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EVALUATION OF THE SPACE AND NAVAL WARFARE SYSTEMS COMMAND (SPAWAR) COST AND PERFORMANCE MEASUREMENT

by

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I. INTRODUCTION

A. BACKGROUND

From the post World War II era to the present, the United States and NATO, and the Soviet Union and the Warsaw Pact nations were engaged in the Cold War. Significant expenditures and the use of vast national resources marked this period by both sides to gain and hold military and economic advantages over the other. During this period of intense competition between these two blocks, advantages gained though military technologies were particularly prized. These leaps in technology provided numerous advantages for the country that invented, developed and exploited the advantage.

First, new technology could provide a distinct military advantage. This is the most obvious military benefit from new technology. The nuclear power program for the Navy is an example. This program provided the Navy submarine force with significant benefits over existing forces, and provided a tangible benefit to the Navy and the nation. The nuclear Navy provided the capability for the Polaris program, that to this day is a viable part of the triad national defense force.

Secondly, new technology provides the nation with a sense of international pride in the international arena. The successes of the space program, for the Soviets in the late 1950s is a case in point. At the time of the Sputnik launch, the United States and much of the world believed that the Soviet Union was not as technologically advanced as the western powers were. The success of Sputnik changed this belief overnight, and altered

the way in which the Soviet Union was viewed by the rest of the world. A similar reaction was seen as the United States progressed with the Apollo Space Program during the 1960s. The United States enjoyed a new period of international respect as successive Apollo mission reached new heights of technological superiority. This sense of heightened respect by the international community was an important added bonus to whatever scientific and scientific gains were made. A case could be made that the international pride the Apollo programs gave the United States was the most significant benefit.

Thirdly, the United States invested in new technology as a force modifier. The Soviet Union and the eastern block enjoyed a numerical superiority of ground forces and equipment during much of the Cold War. The United States and allies countered this numerical superiority with technological superiority. Superiority in technology produced weapons systems that formed the basis for the theory of force modifiers. This theory dictated that an American weapons system could be so technology advanced that it would have the battlefield equivalent of two or more Soviet weapons systems. Therefore, the improved technology, although it might be more costly, would allow the United States to overcome the numerical superiority of the enemy.

Lastly, improvements in military technology can have spillover effects into the civilian sector. Satellite technology and global positioning systems are programs that began as military programs, but have come to have significant civilian benefits as well. Satellite communication began as military programs with military applications. In time, this technology was transferred or co-developed with the civilian sector. Today, satellites

are critical to all telephone networks around the world. This technology, seeded with military dollars, has now become a civilian technology in its own right. There are many other examples of military applications having profound civilian applications in the medical and other fields. The development of penicillin during World War II in a superb example.

One of the common threads to all of these technological advantages is that they were funded and developed in periods of relative prosperity. The United States was obsessed with the Cold War and the threat that the Soviet Union possessed for the safety of the United States and allies. This was also a time of prosperity for most Americans. This combination allowed a prolonged research and development period, which was the catalyst for technologically advanced hardware and weapons systems. The cost of these systems was secondary to the benefit to be gained from the military operations perspective.

These programs may be casualties of the their own success, as a historical review indicates. The Reagan defense buildup of the early to mid 1980s was the end of the high spending days for the United States military. The Department of Defense share of the federal budget has decreased from 9.3% in 1962 to 6.3% in 1986 to 3.2% in 1998. [Ref. 1] The Berlin wall fell in 1989. The Soviet Union began its breakup in 1990, and the Cold War effectively ended in the early 1990s. At this time, more political and public emphasis was placed on the budget deficit. The last budget surplus was in the Johnson Administration in 1968 and the cumulative national debt grew to $5.5 trillion by 1998, when the next surplus appeared. The Cold War and the subsequent military buildup of

the 1980s is generally believed to be a major factor in this deficit, although in reality entitlement programs have also been a large factor. From 1980 to 1998, defense spending, even with the Reagan buildup of the 1980s, fell as a percentage of GDP from 4.81% to 3.19%. In the same period, the combination spending of health care, Social Security, Medicare and interest payment on the debt rose from 8.13% to 11.7% of GDP. [Ref. 1] In spite of these facts, the military continues to be viewed as a major "cash cow" in the federal budget. This is particularly the case when the collapse of the Soviet Union considered. Although the Department of Defense budget makes up only 15.9% of the federal budget, it does represent almost one-half of the FY99 discretionary budget. As such, it has become a target for cost savings during the 1990s. All of these factors have caused cuts in successive defense budgets.

As this occurred, all government agencies have been under increasing scrutiny to spend taxpayer dollars more efficiently and effectively, and to reduce costs to produce a budget surplus. The 1993 Government Performance and Results Act and OMB Circular A-76 are just two of the measures that have been passed by Congress or ordered by the Executive to cut costs and increase efficiency. This Act is discussed later, but it is important to note that Government Agencies are coming under increasing pressure to cut waste and inefficiency, and be more cost effective. As this philosophy becomes more prevalent, Government Agencies not directly affected by these executive orders or legislation are still attempting to become more responsive and cost effective. It is this philosophy that has lead Department of Defense commands such as SPAWAR to take a renewed look at their accounting and cost procedures.

B. PURPOSE

The purpose of this thesis is to examine the cost and performance associated with the operation of four program departments of the SPAWAR Command. SPAWAR is an immense command, comprised of over 6,139 civilian personnel, with an annual budget of over $ 3.549 billion in FY99. In prior fiscal years throughout the cold war, SPAWAR (i. e., its component organizations) was primarily concerned with improving technology and capability to the fleet. Although this is still the primary concern, as the Department of Defense and Navy budget continues to be pressured into the next century, the cost of weapons systems, as well as the associated benefits gained from the corresponding expenditure of funds, will come under increasingly scrutiny. SPAWAR is clearly concerned with better output analysis of its programs to help ensure that scarce funds are properly utilized. This thesis is a first step in assessing how SPAWAR currently identifies and reports its products and output and how to better measure costs and outputs in the future. To better tie costs to output, it is necessary to identify both costs and products. The emphasis of this thesis is on production and output identification in SPAWAR. Cost analysis is a secondary concern after products and outputs are identified, and the process for output measurement are evaluated.

C. RESEARCH QUESTIONS

The central goal, of this thesis is to better understand how SPAWAR's production and financial systems are structured to support its mission. Secondly, this thesis explores how production and financial support systems are structured to support output measurement and cost analysis. The primary research question of this study is:

- How does SPAWAR measure production and performance?

The secondary research questions include:

- What types of products does SPAWAR produce?
- How does SPAWAR measure outputs produced?
- How does SPAWAR measure the products they produce?
- How does SPAWAR relate the costs of the products they produce to performance, production and outputs?

- What measures of internal service activities or products (measures of goods and services produced within the command for other internal command units) are available at present and how are these data collected, analyzed and used?

- Are cost data linked to output or performance data? If so for what services and products?

D. SCOPE, LIMITATIONS, AND ASSUMPTIONS

SPAWAR is a large and complex organization. The Program Directorates are the production components of the command. There are other divisions within the command that play a large role in the SPAWAR organization (i. e. command headquarters, and research) that fall outside the scope of this thesis. There are also classified programs of SPAWAR that are also outside the area of this research. The four Program Directorates are the focus of this thesis. The other divisions are studied only as they affect how the Program Directorates perform their missions.

SPAWAR is an evolving organization. Even without the impetus of federal governmental change, (e. g. following the National Performance Review), different managers and leaders in SPAWAR and the Program Directorates from time to time have made significant changes in management control systems, and financial systems. Further, the command has been completely reorganized and restructured as its headquarters has been relocated from the Washington D. C. beltway area to San Diego in the past five years. SPAWAR officials believe these changes will better support their mission of

supporting the fleet and other military command. Some organizational changes are, in effect, experiments and improvement is under continuous evaluation. Some change will continue into the future and may be expanded, potentially within the Program Directorates, and possibly between the Program Directorates. Some initiatives may be assessed as failures to be scaled back or discontinued. Therefore, as with any one-time "snapshot" of a large and complex organization, especially one as dynamic as SPAWAR, the image will become less reflective of reality over time.

The purpose of this thesis is to investigate production and performance measurement in the Program Directorates selected, and to place measurement indicators in the Program Directorates into the context of the need for improved performance and cost measurement and analysis across the entire SPAWAR organization. It must, therefore be kept in mind that the scope of this thesis is not to explore measurement in all of the systems and programs in each Program Directorate. That task alone would require its own thesis or more for each Program Directorate. The goal here is to gain a better understanding of performance and product measurement, and cost analysis for selected programs in four SPAWAR Directorates.

E. METHODOLOGY

The primary data collection method to be employed are: personal interviews with SPAWAR officials, SPAWAR document review, telephone calls, email survey and literature review on topics of production, performance and cost measurement and reporting.

Interviews were conducted to assess command functional tasks and outputs, workflows and professional responsibilities in the four Program Directorates. It was critical to interview decision-makers in each Program Directorate to assess the processes used in each Program Directorate and Program Managers Warfare, for production, performance, output and cost measurement.

To successfully assess the four SPAWAR Program Directorates, two primary methodologies were employed: empirical and archival research. Both types of research serve the subject matter well for the reasons discussed below.

Archival analysis is useful to define and investigate with organizational, financial and production data. There are "paper trails" from one segment of the command to the next, providing relatively accurate and complete data. Although this process is arduous, transaction flows often can be reconstructed. "The [archival] advantage lies in the ability to access and manipulate a vast quantity of hard, and very often factual, information." [Ref. 2] Data sources analyzed will include budget requests, budget justifications, budget transfers, and expenditure reports. These documents are critical in understanding the budgeting and financial relationships to production cost and output measurement within the Program Directorates.

Analytical research will be the second major method used as a compliment to archival research. "An obvious advantage of analytic research is obviation of the need to search for additional data. Instead there is a search for meaningful relationships among the data which are readily available." [Ref. 3] Archival data cannot be understood without conducting analytical research in an attempt to tie information together to form a

more complete picture of the structure and interrelationships that form the backbone of the production and financial structures of SPAWAR. These two methodologies are interrelated. Interviews will be conducted, and data gathered from each Program Directorate source and in turn more questions will be asked as the interview research process develops. In time, a more complete picture will emerge to address the research questions posed in the thesis.

F. ORGANIZATION OF THE STUDY

This study is organized into eight chapters. Chapter II reviews the SPAWAR mission and current performance measurement approaches. Chapters III through VI detail the structure, cost and performance measurement systems of Program Directorates 15, 16, 17 and 18. Chapter VII compares and contrasts the different measurement methods used by the four Program Directorates, summarizes the results, provides conclusions and presents recommendations for further study.

II. SPAWAR MISSION AND PERFORMANCE

"Take all the various different technological components and horizontally integrate them to provide the warfighters with state of the art, integrated end to end, operational capability." Rear Admiral John Gauss

SPAWAR's mission is to provide integrated information solutions through delivery of fully integrated, tested and supportable systems and training of Sailors and Marines by Operational Platform. SPAWAR also provides technical support and repair services to the fleet through the utilization of the System Support Centers 24 hours a day, seven days a week.

The four Acquisition Categories (ACATs) were established to facilitate decentralized decision making and compliance with statutorily imposed requirements. The categories determine level of review, decision authority and applicable procedures. ACAT I are the major defense acquisition programs. They have unique statutorily imposed acquisition strategy, execution and reporting requirements. Milestone decision authority for these programs is held by the Under Secretary of Defense for Acquisition, on acquisition category ID, or if delegated by the Under Secretary, the Cognizant DoD Component Head (acquisition category IC), or if delegated by the Component Head, the Component Acquisition Executive. These programs typically exceed $355 million of RDT&E or $2.1billion of procurement. Acquisition Category II establishes the Milestone Decision Authority at the level of the DoD Component Acquisition Executive. These programs typically exceed $140 million of RDT&E or $645 million of procurement.

They have unique, statutorily imposed, requirements in the test and evaluation area. Acquisition Categories III and IV allow the DoD Component Heads to delegate milestone decision authority to the lowest level deemed appropriate within their respective organization. [Ref. 3]

TOTAL SPAWAR PROGRAMS

ACAT 1	3
ACAT 2	3
ACAT 3	19
ACAT 4	19
NON-ACAT	12
TOTAL	56

Figure 1- Total Programs

The majority of SPAWAR acquisition programs are ACAT III and ACAT IV. The Program Executive Officer (PEO) and the Milestone Decision Authority are designated to the Commander, SPAWAR.

Performance of the SPAWAR Command is governed by the DoD acquisition regulation 5000.2R which specifies how Acquisition Program Management will be conducted in DoD. It is also under the authority of the SPAWAR IT 21 Strategic Plan which implements the DoD's IT 21 Strategy. Thirdly, it is governed by Acquisition Program Budgeting within the DoD Budget process, focusing on performance and unit cost budgeting.

A. ACQUISITION PROGRAM MANAGEMENT

For nearly 25 years, Department of Defense Directive 5000.1 and Instruction 5000.2 R have been the cornerstones of defense acquisition policy and procedures. In 1996, the updated DoD 5000.1 Directive and DoD 5000.2R Instruction integrated the acquisition policies and procedures for both weapons systems and automated information systems. The goal of the revised instruction is to define an acquisition environment that enables DoD to be the smartest, most responsive buyer of goods and services, at the best dollar value over the lifecycle of the product that meets the warfighter's needs.

1. Acquisition Management Process

The acquisition process is intended to be structured in logical phases, separated by major decision points called milestones. The process begins with the identification of broadly stated mission needs that cannot be satisfied by nonmaterial solutions. Acquisition program stakeholders consider the full range of alternatives prior to deciding to initiate a new Major Defense Acquisition Program (MDAP) or Major Automated Information System (MAIS). Threat projections, system performance, unit production cost estimates, life cycle costs, interoperability, cost-performance-schedule trade-offs, acquisition strategy, affordability constraints, and risk management are major considerations at each milestone decision point. [Ref. 5]

Part 2 of the DoD 5000.2 R instruction establishes the Program Definition. Program definition is the process of translating broadly stated mission needs into a set of

operational requirements from which specific performance specifications are established. An important consideration during the Program Definition phase is the evaluation of Command, Control, Computers, Communications, Intelligence, Surveillance and Reconnaissance (C4ISR) Support. The C4I Support Plan shall include a system description, employment, and operational support requirements including C4I, testing and training, interoperability and connectivity characteristics, management, and scheduling concerns.

Part 3 of the DoD 5000.2 R defines program structure and elements that are necessary to structure a successful program. These elements are proposed by the Program Managers and determined by the Milestone Decision Authority. Program strategies are determined based on good judgment, and provide innovative ways to achieve program success. Every acquisition program establishes program goals for the minimum number of cost, schedule, and performance parameters that describe the program. Program goals are identified in terms of objectives and thresholds. Each parameter includes an objective that is the desired result (e.g., delivering a system under budget) versus a threshold that defines a minimum acceptable result (e.g. delivering a system on budget).

All acquisition programs must have an Acquisition Program Baseline (APB) to document the cost, schedule, and performance objectives and thresholds of that program, beginning at program initiation. The performance measures evolve as the program is better defined. At Milestone One, performance measures are defined in broad terms; during this stage the measures of performance focus on needed capabilities in a program. As the program evolves, more specific program parameters are added to characterize the

major drivers of operational effectiveness and suitability, schedule, technical progress and cost. The Acquisition Program Baseline must contain the key performance parameters stated in the Operational Requirement Document (ORD). The value of an objective or threshold in the APB must be consistent with the ORD. Since these performance parameters may not completely define the operational effectiveness or suitability, the MDA may add additional performance requirements. For Automated Information Systems, an important performance parameter can be economic benefit or return on investment.

Schedule parameters include program initiation, major milestone decision points, initial operating capability, and any other critical system events. These specific events are proposed by the Program Manager and approved by the MDA for each program. [Ref. 6]

Cost parameters shall be limited to Research, Development, Test and Evaluation (RDT&E) costs; procurement costs; and the costs of acquisition items if procured with operations and maintenance funds; total quantity (to include fully configured development and production units); average unit procurement cost (defined as total procurement cost divided by total procurement quantity); program acquisition cost (defined as the total of all acquisition related appropriations divided by the total quantity of fully configured end items); and any other cost objectives designed by the MDA, (e.g. total life cycle costs). The cost parameters must reflect the total program cost and be realistic cost estimates, based on a careful assessment of risk and realistic appraisals of the total program cost. The amount budgeted for a program cannot exceed the total cost threshold established in the APB. [Ref. 6]

2. SPAWAR Information Technology 21 Implementation Plan

Information Technology for the 21st century, IT 21, is a customer driven requirement to modernize the Navy's C4I infrastructure. IT 21 provides for accelerated implementation and customer driven C4I innovations and existing C2 programs that are funded in the budget. The goal is to enable the warfighter to exchange classified and unclassified, tactical and non-tactical information from a single desktop computer, to shorten timelines, and to increase combat power. IT 21 is also one of the Navy's responses to adapt and develop new operational concepts in an ever-changing environment. The military must adapt to new technology to shift from platform centric to network centric warfare. The traditional platform centric warfare focused on mass versus mass, requiring extensive physical infrastructure, large overhead and immense capital expenditure. Network centric warfare leverages intellectual capital, focuses on information, increasing combat power while reducing infrastructure and overhead, resulting in a shift from attrition based warfare to speed of command.

Establishment of the IT 21 Functional Organization addresses the full range of other critical network-centric warfare endeavors, using an end to end, technical and programmatic approach. The technical approach enforces system engineering, integration and testing discipline that mitigates variables and risks from user to user, cradle to grave including requirements analysis, design, acquisition, installation and operations.

SPAWAR command-wide responsibilities start with architectures and technology investigations, and planning for technology insertion. The next level system engineering

and resource allocation functions fuse in the component of IT 21, relating specific capabilities to specific expenditures.

The Program Director (PD) and Program Manager Warfare (PMW) structure is organized to manage applications jointly and to support Local Area Network/Wide Area Network (LAN/WAN) infrastructure products. This facilitates technical management and scheduling of closely linked products. The Radio Frequency (RF) components are also co-managed to provide a single source of throughput capability, supporting the applications. Security Engineering, and Products Definition and Development are managed in a single PD with a cross- cutting interface that extends across the PD structure. The PDs provide for the commercial-off-the-shelf (COTS) and government-off-the-shelf (GOTS) products for IT 21.

Key functions include system integration, test, support, certification and operation required. SPAWAR has put the command Flag billets where they are most closely coupled to the Fleet: SPAWAR 03 (Operations), SPAWAR 04 (Installations), and SPAWAR 05 (Chief Engineer).

a. IT 21 Process

The IT 21 process starts with a review of Fleet Operational needs and then translates them into requirements. Typically, component programs of strategies like IT 21 have current, validated Operational Requirements Documents and other documentation that provide traceability of validated requirements through testing,

evaluation and implementation. The Navy now relies on the Copernicus Requirements Working Group (CRWG), which provides a forum for the fleet to review programs, to provide capabilities and needs, and to prioritize user requirements. The IT 21 strategy builds on this process to capture, analyze, validate and prioritize system requirements. A data base of user requirements is maintained by OPNAV N6 to track user requirements and comments. The CRWG database is referenced in developing plans and analyzing capability needs.

As deficiencies and needs are identified by the operating components, they are validated by the Office of the Chief of Naval Operations and the Commandant of the Marine Corps. These ORDs represent the baseline of IT 21 requirements.

SPAWAR translates the capabilities defined through the CRWG and ORDs into technology solutions, identifying programs that meet the requirements or finding new technologies to meet the fleet's need. Solutions that are identified are submitted for funding through the N6 Program Objectives Memorandum (POM) input. The coordination between SPAWAR and OPNAV N6 results in the SPAWAR program and budget for IT 21. Through its IT 21 investment strategy, SPAWAR attempts to enable the Navy to modernize its C4ISR to meet projected threats, and to leverage technologies that contribute to mission accomplishment.

b. Budget Controls

After requirements and capabilities have been identified, they are translated into the Capabilities Matrix to identify budget controls. This process is similar

to the Acquisition Program Baseline mentioned previously. Ring Charts which are end to end configuration drawings provide a baseline to accurately price the cost estimates of a proposed system. Ring Charts also enable the system engineers to identify any deficiencies in the available products and technology.

As implementation Ring Charts are provided for review, pricing and available resources are reviewed and approved. The SPAWAR Chief Engineer's office leads these efforts, but works as a team with acquisition and subject matter experts located in the PMWs. Details are refined to insure that roles and responsibilities are well defined and that coordination between activities is smooth and efficient.

c. Land Based Test Network

As designs transition to acquisition, the Land Based Test Network becomes a critical resource, providing all team members with the capability to test at the component, subsystem or end-to-end level. The utilization of the LTBN early in the process reduces risk and provides the fully integrated and tested products required for smooth and timely installation. The LTBN is a flexible, virtual network enabling connection and testing of dispersed assets. It also supports connection beyond the LTBN to at-sea units when required.

d. PITCO

Pre-installation, test and check-out (PITCO) is a key process in which the final assembly is completed, the entire software package is loaded and evaluated for risk, "burn in" testing is completed and all components are packaged for shipment. PITCO

includes all COTS software, and any other custom-designed software. It considers rack configuration and the proposed network for each installation. Testing is completed in real and simulated environments. The final step in the PITCO process is the delivery of the system to a consolidated warehouse, where the Automated Information Technology kits are assembled and bundled for shipment to the final destination. At this point the system is ready to install on a ship or shore site.

The result of the PITCO is an end-to-end process for testing and integrating all components versus a piecemeal test and check of systems. The resulting system is a single product, an IT 21 system ready for delivery, with a return on investment comparable to industry, and within an acceptable level of risk.

e. Capability Investment Matrix

The Capability Investment Matrix (the Cube) is being developed as a planning and budgeting tool to analyze and match assignment of dollars to capabilities. The initial phase of the Cube will analyze specific IT 21 Capabilities and relate costs to the Battlegroups (BGs) receiving them. The open architecture of the system will allow incorporation of additional target groups, such as the Marine Expeditionary Forces (MEF), Amphibious Ready Groups (ARG) and shore sites as data becomes available.

The Cube uses three major axes to relate capabilities to activities, to BGs and to individual platforms. Activities are accounted for in a Work Breakdown Structure (WBS) that is compatible with the new SPAWAR network centric organization. The WBS is used to decompose a system by assemblies, subassemblies and components to

illustrate each task and to organize all tasks into their hierarchical relationships to the products and system. The WBS is mandatory for project planning because it provides the basis for work assignments, budgeting, scheduling, risk assessment, cost collection, and performance status evaluation. The SPAWAR WBS elements include Project Management, System Engineering, Prime Mission Products/Engineering, System Test and Evaluation, Shipboard Installation, Integrated Logistics Support, Operations and Maintenance, and Facilities.

The primary data elements of the Cube will be Appropriation Type (OPN, OM&N, R&D), Fiscal Year, WBS elements, Capabilities/Alterations and BG/Ship. Users will be able to access data through Fiscal Year roll-ups or through focused, customized queries. The data model will enable analyses of WBS elements. Additionally the Cube will support Total Ownership Cost tracking by linking key TOC elements to the Cube WBS and data structure. Users will be able to access the Cube via a web-based interface, with differing levels of access and editing capabilities. The Cube is being developed and will be maintained by SPAWAR 05. The data in the Cube is supplied by the PDs and PMWs via excel spreadsheets. DoD currently utilizes the Visibility and Management of Operating and Support Costs (VAMOSC) which provides historical operating and support cost data for weapons systems, organized in a standard cost element structure. The cost elements include mission personnel, unit level consumption, intermediate maintenance, depot maintenance, contractor support, sustaining support and indirect support. The DoN VAMOSC database includes these costs for 217 ship, aircraft, electronics, missile, torpedo, and automated information systems. The Naval Center for

Cost Analysis (NCCA) manages the DoN VAMOSC database. SPAWAR systems will be added to the database starting in FY 2000.

f. Product Resources Board

The Product Resource Board, comprised of the PDs, the Comptroller of SPAWAR, the Chief Engineer, and Chief Installer, will direct the SPAWAR capital planning process with an integrated approach to identifying and managing IT investments, directing continuous identification, selection, control, life cycle management and evaluation of IT investments. This structured process will provide a systematic method to minimize risks while maximizing the return of C4/IT investment resources. The three phases of the capital planning process are: selection, control and evaluation.

In the selection phase, SPAWAR and N6 determine priorities and make decisions on which projects will be funded. All projects are screened against a set of criteria and thresholds to determine if they meet minimal requirements. The costs, benefits, risks and contribution to mission needs of all IT 21 projects are assessed, compared and ranked for priority. The selected projects make up SPAWAR's portfolio of IT 21 investments. The selection phase enables SPAWAR to pursue the projects that best support Navy mission needs, and identifies potential returns before a significant amount of resources are spent. This phase intends to ensure that SPAWAR chooses its investments based on accurate, and current data, focusing on how the projects directly contribute to mission accomplishment.

The control phase helps ensure that SPAWAR is only supporting projects that continue to fit the IT 21 strategy. Once a project is selected, it will be controlled and managed consistently. Progress reviews will examine cost, schedule and expected mission benefits at key milestones in the project's life cycle.

The evaluation phase compares actual versus expected results to assess the project's impact on mission performance; to identify and make changes or modifications that may be needed; and to revise the investment management processes based on lessons learned.

SPAWAR's institutionalization of this capital planning process is intended to synchronize with the architecture process, PPBS, and the acquisition process to ensure that resources are directed to satisfy the information needs of the Navy. [Ref. 7]

g. Battlegroup Planning and Engineering Process

The Battlegroup Planning and Engineering Process is concerned with top level initiation of the planning effort, overseeing this effort as it develops, and monitoring the status. It will assist in making decisions, establishing policy, and providing documentation of facts by battlegroup, emphasizing the complete testing of all components installed on the various ships.

The Battle Group Installation Chart provides a timeline to review processes as they are incorporated into each battlegroup installation timeline. Some of the key activities are:

. Target Architecture Evolution - This ongoing activity manages the projected system level functional requirements based on planned C4I system installations. The target architecture is used for initial cost estimates and budgeting.

. System Design/Integration - This is the process of designing the C4I system to be installed in the target BG. The system design is completed upon the conclusion of the system design review and after the BG build functional baseline has been established. Software Development and COTS hardware integration are performed, followed by Critical Design Review. Products include interface catalogs and configuration drawings.

h. Battlegroup Implementation Review Process

The Battlegroup Implementation Review Process enables a structured, sequential set of reviews to initiate, track and monitor status, to assess risk, to allocate resources, to set policy, to direct and steer implementation, to access progress, to track issue correction and to distribute information throughout the life of the BG. The overall idea is, for each individual process, to have the workers and developers of the BG implementations produce and provide material to a Technical Review Board to review, to analyze, and to condense data into a summary technical report for the Product Review Board.

i. Improved C4ISR Measures of Performance

Development of improved C4I metrics is a critical element in establishing good performance indicators for process improvement initiatives in fleet warfare. Improved metrics should enable the Navy to make the best acquisition decisions in C4I

Improved metrics should enable the Navy to make the best acquisition decisions in C4I R&D programs and to demonstrate the positive impact of IT 21 on the Navy's mission performance.

Performance measurement is the key for each program, project and acquisition through institutionalization of outcome-oriented results that can be evaluated over time. Performance measurement is the application of a measure or a set of measures to the decision making and operations of an organization to assess achievement of mission goals and priorities. For a broad program like IT 21, the ability to develop and measure performance will help to ensure success in competing for funding and programmatic support at all levels in the Navy.

The goal of IT 21 performance measurement is to provide a systematic method for evaluating the inputs (resources), outputs (programs, projects), transformation (acquisition, development), and productivity (contribution to the mission) of the program.

Success in IT 21 will not only cause evaluation of program success relating to cost, schedule, and risk. It will also define what kind of information is available to the decision maker and how it should be used for tactical/strategic advantage. Effective IT 21 metrics must include acquisition measures and performance/proficiency (mission) metrics. SPAWAR has established a Total Cost of Ownership Website for all SPAWAR programs, including the Program Managers Plan to reduce the cost of existing programs over the life cycle of the program as an acquisition metric.

The SPAWAR IT 21 plan establishes performance-based C4I metrics to enable end-to-end testing, focusing on overall success by operational Fleet performance.

By using IT 21 systems and processes, the validity of C4I readiness indicators should significantly improve. Performance measures should allow SPAWAR to translate their business strategies into plans of actions to benefit Navy C4I.

PROGRAM DIRECTORATE 15 - GLOBAL INFORMATION AND NETWORK SYSTEMS

A. MISSION

PD 15 is the Global Information and Network System Program Directorate. The mission of PD 15 is the transformation of the C4ISR warfighting process transformation in support of The IT 21 mission. PD 15 goal is to establish desktop to desktop capability for Network Management, Metropolitan Area Network/Base Area Networks, Local Area Networks and personal computers at sea and ashore with all required software and hardware, provide tactical and support applications, provide messaging/email and databases to the fleet. PD 15 focuses on the fleet also includes tactical and tactical support integration. Tactical integration includes Command and Control, Sensor Data Fusion, Threat Analysis, Decision Aids, and Weapons Fire Control. The tactical support integration includes maintenance, supply, administration, manpower, medical, equipment analysis, ordnance and fuel. Implementation of the PD 15 programs will require a Base Level Information Infrastructure (BLII). The BLII will provide the information technology assets that support base wide connectivity with ship and Deployable Information Resource Requirements and interface joint DoD systems such as GCCS, GCSS, DMS and other Navy wide information systems.

B. STRUCTURE

PD 15 is structured similar to the other program directorates within SPAWAR. There is a Director and Deputy Director of PD 15. Below the Deputy Director are four

divisions that have distinct and unique programs within PD 15. These divisions are called Program Managers Warfare (PMW). The following PMW make up PD 15, PMW 151 Navy Tactical Command Support Systems (NTCSS) Program Office, PMW 152 Naval Messaging Systems Program Office, PMW 157 Global Command and Control System Maritime (GCCS-M) Program Office, and PMW 158 Naval Integrated Networks Program Office. These PMWs are discussed below.

Three main offices support the Director and Deputy Director. They are PD 15E Engineering, PD 15L Logistics, and PD 15P Financial Management. The Engineering Department provide top-system level technical direction in the development, acquisition, deployment and support of PD15 integrated network systems and software applications through translation of operational requirements into engineering terms across the Program Directorate's programs.

The logistics management office provides centralized integrated logistics support services to provide effective and economical support of PD15 cognizant network systems and software applications over their lifecycle. The logistics management office also provides Integrated Logistics Support inputs to the Program Managers to assist in the Planning, Programming, and Budgeting process.

The Financial Management Office provides business and financial support to the Program Managers. This support includes program analysis and development, budget formulation, budget execution including PPBS actions, submission of Program Objective Memorandum input and documentation, financial acquisition planning and management, and management analysis and reporting. This office also coordinates with the Project

Engineers in preparing the yearly spending plans in all programs addressing all tasks and activities. The utilization of the spending plans with the PMWs forms the basis for the obligation plans. During the year, they receive and update plans from the PMWs to reflect the functions actually being performed and the applied funding. They also provide the Director with a consolidated spend plan and respond to higher level tasking. [Ref. 8:interview A]

C. PMW 151

1. Mission

PMW 151 mission is the Naval Tactical Command Support System (NTCSS). The NTCSS program provides standardized support data processing capability to afloat and shore based activities.

2. Structure

PMW 151 is implementing the Naval Tactical Command Support System through an integrated master schedule. PMW 151 provides an open forum for collaborative industry and government system solutions maximizing the use of Commercial-Off-the-Shelf (COTS) and Non-Developmental Item (NDI) technologies for the purposes of promoting joint interoperability and reducing life cycle costs in support of DoD's IT 21 plan.

3. Products/Outputs

The product of PMW 151 is the integrated NTCSS system. This system incorporates the Shipboard Non Tactical ADP Program (SNAP), Naval Aviation Logistics Command Management Information System (NALCOMIS) and Maintenance Resource Management System (MRIS). NTCSS is the standard migratory system for the Navy under the Joint Maritime Command Information Strategy (JMCIS), the Global Command and Control System (GCCS), and the Global Command Support System (GCSS). Appendix A shows the deployment schedule of the NTCSS program assuming the program's budget, performance and schedule does not change in relationship to other Navy priorities.

4. Cost Measurement

Naval Tactical Command Support System is an ACAT I program with financial reporting requirements to the DoD Defense Acquisition Board. In May 1998, the Assistant Secretary of the Navy for Research, Development and Acquisition required the resubmission of the Acquisition Program Baseline in support of the Total Cost of Ownership Reduction Plans. The specific cost drivers of the NTCSS program were identified as (a) mission personnel costs, (b) software maintenance costs, (c) intermediate and depot hardware maintenance costs, (d) hardware procurement and installation costs. The Acquisition Program Baseline documented the rebaselining of the NTCSS installation schedule as a result of funding cuts in FY 99 through FY 02. The Total Cost of Ownership is defined as the total cost of a program to the Navy over its lifecycle.

5. Performance Measurement

Performance measurement of the NTCSS Program is governed under the DoD 5000.2 R that specifies reporting requirements relating to cost, schedule and performance. Based on the resubmitted Acquisition Program Baseline discussed above, the main area of risk for this program is the budget because the NTCSS program line POM 00 no longer includes the funds to procure or install local area networks either afloat or ashore. The schedule outlined in the Acquisition Program Baseline required coordination within the Navy to ensure that the appropriate local area network is available to support the NTCSS installation schedule. As a result the afloat NTCSS installation schedule will shift from FY 02 to FY 05 thus slowing the implementation schedule of the IT 21 plan.

6. Budgeting

The POM 00 has had a significant impact on the installation schedule of the NTCSS program. The funding line for POM 00 includes no funds to procure or install local area networks either afloat or ashore. The $42 million dollar shift in funding from FY 99 to FY 02 to FY 03 through FY 05 will result in the deferring of installations of NTCSS software on a large number of ships, Naval Air Stations, Marine Aviation Logistic Squadrons until after FY 02. [Ref. 9]

The Navy has redirected these funds to other programs managed by program offices. The reallocation of the budgeted funds for the NTCSS program reflects the shifting in priorities of acquisition programs and systems resulting from political and operational necessities. If NTCSS is a major component of the Navy's IT 21 strategic

plan, hopefully funding will become available through reductions in lower priority programs.

D. PMW 152

1. Mission

The mission of PMW 152 is the integration of the Defense Messaging System Ashore (DMS) Joint Program and the DMS Afloat/Navy Modular Automated Communications System (NAVMACS II).

2. Structure

PWM 152 is structured around two integrated product teams, one team working on the Defense Messaging System Ashore Joint Program and another team working on the DMS Afloat/Navy Modular Automated Communications System. The goal of the integrated product teams is to provide an integrated system which can provide the functionality of these systems in support of the IT 21 plan.

3. Products/Outputs

The product of PMW 152 is the integrated Defense Messaging System. The DMS system will provide organizational and individual messaging within a secure, accountable, reliable, electronic messaging system. The DoN DMS program will centrally procure an enabling capability for all Navy, Marine Corps, and Coast Guard organizations. The NAVMACS II system provides automated reception, transmission, cryptology control, and the processing, storage, and LAN distribution of Organizational

and Tactical Messaging while replacing antiquated systems. The NAVMACS II funding will also be utilized to support implementation of the SPAWAR Single Messaging Solution (SMS) in FY 00. Appendix B reflects the costing model used to estimate the Total Cost of Ownership for the NAVMACS II/SMS program. [Ref. 10] The fielding plan provides a bench mark that can be used to monitor the program's status via the work breakdown structure and installations. Any variances in these projected costs and installations can be further investigated allowing management to exercise internal controls as appropriate

4. Cost Measurement

The integrated Navy Modular Automated Communications System (NAVMACS II) is an ACAT IV program with financial reporting requirements to the COMSPAWAR. The Acquisition Program Baseline was reestablished in FY 98 in accordance with the mandate from the Assistant Secretary of the Navy for Research, Development and Acquisition in support of the Total Cost of Ownership Reduction Plans. The specific cost drivers identified of the NAVMACS II program were (a) Indirect/Infrastructure support, (b) Sustaining Support, (c) Prime Mission Product, (d) System Integration and installation.

Cost management is focused on the total cost of systems installed on each platform with the goal of not exceeding budget authority in a given fiscal year. SPAWAR currently does not have a standardized cost database to track obligations and expenditures but is developing this capability as outlined in Chapter 5. All of the PMWs

in PD 15 utilize the Financial Management Information System to assist in the management of Acquisition Programs and measurement of performance relating to budget and execution and the number of systems installed or achievement of milestones as defined by the Acquisition Program Baseline.

5. Performance Measurement

Performance measurement of the NAVMACS II Program is defined by COMSPAWAR specifying objectives and thresholds relating to cost, schedule and performance. Based on the resubmitted Acquisition Program Baseline discussed above, the main areas of risk for this program are budget and schedule. The installation schedule as defined by the Acquisition Program Baseline requires coordination and cooperation within the Navy and Coast Guard to ensure that the (a) initial procurement quantities, (b) initial installation quantities, (c) cumulative number of procured systems, (d) cumulative number of installed systems, (e) hardware upgrade quantities, (f) software upgrade quantities can be accomplished over the time frame FY 01-FY 20.

6. Budgeting

Budgeting within PMW 152 was done based on an engineering estimate of the Total Ownership Cost over the program lifecycle by fiscal year because no actual cost data exists on the fielding cost of the NAVMACS II system since the initial installations are not scheduled until FY 01. The Work Breakdown Structure defines the anticipated costs of each activity broken down into specific tasks i.e. initial spares and repair parts is subdivided into large ships, medium ships, small ships, Coast Guard by fiscal year. As

this program progresses, the annual budgets will reflect the acquisition program goals for a given fiscal year.

E. PMW 157

1. Mission

The mission of PMW 157 is the integration of the Global Command and Control System (GCCS-M) Afloat/Ashore and the Ocean Surveillance Information System (OSIS) Evolutionary Development (OED) programs in support of the Navy's IT 21 plan. The GCCS-M system provides afloat, joint and allied commanders a single, integrated Command, Control and Intelligence (C2I) system that receives, processes, displays and maintains current geography location information on land, sea and air forces integrated with intelligence and environmental information.

2. Structure

PMW 157 is structured as an integrated program team implementing the Global Command and Control System Afloat/Ashore and the Ocean Evolutionary Development systems in support of the Navy IT 21 program.

3. Products/Outputs

The GCCS-M ashore will provide the CNO and the Fleet Commanders and subordinate commands ashore with automated C4I support to receive, process, maintain, and display operational information to assess unit readiness and warfighting capabilities, and to support allocation of resources. This system provides resource information on

assigned forces and positional information on hostile, neutral, allied, and own forces integrated with environmental and other nationally derived information. GCCS-M supports efficient afloat/ashore information exchange and critical connectivity to all echelons of command.

The OED system is a multilevel secure intelligence system providing on-line, automated, near real time support to National, Joint and Naval Commanders. This system supports command, control and intelligence assessment, including indications and warnings and power projection; maintains dynamic databases to support a common air, land, sea and littoral battlefield picture using ground force and maritime symbology.

The integration of the GCCS-M and NTCSS programs has established another system requirement in support of the DoD IT 21 initiatives. The new requirement is for a LAN that provides shipboard classified and unclassified information transfer for network centric warfare. This LAN will implement fiber/copper backbone, switching and routing, commercial basic network and information distribution services such as email, office applications and web cache. Utilization of fast Ethernet technologies will be critical to meet user requirements. [Ref. 11] Appendix C describes some of the key performance parameters of the GCCS-M system in relationship to the Acquisition Program Baseline. The technical specifications will provide management with objectives and thresholds that can be used to monitor the program as it continues toward fielding in the fleet. The specific number of systems is not applicable with this system; what is important is the technical performance of the existing systems which are being upgraded.

4. Cost Measurement

The Global Command and Control System-Maritime (GCCS-M) is an Acquisition II program with financial reporting requirements to COMSPAWAR. The cost drivers identified of the GCCS-M and OED programs were (a) indirect and infrastructure support, (b) fielding support, (c) system integration and installation.

Cost management is focused on the total anticipated cost of systems installed on each platform with the goal of not exceeding budget authority in a given fiscal year. SPAWAR is currently developing a standardized cost database to track obligations and expenditures and enable "what-if" analysis if a program's funding is reprogrammed to another fiscal year and the impact on the number of systems procured and installed.

5. Performance Measurement

Performance Measurement is based on the Acquisition Program Baseline. Since this program is still in development at Milestone II, the key performance parameters of this system are related to the technical aspects for thresholds and objectives. These technical objectives are related to system performance. For example, the Database Query Process objective is less than 10 seconds and the threshold is less than 17 seconds.

As this program progresses the schedule of events has defined the objective and threshold for determining if the program is on schedule. For example, the Operational Test and Evaluation objective is October 2000 with a threshold of April 2001. The Acquisition Schedule provides a good internal control to track progress of the system in relation to the schedule defined for the program. [Ref. 12]

6. Budgeting

Budgeting within PMW 157 was done based on an engineering estimate of the Total Ownership Cost over the program lifecycle because no actual cost data exists on the fielding cost of the GCCS-M/OED program, since the initial operating capability is not expected until December 2000 at the earliest. As this program progresses through the acquisition milestones and phases, budgeted cost of the program will change and the flexibility of the Program Manager to implement this program will be a major challenge.

F. PMW 158

1. Mission

The mission of PMW 158 is to integrate the Automated Digital Networking System (ADNS) as a unified comprehensive replacement for many existing shipboard "stovepipe" communication systems by automatically and dynamically realigning the various shared communication systems. ADNS provides shipboard and shore based exterior communication service management for the maximum utilization of available resources. Resources include automated radio room control, integrated voice, video and data, efficient hardware/system source selection, and integrated network management through the utilization of COTS, NDI and commercial standards.

2. Structure

The structure of PMW 158 is an integrated project team working on the integration of the ADNS system with the Sensitive Compartmented Information ADNS

and the Integrated Shipboard Network System (ISNS) to transition the existing networks installed aboard afloat units, with transportable C4I shelters into a centrally managed and configuration controlled naval intranet information infrastructure.

3. Products/Outputs

The product of the PMW 158 will be a centrally managed and configuration controlled naval intranet information infrastructure. The ADNS system will be network interfaced with the SCIADNS and ISNS to transport real time sensitive information and sensitive compartmented information between ship-to-ship and shore-to-ship.

The ISNS program will integrate existing capabilities provided by the Global Command Control System-Maritime (GCCS-M) and the Naval Tactical Command Support System (NTCSS). The ISNS program also utilizes resources provided by the Automated Digital Networking System (ADNS) to ensure flexible and reliable external communication links. The Integrated Shipboard Network System is designed to provide every Navy ship, including submarines, with a reliable, high speed Local Area Network that will provide internal distribution and off-ship connectivity to the Defense Information System Network (DISN) Wide Area Networks. [Ref. 13] Appendix D is the Total Ownership Cost estimation of the ADNS program. The estimated costs are broken down by work breakdown structures by fiscal year. Included in the TOC plan is the initial procurement quantities, initial installation quantities, initial Battlegroup Ship Spares, and cumulative number of installed systems by platforms. This information provides management some tangible objectives to measure this program's progress.

4. Cost Measurement

The Automated Digital Networking System (ADNS) and the Integrated Shipboard Networking System (ISNS) are ACAT III programs with financial reporting requirements to COMSPAWAR. The Acquisition Program Baseline was reestablished in FY 98 in accordance with the mandate from the Assistant Secretary of the Navy for Research, Development and Acquisition in support of the Total Cost of Ownership Reduction Plans. The specific cost drivers were identified for the ADNS and ISNS Programs.

The identified cost drivers of the ADNS program were (a) sustaining support, (b) mission personnel, (c) system integration and installation, (d) indirect and infrastructure support and (d) prime mission product. The identified cost drivers of the ISNS program were (a) sustaining support, (b) system integration and installation, (c) prime mission product and (d) mission personnel. [Ref. 13]

Cost management in PMW 158 is again focused on the total cost of systems installed on each platform with the goal of not exceeding budget authority in a given fiscal year. The Acquisition Program Baseline and subdivided Work Breakdown Structure enable financial management of these programs related to obligations and expenditures in comparison to the annual budget and overall program providing useful management information.

5. Performance Measurement

Performance measurement of the ADNS and ISNS Programs are defined by COMSPAWAR specifying objectives and thresholds relating to cost, schedule and

performance. Based on the resubmitted Acquisition Program Baseline discussed above the main areas of risk for these programs are budget and schedule.

The Work Breakdown Structure as defined in the Total Ownership Cost estimates for these programs defines the installation schedules and related costs by fiscal year. As a management control tool, these estimates provide a good overview of what will be accomplished by fiscal year given proper budgetary, installation schedules, and anticipated program milestones. Given the uncertainty of the budget process and changes in Navy priorities these TOC plans are living documents to be updated to reflect changes in the external environment beyond the control of the SPAWAR command.

6. Budgeting

Budgeting within PMW 158 for these programs was based on unit cost per platform because of the availability of a FY 98 actual cost data. The TOC estimates were utilized to project the budgetary needs in support of POM 00.

The Work Breakdown Structure previously described helped in the formulation of the POM 00 submission and as SPAWAR develops their own internal cost database, planning, programming and budgeting in the future should be supported by readily available cost data available on all SPAWAR programs.

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IV. PROGRAM DIRECTORATE 16 - INFORMATION AND ELECTRONIC SYSTEMS

A. MISSION

Program Directorate 16 (PD 16), Information and Electronic Systems, is one of four Program Directorates within SPAWAR. The total integration of electronic communications and computer systems in the open environment has immensely improved the capabilities of civilian and military communications. It has also greatly increased the ability of an adversary to disrupt, destroy or intrude into these systems. PD 16 was created to develop and produce systems that can operate in this arena, that can perform whatever goal is required to support the needs of the Navy. To this end, PD 16's mission is comprised of 3 main objectives- information protect, information attack and information exploit.

The information protect portion of PD 16, is the portion of the electronic information spectrum that is concerned with the denial, monitoring, detection, reaction, management and support of Navy communications systems. [Ref. 14]

The information attack portion of PD 16 deals with the intrusion, degradation, disruption, deception and destruction of the enemy's electronic information systems. [Ref. 14]

The exploit portion PD 16 deals with the detection, classification, tracking, intention, targeting and assessment of the electronic information spectrum; as well as developing techniques to exploit that arena. [Ref. 14]

When interlinked, these mission areas form the backbone of the PD 16 mission. The system that will link all of these projects together is the Joint Maritime Information Operations System (JMIOS). JMIOS will support future Information Warfare (IO) operations by providing interoperability and integration of all exploit, attack and defend components. PD 16's mission is the cradle-to-grave management and development of all assigned electronic IO systems within SPAWAR. This includes all associated infrastructures as well as the analysis of required assets. In short, the mission of PD 16 is to provide fleet commanders with the IO capabilities that are available now, and those that will be required in the future. These systems must be fully integrated across the Protect, Defend and Exploit domains. PD 16 must lead and drive the acquisition process in order to provide the fleet this capability.

B. STRUCTURE

PD 16 has a similar structure to the other Program Directorates within SPAWAR. There is a Director and Deputy Director of PD 16. Below the Deputy Director are three divisions that each have distinct and unique programs within PD 16. These divisions are called Program Managers Warfare (PMW). The following PMWs make up PD 16- PMW 161 Information Systems Security (INFOSEC), PMW 162 Naval Information Warfare Activity and PMW 163 Naval Electronic Combat Surveillance Systems (NECSS) Program Office. These PMWs will be discussed below.

There are also three main offices that support the Director and Deputy Director. They are PD16E Chief Engineer, PD16L Logistics, and PD16P Business and Finance.

The Chief Engineer and his staff support the design, development and testing of the hardware and most of the software developed by the Program Directorate. The Logistics Office ensures material support for the product or system that is either currently in development, or scheduled for future development. The L code ensures requirements are measured, the reliability of parts and equipment are checked and availability is verified. The L code also develops and verifies depot level support.

Although PD 16 is comprised of three PMW offices, only two of these offices are physically located at SPAWAR headquarters in San Diego. PMW 161 and PMW 163 are located at the headquarters, while PMW 162 is located at the Naval Maritime Information Center in Suitland, Maryland. Due to its mission and projects, PMW 162 is a highly classified organization. Due to these factors, PMW 162 will not be analyzed in this study.

C. COST MEASUREMENT/BUDGETING

PD 16 is a decentralized organization in many areas. As such, each PMW operates in an autonomous fashion. This autonomy does not flow down to the financial management "P" code however. This may be a result of having only two PMWs to support. The Business and Finance Office for PD 16 is comprised of a department head and four assistants. This office serves all of the finance needs of the PD as well as PMW 161 and 163. The P code works with the Director and the PMW heads, as well as the APMs when developing the budget. Each APM is involved with the budget call. PD 16 is decentralized to such an extent that the APMs work directly with the program sponsors

in order to obtain funds. In this way, the PD and PMWs serve more as coordinators than controllers for budgetary matters.

D. PMW 161

1. Mission

PMW 161 is tasked to enhance the operational capability of the combat commander while reducing the effectiveness of dynamically evolving threats. PMW 161 is an integral component of the overall Information Warfare (IO) program that provides Naval commanders with information superiority by controlling the flow and integrity of the information of the United States and her allies, while denying the enemy the same capabilities. PMW 161 cites a recent General Accounting Office (GAO) report on information security that noted the increasing number of unauthorized individuals and groups who are gaining access to sensitive unclassified information in the Department of Defense information systems. Additionally, the Defense Information Systems Agency (DISA) believes that that there were over 250,000 attacks on DoD systems in 1995 alone. 65% of those attacks were believed to be successful. [Ref. 14] These attacks have resulted in stolen, compromised and corrupted data. PMW 161 must provide information security systems that prevent this type of threat from successfully attacking Navy electronic communications systems. PMW 161 must also develop and manage the Navy's information security research and development program and support developed systems throughout their lifecycle.

2. Structure

PMW 161 is an autonomous organization that deals directly with Program Sponsors, Defense Contractors, Field Activities and various other offices within SPAWAR. These offices include the Comptroller (01), Contracts (02), Installation and Logistics (04) and Chief Engineer (05). PMW 161 is run by a Program Manager, with a Deputy Program Manager (A) as an assistant. There are three divisions in PMW 161 headed by Assistant Program Managers (APM). These divisions are comprised of 161-1 Infrastructure Division, 161-2 Secure Data Division and 161-3 Secure Voice and System Integration Division.

3. Products/Outputs

Unlike the majority of PMWs throughout SPAWAR, PMW 161 produces systems, and provides support functions for the fleet. In terms of production, PMW 161 produces hardware and software in three main areas. The first is the Electronic Key Management System (EKMS). EKMS is comprised of both secure voice systems, such as the STU-III system and secure data systems. There are three levels of secure voice cryptologic equipment: type I, type II and type III. This area also produces key management systems. The second main area of production is network security systems. This includes trusted computer processes, TEMPEST, in-line network encryptors, anti-virus software, network intrusion monitors/detectors, and compartmented mode workstations. The last main area of production is cryptologic security devices. This

includes computer protection devices, crytolographic devices, Fortezza cards and secure terminal equipment. The development and production of computer software is a significant portion of these programs.

PMW 161 also provides security engineering services, which, as noted above is fairly unique within SPAWAR. These services are primarily comprised of developing and installing firewall and intrusion detection systems. Although naval commands have the option of obtaining these services form civilian companies, the system must be approved by PMW 161. PMW 161 is mission funded to provide this service to the fleet. This service is usually provided to major commands including CINCPAC.

Intrusion Detection Systems (IDS) are provided as time and funds dictate. Once a request is approved, a preliminary plan is developed to support the request. The hardware and software requirements are checked against the current inventory sub-components, and are ordered as required. (PMW 161 procures estimated quantities of COTS components on an annual basis in order to conserve funds.) Four weeks-prior to the installation, a site survey is done to ascertain the exact hardware, software and programming requirements. Prefabrication is done at the prime contractor site or at PMW 161. The Field Activity or Contractor's laboratory completes the required programming and software integration. Historically, FY98 is a more representative year to view for this type of service. In FY99, IDS services were given a lower priority due to the need to perform fleet wide Y2K upgrades. (In FY99 there were Y2K upgrades at 36 sites throughout the world at a cost of $ 4.8 million.) In FY98 IDS systems were installed or upgraded at 3 major and 25 minor sites throughout the fleet at a cost of $ 3.77 million. These services are comprised of both

shore-based and ship-based IDS systems. Further, these systems support classified LANs, unclassified LANs or both. Also, some of these systems must be configured to support interoperability between the Navy and other services, as well as with allies and potential allies.

> The uniqueness of all of the current capabilities, and with the requirements of each command, create a situation where no two systems are even remotely alike. So we just can not pump these out [the software and the precise hardware configurations] and have them laying on the shelf for a quick install. [Ref. 8:interview B]

4. Cost Measurement

The Business and Finance Office or "P code," performs limited cost measurement in PMW 161. Cost measurement is focused on the timely performance of obligations and executions. The major concern of the P code is ensuring that all financial and scheduling benchmarks are met. These benchmarks are received for the SPAWAR Comptroller. Benchmarks change year to year, and occasionally within the fiscal year. The main measurement for benchmarks is the receipt of deliverables and the submission of vouchers from Contractors and Field Activities. PD 16 can only measure these deliverables as they are reported to its office or to the PMWs or APMs. The official dates and milestones are in the contacts held by the Comptroller. The P code is not necessarily apprised of the benchmarks because the contracts are changed and modified frequently. Therefore, cost measurement is also performed by the cognizant APM. "They know the benchmarks, and are provided the obligation and expenditure amounts monthly." [Ref. 8:interview C] The P code, PMW and APM have monthly meetings where they review financial data which is charted with the planned amount, obligation benchmark, current

obligation, expenditure bench mark and current expenditure. Appendix E is an example of this data. At this point decisions are made on follow on action. If the benchmarks are being met, than follow on action is not required. If the benchmarks are not made, then the activity is notified of the deficiency and action is taken to rectify it. Depending on the amount of the deficiency, the program can be checked weekly until it is "back on track."

The PD 16 P code uses an Initiation, Obligation Plan database, which is an access program. This is an old SPAWAR program which serves the needs of PD 16. PD 16 does not have the funds (or does not deem it advantageous) to invest in the Financial Information Management System (FIMS) which has been dictated by SPAWAR.

In the Security Engineering Services area, cost measurement is virtually impossible. On the unit level, cost measurement can be developed. The site survey developed by PMW 161 personnel is transformed into a site plan with performance and cost parameters. These parameters can be tested once the system is installed. But developing cost measures that encompass the whole of IDS installations over the fiscal year is virtually impossible. As described above, there are a litany of factors that contribute to the cost of the IDS installation. Each installation is unique. There are also multiple installations at some sites. Therefore to develop a cost measurement that can be applied to all services is difficult at best, and is not attempted at any scale in PMW 161.

5. Performance Measurement

Performance measurement in PMW 161 is much the same as it is throughout other acquisition programs in other PMWs: cost, schedule and performance. As with virtually

all PMW studied at SPAWAR, performance is measured differently for Field Activities than it is for Defense Contractors. Assistant Program Managers (APM) work closely with Defense Contractors, usually through Process Teams. These teams develop build plans for the product and track it through to completion. The primary measurement in this area is scheduling and technical performance. As noted above, the primary systems produced by PMW 161 are software upgrades, cryptographic devices and assist services. The Contractor, the Navy Sponsor or the Field Activity normally proposes these upgrades. If the sponsor proposes a change, the information is relayed to PMW 161. If a change is submitted by someone other than the Defense Contractor and PMW 161, then this change is proposed to the Integrated Control Working Group (ICWG). This group is comprised of the Programs Sponsor, the fleet user, the Contractor, the Navy Field Activity and PMW 161. If this group approves the change in principle, than it is sent to the more technical Configuration Control Board (CCB) for review. If the Defense Contractor has a change proposal, it is brought up at the CCB. The CCB is comprised of the Defense Contractor or Navy Field Activity and PMW 161. The proposal is discussed in terms of scheduling, cost and performance. All of these changes must be approved in order for the proposal to be accepted. If the proposal is accepted, then an Engineering Change Proposal (ECP) is written and the change is incorporated into the technical baseline, which becomes a build plan, as noted in Appendix F. The build plans have, testing, schedule and cost milestones that are tracked by the APM and to a lesser degree by the P code. The Build Plans have testing, cost and scheduling milestones which are tracked by the APM and to a lesser degree by the P code. Performance measurements for

services are driven by the site plan. The site plan has performance parameters that must be meet for a successful IDS installation.

6. Budgeting

Budgeting within PMW 161 is performed by the PD 16 Business and Finance Office as outlined previously. N64 provided PMW 161 $74.81 million in FY99. Of this amount, $19.7 million was RDT&E Navy, $4.9 million RDT&E Army, $39.1 million OPN and $12 million O&M, N. The budgeting for PMW 161 is program specific from the sponsor, and there are reprogramming thresholds given by the Sponsor.

E. PMW 163

1. Mission

PMW 163 is tasked to manage the definition, design, development, test and evaluation, production, integration, installation, operational support, and modernization of tactical electronic warfare, shipboard countermeasures, and related Navy shipboard Cryptologic/Information Warfare (IW) sensor programs. To support the Navy's missions, these sensors must also support the cryptologic exploitation component of the Information Warfare (IO) Command and Control Warfare (C2W) system, and the Space and Electronic Warfare (SEW) mission requirements. To carry out this tasking, PMW 163 supports the Program Sponsor in translating Navy operational requirements into weapons systems acquisition programs that fall under PMW 163s cognizance. PMW 163

must develop and produce systems that are common, scaleable and interoperable with other services and with U. S. allies.

2. Structure

PMW 163 is an autonomous organization that deals directly with Program Sponsors, Defense Contractors, Field Activities and various other offices within SPAWAR including the Comptroller (01), Contracts (02), Installation and Logistics (04) and Chief Engineer (05). PMW 163 is run by a Program Manager, with a Deputy Program Manager (A) as an assistant. There are four divisions in PMW 163 headed by Assistant Program Managers (APMs). These divisions are comprised of 163-1 Technology and Advanced Division, 163-2 Technology Transition and Integration, 161-3 Acquisition Management Director, and 163-4 Joint Project Office.

3. Products/Outputs

PMW 163 produces information warfare systems in seven main programs. The Cooperative OUTBOARD Logistics Update (COBLU) is a joint initiative with the United Kingdom to update all OUTBOARD systems by replacing 84% of the equipment, thereby improving its capability and logistics supportability. This project uses a common core system that uses modular LAN design concepts, which improves scalability.

The Common High Bandwidth Data Link-Shipboard Terminal (CHBDL-ST) is a wide band, full duplex digital data link that supports several Navy and Joint airborne

sensor programs which require data communications with shipboard processors. This system allows surface platforms to transmit and receive SHF intelligence data real time.

The Battle Group Passive Horizon Extension System Surface Terminal (BGHES-ST) system extends the range and capabilities of the CHBDL-ST system by providing over-the–horizon VHF/UHF range. BGHES-ST uses significant amounts of COTS hardware with PMW 163 developed software.

The Combat DF system is an RF Direction Finding signal acquisition and direction finding system with the capability to detect, locate and identify enemy targets at long range. This system also has the capability to input this information directly into ship tactical data systems. Combat DF offers improved capabilities of the OUTBOARD system by providing the ability to exploit unconventional and low probability of intercept (LPI) signals.

The Ships Signal Exploitation Equipment (SSEE) provides the battle group with the capability to exploit signals of interest by providing a state-of-the-art system which detects, acquires and collects data on potential threats to the battle group. This system is designed to upgrade and automate these functions for a variety of surface ships.

The Cryptologic Carry-On Program (CCOP) provides portable, carry-on cryptologic and IO quick reaction capability for air, surface and subsurface platforms. This system will augment existing organic SSES capabilities and provide capabilities where no SSES exists.

Cryptologic Unified Build (CUB) is a library of reusable software segments to meet the requirements of PMW 163 cryptologic systems. These segments are augmented

by PMW 163 developed segments for sensor management and operation and signal analysis. [Ref. 14]

The largest and most expensive project for PMW 163 is the CHBDL system. As described above, this system is vital to the entire IO warfare effort. In FY-97 two Engineering Demonstration Models (EDM) were produced by L3 Communications under direction from PMW 163. These EDMs were installed on the USS John F. Kennedy CV-67 and tested in 1997. Three systems were produced in FY98, and four in FY99. There are four scheduled to be completed in FY00. These systems cost $6.1 million per unit, with installation costs of $1.2 million. Original budgets called for production of 4 to 5 CHBDLs per year, but future year's budgets call for 2 to 3 systems with added capabilities. There will be a total of 31 CHBDL systems produced for large deck ships, with a proposal to add two additional systems for the LPD-17 program.

4. Cost Measurement

Cost measurement in PMW 163 is performed the same as it is for PMW 161. The P code in the PD 16 office performs limited cost measurement for PMW 163. Cost measurement is focused on the timely performance of obligations and executions. The major concern of the P code is ensuring that all financial and scheduling benchmarks are met. These benchmarks are received from the SPAWAR Comptroller. They change year to year, and occasionally within the fiscal year. The main measurement for benchmarks is the receipt of deliverables and the submission of vouchers from Contractors and Field Activities. PD 16 can only measure these deliverables as they are reported to its office or

to the PMWs or APMs. The official dates and milestones are in the contracts held by the Comptroller. The P code is not necessarily apprised of the benchmarks is the contracts as they are changed and modified frequently. Therefore, cost measurement is also performed by the cognizant APM. The P code, PMW and APM have monthly meetings where they review financial data which is charted with the planned amount, obligation benchmark, current obligation, expenditure bench mark and current expenditure. At this point decisions are made on follow on action. If the benchmarks are being met then follow on action is not required. If the benchmarks are not made, then the activity is notified of the deficiency and action is taken to rectify it. Depending on the amount of the deficiency, the program can be followed weekly, using the format shown in Appendix G, until it is back on schedule.

The PD 16 P code uses an Initiation, Obligation Plan Database, which is a Microsoft access database. This is an old SPAWAR program which serves the need of PD 16. PD 16 does not have the funds (or does not deem it advantageous) to invest in the Financial Information Management System (FIMS) which has been dictated by SPAWAR.

5. Performance Measurement

Performance measurement in PMW 163 is much the same as it is throughout other acquisition programs in other PMWs: cost, schedule and performance. As with virtually all PMWs studied at SPAWAR, performance is measured differently for Field Activities than it is with Defense Contractors. Assistant Program Managers (APM) work closely

with Defense Contractors, usually through Process Teams. These teams develop build plans for the product and track it through to completion. The primary measurement in this area is cost, schedule and technical performance. As noted above, the primary system produced by PMW 163 are software upgrades and IO warfare devices.

As with all programs at SPAWAR, "technical performance and schedules drive cost." [Ref. 8:interview C] A standard procedure is followed by PMW 163 for all upgrades and proposed changes to a system under development. The process is then similar for all proposals. There is an Engineering Change Proposal (ECP) developed by SPAWAR, the Contractor or the Field Activity. The office that proposes the ECP is the one that writes it. At that point it is approved, rejected or modified. If it is ultimately approved, the ECP is used to develop Build Plans. There is a point in time in all contracts, where there is a "freeze" in ECPs. This freeze enables the program to be produced without further delay. Changes to the system must then be made at the next modification.

Once in production, the Contractor will issue a monthly Cost Schedule Status Report (CCSR) to PMW 163. This CCSR states progress for all three major parameters, cost, schedule and technical performance. If production is done by a Navy Field Activity, then a letter is sent to PMW 163 with the same information. For more technical issues, a Progress, Status and Management Report (PSMR) is issued.

6. Budgeting

Budgeting within PMW 163 is performed by the PD 16 Business and Finance Office as outlined previously. N64 provided PMW 163 $170.3 million in FY99. Of this amount, $21.95 million was RDT&E (DCP), $2.7 million RDT&E Navy, $129.3 million OPN and $16.4 million O&M, N. The budgeting for PMW 163 is program specific from the sponsor.

V. PROGRAM DIRECTORATE 17 - COMMAND, CONTROL, COMMUNICATIONS AND COMPUTERS

A. MISSION

PD 17 is responsible for developing and installing high capacity, inter-operable Navy communication systems that are integrated, flexible, seamless and affordable in the joint warfare environment. The functions of PD 17 include managing the development, acquisition and life cycle support of integrated communication systems designed to enhance the warfighting capabilities of the joint/coalition commander; management of programs featuring equipment which support reception and transmission of satellite voice and data information using state-of-the-art algorithms over the complete electromagnetic spectrum. Participation on the SPAWAR Board of Directors, Executive Steering Group and Integrated Product Teams attempt to ensure that PD 17 systems meet fleet requirements and interoperability goals while complying with the overall SPAWAR system engineering and architecture guidance, policies and standards.

B. STRUCTURE

PD 17 is structured similar to the other program directorates within SPAWAR. There is a Director and Deputy Director for PD 17. Below the Deputy Director are three divisions that each have distinct and unique programs. These divisions are titled Program Managers Warfare (PMW). The following PMWs make up PD 17, PMW 173 Submarine Communications, PMW 176 Navy Satellite Communications, PMW 179 Advanced Automated Tactical Communications. These PMWs are discussed below.

There are also three main offices that support the Director and Deputy Director. They are PD 17E Chief Engineer, PD 17L Logistics, and PD 17P Business and Finance. The Chief Engineer and his staff provide top-system level technical direction in the development, acquisition, deployment and support of PD 17 integrated communication systems and related products through translation of operational requirements into engineering terms across products and processes of the Program Directorate's programs.

The Logistics Management Office provides centralized integrated logistics support services to provide effective and economical support of PD 17 cognizant communication systems over their life cycle. The Logistics Management Office also provides Integrated Logistics Support inputs to the Program Managers to assist in the Planning, Programming and Budgeting process. [Ref. 8:interview D]

The Business and Financial Management Office provides business and financial support to the Program Managers. This support includes program analysis and development, budget formulation, execution including PPBS actions, submission of Program Objective Memorandum input and documentation, financial acquisition planning and management, and management analysis and reporting. This office also coordinates with the Project Engineers in preparing the yearly spending plans in all programs addressing all taskings and activities. The utilization of the spending plans by the individual PMWs form the basis for the obligation plans. During the year, they receive and update the PMW plans to reflect the functions actually being performed and the applied funding. They also provide the Director with a consolidated spending plan to be provided to COMSPAWAR as required.

C. PMW 173

1. Mission

PMW 173 is the single point of contact within SPAWAR for submarine communication programs. Guided by the OPNAV N87/N6 Submarine Communications Master Plan and in concert with the Navy Satellite Communications (NAVSATCOM) program, PMW 173 is developing a communications support system common to all classes of submarines and fully compliant with the Joint Staff's "C4I for the Warrior" communications architecture.

2. Structure

PMW 173 is implementing the Submarine Communications Master Plan through an integrated master schedule of all related programs. PMW 173 promotes an open forum for collaborative industry and government system solutions maximizing use of Commercial-Off -the-shelf (COTS) and Non -Developmental Item (NDI) technologies for the purpose of promoting joint interoperability and reducing life cycle costs. Submarine communications capabilities will be incrementally increased every 2 years using a phased approach continuing through the year 2005. Phased upgrades are being planned for SSN 688 Class, Trident Class and SEAWOLF Class submarines.

3. Products/Outputs

PMW 173 is coordinating the development of the new Attack Submarine, Virginia Class, exterior communication system with the Ship Acquisition Project

Manager (SHAPM) PMS 450 and the shipbuilder, Electric Boat Division, General Dynamics. All initiatives are coordinated with the fleet to ensure user needs are met in an efficient and affordable manner. PMW 173 also has responsibility for Life Cycle for the fixed base, low frequency communications systems Very Low (VLF) and Extremely Low Frequency (ELF) for strategic communications with submarines. PMW 173 also coordinates with all SPAWAR program offices to ensure submarine requirements and needs are mutually achievable, integrated and supported as well as development and delivery of all exterior submarine communication systems such as high data rate antennas, and phased array antenna systems. External coordination with Naval Sea Systems Command is required for shipboard development and delivery of exterior shipboard installation of all communication systems. [Ref. 8:interview E] Appendix H details the amount of total procurement quantities for the Submarine Low Frequency/Very Low Frequency Communication Receivers (SLVR) from FY 99 to FY 04. [Ref. 16]

4. Cost Measurement

As previously stated, the Acquisition Program Baseline defines what the anticipated cost of a system or product will be over its life cycle while documenting the cost, schedule and performance objectives and thresholds of the program. The Acquisition Program Baseline also establishes the program budget by defining the cost objectives and thresholds that must be met as a program progresses through the milestones to final fielding on platforms and for lifecycle management.

Cost management is focused on the total cost of systems installed on each platform, with the basic budgetary goal of not exceeding budget authority (BA) in a given fiscal year. SPAWAR currently does not have a standardized cost database to track obligations and expenditures but, it is developing this capability through the utilization of the "Cube" as previously described. PMW 173 utilizes the Financial Management Information System (FMIS). FMIS enables the Financial Managers to identify, maintain and control the program requirements within the appropriate level of funding in a given fiscal year. FMIS focuses on PMW fiscal year requirements and allows the P code personnel the ability to track and monitor the assigned expenditures through execution, for comparison of obligated vs. expended funds. FMIS utilizes a Work Breakdown Structure derived from the Acquisition Program Baseline to identify the functions (parts of a system) to establish cost drivers and assign costs, specifying the correct appropriation, scheduling tasks and monitoring the status of funds. FMIS also assists in development of the Acquisition Plan as it identifies the appropriation, obligation and outlay of expenditures. Due to the relatively low budget $55 million of the PMW 173 communication systems, the stability of the annual budget is questionable given that the technology changes in the C4I arena every six months.

5. Performance Measurement

Performance measurement in PMW 173 is driven by the factors important to any acquisition program: cost, schedule and performance. The C4I plan for submarines, the IT 21 requirements and the system integration requirements drive performance

measurement. System integration is driven by communication system computability, with the risk of equipment inavailability. The C4I plan for submarines is driven by performance of the communication system that has the risks of cost overruns and meeting performance parameters. The PMW 173 program manager has to tailor his program to meet the budget cycle while providing the deliverable (system installations) to meet the Battle group Fitting Schedule. [Ref. 8:interview F]

The SPAWAR IT 21 plan assists in performance measurement in its focus on deploying battlegroups by fiscal year. The Navy wants the each battlegroup to have the same communication capabilities. PMW 173 personnel meet two times a year with the fleet to discuss how well their products perform, to resolve issues and to get feedback on what communication improvements Navy users wants. These meetings are in addition to the e-mail communications, providing monthly status reports from the System Centers that supply the maintenance and direct customer service to the fleet. [Ref. 8:interview G]

PD 17 measures the following indicators in relationship to their programs and the IT 21 Core Program Components: technical performance, cost, schedule, funding, test and evaluation, production, logistics, software, contract status. These performance indicators provide a snapshot at a point-in-time to indicate program problems or areas that need special attention. The installation schedule is shown as a graph of the acquisition program status, as indicated by milestones. Indicators outside the thresholds are explained with a proposed resolution. This information is used by COMSPAWAR to oversee the programs under his control. These status reports are provided twice a year and

updated monthly within the PMWs. Appendix E provides an overview showing the major metrics reported and the installation schedule for a PMW 173 product.

6. Budgeting

Budgeting within PMW 173 is done on a unit cost basis due to the fact this is a mature acquisition program and cost per unit is available based on previous installation and procurement information. PMW 173 does budget submittals for Operations and Maintenance Navy, Research and Development, and Other Procurement Navy. The budget submissions reflect the cost elements of each system, quantity and unit cost by fiscal year. This information provides a key element to match program performance with budgeted and actual costs.

The acquisition program baseline provides a plan reflecting the number of systems to be procured and installed in a fiscal year. Adjustments to the program budget are reflected by either an increase or decrease in systems procured and installed in the fleet.

A major issue for PMW 173, as stated, in this chapter is the small relative size of the budget for their programs. Given Navy emphasis on equivalent capability across deploying platforms, PMW 173 is likely to continue to receive funding to meet this goal.

D. PMW 176

1. Mission

PMW 176 provides a joint interoperable, integrated end-to-end Naval ship and shore communications capability in the spectrum above 1GHz. These products represent

the most capable, cost-effective communications mix of military and commercial solutions consistent with integrated C4I architecture. They also satisfy the Navy's vision of a seamless, interoperable, user-oriented information environment.

2. Structure

PMW 176 is matrixed into the following areas: (1) The Integrated Terminal Concept of Navy Satellite Communication, (2) The Navy Extremely High Frequency (EHF) Satellite Communication, (3) Advanced systems engineering and integration efforts on "cross-discipline" areas related to proper execution of commercial solutions.

3. Products/Outputs

The Integrated Terminal Concept of Navy Satellite Communication implements a "strategy of affordability" to meet future requirements for high capacity satellite communications for ships, submarines, and shore commands. This strategy fields terminal, antenna, and supporting equipment to provide end to end SATCOM technical solutions for the military and commercial spectrum from L through Q bands, using innovative procurement, aggressive development/fielding, and non-traditional leasing approaches. Objectives of the strategy include (a) a migrating current "stovepipe" military SATCOM systems, that operate above 1 GHz, to open architecture, modular, multiband terminal systems, (b) maintaining systems deployed in the fleet and ashore in the highest state of readiness possible, (c) maximizing the use of COTS products operating in SATCOM frequencies, (d) promoting advanced technologies for low observable and multifunction antennas to reduce the impact of topside systems on

shipboard survivability, (e) taking the initiative in those areas where warfighter requirements lag operational need, and (f) proposing and implementing strategies to leverage current and future military and commercial products.

The ACAT I Navy EHF SATCOM Program (NESP) is the Navy segment of the joint Milstar program. It provides interoperable, low and medium data rate anti-jam, low probability of intercept/detection connectivity for submarines, ships and ashore. Program focus areas include (a) developing and integrating terminals to provide Navy units with networked, point-to-point or broadcast EHF connectivity, (b) developing and integrating communication interfaces that are unique to the joint Milstar program, (c) monitoring advanced technology insertions including waveform enhancement, improved submarine report-back capacity, encryption, and automated satellite hand-over, (d) coordinating Navy efforts in support of developing the next generation of advanced EHF (AEHF) capability, including efforts in support of the ground, space, and communications planning segments.

Advanced system engineering and integration efforts focus on several "cross-discipline" problems related to proper execution of communications systems, including (a) coordinating the integration of antenna solutions for new construction ships and for benefit platforms, (b) developing and coordinating the transition and technology insertion concepts to enable communications Science and Technology/Research and Development efforts to become production ready, (c) coordinating satellite communication technology demonstrations, and (d) coordinating baseband integration among various program and industry partners. [Ref. 8:interview H]

Appendix I outlines the total cost of the NESP program and the number of total units after the redefined acquisition program baseline. Additional information provided includes the historical average unit procurement cost and program acquisition unit reflecting how program changes have impacted on these cost measures. The programmed unit cost data provides a bench mark that can be used to monitor the program's status. Any variances in these projected costs and installations can be further investigated allowing management to exercise internal controls as appropriate.

4. Cost Measurement

The Navy Extremely High Frequency Satellite Communication Program (NESP) is an ACAT I program with financial reporting requirements to the DoD Defense Acquisition Board. In May 1998, the Assistant Secretary of the Navy for Research, Development and Acquisitions required the resubmission of the Acquisition Program Baseline in support of the Total Cost of Ownership Reduction plans. PMW 176 has focused on return on investment of cost reduction initiatives to support program funding. The Total Cost of Ownership is defined as the total cost of a program to the Navy over its lifecycle.

The NESP Total Cost of Ownership was estimated at $4.6 billion for FY 1982-2002, of which $1.6 billion are sunk costs and $3 billion are future variable costs. Three TOC reduction initiatives in FY 98 focused on high impact future costs including: replacement of the Traveling Wave Tube with a Solid State Power Amplifier; consolidated Installation Process which is a strategy that views all installation jobs from

the perspective of the platform and utilizes a platform installation team to plan all the required equipment installations as an integrated job; and Software Replacement with a Modern Program Language. The cumulative cost avoidance over was estimated at $210 million in return for a cumulative investment of $41million (FY 98 dollars) from FY 2000 to FY2005.

The Traveling Wave Tube replacement initiative was the most effective cost reduction opportunity and was recommended as a NESP High Payback Initiative. The ROI when evaluated using optimistic (i.e. most likely), and pessimistic scenarios resulted in ROI gross potentials of 150% to 250% in the FYDP 2000-2005 time frame, and 510% to 670% ROI in the FYDP. [Ref. 15]

The Acquisition Program Baseline cost update made by the Program Manager of PMW 176 indicated no breach for the key Average Unit Production Cost and Program Average Unit Cost Parameters. In fact, the proposed averages are lower than those currently in the APB. Given the tightening budget for all programs, this ACAT I program appears to be competitive in the ROI arena.

5. Performance Measurement

Performance measurement of the NESP Program is governed under the DoD 5000.2 R that specifies reporting requirements relating to cost, schedule and performance on a quarterly basis. The next NESP program performance measurement will be in November 1999 when the Milestone Decision Review Operational Test determines whether the program is ready to provide the Navy with "Core" and "Hard Core"

communications in all levels of conflict and survivability under extreme conditions, e.g. electromagnetic, physical.

The NESP program needs to achieve the thresholds of the Operational Test since the Acquisition Program Baseline threshold of April 1999 has already been breached. Future funding of this program could be impacted if the Operational Test is not successful. Additionally, the NESP program is dependent on the timely launch of the MILSTAR Flight 3 Satellite.

6. Budgeting

Budgeting for the NESP Program follows the Acquisition Program Baseline noted in this chapter. Due to the tight dollar thresholds, NESP faces more scrutiny from the OPNAV and the Secretary of Defense. While the budget reflects unit cost installation of NESP systems by platform, an emerging issue is the lack of understanding of Program Management by budget personnel. The Acquisition Reform Initiatives began in 1993, but not all budget personnel have been trained in the DoD Program Management process, as evidenced by the endless data calls requiring program manager time and financial personnel time to respond. Ideally, once a program is approved and budgeted for in the FYDP, annual justifications of the program should not be necessary. However, given congressional, DoD and Navy oversight requirements, this is not possible.

E. PMW 179

1. Mission

PMW 179 consolidates and automates Navy tactical radio systems into open, flexible, modular systems that allow evolutionary hardware and software improvement and upgrades. This consolidated approach focuses on baseband-to-Radio Frequency and tactical radio communication systems development, and provides technical expertise on USN, USMC, Joint and Foreign Military Sales Programs. The objectives of the approach are met through integrated system engineering initiatives, and examination and implementation of mobile tactical communication systems.

2. Structure

PMW 179 is structured to focus in the following areas: (1) Automation of radio room functions and radio room requirements by developing an centralized (Tech Control) component controller, (2) Implementation and support of state-of-the art IT control and switching systems consistent with approved SPAWAR 05 architectures, (3) Implementation and support of naval shipboard and shore tactical Radio Frequency (RF) systems that operate between 100Khz to 2GHz.

Automation of radio room functions and reduction of radio room requirements includes developing centralized (Tech Control) component controllers, that, in final form, include the following modules: (1) System Configuration: Setup, Management and System Control, (2) System Monitoring: Automated System Monitoring and Periodic Performance Testing, (3) System Security: Authorization checks on operator/system user

inputs, (4) Information Security Monitoring/Monitor System Security, (5) Theater Spectrum Management, (6) Information Warfare/C2W Tactical Spectrum Management.

Implementation and support of state-of-the-art IT control and switching systems is intended to be consistent with approved SPAWAR 05 architectures, with focus on: (1) Automating configuration control and monitoring of Radio Communication System (RCS) circuits, (2) Planning, monitoring, and controlling of existing radio communications networks, circuits and virtual networks through computer controlled resource/network management, (3) Standardizing ship and shore based switching and multiplexing systems, (4) Providing real-time circuit monitoring, fault detection and localization. [Ref. 8:interview H]

3. Products/Outputs

Products include implementation and support of naval shipboard and shore tactical Radio Frequency (RF) systems that operate between 100 kHz to 2 GHz. This includes High Frequency Systems, Very High Frequency Systems, Ultra High Frequency Systems, UHF Line of Sight Systems and UHF Satellite Communication Systems. Specific initiatives include: (1) Managing general tactical RF communication programs such as the Joint Military Satellite Communication Network Integrated Control System (JMINI) which provides centralized control and decentralized management of voice and data communications operating over non-processed 5-kHZ and 25-kHZ to Joint Chief of Staff validated users. (2) Providing situational awareness intelligence RF programs such as the Commander's Tactical Terminal (CTT) which provides near-real-time tactical

information beyond the battlegroup to the entire theater of operations in support of Theater Ballistic Missile Defense. (3) Fielding naval expeditionary warfare communication radio programs such as the Digital Wideband Transmission System (DWTS) which provides ship-to-ship and ship-to-shore data transmission links, and advanced RF transmission components through the utilization of Digital Modular Radios (DMR). (4) Analyzing existing architectures and current system life cycle costs to determine if existing equipment should be replaced with more robust and/or more cost effective tactical RF communication systems within the 100kHz to 2 GHz spectrums, providing radio systems designed to be centrally linked that also support advanced communication networking and radio room automation. [Ref. 17]

Appendix J outlines the installation schedule for the Joint UHF Satellite Communications Network Integrated (JMINI) Control System. The total number of units to be procured and installed equal 600 over the FY 00 to FY 04 time frame.

4. Cost Measurement

Cost measurement in PMW 179 is very similar to that in PWM 173. COMSPAWAR is the Milestone Decision Authority, and these programs are small in terms of total cost. Since these are mature systems being upgraded in support of the IT 21 initiative, actual costs of these systems and installation costs are available, making cost measurement relatively easy to do within the PMW.

Cost measurement is, again, focused on the total cost of systems installed on each platform within the budget authority appropriated in a given fiscal year. Due to the

relatively small dollar amounts of PMW 179 communication systems, the stability of the annual budget is always an issue because program reductions are easy to justify. However, the SINCGARS system became a Congressional Interest Item in FY 99, and therefore program execution against budgeted cost will be closely monitored.

5. Performance Measurement

Performance measurement in PMW 179 is driven by the factors noted as important to any acquisition program: cost, schedule and performance. The Program Manager of PMW 179 has the same risk issues as faced in PMW 173, i.e., tailoring the program to meet budget constraints while providing the deliverable (upgraded capability) to meet the Battle Group Fitting Schedule.

The performance indicators tracked in PMW 179 relate their programs to the IT 21 Core Program Components previously discussed in this chapter. The installation schedule and acquisition program status are managed as previously discussed. Status reports are provided to COMSPAWAR twice a year and are updated monthly within the PMW.

6. Budgeting

Budgeting within PMW 179 also is conducted on a unit cost basis due to the fact that this is a PMW with mature acquisition programs and cost per unit data available based on previous installation and procurement information. PMW 179 prepares similar budget submittals as those of PMW 173, reflecting the cost elements of each system, quantity and unit cost by fiscal year. [Ref. 16]

The next milestone for this program is the Voice and Data Operational Test in the first quarter of FY 00. If the operational test is successful, the SINCGARS program may receive some preference for funding to help ensure program success.

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VI. PROGRAM DIRECTORATE 18: INTELLIGENCE, SURVEILLANCE AND RECONNAISSANCE (ISR)

A. MISSION

Program Directorate 18 (PD 18), Intelligence, Surveillance and Reconnaissance (ISR), is one of 6 Program Directorates within SPAWAR. PD 18's mission is comprised of 3 main areas- intelligence, surveillance, and reconnaissance.

The intelligence portion of the PD is defined as "the product resulting from the collection, processing, integration, analysis, evaluation, and interpretation of available information concerning foreign counties or areas." [Ref. 18]

The surveillance portion of PD 18 deals with "the systematic observation of aerospace, surface, or subsurface areas, places, persons, or things by visual, aural, electronic, photographic, or other means." [Ref. 18]

The reconnaissance portion of PD 18 deals with "the missions or efforts to obtain information about the activities and resources of an enemy and to secure data concerning the meteorological, hydrographical, or geographic characteristics of a particular area." [Ref. 18]

These assignments placed together form the backbone of the PD 18 mission. This mission is the cradle-to-grave management and development of all assigned ISR development and acquisition programs within SPAWAR. This includes all associated infrastructures and the analysis of required assets. In short, PD 18 designs systems, that are the eyes, ears and brains of the fleet. These systems must receive data and

intelligence in all domains, and relay this to support systems that integrate these data in to usable information for the fleet. They must develop, test, engineer and field all systems and products under their cognizance and, in turn, support the products and systems that they send to the fleet. PD 18 must insure that their ISR systems are designed and installed so that they can be successfully integrated in all maritime and joint applications. Lastly, PD 18 must serve as the ISR expert for the Navy.

B. STRUCTURE

PD 18 is structured similar to the other program directorates within SPAWAR. There is a director and deputy director of PD 18. Below the Deputy Director are five divisions that each have distinct and unique programs within PD 18. These divisions are called Program Managers Warfare (PMW). The following PMWs make up PD 18- PMW 181 Fixed Surveillance, PMW 182 Mobile & Deployable Surveillance, PMW 183 Advance Deployable Systems, PMW 185 METOC Systems and PMW 187 Global Positioning Systems. These PMWs will be discussed below.

Three main offices also support the Director and Deputy Director: PD18E Chief Engineer, PD18L Logistics, and PD18P Business and Finance. The Chief Engineer and his staff support the design, development and testing of the hardware and most of the software developed by the Program Directorate. The Logistics Office ensures material support for the product or system that is either currently in development, or scheduled for future development. The L code ensures requirements are measured, the reliability of

parts and equipment are checked and availability is verified. The L code also develops and verifies depot level support.

C. COST MEASUREMENT/BUDGETING

As noted above, PD 18 is a decentralized organization. As such, each PMW operates in an autonomous fashion. This autonomy carries down to the Finance and Business P code offices. The P codes each manage their financial budgeting and tracking systems differently. SPAWAR as a whole has worked with a contractor, PSA, who developed a financial management tool called the Financial Management Information System (FMIS). Although the Government owns the FIMS program, PSA holds the contract for the installation, instruction and data loading of the system for SPAWAR. The PMWs have been "directed" to use this system, but there are two perceived problems with it. First, although it has significant capabilities, many analysts do not see sufficient advantages to using it. It has only limited interface with the Financial Information Management System (FIMS), that is the system that is used by SPAWAR as the command's budget execution tool. Comments such as "its O. K." and "I'm not totally happy with it, but it does work" were common when describing the FMIS. [Ref. 8:interview I] Additionally, FMIS is costly. One PMW spent $117,000 for the package. Even within SPAWAR, this is a large sum to spend on a management system if the benefits are not apparent. Subsequently, only one PMW (PMW 181), uses FMIS. The rest of the PMWs track spending and scheduling with their own Excel spreadsheets. These were all developed in-house by the P code or by personnel in the PMW. The

bottom line is that there is no centralized or even common budgeting or tracking tool used within PD 18.

D. PMW 181

1. Mission

PMW 181 is tasked to provide Fixed Surveillance Systems for the fleet. These systems comprise of a wide array of assets including broad area fixed, passive, undersea surveillance systems for the detection, classification, localization, and tracking of submarines. This system is comprised of three main elements which include Sound Surveillance Systems (SOSUS), Fixed Distributed Systems (FDS) and Surveillance Direction Systems (SDS).

2. Structure

PMW 181 is a fairly autonomous organization that deals directly with Program Sponsors, Defense Contractors Field Activities and various other offices within SPAWAR including the Comptroller (01), Contracts (02), Installation and Logistics (04) and Chief Engineer (05). PMW 181 is run by a Program Manager, with major offices comprised of the Deputy Program Manager (A), Business & Finance (P) and Logistics (L) There are 12 divisions in PMW 181 headed by Assistant Program Managers (APMs). These divisions are comprised of 181-1 International Programs LANT, 181-2 International Programs MED, 181-3 International Programs PAC, 181-4 Anti-Submarine Warfare C4I, 181-6 FDS-C, 181-8 Shore Systems Design and Development, 181-9 Ship

Operations, 181-10 UWS and Shore Facilities Installation and Maintenance and 181-12 System Testing and Evaluation.

3. Products/Outputs

PMW 181 is coordinating the continued development and upgrading of all Fixed Surveillance systems with the fleet. These systems are comprised of Sound Surveillance Systems (SOSUS), Fixed Distributed Systems (FDS) and Surveillance Direction Systems (SDS). PMW 181 has "cradle-to-grave" lifecycle and maintenance responsibility for these systems. PMW 181 is not currently at the production level, but is at the "maintain and upgrade" level. [Ref. 8:interview I] There are no true production efforts scheduled through FY01.

The main project for PMW 181 recently has been the development and production of the Shore Processing System. This shore processing systems package is a maintenance and upgrade package. This is considered a "technology refresh" which will "economically" enhance their capabilities. [Ref. 8:interview I] The specific schedule of these upgrades is classified, but there are to be approximately 10 accomplished, 3 in the United States and 7 out CONUS. There were approximately 2 to 3 accomplished in FY98, 2 to 3 in FY99 with this pace to continue until all 10 sites are completed. Of the 10 sites, there are approximately 4 to 5 different versions of the system. This makes the upgrade packages both more complex and more costly, then if only one version was in the field. The earlier upgrades were $2.5 million per unit, with the last one budgeted at $1.6

million. Due to industry innovation, the latter systems will be more capable, even at 64% of the initial cost of the system upgrade.

4. Cost Measurement

The P code technician assigned performs cost measurement in PMW 181. Due to the relatively small cost of the systems in PMW 181, COMSPAWAR is the Milestone Decision Authority. Cost measurement is focused on the total cost of the upgrade and maintenance to the system in question, within the budget authority given by the Program Sponsor and allocated by the Program Manager to that system. Cost and budget information is measured and tracked by the P code using the Financial Management Information System (FMIS), as discussed above. Cost and scheduling information is received daily from the Contractors, Field Activities and APMs and is disseminated to the APMs and PMs weekly and when required. The P code also interfaces directly with Government Field Activities and Defense Contractors when cost and schedule performance measurements appear to be out of specification. PMW 181 "Does not require cost performance in any contracts." [Ref. 8:interview J] There are some milestones built into contracts with Defense Contractors, but they are not considered true measurements. Cost measurements are considered difficult because of the variety of different upgrades and maintenance being performed on a wide variety of variants on the systems in question.

5. Performance Measurement

Performance measurement in PMW 181 is much the same as it is throughout other acquisition programs in other PMWs: cost, schedule and performance. As with virtually all PMWs studied at SPAWAR, performance is measured differently for Field Activities than it is with Defense Contractors. APMs work closely with Defense Contractors, usually through Process Teams. These teams develop build plans for the product and track it through to completion. The primary measurement in this area is scheduling and technical performance. As noted above, most of the systems produced by PMW 181 are upgrade and maintenance packages. The Contractor, the Navy Sponsor or the Field Activity normally proposes these upgrades. If the Sponsor proposes a change, the information is relayed to PMW 181. The process is then similar for all proposals. There is an Engineering Change Proposal (ECP) developed by SPAWAR, the Contractor or the Field Activity. The office which proposes the ECP is the one which writes the ECP. This ECP is jointly designed, reviewed and costed. At that point it is either approved, rejected or modified. If it is ultimately approved, the ECP is used to develop Build Plans. The Build Plans have testing and cost milestones, which are tracked by the APM and to a lesser degree by the P code. The PMW 181 personnel stated that there is "No formal procedure" [Ref. 10:interview A] for this process, and many of these steps are deleted or not followed depending on the scope of the project, the Contractor or the personnel involved. If a deadline passed without action, the P code would notice that the command was not billed as expected for the accomplishment of the milestone, or the APM would

not receive technical notification of the completed milestone. At that point, the Contractor or Field Actively would be called and questioned about the missed milestone. The schedule would be altered, or the specification changed according to the circumstances. The PMW personnel consider this as more of a "go-no go" test [Ref. 8:interview K] than a performance measurement.

6. Budgeting

Budgeting within PMW 181 is done on a "level of effort" test [Ref. 8:interview J] basis as opposed to a true unit cost method. As note earlier, there are many models of similar systems, and many unique upgrade and maintenance packages. Therefore it is very difficult for the PMW to budget on a unit cost, as shown in Appendix K. This budgeting process is similar to a "bottom up review." The APMs work with the sponsors and determine what work needs to be done, and then budget accordingly. This is the case because virtually all PMW 181's are mature, post milestone III programs. PMW 181 receives funds from the following accounts: Operations and Maintenance Navy (O&MN), Research and Development Test & Evaluation (RDT&E), Ship Construction Navy (SCN) and Other Procurement Navy (OPN). The sponsor for PMW 181 is N87, who provided $58.2 million in FY99. Each of these budget submissions reflects the following cost elements: quantity, unit cost, date of first delivery, delivery schedule, and installation schedule and program justification. This information provides key elements to match performance with budgeted and actual costs.

E. PMW 182

1. Mission

PMW 182 is tasked to provide the fleet with a modern mobile maritime surveillance capability in littoral regions and open ocean areas of vital national interest in support of Joint and Naval Task Force Commanders. PMW 182 provides the mobile portion of the Navy's Integrated Undersea Surveillance System (IUSS). This is a versatile AntiSubmarine Warfare (ASW) system that provides wide-area ocean surveillance that is both mobile and responsive, against all ASW threats, both deep ocean and shallow water. Recently, the Navy has begun to develop an active system to enhance the passive capability of the IUSS system. This has been the most recent thrust of PMW 182.

2. Structure

PMW 182 is also fairly autonomous within SPAWAR in that it deals directly with Program Sponsors, Defense Contractors, Field Activities and various other offices within SPAWAR including the Comptroller (01), Contracts (02), Installation and Logistics (04) and Chief Engineer (05). PMW 182 is run by a Program Manager, with major offices comprised of the Deputy Program Manager (A), Business & Finance (P), Logistics (L), IUSS Systems (C), MIUW (M), and Training (R). There are six divisions in PMW 182 headed by Assistant Program Managers (APMs). These divisions are comprised 182-1

Passive Automatic/FSP, 182-2 Active Sensors/CLFA, 182-3 T-GOS-23 Integration, 182-4 Joint Projects, 182-5 Production and 182-6 Littoral Systems Engineering.

3. Products/Outputs

PMW 182 produces and upgrades both mobile and deployable maritime surveillance systems. In the mobile area, the Surveillance Towed Array Sensor (SURTASS) system is the primary Navy system currently used in the fleet. The SURTASS system provides the central architecture required for integration and fleet operations and for new capabilities developed with PMW 182. This is comprised of passive towed array systems, utilizing Commercial Off the Shelf (COTS) based computer processing and a communications infrastructure to relay gathered data. There are several components of this architecture. The towed array sensor itself is comprised of a series of hydrophones that receive information and relay this data to processors aboard ship. An adjunct to this system is the Low Frequency Active (LFA) transmitting sonar that supports monostatic and bistatic missions. This 70-ton, 18-transducer sonar expands the current passive operating system. The LFA gives the Navy the capability to acquire, reacquire and track submarines in quiet operating modes as well as measuring ranges. A sister system to the (LFA) is the Compact Low Frequency Active (CLFA) system which provided an active transducer to enable LFA deployment on SWATH-P T-Agos ships. In the software area, PMW 182 is contributing to Joint Task Force Surveillance (JTFS) by providing software infrastructure that enhances the correlation/tracking functions to integrate non-acoustic or additional acoustic sensors.

In shallow water ASW, PMW 182 is producing Twin-Line array systems. This system is comprised of two horizontally separated arrays and signal processors in order to provide improved acoustic performance in high surface clutter environments. This is vital to Navy interests, as shallow water ASW had not been of significant Navy interest during the Cold War. As emphasis is placed in naval operations in the littoral regions, this area of research and production will become ever more significant.

In the area of research, PMW 182 has a number of significant programs. The Scientific Research Program (SRP) is a phased program designed to help fill critical knowledge gaps concerning low frequency sound, and its effects on the maritime environment. Additionally, this program is researching how future PMW 182 programs can support the development of the SURTASS LFA Environmental Impact Statement (EIS). PMW 182 is also working on the Commonality Initiatives. This is a joint effort with both the submarine and surface tactical ASW programs to reduce costs, enhance operability, and combine R & D programs for new sensors and architectures. PMW 182 is also developing the Common Operator Machine Interface (COMI).

Lastly, PMW 182 provides Research & Development and production services for the Mobile Inshore Undersea Warfare (MIUW) program. The emphasis in this program is for deployable surface and subsurface surveillance for inshore areas throughout the world, using acoustic, optic and radar sensors.

The major effort of PMW 182 recently has been development and production of two major programs. One is the upgraded towed array for the SURTASS passive surveillance system. This array will be employed on SWATH and T-AGOS ships as the

current systems are. One array was built with FY99 funds, and will be delivered in PY00. This array was built for the U. S. Navy, but PMW 182 will produce two more passive towed arrays for foreign military sales in FY00 and FY01. These arrays cost $4.1 million per unit. There were to be more arrays produced earlier, but due to budget shortfalls, this program was both scaled back and delayed approximately two years.

The second major program for PMW 182 was the SURTASS Low Frequency Active (LFA) system. As noted above, this system will give the Navy critical, standoff active ASW capabilities. The original plan called for the acquisition of 17 LFA systems. Currently, only two have been built. Both were built in 1990; one is on a MSC research vessel and one is in storage. This program has been seriously delayed due to the bankruptcy of Halter Marine who was contacted to build the SWATH platform for this sonar. The first ship is now scheduled to be completed in FY00. The cost of this system was $13.5 million per system with a follow-up engineering services contract totaling $12.5 million. This is an ACAT II level program. PMW 182 hopes to get additional funds for further procurement of these systems once the two systems are operational.

4. Cost Measurement

The P code assigned performs cost measurement in PMW 182. Cost measurement is focused on the total cost of the upgrade to the systems, as well as the cost of the system as a whole, as is shown in Appendix L. The programs are managed within the budget authority given by the Program Sponsor and allocated by the Program Manager to that system. PMW 182 is sponsored by N-874 for SURTASS systems and N-

6 for MIUW systems. Most of the products produced by PMW 182 are systems upgrades, save for the two major programs outlined above. This makes initial cost measurements more precise and somewhat easier to estimate than with new development programs. Estimates for upgrade programs are based on the cost of the original program or the most recent upgrade. Many of these programs are significant software improvements only, and are supported by COTS hardware, which allows for accurate cost estimation. These estimates are performed either by the Contractor with APM approval, or in the case of Field Activities, are "Engineering Estimates" [Ref. 8:interview L] performed by the APM with other Navy officials.

The cost measurement of the LFA system is based on three main criteria. The first, is the cost of pervious active sonars developed for either the submarine or surface fleet. SPAWAR and the Contractor working in partnership for the prototype and follow on production then make an engineer's estimate. Once the prototype is built, follow on production can be better estimated.

Cost and budget information is measured and tracked by the P code using an Excel spread sheet of their own development. This information is received daily and disseminated to the APMs and PMs weekly and when required. The P code notifies the cognizant APM when cost and schedule performance measurements appear to be out of specification. At that point the APMs take whatever action is deemed necessary. Usually, a telephone call is made or e-mail sent to the APM's counterpart in the Field Activity or Contractor office. Resolution is attempted at this level, prior to formal documentation being sent.

5. Performance Measurement

Performance measurement in PMW 182 is much the same as it is throughout other acquisition programs in other PMWs: cost, schedule and performance. As with virtually all PMWs studied at SPAWAR, performance is measured differently at the Field Activities than it is with Defense Contractors. Assistant Program Managers (APM) work closely with Defense Contractors, usually through Process Teams. These teams develop build plans for production and track the project through to completion. The primary measurement in this area is scheduling and technical performance.

As noted above, the primary systems produced by PMW 182 were major sonar systems and passive arrays. The LFA program is an ACT two program. With major programs of this caliber, an Acquisition Program Baseline cost estimate was made. All cost performance objectives and thresholds of the program were developed and tracked. The program is currently suspended, pending completion of the support structure.

The rest of the production budget is comprised of upgrades. The Contractor, Navy Sponsor or the field activity normally proposes these upgrades. The process is similar to the one outlined in PMW 181. PMW 182 personnel stated that there is "no formal procedure" [Ref. 8:interview L] for this process, and many of these steps are deleted or not followed depending on the scope of the project, the contractor or the personnel involved.

6. Budgeting

Budgeting within PMW 182 is primarily conducted on a unit cost basis for upgrades. Research and Development budgeting is based on "contractors estimates" for various components of the system, and are "rolled up" [Ref. 8:interview M] into a prototype cost. Except for the two major programs discussed, all of PMW 182's programs are post milestone III programs. This makes budgeting based on previous systems procurement and installation cost the most accurate available. PMW 182 is funded by N-6 for SURTASS systems, and N-874 for MIUW programs. Out of a total budget of $74.5 million, $22.6 million was for Research & Development. PMW 182 receives funds from the following accounts: Operations and Maintenance Navy (O&MN), Research and Development Test & Evaluation (RDT&E), Ship Construction Navy (SCN) and Other Procurement Navy (OPN). Each of these budget submissions reflects the following cost elements: quantity, unit cost, date of first delivery, delivery schedule, and installation schedule and program justification. This information provides key elements to match performance with budgeted and actual costs.

F. PMW 183

1. Mission

PMW 183 is tasked to develop and provide the Advanced Deployable System (ADS) for undersea surveillance to provide deployable, real time, accurate data for Joint Force and Naval Task Force Commanders. The need for a deployable capability to detect

quiet diesel-electric submarines and mine-laying activities in shallow littoral regions has been emerging since the end of the Cold War and the advent of possibly hostile states with brown water only capabilities. In 1995, PMW 183 was designated the major office for the ADS.

2. Structure

PMW 183 is autonomous within SPAWAR in that it deals directly with Program Sponsors, Defense Contractors Field Activities and various other offices within SPAWAR including the Comptroller (01), Contracts (02), Installation and Logistics (04) and Chief Engineer (05). PMW 183 is run by a Program Manager, with major offices comprised of the Deputy Program Manager (A), Business & Finance (P), Logistics (L) and Engineering Projects (C). There are five divisions in PMW 183 headed by APMs. These divisions are comprised of 183-1 ADS Engineering Projects, 183-2 Command, Control, Communications, Computers and Information (C4I), 183-3 Underwater Segment, 183-4 Procurement and Analysis Segment and System Integration and 183-5 Optical Deployable Systems.

3. Products/Outputs

PMW 183 has not yet produced the ADS. The program is currently nearing completion of the Program Definition and Risk Reduction (PDRR) phase of the Department of Defense major program acquisition process. A milestone II review is

scheduled for December 1999. If approved, the ADS program will enter the Engineering and Manufacturing Development (EMD) phase in January 2000.

Ultimately, PMW 183 hopes to produce nine shore segment Process Analysis Segments (PAS) suites and six installation segment Platform Alpha (PA) suites. This will require major sub-components, which include, but are not limited to 37 shore sensor arrays and 26 Inter-node cable packs. Underwater components include 800 sensor arrays, 150 repeaters and 750 inter-node cable packs. [Ref. 19]

4. Cost Measurement/Estimation

Estimated cost for this program total $1.02 billion through FY21. This includes $134.6 million in EMD phase II costs, $624.6 million in production costs and $322.6 million in operations and support phase costs. (All amounts are in then-year dollars.) As an ACAT II program, the estimates were not compared to any independent cost estimate (ICE). However, a Naval Center for Cost Analysis (NCCA) representative participated in the cost estimating Integrated Product Team (IPT) for both the ADS Milestone II AOA assessment and the milestone II program estimates. The model used to calculate the cost was the Automated Cost Estimating Integrated Tools (ACEIT) platform. This is the standard SPAWAR cost analysis program. Production costs represent approximately 60% of the total remaining cost for the ADS. The Work Breakdown Structure (WBS) was used as the framework of the lifecycle cost estimate. This is essentially the same model used by other PMWs within SPAWAR for cost estimating, budgeting and planning purposes. [Ref. 19]

Office of the Secretary of Defense (OSD) guidance directs the use of a reference system for estimating costs. The systems command, in this case SPAWAR, attempts to find an existing operating system with a similar mission to that of the proposed system, to serve as a reasonable baseline for estimating and comparing costs. PMW 183 looked to two other PD 18 programs, SOSUS and FDS. Although they did provide some relevant information for components of the system, as a whole they were deemed inadequate. The ADS mission is more of a temporary one, measured in terms of weeks or months. SOSUS and FDS are strategic, high reliability systems designed for markedly longer periods of up to 24 years. Clearly, on the whole, these programs are more unique than similar. Therefore, the models discussed above were more useful. [Ref. 19]

5. Performance Measurement

Specification and schedule information for the ADS program is defined in the Cost Analysis Requirements Description (CARD). The CARD describes technical information, including the WBS and the technical performance characteristics of the hardware. Performance will be measured against these and other technical specifications in the numerous test and evaluation milestones throughout the life of the production.

6. Budgeting

The FY99 PMW 183 budget is $47.1 million; the FY98 budget was $39.5 million. This budget is totally comprised of Research & Development funds provided by N87.

PMW interfaces directly with N87 for all budgetary matters. The current budget is driven by the Program Life Cycle Cost Estimate (PLCCE) for the ADS.

The EMB portion of the budget is expected to peak in FY04 at $25.2 million, as is shown in Appendix M. The production budget will begin in FY05. The ADS budget is expected to peak in FY09 at $66.8 million.

G. PMW 185

1. Mission

PMW 185 is tasked to provide integrated meteorological and oceanographic (METOC) information systems and tactical decision aids and information for warfare commanders, fleet operators and weather forecasters. In caring out this tasking, PMW 185 systems must gather, identify and integrate a significant amount of complex and varying data in order to create an accurate, useful and timely meteorological picture. This data is comprised of weather information gathered above and below the surface of the ocean. For each area that has tactical and strategic significance, METOC systems gather data that includes wind speed and direction, air temperature, humidity refractive effects and precipitation, as well as both commercial and biological ambient noise. At or below the surface, data includes water temperature, salinity, wind-driven circulation, thermal gradients, tides and turbidity. On the ocean floor itself, sub-bottom structures, acoustic dependencies, slopes and shelves of the ocean floor and false targets and wrecks must be located. All these data points must be gathered, by different platforms, at different locations and be integrated and transmitted to the fleet in a timely manor.

2. Structure

PMW 185 is also fairly autonomous within SPAWAR in that it deals directly with Program Sponsors, Defense Contractors, Field Activities and various other offices within SPAWAR including the Comptroller (01), Contracts (02), Installation and Logistics (04) and Chief Engineer (05). PMW 185 is lead by a Program Manager, with major offices comprised of the Deputy Program Manager (A), Business & Finance (P) and Logistics (L). There are nine divisions in PMW 185 headed by Assistant Program Managers (APMs). These divisions are comprised of 185-1 IN-SITU systems, 185-2 METMF(R), 185-3 Space Systems, 185-4 Integrated Tactical Systems, 185-5 Fleet Requirements, 185-6 Fleet Systems, 185-7 Systems Architecture and Engineering, 185-8 Systems Engineering and Y2K and 185-9 Research and Development.

3. Products/Outputs

The main system currently maintained and upgraded by PMW 185 is the Tactical Environmental Support System/Navy Integrated Tactical Environmental Subsystem (TESS/NITES). This upgrade is comprised of procuring workstations, servers, input/output control devices, as well as software to support the evolutionary acquisition TESS. These upgrades are conducted at the Fleet Numerical Meteorological Centers (FNMOC) as well as at six other major shore sites and numerous afloat and smaller shore sites. This system collects all data received from a wide variety of sensors. The data are then processed and used at the site, as well as uploaded to the FNMOC. Collection

systems that are under cognizance of PMW 185 include the Shipboard Meteorological & Observing Oceanographic System (MORIAH), Mini-Rawin System (UMQ-012A MRS) and the Automated Surface Observing System (ASOS). This data is up loaded to one of several satellite systems under PMW 185s cognizance. These systems include the Meteorological Satellite Program USMC [METMF(R)] and the Environmental Satellite Receiver Recorder (SMQ-11). Other communications include the Supplemental Weather Radio (SWR) and the Next Generation Radar Principal User Processors (NEXRADPUPS). A future system in the developmental stage is the Geodetic/Geophysical Satellite Follow-On (GFO).

4. Cost Measurement

The P code assigned performs cost measurement in PMW 185. Due to relatively small cost of the systems in PMW 185, COMSPAWAR is the Milestone Decision Authority for all programs. Cost measurement is focused on the total cost of the upgrade to the system in question, within the budget authority given by the Program Sponsor and allocated by the Program Manager to that system. Because SPAWAR is the sole systems command for the sponsor in these areas, funding has not been an issue for these programs in recent years. PMW 185's sponsor, N096, provided $70.9 million of the $72.9 million budget. This is the only PMW that N096 sponsors in SPAWAR, so both players can manage the program on a more personal basis. Cost and budget information is measured and tracked by the P code using her own excel spreadsheet. This information is received daily and disseminated to the APMs and PMs monthly and when required. This

technician is very aggressive in interfacing directly with Government Field Activities and Defense Contractors when cost and schedule performance measurements appear to be out of specification.

The highest priority system for PMW 185 is the TESS/NITES. Per PMW 185 personnel, tracking cost performance is "extremely difficult" in this PMW due to the "excessive number of variations of current systems and the amount of execution plan changes." [Ref. 8:interview N] Appendix N is an example of a PMW 185 budget document. There are over 10 significant shore installations and 28 shipboard assets that have TESS/NITES equipment. The range of these upgrades is between $103,000 and $3.8 million. This amount can fluctuate depending on how an "upgrade" is defined. A "new keyboard" was recently sent out to the field. This cost was under $1000, but it actually is an upgrade. But to compare the technical scope and cost of that to other multi-million dollar programs is absurd. The PMW is currently not required to answer that question. The costs of these estimates are all based on engineer's estimates and independent government cost estimates. The accuracy of these estimates is further weakened by the large amount of improvements made prior to installations. So even if the estimates are accurate initially, as the upgrades are modified, the budget estimates degrade.

5. Performance Measurement

Performance measurement in PMW 185 is driven by the three main factors found throughout SPAWAR-cost, schedule and technical performance. In this type of

"evolutionary acquisition system" performance measurement is "not performed beyond the early research and development stage." [Ref. 8:interview N] The Naval Research Laboratory, the Office of Naval Research and the Naval Postgraduate School develop the software. These research and development sites estimate the amount of increased performance that will be attained by the software. The Program Sponsor, with advice form PMW 185 determines if the program should proceed. Once the upgrade is initiated, the performance measurements, excluding scheduling, ends.

6. Budgeting

Budgeting within PMW 185 is conducted on a "cost as an independent variable" [Ref. 8:interview N] approach. This approach is taken due to the significant amounts of unique upgrades performed. Since each upgrade must be individually costed, a budget estimation is made and as many upgrades as possible are performed within the subsequent budget constraints. As noted above, there is a significant number of upgrades, of varying scope being conducted on a large number of platforms. The Sponsor, N096 informs PMW 185 of the proposed budget. PMW 185 then informs the Sponsor what upgrades can be conducted on that budget, given the Sponsor's priorities. All of PMW 185's programs are now post milestone III programs. This would appear to make budgeting based on previous systems procurement and installation cost more accurate. But as noted above, there is a large amount of variation from upgrade to upgrade. PMW 182 receives funds from the following accounts: Operations and Maintenance Navy (O&MN), Research and Development Test & Evaluation (RDT&E), Ship Construction Navy (SCN)

and Other Procurement Navy (OPN). Each of these budget submissions reflects the following cost elements: quantity, unit cost, date of first delivery, delivery schedule, installation schedule and program justification. This information provides key elements to match performance with budgeted and actual costs.

H. PMW 187

1. Mission

PMW 187 is the centralized program management site for the Navy, Marine Corps and the Coast Guard for the integration and development of Global Positioning Systems (GPS) and advanced navigation systems. Within this tasking, PMW 187 has a litany of GPS systems that must be installed on aircraft, ships and submarines of the Navy and Marine Corps team in order to increase the ability to complete tactical mission and enhance navigation capabilities.

2. Structure

PMW 187 is also fairly autonomous within SPAWAR as it deals directly with Program Sponsors, Defense Contractors, Field Activities and various other offices within SPAWAR including the Comptroller (01), Contracts (02), Installation and Logistics (04) and Chief Engineer (05). PMW 187 is lead by a Program Manager, with major offices comprised of the Deputy Program Manager (A), Business & Finance (P), Logistics (L) and Navy Deputy to Joint Programs Office. There are ten divisions in PMW 187 headed by Assistant Program Managers (APMs). These divisions are comprised of 187-1 GPS

User Equipment, 187-2 Tactical Aircraft, 187-3 Ship GPS & NAVSSI, 187-4 SABER, 187-5 CSEL, 187-6 Support and Trainer Aircraft, 187-7 Fleet Introduction, 187-8 Advanced Navigation Systems, 187-9 Electronic Navigation and 187-10 GPS Modernization.

3. Products/Outputs

PMW 187 coordinates a vast array of GPS and navigation systems throughout an extensive spectrum of Naval and Marine Corps assets. Recent successes with products developed by PMW 187, most notably GPS navigation systems, have led to an increase in funds and installations of GPS systems throughout the fleet. Congress has mandated that 4,435 military aircraft be fitted with GPS systems by FY-05 as shown in Appendix O. Currently, 2069 aircraft have been upgraded with GPS navigation and targeting systems. Until this system is fully operable, the Interim Portable GPS (IPGPS) systems are being procured and placed on aircraft throughout the fleet.

The Navigation Sensor System Interface (NAVSSI) and ship GPS integration are also under production. This navigation suite will allow surface ships to integrate, monitor, manage and distribute precise position, velocity and time data between ships and aircraft. This will also allow ships systems to choose automatically the most accurate and reliable navigation source for C4I combat and weapons systems. There are currently 60 ships with this increased capability, with an additional 115 scheduled.

At the individual level, the Combat Survivor Evader and Locator (CSEL) system architecture is being developed by PMW 187. Predecessors to this system were used

successfully in Bosnia and the Persian Gulf War. This system is being procured to ensure survivability of downed pilots and small combat teams. Deliveries are scheduled to begin in May 2001.

Lastly, PMW 187 is developing secure GPS systems, which are coming under increasingly high threat of jamming and detection. This effort by PMW 187 includes increased power development, user protection, separate channels, and increased satellite capabilities.

4. Cost Measurement

The P code assigned performs cost measurement in PMW 187. Due to relatively small cost of the systems in PMW 187, COMSPAWAR is the Milestone Decision Authority. Cost measurement is focused on the total cost of the upgrade and maintenance to the system in question, within the budget authority given by the Program Sponsor and allocated by the Program Manager to that system. Cost and budget information is measured and tracked by the P code using her own unique excel spreadsheet. Cost and scheduling information is received daily from the Contractors, Field Activities and APMs and is disseminated to the APMs and PMs weekly and when required. The P code also interfaces directly with Government Field Activities and Defense Contractors when cost and schedule performance measurements appear to be out of specification. As previously stated, the Acquisition Program Baseline (APB) was used for the initial development and production of the GPS system. The APB defines what the anticipated cost of a system or product will be over its lifecycle while documenting the cost, schedule and performance

objectives and thresholds of the program. The APB also establishes the program budget by defining the cost objectives and thresholds that must be met as a program progresses through the milestones to final fielding on platforms. This system was used extensively by PMW 187 when developing the current GPS system.

PMW 187 also measures and analyzes cost performance using Earned Value Measurement (EVM). Planning is central to the EVM process. EVM measures and tracks programs and milestones, indicating when the program is not reaching scheduling or financial milestones. This forces managers to plan as early and as accurately as possible. Leaders within PMW 187 state that obligation and expenditure benchmarks are "their number one priority" [Ref. 8:interview O] when it comes to monitoring financial performance. Personnel state that they are "very alert" to expense and scheduling benchmarks, and that they "get what [they] measure." [Ref. 8:interview O]

5. Performance Measurement

Performance measurement in PMW 187 is much the same as they are throughout other acquisition programs: cost, schedule and performance. As with virtually all PMWs studied at SPAWAR, performance is measured differently for Field Activities than with Defense Contractors. Within PMW 187, Process Teams are developed with the Air Force, Contractor and Field Activities in order to develop performance measurements. These teams are formed on an ad hoc basis whenever a significant upgrade is contemplated.

6. Budgeting

Budgeting within PMW 187 is primarily conducted on a unit cost basis. This is the case because virtually all PMW 187 programs are mature, post milestone III programs. This makes budgeting based on previous systems procurement and installation cost the most accurate available. PMW 187 receives funds from the following accounts: Operations and Maintenance Navy (O&MN), Research and Development Test & Evaluation (RDT&E), and Other Procurement Navy (OPN). Each of these budget submissions reflects the following cost elements: quantity, unit cost, date of first delivery, delivery schedule, and installation schedule and program justification. This information provides key elements to match performance with budgeted and actual costs. Since PMW 187's major current system is the GPS aircraft installation dictated by Congress, the budget is quite stable.

VII. SUMMARY AND CONCLUSIONS

A. SUMMARY

Chapter I provides the background for the thesis. It discusses the strategic and budgetary legacy of the Cold War and how related factors have influenced managing the Department of Defense. It also discusses the Federal budget deficit, and the current and future impact it will have on the Space and Naval Warfare Systems Command (SPAWAR). Chapter I also outlines the purpose, research questions, methodology and organization of the thesis.

Chapter II describes and analyses performance measurements in SPAWAR. As an acquisition command, SPAWAR falls under the direction of the DoD 5000.2R acquisition regulation, that specifies how acquisition programs shall be arranged and reported. Chapter II indicates how this regulation to a great extent dictates cost performance measurement such as the Acquisition Program Baseline. Also described are Total Ownership Cost and the Information Technology 21 (IT 21) Strategic Implementation Plan as they pertain to SPAWAR.

Chapter III describes and analyses the mission and structure of Program Directorate 15, Global Information and Network Systems. PD 15 is comprised of PMW 151, PMW 152, PMW 157 and PMW 158. The mission, structure, products and outputs, cost measurement and budgeting of each of these PMWs is presented. PD 15 produces software and limited hardware for Metropolitan Area Networks, Base Area Networks, Local Area Networks, and other DoD Network Information Systems. PD 15 produces

communications systems that integrate the Naval Tactical Command Support System (NTCSS), the Defense Messaging System, the Global Command and Control Systems-Maritime and the Automated Digital Networking System (ADNS).

PD 15 measures performance based on cost, schedule and performance. The primary tool used is the Acquisition Program Baseline. The individual PMWs track cost schedule and performance using a variety of locally developed computer programs, and spreadsheets. Budgeting is based on a combination of engineering estimates of the lifecycle costs of the individual programs.

Chapter IV describes and analyzes the mission and structure of Program Directorate 16, Information and Electronic Systems. PD 16 is comprised of PMW 161 and PMW 163. The mission, structure, products and outputs, cost measurement and budgeting of each of these PMWs was researched. PD 16 provides both services and products to the fleet, which makes it rather unique. PMW 161 provides computer network support functions that include security engineering services. PD 16 also produces cryptologic equipment, Intrusion Detection Systems (IDS), and combat surveillance systems such as the Common High Bandwidth Data Link-Shipboard Terminal (CHBDL-ST). The majority of programs in PD 16 are post-milestone three upgrade programs vice strict acquisition programs.

PD 16 measures performance based on cost, schedule and performance. The primary tools used are the locally developed computer programs, spreadsheets and budgeting tracking tools. Budgeting is based on engineering estimates made by Field Activities, Defense Contractors and SPAWAR engineers.

Chapter V describes and analyzes the mission and structure of Program Directorate 17, Command, Control, Communication and Computers. PD 17 is comprised of PMW 173, PMW 176 and PMW 179. The mission, structure, products and outputs, cost measurement and budgeting of each of these PMWs is analyzed. PD 17 produces integrated communications systems for submarines, surface ships and for fleet to shore communications. These products include Very Low Frequency (VLF), Extremely Low Frequency (ELF) communications systems and the Extreme High Frequency (EHF) Satellite Communications system.

PD 17 measures performance based on cost, schedule and performance. The primary tool used is the Acquisition Program Baseline combined with locally produced tracking systems. Budgeting is based on combinations of engineering estimates of the lifecycle costs of individual programs.

Chapter VI discussed the mission and structure of Program Directorate 18, Intelligence, Surveillance and Reconnaissance. PD 18 is comprised of PMW 181, PMW 182, PMW 183, PMW 185 and PMW 187. The mission, structure, products and outputs, cost measurement and budgeting of each of these PMWs is covered. PD 18 produces Sound Surveillance Systems (SOSUS), Surveillance Towed Array Sensors (SURTASS), Tactical Environmental Support System/Navy Tactical Environmental Subsystem (TESS/NITES) upgrades and Global Positioning System (GPS). PD 18 is currently in the Program Definition and Risk Reduction (PDRR) phase of the Advanced Deployable System (ADS). The majority of programs in PD 16 are post-milestone three upgrade programs vice strict acquisition programs.

PD 18 measures performance based on cost, schedule and performance. The primary tools used are locally developed computer programs and spreadsheets. Budgeting is based on engineering estimates made by Field Activities, Defense Contractors and SPAWAR engineers.

B. CONCLUSIONS

Based upon extensive review of four major Program Directorates and 14 Program Manager Warfare Divisions a basic understanding of performance measurement metrics currently applied at SPAWAR was established. These metrics include Total Ownership Cost, cost, schedule and performance criteria as defined for DoD Acquisition Commands, and Earned Value Management.

SPAWAR is an acquisition command with the defined mission of providing integrated information solutions through delivery of fully integrated, tested and supportable systems, and the training of Sailors and Marines in the use of these systems by operational platform. The IT21 Plan provides a framework for the integration of SPAWAR systems and products with a focus on providing deploying battlegroups with affordable, state-of-the-art technology. SPAWAR is also governed by acquisition program budgeting and the PPBS process within the DoD. SPAWAR attempts to maintain a focus on performance measurement and unit cost budgeting. The challenge for SPAWAR and other acquisition commands is how to be the smartest, most responsive buyer of goods and services, at the best dollar value over the lifecycle of the products that meet warfighter needs.

The majority of SPAWAR acquisition programs are Acquisition Category (ACAT) III and IV. DoD Regulation 5000.2R does not define specific performance metrics relating to cost, schedule and performance for SPAWAR systems and products. SPAWAR Program Managers have established acquisition program metrics relating to the cost, schedule, and performance parameters that enable management of the programs. Program goals are identified in terms of objectives and thresholds. Each parameter includes an objective that is the desired result (e.g., delivering a system under budget) versus a threshold that defines a minimum acceptable result (e.g. delivering a system on budget). As previously mentioned in this thesis, the starting point is the Acquisition Program Baseline (APB) that documents cost, schedule, and performance objectives and thresholds by program, beginning at program initiation. Performance measures evolve as the program is defined and develops. At Milestone One, performance measures are defined in broad terms. During this stage, measures of performance focus on needed capabilities in a program. As the program evolves, more specific program parameters are added to measure the major drivers of operational effectiveness and suitability, schedule, technical progress and cost.

As presented in Chapter II, the IT 21 process starts with a review of fleet operational needs and then translates these into requirements. As deficiencies and needs are identified by the operating components, they are validated by the Office of the Chief of Naval Operations and the Commandant of the Marine Corps. These Operational Requirements Documents (ORD), represent the baseline of IT 21 requirements.

Performance measurement is, and will continue to be, critical for SPAWAR programs in the future as each program, project and acquisition will attempt to institutionalize outcome-oriented results measurement so that production and even outcomes can be better evaluated over time to assess command achievement of mission, goals and priorities. For a broad program like IT 21, the ability to develop and measure performance will help to ensure success in competing for funding and programmatic support at all levels in the Navy. The goal of IT 21 performance measurement is to provide a systematic method for evaluating the inputs (resources), outputs (programs, projects), transformation (acquisition, development), and productivity (contribution to the mission) of the program.

C. TOPICS FOR FUTURE RESEARCH

Currently, SPAWAR is organized as a decentralized, program management-based organization whose mission is to provide integrated warfare and communication systems for the Navy. While each Program Directorate employs an essentially different management and control system, the goal of SPAWAR is to provide integrated systems for installation on Navy platforms and maintain the state-of-the-art of these systems over their lifecycles. Given the operational and budgetary requirements placed on SPAWAR in delivering these systems and common functionality across battle groups, SPAWAR as an organization has to implement better business practices to meet current and future challenges. A significant amount of SPAWAR, including 4 Program Directorates and 14

Program Managers Warfare has now been studied. The question now becomes, where should future study be directed?

The first issues are whether this study has indicated deficiencies in the current structure at SPAWAR. Does the current structure and organization operate effectively? Are there significant deficiencies that need to be addressed? What performance measurements are important to whom? What is the hierarchy of these metrics? Are they currently being met by SPAWAR? There are at least four areas to analyze in attempting to find answers to that question.

The first is to focus on leaders and technicians at SPAWAR itself. Many of the personnel interviewed voiced concerns about where SPAWAR is presently, relative to its history, and how SPAWAR should develop in the future.

The second area is the leadership of SPAWAR itself. How do the Program Directorates and the heads of the major support divisions, such as Logistics, the Comptroller and the Chief Engineer view how SPAWAR is accomplishing its mission? How does the Commander of SPAWAR assess the manageability of the Command?

Third, how are other DoD and non-DoD organizations with similar missions organized and how do they conduct business? What is the "industry standard" for Navy systems commands? Are there lessons for SPAWAR relative to how NAVAIR and NAVSEA are organized? What methods of production and effectiveness do they use? Also, the military appears to do a poor job of learning lessons across services. Army and Air Force systems commands should be studied to learn how they are structured and how they measure performance effectiveness.

Lastly, the customer should be more involved. There are two immediate SPAWAR customers. The first are the resource sponsors. They deliver the majority of funds to enable SPAWAR to produce systems. Are the sponsors pleased with the cost, schedule and technical performance of the systems procured by SPAWAR? One way to investigate this would be to research one sponsor that has provided funds to SPAWAR, NAVSEA and NAVAIR. N6 may well have provided funds to all three. One might investigate how the three commands performed on programs that are similar in scope (in terms of budget, time frame and system type) over the last 5 years. Investigating non-DoD organizations that provide SPAWAR funds could extend this examination further. The National Security Agency (NSA) has funded PD 16 for cryptologic communications systems. If they have funded the Army or the Air Force, one could investigate how this sponsor judged the products and services they received. DoD entities would have less vested interest in providing critical information concerning SPAWAR's performance.

The fleet is immediate user of most systems produced by SPAWAR; therefore they are the primary customers. How do those served assess SPAWAR performance? Are SPAWAR systems filling required gaps in war fighting needs? More immediately, how does SPAWAR perform in installation and training functions that directly and immediately impact the fleet?

All organizations can increase performance quality. There should be continuous process improvement at SPAWAR. If the organization is lagging behind comparable organizations or failing to accomplish its mission in some areas, then changes may be required. Conversely, if SPAWAR is at the forefront of its community, consistently

producing quality products on schedule and within price guidelines, then only minor improvements may have to be made to keep up with technology and management practice. It is critical to know how SPAWAR compares before major action is taken with respect to organizational change.

1. Centralized vs. Decentralized Organization

SPAWAR currently is a highly decentralized organization. Each Program Directorate and Program Manager Warfare has its own unique mission; its own unique segment of the Navy's war fighting mission. Therefore, each Program Manager Warfare concentrates on the programs and systems that directly impact their individual missions. The SPAWAR Strategic Plan concentrates on the goal of horizontal integration of systems by deploying platforms by having all the PDs and PMWs coordinate their efforts in attempt to ensure battlegroups achieve system compatibility to support their deployment schedules. Unfortunately, each PMW is funded as a separate program from the Program Directorate level, and many different resource sponsors influence which systems are developed, installed and upgraded in accordance with the differing priorities of each resource sponsor. SPAWAR is implementing a partnership with N6 which has already assisted in funding the communication systems of PD 17, with emphasis on upgrading the communication platforms of submarines.

Another issue is the reporting responsibilities of the PDs and PMWs. The majority of the SPAWAR programs are ACAT III and IV, which makes COMSPAWAR the Milestone Decision Authority. While the COMSPAWAR enables the PDs and

PMWs to carry out their programs, the resource sponsors deal directly with the PMWs regarding budget execution and schedule/product characteristics, etc. Options should be considered with respect to how SPAWAR is funded to execute all programs so that program adjustments might be made centrally to support SPAWAR's mission and/or eliminate dual reporting requirements, and to streamline budget and program management given that SPAWAR does not presently control program funding for the PMWs as they deal directly with the resource sponsors.

2. Utilization of Earned Value Management

Earned Value Management is a tool for effectively integrating cost, schedule and technical performance measurement. Earned Value Management relates resource planning to schedules and technical performance requirements, planning all work for the program through completion, integrating program work scope, schedule and cost objectives into a baseline plan that enables measurement of progress against a baseline. This process attempts to assesses objectively the progress at the work performance level and to allow variance analysis from the plan to better forecast the impact of program changes. It also intends to provide useful data to decision makers.

The work packages provide the building blocks for the Performance Measurement Baseline (PMB). The PMB contains all the essential elements for each activity. The PMB is a roll up of all the work packages, which creates a time-phased budget plan. As the PMB tracks the budget plan, it is stated in dollar terms. Currently, SPAWAR is developing a Total Cost of Ownership (TOC) plan for each program. The PMB is

intended to enable management to track program performance using analysis of variances.

Under this procedure, each activity is identified as a work package that can be monitored at any point in time to see if progress is on schedule, within budget or not, and to project whether the total project will be fielded within the budget constraint. Based on interviews conducted, the utilization of this management system would be relatively easy to implement and would allow SPAWAR to monitor program status, relating cost to completion milestone of the program. Unfavorable variances relating to cost, schedule and performance could be analyzed so the root causes of problems could be determined. Since SPAWAR contracts for actual system development and installation, this management tool could help Program Managers by providing timely cost and schedule information to help identify potential problems while they are still manageable.

3. Mission Funding vs. Reimbursable Funding

SPAWAR is mission funded for the civilian personnel, and the projects are funded with a mix of appropriated and reimbursable funding. SPAWAR does not allocate the cost of personnel to the systems it produces; these costs are not part of the system costs. While mission funding, may appear to be a good idea for the Commander and Headquarters of SPAWAR, how would the command account for the number of upgrades, replacements and repairs needed for systems? Another issue is whether it would be cost effective to try to account for all upgrades. DoD now estimates these costs and will do so in the future. If the Navy fully implements its IT 21 strategy and budgets

by deploying platform, and resource sponsors standardize how cost estimation and cost information will be collected, it may make sense to mission fund SPAWAR in the future.

4. Utilization of Activity Based Costing

The Acquisition Program Baselines included in the Total Cost of Ownership Plans provides the framework for Activity Based Costing (ABC) because it identifies the activities that consume resources, and assigns costs to these activities. Currently, SPAWAR does not include indirect costs into the costing of product/products. Therefore, a major management issue of importance is whether and how to allocate indirect costs and primarily personnel costs, into the cost of the product/products. Another benefit of the TOC framework is identification of cost drivers associated with each activity. The SPAWAR TOC plans clearly define the anticipated cost of an activity; then data are used to estimate the cost of each unit procured or installed.

SPAWAR could implement ABC through utilization of the TOC plans, establishing an accounting database for costs. A major issue for SPAWAR and DoD is the standardization of cost allocation methods and system costing methodology. According to our interviews, SPAWAR contracts out the cost estimates for all its programs because the expertise does not exist in-house. The cost estimating personnel located in the Command Comptroller's Department could perform some of these estimate analysis. In this area, an issue to be considered is that although ABC provides more information about product costs, would the additional costs of record keeping justify the management information gained? Based on interviews of SPAWAR personnel, these

additional record keeping costs would not be cost effective. The resource sponsors are more concerned about budget execution and not exceeding project budgets than having the management information that could be gained through ABC. However, the command perspective is not the same as that of the sponsor.

5. Product Measurement Metrics

Currently, SPAWAR utilizes product measurement metrics that relate to cost, schedule and performance of their systems in accordance with the Acquisition Program Baseline and milestone requirements. Depending on what milestone the SPAWAR programs are in, the DoD 5000.2 defines what the general program requirements apply for that stage. Based on our interviews, SPAWAR is attempting to apply metrics such as "installations per battlegroup," as a metric that can be used to guide program fielding once they have reached this stage of production. Current acquisition program guidelines as defined by DoD provide good program guidance for fielding new systems. However, with DoD more concerned with Total Lifecyle Costs of a program from cradle-to-grave, there are no metrics to define the value of system upgrades, nor is there adequate guidance on how to evaluate new technology. This is a major management issue to be addressed by program sponsors and SPAWAR, perhaps through partnerships with private industry, to gain the expertise necessary to evaluate program effectiveness and evaluate new technology opportunities.

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APPENDIX A

NTCSS Deployment Schedule

	FY99	FY00	FY01	FY02	FY03	FY04	FY05
Optimized Ships	54	11	27	19	44	70	55
IMA (MALS)	7	1	1	1	1	2	2
IMA (NAS)	7	1	1	1	5	4	7
OMA (Sqdns)	54	38	50	37	59	64	17
SCN	4	4	5	5	4	0	0
Training/Support	5	8	2	1	2	2	8
TOTAL	**131**	**63**	**86**	**64**	**115**	**142**	**89**

APPENDIX B

GLOBAL COMMAND AND CONTROL SYSTEM – MARITIME (GCCS-M)
ACQUISITION PROGRAM BASELINE

Section A. PERFORMANCE **Key Performance Parameters**	**FY 00 MS-IIIA GCCS-M 4.x (Increment I)** **OBJECTIVE / THRESHOLD**
Database Query Process - Single Condition	≤ 10 seconds / ≤ 17 seconds
Database Query Process - Multiple Condition	≤ 3 minutes / ≤ 5 minutes
Analysis Queries	≤ 15 minutes / ≤ 30 minutes
Archival Query	≤ 60 minutes / ≤ 80 minutes
Throughput	≥ 100% / ≥ 95%
Correct Correlation Percentage	≥ 100% / ≥ 85%
Miscorrelation; Missed Initiation	≤ 0% / ≤ 6%
Miscorrelation; Mis-Association	≤ 0% / ≤ 6%
Track Fragmentation Percentage	≤ 0% / ≤ 6%
Ambiguity Percentage	≤ 0% / ≤ 12%
Operational Availability (A_O)	≥ 0.99 / ≥ 0.95
Probability of establishing tactical communications connectivity with a selected unit within 2000 NM of the TSC within 10 minutes (P_{TC})[1]	0.95
Number of missions which can be simultaneously directed/controlled over a 72 hour period[1]	Fixed TSC: 3 MOCC: 1.5
Number of air sorties which can be simultaneously and continuously supported over a 72 hour period[1]	Fixed TSC: 12 MOCC: 6

Section B. GCCS-M 4.x Product Standards	**FY 00 MS-IIIA GCCS-M 4.x (Increment I)**
DII COE compliance	Goal: Level 7 / Minimum: Level 5
Software development	Developed to common GCCS segment guidelines
Year 2000 compliance	Full Year 2000 compliance
Security guideline compliance	Complies with security guidelines
Documentation / Training	Migration to online documentation and context-based training

Section C. SCHEDULE ***Dates Estimated***	**FY 00 MS-IIIA GCCS-M 4.x (Increment I)** **OBJECTIVE / THRESHOLD**
Streamlined Acquisition Management Plan (SAMP II) Approved	Dec 98 / Jun 99
In House Reviews (INHR's) / Acq. Coord. Team (ACT) / OIPT	Jan 99 / Oct 00
Operational Test and Evaluation (OT&E)	Oct 00 / Apr 01
Follow-on Operational Test and Evaluation (FOT&E)	Jan 01 / Jun 01
NPDM / Milestone IIIB	Dec 00 / Jun 01
Initial Operational Capability (IOC)	Dec 00 / Jun 01

[1] GCCS-M Tactical / Mobile Specific Performance Parameters

APPENDIX C

TOC ESTIMATE: ADNS

(Note all costs are in FY98 $M)

TOC WBS #	PY	FY99	FY00	FY01	FY02	FY03	FY04	FY05	FY06	FY07	FY08	FY09	FY10	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	TOC
TOTAL		24.51	30.44	26.70	34.72	39.34	47.47	43.87	48.65	30.44	33.83	30.33	31.77	30.44	33.83	30.33	31.77	30.44	33.83	30.33	31.77	30.44	33.83	30.33	769.42
DEVELOPMENT	1.0																								
PRODUCTION	2.0	20.51	25.14	20.53	26.94	20.81	26.93	23.34	25.75																189.94
PRIME MISSION PRODUCT	2.1	5.38	7.36	5.92	8.04	5.75	7.02	5.83	7.51																52.80
HARDWARE	2.1.1	5.24	7.07	5.46	7.04	5.10	6.34	5.38	6.93																48.55
HARDWARE RECURRING	2.1.1.1	5.24	7.07	5.46	7.04	5.10	6.34	5.38	6.93																48.55
AFLOAT	2.1.1.1.1	5.02	5.30	4.16	4.22	3.49	4.62	3.88	5.22																35.89
AN/USQ-144B(V)2 PLATFORMS:	2.1.1.1.1.1	1.68	1.86	1.12	0.93	1.12	2.23	2.42	0.93																12.29
AN/USQ-144C(V)2 PLATFORMS:	2.1.1.1.1.2	2.40	2.70	2.10	1.50	0.90	0.60	0.30	2.40																12.89
AN/USQ-144D(V)2 PLATFORMS:	2.1.1.1.1.3	0.95	0.74	0.95	1.79	1.47	1.79	1.16	1.89																10.71
SUBMARINE	2.1.1.1.2	0.22	0.11	0.32	0.86	0.54	0.54	0.32	0.43																
AN/USQ-144(V)3 PLATFORMS:	2.1.1.1.2.1	0.22	0.11	0.32	0.86	0.54	0.54	0.32	0.43																3.35
ASHORE	2.1.1.1.3		1.67	0.98	1.96	1.08	1.18	1.18	1.27																9.31
NCTAMS EURCENT	2.1.1.1.3.1		0.42	0.25	0.49	0.27	0.29	0.29	0.32																
NCTAMS BAHRAIN	2.1.1.1.3.2		0.42	0.25	0.49	0.27	0.29	0.29	0.32																
NCTAMS LANT	2.1.1.1.3.3		0.42	0.25	0.49	0.27	0.29	0.29	0.32																
NCTAMS PACIFIC	2.1.1.1.3.4		0.42	0.25	0.49	0.27	0.29	0.29	0.32																
HARDWARE NONRECURRING	2.1.1.2																								
SOFTWARE	2.1.2	0.14	0.29	0.45	1.00	0.64	0.68	0.45	0.58																4.25
SOFTWARE RECURRING	2.1.2.1	0.14	0.29	0.45	1.00	0.64	0.68	0.45	0.58																4.25
AFLOAT	2.1.2.1.1	0.14	0.15	0.11	0.10	0.06	0.12	0.11	0.15																0.93
AN/USQ-144B(V)2 PLATFORMS:	2.1.2.1.1.1	0.06	0.06	0.04	0.03	0.04	0.08	0.08	0.03																0.42
AN/USQ-144C(V)2 PLATFORMS:	2.1.2.1.1.2	0.07	0.08	0.06	0.04	0.03	0.02	0.01	0.07																0.37
AN/USQ-144D(V)2 PLATFORMS:	2.1.2.1.1.3	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.03																0.14
SUBMARINE	2.1.2.1.2	0.01	0.11	0.32	0.86	0.54	0.54	0.32	0.43																
SUBMARINE AN/USQ-144(V)3 PLATFORI	2.1.2.1.2.1	0.01	0.11	0.32	0.86	0.54	0.54	0.32	0.43																3.14
ASHORE	2.1.2.1.3		0.03	0.02	0.04	0.02	0.02	0.02	0.03																0.19
NCTAMS EURCENT	2.1.2.1.3.1		0.01	0.01	0.01	0.01	0.01	0.01	0.01																
NCTAMS BAHRAIN	2.1.2.1.3.2		0.01	0.01	0.01	0.01	0.01	0.01	0.01																
NCTAMS LANT	2.1.2.1.3.3		0.01	0.01	0.01	0.01	0.01	0.01	0.01																
NCTAMS PACIFIC	2.1.2.1.3.4		0.01	0.01	0.01	0.01	0.01	0.01	0.01																
SOFTWARE NONRECURRING	2.1.2.2																								
SYSTEM INTEGRATION / INSTALLATION	2.2	8.69	10.00	8.16	10.62	8.51	11.64	10.27	10.28																78.16
SYSTEM INTEGRATION DESIGN (DSA)	2.2.1	1.23	1.20	1.10	1.50	1.19	1.53	1.21	1.47																10.43
AFLOAT	2.2.3.1	1.13	1.15	0.94	1.08	0.93	1.27	1.05	1.26																8.82
AN/USQ-144B(V)2 PLATFORMS:	2.2.3.1.1	0.42	0.47	0.28	0.23	0.28	0.56	0.61	0.23																3.10
AN/USQ-144C(V)2 PLATFORMS:	2.2.3.1.2	0.38	0.43	0.33	0.24	0.14	0.10	0.05	0.38																2.05
AN/USQ-144D(V)2 PLATFORMS:	2.2.3.1.3	0.32	0.25	0.32	0.61	0.50	0.61	0.40	0.65																3.67
SUBMARINE	2.2.3.2	0.10	0.05	0.16	0.42	0.26	0.26	0.16	0.21																1.61
AN/USQ-144(V)3 PLATFORMS:	2.2.3.2.1	0.10	0.05	0.16	0.42	0.26	0.26	0.16	0.21																1.61
ASHORE	2.2.3.3																								
SYSTEM INSTALLATION (ILM)	2.2.2	7.46	8.80	7.06	9.11	7.32	10.11	9.06	8.81																67.73
ADNS AFLOAT	2.2.2.1	7.11	7.45	5.63	5.99	5.43	8.12	7.33	6.89																53.94
AN/USQ-144B(V)2 PLATFORMS:	2.2.2.1.1	3.69	4.10	2.46	2.05	2.46	4.93	5.34	2.05																27.09
AN/USQ-144C(V)2 PLATFORMS:	2.2.2.1.2	1.98	2.23	1.74	1.24	0.74	0.50	0.25	1.98																10.66
AN/USQ-144D(V)2 PLATFORMS:	2.2.2.1.3	1.43	1.11	1.43	2.70	2.22	2.70	1.73	2.86																16.19
SUBMARINE AN/USQ-144(V)3 PLATFORMS:	2.2.2.2	0.36	0.18	0.53	1.42	0.89	0.89	0.53	0.71																5.52
SSN	2.2.2.2.1	0.36	0.18	0.53	1.42	0.89	0.89	0.53	0.71																5.52
ADNS ASHORE	2.2.2.3		1.17	0.90	1.70	1.00	1.10	1.20	1.20																8.27
NCTAMS EURCENT	2.2.2.2.1		0.36	0.23	0.43	0.25	0.28	0.30	0.30																
NCTAMS BAHRAIN	2.2.2.2.2		0.36	0.23	0.43	0.25	0.28	0.30	0.30																
NCTAMS LANT	2.2.2.2.3		0.22	0.23	0.43	0.25	0.28	0.30	0.30																
NCTAMS PACIFIC	2.2.2.2.4		0.22	0.23	0.43	0.25	0.28	0.30	0.30																
PROGRAM MANAGEMENT	2.3	1.97	2.43	1.97	2.61	2.00	2.61	2.25	2.49																18.34
SYSTEMS ENGINEERING	2.4	3.24	3.99	3.24	4.29	3.28	4.29	3.70	4.09																30.12
SYSTEMS TEST AND EVALUATION	2.5																								
INITIAL TRAINING	2.6	0.26	0.25	0.23	0.33	0.26	0.34	0.26	0.33																2.26
CLASSROOM TRAINING	2.6.1	0.21	0.20	0.18	0.26	0.21	0.26	0.21	0.26																1.77
AFLOAT / SUBMARINE	2.6.1.1	0.21	0.20	0.18	0.26	0.21	0.26	0.21	0.26																
COST OF TRAINING COURSE	2.6.1.1.1	0.11	0.11	0.10	0.14	0.11	0.14	0.11	0.14																
MPN COST OF STUDENTS	2.6.1.1.2	0.09	0.09	0.08	0.12	0.09	0.12	0.09	0.12																
ASHORE	2.6.1.2			0.20	0.20	0.21	0.21	0.21	0.22																0.48
ON-THE-JOB TRAINING	2.6.2	0.06	0.05	0.05	0.07	0.06	0.07	0.06	0.07																
AFLOAT / SUBMARINE	2.6.2.1	0.06	0.05	0.05	0.07	0.06	0.07	0.06	0.07																
ASHORE	2.6.2.2																								
DATA/DOCUMENTATION	2.7	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85																6.85
PECULIAR SUPPORT EQUIPMENT	2.8																								
COMMON SUPPORT EQUIPMENT	2.9																								
OPERATIONAL/SITE ACTIVATION	2.10																								
INDUSTRIAL FACILITIES	2.11																								
INITIAL SPARES AND REPAIR PARTS	2.12	0.11	0.25	0.16	0.20	0.16	0.19	0.16	0.20																1.42
AFLOAT	2.12.1	0.11	0.15	0.12	0.16	0.11	0.14	0.12	0.15																1.06
ASHORE	2.12.2		0.10	0.04	0.04	0.04	0.05	0.05	0.05																0.37
OPERATING & SUPPORT	3.0	4.00	5.31	6.17	7.78	18.00	19.98	20.06	22.38	29.50	32.76	29.45	30.68	29.50	32.76	29.45	30.68	29.50	32.76	29.45	30.68	29.50	32.76	29.45	562.55
MISSION PERSONNEL	3.1	0.60	1.10	1.57	2.23	2.75	3.43	3.95	4.61	4.61	4.61	4.61	4.61	4.61	4.61	4.61	4.61	4.61	4.61	4.61	4.61	4.61	4.61	4.61	89.35
AFLOAT/SUBMARINE OPERATORS	3.1.1	0.52	1.03	1.50	2.15	2.68	3.35	3.88	4.53	4.53	4.53	4.53	4.53	4.53	4.53	4.53	4.53	4.53	4.53	4.53	4.53	4.53	4.53	4.53	
ASHORE OPERATORS	3.1.2	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	
UNIT LEVEL CONSUMPTION	3.2																								
INTERMEDIATE MAINTENANCE	3.3																								
DEPOT MAINTENANCE	3.4	0.54	0.74	0.59	0.80	0.90	1.05	0.85	1.00	0.51	0.60	0.49	0.53	0.51	0.60	0.49	0.53	0.51	0.60	0.49	0.53	0.51	0.60	0.49	14.49
OVERHAUL AND REPAIR	3.4.1																								
FLEET MODERNIZATION	3.4.2																								
DESIGN AND PLANNING SERVICES	3.4.3																								
MISCELLANEOUS REWORK	3.4.4																								
OUTFITTING AND SPARES	3.4.5	0.54	0.74	0.59	0.80	0.90	1.05	0.85	1.00	0.51	0.60	0.49	0.53	0.51	0.60	0.49	0.53	0.51	0.60	0.49	0.53	0.51	0.60	0.49	14.49
MISCELLANEOUS CONTRACTOR SERVICES	3.5	1.93	1.93	1.93	1.93	1.93	1.93	1.93	1.93	1.93	1.93	1.93	1.93	1.93	1.93	1.93	1.93	1.93	1.93	1.93	1.93	1.93	1.93	1.93	44.37
INTERIM CONTRACTOR SUPPORT	3.5.1																								
CONTRACTOR LOGISTICS SUPPORT	3.5.2	1.93	1.93	1.93	1.93	1.93	1.93	1.93	1.93	1.93	1.93	1.93	1.93	1.93	1.93	1.93	1.93	1.93	1.93	1.93	1.93	1.93	1.93	1.93	44.37
OTHER MISC CONTRACTOR SERVICES	3.5.3																								
SUSTAINING SUPPORT	3.6	0.27	0.44	0.57	0.75	9.90	10.47	9.78	10.72	18.33	21.50	18.30	19.50	18.33	21.50	18.30	19.50	18.33	21.50	18.30	19.50	18.33	21.50	18.30	333.93
ENGINEERING AND TECHNICAL SERVICES	3.6.1	0.27	0.37	0.30	0.40	0.45	0.53	0.42	0.50	0.26	0.30	0.25	0.26	0.26	0.30	0.25	0.26	0.26	0.30	0.25	0.26	0.26	0.30	0.25	7.25
PROGRAM MANAGEMENT	3.6.1.1																								
SYSTEMS ENGINEERING	3.6.1.2																								
INCO SPARES (INSTALLATION AND CHECK-OU	3.6.1.3	0.27	0.37	0.30	0.40	0.45	0.53	0.42	0.50	0.26	0.30	0.25	0.26	0.26	0.30	0.25	0.26	0.26	0.30	0.25	0.26	0.26	0.30	0.25	7.25
SOFTWARE MAINTENANCE/REPLACEMENT	3.6.2			0.14	0.15	0.29	0.31	0.39	0.44	0.51	0.58	0.51	0.58	0.51	0.58	0.51	0.58	0.51	0.58	0.51	0.58	0.51	0.58	0.51	9.85
SOFTWARE UPDATES (TECH REFRESH)	3.6.2.1			0.14	0.15	0.29	0.31	0.39	0.44	0.51	0.58	0.51	0.58	0.51	0.58	0.51	0.58	0.51	0.58	0.51	0.58	0.51	0.58	0.51	9.85
AFLOAT	3.6.2.1.1			0.14	0.15	0.25	0.25	0.33	0.36	0.44	0.49	0.44	0.49	0.44	0.49	0.44	0.49	0.44	0.49	0.44	0.49	0.44	0.49	0.44	
AN/USQ-144B(V)2 PLATFORMS	3.6.2.1.1.1			0.06	0.06	0.09	0.09	0.13	0.17	0.21	0.20	0.21	0.20	0.21	0.20	0.21	0.20	0.21	0.20	0.21	0.20	0.21	0.20	0.21	3.74
AN/USQ-144C(V)2 PLATFORMS	3.6.2.1.1.2			0.07	0.08	0.13	0.12	0.15	0.14	0.16	0.20	0.16	0.20	0.16	0.20	0.16	0.20	0.16	0.20	0.16	0.20	0.16	0.20	0.16	3.40
AN/USQ-144D(V)2 PLATFORMS	3.6.2.1.1.3			0.01	0.01	0.03	0.03	0.05	0.06	0.06	0.08	0.06	0.08	0.06	0.08	0.06	0.08	0.06	0.08	0.06	0.08	0.06	0.08	0.06	1.26
SUBMARINE	3.6.2.1.2			0.01	0.00	0.02	0.03	0.04	0.05	0.05	0.06	0.05	0.06	0.05	0.06	0.05	0.06	0.05	0.06	0.05	0.06	0.05	0.06	0.05	
SUBMARINE AN/USQ-144(V)3 PLATFORI	3.6.2.1.2.1			0.01	0.00	0.02	0.03	0.04	0.05	0.05	0.06	0.05	0.06	0.05	0.06	0.05	0.06	0.05	0.06	0.05	0.06	0.05	0.06	0.05	0.98
ASHORE	3.6.2.1.3					0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	
SOFTWARE SUPPORT FEES	3.6.2.2																								
TRAINING (FOLLOW-ON)	3.6.3		0.07	0.13	0.20	0.28	0.35	0.44	0.51	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	13.84
AFLOAT / SUBMARINE	3.6.3.1		0.07	0.13	0.20	0.28	0.35	0.44	0.51	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	
CLASSROOM TRAINING	3.6.3.1.1		0.07	0.13	0.20	0.28	0.35	0.44	0.51	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	10.84
COST OF TRAINING COURSE	3.6.3.1.1.1		0.04	0.07	0.11	0.15	0.19	0.24	0.28	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	
MPN COST OF STUDENTS	3.6.3.1.1.2		0.03	0.06	0.09	0.13	0.16	0.20	0.23	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	
ON-THE-JOB TRAINING	3.6.3.1.2																								
ASHORE	3.6.3.2									0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	
PUBLICATIONS	3.6.4																								
AMMUNITION HANDLING	3.6.5																								

	TOC WBS #	PY	FY99	FY00	FY01	FY02	FY03	FY04	FY05	FY06	FY07	FY08	FY09	FY10	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	TOC
SIMULATOR OPERATIONS	3.6.6						8.88	9.29	8.53	9.28	16.77	19.83	16.76	17.86	16.77	19.83	16.76	17.86	16.77	19.83	16.76	17.86	16.77	19.83	16.76	302.99
EQUIPMENT REPLACEMENT	3.6.7						3.22	3.50	2.65	2.47	5.13	6.03	4.94	5.29	5.13	6.03	4.94	5.29	5.13	6.03	4.94	5.29	5.13	6.03	4.94	92.13
HW REPLACEMENT (TECH REFRESH)	3.6.7.1						3.22	3.50	2.65	2.47	5.13	6.03	4.94	5.29	5.13	6.03	4.94	5.29	5.13	6.03	4.94	5.29	5.13	6.03	4.94	92.13
AFLOAT	3.6.7.1.1						3.22	3.50	2.65	2.47	5.13	6.03	4.94	5.29	5.13	6.03	4.94	5.29	5.13	6.03	4.94	5.29	5.13	6.03	4.94	
AN/USQ-144B(V)2 PLATFORMS:	3.6.7.1.1.1						1.26	1.40	0.84	0.70	2.09	3.07	2.65	1.40	2.09	3.07	2.65	1.40	2.09	3.07	2.65	1.40	2.09	3.07	2.65	39.66
AN/USQ-144C(V)2 PLATFORMS:	3.6.7.1.1.2						1.80	2.02	1.57	1.12	2.47	2.47	1.80	2.92	2.47	2.47	1.80	2.92	2.47	2.47	1.80	2.92	2.47	2.47	1.80	42.27
AN/USQ-144D(V)2 PLATFORMS:	3.6.7.1.1.3						0.16	0.08	0.24	0.65	0.57	0.49	0.49	0.97	0.57	0.49	0.49	0.97	0.57	0.49	0.49	0.97	0.57	0.49	0.49	10.20
SUBMARINES	3.6.7.1.2						0.16	0.08	0.24	0.65	0.57	0.49	0.49	0.97	0.57	0.49	0.49	0.97	0.57	0.49	0.49	0.97	0.57	0.49	0.49	
SUBMARINE AN/USQ-144(V)3 PLATFORM	3.6.7.1.2.1						0.16	0.08	0.24	0.65	0.57	0.49	0.49	0.97	0.57	0.49	0.49	0.97	0.57	0.49	0.49	0.97	0.57	0.49	0.49	10.20
ASHORE	3.6.7.1.3								0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	
OBRP SPARES (BGSS) KITS	3.6.7.1.4						0.06	0.07	0.05	0.05	0.10	0.12	0.10	0.11	0.10	0.12	0.10	0.11	0.10	0.12	0.10	0.11	0.10	0.12	0.10	1.84
HW INSTALLATION (TECH REFRESH)	3.6.7.2						5.60	5.72	5.82	6.76	11.54	13.68	11.72	12.47	11.54	13.68	11.72	12.47	11.54	13.68	11.72	12.47	11.54	13.68	11.72	209.02
AFLOAT	3.6.7.2.1						5.33	5.59	4.22	4.49	9.40	11.68	9.72	9.66	9.40	11.68	9.72	9.66	9.40	11.68	9.72	9.66	9.40	11.68	9.72	
AN/USQ-144B(V)2 PLATFORMS:	3.6.7.2.1.1						2.77	3.08	1.85	1.54	4.62	6.77	5.85	3.08	4.62	6.77	5.85	3.08	4.62	6.77	5.85	3.08	4.62	6.77	5.85	87.42
AN/USQ-144C(V)2 PLATFORMS:	3.6.7.2.1.2						1.49	1.67	1.30	0.93	2.05	2.05	1.49	2.42	2.05	2.05	1.49	2.42	2.05	2.05	1.49	2.42	2.05	2.05	1.49	34.97
AN/USQ-144D(V)2 PLATFORMS:	3.6.7.2.1.3						1.07	0.83	1.07	2.02	2.74	2.86	2.38	4.17	2.74	2.86	2.38	4.17	2.74	2.86	2.38	4.17	2.74	2.86	2.38	49.41
SUBMARINE	3.6.7.2.2						0.27	0.13	0.40	1.07	0.93	0.80	0.80	1.60	0.93	0.80	0.80	1.60	0.93	0.80	0.80	1.60	0.93	0.80	0.80	
AN/USQ-144(V)3 PLATFORMS:	3.6.7.2.2.1						0.27	0.13	0.40	1.07	0.93	0.80	0.80	1.60	0.93	0.80	0.80	1.60	0.93	0.80	0.80	1.60	0.93	0.80	0.80	16.82
ASHORE	3.6.7.2.3								1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	
INDIRECT / INFRASTRUCTURE	3.7	0.66	1.10	1.50	2.07	2.92	3.10	3.55	4.12	4.12	4.12	4.12	4.12	4.12	4.12	4.12	4.12	4.12	4.12	4.12	4.12	4.12	4.12	4.12	4.12	80.41
ACQUISITION SUPPORT	3.7.1	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	4.90
MISSION PERSONNEL INDIRECT PAY	3.7.4	0.45	0.89	1.29	1.86	2.31	2.89	3.34	3.91	3.91	3.91	3.91	3.91	3.91	3.91	3.91	3.91	3.91	3.91	3.91	3.91	3.91	3.91	3.91	3.91	75.51
DEMILITARIZATION & DISPOSAL	4.0						0.54	0.56	0.46	0.52	0.94	1.07	0.88	1.09	0.94	1.07	0.88	1.09	0.94	1.07	0.88	1.09	0.94	1.07	0.88	16.93
DISPOSAL DEMILITARIZATION	4.1						0.54	0.56	0.46	0.52	0.94	1.07	0.88	1.09	0.94	1.07	0.88	1.09	0.94	1.07	0.88	1.09	0.94	1.07	0.88	16.93
AFLOAT	4.1.1						0.50	0.53	0.42	0.42	0.85	0.99	0.80	0.94	0.85	0.99	0.80	0.94	0.85	0.99	0.80	0.94	0.85	0.99	0.80	15.28
AN/USQ-144B(V)2 PLATFORMS:	4.1.1.1						0.17	0.19	0.11	0.09	0.28	0.41	0.35	0.19	0.28	0.41	0.35	0.19	0.28	0.41	0.35	0.19	0.28	0.41	0.35	5.29
AN/USQ-144C(V)2 PLATFORMS:	4.1.1.2						0.24	0.27	0.21	0.15	0.33	0.33	0.24	0.39	0.33	0.33	0.24	0.39	0.33	0.33	0.24	0.39	0.33	0.33	0.24	5.64
AN/USQ-144D(V)2 PLATFORMS:	4.1.1.3						0.09	0.07	0.09	0.18	0.24	0.25	0.21	0.37	0.24	0.25	0.21	0.37	0.24	0.25	0.21	0.37	0.24	0.25	0.21	4.36
SUBMARINE	4.1.2						0.02	0.01	0.05	0.09	0.08	0.06	0.06	0.13	0.08	0.06	0.06	0.13	0.08	0.06	0.06	0.13	0.08	0.06	0.06	
AN/USQ-144(V)3 PLATFORMS:	4.1.2.1						0.02	0.01	0.05	0.09	0.08	0.06	0.06	0.13	0.08	0.06	0.06	0.13	0.08	0.06	0.06	0.13	0.08	0.06	0.06	1.36
ASHORE	4.1.3						0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.29
DISPOSAL WASTE MANAGEMENT	4.2																									
OTHER DEMILITARIZATION AND DISPOSAL	4.3																									
AFLOAT FIELDING PLAN																										
Initial Procurement Quantities			28	27	25	35	28	36	28	35																242
AN/USQ-144B(v)2 Platforms:			9	10	6	5	6	12	13	5																66
AN/USQ-144C(v)2 Platforms:			8	9	7	5	3	2	1	8																43
AN/USQ-144D(v)2 Platforms:			9	7	9	17	14	17	11	18																102
Submarine AN/USQ-144(v)3 Platforms:			2	1	3	8	3	5	3	4																31
Initial Installation Quantities:			28	27	25	35	28	36	28	35																242
AN/USQ-144B(v)2 Platforms:			9	10	6	5	6	12	13	5																66
CG			5	8	6	2		6																		
DDG			4	2		3	6	6	13	5																
AN/USQ-144C(V)2 Platforms:			8	9	7	5	3	2	1	8																43
CV			1	1		1																				
CVN			1	2	4	1	1	1																		
LHD				3	2	2																				
LHA			2	1	1	1																				
LCC			1	1																						
AOF			2	1																						
ARS							2	1	1																	
AS			1							1																
MCM										7																
AN/USQ-144D(v)2 Platforms:			9	7	9	17	14	17	11	18																102
DD			4	2	3	4	5	5		6																
FFG			4			4	5	5	7	12																
LSD			1	3	3	3	2	4	1																	
LPD				1	2	3		2	3																	
AOE				1	1	3	2	1																		
Submarine AN/USQ-144(v)3 Platforms:			2	1	3	8	3	3	3	4																31
SSN			2	1	3	8	5	5	3	4																
Initial Battle Group Ship Spares (BGSS) Kit Quantities			6	8	7	5	1	1																		28
Cumulative # Installed Systems			28	55	80	115	143	179	207	242	242	242	242	242	242	242	242	242	242	242	242	242	242	242	242	
Hardware Upgrade Quantities:							28	27	23	35	56	63	53	70	56	63	53	70	56	63	53	70	56	63	53	1013
AN/USQ-144B(V)2 Platforms:							9	10	6	5	15	22	19	10	15	22	19	10	15	22	19	10	15	22	19	284
AN/USQ-144C(V)2 Platforms:							8	9	7	5	11	11	8	13	11	11	8	13	11	11	8	13	11	11	8	188
AN/USQ-144D(V)2 Platforms:							9	7	9	17	23	24	20	35	23	24	20	35	23	24	20	35	23	24	20	413
Submarine AN/USQ-144(V)3 Platforms:							2	1	3	8	7	6	6	12	7	6	6	12	7	6	6	12	7	6	6	126
Software Upgrade Quantities:					28	27	53	62	81	98	109	133	109	133	109	133	109	133	109	133	109	133	109	133	109	2172
AN/USQ-144B(V)2 Platforms:					9	10	15	15	21	27	34	32	34	32	34	32	34	32	34	32	34	32	34	32	34	593
AN/USQ-144C(V)2 Platforms:					8	9	15	14	18	16	19	24	19	24	19	24	19	24	19	24	19	24	19	24	19	400
AN/USQ-144D(V)2 Platforms:					9	7	18	24	32	41	43	59	43	59	43	59	43	59	43	59	43	59	43	59	43	888
Submarine AN/USQ-144(v)3 Platforms:					2	1	5	9	10	14	13	18	13	18	13	18	13	18	13	18	13	18	13	18	13	271

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APPENDIX D

NAVMACS II/SMS COST MODEL

(Note: All costs are in FY98 $M)

TOC WBS #	PY	FY99	FY00	FY01	FY02	FY03	FY04	FY05	FY06	FY07	FY08	FY09	FY10	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	Total
TOTAL		11.01	18.92	29.81	32.71	22.62	30.82	57.97	81.16	43.55	52.05	63.69	70.51	43.55	52.05	63.69	70.51	43.55	52.05	63.69	70.51	43.55	52.05	63.69	1142.70
DEVELOPMENT	1.0	0.73	1.79	1.16	1.90	1.94	1.99	2.03	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08	44.82
PRODUCTION	2.0	10.28	17.13	21.22	17.69	6.19	18.00	18.35	31.10																139.96
TOTAL CONTRACTOR	2.1	5.00	8.33	10.32	8.39	1.31	8.47	8.67	18.14																68.63
PRIME MISSION PRODUCT	2.1.1	4.67	7.78	9.64	7.85	1.25	7.91	8.10	16.90																64.11
HARDWARE	2.1.1.1			9.15	7.39	0.99	7.47	7.66	16.37																49.02
HARDWARE RECURRING	2.1.1.1.1			8.90	7.14	0.74	7.22	7.41	16.12																47.53
EQUIPMENT	2.1.1.1.1.1			6.85	5.49	0.57	5.56	5.70	12.40																36.57
LARGE SHIP	2.1.1.1.1.1.1			1.56	1.56		1.28	1.28																	5.68
MEDIUM SHIP	2.1.1.1.1.1.2			1.55	1.29	0.26	1.16	1.03	0.52																5.80
SMALL SHIP	2.1.1.1.1.1.3			1.81	1.57	0.31	1.89	2.05	3.70																11.33
COAST GUARD	2.1.1.1.1.1.4								0.79																0.79
MSC	2.1.1.1.1.1.5								1.45																1.45
SUBMARINE--SSN	2.1.1.1.1.1.6			1.08	0.81		0.68	0.68	4.87																8.12
SUBMARINE--SSBN	2.1.1.1.1.1.7			0.30	0.20		0.10	0.10	1.08																1.77
PATROL COASTAL	2.1.1.1.1.1.8						0.35	0.47																	0.83
SCI CARRY-ON	2.1.1.1.1.1.9				0.06		0.10	0.10																	0.26
TTE	2.1.1.1.1.1.10			0.55																					0.55
INTERNAL INTEGRATION	2.1.1.1.2			2.05	1.65	0.17	1.67	1.71	3.72																10.97
LARGE SHIP	2.1.1.1.2.1			0.47	0.47		0.38	0.38																	1.70
MEDIUM SHIP	2.1.1.1.2.2			0.46	0.39	0.08	0.35	0.31	0.15																1.74
SMALL SHIP	2.1.1.1.2.3			0.54	0.47	0.09	0.57	0.61	1.11																3.40
COAST GUARD	2.1.1.1.2.4								0.24																0.24
MSC	2.1.1.1.2.5								0.43																0.43
SUBMARINE--SSN	2.1.1.1.2.6			0.32	0.24		0.20	0.20	1.46																2.44
SUBMARINE--SSBN	2.1.1.1.2.7			0.09	0.06		0.03	0.03	0.32																0.53
PATROL COASTAL	2.1.1.1.2.8						0.11	0.14																	0.25
SCI CARRY-ON	2.1.1.1.2.9				0.02		0.03	0.03																	0.08
TTE	2.1.1.1.2.10			0.17																					0.17
HARDWARE NONRECURRING	2.1.1.2			0.25	0.25	0.25	0.25	0.25	0.25																1.48
MARKET RESEARCH	2.1.1.2.1			0.04	0.04	0.04	0.04	0.04	0.04																0.24
HARDWARE INTEGRATION	2.1.1.2.2			0.08	0.08	0.08	0.08	0.08	0.08																0.48
T&E / IV&T	2.1.1.2.3			0.05	0.05	0.05	0.05	0.05	0.05																0.32
NEW TECHNOLOGY INSERTION	2.1.1.2.4																								
DOCUMENT UPGRADES	2.1.1.2.5			0.07	0.07	0.07	0.07	0.07	0.07																0.44
SOFTWARE	2.1.1.2			0.49	0.46	0.26	0.44	0.44	0.54																2.63
SOFTWARE RECURRING	2.1.1.2.1			0.25	0.21	0.01	0.20	0.20	0.29																1.16
PURCHASED SOFTWARE	2.1.1.2.1.1			0.25	0.21	0.01	0.20	0.20	0.29																1.16
LARGE SHIP	2.1.1.2.1.1.1			0.11	0.11		0.09	0.09																	0.42
MEDIUM SHIP	2.1.1.2.1.1.2			0.04	0.03	0.01	0.03	0.03	0.01																0.16
SMALL SHIP	2.1.1.2.1.1.3			0.05	0.04	0.01	0.05	0.05	0.09																0.28
COAST GUARD	2.1.1.2.1.1.4								0.02																0.02
MSC	2.1.1.2.1.1.5								0.03																0.03
SUBMARINE--SSN	2.1.1.2.1.1.6			0.03	0.02		0.02	0.02	0.12																0.19
SUBMARINE--SSBN	2.1.1.2.1.1.7			0.01	0.00		0.00	0.00	0.02																0.03
PATROL COASTAL	2.1.1.2.1.1.8						0.01	0.01																	0.01
SCI CARRY-ON	2.1.1.2.1.1.9																								
TTE	2.1.1.2.1.1.10			0.01																					0.01
INTERNAL INTEGRATION	2.1.1.2.1.2																								
LARGE SHIP	2.1.1.2.1.2.1																								
MEDIUM SHIP	2.1.1.2.1.2.2																								
SMALL SHIP	2.1.1.2.1.2.3																								
COAST GUARD	2.1.1.2.1.2.4																								
MSC	2.1.1.2.1.2.5																								
SUBMARINE--SSN	2.1.1.2.1.2.6																								
SUBMARINE--SSBN	2.1.1.2.1.2.7																								
PATROL COASTAL	2.1.1.2.1.2.8																								
SCI CARRY-ON	2.1.1.2.1.2.9																								
TTE	2.1.1.2.1.2.10																								
SOFTWARE NONRECURRING	2.1.1.2.2			0.25	0.25	0.25	0.25	0.25	0.25																1.48
MARKET RESEARCH	2.1.1.2.2.1			0.03	0.03	0.03	0.03	0.03	0.03																0.20
SOFTWARE INTEGRATION (GO	2.1.1.2.2.2			0.07	0.07	0.07	0.07	0.07	0.07																0.41
NEW TECHNOLOGY INSERTION	2.1.1.2.2.3			0.03	0.03	0.03	0.03	0.03	0.03																0.20
T&E / IV&T	2.1.1.2.2.4			0.05	0.05	0.05	0.05	0.05	0.05																0.30
DOCUMENT UPGRADES	2.1.1.2.2.5			0.04	0.04	0.04	0.04	0.04	0.04																0.22
DISTRIBUTION COST	2.1.1.2.2.6			0.03	0.03	0.03	0.03	0.03	0.03																0.15
SYSTEM INTEGRATION/INSTALLATION	2.1.2																								
PROGRAM MANAGEMENT	2.1.3																								
SYSTEMS ENGINEERING	2.1.4																								
SYSTEMS TEST & EVALUATION	2.1.5																								
DEVELOPMENT TEST & EVALUATION	2.1.5.1																								
OPERATIONAL TEST & EVALUATION	2.1.5.2																								
MOCK UPS	2.1.5.3																								
TEST & EVALUATION SUPPORT	2.1.5.4																								
TEST FACILITIES	2.1.5.5																								
TRAINING	2.1.6																								
DATA	2.1.7																								
SUPPORT EQUIPMENT	2.1.8																								
OPERATIONAL/SITE ACTIVATION	2.1.9																								
INDUSTRIAL FACILITIES	2.1.10																								
INITIAL SPARES AND REPAIR PARTS	2.1.11	0.33	0.55	0.68	0.55	0.06	0.56	0.57	1.24																4.54
LARGE SHIP	2.1.11.1			0.16	0.16		0.13	0.13																	0.57
MEDIUM SHIP	2.1.11.2			0.13	0.13	0.03	0.12	0.10	0.05																0.58
SMALL SHIP	2.1.11.3			0.18	0.16	0.03	0.19	0.20	0.37																1.13
COAST GUARD	2.1.11.4								0.08																0.08
MSC	2.1.11.5								0.14																0.14
SUBMARINE--SSN	2.1.11.6			0.11	0.08		0.07	0.07	0.49																0.81
SUBMARINE--SSBN	2.1.11.7			0.03	0.02		0.01	0.01	0.11																0.18
PATROL COASTAL	2.1.11.8						0.04	0.05																	0.08
SCI CARRY-ON	2.1.11.9				0.01		0.01	0.01																	0.03
TTE	2.1.11.10			0.06																					0.06
TOTAL GOVERNMENT	2.2	5.28	8.79	10.90	9.30	4.88	9.53	9.67	12.96																71.31
PRIME MISSION PRODUCT	2.2.1																								
SYSTEM INTEGRATION/INSTALLATION	2.2.2	3.29	5.48	6.80	5.29	0.70	5.40	5.53	8.83																41.34
PREINSTALLATION	2.2.2.1	0.26	0.44	0.54	0.44	0.05	0.48	0.49	1.08																3.79
INSTALLATION & SOVT	2.2.2.2	3.03	5.05	6.25	4.84	0.65	4.93	5.05	7.75																37.55
LARGE SHIP	2.2.2.2.1	0.61	1.01	1.25	1.25		1.03	1.03																	6.18
MEDIUM SHIP	2.2.2.2.2	0.66	1.10	1.37	1.14	0.23	1.03	0.91	0.46																6.90
SMALL SHIP	2.2.2.2.3	1.17	1.95	2.42	2.10	0.42	2.52	2.73	4.94																18.24
COAST GUARD	2.2.2.2.4								0.30																0.30
MSC	2.2.2.2.5																								
SUBMARINE--SSN	2.2.2.2.6	0.17	0.29	0.36	0.27		0.23	0.23	1.62																3.16
SUBMARINE--SSBN	2.2.2.2.7	0.06	0.10	0.12	0.08		0.04	0.04	0.44																0.87
PATROL COASTAL	2.2.2.2.8						0.09	0.12																	0.21
SCI CARRY-ON	2.2.2.2.9																								
TTE	2.2.2.2.10	0.36	0.59	0.74																					1.68
PROGRAM MANAGEMENT	2.2.3	0.58	0.96	1.19	1.12	1.12	1.12	1.12	1.12																8.32
SPAWAR 04 HELPDESK	2.2.3.1	0.06	0.10	0.13	0.13	0.13	0.13	0.13	0.13																0.91
P-SHOP SUPPORT	2.2.3.2	0.04	0.06	0.08	0.08	0.08	0.08	0.08	0.06																0.55
Y2K SUPPORT	2.2.3.3	0.04	0.06	0.08																					0.17
APM SUPPORT	2.2.3.4	0.04	0.06	0.08	0.08	0.08	0.08	0.08	0.08																0.55
PRODUCTION SUPPORT	2.2.3.5	0.33	0.55	0.69	0.69	0.69	0.69	0.69	0.69																4.59
CONTRACTOR MANAGEMENT	2.2.3.6	0.08	0.13	0.16	0.16	0.16	0.16	0.16	0.16																1.14
SYSTEMS ENGINEERING	2.2.4	0.71	1.19	1.47	1.47	1.47	1.47	1.47	1.47																10.74

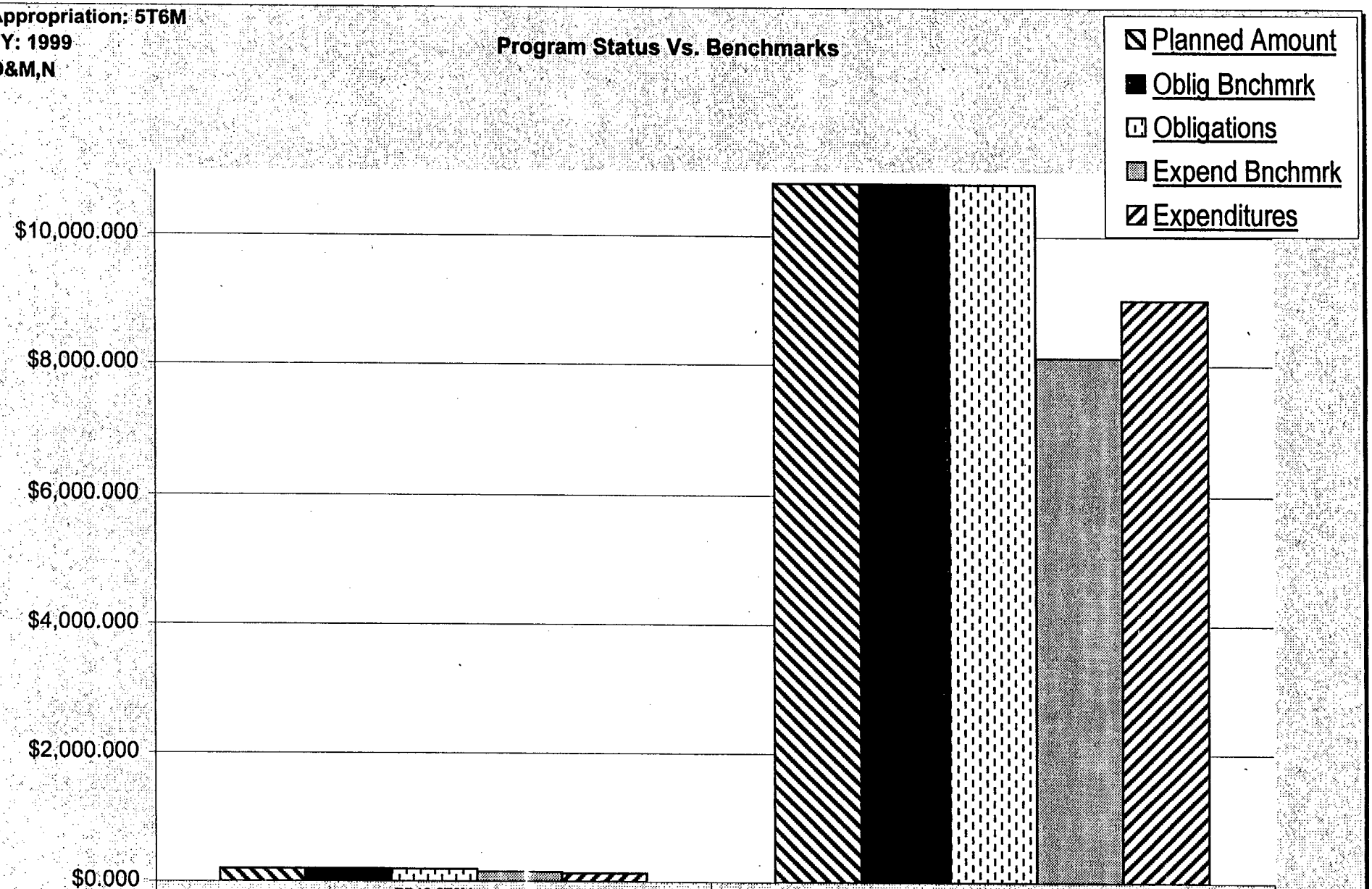
	TOC WBS #	PY	FY99	FY00	FY01	FY02	FY03	FY04	FY05	FY06	FY07	FY08	FY09	FY10	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	Total
MITRE SYS ENG	2.2.4.1		0.39	0.65	0.80	0.80	0.80	0.80	0.80	0.80															5.83
SCI SYS ENG	2.2.4.2		0.11	0.18	0.23	0.23	0.23	0.23	0.23	0.23															1.64
IT-21 ENG	2.2.4.3		0.07	0.11	0.14	0.14	0.14	0.14	0.14	0.14															1.02
IMPLEMENTATION SUPPORT	2.2.4.4		0.06	0.10	0.13	0.13	0.13	0.13	0.13	0.13															0.91
LOGISTICS SUPPORT	2.2.4.5		0.09	0.15	0.18	0.18	0.18	0.18	0.18	0.18															1.33
LOGISTICS ENGINEERING	2.2.4.6		0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02															0.13
SYSTEMS TEST AND EVALUATION	2.2.5		0.39	0.65	0.81	0.81	0.81	0.81	0.81	0.81															5.91
JITC	2.2.5.1		0.17	0.28	0.35	0.35	0.35	0.35	0.35	0.35															2.55
SEMCOR/VALIDITY	2.2.5.2		0.19	0.31	0.39	0.39	0.39	0.39	0.39	0.39															2.81
IT-21 CERT.	2.2.5.3		0.04	0.06	0.08	0.08	0.08	0.08	0.08	0.08															0.55
TRAINING	2.2.6		0.22	0.36	0.45	0.45	0.60	0.55	0.55	0.55															3.72
SYSTEM ADMINISTRATOR CLASSES	2.2.6.1		0.06	0.10	0.13	0.13	0.13	0.13	0.13	0.13															0.95
TECHNICAL ASSISTANCE	2.2.6.2		0.15	0.24	0.30	0.30	0.42	0.42	0.42	0.42															2.68
MANPOWER AND PERSONNEL	2.2.6.3		0.01	0.01	0.02		0.05																		0.08
CONCEPTS & REQUIREMENTS	2.2.6.4																								
DATA	2.2.7		0.06	0.10	0.13	0.13	0.13	0.13	0.13	0.13															0.91
LOGISTICS SUPPORT DEOCUMENT	2.2.7.1				0.12	0.12	0.12	0.12	0.12	0.12															0.70
COMPUTER RESOURCE SUPPORT	2.2.7.2				0.01	0.01	0.01	0.01	0.01	0.01															0.05
PECULIAR SUPPORT EQUIPMENT	2.2.8																								
COMMON SUPPORT EQUIPMENT	2.2.9																								
OPERATIONAL/SITE ACTIVATION	2.2.10																								
INDUSTRIAL FACILITIES	2.2.11																								
INITIAL SPARES AND REPAIR PARTS	2.2.12		0.03	0.04	0.06	0.06	0.06	0.05	0.05	0.05															0.38
SUPPLY SUPPORT	2.2.12.1				0.06	0.06	0.06	0.05	0.05	0.05															0.31
SUPPLY SUPPORT CONCEPTS & REQUI	2.2.12.2																								
OPERATING & SUPPORT	3.0				7.43	13.12	14.49	19.83	35.67	46.42	41.29	48.29	57.95	63.06	41.29	48.29	57.95	63.06	41.29	48.29	57.95	63.06	41.29	48.29	57.95	916.25
MISSION PERSONNEL	3.1				2.85	5.16	5.43	7.92	10.51	16.16	16.16	16.16	16.16	16.16	16.16	16.16	16.16	16.16	16.16	16.16	16.16	16.16	16.16	16.16	16.16	290.43
UNIT LEVEL CONSUMPTION	3.2																								
ENERGY CONSUMPTION	3.2.1																								
REPAIR PARTS/SUPPLIES	3.2.2																								
DEPOT LEVEL REPAIRABLES	3.2.3																								
TRAINING MUNITIONS / EXPENDABLE STO	3.2.4																								
PURCHASED SERVICES	3.2.5																								
INTERMEDIATE MAINTENANCE	3.3																								
DEPOT MAINTENANCE	3.4																								
MISCELLANEOUS CONTRACTOR SUPPORT	3.5																								
SUSTAINING SUPPORT	3.6				1.19	1.99	2.80	2.88	13.26	12.07	6.94	13.93	23.99	28.70	6.94	13.93	23.99	28.70	6.94	13.93	23.99	28.70	6.94	13.93	23.99	298.15
ENGINEERING AND TECHNICAL SERVICES	3.6.1				0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	6.66
ISEA MANAGEMENT	3.6.1.1				0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	2.73
CONFIGURATION MANAGEMENT	3.6.1.2				0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	1.83
WARRANTY TRACKING	3.6.1.3				0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	1.47
HELP DESK	3.6.1.4				0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.63
DOCUMENT MAINTENANCE	3.6.1.5																								
SOFTWARE MAINTENANCE	3.6.2				0.88	0.91	0.91	0.94	0.97	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	20.87
SSA	3.6.2.1				0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	17.68
SSA MANAGEMENT	3.6.2.1.1				0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	2.73
GOTS (NMH) MAINTENANCE	3.6.2.1.2				0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	2.73
CM (GOTS & COTS)	3.6.2.1.3				0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	2.73
COTS SW MAINTENANCE RTR TRA	3.6.2.1.4				0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.84
TECHNICAL ASSISTANCE	3.6.2.1.5				0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	1.72
HELP DESK	3.6.2.1.6				0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	1.68
CUDIXS/NM SSA	3.6.2.1.7				0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	5.25
SW MAINT FEES	3.6.2.2				0.04	0.07	0.07	0.10	0.12	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	3.19
NAVMACS II	3.6.2.2.1																								
SMS	3.6.2.2.2				0.04	0.07	0.07	0.10	0.12	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	3.19
LARGE SHIP	3.6.2.2.2.1				0.01	0.03	0.03	0.04	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.94
MEDIUM SHIP	3.6.2.2.2.2				0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.52
SMALL SHIP	3.6.2.2.2.3				0.01	0.01	0.01	0.02	0.03	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.80
COAST GUARD	3.6.2.2.2.4									0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MSC	3.6.2.2.2.5									0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.09
SUBMARINE--SSN	3.6.2.2.2.6				0.00	0.01	0.01	0.01	0.01	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.62
SUBMARINE--SSBN	3.6.2.2.2.7				0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.09
PATROL COASTAL	3.6.2.2.2.8							0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04
SCI CARRY-ON	3.6.2.2.2.9																								
TTE	3.6.2.2.2.10				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05
TRAVEL/TRAINING	3.6.3					0.77	1.39	1.46	2.14	2.83	4.36	4.36	4.36	4.36	4.36	4.36	4.36	4.36	4.36	4.36	4.36	4.36	4.36	4.36	4.36	73.93
TECHNICAL DATA	3.6.4																								
AMMUNITION HANDLING	3.6.5																								
SIMULATOR OPERATIONS	3.6.6																								
SUPPORT EQUIPMENT REPLACEMENT	3.6.7						0.19	0.16	9.84	7.90	1.25	8.24	17.90	23.01	1.25	8.24	17.90	23.01	1.25	8.24	17.90	23.01	1.25	8.24	17.90	196.69
HARDWARE REFRESH	3.6.7.1								9.82	7.73	0.92	7.86	17.89	22.87	0.92	7.86	17.89	22.87	0.92	7.86	17.89	22.87	0.92	7.86	17.89	192.86
LARGE SHIP	3.6.7.1.1								2.11	2.11		1.73	3.84	2.11		1.73	3.84	2.11		1.73	3.84	2.11		1.73	3.84	32.83
MEDIUM SHIP	3.6.7.1.2								2.19	1.82	0.36	1.64	3.64	2.55	0.36	1.64	3.64	2.55	0.36	1.64	3.64	2.55	0.36	1.64	3.64	34.26
SMALL SHIP	3.6.7.1.3								3.17	2.76	0.55	3.31	6.75	9.23	0.55	3.31	6.75	9.23	0.55	3.31	6.75	9.23	0.55	3.31	6.75	76.04
COAST GUARD	3.6.7.1.4													0.82				0.82				0.82				2.45
MSC	3.6.7.1.5													1.09				1.09				1.09				3.26
SUBMARINE--SSN	3.6.7.1.6								1.08	0.82		0.68	1.76	5.68		0.68	1.76	5.68		0.68	1.76	5.68		0.68	1.76	28.67
SUBMARINE--SSBN	3.6.7.1.7								0.31	0.21		0.10	0.42	1.35		0.10	0.42	1.35		0.10	0.42	1.35		0.10	0.42	6.64
PATROL COASTAL	3.6.7.1.8											0.33	0.44			0.33	0.44			0.33	0.44			0.33	0.44	3.11
SCI CARRY-ON	3.6.7.1.9									0.05		0.08	0.08	0.05		0.08	0.08	0.05		0.08	0.08	0.05		0.08	0.08	0.78
TTE	3.6.7.1.10								0.96				0.96				0.96				0.96				0.96	4.82
SOFTWARE REFRESH	3.6.7.2						0.19	0.16	0.01	0.15	0.33	0.38	0.01	0.15	0.33	0.38	0.01	0.15	0.33	0.38	0.01	0.15	0.33	0.38	0.01	3.83
LARGE SHIP	3.6.7.2.1						0.09	0.09		0.07	0.16	0.09		0.07	0.16	0.09		0.07	0.16	0.09		0.07	0.16	0.09		1.43
MEDIUM SHIP	3.6.7.2.2						0.03	0.03	0.01	0.02	0.05	0.04	0.01	0.02	0.05	0.04	0.01	0.01	0.05	0.04	0.01	0.02	0.05	0.04	0.01	0.53
SMALL SHIP	3.6.7.2.3						0.03	0.03	0.01	0.04	0.07	0.10	0.01	0.04	0.07	0.10	0.01	0.04	0.07	0.10	0.01	0.04	0.07	0.10	0.01	0.92
COAST GUARD	3.6.7.2.4											0.01				0.01				0.01				0.01		0.05
MSC	3.6.7.2.5											0.02				0.02				0.02				0.02		0.10
SUBMARINE--SSN	3.6.7.2.6						0.02	0.01		0.01	0.03	0.10		0.01	0.03	0.10		0.01	0.03	0.10		0.01	0.03	0.10		0.62
SUBMARINE--SSBN	3.6.7.2.7						0.00	0.00		0.00	0.01	0.02		0.00	0.01	0.02		0.00	0.01	0.02		0.00	0.01	0.02		0.10
PATROL COASTAL	3.6.7.2.8									0.00	0.01			0.00	0.01			0.00	0.01			0.00	0.01			0.04
SCI CARRY-ON	3.6.7.2.9																								
TTE	3.6.7.2.10						0.01				0.01				0.01				0.01				0.01			0.05
INDIRECT/INFRASTRUCTURE	3.7				3.33	5.96	6.26	9.03	11.90	18.20	18.20	18.20	18.20	18.20	18.20	18.20	18.20	18.20	18.20	18.20	18.20	18.20	18.20	18.20	18.20	327.67
ACQUISITION SUPPORT	3.7.1			0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	4.68
INSTALLATION SUPPORT	3.7.2																								
CENTRAL C4I	3.7.3																								
FORCE MANAGEMENT	3.7.4				3.17	5.75	6.04	8.82	11.69	17.98	17.98	17.98	17.98	17.98	17.98	17.98	17.98	17.98	17.98	17.98	17.98	17.98	17.98	17.98	17.98	323.20
CENTRAL LOGISTICS	3.7.5																								
CENTRAL PERSONNEL/MEDICAL	3.7.6																								
CENTRAL TRAINING	3.7.7																								
DEMILITARIZATION & DISPOSAL	4.0								1.92	1.56	0.18	1.68	3.66	5.37	0.18	1.68	3.66	5.37	0.18	1.68	3.66	5.37	0.18	1.68	3.66	41.67
NAVMACS (V)	4.1																								
NAVMACS II/SMS	4.2								1.92	1.56	0.18	1.68	3.66	5.37	0.18	1.68	3.66	5.37	0.18	1.68	3.66	5.37	0.18	1.68	3.66	41.67
FIELDING PLAN:																									
Initial Procurement Quantities:					64	52	6	56	58	127															363
LARGE SHIPS					11	11		9	9																40
MEDIUM SHIPS					12	10	2	9	8	4															45
SMALL SHIPS					23	20	4	24	26	47															144
COAST GUARD										10															10
MSC										19															19
SUBMARINE--SSN					8	6		5	5	36															60
SUBMARINE--SSBN					3	2		1	1	11															18
PATROL COASTAL								3	4																7
SCI CARRY-ON						3		5	5																13
TTE					7																				7

	TOC WBS #	PY	FY99	FY00	FY01	FY02	FY03	FY04	FY05	FY06	FY07	FY08	FY09	FY10	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	Total
Initial Installation Quantities:					64	52	6	56	58	127															363
LARGE SHIPS					11	11		9	9																40
MEDIUM SHIPS					12	10	2	9	8	4															45
SMALL SHIPS					23	20	4	24	26	47															144
COAST GUARD										10															10
MSC										19															19
SUBMARINE--SSN					8	6		3	3	36															60
SUBMARINE--SSBN					3	2		1	1	11															18
PATROL COASTAL								3	4																7
SCI CARRY-ON						3		5	3																13
TTE					7																				7
Initial Pre Installation Quantities:					64	52	6	56	58	127															363
Cumulative # Procured Systems					64	116	122	178	236	363	363	363	363	363	363	363	363	363	363	363	363	363	363	363	---
LARGE SHIPS					11	22	22	31	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	---
MEDIUM SHIPS					12	22	24	33	41	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	---
SMALL SHIPS					23	43	47	71	97	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	---
COAST GUARD										10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	---
MSC										19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	---
SUBMARINE--SSN					8	14	14	19	24	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	---
SUBMARINE--SSBN					3	5	5	6	7	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	---
PATROL COASTAL								3	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	---
SCI CARRY-ON						3	3	8	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	---
TTE					7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	---
Cumulative # Installed Systems					64	116	122	178	236	363	363	363	363	363	363	363	363	363	363	363	363	363	363	363	
LARGE SHIPS					11	22	22	31	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	
MEDIUM SHIPS					12	22	24	33	41	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	
SMALL SHIPS					23	43	47	71	97	144	144	144	144	144	144	144	144	144	144	144	144	144	144	144	
COAST GUARD										10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	
MSC										19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	
SUBMARINE--SSN					8	14	14	19	24	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	
SUBMARINE--SSBN					3	5	5	6	7	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	
PATROL COASTAL								3	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	
SCI CARRY-ON						3	3	8	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	
TTE					7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	
Hardware Upgrade Quantities:									64	52	6	56	122	179	6	56	122	179	6	56	122	179	6	56	1389
LARGE SHIPS									11	11		9	20	11		9	20	11		9	20	11		9	171
MEDIUM SHIPS									12	10	2	9	20	14	2	9	20	14	2	9	20	14	2	9	188
SMALL SHIPS									23	20	4	24	49	67	4	24	49	67	4	24	49	67	4	24	552
COAST GUARD														10				10				10			30
MSC														19				19				19			57
SUBMARINE--SSN									8	6		3	13	42		3	13	42		3	13	42		3	212
SUBMARINE--SSBN									3	2		1	4	13		1	4	13		1	4	13		1	64
PATROL COASTAL												3	4			3	4			3	4			3	28
SCI CARRY-ON										3		3	3	3		3	3	3		3	3	3		3	52
TTE									7				7			7					7				35
Software Upgrade Quantities:							64	52	6	56	122	179	6	56	122	179	6	56	122	179	6	56	122	179	6	1574
LARGE SHIPS							11	11		9	20	11		9	20	11		9	20	11		9	20	11		182
MEDIUM SHIPS							12	10	2	9	20	14	2	9	20	14	2	9	20	14	2	9	20	14	2	204
SMALL SHIPS							23	20	4	24	49	67	4	24	49	67	4	24	49	67	4	24	49	67	4	623
COAST GUARD												10				10				10				10		40
MSC												19				19				19				19		76
SUBMARINE--SSN							8	6		3	13	42		3	13	42		3	13	42		3	13	42		254
SUBMARINE--SSBN							3	2		1	4	13		1	4	13		1	4	13		1	4	13		77
PATROL COASTAL										3	4			3	4			3	4			3	4			28
SCI CARRY-ON								3		5	5	3		5	5	3		5	5	3		5	5	3		55
TTE							7				7				7				7				7			35

APPENDIX E

Appropriation: 5T6M
FY: 1999
O&M,N

Program Status Vs. Benchmarks



	PD16-5T6M	INFOSEC-5T6M
Planned Amount	$200.394	$10,820.606
Oblig Bnchmrk	$200.394	$10,820.606
Obligations	$193.243	$10,814.860
Expend Bnchmrk	$150.296	$8,115.455
Expenditures	$132.493	$9,010.508

APPENDIX F

Science Applications International Corporation
An Employee-Owned Company

24 September 1999
99-078

Defense Contract Management Command
7675 Dagget Street, Suite 200
San Diego, CA 92111

Attention: Denise Farnsworth, Code GSOE

Reference: Contract N00039-95-C-0094

Subject: CDRL M002, Engineering Change Proposal (ECP) for the Changes To Edition Fields, National Short Title Validation, And Other Class I Changes To The Tier 1 System (ECP-012)

Dear Ms. Farnsworth:

Copies of the CDRL item M002, Engineering Change Proposal (ECP) for the Changes To Edition Fields, National Short Title Validation, And Other Class I Changes To The Tier 1 System (ECP-012), as specified in the DD-1423 of the reference contract for the Tier 1 System are submitted for approval.

Please contact Mark Hardy, the SAIC designated Point of Contact, at (858) 826-5929 if there are any questions.

Sincerely,

SAIC, Software and Systems Integration Group

Gary D. Allard

Gary D. Allard
Tier 1 System Deputy Program Manager

cc: Eleanor Summers, Code 02-31S (without enclosure)

encl

Organization	Code	Copies
SPAWAR	PMW161-12C	2
NRL	5541	1
DCMC	DCMDW-GSOE	1
CECOM	SED	1
SSC Charleston	42	1
Booz-Allen & Hamilton		1

ENGINEERING CHANGE PROPOSAL (ECP), PAGE 1

1. DATE (YYMMDD): 2/3/98

Form Approved OMB No. 0704-0188

2. PROCURING ACTIVITY NO.: N00039

3. DODACC:

4. ORIGINATOR: Raytheon Systems Company

a. TYPED NAME (FIRST, MIDDLE, INITIAL, LAST): Company

b. ADDRESS (Street, City, State, Zip Code): Naval and Maritime Systems, Post Office Box 3310, Fullerton, California 92834-3310

5. CLASS OF ECP: I

6. JUST. CODE: D

7. PRIORITY: R

8. ECP DESIGNATION

a. MODEL/TYPE	b. CAGE CODE	c. SYSTEM DESIGNATION
SURTASS	05869	AN/UQQ-2(V)1 SURTASS

9. BASELINE AFFECTED: [ ] FUNCTIONAL [X] PRODUCT [ ] ALLOCATED

d. ECP NO.: RSC-003

e. TYPE: P

f. REV.:

10. OTHER SYS/CONFIG ITEMS AFFECTED: [ ] YES [X] NO

11. SPECIFICATIONS AFFECTED

	CAGE CODE	Specification/Document No.	REV.	SCN
a. SYSTEM				
b. DEVELOPMENT				
c. PRODUCT				

12. DRAWINGS AFFECTED

CAGE CODE	NUMBER	REV.	NOR

13. TITLE OF CHANGE: Telemetry Receiver Unit - Universal (TRU-U)

14. CONTRACT NO. & LINE ITEM: N00039-96-C-0073

15. PROCURING CONTRACTING OFFICER
a. NAME (First, Middle Initial, Last): J. Sullivan
b. CODE: 02-22A
c. TELEPHONE NO.: (619) 524-7155

16. CONFIGURATION ITEM NOMENCLATURE: SURTASS TX and Next Evolution System

17. IN PRODUCTION: [X] YES [ ] NO

18. LOWEST ASSEMBLY AFFECTED

NOMENCLATURE	PART NO.	NSN
SURTASS Telemetry Receiver Subsystem		

19. DESCRIPTION OF CHANGE

The TRU-U is to be developed as a replacement of the AT&T Telemetry Receiver Unit (TRU) and other, older array specific receivers. The TRU-U is a COTS-based telemetry receiver that in addition to supporting all the newest SURTASS towed arrays (as well as the Production Baseline Array), will provide increased reliability and enhanced operability. The change involves installation of a single cabinet of hardware that contains all the components of the TRU-U [processor, power distribution unit, time code receiver, speaker, I/O panel, and support hardware for array interface and power supply (based on type)]. The configuration of the TRU-U utilizes hardware components with a great degree of commonality with the Data Processing Subsystem. The processor will be running software that will be developed to universally support all array types with a very easy to use operator interface. Additionally, this change requires several cables and interface panels to be replaced in order to be compatible with the new equipment.

20. NEED FOR CHANGE

This change is required to allow the TX and Next Evolution system to interface to the newest SURTASS towed arrays (A180R, TwinlineR, and RDA w/COAX tow cable). Also, the existing Production Baseline Array (PBA) interface equipment (SCU and AIU) is nearing end of life and is not easily supported. A common Receiver architecture would provide a standard hardware and software configuration, user friendly operator machine interface, and increased maintainability for all ship systems.

21. PRODUCTION EFFECTIVITY BY SERIAL NUMBER: N/A

22. EFFECT ON PRODUCTION DELIVERY SCHEDULE: N/A

23. RETROFIT

a. RECOMMENDED ITEM EFFECTIVITY

b. SHIP/VEHICLE CLASS AFFECTED: T-AGOS 8 (T-8), T-9, T19, T-20, T-21, T-22, and T-23

c. ESTIMATED SHIP DELIVERY SCHEDULE

d. LOCATIONS OR SHIP/VEHICLE NUMBERS AFFECTED: T-AGOS 8 (T-8), T-9, T19, T-20, T-21, T-22, and T-23

24. ESTIMATED COSTS/SAVINGS UNDER CONTRACT

25. ESTIMATED NET TOTAL COSTS: NRE $463 RE PER SHIP $267

26. SUBMITTING ACTIVITY AUTHORIZED SIGNATURE
a. AUTHORIZED SIGNATURE

b. TITLE: M. Holm, Manager, Contracts, Naval and Maritime Systems

27. APPROVAL/DISAPPROVAL

a. CLASS I	b. CLASS II	c. CLASS III
[ ] APPROVAL RECOMMENDED [ ] DISAPPROVAL RECOMMENDED	[ ] APPROVED [ ] DISAPPROVED	[ ] CONCUR IN CLASSIFICATION OF CHANGE [ ] DO NOT CONCUR IN CLASSIFICATION OF CHANGE

d. GOVERNMENT ACTIVITY	e. SIGNATURE	f. DATE (YYMMDD)

g. APPROVAL	h. GOVERNMENT ACTIVITY	i. SIGNATURE	j. DATE (YYMMDD)
[ ] APPROVED [ ] DISAPPROVED			

DD Form 1692, APR 92

Previous editions are obsolete.

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APPENDIX G

COBLU JPO FY99 Financial Status (O&M,N)

COBLU

Period Ending: Jan/1999

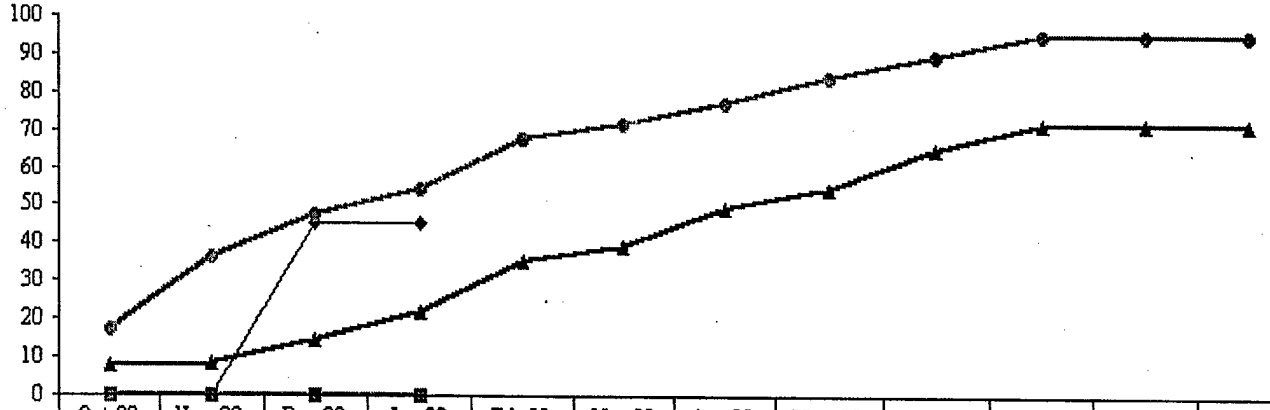
Program: COBLU/JPO
Appn: O&M,N
Subhead: 5U7N
Prog APM: George Colvin
Fin Analyst Lysa Edward

Financial Status FY 99

Printed 1/14/99

Budget $95.00	Obligated		Stars Expenditure		Other Data Reported Expenditure	
Actual	$45.00	47.37%	$0.27	0.29%	$0.27	0.29%
Benchmarks	$54.15	57.00%	$21.85	23.00%	$21.85	23.00%
Deviation	($9.15)	-9.63%	($21.58)	-22.71%	($21.58)	-22.71%

ACTIVITY	BUDGET	INITIATED	OBLIGATED	PCT	EXPENDED	FINAL Pct
NAVSURFLANT	$30.00	$30.00	$30.00	100.00%	$0.00	0.00%
SSC Chas	$65.00	$65.00	$15.00	23.08%	$0.27	0.42%

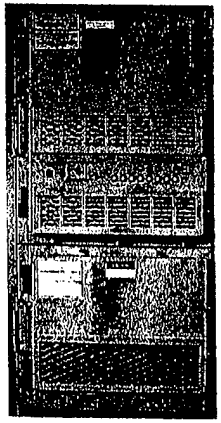


	Oct-98	Nov-98	Dec-98	Jan-99	Feb-99	Mar-99	Apr-99	May-99	Jun-99	Jul-99	Aug-99	Sep-99
Actual Obligations	0	0	45	45								
Actual Expenditures	0	0	0.274	0.274								
Expenditure_Benchmark	7.6	8.55	14.25	21.85	35.15	38.95	49.4	54.15	64.6	71.25	71.25	71.25
Obligation_Benchmark	17.1	36.1	47.5	54.15	67.45	71.25	76.95	83.6	89.3	95	95	95

APPENDIX H

Submarine LF/VLF VMEbus Receiver (SLVR) ACAT IVT (Sponsor N61)

PM/ Sponsor	Technical Performance	Cost	Schedule	Funding	T&E	Production	Logistics	Software	Contract Status	Doc Status	Management/ Global Issues
CAPT Sharp (PMW 173) 619-524-7906 Mr. Mike Leegan (N61D) 703-604-3406											VXI chassis shock qualification



VXI Chassis

VME Chassis

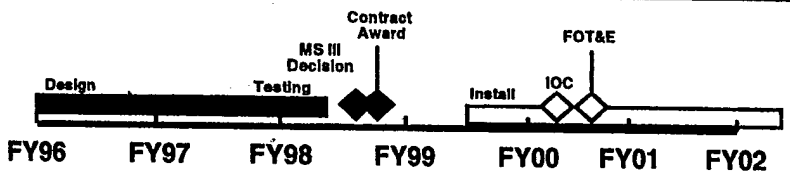
- **Requirement:** ORD Approved Mar 96
- **Milestone Decision Authority:** SPAWAR
- **Milestone Approved/Approval Date:** MSIII / 30 Jun 98
- **Next Planned Review or Milestone Date:** Program Review / Feb 99
- **Contractor(s):** Industry (DBA Systems, Inc. Melbourne, Fl. & Sechan Electronics, Inc. Lititz, Pa.)/Government (SSC San Diego) Team
- **Basic Description of System:**
  - The SLVR is intended to provide the next generation VLF/LF Receiver for use on TRIDENT and all SSN classes and at selected shore sites.
  - SLVR will be capable of receiving and processing all Navy, special, and NATO modes presently required, and will be adaptable and expandable to future requirements through use of COTS hardware and GOTS software.
  - SLVR receivers will replace VERDIN/EVS/TRIDENT IRR receivers.

Issues:

Schedule: The SLVR program will slip, causing a 6 months breach of the 7/99 IOC threshold. This slip is the result of VXI chassis failure to meet MIL-S-901 shock requirements. A chassis redesign is in process. There is no impact to total installation quantities by FY, since the 15 systems procured in FY98 will be installed at shore sites (vice submarines) in FY99.

Installation Schedule (IAW CNO Ser N61/8U555931 21 JUL 98)

Inventory Objective	Installed as of FY98	Planned FY99	FY00	FY01	FY02	FY03	FY04	TC
146	0	15	44	47	40	0	0	0



APPENDIX I

The Navy Extremely High Frequency Satellite Communication Program (NESP)

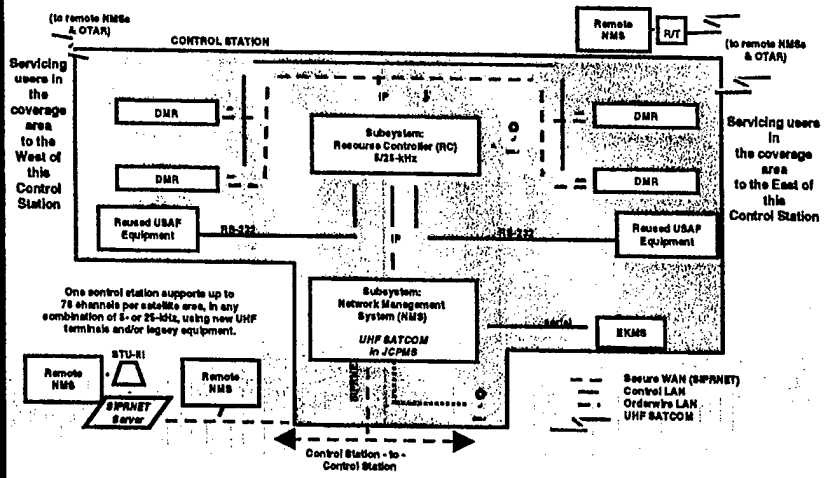
	Production Baseline May 1992		Change #1 March 1993		Proposed Baseline December 1998	
	Objective	Threshold	Objective	Threshold (3)	Objective	Threshold (4)
Then Year $M (info only / no deviation criteria):						
(U) Total RDT&E	408.8		463.4		596.6	
(U) Total Procurement	1642.8		1881.5		1651.6	
(U) Total MILCON	21.5		28.8		8.8	
Base Year $M (FY90):						
(U) Total RDT&E	416.1	478.5	457.4 (1)	526.0	540.7 (2)	594.8
(U) Total Procurement	1337.2	1404.1	1393.2	1465.0	1371.3	1508.4
(U) Total MILCON	18.5	21.3	24.0	27.6	7.7	8.5
(U) Average Unit Procurement Cost (FY90 $M)	3.377	3.884	3.615	4.157	3.420	3.762
(U) Program Acquisition Unit Cost (FY90 $M)	4.428	5.092	4.794	5.513	4.768	5.245
(U) Total Procurement Quantities (info only / no deviation criteria)	396		386		401	

(1) The March 1993 APB includes estimated RDT&E dollars through FY00
(2) The Proposed Baseline includes estimated RDT&E dollars through FY20.
Adjusted to the March 1993 RDT&E timeframe, the proposed baseline objective would be $430.6 (FY90 $M) and within the March 1993 objective of $457.4.
(3) The March 1993 APB threshold is computed at 15% above the objective.
(4) The Proposed Baseline threshold is computed at 10% above the objective.

APPENDIX J

Joint (UHF) MILSATCOM Network Integrated (JMINI) Control System

PM/ Sponsor	Technical Performance	Cost	Schedule	Funding	T&E	Production	Logistics	Software	Contract Status	Doc Status	Management/ Global Issues
CDR Durante (PMW 179) (619) 524-7685 LT Rogers (N612) (703) 601-1224											None



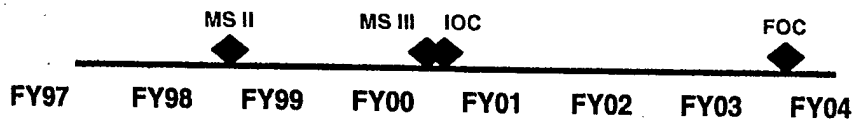
- **Requirement:** ORD 483-06-98 Signed 27 Mar 98
- **Milestone Approved/Approval Date:** M/S II (27 Jul 98)
- **Next Planned Review or Milestone Date:** M/S III 3Q FY00
- **Contractor(s):** SAIC Team (SSC San Diego); ViaSat, Inc.
- **Basic Description of System:** Provide dynamic centralized control and decentralized management of voice and data communications operating over non-processed 5-kHz and 25-kHz UHF MILSATCOM channels to JCS-validated users. Replace TD-1271/WSC-5 equipment at NCTAMS/NCTS Guam and expand channel control capability (centralized control). Provide the UHF MILSATCOM DII COE compliant local and remote communications planning and management tools.

Issues:

None

Installation Schedule

Inventory Objective	Installed as of FY98	Planned FY99	FY00	FY01	FY02	FY03	FY04	TC
600	0	0	374	30	39	107	50	0



APPENDIX K

21. Systems by Subhead by FY

APPROPRIATION/PROJECT/FY: O&MN / 5C3C / 00

PROGRAM DIRECTIVE
FUNDING BY SYSTEM FOR A GIVEN SUBHEAD AND FY
(Dollars in Thousands)

10/21/99

FY 00

ProjectDescription: FSS

Subhead Control $: 34,181.8

System :100 ILS

System/Subhead Control$: $1,975,858.00

Performing Activity	TAC/ Task	Phs	Eff	ct	Task Description	Prev Auth	Req Chgs	Curr Auth	Document #	Amnd	ACRN	Init Act	Oblig Plan	Oblig Act	Init Amt	Comm Amt	PMO Oblig	STARS Oblig	PMO Expend	STARS Expend	Balance
PMW182	1QTR	4	6	20	SOSUS/SDS/SSIPS OPTAR	150.0	0.0	150.0	N0003900TBD1	00	TA				0.0	0.0	0.0	0.0	0.0	0.0	150.0
FTSCPAC	1QTR	4	6	20	PMS FOR IUSS	30.0	0.0	30.0	N0003900WRDU015	00	TA			10/99	25.0	0.0	5.0	5.0	0.0	0.0	0.0
SSC CHS	1QTR	4	6	10	IOSC TASK 1.6 PROGRAM/BUDGET ANALY	65.5	0.0	65.5	N0003900WXDU010	00	TA			10/99	45.5	0.0	20.0	20.0	0.0	0.0	0.0
SSC CHS	1QTR	4	6	20	IOSC TASK 5.1	186.6	0.0	186.6	N0003900WXDU010	00	TB			10/99	166.6	0.0	20.0	20.0	0.0	0.0	0.0
SSC CHS	1QTR	4	6	20	IOSC TASK 5.3	87.9	0.0	87.9	N0003900WXDU010	00	TC			10/99	67.9	0.0	20.0	20.0	0.0	0.0	0.0
SSC CHS	1QTR	4	6	50	IOSC TASK 4.1 SUPPLY SPT/LSF COR	44.0	0.0	44.0	N0003900WXDU010	00	TD			10/99	39.0	0.0	5.0	5.0	0.0	0.0	0.0
SSC CHS	1QTR	4	6	50	IOSC TASK 4.1 SMART PAY (OPTAR IMPAC	57.0	0.0	57.0	N0003900WXDU010	00	TE			10/99	47.0	0.0	10.0	10.0	0.0	0.0	0.0
SSC CHS	1QTR	4	7	10	IOSC TASK 4.2 (TEST, CHECK-OUT, RPR NO	108.2	0.0	108.2	N0003900WXDU010	00	TF			10/99	87.2	0.0	21.0	21.0	0.0	0.0	0.0
Lockheed	1QTR	4	6	10	LIFE CYCLE SPT WORKING GROUP	113.0	0.0	113.0	N0003996C0032	00	TA				0.0	0.0	0.0	0.0	0.0	0.0	113.0
CACI	1QTR	4	6	30	RELIABILITY/MAINTAINABILITY ANALYSIS	50.0	0.0	50.0	N0003997C0048	00	TA			10/99	0.0	0.0	50.0	50.0	0.0	0.0	0.0
CACI	1QTR	4	6	50	FSS SUPPLY SPT, AAP'S & COSBAL DEVEL	318.5	0.0	318.5	N0003997C0048	00	TB			10/99	0.0	0.0	0.0	0.0	0.0	0.0	318.5
CACI	1QTR	4	6	60	MAINT, TRACKING, CAL OF S&TE	25.0	0.0	25.0	N0003997C0048	00	TC			10/99	0.0	0.0	0.0	0.0	0.0	0.0	25.0
CACI	1QTR	4	6	70	PHS&T SUPPORT FOR FSS ASSETS AND L	175.0	0.0	175.0	N0003997C0048	00	TD			10/99	0.0	0.0	0.0	0.0	0.0	0.0	175.0
CACI	1QTR	4	6	80	INSTALLATION, SPT, TRNG FRO SMART/IC	35.0	0.0	35.0	N0003997C0048	00	TE			10/99	35.0	0.0	0.0	0.0	0.0	0.0	0.0
General Dyn	1QTR	4	6	10	LIFE CYCLE SPT WORKING GRP	176.0	0.0	176.0	N0003998C0001	00	TA			10/99	122.0	0.0	54.0	54.0	0.0	0.0	0.0
General Dyn	1QTR	4	6	10	GD ALLOCATED ILS	41.8	0.0	41.8	N0003998C0001	00	TF			10/99	0.0	0.0	0.0	0.0	0.0	0.0	41.8
General Dyn	1QTR	4	6	10	FSS Y2K SUPPORT	26.8	0.0	26.8	N0003998C0001	00	TG			10/99	0.0	0.0	0.0	0.0	0.0	0.0	26.8
General Dyn	1QTR	4	6	10	ECP FSS-LCC-003	285.6	0.0	285.6	N0003998C0001	00	TH			10/99	285.6	0.0	0.0	0.0	0.0	0.0	0.0
					System Totals	1,975.9	0.0	1,975.9							920.8	0.0	205.0	205.0	0.0	0.0	850.1

Subhead/System Control Delta
(SbHdSystem Control $ - Sum Curr AutH)

$0.00

System :110 Field Support

System/Subhead Control$: $853,150.00

Performing Activity	TAC/ Task	Phs	Eff	ct	Task Description	Prev Auth	Req Chgs	Curr Auth	Document #	Amnd	ACRN	Init Act	Oblig Plan	Oblig Act	Init Amt	Comm Amt	PMO Oblig	STARS Oblig	PMO Expend	STARS Expend	Balance
SSC CHS	1QTR	4	6	30	IOSC TASK 1.7 ISEA SUPPORT	803.2	0.0	803.2	N0003900WXDU010	00	TH				0.0	0.0	0.0	0.0	0.0	0.0	803.2
INRI	1QTR	4	6	30	GCCS-M LICENSES	50.0	0.0	50.0	N0003998C0010	00	TA				0.0	0.0	0.0	0.0	0.0	0.0	50.0
					System Totals	853.2	0.0	853.2							0.0	0.0	0.0	0.0	0.0	0.0	853.2

Subhead/System Control Delta
(SbHdSystem Control $ - Sum Curr AutH)

$0.00

System :120 UWS Shore Facility

System/Subhead Control$: $1,156,221.00

APPENDIX L

FY 98 FINANCIAL OVERVIEW

SURTASS X0766 P.E. 0204311N
SURTASS X0766, X0766

AS OF: /08/1999
PRINT: /08/1999
STARS: /06/1999

*Figures relative to CURRENT $ AUTHORIZED

	Oct- 1997 $ Planned	Current $ Changes	09/08/1999 $ Planned	Current $ Authorized	Actual $ Initiated	$* Uninitiated	STARS $ Committed	STARS $ Obligated	$* Unobligated	Actual $ Obligated	STARS $ Expended	Work $ Performed
Stars as of 08/23/19	6,657,728	0	6,657,728	6,058,209	6,058,209	0	0	6,047,257	10,952	0	5,811,177	0
CHANGES	0	0	0	0	0	0	0	0	0	0	0	0
Stars as of 09/06/199	6,657,728	0	6,657,728	6,058,209	6,058,209	0	0	6,047,257	10,952	0	5,811,177	0
SPAWAR Controls				$6,050,589		% Based on Control	99.94%			0.00%	96.04%	0.00%
Aug 99 NAVCOMPT Benchmarks												
Sep 99 NAVCOMPT Benchmarks												
ONR Controls				$6,412,000		% Based on Control	94.31%			0.00%	90.63%	0.00%
Aug 99 NAVCOMPT Benchmarks												
Sep 99 NAVCOMPT Benchmarks												

APPENDIX M

FY94$M	FY00	FY01	FY02	FY03	FY04	FY05	FY06	FY07	FY08	FY09	FY10	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	Total
EMD	$19.6	$17.8	$25.1	$24.7	$25.2	$5.3																	$117.6
Production						$50.6	$57.9	$60.5	$54.5	$51.7	$52.3	$48.2	$45.7	$25.5	$24.4								$471.3
O&S								$5.3	$8.0	$15.1	$12.7	$12.7	$15.8	$13.2	$14.4	$17.8	$15.2	$12.4	$15.1	$12.3	$12.5	$12.3	$194.8
Total	$19.6	$17.8	$25.1	$24.7	$25.2	$55.9	$57.9	$65.8	$62.5	$66.8	$65.0	$61.0	$61.5	$38.7	$38.8	$17.8	$15.2	$12.4	$15.1	$12.3	$12.5	$12.3	$783.7
Then Year $M																							
EMD	$21.6	$19.8	$28.5	$28.5	$29.8	$6.4																	$134.6
Production						$61.7	$72.1	$77.0	$70.8	$68.6	$70.8	$66.6	$64.4	$36.7	$36.0								$624.6
O&S								$6.8	$10.7	$20.8	$18.3	$18.9	$24.0	$20.8	$23.3	$29.4	$26.2	$22.2	$27.8	$23.6	$24.8	$25.1	$322.6
Total	$21.6	$19.8	$28.5	$28.5	$29.8	$68.1	$72.1	$83.8	$81.5	$89.4	$89.1	$85.6	$88.4	$57.5	$59.3	$29.4	$26.2	$22.2	$27.8	$23.6	$24.8	$25.1	$1,081.9

Figure 1-1 ADS Costs by fiscal year

APPENDIX N

UNCLASSIFIED
CLASSIFICATION

COST ANALYSIS

DATE: September 1999

B. APPROPRIATION/BUDGET ACTIVITY: OP,N - BA3 AVIATION SUPPORT EQUIPMENT

C. P-1 ITEM NOMENCLATURE: METEOROLOGICAL EQUIPMENT 4226

SUBHEAD: 53SP

TOTAL COST IN THOUSANDS OF DOLLARS

COST CODE	ELEMENT OF COST	IDENT CODE	PY		FY 1999			FY 2000			FY 2001		
			QTY	TOTAL COST	QTY	UNIT COST	TOTAL COST	QTY	UNIT COST	TOTAL COST	QTY	UNIT COST	TOTAL COST
SP051	AN/SMQ-11 UPGRADES - SPACE	A			VAR		2,596	VAR		2,434	VAR		2,750
SP190	TESS UPGRADES	A			VAR		10,211	VAR		11,099	VAR		12,218
SP200	SMOOS(R) / MORIAH	A			VAR		220	VAR		3,595	VAR		3,659
SP300	MET EQUIPMENT	N/A			VAR		6,756	VAR		5,745	VAR		4,811
SP500	SUPPLEMENTAL WEATHER RADAR	N/A			5	759	3,794	1	794	794			
SP525	MEASURE	N/A						VAR		950	VAR		967
SP550	AVIATION SAFETY SYS UPGRADES	N/A			VAR		1,011	VAR		1,097	VAR		1,322
SP777	INSTALLATION	N/A			VAR		3,327	VAR		5,790	VAR		5,487
SP776	NON-FMP	N/A			VAR		1,475	VAR		1,230	VAR		1,753
SP777	FMP	N/A			VAR		1,852	VAR		4,560	VAR		3,734
	FMP						1,752			4,435			3,607
	DSA						100			125			127
	TOTAL CONTROL						**27,915**			**31,504**			**31,214**

Remarks:

DD FORM 2446, JUN 86

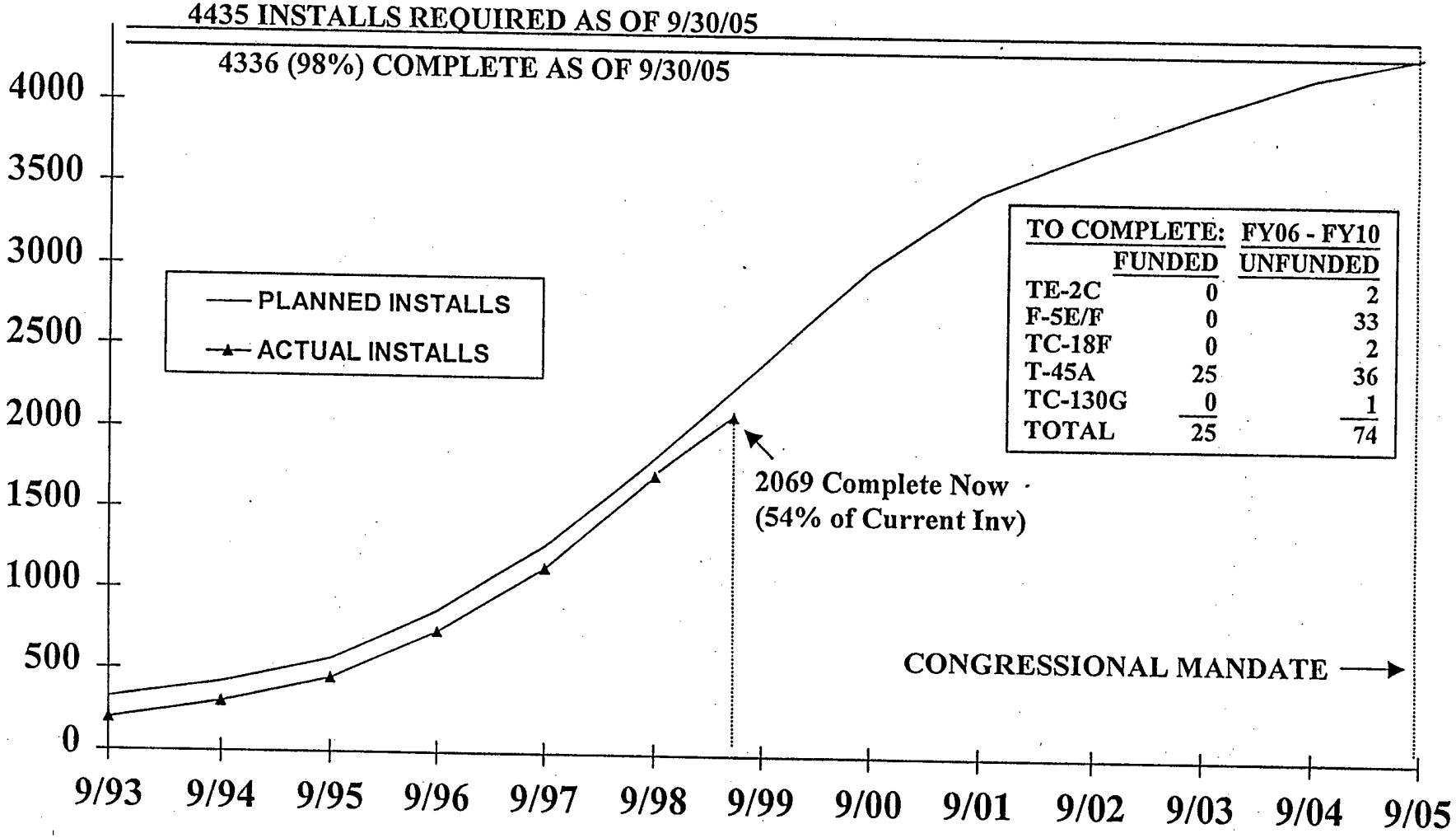
APPENDIX O

NAVAL AVIATION SYSTEMS TEAM

GLOBAL POSITIONING SYSTEM AIRCRAFT INSTALLATION STATUS

AS OF 06/19/99

SPAWAR



TO COMPLETE:	FUNDED	FY06 - FY10 UNFUNDED
TE-2C	0	2
F-5E/F	0	33
TC-18F	0	2
T-45A	25	36
TC-130G	0	1
TOTAL	25	74

LIST OF REFERENCES

1. CBO Report 1999, "Historical Analysis of the Federal Budget from 1962-1999." [http://www.cbo.gov/ showdoc.cfm?index=1059&sequence=0&from=7].

2. Buckley, J. W., Buckley, M. H., Chiang, H., *Research Methodology & Business Decisions,* p.48, National Association of Accountants, 1976.

3. Buckley, J. W., Buckley, M. H., Chiang, H., *Research Methodology & Business Decisions,* p.41, National Association of Accountants, 1976.

4. Defense Acquisition University, *Principles of Acquisition and Program Management I,* Monterey, CA., June 1999.

5. Department of Defense Directive 5000.1, "*Defense Acquisition,*" 15 March 1996.

6. Department of Defense Instruction 5000.2R, *Mandatory Procedures for Major Defense Acquisition Programs and Major Automated Information Systems*, 15 March 1996.

7. Space and Naval Warfare Command Brief, *IT 21 Strategic Implementation Plan Version 1.5.1,*10 October 1998.

8. Personal interviews of SPAWAR San Diego Personnel, Interviewees coded A through O, 14 July 1999 to 29 October 1999 (inclusive dates).

9. Naval Tactical Command Support System (NTCSS) Acquisition Program Baseline Revision 2, 16 December 1998.

10. Navy Modular Automated Communication System II/Single Message Solution - Afloat (NAVMACS/SMS) Cost Model, 30 June 1999.

11. Global Command Control System-Maritime(GCCS-M) Acquisition Program Baseline, 30 June 1999.

12. Integrated Shipboard Network System (ISNS)Total Ownership Cost Reduction Plan, 30 June 1999.

13. Automated Digital Networking System (ADNS)Total Ownership Cost Estimate, 30 June 1999.

14. PMW 161, *Command Brief,* February 1999.

15. Navy Extremely High Frequency SATCOM Program (NESP), "Total Ownership Cost Reduction Plan Working Paper NESP 98-01," 30 June 1999.

16. PD 17, *Communication Systems Program Directorate Command Brief,* March 1999.

17. SPAWAR, "*Total Ownership Cost Virtual Program Office Website.*" [http://vpo.spawar.navy.mil/00/00a/00a-ar/toc/master.nsf].

18. PD 18, *Command Brief*, May 1999.

19. SPAWAR, *Advanced Deployable System (ADS) Program Life Cycle Cost Estimate (PLCCE),* November 1999.

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   Bethesda, MD 20889-5611

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   Monterey, CA 93943

6. Professor Jerry McCaffery, Code SM/Mm 2
   Naval Postgraduate School
   Monterey, CA 93943

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   Manasses, VA 20112