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Maintaining the Shipbuilding Technology Base - Looking at Other Markets

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ABSTRACT

This paper introduces for discussion the need and opportunities for shipyards to diversify into new areas of business. The need for diversification results from reductions in defense spending and the difficulties U.S. shipbuilders are having in gaining new orders. Shipyards have unique abilities that can be competitive strengths in other markets. Among these strengths are the ability to handle large, complex projects, the range of skills among their work force, and their proximity to water transportation facilities. Examples of shipyard participation in new markets demonstrates these strengths. Other markets addressed in this paper serve the utility and process industries, and the opportunities to participate in energy resource research and development.

INTRODUCTION

The intention of this paper is to initiate discussion on ways of using the shipbuilding work force and facilities to supply products and services to other markets. By doing so, the U.S. ship production base can be maintained and the process of lowering costs and improving efficiency can continue.

The military successes and difficulties during the Gulf War demonstrated the need for a strong sealift and naval capability. Recognizing this, it is a national security issue that a strong U.S. shipbuilding base be maintained. With budgets declining and technology changing, there is the need to keep shipbuilding costs under control. It has been a government policy that competition among shipbuilders would insure lower costs and improve productivity.

Domestic commercial shipbuilding has all but ended. The notable exception is Matson's acquisition of a new containership from National Steel and Shipbuilding. Forecasts for the future suggest that the market may improve as older tankers are retired and new mandates for double-hulled ships come into play. There are, however, alternatives to building new tonnage for domestic trade. Further, today's charter rates will not support additional new buildings (1).

A lament from shipbuilders has been "how can we become more productive if there are no ships to build?" As the domestic commercial ship market has declined and the Navy market has begun to shrink, this has become the rationalization for government supports for shipbuilding.

Most shipbuilders are narrow in their perspective seeing themselves as a single product class industry. Evaluating what a shipbuilder does gives insight into a number of functions they perform internally which can be transfered or used to supply products to non-shipbuilding related markets. This means that shipbuilders can look to penetrate other markets to supplement their order books.

Benefits of entry into new markets include diversification of a shipbuilder's project portfolio, and distribution of overhead across a larger range of products. Diversification into

markets that have either constant growth potential or a different business cycle would stabilize the builder's work force and lessen the current feast or famine business environment. Distribution of overhead costs over a number of products lowers project pricing for all products.

DEFENSE SPENDING

The next few years will be difficult times for defense related industries. Fewer dollars will be available for strategic systems. Production lines will be closing down and workers will be displaced.

Shipbuilders will be hard hit. It is estimated that the shipyard labor force will decline from over 100,000 workers to around 60,000 by 1994. The shipyard labor force is skilled but those skills are not directly transferable to other private sector industries (2)

COMMERCIAL BUILDING

Foreign yards have full order books, reflecting a current need for tonnage, but also representing the decline in building capacity as yards have been closed over the years.

Major U.S. yards, with few exceptions, are not involved in commercial shipbuilding. Those shipyards that do have work are relying on Jones Act constraints on shippers. This is simply because U.S. yards are not competitive with foreign builders, particularly Asian builders.

CORPORATE STRATEGIES

Shipbuilders have for the most part, been dedicated to a single business. That is they have concentrated on what they believe they do best, building ships. This strategy has significant strength in providing its adherents with a very clear purpose and direction, which makes a complex business like shipbuilding easier to manage. The managers have familiarity with the core trades and technologies. First hand experience and knowledge is used to make decisions.

As the market has declined, shipyard strategies have changed. Over time, they have followed three generic strategies. As the shipbuilding market became smaller, shipyards first focused on the US market and competed to be the low cost producer in the industry. Secondly, those yards that could not compete on price tried product differentiation emphasizing quality or other attributes. Now, as a third strategy in an even smaller market, shipyards are focusing on narrow market segments. As a result they are becoming specialists in single product types.

All of these strategies have been encouraged by government procurement policies as they have become the only customer. Recent reductions in government spending have forced Electric Boat and Newport News to be identified as shipyards specializing, respectively, in submarines and aircraft carriers.

Some shipyards, as well as other defense related industries, are looking for opportunities to djversify away from U.S. Navy shipbuilding. Electric Boat, for example, is considering moves into commercial shipbuilding (3). But U.S. shipbuilders' inability to penetrate today's commercial market prevents them from being able to maintain a stable workforce into the foreseeable future. Shipyards like Electric Boat who have not done commercial work are at a competitive disadvantage since little of their technology and experience is directly applicable to commercial ship construction (4). Alternative markets must be sought.

WHAT BUSINESS ARE WE IN?

Shipbuilders have unique strengths in comparison to other businesses. The most notable is their ability to deal with large sizes of products. Where other businesses measure their product in pounds, shipbuilders measure theirs in tons.

Shipbuilders are used to dealing in large numbers of constituent parts. Coordinating the procurement and logistics for all the parts that go into a ship is a monumental task. This includes the quality control, financing,

and engineering of these pieces.

Ships have been likened to floating cities. In fact all the aspects of a city are represented. One significant difference, however, is that a ship is designed for a specific mission. All the subsystems are integrated to fulfill this mission.

A ship built for the private sector is a revenue generating entity. There is an advantage to an owner who can get his ship producing first. This means that to be competitive in the market a ship builder must not just be good at moving the iron, but also move it as quickly as possible. For the ship owner, time is money both in terms of revenue production and in time value of capital.

Shipbuilders are providers of products that can be classified as industrial goods. They are providers of manufactured parts such as component piping, and capital items, in this case the ship itself. They are also providers of services. These are procurement, engineering, and quality assurance.

If one were to look at shipbuilders in the abstract it would be to see them as diverse manufacturing and construction operations. They could be perceived as consortiums of many small companies tied together to produce a common product.

By looking at each subunit of a shipyard as an independent business, opportunities to compete in smaller markets may be identified. By looking at the ability of shipyards to plan, engineer, and manage large scale, complex projects we may identify opportunities in markets that require those abilities.

In other periods of downturn, shipyards turned to other markets to sustain themselves and survive. During such a time after World War II, Newport News built railroad cars. At the same time, Electric Boat built truck bodies and automatic bowling pin setters. In general, they capitalized on their structural steel abilities. Shipyards are now in a position to compete in "outfitting intensive" markets. Carson and Lamb suggest this as a competitive strength for competing with European and Asian builders (5).

In other countries, shipyards are part of the heavy industrial base and are more diversified than those in the United States. For example, Mitsubishi Heavy Industries uses their shipyards to fabricate and assemble subunits for power plants. As part of the heavy industrial base, shipbuilding is part of a coherent national industrial policy. Japan, as part of their industrial policy, has been phasing out shipbuilding along with other declining industries (6).

OTHER MARKETS

The U.S. is in need of infrastructure development. Part of this is an ever increasing need for electric power. The U.S. market for electric power has shown a minimum annual rate of growth between 1% and 2%. From the 1950's through the 1960's this rate was considerably higher as the U.S. population and industry grew. This growth in demand prompted utilities to add generating capacity. In the 1970's and 1980's, demand dropped to it's lowest rate of growth, saddling utilities with excess generating capacity.

Electric Utility Construction

Over the next 10 years it is expected that the power market will grow at rates higher greater than 2 percent. Current forecasts indicate utilities have used up the excess generating capacity and are approaching their limits to handle peak load demands. This makes addition of new capacity necessary (7). The need for power is significant enough that there are some in the industry who are predicting a resurgence of nuclear power, particularly with new high temperature gas cooled reactors (8).

Clearly, construction of additional power generating capacity will be an expanding market. As such, entry barriers to different levels of the market should be fairly low. That is, in a growing market there is room for all the players.

Prefabrication and Modularization in Heavy Construction

Utilities and other customers for heavy construction projects are putting a strong emphasis on shortening construction schedules and reducing overall project costs. Construction companies are finding that prefabrication and modular construction are techniques that can give them a competitive advantage.

The major factors driving modularization in heavy construction are the high costs of site labor and construction capital. By moving work off site, companies use less expensive labor. By shortening construction time, the construction company reduces capital costs and provides a customer with quicker revenue generation.

There are other factors that drive an interest in modularization. The geographic location of a construction site can make traditional construction techniques impractical and prohibitively expensive. A construction site may be constrained by limited storage and lay-down space. This is most common with additions to old facilities or reconstruction and refurbishment projects.

Heavy construction companies have used preassembly and modularization in the past. Preassembly is distinguished from modularization in the following way: preassembly assumes that component parts are available and can be assembled on the ground or near the construction site then put into place. Modularization (or prefabrication) involves advanced planning and engineering to allow vendors to assemble large blocks of components in their shops, then to move these to the site and into their final erected position.

Foster Wheeler has been prefabricating portions of process plants and have been able to make a trade-off of reduced erection/site costs for increased transportation and shop costs netting out to lower overall project costs. Foster Wheeler has found that these benefits only accrue if engineering is advanced in the project schedule, and if there is tighter control of material procurement against cost and schedule goals (9).

Two examples of modularization in heavy construction are the Zimmer nuclear-to-coal conversion project and the Murray hydroelectric station project.

The Zimmer generating station conversion used modularization of major components to reduce schedule time by one year. The constructor modularized the electrostatic precipitator system, auxiliary boilers, and steam turbines. The electrostatic precipitator was built in 30 modules, the largest weighing around 500 tons, in a shipyard in Mobile, Alabama (10).

The Murray hydroelectric station was built as a single unit 450 feet long, 146 feet wide, 121 feet deep, weighing 25,000 tons. The unit was erected at Avondale Shipyard from 200 pre-outfitted modules, then floated up river to its final position. The constructor credits the shipbuilding techniques employed by Avondale for making the project technically and economically feasible (11).

These two examples show that shipyards can bring their resources to bear on the heavy construction market. They have unique strengths that provide them with the ability to compete for parts of these projects. These strengths must be balanced against strategic weaknesses and threats inherent in penetrating a new market.

COMPETITIVE STRENGTHS FOR NEW MARKETS

A major shipyard strength is its flexibility. By virtue of having all the major trades and shops on site, shipyards are capable of a wide variety of manufacturing and construction tasks. Shipyard personnel have experience with boilers, control systems, gas turbines, diesel engines, and other complex technologies.

Location is an advantage. Because shipyards are situated with access to water transportation, they can move large assemblies or receive raw material by way of the most cost effective method of shipment.

The two factors above are amplified

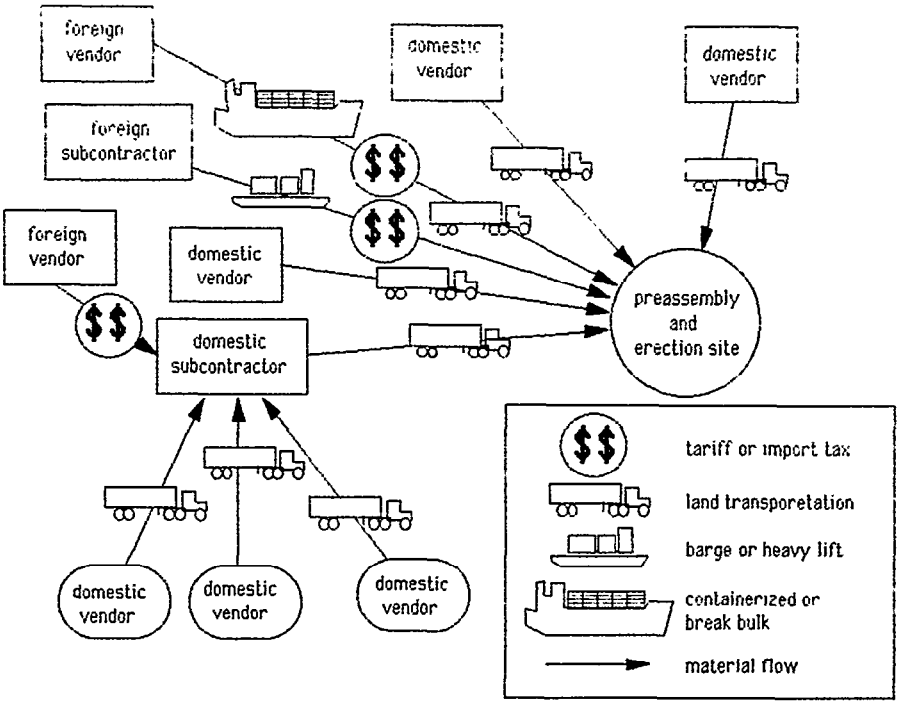

FIGURE 1

Typical flow of material and subassemblies from domestic and foreign sources to a erection site. import duties on foreign sourced material are incurred at each port of entry. Transportation and erection costs are also significant components of total project costs.

when shipyards are used inside a foreign trade zone. A foreign trade zone is a duty free area set up at a port of entry (12). Materials and products brought into these areas can be stored and assembled without incurring duties until they leave the facility. Raw materials or prefinished components can be received and assembled with advantages in reduced tariff costs .

Typical material flow for a construction project is diagramed in Figure 1. Material comes to the construction site from various domestic and foreign sources. There is considerable transportation cost associated with this flow. Further, import tariffs are charged at each port of entry.

The added cost of the import duties for finished products can make it more economical for work to be done in a U. S. shipyard rather than in a foreign facility. If the difference between foreign labor costs and U.S. labor cost is less than the import costs, this can be a profitable opportunity.

Figure 2 shows how a shipyard could fit into this material flow. By focusing imported and foreign sourced material to one location, material can be consolidated and value added. The shipyard could assemble larger units for erection which could be transported by barge or other carrier to the job site. There is likely a savings on tariffs since they are paid on the assembled products rather than individual materials.

This material flow is not unlike that for building a ship except that the product is going inland instead going of to sea. There is a savings in transportation by virtue of the shipyard's location. Access to ocean loading and unloading facilities and the ability to handle heavy lift makes barge or ship modes an alternative to more expensive truck transportation.

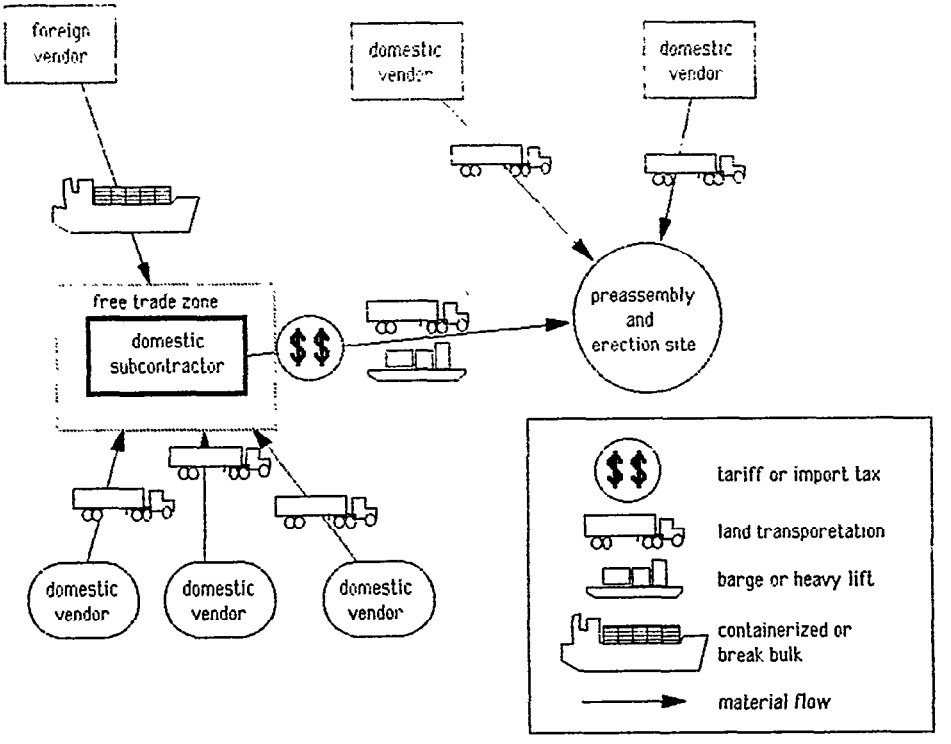

FIGURE 2

This illustration shows how a shipyard, as a domestic subcontraotor whose facilities are established as a foreign trade zone, would function in as a supplier in a heavy construction market. Domestic and foreign sourced material would be delivered to a domestic subcontractor. The subcontractor then builds modular assemblies that are delivered to the erection site. The result is lower costs to the erector by virtue of lower import costs, lower domestic transportation costs, and lower erection costs.

Costs for trucking components to the job site are significantly greater than that for water transportation modes. 1981 figures for freight prices by mode show trucking rates to be 21 times higher than that for water transportation of freight (13) Since those figures were published, there is no indication that that ratio has changed.

Shipbuilders have a technological advantage. They have the facilities and personnel to support specialized needs of heavy construction.

The shipbuilding industry has been a primary source of skilled technicians and engineers familiar with steam boilers and nuclear systems. The complexity of combatant, ship control, and propulsion systems has developed a work force that can provide expertise to civil, utility, or process plant construction.

WEAKNESSES OF THE SHIPBUILDING INDUSTRY

There are two major weaknesses that a shipbuilder must overcome. The first is the mindset of a defense contractor and of a subsidized industry. The second is a lack of familiarity with demands and nuances of a new market.

The biggest weakness that a defense contractor faces in this kind of diversification is eliminating a restrictive mind set dependent on government guidance and bureaucracy. Defense contractors must undo a lot of

overhead that has been built into their corporate structures and that are unnecessary to support a civilian customer.

Some shipyards have not been encouraged to work in the commercial and defense areas simultaneously or to diversify their product base. In some cases, notably Electric Boat, they have been discouraged by government representatives from doing so (14).

FOREIGN COMPETITION

A major threat in the heavy construction industry is the entry of foreign firms. Japanese and European firms have already recognized the growth potential of the U.S. power market. Foreign firms are entering the market using acquisition, an example being Asea Brown Boveri's acquisition of Combustion Engineering.

Foreign firms are not a direct threat to a shipyard working as a vendor to the constructor. However, if the transportation and tariff factors are neutralized by lower labor costs and higher productivity of foreign vendors, then shipyards can be forced out of the market. This requires that U.S. shipyards be cost competitive and that they improve their productivity.

ENERGY RESEARCH AND DEVELOPMENT

Carson and Lamb conclude that government sponsored research and development is a key factor that has given foreign shipyards competitive advantages in the world shipbuilding market. Carson and Lamb recommend that the U.S government should fund more research and development (R&D) of promising marine technologies. This year, the U.S. government is budgeting $2.45 billion for energy R&D and $1.53 billion for transportation R&D (15). It makes sense to try to get the most for the R&D money that is out there.

Coordination of projects among the Department of Defense (DOD), the Department of Energy (DOE), and other government agencies would provide more efficient use of funds. This is a potential market for shipyards that have extensive experience in working on government contracts, and turns what is a liability in commercial markets into a competitive strength.

DOE's current long ' term plan involves technologies for fuel cells, advanced nuclear reactors, advanced diesel engines, advanced batteries, alternative liquid fuels, and superconductivity, (16) that will be of interest to ship owners and builders in the 21st century.

Studies of fuel cell technology in marine applications have been sponsored by the U.S. Navy (17). Fuel cells use a chemical process to convert a hydrogen source and oxygen into electricity releasing high temperature steam and carbon dioxide as byproducts. The process has a conversion efficiency of between 40 and 60 percent. When the steam byproduct is utilized to mechanically generate power, efficiencies approaching 80 percent can be achieved.

As ships become more automated and capable, power requirements become important design considerations. On specialized ships, for example cruise ships, this has been a reason for using diesel electric drives. Studies performed for the Navy indicate that fuel cell technology may be a viable alternative to gas turbines or diesel engines, since their higher efficiency reduces fuel consumption.

A number of demonstration projects and developmental work for fuel cell technology are being funded as part of the DOE's plan supporting President Bush's National Energy Strategy. If shipyards are involved in development of fuel cells and other new technologies, they would have a step along the learning curve when they are used in marine applications.

CONCLUSION

Shipyards should look to expanding their businesses into non-marine heavy construction markets. Where they may not be able to take on whole projects, they can function as vendors to those in the utility or process plant construction industry. Shipbuilders have competitve strengths that can allow them to to penetrate these markets.

Among shipbuilders' strengths are their locations, facilities, and experience with advanced technologies.

There has been no sentiment in the Reagan or Bush administrations toward subsidizing industries, however R&D funds are being budgeted for energy and transportation (18). If shipbuilders' see themselves as part of the larger U.S. heavy industrial base, they can begin to share in development of new technologies that will give them a competitive edge in the shipbuilding market of the 21st century.

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