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Coordinated Shipboard Allowance List Optimization: Configuration Data Management

December 2024

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ABSTRACT

The Naval Supply System Command's Allowancing Department sponsored the thesis topic of Coordinated Shipboard Allowance List (COSAL) optimization. The problem identified was the Fleet's requisition metrics—specifically, gross, net, and allowance effectiveness metrics—were below stated goals over an eighteen-month period. These metrics measure the ability of the ships' supply storerooms to issue parts from onboard stocks to work centers. To narrow the topic, the researchers—who completed a multi-disciplinary curriculum in Logistics Information Systems (IS)—focused myopically on configuration data management and how COSAL discrepancies originate. The researchers conducted interviews and literature reviews of Naval Sea Systems Command and Naval Supply System Command publications to create process maps documenting the COSAL creation and its management processes. Next, the researchers utilized fishbone diagrams to help organize cause and effect analysis. The researchers examined configuration data management through the lens of Business-IT alignment theory as well as business process management principles. The data and research lead to two primary conclusions: Auditing of configuration data throughout a ship's life-cycle is insufficient, and feedback report procedures are not uniformly enforced or incentivized.

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ABOUT THE AUTHORS

LCDR Ben McLaury is a USN Supply Officer. He graduated from Louisiana State University in May 2009. He will receive a Master of Science in Program Management after taking an 18-month multi-disciplinary curriculum in Logistics Information Systems. His operational assignment include serving as Sales and HAZMAT Officer on board USS George H. W. Bush (CVN 77), Assistant Supply Department Head for Seal Team 10, and Supply Officer for USS Barry (DDG 52). His shore assignments include serving as the Property Manager and Agency Program Coordinator for Naval Special Warfare Group TWO and N41 for Naval Construction Group 2. After graduation, LCDR McLaury will report to Naval Supply Systems Command, Head Quarters to work in a variety of positions, like Planning, Policy, or Supply Chain Management.

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LIST OF ACRONYMS AND ABBREVIATIONS

ACIP	Availability Centered Inventory Model
AD	Allowance Document
AEL	Allowance Equipment List
Ao	Operational Availability
APL	Allowance Parts List
ASI	Automated Shore Interface
BPM	Business Process Management
CCF	Configuration Change Form
CDM	Configuration Data Manager
CDMD-OA	Configuration Data Managers Database–Open Architecture
CM	Configuration Management
CNRMC	Commander, Navy Regional Maintenance Center
CNO	Chief of Naval Operations
COSAL	Coordinated Shipboard Allowance List
DDG	Arleigh Burke Class Destroyer
DWF	Digital Workplace Familiarization
ERP	Enterprise Resource Planning
FCFBR	Fleet COSAL Feedback Report
GAO	Government Accountability Office
GE	Gross Effectiveness
GRGB	Get Real Get Better
ILS	Integrated Logistics Support
IS	Information System
JCS	Joint Chief of Staff
JFMM	Joint Fleet Maintenance Manual
ISEA	In-Service Engineering Agent
MBPS	Model Based Product Support
NAVSEA	Naval Sea Systems Command
NAVSEALOGCEN	Naval Sea Systems Command Logistics Center
NAVSUP	Naval Supply Systems Command

NC	Not Carried
NE	Net Effectiveness
NESD	Navy Enterprise Service Desk
NTCSS	Navy Tactical Command Support System
OEM	Original Equipment Manufacturer
OMMS-NG	Organizational Maintenance Management System–Next Generation
OPNAV	Office of the Chief of Naval Operations
PAFOS	Provisioning, Allowance, and Fitting Out Support
PE	Port Engineer
PEO	Program Executive Office
PTD	Provisioning Technical Data
RBS	Readiness-Based Sparing
RMC	Regional Maintenance Center
SCLSIS	Ship Configuration and Logistic Support Information System
SOEAPL	Summary of Effective Allowance Parts List
SURFLANT	Commander, Naval Surface Forces Atlantic
SURPAC	Commander, Naval Surface Forces Pacific
S/F	Ship's Force
TSA	Technical Support Activity
TYCOM	Type Commander
USN	United States Navy
WSS	Weapon Systems Support

I. INTRODUCTION

In 2016, the U.S. Navy advocated for a 355 battleship force-structure goal, which became established policy in the 2018 National Defense Authorization Act (Congressional Research Service [CRS], 2024). According to a 2023 Government Accountability Office (GAO) report, the goal was ambitious given the limitations of the economy and the nation's shipbuilding industry. The Navy's shipyards were behind schedule on the construction of new assets as well as the maintenance and modernization of active ships (Government Accountability Office [GAO], 2023). A critical finding of the GAO report was the Navy's inability to project and deliver materiel requirements during sustainment phases (GAO, 2023). As of May 2024, as part of the Navy's fiscal year (FY) 2025 30-year shipbuilding plan, the Navy has modified its requirements to include 381-manned ships plus 134 autonomous surface and undersea vessels (CRS, 2024). This thesis applies business process management (BPM) principles to configuration management (CM) practices to help the Navy achieve its desired fleet size and operational availability.

According to the Office of the Chief of Naval Operations' (OPNAV) 2022 *Navigation Plan*, readiness is the top priority for the U.S. Navy. Led by the Chief of Naval Operations (CNO), OPNAV described readiness as ships, equipment, and Sailors prepared to fight and win. The OPNAV further deconstructed readiness with different platforms' operational availability metrics, maintenance timelines, part reliability, and manpower (Office of the Chief of Naval Operations [OPNAV], 2022a). This thesis supports the OPNAV's top priority by researching configuration data discrepancies that negatively impact repair timelines.

CM is a discipline that helps ensure the establishment and maintenance of technical integrity of equipment (Quigley & Robertson, 2019). As the world continues to march into the ever-evolving complex systems-of-systems environment, CM is the discipline that will enable the fleet to order the correct part and ensure that part's availability.

Readiness for the supply department onboard ships is measured by two key metrics: gross effectiveness (GE) and net effectiveness (NE). These metrics report the effectiveness of a ship's supply department storeroom to issue repair parts from stock when demanded by a maintenance work center. The difference between the two is that GE considers all demand; meanwhile, NE only computes demand for repair parts designated as onboard spares (Commander, Naval Sea Systems Command [NAVSEA], n.d.-d). Between November 2022 and April, both metrics were below their stated goals of 65% and 85%, respectively (NAVSEA, n.d.-d). Improving these metrics will directly translate into reduced maintenance repair timelines and increased operational availability (Ao) for the fleet.

Storeroom inventories are designed to support 90 days of underway requirements—with *underway* meaning the period when a ship has departed from its port and is at sea-- without any need for replenishment of supplies (NAVSEA, n.d.-d). There is a myriad of reasons for a storeroom not to have every possible repair part onboard, such as fiscal constraints, storeroom size constraints, warehousing costs, perishability, and waste reduction, among other factors; however, there is a more preventable cause—Coordinated Shipboard Allowance List (COSAL) discrepancies—which is one of two focuses of this report. The researchers in this report use the term *COSAL discrepancy* to encompass differences between the CM data in the ship's maintenance information system and the physically installed equipment. This discrepancy leads to the correct spare part not being available in the onboard inventory, the incorrect spare part being stocked, and ultimately inability for the proper maintenance to be conducted. Below is a scenario where a COSAL discrepancy negatively impacts readiness:

> DDG 52's Auxiliary Division orders a gasket for the ship's industrial washing machine, which was recently replaced. Unfortunately, the maintenance information system has the older model with outdated data (a COSAL discrepancy). This COSAL discrepancy will have two negative impacts- the Auxiliary Division orders the incorrect gasket and the Supply Support work center will not have the correct gasket in stock. As a result, they are unable to complete corrective maintenance, which degrades washing machine operation and habitability capabilities on the ship.

This is a simple example with minimal downstream impacts, but it is easy to imagine much more expensive and consequential impacts when this type of COSAL discrepancy occurs with weapon systems or critical power generation machinery.

While COSAL discrepancies can arise in many ways that are discussed later in this research, Chapters IV and V focus on the creation of COSAL and the management of fleet COSAL feedback reports (FCFBR) submitted by ship's force (S/F) personnel. The FCFBR process is manpower intensive and can require extensive research during adjudication, according to Naval Sea System Command (NAVSEA) testimony, which manages FCFBRs (NAVSEA, n.d.-d).

A. PURPOSE

This thesis examines the processes and controls of configuration data management, which impacts afloat storeroom inventories. The researchers initially built a high-level holistic process map for configuration data throughout its life-cycle stages via cause–effect analysis. Configuration data management is the responsibility of the Navy's Technical Support Activity, which is NAVSEA (n.d.-d). However, in practice, FBR responsibilities are split between two Echelon II commands—NAVSEA and NAVSUP—across multiple life-cycle stages. The researchers conducted brainstorming sessions via Microsoft Teams with representatives from multiple entities to develop a well-rounded view of current processes. Ultimately, the thesis attempts to differentiate COSAL discrepancies that arise from initial allowancing and outfitting procedures to those that occur more downstream during the maintenance and operations phases of a ship's life-cycle. This thesis also applies Lean techniques to highlight causal relationships between the negative outcomes and contributing factors.

B. RESEARCH QUESTIONS AND SCOPE

The following primary research question is addressed within this thesis:

- What are the key driving factors for COSAL discrepancies?

The following secondary research questions are addressed within this thesis:

- What are the auditing procedures to detect and resolve discrepancies?
- How can we improve processes and controls to resolve or prevent COSAL discrepancies?

This thesis is limited in scope to the surface fleet. Our primary focus is on destroyers, where both student researchers served as supply officer department heads.

C. NOTES

Due to the Controlled Unclassified Information inherent in technical publications and the internally generated reports utilized by the researchers, the researchers created a Supplemental section. The thesis clearly identifies which sections were relocated from the body into the supplemental.

This report discussed many data and logistics information systems, which have changed names since some publications were last updated. For instance, the configuration database of record was Configuration Data Managers Database-Open Architecture (CDMD-OA) but is now Model Based Product Support (MBPS). In order to avoid confusion, when discussing technical guidance from publications, the writers will replace CDMD-OA with MBPS and Navy 311 with NESD.

1. Lexicon

In Supply officer lexicon, COSAL is a term used interchangeably with inventory; however, for this report, the term COSAL is more encompassing and used to denote the ship's configuration data and its allowances. The *Provisioning, Allowance, and Fitting Out Support* (*PAFOS) Manual* describes the COSAL as both a maintenance document and the compilation of allowance parts and equipment delineated in Allowance Parts Lists (APL) and Allowance Equippage Lists (AEL) (NAVSEA, n.d.-d). Additionally, the term allowance is used to encompass more than just Supply storeroom managed items; a ship's allowance entails all the spare equipment required to operate the ship, like Maintenance Assistance Modules (MAM), Operating Space Items (OSI), Special Equipment, Test Equipment, General Use Consumable List materiel, and the spare parts managed by the supply department (NAVSEA, n.d.-d). Conversely, the term On-Board Repair Parts (OBRP) is used more narrowly and references repair parts managed by the supply department (Commander, Naval Supply Systems Command [NAVSUP], 2014).

D. ORGANIZATION

This paper contains eight chapters. Chapter I is an introduction to this thesis outlining the scope, purpose, and research questions. Chapter II provides an overview of the COSAL, detailing key steps involved from the inception through the management of a COSAL. Chapter III discusses the methodology of cause–effect analysis and process mapping, which are Lean and BPM techniques applied during the research, and a literature review of applicable governing instructions. Chapters IV and V explain and diagram processes for COSAL generation and COSAL management, respectively. Chapter VI presents a basic data analysis of COSAL effectiveness and management metrics. Chapter VII analyzes the results of the research and provides insight to help resolve COSAL discrepancies and improve the aforementioned GE and NE metrics. Chapter VIII is a synopsis of the research and provides recommendations for follow-on areas to investigate.

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II. BACKGROUND

This chapter offers a comprehensive overview of the U.S. Navy's mission and explains the principles and practices of configuration data management. Additionally, it identifies and elaborates on the key roles and responsibilities of personnel involved in the management of the COSAL.

A. NAVY MISSION

The Navy is one of six military branches in the United States (United States Navy [USN], n.d.). According to the Navy's homepage, the Navy projects its presence through the forward deployment of military assets and navigation of the seas. Working alongside allies and partners, the Navy's mission is to uphold the international maritime order, preserve economic prosperity, and ensure the sea lines of communication remain open and accessible (USN, n.d.). Lines of communication are routes in which information, materiel, and/or people can travel between two locations or nodes within a network (USN, n.d.). It is critical that the Navy be prepared to execute its role as directed by Congress and the President (USN, n.d.). The Navy ensures that naval forces are deployed with the appropriate mix of platforms or vessels (aircraft carriers, submarines, and surface ships; USN, n.d.). The capabilities (including air, surface, and undersea warfare) and capacity (the number of ships and personnel) to support its designated mission, support U.S. allies, and operate in foreign waters (USN, n.d.).

Sustainment is crucial for supporting forward deployed operations (Joint Chiefs of Staff [JCS], 2022). This critical function provides logistics and services to maintain operations throughout execution of the Navy's mission execution (JCS, 2022). By coordinating the supply of essentials such as food, fuel, energy, arms, munitions, and maintenance materiel, sustainment enables the Navy along with the 5 other military branches to act freely, endure longer operations, and extend their range of influence (JCS, 2022). This support system allows the Navy to effectively seize, retain, and exploit key opportunities while deployed (JCS, 2022).

B. GET REAL, GET BETTER

The OPNAV initiative "Get Real, Get Better" is being pursued to address performance inconsistencies within the Navy despite its status as a dominant global force (Get Real, Get Better [GRGB], n.d.). According to the initiative's reference page, the primary areas of concern include shipyard delays, force development shortcomings, operational and safety incidents, and personnel management issues (n.d.). These challenges are becoming increasingly significant as global competition increases (GRGB, n.d.). Maintaining the status quo of known inefficiencies in Navy operations is not sustainable (GRGB, n.d.). The initiative builds upon the Navy's core values of honor, courage, and commitment (GRGB, n.d.). It incorporates the "Get Real, Get Better" attitude, which emphasizes self-assessment, self-correction, and continuous learning (GRGB, n.d.). By internalizing these principles, the Navy aims to transform personnel behaviors to include acting transparently in their profession, focusing on critical issues or root cause issues, and manifesting a team dynamic that embraces continuous improvement (GRGB, n.d.). It empowers individuals, from the end users to upper-level leadership, by encouraging ownership of their area of operation, innovation of practices, and facilitating the removal of obstacles (GRGB, n.d.). Tying this initiative back to COSAL oversight, the "Get Real, Get Better" initiative and behaviors are crucial. Effective COSAL management requires meticulous oversight to ensure all necessary parts and equipment are available and in optimal condition (NAVSEA, n.d.-d). In the opinion of the researchers, by manifesting the GRGB principles, the Navy can enhance the efficiency and reliability of its logistics and inventory systems and the reduction of COSAL discrepancies, thereby supporting overall mission readiness and operational success.

C. KEY ROLE PLAYERS

According to the *PAFOS Manual*, COSAL management is primarily the responsibility of NAVSEA, but two different entities play major roles (NAVSEA, n.d.-d). Both are Echelon II commands operating directly for the CNO; they are NAVSEA and NAVSUP (NAVSEA, n.d.-d).

1. NAVSEA

According to its government webpage, NAVSEA is the largest of the Navy's six systems commands, comprising of command staff, headquarters directorates, affiliated program executive offices (PEOs), and numerous field activities; it is headquartered in Washington, DC, (n.d.). NAVSEA's responsibilities include engineering, building, procuring, and maintaining ships, submarines, and combat systems that meet the fleet's current and future operational needs (NAVSEA, n.d.-b). NAVSEA's origins date back to 1794 when Commodore John Barry was tasked with overseeing the construction of a 44-gun frigate and ensuring that all operations aligned with the nation's interests (NAVSEA, n.d.-b). This historical foundation has evolved into the modern NAVSEA organization, which includes 42 activities (NAVSEA, n.d.-b). NAVSEA is the technical support activity and the provider command for the Navy enterprise, tasked with directing resource sponsors to ensure the fleet is properly equipped with the necessary balance of manpower and resources (NAVSEA, n.d.-b). Additionally, NAVSEA establishes and enforces technical authority in combat system design and operation (NAVSEA, n.d.-b). The organization's technical standards and expertise are used to ensure systems are built well and support operational readiness (NAVSEA, n.d.-b). NAVSEA is dedicated to maintaining the Navy's maritime superiority by efficiently providing defense resources, directing resources, and enforcing technical authority in system design and operation (NAVSEA, n.d.-b).

2. Program Executive Offices

NAVSEA's PEOs play a crucial role in the initial conceptualization of support, which occurs at the early point of the acquisition cycle (NAVSEA, n.d.-d). PEOs are organizationally aligned to the Assistant Secretary of the Navy for Research, Acquisition and Development but report and operate as part of NAVSEA (NAVSEA, n.d.-d). Among the seven PEOs, PEO Ships manage the acquisition and entire life-cycle of all nonnuclear ships in the Navy (NAVSEA, n.d.-c). This involves overseeing the entire life span of these vessels, from initial research and development through acquisition, systems integration, construction, and ongoing support (NAVSEA, n.d.-c).

3. Regional Maintenance Centers

Building on NAVSEA's overall responsibility for the readiness and maintenance of naval assets, the Commander, Navy Regional Maintenance Center (CNRMC), headquartered in Norfolk, VA, operates under NAVSEA and oversees four RMCs and two detachment sites. Its primary responsibility is to ensure the Navy's surface ships are maintained and modernized to remain fully combat-ready, both in terms of materiel condition and operational capability (NAVSEA, n.d.-a). CNRMC coordinates both depot-level and intermediate-level maintenance across the fleet, ensuring that resources are allocated effectively to meet the stringent demands of ship maintenance schedules (NAVSEA, n.d.-a).

RMCs play a crucial role in maintaining the Navy's operational readiness by managing essential tasks like CNO maintenance availabilities, ongoing maintenance efforts, modernization projects, and addressing urgent repair needs during voyages (NAVSEA, n.d.-a). They also conduct comprehensive ship readiness assessments and provide support through maintenance assist teams (NAVSEA, n.d.-a). These activities are critical in extending the lifespan of Navy vessels and ensuring they are always prepared to fulfill their mission requirements (NAVSEA, n.d.-a). A significant part of the RMCs' duties involves overseeing the work of alteration installation teams, which are responsible for implementing ship upgrades and modifications. RMCs ensure that only approved alterations are carried out and that modernization efforts adhere to established procedures (NAVSEA, n.d.-d). They synchronize these installations with the ship's broader maintenance schedule to minimize downtime and enhance efficiency. RMCs also confirm that all approved modifications are executed, ensuring that the fleet has the necessary tools and systems to maintain operational independence (NAVSEA, n.d.-d). By managing and coordinating a wide range of maintenance, repair, and modernization efforts across different locations, CNRMC and its RMCs are vital to maintaining the Navy's surface fleet in peak operational condition. Their efforts are essential for ensuring long-term combat readiness and the overall effectiveness of the Navy's ships (NAVSEA, n.d.-a).

4. In-Service Engineering Agents and Technical Support Activities

In-Service Engineering Agents (ISEAs) play a vital role in keeping the Navy's equipment running smoothly, ensuring systems are maintained, upgraded, and adapted to meet changing needs. They handle everything from technical modifications and design changes to managing the entire life-cycle of naval systems, which is crucial for keeping the Navy ready and operational (NAVSEA, n.d.-d). As representatives of the Program Manager, ISEAs are responsible for bringing new systems and equipment on board and sharing configuration data with the Configuration Data Manager (CDM) and Naval Supervising Authority during new ship constructions (NAVSEA, 2019). Examples of ISEAs include key organizations like the Naval Surface Warfare Center and the Naval Undersea Warfare Center (NAVSEA, n.d.-d).

Technical Support Activities (TSAs) are specialized engineering units assigned by a NAVSEA Assistant Program Manager to manage the technical and engineering tasks involved in supplying Navy ships with the right systems and equipment. Their main job is to review PTDs to ensure the technical details and requirements are correct (NAVSEA, n.d.-d). This includes assigning the necessary codes and deciding whether to approve or reject the documentation (NAVSEA, 2019). Once everything is cleared, TSAs forward the approved PTD to NAVSUP, which takes the next steps to support the equipment for NAVSEA (NAVSEA, n.d.-d).

TSAs also play an essential role in updating the APL, which tracks the equipment and parts a ship needs to function properly (NAVSEA, 2019). They send these updates to the CDM, who then updates the ship's configuration records in the Model Based Product Support (MBPS) system to keep everything accurate and up to date (NAVSEA, 2019).

In the broader provisioning process, TSAs are responsible for creating key lists like APLs and AELs, which outline the parts and equipment a ship needs (NAVSEA, 2019). If an APL isn't ready by the time a system is installed, TSAs provide temporary provisioning data to ensure the ship still has what it needs (NAVSEA, 2019) They also review system plans, technical drawings, and manuals to determine if an AEL is required and communicate these needs to NAVSUP (NAVSEA, 2019). When systems are modified or redesigned, TSAs recommend updates to these lists to ensure they remain accurate and complete, including any necessary spare parts (NAVSEA, n.d.-d). Additionally, TSAs take part in configuration quality reviews to make sure the provisioning and documentation processes stay accurate and effective over time (NAVSEA, n.d.-d). In many instances, the organization responsible for ISEA also carries out TSA responsibilities, ensuring cohesive management of both technical support and provisioning function. (NAVSEA, n.d.-d).

5. Configuration Data Manager

The CDM holds exclusive responsibility for the accuracy and upkeep of configuration data for specific ship classes, managing all finalized entries into MBPS (NAVSUP, 2022). These responsibilities include conducting necessary research on submitted information and updating the database (NAVSUP, 2022). The CDM works for NAVSEA; the CDM is an interface coordinator, who takes input from contractors, program managers, ISEA, ship force personnel and others to ensure MBPS processes entries, edits, and deletions appropriately (NAVSUP, 2022).

6. Naval Supply Systems Command

According to its government webpage, NAVSUP Weapon System Support (WSS) serves as a critical component in Naval logistics (NAVSUP, n.d.). Previously known as the Naval Inventory Control Point, the command provides supply support to the Navy, joint, and allied forces (NAVSUP, n.d.). This support is accomplished through a coordinated command structure operating out of Mechanicsburg, Pennsylvania; Norfolk, Virginia; and Philadelphia, Pennsylvania (NAVSUP, n.d.). NAVSUP WSS's history dates back to 1917, when the Naval Aircraft Factory was established (NAVSUP, n.d.). A significant change in the factory's operation occurred in 1995 when the Aviation Supply Office, founded in 1941, merged with the Ships Parts Control Center, established in 1945 (NAVSUP, n.d.). Donning the name Naval Inventory Control Point, this merger centralized the Navy's inventory handling functions and simplified processes (NAVSUP, n.d.). In 2011, the organization was rebranded as NAVSUP WSS as part of the "One NAVSUP" enterprise-wide branding initiative (NAVSUP, n.d.). This emphasized the integrated nature of NAVSUP activities within the Global Logistics Support Network without altering the organization's structure (NAVSUP, n.d.). Currently, NAVSUP supports the operational availability of naval assets through the management of an inventory worth $34 billion and processing of over five hundred thousand requisitions from the Navy, joint, and allied forces (NAVSUP, n.d.).

In an age of rapid advancement in technology, NAVSUP WSS stands at the forefront of supply chain innovations (NAVSUP, n.d.). They have employed advanced information systems such as the LOGCELL 2.0 IT system, which is an integrator of multiple data sources, and the Wholesale Inventory Optimization Model (WIOM) to facilitate improved decision-making and optimize inventory management (NAVSUP, n.d.). NAVSUP is critical in maintaining the Navy's operational readiness by ensuring efficient and effective procurement processes (NAVSUP, n.d.).

7. Type Commanders

Within the Navy, commands are organized into categories by their field of specialization, whether that be at sea, air, or special warfare. Each category is governed by type commanders (TYCOMs) to facilitate administrative functions (Commander, Naval Surface Forces Atlantic [SURFLANT], n.d.). For this research, the focus will be on the TYCOMs: Commander, Naval Surface Forces Atlantic, known as SURFLANT, and Commander, Naval Surface Forces Pacific, known as SURFPAC. The mission of both commands is to crew, train, and equip their assigned surface forces and shore activities, ensuring readiness for prompt and sustained operations in support of U.S. national interests (SURFLANT, n.d.). TYCOMs provide command, operational, and administrative control allowances and policy guidance (SURFLANT, n.d.). They also act as fleet logistics agents for ordnance and supply matters for all operational forces (SURFLANT, n.d.). This research focuses on surface fleet destroyers, planning and analysis, equipment management, materiel, and personnel.

8. Guided Missile Destroyers

According to Navy Fact Files, the Arleigh Burke–class destroyers (DDGs) are advanced ships that utilize the Aegis Weapon System, which includes the SPY-1D radar, various anti-air, and anti-submarine systems, vertical launch systems, the Tomahawk

Weapon System, and Ballistic Missile Defense capabilities (USN, n.d). This technology makes them highly powerful in both offensive and defensive combat roles (United States Navy [USN], n.d.-a). The Arleigh Burke class ships have three versions, known as "flights" (USN, n.d.-a). Flight I includes DDG 51–71; Flight II covers DDG 72–78; and Flight IIA includes DDG 79–124, with Flight III starting at DDG 125 and above (USN, n.d.-a). Currently, there are 71 active DDGs (USN, n.d.-a). The Navy is updating DDG destroyers with mid-life upgrades to maintain their mission effectiveness (USN, n.d.). These updates are also being added to new ships to improve their capabilities and ensure they match the upgraded older ships (USN, n.d.). The main goals are to enhance the ships' manageability, combat power, and cost-efficiency (United States Navy, n.d.-a).

9. Ship's Force

Ships Force (S/F) personnel are those personnel assigned to DDGs to operate and maintain the multitude of weapon and mechanical systems installed (Commander, U.S. Fleet Forces Command [COMFLTFORCOM], 2023). S/F plays a vital role in COSAL oversight; one of their primary duties is conducting periodic (daily, monthly, quarterly, and annual) maintenance of the installed equipment on the ship (COMFLTFORCOM, 2023). This involves ensuring that all necessary tools, parts, and equipment listed in the COSAL are available, so they can complete their required maintenance (COMFLTFORCOM, 2023). This maintenance program supports the ship's operational readiness (COMFLTFORCOM, 2023). During maintenance, materiel is identified to be repaired or replaced through the inventory maintained onboard the DDG (COMFLTFORCOM, 2023). Furthermore, S/F is responsible for sight verifying installed equipment by conducting equipment validations (COMFLTFORCOM, 2023). In addition to maintenance and validations, S/F ensures that adequate allowance materiel is available onboard to support the equipment currently installed. (COMFLTFORCOM, 2023). However, S/F can face challenges in performing maintenance due to the unavailability of necessary parts, which can critically impact the DDG's capabilities (COMFLTFORCOM, 2023).

Table 1. Key Role Players Summary Table

Organization	Superior Command	Role in COSAL
NAVSEA (Naval Sea Systems Command)	Under CNO	Manages fleet-wide ship configuration, overall life cycle maintenance, and technical requirements. Coordinates with PEOs on systems design and modernization.
PEOs (Program Executive Offices)	Under NAVSEA	Procures new ships and/or modifications to shipboard systems. Collaborates with NAVSEA, OEMs, and Ship's Force for accurate initial configuration and life-cycle support.
RMC (Regional Maintenance Centers)	Under NAVSEA	Provides maintenance, repair, and configuration change support. Works with Ship's Force and OEMs to ensure updated provisioning and new equipment installation.
NAVSUP (Naval Supply Systems Command)	Under CNO	Coordinates with NAVSEA, OEMs, and Ship's Force to ensure proper allowances and spare parts are available. Manages logistics, supply chain, and provisioning updates.
CDM (Configuration Data Manager)	Under NAVSEA	Is the gatekeeper for MBPS who ensures data is accurate and updated in a timely manner.
TYCOM (Type Commander)	Under CNO	Oversees the overall readiness and sustainability of DDGs. Works with Ship's Force, NAVSEA, and NAVSUP for necessary updates to COSAL.
Ship's Force (S/F)	Under TYCOM	The end-user onboard DDGs. Conduct maintenance on shipboard equipment. Works with TYCOM to ensure accurate configuration and management of repair part allowances.
Integrated Logistics Support Teams	RMC	ILS encompasses maintenance teams like Port Engineer and Combat Systems Engineer who facilitate depot level maintenance and who are responsible for computing CM changes in MBPS.

Adapted from NAVSEA (n.d.-b), NAVSEA (n.d.-c), NAVSUP (n.d.), SURFLANT (n.d.) and COMFLTFORCOM (2023).

D. COSAL

The Office of the Chief of Naval Operations Instruction (OPNAVINST) 4441.12E defines COSAL as "a consolidated listing of the equipment, components, repair parts, consumables and operating space items required for an individual ship to perform its operational mission" (OPNAV, 2022b, p. 3). A ship's COSAL is unique to that specific ship, not just hull type, and it is dynamic: It is a database that is the culmination of all the allowance parts lists (APL) and allowance equipment lists (AEL) assigned to a ship (OPNAV, 2022b). APLs (Part II, Section A of the COSAL) and AELs (Part II, Section C of the COSAL) are both created using data from the Navy Enterprise Resource Program (OPNAV, 2022b). APLs provide the technical specifications of a piece of equipment and its supply details, including part numbers and national stock numbers (OPNAV, 2022b). They also identify all maintenance-critical repair parts associated with the equipment (OPNAV, 2022b). AELs describe various systems, such as damage control or firefighting equipment for surface combatants, supported by various operating space items (OSIs) (OPNAV, 2022b). OSIs are items managed and held by the department heads (OPNAV, 2022b). AELs specify the required allowances for general category materiel like specialized tools and equipment kept by the operating department (NAVSUP, 2014). A section of the COSAL is the Summary of Effective Allowance Parts List (SOEAPL), which is the summary of allowances for a ship (OPNAV, 2022b). Allowance determination is discussed later in this report in more detail. Managing the COSAL for DDGs is essential to maintaining their operational readiness by ensuring they are equipped with the correct allowances. NAVSEA reviews and approves all allowances and support plans before implementation (NAVSEA, 2019). Three main drivers for updating a ship's allowance database include reprovisioning efforts, fleet requests, and configuration changes (NAVSEA, n.d.-d). This will be discussed in further detail in subsequent chapters. These updates are crucial for aligning shipboard allowances with operational needs and provisioning standards (NAVSEA, n.d.-d).

E. PERSONAL EXPERIENCE

One of the researchers, LCDR Ben McLaury, was the Supply Officer aboard *USS Barry* (DDG 52) from November 2018 through May 2021. COSAL discrepancies were an issue during his tenure. After a two-year maintenance overhaul ended in 2019, the local Afloat Training Group came aboard and measured the supply inventory. To everyone's shock, the ship's repair parts inventory was 25% smaller than a "sister" ship across the pier, referencing DDG 56's inventory. The corrective actions LCDR McLaury took to correct the discrepancy was to request a targeted allowance reconciliation tool.

After ten long months with little transparency on the actions of TYCOM and NAVSUP, approximately 4,230 line items were added to the ship's inventory during one automated ship interface evolution. That did not solve all COSAL discrepancies for the ship though; frequently, throughout his tenure, work centers would order parts not authorized in the COSAL. Through a NAVSEA liaison, LCDR McLaury would verify that the part ordered, and its associated APL were valid requisitions; however, many requisitions were erroneous. Most notably, some were erroneous due to inaccurate configuration data in the ship's maintenance information system thus causing a COSAL discrepancy. His experience aboard *USS Barry* impacted the learning objectives of this thesis, and it is why the researchers focused specifically on CM under the broader NAVSUP Allowancing sponsored topic of COSAL optimization.

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III. METHODOLOGY AND LITERATURE REVIEW

In the 2022 *Navigation Plan,* the OPNAV stated that readiness is the number one priority for the Navy (OPNAV, 2022a). In accordance with this guidance, the overarching principle of this research was to optimize shipboard inventories through CM improvements. BPM was the primary methodology employed to analyze CM practices. According to the textbook titled *Fundamentals of Business Process Management*, BPM is a discipline that ensures large, diverse organizations can deliver consistent and optimal results, despite the depth and complexity of the organization's processes (Dumas et al., 2018). BPM has several techniques and tools that help users discover, identify, analyze, design, and control activities to maximize outcomes and continuously improve (Dumas et al., 2018). BPM is a comprehensive discipline that encompasses many traits of similar philosophies like Total Quality Management, Lean Six Sigma, and Operations Management; BPM distinguishes itself from those similar disciplines by more heavily emphasizing information technology and software as the key resources to align business processes with the organization's objectives and goals (Dumas et al., 2018).

A. STEPS

The researchers of this thesis took the following steps:

a. Conducted a thorough literature review of relevant technical publications.
b. Interviewed stakeholders from NAVSUP, NAVSEA, SURFPAC, SURFLANT, and S/F.
c. Built process flowcharts explaining COSAL creation, FCFBR and conducted cause–effect analysis.
d. Utilized Lean tools and problem-solving mindsets to analyze the results.

B. LEAN TOOLS EMPLOYED

To address the primary research question of why COSAL discrepancies exist, this thesis opened the aperture and conducted process analysis of the entire CM process. J. R. Bradley's (2015) textbook on Lean management describes a process as a series of steps performed by an organization to complete an essential task. Process mapping is conducted to understand workflows better (Bradley, 2015). Mapping has several steps: process identification, information gathering, teamwide brainstorming, process visualization, and review (Bradley, 2015). For this project, the researchers built a process map as a visual aid after thoroughly researching relevant technical publications and interviewing key stakeholders.

A high-level holistic process flowchart was developed to map the COSAL creation process from start to finish, illustrating the roles and interactions of each stakeholder involved in updating and maintaining a ship's COSAL. This visual representation helped deconstruct the business process entailed and highlight the entities and information systems involved. Similarly, a flowchart was developed for the FCFBR process from inception to closure. By providing a clear picture of the existing system, these flowcharts facilitated a comprehensive understanding of the current processes and pinpointed specific areas for potential improvements that could aid in the enhancement of onboard spare parts availability and overall operational efficiency.

C. ROOT CAUSE ANALYSIS

To address the issue of why maintenance work centers submit requisitions for materiel that are neither stocked onboard nor identified as part of a ship's COSAL, the researchers conducted root cause analysis by employing Lean tools such as brainstorming, the 6 M's, and Ishikawa diagrams. Inside the scope of process analysis, the BPM textbook details how to conduct root cause and cause–effect analysis (Dumas et al., 2018). First, for the potential negative outcome concerning requisitions stated above, all factors were considered and categorized as causal or contributing. If causal factors are eliminated, the negative outcome will be resolved; conversely, if contributing factors are eliminated, the negative outcome will exist but be mediated (Dumas et al., 2018). However, before causal and causative analysis is conducted, all factors are brainstormed together by the team and categorized into the 6 M's (Dumas et al., 2018). The 6 M's are the following: Machine, Method, Materiel, Man, Measurement, and Milieu (Dumas et al., 2018). *Machine* encompasses the information systems utilized and can include elements like performance of the system and unfavorable user interfaces (Dumas et al., 2018). *Method* entails the way a process is manifested (Dumas et al., 2018). The *Materiel* category includes initial data, which for the researchers was initial modeling and repair part computation (Dumas et al., 2018). *Man* factors relate to incorrectly performed tasks (Dumas et al., 2018). *Measurement* factors can also include inaccurate calculations or misapplied methodologies (Dumas et al., 2018). *Milieu* factors originate with the external environment and often cannot be controlled but may be lightly influenced (Dumas et al., 2018).

The factors from root-cause and cause–effect analysis can be visually mapped with a fishbone diagram, which is credited to Kaoru Ishikawa, a pioneer in the quality management field (Dumas et al., 2018). On a fishbone diagram, the center line or trunk originates from the issue (Dumas et al., 2018). The factors contributing to the issue are categorized into the 6 M's, with each M representing a separate branch (Dumas et al., 2018). Subcategories are linked to the branches. Collectively, the diagram strongly resembles a fishbone, as shown in Figure 1 (Dumas et al., 2018).

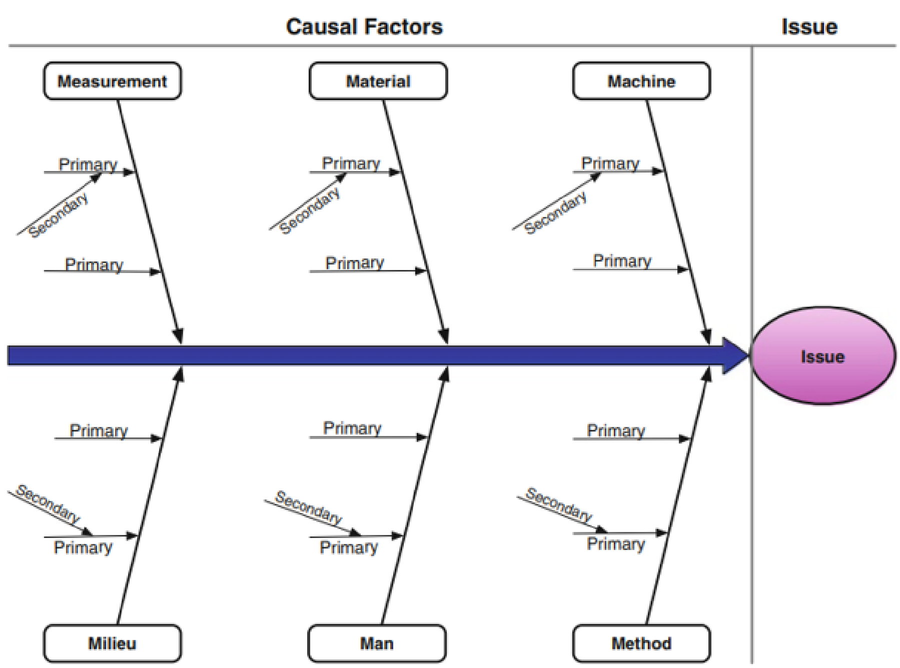

Figure 1. Cause–Effect Diagram. Source: Dumas et al. (2018, p. 240).

D. BPM CYCLE

The BPM cycle is continuous and consists of six different phases: process identification, process discovery, process analysis, process redesign, process implementation, and process monitoring (Dumas et al., 2018). The research conducted in this thesis is limited to the first three stages. An important goal of this research is to build an as-is model, which is manifested by the process flowcharts, and to a slightly lesser extent the fishbone diagrams. Ultimately, the researchers hope to influence stakeholders who can build the to-be model.

Another framework employed by BPM practitioners and the researchers is the Theory of Constraints (TOC) mentality. This theory adapts the continuous improvement mentality by constantly looking for the one bottleneck in the process that limits productivity (Dumas et al., 2018). Once one constraint is removed or mediated, another constraint will manifest (Dumas et al., 2018). Ultimately, with constant identification, analysis, and mediation, productivity or the process will continuously improve (Dumas et al., 2018).

By these methodologies, the research comprehensively addresses the primary and secondary questions, providing a holistic understanding of how to optimize COSAL management, improve onboard spare parts availability, and enhance the readiness of the fleet. The combination of theoretical foundations and methodologies, practical insights, process mapping, and best practices contributes to the development of actionable recommendations for improving CM.

E. LITERATURE REVIEW

For this thesis, technical publications were the primary sources for information utilized for process mapping and cause–effect analysis. The data sources were internal reports generated by NAVSEA and NAVSUP and interviews conducted with key stakeholders. For the methodology, textbooks provided the foundational concepts utilized by the researchers.

1. Publications

The *PAFOS Manual* is an online repository managed by NAVSEA (n.d.-d). A provisioning action team compiled the *PAFOS* from widespread and various acquisition and support publications to serve as a concise guide; it is a working-level handbook, and it is policy (NAVSEA, n.d.-d). In great detail, the *PAFOS* depicts the generation and management of a ship's COSAL (NAVSEA, n.d.-d). The *NAVSEA Provisioning and Allowance Manual 4423.1* supersedes Chapters 4 and 8 of the *PAFOS* (NAVSEA, 2019). It amplifies guidance on provisioning and allowance updates (NAVSEA, 2019).

The *NAVSUP P-488 Coordinated Shipboard List and Allowance Use* explains basic COSAL theory (NAVSUP, 2014). It explains how materiel is identified, and it explains the CM content displayed inside the APLs (NAVSEA, 2014). It illustrates how to use the COSAL, and how the COSAL is maintained and updated (NAVSEA, 2014). Lastly, the *NAVSUP P-488* highlights the general use consumables list (GUCL), which is the allowance for consumables, not repair parts delineated in an APL or AEL (NAVSUP, 2014).

The *Joint Fleet Maintenance Manual* (JFMM), Volume II, serves as a comprehensive guide for the life cycle maintenance of Navy ships, outlining the necessary policies and responsibilities (COMFLTFORCOM, 2023). This volume ensures that all aspects of maintenance determining are conducted with a focus on quality, safety, and optimal operational readiness (COMFLTFORCOM, 2023). It also introduces the Integrated Logistics Overhaul/Integrated Product Support (ILO) concept, designed to enhance onboard logistics support by integrating maintenance and supply needs (COMFLTFORCOM, 2023). The ILO ensures technical documentation and repair parts accurately support the equipment onboard, with a primary goal to improve readiness by providing comprehensive logistics support that reflects the ship's configuration post-maintenance (COMFLTFORCOM, 2023).

Volume VI of the *JFMM* extends the guidance to managing maintenance programs across the Navy, emphasizing the MBPS and Ship Configuration and Logistic Support Information System (SCLSIS) (COMFLTFORCOM, 2023). Collectively, these two information systems facilitate the automated maintenance of the COSAL, which simplifies the process of ordering repair parts (COMFLTFORCOM, 2023). Volume VI specifies the responsibilities of S/F in maintaining accurate configuration logistics support (COMFLTFORCOM, 2023). It requires prompt reporting of any changes in equipment and holds S/F personnel accountable for the accuracy of their configuration records, ensuring that all changes, whether detected or implemented by S/F, are accurately reported (COMFLTFORCOM, 2023).

NAVSUP P-485, *Volumes I* and *II*, are vital resources crafted to assist supply personnel in understanding and performing their duties within operational supply operations (NAVSUP, 2022). These volumes establish the foundational supply management practices required for compliance, permitting deviations only when explicitly marked as optional (NAVSUP, 2022). These publications discuss the FBR enforcement process completed by S/F personnel (NAVSUP, 2022).

Both *NAVSUP P-485* volumes delve into the SCLSIS and Automated Ship Interface (ASI) data flow process, designed for meticulous management and efficient dissemination of information (NAVSUP, 2022). The ASI, a pivotal process within this framework, updates a naval activity's configuration and logistics database (NAVSUP, 2022). This includes modifications to equipment configurations, cancellations or suppression of APL, manual adjustments, updates to allowances, and other logistical changes in the ship's automated files (NAVSUP, 2022).

Responsibility for managing these configurations rests with the supply officer onboard Navy ships, supported by the ship's 3M (maintenance and materiel management) coordinator and leading logistic specialist (NAVSEA, n.d.-d). Together, they ensure the prompt processing of ASI configuration and logistics data (NAVSEA, n.d.-d). Initially, data is input into SCLSIS using 3M up-line reporting procedures, beginning at the ship, advancing to TYCOM, and eventually reaching the Central Data Exchange at Naval Sea Logistics Center (NAVSEALOGCEN; NAVSEA, 2022). Here, the Central Data Exchange consolidates the configuration and logistics data, forwarding it to the appropriate CDM (NAVSUP, 2022). The CDM holds exclusive responsibility for the accuracy and upkeep of configuration data for specific ship classes, managing all entries into the Enterprise Resource Program and SCLSIS databases (NAVSUP, 2022). This task includes conducting necessary research on submitted information and updating the SCLSIS database (NAVSUP, 2022). As the custodian of the SCLSIS database, NAVSUP WSS processes transactions as instructed by the CDM, calculates allowance changes, extracts relevant supply support information, and updates the database (NAVSUP, 2022). Updates, initiated by either the ship or the CDM, generate an output record that is sent back to the ship via the ASI process, closing the loop on this critical data flow cycle (NAVSUP, 2022).

2. Internal Data Reports

This thesis's problem statement is derived from requisition data captured in the Navy's Enterprise Resource Planning program. NAVSUP Allowancing provided this data to the researchers in the aforementioned *Waterfall Chart* report (Wendte, 2024). All requisition data from ships were collated and categorized by U.S. Navy allowance source codes (see Table 2). This thesis focuses on source codes G. Both source codes denote materiel that is Not Carried (NC) as a repair part. The repair part is not a part of the ship's configuration (source code G) (NAVSUP, 2022). The U.S. Navy allowance supply source code identifies the availability of materiel at the time that it is requested (NAVSUP, 2022).

Table 2. U.S. Navy Supply Source Code. Adapted from NAVSUP (2022, p. A9-3).

Code	Description
A	Allowance list materiel issued from storeroom stock
C	Non-allowance materiel issued from storeroom stock, includes non-COSAL, mission essential, or authorized by the TYCOM
D	Allowance list materiel not in stock (NIS) when ordered
F	Stocked non-allowance materiel, which is NIS when ordered
G	NC repair parts not listed in an APL or AEL; there is no allowance for this materiel for this ship
J	NC repair parts delineated in an APL but did not calculate for an allowance

This thesis uses two key metrics to evaluate the effectiveness of a ship's COSAL. The first metric, GE, measures repair parts supplied by onboard inventory (storeroom issues) divided by total demands (NAVSUP, 2022). Its formula utilizing source codes is the following: (A + C) / (A + C + D + F + G + J) (Wendte, 2024). This metric conveys the ship's storeroom ability to satisfy demands, but it does not differentiate demands based on their allowances (NAVSUP, 2022). Conversely, NE excludes demands from materiel that is not carried (NC) (NAVSUP, 2022). Its formula utilizing source codes is the following: (A + C) / (A + C + D + F) (Wendte, 2024). These metrics help managers assess whether the ship's inventory includes the right parts and quantities, highlighting any gaps that need addressing to improve effectiveness (Wendte, 2024).

A second report provided to the researchers is the aforementioned *COSAL FCFBR.* The report generated by Navy Enterprise Service Desk (NESD) captured all COSAL FCFBR generated by the ships and categorized the reports by their status. While many of the FBRs were adjudicated, very few were "resolved" (NAVSEA*,* 2024).

3. Government Reports

The Government Accountability Office (GAO) has generated multiple reports generalizable to this thesis's topic. The researchers did not have to 'cherry pick' reports, as there is a clear consensus that materiel requirements during sustainment phases are poorly forecasted and have downstream impacts to readiness (GAO, 2023). The GAO is an independent and nonpartisan entity that serves Congress (GAO, n.d.). It evaluates the use of taxpayer funds and offers Congress and federal agencies impartial, fact-based information to promote cost savings and enhance governmental efficiency (GAO, n.d.). A 2003 GAO report on the defense inventory revealed that Navy ships often fail to meet the Navy's supply performance objectives for spare parts during typical 6-month deployments. The analysis showed that only about 54% of requisitions could be filled from onboard inventories, falling short of the Navy's 65% goal, with maintenance crews waiting an average of 18.1 days for parts, significantly longer than the Navy's goal of 5.6 days (GAO, 2003). Two fundamental problems contribute to this shortfall: inaccurate ship configuration records and inadequate historical demand data (GAO, 2003). This leads to ships not carrying the correct parts or quantities needed during deployment (GAO, 2023). This issue has significant operational and financial implications, as spare parts shortages delay necessary repairs, adversely affecting a ship's operations and mission readiness (GAO, 2003). Additionally, the Navy incurs extra costs to source parts from off ship and maintain large inventories that are not requisitioned during deployments, with nearly $25 million spent maintaining unused inventories for six ships reviewed for the report (GAO, 2003).

To address these issues, the GAO recommended that the secretary of defense instruct the Navy to develop plans for ship configuration audits, ensure accurate and timely recording of demand data for parts, identify and remove unnecessary spare parts from inventories, and ensure casualty reports are accurately reported with high-priority maintenance work orders to assess the impact of spare parts shortages on operations and readiness (GAO, 2003). Despite these recommendations, the report underscores that the Navy's spare parts supply issues have persisted for over 20 years, indicating a long-standing problem that has yet to see significant improvement (GAO, 2003). The inability to complete maintenance jobs due to spare parts shortages impacts mission readiness, with about 58% of maintenance work orders unfulfilled because the needed repair parts were unavailable (GAO, 2003).

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IV. COSAL CREATION

This chapter contains the process map of COSAL generation. Additionally, this chapter lays out the initial modeling technique utilized by PEOs to forecast on-board repair parts (OBRP), called Readiness-Based Sparing (RBS) (NAVSUP, 2014). Both NAVSEA and NAVSUP utilize several modeling techniques to optimize onboard spares (NAVSUP, 2014); however, the focus of this report is on CM and why spares are not on the shelf at all. The authors lay out a high-level holistic overview of how a COSAL is generated, promulgated to the ship, and how that impacts the ship's storeroom inventory. The authors do not dive too deeply into every sophisticated modeling concept and their parameters.

In an understandable simplification, a COSAL is initiated in a manufacturers' technical documents (NAVSEA, 2019). For instance, the PEO responsible for a weapon system purchases data (technical document information) from the OEM, simulates the parts necessary to achieve the desired Ao; from this, they determine spares and their quantities, and those parts are purchased by the PEO and sent to the ship (NAVSEA, 2019). Storeroom inventories are computed using data collated from all the technical documents relative to a specific ship; that collated data becomes part of the COSAL (NAVSEA, 2019). That is a simplification of the process, and a more layered and in-depth overview is provided in the paragraphs below; however, the authors wanted to paint a picture of the process and highlight the importance of initial sparing determinations.

A. COSAL COMPONENTS

Appendix A of the *PAFOS Manual* provides granular details of the COSAL format (n.d). There are multiple types of COSALs; for instance, there are the Hull, Mechanical, and Electrical (HM&E); Ordnance; Electronic Equipment; Strategic Weapon Systems and other COSALs (NAVSUP, 2014). Each COSAL is tailored to its ship; it is the culmination of APLs and AELs assigned to the ship and confirmed as present by the ship's responsible CDM (NAVSUP, 2014). A COSAL contains an introduction and three parts (NAVSEA, n.d.-d).

1. Introduction

The introduction of a COSAL is comprised of data that establishes materiel support for the ship's installed and portable on-board equipment (NAVSEA, n.d.-d). Additionally, it lists equipment necessary for the ship to conduct its missions (NAVSEA, n.d.-d).

2. Part 1

Part 1 serves as the table of contents and has two primary components- the Summary of Effective Allowance Parts List (SOEAPL) and 5 indices (NAVSEA, n.d.-d). Each index is sorted in a different sequence but contains the same information (NAVSUP, n.d.-d). First, there is the list of APLs and AELs; this list is titled the SOEAPL (NAVSEA, n.d.-d). The SOEAPL is categorized by equipment type and lists all the APLs and AELs assigned to the ship. Index A is arranged alphabetically with noun name; Index B is also arranged alphabetically but by service application; Indices C, D, and E list the APLs or AELs but each sequence is determined differently (NAVSUP, n.d.-d).

3. Parts 2 and 3

While the previous section only lists the APLs and AELs, Part 2 houses the APLs and AELs in their complete forms. Part 3 is composed of six sections that break down the different types of materiel; it is referred to as the Stock Number Sequence List (NAVSUP, n.d.-d). The various types of allowances are as follows: Storeroom Items (SRI), OSI, Maintenance Assist Modules (MAMs), Ready Service Spares, and General Use and Consumables List (GUCL); Part 3 also contains a section for stock number cross referencing and a section for forms and publications (NAVSEA, n.d.-d).

4. Non-APL /AEL Worthy Materiel

The APL does not include every component available for installed shipboard equipment. NAVSEA has established criteria to determine whether an item qualifies as APL-worthy. According to NAVSEA, "An item is considered APL-worthy if it can be operated independently or as part of another system, has its own nameplate, and is determined by the maintenance philosophy to be repairable through the replacement of one or more parts” (NAVSEA, 2019, p. 42). Examples of items that do not qualify as APL-worthy include cooking appliances and electrical hardware such as cable clamps, connection boxes, and connectors (NAVSEA, 2019). However, even if an item is not APL-worthy, it may be included on the APL for the next higher assembly (NAVSEA, 2019). For instance, while a generic monitor is not APL-worthy, the associated radar equipment is APL-worthy (NAVSEA, 2019). Items that do not meet these requirements may still be considered for APL inclusion by exception, with the final determination made by the TSA (NAVSEA, 2019).

Similarly, non-AEL-worthy items are deemed unnecessary for immediate spares or replacement. These items can be acquired or fabricated from materiel already onboard the DDG or are non-military transportable items that can be sourced from local vendors (NAVSEA, 2019). Examples of non-AEL-worthy items include habitability items, such as tables, benches, and cabinets, or safety and security items, such as safes, padlocks, and handrails (NAVSEA, 2019).

B. COSAL DATA

Initially, the COSAL is generated in a linear and sequential approach (NAVSEA, n.d.-d). The first phase in COSAL generation is the initial provisioning cycle (NAVSUP, 2014). The *PAFOS Manual* describes it as the following: “Provisioning is the process of determining which materiel and how much of that materiel is necessary to support and maintain a system or equipment for all levels of maintenance (organizational, intermediate, and depot levels) for an initial period, not to exceed two years” (NAVSEA, n.d.-d, p. 16). Phase 1 in Figure 2 is a flow chart depicting the COSAL creation process. Phase 2 in Figure 2 is a flow chart depicting the flow of the COSAL from its creation to its shipboard utilization.

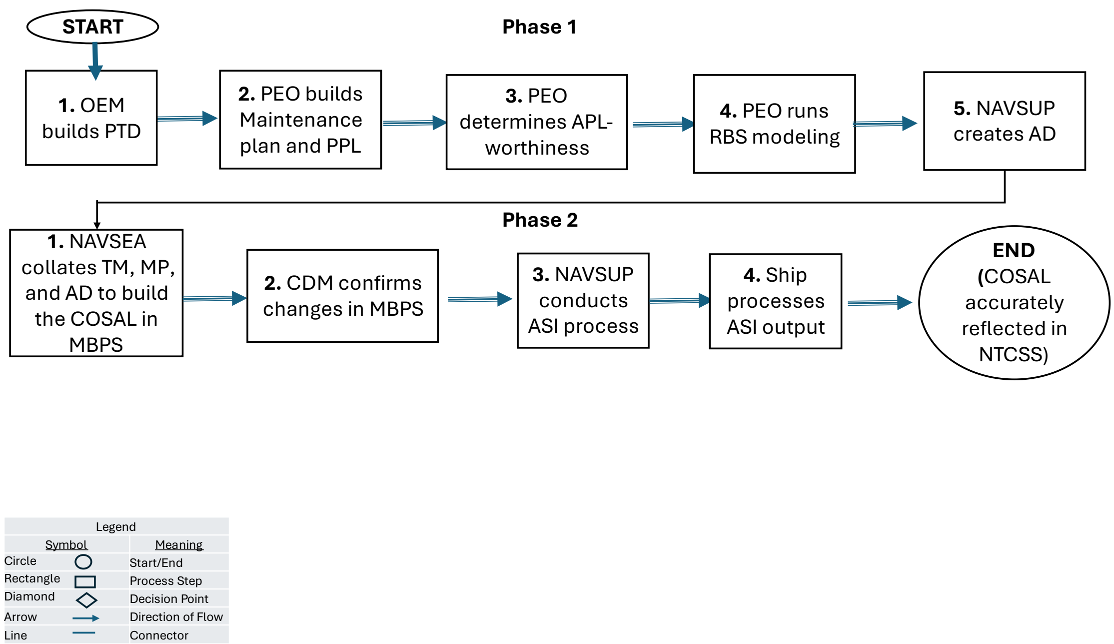

Figure 2. COSAL Creation and Data Flow

1. Phase 1

In the first step of Phase 1, the Original Equipment Manufacturer (OEM) creates and submits the provisioning technical documents (PTD) and drawings for the equipment to the PEO who is managing the system (NAVSEA, 2019). In step 2, the PEO takes the specifications and builds the maintenance plan (MP) and the provisioning parts list (PPL; NAVSEA, 2019). The PPL is used by the technical specialists within the PEO to identify, select, and determine initial spare parts for the equipment (NAVSEA, 2019). According to the *NAVSEA 4423.1*, “The PPL is the basic document used in the provisioning process on which to record the various technical decisions” (NAVSEA, 2019, p. 9). In step 3, the PEO determines the APL-worthiness of the equipment and its subcomponents (NAVSEA, 2019). In step 4., PEO runs RBS modeling and its determinations are saved in the standard allowance file tool, an application within MBPS. In step 5., the NAVSUP Allowancing Department takes the information and creates Allowance Documents (AD; NAVSUP, 2019). For a weapon system, the AD is an APL. AD is a generic term that could encompass APL, AEL, or GUCL; all three examples are ADs (NAVSEA, 2019).

2. Phase 2

In the second phase, NAVSEA combines all the configuration data (AD, TM, MP, drawings, and component identification lists) created by the OEM, NAVSEA, and NAVSUP to build the COSAL in MBPS (NAVSEA, 2019). In step 2., the CDM for the platform confirms the changes in MBPS. In step 3., NAVSUP promulgates the COSAL to the ship via an Afloat Shore Interface (NAVSUP, 2014). In step 4., S/F downloads the ASI. In step 5., the ship's maintenance information system- Navy Tactical Command Support System (NTCSS)- updates its COSAL in its maintenance and Relational-Supply applications, which are used by S/F to write jobs (requests for equipment maintenance) and manage storeroom inventories (NAVSUP, 2022).

3. COSAL Data Summary

The first phase in the Figure 2 diagram depicts COSAL creation and initial provisioning; it is where requirements are determined and documented on an APL, AEL or other AD (NAVSUP, 2014). The second phase depicts the data flow of the COSAL to the ship. There are two primary databases utilized to generate, manage and transfer COSAL data- the central configuration database for NAVSEA, MBPS, and the Navy Enterprise Resource Planning program (NAVSUP, 2014). Both databases will be discussed in greater detail after the researchers highlight the modeling techniques that determine allowances, which is a major component of the data encapsulated in the COSAL.

C. READINESS-BASED MODELING

This paragraph contains Controlled Unclassified Information (CUI) and is located in the supplemental.

1. Sparing Determination with RBS

The first phase of RBS is readiness appraisal; it entails modeling the performance of a system and diagramming the results of an item's failure. (NAVSEA, n.d.-d). The second phase of RBS is sparing determination; it entails data validation from the OEM's technical documents; it focuses on the factors of essentiality, replacement, and maintenance and recoverability (NAVSEA, n.d.-d). It is this point in the process where technical override codes are applied (NAVSEA, n.d.-d). The third phase of RBS is life-cycle maintenance; it entails tracking the readiness of the weapon system as it ages and updating configuration to ensure the desired Ao is continuously met (NAVSEA, n.d.-d).

2. Override Codes

This paragraph contains Controlled Unclassified Information (CUI) and is located in the supplemental.

D. MODEL BASED PRODUCT SUPPORT PROGRAM

Until 2018, NAVSEA's central configuration database was titled Configuration Data Managers Database- Open Architecture (CDMD-OA; NAVSUP, 2018). CDMD-OA was siloed and did not integrate with other engineering and logistical IS; therefore, in-line with OPNAV N41's Digital Transformation Initiative, NAVSEA migrated from CDMD-OA to the MBPS application (NAVSEA, 2018). MBPS operates on Amazon Web Services as a Platform-as-a-Service to support NAVSEA's three primary applications- Navy Product Data Management, Navy Common Readiness Model, and the Navy Data Acquisition Requirements Tool (NAVSEA, 2018). MBPS has taken eight historical IS and combined them into one (NAVSEA, 2018). Those IS consisted of drawings, technical data of weapon systems components, ships' specific configurations, depot maintenance data, readiness and mission modeling, and contract requirements (NAVSEA, 2018).

E. NAVY ENTERPRISE RESOURCE PLANNING

ERP is a software environment that encompasses more than just COSAL data; it is, "…an integrated financial, acquisition, and logistics information technology system that provides financial and budgetary management for all Navy system commands" (Office of the Secretary of Defense [OSD], 2013, p. 217). Like MBPS, the Navy ERP program is a data environment operating on Amazon Web Services that hosts many applications (AWS, 2020). According to the *NAVSUP P-488*, piece parts data, bill of materiel, and other supply support information that constitute COSAL components are only stored in the ERP database (NAVSUP, 2014).

F. SUMMARY OF COSAL AND ALLOWANCES GENERATION

A ship's COSAL is the "complete configuration and logistical profile of a ship" (NAVSUP, 2014, p. 1-3). According to the *NAVSUP P-488*, the COSAL is the culmination of supply and technical documentation from MBPS and ERP (NAVSUP, 2014). NAVSEA's configuration data management IS is now MBPS (NAVSUP, 2018). MBPS is the database that contains the equipment verified by the CDM that is installed on the ship (NAVSUP, 2014). The second database is the Navy Enterprise Resource Planning, which exists in the Navy Data Environment that has the applications and files like the standard allowance file and others that collectively build a ship's COSAL (NAVSUP, 2014). The management of the COSAL will be discussed in further detail in the subsequent chapter. As a reference, Figure 3 and Figure 4 are examples of an APL and AEL taken from the *PAFOS Manual*:

ALLOWANCE PARTS LIST (APL)

EQUIPMENT/COMPONENT NOMENCLATURE/CHARACTERISTICS	TECHNICAL DOCUMENT NUMBER	MANUAL / PLAN	IDENTIFICATION NO.	DATE	PAGE
PUMP CTFGL 900GPM 125PSI 3500RPM MD VLT		MANUAL 347-4249 / PLAN	016110317	03-15-90	1

CHARACTERISTICS

MFR-AURORA PUMP A UNIT OF GENERAL SIGNAL CORP
MFR DWG-2FCS256
MFT ID-5MMX5
PATTERN NO-174
EQUIP SPEC-MILP17639CLASSC2
NSN-7H 4320-01-046-6604
LAPL-01-011
CAPACITY-900GPM
TOTAL DYNAMIC HEAD-125-PSI
SPEED-3500RPM
IMPELLER DIA-9.375
MOUNTING-HORIZONTAL
ROTATION-CW
TYPE DRIVE-MD
NOTE-STAINLESS STEEL REPLACEMENT PUMP END
NSN 7H 4320-00-563-7660 APL 016110682
FSCM-04579

REFERENCE SYMBOL NO.	ITEM NAME	STOCK NUMBER	PART MEC	SOURCE	MAINT	RECOVBLTY	NOTES	QTY IN ONE EQPT/COMP.	U/I	ALL ITEM	1	2	3	4	5-8	9-20	21-50
*SERVICE APPL--FIRE	COUPLING SHFT FLEX FIGHTING-FIRE PUMP INSTALLED	782350006					8	3									
*SERVICE APPL--FIRE	LIGHT ASSY IND FIGHTING-FIRE PUMP INSTALLED	212101421					8	3									
*SERVICE APPL--FIRE	MOTOR AC 440V 100HP FIGHTING-FIRE PUMP INSTALLED	174802512					8	3									
*SERVICE APPL--FIRE	STARTER MOTOR SZ 4 440V FIGHTING-FIRE PUMP INSTALLED	151205726					8	1									
*SERVICE APPL--FIRE	STARTER MOTOR SZ 4 440V FIGHTER-FIRE PUMP INSTALLED	151205727					8	1									
*SERVICE APPL--FIRE	STARTER MOTOR SZ 4 440V FIGHTER-FIRE PUMP INSTALLED	151205728					8	1									
*SERVICE APPL--FIRE	SWITCH ASSY 2 ELEMENT FIGHTER-FIRE PUMP INSTALLED	212102352					8	3									

SHIP TYPE & HULL NO.	PAGE		IDENTIFICATION NO.	DATE	PAGE
SM 101	H 219	ALLOWANCE PARTS LIST (APL)	016110317	03-15-90	1

EQUIPMENT/COMPONENT NOMENCLATURE/CHARACTERISTICS	TECHNICAL DOCUMENT NUMBER	MANUAL / PLAN	IDENTIFICATION NO.	DATE	PAGE
PUMP CTFGL 900GPM 125PSI 3500RPM MD VLT		MANUAL 347-4249 / PLAN	016110317	03-15-90	2

CHARACTERISTICS

REFERENCE SYMBOL NO.	ITEM NAME	STOCK NUMBER	PART MEC	SOURCE / MAINT / RECOVBLTY	NOTES	QTY IN ONE EQPT/COMP.	U/I	ALL ITEM	1	2	3	4	5-8	9-20	21-50
G-234	04576 PACKING, RINGS	1H 0000-LL-CW-1-6876	1	MOOZZ		12	EA		SEE SNSL FOR ALLOW						
	USE 9Z5330-00-450-3894														
MIL-A-17472-1	81349 ASBESTOS SHEET	9Z 5330-00-585-9502	1	PAOZZ		1	SH	P							
MIL-P-24377-	81349 PACKING MATERIAL	9Z 5330-00-450-3894	1	PAOZZ		1	LB	P							
1-2SQX2 3-4LG	04579 KEY-MACH STL 1-2X2	9Z 5315-00-224-4605	1	PAOZZ		1	EA								
11FCS294-6	04579 CUP-GREASE	9C 4730-00-190-5568	3	PAOZZ		2	EA								
11F0633227SS	04579 IMPELLER-PUMP CTFGL	1H 4320-00-660-8533	1	PAOZZ		1	AY								
17HCS256 PUMP	04579 BEARING-SLV	9Z 3120-00-725-0074	1	PAOZZ		2	EA								
2-10-112BG	04579 PUMP,CENTRIFUGAL	7H 4320-01-046-6604	1	PAOOD		1	EA	Z							
2-10-44BG	04579 RING-LTRN SPT	9C 4320-00-713-1424	1	PAOZZ		2	EA								
2-2A132SS	04579 GLAND ASSY	1H 0000-66-CE5-9422	1	XBOZZ		2	AY								
2-8-57MK	04579 CASING, PUMP	7H 4320-01-078-2094	1	PAODD		1	AY	Z							
207WD	04579 SHAFT, SHOULDERED	9C 4320-00-802-2064	1	PAOZZ		1	EA								
6-10-46	04579 BEARING, BALL ANN	9Z 3110-00-554-5962	1	PAOZZ		1	EA								
676-1085-263	04579 FLANGE ASSY	1H 0000-LL-CG2-6025	3	XBOZZ		1	EA								
676-1086-111	04579 RING, WEARING	9C 4320-01-061-7547	1	PAOZG		2	EA								
7207W	04579 RING, WEARING	9C 4320-01-042-2730	1	PAOZG		2	EA								
	END														

SHIP TYPE & HULL NO.	PAGE		IDENTIFICATION NO.	DATE	PAGE
SM 101	H 220	ALLOWANCE PARTS LIST (APL)	016110317	03-15-90	2

Figure 3. Allowance Part List Example Source: NAVSEA. (n.d.-d, Appendix B, p. 6-B-8).

ALLOWANCE EQUIPAGE LIST (AEL)

EQUIPAGE NOMENCLATURE/CHARACTERISTICS	TECHNICAL DOCUMENT NUMBER	MANUAL / PLAN	IDENTIFICATION NO.	DATE	PAGE
CHEMICALS AND EQUIP BOWR/FDWTR TEST AND TREATMENT			2-560004103	03-15-92	1

CHARACTERISTICS
CHEMICALS AND EQUIPMENT BASED ON THE NUMBER OF BOILERS PER SHIP
QUANTITIES IN COLUMN 2 FOR 2 BOILERS
QUANTITIES IN COLUMN 3 FOR 3 BOILERS
QUANTITIES IN COLUMN 4 FOR 4 BOILERS
QUANTITIES IN COLUMN 8 FOR 8 BOILERS OR MORE
QUANTITIES LISTED AMOUNT TO A SIX MONTHS SUPPLY
FSCM-03950
OAATQ-FEEDWATER SYSTEM-TESTING EQUIPMENT

			SEC CL / SOURCE / MAINT / REC-Y	NOTES	CUST	U/I	QTY	COL. 1	COL. 2	COL. 3	COL. 4	COL. 5	COL. 6	COL. 7	COL. 8
ZZA605	APRON-LABORATORY	9Q 8415-00-634-5023	UPAOZZ	1		EA	1		1	2	2				4
MILB26701	BOTTLE POLY 1 QT	9G 8125-00-819-6085	UPAOZZ	1		EA	1		12	18	24				48
92372	CANISTER-GAS MASK-ROCKE	9G 4240-00-764-6301	UPAOOZ	1		EA	1		1	2	2				4
MILW15000 CLASS F	CHLORIDE INDICATOR CL	1H 6810-00-753-4907	UPCOZZ	1		BT	1		2	3	4				8
D-62	DIMETHYLGLYOXIME, AC	9G 6810-01-082-5414	UPAOZZ	1		BT	1		1	2	2				4
GGG-G-521	GOGGLES, INDUSTRIAL	9G 4240-00-190-6432	UPAOZZ	1		PR	1		2	3	4				8
292	HARDNESS TITRATING	1H 6810-01-072-1978	UPCOZZ	1		GL	1		1	2	2				4
MILR24119	ION EXCHANGE COMPOU	1H 6810-01-029-4217	UPAOZG	1		CF	1		6	9	12				24
2240-0050	JERRICAN-5GAL PLASTIC	9L 6640-01-083-9756	UPAOZZ	1		EA	1		2	3	4				8
93497	MASK-GAS ROCKET PROPELL	9F 4240-00-902-5516	UPAOZZ	1		EA	1		1	2	2				4
MILW15000 CLASS B	MERCURIC NITRATE-0.5N CL	1H 6810-00-281-4163	UPCOZZ	1		BT	1		3	5	6				12
MILW15000 CLASS E	METHYL RED-ACID BLUE	9G 6810-00-142-9290	UPAOZZ	1		BT	1		1	2	2				4
OM0575 CLASS 3	MORPHOLINE, TECHNICA	9G 6810-00-419-4298	UPAOZZ	1		CN	1		4	6	8				30
MILW15000 CLASS A	NITRIC ACID 1.0N	1H 6810-00-270-9978	UPAOZZ	1		QT	1		2	4	4				8
BBN411	NITROGEN-TECH	9G 6830-00-244-2741	UPAOZZ	1		CF	1		12	18	24				48
P79	PHENOLPHTHALEIN, ACS	9G 6810-00-223-7612	UPAOZZ	1		OZ	1		1	2	2				4
291	POWDER, HARDNESS BUF	1H 6810-01-072-1977	UPCOZZ	1		BT	1		1	2	2				4
290	POWDER, HARDNESS IND	1H 6810-01-072-1979	UPCOZZ	1		BT	1		1	2	2				4
8268-M11	SCOOP, PLASTIC, 2 IN BOWL	9Q 7330-01-079-0694	UPAOZZ	1		EA	1		2	3	4				8
REFERENCE NO./DESCRIPTIVE DATA	ITEM NAME	STOCK NO.	SEC CL / SOURCE / MAINT / REC-Y	NOTES	CUSTODY	U/I	QTY	1	2	3	4	5	6	7	8

SHIP TYPE & HULL NO.	PAGE		IDENTIFICATION NO.	DATE	PAGE
CG 68	H 309	ALLOWANCE EQUIPAGE LIST (AEL)	2-560004103	03-15-92	1

Figure 4. Allowance Equipage List Example Source: NAVSEA (n.d.-d, Appendix D, p. D-7).

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V. COSAL MANAGEMENT

This chapter will discuss the responsibilities and actions of the key role players who manage configuration data changes during a ship's life-cycle after the materiel support date. Figure 5 provides a visual representation of the three entities responsible for supporting COSAL management. The Port Engineer (PE) serves as the TYCOM representative and maintenance manager, acting as a liaison between the ship and Regional Maintenance Centers (RMCs) to efficiently manage maintenance requirements (COMFLTFORCOM, 2023). Some of these role players have already been introduced in previous sections and are summarized in Table 1 Key Role Players.

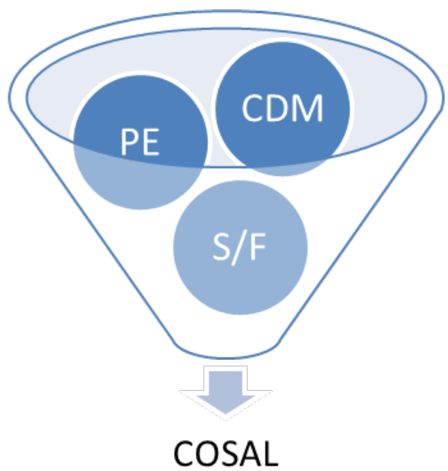

Figure 5. COSAL Changes from Maintenance and Modernization

It is important to understand how frequently a ship's COSAL changes because of maintenance and modernization efforts. Unlike a privately owned car or boat, after a manufacturer delivers a warship to the fleet, it is in an almost constant state of change. There are frequent software and hardware changes for a warship's complex weapon systems. Additionally, the hull, mechanical, and electrical components of a delivered vessel that was designed years previously, maybe even a decade or two before the current warship is delivered to the fleet, also change frequently. The entity responsible for tracking and documenting configuration changes for destroyers is the technical support activity, NAVSEA, and the principal person accountable is the Configuration Data Manager (CDM) (COMFLTFORCOM, 2023).

A. CONFIGURATION DATA MANAGER

Perhaps the most central character in CM for destroyers is the CDM; according to the *JFMM*, there is a CDM assigned to every ship class (COMFLTFORCOM, 2023). The CDM works for NAVSEA (NAVSEA, n.d.-d). "The CDM is solely responsible for the accuracy and maintenance of configuration data for a particular ship class. All configuration data entries into Navy ERP/ (MBPS) databases are made by the CDM" (NAVSUP, 2014, p. 5-25). The *PAFOS Manual* states, "A single activity, the CDM, is designated by NAVSEA as the control authority for the accuracy and completeness of information in (MBPS)" (NAVSEA, n.d.-d., p. 7-2).

After a ship has been delivered to the fleet by the manufacturer, it is the responsibility of the CDM to verify the accuracy of the configuration data encompassed in the official configuration data system of record- MBPS (NAVSEA, 2014). CDMs, who can be either Navy personnel or commercial contractors, often manage multiple units and ensure that each unit's data is maintained in the Weapons System File using COSAL change processes (COMFLTFORCOM, 2023). The CDM is also responsible for tracking ILS milestones during maintenance periods and ensuring the integrity of the MBPS database (COMFLTFORCOM, 2023). This includes updating MBPS with accurate equipment installations, removals, and modifications, as well as managing planning data before availability, and processing installation data upon receipt (NAVSEA, n.d.-d). By keeping MBPS accurate, the CDM plays a crucial role in maintaining operational readiness and effective allowance management (NAVSEA, n.d.-d).

Multiple entities can plan and help execute maintenance and modernization efforts for a ship via the Port Engineer (PE); configuration changes from these maintenance and modernization efforts will be captured differently (COMFLTFORCOM, 2023). Work completed by S/F will be captured by the Ship's Configuration and Logistic Support Information System (SCLSIS; COMFLTFORCOM, 2023). As discussed in Chapter III's Literature Review, this database is periodically updated and feeds information into MBPS; the CDM is responsible for reviewing and approving the final configuration changes that will adjust the ship's COSAL (COMFLTFORCOM, 2023). Other off-ship entities can plan modernization efforts via the PE and push this information directly into MBPS for final approval by the CDM (COMFLTFORCOM, 2023). The CDM is the gatekeeper for all configuration changes before CM is permanently altered in the master database of record- MBPS (COMFLTFORCOM, 2023).

B. PORT ENGINEER

According to the *JFMM Volume II*, the maintenance manager or PE is, "assigned to assist Ship's Force in the tracking of work candidates, development of work packages and tracking of (RMC) or Industrial Activities assigned jobs" (2023, g. II-I-1A-2). In this context, "jobs" refer to requests for maintenance actions. The PE is a TYCOM representative who acts as a liaison between the local RMC and the ship, ensuring all maintenance is completed in the most efficient manner (COMFLTFORCOM, 2023). The PE tracks maintenance requirements via the Current Ship's Maintenance Program (CSMP), which tracks jobs submitted by S/F and work packages submitted by off-ship entities, such as program offices upgrading weapon systems (COMFLTFORCOM, 2023). In the researchers' experience there was both a PE and a Combat Systems engineer maintenance management. The PE focused on HM&E jobs while the CS engineer facilitated weapon system upgrades pushed down to the ship by program offices. The PE is responsible for validating configuration data entered by off-ship maintenance activities; he or she may request assistance from the CDM (COMFLTFORCOM, 2023).

C. S/F

Chapter 5 of the *NAVSUP P-488* discusses COSAL management in detail, and it lays the burden of COSAL management at the feet of S/F, and in particular the Commanding Officer; the *P-488* states, "The primary responsibility for ensuring that accurate and current configuration data is reported to Navy ERP and (MBPS) lies with the ship's Commanding Officer" (2014, p. 5-1). The writers of this thesis would argue that accurate CM lays at the feet of several entities more profoundly than the S/F's Commanding Officer, who does not have visibility in the MBPS or ERP databases. Chapter 5 of the *P-488*, which was last updated in 2014, goes on to state, "During the normal operation cycle, it is a ship's responsibility to report all equipment changes detected or accomplished by an Alteration Installation Team (AIT), an Intermediate Maintenance Activity (IMA), or by the ship's force" (NAVSUP, 2014, p. 5-14). However, in practice based on the researchers' experience as well as their discussions with other role players, significant CM changes completed by off-ship maintenance activities are rarely downloaded from a ship's maintenance system (SLCSIS) and uploaded to MBPS, like the *P-488* states; instead, AIT and IMA initiate configuration changes in MBPS and push the CM "down" the pipeline to the ship, not up through it.

D. COSAL CHANGE MECHANISMS

Managing the COSAL for DDGs is crucial to ensuring these vessels are adequately outfitted with approved allowances to maintain their operational readiness (NAVSEA, n.d.-d). NAVSEA must review and approve all allowances and support plans before implementation (NAVSEA, n.d.-d). The three primary reasons for updating a ship's allowance database are reprovisioning efforts, fleet requests, and configuration changes (NAVSEA, n.d.-d).

Due to considerable equipment or maintenance changes, reprovisioning efforts involve completely revising an APL or AEL (NAVSEA, n.d.-d). When an APL or AEL is revised, it is regenerated and sent to the affected DDGs via automated shore interface, allowing the shipboard allowances to be adjusted (NAVSEA, n.d.-d). This ensures that equipment and parts onboard are up-to-date and aligned with the latest provisioning standards (NAVSEA, n.d.-d).

Next, fleet requests support updates to spare allowances to address actual materiel failures experienced by the ship or to correct inaccuracies in the initial provisioning process (NAVSEA, n.d.-d). These requests are submitted using a fleet COSAL feedback report (FCFBR), allowance change request (ACR), or allowance change request- fixed (ACR-F) (NAVSEA, n.d.-d). FCFBRs enable S/F to communicate with off-the-ship entities about suspected errors with an APL (NAVSEA, n.d.-d). This ensures that inaccuracies in documentation are corrected promptly, maintaining the accuracy of the ship's allowance records (NAVSEA, n.d.-d). For example, a FCFBR would be submitted if the part number or NSN listed in the APL is incorrect in comparison to the TM. An ACR is a formal request to review and revise the authorized allowance for OBRP

(NAVSEA, n.d.-d). Approval of an ACR confirms that the support provided needs adjustment, possibly changing technical codes assigned during initial provisioning (NAVSEA, n.d.-d). Approved ACRs that increase an item's allowance are charged to the COSAL outfitting account (NAVSEA, n.d.-d). An ACR-F is similar in nature, but the key difference is that the allowance materiel is classified as a depot-level repairable (DLR). Depot-level repairable are generally high value, critical materiel that are able to be repaired at depot-level maintenance centers and re-issued to the fleet rather than discarded and replace entirely (NAVSUP, 2022). An ACR would be submitted to increase the allowance of a critical radar part if a DDG is expected to operate its radar beyond normal parameters to support a specialized mission and ensure spare materiel is available onboard. Additionally, NAVSUP can internally generate allowance updates based on fleet usage(demand) and maintenance reporting history (NAVSEA, n.d.-d). These updates are pushed to the ship via ASI and ensure that ship allowances reflect real-world operational needs (NAVSEA, n.d.-d).

Finally, configuration changes require allowance updates to reflect onboard equipment additions, replacements, exchanges, or removals (NAVSEA, n.d.-d). These changes impact the ship's operational capabilities and the need for specific parts and equipment, making it crucial to update allowances to ensure the ship's materiel requirements are accurate (NAVSEA, n.d.-d). Configuration changes are initiated through a configuration change Forms (CCF) or OPNAV 4790/CK. A CCF must be generated through NTCSS or MBPS whenever maintenance actions result in configuration change (NAVSEA, n.d.-d). This includes changes that are identified by S/F such as equipment addition, deletion, replacement, or modification. For example, S/F would submit a CCF if the industrial washing machine onboard had been replaced, but the COSAL still reflected the older model. This ensures the updated equipment is documented and mitigates future discrepancies. See Table 4 in the supplemental section for a summary of the various COSAL change mechanisms. Although not the focus of this research, additional mechanisms such as the Automated Technical Feedback Report (TFBR) and Technical Manual Deficiency/Evaluation Report (TMDR) are available. These tools correct discrepancies in planned maintenance system cards, which provide step-by-step instructions and list the tools, parts, and materiel needed by S/F to complete maintenance or to update technical manuals. S/F follows a similar process to address these discrepancies. From the *NAVSUP P-488*, Figure 10 in the supplemental section highlights various scenarios that can arise and provides the appropriate change mechanism to utilize.

E. FLEET COSAL FEEDBACK REPORT PROCESSING

After initial provision, continuous management of the COSAL is required due to various equipment modifications and the unique operation of each DDG (NAVSEA, 2019). FCFBR is one of several mechanisms that enable S/F to manage their COSAL through electronic communication with off-the-ship entities. To assist in visualizing the information flow and identifying decision points, Figure 6 is a mapping of the FCFBR process.

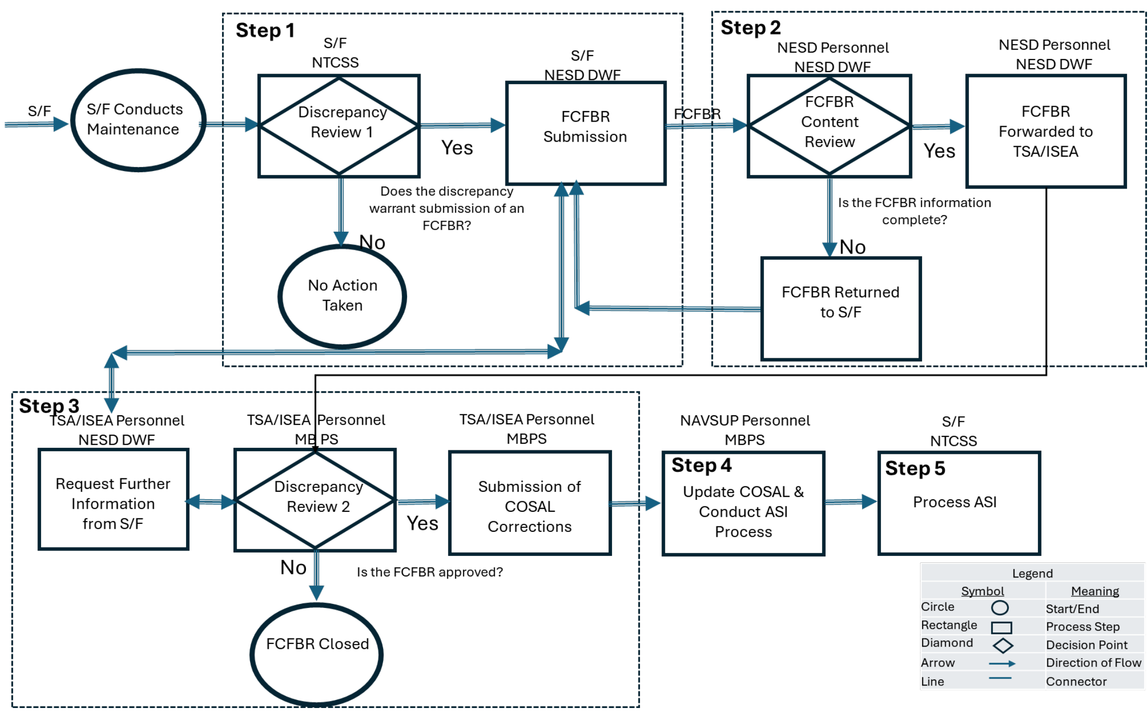

Figure 6. Fleet COSAL Feedback Report Process Map

1. Step 1 (S/F)

In this step, The FCFBR process is set in motion when S/F discovers an unaddressed COSAL discrepancy during preventative or corrective maintenance. These discrepancies may include missing parts numbers or NSNs from the APL. S/F plays a crucial role in identifying discrepancies and their expertise in accurately identifying, interpreting, and applying the correct actions is pivotal in this process (NAVSUP, 2014). Once a discrepancy is identified, S/F reports it to internally to their immediate supervisor; A determination is then made on whether the discrepancy warrants the submission of an FCFBR (NAVSUP, 2014). If deemed appropriate, S/F gathers all relevant data such as APL number, TM details, NSN, and part number in preparation for submission of a FCFBR. Previously, S/F submitted FCFBRs through Navy311, a platform for transferring FCFBRs between the ship and the in-service engineering agent (ISEA) or technical support activity (TSA). In February 2024, Navy311 was consolidated into the Naval Enterprise Service Desk (NESD; Sallarulo, 2024). NESD's provides a digital workspace for S/F to submit FCFBR.

2. Step 2 (NESD)

NESD personnel are responsible for reviewing the FCFBR to ensure all required data fields are completed before forwarding requests to the appropriate ISEA or TSA (Sallarulo, 2024). Each APL is linked to a specific ISEA or TSA. Accurate points of contact are essential to connect NESD and NAVSEA (Sallarulo, 2024). Inaccuracies in ISEA or TSA points of contact caused by data migration challenges or personnel shifts can lead to FCFBRs being left in limbo, causing significant delays, according to conversations with NAVSEA. If NESD discovers that all required information is not included, they will return the FCFBR to S/F. Furthermore, handoffs between entities introduce opportunities for errors to occur due to miscommunication or incomplete transfer of information. This can disrupt the flow of the FCFBR process.

NESD provides around-the-clock assistance for Navy personnel through the integration of IT support systems and the utilization of AI and machine learning capabilities. (NESD Factsheet, 2024) NESD uses a three-tiered approach to support S/F; Tier 0 provides self-service options through a cloud-based platform, enabling S/F to resolve issues independently; Tier 1 is an AI-driven system, similar to server-based chat, that manages common issues and automates responses (NESD Factsheet, 2024). In cases where human intervention is needed, Tier 2 steps in to handle more complex or unresolved issues, according to conversations with NAVSEA.

3. Step 3 (TSA/ISEA)

The TSA or ISEA adjudicates the FCFBR by thoroughly researching the identified discrepancies to ensure its accuracy and that the correct updates are made (NAVSEA, 2019). Once adjudication is complete, ISEA submits the FCFBR updates or corrections to NAVSUP via interactive computer aided provisioning system; a system that exists within MBPS's Navy product data management. If ISEA discovers an error in information provided, they can communicate with S/F to gather clarifying information (NAVSEA, 2019). The interaction between S/F and ISEA continues until correct information is received, allowing the FCFBR to continue to be processed. In addition, ISEA reserves the right to close the request if the determination is made that a FCFBR is not warranted.

As outlined in NAVSEA's provisioning policy, NAVSEA Logistics (SEA 06L) appoints a trusted agent to take on the role of Provisioning Lead (NAVSEA, 2019). The Provisioning Lead is responsible for ensuring that TSAs complete and submit the required updates to NAVSUP for both FCFBR and ACR within 45 days (NAVSEA, 2019). Additionally, PEOs must ensure that an engineering activity is designated and funded to serve as the TSA for processing FCFBRs and ACRs (NAVSEA, 2019).

4. Step 4 (NAVSUP)

If the FCFBR is deemed 'warranted' by TSA/ISEA, then NAVSUP WSS takes appropriate actions to ensure the required database systems are updated. If NAVSEA's ISEA or TSA determines that the item being added to the APL computes for an allowance, they will review the MBPS system and update data to reflect the increased allowance (NAVSUP, 2014). These changes are then included in the NAVSUP ASI update that is sent to the DDG (NAVSUP, 2014).

5. Step 5 (S/F)

S/F receives and processes the ASI update. The changes will be reflected in their onboard NTCSS system, ensuring that the most up-to-date information is available (NAVSUP, 2014).

To summarize subsection E, every ship's COSAL requires continuous management due to various equipment modifications and the unique operations of each DDG. The FCFBR process enables S/F to address COSAL discrepancies through electronic communication with off-ship entities, as outlined in Figure 6. This process starts with S/F identifying discrepancies during maintenance and submitting an FCFBR via NESD, which verifies the request before forwarding it to the appropriate ISEA. The ISEA then adjudicates the discrepancy and updates NAVSUP with changes reflected in the Navy's provisioning systems. NAVSUP subsequently updates database systems and processes an ASI update, which S/F incorporates into their onboard systems, ensuring access to the latest configuration information.

F. SUMMARY

A ship's COSAL is constantly evolving and requires management and oversight (NAVSEA, n.d.-d). Maintenance and modernization efforts will cause significant changes to the COSAL, and these changes are initiated by different entities in different databases (COMFLTFORCOM, 2023). While the CDM exists to approve all configuration changes, data entry is completed by S/F, IMA or AIT, or the PE's maintenance team. This dynamic environment may be a leading cause of discrepancy origination.

In addition to maintenance and modernization efforts, COSALs and OBRPs can change because PEOs re-run modeling and adjust their sparing recommendations (NAVSEA, 2018). Additionally, according to the researchers' conversations with NAVSEA and NAVSEALOGCEN representatives, funding constraints can impact PEO sparing procurements. While these are important factors to consider, the focus of this report is on CM practices, so the researchers focused more specifically on the major configuration changes that occur during maintenance and modernization efforts.

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VI. DATA

This section provides an overview of key findings from NAVSUP Weapon Systems Support's (WSS) *Waterfall Chart* and fleet COSAL feedback report (FCFBR) data from NESD. Together, these tools offer insights into requisition trends, effectiveness, and the FCFBR adjudication process. While this section highlights key findings, further details and supporting data are included in the supplemental section.

The NAVSUP WSS *Waterfall Chart* offers a detailed overview of the fleet's requisition activity, focusing on trends and effectiveness categorized by source codes. It provides insights into the flow of requisitions, including parts not included in a ship's configuration (source code G). Analysis of the Waterfall Chart revealed trends in high-demand requisitions, particularly for depot-level repairable part for the LM 2500. These findings highlight a reliance on requisitions for materiel not included in shipboard configurations. This suggests potential gaps in COSAL alignment with operational needs. Despite slight improvements in effectiveness metrics over time, gross, net, and allowance effectiveness continue to fall short of desired targets.

For open FCFBR requests, the findings highlight variability in the timeliness of adjudication. While many requests are resolved within expected timelines, others remain open for extended periods, underscoring inefficiencies in follow-through and communication between stakeholders. For closed FCFBR requests, a significant number are marked as "No Action Taken" due to issues such as incomplete submissions, obsolete part numbers, or other administrative challenges. Only a small percentage of closed FCFBRs result in actionable outcomes, such as configuration changes, highlighting the need for improved processes and greater accountability. These findings from both the Waterfall Chart and FCFBR data indicate challenges in requisition and feedback management, including gaps in COSAL alignment, inconsistent follow-up, and a lack of standardization.

The remainder of this chapter's content is in the supplemental.

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VII. CAUSE AND EFFECT ANALYSIS

In this chapter, the researchers conducted root cause analysis to uncover the underlying reasons why specific parts are not onboard when needed. Utilizing the fishbone diagram, the researchers categorized potential causes into six distinct branches: human factors, methods, materiel, machinery/IT systems, measurement, and milieu/ environmental conditions. This approach facilitates comprehensive brainstorming by addressing the complexities behind the absence of onboard repair parts.

A. DECOMPOSITION OF PART NOT ONBOARD

The researchers started at a very high level and brainstormed reasons a part is not onboard when ordered by a work center. Figure 7 delineates the researchers' thoughts. Additionally, the researchers focused on allowance source code G requisitions, which have a higher correlation to COSAL discrepancies than the other allowance source codes, based on the researchers' experiences. As annotated previously in Table 2, allowance source code G denotes materiel is not assigned to the ship's COSAL (NAVSUP, 2022).

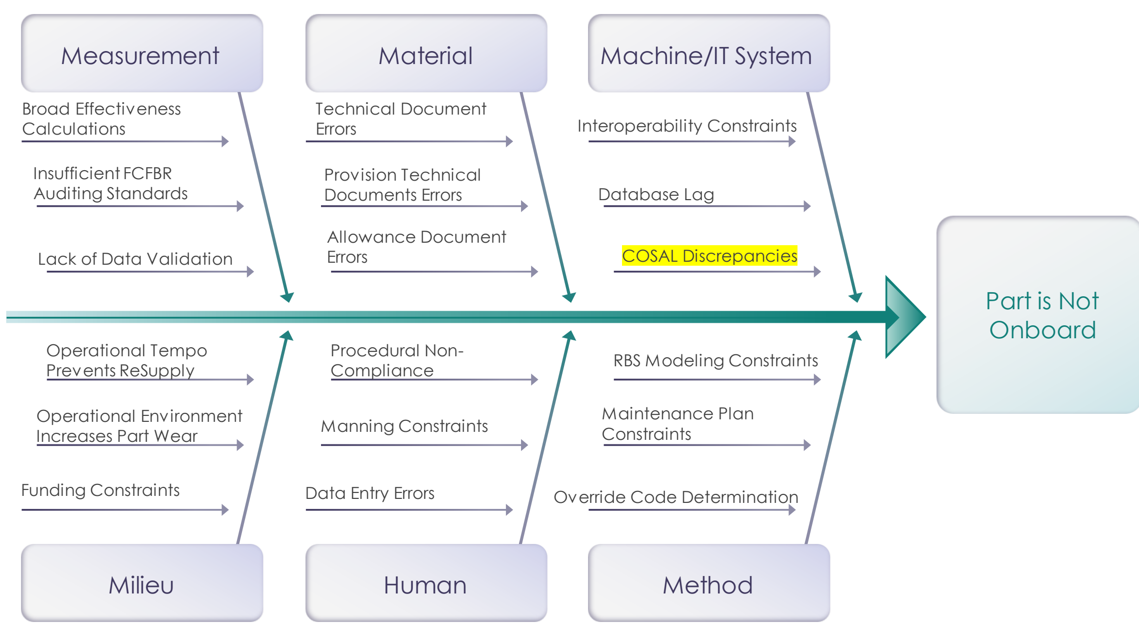

Figure 7. Part Is Not Onboard Fishbone Diagram

B. DECOMPOSITION OF THE COSAL DISCREPANCIES FISHBONE

The researchers identified possible causes that can drive COSAL discrepancies (Figure 8). These findings are explained in much greater context in the paragraphs below. The most profound causative agents will be expounded on in the Recommendations chapter of this thesis.

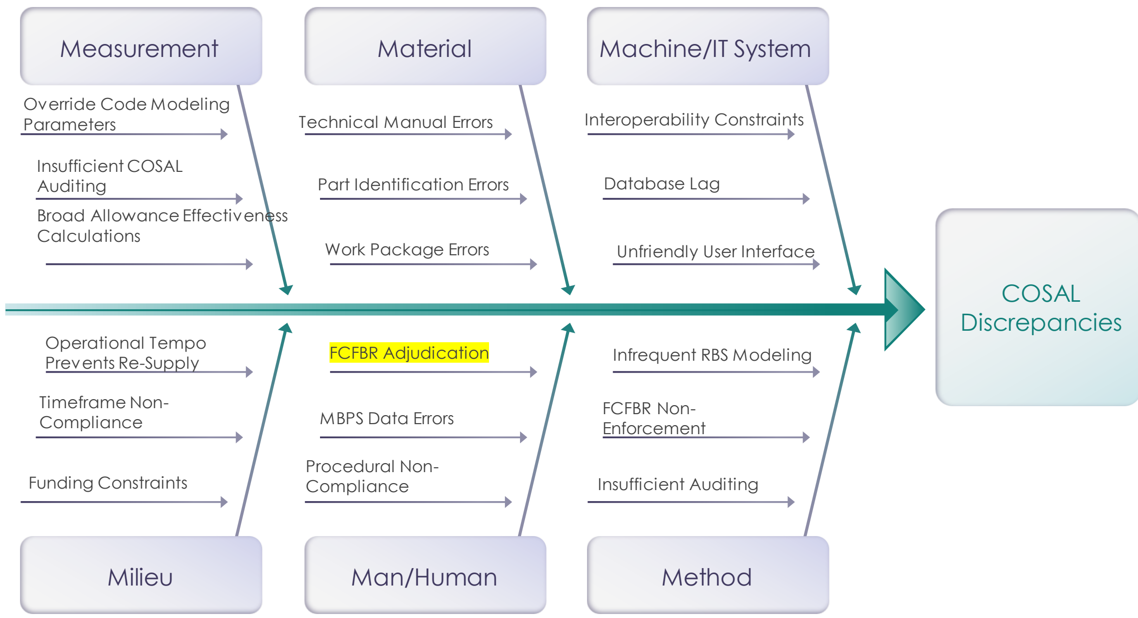

Figure 8. COSAL Discrepancies

1. Machine/IT Systems

Interoperability Constraints: The flow of data from the initiator (PEO, contractor, ILS member, or S/F) through the CDM to the ship's maintenance IS, NTCSS, is not perfectly streamlined and requires human coordination and intervention. For instance, configuration data changes can be initiated in the Amazon Web Services environment through the Integrated Computer Aided Provisioning System (ICAPS); however, data has to be passed to ERP then delivered to the ship via the Revised Alternative Dataflow (RAD) file transfer system and processed through steps referred to as Automated Ship Interface (ASI) (NAVSUP, 2022). During the researchers' discussions with NAVSUP Allowancing, NAVSUP members provided an illustration where erroneous allowance deletions occurred after a ship executed an ASI evolution. For complete data process flows, refer to chapters 7 and 8 of the *PAFOS Manual* and to Figure 2–18 (Strategic Data

Flow for an Operational Activity) in the *NAVSUP P-485 Volume I*, 2022 edition. Thankfully, NAVSEA's digital transformation migration to the Amazon Web Services environment is removing many interoperability issues by migrating all legacy IS to applications that operate in the Amazon Web Services environment (NAVSEA, 2018).

Database Lag: There is an approximate 60-day lag between equipment alterations and configuration data updates to the ship's maintenance IS, NTCSS, according to conversations with NAVSEALOGCEN personnel. In a researcher's personal experience, after a two-year overhaul, the configuration data was 75%, there were only 12,000 out of a total of 16,000 line items in Supply Support. It took ten months after a Targeted Allowance Reconciliation Tool request was submitted for the inventory to be corrected.

Unfriendly User Interface: The researchers cannot speak to the user interface of ICAPS or MPBS; however, the researchers have firsthand experience with NTCSS and the complexities involved with changing configuration data on the ship to be uplinked through the 3M Coordinator for CDM approval. There are many technical data fields that are not intuitive and may not be applicable to every situation. This responsibility is delegated to the work center supervisor position, which is usually a collateral responsibility passed frequently between petty officers of every rate, technical and not technical.

2. Materiel

Technical Manual Errors: In the researchers' experience, technical manuals on the ship tend to be updated less frequently than configuration data, due to the relatively higher pace of change for part numbers and NSNs assigned. Additionally, due to human error, work centers did not replace or manage technical manuals IAW governing procedures, which contributed to work centers erroneously ordering parts not in the COSAL.

Part Identification Errors: Due to size and cost constraints, not all parts have part information stamped, engraved, or tagged. This can lead to the work center ordering erroneous parts not listed in the COSAL. In the researchers' experience, work centers would see a part number engraved and incorrectly assume it's the part number for the entire valve, not just one component of the valve. While the valve is listed in the COSAL, the subcomponent ordered may not be carried, so the requisition or demand will hit the system and negatively impact effectiveness metrics.

Work Package Errors: Erroneous data can originate from the work package and technical documents provided by the OEM, ILS, or contractor. Erroneous data may not be caught by the CDM before the configuration data is permanently altered in MPBS.

3. Measurement

Override Code Modeling Parameters: As previously discussed, during initial RBS modeling, override code determination conducted early in the process negatively impacts the ability of NAVSEA or NAVSUP to increase the allowance for a part with an override code of “Y,” even if that part has high demand. Additionally, the determination of APL-worthiness early in the process strongly influences sparing capabilities. NAVSEA created a work-around titled Miscellaneous Repair Part APLs. “The Miscellaneous Repair Parts APL lists non-APL–worthy items that are maintenance significant but not included in the parent APL or identified to a particular system” (NAVSUP, 2014, p. 3-49). Miscellaneous APLs capture demand and allowance for it; however, this process is manpower intensive and lags behind requirements.

Insufficient Auditing: There was a strong consensus from NAVSUP, NAVSEA, and Force Readiness contacts that there need to be improvement in auditing procedures after equipment alterations and installations. This will be discussed further in the Recommendations section. NAVSEALOGCEN representative stated functional area audits are conducted on CDMs to ensure their ships configuration data is accurate- the exact procedures and frequency of these audits were not discerned by the researchers. This is an area for future research.

Broad Allowance Effectiveness Calculations: To determine the accuracy of the ship’s allowance, NAVSUP divides GE by NE and establishes a recommended baseline of 76.4% (NAVSUP, 2014). This measurement is too broad; it fails to distinguish consumables like cleaning supplies from consumables like industrial washing machine gaskets. The researchers propose splitting demand by its job origin. Demand for repair parts ordered against an APL or AEL should be measured; conversely, demand for cleaning supplies should not be measured.

4. Method

Infrequent RBS Modeling: During RBS modeling, if a part is determined to have override code "Y," there are only a few exemptions to policy which will authorize the part for sparing. RBS modeling is very influential and needs to be conducted more frequently, according to our discussions with NAVSUP and SURFPAC. Even though catchall systems exist, like the automated COSAL Improvement Program, to identify parts that should have allowances, initial modeling heavily influences allowances.

FCFBR Non-Enforcement: FCFBR management is not uniformly conducted, audited or enforced across the fleet. This area is so vital, researchers created its own subsequent fishbone diagram.

Insufficient Auditing: The publications that govern configuration data management do not explicitly state how NAVSEA and NAVSUP proactively audit configuration data management practices and procedures. Rather, the researchers are of the opinion there are predominantly passive auditing procedures. All stakeholders-S/F logisticians, NAVSEA, NAVSUP- look at metrics captured in the Continuous Monitoring Program, like COSAL effectiveness, gross effectiveness, and net Effectiveness. Based on these metrics, stakeholders hunt for errors that may be contributing factors to poor metrics. This subject will be discussed further in the Recommendations section of Chapter VIII of this thesis.

5. Man/Human

FCFBR Adjudication: FBR adjudication is not completed in a timely manner and S/F practices are not uniformly enforced. These issues highlight both method and man concerns. For method, the delays from systemic inefficiencies in the adjudication process. For man, the variability in S/F practice point to gaps in training, adherence to policy, and enforcement by personnel. This subject is so critical, the researchers created a separate fishbone diagram, which is discussed further in this chapter.

MBPS Data Entry Errors: Data entry for configuration management directly into MPBS is delegated to many different participants (NAVSEA, 2019). While the CDM is accountable for information verification, this can be a large volume of work consisting of very detailed minutia that a CDM is challenged to verify.

Procedural Non-Compliance: Standard program management, knowledge, and follow-through is an issue for S/F personnel, according to the researchers' personal experience and testimony from NAVSEA. For instance, ISEAs responding to a ship's FBR engage with the POC in the FBR directly, and that POC may not respond back to the ISEA's requests for information (RFI). Additionally, FBR management at the S/F level is not strictly enforced, in accordance with *NAVSUP P-485* guidance. It is viewed as a tertiary responsibility; the FBR log during the Supply Management Inspection (SMI) is only 1 / ~1000 total points (Commander, Naval Surface Force, U.S. Pacific Fleet [COMNAVSURFPAC], n.d.). Ships can release requisitions that are Not Carried on the COSAL without verifying a FBR is submitted, which is required by the *NAVSUP P-485* (NAVSUP, 2022).

6. Milieu (Environment/External Constraints)

Operational Tempo Prevents Re-Supply: In the researchers' experience, there is insufficient time and prioritization in the ship's schedule for ship-checks and equipment verifications and validations. The *Joint Fleet Maintenance Manual* recommends ship-checks are done early in the planning phase before a ship's availability as well as after the completion of the work (NAVSEA, 2019). While ship-checks for work candidate validation are conducted in advance by experienced professionals, in the researchers' experience, physical equipment validations based on configuration data provided by the Planned Maintenance System Scheduler, an IS within NTCSS, are usually conducted by inexperienced, junior personnel regardless of their technical designator.

Timeframe Non-Compliance: Ship's that undergo equipment alterations or installations are supposed to have associated technical documents processed by the TSA within 15 days and NAVSUP within 30 days, according to the *NAVSEA 4423.1* (2019); however, in the researchers' personal experience, too often APLs are not integrated into the ship's COSAL quickly enough, which negatively impacts readiness and effectiveness metrics.

Funding Constraints: The researchers' discussions with NAVSEA and NAVSEALOGCEN representatives illuminated several downstream impacts from funding constraints. First, PEOs executing requirements under Continuing Resolutions are sometime forced to make cuts to initial sparing baselines, which negatively impact sparing allowances. Additionally, funding constraints prevent PEO's from running RBS modeling as frequently as desired, which has negative repercussions already discussed in this thesis.

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C. DECOMPOSITION OF FCFBR ADJUDICATION FISHBONE

The researchers examined the adjudication process for FCFBRs and identified key factors contributing to inefficiencies and delays (Figure 9). These findings are further detailed in the subsequent paragraphs. The most critical factors will be addressed in greater depth in Chapter VIII of this thesis, with a proposed solution to improve the process.

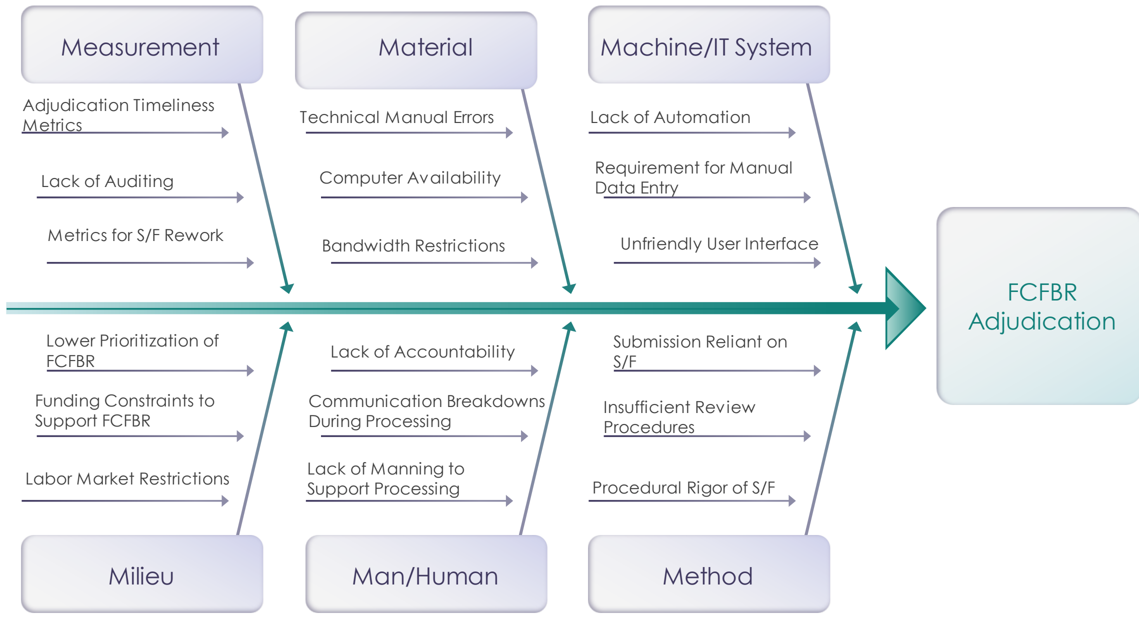

Figure 9. FCFBR Adjudication Fishbone Diagram

1. Machine/IT System

Lack of Automation: Automation is limited in the FCFBR submission process. NESD is not directly integrated with S/F's IS, requiring personnel to manually submit FCFBRs. Although an automated FCFBR program within ICAPS is in development and can identify inaccuracies and route them to the appropriate point of contact, it has not fully replaced user submissions and is primarily accessible only to personnel under Echelon II commands, not S/F personnel. To make ICAPS accessible to S/F, the program would require expanded server capacity and permissions. System downtime or failures can delay FCFBR updates, especially if users encounter scheduled or unscheduled maintenance, which reduces the likelihood they will return to complete the process. Additionally, the lack of data validation tools means discrepancies are not caught early, necessitating further programming and funding to integrate this functionality.

Manual Data Entry Errors: The NESD digital workplace platform requires users to manually enter information such as TM numbers, NSNs, and part numbers. This reliance on manual entry increases the risk of errors at the point of entry, which can lead to delays in routing FCFBRs to the correct recipients. The FCFBR process map highlights the risk of manual data entry errors during the FCFBR submission process.

This is shown in NESD's responsibility to ensure completeness in the data entered prior to routing it the appropriate adjudicator, further complicating the resolution process.

Unfriendly User Interface: The NESD interface is cumbersome and complicated and lengthens the FCFBR submission process. The researchers conducted a trial of the NESD DWF website to further expound the issues a user would experience. Users must navigate multiple steps to reach the correct destination, and pre-populated contact information is based on prior NESD DWF submissions, often leading to outdated or incorrect data. Correcting these inaccuracies requires additional time and effort, which can be frustrating for users and discourages prompt submission. If the information isn't updated, responses may be sent to the wrong command or email address. Additionally, if the user transfers commands before a response is received, it further complicates communication and resolution. Data indicates FCFBR remain open on average 45 days. NAVSEA policy is to close FCFBR by the 45 day mark (NAVSEA, 2019)Materiel

Technical Manual Errors: Inaccuracies in technical manuals and limitations in information availability create significant obstacles in the FCFBR process. Technical manuals contain errors, such as incorrect part details or outdated instructions, which can lead to misidentification of parts and confusion over repair procedures. Additionally, part numbers on equipment become illegible due to wear, tear, or manufacturing flaws, making it challenging for personnel to accurately identify components when submitting FCFBRs. These combined issues delay the adjudication process and require personnel to consult multiple sources or seek external assistance to verify information, adding time and complexity to the FCFBR workflow.

Lack of Computer Availability: Each person has a user account that grants computer access; however, there is limited availability of computer assets for S/F personnel. DDGs are neither funded nor designed to allow all crew members simultaneous computer access. Limited physical space available and Ethernet connections or "drops" on ships constrain this access. Due to these limitations, personnel often must wait for available computers, creating bottlenecks and delaying FCFBR submissions.

Bandwidth Restrictions: Internet connectivity on ships is limited, with DDGs' network capabilities lagging advancements in internet infrastructure. This limitation results in long wait times to access websites necessary for FCFBR submissions, along with frequent timeouts due to unstable connections. These connectivity issues not only slow the FCFBR submission process but may also delay the transmission of critical repair or maintenance data. This problem is further exacerbated when the ship is at sea and reliant on satellite connectivity, especially in communication-denied environments where connectivity demands are restricted to mission-critical needs.

2. Measurement

Adjudication Timeliness Metrics: FCFBRs focus on open and closed categories. Significant delays exist from the initial submission to the research and ultimate closure of FCFBR reports. These delays stem from budget constraints that lead to staffing shortages, limiting the resources needed for the in-depth research required to make accurate corrections to technical documentation and IS. The high volume of FCFBRs submitted further exacerbates these delays, creating bottlenecks in the adjudication process. These delays not only slow down the correction process but also impact operational readiness by limiting the availability of accurate technical information.

Metrics S/F Rework: Current FCFBR metrics focus solely on the status of requests as open or closed, calculated based on the days between these statuses. However, there is a lack of alternative metrics to measure whether an adjudicated request has had favorable outcomes (actions taken to correct a discrepancy) or unfavorable outcomes (no corrective action taken). Unfavorable outcomes often require S/F to rework and resubmit FCFBR requests, leading to further delays and inefficiencies. This rework process places an additional burden on S/F, diverting time and resources that could be used for other mission-critical tasks. Additionally, a lack of metrics tracking resubmission rates may obscure systemic issues that lead to repeated FCFBR failures, with some issues going unsubmitted due to discouragement.

Lack of Auditing: There is a lack of auditing within the adjudication process, hindering continuous performance improvement. Additionally, feedback loops are inadequate, making it difficult to identify and address bottlenecks in the processing chain, which further slows down the overall adjudication timeline. Implementing regular audits could provide critical insights into bottlenecks, helping identify areas for improvements and establishing best practices for faster FCFBR resolution.

3. Method

S/F Reliance: The FCFBR process relies heavily on S/F personnel for submission. S/F personnel often have other high-priority duties, which makes it challenging to prioritize FCFBR management, particularly when they need more dedicated support or automated tools.

Insufficient Review Procedures: There currently needs to be a regular review of procedures to confirm the necessity of each step in the FCFBR process, resulting in inefficiencies. NESD serves as a middleman, creating a communication barrier between end users and adjudicators. This indirect communication can lead to delayed or unclear feedback, which hinders prompt resolution. Furthermore, the lack of process mapping in publications or training materiel means that personnel often learn FCFBR procedures through trial and error rather than following a streamlined, documented approach. This gap makes it difficult for personnel to fully understand the path from request submission to successful configuration updates.

Lack of Procedural Rigor: The responsibility for FCFBR management is typically assigned to junior personnel within the Supply Support work center. Given the complexity of the FCFBR process, assigning it to junior personnel without standardized protocols creates challenges. This inconsistency leads to varied procedural practices across ships and shore facilities, affecting the quality and timeliness of FCFBR management. A consistent, standardized approach would help mitigate these disparities and improve overall efficiency.

4. Man/Human

Lack of Manning: DDGs often face manning shortages that impact their ability to manage FCFBRs. The Navy prioritizes achieving nearly 100% manning for deployed ships, leaving non-deployable commands with a reduction in personnel. Fit, personnel containing the correct skills, and fill, personnel within each position, are applied to maintain minimum manning levels for shipboard operations, but this often results in suboptimal support for FCFBR processes on non-deploying ships.

Lack of Training: There is insufficient training and knowledge gaps among personnel responsible for FCFBR submissions. Basic military training does not cover the specific requirements of FCFBR management, and no formal training exists to address these nuances, relying instead on on-the-job training. This training gap contributes to communication breakdowns across the FCFBR process. Additionally, there is low motivation to complete FCFBRs due to a lack of personal benefit, limited positive feedback, and the impact of unorganized technical libraries and inventory inaccuracies.

Lack of Accountability: More accountability is needed to ensure timely and effective FCFBR adjudication. S/F often concentrates on submitting FCFBRs rather than ensuring discrepancies are corrected, resulting in a lack of accountability needed to drive complete resolution. Adjudicators are frequently driven to close requests within the required timeframe rather than ensuring a successful resolution that addresses the end user's needs. This creates a disconnect between FCFBR submission and comprehensive issue correction, lacking the accountability required for fully resolving discrepancies.

5. Milieu (Environment/External Constraints)

Lower Prioritization of FCFBR: FCFBRs are often given lower priority by commands for several reasons, including the unique challenges posed by a lack of standardization across Navy systems. Tactical commands, such as those on DDGs, focus on near-term mission requirements over long-term sustainment. Each Naval platform, such as DDGs, F-35s, or ground vehicles, relies on specialized materiel management systems tailored to their specific operational needs. This lack of standardization creates a fragmented approach to maintenance and supply, making FCFBR submissions more complex and less universally prioritized. S/F personnel, for example, often prioritize obtaining immediate spare parts over updating IS to prevent recurring issues. Additionally, FCFBR management accounts for less than 1% of total inspection scores (COMNAVSURFPAC, n.d.), further deprioritizing these submissions within command responsibilities.

Labor Market: The labor market presents additional constraints with competition from private-sector opportunities often offering more attractive work-life balance, competitive salaries, and remote work options. This competitive landscape reduces the pool of qualified personnel for both S/F and adjudicator roles, complicating recruitment and retention efforts within the DoD.

Funding Constraints: Budget limitations are a constant challenge, as resources are reallocated to maximize immediate operational readiness and availability. This prioritization of direct mission-supporting expenditures over longer-term improvements leaves limited funding for data accuracy or system upgrades, even though these investments could enhance future operational availability. Challenges in the shipboard operational environment combined with a general lack of incentive to go beyond existing norms, hinder the effective management of FCFBRs.

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VIII. CONCLUSIONS AND RECOMMENDATIONS

This thesis was exploratory; the researchers attempted to identify causal relationships between CM practices and COSAL discrepancies, which can lead to work center demand for parts not carried. The researchers studied Logistics IS at the Naval Postgraduate School and used the curriculum's data management and BPM principles to evaluate CM practices. Through their own technical publication research and discussions with multiple working groups responsible for provisioning policy and COSAL creation and management, the researchers were able to identify and map the key steps for the COSAL creation and FCFBR processes. After gaining a firmer understanding of these processes, the researchers utilized their own experiences and inputs from their discussions to brainstorm different causes inherent COSAL management and FCFBR processes that can potentially contribute to demand for parts not carried.

A. RECOMMENDATIONS

1. Increase Audits on Configuration Data

First and foremost, the researchers strongly advocate for increasing audits of CM throughout a ship's life-cycle and providing transparency of configuration data efforts to the S/F. This recommendation stems from one researcher's personal experience of a severe configuration data lag after the ship left a two-year overhaul, which was discussed in the Background chapter. This recommendation also stems from interviews with NAVSUP Allowancing, NAVSEALOGCEN, and Force Readiness officers. Contacts from all three entities reminisced about previous NAVSEA practices to hire a third party to conduct ship-checks and validate configuration data. According to discussions with NAVSEALOGCEN, they are responsible for conducting functional area audits on the CDM; however, audits conducted by NAVSEALOGCEN only occur at the RMC level; they do not audit configuration data for ships in a CNO availability. The contact from NAVSEALOGCEN, said Huntington Ingalls, a private shipbuilding company, is considered the lead CM integrator for all destroyers, but Huntington Ingalls relies heavily on weapons system manufacturers to provide accurate initial technical document data to be uploaded into MBPS. The researchers propose an ounce of prevention is worth a pound of cure; auditing needs to occur more frequently and applied at different points in a ship's life-cycle.

TYCOM's Future Readiness Teams conduct COSAL reviews for surface combatants before the ships deploy with carrier strike groups. This process entails corrective actions to correct COSAL discrepancies; however, due to the limited number of personnel in the four-crewed office and the manpower intensiveness of the process, this occurs infrequently throughout a ship's life-cycle, and ships not assigned to strike groups may not be groomed at all.

2. Improve FCFBR Management

The researchers strongly advocate that FCFBR management should be an executive officer program administered by the shipboard 3MC. By NAVSEA's own admission, at the S/F level, the FCFBR process is not standardized and not enforced. The primary issue is lack of follow-through. Ships submit FCFBRS and NAVSEA technical representatives read and respond to these reports, but in many instances the ships do not respond back to the technical representatives requests for more clarifying information. The low positive adjudication FCFBR metrics provided in the data section of this thesis convey the lack of effectiveness in current processes. Current policy dictates FCFBR management as the supply department's responsibility; however, the researchers know from personal experience and discussions that the supply department lacks the transparency in the process and situational authority to ensure maintenance work centers are responding to NAVSEA technical representatives' emails.

3. Adjust Provision Policy

The researchers concluded there are certain provisioning policies that need to be pruned. For instance, technical override code "Y" determinations made during the RBS modeling event should not preclude other modeling systems from adding an allowance for a component. NAVSEA has previously made the decision to prohibit creating allowances for repair parts that are not S/F repair capable; however, as evidenced by the large volume of allowance source code G requisitions for compressor blades for the destroyers' main engines, this negatively impacts a ship's ability to be self-sufficient. Current policy is slightly incongruent with the distributed maritime operations concept of self-sufficiency and the CNO's prioritization of Readiness.

B. FURTHER RESEARCH

1. Comparative Analysis Between Shipyards

The authors recommend that a comparative analysis of CM practices across different shipyards is conducted. The Navy's four major shipyards plus the Ship Repair Facility in Yokosuka all have slight nuances. The researchers suggest ships leaving overhauls and maintenance availabilities should have their configuration data spot checked and measured to ascertain if one yard is more effective at CM than others.

2. Data Dive

Currently, requisition data is collated from all DDG 51 platforms; if possible, the researchers recommend parsing data from each unit, measure each ships' not carried demand, then collate ships based on their life-cycle status and which RMC or shipyards the ship just recently left. This data may illuminate high levels of variability in CM performance across the RMCs or shipyards.

3. RBS Evaluation

The frequency of RBS modeling warrants examination. Stakeholders interviewed suggested that RBS modeling may have been conducted over a decade ago, but it is policy to conduct it every five years. Researchers should verify the frequency of RBS modeling and assess its impact on readiness. This analysis would not only validate RBS's alignment with current readiness goals but could also uncover modifications to enhance CM and spare part availability.

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SUPPLEMENTAL

To access the supplemental sections listed here, contact the Dudley Knox Library or, for publicly releasable theses and supplementals only, visit the thesis pages in the library's Calhoun database. Due to the Controlled Unclassified Information inherent in the publications and organizational reports utilized by the researchers, the supplemental section was created to discuss the more technical or sensitive findings.

The material in the supplemental contains sensitive information classified as Controlled Unclassified Information (CUI). To comply with regulatory guidelines and ensure proper handling of such content, these sections have been removed from the main body of the thesis and are instead provided in the supplemental.

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