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A methodological approach for conducting a business case analysis for the Joint Distance Support and Response (JDSR) Advanced Concept Technology Demonstration (ACTD)

NAVAL POSTGRADUATE SCHOOL

MONTEREY, CALIFORNIA

THESIS

A METHODOLOGICAL APPROACH FOR CONDUCTING A BUSINESS CASE ANALYSIS FOR THE JOINT DISTANCE SUPPORT AND RESPONSE (JDSR) ADVANCED CONCEPT TECHNOLOGY DEMONSTRATION (ACTD)

by

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December 2006

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13. ABSTRACT (maximum 200 words)

The Joint Distance Support and Response (JDSR) is an Advanced Concept Technology Demonstration (ACTD) initiative approved by the United States Joint Forces Command (JFCOM). The purpose of ACTD is to exploit mature and maturing technologies and rapidly transit new capability to address military problems, while JDSR aims to establish a common tele-maintenance environment to improve the efficiency of field military services to support war fighters.

The operational concept of JDSR is to provide near real-time maintenance solutions in an operational fighting environment to enhance situational awareness of platforms and weapon systems operational status for the joint task force commander. This common Joint Service tele-maintenance capability is achieved through the use of advanced commercial technologies integrated with the Services' ongoing development initiatives to provide four integrated functions: remote collaboration, information/knowledge sharing, remote weapon/platform diagnostics and distant maintenance mentoring at the point of maintenance.

The purpose of this thesis is to analyze the cost savings and the benefits of implementing the JDSR capability. This thesis will

- Develop a recommended standard for performing business case analyses of J/ACTDs, including defining the analytic structure required in a business case report.
- Conduct the JDSR ACTD business case analysis, including a baseline analysis and an extensive sensitivity analysis.

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The Joint Distance Support and Response (JDSR) is an Advanced Concept Technology Demonstration (ACTD) initiative approved by the United States Joint Forces Command (JFCOM). The purpose of ACTD is to exploit mature and maturing technologies and rapidly transit new capability to address military problems, while JDSR aims to establish a common tele-maintenance environment to improve the efficiency of field military services to support war fighters.

The operational concept of JDSR is to provide near real time maintenance solutions in an operational fighting environment to enhance situational awareness of platforms and weapon systems operational status for the joint task force commander. This common Joint Service tele-maintenance capability is achieved through the use of advanced commercial technologies integrated with the Services' ongoing development initiatives to provide four integrated functions: remote collaboration, information/knowledge sharing, remote weapon/platform diagnostics, and distant maintenance mentoring at the point of maintenance.

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EXECUTIVE SUMMARY

The Joint Distance Support and Response (JDSR) is an approved Fiscal Year (FY) 2002–2006 Advanced Concept Technology Demonstration (ACTD) initiative by the United States Joint Forces Command (JFCOM). The purpose of ACTD is to exploit mature and maturing technologies and rapidly transit new capability to address military problems. The JDSR aims to establish a common tele-maintenance environment to improve the efficiency of field military services to support war fighters by reducing equipment downtime.

The purpose of this thesis is to analyze the cost savings and the benefits of implementing the JDSR capability. This thesis will:

- Develop a recommended standard for performing business case analyses of J/ACTDs, including defining the analytic structure required in a business case report.
- Conduct the JDSR ACTD business case analysis, including a baseline analysis and extensive sensitivity analysis.

The operational concept of JDSR is to provide near real-time maintenance solutions in an operational fighting environment to enhance situational awareness of platforms and weapon systems' operational status for the joint task force commander. This common Joint Service tele-maintenance capability is achieved through the use of advanced commercial technologies integrated with the Services' ongoing development initiatives to provide four integrated functions: remote collaboration, information/knowledge sharing, remote weapon/platform diagnostics and distant maintenance mentoring at the point of maintenance.

The results of the JDSR business case analysis are as follows:

- There was a significant adoption of JDSR capability in the fleet.[1] The number of maintenance actions conducted using JDSR increased from 1,112 in FY01 to 6,453 in FY04. When this number was compared with the number of onboard maintenance actions, a significant jump, from 11% in FY01 to 111% in FY04, was observed.

[1] FY01 to FY04 Technical Assist data for West Coast Regional Maintenance Center (RMC), San Diego.

- JDSR also offered significant savings in maintenance cost. The average cost per maintenance action for the fleet with JDSR capability was $1280.55, compared with $4063.53 for the average cost per maintenance action for the fleet without JDSR capability over the period FY01–FY04.
- The JDSR cost savings varies with the type of naval platforms. In particular, JDSR benefited destroyers, submarines and amphibious assault ships with cost savings throughout FY01 to FY04.
- The base case annualized, compounded Return On Investment (ROI) is 60.7% with a Net Present Value (NPV) of $7527.5M savings and a corresponding NPV of $65.66M invested over a 10-year period from FY07 to FY16.[2]
- The break-even analysis shows that the investment will break even in FY07 with a discounted net savings of $0.9M.
- The base case annualized ROI maintains at a minimum of 59.2% when the discount rate is varied from 4% to 12%.[3]
- Sensitivity analysis indicates that the worst case annualized ROI is 2.7% when the JDSR investment is increased five times and the JDSR benefits and budget relevance are reduced by five and 10 times respectively from the baseline.

[2] FY07 is selected as the base year.

[3] Base case discount rate is set at 5% based on *Circular No. A-94 — 2006 Discount Rates for OMB.* Retrieved September 8, 2006 from http://www.whitehouse.gov/omb/memoranda/fy2006/m06-05.pdf

I. INTRODUCTION

A. PURPOSE OF THE STUDY

The Joint Distance Support and Response (JDSR) is an Advanced Concept Technology Demonstration (ACTD) initiative approved by the United States Joint Forces Command (JFCOM). The purpose of ACTD is to exploit mature and maturing technologies and rapidly transit new capability to address military problems, while JDSR aims to establish a common tele-maintenance environment to improve the efficiency of field military services and support war fighters by reducing equipment downtime. The purpose of this study is to analyze the cost savings and the benefits of implementing the JDSR capability. This thesis will:

- Develop a recommended standard for performing business case analyses of J/ACTDs, including defining the analytic structure required in a business case report.
- Conduct the JDSR ACTD business case analysis, including a baseline analysis and an extensive sensitivity analysis.

B. WHAT IS LOGISTICS AND PRODUCT SUPPORT

The first significant use of the term "logistics" came from Swiss Baron Antonie Jomini in his book, *Summary of the Art of War,* published in 1838. He defined logistics as the practical art of moving armies. The International Society of Logistics Engineers defined the term "logistics" as "the art and science of management, engineering, and technical activities concerned with requirements, design, and supplying and maintaining resources to support objectives, plans, and operations." The Joint Publication 1-02 defined logistics as "the science of planning and carrying out the movement and maintenance of forces" while Acquisition Logistics Guide defined it more generally as "getting the right thing to the right place at the right time."

Joint Publication 1-02 further explained logistics as those aspects of military operations that deal with:

- Design and development, acquisition, storage, movement, distribution, maintenance, evacuation, and disposition of materiel;
- Movement, evacuation, and hospitalization of personnel;

- Acquisition or construction, maintenance, operation, and disposition of facilities; and
- Acquisition or furnishing of services.

Essentially, logistics is a multi-disciplinary specialty that demands a systems view and spans across strategic, applied, operational, and tactical domains. Strategic logistics is probably the most explored area of logistics. Specifically, strategic logistics is the process of planning for, coordinating, and allocating the manpower, materiel, infrastructure, and services required for military needs, war production needs, and civil sector needs.[4]

Applied logistics is comprised of two phases: acquisition logistics (or logistics engineering) and operational logistics (or product support). Acquisition support is concerned with the planning and acquisition of support facilities and personnel before a system is delivered to the user. Product support, the focus of JDSR, is the package of support functions necessary to maintain the readiness and operational capability of weapon systems, subsystems, and support systems. It encompasses all critical functions related to weapon system readiness, including materiel management, distribution, technical data management, maintenance, training, cataloging, configuration management, engineering support, repair parts management, failure reporting and analysis, and reliability growth.[5] The primary objective of product support is to optimize support functions to enable maximum weapon system availability at the lowest cost. This support may be provided by organic units or commercial agencies.

Weapon systems are traditionally designed to be maintained across three levels. At each level, the level of support increases with the availability of better facilities and subject matter experts. At the Organization Level (O-Level), the maintenance of a weapon system is performed by the war fighter. The maintenance performed by the war fighter is generally limited to preventive maintenance of his weapon system or platform and the replacement of failed Line Replaceable Assembly (LRA)/Weapons Replaceable Assembly (WRA). The next Intermediate Level (I-Level) support is performed by the

[4] Defense Systems Management College. (1997). *Acquisition Logistic Guide, Third Edition*. Washington, DC; U.S. Government Printing Office.

[5] U.S. Department of Defense (DOD). (1999). *Product Support for the 21 Century*. Retrieved April 8, 2006 from Defense Acquisition University database.

supporting units that are also deployed with the operation units. At this level, the maintenance personnel is involved in a more in-depth diagnosis of the platform or weapon system failure and has the skill and tool sets to replace sub-components called Shop Replacement Units (SRUs). The final level of support, Depot Level (D-Level), occurs when the recovery of a weapon system to its operational state is beyond the scope and skills of the deployed units or the availability of certain components. Table 1 characterizes the activities performed at each of the three maintenance levels.

O-Level (Organizational)	**I-Level (Intermediate*)**	**D-Level (Depot)**
1. On equipment/system 2. Quick turnaround 3. Repair by replacement of LRA/WRA	1. Between Organizational and Depot 2. Repair by replacement of shop replacement of shop replaceable units or components	1. Overhaul/complex repair 2. System and functional responsibility 3. Production line orientation 4. Supply system support
*For Army, Intermediate includes Direct Support (DS) and General Support (GS):		
- Direct Support:	- General Support:	
Repair by replacement	Repair down to the component level	
Corps level	Echelon above corps	
High mobility	Semi-fixed facilities	
Support units supply	Supports theater supply systems	

Table 1. Characteristics of Traditional Levels of Maintenance[6]

[6] Defense Systems Management College. (1997). *Acquisition Logistic Guide, Third Edition*. Washington, DC; U.S. Government Printing Office.

C. PROBLEM STATEMENTS

There are many logistic support challenges confronting a unit that is deployed in the field. The JDSR ACTD Joint Military Utility Assessment Report dated 15 April 2005 outlined the following challenges:

1. Limited Battlefield Access to Subject Matter Experts (SME)

The multiple levels of maintenance support of weapon systems created an organizational and geographical boundary between frontline troops with the I-Level and D-Level SME. The end of the Cold War and a declining defense budget have also resulted in changes in the force structure. This led to a reduction of units providing I- and D-Level support. For instance, the General Accounting Office (GAO) reported that in the period between fiscal years 1987 and 2001, military depots were reduced from 38 to 19 and there was a corresponding reduction of depot maintenance personnel by 59 percent.[7] In the meantime, war fighters and maintainers alike faced increasingly more complicated and sophisticated platforms and systems.

2. Shortage of Highly Skilled and Experienced Maintenance Personnel

In the same report by the GAO, the number of depot-level maintenance personnel was reduced from an estimated 156,000 in fiscal year 1987 to 64,500 in fiscal year 2001. The downsizing led to an imbalance of age, skills, and experience of depot maintenance personnel. This imposed significant human capital challenges, creating a need to hire, train, and retain skilled personnel in order to retain the logistics capability. The issue was further compounded when the inefficiencies of the remaining depots and the efficiency of contracting depot's maintenance of resources were not adequately addressed while the number of depot facilities was reduced.

3. Lack of Near Real-Time Maintenance on Demand

The geographical boundary between the war fighting unit and the supporting units has been a barrier on the level of responsiveness of the supporting units. SMEs have to travel to the location of the war fighting units in order to resolve maintenance issues. The traveling time may span from days to weeks depending on the proximity of the two units.

[7] General Accounting Office. (2001). *Defense Maintenance, Sustaining Readiness Support Capabilities Requires a Comprehensive Plan*, Retrieved April 28,2006 from General Accounting Office database.

While a SME is traveling to a site to support maintenance, he becomes unavailable to other war fighting units who may require his expertise.

4 Accessibility of Information for Repair and Training

Information regarding the repair of weapon systems and platforms comes primarily from the maintenance manuals. These manuals are usually paper-based and are burdensome to bring along on a deployment. They also run the risk of becoming outdated during a prolonged deployment. Outdated maintenance manuals may lead to wasted efforts or they may aggravate the failure of the weapon systems further.

5 Retention of Corporate Knowledge and Monitoring of Equipment Recovery Status

The ability to apply lessons learned in logistics support continues to be a challenge today. For example, logistics lessons learned from Operation Desert Shield and Desert Storm and other military operations, in particular poor asset visibility, were not effectively applied to Operation Iraqi Freedom and may have contributed to the logistics problems encountered during the operation.[8] Similarly, an effective system and process to capture the diagnosis and repair of systems and to track the recovery status of systems are required for a good asset visibility, among other criteria, of a large-scale operation.

D. CASE FOR CHANGE

The Joint Vision 2010 outlined a framework for the transformation of U.S. forces to continue to achieve military dominance through the application of four operation concepts: dominant maneuver, precision engagement, full dimensional protection, and focused logistics. Focused logistics was identified as critical to realizing the other operational concepts. It was envisioned to be the fusion of information, logistics, and transportation technologies to provide responsive, flexible, and precise product support at all levels of operations.[9]

With focused logistics, product support must adapt to the needs of combat forces that are increasingly more mobile and dispersed. This means that product support must be

[8] General Accounting Office. (2003). *Defense Logistics: Preliminary Observations on the Effectiveness of Logistics Activities during Operation Iraqi Freedom*. Retrieved April 28,2006 from General Accounting Office database.

[9] U.S. Department of Defense. (1996). *Joint Vision 2010*. Retrieved April 8,2006 from http://www.dtic.mil/jv2010/jvpub.htm

performed in a matter of hours or days instead of weeks or months. The current DOD product support infrastructure and processes have been optimized to meet the military operations of the twentieth century, which operated primarily within well-defined battle lines. These infrastructures and processes were conceived during a period of relatively slow and expansive transportation and limited communication and information sharing capabilities. As a result, the product support concept features several levels of inventory and maintenance to deliver service support to war fighters as described in Section B.

The rapid rate of changes due to technological advances, the wider access to modern weaponry, and the emergence of terrorism and asymmetric warfare will create a vastly different battle space in the twenty-first century. The challenges brought about by the external environments are coupled with an internal pressure to do more for less, with a declining budget and a scaling down of personnel. To meet these challenges, U.S. forces will need to be highly agile and mobile. For example, under the next DDX destroyer program, the DDG 1000 Zumwalt is designed to triple the existing naval surface fire coverage and anti-ship cruise missile capabilities with a reduced crew of 150 (threshold) versus the traditional 350 crew members for destroyers.[10] To adequately support the U.S. forces of the future, the present logistics operations will also need to undergo transformation, in step with operational changes, to be highly responsive, lean, and reliable. In summary, the future logistics system must be capable of delivering product support on demand.

E. RESEARCH METHODOLOGY, LIMITATIONS, AND ASSUMPTIONS

To achieve the purpose outlined in Section A, the author would conduct a literature review on business case writing and recommend an analytic structure for performing business case analysis. Next the author would develop the JDSR business case analysis using the suggested structure. In addition, the author would also conduct an analysis of the fleet data recorded during the JDSR demonstration phase. Finally, this thesis would report on the results of the JDSR business case analysis and make relevant recommendations for decision makers.

[10] GlobalSecurity.org. (2006). *DDG-1000 Zumwalt / DD(X) Multi-Mission Surface Combatant*, Retrieved August 18, 2006 from http://www.globalsecurity.org/military/systems/ship/dd-x-specs.htm

The comprehensiveness of the business case analysis presented in this report was limited to the data available to the author.

The follows assumptions were made during the conduct of the analysis:

- The key functional areas of a maintenance operation are generic although each service has its respective unique maintenance operations and processes.
- The cost savings derived from the business case analysis based on the data available from a service or system can be applied across services and systems within reasonable assumptions.
- A conservative approach is adopted for the business case analysis. That is, when there is a choice between higher and lower costs, the higher cost will be used for the analysis. Similarly, when there is a choice between higher and lower benefits, the lower benefit will be used for the analysis.

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II. BACKGROUND

A. BRIEF HISTORY OF TELE-TECHNOLOGY

Traditionally, telephony, broadcasting and computer applications offered separate and distinct services. These services were also regulated by different regulators. In recent decades, developments in telecommunications and computing technologies include fiber optics, satellite technologies, network topology, file sharing and the internet. These innovations coupled with the convergence of telecommunications and information technologies ushers a new era where voice, data and images are combined to offer a wide range of applications and services. For example, new generation of mobile phones are now capable of capturing and transmitting video images. Similarly, the internet is no longer limited to emails, and is capable of offering voice, data and interactive multimedia services.

Tele-maintenance can be defined as the science of maintaining equipment across geographical distances with the aid of telecommunications and information technologies. It has its intellectual roots in telemedicine. The first application of telemedicine was initiated by National Aeronautics and Space Administration for the space exploration programs in the 1960s.[11] It was driven by the motivation to provide health care to the astronauts during their space missions. As such, physiological information about the astronauts was transmitted from both the spacecraft and from their space suits to the ground control center.

With the motivation to enhance operational readiness, reduce the logistics footprints and improve maintenance responsiveness, each Service has developed its own early experiments in tele-maintenance capabilities.[12] These experiments are briefly outlined as follows:

[11] Kirk Lorne Buker. (1997). *Technological and Economic Assessment of Telemedicine: An example of DOD MEDNET in Region Three*. Retrieved October 26, 2006 from Naval Postgraduate School Electronic Library.

[12] D. M. Cutter (2000). *Telemaintenance as a Process to Increase Maintenance Effectiveness and Efficiency.* Retrieved April 8, 2006 from http://www.acq.osd.mil/log/mrmp/AG_meeting_minutes.htm

1. The Army

The Army has set up a Tele-maintenance Integrated Product Team to identify and develop prototypes, and to conceptualize operational concepts for tele-maintenance. Two major initiatives are illustrative of the Army's tele-maintenance efforts:

- The Collaborative Communications Technology project aims to establish a real-time, wireless system that will enable a field soldier to access to SMEs, OEMs and depots. The system is also capable of providing electronic manuals, maintenance records, part inventories, and includes features such as video conferencing and a chat room with a blackboard.
- The Patriot Integrated Diagnostics Support System (IDSS) utilizes multiple connection links to geographically distant SMEs to provide more capability during repair. The overall IDSS evaluation demonstrated that integrating the basic building blocks of personal computers, test equipment, and communications provide a framework for effective system support and low-cost growth of additional capabilities.[13]

2. The Navy

The Navy has a unified Distance Support Anchor Desk plan led by Naval Sea Systems Command and Naval Supply Systems Command. The initiatives outlined in the Distance Support Anchor Desk plan are focused on shipboard workload reduction, fleet support process streamlining and infrastructure development. These initiatives include:

- The Integrated Call Center in Norfolk that offers one-stop telephone service for all types of Fleet logistics requests.
- The Telogistics demonstration project to support the needs of mine warfare community.
- The Video Tele-maintenance project to minimize technical assistance visits for down equipment.
- The Sailor-to-Engineer initiative to provide fleet access to the updated maintenance procedures, technical document and drawings.
- The Integrated Condition Assessment System designed to provide online monitoring of machinery health condition for failure avoidance, failure analysis and remote assistance.

In addition, the Naval Air Systems Command led the Joint Aviation Technical Data Integration (JATDI) program. The JATDI is an integrated data environment that enables war fighters and maintenance specialists to access technical, supply and maintenance information from corporate databases worldwide.

[13] J.O. Mclinnaham, & D.G. Beeler (2003). *Patriot IDSS Program Technology at Redstone Arsenal.* Retrieved October 28, 2006 from http://www.dau.mil/pubs/pm/pmpdf03/may/mcc-m-j03.pdf

3. The Air Force

The Air Force also has several tele-maintenance initiatives even though there was no lead agency established formally. The initiatives include:

- Video connectivity for aircraft damage assessment
- F-22 aircraft Integrated Maintenance Information System to provide a single source, paperless, inter-networks maintenance information.

In 1999, DOD charted an implementation strategy as part of the continued efforts in acquisition and logistics reform in the report Product Support for the 21st Century. It specified the direction to transform weapon system support processes by leveraging and expand on commercial and government best practices. The implementation plan consisted of four areas:

- Reengineer the Product Support Process Staring with the War Fighters
- Competitively Source Product Support
- Modernize through Spares
- Greatly Expand Prime Vendor and Virtual Prime Vendor

B. ADVANCED CONCEPT TECHNOLOGY DEMONSTRATION (ACTD)

The ACTD was conceptualized in 1994 to expedite the acquisition and transition of mature or maturing technologies to war fighters. The focus of ACTD was technology assessment and integration rather than technology development. To do this, ACTD provides prototypes for war fighters to assist them in the evaluation of the proposed capability via military exercises at a reasonable scale to assess its military utility. The impetus for such a program was a declining budget, changes in threat environment, and the need to rapidly introduce new capabilities because of an accelerated pace of technology development.

ACTD has also proven to be an important platform for addressing joint needs. Priority was given to ACTD that could provide joint capability and that could fulfill the operational concepts of dominant maneuver, precision engagement, full dimensional protection, and focused logistics outlined in Joint Vision 2010. JDSR is an example of an ACTD initiative developed to address the operational concept of focused logistics.

The selection criteria of ACTD projects are listed according to the following guidelines[14] :

- The timeframe for completing the evaluation of military utility is typically 2–4 years.
- The technology should be sufficiently mature.
- The project provides a potentially effective response to a priority military need.
- A lead service or agency has been designated.
- The risks have been identified, are understood, and accepted.
- Demonstrations or exercises have been identified that will provide an adequate basis for the utility assessment.
- Funding is sufficient to complete the planned assessment of utility and to provide technical support for the first two years of fielding of the interim capability.
- Developer is ready to prepare a plan that covers all essential aspects such as affordability, interoperability, sustainability, and capability of evolving as the technology and threat change.

C. JOINT DISTANCE SUPPORT AND RESPONSE (JDSR)

JDSR is an approved Fiscal Year (FY) 2002–2006 ACTD. With logistics identified as a key pillar of modern war fighting capability, JDSR aims to address the logistics challenges outlined in the introduction by establishing a common and interoperable Joint Service tele-maintenance capability. This project initiative was approved by the United States Joint Forces Command (JFCOM) with the executive program oversight provided by Deputy Under Secretary of Defense (Advance Systems and Concepts) and the program service lead and technical management provided by the Naval Sea Systems Command (NAVSEA).

The operational concept of JDSR is to provide near real-time maintenance solutions in an operational fighting environment to enhance situational awareness of platforms and weapon systems for the joint task force commander. This common Joint Service tele-maintenance capability is achieved through the use of advanced commercial

[14] Office of Under Secretary of Defense for Acquisition, Technology, & Logistics. (2006). *ACTD Guidelines: Formulation, Selection and Initiation.* Retrieved May 6, 2006 from http://www.acq.osd.mil/actd/formulat.htm

technologies integrated with the Services' ongoing development initiatives to provide four integrated functions: remote collaboration, information/knowledge sharing, remote weapon/platform diagnostics, and distant maintenance mentoring at the point of maintenance.

The JDSR architecture is shown in Figure 1. It is comprised of a Local Maintenance Network (LMN) and the Joint Support Network (JSN). The LMN can be designed to meet the unique fielding requirements of each Service while the JSN can be shared as a joint infrastructure and capability.

The LMN includes a secured Local Maintenance Server (LMS) that can interface with JDSR mobile computing tools such as a digital camera, laptops, and a software suite. It serves as a communications hub to interface with local and wide-area networks, to manage content, and to control the information flow between maintainer and SME. The LMS can also be configured for deployment scenarios with limited bandwidth availability or for base operations where bandwidth limitations are not an issue.

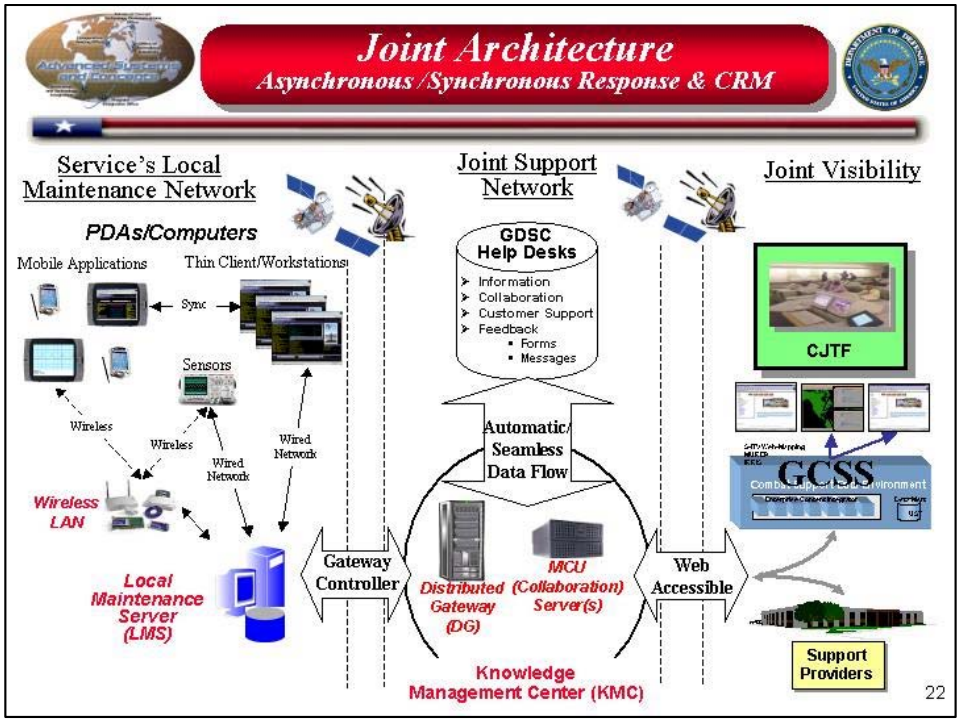

Figure 1 JDSR System Architecture [15]

The JSN comprises of two subsystems known as Knowledge Management Center (KMC) and the Global Distance Support Center (GDSC) or help desk. The KMC consists of a Distributed Gateway (DG) and SME Support Network (SME-SN). The DG serves as a channel for data, transactions, and collaboration among user communities of JDSR. It is the point of entry and exit from the LMN to the support providers. It also serves as a collection point of maintenance actions for knowledge mining and sharing among the maintenance community and facilitates the conversion of data to readiness information for display or interface into the Joint Force Commander's command and control system. The SME-SN consists of a collaboration server with a Microsoft operating system and its associated collaboration software. SME gains access to the network for collaboration or posting of information to the LMN sever via JDSR website.

The Global Distance Support Center (GDSC) is a global help desk facility configured with customer relations software and is the source of the support matrix directory database. It is supported by Distance Support, NAVSEA and is made up of Department of Defense, Service, and Original Equipment Manufacturer (OEM) support

[15] E. Brown (2005). *Business Case Analysis, Joint Distance Support and Response ACTD.*

providers. The OEM support providers can be located anywhere from factories, depots, and program management offices to deployed sister units or direct support maintenance activities.

With the above architecture, JDSR is designed to provide the six primary capabilities: distance maintenance, bandwidth management, electronic documentation, training, increased knowledge base, and situation awareness. The system is capable of providing users with audio and text messages for collaboration. It also enables SME to view the maintenance problem using still or video images. For users with limited bandwidth, JDSR leverages a commercial adaptive compressive algorithms and integrated bandwidth management software to facilitate near real-time collaboration. In addition, JDSR also allows the operational users to access technical orders electronically by exploiting existing Service systems. With the system capturing the solutions to the maintenance issues encountered by the operational users, lessons learned can be shared among the network users to support training or trend analysis. Lastly, JDSR will provide Joint Task Force commanders with greater situation awareness on the maintenance status of major equipment to aid better decision making.

In summary, the capabilities of JDSR are illustrated in Figure 2 with a concept of operations that connects the users, maintainers, SME, program office and the OEM.

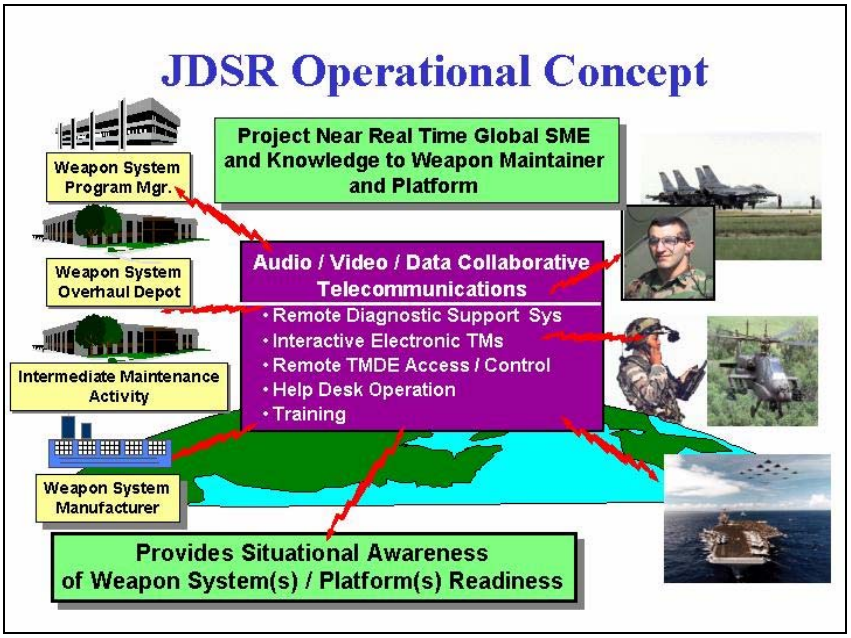

Figure 2. JDSR Operational Concept and Capabilities

D. BUSINESS CASE ANALYSIS (BCA)

A Business Case Analysis (BCA) is an important financial tool that helps decision makers to evaluate alternative approaches and to decide on the allocation of scare resources. It is a structured and systematic methodology that examines and compares the cost and benefits of alternatives on a level playing field. BCA is an all-purpose, commonly used term and is also known by other titles, such as Cost-Benefit Analysis, Economic Analysis, Cost-Effectiveness Analysis, and Cost-of-Ownership Analysis, among others. The purpose of this section is to describe a standardized approach for performing a J/ACTD business case analysis.

The BCA framework is an iterative process that is updated as the business and mission environment changes. It consists of the following elements:

- State objectives of the action being considered.
- Specify assumptions and constraints.
- Identify possible alternatives including status quo.
- Estimate costs and benefits of each alternative.
- Conduct sensitivity, uncertain and risk analysis.
- Draw conclusion and make recommendations.

The ability to make a good decision for the acquisition of a technology and capability is largely dependent on the ability to conduct a sound and reliable BCA. Hence, a sound and reliable BCA will aid decision makers in enhancing the war fighting capability of the forces and prevent unnecessary waste of valuable resources on peripheral capabilities. A sound and reliable BCA is an unbiased and objective analysis of the financial consequences of the various alternatives. It is based on facts, reasonable assumptions, and sound financial principles with its conclusions traceable whenever possible.

Each BCA is unique and has its own set of assumptions, constraints, risks, and environment. Hence, good judgment is required to tailor the proposed BCA methodology to match each particular situation. A BCA methodology can be described as a 4-phase process shown in Figure 3.[16]

[16] Defense Acquisition University. (2006). *Business Case Analysis*, Retrieved April 8, 2006 from https://acc.dau.mil/CommunityBrowser.aspx?id=32524

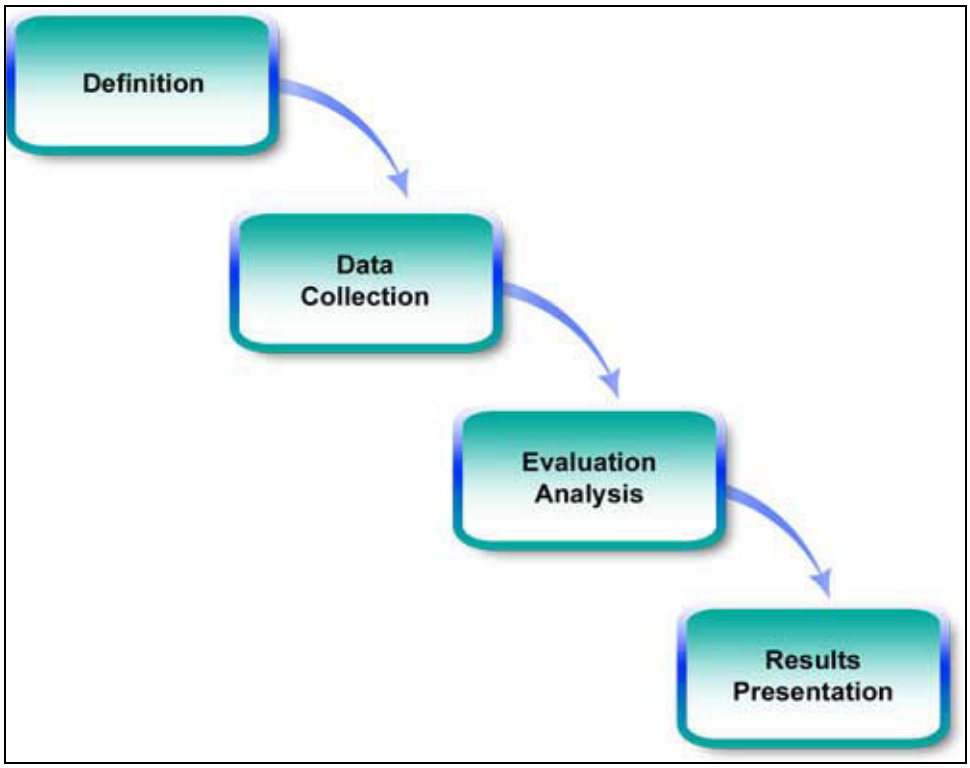

Figure 3. Business Case Analysis Process

1. Definition

In phase 1, the objective and scope of the analysis is defined along with the assumptions and constraints. Potential alternative solutions, including preserving the status quo, are also explored and determined for the analysis.

2. Data Collection

In phase 2, a plan is created for data collection. The plan will specify the types of data required, the potential data sources, and the approaches to obtain these data. In situations where the required data are not available, an estimate is made with the approach for calculating the estimate clearly explained and documented. Upon the completion of data collection, the data is examined for consistency and anomalies. Thereafter, the data are normalized to support "apple to apple" comparisons, such as adjustment for inflation/deflation to account for the time value of money.

3. Evaluation Analysis

The actual BCA computation occurs in this phase. Each alternative is compared against the baseline, which is the status quo, to determine the one that offers the best value. It is also important that the risks associated with each alternative are examined

along with the potential risk mitigation strategies for each identified risk. In addition to risk analysis, a sensitivity analysis must also be conducted. Sensitivity analysis aims to provide insights to the BCA results if the input parameters change or if assumptions change or are proven invalid.

4. Results Presentation

In this phase, the BCA results are summarized into appropriate graphs and tables for representation to the decision makers. The presentation should include key information outlined in phases 1, 2, and 3. Last but not least, the conclusion and recommendations for a suitable course of action are made with respect to the objectives defined in phase 1.

III. JDSR BUSINESS CASE ANALYSIS

A. WORK BREAKDOWN STRUCTURE OF JDSR

The Work Breakdown Structure (WBS) is a hierarchical tree structure that defines and integrates the various tasks of a project. The Department of Defense Handbook, MIL-HDBK-881A, defines it as :

> A WBS displays and defines the product, or products, to be developed and/or produced. It relates the elements of work to be accomplished to each other and to the end product. In other words the WBS is an organized method to breakdown a product into subproducts at lower levels of detail.

There are several benefits of a WBS. It assists in clarifying the relationship among the elements of work to be accomplished. It is effective in project planning and management. It helps to keep track of project status, such as engineering efforts, resource allocation, cost estimates, expenditures, and both technical and cost performance. Lastly, it provides a commonality for integrated program assessment of cost, schedule and technical performance, and its associated risks.

The top level WBS of JDSR comprises two components. The basis of the estimate for these components is derived from the document Business Case Analysis– JDSR ACTD, dated October 30, 2005. The total investment and O&S cost estimated for the JDSR program is given in Table 2. The two top-level WBS components are:

1. Investment

The investment for JDSR is primarily on the infrastructure and the effort to develop, integrate, and certify the capability with existing system. The infrastructure includes the set-up of a help desk, server hubs, gateway, and licenses for supporting software.

2. Operations and Support (O&S)

The O&S cost would include the cost per year to refresh and sustain the tele-maintenance capability. For the business case analysis, all sunk cost will not be considered.

	FY07	FY08	FY09	FY10	FY11	Total
Investment– Distance Support	9.0	9.6	8.3	4.4	4.1	35.4
Investment– Support Systems Development	0.3	1.2	1.4	1.5	1.7	6.1
O&S– Recurring Cost	3.32	3.32	3.32	3.32	3.32	16.6
Total	12.62	14.12	12.52	13.62	9.12	58.1

Table 2. JDSR Investment and O&S Cost (Then Year, $M)

B. ANALYSIS OF FLEET DATA

The FY01 to FY04 Technical Assist data for West Coast Regional Maintenance Center (RMC), San Diego, was provided by Ms. Laprevotte, Supervisory Program Analyst for MARMC Financial Analysis Division. The data included onboard maintenance cost and counts as well as JDSR maintenance cost and counts. The "counts" represented individual technical assist/maintenance actions or "incidents of repair." The cost columns were the total costs for all the technical assists on each hull. These costs could be civilian labor costs, travel costs, contract costs, and "farm out" costs. Military personnel in the RMC also provide technical assists, but the RMC system did not capture the "labor" costs associated with their effort. These data are included in Appendix A.

The graph in Figure 4 shows the adoption rate for JDSR from FY01 to FY04. It is developed based on the data provided, and the following observations are made:

- There was a significant adoption of JDSR capability in the fleet.
- The number of maintenance actions conducted using JDSR had increased from 1,112 in FY 01 to 6,453 in FY04.
- The percentage of JDSR versus onboard maintenance actions saw a significant jump from 11% in FY01 to 111% in FY04.

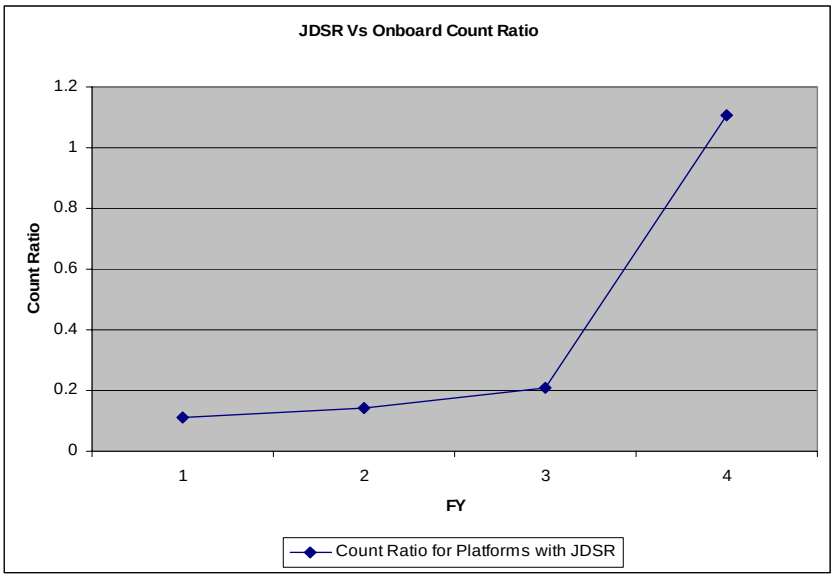

Figure 4. Adoption Rate of JDSR Capability in RMC West Coast

Next, the average cost per count associated with and without the use of JDSR was computed for FY01 to FY04 and tabulated in Table 3. The results show that JDSR also offered significant savings in maintenance cost. The average cost per maintenance action for the fleet with JDSR capability was $1280.55 compared with $4063.53 for the average cost per maintenance action for the fleet without JDSR capability over the period FY01–FY04.

Fiscal Year	Average Cost per Count with JDSR Capability	Average Cost per Count without JDSR Capability	Savings	Percentage Savings
FY01	$1347.55	$1589.30	$241.75	15.2%
FY02	$1302.79	$1583.11	$280.32	17.7%
FY03	$1198.95	$5607.34	$4408.39	78.6%
FY04	$1272.91	$7474.35	$6201.44	83.0%
Average	$1280.55	$4063.53	$2782.98	68.5%

Table 3. Average Cost per Count With and Without JDSR

Specifically, the average cost per maintenance action for the fleet with JDSR capability was $1347.55, compared with $1589.30 for the average cost per maintenance action for the fleet without JDSR capability in FY01. Hence, a savings of 15% was registered for the platforms that were equipped with JDSR in FY01. In FY04, average cost per maintenance action with JDSR capability was $1272.91, compared with $7474.35 for the fleet without JDSR capability. This corresponded to a savings of 83%. Figure 5 displayed the percentage savings due to JDSR from FY01 to FY04.

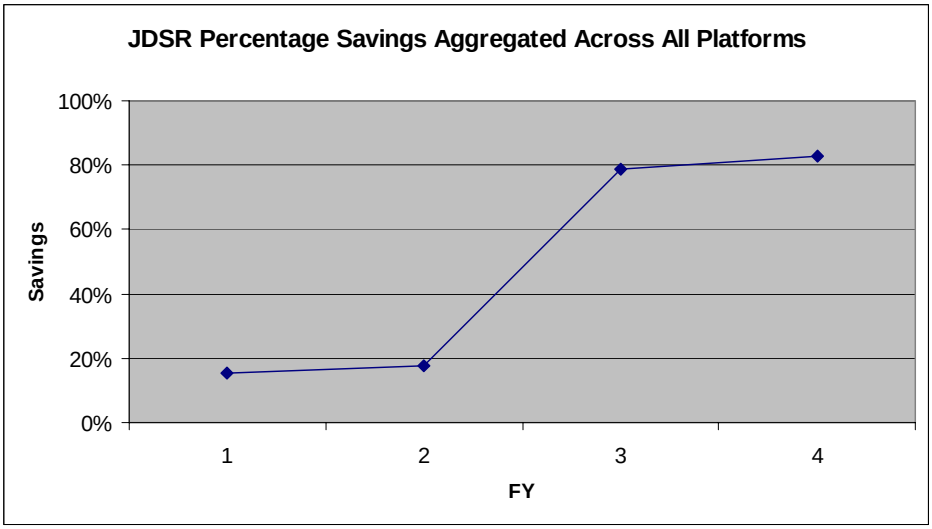

Figure 5. JDSR Percentage Savings Aggregated Across All Platforms

Figure 6 displays the results by platform type; the individual bars have the following meaning:

- JDSR Cost/Count—The average of all maintenance costs accomplished using JDSR on a particular platform type, by fiscal year.
- Onboard Cost/Count with JDSR deployed—The average of all maintenance costs accomplished onboard on a particular platform type with JDSR capability, by fiscal year.
- Onboard Cost/Count without JDSR deployed—The average of all maintenance costs accomplished onboard on a particular platform type without JDSR capability, by fiscal year.

From the diagram, it is observed that the JDSR cost savings varies with the type of naval platforms. In particular, JDSR benefited destroyers, submarines, and amphibious assault ships with cost savings throughout FY01 to FY04. However, there are instances

where the cost per maintenance actions did not improve for platforms such as aircraft carriers and frigates. Consultation with the SME (Subject Matter Expert), Mr. Elijah Brown, Operational Manager, USJFCOM CFFC, explained that cost peaks using JDSR were not uncommon, but should not be a frequent occurrence. These could be attributed to reasons such as learning curve of new users, high volume of maintenance problems along with network issues, process issues, or priority in bandwidth usage. It is also possible that due to the small fleet of carriers and frigates, a bad year in maintenance may skew the cost per maintenance actions on an aggregate level.

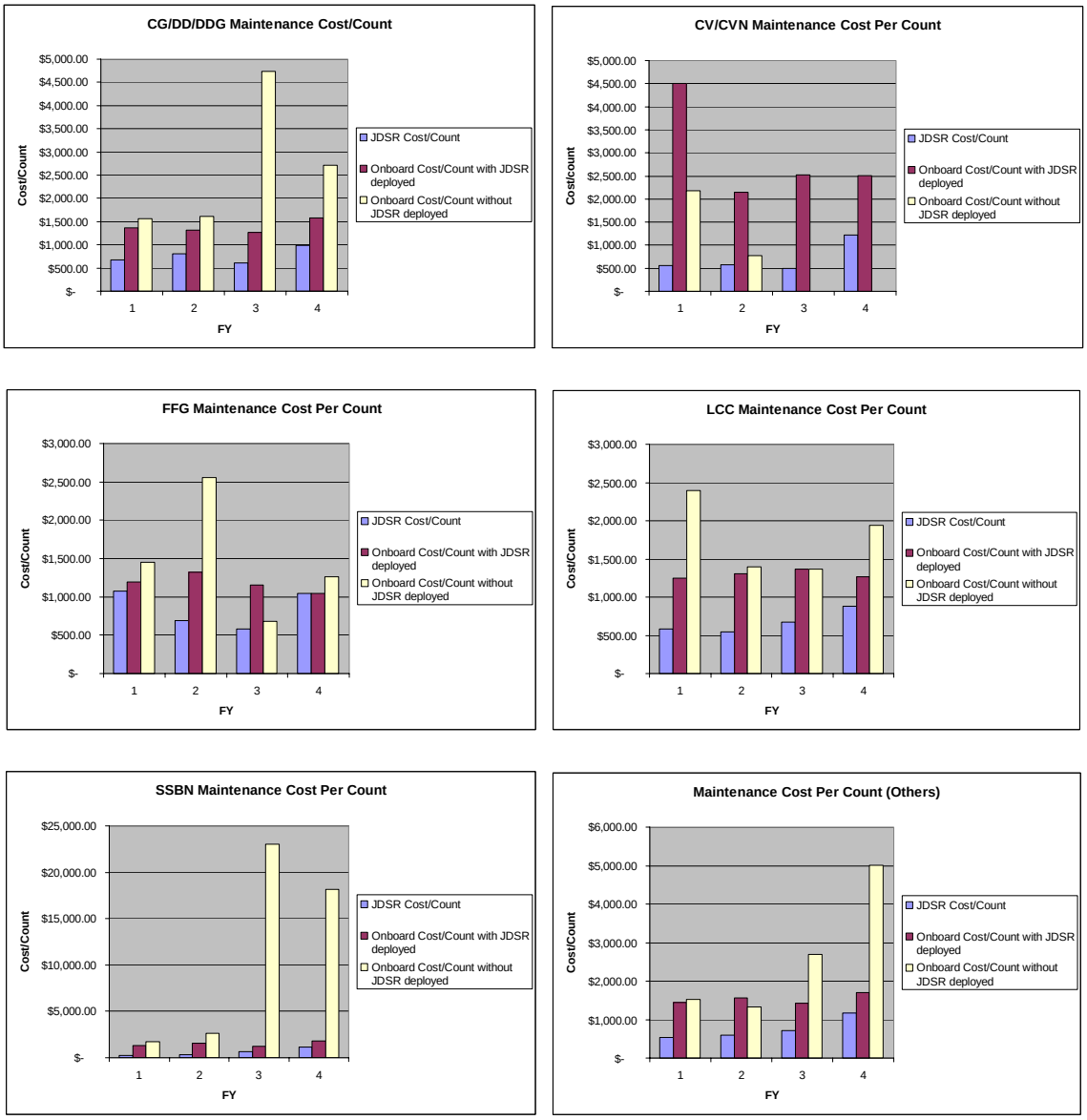

Figure 6. JDSR Percentage Savings in Cost Per Maintenance Actions

C. RETURN ON INVESTMENT

The approach for the Return On Investment (ROI) analysis was to establish a base case with the quantitative benefits that could be attributed to the implementation of JDSR and the relevance of the Navy defense budget.

1. Base Case–Benefits

A summary of JDSR quantitative benefits is listed in Table 4. For the base case, the following JDSR quantitative benefits are considered:

- JDSR can reduce the logistic footprint by a factor of 0.9 as technical manuals no longer need to be transported via 8-square-foot boxes. Instead, users will only need to transport a 0.8-square-foot computer. This assessment is made based on the report Business Case Analysis, JDSR ACTD, 2005.
- JDSR can also reduce the cost for printing, mailing, and storing the technical manuals. The JATDI Validated Rough Order of Magnitude Business Case Analysis reported a cost saving of $6.6M per year from a budget of $7.7M, which was about a factor of 0.9.
- The contributions towards the reduction in maintenance cost through SME collaboration was on average 0.49 based on the FY01 to FY04 Technical Assist data across all platform types.
- JDSR reachback capability to resolve maintenance issues can also reduce the cost of travel by a factor of 0.5. Data collected during the demonstration by JDSR indicated that up to 80% reduction in travel cost per year could potentially be achieved. This assessment is made based on the report Business Case Analysis, JDSR ACTD, 2005.
- The ability to reduce the mean time to repair (MTTR) of weapon systems or platform can potentially reduce the number of spares required to maintain the same level of operational availability. The number of spares required for a system is a non-linear function of the number of systems, its MTTR, and transportation and administrative time for the particular spare. Upon consultation with SME, Prof. Keebom Kang, Associate Professor of Logistics, Naval Postgraduate School, it is advised that any reduction in MTTR with respect to the transportation time has little or no impact on spares provisioning. As an illustration, a MTTR reduction of 50% from 10 hours to 5 hours has little impact on the level of operational availability if the transportation turnaround time is 30 days. Hence, JDSR can potentially reduce inventory cost at the I-Level maintenance facility where the transportation turnaround time is comparable with MTTR. A study conducted by the author using a simulation model developed by Prof. Kang showed that the only driving factor for spares is MTBF (Mean Time between Failures) of a weapon system. Please refer to Appendix B for the

detailed report. Nevertheless, a cost reduction factor of 0.1 is assumed to be applicable for spares purchase for I-Level and O-Level support in the base case.

Description of JDSR Benefits	Quantitative Factor
Reduction of logistic footprint	0.9
Reduction in printing cost	0.9
Reduction in maintenance cost	0.49
Reduction in TDY cost	0.5
Reduction in spares	0.1

Table 4. Summary of JDSR Quantitative Benefits

2. Base Case–Budget Relevance

Next, the FY07 Department of Navy budget was reviewed to identify the relevant budget activity and line items that can potentially result in cost savings with the implementation of JDSR capability. Upon consultation with Mr. Kevin Little, Deputy Comptroller at NPS, it was assessed that Budget Activity 1 (BA1) – Operating Forces are most appropriate to attribute the benefits of JDSR. Next, the appropriate activity groups under Budget Activity 1 were reviewed and the relevant activity groups are identified as:

- 1A1A – Mission and Other Flight Operations
- 1A3A – Intermediate Maintenance
- 1A4A – Air Operations & Safety Support
- 1A4N – Air System Support
- 1A6A – Aircraft Depot Operations Support
- 1B1B – Mission and Other Ship Operations
- 1B2B – Ship Operational Support and Training
- 1B4B – Ship Maintenance
- 1B5B – Ship Depot Operations Support
- 1C1C – Electronic Warfare
- 1C6C – Combat Support Forces

- 1C7C – Equipment Maintenance
- 1D1D – Cruise Missile
- 1D2D – Fleet Ballistic Missile
- 1D3D – In-Service weapons Systems Support
- 1D4D – Weapons Maintenance

The total estimated budget that may enjoy the benefits of JDSR is summarized in Table 3. Detailed information of BA1, FY2007 Department of Navy budget is available at the Department of Navy Financial Management and Comptroller website, http://www.finance.hq.navy.mil/fmb/07pres/OPS.htm.

Budget Activity 1 – Operating Forces from FY2007 Department of Navy budget			
Sub-Activity Group ($M)	**FY05**	**FY06**	**FY07**
Travel	169.8	80.7	84.2
Equipment Purchases	600.9	599.0	630.8
Printing and Reproduction	7.1	4.3	6.1
Equipment Maintenance by contract	615.2	584.9	746.9
Engineering and Technical Services	63.1	42.4	38.7
Transportation	461.1	43.4	51.3

Table 5. Estimated Budget that Could Benefit from JDSR Implementation (in $M)

3. Base Case–ROI

The base case ROI is computed over a period of 10 years from FY07 to FY16, with FY07 as the base year. A 3-year moving average is used to estimate the budget from FY08 to FY16. As for the cost of JDSR investment, only the recurring cost is applicable from FY12 to FY16 as the program would have completed. The budget appropriation/cost element is based on Operations and Maintenance (Purchases) and the discount rate factor is 5%.[17] This factor is in accordance with the instruction from Office of Management and Budget, which instructs U.S. government investment analyses to use

[17] Office of Management and Budget. (2006). *Circular No. A-94 — 2006 Discount Rates for OMB.* Retrieved September 8, 2006 from http://www.whitehouse.gov/omb/memoranda/fy2006/m06-05.pdf

a discount factor equal to the interest rate on U.S. Treasury notes whose duration equals the duration of the investment being analyzed. The annualized ROI is computed using the formula:

$$ROI = \{\text{Net Present Value of Savings/Net Present Value of Investment}\}^{1/10} - 1$$

A Net Present Value (NPV) of $7527.5M savings can be gained for over a 10-year period with a corresponding NPV of $65.66M invested. The return on investment is found to be 11,463.8%, or about 60.7% annual, compounded ROI.

Base Case Annualized ROI = 60.7%

D. SENSITIVITY ANALYSIS

A sensitivity analysis is a process of varying the input parameters of a model over a reasonable range and observing the relative change in the model output. The purpose of the sensitivity analysis is to determine the sensitivity of a model result to uncertainty in the input data. It is an important method to check the quality of a given model and its robustness with respect to changes in input parameters. For the purpose of this study, a sensitivity analysis was conducted by varying the following factors:

- Discount Rate—This factor was varied from 4% to 12% because a large discount rate will reduce the potential benefits of JDSR.
- Investment—This factor was varied from 1 to 5 because a larger investment will reduce the potential benefits of JDSR.
- Budget Relevance—This factor was varied from 0.1 to 1.0 because a lower budget will result in a lower annualized ROI.
- JDSR benefits—This factor was varied from 0.2 to 1 because a lower JDSR benefit will translate to a lower savings.

Figure 7 and 8 shows the discount rate and break-even analysis respectively. From Figure 7, the annualized ROI maintains at a minimum of 59.2% with the discount

rate varied from 4% to 12%. The break-even analysis in Figure 8 also shows that the investment would break even in FY07 with a discounted net savings of $0.9M.

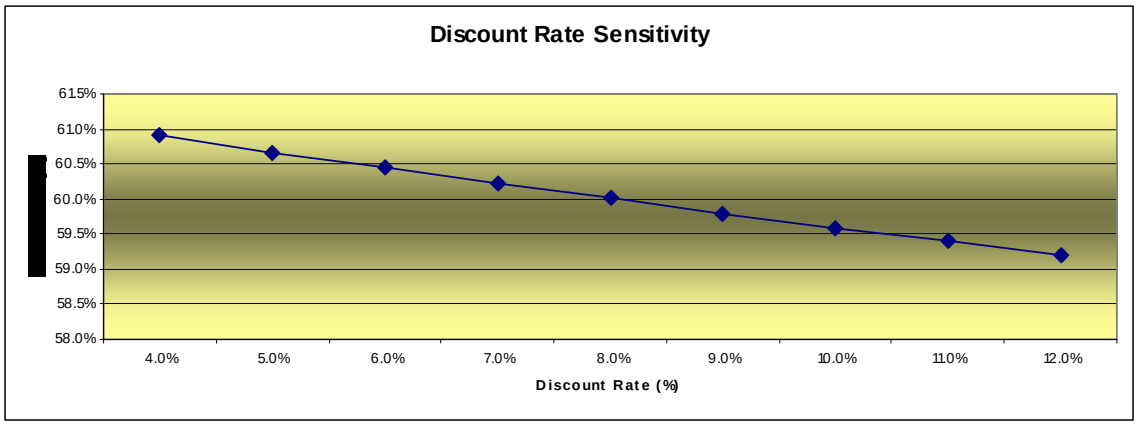

Figure 7. Discount Rate Analysis

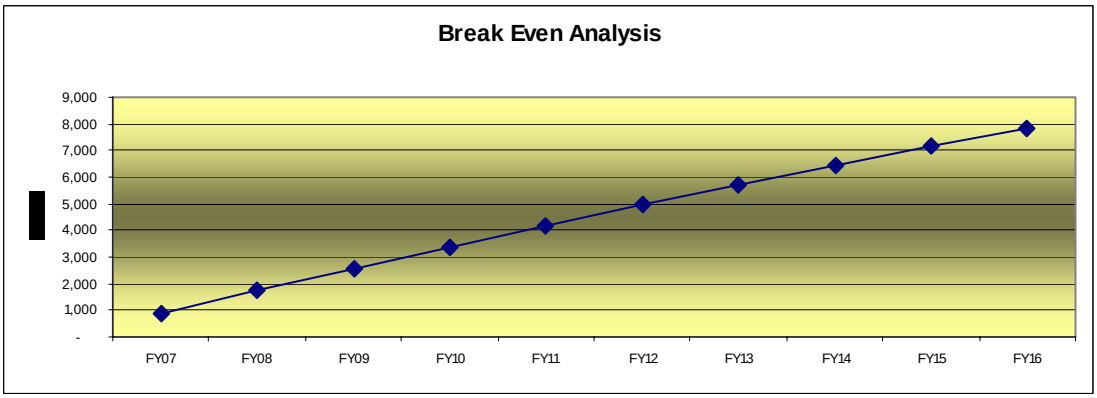

Figure 8. Break Even Analysis

Next, a sensitivity analysis was conducted to better understand the relationship of the annualized ROI with respect to budget relevance, JDSR investment, and JDSR benefits. In the base case, it is assumed that the total estimated budget in BA1 is subject to savings achievable with JDSR. The term "budget relevance" is coined to capture this idea, and the base case for budget relevance was set at 100%. Specifically, the total JDSR investment of $41.5M was increased by a factor of one to five times while the total budget relevance was decreased by as much as 10 times. Five plots of annualized ROI have been generated as the quantitative JDSR benefits decreased from 1.0 to 0.2. These plots are shown in Figures 9, 10, 11, 12, and 13.

In Figure 9, when the JDSR benefits factor remains unchanged, the annualized ROI ranges from 8.7% to 60.7% as the JDSR investment is increased by five times and the budget relevance is reduced by 10 times.

As the JDSR benefits factor was reduced by 20% each time, it was observed that the range of annualized ROI is reduced correspondingly. The results show that the worst case annualized ROI is 2.7%, when the JDSR investment is increased five times and the JDSR benefits and budget relevance are reduced by five and 10 times respectively from the baseline. From this sensitivity analysis, we can confidently conclude that JDSR will result in positive returns and is a project that is worth implementing.

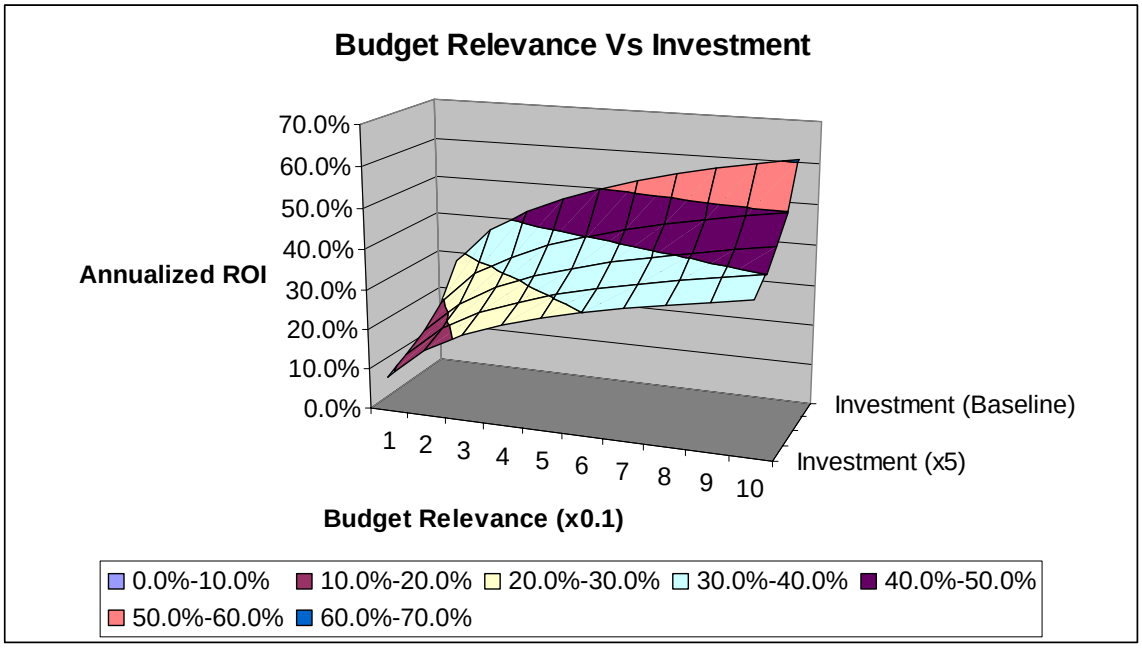

Figure 9. Sensitivity Analysis with JDSR Benefits Factor Equals 1.0

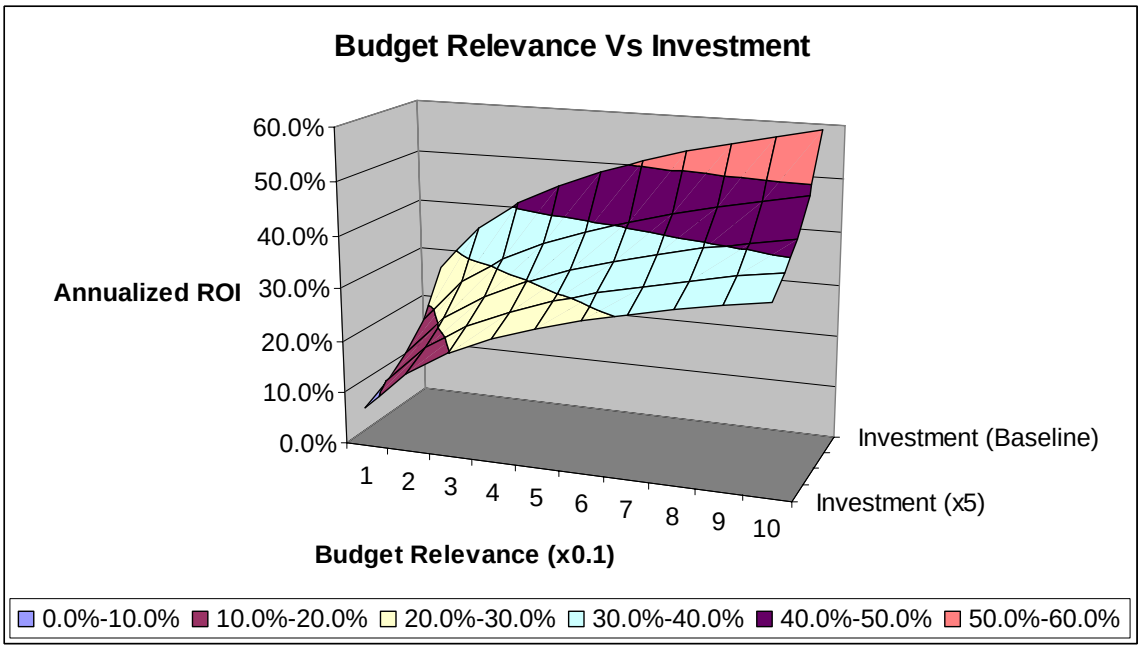

Figure 10. Sensitivity Analysis with JDSR Benefits Factor Equals 0.8

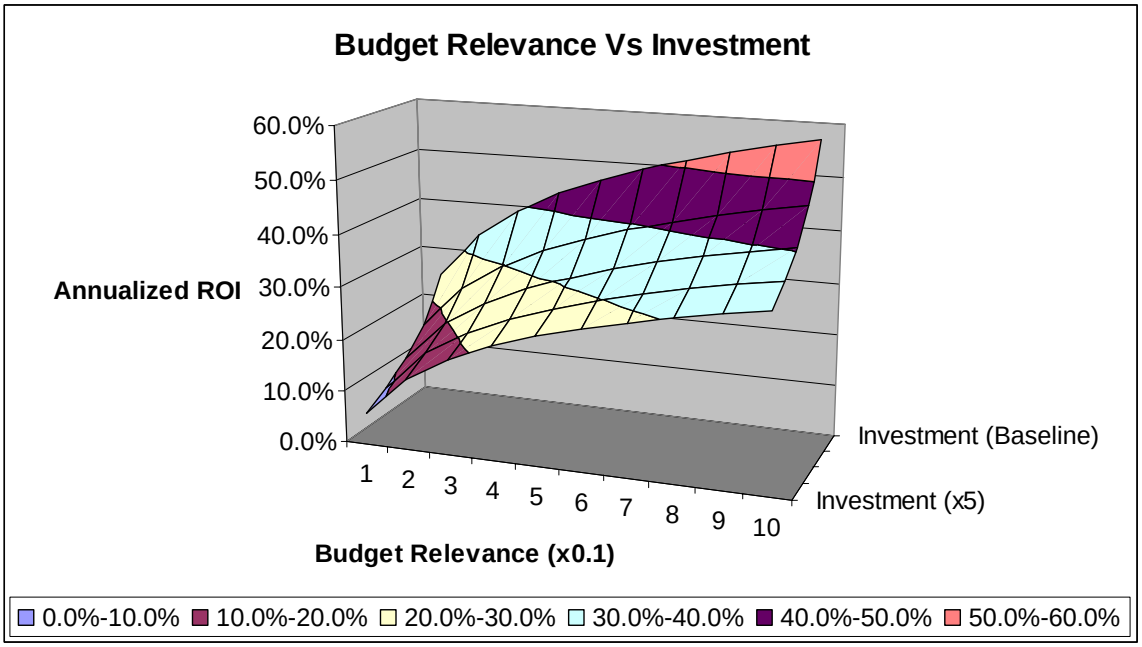

Figure 11. Sensitivity Analysis with JDSR Benefits Factor Equals 0.6

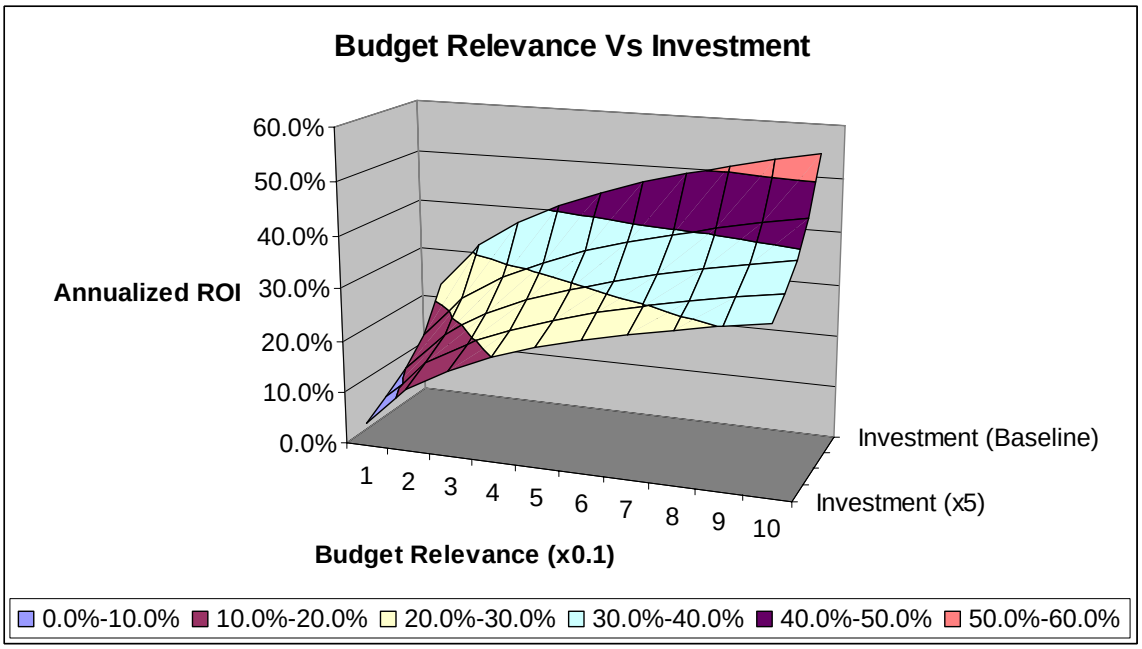

Figure 12. Sensitivity Analysis with JDSR Benefits Factor Equals 0.4

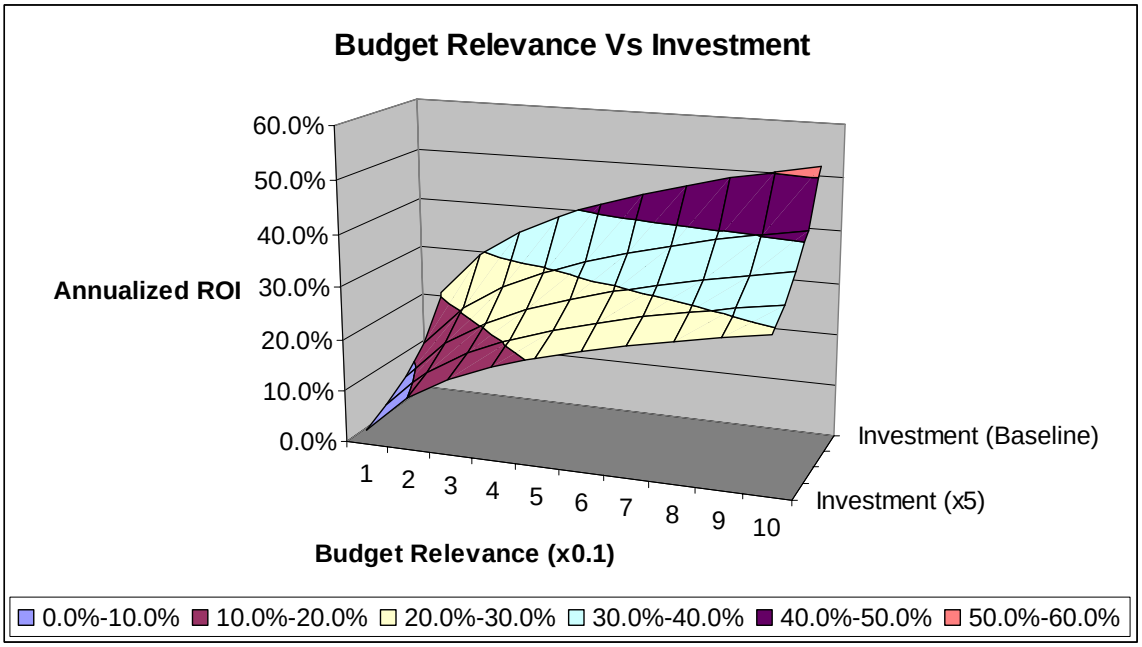

Figure 13. Sensitivity Analysis with JDSR Benefits Factor Equals 0.2

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IV CONCLUSION AND RECOMMENDATIONS

A generic analytic structure for performing business case analysis was recommended, and the JDSR business case analysis was conducted in this study. In addition, an analysis of the fleet data recorded during the JDSR demonstration phase was conducted. The outcome of this study is summarized as follows:

- There was a significant adoption of JDSR capability in the fleet. The number of maintenance actions conducted using JDSR had increased from 1,112 in FY01 to 6,453 in FY04. When this number was compared with the number of onboard maintenance actions, a significant jump from 11% in FY01 to 111% in FY04 was observed.
- JDSR also offered significant savings in maintenance cost. The average cost per maintenance action for the fleet with JDSR capability was $1280.55 compared to $4063.53 for the average cost per maintenance action for the fleet without JDSR capability over the period FY01 – FY04.
- The JDSR cost savings varies with the type of naval platforms. In particular, JDSR is found to benefit destroyers, submarines and amphibious assault ships with cost savings throughout FY01 to FY04.
- The base case annualized, compounded Return On Investment (ROI) is 60.7% with a Net Present Value (NPV) of $7527.5M savings and a corresponding NPV of $65.66M invested over a 10-year period from FY07 to FY16.
- The break-even analysis shows that the investment will break even in FY07 with a discounted net savings of $0.9M.
- The base case annualized ROI maintains at a minimum of 59.2% when the discount rate is varied from 4% to 12%.
- Sensitivity analysis indicates that the worst case annualized ROI is 2.7% when the JDSR investment is increased five times, the JDSR benefits and budget relevance are reduced by five and 10 times respectively from the baseline.

The benefits of JDSR are not limited to those that were presented in the computation of ROI. Other qualitative benefits include the accumulated knowledge database on maintenance actions that can serve to train and to shorten the learning cycles for repairing similar maintenance issues. The capability of JDSR to reduce the MTTR of weapon systems and platforms also leads to an increase in operational availability. JDSR

offers the opportunity to delayer the O- and I-Level maintenance structure because the operational user can now be trained and can access SME for the recovery of the weapon systems in real time.

In conclusion, the cost benefits of JDSR are clearly established in this report. Hence, it is recommended that the implementation of JDSR be supported.

APPENDIX A

FY01 - FY04 FTSCLANT Tech Assists

Prepared By: MARMC Financial Analysis Division [DJS]

Datasource: FY01 - FY04 FTSCLANT LEGACY SYS

FY01					
HULL	**HULL NAME**	**Distance Support Count**	**Distance Support Cost**	**Onboard Count**	**Onboard Cost**
AFDL 0006	USS DYNAMIC	0	$0.00	1	$466.23
AFDM 0007	USS SUSTAIN	0	$0.00	2	$7,495.74
AFDM 0010	USS RESOLUTE	1	$1,755.77	2	$1,320.88
AGF 0003	USS LASALLE	11	$3,140.82	49	$143,058.69
AGF 0011	USS CORONADO	1	$1,607.09	0	$0.00
AOE 0001	USS SACRAMENTO	0	$0.00	2	$3,940.00
AOE 0002	USS CAMDEN	0	$0.00	3	$11,044.75
AOE 0003	USS SEATTLE	5	$415.16	67	$96,608.66
AOE 0004	USS DETROIT	24	$8,018.84	63	$104,722.97
AOE 0006	USS SUPPLY	4	$6,319.85	21	$26,655.18
AOE 0007	USS RAINIER	0	$0.00	4	$2,547.89
AOE 0008	USS ARCTIC	8	$1,778.17	29	$74,596.64
ARDM 0001	USS OAK RIDGE	0	$0.00	3	$2,657.98
ARDM 0004	USS SHIPPINGPORT	0	$0.00	1	$298.00
ARS 0051	USS GRASP	0	$0.00	39	$54,250.62
ARS 0053	USS GRAPPLE	7	$6,900.55	65	$73,114.26
AS 0039	USS EMORY S LAND	8	$3,934.40	23	$75,962.44
CG 0047	USS TICONDEROGA	19	$13,154.96	82	$216,134.97
CG 0048	USS YORKTOWN	3	$1,622.88	74	$117,884.15
CG 0050	USS VALLEY FORGE	0	$0.00	1	$15,000.00
CG 0051	USS THOMAS S GATES	7	$2,360.26	50	$79,934.06
CG 0052	USS BUNKER HILL	0	$0.00	4	$4,170.83
CG 0054	USS ANTIETAM	1	$869.65	2	$7,937.99
CG 0055	USS LEYTE GULF	7	$1,317.65	178	$321,225.50
CG 0056	USS SAN JACINTO	8	$4,599.41	124	$272,403.40
CG 0058	USS PHILIPPINE SEA	12	$10,310.83	76	$90,164.31
CG 0059	USS PRINCETON	1	$390.14	0	$0.00
CG 0060	USS NORMANDY	8	$7,020.49	68	$83,579.00
CG 0061	USS MONTEREY	5	$2,844.67	119	$112,715.30
CG 0062	USS CHANCELLORSVILLE	1	$871.12	0	$0.00
CG 0064	USS GETTYSBURG	8	$8,869.95	107	$201,948.84
CG 0065	USS CHOSIN	1	$515.73	0	$0.00
CG 0066	USS HUE CITY	3	$0.00	60	$69,007.45
CG 0067	USS SHILOH	1	$253.19	5	$13,469.29

CG 0068	USS ANZIO	5	$326.75	115	$139,708.79
CG 0069	USS VICKSBURG	4	$2,933.27	66	$61,911.12
CG 0070	USS LAKE ERIE	2	$1,467.99	0	$0.00
CG 0071	USS CAPE ST GEORGE	0	$0.00	84	$128,625.80
CG 0072	USS VELLA GULF	7	$2,883.71	152	$173,717.09
CV 0063	USS KITTY HAWK	2	$560.60	0	$0.00
CV 0064	USS CONSTELLATION	6	$2,753.02	10	$23,747.76
CV 0067	USS JOHN F KENNEDY	7	$3,005.05	32	$880,067.53
CVN 0065	USS ENTERPRISE	24	$16,318.50	76	$179,732.40
CVN 0068	USS NIMITZ	0	$0.00	15	$32,741.81
CVN 0069	USS DWIGHT D EISENHOWER	5	$1,356.16	38	$34,288.21
CVN 0071	USS THEODORE ROOSEVELT	9	$4,963.72	74	$98,817.92
CVN 0072	USS ABRAHAM LINCOLN	5	$393.98	0	$0.00
CVN 0073	USS GEORGE WASHINGTON	3	$1,415.65	35	$86,883.96
CVN 0075	USS HARRY S. TRUMAN	7	$7,141.02	44	$89,395.40
DD 0963	USS SPRUANCE	7	$3,888.70	132	$231,370.96
DD 0964	USS FOSTER	2	$3,459.17	7	$8,954.90
DD 0965	USS KINCAID	6	$1,548.56	18	$24,877.74
DD 0966	USS HEWITT	2	$631.39	9	$5,785.43
DD 0968	USS ARTHUR W RADFORD	9	$1,041.88	252	$243,628.02
DD 0969	USS PETERSON	8	$1,666.39	179	$248,703.79
DD 0970	USS CARON	2	$736.35	49	$58,873.91
DD 0971	USS DAVID R RAY	1	$0.00	6	$3,064.09
DD 0972	USS OLDENDORF	1		0	$0.00
DD 0973	USS JOHN YOUNG	1	$1,053.46	0	$0.00
DD 0975	USS OBRIEN	2	$382.52	11	$15,295.81
DD 0977	USS BRISCOE	7	$1,572.70	109	$195,038.96
DD 0978	USS STUMP	12	$17,986.40	90	$113,135.95
DD 0980	USS MOOSBRUGGER	0	$0.00	18	$11,840.22
DD 0982	USS NICHOLSON	21	$11,303.28	212	$212,549.16
DD 0985	USS CUSHING	1	$175.58	0	$0.00
DD 0987	USS O'BANNON	10	$5,911.84	108	$138,141.45
DD 0988	USS THORN	29	$13,084.68	94	$152,308.35
DD 0989	USS DEYO	18	$14,595.12	133	$168,114.60
DD 0992	USS FLETCHER	2	$400.43	2	$3,025.29
DD 0997	USS HAYLER	10	$10,643.95	145	$151,878.54
DDG 0051	USS ARLEIGH BURKE	14	$14,178.03	94	$126,143.35
DDG 0052	USS BARRY	8	$2,902.48	150	$139,496.31
DDG 0053	USS JOHN PAUL JONES	0	$0.00	4	$8,587.98
DDG 0055	USS STOUT	18	$7,843.83	100	$130,236.19
DDG 0057	USS MITSCHER	5	$4,402.47	70	$100,917.85
DDG 0058	USS LABOON	2	$5,032.45	99	$83,936.66
DDG 0060	USS PAUL HAMILTON	0	$0.00	1	$1,897.92
DDG 0061	USS RAMAGE	9	$2,398.60	151	$167,633.17
DDG 0062	USS FITZGERALD	0	$0.00	4	$7,186.11
DDG 0063	USS STETHEM	4	$1,767.04	5	$3,823.76
DDG 0064	USS CARNEY	6	$3,432.91	61	$79,553.45

DDG 0065	USS BENFOLD	3	$1,575.55	10	$18,038.01
DDG 0066	USS GONZALEZ	13	$2,855.59	47	$57,668.53
DDG 0067	USS COLE	3	$424.43	18	$179,810.05
DDG 0068	USS THE SULLIVANS	9	$6,247.09	50	$60,015.16
DDG 0069	USS MILIUS	1	$291.06	0	$0.00
DDG 0070	USS HOPPER	0	$0.00	2	$5,234.52
DDG 0071	USS ROSS	14	$11,156.39	115	$104,264.96
DDG 0072	USS MAHAN	5	$1,995.15	80	$76,828.98
DDG 0074	USS MCFAUL	18	$24,202.02	92	$117,082.95
DDG 0075	USS DONALD COOK	7	$4,954.12	78	$175,054.54
DDG 0076	USS HIGGINS	1	$306.47	6	$13,067.56
DDG 0077	USS O'KANE	0	$0.00	2	$10,538.78
DDG 0078	USS PORTER	26	$34,191.33	85	$143,950.57
DDG 0079	USS OSCAR AUSTIN	4	$384.99	35	$31,099.38
DDG 0080	USS ROOSEVELT	4	$7,305.83	19	$18,399.53
DDG 0081	USS WINSTON CHURCHILL	3	$596.12	21	$22,727.87
DDG 0082	USS LASSEN	0	$0.00	2	$0.00
DLR 0003	RETRIEVER	0	$0.00	2	$43.55
FFG 0008	USS MCINERNEY	6	$4,086.09	78	$87,003.61
FFG 0012	USS GEORGE PHILIP	0	$0.00	3	$4,325.47
FFG 0013	USS SAMUEL E MORISON	7	$4,169.19	69	$94,087.27
FFG 0015	USS ESTOCIN	8	$7,497.46	87	$87,192.30
FFG 0028	USS BOONE	2	$89.46	57	$52,450.78
FFG 0029	USS STEPHEN W GROVES	22	$18,090.54	75	$110,137.42
FFG 0032	USS JOHN L HALL	17	$29,019.56	49	$60,520.89
FFG 0036	USS UNDERWOOD	1	$178.93	49	$73,476.38
FFG 0037	USS CROMMELIN	0	$0.00	2	$22,592.44
FFG 0039	USS DOYLE	0	$0.00	66	$71,880.40
FFG 0040	USS HALYBURTON	10	$23,251.11	51	$53,448.76
FFG 0041	USS MCCLUSKY	1	$67.15	5	$2,850.54
FFG 0042	USS KLAKRING	3	$741.12	68	$73,499.47
FFG 0043	USS THACH	2	$1,276.09	10	$23,704.09
FFG 0045	USS DEWERT	5	$522.52	68	$68,467.47
FFG 0047	USS NICHOLAS	8	$4,159.07	97	$115,825.82
FFG 0048	USS VANDEGRIFT	3	$713.83	0	$0.00
FFG 0049	USS ROBERT G BRADLEY	9	$4,005.47	102	$178,716.92
FFG 0050	USS TAYLOR	4	$3,063.17	85	$81,074.04
FFG 0052	USS CARR	20	$17,955.55	89	$114,899.23
FFG 0053	USS HAWES	10	$21,277.14	87	$81,679.75
FFG 0055	USS ELROD	11	$26,714.77	114	$117,494.16
FFG 0056	USS SIMPSON	5	$957.32	68	$64,302.79
FFG 0057	USS REUBEN JAMES	1	$128.99	0	$0.00
FFG 0058	USS SAMUEL B ROBERTS	7	$5,585.79	90	$126,884.18
FFG 0059	USS KAUFFMAN	6	$7,079.75	134	$159,349.49
FFG 0060	USS RODNEY M DAVIS	0	$0.00	4	$9,987.61
LCC 0020	USS MOUNT WHITNEY	5	$709.19	90	$99,210.49
LCM 0008	USS LCM-8	0	$0.00	2	$590.00

LCU 1634	LCU-1634	0	$0.00	2	$2,281.91
LCU 1644	LCU-1644	0	$0.00	1	$268.60
LHA 0001	USS TARAWA	2	$1,101.78	1	$0.00
LHA 0002	USS SAIPAN	7	$4,083.06	27	$55,413.05
LHA 0004	USS NASSAU	8	$4,505.26	72	$148,829.17
LHA 0005	USS PELELIU	1	$235.71	0	$0.00
LHD 0001	USS WASP	12	$3,074.08	113	$167,194.49
LHD 0002	USS ESSEX	1	$520.79	0	$0.00
LHD 0003	USS KEARSARGE	16	$14,197.57	62	$71,719.74
LHD 0004	USS BOXER	2	$2,796.18	4	$19,211.74
LHD 0005	USS BATAAN	18	$20,735.21	107	$163,736.19
LHD 0007	USS IWO JIMA	0	$0.00	24	$63,553.75
LPD 0004	USS AUSTIN	1	$0.00	53	$54,236.89
LPD 0006	USS DULUTH	3	$1,868.66	0	$0.00
LPD 0012	USS SHREVEPORT	5	$1,383.65	104	$100,164.72
LPD 0013	USS NASHVILLE	8	$8,526.71	64	$57,094.34
LPD 0014	USS TRENTON	4	$2,202.31	53	$47,381.64
LPD 0015	USS PONCE	6	$636.88	38	$38,446.13
LSD 0036	USS ANCHORAGE	1	$320.22	1	$582.12
LSD 0037	USS PORTLAND	1	$0.00	46	$53,501.29
LSD 0039	USS MOUNT VERNON	1	$339.04	0	$0.00
LSD 0041	USS WHIDBEY ISLAND	4	$480.80	140	$174,706.86
LSD 0044	USS GUNSTON HALL	6	$1,824.42	110	$149,502.40
LSD 0046	USS TORTUGA	1	$207.53	54	$39,037.11
LSD 0048	USS ASHLAND	5	$3,488.05	68	$62,658.57
LSD 0049	USS HARPERS FERRY	0	$0.00	4	$12,463.17
LSD 0050	USS CARTER HALL	14	$4,378.79	94	$126,920.05
LSD 0051	USS OAK HILL	2	$712.07	79	$91,881.63
MCM 0001	USS AVENGER	1	$134.98	24	$18,325.31
MCM 0002	USS DEFENDER	1	$0.00	54	$83,787.81
MCM 0003	USS SENTRY	0	$0.00	56	$49,876.34
MCM 0004	USS CHAMPION	1	$0.00	44	$33,529.66
MCM 0005	USS GUARDIAN	2	$1,307.74	8	$27,953.82
MCM 0006	USS DEVASTATOR	2	$595.09	24	$24,925.53
MCM 0007	USS PATRIOT	3	$11,260.14	9	$30,588.32
MCM 0008	USS SCOUT	2	$1,276.53	19	$16,094.16
MCM 0009	USS PIONEER	0	$0.00	25	$16,729.63
MCM 0010	USS WARRIOR	3	$2,050.93	39	$26,440.23
MCM 0011	USS GLADIATOR	2	$472.45	29	$24,034.39
MCM 0012	USS ARDENT	5	$5,966.48	47	$153,392.16
MCM 0013	USS DEXTROUS	2	$1,666.22	23	$31,619.39
MCM 0014	USS CHIEF	5	$3,657.62	34	$31,897.30
MCMCL	USS MCM 0001 CLASS HULLS	0	$0.00	1	$59,222.00
MCS 0012	USS INCHON	5	$1,350.33	56	$113,631.14
MHC 0051	USS OSPREY	2	$2,657.91	33	$17,224.05
MHC 0052	USS HERON	1	$0.00	40	$25,219.38
MHC 0053	USS PELICAN	1	$134.30	24	$11,817.26

MHC 0054	USS ROBIN	0	$0.00	34	$21,812.17
MHC 0055	USS ORIOLE	0	$0.00	61	$55,675.85
MHC 0056	USS KINGFISHER	0	$0.00	52	$27,838.29
MHC 0057	USS CORMORANT	5	$806.75	32	$11,186.93
MHC 0058	USS BLACKHAWK	2	$843.72	64	$36,411.71
MHC 0059	USS FALCON	2	$0.00	47	$32,379.61
MHC 0060	USS CARDINAL	8	$1,436.52	22	$49,960.92
MHC 0061	USS RAVEN	3	$3,512.44	12	$25,619.79
MHC 0062	USS SHRIKE	0	$0.00	23	$13,629.51
NR 0001	USS EXP SUB OCEANOGR	0	$0.00	9	$12,648.62
PC 0002	USS TEMPEST	0	$0.00	5	$5,401.76
PC 0005	USS TYPHOON	0	$0.00	4	$2,260.38
PC 0006	USS SIROCCO	1	$877.88	11	$9,185.75
PC 0009	USS CHINOOK	0	$0.00	6	$4,036.67
PC 0010	USS FIREBOLT	0	$0.00	10	$8,805.87
PC 0011	USS WHIRLWIND	0	$0.00	14	$11,761.40
PC 0012	USS THUNDERBOLT	0	$0.00	8	$7,562.27
PC 0013	USS SHAMAL	1	$317.40	4	$3,303.66
PC 0014	USS TORNADO	0	$0.00	9	$11,290.91
SSBN 0735	USS PENNSYLVANIA	0	$0.00	3	$14,757.56
SSBN 0736	USS WEST VIRGINIA	0	$0.00	1	$3,500.00
SSBN 0742	USS WYOMING	0	$0.00	3	$3,799.22
SSBN726CL	USS SSBN 726 CLASS SUBMARINES	0	$0.00	2	$2,833.51
SSN 0021	USS SEAWOLF	8	$440.56	60	$90,169.18
SSN 0022	USS CONNECTICUT	5	$1,841.09	63	$40,455.93
SSN 0571	HISTORIC SHIP NAUTILUS	0	$0.00	2	$2,851.88
SSN 0688	USS LOS ANGELES	0	$0.00	2	$7,061.72
SSN 0690	USS PHILADELPHIA	18	$1,440.60	32	$33,067.91
SSN 0691	USS MEMPHIS	8	$951.10	46	$55,390.68
SSN 0699	USS JACKSONVILLE	5	$4,130.65	54	$102,207.27
SSN 0700	USS DALLAS	6	$500.49	52	$56,631.42
SSN 0701	USS LA JOLLA	2	$0.00	1	$128.77
SSN 0705	USS CITY OF CORPUS CHRISTI	0	$0.00	2	$515.09
SSN 0706	USS ALBUQUERQUE	5	$634.80	37	$23,604.16
SSN 0707	USS PORTSMOUTH	1	$36.84	2	$4,638.83
SSN 0708	USS MINNEAPOLIS-SAINT PAUL	9	$1,032.60	96	$181,046.56
SSN 0709	USS HYMAN G RICKOVER	2	$1,478.24	89	$83,024.12
SSN 0710	USS AUGUSTA	11	$5,537.33	105	$81,886.95
SSN 0711	USS SAN FRANCISCO	0	$0.00	4	$4,233.81
SSN 0714	USS NORFOLK	2	$4,266.35	27	$98,724.43
SSN 0719	USS PROVIDENCE	5	$266.69	50	$29,658.33
SSN 0720	USS PITTSBURGH	6	$836.34	37	$39,064.60
SSN 0722	USS KEY WEST	1	$156.06	3	$3,568.00
SSN 0723	USS OKLAHOMA CITY	0	$0.00	64	$43,447.22
SSN 0725	USS HELENA	0	$0.00	4	$11,252.48
SSN 0750	USS NEWPORT NEWS	1	$4,969.72	42	$55,160.19
SSN 0751	USS SAN JUAN	4	$1,817.83	38	$37,067.64

SSN 0753	USS ALBANY	5	$3,931.14	43	$40,608.59
SSN 0755	USS MIAMI	4	$0.00	9	$13,981.88
SSN 0756	USS SCRANTON	1	$769.22	64	$87,664.68
SSN 0757	USS ALEXANDRIA	11	$837.81	64	$147,590.13
SSN 0759	USS JEFFERSON CITY	1	$76.62	0	$0.00
SSN 0760	USS ANNAPOLIS	10	$2,356.20	46	$54,947.52
SSN 0761	USS SPRINGFIELD	12	$1,878.71	81	$167,553.66
SSN 0762	USS COLUMBUS	0	$0.00	1	$1,755.77
SSN 0763	USS SANTA FE	0	$0.00	6	$34,380.57
SSN 0764	USS BOISE	1	$293.23	43	$42,012.13
SSN 0765	USS MONTPELIER	0	$0.00	31	$31,723.30
SSN 0767	USS HAMPTON	4	$126.77	56	$53,629.32
SSN 0768	USS HARTFORD	6	$421.39	48	$37,072.07
SSN 0769	USS TOLEDO	7	$1,465.81	42	$38,754.91
SSN 0771	USS COLUMBIA	0	$0.00	2	$6,105.65
SSN 0773	USS CHEYENNE	1	$310.70	3	$67,156.65
SSN21CL	USS SSN 21 CLASS SUBMARINES	0	$0.00	2	$85.85
SSN688CL	USS SSN 688 CLASS SUBMARINES	0	$0.00	4	$58,000.00
TAE 0034	USNS MOUNT BAKER	4	$3,095.90	6	$10,039.51
TAFS 0005	USNS CONCORD	0	$0.00	4	$15,011.57
TAFS 0008	USNS SIRIUS	1	$79.35	11	$23,187.08
TAFS 0009	USNS SPICA	0	$0.00	3	$1,366.57
TAFS 0010	USNS SATURN	0	$0.00	10	$7,257.53
TAGOS0001	USNS STALWART	0	$0.00	2	$2,285.64
TAGOS0006	USNS PERSISTENT	1	$137.53	2	$583.57
TAGOS0007	USNS INDOMITABLE	1	$137.53	3	$2,740.52
TAGOS0016	USNS CAPABLE	1	$0.00	1	$292.59
TAK 3003	USNS LT ALEXANDER BOBO	1	$0.00	0	$0.00
TAO 0189	USNS JOHN LENTHALL	1	$0.00	5	$2,330.69
TAO 0195	USNS LEROY GRUMMAN	0	$0.00	5	$1,792.33
TAO 0196	USNS KANAWHA	2	$313.33	3	$886.00
TAO 0198	USNS BIG HORN	0	$0.00	2	$2,403.70
TAO 0201	USNS PATUXENT	0	$0.00	3	$1,345.18
TAO 0203	USNS LARAMIE	0	$0.00	3	$1,880.35
TARC 0007	USNS ZEUS	0	$0.00	2	$1,542.67
TATF 0168	USNS CATAWBA	0	$0.00	2	$1,216.66
WAGB 0011	USCGC POLAR SEA	0	$0.00	2	$21,292.50
WAGB 0083	USCGC MACKINAW	0	$0.00	2	$3,767.66
WHEC 0716	USCGC DALLAS	2	$407.62	14	$20,915.59
WHEC 0720	USCGC SHERMAN	0	$0.00	2	$4,224.52
WHEC 0721	USCGC GALLATIN	1	$0.00	12	$36,699.52
WLB 0203	USCGC KUKUI	0	$0.00	1	$753.52
WLB 0205	USCGC WALNUT	0	$0.00	2	$7,234.51
WLM 0540	USCG WHITE SUMAC	2	$767.06	0	$0.00
WMEC 0039	USCGC ALEX HALEY	0	$0.00	1	$2,155.84
WMEC 0617	USCG VIGILANT	0	$0.00	2	$2,694.16
WMEC 0618	USCG ACTIVE	0	$0.00	1	$359.96

WMEC 0619	USCG CONFIDENCE	0	$0.00	1	$1,464.71
WMEC 0621	USCG VALIANT	0	$0.00	4	$17,905.46
WMEC 0622	USCG COURAGEOUS	0	$0.00	2	$3,615.03
WMEC 0625	USCG VENTUROUS	0	$0.00	2	$14,937.66
WMEC 0628	USCG DURABLE	0	$0.00	2	$486.98
WMEC 0629	USCG DECISIVE	0	$0.00	2	$15,365.08
WMEC 0901	USCGC BEAR	2	$135.87	3	$3,289.39
WMEC 0902	USCGC TAMPA	0	$0.00	6	$20,732.50
WMEC 0903	USCGC HARRIET LANE	0	$0.00	10	$16,707.94
WMEC 0904	USCGC NORTHLAND	0	$0.00	7	$37,990.86
WMEC 0906	USCGC SENECA	1	$226.45	7	$13,502.03
WMEC 0907	USCGC ESCANABA	0	$0.00	4	$18,153.57
WMEC 0908	USCGC TAHOMA	0	$0.00	2	$3,167.18
WMEC 0909	USCGC CAMPBELL	0	$0.00	6	$47,114.87
WMEC 0910	USCGC THETIS	0	$0.00	5	$9,001.03
WMEC 0911	USCGC FORWARD	2	$90.58	6	$37,175.82
WMEC 0912	USCGC LEGARE	0	$0.00	9	$17,157.59
WMEC 0913	USCGC MOHAWK	0	$0.00	7	$44,550.60
WPB 1340	USCG JEFFERSON ISLAND	0	$0.00	1	$0.00
WPB 87302	USCG HAMMERHEAD	0	$0.00	6	$17,830.08
WPB 87303	USCG MAKO	0	$0.00	4	$4,041.68
	FY01 TOTALS:	**1,114**	**$710,397**	**10,746**	**$15,480,516**

FY02					
HULL	**HULL NAME**	**Distance Support Count**	**Distance Support Cost**	**Onboard Count**	**Onboard Cost**
AFDL 0006	USS DYNAMIC	0	$0.00	5	$8,251.72
AFDM 0007	USS SUSTAIN	0	$0.00	2	$5,947.61
AFDM 0010	USS RESOLUTE	0	$0.00	3	$1,008.24
AGF 0003	USS LASALLE	18	$10,276.15	44	$107,801.40
AOE 0001	USS SACRAMENTO	4	$469.64	3	$1,995.54
AOE 0002	USS CAMDEN	3	$198.80	0	$0.00
AOE 0003	USS SEATTLE	15	$15,795.14	111	$287,280.04
AOE 0004	USS DETROIT	21	$5,605.04	37	$107,316.02
AOE 0006	USS SUPPLY	1	$862.46	6	$8,236.50
AOE 0008	USS ARCTIC	3	$0.00	19	$21,253.05
AOE 0010	USS BRIDGE	1	$854.17	1	$0.00
ARS 0051	USS GRASP	1	$356.80	51	$63,107.30
ARS 0053	USS GRAPPLE	5	$2,230.03	54	$85,336.67
AS 0039	USS EMORY S LAND	6	$3,106.25	23	$70,193.69
AS 0040	USS FRANK CABLE	1	$1,764.59	0	$0.00
ATF 0172	USS APACHE	0	$0.00	6	$3,278.40
CG 0047	USS TICONDEROGA	17	$11,549.10	80	$221,748.65
CG 0048	USS YORKTOWN	9	$3,486.81	43	$51,773.57
CG 0051	USS THOMAS S GATES	26	$9,510.76	74	$89,055.65
CG 0052	USS BUNKER HILL	1	$76.56	0	$0.00

CG 0053	USS MOBILE BAY	0	$0.00	2	$3,668.00
CG 0054	USS ANTIETAM	3	$1,099.45	7	$15,218.61
CG 0055	USS LEYTE GULF	25	$40,674.46	75	$88,127.06
CG 0056	USS SAN JACINTO	8	$5,455.24	126	$157,400.48
CG 0057	USS LAKE CHAMPLAIN	2	$433.63	1	$2,200.00
CG 0058	USS PHILIPPINE SEA	11	$13,368.88	95	$275,285.31
CG 0059	USS PRINCETON	0	$0.00	1	$0.00
CG 0060	USS NORMANDY	20	$34,101.46	131	$182,897.53
CG 0061	USS MONTEREY	23	$10,685.15	101	$154,259.07
CG 0064	USS GETTYSBURG	11	$11,472.84	93	$107,985.81
CG 0065	USS CHOSIN	0	$0.00	1	$690.77
CG 0066	USS HUE CITY	18	$7,689.61	76	$143,947.97
CG 0067	USS SHILOH	2	$17,364.97	2	$520.73
CG 0068	USS ANZIO	7	$3,415.82	115	$186,206.62
CG 0069	USS VICKSBURG	14	$10,329.91	62	$74,406.52
CG 0070	USS LAKE ERIE	1	$292.94	0	$0.00
CG 0071	USS CAPE ST GEORGE	6	$2,361.37	109	$121,022.73
CG 0072	USS VELLA GULF	23	$45,617.92	105	$108,301.27
CG 0073	USS PORT ROYAL	4	$2,786.87	7	$11,984.76
CG47CL	USS TICONDEROGA CLASS	0	$0.00	2	$22,949.82
CV 0063	USS KITTY HAWK	0	$0.00	1	$1,553.00
CV 0064	USS CONSTELLATION	2	$402.80	0	$0.00
CV 0067	USS JOHN F KENNEDY	21	$11,276.28	58	$114,386.72
CVN 0065	USS ENTERPRISE	4	$5,887.94	26	$27,415.32
CVN 0068	USS NIMITZ	0	$0.00	1	$0.00
CVN 0069	USS DWIGHT D EISENHOWER	3	$2,106.82	4	$133.24
CVN 0070	USS CARL VINSON	3	$107.84	8	$61,357.84
CVN 0071	USS THEODORE ROOSEVELT	11	$4,628.28	38	$73,003.90
CVN 0073	USS GEORGE WASHINGTON	20	$13,919.45	59	$150,849.45
CVN 0074	USS JOHN C STENNIS	4	$991.36	10	$45,789.37
CVN 0075	USS HARRY S. TRUMAN	11	$6,918.68	63	$99,096.45
DD 0963	USS SPRUANCE	16	$8,659.40	91	$121,215.71
DD 0967	USS ELLIOT	2	$44.60	2	$6,373.16
DD 0968	USS ARTHUR W RADFORD	18	$6,039.62	196	$248,601.69
DD 0969	USS PETERSON	13	$39,084.94	47	$63,620.58
DD 0970	USS CARON	0	$0.00	3	$7,498.93
DD 0973	USS JOHN YOUNG	2	$702.30	5	$4,388.48
DD 0975	USS OBRIEN	1	$0.00	2	$0.00
DD 0977	USS BRISCOE	18	$23,026.59	186	$211,889.75
DD 0978	USS STUMP	4	$760.64	199	$224,346.44
DD 0982	USS NICHOLSON	8	$6,267.95	94	$158,034.35
DD 0985	USS CUSHING	1	$82.94	0	$0.00
DD 0987	USS O'BANNON	0	$0.00	134	$208,659.07
DD 0988	USS THORN	5	$704.97	136	$129,162.98
DD 0989	USS DEYO	9	$2,057.76	185	$174,680.25
DD 0991	USS FIFE	1	$0.00	0	$0.00
DD 0997	USS HAYLER	19	$4,854.19	93	$112,822.84

DDG 0051	USS ARLEIGH BURKE	15	$23,314.15	100	$117,629.02
DDG 0052	USS BARRY	16	$6,218.44	154	$178,691.90
DDG 0053	USS JOHN PAUL JONES	0	$0.00	1	$0.00
DDG 0054	USS CURTIS WILBUR	3	$383.09	4	$10,210.95
DDG 0055	USS STOUT	9	$2,407.89	95	$90,240.61
DDG 0056	USS JOHN S MCCAIN	6	$1,751.47	9	$11,461.91
DDG 0057	USS MITSCHER	5	$2,903.18	89	$77,559.69
DDG 0058	USS LABOON	11	$5,392.76	108	$100,817.65
DDG 0059	USS RUSSELL	0	$0.00	4	$4,625.91
DDG 0060	USS PAUL HAMILTON	0	$0.00	1	$0.00
DDG 0061	USS RAMAGE	15	$7,109.37	49	$56,463.30
DDG 0064	USS CARNEY	12	$19,177.30	66	$89,343.71
DDG 0065	USS BENFOLD	0	$0.00	1	$0.00
DDG 0066	USS GONZALEZ	5	$2,387.19	106	$105,857.90
DDG 0067	USS COLE	5	$391.89	71	$181,805.37
DDG 0068	USS THE SULLIVANS	14	$17,779.07	43	$80,230.85
DDG 0070	USS HOPPER	1	$553.00	3	$5,674.23
DDG 0071	USS ROSS	23	$19,496.66	73	$110,035.22
DDG 0072	USS MAHAN	17	$6,174.48	89	$88,522.80
DDG 0073	USS DECATUR	1	$131.36	8	$4,247.34
DDG 0074	USS MCFAUL	14	$8,174.56	97	$113,868.07
DDG 0075	USS DONALD COOK	20	$4,135.23	119	$144,892.59
DDG 0077	USS O'KANE	2	$1,351.50	4	$16,320.95
DDG 0078	USS PORTER	9	$3,974.18	107	$123,684.45
DDG 0079	USS OSCAR AUSTIN	8	$2,842.76	75	$62,567.84
DDG 0080	USS ROOSEVELT	20	$10,350.80	51	$136,954.80
DDG 0081	USS WINSTON CHURCHILL	7	$1,537.90	44	$64,960.20
DDG 0083	USS HOWARD	1	$602.12	0	$0.00
DDG 0084	USS BULKELEY	2	$816.40	42	$51,830.95
DDG 0085	USS MCCAMPBELL	0	$0.00	5	$1,729.30
DDG 0086	USS SHOUP	1	$1,521.28	1	$2,849.45
DDG 0087	USS MASON	0	$0.00	1	$1,413.83
FFG 0008	USS MCINERNEY	6	$6,683.91	71	$76,354.54
FFG 0009	USS WADSWORTH	0	$0.00	6	$17,660.67
FFG 0013	USS SAMUEL E MORISON	3	$38.28	44	$63,347.72
FFG 0015	USS ESTOCIN	3	$245.62	99	$153,595.23
FFG 0028	USS BOONE	2	$35.09	76	$95,976.92
FFG 0029	USS STEPHEN W GROVES	12	$5,615.62	55	$38,074.83
FFG 0032	USS JOHN L HALL	11	$11,399.47	68	$94,599.02
FFG 0033	USS JARRETT	2	$0.00	8	$17,868.07
FFG 0036	USS UNDERWOOD	11	$8,290.03	39	$41,466.96
FFG 0039	USS DOYLE	7	$9,949.78	42	$25,096.50
FFG 0040	USS HALYBURTON	6	$3,321.58	110	$104,393.74
FFG 0041	USS MCCLUSKY	1	$0.00	5	$4,805.88
FFG 0042	USS KLAKRING	13	$5,002.02	61	$53,084.71
FFG 0045	USS DEWERT	6	$3,334.87	70	$92,146.87
FFG 0046	USS RENTZ	3	$0.00	8	$13,071.96

FFG 0047	USS NICHOLAS	7	$5,313.04	78	$91,069.07
FFG 0049	USS ROBERT G BRADLEY	5	$3,164.69	80	$116,065.79
FFG 0050	USS TAYLOR	13	$12,678.81	73	$98,904.06
FFG 0051	USS GARY	2	$1,959.29	0	$0.00
FFG 0052	USS CARR	7	$4,132.44	96	$92,668.70
FFG 0053	USS HAWES	7	$5,030.35	129	$173,210.68
FFG 0055	USS ELROD	7	$8,020.36	43	$33,843.83
FFG 0056	USS SIMPSON	13	$15,043.88	57	$69,522.09
FFG 0058	USS SAMUEL B ROBERTS	8	$3,998.38	51	$298,298.60
FFG 0059	USS KAUFFMAN	16	$5,875.41	109	$106,959.45
FFG 0061	USS INGRAHAM	1	$0.00	3	$2,344.23
FFG7CL	USS OLIVER HAZARD PERRY CLASS SHIPS	0	$0.00	1	$227.82
LCC 0020	USS MOUNT WHITNEY	10	$13,245.03	69	$65,439.60
LCU 1634	LCU-1634	0	$0.00	2	$5,058.61
LCU 1644	LCU-1644	0	$0.00	2	$0.00
LCU 1648	LCU-1648	0	$0.00	4	$1,967.38
LCU 1656	LCU-1656	0	$0.00	2	$795.22
LCU 1659	LCU-1659	0	$0.00	1	$331.75
LCU 1660	LCU-1660	0	$0.00	1	$0.00
LCU 1662	LCU-1662	0	$0.00	1	$397.61
LCU 1663	LCU-1663	0	$0.00	2	$2,236.55
LHA 0002	USS SAIPAN	10	$4,789.27	116	$215,371.12
LHA 0003	USS BELLEAU WOOD	1	$289.88	5	$22,926.64
LHA 0004	USS NASSAU	15	$16,802.80	173	$259,412.16
LHA 0005	USS PELELIU	2	$725.66	0	$0.00
LHD 0001	USS WASP	39	$14,048.78	74	$124,243.17
LHD 0003	USS KEARSARGE	4	$2,920.71	91	$131,482.72
LHD 0005	USS BATAAN	15	$6,289.17	43	$42,932.30
LHD 0006	USS BON HOMME RICHARD	3	$2,870.00	4	$7,282.01
LHD 0007	USS IWO JIMA	5	$2,869.01	74	$95,690.49
LPD 0004	USS AUSTIN	9	$3,295.40	101	$129,865.86
LPD 0005	USS OGDEN	1	$1,386.28	4	$3,757.70
LPD 0008	USS DUBUQUE	1	$0.00	3	$11,408.65
LPD 0009	USS DENVER	0	$0.00	3	$11,944.28
LPD 0012	USS SHREVEPORT	9	$1,211.80	23	$20,939.55
LPD 0013	USS NASHVILLE	3	$357.08	109	$129,167.09
LPD 0014	USS TRENTON	14	$4,063.18	61	$44,621.40
LPD 0015	USS PONCE	4	$1,057.05	31	$25,493.97
LSD 0037	USS PORTLAND	5	$2,431.52	72	$77,117.38
LSD 0039	USS MOUNT VERNON	0	$0.00	2	$5,096.95
LSD 0041	USS WHIDBEY ISLAND	17	$5,745.69	92	$92,799.71
LSD 0044	USS GUNSTON HALL	7	$3,466.92	109	$151,235.01
LSD 0045	USS COMSTOCK	1	$0.00	11	$6,793.36
LSD 0046	USS TORTUGA	6	$1,369.57	103	$138,845.34
LSD 0048	USS ASHLAND	8	$6,984.39	117	$140,071.48
LSD 0050	USS CARTER HALL	6	$1,456.33	77	$102,351.96
LSD 0051	USS OAK HILL	7	$11,537.83	68	$85,696.56

MCM 0001	USS AVENGER	0	$0.00	54	$57,616.01
MCM 0002	USS DEFENDER	4	$2,355.05	64	$145,488.55
MCM 0003	USS SENTRY	1	$877.88	47	$31,624.12
MCM 0004	USS CHAMPION	3	$5,364.45	38	$25,702.58
MCM 0005	USS GUARDIAN	3	$2,810.48	8	$31,513.93
MCM 0006	USS DEVASTATOR	0	$0.00	25	$22,455.00
MCM 0007	USS PATRIOT	7	$15,243.62	9	$55,985.54
MCM 0008	USS SCOUT	4	$2,093.65	42	$30,769.86
MCM 0009	USS PIONEER	0	$0.00	58	$66,567.76
MCM 0010	USS WARRIOR	3	$2,691.03	54	$39,611.43
MCM 0011	USS GLADIATOR	2	$1,472.92	41	$23,199.14
MCM 0012	USS ARDENT	7	$631.62	41	$100,773.43
MCM 0013	USS DEXTROUS	9	$5,307.09	15	$16,267.06
MCM 0014	USS CHIEF	1	$0.00	33	$18,893.88
MCMCL	USS MCM 0001 CLASS HULLS	0	$0.00	2	$85,000.00
MCS 0012	USS INCHON	0	$0.00	19	$13,942.94
MHC 0051	USS OSPREY	0	$0.00	37	$19,360.55
MHC 0052	USS HERON	4	$3,032.32	72	$40,559.14
MHC 0053	USS PELICAN	0	$0.00	45	$28,451.13
MHC 0054	USS ROBIN	3	$3,118.44	53	$45,035.57
MHC 0055	USS ORIOLE	0	$0.00	50	$15,826.45
MHC 0056	USS KINGFISHER	2	$3,429.46	29	$21,170.82
MHC 0057	USS CORMORANT	0	$0.00	66	$64,723.98
MHC 0058	USS BLACKHAWK	2	$3,434.60	25	$19,619.51
MHC 0059	USS FALCON	0	$0.00	64	$45,415.21
MHC 0060	USS CARDINAL	4	$1,142.21	8	$22,499.15
MHC 0061	USS RAVEN	5	$1,129.72	15	$56,735.97
MHC 0062	USS SHRIKE	1	$72.21	22	$17,930.24
NR 0001	USS EXP SUB OCEANOGR	0	$0.00	4	$357.80
PC 0002	USS TEMPEST	0	$0.00	3	$1,914.35
PC 0005	USS TYPHOON	0	$0.00	6	$1,782.29
PC 0006	USS SIROCCO	0	$0.00	8	$11,132.36
PC 0009	USS CHINOOK	0	$0.00	5	$2,887.79
PC 0010	USS FIREBOLT	0	$0.00	1	$367.03
PC 0011	USS WHIRLWIND	0	$0.00	13	$12,454.65
PC 0012	USS THUNDERBOLT	0	$0.00	5	$3,262.44
PC 0013	USS SHAMAL	0	$0.00	3	$1,707.61
PC 0014	USS TORNADO	1	$917.57	10	$35,497.42
SSBN 0732	USS ALASKA	0	$0.00	2	$199.29
SSBN 0734	USS TENNESSEE	0	$0.00	2	$394.98
SSBN 0735	USS PENNSYLVANIA	0	$0.00	9	$17,111.69
SSBN 0736	USS WEST VIRGINIA	0	$0.00	2	$623.61
SSBN 0739	USS NEBRASKA	0	$0.00	2	$87.60
SSBN 0740	USS RHODE ISLAND	0	$0.00	3	$2,832.30
SSBN 0742	USS WYOMING	0	$0.00	5	$4,442.88
SSN 0021	USS SEAWOLF	10	$493.50	49	$28,076.93
SSN 0022	USS CONNECTICUT	12	$2,553.57	52	$65,248.64

SSN 0571	HISTORIC SHIP NAUTILUS	0	$0.00	3	$3,739.12
SSN 0683	USS PARCHE	0	$0.00	2	$5,466.38
SSN 0690	USS PHILADELPHIA	7	$466.08	52	$49,071.83
SSN 0691	USS MEMPHIS	0	$0.00	42	$36,462.89
SSN 0699	USS JACKSONVILLE	1	$179.00	60	$75,976.59
SSN 0700	USS DALLAS	17	$11,227.57	75	$84,724.42
SSN 0705	USS CITY OF CORPUS CHRISTI	3	$225.01	21	$11,313.54
SSN 0706	USS ALBUQUERQUE	0	$0.00	3	$1,234.37
SSN 0708	USS MINNEAPOLIS-SAINT PAUL	2	$138.96	71	$221,752.99
SSN 0709	USS HYMAN G RICKOVER	2	$1,078.87	35	$63,185.30
SSN 0710	USS AUGUSTA	13	$4,196.54	50	$33,294.25
SSN 0711	USS SAN FRANCISCO	1	$95.83	11	$15,127.07
SSN 0714	USS NORFOLK	0	$0.00	44	$84,244.73
SSN 0715	USS BUFFALO	1	$573.30	0	$0.00
SSN 0716	USS SALT LAKE CITY	3	$2,523.25	11	$83,643.65
SSN 0719	USS PROVIDENCE	11	$2,631.74	45	$27,749.22
SSN 0720	USS PITTSBURGH	19	$3,925.83	72	$50,706.26
SSN 0723	USS OKLAHOMA CITY	10	$3,530.28	51	$38,016.57
SSN 0750	USS NEWPORT NEWS	5	$5,734.34	88	$166,482.45
SSN 0751	USS SAN JUAN	11	$838.59	63	$56,362.10
SSN 0753	USS ALBANY	0	$0.00	6	$2,894.74
SSN 0755	USS MIAMI	6	$486.49	51	$69,075.43
SSN 0756	USS SCRANTON	5	$3,553.46	61	$63,085.65
SSN 0757	USS ALEXANDRIA	0	$0.00	11	$13,503.05
SSN 0760	USS ANNAPOLIS	18	$3,601.00	54	$45,979.10
SSN 0761	USS SPRINGFIELD	15	$1,917.72	48	$36,464.59
SSN 0764	USS BOISE	5	$45.88	55	$131,889.54
SSN 0765	USS MONTPELIER	2	$509.82	64	$94,782.60
SSN 0767	USS HAMPTON	4	$2,835.00	72	$414,676.61
SSN 0768	USS HARTFORD	10	$5,556.44	36	$53,552.52
SSN 0769	USS TOLEDO	12	$10,077.35	56	$44,855.81
SSN 0770	USS TUCSON	0	$0.00	2	$19,974.25
SSN 0772	USS GREENVILLE	0	$0.00	2	$2,895.69
SSN 0773	USS CHEYENNE	1	$527.92	2	$2,668.00
SSN688CL	USS SSN 688 CLASS SUBMARINES	0	$0.00	10	$196,358.69
TAE 0028	USNS SANTA BARBARA	0	$0.00	2	$1,342.04
TAE 0032	USNS FLINT	0	$0.00	5	$5,589.68
TAE 0034	USNS MOUNT BAKER	3	$579.72	14	$11,136.34
TAFS 0003	USNS NIAGARA FALLS	0	$0.00	1	$0.00
TAFS 0005	USNS CONCORD	0	$0.00	2	$18,576.32
TAFS 0007	USNS SAN JOSE	1	$0.00	0	$0.00
TAFS 0008	USNS SIRIUS	3	$361.44	5	$1,771.88
TAFS 0009	USNS SPICA	1	$49.70	6	$2,294.58
TAFS 0010	USNS SATURN	0	$0.00	5	$3,836.57
TAGOS0001	USNS STALWART	3	$893.12	4	$6,698.10
TAGOS0007	USNS INDOMITABLE	0	$0.00	4	$5,675.00
TAGOS0016	USNS CAPABLE	0	$0.00	3	$5,779.69

TAH 0020	USNS COMFORT	0	$0.00	4	$3,137.70
TAK 3003	USNS LT ALEXANDER BOBO	1	$309.64	0	$0.00
TAK 3006	USNS PFC E A OBREGON	0	$0.00	2	$1,431.18
TAO 0189	USNS JOHN LENTHALL	0	$0.00	10	$3,694.25
TAO 0195	USNS LEROY GRUMMAN	0	$0.00	7	$5,739.67
TAO 0196	USNS KANAWHA	0	$0.00	5	$1,907.27
TAO 0198	USNS BIG HORN	0	$0.00	2	$1,529.81
TAO 0200	USNS GUADALUPE	0	$0.00	1	$6,910.30
TAO 0201	USNS PATUXENT	3	$530.96	5	$8,559.10
TAO 0203	USNS LARAMIE	1	$45.88	2	$2,505.32
TAOE 0006	USNS SUPPLY	1	$183.52	14	$16,913.69
TARC 0007	USNS ZEUS	0	$0.00	1	$314.70
WAGB 0010	USCG POLAR STAR	0	$0.00	2	$20,553.52
WHEC 0716	USCGC DALLAS	0	$0.00	18	$34,540.00
WHEC 0721	USCGC GALLATIN	0	$0.00	12	$18,663.49
WHEC 0724	USCG MUNRO	0	$0.00	3	$6,687.26
WLB 0201	USCGC JUNIPER	0	$0.00	2	$3,957.55
WLB 0202	USCG WILLOW	0	$0.00	6	$6,191.25
WLB 0204	USCGC ELM	0	$0.00	2	$697.67
WLB 0392	USCG BRAMBLE	0	$0.00	1	$2,947.61
WLN 0201	USCGC JUNIPER	0	$0.00	1	$1,864.85
WMEC 0615	USCG RELIANCE	0	$0.00	4	$30,331.12
WMEC 0616	USCG DILIGENCE	0	$0.00	2	$17,220.64
WMEC 0617	USCG VIGILANT	0	$0.00	4	$13,892.80
WMEC 0618	USCG ACTIVE	0	$0.00	2	$16,740.92
WMEC 0619	USCG CONFIDENCE	0	$0.00	6	$51,513.11
WMEC 0623	USCG STEADFAST	0	$0.00	2	$18,665.07
WMEC 0624	USCG DAUNTLESS	0	$0.00	2	$13,308.57
WMEC 0901	USCGC BEAR	0	$0.00	4	$3,539.36
WMEC 0902	USCGC TAMPA	0	$0.00	2	$3,802.88
WMEC 0903	USCGC HARRIET LANE	1	$0.00	0	$0.00
WMEC 0904	USCGC NORTHLAND	1	$471.45	0	$0.00
WMEC 0905	USCGC SPENCER	0	$0.00	2	$19,449.92
WMEC 0906	USCGC SENECA	0	$0.00	7	$5,836.09
WMEC 0907	USCGC ESCANABA	1	$275.27	1	$724.66
WMEC 0908	USCGC TAHOMA	2	$753.40	5	$7,770.63
WMEC 0909	USCGC CAMPBELL	2	$282.86	15	$39,254.87
WMEC 0910	USCGC THETIS	1	$356.80	6	$6,711.63
WMEC 0911	USCGC FORWARD	0	$0.00	2	$2,308.72
WMEC 0912	USCGC LEGARE	0	$0.00	7	$11,354.81
WMEC 0913	USCGC MOHAWK	1	$178.40	0	$0.00
WPB 87302	USCG HAMMERHEAD	0	$0.00	1	$2,693.11
WPB 87303	USCG MAKO	0	$0.00	1	$571.33
WPB 87310	USCG TARPON	0	$0.00	1	$490.10
WPB 87314	USCG FINBACK	0	$0.00	2	$2,880.69
WPB 87315	USCG AMBERJACK	0	$0.00	2	$2,854.20
WPB 87322	USCG KINGFISHER	0	$0.00	2	$2,696.18

WPB 87323	USCG SEAHAWK	0	$0.00	2	$3,398.22
WPB 87324	USCG STEELHEAD	0	$0.00	1	$2,510.55
YFNX 0042	SPRUCE BARGE	0	$0.00	3	$726.02
	FY02 TOTALS:	**1,420**	**$920,962**	**10,854**	**$15,344,482**

FY03					
HULL	**HULL NAME**	**Distance Support Count**	**Distance Support Cost**	**Onboard Count**	**Onboard Cost**
AFDL 0006	USS DYNAMIC	2	$7,083.18	3	$701.40
AFDM 0010	USS RESOLUTE	1	$223.68	7	$4,563.17
AGF 0003	USS LASALLE	8	$6,432.84	34	$156,241.14
AOE 0001	USS SACRAMENTO	2	$396.87	0	$0.00
AOE 0002	USS CAMDEN	5	$6,434.60	4	$1,312.61
AOE 0003	USS SEATTLE	8	$4,139.99	77	$68,653.18
AOE 0004	USS DETROIT	32	$24,523.81	88	$161,549.58
AOE 0007	USS RAINIER	2	$3,671.82	3	$16,148.20
AOE 0010	USS BRIDGE	1	$742.30	0	$0.00
ARS 0050	USS SAFEGUARD	0	$0.00	2	$11,533.17
ARS 0051	USS GRASP	6	$4,515.82	46	$85,194.73
ARS 0053	USS GRAPPLE	6	$10,743.14	55	$62,939.68
AS 0039	USS EMORY S LAND	13	$6,033.47	31	$78,919.56
CG 0047	USS TICONDEROGA	21	$12,138.34	143	$246,066.14
CG 0048	USS YORKTOWN	9	$7,838.93	90	$194,910.46
CG 0050	USS VALLEY FORGE	3	$1,679.11	15	$26,994.14
CG 0051	USS THOMAS S GATES	24	$18,340.34	61	$59,145.05
CG 0052	USS BUNKER HILL	5	$1,467.00	2	$10,738.93
CG 0053	USS MOBILE BAY	0	$0.00	4	$13,870.40
CG 0054	USS ANTIETAM	0	$0.00	3	$8,679.54
CG 0055	USS LEYTE GULF	31	$13,527.19	193	$234,287.28
CG 0056	USS SAN JACINTO	18	$14,132.97	98	$94,131.81
CG 0057	USS LAKE CHAMPLAIN	1	$0.00	2	$10,913.13
CG 0058	USS PHILIPPINE SEA	27	$20,197.01	120	$136,561.43
CG 0059	USS PRINCETON	5	$12,224.27	4	$2,999.22
CG 0060	USS NORMANDY	17	$6,164.65	134	$148,002.16
CG 0061	USS MONTEREY	13	$4,523.43	125	$176,193.85
CG 0062	USS CHANCELLORSVILLE	1	$0.00	0	$0.00
CG 0063	USS COWPENS	12	$4,550.09	5	$11,402.79
CG 0064	USS GETTYSBURG	10	$4,323.79	115	$111,547.25
CG 0065	USS CHOSIN	8	$10,254.32	13	$21,143.00
CG 0066	USS HUE CITY	7	$1,823.14	87	$139,912.18
CG 0067	USS SHILOH	2	$351.04	2	$0.00
CG 0068	USS ANZIO	42	$24,502.95	111	$133,080.43
CG 0069	USS VICKSBURG	4	$833.92	123	$142,134.03
CG 0070	USS LAKE ERIE	0	$0.00	2	$13,530.38
CG 0071	USS CAPE ST GEORGE	46	$15,381.37	98	$105,522.66
CG 0072	USS VELLA GULF	10	$2,423.94	178	$261,940.45

CG 0073	USS PORT ROYAL	1	$377.14	0	$0.00
CG 0047CL	USS TICONDEROGA CLASS	0	$0.00	1	$0.00
CG47CL	USS TICONDEROGA CLASS	1	$0.00	1	$5,620.32
CV 0063	USS KITTY HAWK	5	$3,370.22	7	$7,023.23
CV 0064	USS CONSTELLATION	1	$0.00	0	$0.00
CV 0067	USS JOHN F KENNEDY	8	$1,256.54	28	$23,230.08
CVN 0065	USS ENTERPRISE	26	$19,487.16	110	$265,541.58
CVN 0068	USS NIMITZ	8	$5,350.67	8	$27,016.48
CVN 0069	USS DWIGHT D EISENHOWER	4	$716.83	10	$20,319.81
CVN 0071	USS THEODORE ROOSEVELT	44	$19,648.32	69	$168,666.71
CVN 0072	USS ABRAHAM LINCOLN	4	$2,018.08	6	$41,442.05
CVN 0073	USS GEORGE WASHINGTON	19	$5,167.33	31	$67,211.70
CVN 0075	USS HARRY S. TRUMAN	22	$14,438.19	55	$198,672.37
CVN 0076	USS RONALD REAGAN	2	$0.00	7	$17,102.04
DD 0963	USS SPRUANCE	10	$28,019.90	138	$153,186.15
DD 0968	USS ARTHUR W RADFORD	5	$765.58	15	$24,992.15
DD 0975	USS OBRIEN	1	$620.29	0	$0.00
DD 0977	USS BRISCOE	37	$21,547.22	89	$113,141.83
DD 0978	USS STUMP	28	$13,710.62	235	$327,106.25
DD 0982	USS NICHOLSON	0	$0.00	7	$13,234.06
DD 0985	USS CUSHING	3	$538.21	0	$0.00
DD 0987	USS O'BANNON	11	$5,714.39	80	$58,848.72
DD 0988	USS THORN	35	$12,276.69	267	$280,673.49
DD 0989	USS DEYO	43	$40,540.41	101	$158,730.86
DD 0992	USS FLETCHER	23	$8,055.66	34	$53,720.63
DD 0997	USS HAYLER	12	$6,488.78	128	$152,813.43
DD 0963CL	USS SPRUANCE CLASS	0	$0.00	1	$9,826.26
DDG 0051	USS ARLEIGH BURKE	52	$32,092.28	154	$191,503.42
DDG 0052	USS BARRY	11	$14,775.53	75	$107,477.64
DDG 0055	USS STOUT	31	$20,194.52	160	$167,539.17
DDG 0056	USS JOHN S MCCAIN	4	$741.23	6	$1,632.06
DDG 0057	USS MITSCHER	29	$28,162.16	90	$121,547.09
DDG 0058	USS LABOON	21	$11,221.46	129	$141,901.68
DDG 0060	USS PAUL HAMILTON	6	$1,076.58	6	$4,464.04
DDG 0061	USS RAMAGE	15	$7,574.85	137	$162,880.61
DDG 0062	USS FITZGERALD	4	$955.45	15	$15,898.37
DDG 0064	USS CARNEY	4	$1,233.62	85	$156,737.17
DDG 0066	USS GONZALEZ	10	$6,692.94	137	$149,967.04
DDG 0067	USS COLE	20	$6,660.75	106	$170,360.47
DDG 0068	USS THE SULLIVANS	11	$2,128.85	87	$96,260.28
DDG 0069	USS MILIUS	5	$3,596.16	22	$28,065.53
DDG 0071	USS ROSS	13	$5,350.95	113	$166,206.33
DDG 0072	USS MAHAN	15	$5,078.71	100	$129,714.54
DDG 0074	USS MCFAUL	25	$9,218.88	149	$161,181.24
DDG 0075	USS DONALD COOK	34	$17,550.10	85	$112,814.60
DDG 0076	USS HIGGINS	10	$3,766.52	12	$22,672.02
DDG 0077	USS O'KANE	4	$2,527.94	2	$4,698.31

DDG 0078	USS PORTER	26	$32,475.64	78	$102,999.95
DDG 0079	USS OSCAR AUSTIN	24	$10,044.54	77	$85,079.83
DDG 0080	USS ROOSEVELT	11	$6,304.65	81	$111,195.97
DDG 0081	USS WINSTON CHURCHILL	20	$23,565.51	59	$81,656.03
DDG 0083	USS HOWARD	0	$0.00	1	$13,973.95
DDG 0084	USS BULKELEY	9	$10,650.47	69	$78,356.64
DDG 0085	USS MCCAMPBELL	0	$0.00	2	$32,934.47
DDG 0087	USS MASON	2	$310.20	24	$29,394.61
DDG 0088	USS PREBLE	0	$0.00	1	$892.00
DDG 0089	USS MUSTIN	0	$0.00	2	$8,886.70
DDG 0090	USS CHAFEE	0	$0.00	2	$7,136.75
FFG 0008	USS MCINERNEY	8	$1,729.64	75	$65,948.99
FFG 0015	USS ESTOCIN	3	$1,956.51	27	$15,816.19
FFG 0028	USS BOONE	16	$14,374.61	51	$63,068.24
FFG 0029	USS STEPHEN W GROVES	14	$7,588.22	88	$85,559.47
FFG 0032	USS JOHN L HALL	9	$15,648.68	27	$30,965.04
FFG 0033	USS JARRETT	0	$0.00	1	$0.00
FFG 0036	USS UNDERWOOD	3	$996.74	79	$87,767.07
FFG 0037	USS CROMMELIN	0	$0.00	9	$5,995.91
FFG 0038	USS CURTS	0	$0.00	2	$2,174.33
FFG 0039	USS DOYLE	6	$3,149.36	98	$85,954.95
FFG 0040	USS HALYBURTON	10	$2,727.10	71	$90,798.39
FFG 0042	USS KLAKRING	5	$1,365.92	115	$149,136.19
FFG 0043	USS THACH	3	$8,217.97	0	$0.00
FFG 0045	USS DEWERT	6	$5,768.44	38	$40,899.73
FFG 0046	USS RENTZ	1	$165.87	0	$0.00
FFG 0047	USS NICHOLAS	28	$20,751.09	117	$127,987.41
FFG 0048	USS VANDEGRIFT	6	$3,993.70	10	$9,963.00
FFG 0049	USS ROBERT G BRADLEY	2	$3,629.26	72	$54,506.26
FFG 0050	USS TAYLOR	9	$5,736.54	75	$75,455.51
FFG 0051	USS GARY	4	$556.57	5	$1,132.58
FFG 0052	USS CARR	27	$14,181.92	81	$150,746.14
FFG 0053	USS HAWES	24	$8,391.08	67	$100,775.79
FFG 0055	USS ELROD	17	$6,764.18	127	$115,716.50
FFG 0056	USS SIMPSON	6	$3,931.95	49	$49,466.97
FFG 0057	USS REUBEN JAMES	5	$686.69	1	$0.00
FFG 0058	USS SAMUEL B ROBERTS	3	$78.94	94	$124,359.91
FFG 0059	USS KAUFFMAN	28	$8,351.75	55	$107,071.57
FFG 0060	USS RODNEY M DAVIS	8	$4,544.23	13	$28,359.61
LCC 0020	USS MOUNT WHITNEY	20	$7,047.49	40	$45,036.11
LCM 0008	USS LCM-8	0	$0.00	2	$542.50
LCU 1643	LCU-1643	0	$0.00	1	$2,109.12
LCU 1644	LCU-1644	0	$0.00	2	$1,037.82
LCU 1648	LCU-1648	0	$0.00	2	$1,870.92
LCU 1650	LCU-1650	0	$0.00	2	$6,449.27
LCU 1654	LCU-1654	0	$0.00	4	$3,460.62
LCU 1655	LCU-1655	0	$0.00	1	$1,555.60

LCU 1656	LCU-1656	0	$0.00	3	$3,318.52
LCU 1657	LCU-1657	0	$0.00	2	$410.75
LCU 1660	LCU-1660	0	$0.00	4	$7,449.39
LHA 0001	USS TARAWA	10	$5,434.58	7	$8,435.46
LHA 0002	USS SAIPAN	27	$18,764.46	93	$221,757.86
LHA 0004	USS NASSAU	37	$21,906.68	31	$58,576.73
LHD 0001	USS WASP	12	$4,530.35	63	$87,742.18
LHD 0003	USS KEARSARGE	22	$11,786.25	111	$137,037.11
LHD 0004	USS BOXER	6	$7,145.23	7	$13,840.91
LHD 0005	USS BATAAN	34	$39,329.16	70	$114,872.48
LHD 0006	USS BON HOMME RICHARD	6	$6,101.80	6	$5,153.57
LHD 0007	USS IWO JIMA	36	$17,312.48	86	$142,083.52
LPD 0004	USS AUSTIN	16	$7,187.00	35	$100,625.92
LPD 0006	USS DULUTH	2	$876.00	5	$3,787.29
LPD 0007	USS CLEVELAND	5	$274.85	1	$0.00
LPD 0008	USS DUBUQUE	3	$1,680.38	1	$657.39
LPD 0009	USS DENVER	0	$0.00	3	$7,300.18
LPD 0012	USS SHREVEPORT	12	$6,941.77	68	$99,575.94
LPD 0013	USS NASHVILLE	33	$32,066.77	95	$111,698.24
LPD 0014	USS TRENTON	8	$1,812.00	62	$61,137.26
LPD 0015	USS PONCE	20	$9,350.03	34	$37,087.45
LSD 0036	USS ANCHORAGE	3	$957.84	7	$7,072.52
LSD 0037	USS PORTLAND	10	$4,767.63	32	$31,971.84
LSD 0041	USS WHIDBEY ISLAND	10	$7,966.81	85	$113,839.27
LSD 0044	USS GUNSTON HALL	27	$10,349.77	123	$145,055.02
LSD 0045	USS COMSTOCK	2	$54.59	9	$22,913.91
LSD 0046	USS TORTUGA	26	$25,656.04	25	$29,014.26
LSD 0047	USS RUSHMORE	11	$4,698.32	13	$15,972.00
LSD 0048	USS ASHLAND	19	$15,846.24	96	$78,283.10
LSD 0050	USS CARTER HALL	24	$13,448.82	51	$61,205.44
LSD 0051	USS OAK HILL	10	$7,101.03	110	$115,899.59
LSD 0052	USS PEARL HARBOR	3	$13,159.83	6	$8,280.48
MCM 0001	USS AVENGER	7	$6,502.09	74	$73,556.12
MCM 0002	USS DEFENDER	0	$0.00	44	$47,806.96
MCM 0003	USS SENTRY	5	$1,408.02	48	$41,861.50
MCM 0004	USS CHAMPION	5	$4,954.82	28	$43,502.68
MCM 0005	USS GUARDIAN	8	$3,301.19	3	$6,960.88
MCM 0006	USS DEVASTATOR	5	$5,019.73	40	$17,300.06
MCM 0007	USS PATRIOT	5	$3,820.22	2	$5,210.46
MCM 0008	USS SCOUT	12	$17,430.96	54	$66,151.08
MCM 0009	USS PIONEER	6	$6,328.09	36	$43,406.19
MCM 0010	USS WARRIOR	2	$721.12	51	$61,576.50
MCM 0011	USS GLADIATOR	5	$1,274.57	78	$69,935.13
MCM 0012	USS ARDENT	6	$846.16	34	$102,509.32
MCM 0013	USS DEXTROUS	12	$16,952.95	34	$79,278.00
MCM 0014	USS CHIEF	2	$742.80	40	$34,262.50
MCMCL	USS MCM 0001 CLASS HULLS	0	$0.00	1	$49,516.67

MHC 0051	USS OSPREY	1	$45.07	36	$52,232.67
MHC 0052	USS HERON	2	$735.59	48	$30,098.39
MHC 0053	USS PELICAN	1	$611.76	16	$18,589.25
MHC 0054	USS ROBIN	4	$402.48	32	$47,820.38
MHC 0055	USS ORIOLE	2	$487.54	32	$17,652.60
MHC 0056	USS KINGFISHER	5	$622.08	53	$56,634.40
MHC 0057	USS CORMORANT	3	$356.60	58	$48,242.48
MHC 0058	USS BLACKHAWK	3	$4,573.26	42	$47,219.42
MHC 0059	USS FALCON	1	$611.76	21	$12,483.46
MHC 0060	USS CARDINAL	7	$5,104.60	22	$48,413.71
MHC 0061	USS RAVEN	6	$2,591.75	23	$31,929.30
MHC 0062	USS SHRIKE	1	$146.00	31	$51,065.48
NR 0001	USS EXP SUB OCEANOGR	1	$335.40	8	$4,598.31
PC 0002	USS TEMPEST	0	$0.00	20	$28,361.91
PC 0005	USS TYPHOON	3	$0.00	17	$14,389.11
PC 0006	USS SIROCCO	1	$102.49	16	$15,904.20
PC 0009	USS CHINOOK	5	$2,075.28	13	$35,418.01
PC 0010	USS FIREBOLT	4	$882.88	10	$33,827.13
PC 0011	USS WHIRLWIND	3	$3,997.16	10	$15,753.55
PC 0012	USS THUNDERBOLT	0	$0.00	5	$6,742.84
PC 0013	USS SHAMAL	0	$0.00	10	$15,441.21
PC 0014	USS TORNADO	1	$0.00	17	$10,619.54
SSBN 0728	USS FLORIDA	1	$198.82	3	$197.05
SSBN 0733	USS NEVADA	0	$0.00	2	$1,367.30
SSBN 0734	USS TENNESSEE	0	$0.00	3	$7,933.64
SSBN 0736	USS WEST VIRGINIA	0	$0.00	2	$7,480.10
SSBN 0738	USS MARYLAND	1	$755.50	1	$1,654.40
SSBN 0740	USS RHODE ISLAND	0	$0.00	1	$5,142.56
SSBN 0741	USS MAINE	0	$0.00	2	$0.00
SSBN 0742	USS WYOMING	1	$0.00	1	$0.00
SSN 0021	USS SEAWOLF	5	$267.07	57	$65,352.37
SSN 0022	USS CONNECTICUT	8	$4,112.92	43	$36,552.11
SSN 0690	USS PHILADELPHIA	22	$11,468.58	64	$88,380.22
SSN 0691	USS MEMPHIS	6	$415.23	65	$71,816.67
SSN 0698	USS BREMERTON	0	$0.00	2	$2,733.50
SSN 0699	USS JACKSONVILLE	3	$159.29	88	$104,947.36
SSN 0700	USS DALLAS	13	$6,945.16	93	$101,192.32
SSN 0706	USS ALBUQUERQUE	11	$1,094.48	38	$34,490.89
SSN 0708	USS MINNEAPOLIS-SAINT PAUL	7	$4,204.90	42	$33,271.53
SSN 0709	USS HYMAN G RICKOVER	5	$1,581.23	106	$109,486.40
SSN 0710	USS AUGUSTA	7	$24,947.93	54	$25,114.87
SSN 0711	USS SAN FRANCISCO	1	$268.30	9	$8,514.93
SSN 0718	USS HONOLULU	0	$0.00	7	$38,893.80
SSN 0719	USS PROVIDENCE	13	$1,749.60	55	$49,136.49
SSN 0720	USS PITTSBURGH	17	$8,123.06	74	$151,706.87
SSN 0722	USS KEY WEST	1	$126.79	0	$0.00
SSN 0723	USS OKLAHOMA CITY	2	$713.60	52	$76,069.00

SSN 0724	USS LOUISVILLE	2	$0.00	0	$0.00
SSN 0750	USS NEWPORT NEWS	14	$14,813.03	75	$95,746.53
SSN 0751	USS SAN JUAN	10	$1,530.69	43	$63,929.37
SSN 0752	USS PASADENA	3	$405.63	2	$13,985.15
SSN 0753	USS ALBANY	6	$3,148.96	92	$147,233.43
SSN 0754	USS TOPEKA	0	$0.00	2	$18,016.12
SSN 0755	USS MIAMI	13	$4,764.25	62	$87,908.12
SSN 0756	USS SCRANTON	0	$0.00	4	$17,642.67
SSN 0757	USS ALEXANDRIA	16	$5,420.34	49	$42,406.01
SSN 0760	USS ANNAPOLIS	7	$1,018.80	22	$36,131.64
SSN 0761	USS SPRINGFIELD	13	$30,368.91	78	$54,349.82
SSN 0764	USS BOISE	11	$5,193.59	88	$110,330.88
SSN 0765	USS MONTPELIER	5	$632.32	49	$65,444.03
SSN 0767	USS HAMPTON	9	$9,531.17	79	$112,768.44
SSN 0768	USS HARTFORD	8	$1,610.99	51	$36,534.44
SSN 0769	USS TOLEDO	7	$1,204.87	66	$76,667.76
SSN 0771	USS COLUMBIA	2	$388.90	3	$2,251.21
SSN 0773	USS CHEYENNE	1	$1,892.20	1	$16,000.00
SSN21CL	USS SSN 21 CLASS SUBMARINES	2	$7,994.94	2	$8,965.98
SSN688CL	USS SSN 688 CLASS SUBMARINES	0	$0.00	17	$866,149.79
TAE 0033	USNS SHASTA	0	$0.00	2	$4,976.25
TAE 0034	USNS MOUNT BAKER	3	$961.80	3	$5,939.49
TAE 0035	USNS KISKA	0	$0.00	1	$0.00
TAFS 0003	USNS NIAGARA FALLS	0	$0.00	2	$2,493.56
TAFS 0005	USNS CONCORD	1	$638.56	2	$0.00
TAFS 0008	USNS SIRIUS	1	$82.76	7	$4,109.28
TAFS 0009	USNS SPICA	4	$152.19	10	$4,702.44
TAFS 0010	USNS SATURN	2	$356.49	9	$7,097.82
TAO 0189	USNS JOHN LENTHALL	0	$0.00	7	$3,671.20
TAO 0195	USNS LEROY GRUMMAN	0	$0.00	5	$2,245.88
TAO 0196	USNS KANAWHA	0	$0.00	5	$2,535.57
TAO 0197	USNS PECOS	0	$0.00	4	$9,497.24
TAO 0201	USNS PATUXENT	0	$0.00	1	$159.29
TAO 0203	USNS LARAMIE	0	$0.00	3	$6,577.08
TAOE 0006	USNS SUPPLY	4	$3,081.00	20	$42,172.37
TAOE 0008	USNS ARCTIC	6	$1,688.94	18	$34,845.59
TARC 0007	USNS ZEUS	0	$0.00	7	$2,552.00
TATF 0168	USNS CATAWBA	1	$846.46	2	$924.45
TATF 0172	USS APACHE	0	$0.00	1	$1,214.50
WAGB 0010	USCG POLAR STAR	0	$0.00	2	$35,428.60
WAGB 0011	USCGC POLAR SEA	0	$0.00	3	$52,326.11
WHEC 0715	USCGC HAMILTON	0	$0.00	2	$3,721.38
WHEC 0716	USCGC DALLAS	1	$97.23	22	$43,478.04
WHEC 0719	USCG BOUTWELL	3	$989.94	6	$25,179.35
WHEC 0720	USCGC SHERMAN	0	$0.00	1	$3,495.51
WHEC 0721	USCGC GALLATIN	0	$0.00	2	$20,514.21
WLB 0201	USCGC JUNIPER	0	$0.00	2	$3,336.80

WLM 0562	USCG MARIA BRAY	0	$0.00	1	$682.59
WMEC 0620	USCG RESOLUTE	0	$0.00	2	$17,368.06
WMEC 0621	USCG VALIANT	0	$0.00	3	$25,408.01
WMEC 0624	USCG DAUNTLESS	0	$0.00	2	$16,705.67
WMEC 0626	USCG DEPENDABLE	0	$0.00	2	$15,135.57
WMEC 0627	USCG VIGOROUS	0	$0.00	2	$15,897.19
WMEC 0630	USCG ALERT	0	$0.00	2	$12,951.23
WMEC 0901	USCGC BEAR	1	$196.22	3	$1,526.41
WMEC 0902	USCGC TAMPA	0	$0.00	5	$24,701.07
WMEC 0903	USCGC HARRIET LANE	1	$2,322.94	4	$3,266.17
WMEC 0904	USCGC NORTHLAND	0	$0.00	4	$2,885.24
WMEC 0905	USCGC SPENCER	3	$726.55	10	$48,284.18
WMEC 0906	USCGC SENECA	1	$429.58	8	$13,176.55
WMEC 0907	USCGC ESCANABA	0	$0.00	8	$20,214.05
WMEC 0908	USCGC TAHOMA	2	$1,432.93	1	$260.59
WMEC 0909	USCGC CAMPBELL	0	$0.00	2	$3,076.71
WMEC 0910	USCGC THETIS	0	$0.00	2	$4,615.42
WMEC 0911	USCGC FORWARD	0	$0.00	4	$9,532.95
WMEC 0912	USCGC LEGARE	1	$0.00	5	$8,786.21
WMEC 0913	USCGC MOHAWK	1	$346.80	6	$29,176.59
WPB 1309	USCGC AQUIDNECK	0	$0.00	2	$712.15
WPB 1332	USCGC WRANGELL	0	$0.00	4	$3,668.15
WPB 87318	USCG BLUEFIN	0	$0.00	2	$3,929.62
WPB 87332	USCG RAZORBILL	0	$0.00	2	$3,027.11
WTGB 0101	USCGC KATMAI BAY	0	$0.00	2	$3,931.55
YTB 0833	USS SHABONEE	0	$0.00	2	$1,145.56
	FY03 TOTALS:	**2,299**	**$1,438,906**	**11,412**	**$16,282,781**

FY04					
HULL	**HULL NAME**	**Distance Support Count**	**Distance Support Cost**	**Onboard Count**	**Onboard Cost**
AFDL 0006	USS DYNAMIC	0	$0.00	3	$3,947.21
AFDM 0007	USS SUSTAIN	0	$0.00	2	$7,493.16
AFDM 0010	USS RESOLUTE	0	$0.00	2	$6,057.56
AGF 0003	USS LASALLE	59	$123,702.02	24	$40,623.97
AOE 0003	USS SEATTLE	44	$34,404.31	49	$54,388.76
AOE 0004	USS DETROIT	38	$17,341.06	18	$33,357.33
AOE 0007	USS RAINIER	1	$206.80	0	$0.00
ARDM 0004	USS SHIPPINGPORT	1	$429.71	2	$1,220.46
ARS 0050	USS SAFEGUARD	3	$4,200.95	2	$14,899.47
ARS 0051	USS GRASP	27	$33,399.74	37	$57,524.23
ARS 0053	USS GRAPPLE	35	$41,468.24	32	$50,043.46
AS 0039	USS EMORY S LAND	35	$32,787.53	18	$50,937.75
AS 0040	USS FRANK CABLE	2	$190.89	0	$0.00
CG 0047	USS TICONDEROGA	36	$37,958.30	50	$67,689.25
CG 0048	USS YORKTOWN	71	$68,836.15	39	$65,482.91

CG 0051	USS THOMAS S GATES	42	$31,305.73	29	$30,891.25
CG 0052	USS BUNKER HILL	0	$0.00	2	$11,404.22
CG 0053	USS MOBILE BAY	10	$12,410.80	0	$0.00
CG 0055	USS LEYTE GULF	112	$67,673.52	68	$132,176.04
CG 0056	USS SAN JACINTO	95	$68,503.95	81	$86,188.45
CG 0058	USS PHILIPPINE SEA	62	$98,727.53	37	$45,973.27
CG 0060	USS NORMANDY	87	$84,233.25	71	$94,458.91
CG 0061	USS MONTEREY	150	$165,546.21	90	$94,609.76
CG 0063	USS COWPENS	1	$50.96	0	$0.00
CG 0064	USS GETTYSBURG	52	$25,858.25	19	$41,313.13
CG 0065	USS CHOSIN	1	$38.72	0	$0.00
CG 0066	USS HUE CITY	40	$37,728.99	39	$47,715.92
CG 0068	USS ANZIO	110	$179,375.05	59	$85,320.59
CG 0069	USS VICKSBURG	55	$80,164.05	34	$40,509.75
CG 0070	USS LAKE ERIE	2	$927.87	0	$0.00
CG 0071	USS CAPE ST GEORGE	79	$142,843.75	98	$114,560.42
CG 0072	USS VELLA GULF	105	$72,749.75	44	$99,329.43
CG 0073	USS PORT ROYAL	11	$50,068.13	9	$7,121.47
CV 0063	USS KITTY HAWK	1	$100.76	0	$0.00
CV 0067	USS JOHN F KENNEDY	54	$102,189.00	20	$80,769.28
CVN 0065	USS ENTERPRISE	73	$102,708.09	31	$95,346.85
CVN 0068	USS NIMITZ	1	$0.00	0	$0.00
CVN 0069	USS DWIGHT D EISENHOWER	10	$5,917.79	6	$11,187.73
CVN 0070	USS CARL VINSON	2	$6,573.00	0	$0.00
CVN 0071	USS THEODORE ROOSEVELT	26	$24,654.97	14	$20,576.30
CVN 0073	USS GEORGE WASHINGTON	89	$68,671.44	33	$49,803.86
CVN 0074	USS JOHN C STENNIS	2	$1,099.70	1	$2,353.14
CVN 0075	USS HARRY S. TRUMAN	74	$94,055.11	37	$89,289.68
CVN 0076	USS RONALD REAGAN	7	$6,437.29	15	$43,449.14
DD 0963	USS SPRUANCE	89	$112,330.80	60	$66,463.27
DD 0978	USS STUMP	82	$50,268.24	40	$35,144.17
DD 0985	USS CUSHING	10	$3,784.94	4	$9,340.10
DD 0987	USS O'BANNON	55	$57,617.39	63	$417,010.42
DD 0988	USS THORN	52	$31,828.18	46	$69,208.86
DD 0989	USS DEYO	0	$0.00	2	$1,061.57
DD 0992	USS FLETCHER	24	$40,664.99	8	$8,737.43
DD 0997	USS HAYLER	1	$159.29	0	$0.00
DDG 0051	USS ARLEIGH BURKE	78	$51,712.33	65	$62,626.55
DDG 0052	USS BARRY	108	$65,260.75	82	$119,016.61
DDG 0055	USS STOUT	82	$81,069.66	36	$36,066.43
DDG 0056	USS JOHN S MCCAIN	1	$180.99	0	$0.00
DDG 0057	USS MITSCHER	128	$107,175.83	50	$51,904.23
DDG 0058	USS LABOON	87	$79,567.11	83	$374,416.30
DDG 0061	USS RAMAGE	102	$67,642.14	48	$29,624.59
DDG 0062	USS FITZGERALD	1	$37.93	0	$0.00
DDG 0063	USS STETHEM	1	$157.00	0	$0.00
DDG 0064	USS CARNEY	50	$30,427.72	52	$75,747.34

DDG 0066	USS GONZALEZ	76	$77,353.54	43	$61,866.79
DDG 0067	USS COLE	56	$52,869.04	36	$20,933.68
DDG 0068	USS THE SULLIVANS	46	$37,010.96	50	$95,822.89
DDG 0069	USS MILIUS	0	$0.00	2	$3,088.45
DDG 0070	USS HOPPER	10	$9,555.04	0	$0.00
DDG 0071	USS ROSS	86	$101,973.73	56	$67,264.40
DDG 0072	USS MAHAN	59	$63,295.37	56	$59,019.35
DDG 0073	USS DECATUR	11	$12,916.41	3	$0.00
DDG 0074	USS MCFAUL	103	$115,778.58	51	$47,860.69
DDG 0075	USS DONALD COOK	81	$59,939.31	79	$78,695.59
DDG 0076	USS HIGGINS	6	$1,046.20	8	$35,930.21
DDG 0078	USS PORTER	91	$68,371.89	53	$83,602.85
DDG 0079	USS OSCAR AUSTIN	93	$74,524.20	62	$86,739.66
DDG 0080	USS ROOSEVELT	63	$79,915.43	45	$89,425.78
DDG 0081	USS WINSTON CHURCHILL	77	$70,163.39	39	$40,839.92
DDG 0083	USS HOWARD	1	$209.33	0	$0.00
DDG 0084	USS BULKELEY	81	$145,101.56	41	$38,048.10
DDG 0087	USS MASON	58	$60,461.68	16	$13,539.50
DDG 0088	USS PREBLE	9	$3,918.55	2	$4,081.00
DDG 0090	USS CHAFEE	0	$0.00	2	$6,112.64
DDG 0091	USS PINCKNEY	4	$823.73	0	$0.00
DDG 0092	USS MOMSEN	2	$139.12	0	$0.00
DDG 0093	USS CHUNG-HOON	2	$268.57	0	$0.00
FFG 0008	USS MCINERNEY	53	$39,944.83	30	$39,076.48
FFG 0015	USS ESTOCIN	0	$0.00	2	$5,906.20
FFG 0028	USS BOONE	31	$26,442.49	46	$26,543.74
FFG 0029	USS STEPHEN W GROVES	42	$26,268.82	41	$61,281.17
FFG 0032	USS JOHN L HALL	34	$15,064.09	37	$34,750.26
FFG 0033	USS JARRETT	15	$6,930.12	14	$4,984.56
FFG 0036	USS UNDERWOOD	31	$35,282.57	33	$30,848.00
FFG 0037	USS CROMMELIN	8	$2,283.59	7	$11,336.01
FFG 0039	USS DOYLE	47	$54,790.75	40	$31,956.51
FFG 0040	USS HALYBURTON	31	$26,998.35	49	$42,235.84
FFG 0041	USS MCCLUSKY	5	$42.51	4	$4,396.66
FFG 0042	USS KLAKRING	52	$40,705.74	31	$23,348.17
FFG 0043	USS THACH	0	$0.00	1	$209.33
FFG 0045	USS DEWERT	35	$23,986.12	27	$22,455.01
FFG 0046	USS RENTZ	0	$0.00	10	$10,278.85
FFG 0047	USS NICHOLAS	75	$47,273.24	18	$9,129.76
FFG 0049	USS ROBERT G BRADLEY	26	$28,823.99	24	$37,800.01
FFG 0050	USS TAYLOR	71	$134,649.08	54	$71,056.36
FFG 0051	USS GARY	1	$100.75	0	$0.00
FFG 0052	USS CARR	46	$32,821.87	28	$21,620.64
FFG 0053	USS HAWES	61	$31,627.39	33	$25,624.81
FFG 0055	USS ELROD	77	$55,154.42	57	$57,034.69
FFG 0056	USS SIMPSON	47	$75,746.22	25	$59,913.65
FFG 0058	USS SAMUEL B ROBERTS	28	$143,932.03	18	$15,082.33

FFG 0059	USS KAUFFMAN	72	$76,776.22	72	$91,724.06
FFG 0060	USS RODNEY M DAVIS	2	$1,498.53	0	$0.00
HSV 0002	USS SWIFT	6	$6,043.85	7	$3,429.90
LCC 0020	USS MOUNT WHITNEY	40	$22,810.27	20	$27,811.84
LCU 1643	LCU-1643	0	$0.00	1	$0.00
LCU 1645	USS LCU-1645	0	$0.00	1	$1,034.00
LCU 1650	LCU-1650	1	$199.98	0	$0.00
LCU 1657	LCU-1657	0	$0.00	1	$1,447.60
LCU 1658	LCU-1658	1	$0.00	0	$0.00
LCU 1662	LCU-1662	2	$5,484.49	0	$0.00
LCU 1663	LCU-1663	1	$1,030.35	0	$0.00
LCU 2035	LCU-2035	0	$0.00	2	$7,223.36
LHA 0002	USS SAIPAN	83	$110,571.67	88	$92,485.42
LHA 0003	USS BELLEAU WOOD	2	$0.00	0	$0.00
LHA 0004	USS NASSAU	60	$54,803.55	46	$105,978.58
LHA 0005	USS PELELIU	9	$3,174.60	9	$16,134.45
LHD 0001	USS WASP	93	$89,679.07	75	$119,539.16
LHD 0002	USS ESSEX	1	$3,497.00	0	$0.00
LHD 0003	USS KEARSARGE	61	$38,835.98	64	$62,864.31
LHD 0004	USS BOXER	3	$1,971.09	0	$0.00
LHD 0005	USS BATAAN	41	$33,128.63	49	$55,941.63
LHD 0007	USS IWO JIMA	48	$82,663.01	37	$40,730.92
LPD 0004	USS AUSTIN	51	$44,483.63	26	$27,682.76
LPD 0005	USS OGDEN	6	$1,605.24	4	$6,506.84
LPD 0009	USS DENVER	4	$170.81	0	$0.00
LPD 0010	USS JUNEAU	1	$1,289.12	0	$0.00
LPD 0012	USS SHREVEPORT	36	$32,966.32	19	$16,816.66
LPD 0013	USS NASHVILLE	10	$1,863.36	6	$3,049.37
LPD 0014	USS TRENTON	36	$17,385.79	38	$39,981.25
LPD 0015	USS PONCE	58	$68,224.09	45	$69,204.32
LSD 0041	USS WHIDBEY ISLAND	44	$39,093.26	38	$47,649.85
LSD 0042	USS GERMANTOWN	9	$5,516.08	7	$13,195.81
LSD 0043	USS FORT MCHENRY	1	$99.17	0	$0.00
LSD 0044	USS GUNSTON HALL	49	$31,137.76	73	$76,076.50
LSD 0045	USS COMSTOCK	10	$7,940.06	0	$0.00
LSD 0046	USS TORTUGA	72	$43,629.78	51	$55,518.60
LSD 0048	USS ASHLAND	53	$60,882.24	85	$94,713.39
LSD 0049	USS HARPERS FERRY	4	$534.38	0	$0.00
LSD 0050	USS CARTER HALL	48	$27,087.66	33	$63,024.27
LSD 0051	USS OAK HILL	57	$42,274.58	53	$61,464.30
MCM 0001	USS AVENGER	12	$9,139.02	27	$61,859.06
MCM 0002	USS DEFENDER	11	$6,288.68	28	$60,851.51
MCM 0003	USS SENTRY	12	$7,236.91	22	$12,690.12
MCM 0004	USS CHAMPION	5	$5,241.46	21	$11,032.64
MCM 0005	USS GUARDIAN	1	$583.84	9	$54,338.61
MCM 0006	USS DEVASTATOR	10	$11,473.48	46	$62,713.23
MCM 0007	USS PATRIOT	4	$2,771.35	3	$11,858.72

MCM 0008	USS SCOUT	5	$2,171.52	54	$57,164.13
MCM 0009	USS PIONEER	13	$15,973.44	34	$32,773.13
MCM 0010	USS WARRIOR	9	$6,084.36	25	$51,885.99
MCM 0011	USS GLADIATOR	13	$8,038.13	26	$31,049.07
MCM 0012	USS ARDENT	28	$39,967.21	19	$19,777.36
MCM 0013	USS DEXTROUS	38	$67,486.63	24	$111,324.18
MCM 0014	USS CHIEF	5	$4,372.86	22	$27,033.37
MCMCL	USS MCM 0001 CLASS HULLS	0	$0.00	1	$39,948.65
MHC 0051	USS OSPREY	5	$5,249.89	40	$60,676.83
MHC 0052	USS HERON	11	$9,604.35	68	$73,577.29
MHC 0053	USS PELICAN	4	$533.87	32	$14,851.54
MHC 0054	USS ROBIN	14	$12,051.55	20	$8,078.63
MHC 0055	USS ORIOLE	5	$1,174.92	13	$13,605.22
MHC 0056	USS KINGFISHER	9	$13,372.68	31	$34,796.17
MHC 0057	USS CORMORANT	2	$151.70	8	$5,851.10
MHC 0058	USS BLACKHAWK	18	$14,705.79	31	$41,068.97
MHC 0059	USS FALCON	6	$3,783.79	23	$24,385.98
MHC 0060	USS CARDINAL	18	$16,463.04	22	$56,072.31
MHC 0061	USS RAVEN	13	$7,318.02	6	$5,655.66
MHC 0062	USS SHRIKE	12	$4,632.67	36	$188,004.17
NR 0001	USS EXP SUB OCEANOGR	2	$0.00	8	$10,741.75
PC 0002	USS TEMPEST	4	$971.00	12	$14,135.60
PC 0003	USS HURRICANE	1	$96.40	0	$0.00
PC 0005	USS TYPHOON	9	$12,340.24	4	$17,393.32
PC 0006	USS SIROCCO	10	$16,244.65	6	$6,793.25
PC 0009	USS CHINOOK	20	$37,221.68	5	$11,407.26
PC 0010	USS FIREBOLT	16	$34,111.41	1	$0.00
PC 0011	USS WHIRLWIND	9	$18,326.08	2	$3,103.59
PC 0012	USS THUNDERBOLT	6	$5,594.57	3	$2,457.97
PC 0013	USS SHAMAL	1	$305.79	5	$3,057.09
PC 0014	USS TORNADO	11	$36,853.43	3	$2,944.62
SSBN 0734	USS TENNESSEE	1	$210.80	3	$0.00
SSBN 0736	USS WEST VIRGINIA	1	$429.71	0	$0.00
SSBN 0738	USS MARYLAND	0	$0.00	1	$247.91
SSBN 0739	USS NEBRASKA	0	$0.00	4	$6,188.41
SSBN 0740	USS RHODE ISLAND	1	$3,910.73	5	$13,009.75
SSBN 0741	USS MAINE	1	$2,096.34	2	$2,213.00
SSBN 0742	USS WYOMING	0	$0.00	2	$14,425.47
SSBN 0743	USS LOUISIANA	0	$0.00	1	$0.00
SSN 0021	USS SEAWOLF	4	$159.33	17	$14,433.16
SSN 0022	USS CONNECTICUT	19	$15,347.39	50	$112,830.35
SSN 0571	HISTORIC SHIP NAUTILUS	2	$6,747.87	0	$0.00
SSN 0683	USS PARCHE	1	$181.93	0	$0.00
SSN 0688	USS LOS ANGELES	2	$981.10	0	$0.00
SSN 0690	USS PHILADELPHIA	19	$10,207.33	52	$97,304.62
SSN 0691	USS MEMPHIS	10	$4,139.72	22	$25,944.97
SSN 0699	USS JACKSONVILLE	20	$19,646.35	42	$70,666.33

SSN 0700	USS DALLAS	39	$78,216.45	55	$105,034.59
SSN 0706	USS ALBUQUERQUE	10	$712.50	46	$70,859.77
SSN 0707	USS PORTSMOUTH	1	$196.22	1	$7,800.00
SSN 0708	USS MINNEAPOLIS-SAINT PAUL	17	$29,213.18	47	$68,575.05
SSN 0709	USS HYMAN G RICKOVER	17	$23,278.52	34	$67,029.59
SSN 0710	USS AUGUSTA	9	$1,993.72	37	$55,148.38
SSN 0714	USS NORFOLK	6	$6,823.67	9	$74,329.38
SSN 0716	USS SALT LAKE CITY	0	$0.00	2	$8,420.16
SSN 0718	USS HONOLULU	1	$189.63	0	$0.00
SSN 0719	USS PROVIDENCE	4	$1,763.75	6	$1,091.78
SSN 0720	USS PITTSBURGH	26	$16,847.27	89	$78,759.99
SSN 0723	USS OKLAHOMA CITY	24	$32,848.61	48	$130,539.53
SSN 0725	USS HELENA	0	$0.00	1	$2,986.08
SSN 0750	USS NEWPORT NEWS	50	$57,794.15	71	$163,730.53
SSN 0751	USS SAN JUAN	14	$12,151.82	29	$32,132.29
SSN 0753	USS ALBANY	14	$23,546.59	40	$109,660.64
SSN 0755	USS MIAMI	14	$11,092.52	24	$30,457.00
SSN 0756	USS SCRANTON	29	$28,719.14	48	$82,415.71
SSN 0757	USS ALEXANDRIA	11	$4,500.34	62	$86,913.58
SSN 0758	USS ASHEVILLE	0	$0.00	2	$12,945.25
SSN 0760	USS ANNAPOLIS	10	$7,874.56	18	$18,279.26
SSN 0761	USS SPRINGFIELD	6	$11,256.14	11	$13,407.40
SSN 0762	USS COLUMBUS	0	$0.00	1	$44,500.00
SSN 0764	USS BOISE	4	$1,446.90	20	$27,973.72
SSN 0765	USS MONTPELIER	6	$7,369.50	15	$26,028.03
SSN 0767	USS HAMPTON	28	$54,967.15	42	$93,706.65
SSN 0768	USS HARTFORD	14	$7,864.59	25	$67,465.77
SSN 0769	USS TOLEDO	18	$43,083.70	53	$76,634.59
SSN688CL	USS SSN 688 CLASS SUBMARINES	0	$0.00	11	$364,638.02
TAE 0034	USNS MOUNT BAKER	1	$52.70	3	$389.14
TAFS 0008	USNS SIRIUS	2	$2,644.41	0	$0.00
TAFS 0009	USNS SPICA	1	$0.00	2	$877.36
TAFS 0010	USNS SATURN	1	$264.42	3	$6,888.78
TAK 3006	USNS PFC E A OBREGON	0	$0.00	4	$5,718.25
TAO 0189	USNS JOHN LENTHALL	0	$0.00	1	$509.65
TAO 0195	USNS LEROY GRUMMAN	1	$330.93	1	$1,034.15
TAO 0196	USNS KANAWHA	1	$1,604.00	2	$701.08
TAO 0197	USNS PECOS	0	$0.00	1	$1,719.12
TAO 0198	USNS BIG HORN	1	$168.11	0	$0.00
TAO 0201	USNS PATUXENT	1	$1,192.47	4	$2,955.72
TAO 0203	USNS LARAMIE	1	$81.17	1	$917.87
TAOE 0006	USNS SUPPLY	7	$2,046.51	7	$9,882.76
TAOE 0008	USNS ARCTIC	6	$3,704.54	5	$14,273.72
TE MANA	HMNZS TE MANA	1	$0.00	0	$0.00
WHEC 0715	USCGC HAMILTON	0	$0.00	2	$4,484.26
WHEC 0716	USCGC DALLAS	6	$2,792.10	15	$33,402.61
WHEC 0721	USCGC GALLATIN	6	$5,678.37	11	$28,882.36

WIX 0327	USCG EAGLE	0	$0.00	3	$46,198.48
WMEC 0615	USCG RELIANCE	0	$0.00	1	$0.00
WMEC 0617	USCG VIGILANT	2	$19,465.35	2	$16,800.58
WMEC 0618	USCG ACTIVE	0	$0.00	3	$20,319.74
WMEC 0619	USCG CONFIDENCE	0	$0.00	4	$8,072.21
WMEC 0620	USCG RESOLUTE	0	$0.00	2	$8,535.86
WMEC 0623	USCG STEADFAST	0	$0.00	2	$18,092.79
WMEC 0625	USCG VENTUROUS	0	$0.00	2	$16,816.04
WMEC 0627	USCG VIGOROUS	1	$98.11	0	$0.00
WMEC 0629	USCG DECISIVE	0	$0.00	3	$17,400.90
WMEC 0901	USCGC BEAR	0	$0.00	4	$6,855.67
WMEC 0902	USCGC TAMPA	6	$2,626.08	11	$20,846.30
WMEC 0903	USCGC HARRIET LANE	4	$1,870.78	16	$24,454.78
WMEC 0904	USCGC NORTHLAND	1	$407.72	6	$12,592.25
WMEC 0905	USCGC SPENCER	2	$6,793.10	6	$14,304.86
WMEC 0906	USCGC SENECA	1	$101.93	6	$27,594.85
WMEC 0907	USCGC ESCANABA	2	$2,424.90	9	$18,529.17
WMEC 0908	USCGC TAHOMA	1	$1,070.26	4	$9,127.12
WMEC 0909	USCGC CAMPBELL	2	$407.72	5	$20,016.70
WMEC 0910	USCGC THETIS	0	$0.00	2	$16,095.12
WMEC 0911	USCGC FORWARD	2	$400.08	0	$0.00
WMEC 0912	USCGC LEGARE	0	$0.00	1	$3,912.31
WMEC 0913	USCGC MOHAWK	6	$12,990.70	4	$6,644.55
WPB 87315	USCG AMBERJACK	0	$0.00	4	$5,762.42
WTGB 0101	USCGC KATMAI BAY	0	$0.00	2	$7,377.58
	FY04 TOTALS:	**6,453**	**$6,583,243**	**5,929**	**$9,798,024**

APPENDIX B

A. OBJECTIVE

The objective of this study is to investigate the effect of an improvement in mean time to repair (MTTR) of a weapon system on spares provisioning.

B. RESEARCH METHODOLOGY

The study is primarily conducted with the aid of an Arena software simulation model. This model was initially developed to aid in identifying and evaluating promising alternatives to achieve improvements in weapons system-level availability. The research methodology of this study is as follows:

- Establish and validate the base case against the results of the case study in the paper "A Design of Experiment Approach to Readiness Risk Analysis" by Kang, Doerr and Sanchez (2006).
- Investigate the effects of varying the input parameters to gain an understanding of the relationship between operational availability and the factors such as MTBF, MTTR, transportation delay, and spares.
- Investigate the relationship between spares and MTTR, MTBF, and transportation delay.

C. SIMULATION MODEL AND SCENARIO

The scenario is that of a squadron that has 40 UAV (Unmanned Air Vehicles). When a subsystem fails, it is replaced by a spare, if one is available. The failed sub-system is sent for repair and then to the spare pool upon its completion. If spare is not available, the UAV will be grounded. No swapping of sub-systems from another UAV is allowed. Table 6 shows the input factors for the simulation model.

Factors	Range
Engine MTBF	200–400 hours
Propeller MTBF	150–300 hours
Av Computer MTBF	300–600 hours
Spare Engines	1–20 units
Spare Propeller	1–20 units
Spare Av Computers	1–20 units
Engine MTTR	1–30 hours
Propeller MTTR	1–30 hours
Av Computer MTTR	1–30 hours
Transportation Delay	1–15 days

Table 6. Ranges of Input Factors

D. ESTABLISHING THE BASE CASE

The design of experiment used for the simulation runs is a Nearly Orthogonal Latin Hypercube (NOLH) with 33 scenarios. Figure 14 shows a histogram of simulation responses for the Engine MTBF, Engine Repair Time, Number of Spare Engines, and Number of Spare Propellers. It is observed that the average Operational Availability (A_o) ranged from 0.4 to 0.9. The average A_o is 0.61 with a standard deviation of 0.16. The result obtained by Kang, Doerr and Sanchez using NOLH with 257 scenarios with the same simulation model is an average A_o of 0.795 with a standard deviation of 0.085, and a range from 0.599 to 0.976. Hence, the two results are comparable.

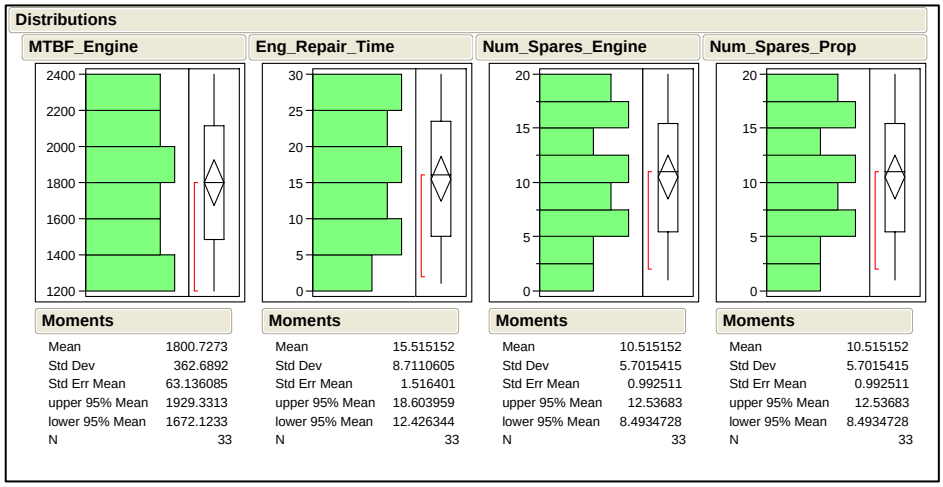


Figure 14. Histograms of Simulation Responses, Base Case

A regression tree for predicting the average A_o is shown in Figure 15. It concluded that the dominant factor affecting average A_o is transportation delay. For example, the first split of the regression tree shows that for transportation delay less than 8, the average A_o is 0.733 for 15 scenarios.

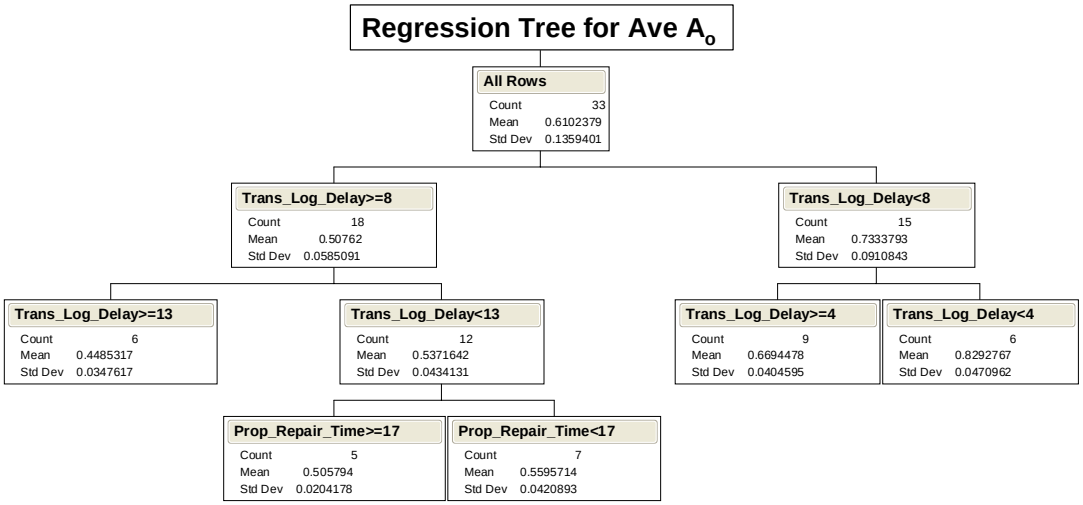


Figure 15. Regression Tree for Average A_o, Base Case

A regression metamodel of the average A_o was also determined using the stepwise function in JMP statistical software, the outcome of which was a metamodel with 4 main effects, i.e. transportation delay, propeller MTBF, engine MTBF, and avionic computer MTBF. No interaction effects were found. A very large t-ratio was observed for the

transportation delay factor. These results are consistent with that obtained by Kang, Doerr and Sanchez (2006) and hence the base case has been established and validated.

Whole Model

Summary of Fit

RSquare	0.960288
RSquare Adj	0.954615
Root Mean Square Error	0.02896
Mean of Response	0.610238
Observations (or Sum Wgts)	33

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	4	0.56786686	0.141967	169.2704
Error	28	0.02348353	0.000839	Prob > F
C. Total	32	0.59135039		<.0001

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	0.619789	0.045502	13.62	<.0001
Trans_Log_Delay	-0.030268	0.001198	-25.26	<.0001
MTBF_Prop	0.0000804	0.000019	4.27	0.0002
MTBF_Engine	0.0000443	0.000014	3.14	0.0040
MTBF_AvComp	0.0000168	0.000009	1.78	0.0858

Effect Tests

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
Trans_Log_Delay	1	1	0.53518630	638.1159	<.0001
MTBF_Prop	1	1	0.01527986	18.2186	0.0002
MTBF_Engine	1	1	0.00824992	9.8366	0.0040
MTBF_AvComp	1	1	0.00265988	3.1714	0.0858

Figure 16. Regression Metamodel for Average A_o, Base Case

Case 1 — Transportation Delay Factor

The transportation delay factor was reduced from 1–15 days to 0–1 days. The reduction in number is realistic because it is common for I-Level maintenance units to be deployed near the frontline units to provide operations support. A plot of the regression tree for predicting the average A_o shows that the dominant factors are propeller MTTR, propeller MTBF, and transportation delay. This result was assessed to be reasonable because the total (2-way) transportation delay ranges from 0 to 48 hours and is comparable to the range of 1 to 30 hours for propeller MTTR. The average A_o has also improved significantly to 0.911 from 0.610. This result is expected as the average A_o is generally defined as uptime divided by the total uptime and downtime of the system. The uptime corresponds to the MTBF, while the downtime is the sum of MTBF, MTTR, and transportation delay. Hence, a huge reduction in transportation delay will result in a much improved average A_o.

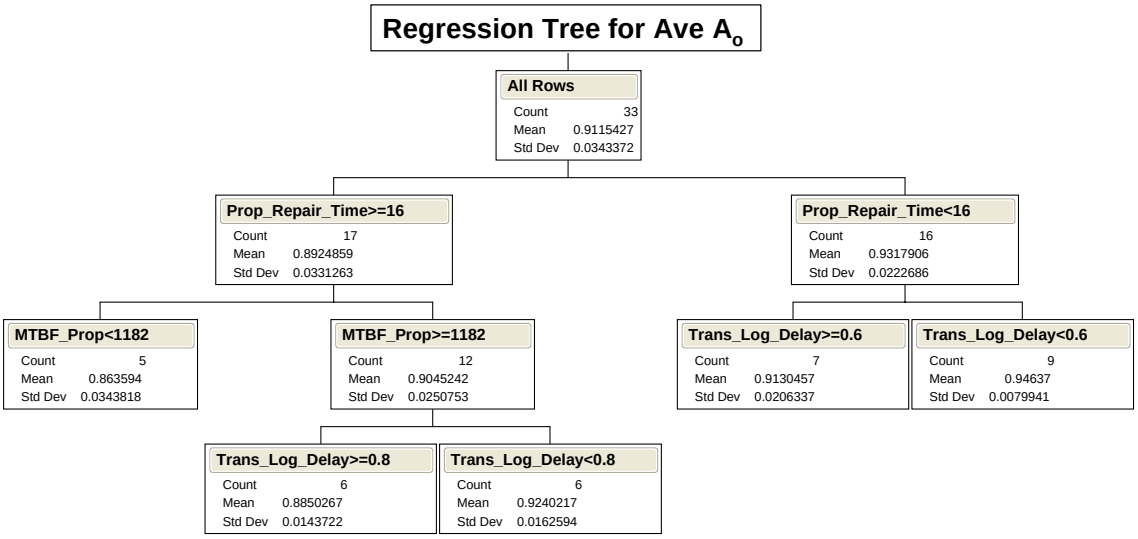
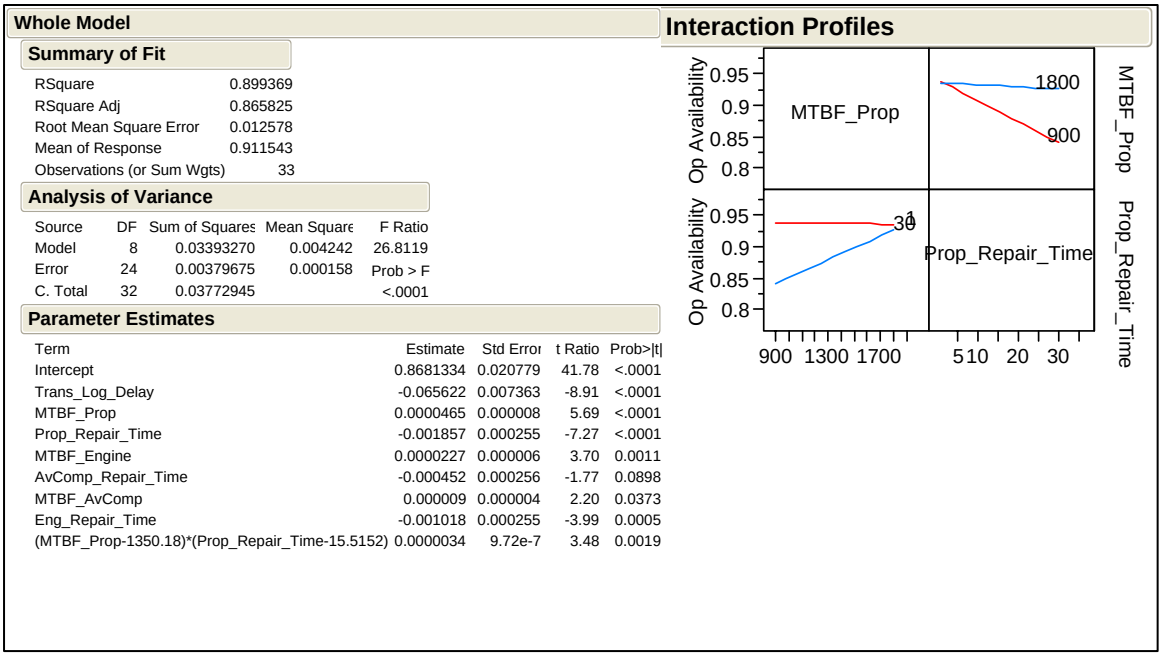


Figure 17. Regression Tree for Average A_o, Case 1

Figure 18 shows the regression model using the stepwise function in JMP for the case with a reduced transportation delay. Factors that are found to be statistically significant include an interaction effect between propeller MTBF and propeller MTTR. For example, when the propeller MTTR is 1 hour, the average A_o increases from 0.85 to 0.92. In this case, the critical component that affects average A_o is no longer limited to the propeller; it includes the engine and avionic computer.



Whole Model

Summary of Fit

RSquare	0.899369
RSquare Adj	0.865825
Root Mean Square Error	0.012578
Mean of Response	0.911543
Observations (or Sum Wgts)	33

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	8	0.03393270	0.004242	26.8119
Error	24	0.00379675	0.000158	Prob > F
C. Total	32	0.03772945		<.0001

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	0.8681334	0.020779	41.78	<.0001
Trans_Log_Delay	-0.065622	0.007363	-8.91	<.0001
MTBF_Prop	0.0000465	0.000008	5.69	<.0001
Prop_Repair_Time	-0.001857	0.000255	-7.27	<.0001
MTBF_Engine	0.0000227	0.000006	3.70	0.0011
AvComp_Repair_Time	-0.000452	0.000256	-1.77	0.0898
MTBF_AvComp	0.000009	0.000004	2.20	0.0373
Eng_Repair_Time	-0.001018	0.000255	-3.99	0.0005
(MTBF_Prop-1350.18)*(Prop_Repair_Time-15.5152)	0.0000034	9.72e-7	3.48	0.0019

Figure 18. Regression Metamodel for Average A_o, Case 1

Next, a regression tree for the average spare is computed and shown in Figure 19. Based on the regression tree, it was found that the sole dominant factor that determines the level of spares required is propeller MTBF as shown.

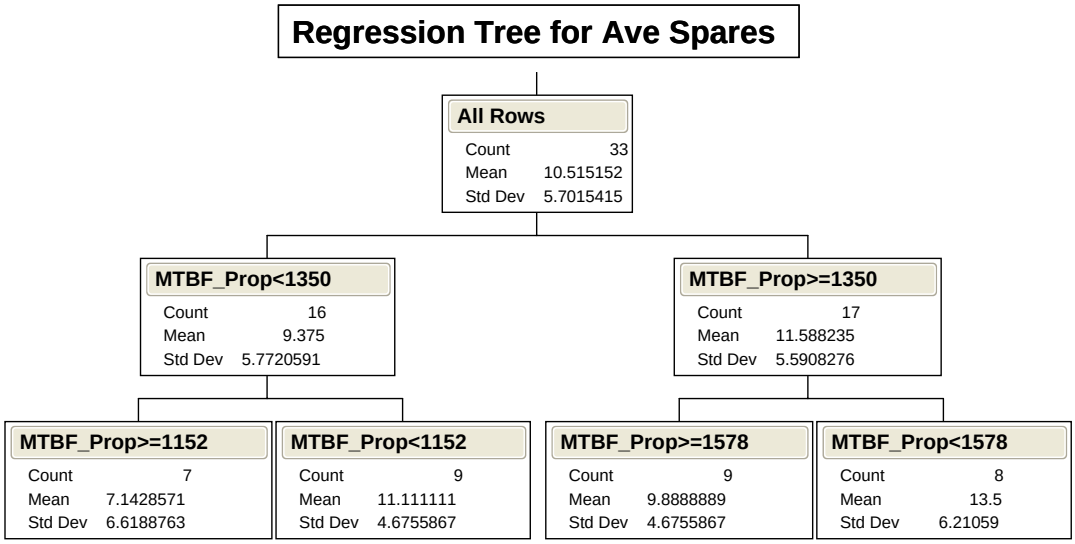
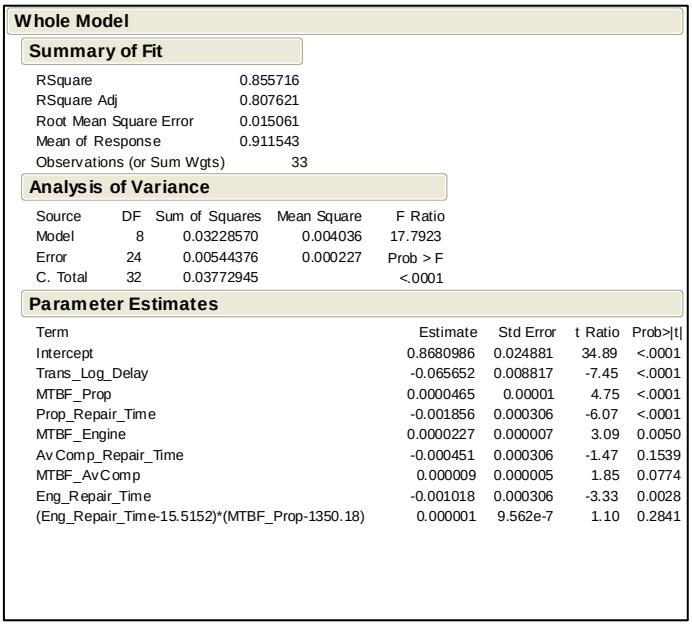


Figure 19. Regression Tree for Average Spares, Case 1

Case 2 — Propeller Spares Factor

The input range for Spares is reduced from 1–20 units to 0–1 units, while holding the transportation delay factor at 0-1 days. The regression metamodel for the average A_o was computed and shown in Figure 20. It had a similar result as Case 1. Clearly, the propeller spares is not statistically significant. A check on the regression tree for average propeller spares indicated that dominant factor is again propeller MTBF.



Whole Model

Summary of Fit

RSquare	0.855716
RSquare Adj	0.807621
Root Mean Square Error	0.015061
Mean of Response	0.911543
Observations (or Sum Wgts)	33

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	8	0.03228570	0.004036	17.7923
Error	24	0.00544376	0.000227	Prob > F
C. Total	32	0.03772945		<.0001

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	0.8680986	0.024881	34.89	<.0001
Trans_Log_Delay	-0.065652	0.008817	-7.45	<.0001
MTBF_Prop	0.0000465	0.00001	4.75	<.0001
Prop_Repair_Time	-0.001856	0.000306	-6.07	<.0001
MTBF_Engine	0.0000227	0.000007	3.09	0.0050
AvComp_Repair_Time	-0.000451	0.000306	-1.47	0.1539
MTBF_AvComp	0.000009	0.000005	1.85	0.0774
Eng_Repair_Time	-0.001018	0.000306	-3.33	0.0028
(Eng_Repair_Time-15.5152)*(MTBF_Prop-1350.18)	0.000001	9.562e-7	1.10	0.2841

Figure 20. Regression Metamodel for Average A_o, Case 2

Case 3 — Propeller MTBF Factor

In this case, the input range for propeller MTBF was reduced from 150–300 hours to 15–30 hours, while keeping the earlier changes made to transportation delay and propeller spares factor. A regression tree for the Average A_o is shown in Figure 8. It is observed that the average A_o was reduced significantly to 0.31 with such a drop in propeller MTBF performance. The propeller MTTR has become the dominant factor that affects average A_o, and is validated by the regression metamodel shown in Figure 22.

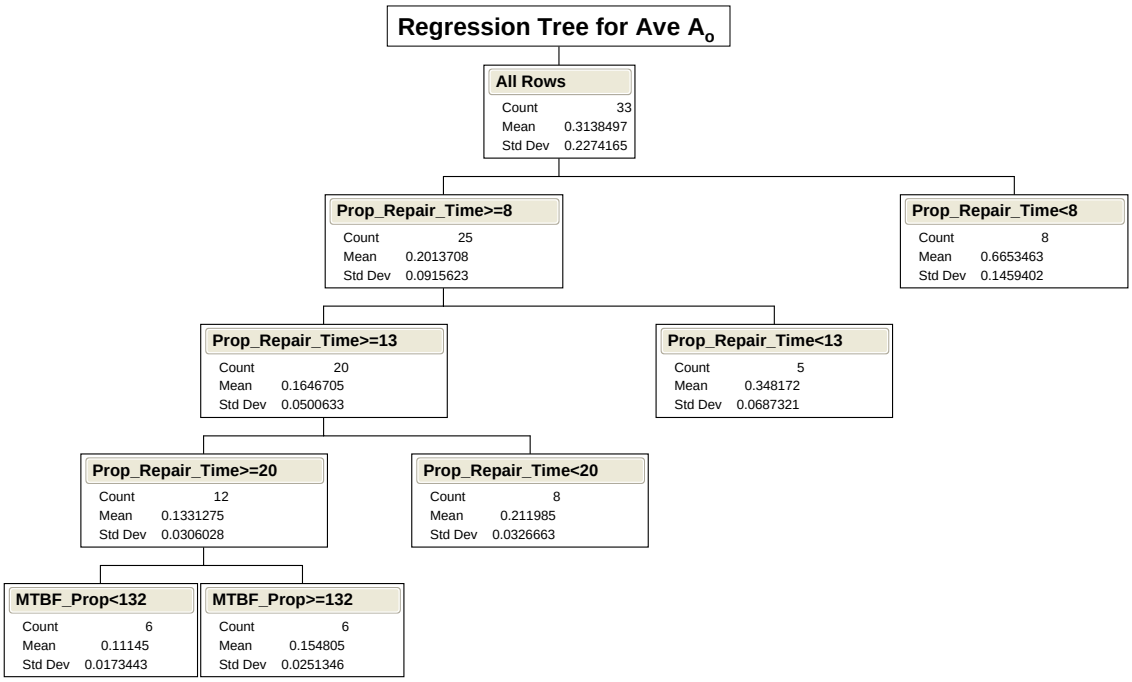


Figure 21. Regression Tree for Average A_o, Case 3

Whole Model

Summary of Fit

RSquare	0.814263
RSquare Adj	0.80188
Root Mean Square Error	0.101225
Mean of Response	0.31385
Observations (or Sum Wgts)	33

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	2	1.3475918	0.673796	65.7593
Error	30	0.3073921	0.010246	Prob > F
C. Total	32	1.6549839		<.0001

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	0.4169295	0.094617	4.41	0.0001
MTBF_Prop	0.0018575	0.000647	2.87	0.0074
Prop_Repair_Time	-0.022817	0.002054	-11.11	<.0001

Effect Tests

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
MTBF_Prop	1	1	0.0844971	8.2465	0.0074
Prop_Repair_Time	1	1	1.2642311	123.3829	<.0001

Figure 22. Regression Metamodel for Average A_o, Case 3

Case 4 — Propeller MTTR Factor

In this case, the changes made to the transportation delay in Case 2 were included. This allowed an assessment to be made on the impact of reducing the propeller MTTR from 1–30 hours to 1–15 hours on spares.

Figures 23 and 24 show the regression trees for the average A_o and average propeller spares respectively. The results are similar to that in case 3. For example, the average A_o is improved slightly to 0.915 from 0.911. In particular, the dominant factor that affects propeller spares is still propeller MTBF even though the propeller MTTR is reduced by 50%.

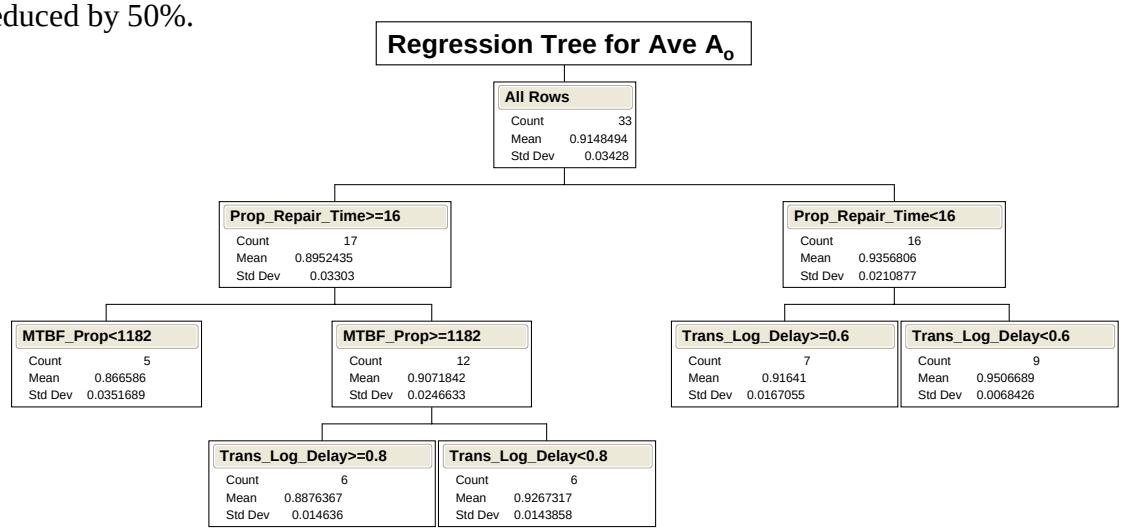


Figure 23 Regression Tree for Average A_o, Case 4

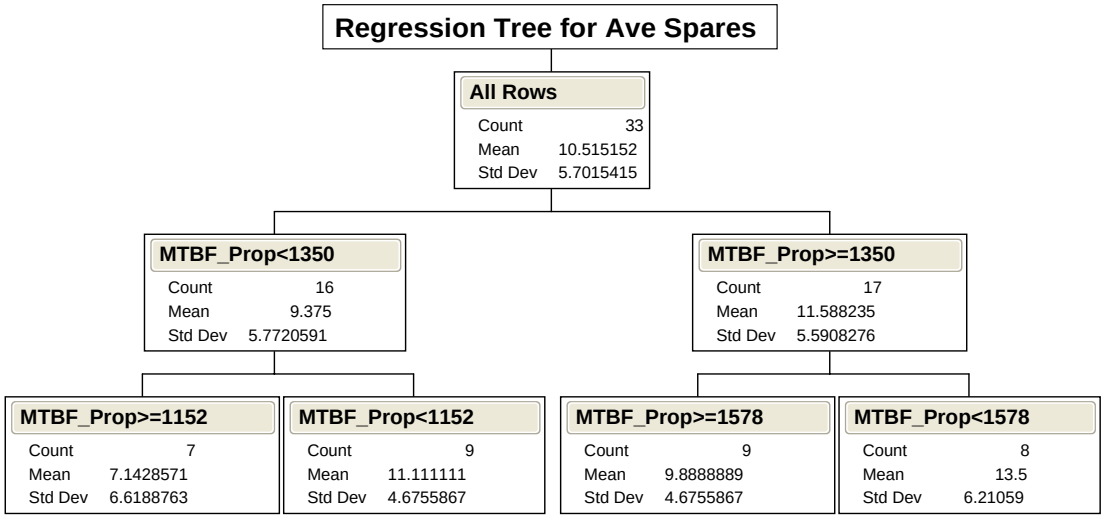


Figure 24. Regression Tree for Average Spares, Case 4

E. CONCLUSION

The objective of this study—to determine the effect of MTTR of a weapon system on spares provisioning—is met. Based on the simulation results, it is found that MTTR has no statistical significance in spares provisioning. Instead, it is concluded that the dominant factor is MTBF.

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