Excerpts from **–**

Shipyard Projects: Planning and Management

Insights, Lessons and Guidance

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[The following several excerpts of this manual are presented to give potential purchasers a sense of the breadth of the contents of the publication. These excerpts are a few of the short sections of the manual; longer sections addressing basic practices and general guidance are also in the book, as shown by the table of contents provided along with these excerpts.]

Introduction

Lessons Learned:

This book includes descriptions of numerous costly lessons learned by participants in the maritime industry in conjunction with shipyard projects. The availability of these "lessons learned" will enable readers to avoid having to re-learn such lessons at great expense to any currently involved organizations.

The organizations that have incurred contractual disasters or major setbacks in their shipyard projects, on which these lessons are based, include commercial ship owners, shipyards, design consultancies, government agencies, major vendors, subcontractors, classification, marine safety agencies, and vessel charterers.

A recurring theme of these examples and lessons learned is that mismanagement of any one topic, no matter how small, can completely destroy the economic benefits of the project for either or both the owner and the contractor.

Ship Owners' Challenges:

When ship owning organizations begin planning a major shipyard project (construction, conversion, mid-life refit, or repair), the planning process should commence by initially focusing on the pre-contract elements of the project. An excellent technical plan and an outstanding ship design will not guarantee a successful project if the rights, responsibilities and obligations of the parties are not well defined in the Contract Documents and effectively managed. For example, the absence of advance arrangements by the owner's team for a visa for an overseas technical representative caused a ship to remain out of service for several months. This minor oversight led to a major impact. (Remember that a ship is owned to provide a service; not to decorate the wharf of a shipyard.)

Owners have to be careful to avoid a fundamental mis-match between the technical requirements of the contract and the current capabilities of the shipyard. A shipyard's historic accomplishments may be less meaningful when there has been a turnover of project and supervisory personnel or when the shipyard has experienced a lengthy loss of continuous workload. Also, the condition of an existing ship being modified may not have been adequately assessed before the owner's team prepared the specification, later resulting in considerable contract growth.

Shipyards' Challenges

Similarly, when shipyards are considering taking on a new project, they have to be careful about the assumptions being made when "translating" the owner's bid package into a fixed price within a fixed schedule. There are potentially numerous pitfalls awaiting the over-anxious or over-confident shipyard. Shipyards anxious to maintain revenue streams may take inappropriate risks, leading to financial difficulties and sometimes an inability to complete the project. New building projects often are based on expected, but not yet routine, technological accomplishments. The shipyard may become obligated to purchase equipment with longer lead times than anticipated. The shipyard may not be familiar with the installation and testing requirements of the newer technologies (especially electronics) required by the owner.

There are many opportunities for shipyards to incur far greater costs than anticipated or included in the fixed price, fixed schedule contracts. A shipyard's insufficient budget allowance for collecting and using data during a project can be disastrous to the bottom line. For example, by neglecting to monitor steel temperatures when applying external coatings to a new VLCC, new coatings had to be applied twice over the

entire hull after removing defectively applied coatings.

1 General Observations – Causes of Project Problems

Most Common Causes of Problems: When I am asked to identify the most common underlying causes of problems that arise in shipyard projects, I point to two parties: ship owners and shipyards.

Ship-owning organizations rarely provide sufficient resources and lead time to prepare the technical specifications and drawings that are central to the project. As a consequence, either (a) the owner's organization finishes defining what it wants from the project after the project has already commenced at the shipyard, or (b) the shipyard and the owner find that the relevant conditions aboard the ship are far different from those assumed when preparing the repair or conversion specification, or (c) the owner's organization changes its mind about what it wants after the project has commenced. Also, owner-furnished equipment ("OFE") is almost always a basis of unexpected costs and schedule impacts.

Shipyards, too, often set themselves up for problems and costly challenges when they bid a job with insufficient investigation and analysis of the bid package (specifications, drawings and the draft contract). Often the estimators give unrealistically low values of labor hours and other cost components because they are thinking too competitively, or they are not familiar with the new-technology aspects of the project. The purpose of the estimate is to give shipyard management the most likely number of engineering and production hours, subcontract costs and material costs. Shipyard management will then make the competitiveness versus risk assessment to determine its bid. However, if the estimators already shaved their numbers to be competitive, management's bid will be skewed too low to be profitable.

Also, when shipyards bid for work that is different from other recently completed jobs, they tend to think there are only small differences that they will be able to work out in process, not realizing that the subtle differences in vessel design will have major productivity and cost impacts. Last, when commercial shipyards bid for work from a public entity, they almost always significantly under–estimate the massive amount of documentation and owner oversight that will become a very costly and delaying component of the project, unlike that of most commercial jobs.

Order of Technical Challenges: Nearly every shipyard project today is essentially an undertaking of cables and the equipment to which they are attached. The installation, connection and testing of cables and connected equipment for electronics, control, alarm, and monitoring, as well a power distribution, are the single biggest challenge of any such project. HVAC system installation and testing are the second biggest challenge. Following those two challenges are piping systems and mechanical systems. The next lower level of challenge is for outfitting. Development of the ship's structure, while large in manpower, is far simpler and less challenging than those other categories. The challenges of painting and coating are on par with the challenges of structure.

When detailed electrical design falls behind schedule, it is a bad omen for the project. When cable installation falls behind schedule, it portends costly and schedule-impacting challenges to the project. Thus, it is essential that both owners and shipyards aggressively address all of the tasks associated with the installation of any types of cables and the equipment to which they are attached: cable schedules, ordering, sequence of cable installation, component installation, individual testing, sub-system testing, system tests and ship trials. Also, don't ignore the possibility of electromagnetic interference between power cables and signal cables.

4 Small Differences Rarely Exist

Small technical differences = large impacts

When project teams (either shipyard or ship owner) are planning the execution of work or the installation of a replacement item of equipment, it is often (too often, in fact) assumed that any small differences from prior work or prior equipment will not affect the execution of the work or installation. This

is fundamental mismanagement: substituting a prayer and/or hope for detailed analysis and planning, as illustrated by these several examples.

(a) When an owner ordered two commercial-grade dishwashers to replace two household-grade ones, the owner failed to appreciate that the new ones required 220v, whereas the old ones were 110v. Unable to install 440v/110v transformers due to space and ventilation considerations, the old dishwashers had to be re-installed.

(b) During a routine repair project, although the 8" diameter of the deck vent connections were the same as piping below the new vent heads, the larger size of the new vent heads themselves interfered with handrails. This necessitated hot work to modify the handrails, when no hot work was expected. The incurred delays, mobilization costs, and fire watch duties were a surprise to all, but the owner was responsible since the vents were owner-furnished.

(c) A vessel owner specified the model numbers for two silencers as replacements on a vessel. The connection sizes and lengths were the same as the two older silencers. However, the diameters of the new silencers were larger than the previous ones, resulting in a lack of adequate space for the insulation to be applied. Other piping in the uptakes had to be re-positioned to accommodate the larger insulated silencers. This was the owner's responsibility because the owner had specified the model number. Also, when classification insisted on new flex connections, the shipyard pointed out that they had not been included in the specification, causing delay in final connections and testing.

(d) Two owner-supplied free-standing refrigerators were provided to the shipyard to replace two older ones in the galley of a service vessel. The dimensions were all compatible with the available space. The new refrigerators were top venting, whereas the older ones vented from the bottom/front. The tight fit of the refrigerators beneath the overhead would not be adequate for heat dissipation. Expensive modifications were necessary to incorporate the new refrigerators to achieve proper heat dissipation.

Observation: Each of these four examples tells a story of extra costs and schedule impacts arising due to faulty assumptions made during project planning, namely, that any small differences can be incorporated effortlessly. Obviously, those assumptions proved unsupportable.

The Lesson Learned: Assumptions are an inexpensive and quick — but unreliable — substitute for thorough analysis. When replacement components are being considered, small dimensions, basic connections, details of arrangements and a complete list of all materials needed for completion should be systematically addressed as much as the big dimensions, weights, flow rates, power requirements, etc.

19 Identify All Project Participants In Advance

The owner of an offshore construction support vessel, operationally limited to coastal waters, had already contracted to have additional equipment placed aboard the vessel to serve the needs of the new charterer. Subsequently, the classification organization advised the owner that the equipment changes implied that the vessels would be used in worldwide service, not in coastal waters only. Therefore, to remain in class, the vessel had to undergo substantial additional modifications to be suitable for such worldwide service. The planned one-month modification then became a very costly five-month conversion.

The Lesson Learned: Project planning should include reviews from all stakeholders and agencies from which approvals are needed, not from only the parties that have financial participation.

43 Consultancies Need to Define Their Deliverables

A client of a design consultancy wanted to procure a custom-designed luxury yacht. The owner wanted it to incorporate features envisioned by an interior designer who had no prior marine experience. The consultancy's design contract did not define the "level" of drawings it would provide to the client/owner for use in the vessel construction contract. Subsequently it was found that many of the interior designer's features could not be incorporated into the structure and operating systems of the vessel

without adding components and structures that made the vessel heavier and more costly to both design and construct than other luxury yachts of the same approximate size. The process of remedying those inconsistencies resulted in a greater design effort by the consultancy than anticipated.

Further, in response to the shipyard's requests, the client told the consultancy that the detailed drawings to be used by the builder were to have been part of the "package" of drawings, whereas the consultancy had expected that the shipyard would produce the detail drawings per industry custom and practice. However, the design contract did not address that issue, leading to the development of those drawings by the consultancy without benefit of an increased budget. The consultancy far exceeded its budget by the time it completed all of the detail drawings needed by the builder.

The Lesson Learned: Design consultancies should incorporate into their design contracts company-standard definitions of the products (drawings, calculations, etc.) that they intend to produce, and contractually state that they will not produce other products (e.g., detailed drawings) if that is not their intention. Those definitions should address content, scope, form, format, and timing of completion.

54 Subcontractor Capability Assumptions

A ship repair yard had been using a subcontractor to blast and paint both interior and exterior surfaces of vapor recovery piping when the yard took on an additional project involving comparable work. After removal of a large quantity of the 14" (355 mm) piping from the vessel, the shipyard brought it to the subcontractor's facility. However, the subcontractor did not have the capability to handle the large diameter piping, having worked only on piping of 10" diameter or less. At the last minute, the shipyard had to find another source to accomplish the work. Not finding a suitable subcontractor to have timely availability, the shipyard set up its own facility to accomplish the work, with all those setup and process costs being far greater than originally budgeted. Fortunately, the shipyard later recovered those setup costs by using the same new capability for several other projects.

As another example, upon receiving an order for three vessels, a shipyard subcontracted with another shipyard to fabricate several structural modules that would be barged to the prime contractor's facility. The subcontractor was extremely slow to start its portion of the project. The reason for the slow start was that it had run out of work several months earlier, dismissing its workforce. Having to rehire (when available) or train new hires, the actual fabrication was very slow. Consequently, the prime contractor had to turn to a different (more expensive) subcontracting shipyard at a distant location for several of the modules.

The Lesson Learned: For shipyards, before making a contractual commitment to a ship owner, it is necessary to confirm that any major or key subcontractor will not only be timely available, but have the capacity, techniques and workforce necessary for the work scope. If the prime contract is with a government agency, be sure the subcontractor can keep up with the required flow of paperwork, too.

Note that the description of the subcontractor's steel modules delay is an example of mismanagement; that is, making decisions based on hopes and prayers rather than fact gathering and careful analysis. At times, a promise from another party appears to be the solution to a developing problem, thereby encouraging the blind acceptance of that promise. Organizations should not allow another's unsupported promises and their own prayers to be the basis for a "solution" to challenging problems when effective performance is at risk.

62 Allowing for Multiple Locations

In response to a request by a local shipyard, a classification organization committed to a certain fee schedule for class surveys during construction of two small vessels. However, while the design work was accomplished at the facility near the classification offices, actual construction was at another facility, several hours away. The classification travel costs ended up exceeding the survey costs, but the class

organization could not alter its fee commitment or otherwise recover those costs.

The Lesson Learned: Inasmuch as vessel builders routinely have parts or all of vessel construction accomplished at multiple sites, service providers should not make assumptions as to where their services will have to be rendered. This lesson also applies to location of equipment deliveries. Every involved party should ask the purchaser of services or equipment, where will these services be performed, or where will the equipment be delivered.

68 Lower Costs vs. Warranty

The operator of a fleet of small service craft was advised that the injectors on a propulsion engine needed replacement due to the very irregular loading on the engine. To save on costs of replacement parts, it was assessed that the condition of the existing injector seals allowed them to be reused when the injectors were replaced. It was subsequently learned that such a procedure voided the engine manufacturer's warranty because the maintenance manual clearly stated that the seals must be replaced when the injectors are replaced. The warranty had "evaporated" when the old injector seals were reused.

The Lesson Learned: When consideration is being given to take irregular or unusual actions involving maintenance of a vessel in order to achieve cost savings, all of the stakeholders should be identified and consulted prior to finalizing the decisions. In this case, since the engine was still under warranty, the manufacturer was still a stakeholder, but now the warranty was voided.

76 Who is Coming, and from Where?

A government agency purchased a new-technology 3-d printer from a distant supplier to reduce the lead time for procurement of replacement parts for older ships. It worked wonderfully, for a while. Then it needed servicing. The agency issued a purchase order to the manufacturer for a technician to come and provide the necessary service. However, due to rules and procedures of the border-control agency, it was nearly one full year before the service technician could enter the country, leaving the ship in a less-than-fully-functional condition for most of a year.

The Lesson Learned: In this period of heightened border-security concerns, organizations may have to look ahead at the possibility of needed service technicians to support already-purchased equipment. That consideration may alter the outcome of the selection of an equipment supplier. Reasonably rapid availability of service technicians may have to become a make-or-break criterion in the equipment-selection process.

78 Why is it "Better"?

Often during development of a part of the contract specifications or drawings by one person, another person in the same organization will suggest an alternate detail or alternate process because the suggested alternate is "better". Taking that advice without inquiry creates risk. The inquiry should focus on the criterion that is being used to make the judgement that the offered detail or process is better. Is the basis of "better" due to one of these considerations: weight, size, noise, cost, power requirements, maintenance requirements, ease of construction, ease of integration, ease of maintenance, earlier availability, easier access, or use of local suppliers/subcontractors? The initially conceived element of design or specification may have been selected based on a different criterion than that behind the new suggestion. Thus, before finalizing that decision about design or specification, a determination needs to be made as to which criterion is more important to the success of the project.

82 Avoiding Subcontract Inconsistencies

A shipbuilder took on a contract to provide a special service vessel for which the smoothness of the hull surface had to meet an unusually high standard. The builder used a subcontract shipyard for the provision of several hull modules that were to arrive with construction primer, not final coating. However, the surface of the delivered modules did not satisfy the smoothness standard; it had not been defined as a requirement in the subcontract. The builder incurred

extra costs and delays to remedy the inconsistency of the modules' hull smoothness. Also, it was learned that the shipbuilder did not have their own inspectors at the subcontractor's facility.

The Lesson Learned: If the builder had sent inspectors to the subcontractor's facility, the deficiency in the subcontract requirements would have been identified before the first of the modules left the subcontractor's facility, and could have been remedied then and there. Subsequent modules would have satisfied the new requirement, possibly through a modification to the subcontract. The rush to get the subcontractor working on the modules led to an incomplete transfer of contractual responsibilities: The prime contract's smoothness requirements were not duplicated in the subcontract. Avoiding possible delays by rushing to get a subcontract started often results in more extensive (and costly) delays later.

87 Risks at Exposed Anchorage During Refits

A semi-submersible drill rig was to be modified for the next charterer. In order to avoid paying for shipyard fees and its higher labor rates, the owner arranged for the vessel to be anchored in an exposed anchorage several kilometers from the nearest dock, using a second vessel anchored nearby as an assembly staging area and accommodation for the labor staff. The actual project schedule far exceeded expectations due to delays in transporting workers between vessels, and delays arising from the need to use man-lifts that were affected by vessel motions in the seaway. This significantly reduced the daily productivity of workers. Also, use of the heavy-lift ship that placed new modules onto the rig was stretched over many extra, very expensive days due to the same vessel motions. Nearly all of that reduced productivity and the encountered delays would have been avoided by having the project undertaken at a shipyard in protected waters.

The Lesson Learned: A carefully considered pre-project risk analysis would have identified the likelihood of such delays and extra costs. Sea conditions during the planned refit period, and the anticipated vessel motions resulting from such sea conditions, could have been addressed by professionals. The decision to use the exposed anchorage with no dock and no shore-based accommodations is a clear example of mismanagement: substituting a prayer and/or hope for detailed analysis and planning.

96 Lack of Specification Creates Costly Surprises

One of the main engines on a twin-screw tug experienced a major failure while operating in a remote location, necessitating a complete engine replacement. To save time of diverting the tug to home port on a single engine, the owner took the vessel to a shipyard near the tug's current, remote deployment. The shipyard acknowledged that it did not have the skills to install a new engine, but would use an owner-approved subcontractor. Upon bringing the tug up the marine railway, the shipyard immediately commenced cutting an access hole into the side of the tug for engine switch-out. The shipyard-ordered replacement engine arrived just as the owner's representative arrived a week later. Upon arrival the owner's rep was surprised by two matters. First, the access cut was on the incorrect side of the vessel. Second, the vessel owner also had ordered a replacement engine that had already arrived, too. (The engine supplier had not questioned the orders, since it assumed that both engines on the tug were being replaced.)

The Lesson Learned: Due to considerable pressure to return the tug to service as promptly as possible, the project had commenced based on a series of emails and phone calls. Clearly, there had been a lack of sufficient communication due to the rush to have the replacement engine installed. These costly errors were not the shipyard's fault, since there was no formally prepared specification that defined the correct side of the vessel, or defined which party was to order the replacement engine. This is, once again, an illustration of the risks that can develop when standard procedures – preparation of a formal specification – are ignored due to the pressure of time.