the cost to building warships down. Each of the "Big Six" shipyards has the ability to expand their scope and volume of work. Their personnel levels are appropriate to meet existing U.S. naval requirements. However, collectively they have up to 40 percent excess capacity at their disposal. This capacity is expensive, and its associated maintenance costs are being absorbed by existing ship construction contracts. In an effort to tap into this excess capacity and restore displaced workforce at these yards, the government would be well served to relax selective technology transfer restrictions in

their dealings with would-be foreign customers. Such an initiative would allow U.S. shipyards to bid for international contracts, and would afford our allies access to quality warships.

For the past several years, the government has attempted to keep ship procurement costs down by demanding competition. In doing so, they have actually driven the costs up by fostering over-capacity. Maintenance of that over-capacity has been accomplished through increased overhead charges from each of the major shipbuilders. The policy of competition for the purchase of naval vessels is no longer viable. The existing bilateral monopoly must be recognized for what it is and steps must be taken to achieve cost savings through reduction of excess capacity. The government should incentivize shipbuilders to eliminate unnecessary redundancy and achieve greater efficiencies in construction and design.

In the commercial shipbuilding arena, the United States is simply not competitive in the construction of large vessels. Previous and possibly current government subsidies, inexpensive labor, and efficiencies of scale have enabled Asian shipbuilders to swallow up the large ship construction market. The United States is, however, competitive in the smaller inland and coastal vessel construction arenas. The U.S. government should pursue incentivizing and capitalizing on these niche markets. Currently, only three of the Big Six shipbuilders are involved in the large commercial vessel ship construction business, with the Jones Act being the primary driver for this expensive market (for Jones Act specific issues refer to the essay entitled – "Now is the Time to Amend the Jones Act").

Again, the U.S. government should pursue an overarching strategy of supporting niche markets, vice trying to sustain the entire shipbuilding industry. The United States cannot compete against countries in the large vessel arena. In the case of Korea, they can sell a vessel for less than what domestic shipyards pay for materials. This is due entirely to government subsidies, and unless the United States decides to follow suit the government should to take action that capitalizes on niche markets (smaller vessels). To this end, the U.S. government should consider legislation that amends existing cabotage laws to afford U.S. owners and operators the opportunity to buy foreign built vessels. To make this fair to those who may have recently entered the Jones Act fleet this initiative would be phased in over a period of years, and a heavy tariff would be levied on owners pursuing foreign markets for Jones Act ships. The details of these tariffs would have to be fleshed out by appropriate authorities, but due consideration should be given to using these monies to incentivize and subsidize our existing inland and coastal trade ship construction efforts.

Currently, ships carry 95 percent of the world's trade and an aging Jones Act fleet will be taxed beyond its limits as this trade is expected to double in the next two decades. Allowing U.S. owners to purchase foreign built vessels at a third of the cost of domestic shipyards is prudent and economically sound. Such an initiative would stimulate the purchase of more vessels and the savings from buying 'foreign' could be passed along to the freight carrier and, in turn, the consumer.

Another Jones Act related initiative that needs continued positive endorsement by the government is the Title XI loan guarantee program. Though not an enabler for competing with subsidized foreign competitors this program does allow shipbuilders to get the monies needed to proceed with contracts for which they might not otherwise receive monetary support. Administered by the Maritime Administration this program is one of the few programs in the Federal Government that actually returns more dollars into federal coffers than it dolls out.

Title XI funding is required to support renewal of the Jones Act fleet and for cruise ship, container ship and FPSO projects. These orders cannot be placed without Title XI funding, which has been used to support $3.8 billion in commercial ship construction since 1994. The proposed presidential budget zeros funding for the Title XI program.

ESSAYS ON MAJOR ISSUES:

Now Is The Time To Amend The Jones Act

The commercial shipbuilding industry in the United States is almost awash. The only reserve buoyancy keeping it afloat is the Jones Act. This Act requires that all vessels operating between U.S. ports be U.S. owned, U.S. operated, and U.S. *built*. The overarching argument for sustaining the Act in its entirety is national defense. Its been long debated that the United States must not lose its industrial commercial shipbuilding base to reliance on foreign investment. This is no longer a viable argument for defense of the Act since the volume of U.S. owned and operated ships would increase dramatically. This increase would be realized by buying foreign built vessels at one-third the cost of domestic vessels. In reality, the United States simply cannot compete with international shipyards when it comes to commercial construction of large vessels. Government subsidies, the costs associated with excess capacity, and inefficiencies have driven the United States to its current condition. This said, I would propose that the Jones Act be amended as follows:

To have Congress introduce legislation that would effectively eliminate the need for Jones Act ships to be built in the United States. Specifically, all vessels involved in noncontiguous trade. All other applicable elements of the Jones Act would remain in effect. All Jones Act participants would still be required to be United States owned and operated.

Essentially, domestic (Jones Act) shipping is made up of three types of services: Ocean, Great Lakes, and Inland Waterways. Ocean shipping is divided into coastwise, intercoastal (that is, between Atlantic, Gulf, and Pacific ports), and **noncontiguous trade** (from the mainland to and from Alaska, Hawaii, Puerto Rico, and Guam). My proposal would target the latter blue water arena - **noncontiguous trade.**

As mentioned earlier, a VLCC (Very Large Crude Carrier) can be purchased in overseas markets for as much as a third of what it costs in the United States. A number of executives at different large shipyards affirmed the reality that a ship they could build for $100 million could be purchased in Korea for $35 million.

Government subsidies kept commercial U.S. shipbuilders active through the 1970's. At that time we were building 20+ merchant ships per year. Today that figure is in the single digits. When President Reagan eliminated shipbuilding subsidies in the 1980's, the cost to build large vessels became prohibitive and owners moved to foreign markets, and in turn, international trade.

Shipping is expected to double in the next two decades, and Jones Act vessels will be in greater demand than they are now. Unless amended, the Jones Act will see its current fleet of ships age into obsolescence without hope of replacement or recapitalization. My proposal would increase the number of Jones Act ships in the fleet and, in turn, support a more robust domestic maritime environment.

There are a number of reasons why this notion of globalizing shipbuilding has not gained traction. For one, domestic shipyards would go out of business, and as the adage goes; since "All politics are local", there are not many Congressmen beating down the door to allow this to happen in their backyard, so to speak.

Another reason often given is the national defense requirement to maintain a fleet of ships ready to answer the call. The argument being that we cannot rely on foreign markets for this fleet in the event they side with the enemy during a conflict. Unit elasticity of demand will see a surge of foreign built U.S. owned ships if the Jones Act is opened up to U.S. ship owners to purchase new-built vessels overseas. That said, there would be more than enough ships to 'press' into service in the event of a conflict.

The final argument centers on the loss of employment in this particular industry. My phase-in proposal would afford a "soft landing" for those in the industry.

The remedy for the current crisis would be to amend the Jones Act to allow U.S. blue water owners to purchase ships overseas. However, to make this fair to those who may have just entered the Jones Act fleet and paid top dollar for a U.S. built vessel, I would propose a 100% tariff in year one to be phased in over a ten year/ten percent reduction per year cycle. Going back to the VLCC (Very Large Crude Carrier) example, a Jones Act operator could purchase a ship in Korea for $35 million. The tariff on this purchase in year one of my proposal would be $35 million. If the owner were to wait another year the tariff would be ten percent less, or $31.5 million in year two.

This would add an element of economic fairness to two groups – those who may have already just entered the Jones Act fleet, and current domestic shipyards who would be forced into a decision. They would either have to take drastic measures to become more globally competitive, or pursue alternative niche markets out of the commercial

shipbuilding arena. The details of this 'tariff' would have to be fleshed out in greater detail, but I believe the essence of the phase-in period is in fact a viable option.

With the tariff monies collected, I would propose the government establish a *trade adjustment assistance* program for those shipyard workers who, over the course of the ten-year phase in period, would be displaced by the more competitive foreign shipyards. Currently, the average age of a domestic shipyard worker is 42.1. The industry is also such that more workers are exiting than entering. That said, trade adjustment assistance for an average aged workforce of 52+ would set them up nicely for an early retirement. Again, this involves another issue for which the details need to be fleshed out.

The United States remains competitive in a number of shipbuilding markets – military, inland, and coastal – and would be well served to pursue competitive advantage in these niche markets verses trying to compete in the commercial large vessel arena. Foreign subsidies simply drive out any form of competition. Another option with the tariff funds collected from foreign built Jones Act ships would be to pass these monies on to those niche shipbuilders to capitalize on their existing advantage – be they military construction, inland tug/barge builders, or freighters for coastal trade.

CDR Tom Criman, USCG

The Case For Maintaining Two Nuclear Capable Shipyards For Submarine Construction

The case for maintaining two nuclear capable shipyards for submarine construction has been under debate since the end of the Cold War. There are many who view the capability as a national treasure that should never be forfeited and there are an equal number who believe there is a significant "peace dividend" to be gained by eliminating unnecessarily duplicative facilities. The views run from maintaining two shipyards in strict competition to the extreme of building all nuclear powered ships (submarines and aircraft carriers) at a single yard. The current teaming arrangement between Electric Boat and Newport News Shipbuilding is a compromise position, but is it the most practical solution?

Proponents of maintaining two nuclear capable shipbuilders categorize the value of their goal in the following areas: competition, a hedge against natural or man-made disaster, improved industrial base, surge capacity and risk reduction. There are several concerns associated with maintaining two nuclear capable shipyards for submarine construction. The major liability is the cost related issue of paying the overhead required to keep two nuclear shipyards open with the current amount of excess capacity. Another concern is the realistic viability of competition in a low rate production environment.

It is very difficult to subscribe to the competition argument for retaining two nuclear capable shipyards. Effective competition at the low projected rates of

production is impossible. Based upon current projections, at best, production of VIRGINIA class submarines would be at the maximum rate of three ships per year. In a study of the DDG 51 program, the Navy determined that it was not feasible to conduct a meaningful competition for purchasing three ships per year divided between two shipyards. Former Assistant Secretary of the Navy for Research, Development, and Acquisition, John Douglass, stated in testimony to the House National Security Committee, Subcommittee on Procurement that his research had failed to find another defense program with continuing competition at such low rates of production.[xvii]

What are the alternatives? Production can continue through the existing teaming arrangement with Electric Boat and Newport News Shipbuilding as separate corporate entities. The previously rejected bid by General Dynamics to buy Newport News Shipbuilding could be reconsidered, allowing the merger of Electric Boat and Newport News. Electric boat could be established as the sole submarine producer with Newport News continuing as the sole aircraft carrier producer. Alternatively, all nuclear shipbuilding could be consolidated at Newport News.

Our recommendation would be to allow a merger of Electric Boat and Newport News Shipbuilding under General Dynamics. The current attempt by Northrop Grumman to derail this merger and add Newport News to its holdings will only exacerbate the situation. The General Dynamics merger will accommodate the most concerns. The only casualty in this solution is competition, which is actually already non-existent. The merger would maintain two facilities with the attendant surge capacity and hedge against disaster, while doing so at a reduced overhead cost and reduced risk. Politically, it should be agreeable to Congress as long as guarantees were made to not completely eliminate either of the two yards.

CAPT Mike Klein, USN

Information Technology Within The Shipbuilding Industries Of Japan And France

Information technology (IT) is broadly defined for this shipbuilding industry study essay as mass data storage, dynamic information transmission, manipulation and retrieval, plus Moore's Law generational increases in speed and capability. Moore's Law quantifies the doubling of computer memory and processing power every eighteen months. As a consequence of this exponential ability, IT is changing fundamental shipbuilding processes. Increased speed within design and manufacturing processes, the flexibility to manipulate multiple variables simultaneously and the connectivity to collaborate, manufacture and finance work from geographically separate locations in a distributed environment is changing business today. Steel manufacturing, cutting, and bending can now be done through digital control. Architectural and engineering problems and operational efficiency can be evaluated in three dimensional (3D) computer simulation. This allows more rapid and much greater manipulation of the complex variables effecting

ship design than ever achieved before. Routine manual labor requirements like pipe bending, welding and painting are being performed by software–controlled robotic equipment.

Japan

Japan has a large national investment and world standing in commercial shipbuilding. They achieved their global competitive edge through reworking fundamental shipbuilding processes for greater efficiency and feeding operational data back into new products and process improvements. Japan is third in total output[xviii]. Two of their major yards (Kawasaki-Mitsui) merged in late 1999 to achieve near term efficiencies. Their long-term national goal is to pursue the more sophisticated ship markets and larger scale projects like the Techno Superliner (TSL). These two market sectors target niches for the Japanese. Further commercial development of Small WAterplane Twin Hull (SWATH) and large floating structures are part of Japan's strategy to remain competitive in the global commercial shipbuilding market[xix].

In 1989, Japan's seven major commercial shipbuilders initiated Computer Integrated Manufacturing (CIM) under governmental assistance. This collaborative project has netted average annual savings of 20% in design man-hours and 30% in construction man-hours[xx]. Advanced CIM (ACIM), started in 1997, further integrates networks and technical exchanges between Japanese shipbuilding corporations, and external disciplines of the shipping industry, marine equipment and machinery. The practical application of design and process modeling through network collaborations is part of ACIM. This software environment supports multi-discipline on-line work between engineers, management and second/third tier suppliers.

Other Japanese IT initiatives are Numerical Control (NC), General Product Modeling Environment (GPME), Senpaku CALS (supporting shipping and classification society), Electronic Commerce (EC), painting robotics, welding automation, and the Zohaku web project. These IT initiatives link multiple disciplines within shipbuilding corporations. Now, through external links and web sites, shipbuilders, outfitters, manufacturers and maritime suppliers are near-real-time collaborators.

The Ship Research Institute (SRI), Japan's government funded organization analogous to the David Taylor Model Basin at Carderock, will be re-established as an autonomous agency in the spring of 2001. The Japan Marine Standards Association (JMSA) oversees standardization within ship and marine technology. Japan has a role in the International Standardization Organization (ISO) spearheading ship application protocols (AP). The collective internal and external government involvement by Japan indicates a strong role in further ship research and development.

Their innovation efforts extend from ship design to shipping and marine technologies. A good example of Japanese IT-enabled innovation is their fast

passenger/car ferries, intermodal port and transport developments. Future shipping and advanced ship designs are a result of the Advanced Monitoring System (AMS)[xxi]. This AMS program monitors, analyzes and optimizes daily ship operations, as well as life cycle maintenance (LCM). This optimization data is synthesized and incorporated into follow-on ship design. This direct feedback mechanism into the next generation design has great appeal to corporate shipping concerns as well as operational budgets.

France

State-supported military and commercial shipbuilding is and has been French national policy and practice. Direction des Constructions Navales (DCN) reports directly to the Ministere de la Defense (MoD) under a January 2001 reorganization. Delegation Generale pour l'Armement (DGA) the French defense procurement agency is responsible for military acquisition. The DCN d'Indret is the state owned naval shipyard. The Pays de la Loire region is the center of naval engineering and Frances' Silicon Valley equivalent. The Institute for Shipbuilding Research (ISR), Ecole Centrale de Nantes, shipyards, trades, electronics/computer companies, and telecommunication manufacturers come together in Loire to create this strategic center of excellence. The long history and continuing state support for shipbuilding only strengths the relative priority within the French national security strategy.

The EU shipbuilding consortium or European Marine STEP Association (EMSA) has committed to establishing the international model data standards of STEP (STandard for Exchange of Product) for interoperable data between Computer Aided Design (CAD) systems. France is an active member of EMSA and the International Standardization Organization (ISO). Improved productivity in French shipyards and marine service organizations is partially attributable to ease of sharing standardized data.

CAD, electronic time management, robotics, radio-navigation, marine propulsion and innovative designing are major French IT developments supporting their robust shipbuilding industry. The extensive shipbuilding capability from military nuclear propulsion to bulk carriers to fast ferries and pleasure boats supports a depth of marine support companies. Marine electronics, marine construction, marine equipment, marine repair and a host of other marine services benefit from information processing, modeling and simulation, data retrieval and automated processes.

Overhead attributable to manual labor and man-hours, schedule delays and ultimately unit costs are decreasing in part due to use of IT. Decreasing costs can directly affect retaining market share of targeted shipbuilding sectors in the ever-increasing competition for new builds. French shipbuilding maintains their competitive edge in cruise liners, due to excellence, design and manufacturing modernization, IT and in part due to government subsidies.

In summary, technology alone cannot make a nation or an industry competitive in the global marketplace. Static application of technology without an awareness of

the changing external international environment is not good business practice. The Japanese fundamentally redesigned and streamlined shipbuilding processes before they applied IT to compensate for high labor rates. France targeted certain shipbuilding niches and devoted IT and national capital to maintaining that sector in a global market. Economies of scale, IT economies of scope and productivity advances due to technology have more effects in the complex sectors of shipbuilding where there is greater return on investment potential.

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OIL POLLUTION ACT OF 1990

The *Exxon Valdez* 1989 oil spill of more than 11 million gallons of crude oil into Alaskan waters resulted in OPA 90. This legislation imposed strict standards on the design specification of oil tankers and the manner in which they are formulated. Double-hull tankers were described as the new industry standard. After 2010, single-hull vessels weighing over 5,000 tons will be excluded from U.S. waters unless equipped with a double bottom or double sides which will permit them to trade in U.S. ports through 2015. Single-hull tankers trading to the U.S. that unload their cargo offshore, in designated lightering areas, will be exempted from the double-hull requirement through 2015.[xxii] Additionally, Aframax and most Suezmax tankers, without double bottoms or double sides and over the age of 23 years, will be barred from U.S. trade beginning in 2000.[xxiii]

The impact of OPA 90 extends worldwide, as it applies to all tankers operating in U.S. waters, not just to U.S.-flag vessels. In addition to ship design issues, OPA 90 addresses issues such as oil pollution liability and compensation, spill response planning, manning standards, and vessel traffic services.[xxiv] OPA 90 has forced the maritime transportation industry to review and institute major changes to its operations. These changes have come at a most opportune time. The market for construction of new tankers and oil shipping rates are just beginning to emerge from a period where depressed profits did not justify the cost of new investments.[xxv]

The American Shipbuilding Association (ASA) is concerned that owners of single-hull tanker vessels are circumventing the intended phase-out schedule described in OPA 90. According to ASA, these ship owners continue to seek waivers, exceptions, and "workarounds" to extend the operational lives of their oil tankers well beyond the phase-out schedule.[xxvi]

Single-hull tanker vessels are designed such that the bottom and side plates are the only structures separating oil in the cargo tanks from the seawater. There is a high probability of serious oil pollution should these plates be damaged as a result of a collision or grounding. Double-hull tanker vessels are designed such that there is a second internal plate that provides a barrier around the cargo tanks thus protecting against extensive structure damage resulting from a collision or grounding.[xxvii]

Since the enactment of OPA 90, there have been 15 double-hull tanker accidents, 9 being OPA 90 double-hull tankers with the remaining 6 built prior to OPA 90. There was zero oil spillage even when the outer structure of the tanker was damaged, extensively in some cases. Statistics indicate that double-hull tankers have performed well.

The bottom line is that the double-hull requirement and phase-out schedules described in OPA 90 are intended to protect the environment from oil spills due to tanker collisions and groundings. Congress has demonstrated its support of OPA 90 and its unwillingness to delay the OPA 90 phase-out schedule by enactment of Public Law 105-85.[xxviii]

As stated previously, the ASA is extremely concerned that ship owners are seeking approval for "workarounds" to OPA 90, Section 4115, requirements such as extending the operational life of a single-hull tanker unable to carry oil because of its age and configuration.[xxix] ASA has raised other concerns. One is ship owners who convert phased-out single-hull oil tankers to chemical service tankers so that they do not have to comply with OPA 90 requirements. Another is that no new double-hull tankers have been introduced into the Alaskan trade in the last 10 years.[xxx] However, the real concern appears to be the state of the shipbuilding industry itself. Over the past decade, a number of shipyards involved in new ship construction and set up, with the capability to build double-hull tankers, have either gone out of business or engage in ship repair only.

While immediate economic benefits to the new standard are hard to come by for the shipbuilding industry, the long-term benefits may be realized yet, in the form of reduced spillage, litigation, fines, and catastrophic clean-up costs, not to mention the clear aesthetic and environmental benefits to society. By these standards, the revised construction guidelines may prove to be the most significant legislation ever implemented within the field of environmental regulation.

Ms. Karen Fishetti, DISA

TECHNOLOGY

The term "More with Less" seems the trademark of U.S. defense structure since the end of the Cold War and its large defense budgets. In order to remain viable in today's market, U.S. shipyards must maximize to improve efficiency and reduce costs. Computer technology produces a vast resource useful through the life of a ship. Design technologies, known as computer-aided design (CAD)/ computer-aided manufacture (CAM), give designers a powerful database tool capable of creating a three-dimensional model of the ship. During design, teams digitally construct the ship verifying fit and function through virtual walk-throughs.[xxxi] Changes in the design are easily implemented and electronically coordinated with all design team members for swift approval. CAD design for the Virginia-class submarine reduced design cycle-time by 35 percent and cut the number of naval drawing approvals by two-thirds.[xxxii] Production engineers use this data to preview robotic processes and program production equipment using CAM

interfaces from the database to the machine. Robotic production to close tolerances facilitates ship construction in sections, or modules, thus allowing corporate teaming of major projects such as the Virginia-class attack submarine (Electric Boat and Newport News Shipbuilding) and the planned DD-21 destroyer (Bath Iron Works and Ingalls Shipbuilding).[xxxiii] After construction, the same database contains all ship specifications crucial to maintaining the ship. Probably most important is ease of future upgrades incorporating the latest commercial-off-the-shelf technology with the potential of saving billions of dollars during a ship's life cycle. The up-front costs of CAD/CAM computer design and production are high, however the benefits through design efficiency, automated production, and life-cycle improvements directly lead to savings and efficiencies critical to the survival of U.S. shipyards.

Col John Grimes, USAF

Conclusion

In conclusion, the US shipbuilding industry can meet our national security requirements. However, the industry is not competitive in the commercial ocean-going market. Our strategy should promote those aspects of the US shipbuilding industry that are competitive – military vessels and small/medium commercial vessels. This will require further consolidation of the military industrial base and a stable procurement plan. To support our successful commercial markets, we should support Title XI while amending Jones Act restrictions on ocean going vessels thus stimulating US worldwide shipping interests.

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[i] U.S. Department of Commerce, *National Security Assessment of the Shipbuilding and Repair Industry*, Volume I of V, January 2001, Unpublished, pg 19.
[ii] Ibid
[iii] Ibid.
[iv] Supra at note 1, pg. 35.
[v] Ibid, pg. 19
[vi] Ibid, pg. 20
[vii] Ibid
[viii] Ibid
[ix] Ibid
[x] Supra at note 1, pg. 35
[xi] Ibid, pg. 35.
[xii] Supra at note 5.
[xiii] Ibid.
[xiv] Ibid.
[xv] Ibid.
[xvi] Supra at note 1, pgs 55,56.
[xvii] Testimony by John Douglass, Assistant Secretary of the Navy for Research, Development and Acquisition, on the New Attack Submarine program before the Subcommittee on Procurement, National Security Committee, U.S. House of Representatives, March 18, 1997.
[xviii] MARAD, 1999.
[xix] Narita and Koenig, November 1999.
[xx] Narita and Koenig, July 1999.
[xxi] Narita and Koenig, September 1999.

[xxii] "Double-Hull Tanker Legislation: An Assessment of the Oil Pollution Act of 1990," Committee of Oil Pollution Act of 1990 (Section 4115) Implementation Review, Marine Board, Commission on Engineering and Technical Systems, National Research Council, 1998, p. 5, Online, Available: http://www.nap.edu/readingroom/books/tanker.

[xxiii] Ibid, p. 18.

[xxiv] Ibid.

[xxv] "Double-Hull Tanker Legislation: An Assessment of the Oil Pollution Act of 1990," Committee of Oil Pollution Act of 1990 (Section 4115) Implementation Review, Marine Board, Commission on Engineering and Technical Systems, National Research Council, 1998, p. 5, Online, Available: http://www.nap.edu/readingroom/books/tanker.

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[xxviii] "Oil Pollution Act of 1990 (OPA 90) Phase-Out Requirements for Single Hull Tank Vessels," Federal Register, Volume 4, Number 76, April 21, 1999.

[xxix] "Statement of Ms.Cynthia L. Brown, President of the American Shipbuilding Association before the House Committee on Transportation and Infrastructure Subcommitteeon Coast Guard and Maritime Transportation," American Shipbuilding Association, June 29, 1999, Online, Available: http://www.americanshipbuilding.com/news-test62999.html.

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[xxxii] "Submarines in Cyberspace", from the Computer Sciences Corporation website, 7 Mar 2001, p. 2, www.csc.com/features/old_features/110900_feature.html

[xxxiii] "Shipbuilder change course", no author, from the Intergraph website, 15 Mar 2001, p. 1, http://www.intergraph.com/impd/articles/mecheng1.htm