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PANEL SP-8

INDUSTRIAL ENGINEERING

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ANALYTICAL EDUCATION: A KEY TO IMPLEMENTING
ADVANCED SHIPBUILDING TECHNOLOGY

The National Shipbuilding Research Council's Committee on Navy Shipbuilding Technology identified this as an important issue.

"Engineers and managers play a key role in productivity innovation by making decisions to innovate and then planning and committing the organization to implementation. The more sophisticated the engineers and managers, the more likely they are to understand the direct links between their skills and productivity.

Many shipyard engineers and managers have worked their way up through the skilled trades. Such employees are likely to have intimate knowledge of that shipyard's practices and procedures, but only limited familiarity with broader engineering and management principles. That kind of background also may not be the best for overseeing the introduction of new technologies."¹

U.S. Shipyards Uncompetitive

We constantly hear the phrase, "the Competitive Challenge" with respect to overseas shipyards. The market for building commercial ships in the United States has disappeared except for a very few needed to satisfy the Jones Act. The "Competitive Challenge" is no myth, but rather a well-documented fact. American shipyards do not build ships as economically or efficiently as either the Europeans or the Japanese. With U.S. prices for tankers 90% higher than in Europe and two to three times higher than the Far East,² it is no wonder that few new contracts are going to U.S. shipyards.

A Depressed Market

The situation is further compounded by the lack of new orders world-wide. The intensifying competition between Far East shipbuilders only makes matters worse for the U.S. Predictions discussed in current literature are consistently expecting the shipbuilding recession to extend through the 1990's. Inevitably there will be casualties both here and abroad. There is simply too much shipbuilding capacity to be supported by the meager demand. In a recent issue of the Marine Engineering/Log, the editor points out:

"The world's shipyards have run out of miracles ... even in the Far East. The year opened with the four major Korean builders receiving not one solitary new building order in January. In the initial phase of first quarter of the current year, export orders on Japanese yards fell to the lowest level ever. Indeed, the first quarter of 1985 'will surely pass into history as one of the bleakest periods ever for salesmen in the international shipbuilding industry,.' in the view of Oslo broker R. S. Platou, A.S."³

"Shipyards will have to close. The Shipbuilders Association of Japan, and other leading authorities feel that market forces will facilitate a "natural selection" that will dictate who the losers will be. The surviving companies will inherit a leaner, fitter industry with a "hi-tech" base."⁴

What About Us

Considering the depressed shipbuilding market and our uncompetitive position, does the U.S. shipbuilding industry have a future?

The answer is a very positive yes! There will be more shipyard closures, but by and large a stronger and more dynamic industry will emerge.

In the short term, the Navy buildup will provide the necessary work to maintain a core of viable shipyards. Beyond that, each yard remaining must be fully committed to implementing advanced shipbuilding methods and technology if they hope to secure new commercial work.

Technology Transfer

Since the mid-1960's, when the Japanese shipbuilders captured the lion's share of the commercial shipbuilding market, many industry experts advised U.S. shipyards to adopt Japanese shipbuilding methodologies which included:

1. "Careful analysis of vessel as to size blocks and shape with refined drawings or sketches of each weldment, together with machinery, piping, etc. to be installed at assembly shop or area.
2. Coordinated material control.
3. Allocation of labor and time schedule for each operation.
4. Installed machinery, piping and other equipment to a great extent before erection.

5. Reduced staging to a minimum.
6. Introduced inorganic-zinc coating in the assembly line.
7. The key to rapid construction is how to weld without distortion and shape or weldments or modules that defy or resist distortion especially when such affects the vessel's measurements and locked-in stresses."⁵

In the past twenty years, aggressive U.S. shipyards have made great strides 'toward closing the competitive gap. They have sent representatives to Japanese yards to get first-hand observations of the methodologies in use there as well as bringing consultants from Japan to accelerate the transition to modern zone-oriented methods.

Technology Transfer Uncovers a Problem

Soon after the technology transfer began in earnest, it became evident that the transfer of ideas and methods was not enough. Managers of the U.S. shipyards were attempting to implement modern technology while maintaining their old style decision-making processes. There has been and still is a serious shortage of analytically trained personnel in shipyards. In the words of Prof. Hisashi Shinto, retired president- of Ishikawajima-Harima Heavy Industries Co., Ltd., "Only America can surpass Japan in shipbuilding. But, we do not worry because America has a human problem, not enough college educated people in middle management."

Why is analytical training so important? The following excerpt from a' paper given in testimony during a 20 June 1984 hearing by the House Merchant Marine Subcommittee helps to answer this question.

"All say that we cannot ignore the need for more educated managers. The singular difference between a traditional up-from-the-trade shop manager, and a shop manager educated to think analytically about the systematic nature of manufacturing is ability to analyze any influence for its impact on an entire manufacturing system.

Insufficient analysis by current middle management is already manifest in a way that threatens to slow shipbuilding technology development in the United States. Where the refined technology from Japan is now being applied, some traditionally educated American managers feel that they have already perfected the "new methods" and are now introducing some innovations that would be of interest even to the Japanese. However, most are still preoccupied with parochial concerns and are not yet talking about contributions for constantly improving an entire shipbuilding system."⁶

Analytical thinkers are constantly gathering data, identifying trends and promoting improved productivity. Accurate feedback describing how systems are performing is critical to the decision-making process and can only be supplied by statistical methods carried out by shop managers, supervisors and workers. Dr. W. Edwards Deming, a consultant in statistical studies who is renowned for his work in Japan which created a revolution in quality and in methods of administration, insists that educational efforts must cover the whole company.

The SPC Helping to Meet the Challenge

The Ship Production Committee (SPC), under the auspices of the Society of Naval Architects and Marine Engineers (SNAME), was established to identify ways of improving productivity and helping U.S. shipyards meet the competitive challenge from foreign shipbuilders. The SPC consists of eleven technical and research panels that cover the whole spectrum of shipbuilding. Funding for this work comes jointly from the U.S. Maritime Administration, the U.S. Navy, and from private industry. In recent years, the SPC panels have funneled the bulk of their limited resources toward implementing advanced technology in shipyards and identifying the educational needs of shipyard personnel.

Panel SP-8 on Industrial Engineering is one of those eleven SPC panels. The role of SNAME Panel SP-8 is to raise the awareness of shipyard decision-makers to the benefits of scientific management and to promote the use of an analytical approach to problem solving in shipbuilding. This is done through the effective use of industrial engineering techniques to assist in the selection of advanced shipbuilding technologies most appropriate to a given yard, and to later assist in the implementation of results-oriented projects.

From its birth in 1978, Panel SP-8 worked primarily to develop labor standards and identify new technologies. In the early 1980's. SP-8's panel members began shifting their attention to the problem of implementing advanced shipbuilding technology and the issue of formal analytical education. They recognized the impact that highly trained Industrial Engineers (I.E. 's) were having in other industries. They felt that the 'I.E. expertise was needed in shipyards to fully utilize the new technologies. The National Research Council's Committee on Navy Shipbuilding Technology recently reconfirmed this as an important issue.

Engineers and managers play a key role in productivity innovation by making decisions to innovate and then planning and committing the organization to implementation. The more sophisticated the engineers and managers, the more likely they are to understand the direct links-between their skills and productivity.⁷

But Why Industrial Engineers?

As defined by the Institute of Industrial Engineers, the profession of industrial engineering involves the design, improvement, and installation of integrated systems of people, materials and equipment. It draws upon specialized knowledge and skill in the mathematical, physical, and social sciences together with the principles and methods of engineering analysis and design in order to specify, predict, and evaluate the results to be obtained from such systems.

Although industrial engineering schools teach their degree students an analytical, integrated-systems approach to setting and achieving company goals, shipyards generally are not taking full advantage of this training. Few-commercial shipyards even employ people with actual industrial engineering degrees.

The industrial engineer, like other specialists, can function best as part of a management structure which promotes teamwork. Coordination of efforts among the designers, builders, facilities maintenance, and support groups is critical to achieving the best overall results. Properly assigned, industrial engineers can help a shipyard to select and implement appropriate new techniques, while at the same time making a better profit on the vessels presently under contract.

SNAME Panel SP-8 Programs

Panel sponsored projects are now aimed at increasing the role of industrial engineers and use of industrial engineering techniques in shipyards. The first of these, entitled, "Industrial Engineering Curriculum for Use in Shipyards," was co-sponsored by Panel SP-9 on Education. That effort produced a matrix of shipyard problems and situations to which the most effective industrial engineering techniques are being, or can be, applied. From that matrix evolved a curriculum ranking those techniques and listing sources of educational materials and training courses related to them.

That effort set the stage for a Fiscal Year 1984 project entitled, "Shipyard Training Packages for Industrial Engineering Procedures." The technical objective of this effort is to develop shipyard oriented training materials that will address the theory and practice of basic industrial engineering techniques identified in the curriculum discussed earlier. These materials can be integrated into existing employee training programs and college level courses of instruction to improve employee performance and stimulate interest for a career in the U.S. shipbuilding industry.

To further demonstrate Panel SP-8's commitment to increased training in basic industrial engineering techniques, it is sponsoring a series of workshops on methods engineering for the shipbuilding industry. The workshops, conducted by the Institute of Industrial Engineers, are an outgrowth of a five-day pilot workshop held in Atlanta in 1981. They are designed to train and instruct shipyard managers and personnel in the techniques of methods engineering in shipbuilding. Workshops are scheduled to be held in late September, 1985 at four sites around the country. There will be no charge for attending these workshops.

Greater management awareness of industrial engineering techniques and the more effective use of these techniques by personnel responsible for the implementation of new technologies will ensure smooth and rapid integration of these technologies into existing organizational structures. To facilitate this awareness, a project entitled, "Optimal Use of Industrial Engineering Techniques in Shipyards" proposes to produce a comprehensive report concerning the analytical procedures available to shipyards through increased recognition and use of industrial engineering techniques. This project will specifically address ways in which these procedures may be used to support the implementation of advanced shipbuilding techniques such as Group Technology, Product Work Breakdown Structure, Flexible Manufacturing, and 'Accuracy Control. Recommendations on organizational relationships between and I.E. department and other functional departments will also be made.

Additionally, FY-85 plans include a follow-on effort to develop additional training packages for industrial engineering procedures. Also, a materials handling and facilities layout training module will be developed. Finally, phase one of a two-phase effort to identify the impact of workload variability will get underway. These projects are further proof that Panel SP-8 is deeply committed to the educational and training needs of U.S. shipbuilders.

In Conclusion

Not only U.S. shipyards, but shipyards worldwide, are feeling the impact of declining new construction orders. As the shipbuilding depression continues, it is forcing all yards to become as efficient as possible if they intend to stay in business. Many shipyards will close, but those that remain will have had to make significant changes in their ways of building ships. Industry analysts agree that how well shipyards implement advanced shipbuilding technology will determine their success or failure.

Industrial engineers can help maximize the benefits of these advanced techniques. The analytical skills they bring to the industry will help provide the data feedback needed for full implementation. Where industrial engineers are not available, the alternative is to train shipyard personnel in industrial engineering techniques. Such training needs to be focused to specific needs in order to fill the educational void as rapidly and economically as possible.

SNAME Panel SP-8 recognizes the void exists and is working to fill it. SP-8 is sponsoring programs that range from identifying how industrial engineering techniques can best be used in shipyards, to developing training materials for self training, to actually providing methods engineering workshops. These programs will do much to close the competitive gap; but ultimate success depends on the total commitment of U.S. shipbuilders to such programs.

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