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THE NATIONAL SHIP BUILDING RESEARCH PROGRAM

Executive Summary

Feasibility Of Shipbuilding Standards

U.S. DEPARTMENT OF COMMERCE

MARITIME ADMINISTRATION

IN COOPERATION WITH

BATH IRON WORKS CORPORATION

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STANDARDS FOR SHIPBUILDING
AN EXECUTIVE SUMMARY OF TASK S-15
FEASIBILITY OF SHIPBUILDING STANDARDS

1. History of the Study

In the **summer of 1970**, the Maritime Administration Office of Advanced Ship Development joined forces with the Ship Production Committee of SNAME in a joint venture to plan and finance research projects that would improve the ability of U.S. shipyards to compete in the world shipbuilding market. In January 1973, more than twenty senior shipbuilders representing fifteen different shipyards met in Annapolis to plan the research in ship producibility. As a result 27 research needs were identified and a research program initiated to meet these needs. One of the major research tasks was S-15, "Feasibility of Shipbuilding Standards".

2. Objective of Task S-15, Feasibility of Shipbuilding Standards

The original objective of this task was to examine the various aspects of the shipbuilding experience to determine if it was feasible to apply a body of standards describing material, machinery, and components to reduce the costs of ship construction. The challenge was to determine if technical knowledge could be gathered into a systematic description which could be used effectively by U.S. shipyards to reduce the time cycle for construction and to reduce the cost and risk associated with the building of ocean going ships.

3. Scope of Task S-15, Feasibility of Shipbuilding Standards

The scope of this task was developed to answer whether standards, especially ones covering materials and equipment, would offer yards the possibility of constructing vessels at a reduced cost. The potential cost reduction areas were further delineated as:

- Reduction in build cycle duration
- Lower risk to both owner and yard
- Lower material cost
- More reliable equipment
- Simplified installation
- Better communication

4. Approach to the Study

Initially the task team determined that any answer to the question of feasibility would have to address:

- Technical feasibility
- Economic feasibility
- Business risk
- Political acceptability

The quest for full evaluation of the feasibility of standards would not only have to investigate these four areas but would have to investigate the much more complicated area of relationships which these have to one another.

The task force next determined that the following questions would have to be resolved before a complete understanding of the problem could be achieved:

- a) What is the definition of "standards"?
- b) What constitutes standard material? Is it reproducibility, identity, similarity, interchangeability?
- c) What items are already "standard" in currently used ship construction contracts?
- d) Do the commonly used detailed specifications describe standard parts and/or material? If so, are standard parts or materials being utilized as extensively as beneficially practical?
- e) What are the risks that we will be able to reduce through the establishment of standards?
- f) What areas offer the most promise of benefits from the establishment of standards?

5. Definition of "Standards"

Today many people, especially engineers and technocrats, talk knowingly about standards and standardization. Many engineers belong to professional societies which generate and approve standards. Most engineers profess to understand these terms and to use them frequently in their work. However, no nationally or internationally accepted or approved definitions exist for these terms. Our researchers find that a communication gap exists because of a lack of accepted definitions of terms.

The American National Standards Institute (ANSI) has a committee working on a definition.

The International Standards Organization (ISO) definition is not satisfactory for daily use.

H. E. Maynard suggests in the "Industrial Engineering Handbook" that "a standard is in effect merely an announcement of intention, while standardization is the fulfillment of that intention".

A given standard may address one or more areas of concern as well as multiple levels of detail. For example, standards may define such areas of concern as:

- Nomenclature (e.g. definitions, symbols)
- Performance (e.g. speed)
- Operating characteristics (e.g. pressure)
- Design (e.g. safety factors)
- Envelopes (e.g. size limitations)
- Interfaces (e.g. connections to other items)
- Construction Method (e.g. weldment)
- Procedures (e.g. tests and documentation)
- Software (e.g. certificates, drawings)

Also, **standards may apply to various levels of application.** A standard may define one or more areas of concern about different levels of application, such as:

- Full ship
- **System**
- **Component**
- **Part**

Thus we can see that the standards we all use can deal with some combination of “areas of concern” and “levels of application”.

To solve the problem of the lack of a suitable definition, our researchers offer the following as a definition of a formal standard:

“An American Marine Standard is a mutually agreed upon, formally published description of an item and/or procedure for the purpose of defining characteristics of the item and/or procedure that must be the same within specified tolerances as other items and/or procedures conforming to the standard”.

Although this definition may not be complete or adequate, it does offer a point of reference for future discussions. Among the people working regularly with standards, understanding such a definition becomes almost intuitive.

Additionally, informal standards exist and are recognized as being useful, but not as useful as published, codified documents which describe a duplicatable product, process, or procedure.

6. Results of Study

Our conclusions address the areas of:

1. Technical feasibility
2. Economic feasibility
3. Business risk
4. Political acceptability

Marine Standards Are Technically Feasible

There is no doubt that U.S. merchant ships are actually being built today through the use of standards. In fact, a surprisingly large body of standards is already required to build today's vessels. An examination of four shipbuilding contracts showed that an average of forty-one standards were cited in the original construction contract. The successive tiers of standards which were cited in these forty-one raised to several hundred the number of published standards invoked in a typical ship construction contract.

Additionally, many non-contractual standards are in use. Yards have various standards which serve to simplify decision making for the managers. The benefits extend from marketing to delivery.

However, an analytical examination of the present uses of these existing standards shows that several significant problems still remain. Shipbuilders and ultimately owners and vendors are missing significant benefits because:

1. Obsolete and inadequate standards are being incorporated into the shipbuilding contract.
2. Available and potentially useful standards are being passed over and not used.
3. No organization exists to help identify areas where standards are needed or to develop needed standards.
4. Invoked standards are not being completely complied with.
5. It is not always clear which parts of a cited standard are intended to govern.

Marine Standards Are Economically Feasible

Several independent studies have been made to quantify the amount of savings which are possible through the use of standards. All the studies that we found reached the same conclusions:

- **There is no question that the intelligent use of standards causes significant reductions in costs.**
- No one has successfully quantified the amount of savings for a whole industry.
- A lot of money could be spent researching the problem without additional benefits.

From interviews we determined that the utilization of standards by the owners, vendors, Naval Architects and yards varied so extensively that no common baseline existed for savings calculations. To further frustrate attempts at quantification, there is no common agreement among U.S. shipbuilders as to how much utilization is possible.

Europe and Japan both have found that less than 1,000 distinct shipbuilding standards are required to augment the industrial standards base.

Marine Standards Can Reduce Business Risk

The greatest potentials for reducing business risk by using standards appear to be in the areas of design and purchasing.

Some of the potential advantages in the area of **Design** are:

- Improved communications
- Reduced risks of product failure
- Reduced elapsed time for design
- Improved quality of original design
- Reduced requirements for design reiteration
- Improved reliability, performance and safety
- Reduced need for custom designing
- Standardized technical information from vendors
- Construction method known to designer and builder
- Streamlined process for obtaining regulatory approval.

Some of the advantages in the area of **Purchasing** are:

- Improved communications with designers and vendors
- **Faster delivery of equipment**
- **Simplified inventory control**
- Reduced effort involved in approval cycles
- **Improved reliability, performance and safety characteristics**
- Less need to buy custom equipment

Additionally, standards offer an opportunity to reduce the risks by:

- Providing a basis for clearer communication between owners, operators, designers, vendors and yards
- Permitting reuse of practices, methods procedures, parts, etc. which have proven that they do provide satisfactory performance and reliability.

Marine Standards Can Be Politically Acceptable

The standards system in the United States is generally based on voluntary standards developed and approved by the affected community. This is in contrast to Japan, for example, where the national government directs the standards development and approval efforts. Currently U.S. federal agencies charged with enforcement of certain regulations, particularly relative to safety, are asking the public sector for standards which can be utilized for a measuring tool. One specific example is the Power Press Manufacturers Association development of a new set of safety standards so that OSHA would not impose some federally developed (and very possibly unrealistic) regulations. The industry developed standards were adopted by OSHA.

In Europe the shipbuilding community often joins with the government in funding standards development by an independent shipbuilding research association. The British Shipbuilding Research Association is one such jointly funded organization.

In the U.S. there are approximately one hundred organizations which write and/ or authorize standards for public use. Some engineers from the shipbuilding industry participate in these standards generating activities. However, the development of standards specifically for shipbuilding use is not systematic, organized, or coordinated. Shipbuilders would be well advised in the long run to expand the use of standards which they have helped to develop.

Any proposal that the U.S. Shipbuilders expand their participation in standards development will meet with a mixed reception and will require a concerted effort by proponents before any significant financial support is made available from the Industry.

It is the considered conclusion of the research team that the potential payback to the shipbuilders from an investment in standards is far greater than for any comparable capital investment purchase.

7. CONCLUSIONS

SHIPBUILDING STANDARDS ALREADY EXIST AND ARE IN USE.

The research determined that shipbuilding standards are feasible and are in fact very frequently used. Contractual shipbuilding requirements do exist which are identified by standards. Many documents which are not identified as standards are utilized in shipbuilding as standards. "Industrial" standards are used frequently for contractual and technical purposes.

The places in which standards are found, such as contract documents, purchase specifications, and ship specifications would seem to indicate that these standards are being invoked:

- To reduce the business risk
- To gain economic benefits
- To aid in technical documentation
- To assist contract administration

Unfortunately, there is often a negative cast to the citation of standards in that they often appear to have been included to aid in a post-construction legal debate. Standards should be used to define a ship and its characteristics in such a manner that the risk and consequently the total cost to the owners, vendors, operators and builder is minimized.

ADDITIONAL SHIPBUILDING STANDARDS ARE NEEDED.

Although many marine standards are in use, more standards are needed. Existing shoreside standards should be used. New marine standards should be developed.

The research team found that communication between owners, vendors, operators, designers and the yards is helped when the same standards are understood by all of the parties. Additionally, the team found that some areas of inadequate communications are areas in which other industries have already developed standards. It would be an advantage to the shipbuilders if existing shoreside standards could be applied (possibly in a Marineized form) to the Marine Industry.

Often disputes arise over whether the construction details of the ship are consistent with the terms of the construction contract. If standards **were to be used to describe** the ship, these disputes would be greatly minimized.

Many standards exist today which can be used for this purpose. There are about 7000 published standards in the United States. Several hundred of these can be used in shipbuilding. To make this possible, it will be necessary to review the total body of standards and to codify, index, and publish those which would lend themselves to marine use.

However, this will not provide the total coverage needed because of the unique nature of shipbuilding. It will also be necessary for owners, designers, operators, and builders to decide which open areas need the benefit of new standards.

With the areas of need identified, priorities and schedules for standards development must be determined. The content of standards, the method of writing and the mechanism for approvals must be developed. This means that a systematic approach must be taken.

THE MARITIME INDUSTRY NEEDS TO DEVELOP THE CAPABILITY TO MANAGE A STANDARDS PROGRAM.

In the United States, standards have been traditionally developed and implemented voluntarily with the consensus support of those parties who were substantively involved. The participation by the Maritime Industry has been quite limited and consequently the benefits to the industry have been limited. Often the absence of a viable alternative standard has prevented a yard from rejecting a deleterious regulatory or owner requirement. Northern European and Japanese yards have at their disposal about 700 national shipbuilding standards which are used to describe any ship which they propose to build. These National Standards are supplemented by yard standards. Such a pool of applicable standards should be developed in the United States.

8. Recommended Action

If the Marine Industry would take the following recommended action steps, there would be distinct benefit to all. Successful Northern European and Japanese yards have done so. Successful segments of the vendor community have taken such action. Other segments of U.S. industry depend on standards as an asset to their business. The Marine industry should do likewise. The task team recommends the following action steps:

1. Develop and Support a National Shipbuilding Standards Program.

This should include

- a) publish a list of standards known to be in use in shipbuilding today.
- b) publish a list of existing standards including vendor, yard, design, and owner standards which could be used beneficially by shipbuilders.
- c) Develop standards to fill the remaining areas of need.
- d) Encourage yards to appoint a standards coordinator and to participate in a standards program.

2. Reactivate SNAME Panel SP-6 to act as a high level standards planning committee.

This group should be composed of executives representing shipyards, owners, vendors, designers and regulatory bodies. Their duties should be to develop the policy and the direction of a standards program.

They should:

- a) Establish objectives and time-phased goals for a standards program.
- b) Establish priorities and schedules for standards development.
- c) Supervise the operations of a standards writing and approval group.

3. Systematically encourage the Marine Industry to utilize standards.

Industry participation in the standards develop-merit and approval cycle should be sought. Yards should be encouraged to appoint a standards liaison person. The industry should be asked to share existing in-house standards which they feel should have broader application. Existing standards and specifications should be kept up to date. The impact of the Federal Government's policy apropos the imposing of standards should be evaluated.

None of these steps are revolutionary. All are in use in the United States today. Nevertheless, the negativists can mount an attack on these recommendations by showing that many obstacles exist. We agree there are obstacles. However, we feel that all these obstacles can be overcome with a reasonable level of effort. We feel that the long term financial benefits of a cooperative effort will be many, many times greater than the costs of the program.

To this end, a program plan is being developed which details how to implement these recommendations, and this proposal will show priorities, schedule dates and responsible parties. The BIW task team plans to submit the program plan to the Industry for review and input through the Society of Naval Architects and Marine Engineers. BIW plans to solicit Industry for their (task team) approval, in order to proceed on a sanction basis.

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