Chapter Six

CONCLUSIONS AND RECOMMENDATIONS

The USS *Nimitz* left NNS on June 25, 2001, for three days of sea trials. She then returned to the Norfolk Naval Base to prepare for transit to her home port of San Diego, California, where a four-month PSA/SRA started in mid-January 2002. The Puget Sound Naval Shipyard managed this availability. The PSA portion was funded from the SCN budget with NNS as the prime contractor. The PSA completed work not finished during the RCOH at NNS and covered any warranty items that needed attention. The SRA portion was funded from the Other Procurement, Navy (OPN) and the O&MN budgets. During the SRA, SPAWAR installed and upgraded its suite of command, control, communications, computers, and intelligence (C4I) equipment, and NAVSEA completed the installation of the ship's combat system. After the PSA/SRA, the USS *Nimitz* began the training cycle for her next deployment.

By many measures, the CVN 68 RCOH was successful. Significant structural and functional system repairs were accomplished, the crew habitability and living environment were improved, and operational systems were modernized. The new fiber-optic-cable plant supports integrated networks which will enable transformation to future ForceNet technologies. The USS *Nimitz* will return to the fleet well prepared to meet its operational requirements for the next 20+ years.

COST AND SCHEDULE GROWTH

Despite the overall success of the RCOH, CVN 68 left NNS several months later than originally planned, and the NNS portion of the

total RCOH cost grew by 20 percent. Most of the schedule slippage and a portion of the increase in cost were due to a four-month labor-force strike in the middle of 1999. Costs also grew due to a significant increase in the NNS overhead rate (an average of almost 10 percentage points over the originally budgeted figure) and a growth of more than one-third in the material budget. The preceding cost-growth and schedule-slippage numbers might be underestimates, however, if work originally intended for completion within the RCOH had to be postponed. We know that the scope of the NNS work was increased due to the transfer of work originally programmed for accomplishment by the ship's force and large quantities of work added late in the RCOH. However, we are uncertain whether the total work initially specified in the contract work package was accomplished or whether some work was deferred because of cost growth to later CVN 68 availabilities.

We are also uncertain about all the causes of the growth in the overhead rate. Certainly, the strike had some short-term impact, but the rate stayed 10 percentage points above the budgeted rate for the duration of the project. Increased employee benefits resulting from the strike settlement accounted for some of the growth, and the business base over which expenses are spread changed, resulting in a higher overhead rate. Still, the RCOH finances are so complex that it is unclear how large a role the strike and the business-base changes played or how much other factors may have contributed to the higher overhead rates.

Part of the growth in material expenses was due to greater-than-planned subcontracting efforts (which NNS records in the material budget). At the Navy's request, NNS hired local firms to complete a number of habitability-related tasks, such as tiling and painting. Many of these tasks were originally in the ship's force work package but were shifted to NNS during the execution of the RCOH.[1] Again, it is hard to pinpoint where and why the material budget grew by over $70 million. A major changeover to a new budgeting and accounting system during the course of the RCOH made it almost impossible to track material costs for a period of time.

[1]Seven different A-mods added almost $10 million for "crew unburdening."

PROBLEMS IN THE PLANNING AND EXECUTION PROCESSES

Planning for the CVN 68 RCOH began approximately five years before the ship was scheduled to enter NNS to start the RCOH. Initially, PMS 312 assumed responsibility for developing the nonnuclear repair portion of the work package. TYCOM personnel were involved during the initial stages of planning, providing information on the material condition of the ship and on the types of repairs they believed were needed. However, as the planning process progressed, the role of the TYCOM staff diminished and, in their opinion, they were given little authority in the development of the work package.

After approximately two years, SUPSHIP NN Code 1800, the organization whose personnel are most familiar with carrier availabilities (i.e., the ex-PERA-CV analysts), became involved in the planning process. It played a key role in the development of the work package that was included with the RFP for the execution of the RCOH. NNS, the shipyard that has built all of the U.S. Navy's nuclear-powered aircraft carriers and that has accomplished a number of carrier availabilities, including the CVN 65 RCOH, played only a minor role in developing the nonnuclear work package. NNS did provide initial estimates of the costs of the tasks in the work package.

At the same time that planning was under way, the budgeting process was identifying the funding needed for the RCOH. Unfortunately, the planning and budgeting processes were disconnected, resulting in the development of a work package whose costs were not directly tied to available budget. As often happens with large programs, reductions were made in the RCOH budgets over time to pay other bills (e.g., the cost of operations in Bosnia) or to "fair-share" overall reductions in the SCN budget.

In addition to the reduction in the RCOH budget, the cost of the contractor proposal NNS submitted was greater than the initial estimates provided to the Navy. Contract negotiators, therefore, faced the difficult task of shaping the work package to fit the available budget. Because the Navy contract negotiators had not previously developed suitable options for reducing the work content to meet lower budgets and higher-than-expected costs, decisions were made that adversely affected the ability to successfully complete the RCOH.

Known tasks were delegated to the E&S pool, which was reduced to match the available budget, and tasks originally designated as repair actions were changed to open and inspect in the hope that no repairs would be necessary.

As the RCOH got under way, a large number of changes had to be made to the basic work package, resulting in a significant reduction in the money available for growth. Many of these changes were the result of tasks identified between the issuance of the RFP and the negotiation of the execution contract. Because this initial round of approved changes significantly depleted the change (E&S) budget, money became tight and the approval of subsequent significant changes was frequently delayed.

The nature of the open-and-inspect tasks in the work package, the complex nature of the RCOH, and a lack of clear understanding of the ship's material condition resulted in thousands of IRs and FMRs—many more than would normally be expected for a carrier availability, even one with the increased scope of an RCOH. These reports overwhelmed the limited number of RCOH staff personnel at SUPSHIP NN and made management of the RCOH difficult. Navy management of the RCOH was also hampered by the lack of timely, accurate, and useful data on the progress of the repairs and the estimated costs at completion. The NNS labor strike in the middle of the RCOH created further problems that resulted in cost growth and schedule slippage.

As the RCOH neared completion, Navy leadership recognized that the ship would not be delivered mission-ready without a significant infusion of additional funds. The Navy made additional funds available, and a large amount of work that had previously been shelved for lack of funds was approved. This influx of work caused problems in managing the NNS workforce, not only on the RCOH but also for other projects in the shipyard. Overtime was needed to maintain schedules and some inefficiency resulted, although NNS was much more efficient than it had been when vital changes were delayed because of lack of funds.

The end result was an RCOH cost approximately 20 percent greater than the negotiated contract and a slip in the delivery schedule of several months. Part of the cost increase was due to growth in the

work package, probably resulting from insufficient planning, decisions made during contract negotiations, and the lack of clear understanding of the material condition of the ship; and part was due to the strike, an increase in overhead rates at NNS, and NNS workforce inefficiencies.

AREAS FOR IMPROVEMENT

Most aspects of the CVN 68 RCOH planning and execution processes went very well, especially considering the complexity of the project and the fact that this was the first Nimitz-class RCOH. But there certainly was room for improvement, which could help keep the RCOHs for the rest of the class within cost and schedule constraints.

The Navy organizations learned many lessons during the CVN 68 RCOH and made a number of improvements during the planning of the CVN 69 and 70 RCOHs and the execution of the CVN 69 RCOH. For example, the Navy and the contractor improved methods of sharing financial data and communicating to support just-in-time decisionmaking. Other improvements for the CVN 69 RCOH include the following:

- Reduction of the work-package development and advance-planning phase from five years to four years by stabilizing budgets, developing reusable planning products, and building an experienced workforce to accomplish these tasks.
- Use of integrated product and process development, which allowed significantly more TYCOM involvement in the development of the work package and more contractor involvement in job-scope planning.
- Prestaging of critical equipment such as propellers and generator rotors, which reduced cost and schedule uncertainties associated with the open-and-inspect strategies used on CVN 68.
- Better job-scope development, which allowed entry into the CVN 69 execution contract with only 14 “Class F” estimates (in which the cost of the job can be estimated only to within +/– 40 percent due to limited understanding of the job scope), as compared with more than 90 on CVN 68.

- Tighter management of the E&S growth pool, based on weekly metrics.
- Improved efficiency of the contractor workforce resulting from improved cost-accounting procedures and weekly reviews of expenditures with cost-account managers.

Specific examples of improvements new to the CVN 70 RCOH planning process include the following:

- A new emphasis on strategic planning, which strikes right at the heart of workload forecasting, perhaps the biggest cost driver in the shipbuilding industry. By looking at long-range workforce, facilities, and schedule requirements for aircraft carriers, surface ships, and submarines, the Navy is making early modifications to overhaul schedules, preventing unexpected business-base changes which drive up overhead costs.
- A new contracting strategy based on the development of discrete annual planning packages, which allow the contractor to complete specific tasks during each of the advance-planning years. This is reducing the cost of ship checks and drawing development and will provide a better understanding of the cost of work prior to the start of an RCOH.
- A new modernization strategy, which installs approved ship alterations (rather than engineering-change proposals, as in the new-construction vernacular). This strategy will improve configuration control and logistics supportability and will reduce life-cycle costs by creating more reusable planning products.
- A new work-assignment strategy that maximizes the use of customer-contracted teams whose familiarity with certain new technologies will provide higher-quality work at a reduced cost.

In addition to the above, we recommend the following three areas for improvement during the RCOH planning and execution processes.

The Planning Process

Effective planning is critical to the success of an RCOH. Also, effective planning for the first and second RCOHs can serve as a sound

basis for the planning of subsequent RCOHs. It is important that the organizations knowledgeable about the current condition of the ship, its past maintenance history, and carrier overhauls and maintenance in general be directly involved from the initial stages of the RCOH planning process. These organizations include SUPSHIP NN Code 1800, the TYCOM, and NNS. Although Code 1800 became involved late in the CVN 68 planning process, it was fully integrated in the planning for the CVN 69 RCOH and is the lead organization for the planning of the CVN 70 and 71 RCOHs. It appears that the Commander, Naval Air Forces Pacific (COMNAVAIRPAC), the TYCOM for CVN 68, could have played a more prominent role in the planning of her RCOH. The Commander, Naval Air Forces Atlantic (COMNAVAIRLANT), the TYCOM for CVN 69, was very active in the planning of that ship's RCOH.

Although NNS was responsible for planning the nuclear part of the CVN 68 work package, its experience was not well utilized in the planning of the nonnuclear-repair package. We were informed that NNS's primary role in the nonnuclear portion consisted of providing the Navy with estimates of the costs for performing various work-package tasks. Since NNS is the organization that will execute a major portion of the total work package and since it has practical experience with large-carrier availabilities, its expertise and knowledge should be used in the development of nonnuclear repair packages.

The above organizations should work together to develop a list of tasks for possible inclusion in the work package of each RCOH. This list should be general in nature and should cover all *potential* tasks. Each carrier will have a previous maintenance history and a current maintenance condition, so not all potential tasks will be required for every carrier. Certain nonnuclear repair tasks required for CVN 68 may not be required for CVN 69, and vice versa. But a list of all possible repair tasks would form the basis for determining what should be included in the work package for each RCOH.

Each task should have a priority established from a set of priority rankings. These priority groupings would range from the highest priority, indicating tasks that must be accomplished during the RCOH, to the lowest priority, indicating tasks that could be done during the RCOH if budget were available but that could be deferred

to a later maintenance availability without degradation of the safety or operating capability of the ship.

For each task, preferred performing organizations (NNS, ship's force, or customer-contracted teams) should be identified, along with an estimate of the associated costs (plus, possibly, the costs associated with having alternative organizations perform the task). The higher-priority tasks, in combination with their cost estimates, would determine the minimum budget necessary for a safe and operationally capable ship. The priority list and estimated costs could be used when budgets are constrained to establish the tasks to be included in the work package.

Finally, planning for each task should include some understanding of its relationship with other tasks in the list. Performing one task may require that another task also be accomplished. Or, if one task, such as replacing a major component, is not included, then another task, such as repairing that component, may be required.

The task list could be updated and refined with each successive RCOH. In this manner, knowledge and information gained during the execution of an RCOH could flow into the planning of subsequent RCOHs.

The participation of the organizations involved in the planning process should not stop with the development of the work package that forms the basis for the RFP. The Navy organizations should also be involved in the contracting process to provide inputs on the actions to take when budgets are constrained or when certain tasks are removed from the work package. The planning organizations, in conjunction with PMS 312 and the Navy contracting organizations, should work with NNS to produce the best possible work package for each carrier, given the budget that is available.

Data and Estimating Capabilities

Useful data and effective forecasting capabilities are essential for the successful planning and execution of an RCOH. During planning, historical availability and maintenance data on the Nimitz class and the specific carrier approaching its RCOH are needed to form a work package of tasks to be accomplished during the RCOH. Also, RCOH

planning would benefit from a database of agreed-upon costs for the various tasks. These data would help in formulating the funding required for the RCOH, justifying budget requests, and determining which tasks should be included in the RCOH work package if the available budget is less than the required funding.

During RCOH execution, timely, useful, and accurate data are needed if the current cost and schedule status of the RCOH are to be inferred. Forecasting methods are needed to project the estimated cost and schedule at completion. Finally, PMS 312 must establish processes and criteria for informed decisionmaking during RCOH execution when inspections result in FMRs for increases in the work, and costs, of the NNS portion of the RCOH work package.

Historical availability data for the Nimitz class are available and are maintained by SUPSHIP NN Code 1800. This database was used for the planning of the CVN 69 RCOH. However, the Navy lacks sufficient cost data and estimating capability to support the RCOH budget and contracting processes. Currently, it relies on NNS to provide cost estimates for the tasks contained in the work package produced by the planning process. SUPSHIP NN does have a limited cost-estimating capability, but it did not have enough time to effectively check the cost estimates provided by NNS for the CVN 68 RCOH. It has no way to develop its own cost estimates or to effectively check those provided by NNS unless the staff is augmented or sufficient time is available to prepare its estimates.

We are not suggesting that the Navy develop its own cost-estimating database and methods. Rather, we believe that the Navy and NNS should work together to develop an agreed-upon database of costs for the wide range of tasks that may form the work package for a specific RCOH. In general, there should be an open-book data environment between the Navy and NNS. Since NNS is the sole organization that has the facilities and expertise to accomplish a Nimitz-class RCOH, there should be no threat of misuse of the common data in a competitive environment. The data available in the open-book data environment should be at the level required for effective planning and execution. For example, the shared database should include man-hour estimates to accomplish a specific task, but need not necessarily include the rates that would apply at the time of the RCOH execution. Furthermore, the Navy must understand the

business-sensitive nature of the data and protect against any possible misuse, especially if any of the data could also be appropriate for other projects that have a competitive aspect.

In general, NNS must be contracted to share data, information, and knowledge not only when the Navy specifically requests them, but also when such sharing is important for broader understanding and better decisionmaking. Along these same lines, the data flowing to the Navy during the RCOH execution must be timely, accurate, and useful for decisionmaking. Currently, progress-related data are received several months after the period to which they apply and are often displayed in a manner that is confusing and unhelpful for Navy project management. During the CVN 68 RCOH, a change in the basic data-collection and management-information system within NNS resulted in some needed data being unavailable or inaccurate.

In an open-book data environment, the Navy would have access to the same data that are used to formulate the quarterly CPRs. That would allow the Navy to monitor the cost and schedule status on a near-real-time basis and would permit more-timely decisionmaking.

Establishing an open-book data environment would require major changes by both the Navy and NNS. But these changes could lead to a more-effective relationship that would benefit both organizations.

The Relationship Between the Navy and NNS

The relationship between the Navy and NNS is strained. Many in the Navy express a degree of mistrust of NNS, perceiving that it at times withheld data and information that would have been useful for RCOH planning and execution. NNS has equally valid concerns that freer information flows would jeopardize future negotiations with the Navy. These problems must be resolved for subsequent RCOHs.[2] The Navy and NNS must feel more confident in each other and must work more closely together during both the planning and execution phases. They must commit to a long-term relationship with

[2]Mistrust and miscommunications do not appear to exist between the Naval shipyards and the carrier TYCOMs.

mutually agreed-upon objectives and effective communication strategies that lead to openness and trust.

The two areas for improvement outlined above would require a closer relationship between the two organizations. If the level of mistrust cannot be overcome, the Navy and NNS will not be able to effectively interact during the planning process or agree on an environment where they share data and forecasting expertise.

We are unsure of how to improve the relationship between the Navy and NNS. Interaction during planning and sharing data and expertise would certainly help. Possibly, the two organizations could consider assigning employees to each other's organizations for periods of time. This is a technique often used by U.S. military services in their interactions with the militaries of other nations. However it is accomplished, a solid partnership between the Navy and NNS is needed to successfully plan and execute the remaining Nimitz-class RCOHs.