REENGINEERING AND REINVENTING THE U.S. NAVAL SHIPYARDS

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The Tom Clancy novel, *The Hunt for Red October*, thrilled millions of readers. In it he tells the story of the Soviet submarine Red October "defecting" to the United States and the hunting of the Red October by the USS Dallas (SSN 700), a 688 class attack submarine, The novel vividly portrays the enormous complexity and technological sophistication of an attack submarine. While the descriptions of the advanced technology, operating speed, agility and firepower of the 688 class submarine engrossed many people, few realize what it takes to maintain, repair and modernize a nuclear-powered submarine. This article chronicles the application of project management, as part of the Advanced Industrial Management (AIM) program, a reengineering of the business processes at the naval shipyards, to the repair and modernization of another 688 class submarine, the USS Providence (SSN 719).

Faced with rapidly declining defense budgets and increasing competition from private shipyards, the naval shipyard community has had to rethink and fundamentally change the way it operates. The AIM Program has been the mechanism to define and effect these changes. AIM defines a new organizational structure, project management, and new processes for planning and executing projects and provides the information technology needed to support these changes. The prototype project, to test the implementation of many of the AIM reengineered processes, was the USS Providence (SSN 719) Depot Modem. ization Period (DMP) at the Charleston Naval Shipyard.

Advanced Industrial Management (AIM)

The AIM Program is leading the naval shipyards in a reengineering of the core business processes, a redesign of the shipyard's management organization, and an information technology infrastructure to support the reengineered business process. The Naval Sea Systems Command (NAVSEA) serves as the corporate headquarters for the naval shipyards and manages the AIM Program together with significant participation from the shipyards [1].

The eight public sector U.S. Naval Shipyards are large industrial facilities that perform overhaul, repair, and modernization of complex surface ships and submarines of the U.S. Navy. Total employment is approximately 50,000, including military and civilian personnel covering a wide range of blue- and white-collar disciplines. The shipyards have done as much as 3.5 billion dollars a year in repair work. The naval shipyards are comparable in employment and revenue to Mobil Oil Corporation.

The ship repair and modernization processes are very complex and labor-intensive. This is due to the difficulty in accessing machinery and components, the complexity of the systems, and safety requirements. Some projects, such as an aircraft carrier life extension, can be as large as 1.5 million labor-days. There are over 72 separate trade skills that have to be managed. Many of these trade skills require extensive training and qualifications that are not available on the ordinary labor market, e.g., nuclear-trained machinists, sound isolation installation technicians, certified welders, optical specialists, divers, etc.

The shipyard management process and organization was designed for the days when the shipyards built ships, despite the fact that the last ship built in the naval shipyards was almost 25 years ago. The business environment and product line have changed, and today's workload consists of increasingly complex surface ship and submarine maintenance and modernization. Increasing competition from private shipyards, declining defense dollars, and the actions of the Congressional Base Realignment and Closure Commission have added to the pressure to cut costs, and have resulted in naval shipyards experiencing the most severe downsizing challenge since the end of World War II. Consequently, radical changes in business practices and the shipyard culture are necessary to meet the challenges of the 1990s and beyond.

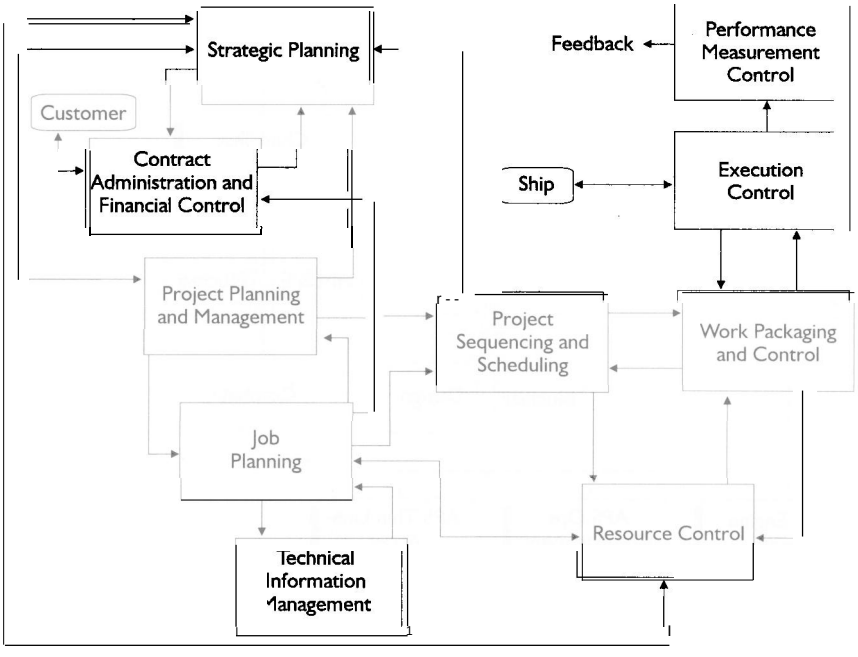
The shipyards' organizational structure was a hierarchical organization based on the function or trade skill. The department heads were not only responsible for managing their functional organization, but were also required to manage their segment of the work on the ships. No one was responsible for the total work performed on a ship, only for their piece of the work. The shipyards used a ship superintendent to coordinate the activities of these senior managers. However, the ship superintendents did not have the structure, resources, nor authority to manage and control all activities on the project. They did not create the project

schedules and budgets, nor were they considered part of the shipyard's senior management. A study by senior Navy managers found that shipyard managers were unable to properly plan, estimate, schedule, and execute production work. Crisis management was evident at all levels [2]. The AIM Program is in response to these findings.

The AIM business model consists of three parts: Business Process Model, Organizational Model, and the supporting Technical Architecture. The process model is the base model and the organizational model and technical architecture is based on the requirements of the process model. The AIM process model provided the reengineered business processes, without regard to organization, that focuses the naval shipyards' attention on the core reason they exist, to fix ships [3].

The AIM approach to redesign the shipyard's organizational structure is to institute a strong project management structure, where the project superintendent is the manager responsible for the life cycle of the project and is accountable for meeting the cost and schedule agreed to by the customer. The project superintendent relies on the rest of the shipyard to supply resources and in some cases to perform the assigned work to the budget and schedule approved by the project superintendent. The project superintendent has direct management authority and control over resources engaged in shipboard work in order to ensure responsiveness to tactical decisions and customer requirements. Thus, the project management organization supplants the functional line organizations for management of shipboard work. [4]

AIM is a fundamental business and cultural change designed to reinvent the naval shipyards. It is a business process reengineering of the naval shipyard's processes, information infrastructure, and organization structure to lead the naval shipyards into the 21st century. The results of projects like the SSN 719 measure the success of the AIM Program and project management.



Submarine Maintenance Cycle

The modern nuclear-powered attack submarine is a truly fantastic ship. Its unique capability allows it to cruise for months at a time anywhere in the world's oceans at speeds exceeding 30 knots. Its mobility, operating range and quiet operating capability make it extremely difficult for hostile forces to detect and track. The 688 class submarine contains a sophisticated nuclear power plant, complex weapons and communications systems, modern sonar systems, state-of-the-art torpedoes and missiles, as well as living and working space for a crew of 130. All of this equipment and personnel are contained within a 360-foot-long cylindrical pressure hull structure of HY-80 steel (yield strength of 80,000 ASI). This complex vessel contains thousands of components and several hundred miles of cables and piping runs. Repairing and modernizing this modem warship is not only a tremendous technical challenge, but also one of the more complex management problems existing today.

All nuclear submarines are maintained in accordance with an engineered operating cycle. The operating cycle fulfills the dual objectives of properly maintaining and repairing the submarine so that it can operate in a safe and dependable manner, while also modernizing the submarine to enhance its war-fighting capabilities. Figure 1 on the following page depicts the notional engineering operating cycle for an SSN-688 class submarine.

An availability is the amount of time the shipyard has to perform the scheduled repairs, maintenance, and modernization. There are three different types of availabilities for a 688 class submarine:

- Selected Restricted Availability (SRA) — a short-duration repair period typically conducted at two-year intervals.
- Depot Modernization Period (DMP) — an extensive modernization and repair period conducted at six-year intervals. A DMP typically takes one year to complete.
- Refueling Overhaul (ROH) — a complex repair and modernization availability conducted when required,

to refuel the submarine's reactor plant.

The USS Providence (SSN 719) was to begin a DMP in late September 1992 at Charleston Naval Shipyard. Initial planning of this DMP envisioned a 140,000 labor-day work package, and 12 months to complete the work at a cost of approximately $61 million. The work package for this availability included extensive weapons systems upgrades, an updated fire control system, the replacement of several components in the propulsion plant and extensive repair work.

CHARLESTON NAVAL SHIPYARD ENVIRONMENT

The USS Providence (SSN 719) presented several unique challenges to the Charleston Naval Shipyard (CNSY). First, it was the initial 688 class DMP conducted at CNSY. This created significant concerns regarding training facilities, tooling, and work processes to successfully execute this complex work package. Second, the 688 class submarine was to be the mainstay of the planned workload beyond fiscal year 1994. Faced with a declining workload, it was a strategic objective of the Charleston Naval Shipyard to become the premier 688 class submarine repair and modernization shipyard. The shipyard believed that successful execution of this project would enhance its position in securing future submarine work. Third, initial experiments with project management, and the initial AIM reengineered processes, yielded some encouraging results.

Captain Tom Porter, Charleston Naval Shipyard Commander, decided to conduct the USS Providence availability using a project management organization. Additionally, in conjunction with the AIM Program Office of the Naval Sea Systems Command (NAVSEA), Charleston would adopt the certain AIM reengineered processes that directly supported the planning, scheduling, and execution of the work, while the other AIM

Figure 1. **Extended Submarine Engineering Operating Cycle**

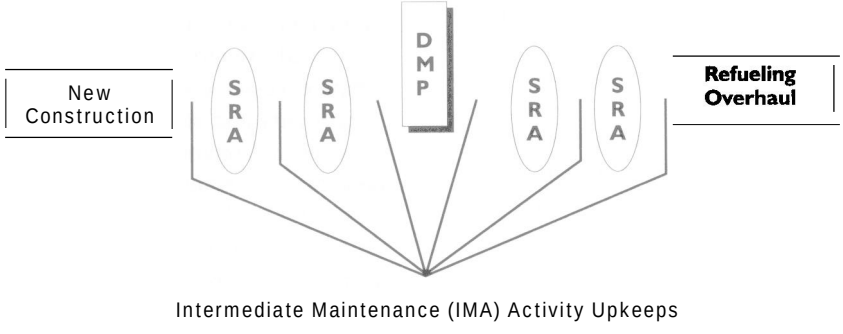
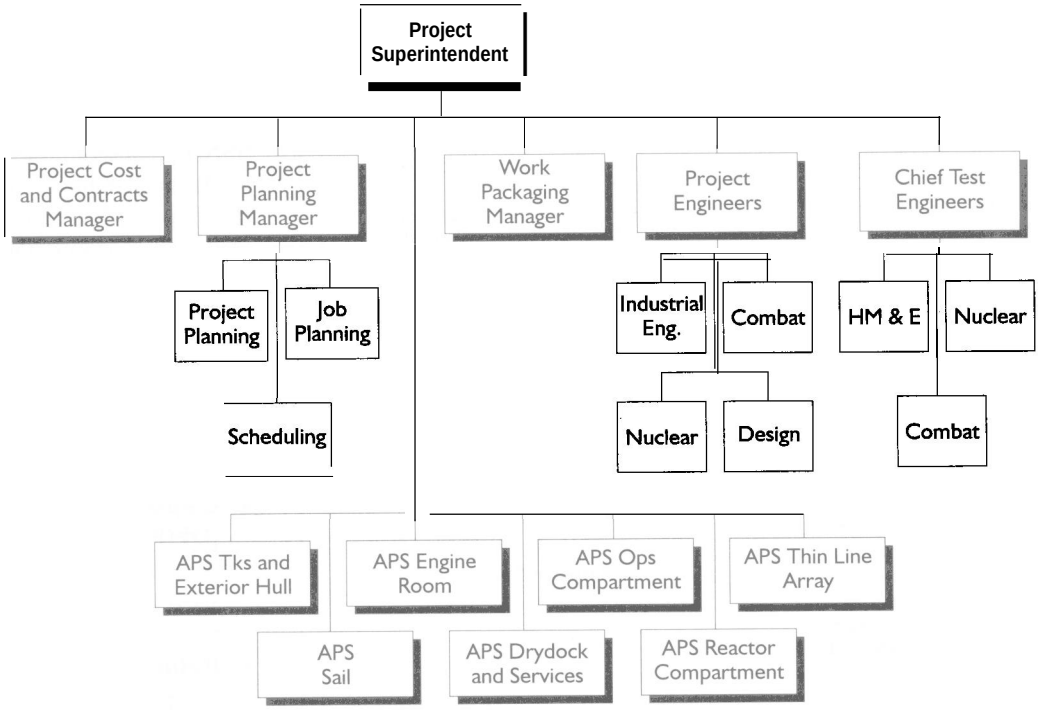


Figure 2. SSN 719 **Project Team**



processes were undergoing analysis and testing prior to being rolled out to the shipyards.

The SSN 719 Project Team

The SSN 719 project team had three major assignments:

- Establish a project management organization.
- Adopt the AIM reengineered processes that directly supported project management in planning, scheduling, and executing the work to be accomplished in the work package.
- Execute the prototype project.

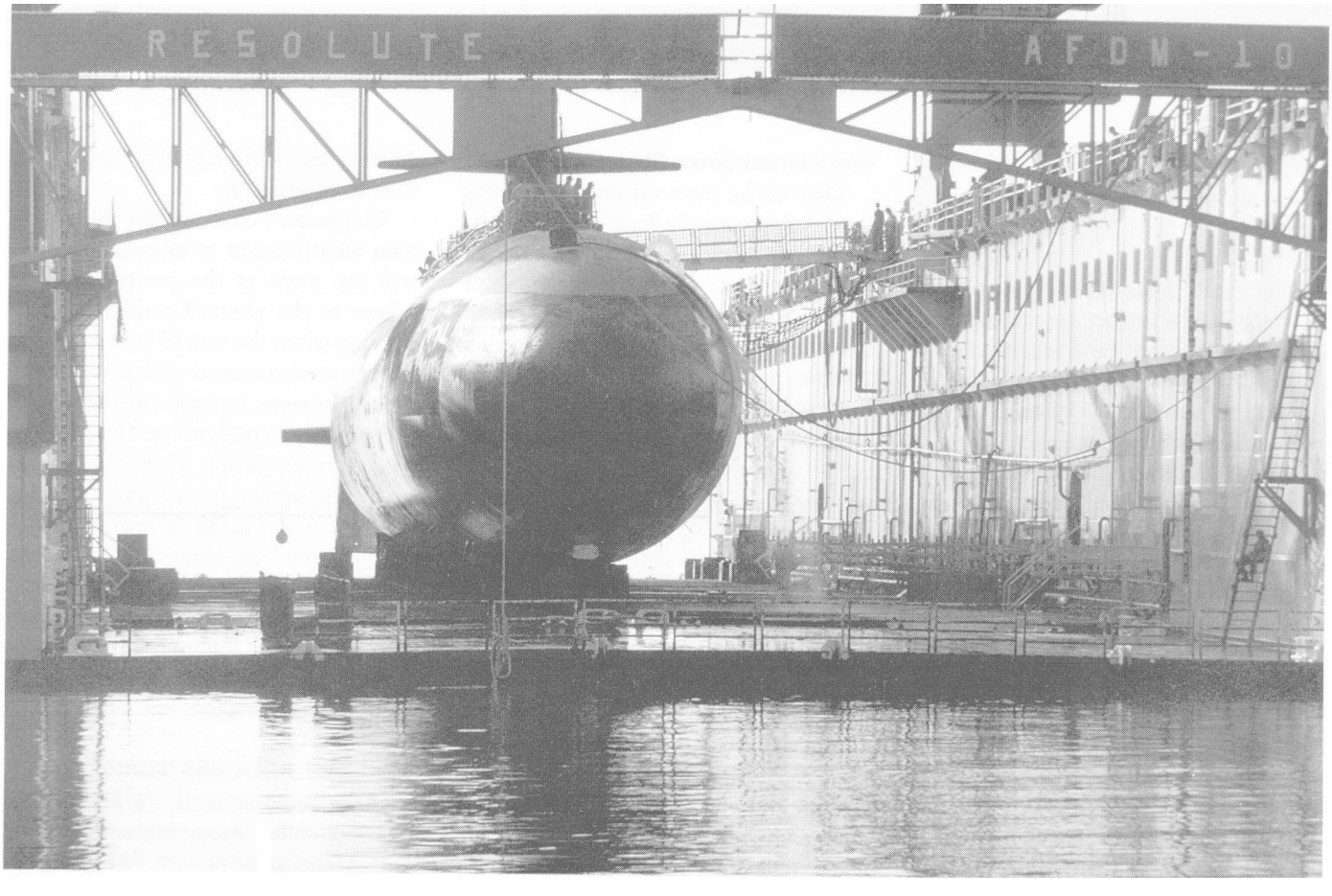
This was a particularly ambitious tasking because of the existing culture within the shipyard. Historically, the shipyard had a strict functional organizational structure. There was strong allegiance by both blue-collar and white-collar employees for their parent shops and departments. The concern was not so much with ship (project) success, even though projects are the primary source of revenues for shipyards, but rather with the success of the individual's own department. In addition to this functional bias, there were two scheduled reductions in force due to the decreasing workload. The entire workforce was apprehensive about the future and was suspicious of any changes.

As depicted in Figure 2, the structure of the project team supported the reengineered business process and functioned as an empowered, high-performance organization.

These key team members, assigned six to seven months prior to ship's arrival, were collocated to improve communications and establish ownership of the various planning products produced by the project team. Team building sessions firmly established the project's goals and strategy. There was a sense of urgency on the project due to decreasing workload and increased competition for submarine work. After forming the start-up team, the project superintendent established a clear policy of professionalism for the project, a policy that encouraged the identification of problems in a free and open manner and a policy that aggressively pursued corrective actions.

Captain Porter provided initial guidance to the project team, reviewed their status on a regular basis and remained a strong supporter throughout the project. This strong top management support was vital to the success of the entire project and enabled the project team to implement the AIM-reengineered processes and develop new processes as needed, when many managers did not believe these new processes could work at a naval shipyard.

The project team initially conducted an extensive process review in an attempt to



apply the AIM-reengineered processes. The following AIM concepts were implemented on the SSN 719 project:

- The AIM organizational structure, which has a project superintendent with the authority and accountability for the entire life-cycle of the project and the performance of all activities associated with the project.
- The AIM concept that the project superintendent must build a project team and then empower it to take responsibility for all aspects of the project.
- The AIM concept that each process adds value to the preceding process.
- A work breakdown structure (WBS) based on shipboard components. This WBS gave the Charleston project team the flexibility to support the daily execution schedule strategy without extensive rescheduling or changes of work instructions.

Work Breakdown Structure

One of the most pressing issues was the development of a flexible work breakdown structure (WBS) that could be reused by future projects for other ships of the same class. The team recognized that the individual components of a ship (motors, pumps, etc.) provided a convenient structure for which all work could be planned and executed. By identifying a phase of work on a physical piece of equipment, a flexible, component-based work breakdown structure could be created [5]. Component Unit Phase is the name of this component-based work breakdown structure. (See Glossary.)

A "phase" describes the type of work performed on a specific Component Unit. Fourteen phases are standard within the process. Phases include fabricate, remove, repair, reinstall, test, etc. By standardizing the Phases and Component Units, all work instructions, references, estimates, work assignments, etc., are reusable on other projects and among the naval shipyards.

Component Units are the most common identification to manage and control the work at the project level. It relates to the physical configuration of the ship when the unit of work concerns specific components or groups of components. Common examples include tanks, pumps, valves, and motors. It relates to other project work, such as services, when appropriate for management purposes. It is not a bill of material, since "components" are identified only to the level of detail required to plan, budget, schedule, execute and control the project, and it can be used to describe a service and other work or service required for the project.

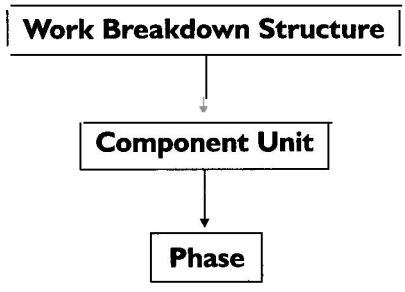
PROJECT PROCESS TEAMS

After determining the WBS, the project team shifted its attention to planning and executing the project. As depicted in

Figure 3, the project team adapted the five AIM reengineered processes of Project Planning, Scheduling and Sequencing, Job Planning, Work Packaging and Control, and Execution. The SSN 719 project team then organized into process teams. Each process team was responsible for developing the products produced by a particular process. Process teams were established when the inputs were available to perform the process and disbanded when the products were produced.

Key managers on the project were members of several teams as the focus of the project shifted during the project life-cycle. As the project progressed through the life-cycle, the make-up of the teams changed. Specialists were brought on board when their particular skills were required, such as scheduling personnel when the project was developing and maintaining its project schedule, or engineering or trade disciplines for the job planning and work packaging and control processes. The project began with the project planning process team and finished with the execution process team.

Glossary of Terms



Component Unit - a standard unit of work within an established ship class work breakdown structure, around which Component Unit Phases and Task Group Instructions are organized. It relates to the physical configuration of the ship (class) when the unit of work concerns specific components or groups of components. The Component Unit relates to other project work, such as services, when appropriate for management purposes. It differs from a bill of material in that "components" are identified only to the level of detail required to manage the project and it can describe a service required for the project in lieu of a physical item.

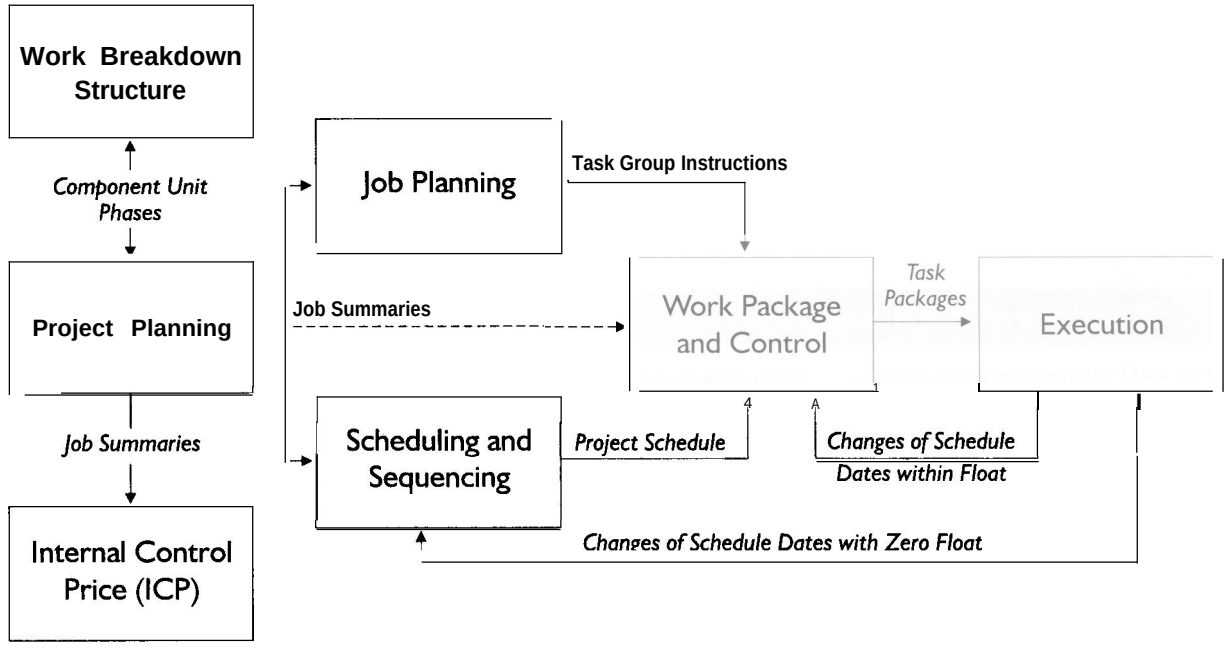
Component Unit Phase - normal, predetermined step in the repair, maintenance, or modification of equipment or part of a system. Phases can be applied to each Component Unit depending upon the required repair, maintenance, or modification.

Job Summary- a strategic grouping of work within a specific section of the customer-authorized work package that the project team establishes to plan and price the work.

Task Group Instruction - the document used to provide the detailed work instructions and necessary technical information for accomplishment of the specific tasks within a Component Unit Phase.

Task Package - one or more Task Group Instructions, which can be grouped in whatever configuration is deemed the most efficient for execution.

Figure 3. **Project Management Processes**



Project Planning Process

The project planning team performed the project planning process by establishing the Job Summary as a grouping of Component Units by which to plan, schedule, and manage work. The job summary contains an arbitrary number of Component Units and Phases in the authorized work package that share some common association. This association is a work evolution with an easily recognizable beginning and end and is often system-oriented. The job summary also includes an estimate of labor and materials to perform the work.

Job summaries initiate the entire management process. If not developed and issued on time, and if they do not contain the necessary information, it can cause a delay in the entire process. The project team closely monitored the development and issuance of the job summaries.

After issuance of the job summaries, the project was able to gain a good deal of momentum. The job summaries allowed: detailed technical job planning, scheduling and sequencing, initial work packaging and final development of the project budget to all be conducted in parallel. This was a major breakthrough. It enabled the shipyard to maximize the effectiveness of the valuable planning time during the six months immediately prior to the ship's arrival.

Developing Job Summaries

The development and review of job summaries was a critical factor in the success of the SSN 719 project. Simply put, they brought the project team together.

Job summaries were conceived as a mechanism for the project team to define their execution and cost control strategies at a fairly detailed level. In addition, the development of job summaries made sure that the project team had "bought in" on the total objectives of the project. Job summaries also provided a link back to the customer work authorization document. In conducting the job summary reviews, the team developed a common purpose, agreed to performance goals, and defined a common approach to the work.

The project team conducted an uninterrupted review of every job summary. In conducting the reviews, it became evident that people were buying into and developing ownership of the project. This uninterrupted period was a major factor in this diverse group's ability to perform as a team. This process provides a vehicle to focus on customer interests and expectations, provides a method to search for the most efficient and effective methods of execution, and focuses on the internal processes that determine success. It establishes an environment that continually seeks improvement, and it concentrates on preventing problems instead of reacting to them. Finally, this process focuses on teamwork to achieve the project's goals.

Budgeting With Support Organizations

The SSN 719 project team negotiated for products and services with the shipyard support organizations. The team did its homework and determined the products that the project would require from the support organizations and approximately how long it would take to produce each product. With this knowledge, the team negotiated a realistic budget for each product and only for the products the project required. For service work, the team negotiated with the support organizations an agreed-to level-of-effort, tied to a particular key event or milestone. As a result, the team had a significant measure of control over the costs of support work.

The Internal Control Price (ICP) was the project's budget and internal cost performance goal. Since the job summary provided labor estimates and material estimates, all the data was available during project planning to establish an internal cost goal. Labor and material estimates were benchmarked against performance achieved by competing shipyards to produce an aggressive budget. The project team examined the basis of each estimate, including a risk analysis, during the review of each job summary.

Project Scheduling and Sequencing Process

The scheduling team initiated the scheduling and sequencing process as soon as the sequence, duration, and crew size of each Component Unit Phase within a job summary was established. The job summaries provided all the necessary schedule information. The scheduling team leader conducted review meetings that included the project superintendent, assistant project superintendents, project engineers, test engineers, and the work packaging team leader. These meetings culminated in the project schedule. In addition, these meetings developed a comprehensive understanding of the scope of work and work breakdown structure. The project team was able to develop a notional staffing plan, which allowed the scheduling team to resource and shift level the schedule. The project team then conducted "what if" analysis of the schedule to aid in the identification and resolution of problems. The resulting integrated schedules were key factors to the success of the project.

This involvement by the project team in the development of the project schedule brought the collective knowledge and experience of these individuals to the process. It also ensured that the supervisor responsible for the execution of the work fully and completely understood the scope, goals, and strategies of the project. The project scheduling team developed the project schedule from the data developed in the job summaries. The production and scheduling personnel had confidence in the schedule and the data that built it. Since the project schedule was the basis for the project's Budgeted Cost of Work Schedule (BCWS) this gave credibility in this

earned value tool as a measure of performance.

Job Planning Process

The challenge with work or technical instructions in the naval shipyards is to have them written at levels consistent with the work, and to contain the detail necessary to efficiently perform the work. The job planning process team leader made sure that all work requirements were written to the level of detail necessary to perform the work for each task. The objective was to produce a work document with a maximum of clear instruction, allowing the mechanics to do their work with a minimum of difficulty. The detailed technical work instruction describing how to accomplish a task in a particular Component Unit Phase is a Task Group Instruction (TGI). The Task Group Instruction contains the sequenced work steps, technical information on the work to be performed, labor-hour allowances, crew size, duration, equipment and special tools required, and material list by the Component Unit Phase. The SSN 719 project team closely monitored the development of Task Group Instructions. The mechanics couldn't do their work without the Task Group Instructions. If the Task Group Instructions were inaccurate, incomplete or issued late, delays were created in the work packaging and execution processes. The TGIs had to be of the highest quality to support the many inspections and certifications required in submarine work.

One of the potential benefits of a well. developed Task Group Instruction is less planning on future projects. A Task Group Instruction should be reusable for the same work within a ship class.

Work Packaging and Control Process

The work packaging and control process team was responsible for assembling Task Group Instructions into Task Packages to efficiently utilize resources and working space. The work packaging team performed numerous activities after receiving Task Group Instructions from job planning and before issuing Task Packages for execution. These activities included:

- Together with the execution team, deciding the most efficient and effective way to group and issue Task Group Instructions.
- Reviewing the schedule to ensure that priorities and work coincided with the plan and the sequencing requirements.
- Ensuring the accomplishment of all technically mandatory predecessor tasks.
- Ensuring the work space is available.
- Ensuring proper plant conditions prior to authorizing work to begin.
- Ensuring all necessary material, up-to-date technical instructions, and references are available to the mechanic.
- Accounting for all certification requirements involved.

Execution Process

The execution process team met the execution challenge by adopting three basic philosophies:

- Assign the people to the available work and do not find work for the available people.
- A first-line supervisor can supervise trade skills other than his own.
- The skill resides with the mechanic.

The execution process team consisted of assistant project superintendents (a second-level supervisor, assigned a specific area of responsibility), and first-line supervisors who reviewed the project schedule with the work packaging team for all the work that was open or scheduled to start in the next two weeks. Using the Critical path Method, they were free to make these adjustments as long as they were within float and they did not cause a delay in a key event. After the execution team and the work packaging team determined the work for the next two weeks, the project team compared the number of people required, assessed the variance and adjusted the project's labor force.

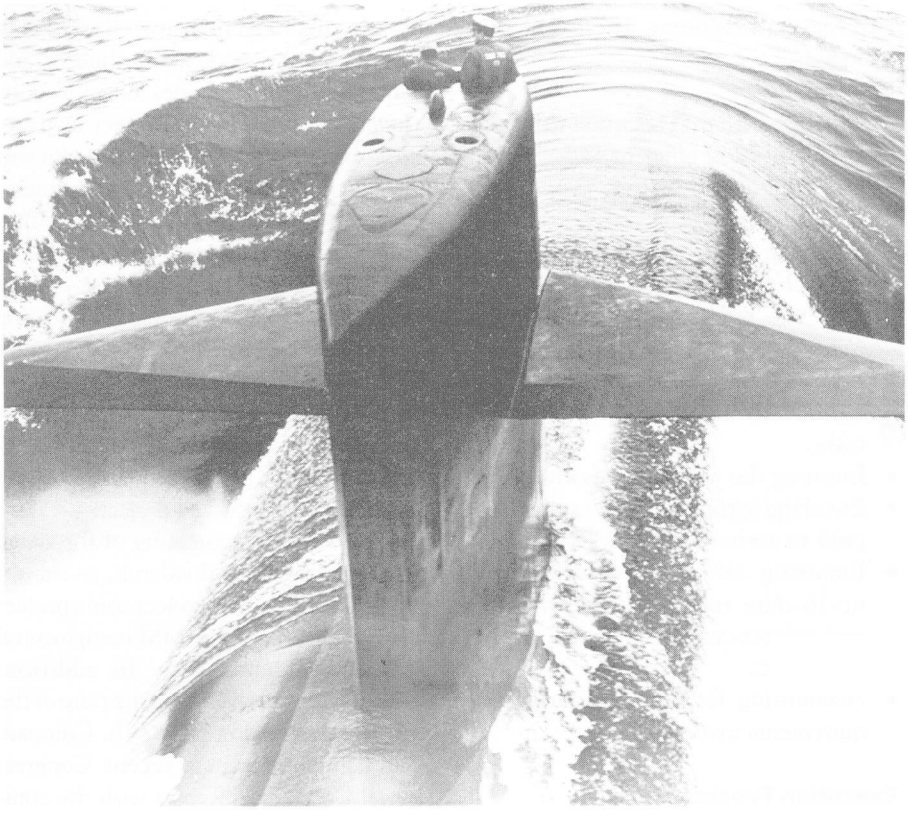
OUTLOOK

The planning and preparation accomplished by the SSN 719 project team greatly enhanced the supervisor's ability to execute the work within budget and schedule. The strategies developed by the project team in the project management plan set the stage for the efficient execution of the work. The job summaries, Task Group Instructions and integrated schedules allowed for the efficient assembly of Task Packages. The control of the release of work until the meeting of all prerequisites, permitted the assistant project superintendents and first-line supervisors to execute the work in the most productive manner possible and to effectively use cost and schedule reports to monitor and control the project.

The AIM reengineering of the naval shipyards is paying dividends, as the results of the SSN 719 project using project management and the AIM reengineered processes demonstrate. In addition, other organizations are taking note of the AIM reengineering approach. Compare this comment from a recent Congressional Committee Report with the comments contained in the study conducted by senior Navy managers:

> *"The Committee supports the Navy's efforts to improve naval shipyard management processes through the Advanced Industrial Management (AIM) program. The Committee recognizes that management processes as well as industrial capabilities can be modernized to achieve greater efficiency. The Navy is encouraged to implement this program in a timely fashion. Further, the Committee recognizes that many elements of the AIM Program may be applicable to other Department of Defense industrial activities and encourages the Secretary of Defense to consider adopting the relevant portions of the AIM Program as a DOD-wide standard system. "*

In fact, this is becoming the case. Frank Bankes, AIM program manager for NAVSEA, and the NAVSEA AIM program team, assisted the Joint Logistics Command in a comprehensive review of their business processes. He recalls, "The Joint Logistics Command is responsible for all Army, Navy, Marine and Air Force maintenance depots. They are looking to



Results of the Project

The $61 million modernization of the SSN 719 was completed on schedule and was 20 percent under the cost in labor-days of similar modernization projects.

The short-term result of the SSN 719 project was in the immediate cost impact. The long-term result was to confirm the business process and organizational changes being implemented by the AIM Program and the payback possible through project management. By focusing on why they are in business, to fix ships, by focusing on the processes required to fix ships, and by having one person, the project superintendent, accountable for these processes, the naval shipyards are successfully reengineering their business.

reengineer their business processes. After evaluating several options, they are strongly considering adapting the AIM reengineering approach as the methodology to redo their business processes."

LESSONS LEARNED

This article has focused on project management as it was implemented on the SSN 719 submarine modernization and repair project at the Charleston Naval Shipyard. In analyzing the SSN 719 project, ten factors were identified that were critical to the success of the project [6]. These critical success factors are not peculiar to the naval shipyards but rather are basic principles for the implementation of project management. These principles apply whether it is the first time the organization has tried project manage. mentor when anew project is established within an organization that already practices project management.

Throughout this article we have used the job title "project superintendent." However, in most project management applications, the person responsible for the life cycle of a project is commonly referred to as the project manager. Because of the universal applications of the principles learned on the SSN 719 project, we conclude this article by using "project manager" in describing the ten critical success factors for implementing project management.

1. The project manager must be the recognized official responsible for managing the project. The project manager must be fully and actively supported by top management and, through their example, by all key senior managers in the organization. The project manager must be the organization's representative to the customer and the recognized official responsible for managing the project.
2. The project manager must be responsible for and control all funds on the project. Control of cost is a key concept of project management. The project manager is responsible for accomplishing the project within the overall project budget, and needs the authority to control all expenditures against that budget.
3. The project manager must place primary emphasis on team building, empowerment and relationship management. The project manager must work with the team members to make sure they understand their respective scope of responsibility and what is expected of them. The project manager must empower the staff by delegating decision-making authority to the appropriate level and must also recognize that the support of all the departments in the organization is needed.
4. The project team must be assigned early, kept intact, and located near the work site in contiguous spaces. Assemble the project team early and add additional resources as required. Once established, it is critical to keep the team intact to maintain momentum, learning, and commitment. House the team together and locate them near the work site to enhance the team atmosphere, the exchange of information, and to facilitate and maximize time at the work site.

5. The project team must take responsibility for the project planning process. The project manager takes the guidance provided by top management and with the project team develops a project management plan. In doing so, the project manager ensures that everyone on the team has a common vision of success, and fully understands and accepts the organization's goals. The project team must take an active role in the entire planning activity, including analyzing the work package, defining the strategies, and breaking the work down. To be able to establish a realistic, resource-loaded plan to which they are committed to achieving, the project manager and the team must take responsibility for planning the project. This active involvement is essential to build the required understanding and ownership of the project.
6. The project team must be able to perform true schedule and resource load analysis. The project team must identify the technical sequence required to perform the work. This forms the basis of the schedule. The project team can then load the schedule with the resources and produce a staffing plan. The project team can do "what if" analyses to determine the impact on the schedule of changing staffing levels. A schedule that accurately reflects the status of the project and represents a usable plan for future work and personnel requirements is essential for controlling costs and measuring performance.
7. The project team must control the application of labor resources to the project. The project manager must control how and when people charge to the project if costs are to be controlled. Strict application of resources starts with the development of sound budgets and continues with the development and maintenance of a staffing plan that accurately reflects the work to be done and the schedule.
8. The project team must closely monitor the process of developing work instructions. If the work instructions are not accurate, complete, or issued promptly, the work packaging and execution processes are delayed.
9. The project team must manage the work packaging process. An important aspect of the SSN 719 project's success was the process used to ensure that the mechanic had the information and material required to *complete the assigned job*. The supervisors and the work packaging team worked closely to ensure that the mechanic had everything required *before starting the job*.
10. The project team must control changes to the scope of the contracted work package. To ensure proper work flow and efficiency the project team must employ a disciplined process for controlling changes, assessing cost and schedule impacts, pricing changes, and discussing the changes with the customer to ensure that the customer wants the change and is willing to pay for it. Without such controls, the project team will not meet its cost and schedule performance goals.

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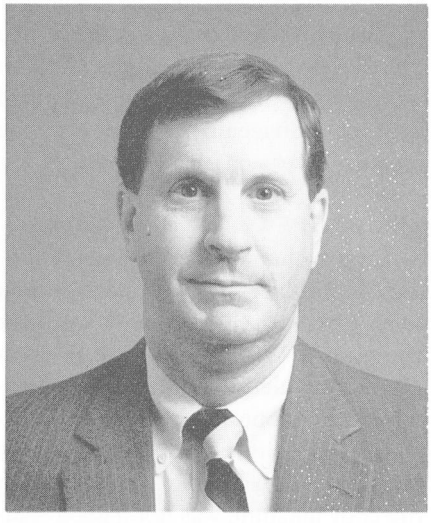

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