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DEFINE BILLET DESCRIPTIONS AND SKILL SETS THAT ARE NEEDED TO PERFORM LEAD SYSTEM INTEGRATION (LSI) FUNCTIONS

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THESIS

DEFINE BILLET DESCRIPTIONS AND SKILL SETS THAT ARE NEEDED TO PERFORM LEAD SYSTEM INTEGRATION (LSI) FUNCTIONS

by

Lisa M. Banta

March 2023

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13. ABSTRACT (maximum 200 words)

In 2008, Congress passed Public Law 110-181, which directed the Secretary of Defense to properly size and train the Department of Defense workforce to do more inherently governmental functions. There was no training path established to support this law. Therefore, the Naval Postgraduate School (NPS) established such training for the functional area of Lead System Integrator (LSI). The LSI area of study has been conducted at NPS for years through research and cohort classwork. This thesis is a continuation of the Lead System Integrator Cohort 4 Final Report, which did not address the LSI-based billets needed for the System of Systems Mission Assurance phase (more commonly known as the "fielding of the system") for the warfighter. The goal of this research is to discover whether a reference exists for project/program managers to properly staff their LSI teams through expanded roles and responsibilities with proper Knowledge, Skills, and Abilities (KSAs). Through comparison and analysis of organizational charts, traditional NAVAIR job titles, and known LSI functional areas, this thesis tries to define position descriptions and KSAs that are needed to perform an LSI function. The study used four different program offices that state they operate projects as LSI inside their program offices.

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DEFINE BILLET DESCRIPTIONS AND SKILL SETS THAT ARE NEEDED TO PERFORM LEAD SYSTEM INTEGRATION (LSI) FUNCTIONS

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ABSTRACT

In 2008, Congress passed Public Law 110-181, which directed the Secretary of Defense to properly size and train the Department of Defense workforce to do more inherently governmental functions. There was no training path established to support this law. Therefore, the Naval Postgraduate School (NPS) established such training for the functional area of Lead System Integrator (LSI). The LSI area of study has been conducted at NPS for years through research and cohort classwork. This thesis is a continuation of the Lead System Integrator Cohort 4 Final Report, which did not address the LSI-based billets needed for the System of Systems Mission Assurance phase (more commonly known as the "fielding of the system") for the warfighter. The goal of this research is to discover whether a reference exists for project/program managers to properly staff their LSI teams through expanded roles and responsibilities with proper Knowledge, Skills, and Abilities (KSAs). Through comparison and analysis of organizational charts, traditional NAVAIR job titles, and known LSI functional areas, this thesis tries to define position descriptions and KSAs that are needed to perform an LSI function. The study used four different program offices that state they operate projects as LSI inside their program offices.

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LIST OF ACRONYMS AND ABBREVIATIONS

BAM	Baseline Assessment Memorandum
CDRL	Contract Data Requirements List
CM	Configuration Manager
CSPT	Command Spend Plan Tool
CYA	Color Year Amount
DAG	Defense Acquisition Guide
DOD	Department of Defense
DEMIL	Demilitarization
DFAR	Defense Federal Acquisition Regulations
ECP	Engineering Change Proposal
FAR	Federal Acquisition Regulations
HW	Hardware
IETM	Interactive Electronic Technical Manual
IGS	Integrated Government Schedule
IMP	Integrated Master Plan
IMS	Integrated Master Schedule
KSA	Knowledge, Skills and Abilities
LSI	Lead System Integrator
NATOPS	Naval Air Training and Operating Procedures Standardization
IDEF	Integrated DEFintion Methods
LCC	Life Cycle Cost
LSI	Lead System Integrator
MCS	Mission Communication System
NAVAIR HQ	Naval Air Systems Head Quarters
NTSP	Navy Training Support Plan
OEM	Original Equipment Manufacturer
OFP	Operational Flight Profile
POM	Program Objective Memorandum

PM	Project/Program Manager
PMA	Program Management Activity
PMT	Program Management Tool
PPBE	Planning, Program, Budget and Execution
SE	Systems Engineer
SoS	System of Systems
SoSE&I	System of Systems Engineering and Integration
SHrM	Society for Human Resource Management
SERC	Systems Engineering Research Center
SW	Software
T&R	Training and Readiness

EXECUTIVE SUMMARY

Historically, the U.S. government took charge of a project, from cradle to grave. But in the 1990s, the government shifted more of that responsibility to private-sector contractors. The goal was to develop a partnership with the smaller companies in the community and share financially through contracting in support of various government efforts. Fast forward to the present and we see the government again wanting more control over their programs.

According to Valerie Grasso, "the government acquisition workforce was reduced by more than 50 percent between 1994 and 2005" (Grasso 2010, p. 2). Due to lack of "technical innovation and overall system optimization," larger companies are able to get a workforce with more technical knowledge and expertise, compared to the government. The larger companies are able to recruit out of college to better handle a "rapidly developing commercial technologies that can be used to achieve the government's program mission and objectives" (Grasso, 2010, p. 2).

In 2008, Congress decided to promote more oversight by the government to better track Cost, Schedule, and Performance on acquisition efforts. This change of policy was due to recent program overruns in terms of both cost and schedule. Congress decided to pass Public Law 110-181, which directed the Secretary of Defense to properly size and train the DOD workforce to perform more inherently governmental functions. One of those inherently governmental functions was performing as the Lead System Integrator (LSI) for a project. An LSI is the person who coordinates all aspects of a project, from contract to fielding, and manages all the different companies. The LSI can be thought of as the hub at the center of a bicycle tire, and the various companies are the spokes. The program manager of the LSI will contract for various parts of a program or hire labor to perform the effort needed to create a product. The program manager will integrate the various system elements like hardware, software, components, people, material resources, requirements, real estate, facilities, data/information, and consumables into a project.

The objective of this thesis was to determine if the Knowledge, Skills, and Abilities (KSAs) required to manage an LSI program currently exist in NAVAIR. To that end, the thesis sought to answer the following questions: What does the composition of a Lead System Integrator team look like? What defines the LSI billets through roles and responsibilities? Does this exist presently in Navy System Commands?

The research questions were developed to determine if NAVAIR has the proper skilled labor to perform as an LSI team. During the review of organizational charts (see Appendix B), all that was shown was traditional functional areas. For example, the organizational chart shows Configuration Management, not Change Management, as it was discovered in Cohort 2 class or Systems Engineer when an Architect or Modeling Engineer was needed. The answering of the thesis questions would give some insight into whether DOD trained its people, as per Public Law 110-181, to do inherently governmental work such as LSI. Chapter III took the work that was completed from Cohort 4's class, and further decomposition of Cohort 4's work, through functional activities via IDEF0 diagrams, was performed. A thorough review of all the required acquisition references presently used by NAVAIR was conducted, to include but not limited to the Defense Acquisition Guide (DAG), to address the breakdown of the functional activities on the IDEF0 diagrams.

The results of the research were as follows:

What does the composition of a Lead System Integrator team look like? This could not be determined from just looking at the PMA's organizational charts. The four control PMAs did demonstrate they understood the mission in which their product would operate, but it was unclear if they understood the SoS they were part of or how they interacted with those other systems.

What defines the LSI billets through roles and responsibilities? At present there is no set LSI training track that has been established by NAVAIR. Nor is there verbiage in position descriptions that designate positions as LSI positions with matching roles and responsibilities. The DAG's various chapters are designed to support NAVAIR policy documents by providing functional areas with guidance on best business practices through the various acquisition milestones.

Do the KSAs to establish an LSI team exist presently in Navy System Commands? The answer is yes, in some instances. The roles and responsibilities are similar to traditional roles and responsibility except for scope. There are a couple of areas that were found deficient, which are Program Management, System Engineering and Configuration Management.

From the review of the control group, the thesis found that there is no way to look at a program office organizational chart and determine what an LSI team looks like. The organizational charts showed a typical program structure: PM, SE, Logistics, etc. Even with all the research on the topic from NPS faculty, nothing today has been implemented in the form of a regulation, documentation or training that defines the LSI billets through roles and responsibilities.

Although there are LSI programs being run at NAVAIR, the teams are manned through traditional hiring processes, billets and KSAs. NAVAIR does not have a process in place to establish an LSI team. NAVAIR has the capacity and the manpower but no set training or KSA requirements in place for a human resources department to make hiring decisions to support an LSI program. In order to follow such a process, NAVAIR would need an increase in KSAs', roles and responsibilities (position description), and a communication plan to show who and how to work with stakeholders and program interdependencies.

References

Grasso, Valerie Bailey. 2010. *Defense Acquisition: Use of Lead System Integrators (LSIs) Background, Oversight Issues, and Options for Congress*. Report for Congress, Congressional Research Service. https://fas.org/sgp/crs/natsec/RS22631.pdf.

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I. INTRODUCTION

Historically, the U.S. government took charge of a project, from cradle to grave. But in the 1990s, the government shifted more of that responsibility to private-sector contractors. The goal was to develop a partnership with the smaller companies in the community and share financially through contracting in support of various government efforts. Fast forward to the present and we see the government wanting more control over their programs again.

According to an article from Valerie Grasso, a Specialist in Defense Acquisition, the government acquisition workforce was reduced by half between 1994 and 2005: "the lack of sufficient in-house expertise could also result from the growing complexity of the systems being acquired" (Grasso 2010, p. 2). Due to lack of "technical innovation and overall system optimization," larger companies "often have better knowledge and expertise, when compared to federal government agencies, of rapidly developing commercial technologies that can be used to achieve the government's program mission and objectives" (Grasso 2010, p. 2). This chapter will outline the path to answering the thesis questions. For any Program Manager to assemble a team, they need to know what the mission is and what Knowledge, Skills, and Abilities (KSAs) are needed to satisfy the mission. If you have the KSAs, then get to work; but if you do not, then what is missing and how can you get the people trained or hire what you need?

A. BACKGROUND

In 2008, Congress passed Public Law 110-181, which directed the Secretary of Defense to properly size and train the DOD workforce to do more inherently governmental functions. Specifically, because of the "concern about the government's use of private-sector lead system integrators (LSIs) for executing large, complex, defense-related acquisition programs" (Grasso, 2010, p. 9), the goal moving forward was to minimize the number of private-sector contractors used as Lead System Integrators (LSIs). Public Law 111-23, Weapons System Acquisition Reform Act of 2009, tasked the Secretary of Defense to revise the Defense Federal Acquisition Regulation Supplement (DFARS) to reflect organizational conflicts of interest that might arise from the use of private-sector LSIs. To better educate the acquisition workforce, the Naval Postgraduate School (NPS) has been conducting research and courses to define the strategy and the challenges of System of Systems (SoS) integration.

B. CHANGING TIMES

However, changing times have brought increased costs for labor, contracts, and parts. Today, the government would once again like to take charge of projects from cradle to grave by negotiating contracts with industry and serving as LSI for those contracts. Now the question is: How did managers establish and manage LSI teams prior to the 1980s? Very few managers from the 1980s are presently in the workforce, as many have retired, and there is no evidence of an LSI guidebook to date. Defense Acquisition University (DAU) and Program Manager Institute (PMI) do not discuss the concept of LSI.

From the previous statement, the question arises as to whether the government has "the in-house, technical, and project-management expertise needed to execute large, complex acquisition programs" (Grasso 2008, p. 5). There are a variety of reasons why the DOD may not be ready to assume the LSI role for a project, and "lack of in-house expertise may include the downsizing of the DOD acquisition workforce and the increase in the size and scope of DOD procurement activities" (Grasso 2010, p. 5).

C. NAVAL POSTGRADUATE SCHOOL LSI PROGRAM

In 2014, the Naval Postgraduate School (NPS) started offering an LSI program track to dive deeply into an SoS or holistic approach to defense programs, with the intent to uncover the traits needed to function as an LSI. The Department of Systems Engineering presently offers an academic certificate in Lead Systems Integration. These courses make students think about projects from an SoS architecture and acquisition perspective. With the ever-changing technologies in the battlefield and the decreasing availability of funds for new programs, the Program Management Activity (PMA) need to have better control and insight into the cradle-to-grave life cycle of a project. This information would eventually allow the government to assume inherently governmental functions as LSI for new and existing acquisition programs.

So far, there have been four LSI cohorts or classes at NPS. Each cohort has looked at various aspects of an LSI team, but none of them have specifically addressed what an LSI team should look like and if program offices have the necessary KSAs to set up an LSI team for an acquisition project. A program manager needs to ensure due diligence has been done to have all correct skills in place to execute an LSI project.

Dr. Vaneman and Prof. Carlson's research from 2018 defined LSI as "an acquisition strategy that employs a series of methods, practices, and principles to increase the span of both management and engineering acquisition authority and control to acquire a System of Systems or highly complex systems" (Vaneman and Carlson 2018, p. 126). NPS LSI Cohort 4 analyzed the System of Systems Engineering and Integration (SoSE&I) "Vee" into functional activities, shown by Figure 1.

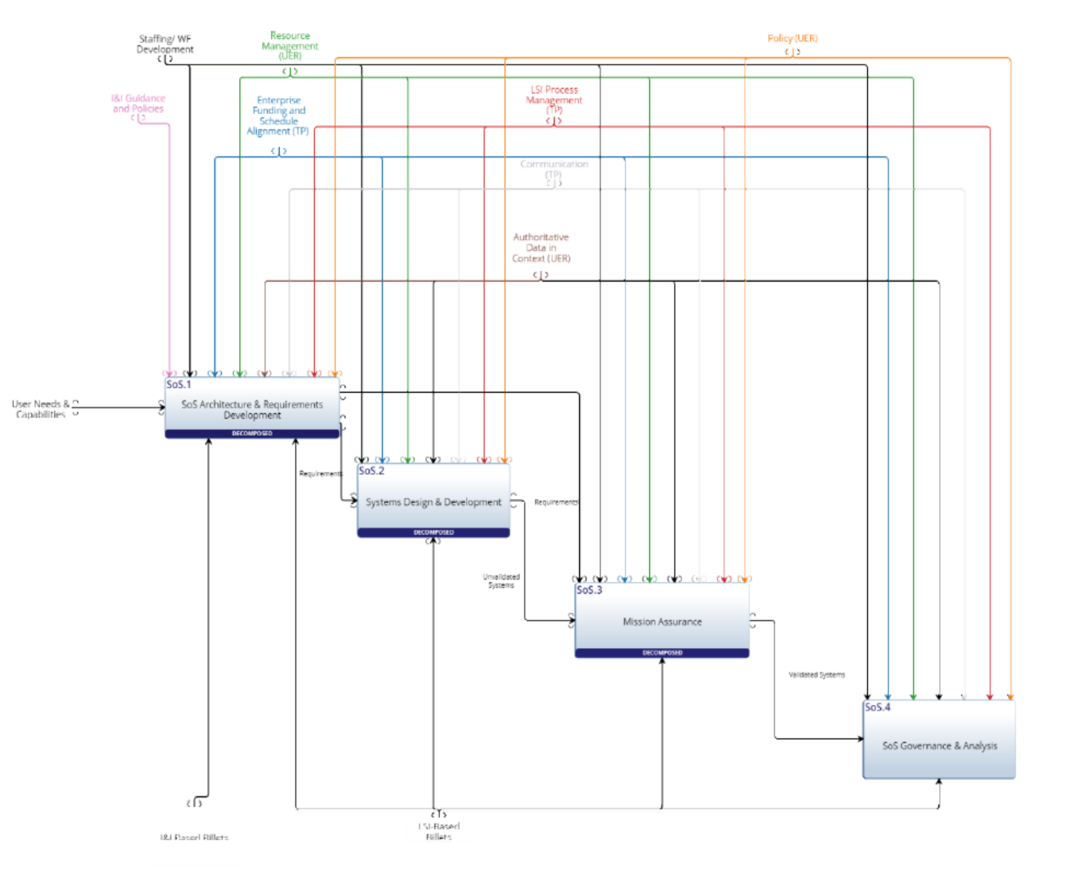

Figure 1. System of Systems E&I Process Level 1. Source: NPS LSI Cohort 4 (2018).

Dr. Vaneman and Prof. Carlson's various research efforts provides insightful contributions from years of experience in this field and a valuable framework for further research. Among the opportunities their research provides to build upon is the question of exploring the most appropriately qualified manpower needed for an LSI team. The one element missing from this research is the determination of the LSI-related billets to perform those functions. Having a list of the LSI-related billets would allow a Program Manager to know what KSAs they need on their team to accomplish their mission.

D. RESEARCH QUESTIONS

This thesis represents a continuation of NPS LSI Cohort 4 research in exploring the manpower aspect of Cohort 4. It will address the following research questions: (1) What does the composition of a Lead System Integrator team look like? (2) Can an LSI billet be defined through standard roles and responsibilities or Position Descriptions? (3) Do these KSAs exist presently in Naval Air Systems Command?

E. SIGNIFICANCE

For any Program Manager to assemble a team, they need to know what the mission is and what KSAs are needed to satisfy the mission. In the past, the government did not worry about the LSI team since it paid a contractor to perform the LSI role. As the government wants to take back control over this inherently governmental role, but they need to know what team KSAs are needed to create the team.

F. METHODOLOGY

To begin to answer the research questions, Cohort 4's work (described in Chapter II, Figures 6–9) is further decomposed in conjunction with the Defense Acquisition Guide (DAG) and SoSE&I "Vee" to address the breakdown of the functional activities in the IDEF0 diagrams.

The IDEF0 created a guide and model to systematically break down each functional activity of the SoSE&I process into what needs to be delivered or tasking that needs to be completed. Breakdown for each deliverable or tasking was accomplished with the aid of the DAU AcqNotes, which gave the definitions of many of the deliverables, and the DAG, which broke down the different functional area responsibilities, to determine the deliverables needed to satisfy the functional activity. Using the deliverables or tasking and determining the KSAs required to accomplish them was the next step. As stated earlier, the SoSE&I model depicts activities at a high level that will need to be performed by Engineering, Management, Contracts, and the Fleet throughout the life cycle, but does not provide implementation guidance or manpower requirements.

G. THESIS OVERVIEW

This thesis contains five chapters. Chapter I provides a general overview of historical regulations and reason for this thesis. Chapter II explores additional research articles and references. Chapter III analyzes current billet titles or functional areas, deliverables, and position descriptions. Chapter IV compares the findings in Chapter III with program offices acting as LSIs. Finally, Chapter V details the conclusions of this research.

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II. LITERATURE REVIEW

Before the 1980s, the government was organic and mostly self-sufficient in the creation of new projects. It normally provided all the necessary functional areas for a project and only outsourced manpower on unique items. This was the time when the government understood manpower requirements, and how to establish and manage an LSI team. While NAVAIR program offices create and manage new projects, only a few NAVAIR program offices have actually established and managed an LSI team. How did these offices know what to do and who to hire to accomplish such a task? Many books that discuss the LSI concept, yet none mention how to set up an LSI team.

The below research combines various concepts: SoSE&I "Vee," LSI Enterprise Framework, Integrated DEFinition (IDEF) function model and the Defense Acquisition Guidebook. The below readings facilitated the research required to answer the thesis questions and set the stage for the research methodology that will be described in Chapter III.

A. SYSTEMS INTEGRATION: A KEY ENABLER FOR SYSTEM OF SYSTEMS ENGINEERING AND INTEGRATION

Vaneman and Carlson, in *Lead Systems Integration: A Key Enabler for System of Systems Engineering and Integration,* introduce the concept of the SoSE&I "Vee" and how it is used. The SoSE&I "Vee" is a graphic illustration that shows "the foundation for delivering these complex systems" (Warren & Carlson 2019, p. 3). It provides "useful context in using the overall SoS architecture for performing top-down engineering (as in traditional SE) and performing bottom-up verification and validation" (Warren & Carlson 2019, p. 3).

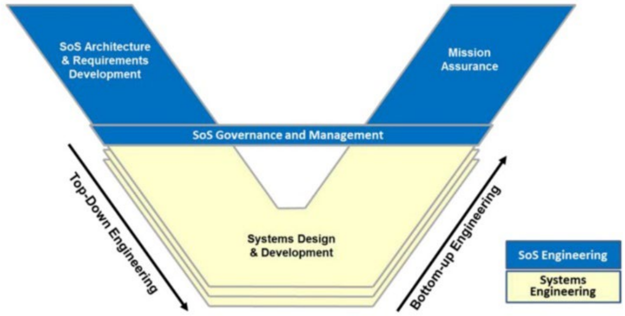

Figure 2. SoSE&I "Vee." Source: Vaneman (2016).

Expanding the SE "Vee" into SoSE&I "Vee" (Vaneman 2016) provides a foundation for comparing and combining the four enterprise levels with the life cycle functional activities (Vaneman and Carlson 2019). This "Vee" pictorially shows the traceability between the different "capabilities and interdependencies of a SoS that can be executed by the government LSI, across multiple systems, programs, and stakeholder levels" (Vaneman and Carlson 2019, p. 418). The SoSE&I "Vee" life cycle functional activities (FigureF 2) depicts various milestones of the life cycle of a product. This research decomposed each of these life cycle functional activities to examine what is needed to satisfy the activity. The items reviewed were the controls (regulations, DOD policies, and Congressional requirements), inputs, outputs, and mechanisms (workforce descriptions or KSAs).

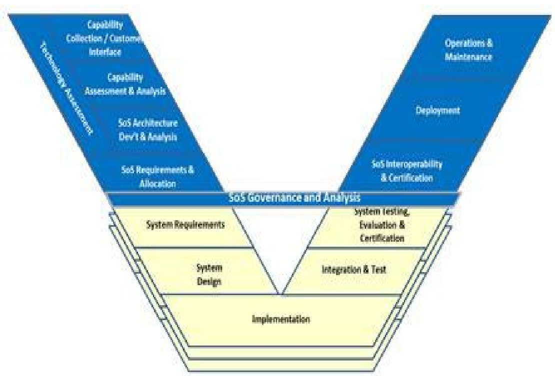

Figure 3. SoSE&I "Vee" Life Cycle Functional Activities. Source: Vaneman and Carlson (2019).

As Vaneman and Carlson note, the four top-level functions can be further decomposed into "additional, actionable detail" (2019, p. 10). They also point out that the SoSE&I "Vee" does not include each function's input and output, its rules and policies, and its needed skills (Vaneman and Carlson 2019, p.10). These will be further decomposed in Chapter III. Cohort 4's work sets the high-level model of the inputs and outputs to satisfy the life cycle functional activity. Chapter III will take the SoSE&I "Vee" model and break down each function using a modified IDEF0 diagram to discover, down to the KSAs and deliverables, what is needed for an LSI team member to complete the activity.

B. DEFINING AN ENTERPRISE LEAD SYSTEMS INTEGRATION (LSI) FRAMEWORK

During the 12th Annual Systems of Systems Engineering Conference in 2017, Dr. Vaneman and Prof. Carlson presented *Defining an Enterprise Lead System Integration (LSI) Framework.* This resource explains the LSI Enterprise Framework. The framework is used to "identify how existing processes can be enhanced and used more efficiently" (p. 3) for a successful LSI effort. These touchpoints, shown in Figure 4, "are the functions that assert and execute SoS, complex system, and stakeholder trade space to affordably optimize integrated warfighting capabilities across the system of systems life cycle" (Vaneman and Carlson 2017, p. 3). The LSI touchpoints "identify how existing processes can be enhanced and used more efficiently" (p. 3). Figure 4 compares program office functions with LSI touchpoints.

An LSI program needs to have a team that can think outside the box. The team needs to have three important thought processes, according to Vaneman and Carlson:

> First, the LSI must have sufficient insight of lower level of system decomposition. Second, the LSI must understand the role of the constituent systems in the SoS capabilities and requirements. Third, the LSI must ensure there is a strong governance model that provides technical authority with a strong voice within the development and acquisition of constituent systems. (2017, p. 3)

The research from this reading exposed the comparison between typical program office functions and LSI touchpoints. Some line up, some are similar, and others are totally different. There are also touchpoints that align to an actual LSI billet in a program office.

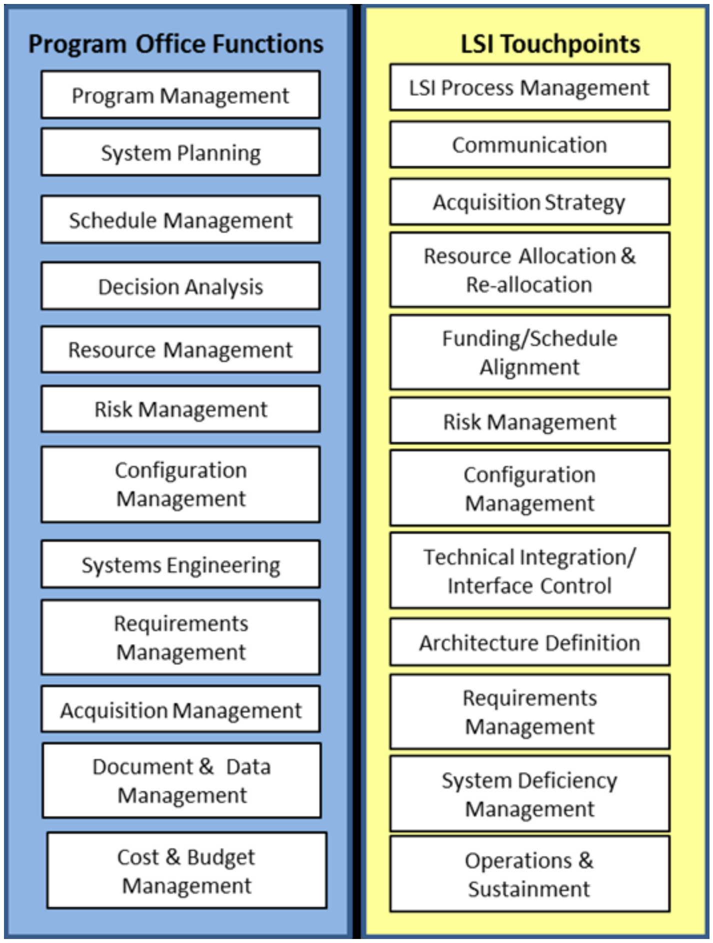

Figure 4. Program Office Functions vs. LSI Touchpoints. Source: Vaneman and Carlson (2017).

The Program Office Functions vs. LSI Touchpoints figure (Figure 4) was a crucial guide while working through Chapter III. This table was used while decomposing all the different KSAs and deliverables to accomplish the functional activity. This created traceability back to the functional area or billet which would perform this activity or create a deliverable and the KSAs needed. The touchpoints were a guide to get started and set the path for Chapter III's work.

C. MANAGING COMPLEX SYSTEMS ENGINEERING AND ACQUISITION THROUGH LEAD SYSTEMS INTEGRATION

Dr. Vaneman and Prof. Carlson, in *Managing Complex Systems Engineering and Acquisition through Lead Systems Integration*, show how to use LSI to manage a complex project. This work uses Cohort 4's effort to help demonstrate how LSI can be used. To begin to answer the research questions, there needs to be an understanding of Cohort 4's work of using the generic Integrated DEFinition Function Model IDEF0 (Figure 5). The IDEF0 "was selected to help define the LSI implementation strategy, since the model includes the system function, inputs and outputs, controls or governing rules and policies, and mechanisms that represent the elements that perform the function" (Vaneman and Carlson 2018, p. 58).

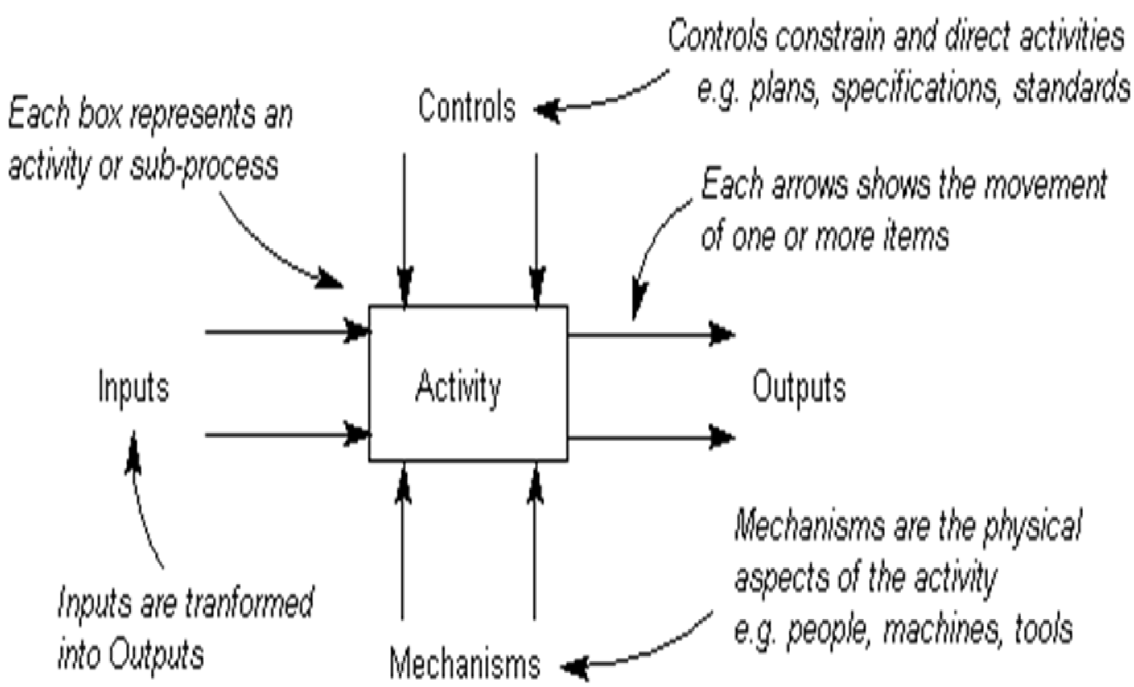

Figure 5. IDEF0 Model. Source: Vaneman and Carlson (2018).

By taking the generic Integrated Definition Function Model (IDEF0) (Figure 5) and adapting it to show the SoSE&I activity functions, one can explore what inputs, outputs, controls and mechanisms are needed to perform the SoSE&I functions.

This process of defining the various sides of the IDEF0 allows for the traceability of LSI and traditional activities across the acquisition process through alignment of touchpoints or KSAs to the various deliverables. Cohort 4 completed the majority of this IDEF0 decomposition with the exception of the knowledge skills and abilities needed to act as the mechanisms.

In Vaneman and Carlson’s view, because Public Law 110-181 specifies that LSI is an inherently governmental function, “the key challenge for staffing and workforce development is to recruit and train a qualified government [workforce]” (NPS-NAVAIR LSI Cohort #2, 2015. Pg. 32) to assume roles, responsibilities and frame of mind to take over as LSI. Figure 6 shows the overarching pictorial comparison of how the SoSE&I model was depicted in the IDEF0 model.

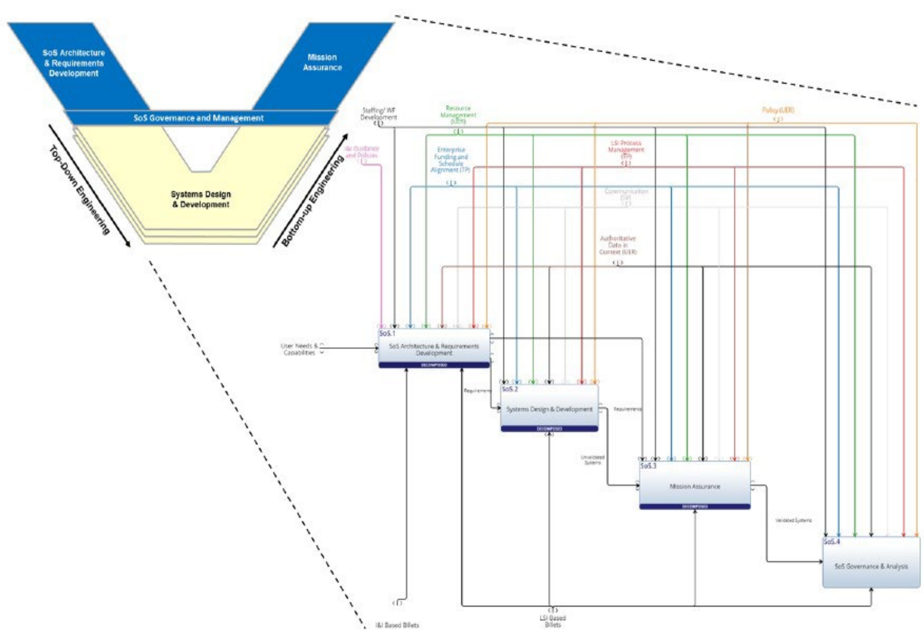

Figure 6. System of Systems E&I “Vee” Viewed as an IDEF0 Model. Source: NPS LSI Cohort 4 (2018).

By using the SoSE&I process as a guide, one can systematically break down each functional activity using the modified IDEF0 methodology described above in order to capture all of the various aspects of each functional activity along the SoSE&I "Vee." It is important to note that the SoSE&I model depicts the high-level activities that need to be performed, not the everyday activities.

Cohort 4 research used existing documentation and instructions to determine the controls for each functional activity. If there were existing LSI instructions, they were used in conjunction with existing traditional instructions and documents. Inputs were determined from various references and from the functional activities depicted in the SoSE&I "Vee." In some cases, the inputs and outputs were derived from the functional activities that came before or fed the next activity or function. For example, mission needs would be an input into a functional activity, and the output would be a requirements letter for funding. The outputs are products from the functional activity; these products either end or are the inputs to another functional activity. The mechanism represents a billet description or, if not a formal billet description, the KSAs needed for a formal billet description.

The left side of the SoSE&I, known as the SoS Architecture and Requirements Development stage, is broken down in Figure 7. This is the beginning of any program. Here is where requirements, funding, industry, academia, gap analysis and the SoS inputs start to form into a targeted solution. It reviews various direct impacts to the industry from a market, political, climate, and economic perspective. For example, it includes the grants an industry may provide to academia for various STEM research projects. It may also include a gap analysis of the Area of Operation capabilities from which the new system will operate. The results may identify things that are missing or new requirements that have been captured, but not contracted for. This stage relies heavily on existing DOD acquisition processes and controls.

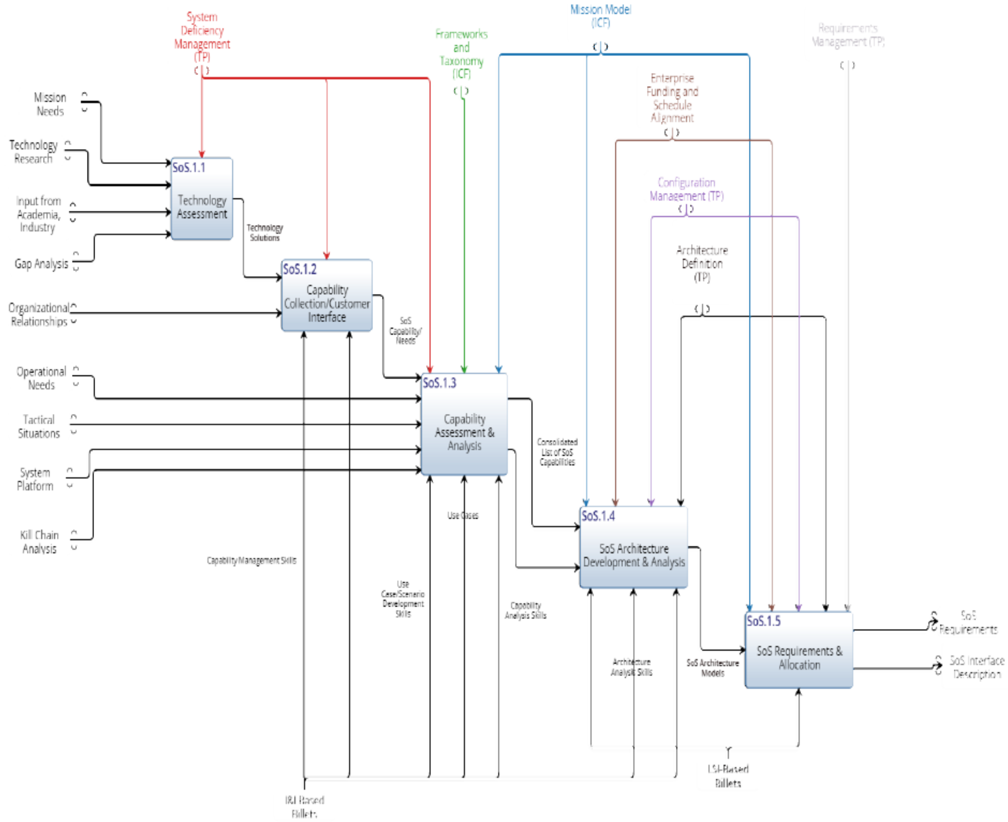

Figure 7. System of Systems Architecture and Requirements Development Stage. Source: NPS LSI Cohort 4 (2018).

INCOSE defines the development stage as necessary "to transform the requirements into an effective product, to permit consistent reproduction of the product where necessary, to use the product to provide the required services to sustain the provision of the services and to dispose of the product when it is retired from service" (INCOSE 2015, p. 61). Using the IDEF0 model puts the focus on an SoS perspective, as opposed to making the best product. For this stage and the subsequent successful integration into the SoS for which the product must operate, there must be a complete downward flow of SoS Interface Description and Requirements from the various components of the system (Figure 8).

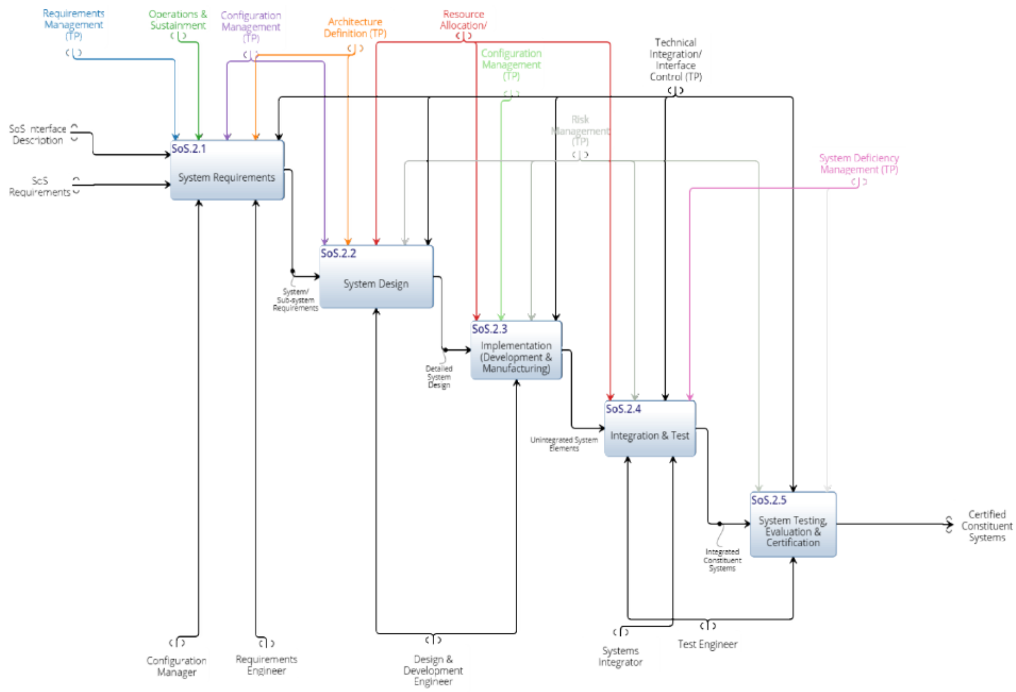

Figure 8. System Design and Development Stage Source: NPS LSI Cohort 4 (2018.)

The right-hand side of the SoSE&I (model or "Vee"), depicted in Figure 9, is the Mission Assurance stage. INCOSE calls this the Technical and Management Human Systems Integration (HSI) stage. HIS takes the management and technical processes of the product by "integrating human consideration within and across all system elements" (INCOSE 2015, p. 251). This stage is where the Fleet introduces the new systems into the SoS for real-world testing.

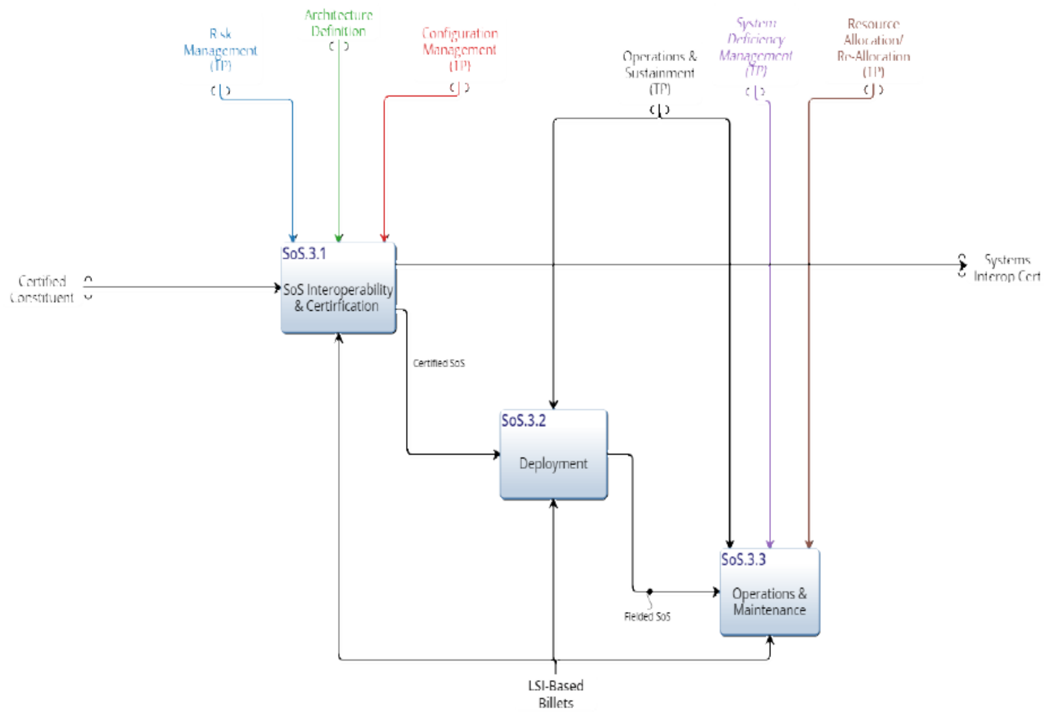

Figure 9. Mission Assurance Stage Source: NPS LSI Cohort 4 (2018).

The purpose of the SoS Architecture and Requirements Development stage is to provide a "foundation from which Resource Sponsors can prioritize" Warfighter requirements, funding and "improve Integration and Interoperability across the System of Systems" (Vaneman and Carlson 2018, p. 14).

D. DEFENSE ACQUISITION GUIDEBOOK (DAG)

The Defense Acquisition Guidebook or DAG is a set of guidebooks of best practices for different competencies and is used as a reference through the acquisition process. The DAG is a companion to NAVAIR policy documents "by providing the acquisition workforce with discretionary best practices that should be tailored to the needs of each program. It is intended to inform thoughtful program planning and facilitate effective program management" (DAG Foreword).

Chapter I's purpose "is intended to provide Program Managers information needed to thoughtfully organize, plan, and execute a DOD acquisition program regardless of acquisition category, business model, or program type, whether providing a service or product" (DAG, Chapter I, p. 1).

Chapter II Analysis of Alternatives (AoAs) and cost estimation. According to the DAG, Chapter II "provides explanations of the Office of the Secretary of Defense's Office of Cost Assessment and Program Evaluation's (CAPE's) policies and procedures found in DoDI 5000.73, Cost Analysis Guidance and Procedures and the Operating and Support Cost Estimating Guidebook as well as information required by DoDI 5000.02, Operation of the Defense Acquisition System" (DAG, Chapter II, p. 1).

Chapter III, Systems Engineering, establishes the technical framework "for delivering materiel capabilities to the warfighter" (DAG, Chapter III, p. 1). Systems Engineering follows the SETR events to validate the design of the product to the requirements established by the Warfighter.

Chapter IV, Life Cycle Sustainment, comprises "the range of planning, implementation and execution activities that support the sustainment of" the product (DAG, Chapter IV, p. 1).The DoDI 5000.02G is a formal guide for program managers and product supply managers to use to create a Logistics Life cycle Sustainment Plan.

The DAG complements all the government policy documents or controls used by the federal workforce. The DAG resource assisted in the research of mechanisms at every point on the SoSE&I "Vee" to describe what needs to be done and what billet is responsible to get it done. These resources were key to breaking down all the deliverables in the SoSE&I functions and allowed the derivation of KSAs needed to satisfy those deliverables. The government resources were invaluable in completing the research for Chapter III.

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III. METHODOLOGY

Chapter III addresses the methodology used to explore the KSAs needed to perform as an LSI Team. Cohort 4 IDEF0 diagrams will be used and will be decomposed even further to include the LSI billets (described in Chapter II, figures 6–9). The Defense Acquisition Guide (DAG) will be used to address some of the missing areas discovered in the breakdown of the functional activities on the IDEF0 diagrams.

The IDEF0 provides a reliable guide and model to systematically decompose each functional activity of the SoSE&I process into what needs to be delivered or tasking that needs to be completed. Using the deliverables or tasking to determine the KSAs required to accomplish them was the next step. The diagrams in the following sections will show a further breakdown of each required task that needs to be completed to satisfy the SoSE&I activity function. In all diagrams, the required tasks are written as KSAs and are outlined with a red box.

A. SYSTEM OF SYSTEMS 1.1 TECHNOLOGY ASSESSMENT

Various inputs are taken from industry, academia, and present SoS to assess all potential solutions for a new requirement. Development of system goals can begin as well as requirements for critical technologies. Once the evaluations have been completed, the team can start to decide what products and tasks need to be developed to satisfy the function. Figure 10 shows the decomposed KSAs in red (discussed below).

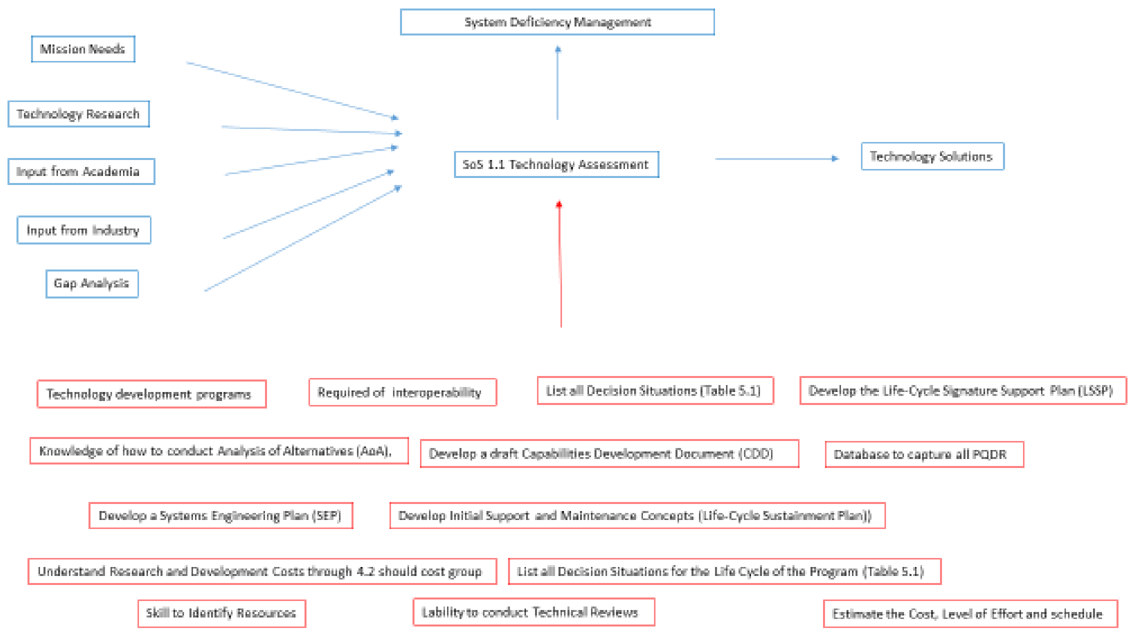

Figure 10. System of Systems 1.1 Technology Assessment.

By conducting an Analysis of Alternatives (AoA), several courses of action will be discovered for further evaluation and eventual selection. The system team will develop a draft Capabilities Development Document (CDD) for the new system to be developed. From this document, the team will decide whether Government or Industry will develop each capability. This is the time to also think about how this new system will interact with the SoS in which it is expected to work. Accordingly, a Systems Engineering Plan (SEP) will need to be developed. As defined by the DAG System Engineering Process, the SEP "identifies the most effective and efficient path to deliver a capability, from identifying user needs and concepts through delivery and sustainment" (DAG 3.2, p. 1). Keeping with the framework of a system, stakeholders will need to develop initial support and maintenance concepts through a Life-Cycle Support Plan (LCSP). This is done in parallel with the other documents under development. For example, Logistics needs to understand the thought process of how decisions are made as they create their plan for sustainment, logistical footprints, and sparing for the life cycle costs (LCC) of the system.

There needs to be an agreed-upon database among stakeholders to capture Product Quality Deficiency Reports (PQDRs). PQDRs are used for tracking all changes, including why the changes were made for historical record. PQDRs will need to be captured for all "new or newly reworked government-owned products that do not fulfill their expected purpose, operation, or service" (PDREP n.d.). PQDRs are also a good way to capture "premature failure of items within an identified warranty period or specified level of performance" (PDREP n.d.). PQDRs show the discrepancy as well as the correction, which can create lessons learned for similar and new projects in the future.

At this early stage of the program, various government schedules (IMP/IMS/IGS) need to be created and updated monthly as the program moves forward. In the schedule, government resources required to support the plan need to be identified and ordered. Coordination with Chief Development Tester to add all Development Test and Evaluation (DT&E) activities present and future, technical assessments, risk areas, technical reviews and audits needs to be incorporated into the schedule.

The Government Cost Department should be able to estimate the cost, effort, and schedule as a measuring stick through historical data from other programs, to develop a cost model for the research and development of a new system. The data is used as a planning tool to allow for the correct funding to be planned.

B. SYSTEM OF SYSTEMS 1.2 CAPABILITY COLLECTION/CUSTOMER INTERFACE

Figure 11 compares the Technology Readiness Assessment (TRA) of the product under development to the System of Systems. For this comparison, the program needs to have the ability to procure the right supplies, resources, and services to support the system. The most important resource is funding for the product to be developed. There needs to be a development of the Cost Capability Analysis (CCA). This effort is accomplished through comparison of historical programs and industry.

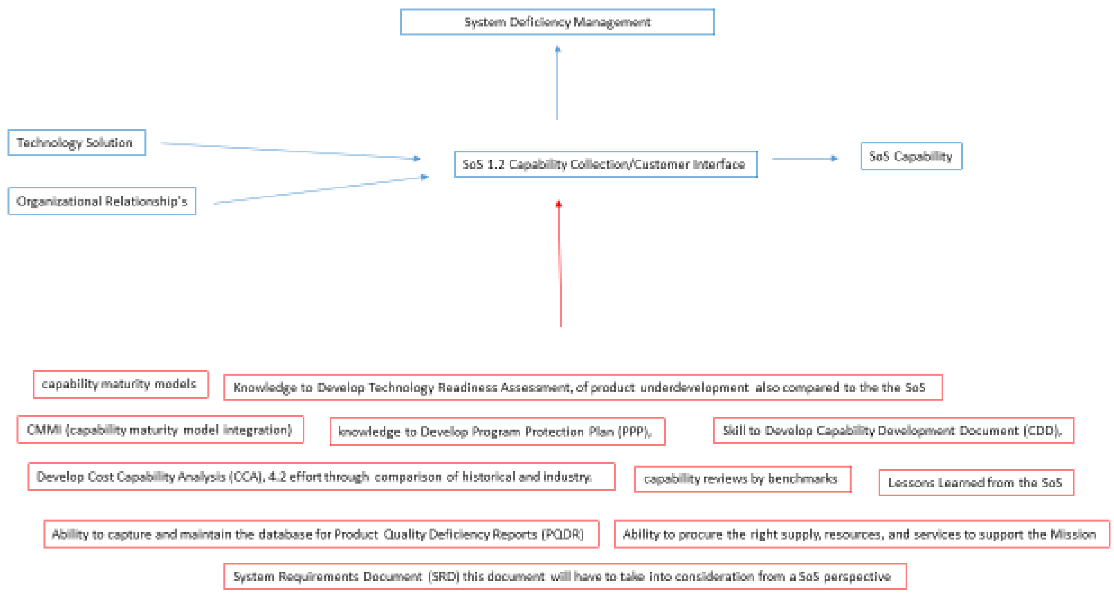

Figure 11. System of Systems 1.2 Capability Collection/Customer Interface.

Also, lessons learned from all present and historical programs will be very helpful when looking at how different types of programs interact with other platforms. The interoperability of other System of Systems requires many different moving parts, which must be considered when looking at creating or updating a new product. The market research process involves not just going to industry and asking about the new innovations but also talking to the stakeholders from the area of operation in which your new product will be functioning. Seeing how the new product will be used will assist in the requirements gathering and ultimately satisfying the customer. The next piece to create is the System Requirements Document (SRD), a document that takes the System of Systems perspective into consideration.

While performing market research, the capability maturity models of the new system and the System of Systems will be reviewed. There also needs to be capability reviews by benchmarks as a system and as a System of Systems. These reviews would be set up as part of the acquisition process to ensure the right technology is being used to support the System of Systems. Captured lessons learned from other efforts and shared experiences from the System of Systems can be applied to planning and integration. The

Capability Maturity Model Integration (CMMI) model is a collection of best practices of software that help “organizations streamline process improvement and encourage productive, efficient behaviors that decrease risks in software, product, and service development” (White 2021, p. 1). The CMMI model can be used to improve an organization’s ability to meet its business objectives, requirements development, systems design, development and systems integration.

Additionally, there needs to be a System of Systems PQDR database to keep track of failures and fixes. A Risk Management Plan (RMP) also forces a process that can be tracked in the absence of the team or Subject Matter Experts who found the risk or opportunity. The RMP can be used at any time of the life cycle, from upgrades to Engineering Change Proposals (ECPs), and should capture the System of Systems impacts. Development of a Program Protection Plan (PPP) is a document that each program office creates to address their particular mission to prevent unauthorized access. The program’s PPP goes hand in hand with the Security Classification Guide (SCG). The PPP should be updated any time the SCG is updated. There must be knowledge of how to develop a TRA and the understanding of how to use system and System of Systems information results. From a System of Systems perspective, the team wants to know the individual TRLs and “the level of integration with other parts of the system, and its operating environment in terms of actual system performance in an operational environment” (GAO-16-410G 2016, p. 15).

Figure 12 is not just for the system under development, but also for the System of Systems that is fielded. Adding new technology into an existing System of Systems could create an inoperable system or non-functioning system. Developing a CCA allows for trade space between cost and warfighter requirements. The CCA will provide a list of alternatives that show the different warfighter requirements, with an emphasis on capability vs. affordability. This analysis is a good tool to use when planning for future funding and contracts. Though only a planning tool, it can be updated as the system matures and actual data becomes known.

Developing the initial CDD and SRD needs to be done from a System of Systems perspective. These documents must be updated as a system matures. The CDD is a living document and needs to reflect the end item. This is a record of all the changes the end item goes through. As part of the SoS, it shows all the changes each end item has made and why. The SRD does the same except it also shows the requirements of each end item. The SRD is where one should see the ties to each system as they are a requirement of each other.

C. SYSTEM OF SYSTEMS 1.3 CAPABILITY ASSESSMENT AND ANALYSIS

Figure 13 shows the update and refinement of acquisition documents that were started in System of Systems 1.1 and 1.2. The SRD will have to consider the SoS perspective and what is required for the new product to enhance the mission of the overall system. This is where a thorough understanding of what the customer expects from the new product is essential. System of Systems 1.3 is where the capability documents are created. The team needs to understand the Mission Model, Kill Chain, Operational Needs, and the SoS Capability needs. This new project needs to complement the existing project.

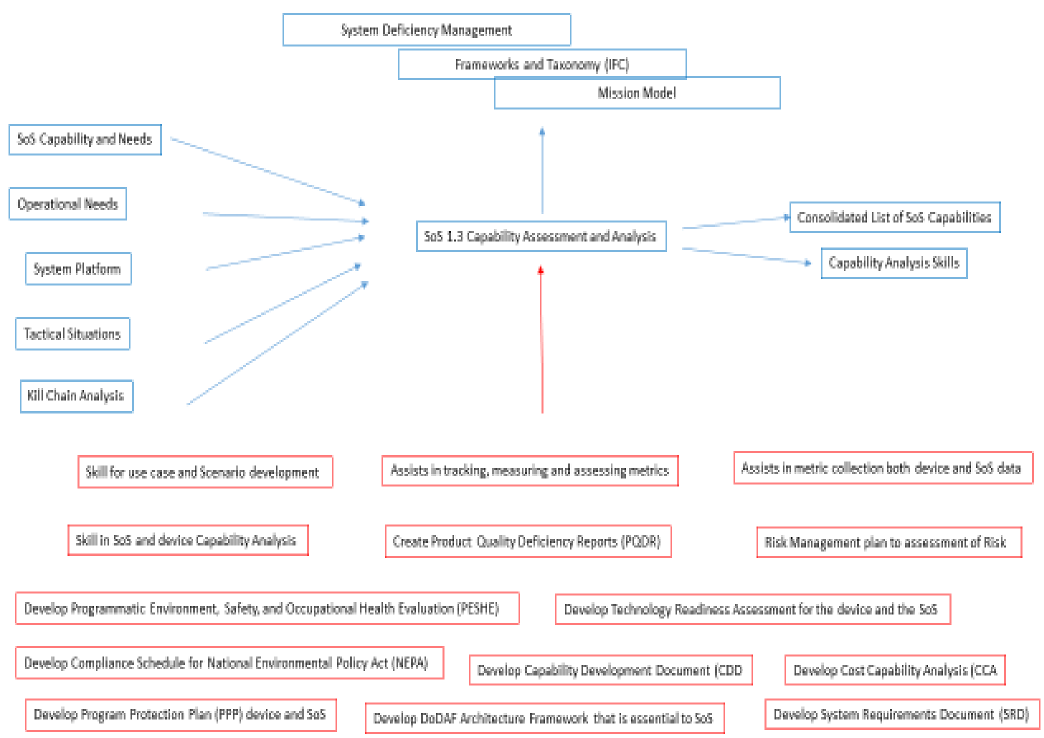

Figure 12. System of Systems 1.3 Capability Assessment and Analysis.

The DOD Architecture Framework (DODAF) provides “a standard framework for developing architectural views and presenting data that supports systems engineering” (DoDAF, Mar 2011). The Capability Development Document (CDD) will show the expected capability of the product, but a team needs a big picture of the system in which it will work. Concept of Operations (CONOPS) of the project is information that is taken from the Warfighter that will be using the product. It shows how the Warfighter plans to use the project through missions and the possible environment in which the Warfighter will operate. The CDD and the CONOPS feed into the SRD. The SRD describes the functional and performance requirements at project level.

D. SYSTEM OF SYSTEMS 1.4 ARCHITECTURE DEVELOPMENT AND ANALYSIS

Figure 13 shows the update and refinement of acquisition documents that were started in System of Systems 1.1–1.3. The development of the DODAF is essential to a System of Systems. The architecture definition process includes “the possible usage of other viewpoints and views to present how the system architecture addresses stakeholders’ concerns” in various models (INCOSE 2015, p. 68).

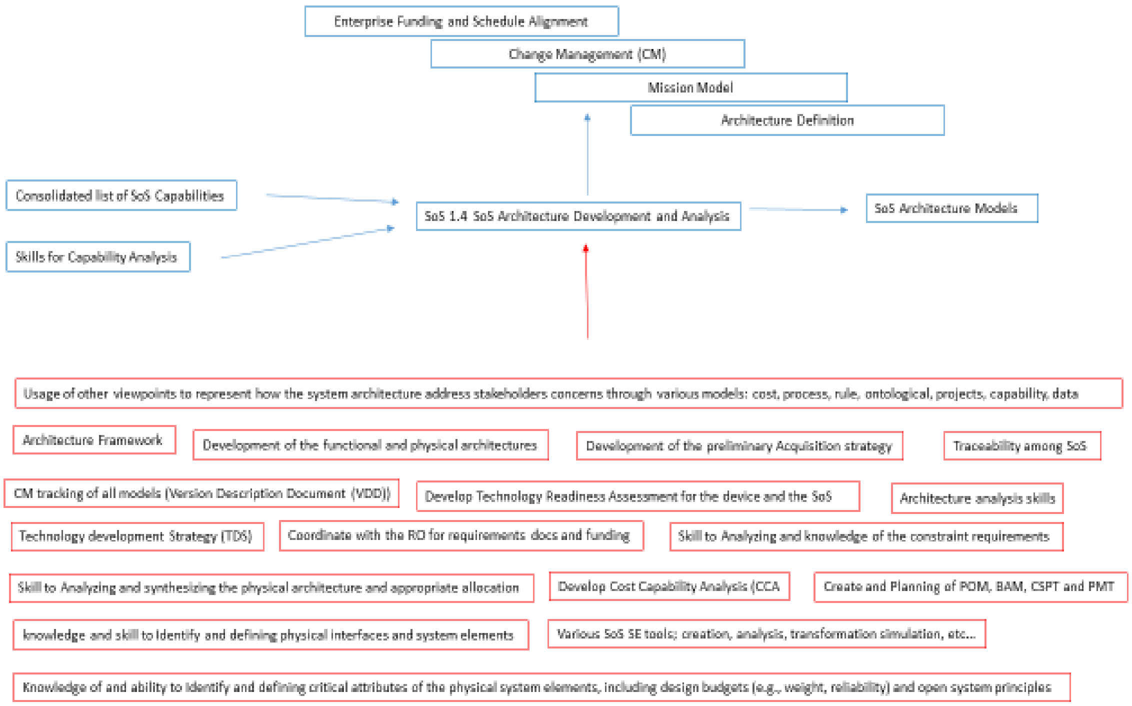

Figure 13. System of Systems 1.4 Architecture Development and Analysis.

The PQDR will continue to give traceability to all the decisions made for each discrepancy found during testing at all stages of the life cycle. Mission Level assessment allows for an end-to-end assessment of the entire platform and its boundaries. This assessment is geared towards identification of integration and interoperability (I&I) gaps in capabilities. The DODAF is a language that can be used to display different modeling viewpoints. The DODAF can be used to translate the outputs of the Warfighter Requirements Definition and Requirements Analysis processes into a system architecture baseline that satisfies the documented requirements for hardware, software, and human elements. It must synthesize alternative design solutions by considering requirements and constraints; identifying and defining interfaces and system elements (hardware and software); and establishing design budgets (e.g., weight, reliability). And finally, it must generate architecture and final design based on analysis of alternative designs through collaboration with stakeholders to establish a baseline of requirements.

Modeling the SoS in this way can show the architecture or interconnections between systems. The modeler needs to understand the tool and the information needed to put into the modeling tool. The modeler needs to be proficient in the tool as well as the business rules in place to create the model.

This is a time in the acquisition process when tools such as the Program Management Tool (PMT), Command Spend Plan Tool (CSPT), and Program Objective Memorandum (POM) are started and tracked monthly going forward. The PMT and CSPT tools are how the funding documents get their information to fund a contract.

E. SYSTEM OF SYSTEMS 1.5 REQUIREMENTS AND ALLOCATION

Figure 14 shows the process of incorporation and gathering of the new requirements and maintains a current, approved set over the entire acquisition life cycle. It provides full traceability to stakeholder capabilities, requirements, and the rationale for those changes.

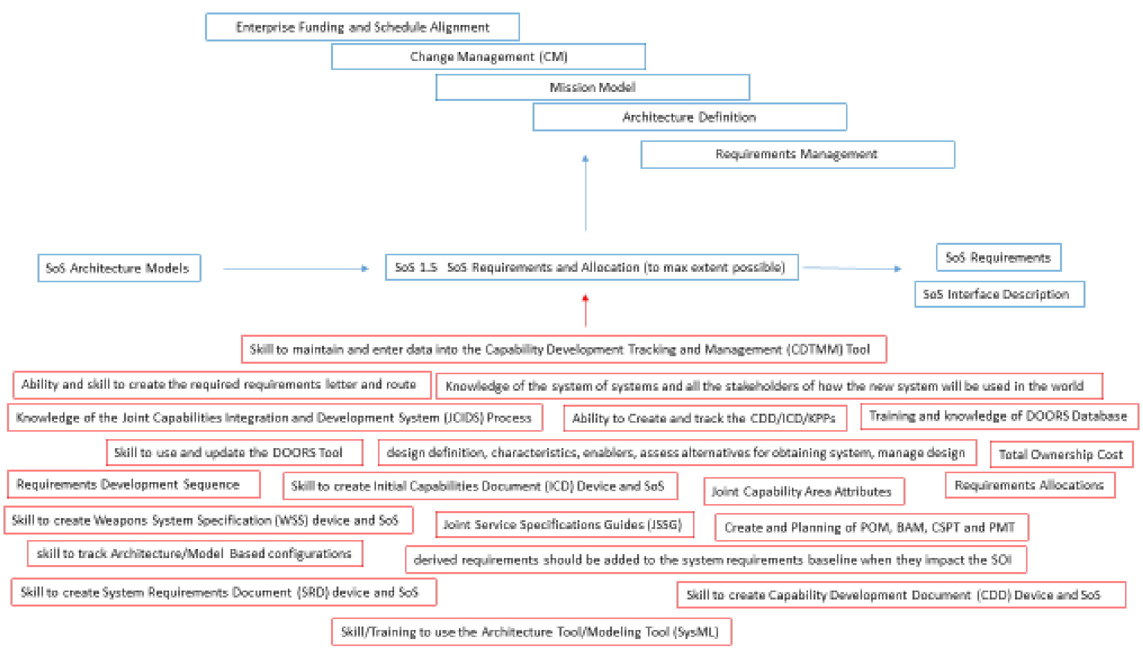

Figure 14. System of Systems 1.5 Requirements and Allocation.

System of Systems Requirements evaluates various stakeholders' missions and their requirements, then transforms those mission requirements into a functional and technical view of a system that will meet the stakeholders' needs. Another way to look at a project is in a holistic view. Like the spokes of a bicycle wheel, all the stakeholders are interconnected and are part of the larger mission, which allows the wheel to go around in a circle.

For managers to make a better acquisition decision, the overarching system model needs to be well thought out and every aspect explored, from concepts to overall system performance.

F. SYSTEM OF SYSTEMS 2.1 SYSTEM REQUIREMENTS

Figure 15 reviews all the documents that need to be created or refined to validate and verify that the Stakeholder Requirements have been captured correctly and have traceability throughout the process. All derived requirements should be added to the system requirements baseline, as part of the CDD, to show traceability back to all requirements.

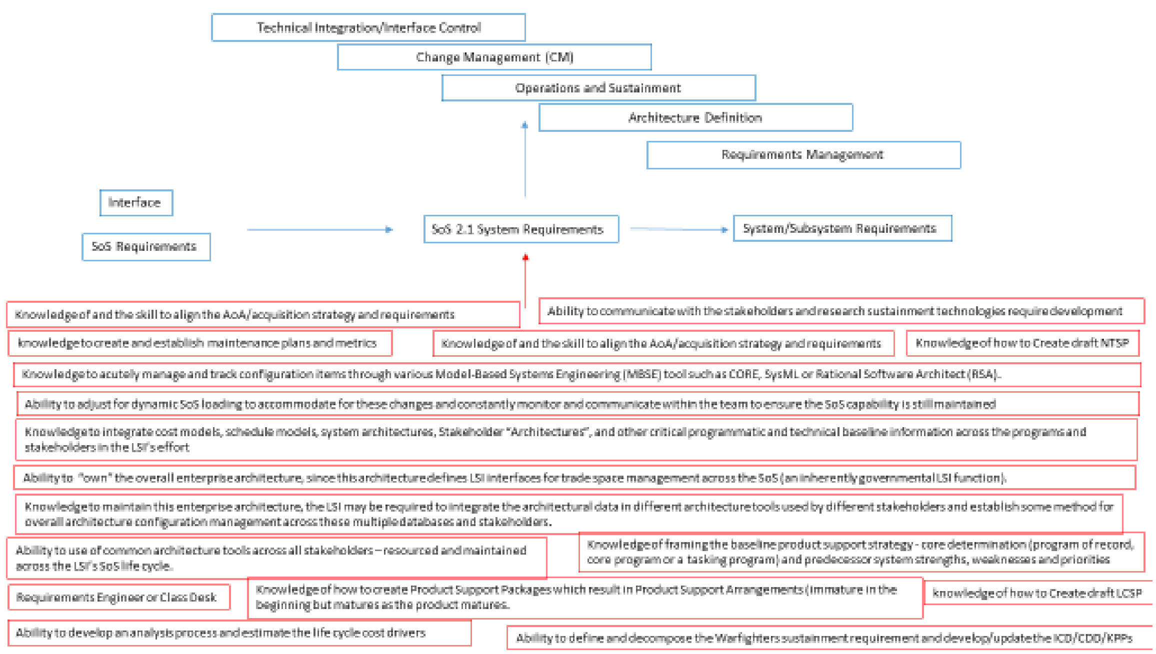

Figure 15. System of Systems 2.1 System Requirements

During Cohort 2 class, they found that Configuration Management (CM) or Change Management (Cohort 2 2015, p. 20) is a functional area that is only concerned with the project configuration. As an LSI project, there needs to be an understanding of the entire system while being aware of all changes to any product in the entire system. Without this understanding, the risk of failure is high. The definition of Asynchronous CM "is especially complex for an LSI that must establish and maintain the overall System of Systems CM baseline throughout the product and systems life cycle for all baselines." (Cohort 2 2015, p. 21). For example, while you are at work, your home (SoS) that has been heated by firewood for years has a requirements change to natural gas. That change requires that various other changes will need to be made, such as removal of the fireplace and installation of a natural gas unit. These changes will take time, money, and an understanding of all the impacts to your home and way of life.

For the Architecture Definition, one will need skill and ability to develop and use various Model-Based Systems Engineering (MBSE) tools such as CORE, Rational Software Architect (RSA), and Modeling and Simulation Enterprise (MSE).

The JCIDS process ensures that "the capabilities required by the joint warfighter are identified, along with their associated operational performance criteria (requirements), in order to successfully execute the missions assigned" (AcqNotes JCIDS 2021). There are four common documents that are updated during the life cycle of a product: Initial Capabilities Document (ICD), Capability Development Document (CDD), System Requirements Document (SRD), and Weapons System Specification (WSS). The actual requirements process needs to be completed not only for the product, but for the SoS product with which it is meant to operate.

Another important point to evaluate is if the SoS stakeholders "hold different Assumptions, Limitations, or Constraints (ALCs) about the expected use of systems, and the requirements for component System of Systems" (Cohort 2 2015, p. 23). This reinforces a need to maintain this information through a Capability Development Tracking and Management (CDTMM) Tool. There needs to be a way to track and manage the requirements, especially the reason for changing a requirement.

Once the (CDD/ICD) documents have been created, Logistics must start establishing the fielding and sustainment plan. This requires knowledge to create and establish maintenance plans and metrics through the Logistics Cycle Sustainment Plan (LCSP), Product Support Package (PSP) and Navy Training System Plan (NTSP). Logisticians need to start thinking about what support footprint will be used through collaboration with SoS stakeholders to see how there can be synergy to share logistic posture, and develop a process to estimate an analysis process to estimate the life cycle cost drivers.

As reported by Cohort 2, "Systems of Systems Deficiency Management (supported by laboratory and flight test verification and validation activities) is more challenging for LSIs in complex System of Systems environments involving multiple programs and stakeholders" (Cohort 2 2015, p. 24). This should be mitigated by a comprehensive and complete Operational Test Plan.

G. SYSTEM OF SYSTEMS 2.2 SYSTEM DESIGN

Figure 16 continues to refine acquisition documents with a configuration and risk focus and is discussed below. The Technical Integration / Interface Control is a relatively new control for a government LSI team. In this capacity, the Systems Engineer (SE) is conducting a non-traditional SoS Engineering & Integration (SoSE&I) role.

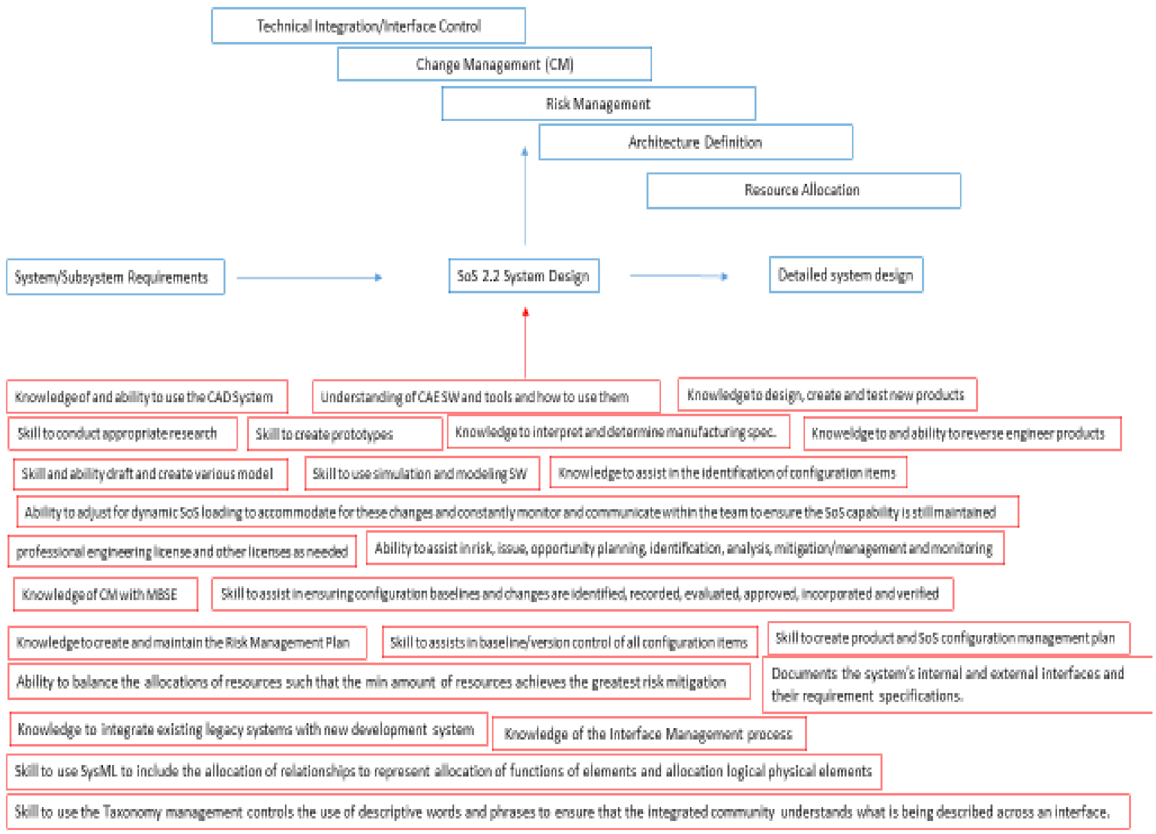

Figure 16. System of Systems 2.2 System Design.

The SoSE&I needs to manage the trade space at the point of interface between System of Systems. Looking at this from an SoS perspective allows one to see the technical maturity of the systems inside the SoS. In turn, this allows for the documentation of risks and opportunities in the LSI's efforts.

Through Change Management and Model-Based Systems Engineering (MBSE) tools (CORE or RSA), one can better track configuration changes to the system as the system matures. The System of Systems also needs to be updated for SoS inoperability.

The sustainment plan needs to be in place before the system is fielded, not after it is fielded. As part of these requirements, the PSM and the Warfighter will need to decide what the Maintenance Plan will be so that resources, training, maintenance concepts, and requirements can be allocated.

H. SYSTEM OF SYSTEMS 2.3 IMPLEMENTATION

Figure 17 implements the design into a real, tangible item through prototypes. This is also the time to start the integration of existing legacy systems with the new development system.

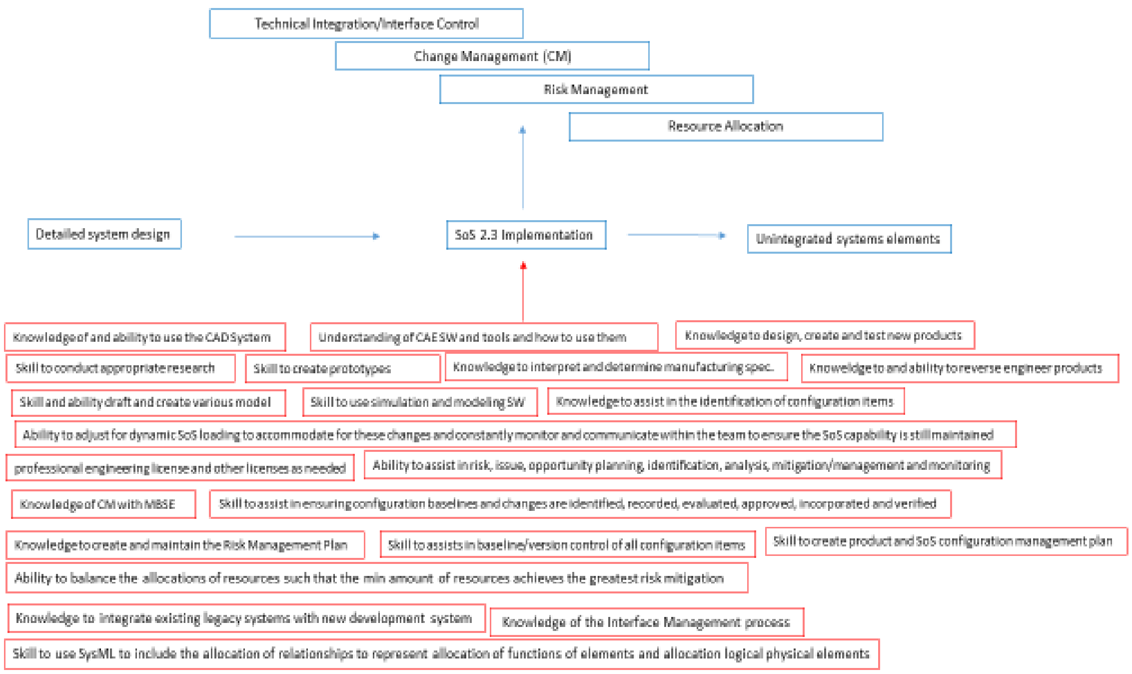

Figure 17. System of Systems 2.3 Implementation.

At this point the engineering team will be creating prototypes and running various modeling and simulation tools. Various acquisition documents need to either be created or updated from the System of Systems 2.2 activities. One such document is the Risk Management Plan (RMP). The RMP "is a continuous process that is accomplished throughout the life cycle of a system and should begin at the earliest stages of program planning" (AcqNotes, 2022).

The Configuration Management Plan (CMP) is another document that "should be updated periodically to reflect changes in procedures, rules, regulations, and best practices to maintain proper Configuration Management" (AcqNotes, 2022). This tool is a great way for PM and SE to control modifications and release the modifications to the Warfighter to address the fielded devices. If this is done from an SoS perspective, then all stakeholders would be aware of possible impacts to the mission. CMP assists with the identification of baseline/version control and a record of all configuration changes made. This is also a check for the developers to ensure they captured all requirement changes properly, so they may be shared amongst the stakeholders. This is also a good opportunity to use the System model to communicate changes to the stakeholders. This model could assist with trade space conversations between the various interdependencies while still determining overall SoS mission effectiveness.

Additionally, this process requires an Interface Systems Plan to be created. This document is new to the normal acquisition process and captures many of the same elements of a CMP. DODAF creates different views, operational or system, that displays a picture to "describe interface relationships in a manner common across the DOD user community" (DAU Interface Management 2021, p. 158).

I. SYSTEM OF SYSTEMS 2.4 INTEGRATION AND TESTING

Figure 18 shows integration and testing of the system and System of Systems. This is the most exciting and stressful time for many programs. Here is where all the hard work and long hours get tested, and many more documents are updated. During the integration and testing, the team needs to address the SEP, Program Protection Plan (PPP), and decide whether Live-Fire is necessary for this program.

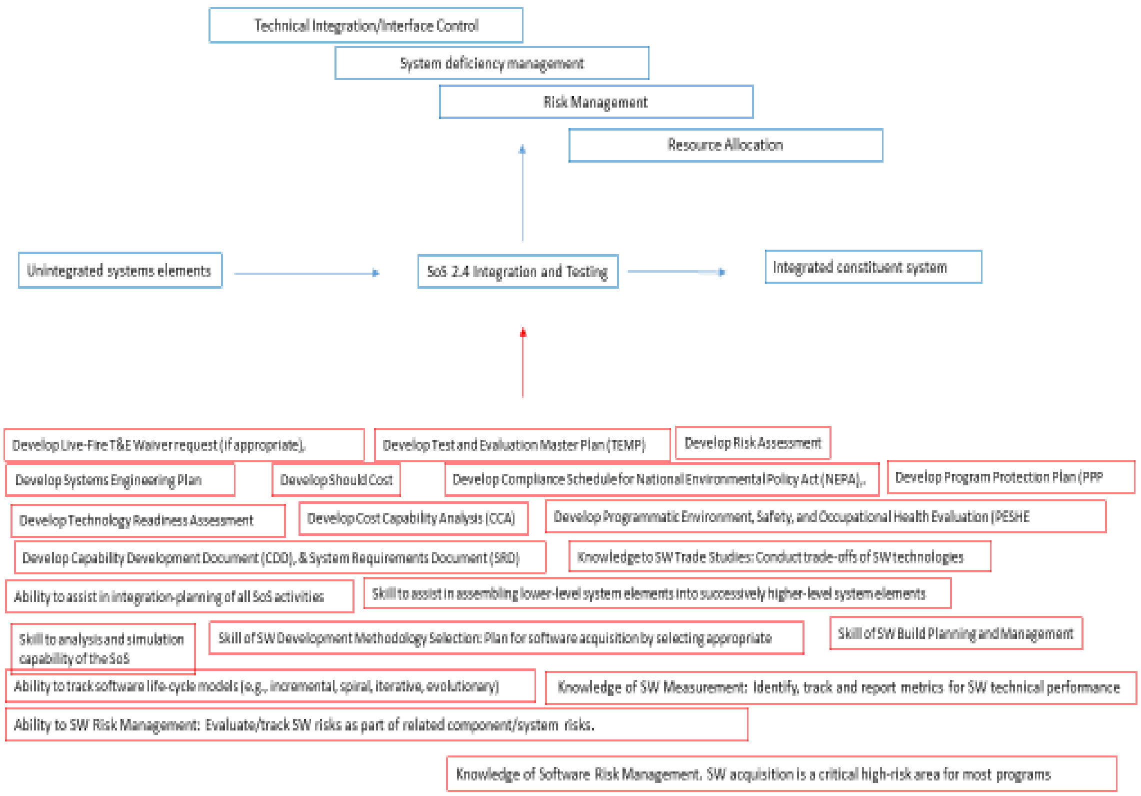

Figure 18. System of Systems 2.4 Integration and Testing.

A PPP needs to be created so that various parts of the system can have the proper classifications. It should also include the SoS classifications. The Cost Capability Analyst supports the Program Manager in using Multi-Objective Decision Analysis to make cost-effective decisions from the trade space between cost and Warfighting capabilities. This will not be done in a vacuum, and the SoS stakeholders will need to be involved in the decision-making process. Conducting the Technology Readiness Assessment (TRA) is crucial. The TRA provides a "metrics-based process and accompanying report that assesses the maturity of critical hardware and software technologies" (NAVAIRINST 3910.1 2009, p. 4).

J. SYSTEM OF SYSTEMS 2.5 SYSTEM TESTING EVALUATION AND CERTIFICATION

This part of the acquisition process (Figure 19) is all about testing for real-world usage. This is where the Warfighter gets to work with other stakeholders to see if the new system meets the operational requirements that it was built for and if it works in the real environment to support the SoS Warfighter effort.

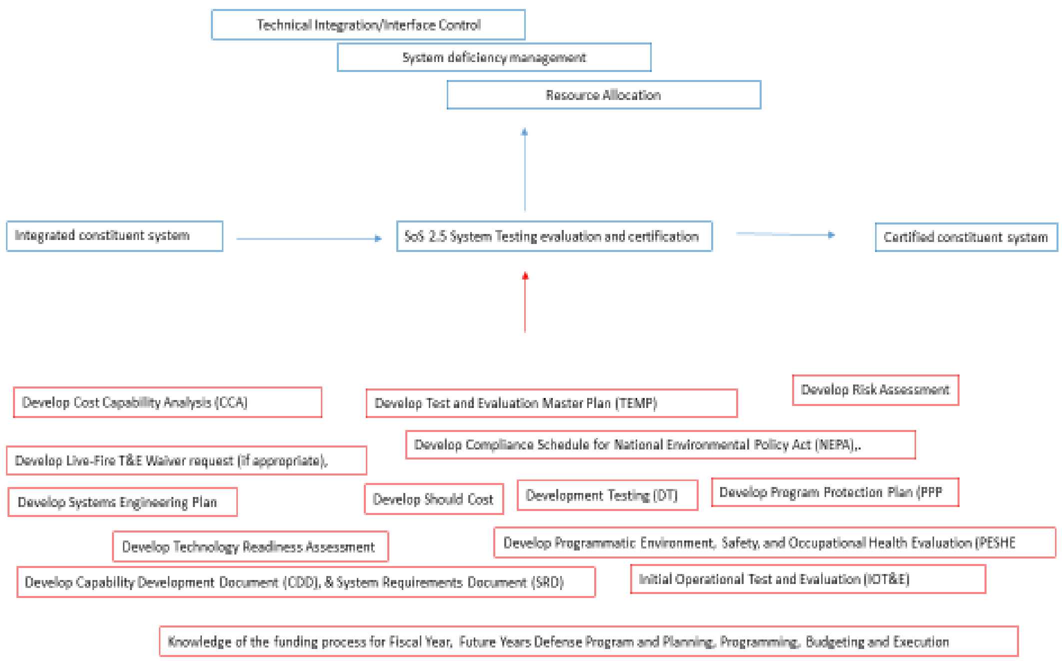

Figure 19. System of Systems 2.5 System Testing Evaluation and Certification.

Before any testing can begin, the following documents need to be developed and updated: Live-Fire T&E Waiver request (if appropriate); Test and Evaluation Master Plan (TEMP); Risk Assessment; Systems Engineering Plan; Programmatic Environment, Safety, Occupational Health Evaluation (PESHE); and Compliance Schedule for National Environmental Policy Act (NEPA). Through testing, the system team and stakeholders may find the need to change or update the Capability Development Document and System Requirements Document during testing.

Part of the TEMP is testing of the software. The software is the most complex and agile part of a product. The software needs to be cutting edge at the same time mature enough to work with other systems to accomplish the intended mission. The TEMP needs to measure technical performance of the deployable build with a build plan that can address various “dependencies, synchronization and integration; prototype- or target-hardware availability to enable developmental and operational testing of builds; and detailed SW staffing plans (derived from SW effort and schedule estimates)” (DAG SE 2020).

K. SYSTEM OF SYSTEMS 3.1 SYSTEM OF SYSTEMS INTEROPERABILITY AND CERTIFICATION

At this point (Figure 20), most of the acquisition documents will need to be maintained and/or updated. A continuous knowledge of the baseline/version control of all SoS configurations (HW/SW/Models) is especially important to ensure real-world operational success.

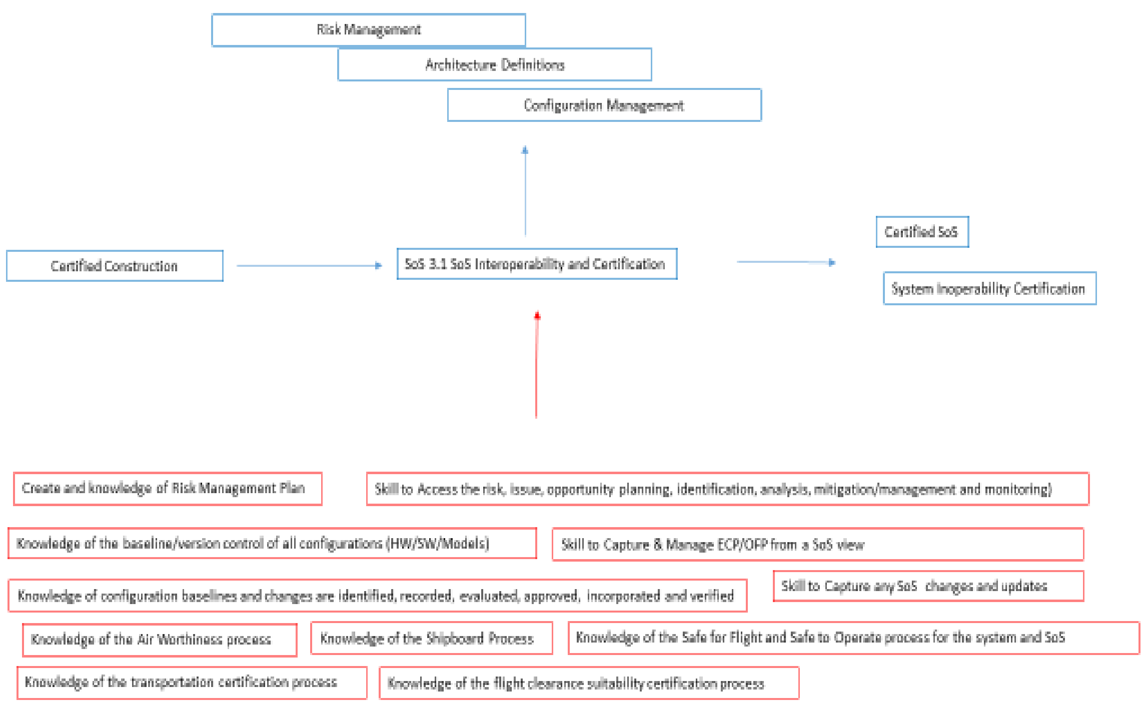

Figure 20. System of Systems 3.1 System of Systems Interoperability and Certification.

Through continuous tracking of all SoS baselines, changes are identified, evaluated, approved, incorporated, and verified through a tool. NAVAIR uses CMPro to track the changes as they appear. Depending on the platform, other items of consideration are shipboard integration, air worthiness, and transportation requirements. All of them have their own processes and testing, but do not have a tool to share or alert others when changes are made.

L. SYSTEM OF SYSTEMS 3.2 DEPLOYMENT

Deployment of the system (Figure 21) may be considered the final part of any program, but it is not. This is the part in the program life cycle when the Logistics team takes over to sustain the system.

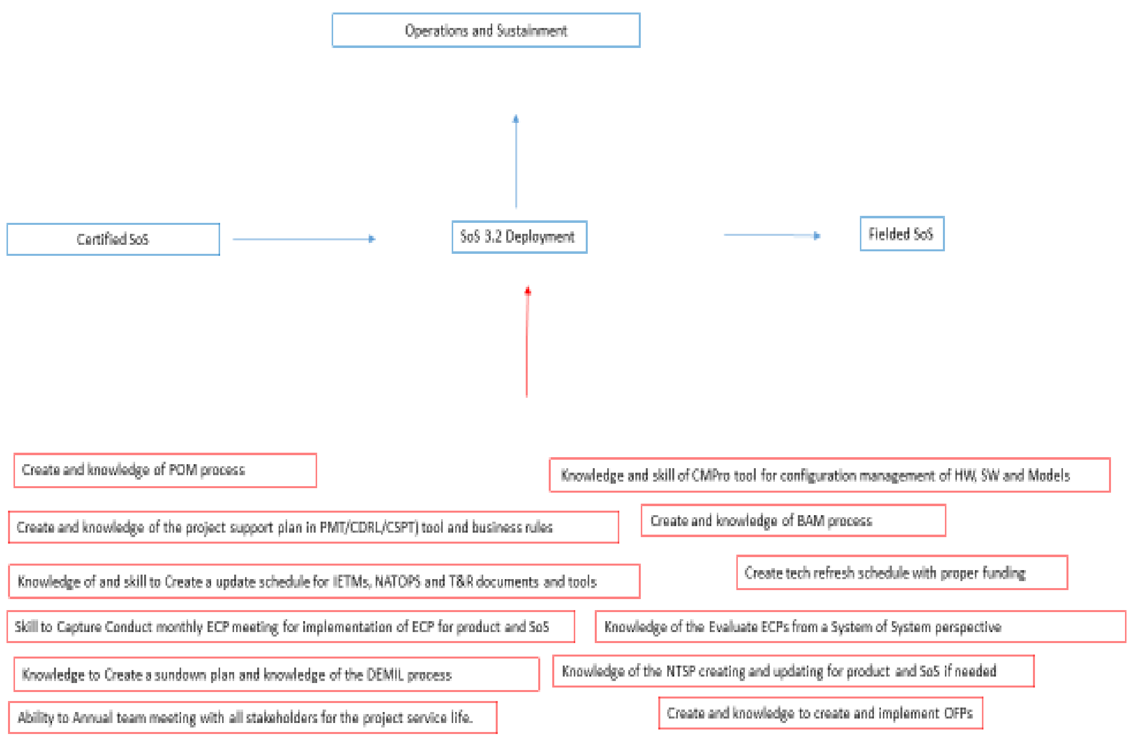

Figure 21. System of Systems 3.2 Deployment.

The following skills are needed to create the sustainment plan for the day-to-day operations:

- Create a project support plan in the PMT database to account for all contract actions that require payment, which is tracked at both the PMA and Program Executive Office levels.

- Maintain and update the CSPT monthly for contract payments, materials, license, and burn-down rate for labor.

- Create a technology refresh schedule to plan for money and the new technology that will be used on the system, as technology and cyber requirements are constantly changing and being updated.

Necessary skills also include the ability to track and know when the publication updates are available from the NATEC website. For an LSI, there needs to be an announcement for all stakeholders, so they can also assess the impacts to their system. The importance of keeping abreast of all changes and updates made to various systems in an SoS was mentioned earlier (see section K in this chapter). Acquisition professionals know that there are monthly Engineering Change Proposal (ECP) meetings to evaluate impacts to their particular system, but all the SoS stakeholders need to evaluate ECPs from an SoS perspective. Cybersecurity has become an integral part of every system, whether standalone or internet-capable. There are new acquisition documents that need to be developed and maintained: System Security Plan, Vulnerability Assessment, Security Risk Management Plan, System Security Architecture Views, and Cybersecurity Test Plan. All are required as part of the Authorization to Operate (ATO) package.

Although configuration management is not a new concept, a paradigm shift in how to communicate updates and changes to the SoS is needed. The tools we use need to be more DOD-accessible so that all stakeholders can share their systems' life cycle changes.

M. SYSTEM OF SYSTEMS 3.3 OPERATIONAL AND MAINTENANCE

The Operational and Maintenance process is “a significant percent of total costs”; it is also important to keep in mind that “maintenance is an important part of the system definition” (INCOSE 2015, p. 99). This section is the final report card of the program. Here is where the logistics sustainment plan is put to the test.

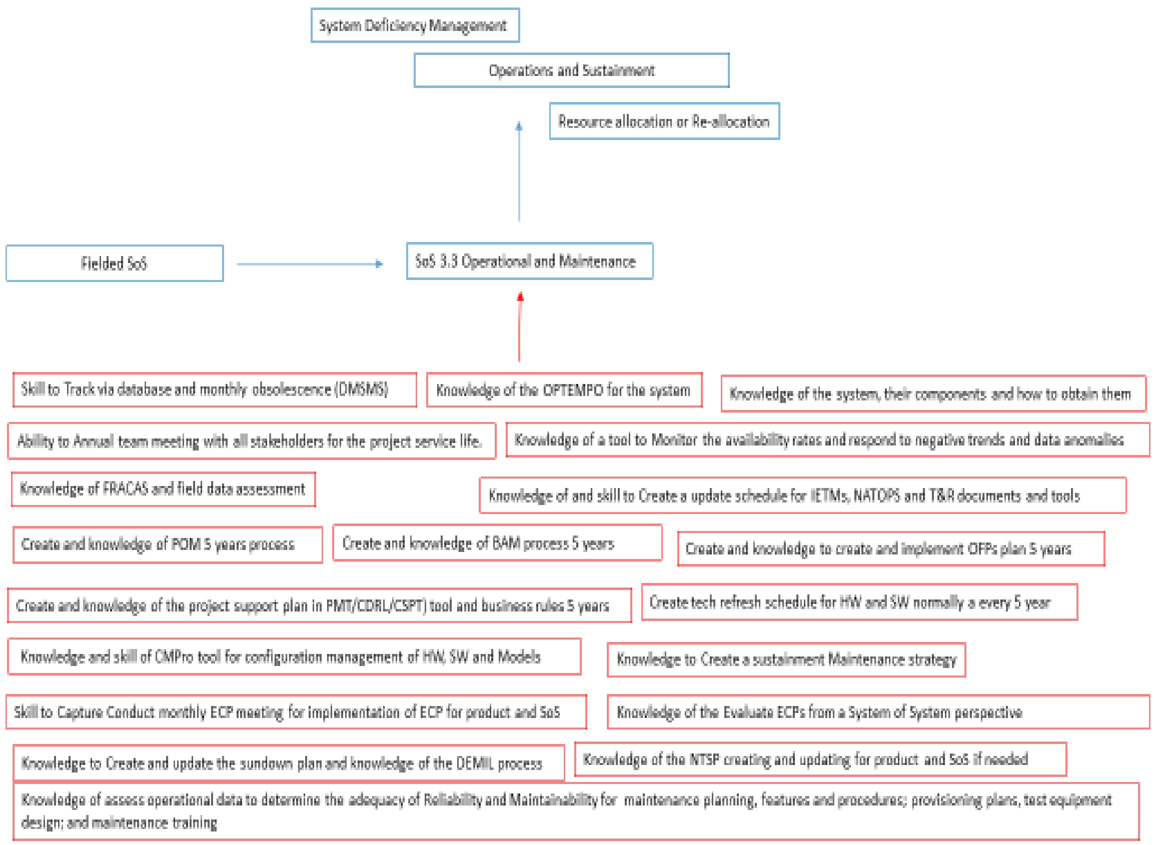

Figure 22. System of Systems 3.3 Operational and Maintenance.

During this phase, the Warfighter is using the product in the real world and doing the mission it was designed for. Here is where “system installation procedures, operating and maintenance instructions, inspections and calibration procedures, and procurement data” (INCOSE 2015, p. 222) gaps in support are discovered.

Funding is always an issue for any system, especially LSI. To ensure that Warfighter capability in the mission is maintained throughout its LCC, an effort is made to communicate with "multiple independently developed support strategies (or existing legacy system support strategies) across the systems in the LSI's effort which may also be at different levels of maturity" (Vaneman and Carlson 2018, p. 47). The DOD gives each branch money to sustain their programs and create new ones. This is where the awareness of program budget planning needs to come into play by the ROs. Initial creation of POM, Baseline Assessment Memorandum (BAM), PMT/CDRL/CSPT, and HW /SW upgrades and tech refresh for the next five years was mentioned earlier (see section B of this chapter). This would be a great place to create an IGS for the System of Systems to lay out each life cycle for stakeholder planning.

Another concern is footprint and "support requirements for the entire System of Systems so that the logistic element requirements can be allocated effectively to the constituent systems and supporting stakeholder Product Teams" (Cohort 2 2015, p. 30). As with all documents, there is a need to keep day-to-day manuals and update pubs such as IETMs, NATOPS and T&R. These documents normally only impact the specific system, not the SoS.

The system will have to conduct as-needed or monthly ECP meetings to evaluate and implement changes into the system. ECP changes need to be evaluated to assess whether the change will impact how the system interacts with the SoS.

Including a highly detailed sundown plan is essential to the LCC or cradle-to-grave system. No one person normally stays with a program for 40 years, but those involved with the initial sustainment plan need to set the expectations for the sundown of the system. Each system has its own specific training system. The Navy Training Support Plan (NTSP) document is used to explain the system and show the different devices that are associated.

The ability to track the various databases to track Diminishing Manufacturing Sources and Material Shortages (DMSMS) for the system and SoS is essential. All SoS stakeholders need to establish an annual team meeting to share all updates, including ECPs, OFPs, parts replacement, DMSMS, HW/SW upgrades, tech refreshes, new mission requirements, and any other system changes inside the SoS that can impact the SoS. The stakeholders meeting is a good time to update and maintain a five-year plan (IGS) of the SoS and the systems within.

N. SUMMARY

Chapter III reviews the five volumes of the DAG to determine the KSAs that were needed to create or update the acquisition documents. NAVAIR has numerous documents that explain how to create and who should create, and how to maintain and update all the documents during the acquisition cycle (cradle to grave). All the various KSAs from the diagrams in Chapter III are collected and summarized in Appendix A. Appendix A shows the relationship of the KSAs to traditional billets based upon the DAG. Chapter IV will compare the data collected in Appendix A to four known LSI PMAs.

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IV. LSI KNOWLEDGE, SKILLS AND ABILITIES COMPARISONS

To answer the thesis questions necessitated a comparison between the KSAs needed to perform as an LSI (discovered in Chapter III) and those in NAVAIR PMAs (PMA-213/268/274/281). The selected PMAs have known LSI projects in them. In previous LSI classes, four NAVAIR PMAs revealed that they had LSI projects in their programs. A summary of these PMAs is included in appendixes B and C. Appendixes B and C were used to determine if the KSAs identified in Chapter III could be seen in the organizational charts (Appendix B) or the interface slides (Appendix C).

The following is a brief overview of each of the four PMAs' missions. PMA 213, Naval Air Traffic Management Systems, touches every platform in the Navy and Marine Corps Fleet, which means that their systems need to interact with every aircraft in the inventory and airfield around the world for emergency landings. PMA-268, Unmanned Carrier Aviation MQ-25, took a top-level approach to understand stakeholders that MQ-25 will need to communicate with and missions they need to support in the Fleet with manned aircraft, ships, and airfields. The mission of PMA-274, Presidential Helicopter, is to fly the President and other government officials. The communication system is government designed and built. This aircrafts mission requires the President and other government officials the capability to communicate with numerous U.S. agencies as well as conduct international calls. PMA-281 develops weapons that must interact with a multitude of air and ship platforms with a variety of different networks to provide advanced capability to the Warfighter.

The Chapter III analysis was broken down into KSAs and are shown in Appendix B. These KSAs were determined through an analysis of the organizational chart billets (Appendix B) (i.e. Systems Engineer, Director of Logistics or Program Manager) then functional areas (i.e. Architecture or Requirements Management) and then mapped the functional areas to KSAs to better compare to the control group (PMA-213/268/274/281) through their organizational charts (see Appendix B). After examining the first functional area (SE), it appeared that several of the KSAs were missing or were only partially performed by the four control group PMAs. For example, Table 1 depicts the different

Systems Engineering KSAs that were LSI specific and not found in the four control group PMAs. The second functional area that lacked some of the needed KSAs was that of Reliability and Maintainability (R&M) Engineering, whose functions are to reduce cost and schedule risks by preventing and identifying R&M discrepancies.

Table 1. Comparison of KSAs to PMA Responsibilities: Systems Engineering

KSA (taken from Ch3 diagrams)	**Functions**	**Traditional Billets**	**LSI Role**	**PMA -213**	**PMA -268**	**PMA -274**	**PMA -281**	**Does this KSA exist yes/no/ partial? ***
Skill to create Capability Development Document (CDD) Device and SoS	Requirements Management	System Engineer	x					Partial
Skill to create ICD Device and SoS	Requirements Management	System Engineer	x					Partial
SoS design definition, characteristics, enablers, assess alternatives for obtaining system, manage design	Requirements Management	System/ Requirements Engineer	x					Partial
Knowledge of framing the baseline product support strategy – core determination and predecessor system	Reliability/ Maintainability/ Diagnostics Engineering	Systems Engineer	x					Partial

KSA (taken from Ch3 diagrams)	Functions	Traditional Billets	LSI Role	PMA -213	PMA -268	PMA -274	PMA -281	Does this KSA exist yes/no/ partial? *
strengths, weaknesses and priorities								
KSA (taken from Ch3 diagrams)	**Functions**	**Traditional Billets**	**LSI Role**	**PMA -213**	**PMA -268**	**PMA -274**	**PMA -281**	**Does this KSA exist yes/no/ partial? ***
System Requirements Document (SRD) this document will have to take into consideration from a SoS perspective	Requirements Management	Systems Engineer	x					Partial
Knowledge to Develop Technology Readiness Assessment, of product underdevelopment also compared to the SoS	System Engineer	System Engineer	x					Partial
Develop Technology Readiness Assessment for the device and the SoS	System Engineer	System Engineer	x					Partial
Knowledge and skill to Identify and defining physical interfaces	System Engineering	System Engineering	x					Partial

KSA (taken from Ch3 diagrams)	Functions	Traditional Billets	LSI Role	PMA -213	PMA -268	PMA -274	PMA -281	Does this KSA exist yes/no/ partial? *
and system elements								
KSA (taken from Ch3 diagrams)	**Functions**	**Traditional Billets**	**LSI Role**	**PMA -213**	**PMA -268**	**PMA -274**	**PMA -281**	**Does this KSA exist yes/no/ partial? ***
Skill/ Training to use the Architecture Tool/ Modeling Tool (SysML)	System Engineering	System Engineering	x					Partial
Skill to use SysML to include the allocation of relationships to represent allocation of functions of elements and allocation logical physical elements	System Engineering	System Engineering	x					Partial
Skill to analysis and simulation capability of the SoS	System Engineering	System Engineering	x					Partial
Knowledge to properly use SoS SE tools; creation, analysis, transformati on	System Engineering	System Engineering	x					Partial

KSA (taken from Ch3 diagrams)	Functions	Traditional Billets	LSI Role	PMA -213	PMA -268	PMA -274	PMA -281	Does this KSA exist yes/no/ partial? *
simulation, etc…								
KSA (taken from Ch3 diagrams)	**Functions**	**Traditional Billets**	**LSI Role**	**PMA -213**	**PMA -268**	**PMA -274**	**PMA -281**	**Does this KSA exist yes/no/ partial? ***
Knowledge to acutely manage and track configuration items through various Model-Based Systems Engineering (MBSE) tool such as CORE, SysML or Rational Software Architect (RSA).	System Engineering	System Engineering	x					Partial
Skill to create Weapons System Specification (WSS) device and SoS	System Engineer	System Engineer	x					Partial

KSA (taken from Ch3 diagrams)	Functions	Traditional Billets	LSI Role	PMA -213	PMA -268	PMA -274	PMA -281	Does this KSA exist yes/no/ partial? *
Knowledge to apply CMMI (Capability Maturity Model Integration)	System Engineer	System Engineer	x					Partial
KSA (taken from Ch3 diagrams)	**Functions**	**Traditional Billets**	**LSI Role**	**PMA -213**	**PMA -268**	**PMA -274**	**PMA -281**	**Does this KSA exist yes/no/ partial? ***
Ability to adjust for dynamic SoS loading to accommodate for these changes and constantly monitor and communicate within the team to ensure the SoS capability is still maintained	Acquisition Management	Acquisition Management	x					Partial
Skill to use the Taxonomy management controls the use of descriptive words and phrases to ensure that the integrated community understands	Acquisition Management	Acquisition Management	x					Partial

KSA (taken from Ch3 diagrams)	Functions	Traditional Billets	LSI Role	PMA -213	PMA -268	PMA -274	PMA -281	Does this KSA exist yes/no/ partial? *
what is being described across an interface								
Ability to assist in integration-planning of all SoS activities	Acquisition Management	Acquisition Managemen t	x					Partial
KSA (taken from Ch3 diagrams)	**Functions**	**Traditional Billets**	**LSI Role**	**PMA -213**	**PMA -268**	**PMA -274**	**PMA -281**	**Does this KSA exist yes/no/ partial? ***
Create tech refresh schedule for HW and SW normally a every 5 year from SoS perspective	HW/SW Engineer / Configuration Management	HW/SW Engineer / Configuratio n Managemen t	x					Partial
Knowledge of the baseline/ version control of all configuratio ns (HW/SW/ Models) from SoS perspectives	HW/SW Engineer / Configuration Management	HW/SW Engineer / Configuratio n Managemen t	X					Partial
Develop DoDAF Architecture Framework 2.0 that is	Architecture Engineer	Architecture Engineer	X					Partial

KSA (taken from Ch3 diagrams)	Functions	Traditional Billets	LSI Role	PMA -213	PMA -268	PMA -274	PMA -281	Does this KSA exist yes/no/ partial? *
essential to SoS								
Knowledge of and ability to Identify and defining critical attributes of the physical system elements	Test & Engineering	Test & Engineering	x					Partial

* If partial, exists in a traditional program office but needs expansion for SoS efforts.

* Source: adapted from Excerpt of Systems Engineering (See Appendix A for full comparison of all roles)

Another functional area that seems to be absent from the control group PMAs is Model-Based Systems Engineering (MBSE). MBSE can use various tools such as CORE, GENESYS, Rational Software Architect (RSA), Modeling & Simulation (M&S), Modeling and Simulation Enterprise (MSE), as well as different Languages such as System Modeling Language (SysML) or Unified Modeling Language (UML). These tools have existed in the government since 1996, yet many PMAs do not use them. These tools are designed to allow for the creation of a system within them and then display numerous views of the project and that can highlight the interdependencies and various facets of the system. Some of the gaps in the functional areas for the control group PMAs, functional areas like Requirements Management and Reliability & Manageability (R&M) Diagnostics Engineering, could easily be addressed by adding billets to include those KSAs as there were no billets related to those functional areas in the control group PMAs.

A comparison of the LSI KSAs for Program Manager from Chapter III was also performed against the four control PMAs (Appendix A, Excerpt of PM). The discovery was similar to that for the Systems Engineer and are shown in Table 2. The four control

PMAs have similar KSAs for a Program Manager, but the scope of the responsibility needs to expand. Normally the Program Manager only interfaces with his project team and the customer, but in an LSI role they will have to interface with additional stakeholders whose programs have interdependencies with their POR. This interface will keep their products relevant and avoid interoperability issues.

Table 2. Comparison of KSAs to PMA Responsibilities: Program Manager

KSA (taken from Ch3 diagrams)	**Functions**	**Traditional Billets**	**LSI Role**	**PMA -213**	**PMA -268**	**PMA -274**	**PMA -281**	**Does this KSA exist yes/no/ partial? ***
Ability to Annual team meeting with all stakeholders for the project service life	Program Management (PM)	Program Management (PM)	x					Partial
Ability to communicate with the stakeholders and research sustainment technologies require development	Program Management (PM)	Program Management (PM)	x					Partial
Ability to adjust for dynamic SoS loading to accommodate for these changes and constantly monitor and communicate within the team to ensure the SoS capability is still maintained	Program Management (PM)	Program Management (PM)	x					Partial

KSA (taken from Ch3 diagrams)	Functions	Traditional Billets	LSI Role	PMA -213	PMA -268	PMA -274	PMA -281	Does this KSA exist yes/no/ partial? *
KSA (taken from Ch3 diagrams)	**Functions**	**Traditional Billets**	**LSI Role**	**PMA-213**	**PMA -268**	**PMA -274**	**PMA -281**	**Does this KSA exist yes/no/ partial? ***
Skill to use the Taxonomy management controls the use of descriptive words and phrases to ensure that the integrated community understands what is being described across an interface	Program Management (PM)	Program Management (PM)	x					Partial
Ability to assist in integration-planning of all SoS activities	Program Management (PM)	Program Management (PM)	x					Partial
Ability to communicate with the stakeholders and research sustainment technologies require development	Program Management (PM)	Program Management (PM)	x					Partial

KSA (taken from Ch3 diagrams)	Functions	Traditional Billets	LSI Role	PMA -213	PMA -268	PMA -274	PMA -281	Does this KSA exist yes/no/ partial? *
Knowledge of the system of systems and all the stakeholders of how the new system will be used in the world	Program Management (PM)	Program Management (PM)	x					Partial
KSA (taken from Ch3 diagrams)	**Functions**	**Traditional Billets**	**LSI Role**	**PMA-213**	**PMA -268**	**PMA -274**	**PMA -281**	**Does this KSA exist yes/no/ partial? ***
Ability to Annual team meeting with all stakeholders for the project service life	Program Management (PM)	Program Management (PM)	x					Partial
Ability to Annual team meeting with all stakeholders for the project service life	Program Management (PM)	Program Management (PM)	x					Partial
Ability to Annual team meeting with all stakeholders for the project service life	Program Management (PM)	Program Management (PM)	x					Partial

* If partial, exists in a traditional program office but needs expansion for SoS efforts.

* Source: adapted from Excerpt of Systems Engineering (See Appendix A for full comparison of all roles)

A PM's job is to manage the Cost, Schedule and Performance of the project. Additionally, they need to manage the communication up and down the chain of command. When the chain of command is linear, with one customer, this is an easy task. When the array of stakeholders looks more like that of a bicycle wheel with various spokes, the PM's scope of communication becomes more difficult, with different information needed at the ends of the various spokes.

Since "the LSI owns the requirements, design, and product baselines" (Cohort 1, 2014), the LSI team should have the KSAs to track the requirements, design and product baseline. As Cohort 1 noted, "As the LSI PM takes on responsibility for product design and development, more talent in areas of system design and architecture is required" which includes "conceptual design talent and technicians who can use modern SE tools" (Cohort 1, 2014). The PM needs to understand all of the various stakeholders' needs and the impacts their project may have to those stakeholders. Any change to the system will impact the SoS, and the PM is the agent of change and communication for such events.

Another functional area in which the proper scope of the KSAs is missing is Configuration Management (CM) as shown in Table 3. This will assist the systems engineering functional areas. The functional area of CM requires an expansion of scope for an LSI team. The LSI needs to increase his scope to include the configuration of the systems that impact his system, taking an SoS view, to ensure that changes that occur on systems that impact his can be understood and analyzed so that he can still meet the overall mission requirements. As noted by Cohort 2, "Asynchronous CM is especially complex for an LSI that must establish and maintain the overall SoS CM baseline throughout the product and systems life cycle for all baselines" (Cohort 2, Para 5.8, pp. 20–21).

Table 3. Comparison of KSAs to PMA Responsibilities: Configuration Management/Change Management.

KSA (taken from Ch3 diagrams)	Functions	Traditional Billets	LSI Role	PMA -213	PMA -268	PMA -274	PMA -281	Does this KSA exist yes/no/ partial? *
Ability to Annual team meeting with all stakeholders for the project service life	Program Management (PM)	Program Management (PM)	x					Partial
KSA (taken from Ch3 diagrams)	**Functions**	**Traditional Billets**	**LSI Role**	**PMA -213**	**PMA -268**	**PMA -274**	**PMA -281**	**Does this KSA exist yes/no/ partial? ***
Knowledge of the Evaluate ECPs from a System of System perspective	Configuration/ Change Management (CM)	Configuration/Change Management (CM)	X					Partial
Skill to Capture Conduct monthly ECP meeting for implementation of ECP for product and SoS	Configuration/ Change Management (CM)	Configuration/Change Management (CM)	X					Partial
Knowledge of the baseline/ version control of all configuration	Configuration/ Change Management (CM)	Configuration/Change Management (CM)	x					Partial

KSA (taken from Ch3 diagrams)	Functions	Traditional Billets	LSI Rol e	PMA -213	PMA -268	PMA -274	PMA -281	Does this KSA exist yes/no/ partial? *
s (HW/SW/ Models)								
KSA (taken from Ch3 diagrams)	**Functions**	**Traditional Billets**	**LSI Role**	**PMA -213**	**PMA -268**	**PMA -274**	**PMA -281**	**Does this KSA exist yes/no/ partial? ***
Skill to Capture & Manage ECP/OFP from a SoS view	Configurat ion/ Change Managem ent (CM)	Configuratio n/Change Managemen t (CM)	X					Partial
Skill to create product and SoS configuration management plan	Configurat ion/ Change Managem ent (CM)	Configuratio n/Change Managemen t (CM)	X					Partial

*If partial, exists in a traditional program office but needs expansion for SoS efforts.

* *Source: adapted from Excerpt of Systems Engineering (See Appendix A for full comparison of all roles)*

The different programs don’t need to track everything about other SoS programs, just enough to understand the different interfaces and track any changes that can impact the mission. Another reason this is important is during Diminishing Manufacturing Sources and Material Shortages (DMSMS). When systems make changes, there needs to be a signal or coordination to look at other components of systems to see if any of them are impacted, and if changes are made, how they will impact the SoS and the overall mission. This is why the PM should have a communication plan with the various stakeholders to address the impacts of changes and asynchronous configuration management. These skills were not shown or demonstrated within the four control PMAs.

The three main areas in which a PMA needs to expand the KSAs are Program Management, Systems Engineering and Configuration Management. Their KSAs need to be expanded to enable the LSI team to perform effectively. The LSI team needs to gain an SoS understanding and increase their scope to include systems that can affect their overall mission contribution. There also needs to be a paradigm shift of the government to ensure that these expanded position descriptions are in place under the proper functional area.

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V. CONCLUSION

The objective of this thesis was to determine the KSAs required to perform as an LSI team and then determine if those KSAs currently exist in NAVAIR PMA's. This study is a continuation of the Lead System Integrator Cohort 4 project, which determined the functions needed to be performed by an LSI team. Their study used the SoS "Vee" as the basis, as there are many similarities between SoS and LSI functionality. That information was used to determine the KSAs that were then needed to perform those functions. After those were determined, four NAVAIR PMAs, that have some LSI functionality, were used as controls to determine if NAVAIR has the needed KSAs.

What does the composition of a Lead System Integrator Team look like?

The composition and size of a Lead System Integrator team is not an easy question to answer. There is not a "one size fits all" composition for an LSI team. Looking at this question from the perspective of the four control PMAs has provided valuable insights such as the following. As discovered in Chapter IV, just looking at a PMA's organizational chart and the position titles (Program Manager, Systems Engineer, Configuration Manager, etc…) does not give a true view of the KSAs/Roles/Responsibilities that exist in a PMA. A deep dive of each position via their Position Descriptions (PD) would have to be done, which was not part of the scope for this research. To establish an LSI team, one needs to understand the mission for which the product will perform. This can be accomplished through the use the LSI framework by identifying the architecture of the SOS and how one's system fits into it. The four control PMAs did demonstrate they understood the mission in which their product would operate, but it was unclear if they understood the SoS they were part of or how they interacted with those other systems. The four control PMAs did have Systems Engineering, Program Management and Configuration Management position titles that exist in a traditional program office, but the KSAs need expansion for an LSI team and the SoS efforts.

Can an LSI billet be defined through standard roles and responsibilities or Position Descriptions?

The roles and responsibilities of an LSI team need to be fully articulated based on need and they do not currently exist. There needs to be an increase in scope of the roles, their responsibilities, and ultimately position descriptions to include the increase in LSI scope for Program Management, System Engineering, and Configuration Management, just to name a few functional areas. These three primary areas need to be reviewed for inclusion of the SoS and LSI. This is the first step in understanding the roles and responsibilities and the potential scope increase for an LSI team.

Once the right SoS and LSI KSAs are identified, a program can create LSI billets, and roles and responsibilities that are needed based on the PMA's mission. This may also require additional training, tools, and updated guidance. Currently, this information does not readily exist in any form to help a program office to properly identify needed billets. However, using a comparison process such as the one used in this research provides a first step in identifying the KSAs.

Do these KSAs exist presently in Naval Air Systems Command?

The required KSAs for a successful LSI do not exist in the four NAVAIR control PMAs. However, there are correlations. Chapter III research found that NAVAIR has KSAs that exist from a single product viewpoint, PMA to customer, but not from a PMA to various stakeholders with interdependent systems. Chapter IV discussed three primary functional areas for which the scope of roles and responsibilities must be increased and skills created, such as MBSE for Systems Engineering. Program Management responsibilities for any program allows for the proper modification to any team to address role, responsibility, and communication gaps. With that being said, a Program Manager could augment his staff through contractor support or create, through increased government training, the KSAs needed to support the LSI team. The same can be said about increasing the Configuration Management responsibilities.

A. SUMMARY

The research questions in this thesis were asked as a result of NAVAIR leadership increasingly requiring Program Managers to create LSI programs. The Program Managers are not given any training or "How To" guide to assist with this new requirement from Leadership. Overall, NAVAIR does have the basic KSAs, as the LSI KSAs are not unique to NAVAIR or other government agencies. However, for an LSI program, the KSAs must increase in scope to include a SoS view and provide a communication plan to show who and how to work with the various stakeholders and programs. Systems Engineering needs to expand and understand all the stakeholders, the program dependencies, and create a communication plan to continuously share all interface changes with all stakeholders and programs. From a Configuration Management perspective, the tools and Configuration Management Plans can easily incorporate stakeholders and programs that need to be included on any and all changes. From a Modeling perspective, more emphasis is needed on using modeling tools and having trained personnel not only to create the models but also to read and understand them.

This research has shown that NAVAIR does not have all of the KSAs identified, or the billets described, to easily form an LSI program office. The four control PMAs demonstrated this. Most of the KSAs exist today but several need to expand or be added to fully support the efforts needed to perform as a successful LSI program. However, expanding the KSAs is entirely possible as suggested by this research, and a valuable first step toward integrating LSI into the NAVAIR acquisition process.

B. RECOMMENDATIONS FOR FUTURE RESEARCH

This thesis uncovered new questions that were out of scope for this research. Recommended the following questions for future research:

- For Cybersecurity: how is the Authorization to Operate (ATO) addressed from an SoS perspective? Is there a need for overarching ATO or just individual ATO?

- Should CSS, rather than government, identify LSI billets to develop Level of Effort requirements?
- What is the most effective way to gather and publish Best Practices from existing NAVAIR LSI programs and to share successful strategies, tools, and processes?
- What are the LSI Workforce talents and composition that have enabled success?
- How have successful LSI programs established flexible, productive relationships with their sub-vendors, whether they were commercial, FFRDC, or government?
- How can the research in this thesis be used to guide manpower and contract decisions for an LSI Team?
- How might a guidebook for program offices be created to show how to build an LSI team?

APPENDIX A: COMPARISON OF KSAS AND PMA RESPONSIBILITIES

Milestones/Program Deliverables	KSA (taken from Ch3 diagrams)	Reference	Functions	Traditional Billets	LSI Role	PMA-213	PMA-268	PMA-274	PMA-281	Does this KSA exist yes/no/partial? If partial, exist in a traditional program office but needs expansion for SoS efforts
Initial Capabilities Document (ICD) Capabilities Development Document (CDD) Key Performance Parameters (KPPs)	Develop a draft CDD/ICD/KPPs	CH4-3.1.1.1	Requirements Management	System Engineer		x	x	x	x	
	Update the CDD/ KPPs	DAG CH3-3.2	Requirements Management	System Engineer		x	x	x	x	
	Skill to create Capability Development Document (CDD) Device and SoS		Requirements Management	System Engineer	x					Partial
	Ability to define and decompose the Warfighters sustainment requirement and develop/update the ICD/CDD/KPPs	DAG CH3-3.2	Requirements Management	System Engineer		x	x	x	x	
	Skill to create ICD Device and SoS		Requirements Management	System Engineer	x					Partial
	Ability to track the ICD/CDD/KPPs	DAG CH3-3.2	Requirements Management	System Engineer		x	x	x	x	
DOORS Database	Training and knowledge of DOORS Database		Requirements Management	System/ Requirements Engineer		x	x	x	x	
	Skill to use and update the DOORS Tool		Requirements Management	System/ Requirements Engineer		x	x	x	x	

	SoS design definition, characteristics, enablers, assess alternatives for obtaining system, manage design		Requirements Management	System/ Requirements Engineer	x					Partial
	Requirements Allocations		Requirements Management	System/ Requirements Engineer		x	x	x	x	
	Requirements Development Sequence		Requirements Management	System/ Requirements Engineer		x	x	x	x	
FRACAS	Knowledge of FRACAS and field data assessment	DAG Chapter III	System Engineer	Reliability/ Maintainability/ Diagnostics Engineering		x	x	x	x	
	Knowledge of the Interface Management process	DAG Chapter III	System Engineer	Reliability/ Maintainability/ Diagnostics Engineering		x	x	x	x	
	Knowledge to integrate existing legacy systems with new development system	DAG Chapter III	System Engineer	Reliability/ Maintainability/ Diagnostics Engineering		x	x	x	x	
	Skill to assist in assembling lower-level system elements into successively higher-level system elements	DAG Chapter III	System Engineer	Reliability/ Maintainability/ Diagnostics Engineering		x	x	x	x	
	Knowledge of framing the baseline product support strategy – core determination (program of record, core program or a tasking program) and predecessor system strengths, weaknesses and priorities		Reliability/ Maintainability/ Diagnostics Engineering	Systems Engineer	x					Partial
Authority to Operate (ATO)	Knowledge of the ATO process	DAG CH9 p 22	Cybersecurity	Information System Security Manager (ISSM)		x	x	x	x	
	Ability to create the ATO package	DAG CH9 p 23	Cybersecurity	Information System Security Manager (ISSM)		x	x	x	x	
	Knowledge of the ATO regulations and instruction	DAG CH9 p 24	Cybersecurity	Information System Security Manager (ISSM)		x	x	x	x	
Program Protection Plan (PPP)	Knowledge to Develop and update Program Protection Plan (PPP)	DAG Ch1 p155	Security	Program Security Manager		x	x	x	x	

	Develop Program Protection Plan (PPP) device and SoS		Security	Program Security Manager	x					partial
Analysis of Alternatives (AoA)	Knowledge of how to conduct Analysis of Alternatives (AoA),	DAG Ch2-2.3 DAG CH4-3.1.2	Decision Analysis	Cost Engineer/ Decisions Analysis		x	x	x	x	
PQDR PRODUCT DATA REPORTING AND EVALUATIO N PROGRAM	Skill to update database to capture all PQDR	DLAR 4155.24/ SECNAVIN ST 4855.21 Product Quality Deficiency Report Program 10.9.3 NAMP	Test Director	Commander, Fleet Readiness Centers, Quality Management Group		x	x	x	x	
	Create Product Quality Deficiency Reports (PQDR)		Test Director			x	x	x	x	
	Ability to capture and maintain the database for Product Quality Deficiency Reports (PQDR)		Test Director			x	x	x	x	
	Assists in tracking, measuring and assessing metrics		Test Director			x	x	x	x	
CDTMM	Skill to maintain and enter data into the Capability Development Tracking and Management (CDTMM) Tool	AcqNotes: Requirement s Development	Requirements Manager	APMSE (Class Desk)		x	x	x	x	
Risk Assessment / Risk Management Plan	Assessment of risk through a Risk Management plan	Department of Defense Risk, Issue, and Opportunity Management Guide for Defense Acquisition ProgramsAcq Notes PMA 274 Program RMP MARCORS YSCOM Order SPAWARIN ST 3058.1 NAVFACIN ST 5000.15	Risk Management	APMSE (Class Desk)		x	x	x	x	
	Ability to assist in risk, issue, opportunity planning, identification, analysis, mitigation/ management and monitoring		Risk Management	APMSE (Class Desk)		x	x	x	x	

	Skill to Access the risk, issue, opportunity planning, identification, analysis, mitigation/ management and monitoring	5000.3 MCSC 06 SPW 05A FAC CI 6 Jun 2008 7 Apr 2008 6 Mar 2008 NAVSUPIN ST 5000.20 NAVAIRINS T 5000.21B NAVSEAIN ST 5000.8 SUP 31 AIR-4.1 Ser TAB/ 032 10 Jun 2008 24 Jan 2008 21 Jul 2008	Risk Management	APMSE (Class Desk)		x	x	x	x	
	Develop Risk Assessment	DAG Ch3 p16	Risk Management	APMSE (Class Desk)		x	x	x	x	
	Knowledge to create and maintain the Risk Management Plan	DAU SE Brainbook	Risk Management	APMSE (Class Desk)		x	x	x	x	
ECP/OFP	Skill to Capture & Manage ECP/OFP from a SoS view		DT TEAM	APMSE (Class Desk)	x					partial
	Create and knowledge to create and implement OFPs plans	DAG CH8	DT TEAM	APMSE (Class Desk)		x	x	x	x	
Air Worthiness	Knowledge of the Air Worthiness process	FAA Website NAVAIRINS T 13034.1D NAVAIRINS T 13034.1F, 30JUN2016.	APMSE (Class Desk)	APMSE (Class Desk)		x	x	x	x	
Shipboard Process	Knowledge of the Shipboard Process	Aviation Certification for shipboard operations, granted by NAVAIR Lakehurst. Airworthiness Certification for shipboard operations, granted by NAVAIR Engineering Launch/ Recovery envelope for shipboard operations	DT	APMSE (Class Desk)		x	x	x	x	

Safe for Flight/Safe to Operate	Knowledge of the Safe for Flight process for the system and SoS		APMSE (Class Desk)	APMSE (Class Desk)	x					Partial
	Knowledge of the Safe for Flight and Safe to Operate process for the system and SoS		APMSE (Class Desk)	APMSE (Class Desk)	x					Partial
	Knowledge of the flight clearance suitability certification process	NAVAIRINST 13034.1D (2010)		APMSE (Class Desk)		x	x	x	x	
Systems Engineering Plan (SEP)	Knowledge of how to develop Systems Engineering Plan (SEP)	SEBoK DAG CH3-2.2	System Engineer	System Engineer		x	x	x	x	
	Knowledge of how to update Systems Engineering Plan (SEP)	SEBoK DAG CH3-2.3	System Engineer	System Engineer		x	x	x	x	
Manpower Personnel Parameters/ Requirements Training	Skill to Identify human resources	DAG Ch1 p97 / CH4-3.1.3.3	Resource Management	Resource Management		x	x	x	x	
	Human Systems Integration	DAG Ch5-3.2 / 5–3 Table 1 pg4	Resource Management	Resource Management		x	x	x	x	
	Target Audience Description (TAD)	DAG CH5-4.2.2.1	Resource Management	Resource Management		x	x	x	x	
	Knowledge of the process to get resources	DAG Ch4 p9 / DAG CH5-2.1	Resource Management	Resource Management		x	x	x	x	
System Requirements Document (SRD)	Develop System Requirements Document (SRD)	DAG CH-3.3.3.2	Requirements Management	Systems Engineer		x	x	x	x	
	System Requirements Document (SRD) this document will have to take into consideration from a SoS perspective		Requirements Management	Systems Engineer	x					Partial
Technology Readiness Assessment	Develop Technology Readiness Assessment for the device and the SoS	DAG CH3-3.2.2	System Engineer	System Engineer		x	x	x	x	

	Knowledge to Develop Technology Readiness Assessment, of product underdevelopment also compared to the SoS		System Engineer	System Engineer	x					Partial
	Skill to Analyzing and knowledge of the constraint requirements	DAG CH3-3.2.2	System Engineer	System Engineer		x	x	x	x	
	Develop Technology Readiness Assessment for the device and the SoS		System Engineer	System Engineer	x					Partial
Modeling this is rather new to many program offices.	Knowledge and skill to Identify and defining physical interfaces and system elements	SEBoK DAG CH3-2.4.2	System Engineering	System Engineering	x					Partial
	Skill/Training to use the Architecture Tool/Modeling Tool (SysML)	SEBoK DAG CH3-2.4.2	System Engineering	System Engineering	x					Partial
	Skill to use SysML to include the allocation of relationships to represent allocation of functions of elements and allocation logical physical elements	SEBoK DAG CH3-2.4.2	System Engineering	System Engineering	x					Partial
	Skill to analysis and simulation capability of the SoS	SEBoK DAG CH3-2.4.2	System Engineering	System Engineering	x					Partial
	Knowledge to properly use SoS SE tools; creation, analysis, transformation simulation, etc…	SEBoK DAG CH3-2.4.2	System Engineering	System Engineering	x					Partial
	Knowledge to acutely manage and track configuration items through various Model-Based Systems Engineering (MBSE) tool such as CORE, SysML or Rational Software Architect (RSA).	SEBoK DAG CH3-2.4.2	System Engineering	System Engineering	x					Partial
Weapons System Specification (WSS)	Skill to create Weapons System Specification (WSS) device and SoS		System Engineer	System Engineer	x					Partial

Capability Maturity Model Integration(CMMI)	Knowledge to apply CMMI (Capability Maturity Model Integration)	SEBoK/ CMMI: The DOD Perspective	System Engineer	System Engineer	x					Partial
Capability Analysis	Skill in SoS and device Capability Analysis		Decision Analysis							no
Joint Service Specifications Guides (JSSG)	Ability to us the Joint Service Specifications Guides (JSSG)	AcqNotes Requirements Development	Acquisition Management	Acquisition Management		x	x	x	x	
	Ability to adjust for dynamic SoS loading to accommodate for these changes and constantly monitor and communicate within the team to ensure the SoS capability is still maintained		Acquisition Management	Acquisition Management	x					Partial
	Skill to use the Taxonomy management controls the use of descriptive words and phrases to ensure that the integrated community understands what is being described across an interface		Acquisition Management	Acquisition Management	x					Partial
	Ability to assist in integration-planning of all SoS activities		Acquisition Management	Acquisition Management	x					Partial
Trade Studies	Knowledge to SW Trade Studies: Conduct trade-offs of SW technologies	DAG CH3-2.3.1	SW Engineer	SW Engineer		x	x	x	x	
SW Development Methodology	Skill of SW Development Methodology Selection: Plan for software acquisition by selecting appropriate	DAG CH3-2.3.1	SW Engineer	SW Engineer		x	x	x	x	
SW Build Planning and Management	Skill of SW Build Planning and Management	DAG CH3-2.3.1	SW Engineer	SW Engineer		x	x	x	x	

SW Measurement	Knowledge of SW Measurement: Identify, track and report metrics for SW technical performance	DAG CH3-2.3.1	SW Engineer	SW Engineer		x	x	x	x	
software life-cycle model	Ability to track software life-cycle models (e.g., incremental, spiral, iterative, evolutionary)	DAG CH3-2.3.1	SW Engineer	SW Engineer		x	x	x	x	
SW Risk Management	Ability to SW Risk Management: Evaluate/track SW risks as part of related component/ system risks	DAG CH3-2.3.1	SW Engineer	SW Engineer		x	x	x	x	
Software Risk Management	Knowledge of Software Risk Management. SW acquisition is a critical high-risk area for most programs	DAG CH3-2.3.1	SW Engineer	SW Engineer		x	x	x	x	
OFP	Create and knowledge to create and implement OFPs		SW Engineer	SW Engineer		x	x	x	x	
Tech Refresh Plan	Create tech refresh schedule for HW and SW normally a every 5 year from SoS perspective		HW/SW Engineer / Configuration Management	HW/SW Engineer / Configuratio n Management	x					Partial
	Knowledge of the baseline/version control of all configurations (HW/ SW/Models) from SoS perspectives		HW/SW Engineer / Configuration Management	HW/SW Engineer / Configuratio n Management	X					Partial
Models from various viewpoints / Version Description Document (VDD)	Develop DoDAF Architecture Framework 2.0 that is essential to SoS	DoDAF Architecture Framework 2.0	Architecture Engineer	Architecture Engineer	X					Partial
	Development of the functional and physical architectures		Architecture Engineer	Architecture Engineer		x	x	x		

	Architecture analysis skills		Architecture Engineer	Architecture Engineer		x	x	x		
	Skill to Analyzing and synthesizing the physical architecture and appropriate allocation		Architecture Engineer	Architecture Engineer		x	x	x		
	Knowledge and skill to Identify and defining physical interfaces and system elements		Architecture Engineer	Architecture Engineer		x	x	x		
	Skill to use other architectural viewpoints to represent how the system architecture address stakeholders concerns through various models: cost, process, rule, ontological, projects, capability, data		Architecture Engineer	Architecture Engineer		x	x	x		
	Knowledge of the system of systems and all the stakeholders of how the new system will be used in the world		Architecture Engineer	Architecture Engineer		x	x	x		
	Skill to track Architecture/Model Based configurations		Architecture Engineer	Architecture Engineer		x	x	x		
	Knowledge to maintain this enterprise architecture, the LSI may be required to integrate the architectural data in different architecture tools used by different stakeholders and establish some method for overall architecture configuration management across these multiple databases and stakeholders.		Architecture Engineer	Architecture Engineer		x	x	x		

	Ability to "own" the overall enterprise architecture, since this architecture defines LSI interfaces for trade space management across the SoS (an inherently governmental LSI function).		Architecture Engineer	Architecture Engineer		x	x	x		
	Knowledge to integrate cost models, schedule models, system architectures, Stakeholder "Architectures," and other critical programmatic and technical baseline information across the programs and stakeholders in the LSI's effort		Architecture Engineer	Architecture Engineer		x	x	x		
Programmatic Environment, Safety, and Occupational Health Evaluation (PESHE)	Develop Programmatic Environment, Safety, and Occupational Health Evaluation (PESHE)	AcqNotes	Risk Management	APMSE (class Desk)		x	x	x		
Earned Value Management (EVM) Cost Capability Analysis (CCA) Cost Analysis Requirements Description (CARD	Create and track EVM	DAG CH1-4.2.16	Cost Engineer/ Decisions Analysis	Cost Engineer/ Decisions Analysis		x	x	x		
	Understand Research and Development Costs through the Cost Team		Cost Engineer/ Decisions Analysis	Cost Engineer/ Decisions Analysis		x	x	x		
	Develop Cost Capability Analysis (CCA) through comparison of historical and industry		Cost Engineer/ Decisions Analysis	Cost Engineer/ Decisions Analysis		x	x	x		
	Understand Total Ownership Cost	DAG CH2-2.3.2	Cost Engineer/ Decisions Analysis	Cost Engineer/ Decisions Analysis		x	x	x		
	Develop Should Cost program	DAG CH2-2.3.2	Cost Engineer/ Decisions Analysis	Cost Engineer/ Decisions Analysis		x	x	x		
	Estimate the Cost, Level of Effort and schedule	CARD DAG CH2-3.1 / CH4-3.1.5.3.1	Cost Engineer/ Decisions Analysis	Cost Engineer/ Decisions Analysis		x	x	x		

	Knowledge of and ability to Identify and defining critical attributes of the physical system elements, including design budgets (e.g., weight, reliability) and open system principles		Test & Engineering	Test & Engineering	x					Partial
	Knowledge of the system of systems and all the stakeholders of how the new system will be used in the world		Requirements Management	Systems Engineer	x					Partial
Live-Fire T&E	Develop Live-Fire T&E Waiver request (if appropriate)	DAG CH8-3.2.5.5	Assistant Program Manager (Test & Evaluation) ,Chief Developmental Tester	Assistant Program Manager (Test & Evaluation) ,Chief Developmental Tester						no
	Develop Live-Fire T&E plan	CH8-4.3.3 / 3.2.5	Assistant Program Manager (Test & Evaluation) ,Chief Developmental Tester	Assistant Program Manager (Test & Evaluation) ,Chief Developmental Tester						no
Test and Evaluation Master Plan (TEMP)	Develop Test and Evaluation Master Plan (TEMP)	DAG CH8-4.2.4 / 4.3	Assistant Program Manager (Test & Evaluation) ,Chief Developmental Tester	Assistant Program Manager (Test & Evaluation) ,Chief Developmental Tester						no
Technology Readiness Assessment	Develop Technology Readiness Assessment	DAG CH8-3.8.1	System Engineer	System Engineer		x	x	x	x	
Initial Operational Test and Evaluation (IOT&E)	Prepare IOT&E	DAG CH82.2.2.2	Warfighter/ Assistant Program Manager (Test & Evaluation) Chief Developmental Tester	Warfighter/ Assistant Program Manager (Test & Evaluation) Chief Developmental Tester		x		x	x	no
	Conduct IOT&E	DAG CH82.2.2.2	Warfighter	Warfighter		x	x	x	x	
	Write IOT&E Report	DAG CH82.2.2.2	Warfighter	Warfighter		x	x	x	x	
	Evaluate IOT&E Report findings	DAG CH82.2.2.2	Assistant Program Manager (Test & Evaluation) ,Chief Developmental Tester	Assistant Program Manager (Test & Evaluation) ,Chief				x		no

				Developmental Tester						
Development Testing (DT)	Conduct Development Testing (DT)	DAG CH8-2.2.1	Assistant Program Manager (Test & Evaluation) ,Chief Developmental Tester	Assistant Program Manager (Test & Evaluation) ,Chief Developmental Tester						no
	Create and knowledge of the project support plan in (PMT/CDRL/CSPT) tool and business rules 5 years	CDRL CH1-4.2.16.1.4 EVM Chapter	Program Management (PM)	Program Management (PM)		x	x	x	x	
	Skill to Identify Resources/IPT Development	DAG CH4-3.1.3.5	Program Management (PM)	Program Management (PM)		x	x	x	x	
	Capability reviews by benchmarks	DAG Ch1	Program Management (PM)	Program Management (PM)		x	x	x	x	
Integrated Product and Process Development (IPPD) Integrated Product Teams (IPTs) for acquisition planning activities.	Ability to procure the right supply, resources, and services to support the Mission	DAG CH1-3.3.5	Program Management (PM)	Program Management (PM)		x	x	x	x	
	Create and Planning of POM, CSPT and PMT	DAG CH1-3.2.2.3	Program Management (PM)	Program Management (PM)		x	x	x	x	
	Development of the preliminary Acquisition strategy	DAG CH1-4.1	Program Management (PM)	Program Management (PM)		x	x	x	x	
	Coordinate with the RO for requirements docs and funding	CH 4–3.1.5.3.	Program Management (PM)	Program Management (PM)		x	x	x	x	
	Knowledge of the Joint Capabilities Integration and Development System (JCIDS) Process	DAG CH1-3.2	Program Management (PM)	Program Management (PM)		x	x	x	x	
	Ability and skill to create the required requirements letter and route	DAG Ch1	Program Management (PM)	Program Management (PM)		x	x	x	x	
	Knowledge of the system of systems and all the stakeholders of how the new system will be used in the world	DAG CH1	Program Management (PM)	Program Management (PM)		x	x	x	x	

	Knowledge of and the skill to align the AoA/acquisition strategy and requirements	DAG CH1-4.1	Program Management (PM)	Program Management (PM)		x	x	x	x	
	Knowledge of the funding process for Fiscal Year, Future Years Defense Program and Planning, Programming, Budgeting and Execution	CH 4–3.1.5.3.	Program Management (PM)	Program Management (PM)		x	x	x	x	
	Knowledge to Create a sundown plan and knowledge of the DEMIL process	CH 4–3.1.5.3.	Program Management (PM)	Program Management (PM)		x	x	x	x	
	Ability to Annual team meeting with all stakeholders for the project service life		Program Management (PM)	Program Management (PM)	x					Partial
	Create and knowledge to create and implement OFPs plan 5 years	CH 4–3.1.5.3.	Program Management (PM)	Program Management (PM)		x	x	x	x	
	Ability to communicate with the stakeholders and research sustainment technologies require development		Program Management (PM)	Program Management (PM)	x					Partial
	Ability to adjust for dynamic SoS loading to accommodate for these changes and constantly monitor and communicate within the team to ensure the SoS capability is still maintained		Program Management (PM)	Program Management (PM)	x					Partial
	Skill to use the Taxonomy management controls the use of descriptive words and phrases to ensure that the integrated community understands what is being described across an interface		Program Management (PM)	Program Management (PM)	x					Partial
	Ability to assist in integration-planning of all SoS activities		Program Management (PM)	Program Management (PM)	x					Partial
	Ability to communicate with the stakeholders and research sustainment technologies require development		Program Management (PM)	Program Management (PM)	x					Partial

	Knowledge of the system of systems and all the stakeholders of how the new system will be used in the world		Program Management (PM)	Program Management (PM)	x					Partial
	Ability to Annual team meeting with all stakeholders for the project service life		Program Management (PM)	Program Management (PM)	x					Partial
	Ability to Annual team meeting with all stakeholders for the project service life		Program Management (PM)	Program Management (PM)	x					Partial
	Knowledge of assess operational data to determine the adequacy of Reliability and Maintainability for maintenance planning, features and procedures; provisioning plans, test equipment design; and maintenance training	DAG Ch4	Program Management (PM)	Program Management (PM)		x	x	x	x	
	Knowledge of the system, their components and how to obtain them	DAG CH4	Program Management (PM)	Program Management (PM)		x	x	x	x	
	Ability to Annual team meeting with all stakeholders for the project service life		Program Management (PM)	Program Management (PM)	x					Partial
	Knowledge of a tool to Monitor the availability rates and respond to negative trends and data anomalies	DAG CH4	Program Management (PM)	Program Management (PM)		x	x	x	x	
	Skill to assists in baseline/version control of all configuration items	DAG CH3-4.1.6	Configuration/ Change Management (CM)	Configuratio n/Change Management (CM)		x	x	x	x	
	Knowledge of the Evaluate ECPs from a System of System perspective		Configuration/ Change Management (CM)	Configuratio n/Change Management (CM)	X					Partial
CMPro, ECP, OFP	Skill to Capture Conduct monthly ECP meeting for implementation of ECP for product and SoS		Configuration/ Change Management (CM)	Configuratio n/Change Management (CM)	X					Partial
	Knowledge of the baseline/version control of all configurations (HW/ SW/Models)		Configuration/ Change Management (CM)	Configuratio n/Change Management (CM)	x					Partial
	Skill to Capture & Manage ECP/OFP from a SoS view		Configuration/ Change Management (CM)	Configuratio n/Change Management (CM)	X					Partial

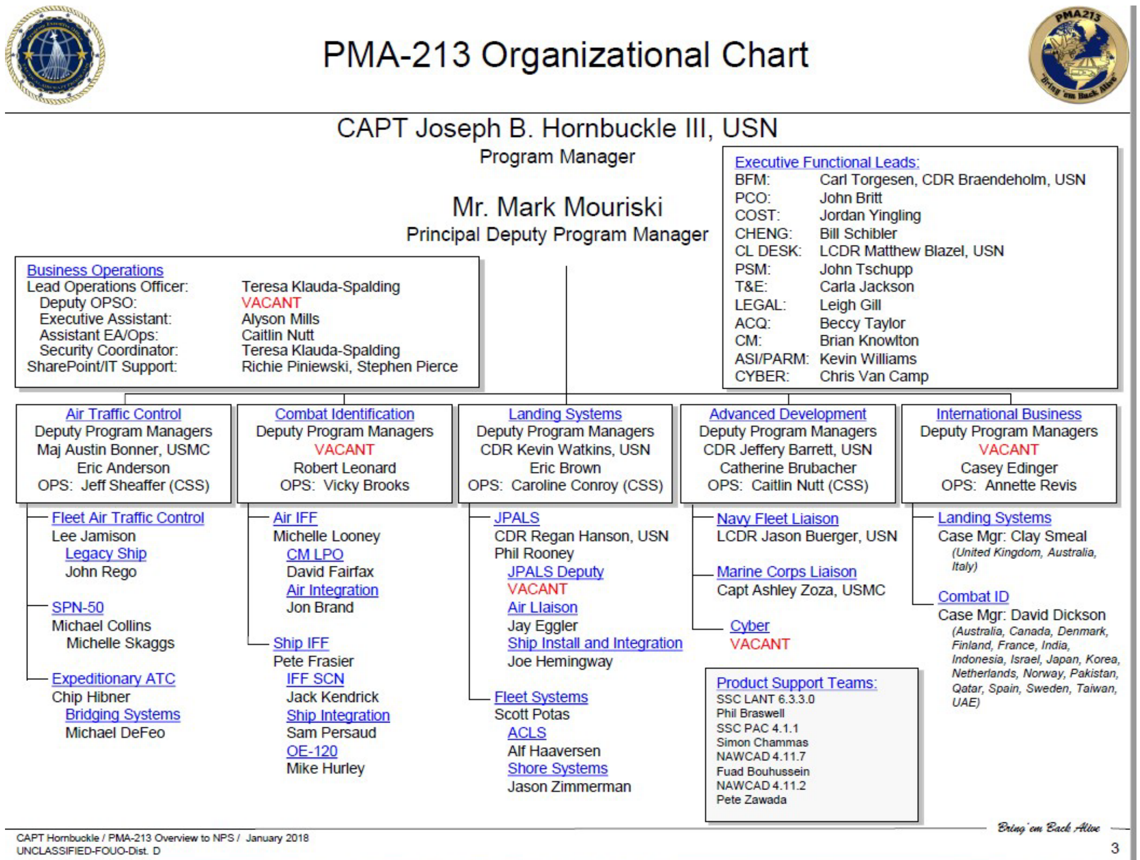
	Skill to create product and SoS configuration management plan		Configuration/ Change Management (CM)	Configuration/Change Management (CM)	X					Partial
	Knowledge and skill of CMPro tool for configuration management of HW, SW and Models	CMPro tool NAMP 2.4.3.O	Configuration/ Change Management (CM)	Configuration/Change Management (CM)		x	x	x	x	
LCSP	Develop the Life-Cycle Sustainment Plan (LCSP)	DAG CH4-2.1/Table 1	Logistics	Logistics		x	x	x	x	
	Develop Initial Support and Maintenance Concepts (Life-Cycle Sustainment Plan))	DAG CH4	Logistics	Logistics		x	x	x	x	
	List all Decision Situations for the Life Cycle of the Program	DAG CH4	Logistics	Logistics		x	x	x	x	
	Skill to Identify Resources	DAG CH4	Logistics	Logistics		x	x	x	x	
POM	Create and Planning of POM, BAM, CSPT and PMT	DAG CH1-3.2.2.3 / CH4-3.1.5.3.2	Logistics	Logistics		x	x	x	x	
	Create and knowledge of POM that it is a 5 years process	DAG CH4-3.1.5.3.2	Logistics	Logistics		x	x	x	x	
	Coordinate with the RO for requirements docs and funding	DAG CH4-3.1.5.3.2	Logistics	Logistics		x	x	x	x	
	Ability to develop an analysis process and estimate the life cycle cost drivers	DAG CH4-3.2.1.1.5	Logistics	Logistics		x	x	x	x	
	knowledge to create and establish maintenance plans and metrics	DAG CH4-3.2.1.2	Logistics	Logistics		x	x	x	x	
PMT/CDRL/ PID/SPIDS	Knowledge of the funding process for Fiscal Year, Future Years Defense Program and Planning, Programming, Budgeting and Execution	DAG CH1	Program Manager	Program Manager		x	x	x	x	

	Create tech refresh schedule with proper funding	DAG CH5	Program Manager	Program Manager		x	x	x	x	
	Create and knowledge of the project support plan in PMT/CDRL/CSPT tool and business rules 5 years	Enterprise Tools website	Program Manager	Program Manager		x	x	x	x	
	Ability to create and update all PMT databases	Enterprise PMT Tool	Program Manager	Program Manager		x	x	x	x	
	Ability to track all SPIDS and PIDs through the life cycle	Enterprise SPID/PID Tool	Program Manager	Program Manager		x	x	x	x	
	Ability to close out SPIDs and PIDs	Enterprise SPID/PID Tool	Program Manager	Program Manager		x	x	x	x	
NTSP	Knowledge of how to develop NTSP	DAG CH5-4.2.3.2 OPNAVINST 1500.76D N13M 29 Jul 2021	Logistics	Logistics		x	x	x	x	
	Knowledge to update every 5 years		Logistics	Logistics		x	x	x	x	
	Ability to find the proper artifacts to develop NTSP		Logistics	Logistics		x	x	x	x	
LA Guidebook is a Control	The PM can refer to the LA Guidebook for details on how to plan, schedule, and execute an ILA to support the Milestone B decision	DAG CH4	Logistics	Logistics		x	x	x	x	
ILA	Ability to balance the allocations of resources such that the min amount of resources achieves the greatest risk mitigation	DAG CH4-4.1.2.2	Logistics	Logistics		x	x	x	x	

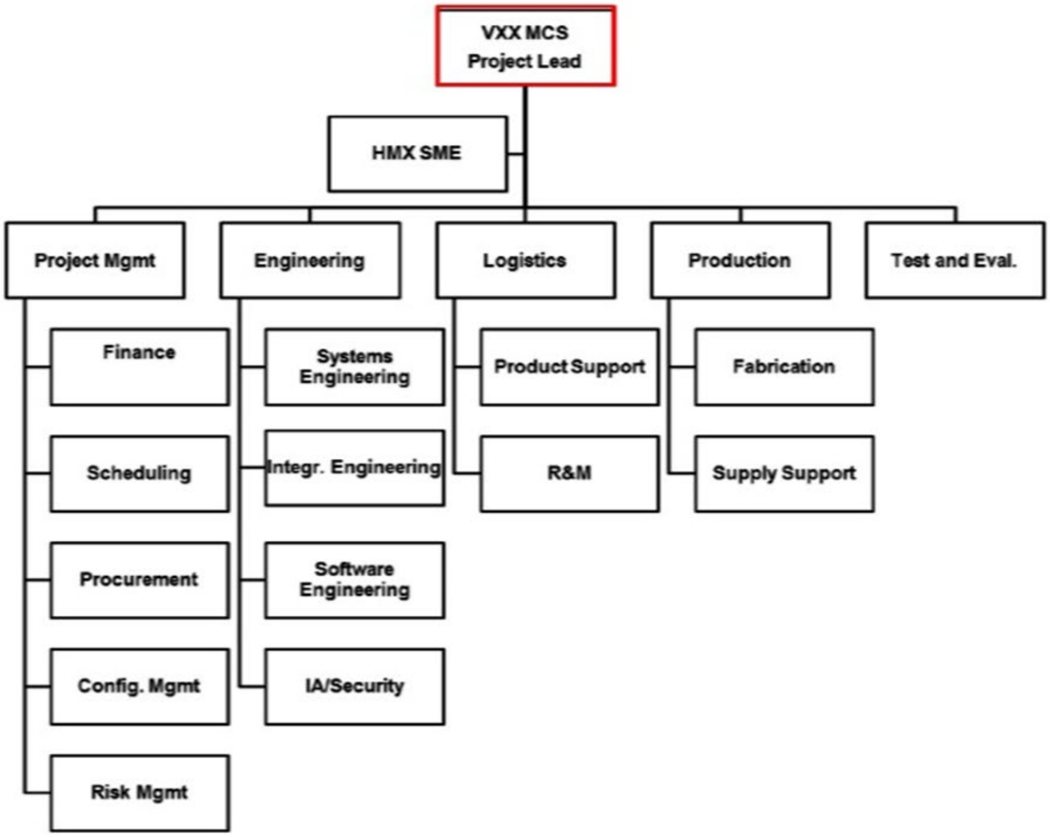
Product Support Package	Knowledge of how to create Product Support Packages which result in Product Support Arrangements (immature in the beginning but matures as the product matures.	DAG CH4-3.5.3	Logistics	Logistics		x	x	x	x	
DMSMS	Ability to create database to track monthly obsolescence	DAG CH 4–3.5.2.	Logistics	Logistics		x	x	x	x	
	Skill to Track database and monthly obsolescence	DAG CH 4–3.5.2.	Logistics	Logistics		x	x	x	x	
	Ability to communicate obsolescence	DAG CH 4–3.5.2.	Logistics	Logistics		x	x	x	x	
Common Tools	Ability to use of common architecture tools across all stakeholders – resourced and maintained across the LSI's SoS life cycle.		Logistics	Logistics	X					Partial
IETMs	Knowledge to Create an IETMs	Department of Defense Handbook for Interoperability of Interactive Electronic Technical Manuals (IETMs)	Logistics	Logistics		x	x	x	x	
	Knowledge to update IETMs on a schedule		Logistics	Logistics		x	x	x	x	
	Knowledge to incorporate ECPs and other updates in to the IETMs		Logistics	Logistics		x	x	x	x	
	Ability to update computer assets that IETMs is on		Logistics	Logistics		x	x	x	x	
DEMIL	Knowledge to Create a sundown plan and knowledge of the DEMIL process	DOD Manual 4160.28 V1 Defense DEMIL	Logistics	Logistics		x	x	x	x	

BAM	Create BAM		Logistics	Logistics		x	x	x	x	
	Knowledge of the BAM process		Logistics	Logistics		x	x	x	x	
Product Support Strategy	Knowledge of framing the baseline product support strategy – core determination (program of record, core program or a tasking program) and predecessor system strengths, weaknesses and priorities	DAG CH 4–3.1.5	Logistics	Logistics	X					Partial
IETMs, NATOPS, T&R	Knowledge of IETMs, NATOPS and T&R documents and tools	Squadron Operations Instruction CNAF M3710.7 Master Training Task List and Platform NATOPS	Warfighter	Warfighter		x	x	x	x	
	Skill to create and update schedule NATOPS and T&R documents		Warfighter	Warfighter		x	x	x	x	
	Ability to report ITEMs updates to PMA	Department of Defense Handbook for Interoperability of Interactive Electronic Technical Manuals (IETMs)	Warfighter	Warfighter		x	x	x	x	
	Knowledge of the OPTEMPO for the system	DAH CH4-3.1.2.1.2	Warfighter	Warfighter		x	x	x	x	
Sustainment	Knowledge of the Safe to Operate process for the system and SoS		Warfighter	Warfighter	x					Partial
	Knowledge of the Safe for Flight process for the system and SoS		Warfighter	Warfighter	x					Partial

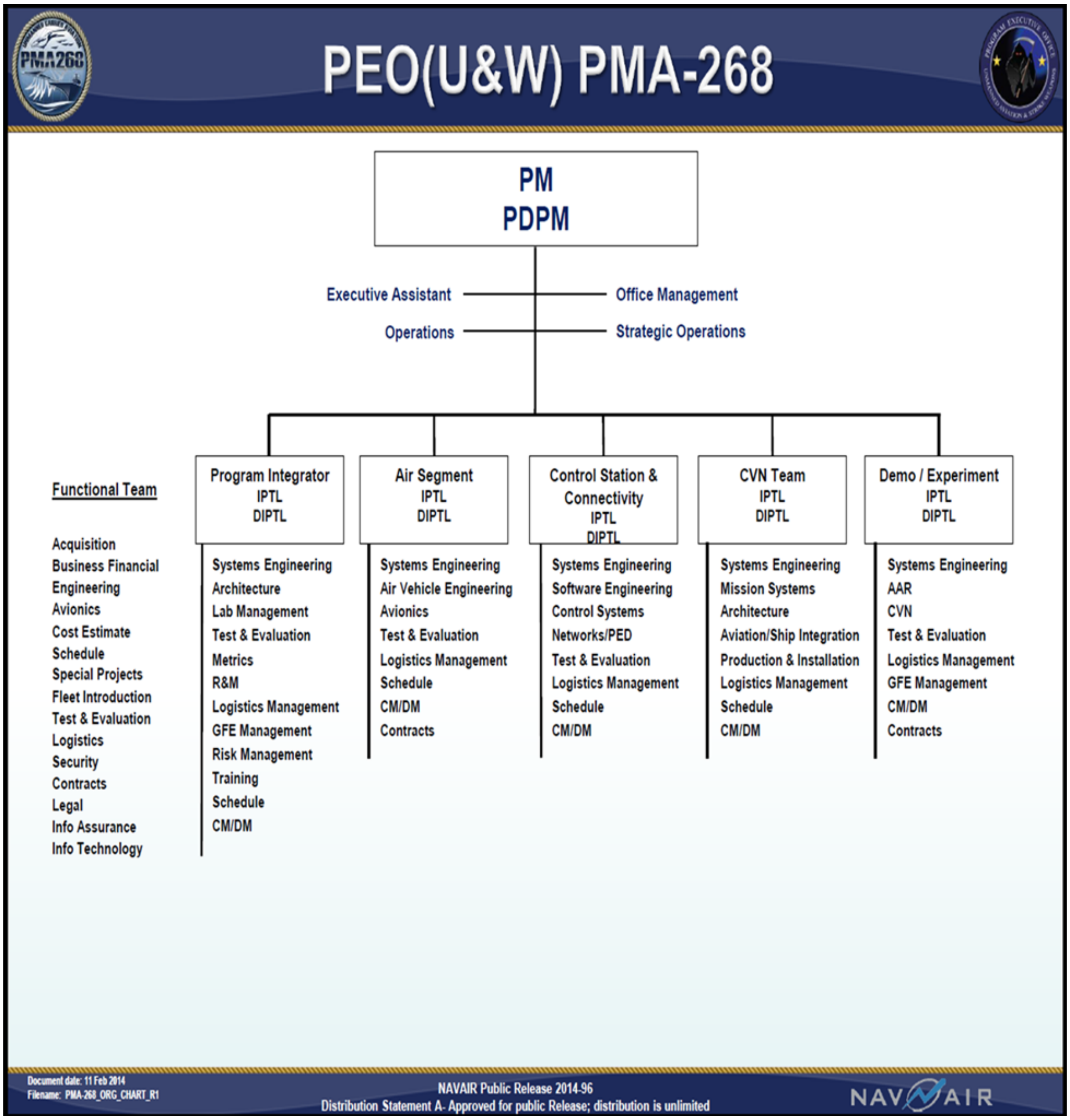
APPENDIX B: PMA ORGANIZATIONAL CHARTS



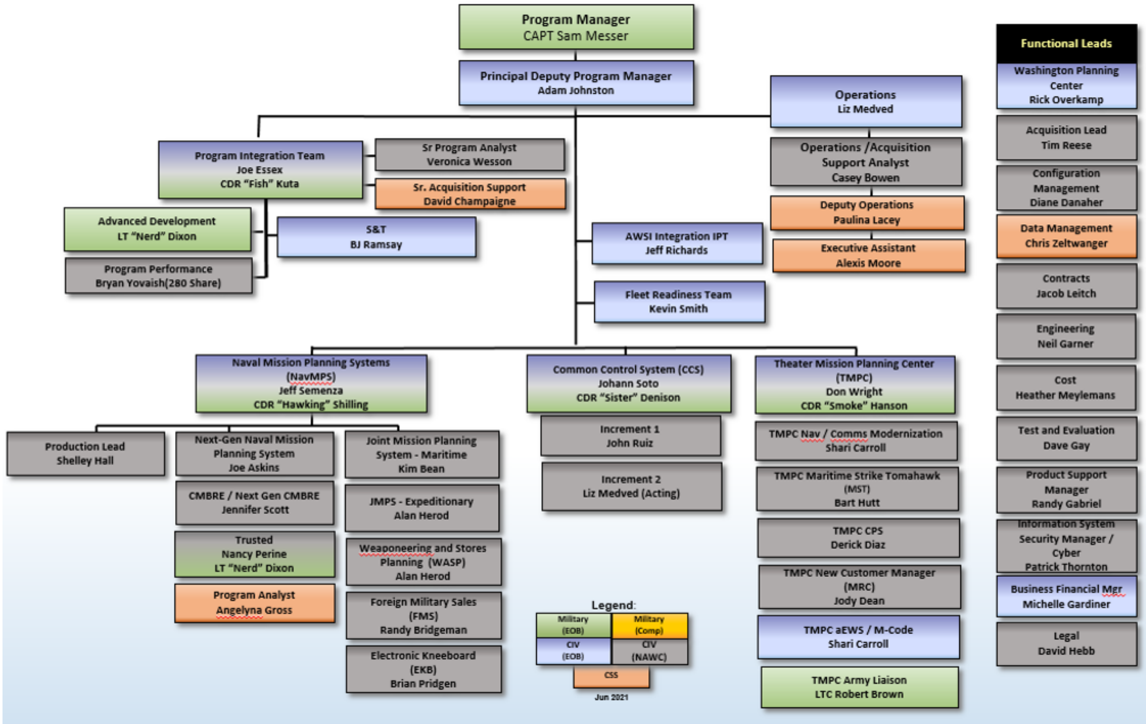
PMA-213, Lead System Integrator Discussion from NPS LSI Class Brief, Jan 2018.



PMA-274 MCS Org Chart from NPS LSI Class Brief Sept 2014.

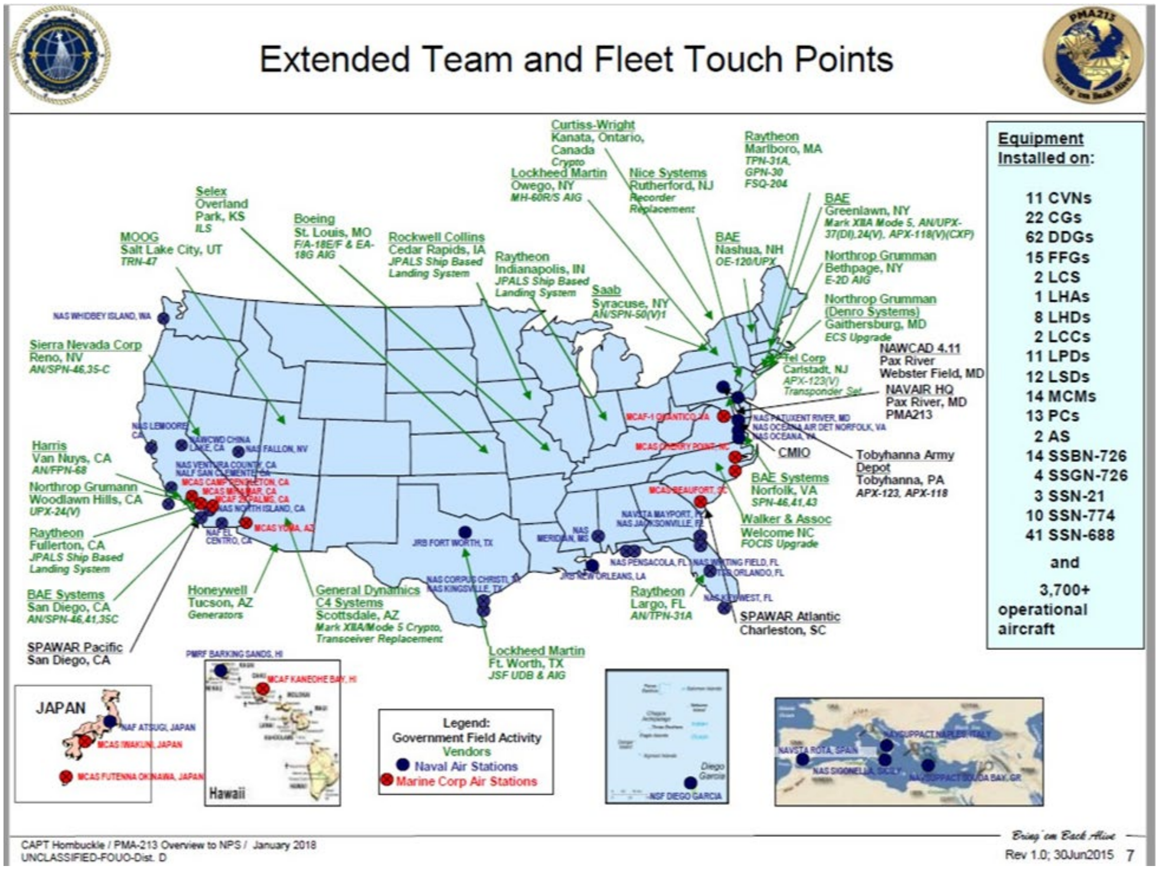


Unmanned Carrier Launched Air Surveillance and Strike (UCLASS) from Program Overview Brief, PMA-268, NPS Class Brief, Jul 2014.

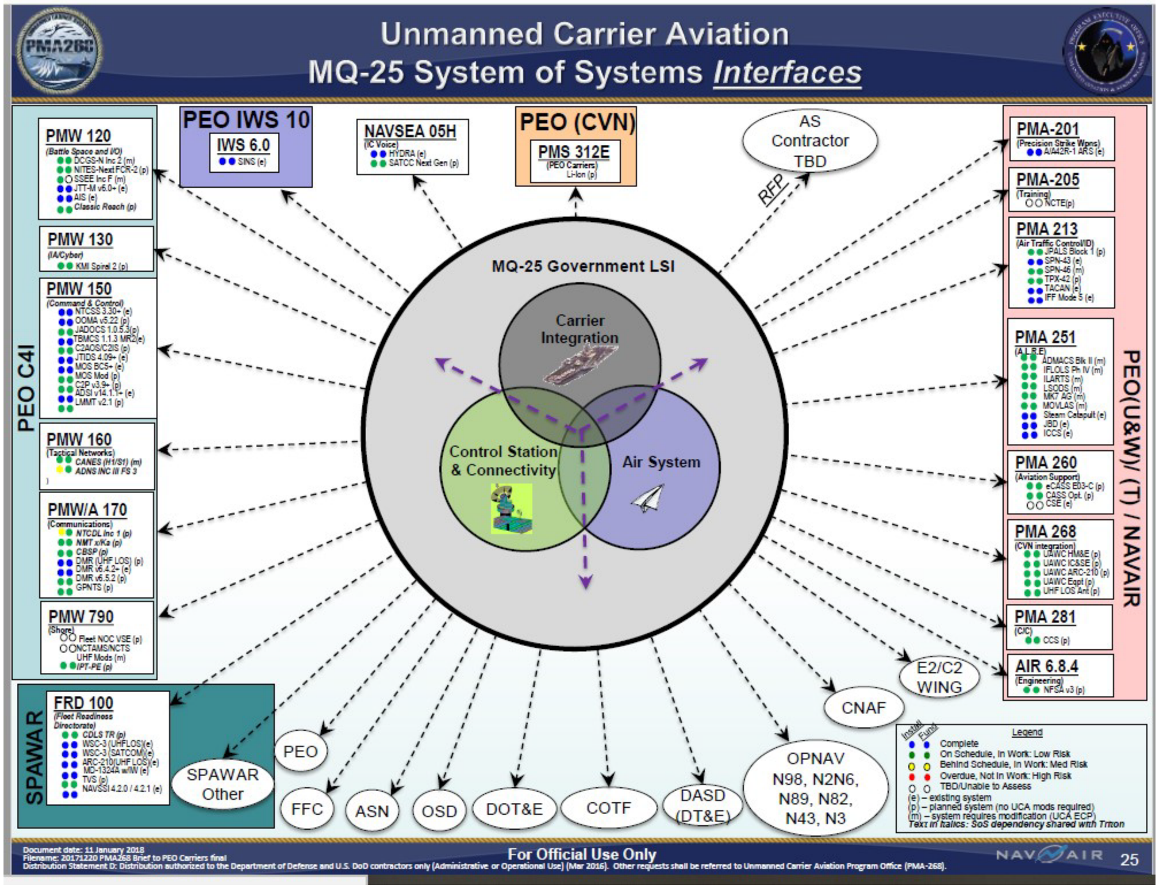


PMA-281 Organization Chart from NPS Class Brief, Jul 2017.

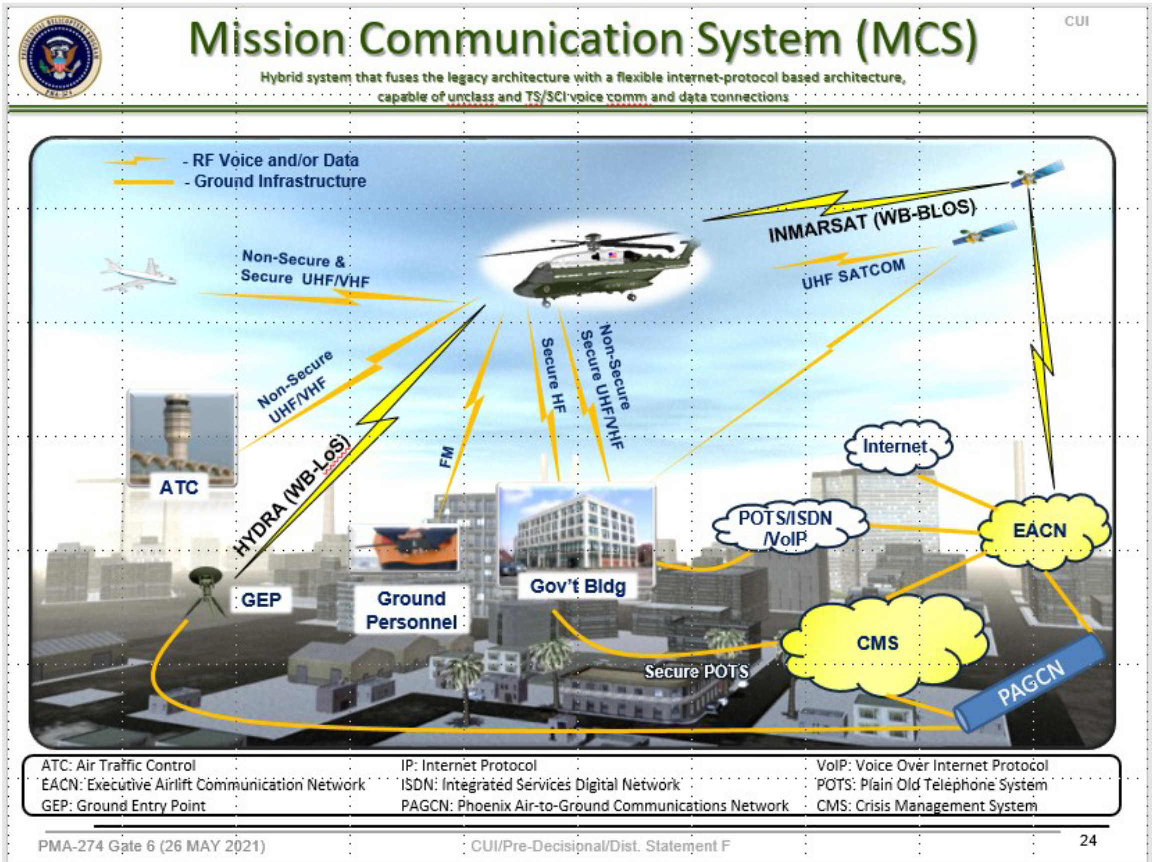
APPENDIX C: INTERFACES



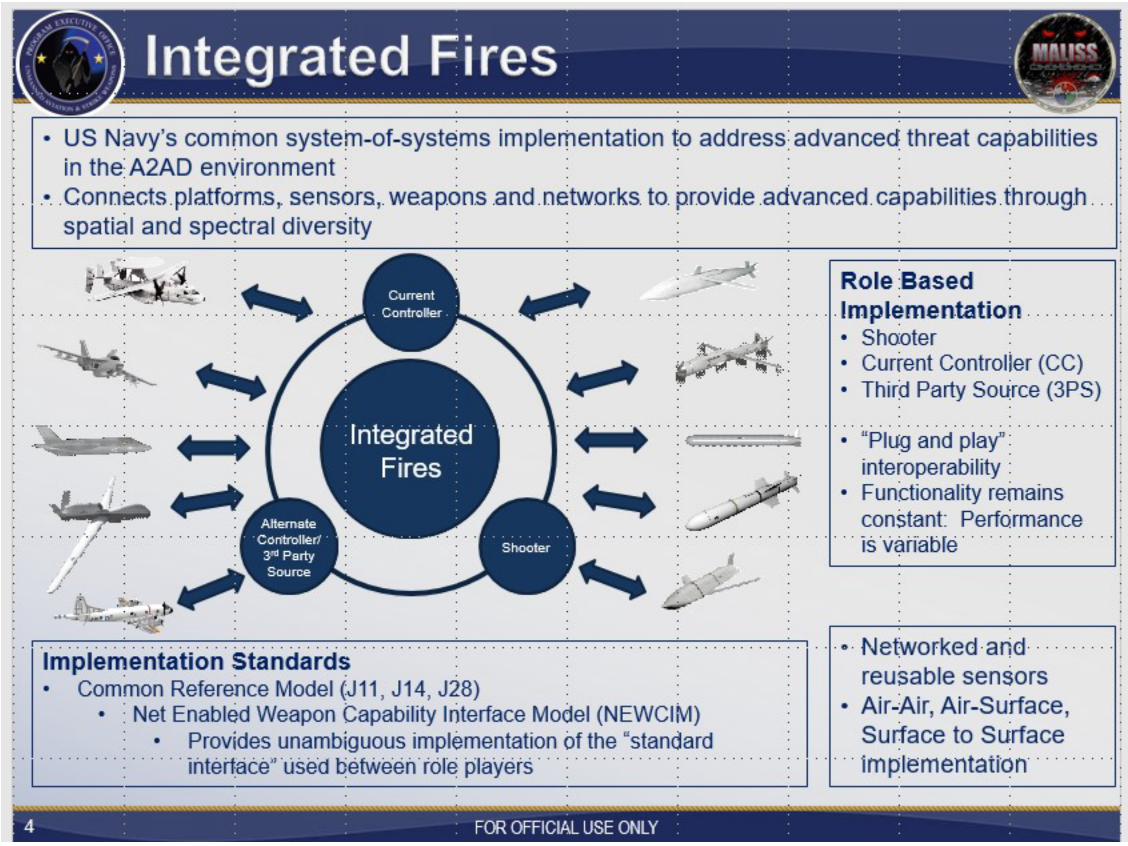
From PMA-213, Lead System Integrator Discussion, NPS LSI Class Brief, Jan 2018.



Unmanned Carrier Launched Air Surveillance and Strike (UCLASS) from Program Overview Brief, PMA-268, NPS LSI Class Brief, Jul 2017.



PMA-274 MCS Org Chart, The Roles of the Government-Led Lead System Integrator (LSI), from NPS LSI Class Brief, Sept 2014.



PMA-281 Mission Area Lead Integrator for SUW/STW (MALISS) from Organization Chart, NPS LSI Class Brief, Jul 2017.

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