the intent of the contract, which intent was stated above, namely, at the time of Vessel Delivery the Purchaser receives the ship and 100% of the other deliverables, but the Contractor will have received a lesser percentage of the total contract price per the contract retainage. In other words, the Contractor is implicitly seeking a waiver of the requirement to deliver the ship in a complete and fully functional condition. In that case, the Contractor should not receive all the funds that otherwise would have been paid at the time of Vessel Delivery.

The Purchaser may grant that implicitly requested waiver if the contract retainage is ample to cover all of:

- the correction of those deficiencies
- all warranty corrections, and
- any possible liens or claims by subcontractors and vendors. However, such granting of a waiver creates risks if the Contractor does not correct the outstanding deficiencies. Under other clauses, the Purchaser may not have the right to use the contract retainage to rectify items, which clearly were not warranty items, because they didn't break *during* the warranty period.

It is recommended that the Agreement allow the Purchaser to create a special retainage for each such uncorrected pre-delivery deficiency in order to give the Contractor incentive to have that deficiency corrected during the first half of the warranty period. At the end of the first half of the warranty period, any such special retainages are paid to the Contractor if the corresponding deficiency has been corrected. If it is not corrected by that time, the Purchaser can use those funds to have it corrected during the second half of the warranty period. The reason for that time limit on the expenditure by the Purchaser is, again, that the temporary business and legal relationship is expected to conclude at that time.

9.2.32 Technical Project as Basis of Agreement

The previous sub-sections of this section on Formation of the Shipbuilding Agreement have discussed the purpose and concerns of a number of the clauses of a typical commercial shipbuilding agreement. Other clauses may also be appropriate if they are not already included in the Terms and Conditions of the contract documents. Government contract forms will vary considerably among the many possible government agencies (federal, state, local, educational institutions, quasi-governmental agencies, etc.), but will all contain the equivalent of the clauses discussed above, as well as possibly others that are required by the agency's procurement regulations.

When a set of contract documents is being developed, the Agreement and Terms and Conditions are usually built up from a previous set of similar documents. If, however, the nature of the vessel acquisition is going to be significantly different, then the use of the prior documents as a starting point has to be addressed more carefully. For example, if the prior acquisition was for a ship of the Contractor's standard design, and the new acquisition is for a unique design, there are many aspects of the Agreement that will have to be modified. If the contractor has never constructed a ship of the type being acquired, a more-rigorous set of checkpoints may have to be incorporated into the Agreement and the supporting Specifications

Essentially, besides establishing a temporary business and legal relationship between the Contractor and Purchaser, the Agreement and the supporting documents should identify potential risks (technical, financial and schedule) assign responsibility for avoiding those risks, and address the consequences if those risks are not satisfactorily avoided. Thus, the nature of the technical project and the risks associated with its achievement are the most important factors in the creation of the contract documents. The entire set of contract documents must be integrated and consistent with each other, but primarily must be appropriate to the technical aspects of the project.

9.3. FORMATION OF CONTRACT SPECIFICATIONS AND PLANS

9.3.1 Introduction

The Contract Specifications and the Contract Plans are technical documents, which are non-ambiguously identified in the Agreement by those titles. The purpose of those documents is to define the technical products or deliverables, which the Contractor is to provide to the Purchaser. The Agreement, or perhaps, but not preferably, the General Section of the Specifications identifies the regulatory requirements and classification rules that are to be satisfied incorporation of certain design and construction features into the vessel. Those design and construction features arising from regulatory requirements and classification rules however, essentially are generic, not unique to the vessel being acquired under a specific contract. Many of the design and construction features identified by the Contrac Specifications and Contract Plans are unique to the essel, making it different from other vessels. These documents may also define other features that are not necessarily uniqu for this vessel, but are not included in the regulatory requirements and classification rules

Thus, the Contract Specifications and the Contract Plans as components of the contract documents, define the hear of the project and possibly make it different from other ship construction projects to the appropriate extent. This section

first addresses the intent and limitations of those documents and then generally addresses the components within those documents as well as special concerns associated with several of those components. This subchapter, however, is not a substitute for a course of study neither on specification preparation nor on the development of plans.

9.3.2 Non-Included Features

The Contract Specifications and Contract Plans define the unique features of the vessel and other non-unique features that are not already addressed by the appropriate regulatory requirements and classification rules. It was pointed out in the first section under the topic of Decision-Making Authority, that numerous details, which are not already defined in the Contract Specifications and Contract Plans will have to be developed by the Contractor after the contract is executed. Except for unusual cases, when the parties executed the shipbuilding contract, the authority to make those additional decisions as to the form of the numerous details was passed from the Purchaser to the Contractor. The Purchaser's naval architects and marine engineers who are developing the Contract Specifications and Contract Plans must keep in mind that they will have yielded to the Contractor the right to make those decisions.

Thus, if the exact form of any lesser details is important to the Purchaser, the Contract Specifications and Contract Plans should describe them to an appropriate level of detail. If such details are not already incorporated into the Contract Specifications and Contract Plans generally the Purchaser will have to accept the Contractor's *solution* to those details. The Purchaser's staff should bear in mind that it is most likely the Contractor will be seeking minimum-cost solutions to those technical details when working under a fixed-price contract.

The Purchaser's naval architects and marine engineers should not use the drawing review process as a mechanism to impose on the Contractor a more-expensive solution if the Contractor's solution is in all regards consistent with the contract documents. For example, if the form of mounting an item of equipment on a deck is important to the Purchaser for reduced noise transmission, that form of mounting cannot be announced after the Contractor has prepared drawings or even after the contract has been executed. Rather, because the form of mounting to minimize noise transmission likely will cost more than another form of mounting, the Contractor should have been given the opportunity to consider it before developing its bid price for the work.

9.3.3 Identifying the Required Type of Specification

In general, there are three types of specifications

1. design or end product specifications
2. performance specifications; and
3. procedural specifications

Each of these three types of specifications leads to a different assignment of responsibilities between the Purchaser and the Contractor. A typical Contract Specification will include, for all the different aspects of the ship, more than one type of specification and may even include all three types. The type of specification used for the hull form for example, can be entirely different from the type of specification used for the ballast pumps.

A design or end product specification is a representation by either drawings or verbal descriptions or both, of what that aspect of the ship should look like upon completion. The use of a Contract Plan for the hull lines serves to define the form of the hull from which the Contractor cannot vary. The hull form may be subject to variance if confirming model tests are to be conducted by the Contractor. Another example of a design or end-product specification may be for hull coatings. The Contract Specification may define the type, composition and color of the coatings, as well as perhaps the manufacturer, and then go on to define the thicknesses of each of the primer, undercoat and topcoat. That is, the final configuration of the coating layer-by-layer, has been defined by the Contract Specifications. An associated procedural specification as discussed below, establishes the criteria for appropriate surface preparation and material application.

A performance specification on the other hand, does not in any way describe what the object will look like, but instead will describe how it is to perform. A specification for the ballast pumps on a ship, for example, could state that the two ballast pumps shall each separately be capable of pumping into and out of the ship's ballast tanks a certain number of tons of ballast water per hour. Thus, the shape, material content, and weight, among other parameters, for each of those pumps will be selected by the Contractor provided that each can pump the required number of tons of ballast water per hour. Note, too, that a loosely written specification for two ballast pumps of equal capacity may even result in two different brand names; it is all at the discretion of the Contractor under a performance specification. The Purchaser can write a *tighter* specification to avoid that two-brand possibility. See the sub-section, below, on Brand Names or Equal to supplement this discussion.

A procedural specification usually supplements one of the two other forms of specification by defining part of the procedure that is to be followed in achieving the other part

of the specification either in the design process or the construction stage. An example of a construction procedural specification pertains to coatings the design specificatio for the coatings, as described above, may be supplemented by a procedural specification that requires the Contracto to apply the coatings in accordance with the practices recommended by the coating manufacturer pertaining to surface preparation, air temperature, steel temperature, relative humidity, direct sunlight, wind speed, etc.

An example of a design procedural specification ma relate to power and signal cables. The design of the cable trays may be solely at the discretion of the Contractor other than regulatory requirements and classification rules. That is, the cable trays are defined by a performance specific tion. However, that performance specification may be sup plemented by an applicable design procedural specificatio which may state that when designing the cable trays, the Contractor shall also comply with the requirements of an identified electro-magnetic interference (EMI) standard t ensure that the EM emissions of po wer cables do not interfere with the signals within the control, alarm and monitoring cables.

The naval architects and marine engineers who develop the Contract Specifications and Contract Plans for the Pur chaser can select whichever form of specification best suit the needs of the project for each item and each aspect of the ship. However, it is their responsibility to ensure that all of those specifications are compatible with one anothe . For example, if the EMI procedural specification requires t o levels of cable tray to avoid the interference, the ship's basic design by the Purchaser's staff will have to provide ample space for those two levels; otherwise the requirements imposed on the Contractor may be impossible to achieve.

9.3.4 Standard Forms of Specifications

The technical Contract Specifications can be arranged i nearly any sequence; but there are standard sequences that have been used by industry in v arious countries. In the United States, for example, the U.S. Maritime Commission in the 1930s and 1940s, followed by the U.S. Maritime Administration in more recent years, have developed and used a standard set and sequence of section headings, as indicated in Table 9.V. Each of those section headings includes multiple standard sub-headings (not sho wn herein due to size and number).

The value of using a standard group of headings and a standard sequence is that both shipo wners and ship yards have become accustomed to using those standards. Of course, many of the section headings in Table 9.V may not be applicable to every project, and thus those section numbers should not be used. Other widely used standard specification headings can be used as well. A major benefit o starting with a standard is that is reduces the likelihood of inadvertently omitting some specification items Additional sections for special shipboard features can be added by selecting section numbers that are not already used.

As to the actual content of the sections, distinct from the headings, it is noted that generic guideline, example or standard specifications also h ve been developed and published by many organizations worldwide. Sometimes those published specifications are quite helpful to persons dveloping specifications for a particular aspect of a ship for the fir time. A review of such publications by specification writer will help assure that salient points will be addressed in the new specification though it is not necessarily as suggested by the guidelines. When the ship type, or the system within the ship, is innovative or represents a new application of existing technology, the final specification may ve only faint resemblance to the previously published specifications

The U.S. Na vy, for example, has used its *Gen Specs*, being general or standard specifications for its use in defin ing particular aspects of the intended product in naval construction. With rapidly developing materials technology and innovative design concepts, however, those Gen Specs do not appear to be relevant to each new class of vessel as they once had been. Since the mid-1990s, the U.S. Na vy has been relying less on these Gen Specs and more on specifi cations developed for the particular vessel design, materials technology and application concepts being employed in the development of its newest ships. That Gen Spec should not be confused with the section of general specification contained within most contracts.

The U.S. Maritime Administration has published *Guideline Specifications for Merchant Ship Construction.* The most recent edition (1995) is intended as a helpful generic package for ship operators and shipb uilders who will design specific commercial ships. That publication states, *"These specifications can be used as starting points for the preparation of construction specifications for any type of ship. …. [They] are intended to provide guidance to the maritime industry for the preparation of specifications. …. They cover all aspects of potential contract work, but may require modifications, as appropriate, to the ship design being contemplated."*

Recognizing that the value of such specifications has di minished due to numerous de velopments, the U.S. Maritime Administration no longer intends to update its published specifications

Because published specifications from any source, are only generic, guideline, example or standard, the contract specification has to be more supportve of the exact ship type

TABLE 9.V Possible Specifications Section Headings

1 General
2 Structural Hull
3 Houses And Interior
4 Sideports, Doors, Hatches,
5 Hull Fittings
6 Deck Coverings
7 Insulation, Linings And Battens
8 Kingposts, Booms, Masts, Davits
9 Rigging and Lines
10 Ground Tackle
11 Piping--Hull Systems
12 Air Conditioning, Heating and Ventilation
13 Fire Detection And Extinguishing
14 Painting and Cementing
15 Na vigating Equipment
16 Life Saving Equipment
17 Commissary Spaces
18 Utility Spaces and Workshops
19 Furniture and Furnishings
20 Plumbing Fixtures & Accessories
21 Hardw are
22 Stowage & Protective Covers
23 Miscellaneous Equipment Stowage
24 Name Plates, Notices andMarkings
25 Joiner Work and Interior
26 Stabilization
27 Container Stowage and Handling
50 Main And Auxiliary
51 Main Diesel
52 Reduction Gears and Clutches—Main
53 Main Shafting,Bearings, Propeller
55 Distilling Plant
56 Fuel Oil
57 Lubricating Oil
58 Sea Water
59 Fresh Water System
60 Feed and Condensate
61 Steam Generating
62 Air Intake, Exhaust and Forced Draft
60 Feed and Condensate
61 Steam Generating
62 Air Intake, Exhaust and Forced Draft
63 Steam and Exhaust
64 Machinery Space
65 Air Conditioning & Refrigeration Equipment
66 Ship's Service
67 Car go Refrigeration—Direct Expansion System
68 Liquid Cargo
69 Cargo Hold Dehumidificatio
70 Pollution Abatement and Equipment
71 Tank Level Indicators
72 Compressed Air
73 Pumps
74 General Requirements For Machinery Pressure Piping
75 Insulation—Lagging For Piping and Machinery
76 Diesel Engines Driving Generators
78 T anks—Miscellaneous
79 Ladders, Gratings, Floor Plates, forms & Walkways in Mach'y
80 Engineer's and Electrician's shops, Stores And Repair
81 Hull Machinery
85 Instruments and Miscellaneous Boards—Mechanical
86 Spares—Engineering (Crating And Storage)
87 Electrical Systems, General
88 Generators
89 Switchboards
90 Electrical
91 Auxiliary Motors and Controls
92 Lighting
93 Radio Equipment
94 Na vigation Equipment
95 Interior Communications
96 Storage, Batteries
98 T est Equipment, Electrical
99 Centralized Engine Room and Bridge Control
100 Planning And Scheduling, Plans, Instruction Books,
101 T ests And Trials
102 Deck, Engine and Stewards Equipment and Tools,
103 Requirements For Structure-borne Noise

Appendix A: Owner Furnished Equipment

and the newest materials technology to achieve the intended result. Also, because published specifications try to be ap plicable to multiple ship types and multiple situations, it is likely that the contract specifications could be briefer tha the published ones. Specification writers should be cautious however, regarding the goal of achieving brevity in their work. It sometimes appears that due to the absence of information deleted for the sake of brevity, such shortened, and thus possibly ambiguous, specifications may lead to disputes

9.3.5 Contract Deliverables

At the beginning of this section it w as stated that the purpose of the Contract Specifications and Contract Plans is t define the technical products or deliverables which the Contractor is to provide to the Purchaser Note the use of the plural of “technical products or deliverables.” The Purchaser is paying the Contractor not only for the ship itself, but also for numerous other deliverables. Without many of those other deliverables, the ship by itself is not completely usable or maintainable by the shipowner. Some of those deliverables are defined by the applicable r gulatory requirements and classification rules. The rest have to be defined by the Agreement, primarily the financial del verables, or the Contract Specifications primarily the technical deliverables.

The contract deliverables, other than the hardware of the ship and spare parts, will take many forms. Some of the deliverables will be engineering calculations, trim, weight and stability calculations, finite element analyses fatigue strength calculations, electrical load and fault-current analyses, heat-load and heat-balance calculations, among others.

Some will be dra wings, detail plans for re view, classification-appr ved plans, as-built/as-fitted dr wings, and others); some deli verables will be copies of ship yard

correspondence with classification and r gulatory bodies; some will be certificates from classification and gulatory bodies, and possibly from others. Some deliverables will be test and trial agendas and subsequent reports, and some will be warranty forms from v endors and others; and some deliverables may be shipyard scheduling information, hazardous waste disposal records, insurance information, among many other possibilities. This list is by no means complete.

The completion and deli very of each of those deli verables from Contractor to Purchaser represents a source of costs to the Contractor If each of them is to be accomplished, the Contractor must know about them prior to bidding or pricing the work in order to have the budget available for each of them. Accordingly, the persons developing the Contract Specifications for the Purchaser must ensure that each suc deliverable, hardware, drawings, calculations, correspondence, computerized files etc. is identified as a require deliverable in the documents made available to bidding shipyards from the outset. All of the deliverables, besides the ship itself, have to be defined by the contract documents or th y are beyond the work scope requirements of the Contractor.

9.3.6 Defining the Complete Scope of Work

In addition to the ship, the spares and all the other contract deliverables, the entire scope of w ork which the Contractor will have to undertake needs to be defined to the xtent that there is sufficient information in the bid package or a the time of contract ne gotiations such that the Contractor can identify and estimate all sources of costs. In other words, if an shipowner's requirement for any information, materials or special tests will cause the Contractor to incur costs, such items must be separately identified in the contract doc uments as a Contractor responsibility.

Some examples of such items are:

- the payment of fees for classification and rgulatory approvals, if needed,
- confirming model tests if th y are to be accomplished after contract signing,
- maintenance of a detailed weights-and-centers spreadsheet for every item of equipment if appropriate,
- rental of testing equipment if it will be needed (test weights, electrical load banks, etc.), and
- any special testing requirements on shipowner-furnished equipment that the Contractor has to perform.

There are some aspects of technical specifications tha cannot be glossed over without increasing the likelihood of some consequential disputes. A negative example, one to be avoided, is illustrated by the follo wing wording taken from a recent specification. "*All work necessary to perform the specified work shall be deemed to be part of the specified work whether specified or not.*" This was an attempt by the specification writers to co vey to the Contractor the responsibility to make everything complete and functional at no extra cost to the Purchaser However, such wording is too broad to be usable for estimating and pricing, and thus likely could not be enforced in court.

The intent may ha ve been to include, for example, the unspecified supply and installation of remote motor con trollers for some of those electrical motors defined by th specifications. But inasmuch as the specification writer h information particular to the specified moto , that writer was in a better position to kno w if a remote motor controller would be needed. When estimating the work scope, the Contractor would not automatically know that a remote motor controller would be required, and thus the cost of it would not be included in the fi ed contract price.

A Purchaser should not rely on requirements such as *first class marine practice* or *best marine practice* or other ill-defined phrases in order to ensure quality of material selectio or quality of workmanship. Highly subjective requirements, phrased as those, are not conducive to quantitative estimating, and thus cannot be included in the price of the shipbuilding contract.

It should be remembered that, in soliciting bids or requesting pricing from a potential Contractor, the Purchaser is seeking quantities, quantities of production hours, material costs, subcontractor costs, facility and equipment costs, and schedule days. Accordingly, all aspects of the Contract Specifications and Contract Plans must be suitable for *translation* into such quantities. Broad concepts, such as the negative example given above, are not directly translatable into quantification prior to accomplishment of most of the re maining design de velopment, and thus do not constitute well-defined specification

9.3.7 Shipyard Schedule and Updates

Many requests for proposals or similar solicitations by shipowners from bidding shipyards require that a preliminary schedule be supplied with the bid to ensure that the bidder has an understanding of the work scope comparable to that of the Purchaser's staff. It is common, but not necessary, for the contract documents to require that the Contractor provide the Purchaser with a detailed schedule within a stipulated period of time after contract e xecution. There are many reasons why the Purchaser' s staff wishes to see that schedule, some of which have been discussed in Section 9.2 (see the subsection on Project Schedule) and some of which are discussed in the follo wing subchapter 4 on Management of Contracts During Performance.

The Contract Specifications may present more detailed requirements for the project scheduling to supplement the general requirements of the Agreement. The more detailed requirements may address, for example, the use of separate activities for each of engineering, procurement, installation and testing for each item of equipment. The necessity of providing the Purchaser with updates may be supplemented by stating that such updates shall be made periodically, the period depends on the particular project, or more frequently if major changes have been agreed upon.

If both the Agreement and the Contract Specification address the Contractor's responsibilities regarding project schedule, it is essential to ensure that they complement one another and do not conflict

9.3.8 Engineering Design Responsibilities

In Section 9.1, the subsection on Decision-making Authority pointed out that between the Contract Specifications an Contract Plans, on one hand, and the shipyard's detailed plans or working drawings, on the other, numerous developmental design decisions likely will have to be made. Some of them will be guided or controlled by the regulatory requirements, classification rules or identified standard such as industry standards or Mil Specs, but many others are not so guided or controlled. In almost all shipbuilding contracts, when the parties executed the shipbuilding contract, the authority to make those decisions was passed from the Purchaser to the Contractor. The only residual decision-making authority that the Purchaser retains is indirect confirmation through review of the detail plans or working drawings.

From the shipyard's perspective, however, that decision-making authority is a mixed blessing. It is appreciated by shipyards because it gives shipyards the authority to seek least-cost solutions to ship production. In contrast, however, it puts them at a disadvantage when bidding the work because each shipyard does not know with certainty how much economy, compared to the Contractor's competitors, it will be able to build into the vessel though the use of such opportunities.

A shipyard is put at a further disadvantage when it has responsibility for significant design development because it must use or hire naval architecture and marine engineering design staff or subcontractors to accomplish that design development. This creates risks for the shipyard because the naval architects may be more likely to perfect the vessel's performance attributes or operational efficiency instead of making the ship more economically producible (see Chapter 14–Design/Production Integration).

The Purchaser's staff, when developing the Contract Specifications and Contract Plans should bear in mind the shipyard's general wariness at having to incur such risks arising from undertaking significant design development. This does not mean that a Purchaser must allow the Contractor to avoid that responsibility, but it does mean that the Purchaser, through the Contract Specifications and Contract Plans must ensure that it is perfectly clear that the Contractor will, in fact, have those responsibilities as appropriate to the project.

Accordingly, the Contract Specifications or the Agreement must clearly define the Contractor's responsibilities to perform all the engineering and design development tasks necessary to translate the requirements of the contract documents into material procurement, equipment procurement, detail plans, working drawings, and production plans, all of which are then used for ship production. If the Purchaser is not going to be providing any additional engineering or design support for the project, it might be best to clearly state, rather than merely imply, that no additional design information is being provided by the Purchaser.

When the Purchaser is assigning to the Contractor such responsibilities, the Purchaser's technical staff should be mindful of the fact that they will no longer have control over those decisions. If the Purchaser's technical staff is concerned that the Contractor may find means of making the ship construction too economical to suit the Purchaser, then *tighter* or more-detailed specifications should be developed for those particular aspects of the ship that are of greatest concern to the Purchaser. A Purchaser's technical staff should be cautious when responding to a Contractor's request for additional design information by means of *clarifications*. This may be symptomatic of the Contractor's reluctance to undertake the design effort that it is contractually obligated to accept. Further, it may lead to allegations by the Contractor that the design information, if provided by the Purchaser, implies a greater work scope than otherwise required, thus necessitating a Change Order.

9.3.9 Brand Names/ Or Equal

One mechanism that is often used in Contract Specification developed by the Purchaser is to identify a particular brand name and model number of an item of equipment, and then state that the Contractor must provide and install that particular item *or equal*. The intent, by the Purchaser, is to ensure that a certain quality is achieved. While this may be a worthwhile effort, it may not lead to the Purchaser's expected results for any of several reasons.

When an *or equal* mechanism is utilized in the specifications, the specifications usually reserve to the Purchaser the right to accept or reject the substitution proposed by the Contractor. The Purchaser can minimize the likelihood of a misunderstanding of what will or will not be acceptable by giving greater definition. In particular, the Contract Spec-

ifications could define what parameters are going to be co sidered when determining if a shipyard-offered substitution is truly *equal*. For example, the parameters that could be important for a motor/pump combination on a high-speed passenger ferry likely would be different than those being considered for a large tanker. Table 9.VI presents a partial list of parameters that might be considered in such situations; other parameters would be appropriate for other forms of equipment.

Another mechanism used in shipb uilding contracts to limit the choices for equipment that will be made by the Contractor is to negotiate or include a *maker's list* for various items. The maker's list identifies the brand name and mode of equipment that is included in the base-line design.

Some maker's lists will include more than one possible brand name and model for several particular items of equipment. Whether or not the Contractor has the right to seek an equivalent to the items on the mak er's list must be defined in the contract documents; without such clarificatio the Contractor may interpret that it does ha ve such rights and the Purchaser may interpret that it does not.

TABLE 9.VI Selected Parameters for Determing Equivalency of Combined Pump/Motor

Maximum Continuous Rate of Output
Maximum Peak Rate of Output
Pressure at Various Rates of Output
Materials of Construction
Weight
Audible Noise
Vibration Transmission
Mean Time between Failures
Metric or Non-metric Fittings
Electrical Feedback Characteristics
Controllability of Rate of Output
Power Requirements and Efficien y
Availability of Spare Parts
Availability of Tech Rep's
Proven Marine Experience
Manuals in the Selected Language
Ease of Maintenance
Commonality with Purchaser's Fleet

9.3.10 Review of the Contractor's Equipment Selections

In Section 9.2, the Purchaser's review of the Contractor's detail plans and/or w orking drawings has been discussed. In a similar manner, some Purchasers may seek to re view the Contractor's selection of major items of equipment that are not already identified by brand name and model num ber, or are not covered by an *or equal* clause, or are not included in a mak er's list. The purpose of the Purchaser' s pre-purchasing review of the Contractor's purchase technical specifications that will accompa y a purchase order is to ensure that the Contractor's interpretation of the Contract Specification s requirements pertaining to that item of equipment is compatible with the Purchaser' s interpretation. If the Purchaser seeks to have this right of an advance review of the purchase technical specifications for selected item of equipment, the contract documents should create that right, remind the Contractor to provide the purchase technical specifications on a timely basis so as to not delay th schedule, and indicate the period of time that the Purchaser has to conduct such review.

As with the review of the Contractor's detail plans and/or working drawings, some Purchasers may try to use this review process to *persuade* the Contractor to adopt the Purchaser's interpretation when, in fact, alternate interpretations may also be valid. When the contract was executed, the Purchaser not only gave the Contractor the responsibility to select that item of equipment, but also gave the Contractor the right to select it to maximize the benefit to the Contracto . The burden of demonstrating that the Contractor -selected item is not compatible with the contract documents lies with the Purchaser. If the Purchaser can show that the Contractor-selected brand name and model does not satisfy the contractual requirements, the Contractor must re vise its purchase order to achieve such compliance.

In some cases, the process of such review may lead the Purchaser to appreciate that, although the Contractor's selection is consistent with the contract documents, the Purchaser now sees that such a v alid, alternate interpretation of the contract documents leads to a less-than-satisfactory equipment selection. The Purchaser may then seek to use this review process as a basis for requesting a Change Order to achieve a more-satisfactory equipment selection. How ever, this action by a Purchaser may result in higher costs, delays, impacts on drawings and engineering, and secondary impacts on other contract deliverables.

9.3.11 Resolution of Interferences

Composite drawings present isometric vie ws of spaces or compartments within the ship, including scaled representations of all structure, equipment items and distrib utive sys-

tems. If prepared in advance of physical construction, composite drawings can identify physical interferences that would result from the use of unmodified Contract Specificatio and Contract Plans. Today 3D product models can perform the same function. It is not a common practice for the shipowner's naval architects and design engineers to prepare composite drawings of the structures, items of equipment and distributive systems shown in and/or described by the Contract Specifications Contract Plans or other contractually-defined standards. Thus it is possible, if not likely, that interferences between elements of the contract design will result from a strict interpretation of the contract documents.

In the event that the resolution of such interferences has an impact on the productivity of the shipyard's crafts, the Contractor may look to the Purchaser for compensation for that rework or temporarily-reduced productivity. To avoid that situation, either the Agreement or the Contract Specifications could advise the Contractor of the possibility of such interferences, require the Contractor to not undertake physical construction until the possibility has been examined and addressed, and further require that the resolution of such interferences are to be achieved by Contractor at no additional cost to Purchaser. In ship conversion or repair, the Contractor could be given access to the vessel for a pre-bid ship check to identify potential interferences if the Contractor is responsible for the correction of them at no additional cost.

9.3.12 Inspection of Contractor's Workmanship

The Agreement, as discussed in Section 9.2, usually includes a clause which establishes the right of the Purchasers' representatives to have access to the vessel and shops, including subcontractor sites, and to inspect work in progress. The use of inspection deficiency reports, or quality deficiency reports, has also been addressed in Section 9.2 in the section on Inspection of Workmanship and Materials. Inspection deficiency reports should only be issued if the Purchaser's representative can point to a part of the Contract Specifications or Contract Drawings with which compliance has not been achieved.

Many Contract Specifications state that the Contractors workmanship shall be adjudged by the Purchaser's representative, and only that individual shall have the authority to make a determination of satisfactory workmanship. However, if there is no other identified standard against which the workmanship will be measured, the Contractor is effectively being asked to work to the unwritten standards in the mind of that Purchaser's representative. This is often an unsatisfactory mechanism, since the Contractor cannot know in advance what standard will thus be applied.

Accordingly, the Contract Specifications should include sufficient information to provide a non-ambiguous basis for determining if the Contractor's workmanship is adequate. Certainly the workmanship must satisfy the applicable regulatory requirements and classification rules. The workmanship must also satisfy any applicable standards that are identified in the contract documents usually in the Contract Specifications or in the Agreement. These referenced standards may be marine industry standards, professional society standards, such as SNAME standards, well-distributed government standards, such as U.S. Navy Mil Specs, or even standards that are applicable but not necessarily unique to the marine industry. The Agreement or the General Section of the Specifications typically contains express language requiring the Contractor to correct, at no additional cost to the Purchaser, any workmanship or materials which fail to meet the standards.

The lack of an identified standard against which workmanship can be judged creates risks for both parties, which risks may result in disputes, an unsatisfactory product, rework and delay. Thus, the developers of the Contract Specifications should take the time and effort to include therein the standards against which the on-site Purchaser's inspectors will determine the acceptability of workmanship that is not already covered by applicable regulatory requirements and classification rules

9.3.13 Identification of Item's Entire Work Scope

This is the heart of technical specification writing. It is fairly complex matter, and not to be undertaken lightly or by unpracticed personnel. The history of risks and consequences that are associated with incomplete or misleading specifications is a sufficient basis for many books. The previously mentioned *contractual disasters.* As a foundation for discussing this subject, four points that have been already discussed are brought to the forefront.

First, at the beginning of this section, the three basic forms of specifications were discussed design or end product; performance; and procedural.

Second, the desirability of a voiding too-broad specification language as also discussed. The negative example was given, *all work necessary to accomplish the specified work .....*

Third, the fact that the Contractor is given rights, not just responsibilities, to make decisions about details and materials after the contract is executed has been discussed several times in Sections 9.2 and 9.3.

Fourth, the shipyard's decision-making authority gives it the right to implement least-cost solutions in design development and materials selection as long as it remains consistent with the Contract Specifications Contract Plans, the

defined r gulation, the selected classification rules and th identified standards

The identification of the entire ork scope for each item requires that those four points be k ept in mind when each element of the technical specifications is d veloped. For each element of the technical specifications the specifica tion writer must be able to express in words and in supporting sketches or drawings what is important, and therefore stated unambiguously, and what is also to be included b ut is not as important, allowing the Contractor to make detail decisions.

Each technical specification must r veal whether the performance is important to the shipo wner, or if the form/design/configuration is more important. If the specification is design or end product, generally the Purchaser is responsible for performance. A contract which includes a *design certification process* by the Contractor may serv e to alter the assignment of certain risks. Precisely which risks and responsibilities are different from the usual form of contract will depend on the specific ording of the section of the Agreement which describes the design certification process. If cer tain procedures and/or standards are to be used or achie ved in the de velopment of details or the e xecution of the w ork, those procedures and standards must be clearly identified

The writer of technical specifications must also under stand what decisions the Contractor may be able to mak e with respect to each technical aspect while still being consistent with the contract documents, and determine whether a possible *least-cost* solution will be acceptable; if not, a more tightly defined solution is to be specifie

All of the elements of the w orkmanship and materials must be adequately defined to enable a shi yard to translate the technical specification into quantities labor hours, material costs, and subcontractor costs, or the performance capabilities of the technical item must be translatable into such quantification after the Contractor s suitable pre-bid design effort.

There is no single style or form of technical specifica tions that is superior to other possible styles or form. Each organization developing Contract Specifications and Con tract Plans should use the style and form with which it is most comfortable, provided that such style and form has not resulted in prior contractual disasters or near-disasters. Individual styles or forms should gi ve way to corporate styles and forms, so that a Contractor is not confronted with different styles or forms in the same Contract Specification

A specification-related risk that is too often encountere is that of *pride of authorship*. Even if a contractual disaster or near-disaster has previously resulted from the use of a particular wording of a specification the writers of it may continue to belie ve that the troubles were not due to the specification but rather due to an alleged intransigent attitude by the shipb uilder. This pride of authorship has no place in a professional engineering environment; if the wording of a specification has pr ven unsatisfactory in the past, instead of pointing the finger of responsibility at some othe party, the wording should be changed, based on a *lesson-learned* analysis of the disaster or near-disaster.

9.3.14 Technical Documentation Requirements

In addition to the hardware of the ship itself and spare parts, Purchasers usually require substantial, supporting documentation. This documentation is additional to the certifi cates from re gulatory agencies and classification which have been described in Section 9.2 with a sample listing of them.

Some of the required documentation is short-lived, such as megger readings after installing (pulling) electrical cable or steel and air temperature readings when applying coatings. Once ship construction and testing is satisf actorily completed, no one will be interested in that documentation. Other components of the documentation are long-lived, such as the sea trial results for all the machinery, forming a lifetime engineering database for those items. Examples of the types of documentation which may be required are listed in Table 9.VII.

The development of each of those items of documentation represents additional cost to the Contractor . Some of those documentation items may be generated by the Contractor or its na val architects and design engineers in the course of obtaining re gulatory and/or classification ap provals. For those documentation requirements which are not needed for such purposes, the Contractor cannot be expected to prepare them unless the need for them is clearly stated in the Contract Specifications or in the Agreement, so that they can be included in the Contractors' budget. Even for those documentation items generated in the course of obtaining regulatory and/or classification appr vals, the Contractor may not be obligated to go the extra step of providing them to the Purchaser unless they, too, are identifie in the contract documents as being *deliverable* to the Purchaser. If any of those documentation deliverables are to be provided to the Purchaser in computerized form, the Contract Specifications should clearly state that requirement i order to avoid disputes over interpretation of what constitutes usual practice.

9.3.15 Common Problems with Specification Language

The work scope of shipbuilding contracts is sometimes beset by problems with grammar and w ord usage. The idea of

using a common language between the Contractor and Purchaser is to ensure complete understanding. Contract documents between, say, a European shipowning organization and an Asian shipbuilder may be in English because both parties are reasonably fluent in English as well as their own language, but not fluent in the other partys language. Once a common language is selected, it is important that both parties use it in the same, correct manner.

Significant problems have arisen over colloquial word usage when involving two parties that both use English. For example, when a project involves a British naval architect and an American shipyard; both parties speak English as their native tongue, but in fact the colloquialisms that each use sometimes have significantly different meanings. For example, Americans *pull* cable when installing it, whereas the British *pull* cable when removing it. The point made here is to avoid colloquialisms for which others may not have the same working definition

Words and phrases such as *workmanlike*, *first-class marine practice* and *good shipbuilding practice* cannot be relied upon and should generally be avoided. The very subjective nature of these phrases, coupled with the differing perspectives and expectations of the Purchaser and Contractor, effectively renders such phrases useless; they do not adequately support the Purchaser's interests or bind the Contractor to any meaningful extent.

The words *any* and *all* are not equivalent. *Any* is an indeterminate number or amount, which may mean one, some or all. It is usually better to use *all* or *any and all* to preclude the shipyard from misconstruing the work scope. In ship repair, phrases such as *as necessary, as required, to suit* and *as directed* must be used with extreme care in order to avoid ambiguities. Those phrases do not lend themselves to development of estimates of quantities, which is basis of a bid and contract. In cases where the extent of repairs cannot be known beforehand, the specification should be care fully drawn and a procedure should be implemented to handle open and inspect items and other conditional work.

TABLE 9.VII Examples of Documentation Required by Shipowner for New Ship Construction

Hull Model Test Results	Responses to comments on drawings
Propeller Model Test Results	Finite Element Analyses
Propeller-induced Vibration Studies	Fatigue Analyses (Structural)
Preliminary Weights and Centers Reports	Heat Load Calculations
Preliminary Trim, Weight and Stability	Electrical load Calculations
Final Weights and Centers Reports	Fault Current Analyses
Final Trim and Stability Reports	Inspection Deficiency Reports
Damage Stability Analyses	Responses to inspection Reports
Tank Capacity Tables	Temperature/Humidity during coatings
Correspondence with Classification Organization	Megger readings (electrical cable)
Correspondence with Regulatory Agencies	Noise Level Readings
Detailed Initial Schedule (engineering, procurement, production and testing)	Test Results (numerous types)
Updated Schedules as appropriate and per contractual requirements	Vibration readings
Working Plans	Crane and Trolley Test Results
Detailed Drawings	Dock-trial Test Results
Production Sketches	Sea-trial test Results
Drawings submitted to Classificatio	Operational Placards on the Bridge
Drawings submitted to Regulatory Agencies	Safety Placards throughout the ship
P.O. Technical Specification	Progress photographs
	Component Manuals
	System Manuals
	Final photographs
	As-built (as-fitted Drawings

9.3.16 Shipowner-Furnished Equipment

The decision by the Purchaser to supply shipowner-furnished equipment (OFE) to the Contractor for installation aboard the new ship may be based on any of several possibilities:

- long lead time procurement requirements,
- already-stocked by the shipowner's organization,
- absolute control over equipment selection;
- potential savings, and
- easier procurement than by shipyard, among other possible reasons.

Regardless of the motivation and/or reasoning by the Purchaser, which results in the use of OFE, none of them can guarantee a risk-free relationship between the Purchaser and the Contractor.

The incidence of disputes and/or misunderstandings associated with OFE is far too common to dismiss as an aberration. Rather, analysis of past OFE-related disputes indicates that there are six aspects of OFE that often are not adequately addressed in the specifications thereby causing disputes and/or misunderstandings: content, form, place of delivery, schedule of delivery, vertical integration, and horizontal integration.

Each of these elements of OFE are discussed herein to promote an understanding of the potential problems that must be circumvented by appropriate specification language

The content of the OFE needs to be defined with sufficient precision so that the Contractor knows what is and what is not being provided. The Contractor will be responsible for supplying all of the necessary fixtures, fittings and connections that are necessary to incorporate the OFE into the ship; but the Contractor must base its bid price on an understanding of what hardware it has to provide. Consideration of the interface hardware provides examples: foundations; conversion fittings (metric to imperial units) connector cables and hoses; and resilient mountings; among others. Some Purchaser's have supplied the entire propulsion system as OFE, in which instances questions arose over which shaft bearings and which foundations were also to be OFE. One shipowner thought the rudder and its control mechanism were part of the propulsion system that was being purchased separately from a vendor. Other shipowners have mistakenly thought that the governor is always part of the shipowner-supplied diesel engine; this is not necessarily correct. These examples are mentioned to illustrate that what is going to be supplied as part of the OFE may be obvious to one party may be far from obvious to another.

The form in which OFE will arrive at the shipyard should be communicated to the Contractor by the specifications to ensure that all costs and schedule impacts arising from the OFE can be included in the bid price. The extent of assembly work that will be required if the OFE arrives in pieces is important to the Contractor. The need to provide temporary protective covering or other maintenance services prior to shipboard installation may also be a cost basis to the Contractor. Any other aspects of the form of OFE that may require labor or materials to prepare the OFE for shipboard installation should also be addressed in the specifications

The place of delivery of OFE is usually addressed in the Agreement, such as the Contractor's warehouse at a specific street. However, if it is not addressed in the Agreement, the point of delivery should be included in the specifications. If some of the OFE is being delivered at a near-by seaport or airport, and other OFE is being delivered to the shipyard, that differentiation should be made. If the Contractor has to provide transportation of the OFE from a remote (non-shipyard) location, the Contractor may wish to include those costs in its bid price (drivers, insurance, truck rental, etc.).

The Contractor is usually required, per the Specifications, to provide to the Purchaser a report on the condition of the OFE upon its delivery to the shipyard, identifying any damages or unexpected conditions. The Purchaser is usually responsible for correction of those damages or conditions, and the Contractor becomes responsible for any subsequently noted damages.

In order to plan the work appropriately, the schedule of delivery of OFE must be communicated to the Contractor if it is not already stated in the Agreement. If the schedule of delivery is not identified by the contract documents it may be established by the Contractor and communicated to the Purchaser through development and transmittal of the detailed project schedule. If this occurs, the Purchaser may face OFE delivery commitments that cannot be achieved, in which case the Purchaser must advise the Contractor of more appropriate OFE delivery schedules before the project is substantially underway.

Vertical integration of OFE refers to the process of integrating each item of OFE with all those parts of the ship which the Contractor has responsibility to supply. This integration may include consideration of piping and electrical connections, air and exhaust connections, fuel and lube oil supply, water and steam connections, the structural foundation, as well as the control, alarm and monitoring systems. Before the physical integration takes place, the design integration requirements have to be addressed by having the Purchaser supply to the Contractor all relevant connectivity and interface information. The vertical integration also addresses the need for component, system and ship testing as appropriate. The Contractor will need to know, for scheduling purposes, if the vendor's technical representative will have to conduct independent tests to ensure proper installation as a basis for issuing the vendor's warranty.

Horizontal integration of OFE refers to the process of integrating each item of OFE with other items of OFE, as appropriate. When the Purchaser is supplying multiple components of a system as OFE, responsibility for the compatibility and connectivity of all those components with one another usually rests with the Purchaser, not the Contractor. For example, if the OFE includes a diesel engine as well as a torsional coupling, the compatibility of the physical mating of the torsional coupling to the engine's flywheel may have to be assured by the Purchaser, not by the Contractor. If hydraulic cylinders as well as a hydraulic power pack are being supplied as OFE, the hydraulic, electrical, control and alarm connections between them need to be addressed, since the Contractor may otherwise believe that the Purchaser is supplying and arranging for all those connections to be completed by the vendor of the equipment.

Accordingly, specification writers must thoroughly investigate, understand and communicate in the written Contract Specifications all aspects of OFE that may cause the Contractor to incur costs and/or schedule impacts. If any assumptions have to be made by the Contractor to price the OFE-related work, the specification writer should realize tha

the assumptions will be "least-cost"ones, placing a greater burden on the Purchaser and the vendors of the OFE, at the expense of the Purchaser unless clearly stated otherwise in the Contract Specifications

9.3.17 Identifying Necessary Tests and Trials

The process of conducting any test or trial represents a cost to the Contractor. In order to prepare a complete bid, the Contractor has to know in advance the nature and extent of all tests and trials that need to be conducted.Thus the Contractor must be able to ascertain from the contract documents, primarily the Contract Specifications both the nature and the extent of the required tests and trials.The necessity for tests may originate with regulatory agencies, classification organizations, the Purchaser's additional requirements, or the OFE vendor's requirements.

Many of the tests and trials will have to be conducted to satisfy the regulatory requirements and the classificatio rules. If, as is customary, the Contractor is solely responsible for obtaining all regulatory and classification approvals, the Purchaser need not spell out each and every such test that is within that part of the work scope. However, if the Agreement doesn't already state it,the specifications should clearl state that the Contractor must perform all inspections and tests necessary to obtain all the approvals and certificates fro the various regulatory agencies and the classification or ganization that are listed else where in the contract documents, all at no additional cost to the Purchaser.

The more challenging aspect of this section of the specifications is to address the Purchaser s additional test requirements and the OFE vendor's test requirements that are supplementary to the other, already-addressed tests and trials. There is no nearly universal set of tests that falls within this category. Every ship type has differing requirements, and within each ship type, every Purchaser will have differing requirements. The Purchaser's and OFE vendor's test and trial requirements are shaped, in part, by their perception of what is needed above and beyond the regulatory and classification tests and trials. It should be noted that the duration or extent of tests and trials is also an important cost factor to the Contractor. If, for example, there is special equipment aboard the ship due to its particular shipowner and mission, some Purchasers may require a full 24-hour heat run, and others may be content with a 4-6 hour test; the Contractor must know the extent of those tests and trials in advance of bidding, perhaps by references to appropriate SNAME, ASTM, or other standards and procedures.

9.3.18 Compartment Closeouts

During the process of ship construction and testing, every component and system will have been tested, all the structural work will have been inspected, and all of the coatings, deck finishes and overhead closures will have been inspected. However, those inspections and tests will have taken place while the ship yard personnel were still active in each space or working on each deck area,and while shipyard equipment was still widely distributed throughout the ship. Compartment closeouts are the inspection activity by the representatives of the Purchaser to confirm that the ship yard has cleaned-up and withdrawn from each compartment prior to ship delivery.

For these purposes, a compartment is any of the following: tanks, void spaces, each level of sections of cargo holds between deep web frames or bulkheads, control rooms, equipment rooms, reefer spaces, store rooms, accommodations, heads, galleys, sections of passageways, chart room, interior bridge, bridge wings, steering gear flat paint rooms, chain lockers, shaft alley, each level of each of the machinery spaces, bosun's locker, each section of the weather deck, and every other type of area that may be appropriate to the individual ship.

This section of the Contract Specifications could require the Contractor to prepare each such compartment for a joint inspection after the shipyard has completed and withdrawn from each compartment. This would include, but not be limited to, removal of scaffolding and ladders, withdrawing of welding leads and gas hoses, removal of temporary lighting and ventilation, paint touch-up where temporary clips have been removed, picking up papers, cans, welding rod stubs and other disposables, clearing out all bilge suctions, disposal of all temporary protective materials, and confirmation of the placement of labels on cables and piping, if required by the specifications among other possible aspects of these compartment close-out inspections.

To avoid having the Contractor present all the compartments on a ship for close-out inspection at the same time, the specifications could require the Contractor to present i advance a list of all the compartments and a proposed close-out inspection date within a few weeks prior to vessel delivery, which schedule would be subject to negotiation if needed. Certainly many of the compartments can be closed out prior to sea trials, and the remaining ones closed out in orderly fashion between the conclusion of sea trials and Vessel Delivery.

9.3.19 Disposal of Hazardous and Toxic Materials

The process of ship construction may occasionally create waste materials that are deemed hazardous or toxic ac-

cording to environmental regulations. For example, in some jurisdictions, empty but wet paint cans are hazardous materials. Ordinarily, the Contractor will be solely responsible for the proper transportation and disposal of any toxic or hazardous materials resulting from the construction process.

If the delivery to the shipyard and installation of OFE creates any toxic or hazardous materials, the handling, transportation and disposal of them has to be carefully addressed by the Contract Specifications. First the specifications have to identify them by type, constituents, and quantity. Second, the specifications have to assign to the Contractor the responsibility for containing those materials to prevent contamination of the shipyard or the ship itself. Third, the specifications must call for the Contractor to provide safety and health appliances for employees as may be appropriate and consistent with health and safety regulations. Fourth, the specifications then should address the need to transport those materials over public highways by carriers who are licensed to do so, and fifth to dispose of the materials at landfills, incinerators or by other means at facilities that are licensed to undertake such disposal, all at no additional cost to the Purchaser.

9.3.20 Work Performed by OFE Vendors

When the vendor of OFE sends a technical representative (*tech rep*) to the shipyard to direct or oversee the installation or start-up of OFE, the Contractor may have to provide support services to that tech rep. These services may be limited to the provision of temporary lighting and ventilation or scaffolding and ladders. Sometimes the OFE vendor's tech rep may require the assistance of several of the shipyard's mechanics or other craftsmen for a period of time.

For each instance where the OFE vendor's tech rep will require shipyard support services, the rendering of those services will be a cost to the Contractor. Accordingly, the Contract Specifications could advise the Contractor of the need to provide such support services and indicate the nature and duration of the manpower and equipment needed for such support services. If this matter is not adequately covered by the Contract Specifications the Purchaser may be asked later for a Change Order to cover those costs.

9.3.21 Facilities for Shipowner's Representatives

Most shipyards have rooms in their office buildings set aside for use by the Purchaser's representatives during the design, construction, testing and trials phases of the ship construction project. Some shipowners' organizations require more space than others, and some require particular equipment to be provided within those facilities. Unless the contract documents, usually the Contract Specifications indicate the type, size and furnishing of the facilities, only minimal facilities may be provided, if any.

Thus, this section of the Contract Specifications shoul indicate the requirements for each of the following:

- total area to be provided,
- number of different rooms within that total area and approximate area of each room,
- the fact that the rooms should be located contiguous to one another,
- the number of desks and chairs to be in each room,
- the capacity of the conference table (if required),
- the size and number of drawing tables,
- the number of telephone lines in each room and number of connection points for each,
- the total number of telephones to be provided,
- the total number of fax machines to be provided,
- the presence of a xerographic copier of a nominated copying rate and document reproduction size,
- other features that will facilitate the obligations and work of the Purchaser's representatives, and
- proximity of the offices to the ship before launching

For reasons of security, if considered appropriate, the specification could require that the phone and fax lines for those offices be run directly from the street and not go through the shipyard's centralized phone system. (Cellular phones are not a form of secure communications.) For reasons of convenience, the specification could require the shipyard to temporarily provide a certain number of pagers for use by the Purchaser's representatives.

9.3.22 Development of Contract Plans

Throughout this section on Formation of Contract Specifications and Plans, the emphasis has been on the wording of the Contract Specifications and only occasionally have the Contract Plans been mentioned. This is not to lessen the importance of the Contract Plans, but rather recognizes that the Contract Plans are usually considered to be part of the Contract Specifications or at least to be below the Contract Specifications in the hierarchy discussed in Section 9.2 on Formation of the Agreement.

The purpose of Contract Plans is to convey to the Contractor the spatial relationships, the configurations the arrangements and the appearances of the various parts of the vessel that are not capable of being conveyed solely by written words. By identifying them as Contract Plans, the intent is that they are non-alterable except by a formal Change Order.

The contract-level design expressed in part by the Con-

tract Plans can vary considerably; some contract-level designs will include only a few drawings and be sparse with details; others will include a large number of drawings, each of which contains considerable details.

From the outset of the project, the Purchaser and its naval architects and design engineers have to decide what design configurations pertaining to the ship must be controlled entirely by the Purchaser (these become the Contract Plans), what design configurations can be determined from regulatory and classification requirements and what design configurations can be determined by the Contractor so long as they satisfy all other contractual requirements. The phrase *design configurations* is used here because that is the type of information that is best contained in plans rather than specifications. In other words, development of the list of drawings that will be Contract Plans is the output of a risk-decision analysis. If the configuration of a certain aspect of the ship is not included in a Contract Plan, the final configuration will be determined by the Contractor in its search for a least-cost solution.

If the presence of inclined ladders in a particular area of the ship is important to the Purchaser, for example, when regulations would otherwise permit vertical ladders, that requirement may be best communicated to the Contractor in a Contract Plan. The shape of the hull may be considered too important to be left to the discretion of the Contractor; but if the vessel is a low-speed barge, only general guidance as to the bow and stern configuration may be necessary, thereby allowing the Contractor to design it as a least-cost solution.

Once a decision is made as to what information will be conveyed to the Contractor by the Contract Plans, the Purchaser's naval architects and design engineers must ensure that the Contract Plans are not misleading. For bidding purposes, the Contractor is allowed to rely on information contained within the Contract Plans as being consistent with the nominated regulations and classification rules. If, for example, the Contract Plans include a schematic ventilation plan showing 14 fire dampers, the Contractor is allowed to rely on the fact that only 14 fire dampers will satisfy regulatory requirements. If a lesser number is required, the Contractor is still obligated to install the indicated 14 fire dampers; but if a greater number is required, the excess above 14 may become the basis of an essential Change Order.

Tolerances that are to be achieved are often implied by reference to a standard, in which case the standard should be reviewed for applicability before citing it. However, if tolerances for certain elements of the ship are of special concern to the Purchaser, they should be expressly stated in the relevant Contract Plans or Contract Specifications. For example, the tolerances within cell guides for container ships may be different from normal shipbuilding standard tolerances.

9.3.23 Interpretation of Contract Plans

In order to avoid misunderstandings that arise later, it may be advisable for the Purchaser's naval architects and design engineers to seek regulatory and/or classification approvals of the anticipated Contract Plans before the contract is executed. Problems have arisen in the past due to the fact that the Purchaser's naval architects did not interpret the classification requirements in the same manner as the classification organization itself. Pre-contract approval of the Contract Plans, however, does not eliminate the need for further approvals of the more-detailed plans that are to be developed by the Contractor after contract execution.

The Purchaser's naval architects and design engineers should appreciate that many objects shown on Contract Plans are representations only, and do not indicate with precision the dimensional proximity of structures or other items of equipment. This means that the Contractor will have a *window* of placement of that item of equipment. If clearances around that item of equipment are important, it would be best if the drawing noted that requirement, possibly with reference to an appropriate Contract Specification item.

Both parties have to recognize that the notes contained within a drawing are as much a part of that drawing as are the graphical representations. If the note states that the dimensions and linear weight of a stiffener is *typ.* or typical for a group of stiffeners, the Contractor cannot pretend that the information was lacking. On the other hand, the Purchaser's naval architects need to appreciate that shipyard personnel cannot read the minds of the persons preparing the drawings. Thus, the working rule should be that if there is any doubt as to how someone other than the author of a plan will interpret part of it, then more information is better than less and more notations are better than fewer, even at the risk of making the drawing look too *busy*. If it is necessary to refer to a second Contract Plan to fully understand the first, it is best to not assume the Contractor will examine both plans concurrently. Rather, the first plan could reference the second one, and vice-versa, to ensure clarity, without which risks are being created.

A previous sub-section of this section addressed the subjects of composite drawing and the resolution of interferences. Naval architects and design engineers who have not prepared composite drawings prior to the execution of the contract should anticipate that likely there will be interferences arising from a strict interpretation of the contract documents. Accordingly, those persons should be prepared to accept variations from the Contract Specifications and Con

tract Plans that need to be altered to eliminate such interferences. Again, it can be expected that the Contractor will seek to eliminate those interferences in a least-cost manner

If the Purchaser's naval architects and design engineers are not going to be receptive to Contractor-determined resolution of interferences, which arise from the contract documents, perhaps they may wish to undertake the development of composite drawings prior to contract execution. However, this would be meaningful only for those situations in which the Purchaser wishes to control nearly all of the spatial relationships, configurations arrangements and appearances through the use of a large number of Contract Plans, which is fairly common for naval combatant vessels and passenger ships.

Contract Plans generally should not include quantities of materials, though they could indicate types of materials in a Bill of Materials at the top of the drawing if the types are not already identified in the Contract Specifications. The presence of exact quantities on Contract Plans may lead to allegations of extras by the Contractor, resulting in an otherwise unnecessary Change Order.

If the Contract Specifications and Contract Plans are available in computerized format, the Purchaser can provide them to bidders as long as a contractually binding hard (*paper*) copy, produced by the original developer of them and not by another party, becomes the official contract document

9.3.24 Use of Guidance Plans

Some naval architects who develop and/or assemble the technical documents for a shipbuilding contract incorporate into the contract package several *Guidance Plans* in addition to Contract Plans. One possible reason for the differentiation between Guidance Plans and Contract Plans may be that the naval architect has in mind a different degree of required compliance by the Contractor.

Another possible reason for the inclusion of Guidance Plans is to give the Contractor a *starting point* for its own design development responsibilities. A third possible reason for incorporating two different types of plans in the contract package is to encourage the Contractor to seek alternative, lower-cost means which will lead to savings for both Purchaser and Contractor. There are several other possible reasons for including Guidance Plans in a contract package.

The realization that there may be any of several reasons for using Guidance Plans in addition to Contract Plans points out a potential cause of contractual difficulties. Namely, the Contractor may attach a different significance to the Guidance Plans than intended by the Purchaser. The means of avoiding such difficulties or disputes is to either void using Guidance Plans, or to define the use of the word *guidance*. For example, the phrase Guidance Plans can be defined in the Agreement to mean plans from which the Contractor may vary, at no additional cost to the Purchaser, only if approved in advance by the Purchaser.

Another possible definition of Guidance Plans could be for example, plans which must be adhered to in all respects except that the exact dimensions shown or implied therein may result in physical interferences with other components of the ship, which interferences are to be resolved by the Contractor at no additional expense to the Purchaser. There are, of course, many other possible definitions of Guidance Plans; but failure to define the term when Guidance Plans are included in the contract package, may lead to confusion at best, or serious disputes at worst.

9.3.25 Newbuilding, Repair and Conversion

Although this chapter is intended to apply to new ship construction, certain aspects of it also apply to ship conversion and repair. It should be appreciated, however, that this section on Formation of Contract Specifications and Plans is least applicable to ship repair, and a slightly greater portion of it may apply to ship conversion.

For ship repair, the specifications address each repair item individually, although the general section of the Contract Specifications may be somewhat applicable to repair as well as newbuilding. Ship conversion, which involves a significant amount of new steel and/or new arrangements, may appear to be more related to newbuilding than to ship repair. However, ship conversion specifications are even more difficult to write than newbuilding specifications. The reason for that greater difficulty is that in ship construction the specifications and plans must only define the final product, but in ship conversion, the specifications and plans must define both the starting point (the ship before conversion) as well as the end point.

These points about ship repair and ship conversion specifications are included only to caution the reader that those types of projects are quite different from new ship construction. Accordingly, the formation of Contract Specifications for ship repair and the formation of Contract Specifications and Plans for ship coversion will be a measurably different process than discussed above.

9.4. MANAGEMENT OF CONTRACTS DURING PERFORMANCE

9.4.1 Introduction

The purpose of active and responsible contract management is two-fold. First is the necessity of monitoring your own

team's responsibilities and managing them through the use of your own contract management team's resources and through the timely redirection or re-allocation of those resources as appropriate. The second purpose is monitoring the other party's fulfillment of its responsibilities and notifying that party when the potential or actual failure to fulfill its responsibilities arises

The responsibilities of each party are defined by the contract documents, primarily by the Agreement, the Contract Specifications and the Contract Plans. The preceding sections focused on the development and formation of those documents in a manner that provides a contractually-binding foundation or basis that will ensure the Purchaser gets the product it has bargained for, and the Contractor has to produce no more than it is being paid for.

With that foundation in place, the Contractor expects that it should be able to proceed with its planning, engineering, procurement, production and testing with only minimal interference from the Purchaser. At the same time, the Purchaser believes it has the right to expect that the Contractor will provide all the plans, schedules and documentation supporting the design, construction and testing in a timely manner, and expect that the Contractor will construct and deliver the ship on time.

These two sets of expectations suggest that, aside from engineering and production work, there is not much for either party to do besides watch the ship being designed and built. That perception is not only wrong, but also dangerous. In fact, there are a tremendous number of contract management activities that must be addressed by both parties during contract performance. If one party or the other takes the attitude that it shouldn't have to do much contract management now that the contract has been signed, then that party is likely to pay a severe price for not having actively managed the contract.

In other words, those are theoretical expectations, and are not fully achieved in practice. Sometimes actual practice varies considerably from those theoretical expectations due to either or both parties' mismanagement of the contract during contract performance.

9.4.2 The Origins of Contract Mismanagement

Shipowners' on-site representatives sometimes believe that the Contractor has the attitude that the shipyard will follow the spirit of the Contract Specifications and Plans but will not always meet certain exact requirements as stated therein. This, in the eyes of the shipowners' representatives, undermines the contractual requirements and dilutes the effort that was put into defining the Specifications and Plans. If that situation is developing, shipowners' representatives must manage the contract more aggressively to get the Contractor's actions into alignment with its contractual responsibilities.

Similarly, from the shipyards' perspectives, it sometimes appears that shipowners expect the shipyard to modify the Specifications and Plans to suit certain more-costly interpretations of the shipowners' representatives, but without formally changing the Contract Price or performance period. Sometimes Purchasers' engineering staffs try to use the drawing review process to micro-manage the detail design decisions that were ceded to the Contractor. From the shipyards' perspectives, any such behavior by shipowners' representatives undermines the right of the Contractor to select the means of achieving compliance with the Specifications and Plans, all at a fixed price. If that situation is developing, the shipyard must also manage the contractual relationship with the shipowner's representatives more aggressively in order to restrain them from asking for more than they have the contractual right to do.

It is appropriate to recall part of the introduction to this chapter:

> . . . But there is another form of disaster involving ships; namely, contractual disasters, situations in which the shipyard and ship shipowner are both terribly harmed due to mismanagement of the shipbuilding contract.

It is noted that disasters result from *mismanagement of the shipbuilding contract.* This means that the contractual disasters can originate not only with poorly developed contracts, which development is part of contract management, but that contractual disasters can also evolve from improper or unsuitable management during contract performance.

In other words, situations arise in which one party or the other, Contractor or Purchaser, are not managing the contract, but instead are either expecting to maintain a relationship with the other party while operating contrary to the rules of the contract, or are simply neglecting their responsibility to actively manage their side of the contract. The risks associated with such actions are often translated into an abandonment of the rights of one party or the other in order to avoid litigation, or may result in litigation or arbitration. By developing a clear understanding of each party's contract management responsibilities during contract performance, and then fulfilling those responsibilities both parties are assured of achieving what they bargained for during contract formation and the described adverse risks can be avoided.

9.4.3 The Contract Management Team

The actual management of the contract for each of the Contractor and the Purchaser is usually accomplished by a number of specialists who, collectively, constitute the contract

management team. Depending on the size, complexity, uniqueness and schedule of a shipbuilding project, and possibly depending on other factors, too, the size of the contract management team *after the contract is executed* may be as large as several dozen individuals, as in large navy projects or cruise ships, for example, or as few as one individual occasionally aided by consultants, as in a small pilot boat, for example.

Some shipowners undertake a sufficient number of ship building contracts to warrant having a full-time staff of contract management specialists; and other shipowners use an outside team of specialists or consultants. Usually a shipyard's contract management team consists of its own staff members, but occasionally the ship yard will utilize specialist consultants if the ship type is unique or new to the shipyard, if the shipyard is experiencing a temporary surge of business, or to mitigate risks when contracting with certain shipowners.

Regardless of the type and size of the Purchaser's contract management team, it is important that the remainder of the Purchaser's organization give prompt, effective support to the team whenever such needs arise. If there is any shipowner-furnished equipment, the most important group to provide support will be the shipowner's purchasing department. A lack of expediency and/or accuracy in ordering the OFE can easily result in major contract problems.

Sometimes the additional support from the Purchaser's organization may be the timely need for information from the vessel operations department, or it may be to consent to the temporary use of specialist consultants when dealing with some particular design or construction problem. Another form of support for the contract management team may be the need for approval from senior management of the deferral of changes requested by the operations department until a subsequent drydocking or ship repair period in order to cease requesting change orders from the Contractor near the end of the construction phase.

9.4.4 Effective Management

An important question on which to focus at the outset of a shipbuilding project for both shipyards and the shipowners is: how will the success of the contract management effort be measured? Some contract management teams have waited until the project was completed, and then with hindsight considered how much the budget grew during the project and how much later than the original contract Delivery Date the ship was delivered. For some organizations, that may be an acceptable form of measurement, but it does not lend itself to actually managing a contract; rather, the participants having that perspective are essentially observing developments, not managing a contract.

A more appropriate means of measuring a contract management team's performance is to have regular opportunities to alter the emphasis and re-allocate resources being applied to the contract. This is comparable to a ship navigator's course correction at regular intervals. In that situation, the navigator determines the ship's actual position relative to its anticipated position at that time, and then establishes the new, corrected course and speed which should get the vessel to its objective in a timely manner.

Similarly, the contract management team for both the Purchaser and the Contractor establish waypoints in each of the functional areas that are discussed below. Periodically, the actual contract progress in each of those functional areas is compared to the *baseline* or *planned* status that should have been achieved by that time. If appropriate, the team can then reassign resources within those functional areas that appear to be impacting or close to impacting the project. This applies to the contract management teams and resources for both the Contractor and the Purchaser.

9.4.5 Managing the Entire Contract

In this chapter, the importance and the role of technical persons in formation of the Agreement, as well as in the formation of the Contract Specifications and Contract Plans has been discussed and emphasized. Too often, however, the contract management team focuses on management of the Contract Specifications and Contract Plans and leaves aside management of the Agreement. Perhaps this situation arises because the Agreement looks too *legalistic* or has been modified and formatted by attorneys. Nevertheless, the entire contract has to be managed, including the Agreement as well as the technical aspects of the contract documentation. The business managers and lawyers of the two contracting parties are not involved in the daily contract management tasks. Thus, abandoning to organization's business managers or lawyers the management of the Agreement is equivalent to not managing the Agreement at all. That is, if the contract management team does not manage the Agreement as well as the technical documents, then the Agreement will not have been managed, creating unnecessary risks and likely incurring unnecessary costs.

A maritime industry contract management-training program (3) usually starts in the following manner: "*Read the Contract. Nearly every answer you may need, regardless of how the question is phrased, is found in the Contract.*"

Of course, the Contract includes all of the contract documents, including the Agreement. Many of the answers needed during the project are found in the Agreement but not in the technical documents. Accordingly, members of the contract management team should familiarize them-

selves with the table of contents of the Agreement, so that when questions arise, they can easily refer to and study the relevant sections of the Agreement as easily as they do with the Contract Specifications

9.4.6 Contract Management Phases

There are numerous non-maritime books on contract management, but a reader of them from the maritime industry has to be aware that actual contract management practices vary between industries. Thus, the direct adaptation of the recommendations of generic contract management books may create difficulties within the maritime industry. A directly relevant paper, *An Owner's Management of Ship Construction Contracts* (5), addresses shipbuilding contract management from a shipowner's perspective.

That paper views shipbuilding contract management in five phases:

1. pre-contract management functions,
2. early management functions,
3. continuous Management Functions,
4. intermittent management functions, and
5. later management functions.

As illustrated in Figure 9.4, those phases occur at various times relative to project initiation, contract execution, physical construction, ship delivery, and end of warranty.

Within those five phases of contract management, the cited paper lists a total of 38 managerial activities relevant to many shipbuilding contracts. Although that paper is written from a shipowner's perspective, it is recognized that shipyards have reciprocal or initiating functions associated with each of those shipowner's management activities. A brief description of those 38 management activities is given in the *Appendix* to this chapter.

The progress of nearly all aspects of a shipbuilding project can be tracked by the communications between the Contractor and the other parties, including the Purchaser, regulatory agency and classification organization. Nearly every step of progress is accompanied by a communication from the Contractor, and followed-up by a communication from one of the other parties.

9.4.7 Contract Communications

Equally, if there is any shipowner-furnished information, equipment or materials, the delivery of such items to the shipyard is also accompanied by a communication. Thus, tracking the actual communications will create an understanding of the status of each aspect of the project. Both the Contractor and the Purchaser can employ this fundamental

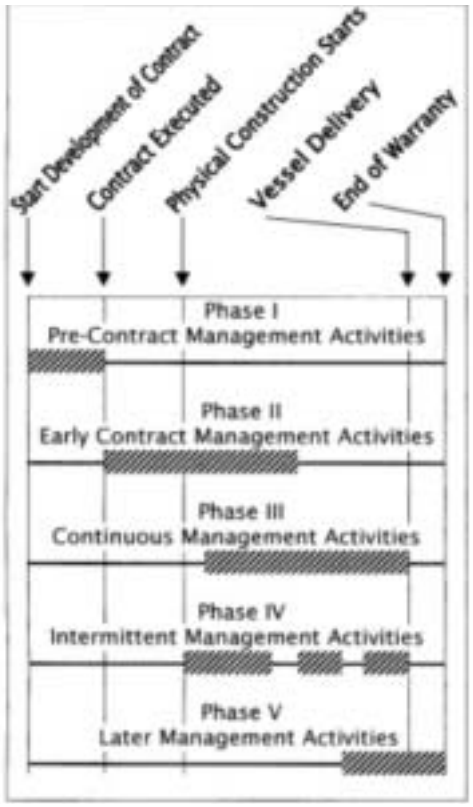

Figure 9.4 Five Phases of Contract Management

mechanism. For example, if the Contractor is producing detail drawings that are to be reviewed by the Purchaser in advance of construction, the transmittal of those drawings is the communication that evidences the status of the Contractor's design development. If the Purchaser then sends comments pertaining to those drawings to the Contractor, the transmittal of those comments is the communication that evidences the Purchaser's review of the design development.

As another example, if there will be some shipowner-furnished equipment (OFE) as part of the project, its arrival at the shipyard will result in a delivery receipt and possibly an inspection report upon opening of the crate. Since both parties, Contractor and Purchaser, will get copies of both the receipt and the inspection report, those communications serve to evidence the arrival of the OFE and its condition upon arrival.

9.4.8 Functional Areas of Contract Management

In order to create an orderliness out of the hundreds or thousands of communications that will be created during a ship-

building project, the communications can be divided into functional areas, as illustrated in Table 9.VIII. The status of each of those functional areas generally can be determined with adequate accuracy by tracking the communications between the parties pertaining to each of those functions.

9.4.9 Contract Management Procedures

The tracking of communications to monitor the status of each functional area is the first step in active contract management during contract performance. Recall the analogy, above, to the ship navigator's course corrections. The first step was to determine the position and current course of the ship.

Similarly, the status of the contract work, in each functional area, including both the Contractor's and Purchaser's roles, can be reasonably determined from the communications being tracked.

The second step in the previously stated navigator's analogy is to determine where the ship should have been at the time of measuring its actual location and course. In contract management, a review of the project's schedule and the anticipated status of each functional area relative to that schedule serve to establish the progress that should have been made since the last *course correction*. This assumes that the project schedule has sufficient detail is a valid representation of all activities in the project (engineering, purchasing, production and testing), and is not merely a *showpiece* prepared to satisfy a contractual requirement.

In the analogy, as the final step the navigator would then determine how the ship's course and speed should be adjusted in order to assure timely arrival at the intended destination, if possible. Similarly, the contract management team considers the difference between the actual status in each functional area and the intended status at that same time, and then evaluates what reallocation of resources are appropriate to correct any untoward variations.

Of course, even without reference to communications, the Contractor tracks the actual physical progress of the ship construction relative to the planned and updated schedule. Whenever a discrepancy arises between actual and the latest-planned schedules, the Contractor must evaluate whether that schedule slippage will have any subsequent impact on ship delivery or the availability of resources that may be in short supply, such as, having a limited number of workers in a particular craft available for the project. The Contractor may then redirect the use of its resources to avoid the developing impacts.

This process of *course correction* is equally applicable to both the Contractor and the Purchaser. For example, relating to the Contractor, if it is determined that electrical installations are falling behind schedule, the shipyard would consider how to temporarily increase the rate of electrical installations by assigning more electricians or by the judicious use of overtime, among other possibilities. The Purchaser may have similar responsibilities. For example, if the review of detail drawings by the Purchaser's engineering consultants or staff is not keeping apace with the shipyard's submittal of them, in order to not lose the right to timely comment on the drawings, the Purchaser would consider a temporary increase of the drawing review staff.

9.4.10 Functional Spreadsheets

The generally described contract management procedures rely on both the Contractor and the Purchaser having an expected status or target against which to measure the actual status in each functional area identified in Table 9.VIII. Many of those targets can be developed in both form and content in advance, and the form of others can be developed in advance but completed as to content during contract performance. For example, an advance drawing schedule identifies each of the drawings, and the target date for completion of each, that the shipyard will develop to suit its needs. Also, the shipyard will have a detailed planned schedule developed in advance for construction and testing.

TABLE 9.VIII Functional Areas of Contract Management

Drawings
Equipment Purchase Orders
Engineering Analyses and Reports
Weight Control
Schedules
Classification
Regulatory Authority
Owner Furnished Information
Owner Furnished Equipment (or Materials)
Secondary Contracts
Change Orders
Inspection by Shipowner
Inspection Deficiency Reports
Test and Trials
Invoices and Progress Payments
Spare Parts and Hardware Deliveries
Paper/Computerized Deliverables
Warranty Items

The content of some functional areas cannot be define in advance. For example, the number and subject of inspection deficiency reports cannot be anticipated, but the means of communicating about such deficiencies can be planned in advance.

The anticipated and the routine contract management procedures for ship construction are achieved with the aid of spreadsheets in each of the functional areas that pertain to the particular project. Some contract management teams use checklists, but it is recognized that a checklist is a limited form of spreadsheet, not suitable for easy updating and the addition of other information. A spreadsheet, on the other hand, whether manual or computerized, allows for multiple data entries for each line item.

As an example, the column headings for a spreadsheet for inspection deficiency reports (I.D.R.'s) are listed in Table 9.IX. Upon inspection, if the shipowner's representatives identify a deficiency relative to the Contract Specification or Contract Plans, an I.D.R. is sent to the Contractor.

The Contractor may acknowledge that it constitutes a deficiency and correct it then or at some other time; the Contractor may dispute that it is a deficiency; or the Contractor may offer a credit if correction of it is waived by the Purchaser

The spreadsheet has to be capable of addressing each possible outcome, as well as have as its final column the date of closeout, when the issue was resolved between Contractor and Purchaser due to either correction or waiver-with-credit. Any special retainages associated with the deficiency are noted in the same spreadsheet.

Thus, at a glance, the contract management team for either Purchaser or Contractor will know the status of all the identified I.D.R's. This forms a status report that both parties can use for continuing or concluding the management of that functional area.

As another example, nearly all of the inspections to be performed by the shipowner's representatives can be listed in an inspection spreadsheet long before actual construction commences. The approximate target date of such inspections can be inferred from the Contractor's detailed schedule. The spreadsheet then performs two functions: 1. it ensures that the shipowner's representatives do not overlook any intended inspections, and 2. it tracks the timeliness of the Contractor's preparations for inspections.

Similar use is made of all the other spreadsheets developed for each of the other functional areas listed in Table 9.VIII as well as any other functional areas appropriate to the specific project

TABLE 9.IX Spreadsheet Column Headings for Inspection Deficiency Reports

I.D.R. Number
Date of Inspection
Specification Item Numbe
Date Acknowledged by the Shipbuilder
Intended Correction date by Shipbuilder
Date of First Reinspection if Not Final
Date of Second Reinspection if Not Final
Date Disputed by Shipbuilder
Amount of Credit for Waiver
Amount of Special Retainage
Date of Closeout

9.4.11 Active versus Passive Contract Management

The theme of this section on the Management of Contracts During Performance is captured by a principle of contract management stated in (3):

"Both parties to a contract must be active participants during performance; passive contract management is taxed, active contract management is rewarded."

It was noted above that passive contract managers are no more than observers of the project's events, having no influence on any adjustment in how the responsibilities of each party are being fulfilled. However, once a decision is made instead to be active contract managers, mechanisms have to be developed to measure the success of that active contract management. As discussed in the prior section, the use of spreadsheets, either manual or computerized, associated with each applicable functional area has been found to be an effective means of monitoring the effectiveness of such management.

The initially developed spreadsheets constitute the targets for performance by both the Contractor and the Purchaser. The updating of the spreadsheets establishes the actual point of progress in each functional area. Noting the difference between target and actual progress, the relevant party can redeploy or reallocate its available resources, or supplement those resources if appropriate, to get the project back on course to the extent needed.

It should not be forgotten however, as quoted earlier from (3), that *"Contract management should commence the moment a contract is contemplated, not after it is signed."* As discussed in the prior subchapters on formation of the key components of the contract, that stage of contract management is the most important, as it creates the contractually-binding foundation for all subsequent participation by both parties.

9.5 REFERENCES

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9.A APPENDIX

9.A.1 Shipowner's Contract Management Activities

The following constitutes a brief description, from a shipowner's perspective, of each of the activities of contract management, divided into the five phases of contract management identified in Section 4. These descriptions are adapted from *An Shipowner's Management of Ship Construction Contracts* (5). The activities described below start with the draft Agreement, draft Contract Specifications and draft Contract Plans. The corresponding shipyard's contract management activities, in addition to engineering, purchasing, production and testing, usually are either parallel activities or mirror images of the shipowner's activities. They are not separately discussed below.

In these descriptions, OFI indicates Shipowner-Furnished Information and OFE indicates Shipowner-Furnished Equipment, or Materials. The phrase *secondary contract* refers to a contract let by the ship shipowner to an organization other than the Contractor, but which is meant to support or supply the Contractor.

9.A.2 Phase I—Pre-Contract Management Activities

Organization—Development and structuring of Shipowner's contract management organization, including functional and reporting relationships pertaining to prime and all secondary contracts associated with the project (contractor, engineering, regulatory, classification suppliers, vendors, services, etc.). A *secondary* contract is one between the Purchaser and a vendor or service-provider other than the prime Contractor, which secondary contract supports the project of the prime contract. Generally, the Purchaser has responsibility for the performance of the secondary contractors, and the Contractor has responsibility for the performance of the subcontractors.

Specifications—General: Review of specifications to maximize Shipowner's and Contractor's mutuality of interpretation of each party's technical responsibilities and to identify ambiguous or incomplete aspects of specification which may require clarifications

Specifications—Schedule: Development of specification to supplement the Naval Architect's specifications with section or sub-section pertaining to the Contractor's schedule development and schedule-reporting commitments.

Specifications—Tests and Trials: Development or modification of proposed specification pertaining to tests & trials as necessary to maximize pre-delivery verification of all systems and components modified by the shipyard.

Specifications—Downward Review: Coordination between specifications and contract plans to maximize consistency between those components of the contract.

Specifications—Upward Review: Coordination between agreement and specifications to maximize consistency between those components of the contract.

Communications: Review of specifications to identify all contractually anticipated communications evidencing compliance with contractual obligations by both Shipowner and Contractor. (see *Deliverables*)

Deliverables Control Spreadsheets: Development of computer-based, revisable, detailed lists and related information for each party's communications, approvals, reports, other software and hardware deliverables in hard-copy and electronically.

9.A.3 Phase II—Early Management Activities

Project Kick-Off Meeting—Meet with Contractor's contract management team to develop mutual interpretations where ambiguities exist and to discuss other administrative and procedural matters, which may be relevant to a smooth-running contractual relationship. Some of the other matters, as identified in reference 2 are:

- Avenues for exchanges of documentation and information,
- Clarify contract specifications & plans
- Clarify precedences, inclusions, exclusions,
- Identify OFI that is needed early to get project started,
- Identify what is not already included in price & work scope,
- Identify unit prices for labor, services, lay days, material mark-up,
- Identify crafts and services that will be directly charged in change orders,

- Procedures to control shipowner property (if applicable),
- Billing and payment practices,
- Reporting requirements (weights, stability, vibration, noise, EMI, others),
- Change order procedures, including distributed, limited authority,
- Number of change order hours that automatically gives one day extension,
- Quality control, testing, inspections, compartment close-outs,
- Identify standards that will apply to key inspections,
- Turn-around times for condition reports and change proposals,
- Disposal of hazardous and/or toxic materials,
- Spare-parts requirements,
- Subcontract, or prime contract) issues,
- Where shipowner will inspect the subcontractor's work,
- Up dating & release of scheduling information,
- Special retainages for outstanding deficiencies and
- Fire watch, fire response pressurized fire main

Schedule: Review of Contractor's proposed critical path network to ensure all elements of the work scope are properly included, such as completion of design, engineering, procurement, production, subcontracts, tests & trials.

CFE Procurement: Monitoring of Contractor-furnished equipment (CFE) having long-lead time procurement windows. Failure by the Contractor to allow realistic, that is, long lead times for major or specially-manufactured equipment is a too-frequent problem leading to costly repercussions in ship construction projects. For that reason, the Purchaser should consider monitoring the Contractor's ordering process and its schedule.

OFI Procurement: Procurement of Shipowner Furnished Design Information as required by contract.

OFI Schedule: Coordination with contractor for timely delivery of Shipowner-Furnished Information.

OFE Procurement: Procurement of Shipowner Furnished Materials & Equipment and associated technical information.

OFE Schedule: Coordination with contractor for timely delivery of Shipowner-Furnished Materials & Equipment.

Secondary Contracts: Management of Shipowner's secondary contracts for design, support services and any OFE or OFI.

Drawings: Receipt and review of Contractor's detail drawings, including bills of material, and preparation of comments as appropriate.

9.A.4 Phase III—Continuous Management Activities

Critical Path Network: Review of Contractor's updates of the critical path network to ensure that schedule updates reflect actual project conditions and vents (start, percent complete, finish)

Progress Meetings: Leadership at regular progress meetings with Contractor and follow-up to ensure all obligations by both parties arising there from are timely satisfied

Progress Monitoring: On-site identification of when critical path activities have started and finished to monitor Contractor's performance vis-à-vis its own planned schedule.

Progress Payments: Review of Contractor's progress invoices to ensure that all invoiced amounts have been earned.

Classification: Oversight and review of Contractor's communications with classification organization.

Regulatory: Oversight and review of Contractor's communications with appropriate regulatory authorities.

9.A.5 Phase IV—Intermittent Management Activities

Contract: Maintenance of up-dated contract including changes to price, technical specifications contract drawings and delivery date.

Change Specifications: Development or review of technical aspects of proposed changes and Shipowner's estimate of cost of changes.

Change Negotiation: Negotiation of proposed changes after review and acceptance by technical staff.

Delays: Review of Contractor's requests for *force majeure* delays and oversight of other potential causes of delay

Extensions: Review of contract extensions requested by Contractor in association with potential changes.

Rework: Identification and documentation of types areas and timing of Contractor's own rework necessitated by its own errors.

9.A.6 Phase V—Later Management Activities

Inspections: Identification of ork in progress and completed items to be inspected and accepted.

Deficiencies: Development of inspection deficiency reports for transmittal to ship yard and follow-up to ensure correction of cited deficiencies

Tests & Trials: Review of draft agendas for tests and trials, oversight of tests and trials, review of final reports o tests & trials.

Acceptances: Preparation of notices of acceptance of inspections, tests and trials, and conveyance of the acceptance to Contractor.

Compartment Closeouts: Final closeout inspection of each compartment upon presentation by Contractor (includes

each tank and void space as well as working spaces), and conveyance of the acceptance or deficiencies to Contractor.

Manuals: Review of draft manuals, including signs and placards, preparation of comments to Contractor, review of final manuals

Spare Parts: Development of approved spares lists and communications with Contractor to ensure timely arrival of spares.

Delivery: Development of draft vessel delivery documentation and inventorying and filming of status of ship at time of delivery.

Warranty: Accumulation of warranty items identified by operational staff, transmittal of reports to shipyard and follow-up to ensure correction of cited warranty items.