Naval Sea Systems Command (NAVSEA)
SHIP

Logistics Requirements Funding Summary Tool (LRFST)

NAVAL SEA SYSTEMS COMMAND
LOGISTICS REQUIREMENTS & FUNDING SUMMARY TOOL

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ABSTRACT

The United States Navy has focused on planning and estimation of operations and support costs for programs. A task force created by Secretary Stackley (Assistant Secretary Navy Research, Development & Acquisition) to identify actions for achieving this goal recommended creating a logistics tool similar to that developed by the United States Marine Corps (USMC). This paper demonstrates the tool, development approach, cost estimating methodologies, interface, and deployment to the next generation aircraft carrier program.

EXECUTIVE SUMMARY

This paper documents the approach, methodology, and results of the development of the Naval Sea Systems Command (NAVSEA) Ship Logistics Requirements Funding Summary Tool (NAVSEA SHIP LRFST) effort. The current NAVSEA SHIP LRFST development effort consists of two phases (hereafter the Pilot Phase) using the USS John F. Kennedy (Carrier, Fixed Wing Aircraft, Nuclear (CVN)-79) as a pilot program. This paper provides is a comprehensive understanding of the LRFST development processes that includes tool development, data collection, methodology development, pilot testing, and the Microsoft (MS) SharePoint hosting site. In the past, limited capability existed within NAVSEA to develop a Logistics Requirements Funding Summary (LRFS) and logisticians charged with LRFS development may not have had the necessary training or background to perform cost estimation of logistics requirements. The purpose of the LRFST is to provide a user-friendly, MS Excel-based tool that allows program managers, product support managers, and life cycle logisticians to quickly generate or review LRFSs for all types of NAVSEA programs. The Pilot Phase (Phase I and II) focuses on providing limited deployment of the tool using CVN-79 as a pilot program.

During the Pilot Phase, the LRFST development team reviewed NAVSEA LRFS policies, identified the NAVSEA SHIP LRFST requirements based on users' needs, and conducted data collection. The Development Team developed the LRFST framework by leveraging the United States Marine Corps LRFS Cost Estimating Tool (USMC LRFS CET) and executed tool development. As part of the data collection process, the Development Team conducted a series of intensive interviews with key personnel from the Program Executive Office (PEO) Carriers. The Development Team also collected historical program data from CVN-78 and CVN-79, as well as prior programs. The Development Team also examined budget data, previous LRFS results, and planning data and incorporated "must have" features of past development efforts.

The Development Team initiated a series of Integrated Product Team (IPT) meetings to better understand the acquisition logistics and product support requirements associated with a LRFS. These meetings provided the opportunity to identify activities and cost drivers unique to the ship programs. From these meetings, the IPT established the framework of the user interface and identified key programmatic inputs required to generate a LRFS estimate. The Development Team developed a conceptual architecture for the tool with a goal to facilitate the development of defensible program LRFSs addressing the total life cycle. Subsequently, the Development Team successfully tested and completed the tool's deployment at the end of the Pilot Phase.

This paper serves as the fundamental guide and documentation on "how the NAVSEA SHIP LRFST was developed and is maintained." Additional LRFST documentation includes the System Manual and User's Manual. The System Manual is intended to address the details of how the NAVSEA SHIP LRFST works from a developer/programmer/administrator perspective. The User Manual is a consolidated printed version of the embedded Help Files.

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1. Introduction

This paper documents the approach, methodology, and results of the development of the Naval Sea Systems Command SHIP Logistics Requirements Funding Summary Tool (NAVSEA SHIP LRFST) effort. The current NAVSEA SHIP LRFST pilot development effort consists of two phases using USS John F. Kennedy (CVN-79) as a pilot.

The paper provides users, decision makers, and stakeholders with a comprehensive understanding of the LRFST development processes that includes tool interface development, data collection, methodology development, pilot testing, and development of a Microsoft (MS) SharePoint hosting site. In the past, limited capability existed within NAVSEA to develop a Logistics Requirements Funding Summary (LRFS) and logisticians charged with developing a LRFS may not have had the necessary training or background to perform cost estimation of logistics requirements. The purpose of the LRFST is to provide a user-friendly, MS Excel-based tool that allows program managers, product support managers, and life cycle logisticians to quickly generate or review LRFSs for all types of NAVSEA programs.

1.1 Background

To address the concern that a greater balance must be struck between acquisition cost (lowering) and Total Ownership Cost (TOC), or more specifically, Operating and Support (O&S) costs, Assistant Secretary of the Navy (ASN) Stackley directed the establishment of a task force charged with balancing acquisition costs and life cycle costs for shipbuilding programs. The initial focus of this Task Force was on surface ships. Task Force membership included:

- ASN for Research, Development and Acquisition (ASN(RDA))
- Naval Operations for Warfare Systems and Fleet Readiness and Logistics (OPNAV N9/N4)
- United States Fleet Forces (USFF) Command
- Naval Surface Forces (SURFOR)
- Program Executive Office (PEO) Ships
- Littoral Combat Ship (LCS)
- PEO Carriers
- NAVSEA 05C/05D/06
- Naval Supply Systems Command (and NAVSUP)

The Task Force's two primary objectives were to: 1) propose draft policy for ship acquisition that balances ship acquisition costs and life cycle costs, and 2) identify governance, organizational, budget, or other acquisition enablers or barriers.

Specific Task Force LRFS-related findings include:

- Based on the Secretary of the Navy Instruction (SECNAVINST) 5000.2E Requirement, the LRFS is a required adjunct of the Life Cycle Sustainment Plan (LCSP) and the program's basis for relating LCSP execution to programmatic resources.
- A LRFS should be used to relate both program-specific and non-program (infrastructure) resource requirements to any and all aspect of LCSP execution.
- The Program Manager (PM) shall ensure that LRFS sustainment funding requirements are comprehensive, current, and incorporated into systems planning, budgets, and analyses.
- There is a lack of LRFS understanding and standardization among both Ship Acquisition Program/Project Managers (SHAPMs) and Participating Acquisition Resource Managers (PARMs).
- Poor quality of LRFS reports leads to high deficiency ratings.

- Eighty-six percent (86%) of all NAVSEA LRFSs received a Yellow or Red rating by the Independent Logistics Assessment (ILA) Board based on the analysis derived from all Acquisition Categories (ACATs) and Milestones from Calendar Year (CY) 2000 to 2013.
- Deficiencies yield moderate to significant impacts to supportability in terms of cost, schedule, and performance (readiness).

As a result of these findings, the Task Force recommended that NAVSEA "Invest and use the Logistics Requirements Funding Summary (LRFS) Cost Estimating Tool (CET)" similar to the tool that was developed for the United States Marine Corps (USMC). Specifically, at a Task Force Principals Directive from Principals Briefing on August 17, 2014, the Task Force approved the recommendation to proceed with a NAVSEA LRFS Tool (with limited deployment). Admiral Moore proposed USS John F. Kennedy (CVN-79) aircraft carrier program as a pilot.

Acquisition and Commonality Directorate - Logistics (SEA 06L), in collaboration with Deputy Assistant Secretary of the Navy (DASN) SHIPS and PEO Carriers, initiated the task to provide a NAVSEA SHIP LRFST, relevant data, and methodologies. SEA 06L is responsible for the development and implementation of logistics policies, processes, and technologies to ensure life-cycle support for all ship classes and weapons systems from acquisition through Fleet introduction, operations and sustainment, and subsequent disposal (cradle to grave). SEA06L assists NAVSEA Program Offices and affiliated PEOs across all Navy Warfare Enterprises in planning and assessing lifecycle supportability and ensuring that Fleet material readiness and mission performance requirements are met.

The principal development team for the NAVSEA SHIP LRFST task selected Booz Allen Hamilton (Booz Allen) because of their prior experience in the development of the USMC LRFS CET. DASN SHIP provided oversight as the sponsorship. The SEA 06L[1] served as Contracting Officer Representative (COR) and provided policy and technical guidance. PEO Carriers leadership and logicians provided the CVN-79 program data and user requirements for development of the pilot tool. In addition, an IPT was established to provide subject matter expertise as well as guidance to the Development Team. The IPT consisted of acquisition professionals from Life Cycle Logistics, Naval Facilities Engineering Command (NAVFAC), Program Management, and the Cost Engineering and Industrial Analysis (SEA05C) community.

1.2 Purpose

The purpose of this task was to develop a NAVSEA SHIP LRFST that incorporates cost estimating data and methodologies in a user-friendly automated environment for logisticians and decision makers to determine their program's funding requirements. The LRFS document provides logistics requirements visibility when required for Program Objectives Memorandum (POM) and budget submissions. The LRFS is a means for the acquisition Program Manager (PM), Product Support Manager (PSM), and logistician to identify a program's supportability requirements by relevant appropriation and phasing, in one document, across the current Future Years Defense Program (FYDP), and beyond.

The NAVSEA SHIP LRFST assists in the development of the Planning, Programming, Budgeting, and Execution (PPBE) process, LCSP, the Life Cycle Cost Estimate (LCCE), and other documentation in support of acquisition milestones and program execution. This includes product support management responsibilities of the Total Life Cycle Systems Management and duties of a PM for fielded systems throughout their operational service life.

[1] In 2015 the functions of NAVSUP Logistics Readiness & Analysis Division NAVSUP (N00AL1) were transferred to SEA 06L

1.3 Scope

The scope of this task included developing and sustaining a tool enabling LRFS development through data collection, creation of a cost model framework and interface, and analyses of results (e.g., quantifiable Course of Action (COA) recommendations). The NAVSEA SHIP LRFST is designed to provide Government stakeholders with a basis for developing and defending logistics requirements funding decisions as well as documenting findings in a report. The tool is intended to assist the Life Cycle Logisticians (LCLs) in each Program Management Office/Team (PMO/PMT) with their program's logistics funding requirements. Each Integrated Product Support (IPS) Element is represented in one or more of the tailored cost estimating tool modules integrated into the overall NAVSEA SHIP LRFST.

1.3.1 CVN-79 Pilot Phase

The scope of the NAVSEA SHIP LRFST Pilot effort included developing an automated LRFST using the CVN-79. The results of the CVN-79 LRFS include program office-specific acquisition logistics and sustainment costs (including program office-specific maintenance activities) as related to the Hull Mechanical and Electrical (HM&E) and propulsion elements. Non-program office-specific costs such as unit-level manpower, unit operations, and maintenance costs were not included in the LRFS (Fleet responsibility vs. Program Office). Highlights of the Statement of Work (SOW) include the following:

"This task order effort is to develop and provide NAVSEA Ship LRFS Pilot Tool deliverables to SEA 06L. Specifically, this effort consists of development of an automated LRFS tool using CVN-79 as a pilot. The results of the LRFS Pilot Tool shall include program-office-specific acquisitions logistics and sustainment costs as related to the CVN-79 platform (HM&E), propulsion, electronics and ordinance/air systems. The analyses to be conducted under this Survivability/Vulnerability Information Analysis (SURVIAC) Technical Area Task (TAT) shall evaluate historical CVN-78/79 program logistics acquisitions and Operations and Support (O&S) cost data collected in an earlier phase. Critical facets of this effort include defining ground rules and assumptions, collecting, analyzing and validating data from the logistics Subject Matter Experts (SMEs), ensuring all applicable platform-specific data are analyzed and documenting each cost estimating methodology. The automated LRFS Pilot Tool shall enable the Life Cycle Logistician to develop an accurate LRFS estimate in support of the Life Cycle Sustainment Plan (LCSP), Planning Programming Budget Execution (PPBE) process, the Integrate d Logistics Assessment, and other programmatic documentation developed in support of acquisition milestones and programmatic execution. Provide the decision maker a better understanding of the carrier's acquisition logistics and sustainment cost impact to the carrier's lifecycle cost. Furthermore, the analysis shall enhance the Tool's ability to identify possible cost savings opportunities based on the system's sustained performance and impact to long-term survivability and required."

2. Policy and Guidance

The NAVSEA SHIP LRFST development team referenced established logistics and cost estimating policy and guidance during the tool development effort to ensure compliance. Overarching policies and guidelines used include the documents in Table 2-1 below. A complete list of all relevant documents and relevant excerpts used are included in Appendix A: NAVSEA SHIP LRFST Policy and Guidance.

Table 2-1: Overarching Policy and Guidance

Date	Title
Sep 2011	SECNAVINST 5000.2E Sep 2011
Jan 2014	NAVAIRINST 7040.16D Funding Of Integrated Product Support Costs
Oct 2015	NAVSEA LRFS Instructions Draft
Jan 2010	DoN Total Ownership Cost (TOC) Guidebook
Oct 2011	MIL-STD-881C, DoD Standard: Work Breakdown Structure (WBS)
Dec 1992	DoD 5000.4-M - Cost Analysis Guidance and Procedures
Dec 2012	SECNAVINST 5223.2A DoN Cost Analysis
Oct 2010	DASN(C&E) DON Cost Estimating Guide
Feb 2010	NAVSEA 05C Cost Estimating Handbook
Sep 2011	NAVSO P-3692 ILA Handbook
Dec 2012	SECNAV INSTRUCTION 5420.196A Establishment And Review Of DoN Independent Cost Estimates (ICE) for ACAT IC & IA
Jan 2010	ASN RDA Memo Service Cost Position (SCP)
Mar 2009	GAO-09-3SP GAO Cost Estimating and Assessment Guide DTD
Oct 1992	OMB, Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs, Circular No. A-94 Revised
Jan 2004	Defense Acquisition Guidebook
Dec 2011	DoD Integrated Product Support Element Guidebook
Apr 2011	DoD Product Support Manager Guidebook
Mar 2012	Operating and Support Cost-Estimating Guide (Office of the Secretary of Defense (OSD) Director of Cost Assessment and Program Evaluation (CAPE)

3. Ground Rules and Assumptions (GR&AS)

To guide each phase of the tool's development, GR&As, divided into the following three sub-categories, were established.

3.1 Overarching GR&As

In developing the LRFST, it was assumed that the experience level of the end user might vary significantly from users who have little or no logistics experience to users with 30+ years of experience and little or no experience with cost modeling. Based on these two assumptions, the Development Team developed the NAVSEA SHIP LRFST to support the wide spectrum of logistics and cost modeling experience levels. The Development Team designed the tool with an option to request the most basic programmatic information from the user and apply that information to select the appropriate models for the user's program and generate costs for each cost element.

The accuracy of the LRFS is directly dependent upon the amount of programmatic information the user provides. Given the varying degrees of programmatic knowledge among the different end users of the NAVSEA SHIP LRFST, it is assumed that the user will have information specific to the program that will improve the accuracy of the LRFS that is being generated. For example, the user can generate a LRFS by providing minimal programmatic information (i.e., program schedules). As the user provides additional information, the NAVSEA SHIP LRFST estimate is refined to better represent the requirements of the program. In short, the NAVSEA SHIP LRFST is designed to produce estimates with minimal programmatic information, but will allow the user to provide more cost data to refine the estimate, if and when such data becomes available and as plans mature.

3.2 Data Collection GR&As

It is assumed that ships within the CVN class will have similar costs or cost relationships unless actual data proves otherwise. In addition, ships with similar support strategies and program status are assumed to have similar costs.

The NAVSEA SHIP LRFST includes a database of cost models, which automatically generate cost estimates for each LRFS cost element within the NAVSEA Cost Element Structure (CES). The Development Team developed these cost models based on historical cost data from the CVN-78 and CVN-65 (i.e., Disposal Costs). To account for the differences between ships within the CVN class and various programmatic changes, the cost models, which reside in the NAVSEA SHIP LRFST library, are organized and sorted based on the various categories. With this framework, the data collection effort included capturing the relevant programmatic details above for all cost-data points collected. The tasks outlined in the previous CVN-78 LRFS and the Ship Builder task list provided an outline of future costs within the ship class. This information, coupled with financial actuals grouped by entity, provides an accurate picture of the lifecycle cost of the CVN-78 and the requirements at the low task level.

Within the LRST, user inputs determine how costs are assigned to the tasks and are cross-checked to the historical data to ensure they are mapped to the correct cost elements.

3.3 Tool Development GR&As

Given that the end user is assumed to have varying degrees of experience with respect to logistics and cost estimating, the NAVSEA SHIP LRFST was designed to require minimal active manipulation of the cost models by the user outside of certain functions such as:

- The addition of travel, labor, product, material, and miscellaneous costs by stakeholders

- The addition of task and element specific cost values to override default and forecast values
- The assignment of appropriations for cost elements and tasks

The tool is designed to be intuitive for ease of use; it was not intended to require extensive training. A user can develop an initial draft LRFS with little or no training by providing answers to a limited number of questions that define the program, mapping custom tasks to the NAVSEA CES, and capturing stakeholder inputs. To achieve this, the LRFST is designed with features that include instructions, definitions, and tool tips to guide the user along with an extensive context-sensitive Help utility familiar to nearly all computer workstation users.

4. TOOL DEVELOPMENT

The tool development process, captured below in Figure 4-1, includes: identifying user requirements, developing the conceptual model architecture, building the tool interface, developing and integrating the associated calculation database for the NAVEA SHIP LRFST, testing and delivery, and making revisions as a part of the continuous development cycle until the end of the development process. To ensure that the tool conformed to established performance and quality criteria, the Development Team presented it at each development milestone to the NAVSEA SHIP LRFST SEA 06L Lead, PEO Carriers logisticians, and NAVSEA SHIP LRFST IPT members for review, validation, and approval.

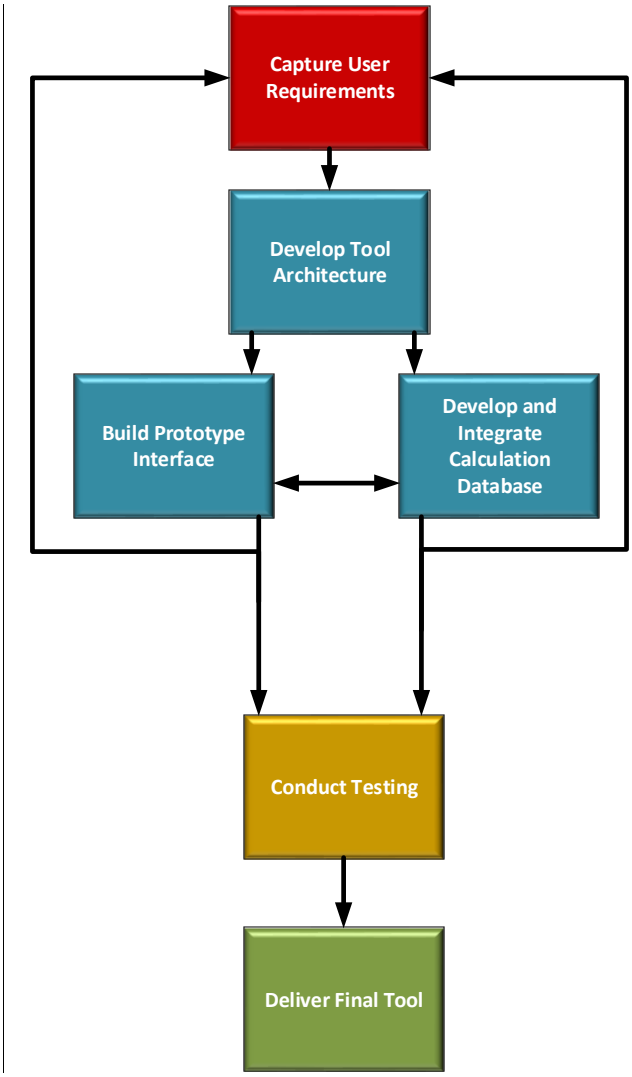

Figure 4-1: NAVSEA SHIP LRFST Development Process

4.1 User Requirements

The Development Team leveraged the Use Case Analyses work performed for the USMC LRFS CET task to identify user requirements for the NAVSEA SHIP LRFST. A Use Case describes how a type of user (called an actor) uses a system to achieve a goal. Based on the broad range of potential users' level of functional logistics knowledge, program-specific knowledge, and cost-

estimating knowledge, Use Cases are highly useful techniques for describing required interactions within the context of defined tasks (Use Case Applications) and various user-dependent Use Case parameters. Use Cases provide the appropriate mix of defined requirements and flexibility in development. The key objective of the Use Case Analysis is to define:

- Who will be using the system
- What will they be using the system to do

By defining these parameters, the Development Team was able to tailor the tool to support a broad range of requirements, thus determining the appropriate mix of required and optional inputs, the appropriate advanced estimate refinement capabilities, and the various required outputs of the NAVSEA SHIP LRFST.

4.1.1 Use Case Approach

The Development Team created a set of LRFS purposes, referred to as "Use Case Applications," that are nested with the overarching NAVSEA SHIP LRFST goal: to facilitate the development of defensible NAVSEA Ship program LRFSs at all stages of the acquisition life cycle. These purposes were derived from the review of the NAVSEA ILA and LRFS policies, interviews conducted with SEA 06L and PEO Carriers logisticians, and dialogue during IPT sessions. Additionally, the Development Team developed a set of user-dependent parameters, referred to as "Use Case Parameters" to represent a collective description of potential users. Each Use Case Parameter represents a generalized range of measure, from "low" to "high." All potential users and primary stakeholders fall somewhere within the generalized range of measure for each parameter, regardless of their particular title. Figure 4-2 depicts the Development Team's approach to the Use Case Analysis and the user-based considerations applied to tool development requirements. Specific titles and expected levels of proficiency were reviewed when analyzing the "Typical" Use Case (captured in Section 4.1.2).

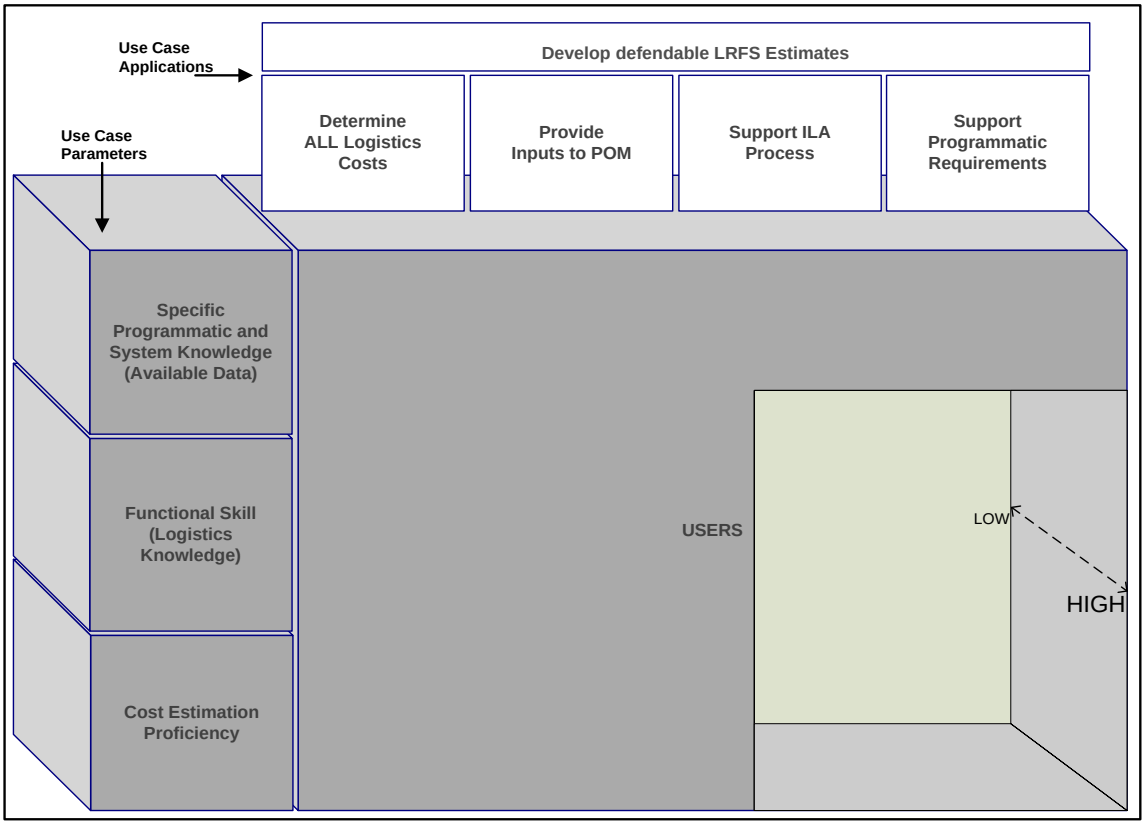

Figure 4-2: NAVSEA SHIP LRFST Use Case Analysis Approach

As shown in Figure 4-2, users of the NAVSEA SHIP LRFST will have varying levels of available program-specific data, logistics functional knowledge, and cost estimating proficiency. As such, the tool had to be developed to account for the wide range of possibilities. The development considerations included:

- User Interface Features
- Inputs and Indicators
- NAVSEA SHIP LRFST Outputs

These considerations lead the Development Team to define limited requirements for LRFS estimate generation including additional optional features for advanced refinement of data and cost models (impacts to user-inputs, calculation methods, data collection requirements), as well as general and specific outputs that support a wide range of LRFS purposes (impacts to required tool outputs). By tailoring the outputs to support a wide range of purposes, users have the ability to extract what they need for their specific requirements – from capturing all logistics related costs to supporting the decision-making process for Program Managers. While the Use Case approach helped outline general user-based tool development considerations, the Development Team developed a Typical Use Case to better answer the primary questions posed (see below).

4.1.2 Typical Use Case

As outlined in Figure 4-3, the Development Team constructed a Typical Use Case to further capture user requirements.

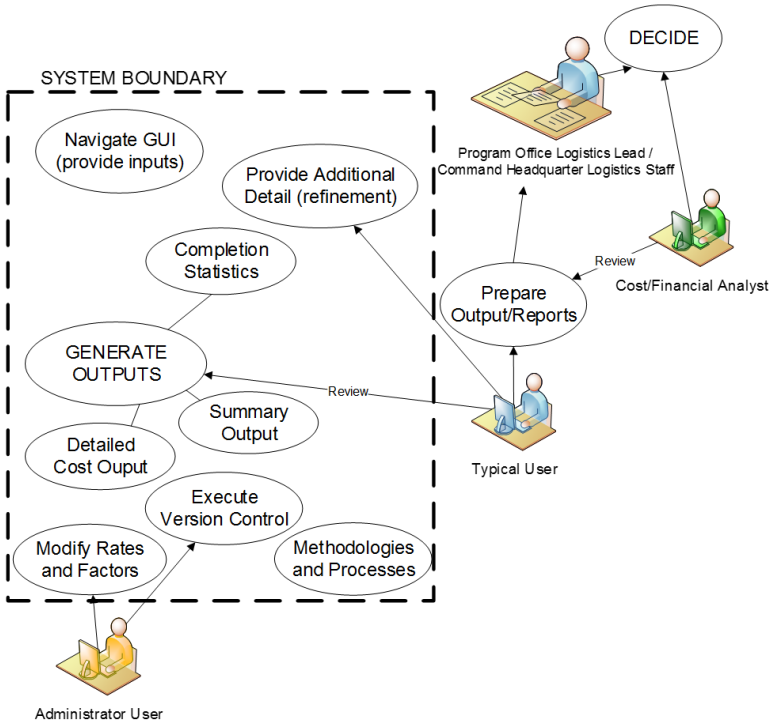

Figure 4-3: Typical LRFST Use Case

As depicted in Figure 4-3, there are several user categories:

- "Typical User," who is a logistician supporting the Program Management Team (PMT). The Typical User's primary responsibility is to generate a LRFS for the program, likely individuals assigned as ILS Manger for the Program Office.
- "System Administrator," who will execute LRFST version control and distribute updates on behalf of SEA 06L.
- "Cost Analyst," who will use the LRFST to review cost methodologies employed within the tool, likely individuals assigned to the Cost Engineering and Industrial Analysis Division (SEA 05C) of the Naval Systems Engineering Directorate (SEA 05).
- "Program Office Logistics Lead and Command Headquarters Logistics Staff," who will use the LRFST to review CESs associated with specific logistics disciplines against evolving ILS processes and procedures, likely individuals assigned as Life Cycle Support PAPM and SEA 06L Logistics Staff.

4.2 Tool Architecture

Figure 4-4 below summarizes the tool architecture as a six-step process; with a tiered input step, three additional steps for stakeholder input, calculation and review, and two final steps for reporting. Each subsequent step of the process provides the tool the information it needs to develop an estimate and represents a more detailed look at the logistics requirements for the program. These steps are:

- Step 1) User Data Input
- Step 2) Application of Cost Database Values
- Step 3) Solicitation and Inclusion of Stakeholder Input
- Step 4) User Estimate Review

- Step 5) Output of Estimate Results
- Step 6) Utilization of Estimate Results in Reporting

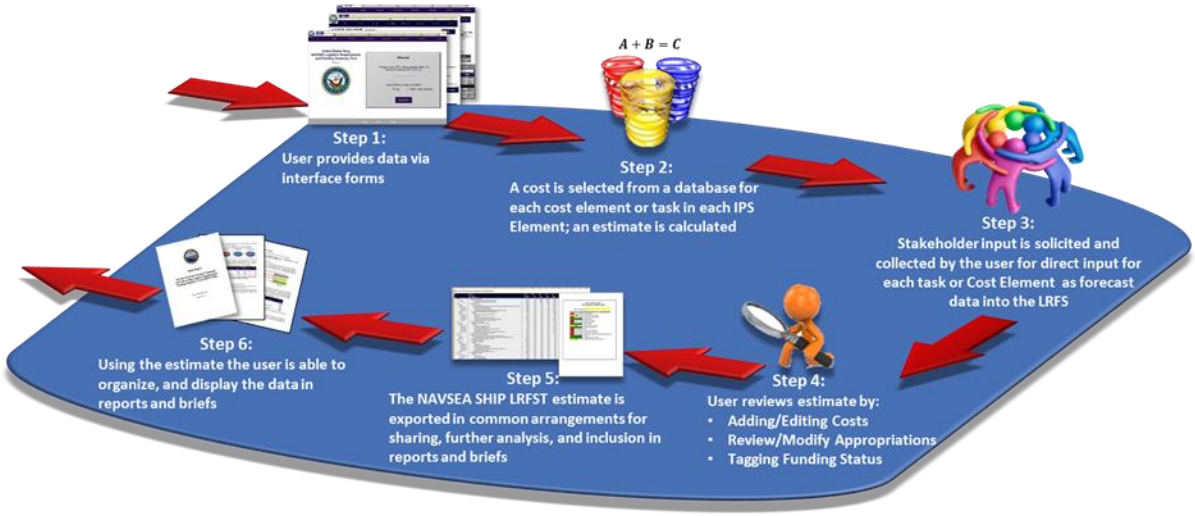

Figure 4-4: Tool Architecture Overview

The Development Team also designed the tool to accept estimates, actual costs, and other input data from external stakeholder sources during the data input process or during the estimate review. The user can enter this information repeatedly at any time. Based on the input values and completeness of the information, the tool estimates and populates the costs associated with each applicable Logistics Cost Element. In the remaining steps, the user has the opportunity to revise and recalculate, or export the results.

Because much of the process is user-driven, the estimate fidelity relies on the programmatic information provided. The Development Team designed the tool to accommodate instances where certain inputs are undetermined. If the user cannot provide certain metrics, the tool may opt to utilize an alternative methodology from the database to calculate a cost. To support tool users, the tool includes a wizard to guide users through the tiered input process.

4.3 Tool Implementation

The Development Team applied lessons learned from the USMC LRFS CET in the development of the NAVSEA SHIP LRFST. While the overall tool architectures are similar between the USMC and NAVSEA SHIP tools, the user interface of the LRFST resembles more closely to a web-based application as opposed to a stand-alone MS Excel tool. The Development Team designed the LRFST to easily transition to a web-based platform. Like the USMC LRFS CET, the NAVSEA SHIP LRFST is a MS Excel-based tool that does not rely on special programming languages or developer tools other than the MS Visual Basic Application (VBA). In developing the LRFST, the Development Team heavily leveraged CVN-78/79 program data and applications as a prototype. It was determined that because the carrier program requirements are representative of tool interface and cost model function requirements of other ship programs, if the LRFST could successfully develop a LRFS for a carrier program, the tool should also be applicable for other ship programs. The Development Team and the Government worked together to prioritize the development of all tool interface functions based on the need and complexity of carrier programs.

The Development Team demonstrated various iterative versions of the LRFST to SEA 06L, PEO Carriers logisticians, and key IPT participants to ensure the tool was functioning as required.

4.4 Tool Tests

Near the end of the LRFST development, the Development Team and PEO Carriers logisticians conducted test events to evaluate how the LRFST performed with actual program data and scenarios.

4.4.1 Develop a LRFS for the CVN-79 Program

The first test involved developing an actual LRFS for CVN-79 by using the LRFST. The carrier ship program has a unique execution, specific objectives, and scheduling, which served to accomplish the main objective of testing the NAVSEA SHIP LRFST for deployment suitability. The Development Team collected the relevant cost data for the CVN-79 including actuals, near term spend plan, budget data, as well as contract data. The Development Team also collected programmatic data such as program milestones and schedules. Once properly entered in the LRFST, the information produced a LRFS using the Outputs feature of the tool. PEO Carrier logisticians validated the results of the LRFS in that both program actual costs and estimated costs were within the range of the expected value based on the known data.

4.4.2 Usability Test

This test focused on the NAVSEA SHIP LRFST's usability and performance to ensure that the tool accommodates users of varying computer, logistics, technical, and cost estimating expertise and provides them with the functionality to develop cost estimates. Based on the results of this test, a tool modification list was generated to include future action items and necessary modifications for tool improvement.

5. Data Collection and Cost Analysis

The NAVSEA SHIP LRFST includes individual Cost Estimating Relationships (CERs), rates, and factors for each LRFS cost element. Each cost estimating methodology is fully documented and supported by data collected from programs that are analogous with respect to the cost element being estimated. The data collection and cost analysis process, implemented to collect appropriate data to support the cost analysis needed to build the NAVSEA SHIP LRFST library, is described below.

The LRFST maintains a database of cost models for each logistic task. This enables the tool to generate a LRFS automatically for the NAVSEA Ship program. Each cost model within the database is linked directly to a specific cost element (the IPS group's most basic level) which represents a major activity or cost driver within the IPS element. Each cost model is also categorized by associating it with a corresponding Stakeholder, Logistic Group, and Task Group. Categorizing the cost models allows the LRFST to group costs in a way that enables the user to easily manage and update tasks and costs. Each cost model provides an estimated cost for each Fiscal Year (FY) for a total of 22 FYs and assigns an appropriation to each cost based on the FY in which the cost is estimated.

5.1 Data Collection and Cost Analysis Methodology

The data collection methodology establishes the foundation and scope of the data collection effort, ensuring that the process is sound and reflects the needs of all key stakeholders. The data collection methodology is divided into six distinct steps, detailed below.

5.1.1 Step 1. Review of the LRFS Cost Estimating Methodologies

The Development Team conducted various meetings with NAVSEA logistics SMEs to review the previous CVN-78 LRFS. These reviews identified all of the tasks and entities within the previous LRFS and how they relate to the anticipated costs for the CVN-79. The Development Team utilized industry-approved cost estimating methodologies for each LRFS cost element and sub-element to map and categorize the previous costs. From these cost estimating methodologies, the Development Team identified the cost drivers needed to build the estimate and the types of data to target in the data collection process.

Next, the Development Team reviewed the methodologies with the PEO Carriers logisticians and SEA 06L logistician SMEs to receive additional input regarding the identified cost drivers. Feedback and recommendations obtained from the Program Office ensured that the cost estimating methodologies identified properly represent the costs associated with how each element is being managed and tracked. Conducting these reviews with the logistician SME and the IPT members allowed each major stakeholder to evaluate the process to ensure that all LRFS requirements are properly reflected in the tool.

5.1.2 Step 2. Identify Data Sources for Each LRFS Cost Element

After identifying the different types of cost data required for the cost elements, the Development Team worked with PEO Carriers logisticians and SEA 06L logistician SMEs to identify ships that had previously developed LRFS estimates. Data and estimating methodologies from existing LRFSs were used to support the development of cost models for the NAVSEA SHIP LRFST. Primary sources of data collected include program office data, cost estimate data (e.g., LRFS, Program Office Estimates (POEs)), and financial and accounting reports containing cost data.

5.1.3 Step 3. Collecting and Mapping the Data/Methodologies

In Step 3, the Development Team mapped cost data to the appropriate logistics discipline and cost element within the LRFST CES. This data mapping provided the foundation for the LRFST model selection process, which maps the cost models developed against programmatic information provided by the end user.

5.1.4 Step 4. Developing Costing Methodologies

Using the data collected, the Development Team developed CERs for the different LRFS cost elements and documented each model to enable users to fully understand the costs included in each LRFST CES item.

5.1.4.1 Developing Default Values for Each Cost Model

Each cost model developed includes default values that enable the LRFST to generate estimates in the absence of user-provided data. If the user is unable to provide programmatic information because it is not available, the use of default values from the analogous CVN-78 will produce an estimate for the LRFS. As the user provides additional programmatic information that is more representative of the ship and tasks being estimated or overrides the data with Stakeholder input, the cost estimates becomes increasingly more accurate.

5.1.4.2 Mapping Tasks to Cost Elements

The Development Team derived the LRFST CES based on the Draft NAVSEA LRFS Instructions, which is the authoritative source for reporting logistics costs within NAVSEA. Specific CVN-class logistics tasks were mapped to each of the CES items, as applicable. This mapping allows the user to manage the LRFS by CES and understand how the logistics costs are spread across the various logistics disciplines. Since the LRFS is a living document, the NAVSEA SHIP LRFST provides the user the ability to add additional tasks and map them to the CES. The tool provides an initial mapping and it is recommended that the user utilize this mapping, but the flexibility to customize the tasks based on programmatic requirements and changes is an attribute of the LRFST.

5.1.5 Step 5. Reviewing the Costing Methodologies Developed and Building the Data Repository

Key stakeholders reviewed the cost methodologies and provided input to the Development Team so that they understood how the methodologies should be applied. This understanding helped to refine the logic applied in developing the individual cost models and the LRFST model selection process. Cost estimating methodologies, which have been thoroughly reviewed, evaluated, and approved, are retained in the LRFST cost model library in the form of individual cost models, each with a cost calculation methodology, default data, assigned relevancy, and applicability criteria.

To apply the best-fit cost methodology to a given estimate, the Development Team designed a cost model selection process to apply appropriate models based on user input. They developed the cost model selection process by considering various relevancy and applicability criteria and confidence parameters for the cost methodologies and the collected data, all within the context of the CES. The cost model selection process recognizes that: 1) some methodologies are preferred over others (i.e., Build-Up is preferred to an application of rates and factors), 2) that specific collected data may be more relevant to some programs than to others, 3) that some methodologies (or cost elements) may not be applicable in all cases, and 4) that the nature of statistical relationships garners varying degrees of confidence between various cost models. The selection process compares the

assigned relevancy and applicability criteria for the individual CES and/or cost models against provided user inputs and calculates a total relevancy value. The relevancy value, coupled with the specified confidence factor for the cost model, ensures that the best-fit model is selected for use. Figure 5-1 below depicts the LRFST Model Selection Framework.

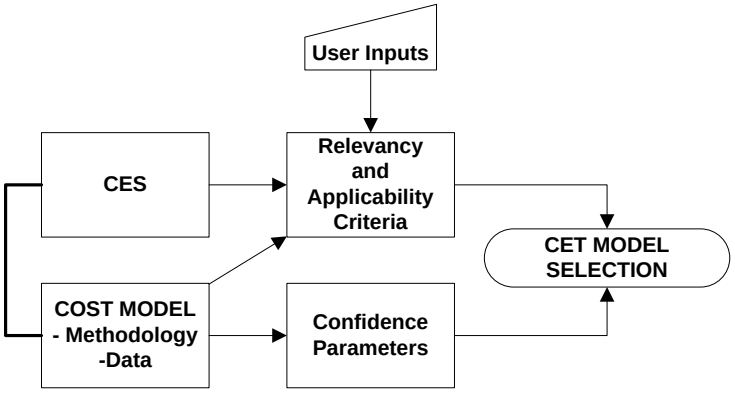

Figure 5-1: CET Model Selection Framework

5.1.5.1 Model Selection Process

Although the NAVSEA SHIP LRFST System Manual details model selection process calculations, this paper provides a brief overview for context. The model selection process provides an opportunity for each cost model within the NAVSEA SHIP LRFST cost model repository to be placed in a hierarchy and to determine which will be used as the final estimate figure. As the user provides additional information to describe the ship being estimated, the NAVSEA SHIP LRFST selects the most appropriate cost data that will provide an increased level of confidence in the estimate being developed.

5.1.5.2 Relevancy and Applicability Criteria

The Development Team established relevancy and applicability criteria for each cost element and cost model around cost methodologies and programmatic details. The relevancy and applicability criteria may be grouped into two categories: general criteria and specific criteria. General criteria is employed across the entire LRFST, regardless of cost element or cost model, whereas specific criteria are unique to certain cost elements or cost models. General and specific criteria affect the mapping of the tasks within the model selection process.

Specific criteria cannot be easily categorized, as it is unique to individual cost elements and/or individual cost models. Specific criteria include those programmatic and/or system-specific details that may render certain cost elements not applicable or render certain cost models not applicable. For example, a cost model for facilities construction may include a unique facility that is only relevant to a specific ship, so if the user were to select a different task or cost element for their estimate, that particular task would be rendered not-applicable by the specific criteria established.

6. Organizational Responsibilities

Figure 6-1 outlines the organizational structure of the NAVSEA SHIP LRFST team. This team consists of the SEA 06L Lead who serves as the COR, a DASN Ships Sponsor, CVN-78/CVN-79 Co-Leads for the pilot LRFST, and members of the Booz Allen Development Team.

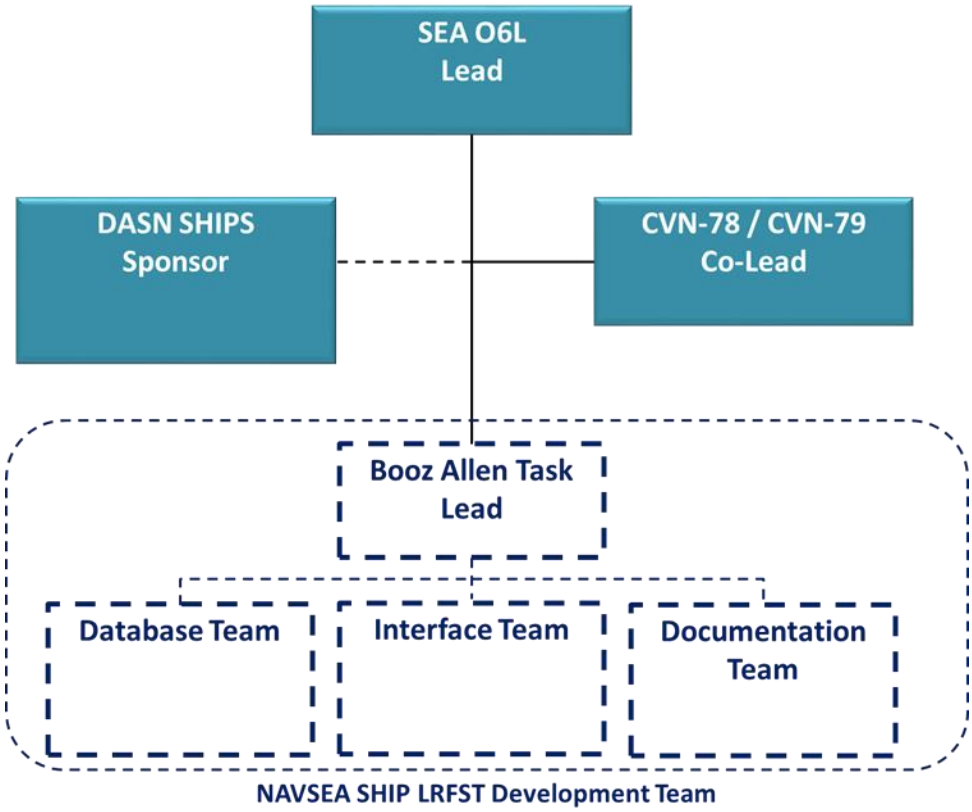

Figure 6-1: NAVSEA SHIP LRFST Project Organizational Diagram

6.1 The Booz Allen Development Team

The Booz Allen Development Team supports this effort by: implementing a data collection and synthesis framework, developing the tool, providing analysis of findings (e.g., quantifiable COA recommendations) that serve the Government stakeholders with a basis for developing and defending the identification of the logistics requirements funding decision, and documenting findings in a report. They are responsible for all actions necessary to effectively support program technical activities including business planning, coordinating actions among the logistics IPTs, Help Desk support, and demonstrations.

6.2 SEA 06L Lead – COR

The SEA 06L Lead, serving as the COR, inspects and accepts all contract deliverables associated with this task order. Additionally, the SEA 06L Lead, in a supporting role to the Contracting Officer, provides advice and expertise on policy issues directly related to SEA 06 Acquisitions and Commonality. Moreover, the SEA 06L Lead shares the responsibilities with the CVN-78/CVN-79 Co-Lead in overseeing the overall NAVSEA SHIP LRFST development process as described in the Section 6.3 below.

6.3 CVN-78/CVN-79 - Co-Lead

The Co-Lead, assigned from CVN-78 and CVN-79, collaborates with the SEA 06L Lead to ensure that the tool development effort supports the SEA 06L NAVSEA SHIP LRFST development process. Furthermore, the Co-Lead collaborates with the SEA 06L Lead to ensure that the tool will fulfill the requirements for the development of a LRFS for the CVN-78 and CVN-79 programs. The CVN-78/CVN-79 Co-Lead and SEA 06L Lead are responsible for establishing the analytical framework, overseeing the selection and use of historical data, the approval of cost tool features and validating the completion of the tool.

6.4 Integrated Product Team (IPT)

The IPT brings together all of the key stakeholders in a collaborative team environment to address the critical decision points throughout the development of the NAVSEA SHIP LRFST life cycle. The IPT provides subject matter expertise as well as guidance. The IPT consists of a diverse team of acquisition professionals encompassing the Logistics, Engineering, Program Management, Operations Research, and Financial competencies.

7. Documentation

In addition to the NAVSEA SHIP LRFST report, the following documentation is provided as part of this development effort:

- NAVSEA SHIP LRFST User's Help File
- NAVSEA SHIP LRFST System Manual

7.1 NAVSEA SHIP LRFST User's Help File

The User's Help File is a "how-to" guide to the NAVSEA SHIP LRFST and allows any end user with basic knowledge of the tool to get function-specific help with formats, calculations, detailed definitions, advanced operations, and instructions. This User's Help File is incorporated into the tool in the format of a dynamic interactive HTML Help File. The Help File is designed for use as an immediate reference while using the tool and as an on-demand aid to the end user. The Development Team constructed the Help File concurrently with the development the tool.

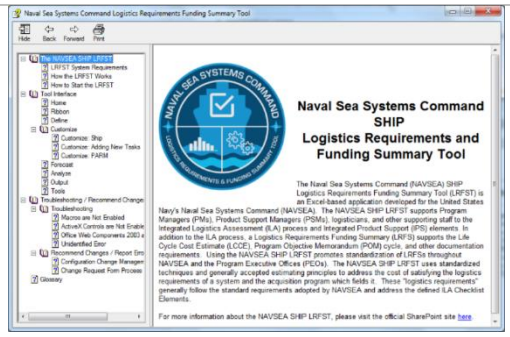

Figure 7-1: Embedded User's Help File

7.2 NAVSEA SHIP LRFST System Manual

The System Manual includes an executive summary of NAVSEA SHIP LRFST system functionality and provides tool "super-users" and/or tool administrators the ability to update and/or modify particular attributes or internal system data. The System Manual provides detailed information on the NAVSEA SHIP LRFST processes, functions, and architecture; additionally, it provides the reader an end-to-end understanding of how the tool leverages inputs, selections, and calculations against an internal repository of cost models and data values to generate a relevant LRFS. The System Manual includes detailed descriptions of calculation methods, formulas, and source locations within the NAVSEA SHIP LRFST. Additionally, System Manual appendices document the system's internal repository of rates and factors (e.g., inflation indices, labor rates, etc.), cost model equations, and cost model data values.

APPENDIX A: NAVSEA SHIP LRFST POLICY AND GUIDANCE

NAVSEA SHIP LRFST
Policy and Guidance

APPENDIX B: NAVSEA SHIP LRFST COMPLIANCE MATRIX

NAVSEA SHIP LRFST Compliance					
	Requirement	Complete	Incomplete	Source	Comment
Policy	The LRFS compares budgeted requirements versus received or planned funding for all IPS elements and related disciplines, by fiscal year and appropriation, and is traceable to Integrated Master Schedule (IMS) tasks and activities.	●		NAVSEA LRFS Instructions	
Policy	The LRFS provides the program's basis for relating LCSP strategy execution to programmatic resources. The LRFS is a working document and the PM must ensure the applicable section(s) of the LCSP is assessed and updated with current LRFS information.	●		NAVSEA LRFS Instructions	
Policy	The LRFS is used to support, justify, manage and control funding requirement development and execution. The LRFS is not a formal budget document, but satisfies existing policy to determine logistics requirements and funding; provides visibility of logistics requirements when required for POM and budget development and submission;	●		NAVSEA LRFS Instructions	
Policy	LRFS identifies funding information necessary to meet the system/equipment support requirements for the life of the program; and provides a process to compare and assess risk between requirements and controls.	●		NAVSEA LRFS Instructions	
Policy	The LRFS shall be developed and maintained using the NAVSEA template and the Work Breakdown Structure (WBS). Tailoring of the template is acceptable upon approval of the PM, providing the logistics requirements are fully addressed.	●		NAVSEA LRFS Instructions	
Policy	The LRFS shall follow the IPS element structure. Revisions and updates to this structure may be used with appropriate rationale and justification, providing funding requirements are still documented appropriately.	●		NAVSEA LRFS Instructions	
Policy	Appropriate cost estimating techniques shall be used to determine the funding requirements. NAVSEA 05C is the NAVSEA technical authority for cost estimating and analysis and may be consulted for assistance.	●		NAVSEA LRFS Instructions	LRFST IPT includes members from NAVSEA 05C .
Policy	Identify the logistics funding portion of the cost required to develop, test, and sustain readiness, sustainment, and cost requirements (e.g. KPPs, KSAs).	●		NAVSEA LRFS Instructions	
Policy	It supports the justification and rationale for managing the day-to-day exercise of program management.	●		NAVSEA LRFS Instructions	
Policy	LRFS should be used as a management tool to execute the product support strategy. Ensure the sustainment funding requirements are integrated and consistent with overall program funding requirements.	●		NAVSEA LRFS Instructions	
Accuracy	NAVSEA SHIP LRFST creates an LRFS that conforms to ILA assessment criteria	●		NAVSEA SHIP LRFST Pilot Measure of Success (May 2014)	
Accuracy	NAVSEA SHIP LRFST aligns with current statutes, regulations, policies, procedures, and best practices of acquisition programs through proper planning and tracking of logistics competency participation including the support and early identification of the logistics requirements of the program	●		NAVSEA SHIP LRFST Pilot Measure of Success (May 2014)	
Accuracy	NAVSEA SHIP LRFST aligns with current statutes, regulations, policies, procedures, and best practices of acquisition programs through proper planning and tracking of logistics competency participation and given certain descriptors of the system, the support system, and the acquisition program, logisticians will be able to define logistics tasks and costs associated with developing, producing/procuring, and fielding an operationally effective and supportable platform.	●		NAVSEA SHIP LRFST Pilot Measure of Success (May 2014)	
Accuracy	The tool provides the capability to address programs' costs, schedules, and factors with program office participation given minimal information and expertise.	●		NAVSEA SHIP LRFST Pilot Measure of Success (May 2014)	
Efficient	The tool enables program managers, product support managers, and logisticians to automatically generate a LRFS	●		NAVSEA SHIP LRFST Pilot Measure of Success (May 2014)	
Efficient	The tool is "user-friendly" for LRFS cost estimating. Users should have an ease of learning and understanding of the tool that have varying computer experience, program expertise, background, and LRFS estimate experience.	●		NAVSEA SHIP LRFST Pilot Measure of Success (May 2014)	
Efficient	The tool enables the program office to develop a LRFS that is more robust or in less time than traditional methods. As a result, the tool should reduce touch time to LFRS and reduce human error.	●		NAVSEA SHIP LRFST Pilot Measure of Success (May 2014)	
Effective	The tool provides visibility of support requirements to decision makers including the ability to manipulate data quickly, minimize errors, what-if scenario analysis, and family of systems analysis	●		NAVSEA SHIP LRFST Pilot Measure of Success (May 2014)	
Effective	The tool provides visibility of support requirements to decision makers including support of budget drills and TOC requests on a continous basis through annual budgeting process	●		NAVSEA SHIP LRFST Pilot Measure of Success (May 2014)	
Effective	The tool is suitable for ship platforms based on the usability and performance test against CVN 79 and relevant PARM data with program office logisticians	●		NAVSEA SHIP LRFST Pilot Measure of Success (May 2014)	
Effective	Cost element structure must be standardized in accordance with DoD guidance and tailored for significant platform deviations	●		NAVSEA SHIP LRFST Pilot Measure of Success (May 2014)	
Affordable	Costs for updates will be less than the historical annual costs for producing the LRFS	●		NAVSEA SHIP LRFST Pilot Measure of Success (May 2014)	
Affordable	Costs for data capture will be less than historical annual costs by having stakeholders provide their data directly	●		NAVSEA SHIP LRFST Pilot Measure of Success (May 2014)	
Affordable	Configuration management costs will fall as a result of traceable LRFS input and organization	●		NAVSEA SHIP LRFST Pilot Measure of Success (May 2014)	

APPENDIX C: CONTRIBUTORS

The NAVSEA SHIP LRFST and information in this paper are the result of a team effort from NAVSEA, the CVN Program Office, and Booz Allen Hamilton. I would like to take this opportunity to recognize the following people for their contributions:

Charles Gu	Booz Allen Hamilton
John Ko	Booz Allen Hamilton
Dawn Weiss	Booz Allen Hamilton
Adam Janney	Booz Allen Hamilton
Brian Davis	Booz Allen Hamilton