

**U.S. Coast Guard Financial Management: A Systems Approach to Business  
Process Reengineering**

by

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Submitted to the System Design and Management Program  
in Partial Fulfillment of the Requirements for the Degree of

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## **ABSTRACT**

The United States Coast Guard (USCG) is undertaking an enterprise-wide Financial Management Business Process Re-Engineering (FM BPR) effort that will transform its delivery of financial management services which support worldwide operations and mission support activities. The planned changes will include deployment of new commercial-off-the-shelf financial management software, and simultaneous changes to USCG organizational structures and FM processes. Proposed changes to the USCG FM system are intended to bring the Service into compliance with Federal standards for financial operations, while simultaneously improving delivery of financial business support to end users.

This thesis applies Dr. Nancy Leveson's System Theoretic Process Analysis (STPA) safety methodology to perform a hazard analysis on aspects of the re-engineered (future state) business processes to help ensure the system can deliver its intended performance. Application of STPA on the USCG FM system was conducted with the aid of the Safety Hazard Analysis Tool (SafetyHAT) software released in March 2014 by the Volpe National Transportation Systems Center. SafetyHAT is intended to aid users in performing hazard analysis using STPA. The use of SafetyHAT for this thesis research is its first application outside of the Volpe Center and transportation domain. Recommendations for tailoring the tool to the financial management and other domains are proposed.

The application of STPA on targeted aspects of the USCG FM system identified 205 causal factors for potential system hazards. Recommendations to appropriately remediate the causal factors are proposed based on systems theory principles and tools. Recommended improvements include robust feedback and communication channels illustrated using the system control diagram used to perform STPA. System dynamics modeling is also used to quantitatively illustrate the non-linear interactions that exist in the USCG FM system, and how the system design will affect its performance over time. The simulations show that if the causal factors identified using STPA are not addressed, the FM system may fail to achieve its intended performance. Other recommendations include the expanded use of system dynamic modeling to inform future design decisions for the USCG FM system, including trade-offs driven by resource limitations, as the re-engineering effort progresses.

Thesis Supervisor: Dr. D. Van Eikema Hommes, Ph.D.  
Title: Lecturer, Engineering Systems Division

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I would like to thank the USCG for sending me to the finest academic institution on the planet--MIT. I'm fortunate to be a part of such a tremendous organization filled with exceptional leaders, mentors, innovators, patriots and friends. Every tour is has been both professionally and personally rewarding, especially the opportunity to attend MIT-SDM. Reinvigorated by the new ideas and opportunities I've been exposed to while completing the SDM Program, I am very much looking forward doing all I can to make our Coast Guard better for the future.

With that, earlier this year I received notification that I was selected to serve as the Deputy Project Manager for the USCG's Financial Management Service Improvement Initiative (FMSII) Project after completing the MIT-SDM Program. Suffice to say I am excited for the opportunity, and motivated to contribute in any way possible to make sure the opportunity to improve the USCG and its financial operations is maximized. Following this assignment (which is expected to be four-years), I also hope to be at an operating unit or the user end of the FM system I will have hopefully improved.

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## List of Acronyms

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A	Actuator
AM	Acquisition Manager
BPR	Business Process Re-engineering
CAS	Core Accounting System
CAST	Causal Analysis based on Stamp
CFO	Chief Financial Officer
COTS	Commercial Off The Shelf
CP	Controlled Process
DCMS	Deputy Commandant for Mission Support
DCO	Deputy Commandant for Operations
DHS	Department of Homeland Security
DOL	Director of Logistics
ESD	Engineering Systems Division
FINCEN	USCG Finance Center
FM	Financial Management
FMA	Financial Management Application
FSIO	Financial Systems Integration Office
FTA	Fault Tree Analysis
GL	General Ledger
INCOSE	International Council on Systems Engineering
LC/SC	Logistics Center/Service Center
MIT	Massachusetts Institute of Technology
MS	Microsoft
MS	Mission Support
OFF	Oracle Federal Financials
OMB	Office of Management and Budget
OP	Operation
Org	Organizational
PR	Procurement Request
S	Sensor
SD	System Dynamics
SafetyHAT	Safety Hazard Analysis Tool
SAP	Simplified Acquisitions Procedures
SDM	System Design and Management
SOP	Standard Operating Procedures
SSP	Shared Service Provider
STAMP	System-Theoretic Accident Model and Processes
STPA	System-Theoretic Process Analysis
US	United States
USCG	United States Coast Guard

## **Chapter 1: Introduction**

### 1.1 Thesis Motivation

I am an officer in the United States Coast Guard (USCG) with a background in financial resource management, acquisition project management, and engineering system design. In my most recent assignment, I had the opportunity to serve as the “action officer” for formulating the USCG’s Fiscal Year 2013 \$10 billion budget, including strategic planning and programming of resources that sustain the USCG’s 50,000 member military and civilian workforce and worldwide operations. In this role, I saw firsthand the complexity of the USCG as an organization, and the importance of maintaining good business practices, and accountability and stewardship of resources. I was also reminded of the criticality of ensuring that personnel on the front lines--who perform missions on a 24/7/365 basis--have the tools and support mechanisms in place enabling them to do what is asked of them.

Providing systems, processes, an organizational structure and operating environment that can achieve this goal is not straightforward. Limited resources (people, funding, assets, and information) and cultural inertia are two examples of many challenges that USCG leaders face. Through this thesis I hope to use the problem-solving methods and *systems thinking* I have acquired from the MIT-SDM Program to provide insights and recommendations that can be used to make the USCG better.

### 1.2 Opportunities and Challenges

This thesis research focuses on an improvement opportunity associated with the USCG’s delivery of Financial Management (FM) services<sup>1</sup>. The USCG has reached a point where the procedures and financial software applications used to support its operations and activities are no longer adequate. Stronger management practices and controls are required to manage the USCG’s budgetary resources (monies appropriated by Congress for Coast Guard missions), especially in the current fiscal environment marked by stringent standards and oversight. The USCG is pursuing a multi-million dollar effort to replace its Oracle Federal Financials (OFF)

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<sup>1</sup> Coast Guard financial management encompasses a wide range of activities that includes funds distribution and financial administrative controls; request to procure goods/services (including transactional approvals); and procure to pay for services.

financial management application. The OFF application currently being used poses significant security, “auditability,” and funds control risks. The USCG expects to transition to a Commercial Off the Shelf (COTS) financial software application provided by a Shared Service Provider (SSP) in Fiscal Year 2015. This shift is intended to make the USCG conform to Department of Homeland Security (DHS) and Office of Management and Budget (OMB) direction on Financial Management System (FMS) replacements, and ensures a future system will use business processes developed by the Financial Systems Integration Office (FSIO) [1]. Making the transition to a new FM application will enable the USCG to conduct FM operations more efficiently.

The proposed changes to the USCG FM system are broader than the procurement and integration of a new financial software application. As part of this transition, the USCG will concurrently re-engineer its FM business processes to conform to FSIO standards. This business process reengineering poses both challenges and benefits<sup>2</sup>. On one hand, the USCG would conduct business in a more modernized way that is transparent, auditable with the requisite internal controls in place that ensure stewardship and governance of its \$10B+ annual budget, and alleviate some administrative functions from frontline operating units. On the other hand, the transition requires significant changes to the way FM is currently executed. Since the reengineered system is markedly different from the status quo, there exists significant uncertainty. Of particular interest, is the potential impact on USCG front-line operating units whose day-to-day operations hinge upon the FM system’s ability to support their missions. If the USCG’s re-engineered FM system does not function as intended, the users will be challenged to efficiently *and* effectively perform their missions—save lives, secure the Nation’s ports and waterways, and prevent or respond to maritime accidents. Furthermore, if the re-engineered FM system does not perform and deliver its intended benefit, an entirely new set of challenges could emerge that will greatly complicate the day-to-day business of USCG front-line units and personnel instead of improving it.

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<sup>2</sup> Due to the pre-decisional nature of the “to-be” state of the new financial management organization, my research includes assumptions based on information contained in the BPR report required to keep my research effort progressing. This approach was necessary due to timeline incompatibilities with my research timeline and future decisions regarding the new financial management organization.

Designing and implementing the USCG’s future FM system is a very complex and challenging endeavor, and accordingly, my research focuses on applying systems thinking and tools to this immense effort. Through my research I hope to provide constructive recommendations for implementing the changes to the USCG FM system that are currently being contemplated. Additionally, I hope to contribute to the analytical processes and methods so they can be employed to address future challenges both within the USCG, in other organizations, and across other domains beyond financial management systems.

### 1.3 Research Question:

In anticipation of reengineering the USCG’s business process and implementing the FM software application, it is beneficial to consider what challenges may occur for front-line operating units when the new system is operated. Furthermore, once the challenges are identified, it is also necessary to identify and use system methods to address the challenges in the system. Accordingly, I proposed and gained approval to address the following two research questions:

**Table 1: List of Thesis Research Questions**

<b>Number</b>	<b>Thesis Research Question</b>
1	What challenges will the USCG’s new FM software application and re-engineered business process create for front-line operating units once it is implemented?
2	What system analysis methods may help identify the causal factors that create the challenges—or system hazards—and mitigate or abate them in the new USCG FM system?

The research conducted in this thesis will specifically focus on identifying system hazards in the re-engineered FM system based on the proposed implementation of the “to-be” state<sup>3</sup>. The analysis will identify the causal factors that can lead to system accidents and losses, and recommend appropriate actions to mitigate or eliminate their existence.

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<sup>3</sup> The future (to-be) state of the USCG FM system remains notional and pre-decisional. To facilitate the thesis research, the to-be state reflected in the May 2013 BPR document (Draft) was assumed as the baseline for conducting the analysis.

## 1.4 Thesis Overview

Chapter 2 provides a general overview of the USCG FM system and the changes that are being considered relating to the implementation of the new FM application and Business Process Re-engineering effort. It includes a high-level description of the Core Accounting System (CAS) financial management software, along with an overview of the USCG's FM BPR effort. This chapter also describes the scope of the research and the boundary limits of the system that will be analyzed for the thesis.

Chapter 3 conducts a review of literature and system methods used to develop this thesis. The review of methods includes Dr. Nancy Leveson's System-Theoretic Accident Model and Processes (STAMP), and System-Theoretic Process Analysis (STPA) methodologies. The chapter explores system process models and control structures, and their relationship to system safety and causality. Other methods for performing a hazard analysis are presented, specifically Fault Tree Analysis. Finally, the chapter presents the Volpe National Transportation Systems Center's Safety Hazard Analysis Tool (SafetyHAT) software application as a efficient means perform the STPA.

Chapter 4 analyzes the future state, or "to-be" state, of the USCG FM System through the application of STPA to identify system hazards. Using STPA, a request to procure a product or service by a USCG operational unit using the new reengineered FM system is analyzed. The analysis is facilitated by the use of the SafetyHAT software tool. Based on the results of the analysis, requirement statements that address each hazard are presented, along with an assignment of responsibility for remediation within the USCG system development organization. In this section, a qualitative model is also presented to show how USCG FM system hazards can act to degrade the performance of the FM system.

Chapter 5 applies system dynamics to illustrate how the hazards identified through the application of STPA could degrade the performance of the USCG FM system, over time, when it is operated. The system dynamics models and simulations are presented as a means to improve system learning and provide a better understanding of the non-linear relationships that exist between variables and components interactions in the FM system.

Chapter 6 provides conclusions and recommendations relating to the USCG FM system based on the application of methods and findings outlined in the previous chapters. It also provides an assessment of the utility and recommendations for the future application of Leveson's STPA methodology using the SafetyHAT software on complex socio-technical systems.

## 1.5 Proviso

The reader of this thesis must be aware that the future state if the USCG FM system remains pre-decisional and notional. Also, the views expressed in this academic paper are those of the author and do not reflect the official policy or position of the US government, DHS or the USCG. As a footnote to the academic research and recommendations outlined in this thesis, some assumptions had to be made regarding details of the future state and design of the USCG FM system based on the information available to me at the time. If the need arises or the assumptions need to be updated, the system tools, models and methods developed for this thesis remain available and can be evolved. With this said, I hope this research will improve our FM management system operations, but also serves as a "how to" guide for applying STPA and systems thinking to other fields and programs in the USCG, or beyond.

## Chapter 2: Background

### 2.1 Overview of the Coast Guard

The USCG is an operating agency within the Department of Homeland Security. The organization of the USCG is represented in Figure 1 below:

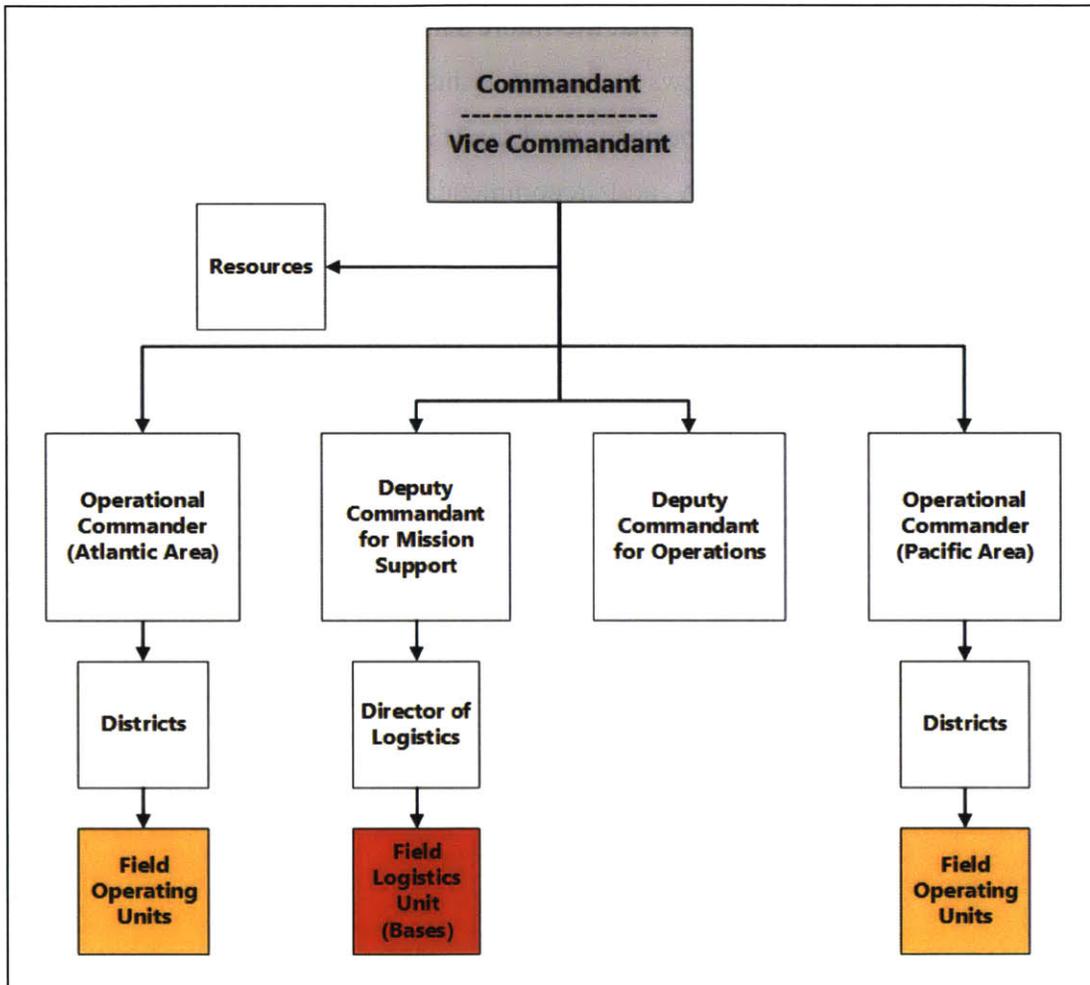


Figure 1: Organizational Structure of the USCG

The Commandant and Vice Commandant, and their Deputy Commandant for Mission Support (DCMS) and Deputy Commandant for Operations (DCO) represent the senior headquarters policy-making and strategy entities of the USCG. The strategy and policy organizational entities are responsible for the allocation of resources to the field, including people, funding, physical assets (e.g., ships, aircraft, and boats), support systems and network. They also define the

organizational structure of the Service and the governing business processes that are employed. The Atlantic Area and Pacific Area Operational Commanders are responsible for performing USCG missions in the field, which is enabled by assigned personnel, funding, physical assets, and other USCG support systems<sup>4</sup>. The interactions of the field operating units and field logistics unit denoted in Figure 1 above, as they relate to the delivery of financial management and procurement services, will be analyzed in detail in subsequent sections and chapters of this document. In Figure 1, the tan blocks represent USCG front-line operating units that are supported by the new USCG FM system. The red blocks represent the mission support entities that deliver FM services and support to the operating units.

## 2.2 Core Accounting System Replacement

The USCG Core Accounting System (CAS) is the primary FM software application utilized by the USCG for a full range of financial transactions. The system is used by the USCG to record financial transactions affecting apportionments; reapportionments; allotments; agency restrictions; financial plans; program operating plans; obligations; expenditures; and anticipated, earned, and collected reimbursements of financial resources appropriated by the Congress. CAS is used for preparing and reconciling financial reports that display obligations and remaining unobligated balances by appropriation and allotment for accounts and object class [2]. CAS is also the primary mechanism the USCG uses for FM operations, including monitoring for how resources are allocated and spent. The data housed in the financial application is critically important, and is used extensively for decision-making by USCG leadership. This data is also used to report financial performance metrics, such as funds expended or remaining in a fiscal period, to stakeholders throughout the Executive and Legislative branches, and to the public.

In its current state, the USCG FM application (and other associated feeder and mixed systems) is unstable and unreliable, and no longer practicable to continue operating or maintaining. As stated in the President's Fiscal Year 2014 Budget Request to Congress relating to the procurement of a new FM software application [3]:

---

<sup>4</sup> By law the Coast Guard has eleven missions that include: ports, waterways, and coastal security; drug interdiction; aids to navigation; search and rescue; living marine resources; marine safety; defense readiness; migrant interdiction; marine environmental protection; ice operations; and other law enforcement. Other support systems include, but are not limited to: human resources, intelligence, engineering & logistics, and information technology.

*“The legacy Core Accounting System (CAS) suite suffers from poorly documented customization, and is resource-intensive and non-compliant with the Federal Financial Management Improvement Act (FFMIA) of 1996. The CAS suite does not meet Statement on Standards for Attestation Engagements (SSAE) 16 Internal Controls Over Financial Reporting (ICOFR) requirements. The FMSII supports the DHS Chief Financial Officer’s strategic goals to provide efficient financial management services and operations and to strengthen DHS’s financial management systems. The FMSII also supports the DHS Chief Procurement Officers’ strategic initiative to improve federal procurement data quality and to maintain procurement systems performance. Modernization of the USCG’s legacy financial systems is a critical near-term priority.” [4]*

The requested funding has since been appropriated by Congress to advance this project, and the USCG is well along the way to replacing the FM application. The project is being completed by the USCG’s acquisition directorate according to the procedures outlined in the Department of Homeland Security’s Major Systems Acquisition Manual [5]. Sponsorship for the FM application project is provided by the USCG’s Assistant Commandant for Resources and Assistant Commandant for Acquisition.

### 2.3 Business Process Reengineering Initiative and Team

In conjunction with the replacement of the USCG’s FM application, a concurrent effort is being undertaken to realign business processes that enhance the operating capability of the USCG through improved mission support delivery. At the center of this effort is the work of the Financial Management Business Process Re-Engineering (FM BPR) Team, which is sponsored by the Deputy Commandant for Mission Support (DCMS) and Assistant Commandant for Resources/Chief Financial Officer. The goal of the FM BPR team is to evaluate current policies, authorities, procedures, processes and organization of funding execution and accountability, in order to make recommendations on how to achieve the desired future state. This effort is currently underway, and in doing so, a top priority is to align the future (or “to-be”) FM Operating Model more closely with the Mission Support (MS) Business Model that has been developed and deployed throughout the USCG over the past several years. The MS Business Model defines way the USCG supports its people, platforms and systems [6]. The recommended

model will also be compliant with all laws, regulations, and Federal policies, and complementary to the potential functionality of a new, commercial-off-the-shelf (COTS) financial management application (FMA) [1].

As with any effort as comprehensive and organizationally impactful as implementation of the FM BPR will likely be, there is undoubtedly a resistance to change that is harbored by the users of the system. As presented in the USCG FM BPR report, this resistance is largely brought about by skepticism, concern, and fear of potentially debilitating impacts if the transformation cannot be implemented as designed or envisioned [1]. The current USCG FM system, albeit not fully optimized, is functional. Parallel to the work of the BPR team, stakeholder engagement and change management efforts are ongoing for field and Headquarters stakeholders in sub-teams to make the transition to the re-engineered FM system as smooth as possible. Conducting a hazard analysis on the future USCG FM system to identify potential gaps that may exist, and recommending strategies and measures to abate them, could prove useful in overcoming the resistance to change.

**Table 2: Key Findings Related USCG FM System**

Organizational and Process Changes
Organizational and process changes are required to better integrate the Mission Support organization with the financial operational model.
The MS Business Model and FM Operations Model are not aligned. Business practices are inconsistently linked or decoupled from funds management, producing gaps, inefficiencies, causing the USCG to miss opportunities for greater effectiveness.
Financial Management Application
CAS is at high risk of catastrophic failure. Over time, customizations to Oracle Federal Financials (OFF) have prevented the application of security patches since 2008. The Coast Guard has decided to pursue replacing CAS with a COTS product provided by a Shared Service Provider (SSP). This strategy aligns with DHS and OMB direction on Financial Management System (FMS) replacements and ensures a future system will use standard Financial Systems Integration Office (FSIO) business processes. In preparation, the Coast Guard must re-engineer its business processes to conform to FSIO standards.

## Sustained System Performance and Auditability

Despite unprecedented improvement in the Service's audit performance, sustaining a clean, full-scope audit opinion requires integrated business processes that organically incorporate audit requirements instead of routinely relying on the heroic efforts of business and financial managers.

The following table contains a summary of the key findings of the USCG's BPR Report (Draft) and is presented to provide additional context as to why the changes to the USCG FM system are being pursued: [1]

Taken together, these reasons make a compelling need for the changes the USCG is implementing. Addressing these shortcomings with a system approach is necessary to sustain the clean audit opinion, but also to improve the reliability of our financial information and reporting<sup>5</sup>. The USCG is also committed to directing significant attention to strengthening its internal controls over key financial and business activities [7]. The BPR also recognizes the need to take a holistic, or systems approach to addressing the challenges regarding the USCG's FM System:

*Current Coast Guard FM business processes are complex, cumbersome, confusing, inconsistent, non-standardized, difficult to audit, and reliant on an outdated and unstable Core Accounting System (CAS) and mixed systems. The current FM structure is also disparate, multi-layered, and inefficient. Collectively, these factors result in a system with high maintenance costs, numerous audit liabilities, and administrative requirements that place an undue burden on front line units. These causes for action provided basic assumptions, constraints, guidelines, and minimum requirements for the scope of this effort and the final recommended business model [1].*

A complete draft of the USCG FM BPR is provided in the Appendix.

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<sup>5</sup> A clean opinion indicates that an independent auditor has reviewed the USCG financial statements and found them to be in full compliance, without exception, with applicable laws and accounting standards. The USCG is the first Armed Service to accomplish this achievement. Sustaining the clean audit opinion is a shared priority for the USCG and DHS [7].

## 2.4 System Boundary and Assumptions:

The USCG's entire FM is an extremely large and complex socio-technical system that would be nearly impossible to accurately model and meaningfully analyze. The research and application of methods in this thesis is therefore focused to the evaluation of funds management and targeted procurement activities of a frontline field-operating unit. An example of a frontline operating unit would be a small boat station, patrol boat, or aids to navigation team represented as a field operating unit in the USCG organizational structure in Figure 1 above. These units are typically staffed by 15 to 75 personnel, and have an annual operating budget of less than \$100,000 in funds designated to support operations and unit level maintenance [2]. The activity encompasses actions by system operators to request and receive a product or service from a non-governmental source using the to-be state of the USCG FM system [8].

Financial management operations are accomplished by complex, interacting loops in the FM organization (system). Within the system are numerous USCG Headquarters strategy and policy elements, field logistics and operations activities, and external stakeholder elements. Figure 2 below depicts a high-level organizational control structure of the USCG FM system, and includes the boundary of the system of interest where research and focus occurs. These lower levels of the organization are where mission execution is accomplished. The financial resources, policies and regulations for the operation units, however, are established at the strategy and policy level of the organization. Additionally, although these higher-level echelons are not directly considered in the analysis in this thesis, the recommendation regarding the design and implementation of the system would have to be championed at these levels. This will be addressed in later sections and chapters.

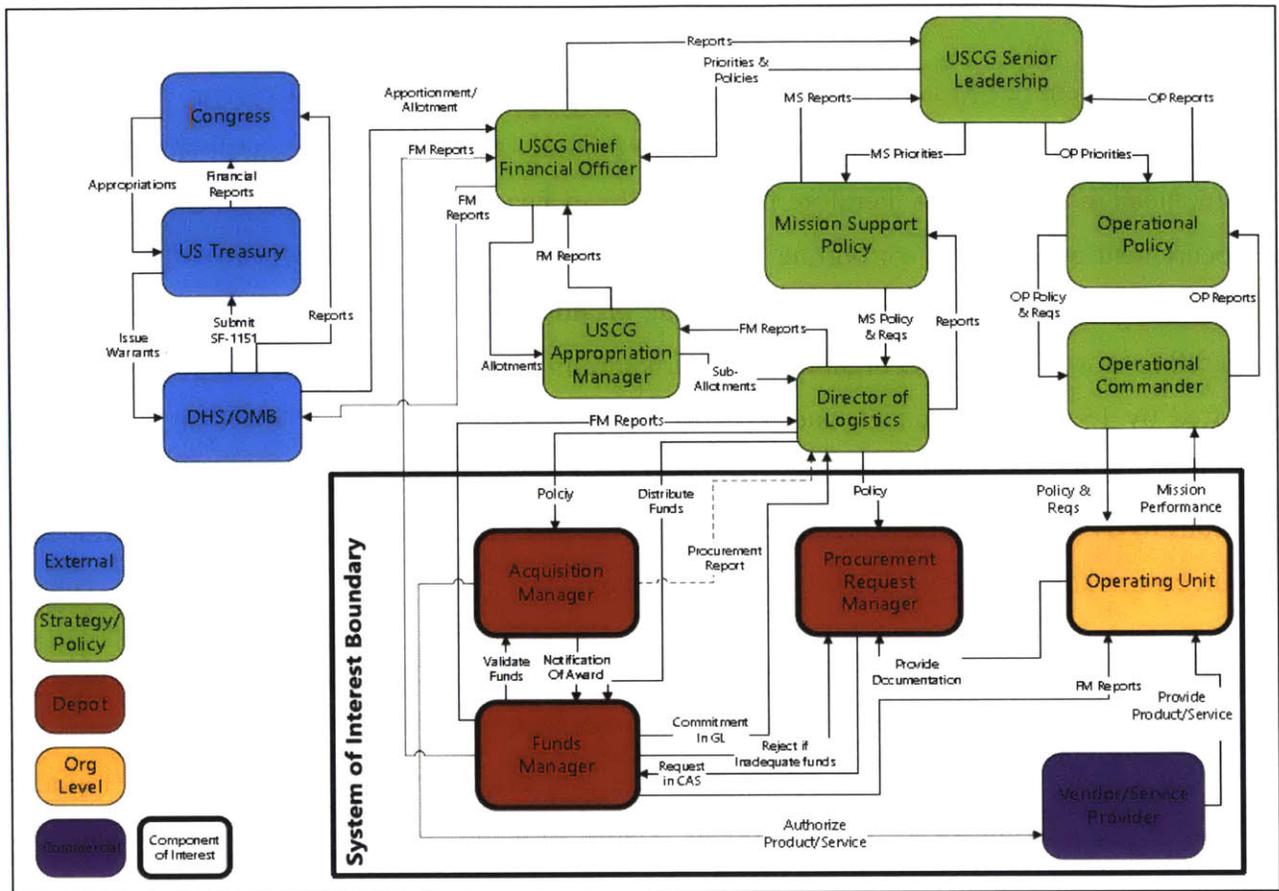


Figure 2: USCG Organizational Structure and High-Level Control Diagram

## 2.5 Targeted Analysis and Research Relating Business Process Reengineering

Building upon the information provided above, Figure 3 denotes the concentration of activity throughout the echelons of the organization relating to financial management and mission support activities. The concentration of activities for operations (specifically, the operating units being analyzed) exists in the “Request to Procure” phase highlighted within the red circle [1]. Since system hazards that persist or affect users operating on the front lines would likely be felt most acutely, this is the focus of the research effort. The results of evaluating the system at this level would also apply at other echelons of the system, or in preceding or following FM activities.

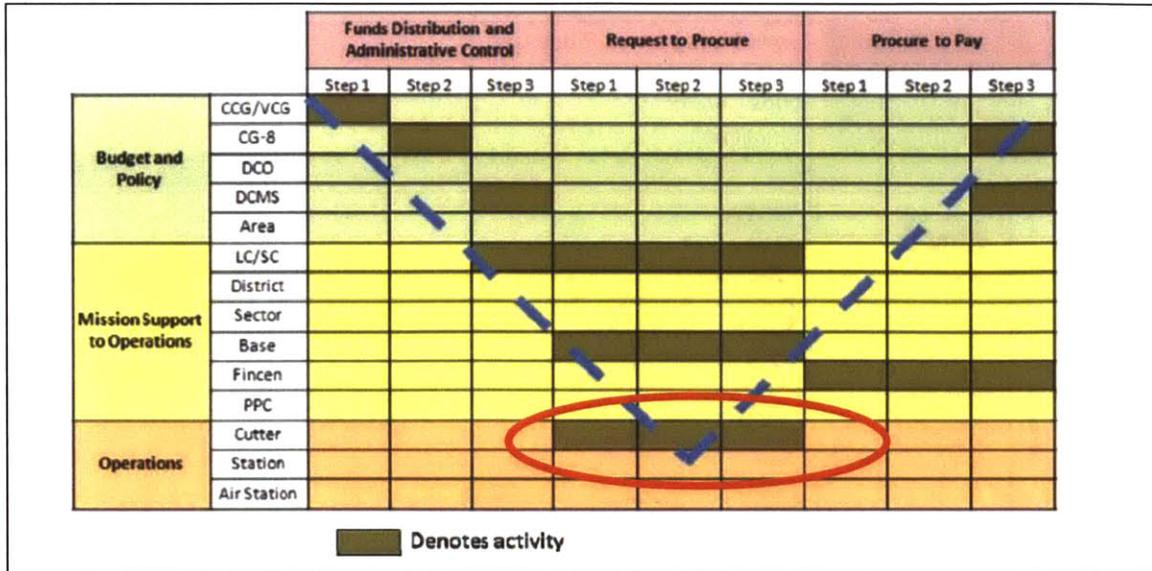


Figure 3: Concentration of FM Activity Denoted for Operating Units (USCG BPR Report, 2013)

The USCG BPR report process diagrams were used as the basis for developing the system control diagram. Figure 4 below, contains a process diagram for how a typical transaction would be initiated and executed. The activity represented below details how an operating unit would request to procure a product or service from a commercial vendor.

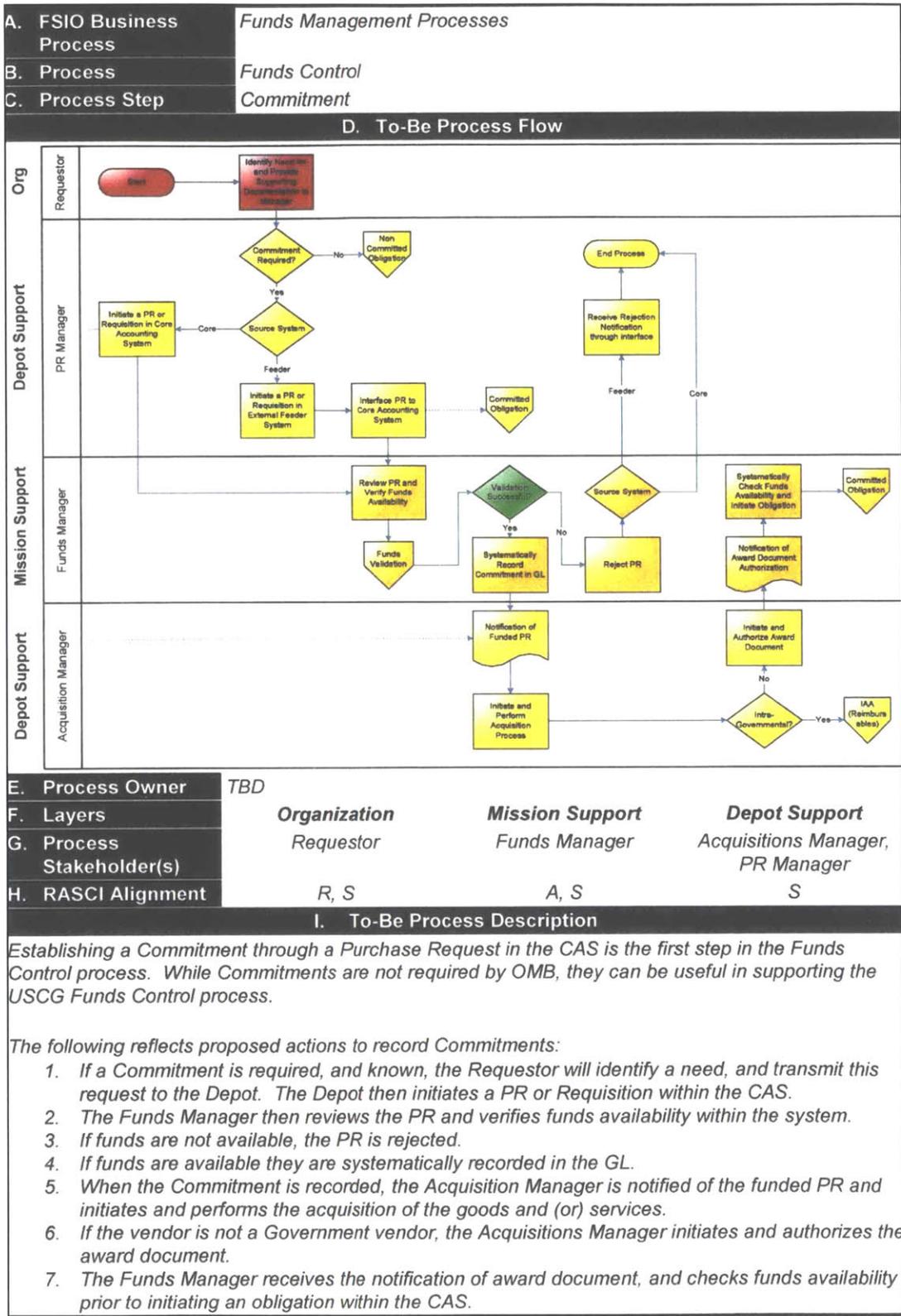


Figure 4: USCG Funds Management Process Based on To-Be State [1]

Figure 5 contains additional information relating to the ‘to-be’ process regarding internal control objectives and risks.

J. Financial System/Application	CAS Purchasing & GL Modules	K. Funding Level	N/A
L. Timing/Frequency	N/A	M. Duration	N/A
N. FTE Requirement	N/A	O. Military or Civilian	N/A
Internal Control Considerations			
Ref	Control Objective	Risk	Description of Control and Monitoring Activities
1.	Total commitments do not exceed funding limitations in the financial system.	In the financial system the USCG may record commitments in excess of funding limitations.	
2.	All commitment transactions are properly authorized in the financial system.	In the financial system the USCG records unauthorized commitment transactions.	
3.	All commitment transactions are recorded in the financial system with the proper fiscal period, appropriation symbol, and amount.	All commitment transactions recorded in the USCG financial system do not reflect the proper fiscal period, appropriation symbol, and amount.	
Assumptions			
Ref			
1.	Approvals and Segregation of Duties will be implemented.		
2.	Contract Information Management System (CIMS) will no longer interface with the new CAS. Contracts will be managed in a Commercial Off the Shelf (COTS) module inherently integrated with the new CAS (e.g., Contract Lifecycle Management (CLM) /PRISM).		
3.	PRs related to large contracts will be treated the same as other PRs.		
Gap Analysis			
Ref	Gap	Impact	
1.	TBD	TBD	
Other Considerations / Comments			
1.			

Figure 5: USCG FM Future State Control Objectives & Risk [1]

It is worth noting that the process diagrams included in Figure 4 are linear, beginning with the operational unit that initiates the process, and ending with an award (order being made for procurement) made by the contracting officer and the requisite records being made in the FM application. This is significant due to the fact that feedback mechanisms or the manner in which the various system components (people and teams, software applications, IT systems, USCG

units) interact is not inherently obvious. This may suggest a lack of consideration of the necessary feedbacks, and hence inherent risk in the re-engineered process. Also, in the USCG's FM system, transactions are completed by several sequential and sometimes iterative steps. The complexity of these interactions is not captured in the process diagrams, and will be analyzed and discussed in greater detail in subsequent portions of this thesis.

The BPR study is a positive step in the challenging process of realigning the USCG's FM and business support systems. The BPR study does not, however, provide complete insight into the expected performance or behavior of the system in operation, and does not address system hazards. Rather, the BPR report represents the various activities as linear processes by specifying how various FM activities, based on a defined set of assumptions, conditions, and constraints will be sequentially performed. It does not address, for example, how the future system state would perform if organizational elements (funds managers, acquisition managers) do not interact in an effective manner, if the system is not designed correctly, or if it lacks the necessary capacity or configuration to support its customers. Considering this, it is important that the system is first analyzed and tested to the extent possible of understanding its likely performance when operated, thus identify hazards where possible.

## **Chapter 3—Literature Review**

A literature review is conducted to gain insight as to whether STPA is an appropriate method to answer the research questions posed above. This was achieved by first exploring systems theory as it applies to the USCG FM system. Also, the applicability of using STAMP and STPA (which is based on STAMP) methodologies is presented, including a discussion of tools to facilitate the analysis and ways to gain insight into the results of the hazard analysis.

### **3.1 A Systems Approach**

Systems are characterized by the interaction of hardware (built things), software, data, humans, processes and procedures [9]. In our modern society these interactions grow more and more complicated and dynamic as individual entities and technology also become more complex over time. Examples of socio-technical systems can be found in virtually all domains, including transportation, financial services, health care, entertainment, security, defense, energy, and so forth. For designed systems, it can be difficult to predict the performance or behavior that emerges when a system is “in operation” [10]. The International Council on Systems Engineering (INCOSE) states that a systems approach for analyzing systems focuses on systems as a whole, not on the individual parts. Taking a “systems approach” emphasizes focusing on the system in its entirety—in operation—as opposed to the individual components in isolation or in a static state [9]. The properties that emerge from systems are derived from the relationships, interactions and feedback among the system components. Quite often, the relationships and interactions behave in a non-linear manner.

The USCG, as it exists within the DHS, which in turn is an entity inside of the larger Federal Government, is a socio-technical system. The USCG is comprised of people, ships, aircraft, buildings, communications and information technology systems, training systems, intelligence systems, industrial processes, etc., which interact according to specific protocols, processes and procedures. Together, these entities interact to bring about measurable mission performance<sup>6</sup>. Systems thinking, which addresses the complex interactions among various human and built components and the emergent behavior or performance of the total systems, is a useful way to

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<sup>6</sup> The USCG’s measurable mission performance includes, but is not limited to, number of lives saved, tons of cocaine interdicted, vessel boarded and inspected, or escorts performed.

look at the USCG's FM system [11]. A "systems approach" is especially necessary when considering significant changes that effect its fundamental organization and the processes and activities of the people operating it.

### 3.2 STAMP Causality Model Overview

Hazard analysis is a method of identifying deficiencies and risks in systems before accidents occur. Because the hazard analysis methodology used in my research, STPA, is based on Systems-Theoretic Accident Model and Process (STAMP), it is necessary to begin by discussing STAMP, and how it is used to understand the causality of accidents. With STAMP, accidents are considered to be a control problem. In Leveson's paper *A Systems Theoretic Approach to Safety Engineering*, it is stated that accidents should not be seen as a component reliability problem, but rather as a result of inadequate control or enforcement of safety constraints on the design, development and operation of the system [12].

As Leveson presents in her work, the STAMP model of accident causality is built on three concepts: 1) safety constraints, 2) hierarchical safety control structure, and 3) process models. In STAMP, systems are viewed as interrelated components kept in a state of dynamic equilibrium by feedback control loops. Systems are not treated as static, but as dynamic processes continually adapting to achieve their ends while reacting to changes in themselves and their environment [13].

#### 3.2.1 System Safety Constraints

In a general sense, safety constraints allow system designers to specify safety-related requirements [14]. An example of a safety constraint would be an electro-mechanical interlock on a machine that prevents its movement or operation if controllers are in certain positions; physical barriers that protect humans from coming in contact with hazardous materials; or protocols that direct operations in a manner that prevents accidents from occurring. In the context of the USCG's FM system, a safety constraint would be for individuals (e.g., funds managers) to have established credentials in order to access and perform tasks in the FM application. Another example would be that transactions (procurements) could not be performed in the FM software application if there were an insufficient account balance. Accidents occur

when safety constraints are not enforced. The USCG's financial system is laden with safety constraints. The constraints are codified in laws, regulations, and job process guides, and hard-coded into FM applications. There may be gaps, and even in spite of these constraints, it is possible that accidents can occur based on the manner in which the human controllers interact and operate the system.

### 3.2.2 *System Control Structure*

Leveson describes that systems exist as hierarchical structures, where each level imposes constraints on the activity of the level below it. Constraints, or lack thereof, bring about the performance or behavior of lower level processes. Control processes operate between levels to control the processes at lower levels in the hierarchy. These control processes enforce the safety constraints for which the control process is responsible [13]. In the USCG, constraints are typically enforced through the hierarchal chain of command structures outlined in Figures 1, 2, 4 and 5 as presented above.

Accidents occur in a system when the governing processes intended for control are not present, or when the safety constraints of the system are violated. By describing accidents in terms of a hierarchy of control based on feedback mechanisms, adaptation also plays a central role in the understanding and prevention of accidents [13]. Systems can migrate from a "safe" state of operation to an unsafe state over time. For example, a change in staffing, lapse in training, modifications to a system component, or processes employed by the operators can cause the system to move to an unsafe state. At each level of the hierarchical structure, inadequate control may result from a missing constraint (unassigned responsibility for action in the system), inadequate safety control commands (unspecified processes, design deficiency), commands that were not executed correctly at a lower level (training gap), or inadequately communicated or processed feedback about constraint enforcement [13].

The following is a generalized model of a socio-technical hierarchy control structure from Leveson's book, *Engineering a Safer World* [13]. Figure 6 below represents the manner in which systems are developed and operated, including the critical feedback loops that exist in the system.

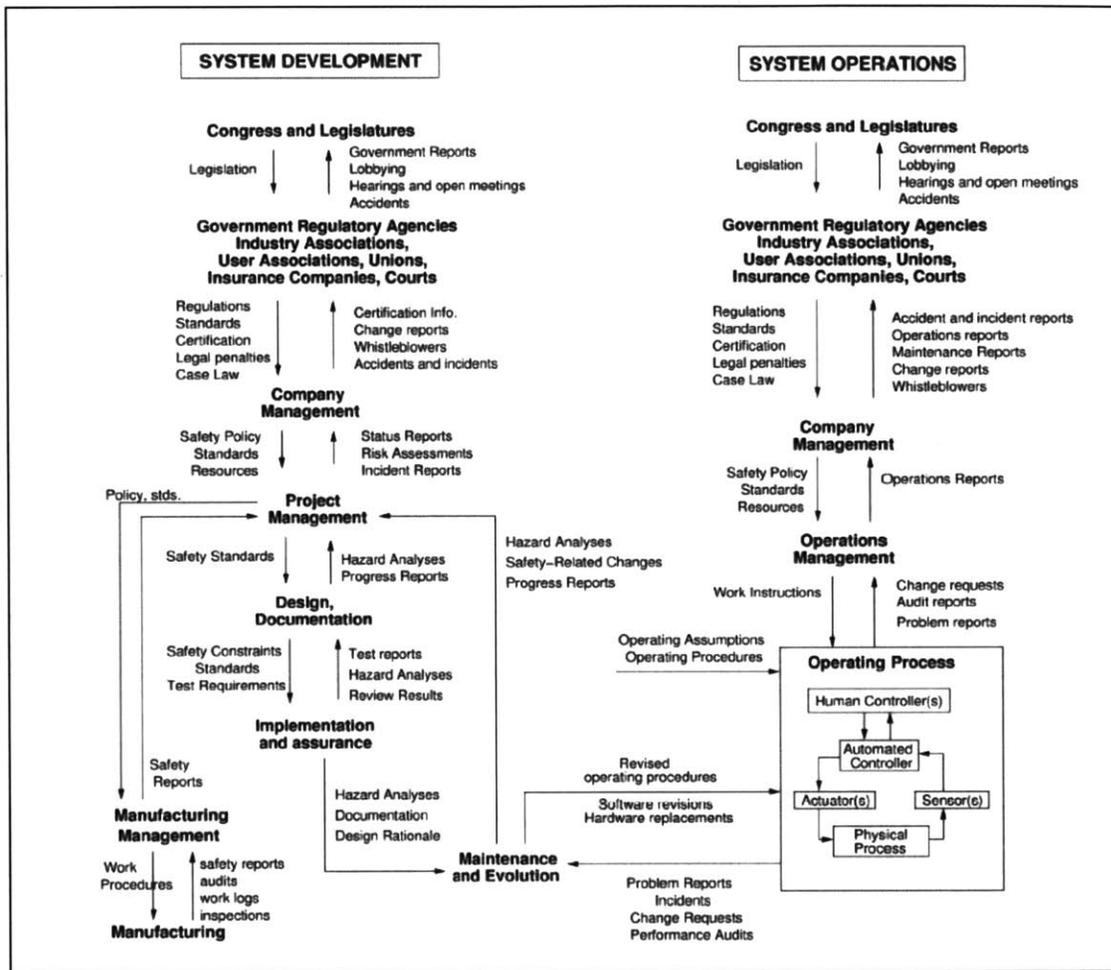


Figure 6: Generalized Control Structure Diagram [13]

Of special note is the Operating Process that is embedded within the System Operation structure in the lower right portion of Figure 6. From within the operating process emerges the measurable output and usefulness of the system. Inside of the operating process is a control loop that consists of a controller (that can be automated or a human), actuator(s), controlled process, and sensor(s). When the system is operated, it is the interactions and feedback that occur among these components that determine the state, safety, performance or behavior (output) of the system. The same operating process, as it would exist in the USCG FM system operation, is described in greater detail in Figure 7 and in the following text below.

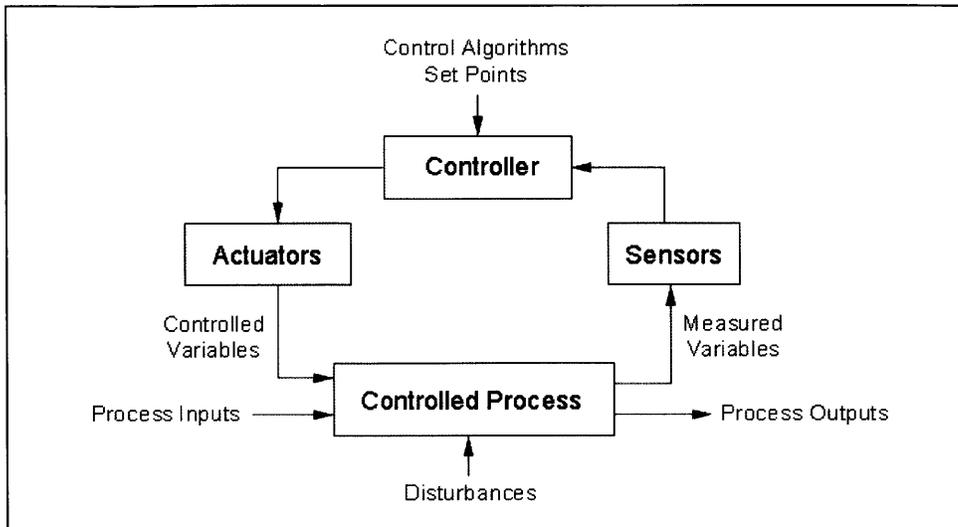


Figure 7: Control Loop (Leveson)

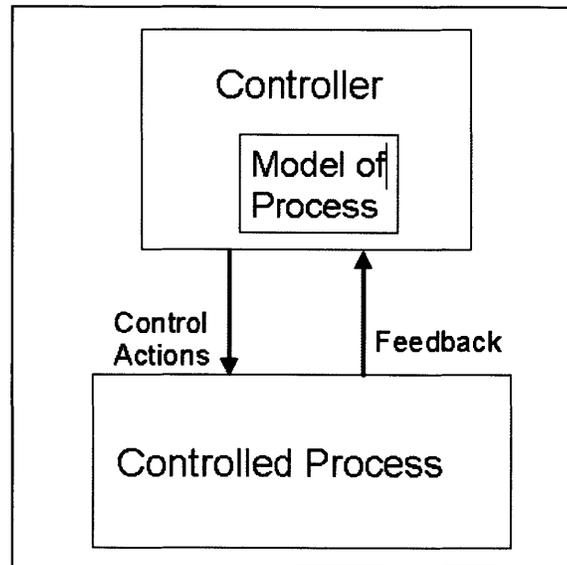
1. **Controller:** Funds manager; makes decisions and takes action to control the system, based on the process model
2. **Actuator:** Transmits or conveys data or information downward from the controller to affect the state of the system to the controlled process
3. **Controlled Process:** USCG's FM software (Core Accounting System); financial transactions that support USCG operations
4. **Sensor:** Conveys upward feedback for the state of the system to the controller, who interprets the observed condition

This generalized theoretical control diagram serves as the basis for performing the STPA analysis, specifically for creating the control diagram for the USCG FM system which is addressed in Chapter 4.

### 3.2.3 System Process Models

Process models are required for control in systems. In STAMP (and STPA), the goal of a process model is the enforcement of safety constraints by the controller. Enforcing safety constraints is achieved by implementing control actions (downward in the system via actuators), receiving observed behavior of the process (upward in the system via system sensors), and assessing the model's condition or state [13]. In the USCG's FM system, the process models of the system controllers, particularly those of the individuals who operate it, are extremely

important for achieving safe system performance. In the USCG FM system, the process models of the controllers can be thought of as the aggregation of their past experiences, training, certification, job description, understanding of the system goals, and criteria used for decision-making necessary to achieve desired system performance<sup>7</sup>. Flawed decision-making can be the result of inaccurate or miscalibrated process models. The following figure is a generalized process model for a controller in a system.



**Figure 8: Generalized Process Control Model [10]**

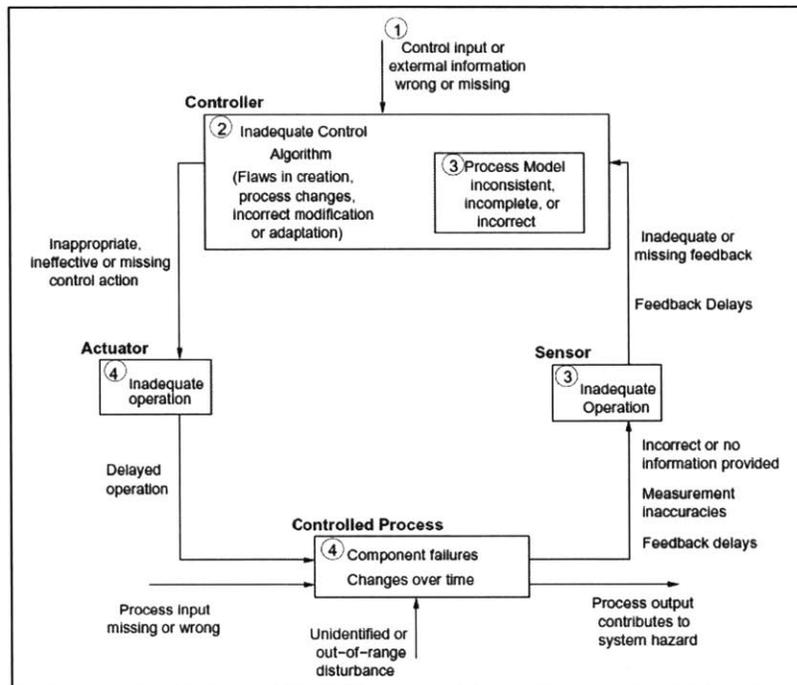
A controller's (human, software-hardware) flawed model of the process could result in "unsafe" control actions, affect the controlled process, and create hazards in the system. In STAMP, accident causality, or the presence of hazards, can be classified by the following:

1. Unsafe Inputs
2. Unsafe Control Algorithms or Control Actions
3. Inconsistent, Incomplete or Incorrect Process Models
4. Response of the Controlled Process

Figure 9 below illustrates how the classification of accident causality would exist in a system and lead to hazards.

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<sup>7</sup> In the Coast Guard's financial management system, process models can also be thought of as the *mental models* for the individual system operators.



**Figure 9: Accident Causality (Leveson)**

Note: In the STPA analysis performed in the research, a more specific set of causal factor guidewords is used to analyze the system.

### 3.3 STPA Method

Based on STAMP, System Theoretic Process Analysis (STPA) is a hazard analysis technique that treats safety as a control problem, rather than a specific component or design problem. STPA builds upon the causal factors identified in STAMP and improves techniques for analyzing system hazards [13]. Systems, both in design and operation, are comprised of interacting loops of control comprised of controllers, actuators, controlled processes and sensors as presented in the prior section. Among the primary benefits of using STPA is that it can be applied during the design phase, prior to the implementation of the design and system operation. For this reason, STPA is applicable to analyzing the future state of the USCG FM system [15]. Moreover STAMP (which STPA is built upon) has also been proven as a useful method for investigating accidents that have occurred in USCG systems<sup>8</sup> [16] [17]. Since STPA is a

<sup>8</sup> Two of my USCG MIT-SDM predecessors, Jon Hickey and Steven Osgood, used system engineering tools and methods (specifically STAMP and CAST methods) to analyze and recommend improvements for USCG systems and programs.

relatively new method for hazard analysis, I anticipate this research will be useful for the USCG in the future, as well as other organizations that design and operate complex socio-technical systems

STPA is performed in two steps. The first step entails identifying the potential for inadequate control in the system that could cause a hazardous state. Inadequate system controls result in hazard states, and can cause accidents (losses) [13]. Inadequate controls occur because [15]:

1. A required control action to maintain safety is not provided
2. An incorrect or unsafe control action is provided that induces a loss
3. A potentially correct or adequate control action is provided too early, too late, or out of sequence
4. A correct control action is stopped too soon

Systems typically require control action from both human and automated controllers to maintain safe operation. In STPA, a functional control structure diagram for the system of interest must be defined. Defining the control structure is an important preliminary step in STPA, and requires a detailed understanding of the system, especially the interactions between system components. The resolution and level of detail provided in the control diagram is proportional to the usefulness derived from performing the hazard analysis. Inadequate control in a system would fall into one of the four above categories outlined above.

The second step in STPA is to determine how potentially hazardous control actions occur in the system. This is achieved through an examination of the control loops in the system. Based on the results of the analysis, additional controls or mitigating measures can be integrated into the system to increase system safety and performance [13]. Figure 10 below presents generalized approaches that can be used to address system hazards. For system stakeholders, it is worth noting the relationship between the approach to mitigating hazards or risks in the system, and the effectiveness and cost of the approach. From this figure, it is most effective to eliminate hazards as compared to focusing on damage reduction measures. As is the case in most projects, specifying requirements early in the project lifecycle is preferred, compared to waiting until the system is substantially developed or built.

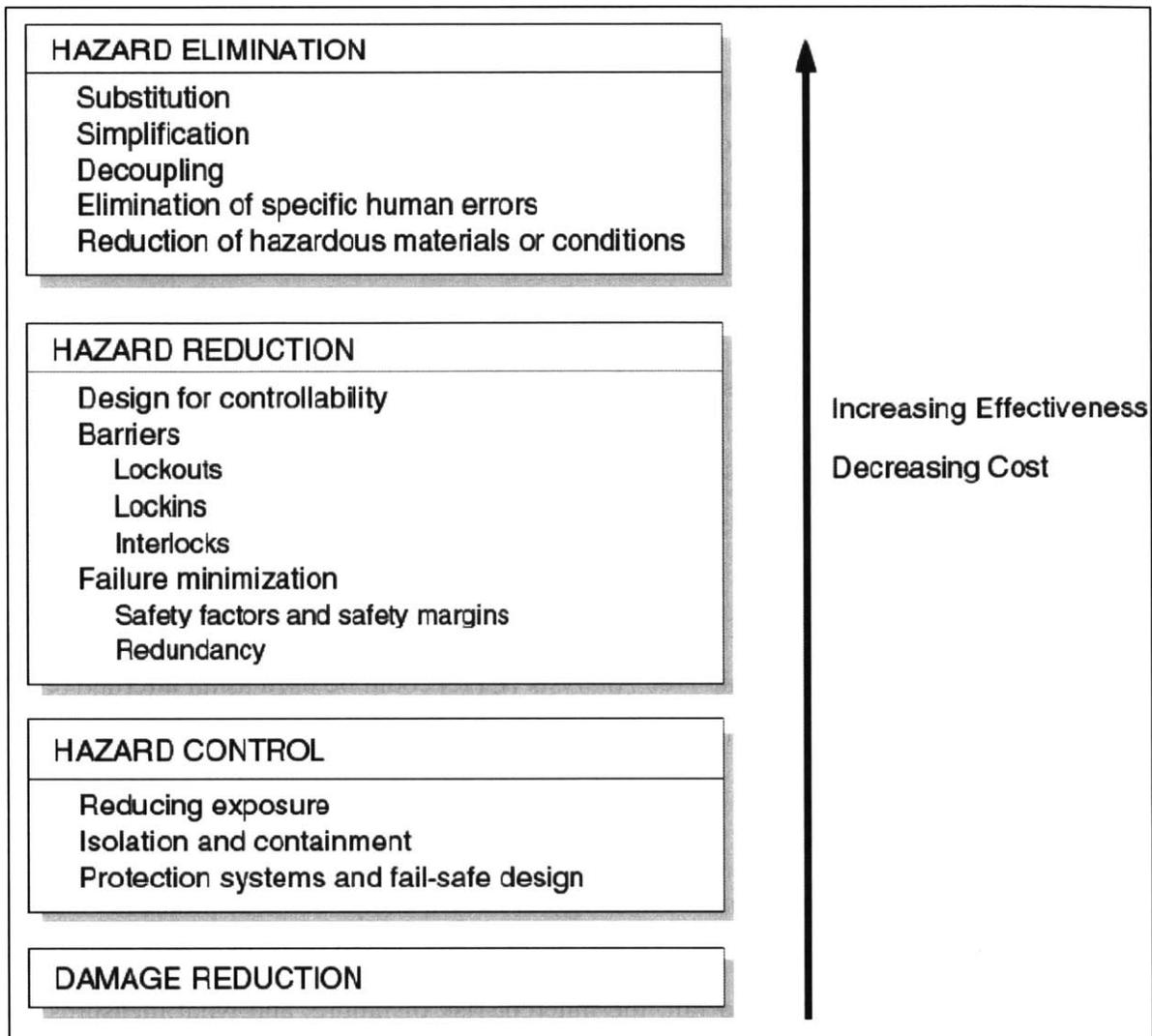


Figure 10: Addressing System Hazards [13]

### 3.4 Safety Hazard Analysis Tool (SafetyHAT)

As in STAMP, a thorough and methodical process must be followed to conduct a hazard analysis using the STPA methodology. Depending on the size and complexity of the system, using STPA can become difficult if only using basic tools such as spreadsheets to perform the analysis. For example, a modification to the control diagram, controller actions and/or hazards necessitates tremendous care to ensure the changes are consistently documented and the integrity of the analysis is maintained. The complexity of the process can be overwhelming, especially if there are breaks during the analysis or multiple people performing the analysis.

In response to this challenge, Dr. Qi Van Eikema Hommes and Mr. Chris Becker from the Volpe National Transportation Systems Center developed the Safety Hazard Analysis Tool (SafetyHAT) as a means to efficiently perform STPA. SafetyHAT is built on a Microsoft Access software platform, and guides users through the application of STPA based on the two-part process of Leveson. With SafetyHAT, the application of STPA is possible in a methodical, repeatable, and traceable manner. [18].

### 3.5 Other Safety Hazard Analysis Techniques

Other hazard analysis techniques could be applied to the USCG FM system. The utility of an alternative method to STPA depends on its attributes, including the appropriateness of applying it at a particular stage of the system development or operation; whether a qualitative or quantitative analysis is preferred; and the desired level of effort or detail desired for the analysis. For the USCG FM system, a Fault Tree Analysis (FTA) could be used as an alternative to STPA to identify system hazards and root causes in the early phases of system development [19].

#### 3.5.1 *Fault Tree Analysis:*

Fault Tree Analysis is a top-down methodology of hazard analysis in which unsafe conditions (or risks) in systems that contribute to an undesirable state or risk are decomposed pictorially to understand how the system could fail, the inherent risk of failure, and what measures could be used to mitigate or manage the risk in the system. In an FTA, a structured logic diagram is used to perform the analysis and decompose events or actions by systematically walking through the chain of causation [20]. FTA is performed by resolving the causes for an undesirable event using an appropriate logic diagram. The decomposition of the event is continued until the basic causes are identified [21]. When the causes are identified, mitigating measures can then be used to address them.

With FTA, the control mechanism for the system is not specifically considered. Also with FTA and other linear approaches, there is more of a focus on *component reliability*, rather than overall *system safety* [10]. For illustration purposes, Figure 11 below is a basic Fault Tree Analysis diagram developed to analyze a hot water heater tank explosion.

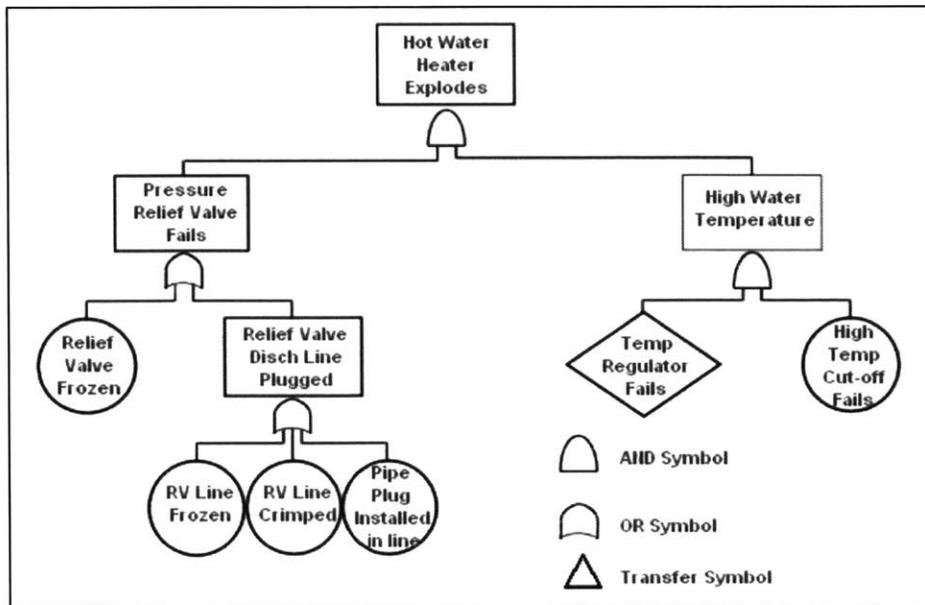


Figure 11: Example Fault Tree Analysis (Resource Engineering, Inc. Image)

### 3.6 System Dynamics

System dynamics is a powerful method of analyzing and understanding complex socio-technical systems. In John Sterman’s book, *Business Dynamics*, he states that “All too often, well-intentioned efforts to solve pressing problems lead to policy resistance, where our policies are delayed, diluted, or defeated by the unforeseen reactions of other people or of nature. Many times, our best efforts to solve a problem often make it worse” [22]. As described in Sterman’s work, system dynamics is an analytical method to improve learning in complex systems, so the effects of actions can be better understood before they are taken. System dynamics is founded in the theory of non-linear dynamics and feedback control, and can help in the understanding the sources of policy resistance. Systems dynamics models are built to solve important problems. The models enable simulations in the systems, and allow system owners to design more effective policies and take better actions that achieve desired performance [22].

In *Business Dynamics*, Sterman describes how system dynamics models can improve the understanding of one’s decisions, so adjustments can be made to align decision-making with the state of the system. With this understanding, mental models can be adjusted and be used to redesign processes and the system itself. Learning in systems involves continuous experimentation, and iterative adjustments to both the structure of the system and the variables

that influence the system's performance. Through learning, systems can be improved and more successful policies implemented, which is extraordinarily useful in complex systems [22]. Among the most useful aspects for learning in systems is the ability to build an understanding of how specific variables and system influencers reinforce desired system behavior, and those that degrade or counteract against it.

The use of causal loop diagrams is a method of relating key variables that may exist in a system. Causal loops are also an effective method of capturing one's hypotheses about the causes of dynamics, and communicating the feedbacks that may be responsible for the problem or condition that is being analyzed in the system. Causal loops consist of variables connected by arrows denoting the causal influence (positively reinforcing, or negatively balancing) among the variables. These are called causal links [22]. Figure 12 below is a simple causal loop diagram that explains population dynamics in a system of interest. Of note is the positive and negative influence, denoted by (+) and (-) symbols, the variables births and deaths have on the population. The parallel lines across the arrows denote a delay that would occur in the system. Generally, a change in the population would not instantaneously result in a greater number of deaths or birth, but both the number of deaths and births would increase (or decrease) as the population size also increased (or decreased).

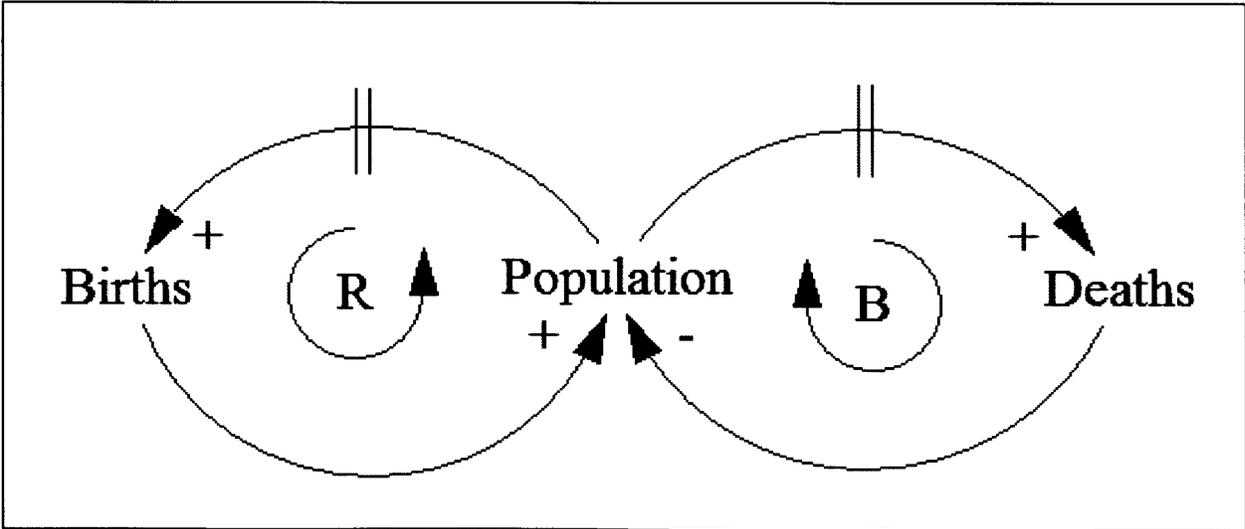


Figure 12: Causal Loop Diagram For Population (Image Wordpress.com)

Performing simulations to quantitatively analyze variables in systems is extremely complex. In a system dynamics model, the relationships between variables would be represented with various mathematical functions and formulas. Fortunately, software applications, such as Vensim, are commercially available and used to develop, analyze, and adjust complex systems based on user inputs [23]. With applications such as Vensim, it is possible to develop very complex models to analyze how systems respond to various inputs over time. Additional information regarding the use of system dynamics modeling and simulation is provided in Chapters 4 and 5.

### 3.7 Literature Review Summary

Based on the literature review conducted, and in consideration of other analyses conducted on USCG systems using techniques built on STAMP, STPA is an appropriate methodology for analyzing the USCG FM system. Although the FTA methodology is also presented and discussed in the preceding section, its applicability and utility for analyzing complex socio-technical systems, such as the USCG FM system, is assessed to be less than that of STPA. Furthermore, STPA is a relatively new methodology and it is therefore desirable to apply it to new problems and build upon existing work. Considering the thesis work of my two USCG colleagues and MIT-SDM Program predecessors, this will be especially beneficial for enhancing the culture of *system thinking* within the USCG.

Considering the scope and complexity of the analysis that will be performed, employing Volpe's SafetyHAT tool is also appropriate for the analysis. To date, the use of SafetyHAT has not been documented or assessed outside of the Volpe Center. Finally, system dynamics will prove useful to facilitate learning and a better understanding as to how the USCG FM system will perform once it is implemented. System dynamics modeling can be used to help system designers develop improvements to the USCG FM system and make informed decisions regarding design changes or trade-offs.

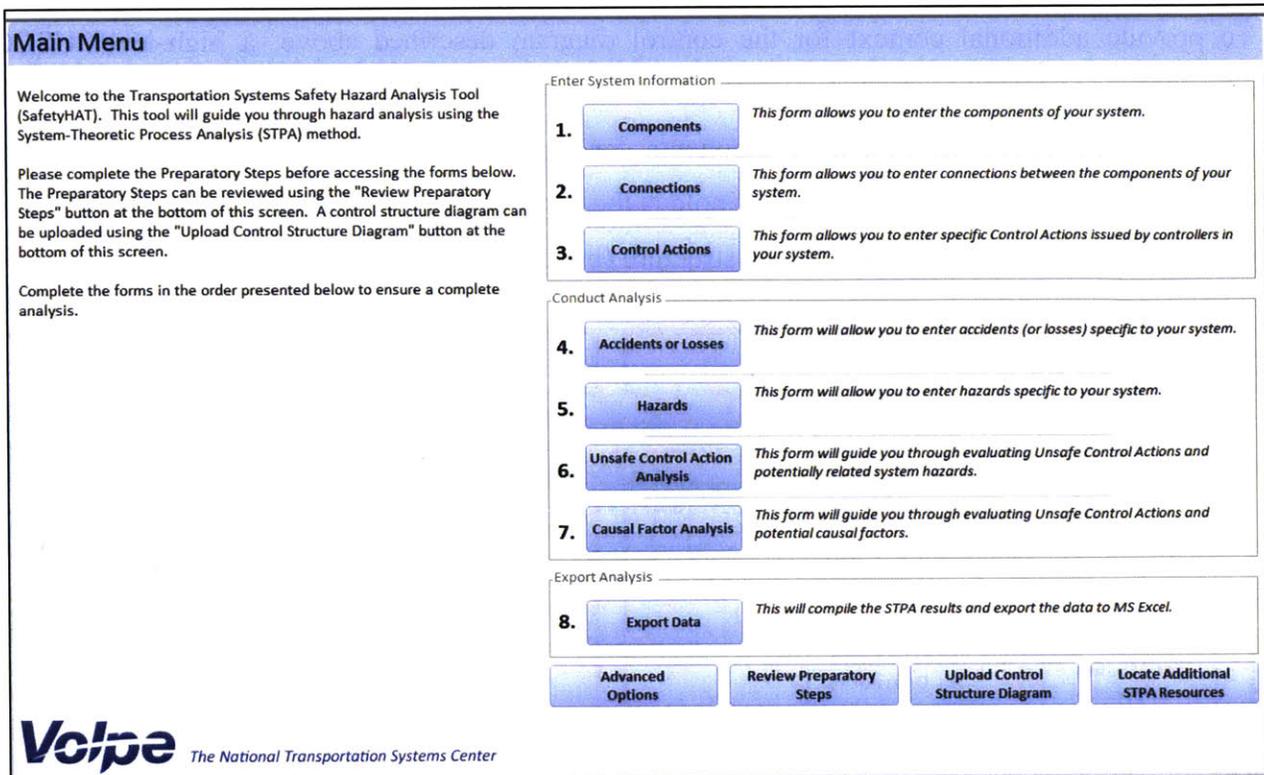
## **Chapter 4: Application of STPA**

### 4.1 STPA Analysis

To facilitate the analysis of the “to be” state of the USCG FM system, a procurement transaction of a generic product or service was analyzed. For the transaction, it is assumed that the operating unit making the request to procure the product or service is supported by a Base logistics activity, as described in Figure 2. The processes and constraints that govern this request are based on the information outlined in the Draft BPR report. The system hazard analysis for this transaction was conducted according to the STPA methodology described in Leveson’s book *Engineering a Safer World*, and paper *Modeling and Hazard Analysis Using STPA* [13] [15].

#### *4.1.1 SafetyHAT Preparatory Steps*

Thanks to my thesis advisor, Dr. Qi Van Eikema Hommes and her colleagues at the Volpe National Transportation System Center, I was able to use the SafetyHAT Tool for this analysis and research prior to its formal release outside of the Volpe Center. The SafetyHAT tool facilitated the STPA in an extraordinarily efficient, highly effective, well-organized manner. With an understanding of how to conduct an STPA hazard analysis, the tool guides users through the STPA process in eight sequential steps based on Leveson’s work. Overall, the tool is very intuitive, and has features the user can reference to guide the analysis. Figure 13 below shows the main screen in SafetyHAT, and identifies the steps and actions required for the analysis:



**Figure 13: SafetyHAT Analysis Steps as Represented on Main Menu Screen**

As a preparatory step for applying STPA using SafetyHAT, the user must first identify the system losses (accidents) and hazards. Also, a hierarchical control structure diagram for the system being analyzed must also be developed. For this analysis the control structure diagram replicates the FM system where an operating unit makes a request for a product or service, through the point in the process where the requested product/service is delivered to the operating unit by a commercial vendor.

The Microsoft Visio software program was used to generate the control diagram for the system. Developing the control diagram was an iterative process. It is worth noting there was significant learning about the system operation during the iterations, which ultimately helped in the understanding and analysis of the system. Also, as in most complex socio-technical systems, there was a need to differentiate between time-sequenced steps in the processes in order to perform the hazard analysis. Using the MS Visio layer functions greatly helped with this process.

To provide additional context for the control diagram described above, a high-level USCG control structure is presented below in Figure 14. The diagram helps illustrate the hierarchy and relationships of various system components for both the system development and system operation entities within the USCG. Of note is the system of interest boundary embedded within the system operation side of the control structure (bottom right of the figure below).

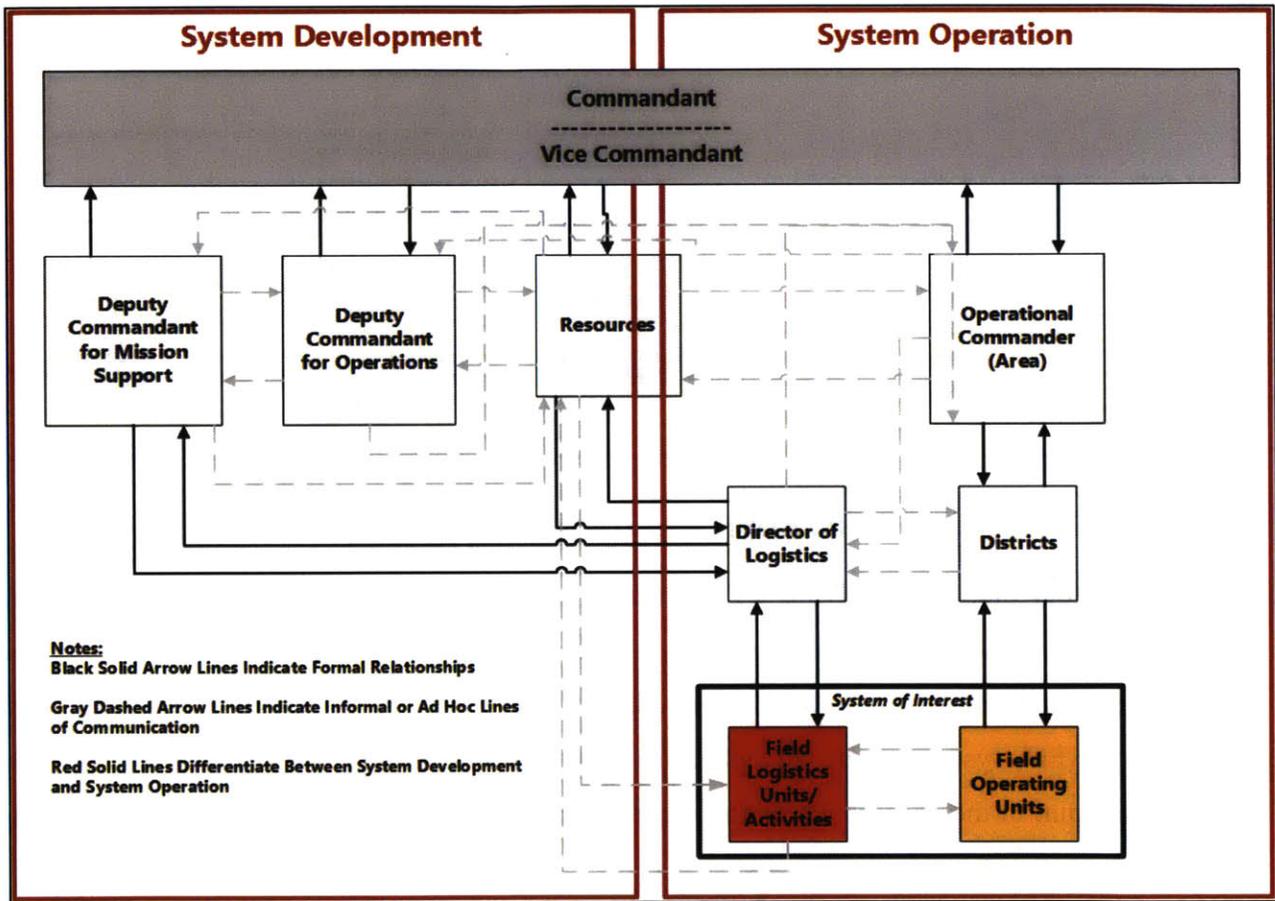


Figure 14: Generalized USCG Control Structure Diagram

A more detailed control diagram is provided below in Figure 15. This diagram shows the level of detail needed to actually perform the hazard analysis using STPA, including the individual components of the system, loops, and feedback pathways. Each of the funds management and procurement steps that must occur from the operating unit’s request, through delivery of the product or service, is represented in the various color-coded loops. The sequencing of activities and actions indicated by the system components are based on information outlined in the USCG FM BPR Report and activities specified in the Simplified Acquisitions Procedures (SAP)

Manual, USCG Finance Center Standard Operating Procedures [1] [8] [24]. Note: the control diagram does not include or represent iterations caused by errors that may occur as the request progresses through the FM system.

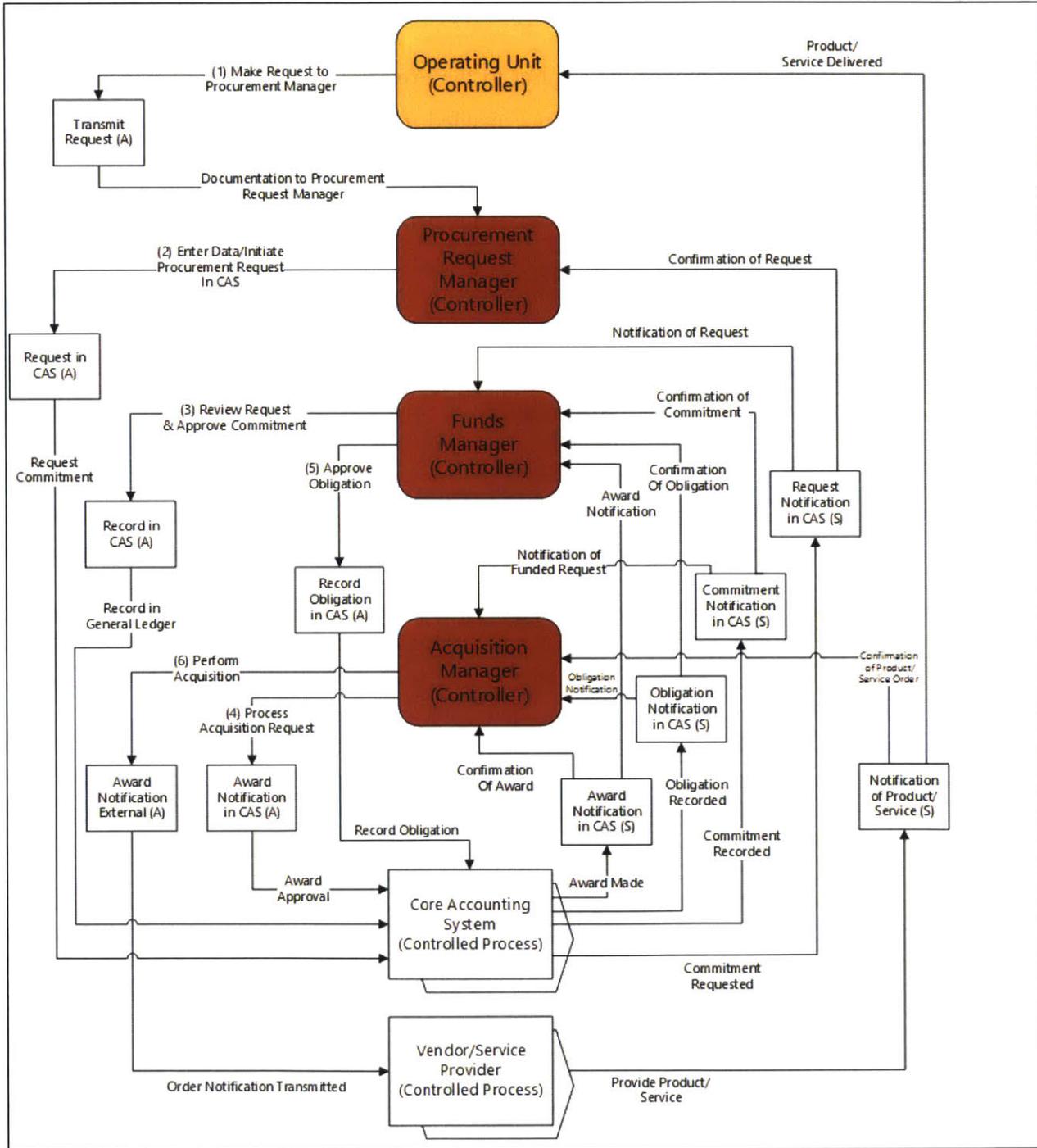
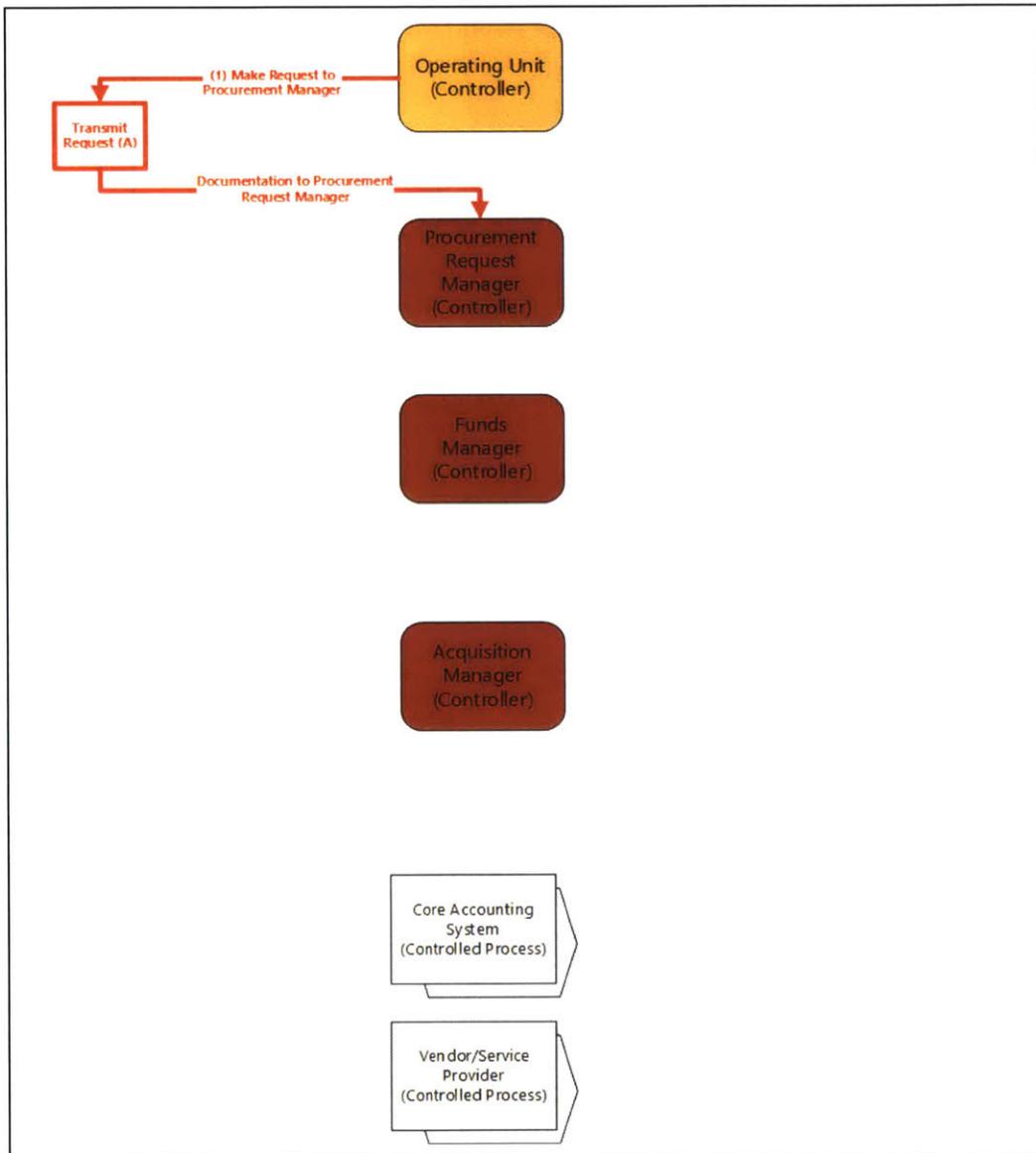


Figure 15: USCG FM Control Diagram Structure (Organizational Unit Committed Obligation)

When represented concurrently, the various steps in the control diagram become difficult to distinguish. To better describe how the FM system operates, each of the individual steps required to complete the transaction in the USCG FM system is broken out and described in more detail.

**Step 1:** The Operating Unit makes the request to the Procurement Request Manager based on the requirement to obtain a product or service needed to support the unit's operations. This action is represented in the red colored line in Figure 16.



**Figure 16: Request to Procurement Request Manager (Step 1)**

**Step 2:** The Procurement Request Manager enters the necessary data into the FM application (Core Accounting System, CAS). The request is then transmitted to the Funds Manager. This step is represented below in Figure 17 as the bold magenta colored loop.

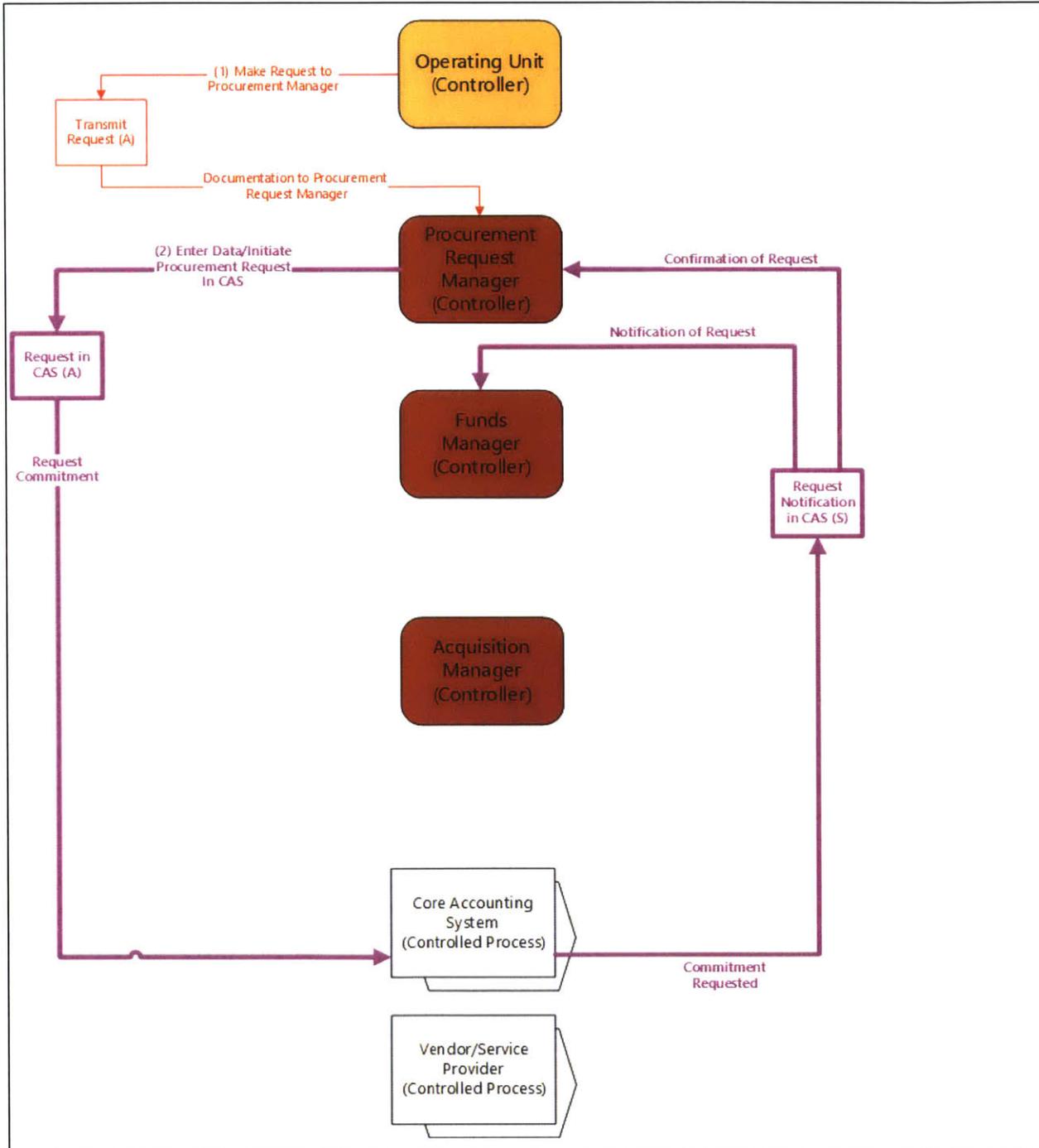
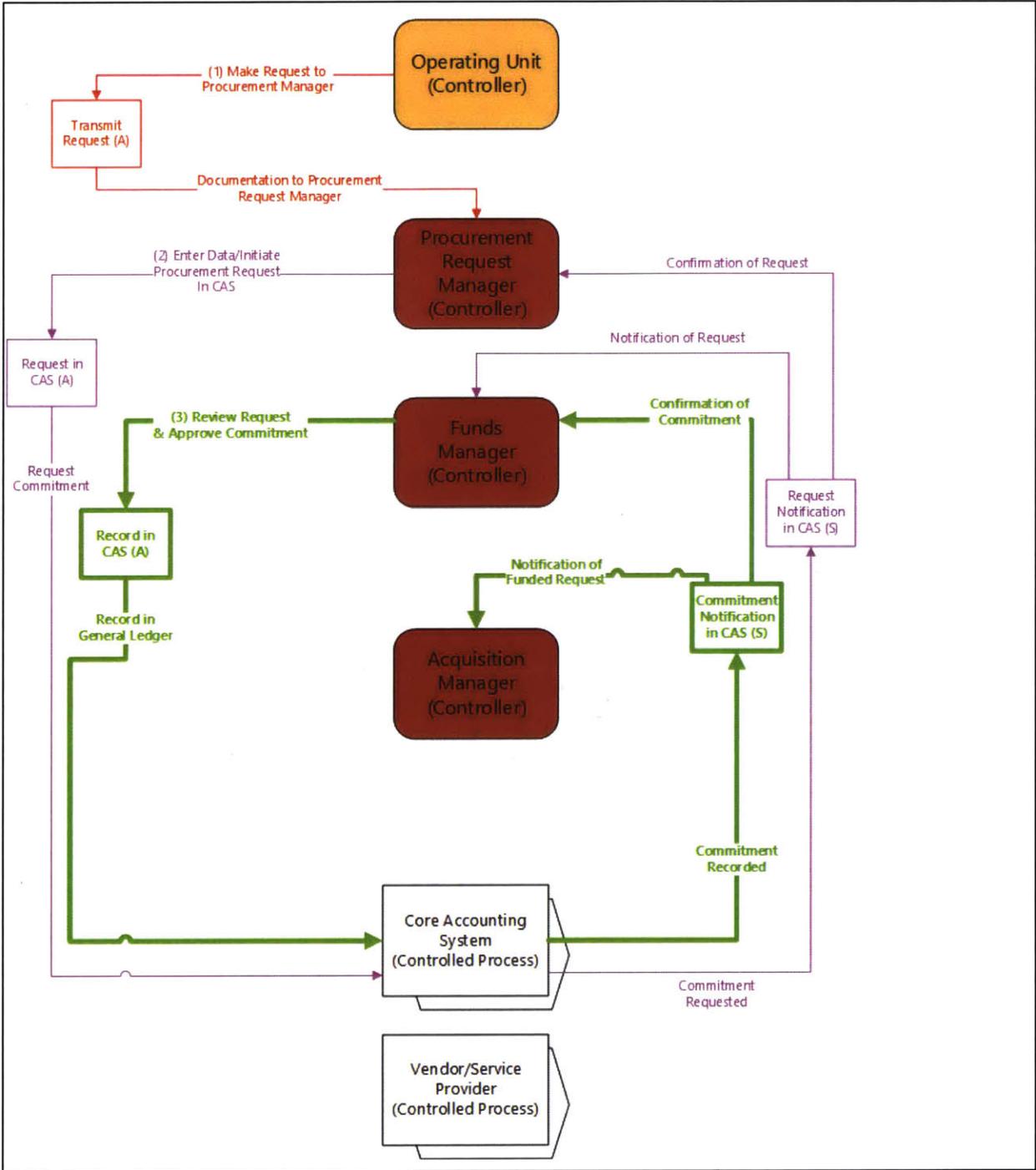


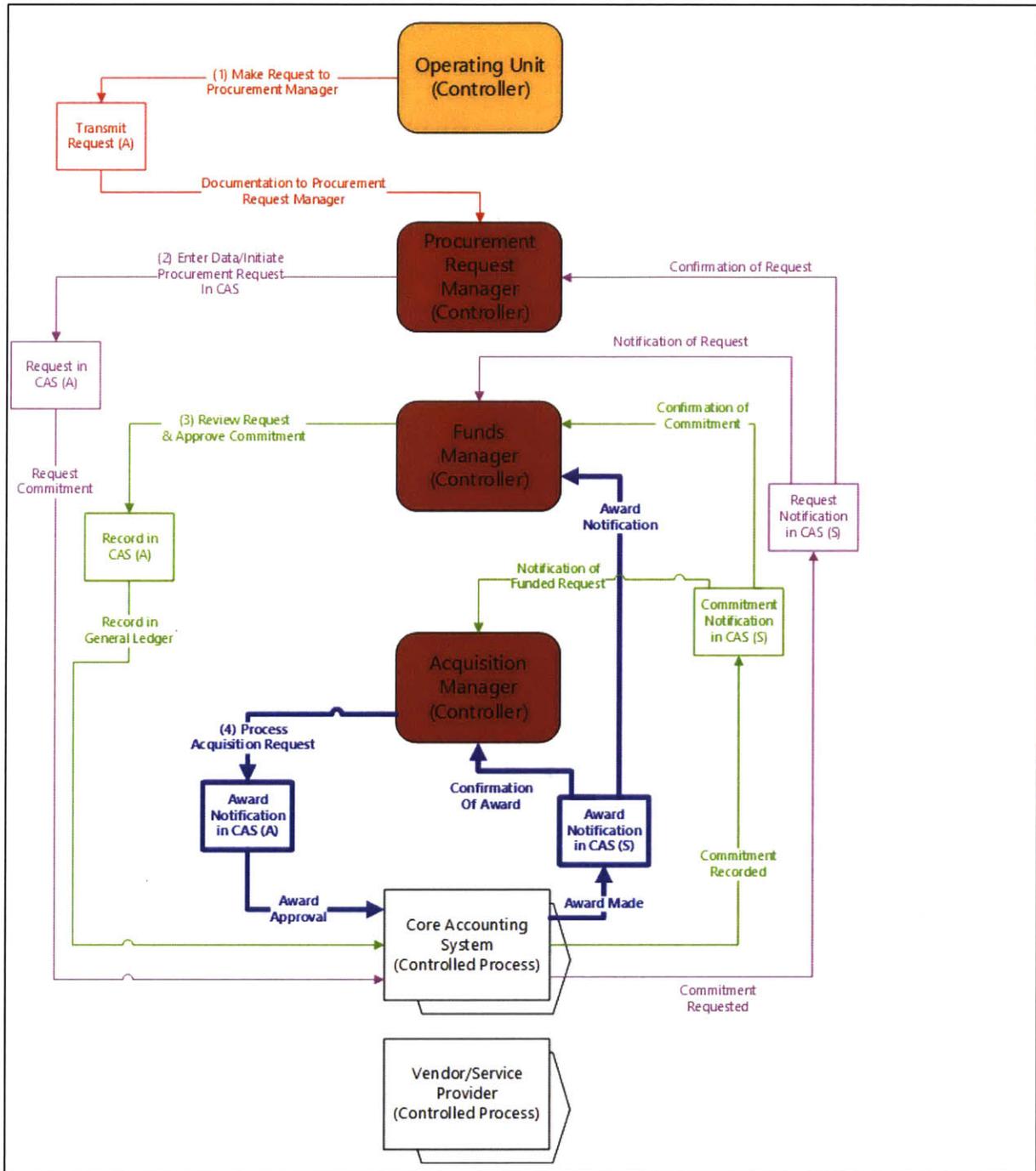
Figure 17: Enter Request in CAS (Step 2)

**Step 3:** The Funds Manager reviews the request and approves it in CAS. Notification of the approved request is made to the Acquisition Manager. This step is represented below in Figure 18 as the bold green colored loop.



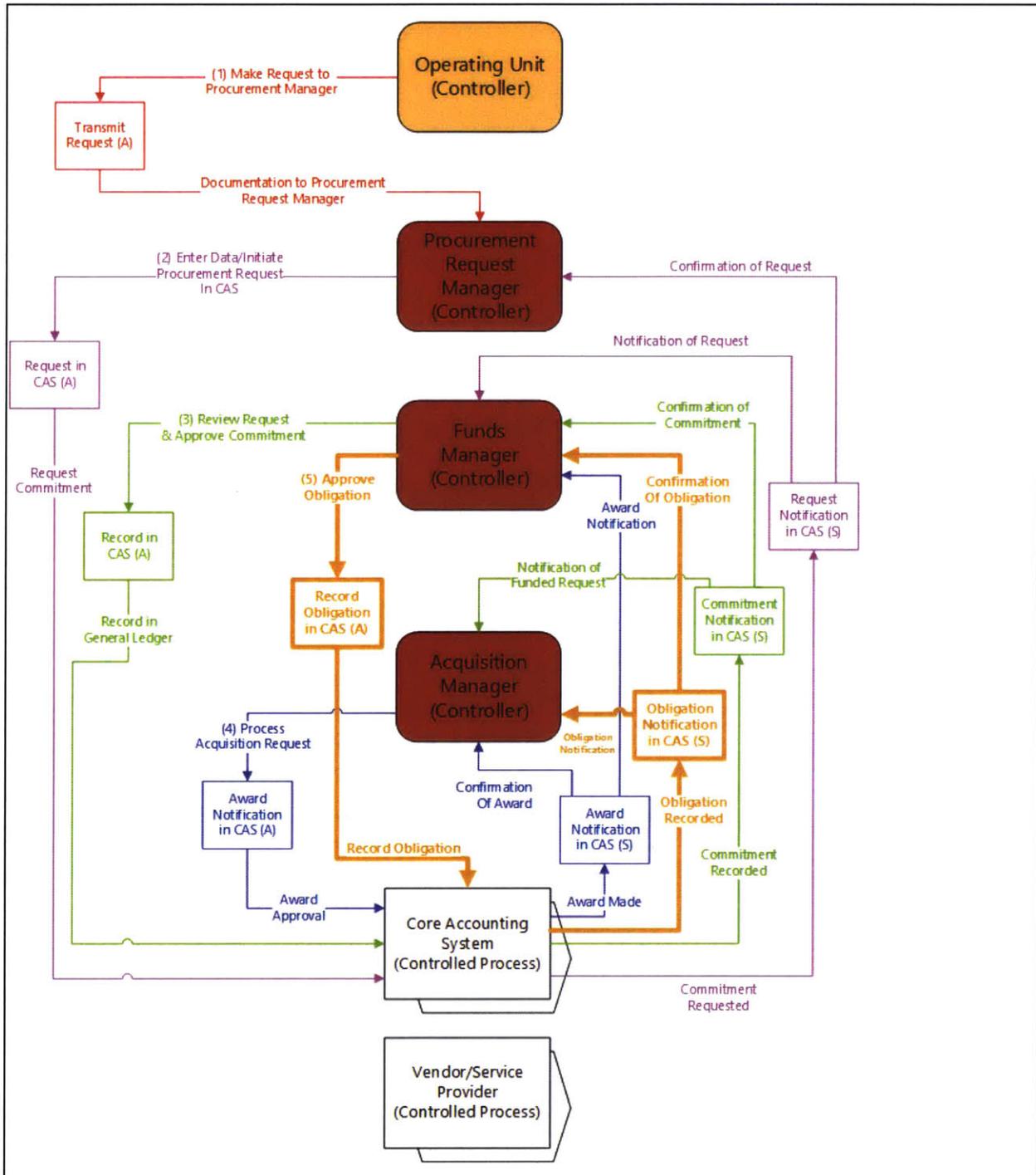
**Figure 18: Review and Approve Commitment (Step 3)**

**Step 4:** The Acquisition Manger performs the acquisition process and makes the award notification in CAS. The Funds Manager is notified for additional funds management actions required to complete the procurement in CAS. This step is represented below in Figure 19 as the blue colored loop.



**Figure 19: Process Acquisition Request (Step 4)**

**Step 5:** The Funds Manager approves the obligation in CAS for the final amount of the award based on the Acquisition Manager's prior acquisition process. This step is represented below in Figure 20 as the bold gold colored loop.



**Figure 20: Approve Obligation (Step 5)**

**Step #6:** The Acquisition Manager provides notification to the vendor that is authorized to deliver the contractually agreed-upon product or service. This step is represented below in Figure 21 as the olive colored loop, and completes the process for the committed obligation process that is being analyzed. Upon notification, the vendor will deliver the product or service to the operating unit.

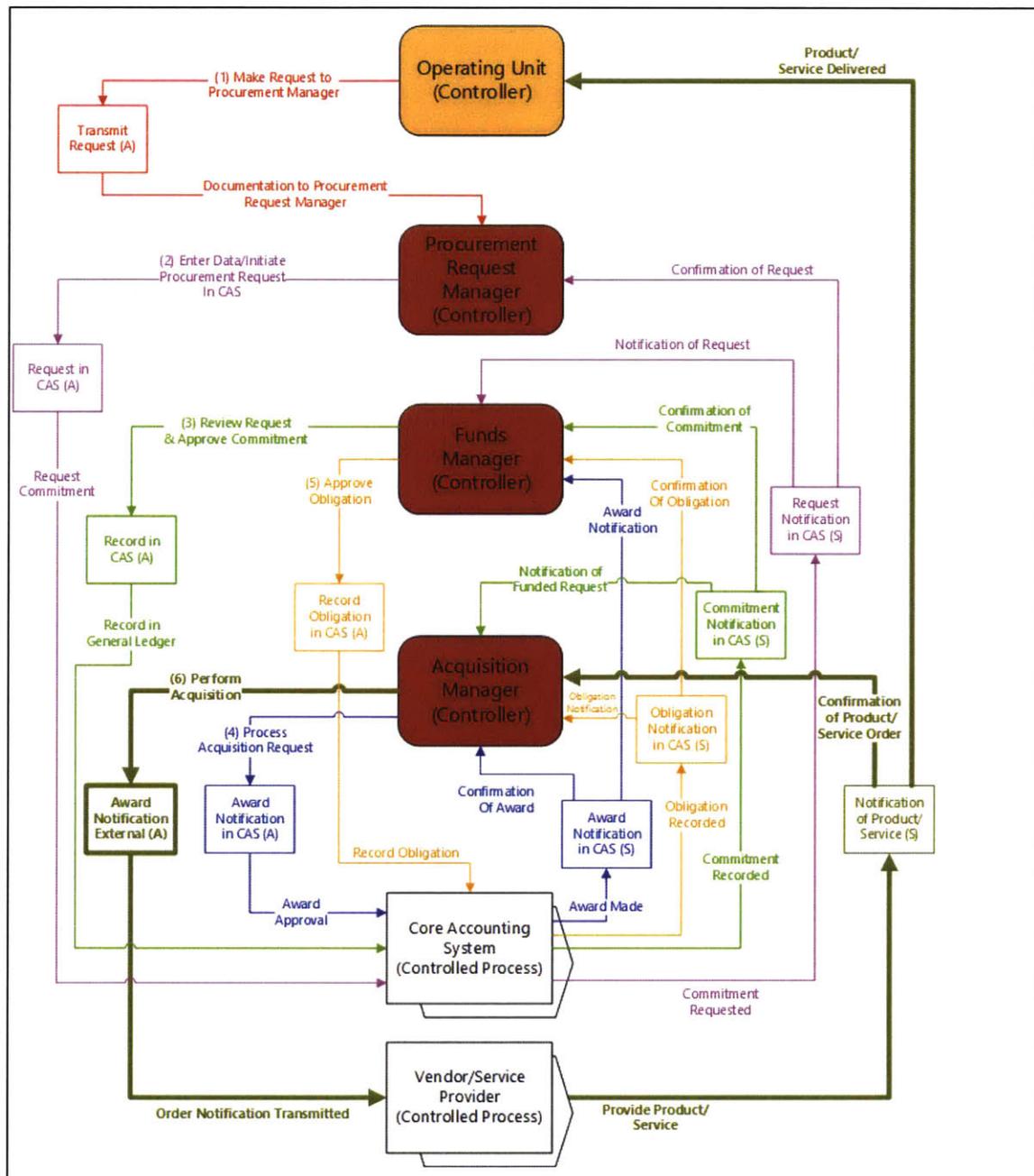


Figure 21: Process Acquisition (Step 6)

#### 4.1.2 SafetyHAT Analysis

Based on these preliminary steps outlined above, the STPA analysis was performed using SafetyHAT, and is described below.

##### Step 1: System Component Input

In this first step, components (controllers, actuators, sensors and controlled processes) for the system are input based on the structure of the control diagram. A description for each of the components is also provided<sup>9</sup>. Figure 22 below includes the listing of the system components according to the control structure diagram presented above.

The screenshot shows the 'System Component Input Form' in SafetyHAT. The interface includes a progress bar at the top indicating 'Step: 1' out of 8. The main area is split into two panels. The left panel, 'Review Existing System Components', displays a list of components with sorting options. The right panel, 'Add New System Component', contains input fields for the component name and description, along with action buttons. The bottom of the form features a navigation bar with buttons for returning to the main menu, navigating between steps, viewing the control structure diagram, closing the form, and accessing form guidance. The Volpe logo and organizational name are located in the bottom left corner.

Figure 22: System Component Input Form (Step 1) in SafetyHAT

<sup>9</sup> In this step (Step 1), and in all of the other subsequent steps, SafetyHAT allows the user to enter detailed descriptions relating to the components, connections, and actions to support the analysis.

## Step 2: System Connection Input Form

System connections represent the directional flow or interactions (upward, downward, input, output) between system components, as represented in the control structure diagram. Components have different functions in the system, and are therefore assigned as “component types” in this step (Figure 23).

From	Type	To	Type
Acquisition Manager	Controller	Award Notification in CAS (A)	Actuator
Acquisition Manager	Controller	Award Notification External (A)	Actuator
Award Notification External (A)	Actuator	Vendor/Service Provider (CP)	Controlled Process
Award Notification in CAS (A)	Actuator	Core Accounting System (CP)	Controlled Process
Award Notification in CAS (S)	Sensor	Acquisition Manager	Controller
Award Notification in CAS (S)	Sensor	Funds Manager	Controller
Commitment Notification in CA	Sensor	Acquisition Manager	Controller
Commitment Notification in CA	Sensor	Funds Manager	Controller
Core Accounting System (CP)	Controlled Process	Obligation Notification in CAS (S)	Sensor
Core Accounting System (CP)	Controlled Process	Commitment Notification in CA	Sensor
Core Accounting System (CP)	Controlled Process	Request Notification in CAS (S)	Sensor
Core Accounting System (CP)	Controlled Process	Award Notification in CAS (S)	Sensor
Funds Manager	Controller	Record Obligation in CAS (A)	Actuator
Funds Manager	Controller	Record in CAS (A)	Actuator
Notification of Product/Service	Sensor	Operating Unit	Controller
Notification of Product/Service	Sensor	Acquisition Manager	Controller
Obligation Notification in CAS (S)	Sensor	Funds Manager	Controller
Obligation Notification in CAS (S)	Sensor	Acquisition Manager	Controller
Operating Unit	Controller	Transmit Request (A)	Actuator
Procurement Request Manager	Controller	Request in CAS (A)	Actuator
Record in CAS (A)	Actuator	Core Accounting System (CP)	Controlled Process
Record Obligation in CAS (A)	Actuator	Core Accounting System (CP)	Controlled Process
Request in CAS (A)	Actuator	Core Accounting System (CP)	Controlled Process
Request Notification in CAS (S)	Sensor	Funds Manager	Controller
Request Notification in CAS (S)	Sensor	Procurement Request Manager	Controller
Transmit Request (A)	Actuator	Procurement Request Manager	Controlled Process

Figure 23: System Connections Input Form (Step 2) in SafetyHAT

## Step 3: Control Action Input Form

Control actions for the system result in the change of the system state. Control actions are necessary to ensure the system functions properly, and ultimately, ensure the safety of the system when it is operated. In this step, control actions for each of the controllers are specified. For example, in the simulated transaction, the Procurement Request Manager would *initiate the procurement request (PR) in the CAS FM application*. A similar input is provided for each of the other controllers (Operating Unit, Funds Manager, Acquisition Manager), along with a description

of the control action. Table 3 below includes a complete listing of control actions for each system controller derived from the information outlined in the USCG FM BPR Report.

**Table 3: Summary to Control Actions**

Controller	Control Action Description
Operating Unit	Makes request to the procurement request manager to initiate an order for products or services
Procurement Request Manager	Initiate Procurement Request (PR) in CAS
Funds Manager	Review request and approve commitment
	Approve obligation
Acquisition Manager	Perform acquisition process for the core accounting system
	Perform acquisition process for external notification to vendor

The input form for this step of the STPA in SafetyHAT is provided in Figure 24 below:

**Figure 24: Control Action Input Form (Step 3) in SafetyHAT**

*Step 4: Accident (or Losses) Input Form*

In the STPA hazard analysis, an accident is defined as an undesired event or condition resulting from a system hazard under worst-case environmental conditions. Accidents lead to losses, but should not be confused with hazards, which are *system states* that lead to accidents. In this stage of the STPA, two separate and distinct accidents are identified in the table below that can occur in the FM System:

**Table 4: Description of Potential System Accidents**

<b>Accident Type</b>	<b>Description</b>
Operating Unit cannot meet operational requirements or commitments.	A breakdown in the financial management/procurement system results in the inability of the frontline operating unit to perform its missions.
Violation of USCG Financial Management Laws and/or policies.	A breakdown in the system results in the violation of Federal/USCG financial management laws or regulations that occur while operating the financial management system.

These accidents represent the two most likely scenarios of losses that occur in the USCG FM system, although certainly other accident types could be defined. Accordingly, this input is provided to SafetyHAT, as represented in Figure 25 below.

Figure 25: Accident (or Losses) Input Form (Step 4) in SafetyHAT

### Step 5: System Hazards Input Form

Hazards are defined as system states or conditions that lead to a system accident under a specific set of worst-case conditions. Hazards are high-level and broadly defined conditions that cause a system accident. For the USCG’s FM system, there are five likely system hazards that exist as presented in Table 5 below. In this step of STPA, each of the hazards is also associated with possible accidents that could result from the system operation. In identifying the system hazards, the list of hazards should be complete, but it is not required to specify every possible hazard scenario. Typically, the number of hazards identified is less than seven [25].

**Table 5: Description of System Hazards and Associated Accident(s)**

<b>System Hazards</b>	<b>Description</b>	<b>Associated Accident(s)</b>
Commitments or obligations are not in line with USCG financial policy, spending plans, or congressional intent.	Commitments or obligations are not in line with USCG missions, spending plan, financial resources management policy, congressional intent, or do not reflect the correct amount or purpose.	Violation of USCG Financial Management Laws and/or policies.
Commitments or obligations are recorded in excess of funding limitations.	The total commitments or obligations exceed funding limitations in the financial system.	Violation of USCG Financial Management Laws and/or policies.
Financial commitments or obligations are inaccurately or improperly recorded in the financial system.	Transactions (commitments and/or obligations) are not properly entered in the financial system, i.e., do not contain the correct fiscal period, appropriation symbol, amount, quantity, and/or purpose.	Violation of USCG Financial Management Laws and/or policies.
Operating unit has missing and/or inoperable equipment, services, or supplies; or lacks qualification.	The procurement of products/services did not occur in a manner that enabled the operating unit to obtain supplies or services to repair assets or maintain a required state of readiness and/or crew qualification.	Operating Unit cannot meet operational requirements or commitments.
		Violation of USCG Financial Management Laws and/or policies.
USCG contracts are executed prior to sufficient funds being appropriated or committed.	USCG contracts are executed, or funds obligated, prior to sufficient funds being appropriated or committed.	Violation of USCG Financial Management Laws and/or policies.

Figure 26 below shows the Hazard input form. The highlighted system hazard on the left-hand side of the column (*Commitments or obligations are recorded in excess of funding limitations*) is associated with the accident on the lower right-hand side (*Violation of USCG Financial Management laws and/or policies*), consistent with the information also presented in Table 5.

**Figure 26: Hazard Input Form (Step 5) in SafetyHAT showing system hazards**

*Step 6: Unsafe Control Action (UCA) Analysis Input Form*

In this step, an assessment is performed to identify potential unsafe control action scenarios that could lead to an unidentified system hazard. In this stage of the analysis, the control actions that were input in Step 3 are assessed using the six unsafe control actions categories presented in Table 6 below, for each of the four controllers.

**Table 6: Possible Unsafe Control Actions Scenarios in SafetyHAT**

Unsafe Control Action Category
Provided when the control action is not needed or unsafe
Provided, but the intensity is incorrect (too much or too little)
Provided, but executed incorrectly
Provided, but duration is too long or too short
Provided, but the starting time is too soon or too late
Not provided when needed to maintain safety

Completing this step, however, requires the user to have a solid understanding of how the system operates, including an understanding of the controllers' actions, process model and system constraints. Not all of the unsafe control action categories are applicable to each of the control actions. Figure 27 below shows the SafetyHAT input form used to analyze each of the control

actions. In the figure, the operating unit's action *Makes request to the procurement request manager to initiate an order for products or services* is analyzed by assessing if an unsafe control action applies to a particular hazard.

Figure 27: Unsafe Control Action Analysis Input Form (Step 6) in SafetyHAT

Table 7 provides a summary and description of the Unsafe Control Actions identified in the system.

### Step 7: Causal Factor Analysis

The final step of STPA using SafetyHAT is to evaluate each of the previously identified unsafe control actions that could lead to a system hazard. This is the most time consuming part of using STPA, and is where the benefits of the SafetyHAT tool are most noticeable. The input form for Step 7 is provided in Figure 28 below.

**Table 7: Component Unsafe Control Actions**

<b>Component Name</b>	<b>Control Action</b>	<b>Unsafe Control Action Description</b>
Procurement Request Manager	Initiate Procurement Request (PR) in CAS	The procurement request manager did not initiate the procurement request, which prevented the product/service from progressing through the financial management system.
Procurement Request Manager	Initiate Procurement Request (PR) in CAS	The request was initiated in the financial management system, but contained data errors, or possibly incorrect routing for transmittal to the level.
Procurement Request Manager	Initiate Procurement Request (PR) in CAS	The product/service requested is incorrect--i.e. wrong vendor, incorrect funding level, wrong quantity, incorrect unit cost or total amount, or incorrect accounting information.
Procurement Request Manager	Initiate Procurement Request (PR) in CAS	The procurement request manager initiated the procurement request too late, which delayed its progress through the financial management system.
Operating Unit	Makes request to the procurement request manager to initiate an order for products or services	The operating unit does not initiate the request to the procurement request manager, which prevented the product/service from being delivered.
Operating Unit	Makes request to the procurement request manager to initiate an order for products or services	The operating unit transmits the incorrect request information (vendor, product, quantity, type, etc.), or makes the request to the incorrect PR manager. This action prevents the transaction from being properly initiated by the PR manager.
Operating Unit	Makes request to the procurement request manager to initiate an order for products or services	The operating unit does not provide all of the required request information to accurately initiate the procurement process.
Operating Unit	Makes request to the procurement request manager to initiate an order for products or services	The operating unit is unable to transmit/provide all of the required request information within prescribed lead-time requirements, which prevents the product/service from being procured and delivered within the required timeframe.
Funds Manager	Approve obligation	The funds manager did not approve the obligation, which delays subsequent steps in procurement process from occurring.
Funds Manager	Approve obligation	The funds manager approves the committed obligation, but the obligation contains inaccurate information that creates errors in the core accounting system.
Funds Manager	Approve obligation	Following the award in CAS, the Funds manager approves the obligation for an amount that exceeds the level of available funding in the system or makes a duplicate entry in the financial management system.
Funds Manager	Approve obligation	The funds manager records the committed obligation too late, which prevents the procurement from progressing through the financial management system.

Funds Manager	Review request and approve commitment	The funds manager received the request, but did not review, verify and/or approve the commitment, which prevented the request for products or services from progressing through the financial management system within acceptable limits.
Funds Manager	Review request and approve commitment	The funds manager reviews and approves the commitment, but it contains errors or inaccurate information that prevents the procurement from progressing through the financial management system.
Funds Manager	Review request and approve commitment	Funds manager approves the procurement request (commitment) for an amount that exceeds the level of funds available in the system.
Funds Manager	Review request and approve commitment	The funds manager reviews, verifies and approves the procurement request too late which prevents the request from progressing through the financial management system within acceptable limits.
Acquisition Manager	Perform acquisition process for external notification to vendor	For External: The acquisition manager does not complete the acquisition process, which results in an unacceptable delay in the delivery of the requested products/services from the vendor to the operating unit.
Acquisition Manager	Perform acquisition process for external notification to vendor	For External: The acquisition manager performs the acquisition process, but all of the steps required to place the order to the vendor are not completed, or are made out of sequence. These conditions could result in delays and/or cause the vendor to provide the incorrect product or service to the operating unit as originally requested. The action could also violate USCG financial management or procurement regulations.
Acquisition Manager	Perform acquisition process for external notification to vendor	For External: The acquisition manager performs the acquisition process, but it is incorrect (i.e., contains wrong vendor, incorrect funding level, wrong quantity, incorrect unit cost or total amount, and/or incorrect accounting information), which results in an incorrect order being prepared for the vendor. This action will likely delay the procurement process and introduce financial errors in CAS.
Acquisition Manager	Perform acquisition process for external notification to vendor	For External: The acquisition manager performs the acquisition process, but it occurs too late and results in an unacceptable delay in processing the order and consequently the delivery of products/services from the vendor to the operating unit.
Acquisition Manager	Perform acquisition process for the core accounting system	CAS: The acquisition manager does not perform the acquisition process, which results in delays in the procurement of the goods or services.
Acquisition Manager	Perform acquisition process for the core accounting system	CAS: The acquisition manager performs the acquisition process, but the transaction is not executed properly and cannot be completed (i.e. incorrect financial information, wrong vendor, insufficient procurement authority), which delays the procurement process and/or violates USCG policies. The process can also be performed out of sequence with other actions, which could be a violation of financial management or procurement regulations.
Acquisition Manager	Perform acquisition process for the core accounting system	CAS: The acquisition manager performs the acquisition process, but it is incorrect (i.e., contains wrong vendor, incorrect funding level, wrong quantity, incorrect unit cost or total amount, and/or incorrect accounting information), which results in erroneous obligations being recorded in CAS. This action will likely delay the procurement process and introduce financial errors in CAS.
Acquisition Manager	Perform acquisition process for the core accounting system	CAS: The acquisition manager performs the acquisition process, but the delayed action prevents the procurement process from being completed within time limits.

**Causal Factor Analysis** Step: 1 2 3 4 5 6 7 8

Unsafe Control Action Details

**Controller 1 of 4**  
Acquisition Manager

**Description 1 of 8**  
For External: The acquisition manager performs the acquisition process, but all of the steps required to place the order to the vendor are not completed, or are made out of sequence. These conditions could result in delays

UCA Analysis Completed

Associated Hazards:  
Operating unit has missing and/or inoperable equipment, services, support contracts are executed prior to sufficient funds being appropriate

Previous Controller Previous Record Next Record Next Controller Add Note

Existing Causal Factor Analyses Sort: Order Entered Component Name A-Z

**Existing Causal Factors for Selected Unsafe Control Action**

Causal Factor	Component Name or Connection From	Connection To
Controlled component failure, change over time	Vendor/Service Provider	
Actuator inadequate operation, change over time	Award Notification Extension	
External disturbances	Acquisition Manager	
Process model or calibration incomplete or incorrect	Acquisition Manager	
Controller to actuator signal ineffective, missing	Acquisition Manager	Award Notification Extension
Actuation delivered incorrectly or inadequately	Award Notification Extension	Vendor/Service Provider
Sensor to controller signal inadequate, missing	Notification of Product	Acquisition Manager

**Causal Factor Analysis**

Select: Component or Connection  
Component

Causal Component  
Vendor/Service Provider (CP)

Component Type  
Controlled Process

Select the Appropriate Causal Factor  
Controlled component failure, change over time

Enter or Select a Causal Factor Description  
The vendor's requirements for taking orders have changed, or new and unfamiliar information is required.

(All Causal Factor Descriptions for Selected Component / Connection and Causal Factor)

Delete Existing Modify Existing Save As New

Return to Main Menu Step 6: Unsafe Ctl Action Analysis Step 8: Export Data View Control Structure Diagram Close Form

Volpe The National Transportation Systems Center Causal Factor Diagram Form Guidance

Figure 28: Causal Factor Analysis Input Form (Step 7) in SafetyHAT

The analysis performed in Step 7 includes an assessment of causal factors of the unsafe control actions initiated by system controllers. In this part of the STPA, causality is examined for each of the system controllers, actuators, controlled processes, sensors, and connections between the components. To aid with the analysis, the SafetyHAT tool has a listing of generalized descriptions for how a UCA could occur in the system based on the research and work of Leveson and others [13]. Research at the Volpe National Transportation Systems Center further adopted Leveson's UCA guidewords to transportation systems, and built them into SafetyHAT (Figure 29) [26].

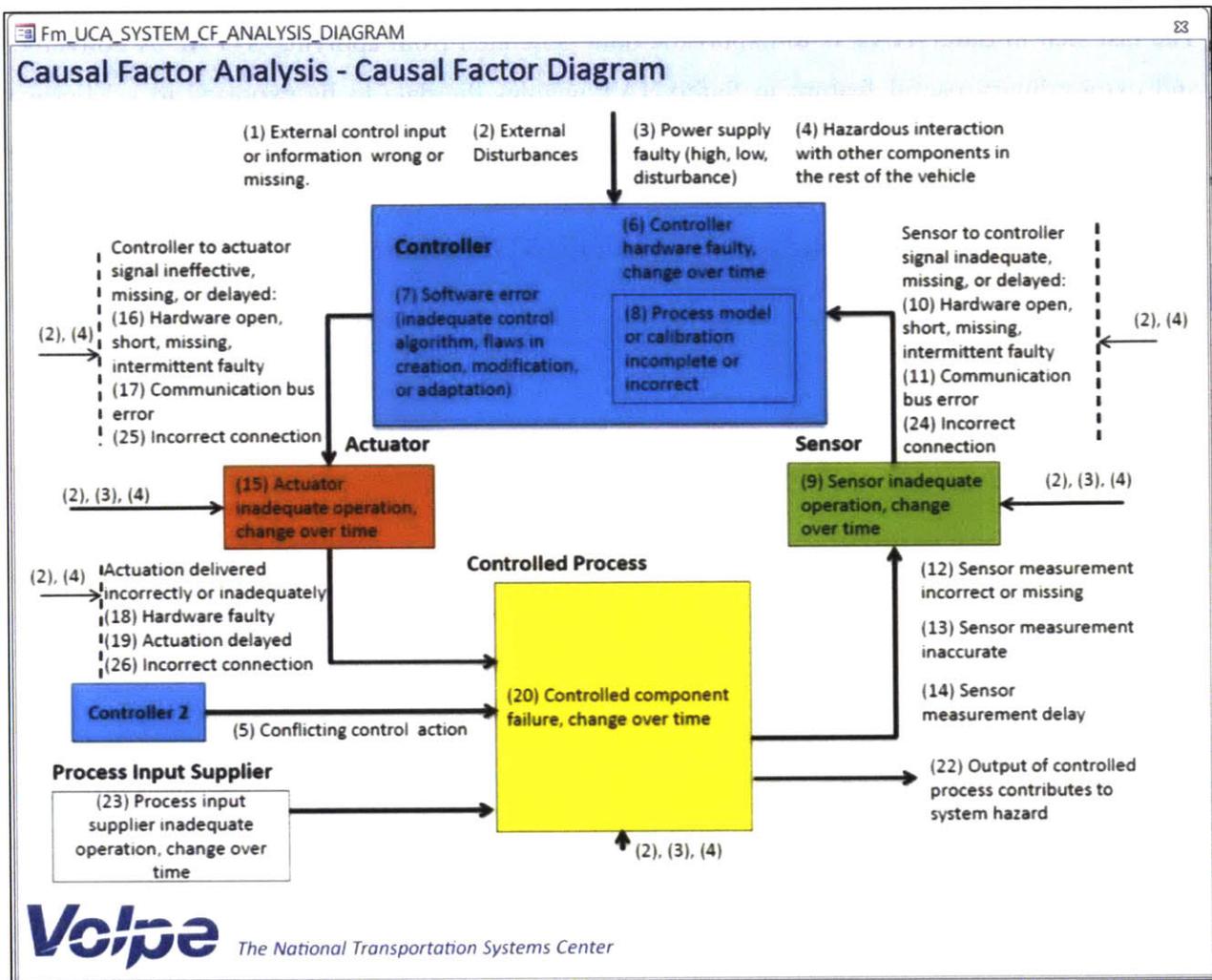


Figure 29: Causal Factor Analysis Diagram Provided For SafetyHAT STPA Analysis

Although the form and guidewords are useful in performing STPA, and were used to analyze the USCG FM system, it still requires the user to provide (and record) the details of how the causal factors would relate to the actions made during the operation of the FM system. This includes all of the steps and actions taken from when the operating unit initiates the request until the product or service is delivered. A complete list of causal factors for the STPA of the USCG FM system is presented in Table 8 (discussed in greater detail below). Also, in Chapter 6 of this document, recommended causal factor guidewords are proposed that are more applicable to Federal financial management operations. A complete summary of the STPA analysis data derived from SafetyHAT is provided in Appendix B.

*Step 8: Export Data*

The last step in SafetyHAT is to export the data generated from applying STPA. A convenient and extraordinary useful feature in SafetyHAT enables the data to be exported to a Microsoft Excel workbook where SafetyHAT STPA inputs and outputs are separated on individual tabs. With the workbook, desired analytical operations can be performed. Figure 30 depicts a representative data export in Microsoft Excel for the STPA performed using SafetyHAT.

Data Export\_4.1.v2 - Excel

Scott

HAZ_NO	HAZARD	UCA_NO	COMPONENT_NAME	UNSAFE_CONTROL_ACTION	UCA_DESC	CAUSAL_FACT_NO	CF_DESC	CF_USER_DESC	FROM_COMP
2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks	1	Procurement Request Manager	Provided, but the intensity is incorrect (too much or too little)	The product/service requested is incorrect--i.e. wrong vendor, incorrect funding level, wrong quantity, incorrect unit cost or total	129	Process model or calibration incomplete or incorrect	Lack of training, poor job performance, improper prioritization of tasks, or lack of feedback regarding the status of the system caused the PR manager to introduce errors	Procurement Request Manager
3	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks	1	Procurement Request Manager	Provided, but the intensity is incorrect (too much or too little)	The product/service requested is incorrect--i.e. wrong vendor, incorrect funding level, wrong quantity, incorrect unit cost or total	133	External disturbances	Excessive workload, job pressure, or some form of distraction caused the PR manager to inaccurately make the request--i.e. introduction of errors.	Procurement Request Manager
4	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks	1	Procurement Request Manager	Provided, but the intensity is incorrect (too much or too little)	The product/service requested is incorrect--i.e. wrong vendor, incorrect funding level, wrong quantity, incorrect unit cost or total	210	Controlled component failure, change over time	A CAS system error prevents the commitment from being accurately recorded.	Core Accounting System (CP)
5	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks	1	Procurement Request Manager	Provided, but the intensity is incorrect (too much or too little)	The product/service requested is incorrect--i.e. wrong vendor, incorrect funding level, wrong quantity, incorrect unit cost or total	259	Actuator inadequate operation, change over time	A system error caused the introduction of errors as the request progressed through subsequent stages of the approval process.	Request in CAS (A)
6	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks	2	Procurement Request Manager	Provided, but executed incorrectly	The request was initiated in the financial management system, but contained data errors, or possibly incorrect routing for transmittal to	127	External disturbances	Excessive workload, job pressure, or some form of distraction caused the PR manager to inaccurately make the request--i.e. introduce errors.	Procurement Request Manager
7	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks	2	Procurement Request Manager	Provided, but executed incorrectly	The request was initiated in the financial management system, but contained data errors, or possibly incorrect routing for transmittal to	129	Process model or calibration incomplete or incorrect	Lack of training, poor job performance, improper prioritization of tasks, or lack of feedback regarding the status of the system caused the PR manager to introduce errors	Procurement Request Manager
8	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks	2	Procurement Request Manager	Provided, but executed incorrectly	The request was initiated in the financial management system, but contained data errors, or possibly incorrect routing for transmittal to	210	Controlled component failure, change over time	A CAS system error prevents the commitment from being accurately recorded.	Core Accounting System (CP)

Union\_COMPLETE\_ANALYSIS | Qry\_HAZ\_EXPORT | Qry\_COMP\_EXPORT | Qry\_CONN\_EXPORT | Qr ...

Figure 30: Representative Data Export for SafetyHAT STPA Analysis

The application of STPA to the USCG FM system identified a total of 205 causal factors. The following sections of this document deal with analyzing and recommending actions to mitigate the presence or effect of the hazards in the system.

## 4.2 Interpretation of Data

### 4.2.1 *Hazard Mitigation*

For the hazard analysis performed on the USCG FM system, the causal factors relating to the unsafe control actions is of particular interest so that actions can be taken to mitigate their impact in the system or eliminate their presence. The list of causal factors identified using STPA (SafetyHAT Step 7) is included in Table 8 below. Based on the STPA results from SafetyHAT, requirements were generated to mitigate the hazard and risk to the system based on their causality, and also included in Table 8. Additionally, building upon the information presented in Chapter 2 regarding roles and responsibilities in the USCG FM system, primary responsibility for remediating the hazard is recommend for assignment to either the sponsor/acquirer of the financial management software application (CAS), or the Business Process Reengineering Team. These requirements and assignment of primary responsibility will enable these responsible USCG elements to address them in the system. It is worth noting that one benefit of using SafetyHAT is that the hazard analysis process is completely repeatable and traceable, which is especially important for follow-on work that may generate new system requirements.

**Table 8: USCG FM System STPA Analysis Causal Factors**

<b>Causal Factor #</b>	<b>Causal Factor Description</b>	<b>Causal Factor User/Detailed Description</b>	<b>From Component</b>	<b>To Component (if applicable)</b>	<b>Requirement Statement</b>	<b>Primary Hazard Remediation Responsibility</b>
1	External control input or information wrong or missing	The requirements of the operating unit were not correctly interrupted/explained, resulting in a time lag in the process.	Procurement Request Manager		The operating unit shall have a means to convey a time requirement associated with the request.	Financial Application Sponsor/Acquirer
2	Process model or calibration incomplete or incorrect	Lack of training, poor job performance, improper prioritization of tasks, or lack of feedback regarding the status of the system prevented the service from being ordered (and thereby delivered) within the required time.	Procurement Request Manager		The procurement request manager shall have a means to receive and track the time requirements associated with the request.	Financial Application Sponsor/Acquirer
16	Process model or calibration incomplete or incorrect	The acquisition manager does not make the award in CAS due to lack of training, improper prioritization of workload, sub-par job performance, or no feedback on the status of the system (i.e. follow-on notification or reminder to perform the task).	Acquisition Manager		The acquisition manager shall have a means to receive and track the time requirements associated with the request.	Financial Application Sponsor/Acquirer
19	External disturbances	Excessive workload, form of distraction, or other pressure could cause the delayed action.	Acquisition Manager		The acquisition manager (and other system controllers) shall be provided a work environment conducive to completing accurate and timely financial management services. This includes sufficient workforce capacity to complete request/tasks within time limits.	Business Process Reengineering Team
21	Actuator inadequate operation, change over time	A CAS system error could prevent the award transaction from being recorded in CAS in a timely manner as required.	Award Notification in CAS (A)		The CAS shall record transactions within [specify time].	Financial Application Sponsor/Acquirer
22	Process model or calibration incomplete or incorrect	The acquisition manager may lack the proper training or sense of prioritization for the task or does not know the status of the system and realize action is required.	Acquisition Manager		The acquisition manager shall receive training and feedback regarding job requirements and performance expectations.	Business Process Reengineering Team

26	Process model or calibration incomplete or incorrect	The acquisition manager does not make the award to the vendor due to lack of training, task prioritization, sub-par job performance, or lacks sense of urgency to complete the transaction/order the product or service.	Acquisition Manager	The acquisition manager shall receive training and feedback regarding job requirements and performance expectations.	Business Process Reengineering Team
28	External control input or information wrong or missing	The delay could be caused by a delay in input from another controller-, i.e., the funds manager.	Acquisition Manager	Funds managers (and other system controllers) shall take action on requests within [specify time].	Business Process Reengineering Team
29	External disturbances	External disturbances in the form of excessive workload, job stress, or other distraction could cause a delay or lag in the acquisition manager's action.	Acquisition Manager	The acquisition manager (and other system controllers) shall be provided a work environment conducive to completing accurate and timely financial management services. This includes sufficient workforce capacity to complete request/tasks within time limits.	Business Process Reengineering Team
30	Process model or calibration incomplete or incorrect	The process model of the acquisition manager inhibits him/her from making the award to the vendor in a timely manner. This could be caused by lack of training, sub-par job performance, improper prioritization, or lack of feedback regarding the state of the system and action that is required.	Acquisition Manager	The acquisition manager shall receive training and feedback regarding job requirements and performance expectations.	Business Process Reengineering Team
50	External disturbances	Excessive workload, job pressure, or distraction could prevent the funds manager from recording the obligation in CAS.	Funds Manager	The funds manager (and other system controllers) shall be provided a work environment conducive to completing accurate and timely financial management services. This includes sufficient workforce capacity to complete request/tasks within time limits.	Business Process Reengineering Team
51	Actuator inadequate operation, change over time	The funds manager attempted to record the obligation, but the action was not communicated to the core accounting system.	Record Obligation in CAS (A)	Funds managers shall have access to the CAS to perform financial operations.	Business Process Reengineering Team

53	Input to controlled process missing or wrong	The information that should have been provided by the funds manager is missing, which results in incomplete or inaccurate information in the core accounting system.	Core Accounting System (CP)	The funds manager shall have a feedback mechanism to ensure transactions are complete and free from data entry or approval errors.	Financial Application Sponsor/Acquirer
54	Output of controlled process contributes to system hazard	Missing information results in errors within CAS and prevents accurate reporting of financial management information.	Core Accounting System (CP)	The CAS system shall not record transactions that are missing information.	Financial Application Sponsor/Acquirer
55	Sensor inadequate operation, change over time	The funds manager is not aware that action is required to record the obligation in CAS.	Award Notification in CAS (S)	The funds manager (and other system controllers) shall be notified of required actions, and have feedback regarding the state of the system, including pending actions required.	Financial Application Sponsor/Acquirer
57	Process model or calibration incomplete or incorrect	The funds manager recorded the excessive obligation due to lack of training, poor job performance, improper prioritization of workload, or missing feedback regarding the status of the system.	Funds Manager	The funds manager shall receive training and feedback regarding job requirements and performance expectations. The CAS shall not allow users to record obligations that exceed the availability of available funding.	Business Process Reengineering Team
58	Actuator inadequate operation, change over time	A system error caused the funds manager to inadvertently enter a transaction in CAS that exceeded the level of available funding.	Record Obligation in CAS (A)	Funds managers shall not be able to enter or approve transactions in CAS that exceed the amount of available funding.	Financial Application Sponsor/Acquirer
61	Sensor inadequate operation, change over time	The funds manager is not made aware of the excessive obligation in a manner that prevents it from being recorded in the system.	Award Notification in CAS (S)	Funds managers shall not be able to enter or approve transactions in CAS that exceed the amount of available funding.	Financial Application Sponsor/Acquirer
65	External disturbances	Excessive workload, job pressure, or distraction could prevent the funds manager from recording the obligation in CAS in a timely manner.	Funds Manager	The funds manager (and other system controllers) shall be provided a work environment conducive to completing accurate and timely financial management services. This includes sufficient workforce capacity to complete request/tasks within time limits.	Business Process Reengineering Team

66	Process model or calibration incomplete or incorrect	The funds manager did not record the obligation in a timely manner due to lack of training, poor job performance, improper prioritization of workload, or missing feedback regarding the status of the system.	Funds Manager	The funds manager shall receive training and feedback regarding job requirements and performance expectations.	Business Process Reengineering Team
67	Conflicting control action	Input from a different funds manager overrode or delayed recording the obligation in CAS.	Core Accounting System (CP)	Funds managers shall be able to determine who is responsible for taking actions, including designated responsibility for taking primary (and back-up) actions on requests, and receive confirmation for the completed action.	Financial Application Sponsor/Acquirer
72	Process model or calibration incomplete or incorrect	The funds manager did not accurately record the obligation. The error could be the result of lack of training, poor job performance, distraction, or missing feedback regarding the status of the system.	Funds Manager	The funds manager shall receive training and feedback regarding job requirements and performance expectations.	Business Process Reengineering Team
73	Actuator inadequate operation, change over time	A CAS system error prevented the obligation from being accurately recorded, including the introduction of data errors.	Record in CAS (A)	The CAS shall accurately record obligations based on user inputs and data provided.	Financial Application Sponsor/Acquirer
77	Sensor inadequate operation, change over time	Lack of information regarding the status of the system could cause the funds manager to record the inaccurate obligation in the CAS.	Award Notification in CAS (S)	The funds manger (and other system users) shall be able to access or be notified of the state of requests and pending or completed actions taken by controllers.	Financial Application Sponsor/Acquirer
82	External disturbances	Excessive workload, job pressure, or distraction could cause the funds manager to record a commitment that exceeds the level of funding available.	Funds Manager	The funds manager shall receive training and feedback regarding job requirements and performance expectations. This includes sufficient workforce capacity to complete request/tasks within time limits.	Business Process Reengineering Team
83	Process model or calibration incomplete or incorrect	The funds manager recorded the excessive commitment due to lack of training, poor job performance, improper prioritization of workload, or due to an effective feedback mechanism regarding the status of the system.	Funds Manager	The funds manager shall receive training and feedback regarding job requirements and performance expectations.	Business Process Reengineering Team

84	Actuator inadequate operation, change over time	A CAS system error could cause the funds manager to record a commitment that exceeds the level of available funding.	Record in CAS (A)		Funds managers shall not be able to enter or approve transactions that exceed the amount of available funding.	Financial Application Sponsor/Acquirer
89	Actuator inadequate operation, change over time	A CAS system error prevented the commitment from being recorded in a timely manner, which delays the procurement and delivery of the products or services to the delayed start for follow-on financial management or procurement activities.	Record in CAS (A)		Users shall have access to the CAS to approve and record commitments in [specify time] so follow-on financial management activities can occur.	Financial Application Sponsor/Acquirer
93	External disturbances	Excessive workload, job pressure, or distraction could prevent the funds manager from taking action to review, verify and approve the procurement request.	Funds Manager		The funds manager shall receive training and feedback regarding job requirements and performance expectations. This includes sufficient workforce capacity to complete request/tasks within time limits.	Business Process Reengineering Team
95	Controller to actuator signal ineffective, missing, or delayed: hardware open, short, missing, intermittent or faulty	A missing or ineffective means to communicate the request to the procurement manager ultimately delays or prevents the delivery of the required products or services.	Operating Unit	Transmit Request (A)	The operating unit shall have a means to communicate requests to the procurement request manager.	Business Process Reengineering Team
96	External disturbances	Excessive workload or distractions could prevent the operating unit from conveying the request in a timely manner.	Operating Unit		The operating unit (and other system controllers) shall be provided a work environment conducive to completing accurate and timely financial management services. This includes sufficient workforce capacity to complete request/tasks within time limits.	Business Process Reengineering Team
97	Process model or calibration incomplete or incorrect	Lack of feedback regarding the status of the system (and specifically, the status of the pending request for a product or service) could inhibit the operating unit from submitting the request for products or services.	Operating Unit		The operating unit shall be provided with a feedback mechanism to communicate the status of requests, including any missing or incomplete information required by other system controllers.	Business Process Reengineering Team

99	Process model or calibration incomplete or incorrect	Lack of feedback regarding the status of the system (and specifically, missing details regarding the request, or status, for the product or service) could be the cause for submitting the incorrect information.	Operating Unit	The operating unit shall be provided with a feedback mechanism to communicate the status of requests, including any missing or incomplete information required by other system controllers.	Business Process Reengineering Team
102	External control input or information wrong or missing	The operating unit obtains incorrect or incompatible information (regarding the product or service) from a source external to the system, which is transmitted to the procurement request manager for action. The errors or information incompatibility prevents the transaction from being initiated by the PR manager.	Operating Unit	The operating unit shall be provided with a feedback mechanism to communicate the status of requests, including any missing or incomplete information required by other system controllers.	Business Process Reengineering Team
104	External control input or information wrong or missing	The operating unit obtains incomplete information (regarding the product or service) from a source external to the system, which is transmitted to the procurement request manager for action. Also, the operating unit may not be aware of all the requirements necessary for the procurement manager to initiate the transaction.	Operating Unit	The operating unit shall be provided with a feedback mechanism to communicate the status of requests, including any missing or incomplete information required by other system controllers. The operating unit shall be provided with training regarding procedures and processes to make requests.	Business Process Reengineering Team
105	External disturbances	Excessive workload or distractions could prevent the operating unit from conveying all of the required information relating to the request in a timely manner.	Operating Unit	The operating unit (and other system controllers) shall be provided a work environment conducive to completing accurate and timely financial management services. This includes sufficient workforce capacity to complete request/tasks within time limits.	Business Process Reengineering Team

107	Process model or calibration incomplete or incorrect	Lack of feedback regarding the status of the system (and specifically, the status of the pending request for a product or service) could inhibit the operating unit from providing all of the information required to initiate the procurement process. The operating unit may also not be aware of the requirement to provide information.	Operating Unit		The operating unit shall be provided with a feedback mechanism to communicate the status of requests, including any missing or incomplete information required by other system controllers. The operating unit shall be provided training regarding procedures and processes to make requests.	Business Process Reengineering Team
108	Actuator inadequate operation, change over time	A missing or ineffective means to communicate the request to the procurement manager prevents the initiation of the process to procure the required products or services.	Transmit Request (A)		The operating unit shall have a means to communicate requests to the procurement request manager.	Business Process Reengineering Team
109	External control input or information wrong or missing	The operating unit cannot obtain the necessary information required to initiate the request, or the operating unit does not have an accurate account balance(s) due to erroneous system reporting. The erroneous reporting may be the result of other unsafe control actions.	Operating Unit		The operating unit shall have a means to determine committed, obligated and available funding balances. The operating unit shall be provided with a feedback mechanism to communicate the status of requests, including any missing or incomplete information required by other system controllers.	Business Process Reengineering Team
110	External disturbances	Excessive workload or distractions could prevent the operating unit from initiating the request in a timely manner.	Operating Unit		The operating unit (and other system controllers) shall be provided a work environment conducive to completing accurate and timely financial management services. This includes sufficient workforce capacity to complete request/tasks within time limits.	Business Process Reengineering Team
111	Process model or calibration incomplete or incorrect	Lack of feedback regarding the status of the system could inhibit the operating unit from submitting the request for products or services.	Operating Unit		The operating unit shall be provided with a feedback mechanism to communicate the status of requests, including any missing or incomplete information required by other system controllers.	Business Process Reengineering Team
112	Controller to actuator signal ineffective, missing, or delayed: hardware open, short, missing, intermittent, or	A missing or ineffective means to communicate the request to the procurement manager prevents initiation of the procurement process, and ultimately delivery of the	Operating Unit	Transmit Request (A)	The operating unit shall have a means to make a request, including means necessary to make requests under non-routine circumstances or when deployed.	Business Process Reengineering Team

faulty

required products or services.

114	External disturbances	Excessive workload, job pressure, or some form of distraction prevented the PR manager from initiating the request in a timely manner.	Procurement Request Manager	The procurement request manager (and other system controllers) shall be provided a work environment conducive to completing accurate and timely financial management services.	Business Process Reengineering Team
116	Hazardous interaction with other components in the rest of the [FM system]	Miscommunication or communication among individual PR managers could confuse who is responsible (or lead) for initiating the procurement on behalf of the operating unit.	Procurement Request Manager	Procurement request manager shall be able to determine who is responsible for taking actions, including designated responsibility for taking primary (and back-up) actions on requests, and receive confirmation for the completed action.	Financial Application Sponsor/Acquirer
118	External control input or information wrong or missing	The requirements of the operating unit were not correctly interpreted/explained, so the PR manager did not take appropriate action to initiate the request.	Procurement Request Manager	The operating unit shall receive training regarding procedures necessary to make requests.	Business Process Reengineering Team
119	External disturbances	Excessive workload, job pressure, or some form of distraction prevented the PR manager from initiating the request.	Procurement Request Manager	The procurement request manager (and other system controllers) shall be provided a work environment conducive to completing accurate and timely financial management services. This includes sufficient workforce capacity to complete request/tasks within time limits.	Business Process Reengineering Team
121	Process model or calibration incomplete or incorrect	Lack of training, poor job performance, improper prioritization of tasks, or lack of feedback regarding the status of the system prevented the service from being ordered.	Procurement Request Manager	The procurement request manager shall receive training and feedback regarding job requirements and performance expectations.	Business Process Reengineering Team

123	Hazardous interaction with other components in the rest of the [FM system]	Miscommunication or communication among individual PR managers could confuse who is responsible (or lead) for initiating the procurement on behalf of the operating unit, so it was never initiated.	Procurement Request Manager	Procurement request manager shall be able to determine who is responsible for taking actions, including designated responsibility for taking primary (and back-up) actions on requests, and receive confirmation for the completed action.	Financial Application Sponsor/Acquirer
127	External disturbances	Excessive workload, job pressure or some form of distraction caused the PR manager to inaccurately make the request, i.e., introduce errors.	Procurement Request Manager	The procurement request manager (and other system controllers) shall be provided a work environment conducive to completing accurate and timely financial management services. This includes sufficient workforce capacity to complete request/tasks within time limits.	Business Process Reengineering Team
129	Process model or calibration incomplete or incorrect	Lack of training, poor job performance, improper prioritization of tasks, or lack of feedback regarding the status of the system caused the PR manager to introduce errors into the procurement request.	Procurement Request Manager	The procurement request manager shall receive training and feedback regarding job requirements and performance expectations.	Business Process Reengineering Team
133	External disturbances	Excessive workload, job pressure, or some form of distraction caused the PR manager to inaccurately make the request, i.e., introduce errors.	Procurement Request Manager	The procurement request manager (and other system controllers) shall be provided a work environment conducive to completing accurate and timely financial management services.	Business Process Reengineering Team
142	Process model or calibration incomplete or incorrect	The acquisition manager makes an incorrect order due to lack of training, task prioritization, sub-par job performance, or inadequate sense of urgency to complete the transaction/order the product or service.	Acquisition Manager	The acquisition manager shall receive training and feedback regarding job requirements and performance expectations.	Business Process Reengineering Team
147	External disturbances	A disturbance caused by job stress, excessive workload, or other distraction could contribute to the AM not completing the order correctly.	Acquisition Manager	The acquisition manager shall receive training and feedback regarding job requirements and performance expectations. This includes sufficient workforce capacity to complete request/tasks within time limits.	Business Process Reengineering Team

148	Process model or calibration incomplete or incorrect	The acquisition manager does not properly execute the transaction due to a process model problem. Potential causes: lack of training, poor job performance, or no feedback mechanism regarding the status of the system or vendor specific requirements necessary to properly complete the acquisition process.	Acquisition Manager		The acquisition manager shall receive training and feedback regarding job requirements and performance expectations.	Business Process Reengineering Team
149	Controller to actuator signal ineffective, missing, or delayed: hardware open, short, missing, intermittent or faulty	The systems required by the AM to complete the acquisition process are not available.	Acquisition Manager	Award Notification External (A)	The CAS and other systems, materials, infrastructure, means of communication and resources shall be available and accessible to the acquisition manager.	Business Process Reengineering Team
150	Actuator inadequate operation, change over time	The means to transmit the order to the vendor does not exist, so the process is not completed.	Award Notification External (A)		The operating unit shall have a means to communicate requests to the procurement request manager.	Business Process Reengineering Team
151	Actuation delivered incorrectly or inadequately: incorrect connection	The order is transmitted to the incorrect vendor.	Award Notification External (A)	Vendor/Service Provider (CP)	The acquisition manager shall have a means to make and confirm orders are submitted to correct vendor for fulfillment.	Business Process Reengineering Team
152	Controlled component failure, change over time	The vendor's requirements for taking orders have changed, or new and unfamiliar information is required. Consequently, the order is delayed or the incorrect product or service is provided.	Vendor/Service Provider (CP)		The acquisition manager shall be able to receive confirmation that the vendor has received all required information necessary to fulfill the order, and the product or service is being provided to the operating unit.	Business Process Reengineering Team
156	Controller to actuator signal ineffective, missing, or delayed: hardware open, short, missing, intermittent or faulty	The AM is not able to perform the acquisition process because the required systems are not available, so the action is delayed.	Acquisition Manager	Award Notification External (A)	The CAS and other systems, materials, infrastructure, means of communication and resources shall be available and accessible to the acquisition manager.	Business Process Reengineering Team
157	Actuator inadequate operation, change over time	The acquisition manager performs the acquisition process, but a system error (SWS, CAS) causes a delay in transmittal to the vendor. The time lag results in the inability of the vendor to provide the service to the operating unit in a timely manner.	Award Notification External (A)		The acquisition manager shall have the tools and systems available to perform assigned tasks.	Business Process Reengineering Team

158	Process input supplier inadequate operation, change over time	The vendor does not receive the order notification in a timely manner from the acquisition manager.	Vendor/Service Provider (CP)		The procurement manager shall have a feedback mechanism to verify orders are received and being fulfilled by vendors.	Business Process Reengineering Team
159	Actuation delivered incorrectly or inadequately: actuation delayed	A delay in the means of transmittal (mail, electronic, other) causes a delay in the delivery of the order to the vendor. This in turn causes a delay in the vendor receiving and completing the order to the operational unit.	Award Notification External (A)	Vendor/Service Provider (CP)	The acquisition manager shall have a means to convey an order to a vendor within specified time requirements.	Business Process Reengineering Team
160	External control input or information wrong or missing	The acquisition manager does not make the award because input from another system component is missing or not received by the AM.	Acquisition Manager		The acquisition manager (and other system controllers) shall have a feedback mechanism regarding the status of requests, including pending or completed transactions.	Financial Application Sponsor/Acquirer
161	Controller to actuator signal ineffective, missing, or delayed: hardware open, short, missing, intermittent or faulty	The systems required by the AM to complete the acquisition process are not available, or the AM does not perform the acquisition process.	Acquisition Manager	Award Notification External (A)	The CAS and other systems, materials, infrastructure, means of communication and resources shall be available and accessible to the acquisition manager.	Business Process Reengineering Team
164	Actuator inadequate operation, change over time	A system error prevents the AM from completing the acquisition process and initiating the notification to the vendor.	Award Notification External (A)		The CAS shall record approved actions and make notification to other system components or entities so follow-on tasks can be performed by others.	Financial Application Sponsor/Acquirer
165	Actuation delivered incorrectly or inadequately: hardware faulty	The means of delivering the notification to the vendor does not exist, so the acquisition process is not completed. The vendor does not receive the order, nor deliver a product or service to the operating unit.	Award Notification External (A)	Vendor/Service Provider (CP)	The acquisition manager shall have a means to convey an order to a vendor within specified time requirements.	Business Process Reengineering Team
166	Controlled component failure, change over time	The vendor's requirements for receiving orders have changed, or they are new and unfamiliar. Consequently, the order is not received by the vendor.	Vendor/Service Provider (CP)		The acquisition manager shall be able to receive confirmation that the vendor has received all required information necessary to fulfill the order, and the product or service is being provided to the operating unit.	Business Process Reengineering Team

167	Sensor to controller signal inadequate, missing, or delayed: hardware open, short, missing, intermittent or faulty	There is no means for the vendor to contact or communicate information to the AM, including what's required to complete the order. Therefore, the order is not completed.	Notification of Product/Service (S)	Acquisition Manager	The acquisition manager shall have multiple, reliable means to communicate with vendors and receive updates regarding the status of orders that are pending, in-progress, or completed.	Business Process Reengineering Team
168	Sensor to controller signal inadequate, missing, or delayed: hardware open, short, missing, intermittent or faulty	There is no means for the vendor to contact or communicate information to the AM, including what's required to complete the order.	Notification of Product/Service (S)	Acquisition Manager	The acquisition manager shall have multiple, reliable means to communicate with vendors and receive updates regarding the status of orders that are pending, in-progress, or completed.	Business Process Reengineering Team
169	External disturbances	A disturbance caused by job stress, excessive workload, or other distraction could contribute to the acquisition process being improperly performed.	Acquisition Manager		The acquisition manager (and other system controllers) shall be provided a work environment conducive to completing accurate and timely financial management services. This includes sufficient workforce capacity to complete request/tasks within time limit.	Business Process Reengineering Team
170	Process model or calibration incomplete or incorrect	This acquisition manager does not properly complete the acquisition process due to a process model problem. Potential causes: lack of training, poor job performance, or no feedback mechanism regarding the status of the system.	Acquisition Manager		The acquisition manager shall have a feedback mechanism to verify orders are received and being fulfilled by vendors.	Business Process Reengineering Team
172	Actuator inadequate operation, change over time	A system error in CAS prevents the acquisition process from being accurately completed, and possibly introduces corrupt data into the procurement process.	Award Notification in CAS (A)		The CAS shall accurately record acquisition manager actions.	Financial Application Sponsor/Acquirer
173	Controlled component failure, change over time	A CAS system error prevents the acquisition process from being completed and recorded.	Core Accounting System (CP)		The CAS shall be able to complete and record accurate procurement transactions.	Financial Application Sponsor/Acquirer
174	Sensor inadequate operation, change over time	The acquisition manager does not receive a status output regarding the status of the acquisition process from the CAS.	Award Notification in CAS (S)		The acquisition manager shall have a feedback mechanism to verify obligations are completed and necessary actions (by other controllers) are being taken and their pending status.	Financial Application Sponsor/Acquirer

175	Sensor to controller signal inadequate, missing, or delayed: hardware open, short, missing, intermittent or faulty	The acquisition manager is not alerted to an improper operation in CAS, which prevents the acquisition process from being completed.	Award Notification in CAS (S)	Acquisition Manager	The CAS shall provide notification to next in line controllers of required actions.	Financial Application Sponsor/Acquirer
176	External disturbances	Excessive workload or pressure prevents the acquisition manager from completing acquisition process.	Acquisition Manager		The acquisition manager (and other system controllers) shall be provided a work environment conducive to completing accurate and timely financial management services. This includes sufficient workforce capacity to complete request/tasks within time limit	Business Process Reengineering Team
178	Controller to actuator signal ineffective, missing, or delayed: hardware open, short, missing, intermittent or faulty	The CAS system is unavailable, so the AM cannot perform the acquisition process.	Acquisition Manager	Award Notification in CAS (A)	The CAS and other CG data networks and means of connectivity shall be available for the acquisition manager and other users [specify availability rate].	Business Process Reengineering Team
180	Actuator inadequate operation, change over time	A CAS error prevents the acquisition process from being completed.	Award Notification in CAS (A)		The CAS shall accurately record acquisition manager actions.	Financial Application Sponsor/Acquirer
181	Sensor measurement incorrect or missing	The status of award notification in the CAS is not available to the acquisition manager.	Core Accounting System (CP)	Award Notification in CAS (S)	The acquisition manager shall have a feedback mechanism via CAS regarding the status of completed or pending actions.	Financial Application Sponsor/Acquirer
182	Sensor to controller signal inadequate, missing, or delayed: hardware open, short, missing, intermittent or faulty	The acquisition manager is not alerted to the required action in CAS, which prevents the acquisition process from being performed.	Award Notification in CAS (S)	Acquisition Manager	The acquisition manager shall have a feedback mechanism via CAS regarding the status of completed or pending actions.	Financial Application Sponsor/Acquirer
183	External disturbances	External disturbances in the form of excessive workload, job stress, or other distraction could prevent the acquisition manager from executing the process correctly in CAS.	Acquisition Manager		The acquisition manager (and other system controllers) shall be provided a work environment conducive to completing accurate and timely financial management services.	Business Process Reengineering Team
184	Process model or calibration incomplete or incorrect	The acquisition manager does not make the award correctly in CAS due to lack of training, sub-par job performance.	Acquisition Manager		The acquisition manager shall receive training and feedback regarding job requirements and performance expectations.	Business Process Reengineering Team

186	Actuator inadequate operation, change over time	A CAS system error prevents the award transaction from being correctly recorded in CAS.	Award Notification in CAS (A)		The CAS shall be able to record acquisition manager inputs.	Financial Application Sponsor/Acquirer
188	Sensor to controller signal inadequate, missing, or delayed: hardware open, short, missing, intermittent or faulty	The acquisition manager is not alerted to an improper operation in CAS, which prevents the acquisition process from being executed properly.	Award Notification in CAS (S)	Acquisition Manager	The acquisition manager shall have a feedback mechanism via CAS to receive notification regarding the status of completed or pending actions, including what actions or information are not provided or missing in the system.	Financial Application Sponsor/Acquirer
189	Controller to actuator signal ineffective, missing, or delayed: hardware open, short, missing, intermittent or faulty	The CAS system is unavailable, so the AM cannot perform the acquisition process, which delays the award transaction.	Acquisition Manager	Award Notification in CAS (A)	The CAS shall be available to users [specify time requirement].	Financial Application Sponsor/Acquirer
190	Controlled component failure, change over time	A CAS system error prevents the acquisition process from being completed in a timely manner.	Core Accounting System (CP)		The CAS shall record transactions within [specified timeframe].	Financial Application Sponsor/Acquirer
191	Sensor inadequate operation, change over time	The acquisition manager does not receive a status output regarding the status of the acquisition process from the CAS. As a result, the process is delayed.	Award Notification in CAS (S)		The acquisition manager shall have a feedback mechanism to verify obligations are completed and necessary actions (by other controllers) are being taken and their pending status.	Financial Application Sponsor/Acquirer
192	Sensor to controller signal inadequate, missing, or delayed: hardware open, short, missing, intermittent or faulty	The acquisition manager is not alerted to the required action in CAS, which prevents the acquisition process from being performed in a timely manner.	Award Notification in CAS (S)	Acquisition Manager	The acquisition manager shall have a feedback mechanism via CAS to receive notification regarding the status of completed or pending actions, including what actions or information are not provided or missing in the system.	Financial Application Sponsor/Acquirer
194	Sensor to controller signal inadequate, missing, or delayed: hardware open, short, missing, intermittent or faulty	The funds manager does not receive feedback regarding the excessive obligation, or possibly the existence of a duplicate entry.	Obligation Notification in CAS (S)	Funds Manager	The funds manager shall have a feedback mechanism via CAS to receive notification regarding the status of completed or pending actions, including what actions or information are not provided or missing in the system.	Financial Application Sponsor/Acquirer

195	Sensor inadequate operation, change over time	Information regarding the excessive obligation is not reported in a timely manner from CAS.	Obligation Notification in CAS (S)		The CAS shall not allow users to record obligations that exceed the availability of funds. If excessive obligations are requested, higher-level authorities receive notification.	Financial Application Sponsor/Acquirer
197	Conflicting control action	Input from a different funds manager could provide conflicting information that results in the excessive obligation being approved and recorded in the CAS financial system.	Core Accounting System (CP)		Funds managers shall be able to determine who is responsible for taking actions, including designated responsibility for taking primary (and back-up) actions on requests, and receive confirmation for the completed action.	Financial Application Sponsor/Acquirer
199	Process model or calibration incomplete or incorrect	The funds manager did not approve the obligation due to lack of training, poor job performance, improper prioritization of workload, or missing feedback regarding the status of the system.	Funds Manager		The funds manager shall receive training and feedback regarding job requirements and performance expectations.	Business Process Reengineering Team
200	Controller to actuator signal ineffective, missing, or delayed: hardware open, short, missing, intermittent or faulty	The unavailability of a system prevented the funds manager from approving the obligation.	Funds Manager	Record Obligation in CAS (A)	The CAS shall be available to users [specify time requirement].	Financial Application Sponsor/Acquirer
203	Sensor to controller signal inadequate, missing, or delayed: hardware open, short, missing, intermittent or faulty	The funds manager does not receive feedback regarding the need to approve the obligation.	Award Notification in CAS (S)	Funds Manager	The funds manager shall have a feedback mechanism via CAS to receive notification regarding the status of completed or pending actions, including what actions or information are not provided or missing in the system.	Financial Application Sponsor/Acquirer
205	Sensor inadequate operation, change over time	Lack of information from CAS regarding the status of the system could delay the funds manager from approving the obligation.	Award Notification in CAS (S)		The acquisition manager shall have a feedback mechanism to verify obligations are completed and necessary actions (by other controllers) are being taken and their pending status.	Financial Application Sponsor/Acquirer
206	Actuator inadequate operation, change over time	The funds manager attempted to record the obligation, but a system error prevented the action from being completed in a timely manner.	Record Obligation in CAS (A)		The CAS shall be able to record funds manager inputs.	Financial Application Sponsor/Acquirer

207	Controller to actuator signal ineffective, missing, or delayed: hardware open, short, missing, intermittent or faulty	The unavailability of a system prevented the funds manager from approving the obligation in a timely manner.	Funds Manager	Record Obligation in CAS (A)	The CAS shall be available to users [specify time requirement].	Financial Application Sponsor/Acquirer
208	Sensor to controller signal inadequate, missing, or delayed: hardware open, short, missing, intermittent or faulty	The funds manager is not aware of the requirement to approve the obligation, which delays the process.	Award Notification in CAS (S)	Funds Manager	The funds manager shall have a feedback mechanism via CAS to receive notification regarding the status of completed or pending actions, including what actions or information are not provided or missing in the system.	Financial Application Sponsor/Acquirer
209	Controlled component failure, change over time	A CAS system error prevents the obligation from being completed and recorded in a timely manner, which delays the acquisition of the product or service.	Core Accounting System (CP)		The CAS shall record transactions within [specified timeframe].	Financial Application Sponsor/Acquirer
210	Controlled component failure, change over time	A CAS system error prevents the commitment from being accurately recorded.	Core Accounting System (CP)		The CAS shall be able to complete and record accurate procurement transactions.	Financial Application Sponsor/Acquirer
211	Output of controlled process contributes to system hazard	Inaccurate information that originated from prior financial transactions causes the funds manager to subsequently approve the obligation with inaccurate information present.	Core Accounting System (CP)		All system users shall be made aware of actions (including relevant details) taken as a request advances through the funds management processes.	Financial Application Sponsor/Acquirer
213	Sensor inadequate operation, change over time	Input received from a prior financial transaction initiated by another controller is not received, contains inaccurate information, and creates a system hazard.	Commitment Notification in CAS (S)		The CAS shall notify subsequent users when approvals or actions are completed in the system. Notifications shall include transaction details, including whether additional action is required by another system user or stakeholder.	Financial Application Sponsor/Acquirer
214	Sensor to controller signal inadequate, missing, or delayed: hardware open, short, missing, intermittent or faulty	The acquisition manager does not receive timely notification of the requirement to perform the acquisition process.	Commitment Notification in CAS (S)	Acquisition Manager	The CAS shall notify subsequent users when approvals or actions are completed in the system. If action is not taken, subsequent notifications will be made to primary and secondary controllers. Notifications shall include transaction details, including whether additional action is required by another system user or stakeholder.	Financial Application Sponsor/Acquirer

215	Controlled component failure, change over time	A CAS system error prevents the acquisition/award from being accurately recorded or notifying the acquisition manager of a pending problem with the acquisition.	Core Accounting System (CP)		The CAS shall be able to complete and record accurate procurement transactions.	Financial Application Sponsor/Acquirer
217	Controlled component failure, change over time	A CAS system error allows the obligation to be approved for an amount that exceeds the amount of funds available.	Core Accounting System (CP)		The CAS shall not allow users to record obligations that exceed the availability of funds.	Financial Application Sponsor/Acquirer
218	Sensor to controller signal inadequate, missing, or delayed: hardware open, short, missing, intermittent or faulty	The funds manager does not receive feedback regarding the state of the system and that the obligation has not yet been approved.	Obligation Notification in CAS (S)	Funds Manager	The CAS shall notify subsequent users when approvals or actions are completed in the system. If action is not taken, subsequent notifications will be made to primary and secondary controllers. Notifications shall include transaction details, including whether additional action is required by another system user or stakeholder.	Financial Application Sponsor/Acquirer
219	Sensor to controller signal inadequate, missing, or delayed: hardware open, short, missing, intermittent or faulty	The funds manager does not receive feedback regarding the state of the system, including that the obligation contains errors.	Obligation Notification in CAS (S)	Funds Manager	The CAS shall notify subsequent users when approvals or actions are completed in the system. If action is not taken, subsequent notifications will be made to primary and secondary controllers. Notifications shall include transaction details, including whether additional action is required by another system user or stakeholder.	Financial Application Sponsor/Acquirer
220	External disturbances	Excessive workload, job pressure, or distraction could prevent the funds manager from approving an accurate or correct commitment.	Funds Manager		The funds manager shall receive training and feedback regarding job requirements and performance expectations. This includes sufficient workforce capacity to complete request/tasks within time limits.	Business Process Reengineering Team
221	Process model or calibration incomplete or incorrect	The funds manager did not accurately record/approve the commitment. The error could be the result from lack of training, poor job performance, distraction, or missing feedback regarding the status of the system.	Funds Manager		The funds manager shall receive training and feedback regarding job requirements and performance expectations.	Business Process Reengineering Team

222	Sensor to controller signal inadequate, missing, or delayed: hardware open, short, missing, intermittent or faulty	Inaccurate financial information that originated from a different controllers prior action is conveyed to the funds manager.	Request Notification in CAS (S)	Funds Manager	System controllers and FM personnel shall receive job/task specific training required by their position.	Business Process Reengineering Team
223	Sensor inadequate operation, change over time	Inaccurate financial information that originated from prior step in the process is transmitted to the funds manager.	Request Notification in CAS (S)		The CAS shall notify subsequent users when approvals or actions are completed in the system. Notifications shall include transaction details, including whether additional action is required by another system user or stakeholder.	Financial Application Sponsor/Acquirer
224	Actuator inadequate operation, change over time	A CAS system error prevented the commitment from being accurately recorded, including the introduction of data errors. These errors prevent the commitment from progressing further in the financial management system.	Record in CAS (A)		The CAS shall accurately record funds manager and under designated user inputs without the introduction of erroneous data or information.	Financial Application Sponsor/Acquirer
225	External disturbances	Excessive workload, job pressure, or distraction could prevent the funds manager from completing the necessary steps in a timely manner.	Funds Manager		The funds manager shall receive training and feedback regarding job requirements and performance expectations. This includes sufficient workforce capacity to complete request/tasks within time limits.	Business Process Reengineering Team
226	Sensor to controller signal inadequate, missing, or delayed: hardware open, short, missing, intermittent or faulty	Timely notification of the requirement to perform the action was not received by the funds manager.	Request Notification in CAS (S)	Funds Manager	The funds manager shall be notified of pending system actions. If action is not taken, subsequent notification shall be made to the primary and secondary funds manager of the pending action.	Financial Application Sponsor/Acquirer
227	Controller to actuator signal ineffective, missing, or delayed: hardware open, short, missing, intermittent or faulty	Systems required by the funds manager to approve the commitment were not available, which delayed the action.	Funds Manager	Record in CAS (A)	The CAS shall be available to users [specify time requirement].	Financial Application Sponsor/Acquirer
228	Controlled component failure, change over time	A CAS system error prevents the commitment from being completed in a timely manner.	Core Accounting System (CP)		The CAS shall record transactions within [specified timeframe].	Financial Application Sponsor/Acquirer

230	Sensor inadequate operation, change over time	Information regarding the status of the transaction was not available to be sent to the funds manager.	Request Notification in CAS (S)	The CAS shall notify subsequent users when approvals or actions are completed in the system. Notifications shall include transaction details, including whether additional action is required by another system user or stakeholder.	Financial Application Sponsor/Acquirer
231	Hazardous interaction with other components in the rest of the [FM system]	The funds manager did not take action on the request because of confusion or conflicting guidance regarding responsibility for completing the action with another funds manager.	Funds Manager	The funds manager (and other system controllers) shall have a means to specify who has primary (or back-up, if applicable) responsibility for taking action on a pending or incomplete request. All users shall have visibility of the status in the system.	Financial Application Sponsor/Acquirer
232	Hazardous interaction with other components in the rest of the [FM system]	The acquisition manager does not take action due to confusion or conflicting guidance regarding which acquisition manager has the responsibility for completing the acquisition process.	Acquisition Manager	The acquisition manager (and other system controllers) shall have a means to specify who has primary (or back-up, if applicable) responsibility for taking action on a pending or incomplete request. All users shall have visibility of the status in the system.	Financial Application Sponsor/Acquirer
233	Actuator inadequate operation, change over time	A system error prevents the AM from completing the acquisition process accurately.	Award Notification External (A)	The CAS shall enable the acquisition manager to complete necessary actions for making and recording obligations.	Financial Application Sponsor/Acquirer
234	Process model or calibration incomplete or incorrect	The funds manager did not take action regarding the request due to lack of training, poor job performance, and/or improper prioritization of workload.	Funds Manager	The funds manager shall receive training and feedback regarding job requirements and performance expectations.	Business Process Reengineering Team
235	Actuator inadequate operation, change over time	A CAS system error prevented the commitment from being approved.	Record in CAS (A)	The CAS shall be able to record financial commitments.	Financial Application Sponsor/Acquirer
236	Controller to actuator signal ineffective, missing, or delayed: hardware open, short, missing, intermittent or faulty	Systems required by the funds manager to approve the commitment were not available, which prevented him/her from taking action.	Funds Manager	Record in CAS (A) The CAS and other systems, materials, infrastructure, means of communication and resources shall be available and accessible to the funds manager.	Financial Application Sponsor/Acquirer

237	Controlled component failure, change over time	A CAS system prevents the commitment from being completed and recorded.	Core Accounting System (CP)		The CAS shall allow commitments to be completed and recorded.	Financial Application Sponsor/Acquirer
238	Output of controlled process contributes to system hazard	Inaccurately reported information reported from, or stored in, CAS causes the funds manager to approve the request even though it exceeds the level of available funds.	Core Accounting System (CP)		System controllers and financial management personnel shall receive job/task specific training required by their position.	Business Process Reengineering Team
239	Sensor inadequate operation, change over time	The funds manager is not aware that the approved amount exceeds the level of available funding.	Commitment Notification in CAS (S)		The CAS shall notify subsequent users when approvals or actions are completed in the system. Notifications shall include transaction details, including whether additional action is required by another system user or stakeholder.	Financial Application Sponsor/Acquirer
240	Actuator inadequate operation, change over time	A missing or ineffective means to provide the request to the procurement request manager prevents the initiation of the process to procure the required products or services.	Transmit Request (A)		The operating unit shall have a means to make a request to the PR manager, including confirmation of the submitted request and feedback/status.	Business Process Reengineering Team
241	Actuation delivered incorrectly or inadequately: hardware faulty	Not all of the required information is conveyed from the operating unit to the procurement request manager, which prevents the request from proceeding in a timely manner.	Transmit Request (A)	Procurement Request Manager	The operating unit shall have standardized methodology and procedures for conveying request information to PR manager.	Business Process Reengineering Team
242	External disturbances	Excessive pressure, distraction, or workload could cause the operating unit to transmit or submit incorrect information.	Operating Unit		The operating unit (and other system controllers) shall be provided a work environment conducive to completing accurate and timely financial management services. This includes sufficient workforce capacity to complete request/tasks within time limits.	Business Process Reengineering Team
243	Sensor inadequate operation, change over time	The operating unit does not have adequate feedback or input that enables them to provide the necessary information regarding the expected product or service that is to be provided by the vendor at the front-end of the process.	Notification of Product/Service (S)		The operating unit shall have a feedback mechanism to be made aware that products or services are available for delivery.	Business Process Reengineering Team

244	Controller to actuator signal ineffective, missing, or delayed: hardware open, short, missing, intermittent or faulty	A missing or ineffective means to make the request to the procurement manager delays or prevents the submission of an accurate request to the PR manager, and the procurement is therefore not initiated.	Operating Unit	Transmit Request (A)	The operating unit shall have a means to make a request to the PR manager, including confirmation of the submitted request and feedback/status.	Business Process Reengineering Team
245	Actuation delivered incorrectly or inadequately: hardware faulty	Information is incorrect or missing as it is conveyed from the operating unit to the procurement request manager, which prevents the request from proceeding in a timely manner.	Transmit Request (A)	Procurement Request Manager	The operating unit shall have standardized methodology and procedures for conveying request information to PR manager.	Business Process Reengineering Team
246	Actuator inadequate operation, change over time	A missing or ineffective means to provide the request to the procurement request manager prevents the process from being accurately or completely initiated.	Transmit Request (A)		The operating unit shall have a means to make a request to the PR manager, including confirmation of the submitted request and feedback/status.	Business Process Reengineering Team
247	Controller to actuator signal ineffective, missing, or delayed: hardware open, short, missing, intermittent or faulty	The operating unit does not obtain all of the information required to make the request, is not aware of what procedures or steps to follow, or who/where the request should be made to.	Operating Unit	Transmit Request (A)	The operating unit shall have a means to make a request to the PR manager, including confirmation of the submitted request and feedback/status.	Business Process Reengineering Team
248	Actuation delivered incorrectly or inadequately: incorrect connection	The operating unit does not make the request to the correct procurement request manager, so it is rejected.	Transmit Request (A)	Procurement Request Manager	The operating unit shall have a standard methodology and procedures to convey request information to PR manager.	Business Process Reengineering Team
249	Controller to actuator signal ineffective, missing, or delayed: hardware open, short, missing, intermittent or faulty	Systems required by the PR manager to initiate the request are not available, which delays the process.	Procurement Request Manager	Request in CAS (A)	The CAS and other systems, materials, infrastructure, means of communication and resources shall be available and accessible to the procurement request manager.	Business Process Reengineering Team
250	Actuator inadequate operation, change over time	A CAS system error prevented the PR manager from making the request to the next component (e.g., funds manager) and delayed the process.	Request in CAS (A)		The CAS shall allow users to transmit requests to subsequent level users, and received feedback/status regarding the status of the system and request.	Financial Application Sponsor/Acquirer
251	Controlled component failure, change over time	A CAS system prevents the commitment request from being recorded, and delays the process.	Core Accounting System (CP)		The CAS shall record transactions within [specified timeframe] upon a user's input/approval action.	Financial Application Sponsor/Acquirer

252	Actuator inadequate operation, change over time	A system error prevented the PR manager from making the request to the next component (e.g., funds manager).	Request in CAS (A)		The CAS shall allow users to transmit requests to subsequent level users, and received feedback/status regarding the status of the system and request.	financial Application Sponsor/Acquirer
253	Controller to actuator signal ineffective, missing, or delayed: hardware open, short, missing, intermittent or faulty	Systems required by the PR manager to initiate the request are not available, which prevents the process from being completed.	Procurement Request Manager	Request in CAS (A)	The CAS and other systems, materials, infrastructure, means of communication and resources shall be available and accessible to the procurement request manager.	Business Process Reengineering Team
254	Actuation delivered incorrectly or inadequately: hardware faulty	A missing or ineffective means to convey the request to the funds manager prevents request from being initiated in CAS.	Request in CAS (A)	Core Accounting System (CP)	The operating unit shall have a means to communicate requests to the procurement request manager.	Business Process Reengineering Team
256	Sensor to controller signal inadequate, missing, or delayed: incorrect connection	The request was made, but is mistakenly sent to an incorrect funds manager, which will prevent or delay the request from advancing through subsequent stages in the system.	Request Notification in CAS (S)	Funds Manager	The procurement request manager (and other system users) will have a feedback mechanism that specifies details regarding pending or incomplete actions. Updates will be automatically generated until all transactions are complete.	Financial Application Sponsor/Acquirer
257	Sensor inadequate operation, change over time	Information regarding the status of the transaction was not available to be sent to the PR manager regarding the errors in the system.	Request Notification in CAS (S)		The operating unit shall have a feedback mechanism to verify actions are taken on requests, and are aware of the pending status, and whether additional information or action is required.	Business Process Reengineering Team
258	Actuator inadequate operation, change over time	A financial system problem caused the introduction of errors after it was initiated by the procurement request manager.	Request in CAS (A)		The CAS shall not introduce erroneous data or errors.	Financial Application Sponsor/Acquirer
259	Actuator inadequate operation, change over time	A system error caused the introduction of errors as the request progressed through subsequent stages of the approval process.	Request in CAS (A)		The CAS shall not introduce erroneous data or errors.	Financial Application Sponsor/Acquirer
260	Actuation delivered incorrectly or inadequately: hardware faulty	Information/data relating to the request submitted by the PR manager is corrupted as it is conveyed to the CAS system.	Request in CAS (A)	Core Accounting System (CP)	The operating unit shall have a means to communicate requests to the procurement request manager.	Business Process Reengineering Team

261	Controller to actuator signal ineffective, missing, or delayed: hardware open, short, missing, intermittent or faulty	The procurement request manager does not enter the correct information in CAS, which is a foundational early step in the financial and procurement processes.	Procurement Request Manager	Request in CAS (A)	The operating unit shall be made aware of the request details. The procurement request manager shall receive training necessary for the assigned position.	Business Process Reengineering Team
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4.2.1 Hazard Mitigation (continued)

Each of these causal factors will have to be individually addressed by the responsible USCG entity identified in Table 8. For the USCG FM system, some of the hazards identified can be eliminated through the FM application’s coding and addressed in the project requirements or through technical specifications. For example, incorporating relatively simple software algorithms can prevent funds managers from approving commitments when there is an insufficient level of funding or balance recorded in the CAS.

Other hazards that result from UCAs require a more detailed analysis so positive measures can be taken in the system to abate their presence. For example, inadequate staffing levels (which is a design decision) in the system can lead to excessive workload and job pressure for individuals who act as the procurement request managers, funds managers, or acquisition managers. In a resource-constrained environment with limited personnel and/or other forms of support available to the USCG FM system (supporting IT Systems, optimal work setting, operating budgets, training, and so forth) system developers will be faced with making tough trade-off decisions. If left unabated in the system, these hazards could have degrading effects on system performance.

The causal factors presented in Table 9 were identified in the STPA using SafetyHAT. These select causal factors that pertain to workload, job pressure, training, and feedback will be analyzed in more detail in Chapter 5 to illustrate how system dynamics can be used to address them in the USCG FM system.

**Table 9: Unsafe Control Actions For Detailed Analysis**

<b>Causal Factor #</b>	<b>Causal Factor Description</b>	<b>Causal Factor User/Detailed Description</b>	<b>Component</b>
2	Process model or calibration incomplete or incorrect	Lack of training, poor job performance, improper prioritization of tasks, or lack of feedback regarding the status of the system prevented the service from being ordered (and thereby delivered) within the required time.	Procurement Request Manager
19	External disturbances	Excessive workload, form of distraction, or other pressure could cause the delayed action.	Acquisition Manager
65	External disturbances	Excessive workload, job pressure, or distraction could prevent the funds manager from recording the obligation in CAS in a timely manner.	Funds Manager

116	Hazardous interaction with other components in the rest of the [FM system]	Miscommunication or communication among individual PR managers could confuse who is responsible (or lead) for initiating the procurement on behalf of the operating unit.	Procurement Request Manager
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### 4.3 System Communication and Feedback

The STPA revealed the need for effective feedback, communication and monitoring in the USCG FM system. For example, there does not appear to be a specific feedback mechanism between the procurement request manager and the operating unit in the CAS FM application as illustrated in Figure 16. Provided in Figure 31 are recommendations for adding or strengthening feedback and communication mechanisms in the FM system within the bounds of the system that was analyzed. This may be especially beneficial to the FM system, considering that individual components that comprise it (operating units, procurement request managers, funds managers, and acquisition managers) will likely be separated by significant distances where face-to-face and/or daily interactions are not feasible. Moreover, many of these organizational elements are not in the same chain-of-command, which, absent other mechanisms to enforce and verify the effectiveness of system constraints, could prove problematic when the system is operated.

The specific details for improving the system communication and feedback are left to the FM BPR Team and FM system sponsor and acquirer. With that being said, the solution must address the needs of the various system users and operators with regard to the status of “requests” as they are processed through the system. The information and recommendations outlined in Table 8 can guide this work. To validate the efficacy of the system, designers should at a minimum provide a loop for feedback and communication between all of the system operators during each of the steps required to complete a request transaction. Use of the system control diagram will be useful for this effort as presented below in Figure 31.

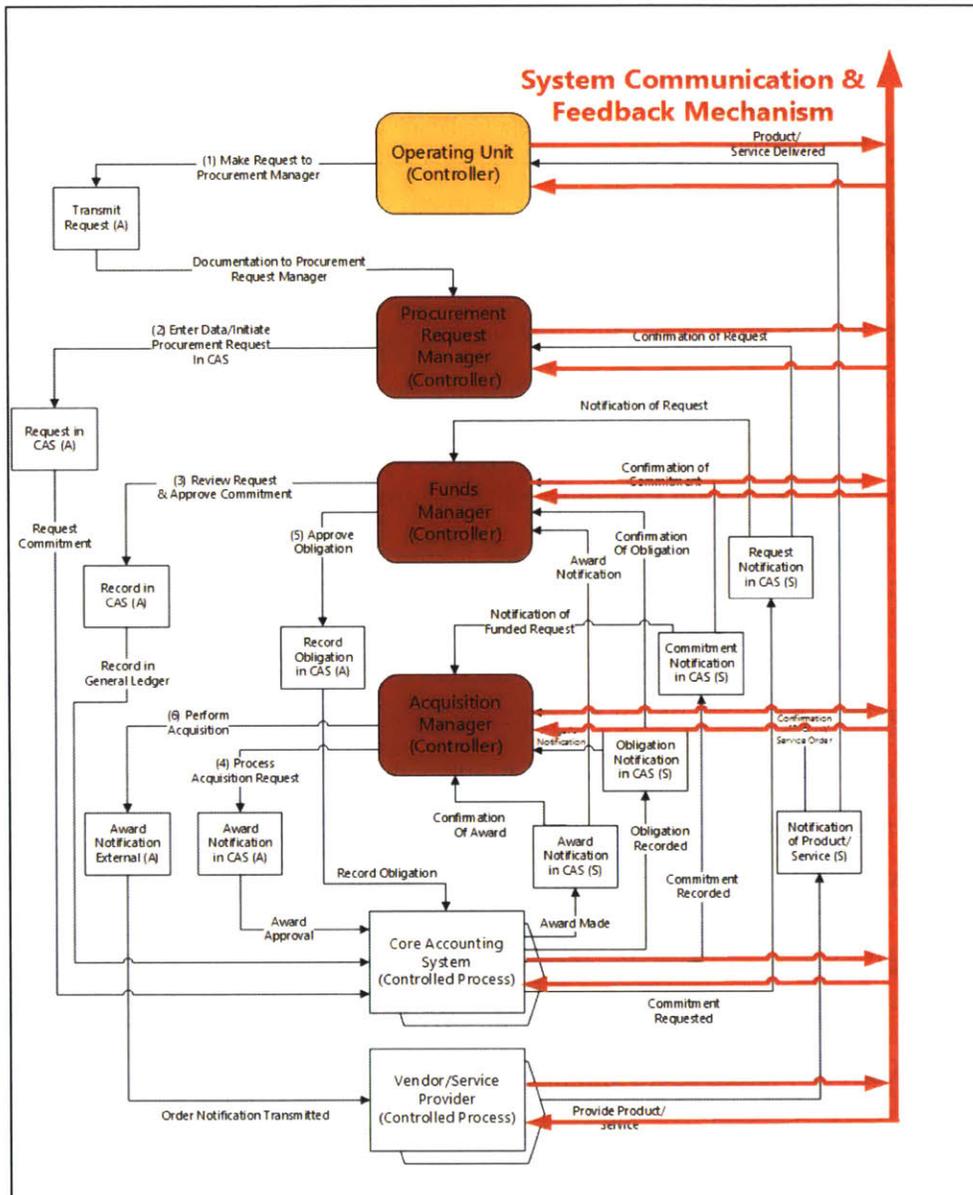


Figure 31: System Control Diagram with Feedback & Communication Pathways

#### 4.4 System Approach for Development and Operation

The STAMP and STPA methodologies view safety in a top-down manner. In the same way, gaps or challenges that exist in a system should also be addressed with a top-down approach. With regard to the USCG FM system, the stakeholders at the strategy and policy level must ensure the results of the STPA analysis are addressed in the system design before operation. Evaluation of the USCG System Development and System Operation structure should be utilized to ensure necessary safety constraints are established during development, and maintained and

enforced during operation. The causal factors analysis provided in Table 8 should be utilized for this effort. The figure below (Figure 32) identifies areas where attention should be given for designing and monitoring the operation of the USCG FM system:

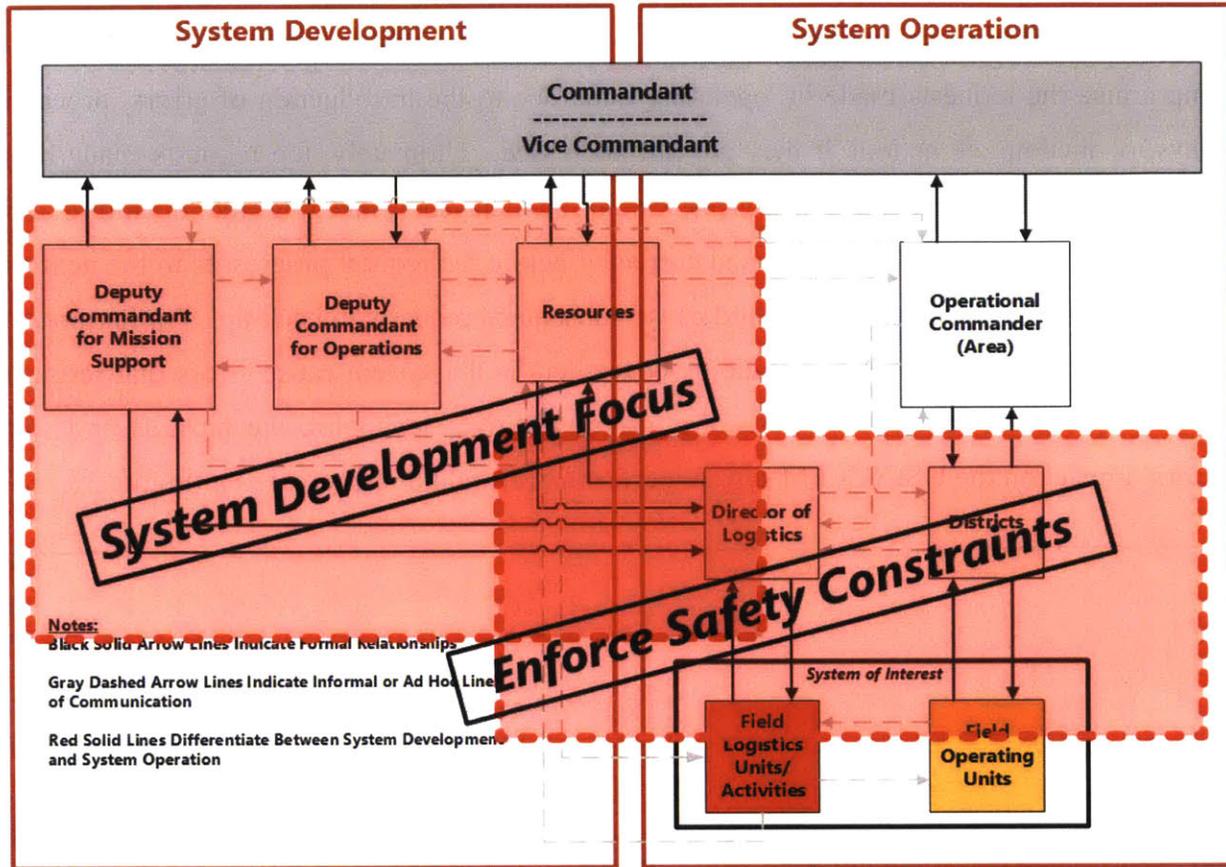
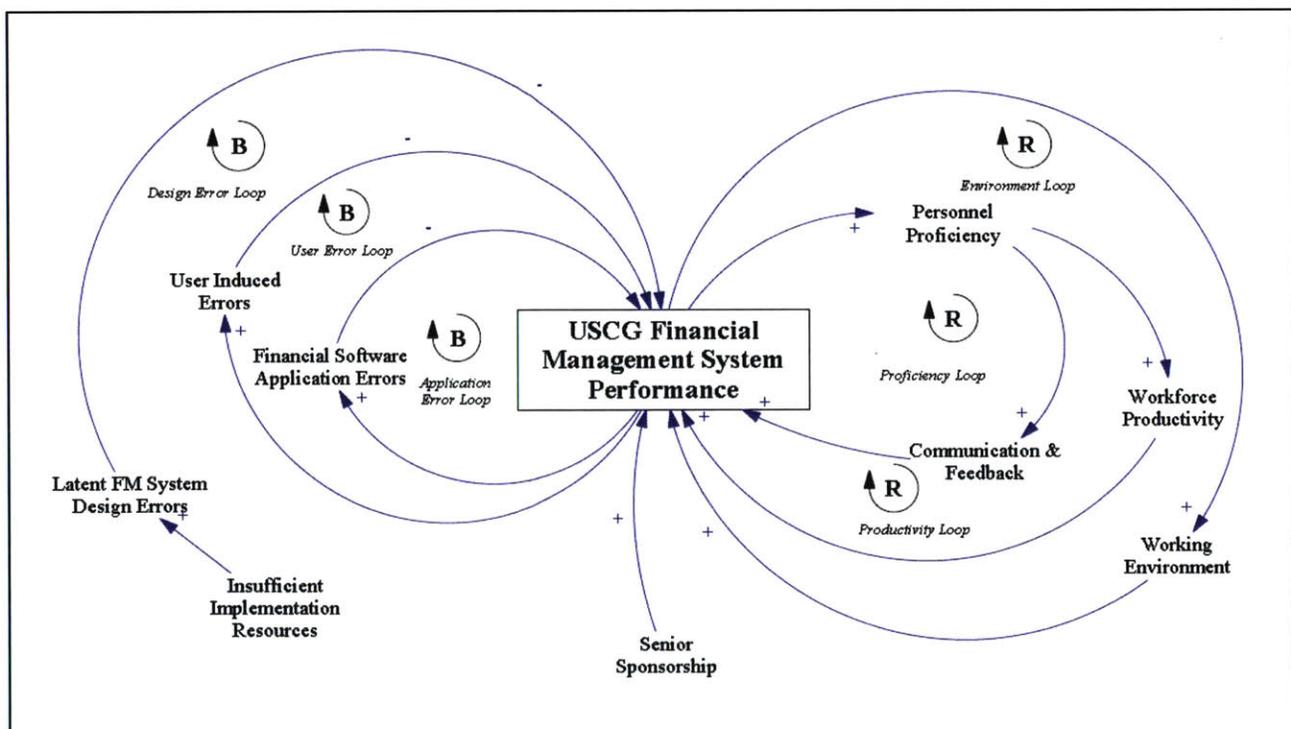


Figure 32: Annotated System Development and System Operation Diagram

The analysis of the USCG FM system using STPA contained in this thesis was limited to one segment of the FM system. Given resource constraints, it may not be practical to complete a detailed analysis on the entire re-engineered FM system. There are, however, insights and recommendations derived from the STPA hazard analysis that translate to other facets of the FM system. As a starting point, the recommendations outlined in Table 8 and insights provided in the system dynamics simulations (addressed in Chapter 5) relating to overall system performance should be accessed for their applicability to other aspects of the FM system.

#### 4.5 Achieving System Performance

The system dynamics causal loop analysis method introduced in Chapter 3 is a useful way of understanding the effects that the UCAs have on the performance of the USCG FM system. For the transaction that was analyzed in the preceding sections, system hazards will likely compromise the requests made by operating units due to the introduction of errors, processing delays, or incomplete actions if they are not addressed. Ultimately, the requests made by the operating unit for products or services would be delayed, impacting the operating unit's readiness. Even if errors are caught and corrected before the request progresses to the next step, the added effort will delay progress and cause subsequent requests to back up. Furthermore, the unsafe control actions (or errors) made by controllers in the system cause errors that result in a significant financial audit liabilities. From a **qualitative** standpoint, the hazards and causal factors' impact on the USCG's FM system performance could be represented in Figure 33.



**Figure 33: Qualitative Model of Factors Impacting USCG FM System Performance**

Here it is shown that deficiencies in the design of the system, user operation (operating unit, procurement request manager, funds manager, and/or acquisition manager), and software

application degrades the FM system's performance. Conversely, user proficiency, effective communication and feedback, a productive operating environment and strong project sponsorship will enhance the overall performance of the USCG FM system. This is only a **qualitative** analysis. With the use of system dynamics modeling and Vensim, it is also possible to **quantitatively** analyze the FM system design to better understand how hazards and controller actions interact to impact its performance. This is performed for the causal factors listed Table 9 in the next chapter.

## **Chapter 5: Use of System Dynamics**

### 5.1 Experimentation Using STPA Results:

To facilitate learning in the USCG FM system, a system dynamics model using Vensim was built to simulate its performance in operation based on the results of the STPA. As presented in Chapter 4, workload pressures and accuracy in processing requests can be a function of the FM system's workforce size. For example, if the workforce size is too small relative to the workload introduced into the FM system, worker accuracy will decrease, and have secondary effects on productivity. Because of this relationship, these variables are included in the structure of the system dynamics model. In order to develop the system dynamics model and perform the simulations, extensive use was made of the theories and examples presented in lectures and course materials provided in MIT's System Dynamics (MIT Course ESD.74) and System Project Management (MIT Course ESD.36) courses, taught by Professors Dr. Brad Morrison, and Dr. James Lyons, respectively [27] [28].

### 5.2 Evaluating the FM System

#### 5.2.1 *USCG FM System Model*

For building the model and performing a baseline simulation, it is assumed that the reengineered financial system would have an initial steady-state capacity to process orders at the rate they are submitted<sup>10</sup>. The system performance is generally defined by the rate at which work is completed and introduction of errors that occurs in the process. For the USCG FM system, variables that influence the performance would include the rate and manner requests are made by the operating unit, the workforce that accomplishes the work, and the effect of the working environment or productivity.

To achieve maximum throughput in the system, the controllers and other components and processes outlined in the preceding sections must interact in a harmonious and effective manner. From a practical standpoint, the degradation of performance will be manifested by decreased efficiency in processing requests submitted by operating units. To illustrate, erroneous or

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<sup>10</sup> The to-be state will be evolved from the current organizational state, which currently functions and fulfills operating units' requirements to acquire products and services and manage financial resources.

delayed actions by a procurement request manager, funds manager, or acquisition manager (e.g., system controllers) would decrease the system's overall throughput capacity, creating a highly problematic backlog of requests. An increase, oscillation, or sudden spike in the number of orders introduced to the system would also further stress individual components and likely result in decreased individual performance, and an overall degradation of the system's performance. Additional effects can also be modeled to simulate an overall loss of system effectiveness. For example, when a request is not completed or is completed with errors it has to undergo a "rework cycle." Rework is the unnecessary effort of redoing a process or task that was incorrectly or improperly completed the first time, and can lead to significant time and money resource inefficiency [29]. The manner and degree to which this might occur could also be evaluated using system dynamics. The basic system dynamic model used to perform experiments on the FM System is represented in Figure 34.

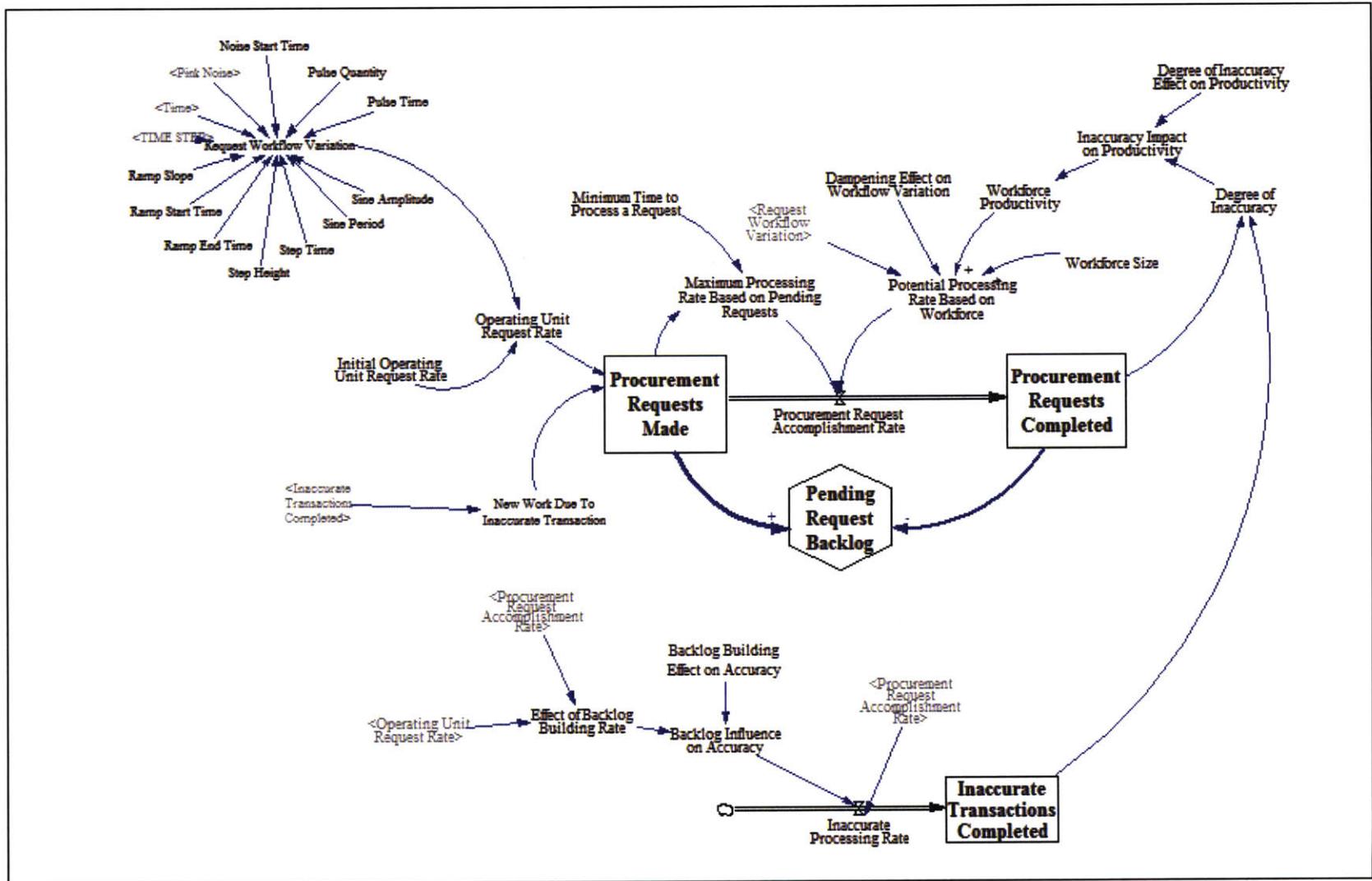


Figure 34: System Dynamics Model Structure For Backlog and Inaccurate Requests (Vensim)

The important output variables in the model are the requests made by the operation unit (Requests Made), the number of requests completed over a period of time (Requests Completed), and the backlog (Pending Request Backlog). The rate at which requests are completed (Request Accomplishment Rate) is a function of the request submission rate, which will fluctuate for various reasons<sup>11</sup>, the size of the workforce accomplishing the work, worker productivity, and the average time to process a request. The workflow variable structure in the model is a means to vary the way requests are introduced into the system, e.g. sinusoidal input, steady rate increases, pulses, or steps increases or decreases. These variables can be changed to perform desired simulations. For the simulations, the time unit is presented in terms of weeks.

The output variable of Inaccurate Transaction Complete accounts for the accumulation of inaccurate transactions that would occur over time due to causal factors identified in STPA, including distraction, workload, and job pressure. In the USCG FM system, these inaccuracies would represent a latent audit liability and would assumedly have to be corrected at a later point in time. A complete documentation of the model, including variables, initial variable values, and equations is contained in Appendix C of this document.

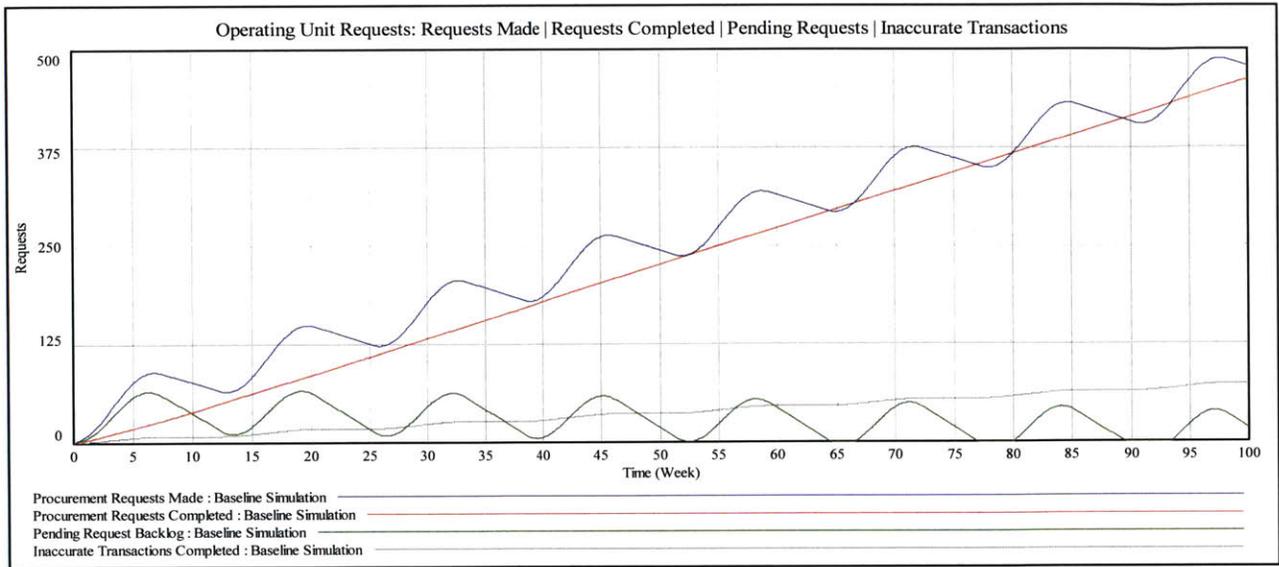
### 5.2.2 *Simulations*

Based on the information outlined above, and initial model settings, a baseline output for the variables Requests Made, Requests Completed, Pending Requests and Inaccurate Transactions is presented below in Figure 35<sup>12</sup>. The baseline simulation represents the initial operating performance of the FM system. For the purposes of demonstration, the system has slightly more throughput capacity as compared to the input of requests (work) as illustrated by the size of the request backlog. This simulation result suggests the FM system would perform satisfactorily in operation.

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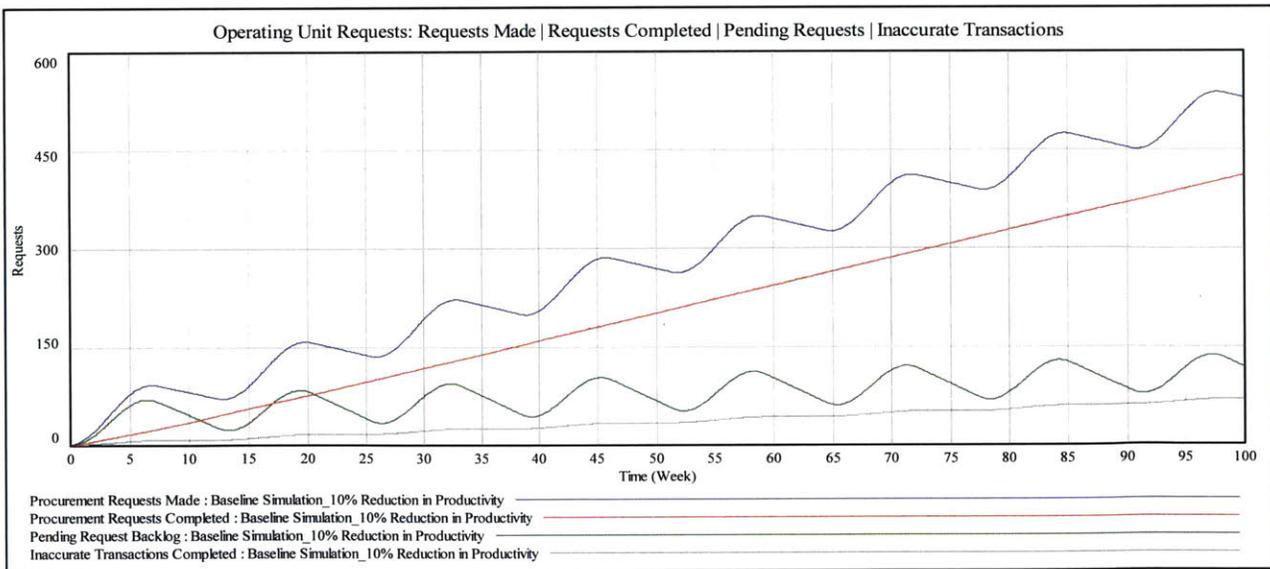
<sup>11</sup> The model is initialized with a sinusoidal shaped input to represent fluctuations in submitting procurement requests intended to replicate quarterly spending metrics and workflows. It is possible to replicate other workflow characteristics using the model inputs variables.

<sup>12</sup> Although the model variables are initialized to achieve equilibrium conditions and baseline equilibrium to compare simulations against, it is not appropriate to assume that the actual USCG FM model design, capacity and robustness is commensurate with the actual work input that will be generated by the units that it is intended to serve.



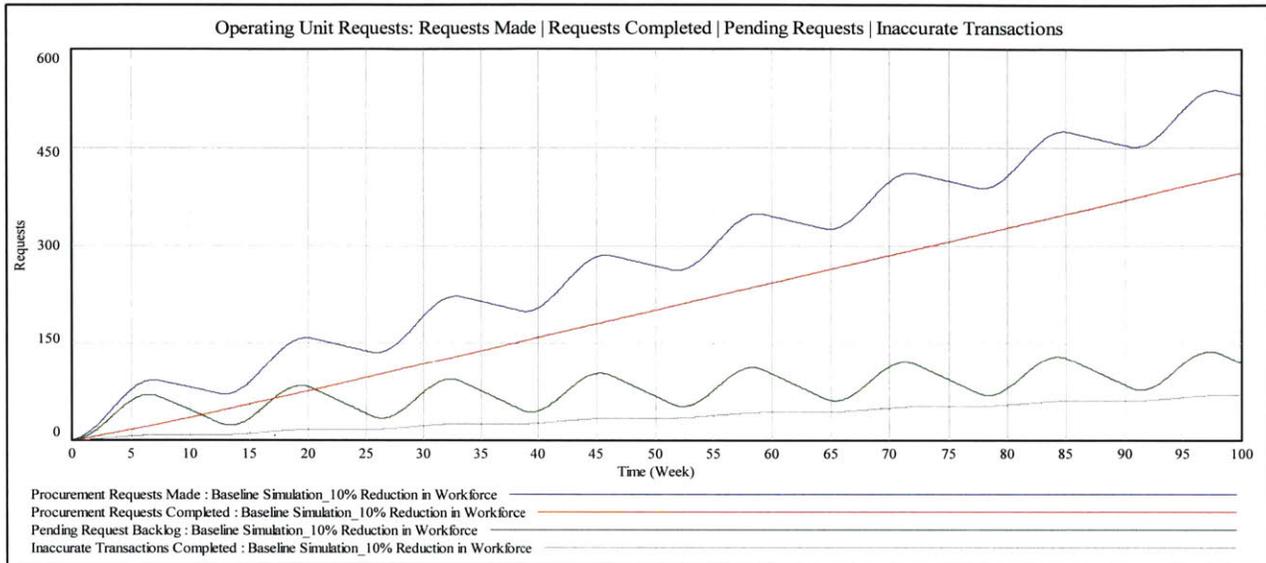
**Figure 35: System Dynamics Model Output (Baseline Variable Inputs)**

For the purposes of demonstration and system learning, another simulation is performed where worker productivity is decreased by 10%, and all other variables are held constant. With the decrease in productivity, there is both a decrease in requests completed, and an increase in backlog. The graphical results, for the same variables displayed above, are presented in Figure 36. Note the growth to the backlog, which would be highly problematic for the operating units:



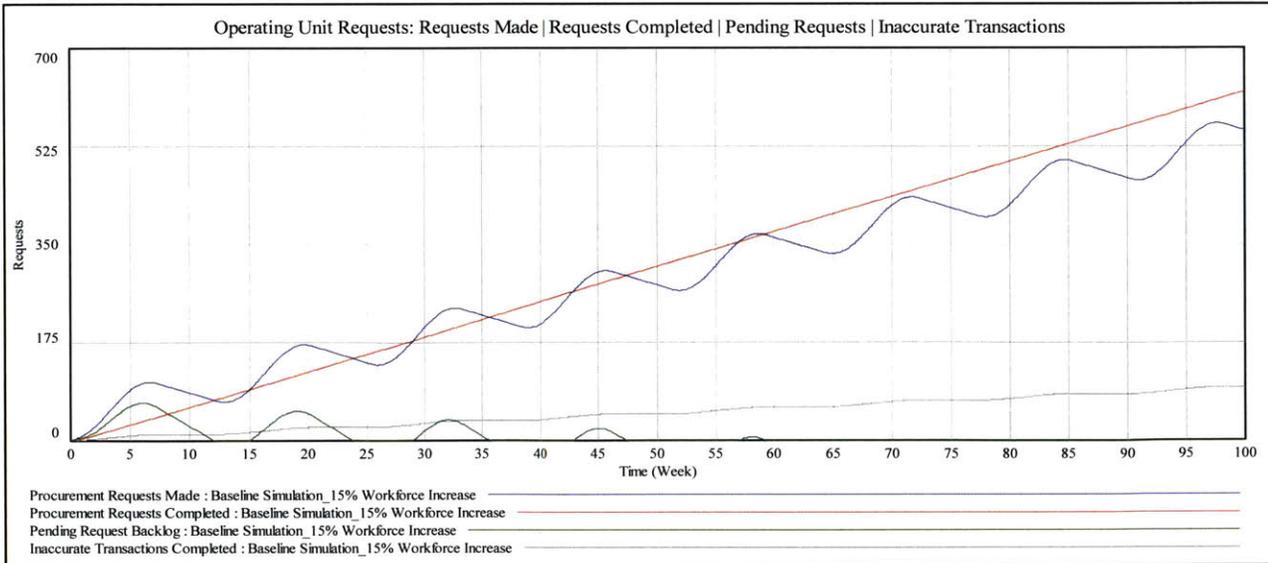
**Figure 36: System Dynamics Model Output Worker Productivity Changes (Vensim)**

Another simulation was performed to evaluate changes in the system’s capacity, as it relates to the size of the workforce. The model inputs are changed to represent a 10% decrease in the size of the workforce. With all other initial variables reset to the baseline condition, the decreased workforce dramatically increases the size of the backlog as represented in Figure 37.



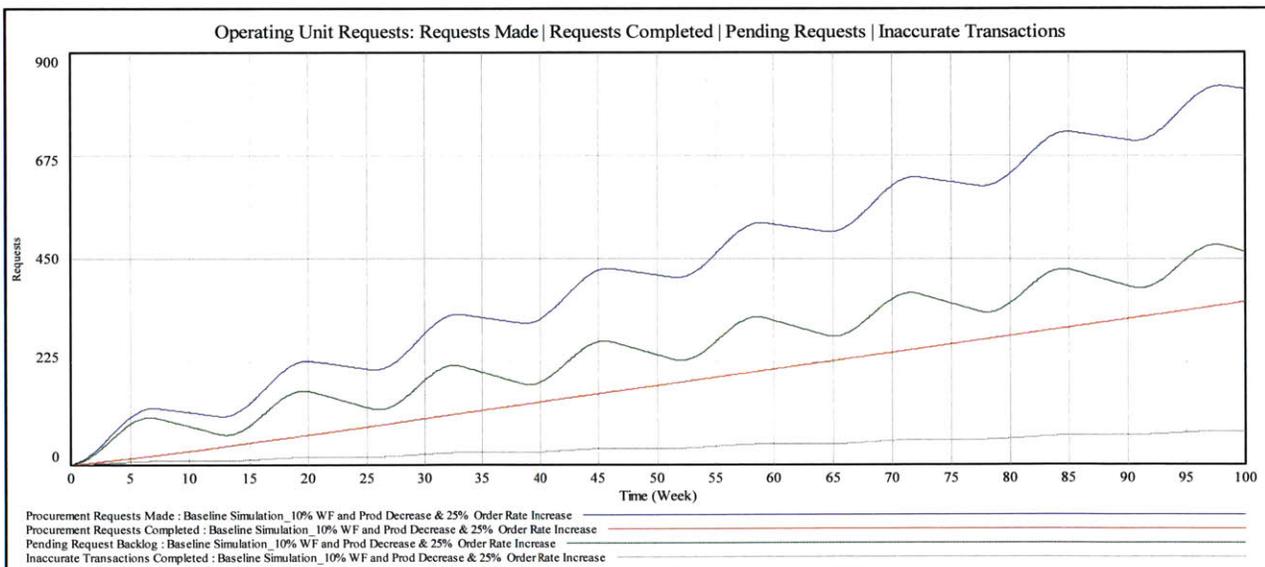
**Figure 37: System Dynamics Model Output For Workforce Size Reduction (Vensim)**

Conversely, if the size of the workforce is increased by 15%, and all other variables are held constant, the backlog of work and rate of accumulation of inaccurate transactions would significantly decrease as represented in Figure 38. This type of simulation could prove useful for making design trade-offs for the USCG FM system, including allocation of personnel resources to the FM system.



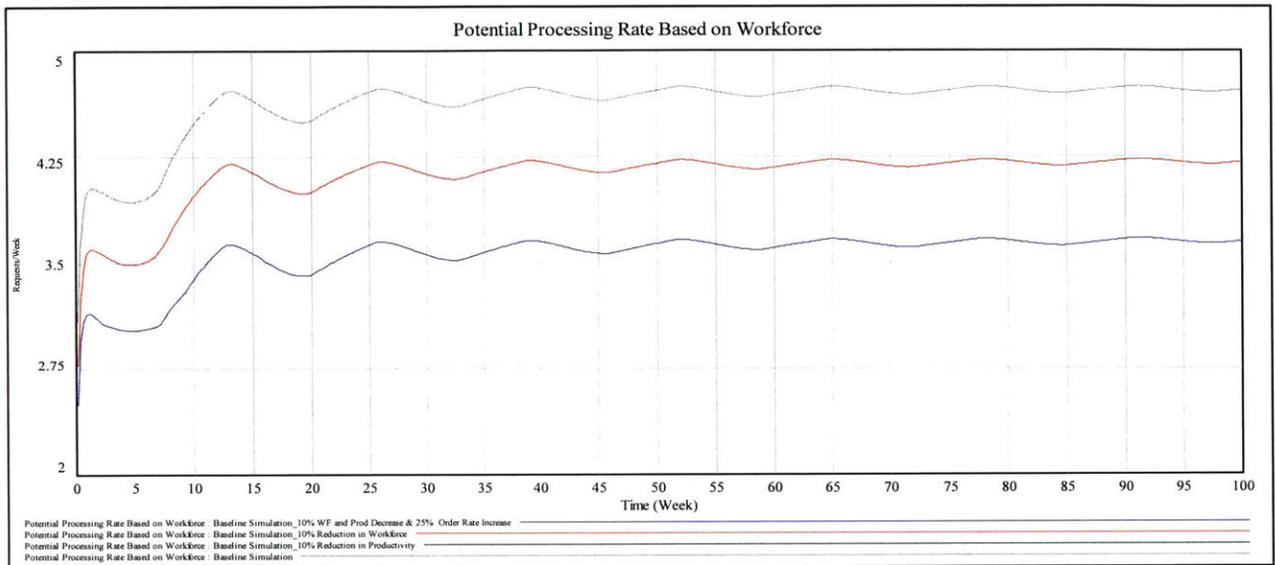
**Figure 38: System Dynamics Model Output For Workforce Size Increase (Vensim)**

Other simulations that can be performed to learn about the system and the way it responds to changes in multiple variables using the model. For example, with both of the decrease in workforce size and worker productivity simulated re-applied, and a 25% increase in the rate requests are made to the system (surge operation, service provided to other units), the response is as shown below in Figure 39. In this simulation, the FM system is completely overwhelmed.



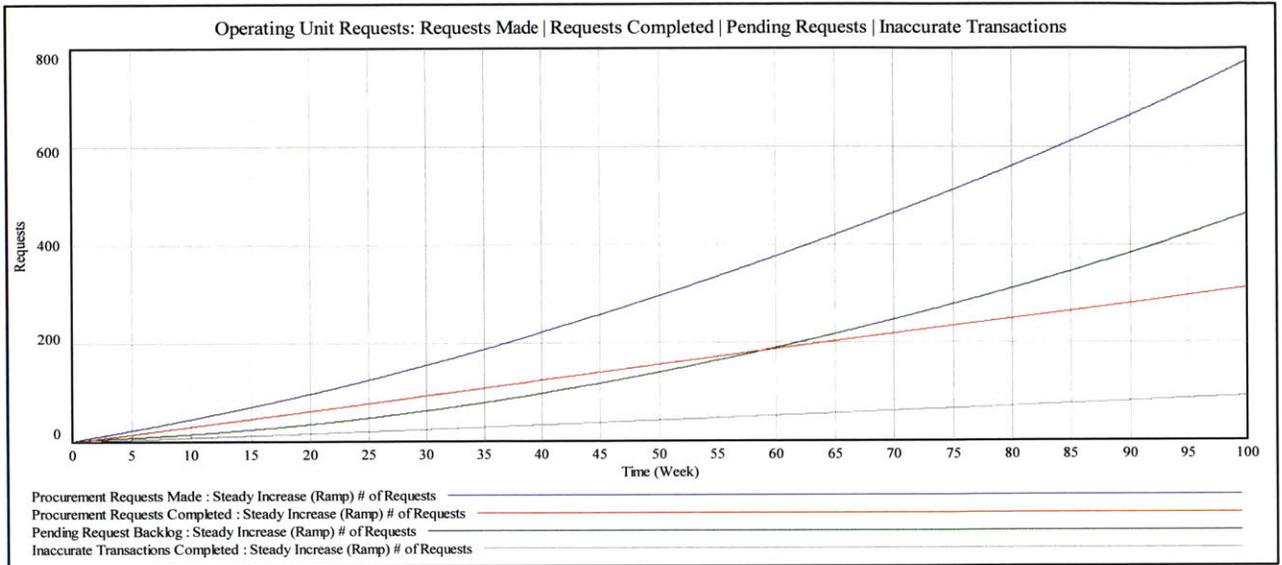
**Figure 39: System Dynamics Model Output for Workforce, Productivity, and Requests Changes (Vensim)**

Using Vensim, it is also possible to isolate and learn about the behavior of one, or a few related, system variables, which could also be valuable when making system design decisions or trade-offs. As shown in Figure 40, the potential processing rate for requests is dramatically impacted as the size of the workforce, workforce productivity, and requests made are increased.



**Figure 40: Potential Processing Rate Based on Workforce For Multiple Simulations**

Using the basic system dynamics model, simulations can also be conducted where there is a steady increase over time in the rate of requests made to the system by the operating unit. In such a scenario, it can be seen (Figure 41) that the FM system cannot support the additional infusion of work, and there is an exponential rate of degradation of system performance. Under real circumstances, this could occur through the introduction of additional work (additional units to support) or new work requirements (new FM procedures or processing requirements) without a commensurate increase in resources to perform the work.



**Figure 41: System Response To Steady Increase in Number of Requests Made Over Time (Vensim)**

Vensim has additional functionalities that allow for changes to multiple input variables for efficient analyses and exploration of the sensitivity of changes to certain variables. This mode is represented in Figure 42.

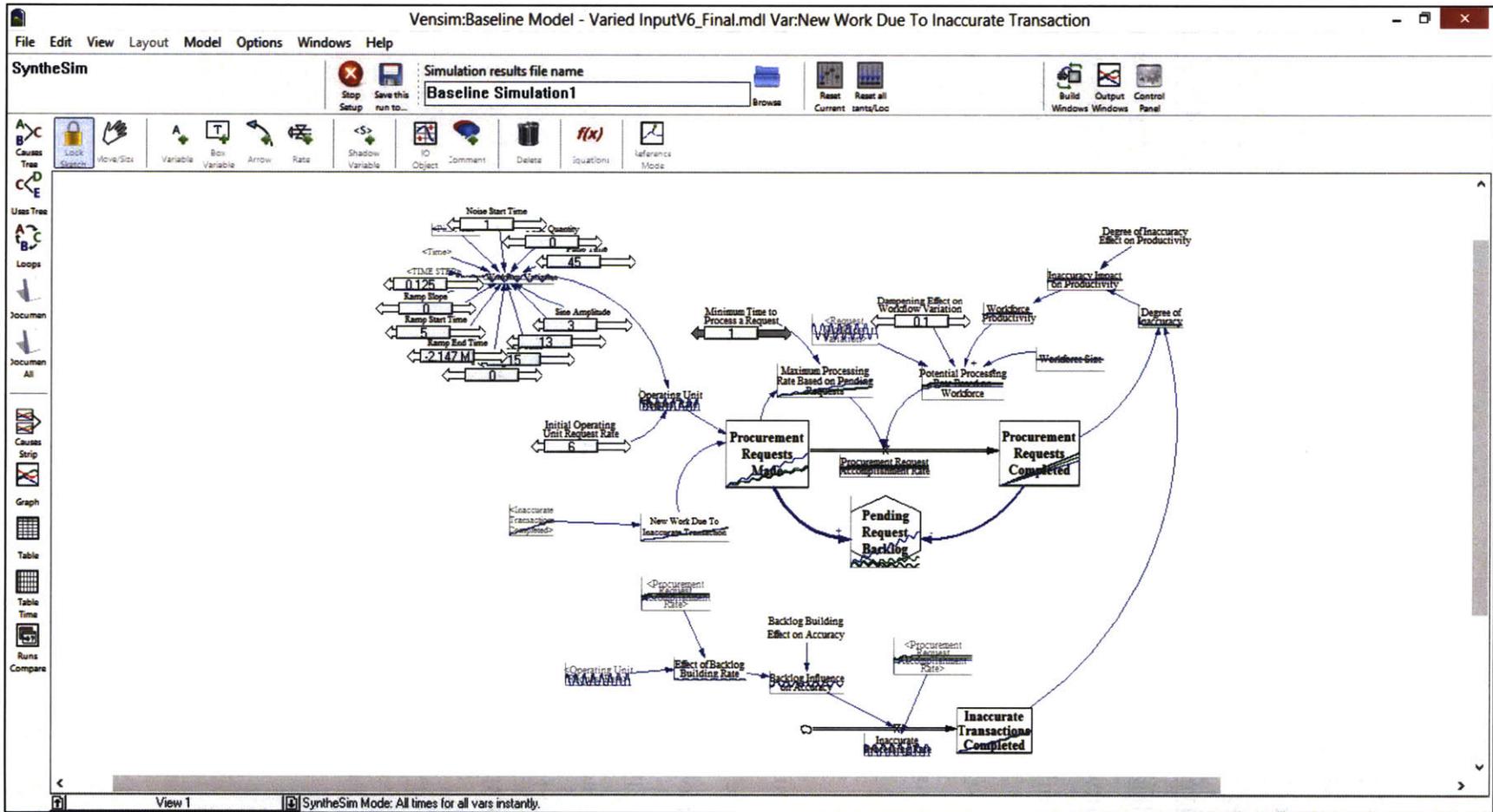


Figure 42: Vensim Desktop View in *SyntheSim* Mode (Vensim)

### 5.3 Recommendations

The purpose for including these simulations as part of this thesis is not to comprehensively analyze the design or recommend an optimized USCG FM system. Rather, the goal is to demonstrate how the use of systems dynamics models can be used to inform design decisions and improve system performance through experimentation and learning *before* operation. Most importantly, use of the models includes an illustration of the negative effects that will persist if the system hazards identified using STPA are not mitigated. An analogy is using Finite Element Analysis software for structural design and fatigue analysis in ship-hull design. Before the ship is actually built, there are additional analyses, prototypes built, and other testing that also occurs.

With regard to the implementation of the new FM software application and/or re-engineered business processes, a prototype or pilot should be tested in small scale before full-system operation to the extent possible given the complexities of using parallel FM software applications. Similar approaches have been taken within the USCG when shifting to a new and unfamiliar business (logistics) processes. In 2007-2008 two USCG Sectors were used to prototype the implementation of a new small boat maintenance business model. Such an approach also makes the overall effort more manageable, and validates or demonstrates that the system can perform as it was designed to. If unforeseen challenges arise, they can be expediently addressed. This approach, coupled with active monitoring and measurement of performance (supported by theoretic system dynamics modeling) can positively contribute to the successful implementation of the new processes throughout the entire USCG [30].

## **Chapter 6: Conclusions, Recommendation & Future Research**

### 6.1 Addressing Thesis Questions

Based on the research and analysis performed in the preceding chapters, the following discussion is provided relating to the thesis questions originally presented in Chapter 1 Table 1, and repeated below:

<b>Number</b>	<b>Thesis Research Question</b>
1	What challenges will the USCG's new FM software application and re-engineered business process create for frontline operating units once it is implemented?
2	What system analysis methods may help identify the causal factors that create the challenges—or system hazards—and mitigate or abate them in the new USCG FM system?

### 6.2 Applicability of STPA

Using the STPA methodology to evaluate the USCG FM system, we identified a total of 205 causal factors relating to the design and operation of the system, CAS FM software application, system capacity and worker environment that can lead to system accidents. The outcome of this analysis unequivocally demonstrates the utility of STPA to methodically evaluate a complex system and identify its hazards in a rigorous, traceable, repeatable manner that addresses the entire system. The STPA results will allow the system designers and sponsors to revalidate requirements and the designs. An important aspect of applying the STPA method is developing the system control diagram. This requires a thorough understanding of the system and how the various components interact. Furthermore, the system control diagram is also extremely useful to system owners for developing and implementing hazard control, reduction and/or elimination measures.

### 6.3 System Dynamics Modeling & Simulation

The use of system dynamics is a powerful method to understand the behavior of complex systems that have non-linear relationships between inputs and outputs. The basic simulations performed in Chapter 5 are useful to begin understanding how the USCG FM system will respond to various inputs, based on the system design. To facilitate a more robust analysis, additional features can be incorporated into system dynamics model of the USCG FM system. Additional features for the SD model could represent delays in the FM system caused by late or non-existent controller action, the impact of re-work, endogenous factors that affect worker productivity and accuracy in processing requests and transactions, and the effect that staffing levels have on the throughput capacity and resiliency of the USCG FM system.

The model and outputs can be useful in conveying information to stakeholders and decision-makers regarding expected system performance, and most importantly, allow for testing of any changes proposed on the system. This would include measures taken (or not) to mitigate the hazards identified in STPA, or other design changes to the system. Perhaps the most useful learning that can occur through the use of system dynamics is insight as to how resource trade-offs will affect the operation of the USCG FM system—especially the current constrained fiscal environment.

Beyond the evaluation of the USCG FM system, use of system dynamics in other areas (mission planning, resource allocation, project management, and logistics) can also improve the USCG's mission outcomes and business processes.

### 6.4 Sponsoring and Leading Change

Many of the concepts Ralph Katz presents in his work *The Human Side of Managing Technological Innovation*, are applicable to the USCG's efforts to reengineer its FM system. Among the most applicable is the need for strong sponsorship by USCG senior leaders to prepare the system for the changes that are needed. Before the changes can be implemented, there must first be a common understanding of the problem and consensus on how to resolve it, especially when considering that systems are often fundamentally resistant to change. This will require very strong and active sponsorship and the assemblage of credibility and trust for the agents that

will implement it. In his work, Katz also presents very powerful insights into the benefit of building (or strengthening) information networks across organizational boundaries. In general, organizations do not serve to integrate efforts within a system; rather they differentiate between the roles and responsibilities that individuals have in it [31].

In the context of the USCG FM system, the information networks that bridge the system development and system operation sides of the organization must be strongly connected to ensure the system achieves and maintains its envisioned level of performance. These networks will also be useful in calibrating the process models—or mental models—of the individuals who operate the system [32]. Implementing the changes outlined in the Draft BPR and transition to the new FM application will surely be a challenge. With the right design of the approach for implementation, it can be successful. It is my hope that the information and findings presented in this thesis will contribute to its success.

## 6.5 Utility of SafetyHAT

The SafetyHAT application developed by the Volpe Center facilitated a thorough review of a very complex socio-technical system that was used to define new traceable requirements for the system. I am very thankful to my advisor for making it available. The application was very intuitive to use and allows even novice or first-time STPA users to conduct a hazard analysis without becoming overcome by the challenges associated with an expansive listing of causal factors and hazards. Moreover, the ability to revise prior steps or portions of the analysis while preserving the integrity of the unaffected data or information was especially useful. During the analysis, I performed multiple iterations caused by changes in the system control diagram and omissions made during prior steps.

To improve the user experience of SafetyHAT, it is recommended that the user first customize the causal factor analysis “guidewords” in a way that tailors the language to their specific domain, i.e., food safety, cyber-security, finance, aviation operations, within the context of the STPA methodology and presented by Leveson and related literature and research. This will facilitate a better analysis using STPA, and make the output easier for engineers and decision-makers to understand and take action on.

Based on the analysis performed using SafetyHAT in the domain of financial management operations, more applicable guidewords were identified relating to the USCG FM system<sup>13</sup>. The following figure contains causal factor guidewords that may enable other STPA and SafetyHAT users to perform a hazard analysis in the field of government FM operations. This evolved list of guidewords (Figure 43) may also serve as a basis to develop guidewords for other fields or domains. Recommended changes to guidewords are contained in the red dashed ovals.

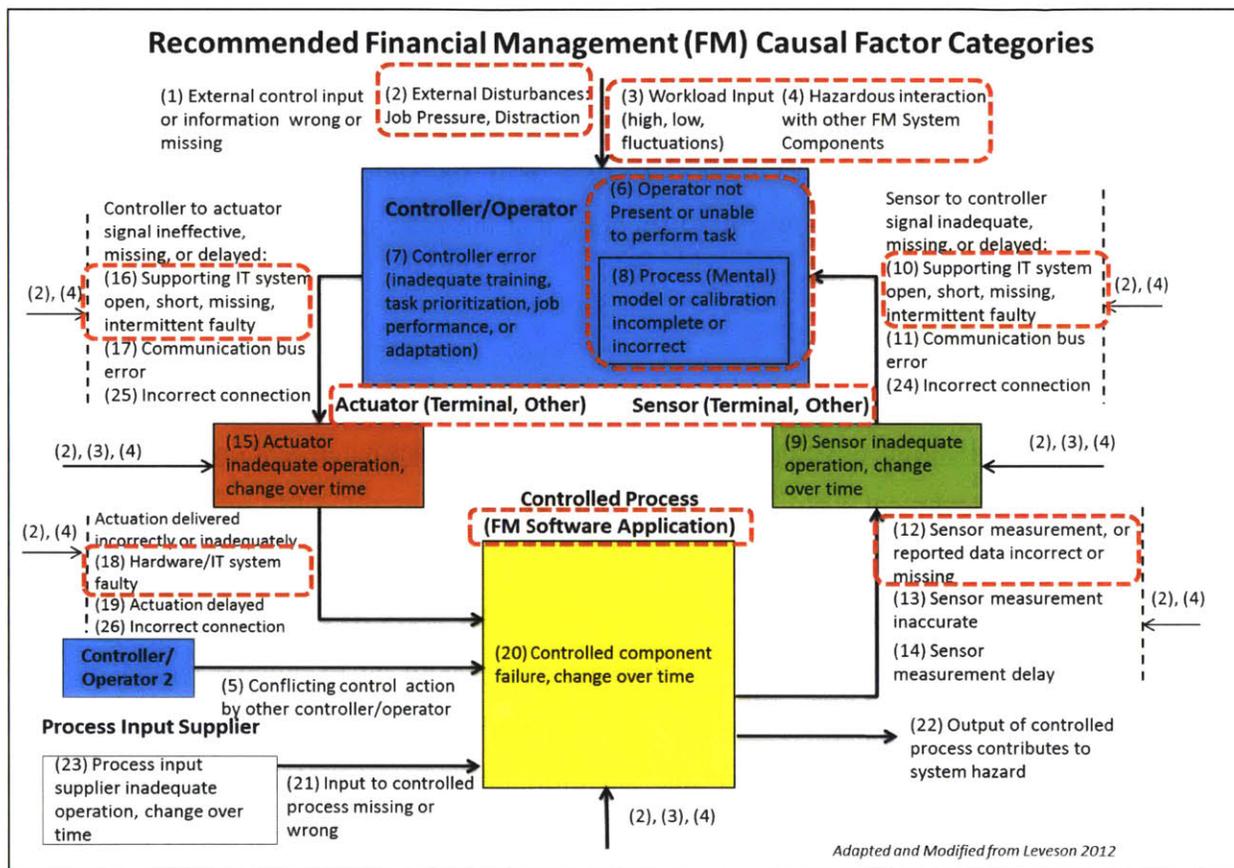


Figure 43: Suggested Causal Factor Guidewords for Government Financial Management

<sup>13</sup> The original SafetyHAT guidewords were developed for and are most applicable to transportation systems.

## 6.6 Future Areas of Study and Research

The following opportunities for future areas of study and research based on this thesis include:

- Continue to use STPA and system dynamics modeling and simulation to throughout the design and implementation of the USCG's FM system re-engineering effort, especially to develop and inform design trade-off decision-making.
- Perform a retrospective comparison between system hazard analyses using STPA and other methodologies used in the past by the USCG to evaluate the efficacy of the different methods. The comparison should consider the level of effort and results derived from the different methods.
- Perform additional hazard analyses using the Volpe National Transportation Systems Center's SafetyHAT software to continue evolving the causal factor guidewords to other fields and domains and build the expertise of using STPA to evaluate complex socio-technical systems.

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## **Appendix**

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- A. USCG Financial Management Business Process Re-Engineering Draft Report
- B. USCG Financial Management STPA Analysis--SafetyHAT Data Export
- C. Documentation for Vensim System Dynamics Model of USCG FM System

UNITED STATES COAST GUARD

# Financial Management Business Process Reengineering

Final Report

May 15, 2013



The Financial Management Business Process Re-Engineering (FM BPR) Team was chartered on August 9, 2012 by the Deputy Commandant for Mission Support (DCMS) and the Assistant Commandant for Resources (CG-8) to examine the current policies, authorities, procedures, processes and organization of funding execution and accountability in the Coast Guard, exclusive of budget formulation.

Pre-Decisional...For Internal Coast Guard Use Only

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1. Executive Summary

The Financial Management Business Process Re-Engineering (FM BPR) Team was chartered by the Deputy Commandant for Mission Support (DCMS) and Assistant Commandant for Resources (CG-8) to examine the current policies, authorities, procedures, processes and organization of funding execution and accountability in the Coast Guard, exclusive of budget formulation (Appendix A). The charter required the project team to provide findings, recommendations, and courses of actions (COA) leading to a future FM Operating Model that is more closely aligned with the Mission Support (MS) Business Model; compliant with all laws, regulations, and Federal policy; and complementary to the potential functionality of a new, commercial-off-the-shelf (COTS) financial management application (FMA). In essence, the FM BPR Charter asks “What is the optimal organization design to enable the capabilities a new financial management application and that best align standardized FM processes with mission support?”

1.1 Stakeholder Engagement and Change Management

Parallel to the FM BPR was a robust effort to analyze and overcome natural resistance to change, promised to be acute given the nature and magnitude of the changes the FM BPR was contemplating. Stakeholder engagement and change management efforts included extensive, repeated stakeholder analysis, two service-wide stakeholder surveys, comprehensive, repeated briefings to operational and support leadership, and inclusion of field and Headquarters stakeholders in sub-teams and a subject matter expert (SME) workgroup.

1.2 Findings

Three main findings from benchmarking, research, stakeholder input and organizational analysis were central to the development of the recommended FM Operating Model:

- Support processes should be modeled in accordance with the Federal Enterprise Architecture (FEA) Business Reference Model (BRM) to cleanly align activities with supporting COTS FMA and enable Coast Guard compliance with government auditing and reporting requirements.
- FM processes should be modeled in accordance with Financial Systems Integration Office (FSIO) standards and infused into BRM structured support processes with configuration and internal control oversight from the CFO.
- Support and financial processes should be delivered to the operational Coast Guard via a Front-End-Back-End business model with front end units focused on customer support and back end units focused on enterprise process efficiency.

Although the notional FM Operating Model satisfied most objectives of the FM BPR Charter, it did not fully align with an evolving MS Business Model. To achieve full alignment, the FM BPR identified and recommended modifications to the scope and

structure of the MS Business Model that would allow both models to combine for the creation of an overarching Coast Guard Business Model.

### 1.3 Coast Guard Business Model

FM BPR adapted a notional FM Operating Model into a modified MS Business Model, which has steadily evolved since Coast Guard Modernization. Referred to as the Coast Guard Business Model (CGBM), the key components of this “to-be” model include

- Business Line Service Delivery Structure – Segmentation of the Coast Guard into mission support levels with standardized roles, responsibilities, and capability:
  - Strategy and Policy Level (S&P)
  - Functional Depot Level (Functional D-level)
  - Regional Depot Level (Regional D-level)
  - Organizational (O-level)
- Integrated Standard FM Processes – Standardized FM processes infused into business functions and executed at assigned organizational entities. Development of standard business functions that align with BRM Business Lines, and executed through product/service lines.
- Aligned Funds Distribution, Technical Authority, and Internal Controls - Alignment of expertise and authorities to create single points of accountability, specifically to certify and obligate funds, at D-level entities; distribution of budgetary authority (funds) to D-level entities within Business Functions; and designation of D-level entities as assessable units.
- Business Intelligence, Reporting, Assessment and Assurance – Establishment of a hierarchy of reporting and monitoring capabilities, activities and requirements to ensure transparency and visibility of funds, business activities and performance measurements:
  - Analytical Reports
  - Standardized Push Reports
  - Supported Unit Ad Hoc or On-Demand Reports
  - Internal 3rd Party Assessment
  - Statements of Assurance
- Uniform and Focused Contingency Business Operations - Leveraging the capabilities developed in the CGBM to focus mission support on contingency response.

### 1.4 Recommendations

The following are the high-level recommendations to implement the CGBM:

- Adopt CGBM organizational level designations

- Establish business lines, business functions, and service/product lines with associated functional owners and defined responsibilities and authorities at each CGBM organizational level.
- Integrate FM processes into business functions and consolidate budget authority and obligation authority at the depot level
- Align funds distribution with business lines
- Align the Comptroller evaluation and delegation chain with the COCO evaluation and delegation chain to create FM single points of accountability
- Develop an expanded system of internal controls including D-level assessable units and increased 3<sup>rd</sup> party inspections/audits.
- Develop a uniform FM contingency operations response capability that aligns with the CGBM
- Develop a robust knowledge management capability and expanded business intelligence system
- Revamp FM and DCMS doctrine

#### 1.5 Conclusion

The FM BPR recommendations reflect the steps required to implement the CGBM and are subject to the approval of Coast Guard leadership. However, unlike previous studies, these recommendations are not intended to remediate a specific gap, but rather to build a cohesive model. In the former case, a decision to not implement a recommendation resulted in an enduring gap for which the Coast Guard has decided to assume the risk. In the FM BPR, each recommendation is part of a holistic model. “Picking and choosing” from the FM BPR’s comprehensive and interdependent list of recommendations puts at risk any expected outcome. The recommendations are not scalable and do not enjoy a simple time-linear relationship. However, sequencing the implementation of recommendations may be necessary and beneficial.

2. Background

Current Coast Guard FM business processes are complex, cumbersome, confusing, inconsistent, non-standardized, difficult to audit, and reliant on an outdated and unstable Core Accounting System (CAS) and mixed systems. The current FM structure is also disparate, multi-layered, and inefficient. Collectively, these factors result in a system with high maintenance costs, numerous audit liabilities, and administrative requirements that place an undue burden on front line units. These causes for action provided basic assumptions, constraints, guidelines, and minimum requirements for the scope of this effort and the final recommended business model:

2.1. FM and DCMS Alignment

The MS Business Model and FM Operations Model are not aligned. Business practices are inconsistently linked or decoupled from funds management, producing gaps, inefficiencies, and missed opportunities for greater effectiveness.

2.2. CAS Replacement

CAS is at high risk of catastrophic failure. Customizations to Oracle Federal Financials (OFF) has prevented the application of security patches since 2008. The Coast Guard has decided to pursue replacing CAS with a COTS product provided by a Shared Service Provider (SSP). This strategy aligns with DHS and OMB direction on Financial Management System (FMS) replacements and ensures a future system will use standard Financial Systems Integration Office (FSIO) business processes. In preparation, the Coast Guard must re-engineer its business processes to conform to FSIO standards.

2.3. Audit Sustainability

Despite unprecedented improvement in the Service's audit performance, sustaining a clean, full-scope audit opinion requires integrated business processes that organically incorporate audit requirements instead of routinely relying on the heroic efforts of business and financial managers.

2.4. Federal Requirements and Best Practices

As cited in audit findings, due to current business processes, CAS and mixed systems, the Coast Guard is not able to fully comply with all laws and regulations. Specifically:

- Federal Managers' Financial Integrity Act of 1982 (FMFIA)
- Federal Financial Management Improvement Act of 1996 (FFMIA)
- Associated circulars and implementing directives (OMB A -11/123/127/136)

2.5. Previous Coast Guard Studies and Decisions

Previous studies have produced FM transformation recommendations that remain relevant. Specifically, the 2006 Financial Management Transformation Task Force (FMTTF) resulted in a Commandant decision directing consolidation of budget authority

and obligation authority to an intermediate level of the Coast Guard, raising the authority levels above the operational unit. This decision has been only partially implemented.

### 3. Objectives and Assumptions

#### 3.1. Objectives

The charter provided the following objectives:

- Identify the characteristics and structure of the “as is” state.
- Develop and validate the requirements and characteristics of a “to be” state.
- Engage agencies noted for financial management success; assess their financial management business models relative to the Coast Guard’s and catalog findings.
- Develop at least three notional future financial management business models. Include in each design authority, policy, process and organizational structure (including people) impacts, while noting respective costs, risks, and implementation strategies. Implementation strategies must sequence within CAS project constraints.

#### 3.2. Assumptions

The FM BPR provided the following assumptions:

- The future financial management business model is compliant and aligns with relevant laws, regulations and Federal policy.
- The FMTTF (Nov 2006) and its signed decision memo provide the fundamental vision and objectives for the transformation of the FM Operating Model.
- The FM Operating Model is compliant and aligns with Common Government-wide Accounting Classification (CGAC) requirements and a service-wide single General Ledger. (CGAC is one component of broader, Financial Management System Accounting Data Standards (FADS))
- The scope of the charter includes personnel, processes, and functions involved in the following Financial Standards Integration Office (FSIO) lines of business:
  - Funds distribution and administrative control
  - Request to procure
  - Procure to pay
  - Reimbursable management
  - Bill to collect
  - Grants management
  - Acquire to dispose
  - Record to report
  - Business intelligence reporting.

Expanded assumptions and considerations for implementation subsequently submitted for approval are found in Appendix B.

4. Study Approach and Methodology

4.1. Overview

After assessing several approaches, the FM BPR was essentially split into two sub re-engineering efforts with both efforts following the standard BPR methodology described in Appendix C.

The first effort addressed aligning the FM service delivery structure with the MS Business Model and focused primarily on organizational strategy, structure, roles and governance. The primary goal was to “diagnose” the “As Is” state in order to define the primary strategic misalignments that drove inefficiency or ineffectiveness. From that understanding, the FM BRP developed key principles of the “To Be” state to address financial and business operations weaknesses while accomplishing charter objectives.

The second effort addressed the replacement of CAS with a FSIO-compliant system and focused primarily on standardizing FM processes and their process steps. This effort relied heavily on previously conducted process mapping to develop the “As-Is” and on known, standard FSIO processes and best practices to develop the “To-Be”.

The two efforts were later merged; overlaying the “where and whom” in the first effort with the FSIO process steps from the second effort. The resulting FM Operating Model was then reviewed by Subject Matter Experts (SME) to determine how well its principles, and the operating blueprint developed to implement them, addressed the identified weaknesses, satisfied the charter objectives, and performed against organizational expectations

Benchmarking other agencies was used to help validate processes, structure and other FM BPR recommendations (Appendix D). A comprehensive Stakeholder Engagement and Change Management Plan (Appendix E) was also employed to garner broad organization input, ownership and support.

4.1.1. Governance and Stakeholder Involvement

The FM BPR chartered and implemented a governance and oversight structure that promoted involvement of key stakeholders in the development of notional FM Operating Model attributes, COA’s and recommendations. The FM BPR governance structure is displayed in Figure 4.1. Governance team members routinely received briefs on methodology and interim decision points, reviewed and furnished feedback on working documents, and provided advice and direction to the FM BPR team. Appendix F provides a full list of FM BPR contributors.

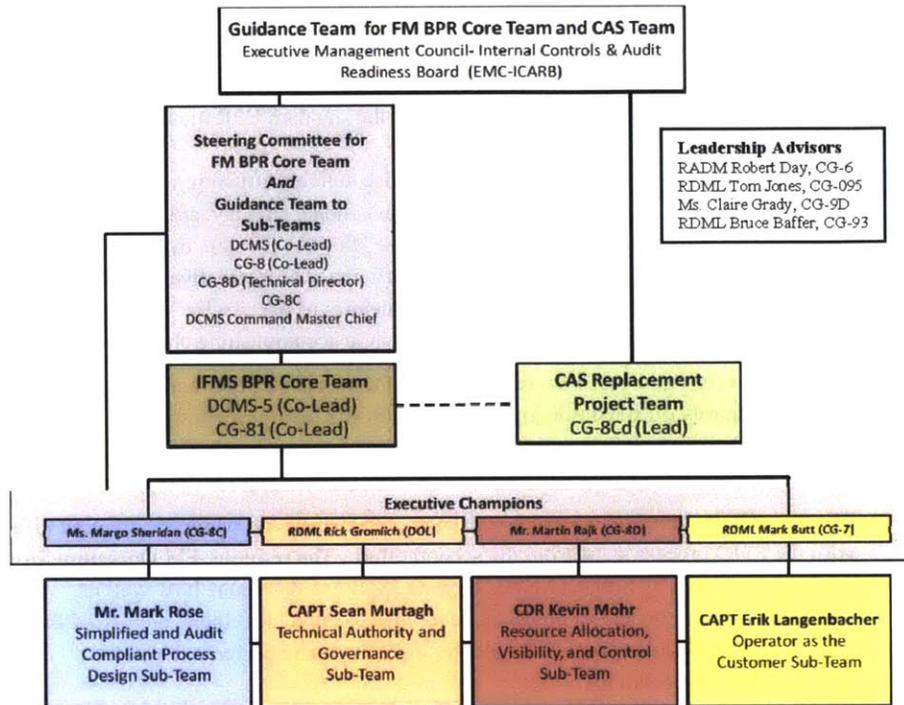


Figure 4.1: FM BPR Governance Structure

4.1.2. Benchmarking

The FM BPR performed extensive research and benchmarking of previous FM improvement efforts conducted inside the Coast Guard and by other Federal agencies. From previous studies and implementation efforts, the team looked for sources of fundamental strategy that have been less than fully matured within the Service. External benchmarking looked for novel and/or proven ideas that could be implemented “off the shelf” through wholesale re-engineering. Ultimately, the external benchmarking effort had mixed results, as finding a useful business model analog to the Coast Guard is difficult. Benchmarking previous studies was more productive, and provided several strategic findings that were integrated into the analysis and development of recommendations.

4.2. Organizational Structure Reengineering

4.2.1. Defining the “As-Is” State

The initial tool used to dissect the current state of Coast Guard FM operations was the “V” chart, depicted below in Figure 4.2. The “V” chart was used to articulate

where FM activities were performed in the “As-Is” state. The rows of the “V” chart represented units which fell within three primary organizational tiers: Budget and Policy, Mission Support to Operations, and Operations. The columns represented future FSIO processes with the FM BPR effort focused on three key processes: Funds Distribution and Administrative Control, Request to Procure, and Procure to Pay. A “V” chart was developed for each Allotment Fund Code (AFC) and included detailed information on what activities took place as funds were distributed and executed at various levels, and what interfaces were needed to perform those activities. A comprehensive collection of “V” charts can be found in Appendix G.

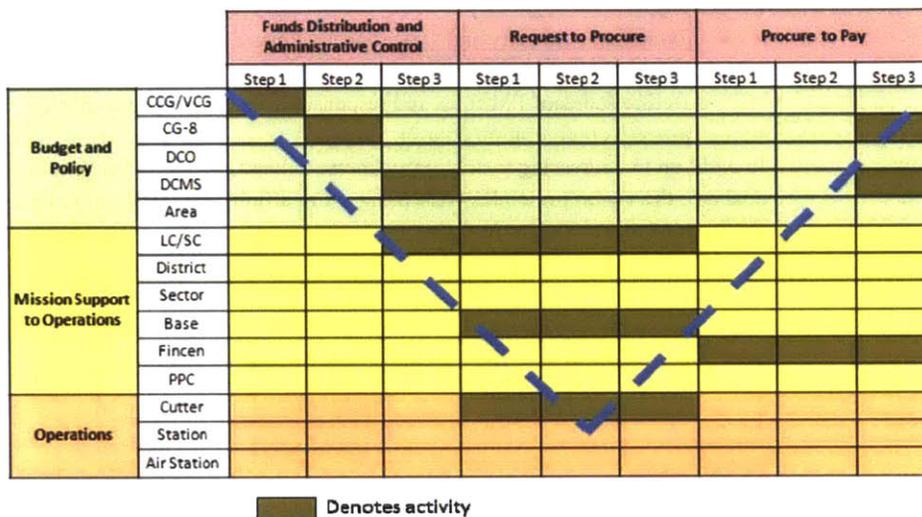


Figure 4.2: Generic Model of a “V” Chart

Describing the “As Is” state in terms of the primary requirements of the envisioned “To Be” state simplified the task of cataloging changes to the current structure and processes that would be required to meet the charter objectives. In addition to identifying major variations of the current state from FSIO and the MS Business Model, analysis of the “V” charts identified departures from financial laws and policies, and misalignment with government or industry best practices.

4.2.2. Development of “To-Be” Vision Principles

Since a goal of the FM BPR was to design a future FM Operating Model, the gaps identified in “As-Is” analysis were not individually listed for solution. Rather, these gaps were categorized into thematic weaknesses, and for each area of weakness, a principle of the “To-Be” vision was created. After consultation with

the FM BPR ESC, the FM BPR developed and defined the following vision principles for a notional FM Operating Model:

- **Standardized and Audit Compliant Process Design:** Codify key financial management processes to comply with FSIO standards, and minimize variation across support communities of practice.
- **Operator as the Customer:** Deliver financial management as a valued, performance-measured service to the operational commander.
- **Resource Allocation, Visibility and Control:** Optimize the level to which budgetary and obligation authority is distributed with metrics and robust business intelligence providing for visibility and control.
- **Technical Authority and Governance:** Ensure positions responsible for financial management are accountable to the FM Technical Authority. Define standard FM roles and responsibilities. Clarify and enforce FM process configuration control.

In addition to addressing thematic weaknesses identified during the “As Is” analysis, the vision principles were designed to affinitize with those of the MS Business Model as shown in figure 4.3.

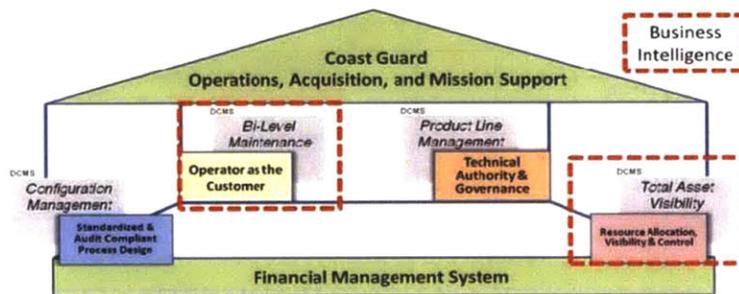


Figure 4.3: Alignment of Financial Management and Mission Support Business Models

4.2.3. Developing Attributes of a Notional FM Operating Model:

SME sub-teams were formed for each vision principle with the responsibility of developing primary and secondary attributes of a future FM Operating Model, which would also inform the implementation of courses of action. Each sub-team drew on their individual professional expertise and on the accumulated research and information gathered through benchmarking. Development followed a systematic, iterative process that included approval and refinement by the FM BPR ESC and Executive Champions. The primary attributes of a future FM Operating Model are listed in Table 4.1 and a full list of attributes and sub-attributes is listed in Appendix H.

<b>Standardized and Audit Compliant Process Design</b>
Financial Management structure and strategy follows the DCMS "Mission Support Business Model". Collectively they form the "Coast Guard Business Model".
Coast Guard Financial Resource Management is organized into <i>standard functional areas</i> .
Coast Guard Financial Resource Management incorporates <i>standard processes and roles</i> .
All support activities impacting financial resources (e.g., travel orders) will incorporate standard financial processes.
Coast Guard uses integrated, off-the-shelf IT systems and services with standard interfaces to support Financial Resource Management.
The Coast Guard uses a <i>standard accounting classification structure</i> .
The Coast Guard uses a single General Ledger and standard General Ledger posting logic down to the transaction level.
<b>Operator as the Customer Team</b>
Supporting commander(s) ("FM Provider(s)") must provide <u>ALL</u> FM services to operational commander ("Supported Units").
<u>Supported units must have ability to request FM services from FM provider(s) for unit level actions.</u>
Supported and Supporting units will have formal Service Level Agreements (SLAs) to govern FM relationship and responsibilities.
Supported commander will have discretion over unit level funds.
Support unit is the custodian of general purpose property and Depot Level OM&S. Appropriate Depot Supporting unit (Base, LC/SC) maintains administrative control and reporting responsibility.
The Coast Guard has a designated financial management team/capability to support contingency operations.
<b>Technical Authority and Governance</b>
Financial Management Technical Authority and Governance will be designed, managed and implemented through promulgation of a Financial Management organizational doctrine. Doctrine will be rooted in external and internal requirements.
Financial Management Technical Authority must implement controls to maintain adherence to the Financial Management Doctrine.
Financial Management Technical Authority must monitor and produce reports reflecting the status and condition of the Service's FM operations.
Financial Management Technical Authority must assess effectiveness of controls and efficiency of the Financial Management Doctrine.
<b>Resource Allocation, Visibility, and Control</b>
Appropriations are formally allotted to one responsible official and management will not be split outside that official's chain of command. Collaborative stakeholder teams will help decide the allocation and use of funds.
<i>Budget authority</i> is consolidated at the Depot Level.
<i>Obligation authority</i> is consolidated at the Depot Level.
There is complete visibility for budget, funds distribution, obligation, and performance.
There are internal controls to ensure financial resources are obligated and expended appropriately.

Table 4.1: Primary Attributes of a Future Financial Management Business Model

4.2.4. Course of Action (COA) Development

The attributes and sub-attributes served as the basis for the development of three COAs of varying levels of aggressiveness with regard to organizational change: aggressive (Red COA), moderate (White COA), and minimal change required to

accommodate replacement of the CAS (Blue COA). A template was developed by analyzing common trends in attributes and sub-attributes and crafting business model parameters to which each COA must conform. Each COA must:

- Adopt a system with 24/7 and contingent support, and binding service level agreements
- Adopt standard FM models and processes
- Align with the MS Business Model and Field Support CONOP
- Consolidate budget authority and obligation authority at the “D-level”
- Improve and expand business intelligence, financial management reporting and communication
- Improve internal controls and technical authority through a system of assurance and assessment

4.2.4.1. Stakeholder Workgroup:

A FM BPR stakeholder workgroup brought together FM SMEs from across the organization. The SMEs were tasked with evaluating and revising notional COAs and scoring each COA against a set of evaluation criteria weighted by the FM BPR ESC and Executive Champions. COAs were briefed to FM BPR Executive Champions during a “report-out” session. The minutes and team products of the stakeholder workgroup can be found in Appendix I.

4.2.4.2. Results and Sensitivity Analysis

The Red (most aggressive) COA was scored the highest (Appendix J). Given wide variance in weights assigned between operations focused, mission support focused, and overall service efficiency focused criteria, a sensitivity analysis was conducted to see if the results would have changed under extreme conditions. Even if a 100% weight was given to any focused criteria, the preferred COA remains the Red COA.

4.3. Business Process Re-engineering

The second effort examined how the Coast Guard would incorporate the standardized business processes outlined in FSIO, and delivered through the COTS FMA, into the notional FM Operating Model. To accomplish this task, the FM BPR documented both the “As-Is” (Appendix K) and “To-Be” (Appendix L) process states at the FSIO process and process step level of detail, which was determined to be the lowest level necessary to complete a thorough Gap Analysis (Appendix M). SMEs from across the Coast Guard helped review and validate all process assumptions and documentation.

5. Findings and Conclusions

The results of the FM BPR analysis (Appendix N) reflected the need for a fundamental shift in Coast Guard’s FM and business operations strategy. This shift is accomplished by merging standard FM processes with an organizational structure that aligns with a modified MS Business Model, producing a Coast Guard Business Model (CGBM). A conceptual representation of the CGBM is presented in Figure 5.1. Fundamental components include:

- Business Line Service Delivery Structure
- Integrated Standard Financial Management Processes
- Aligned Funds Distribution, Technical Authority, and Internal Controls
- Business Intelligence, Reporting, Assessment and Assurance
- Uniform and Focused Contingency Business Operations

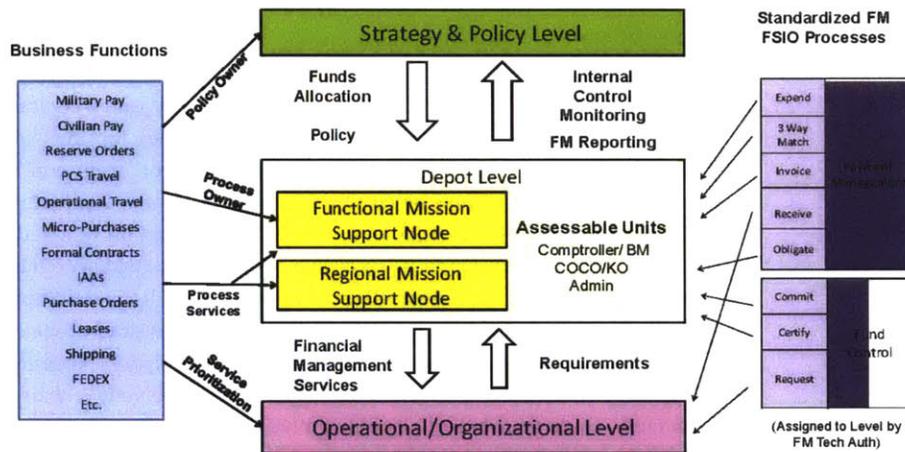


Figure 5.1: Coast Guard Business Model Blueprint

5.1. Business Line Service Delivery Structure

5.1.1. Organizational Levels

Following on National Academy for Public Administration (NAPA) Echelon Study recommendations and the MS Business Model construct, the CGBM Blueprint segregates the Coast Guard FM and business operations structure into three levels: Strategy & Policy, Depot, and Operations/Organization. The Depot Level is subdivided into functionally and regionally focused units.

- **Strategy and Policy (S&P):** S&P level consists of Assistant Commandants and HQ Directors. S&P level commanders are policy owners over their lines of

business. They provide initial and subsequent resource allocation decisions based on program analysis and close collaboration with key stakeholders. S&P level units are also “supported units” receiving day-to-day FM support and services from the D-level.

- **Depot Functional:** D-level (functional) consists of Logistics and Service Centers that represent the “back-end” of the service delivery model. D-level (functional) units represent the single point of accountability for business functions and service/ product lines. They oversee service-wide processes and process efficiency, and tackle complex support tasks that cannot be handled at a regional level. D-level (functional) units are assigned Field Comptrollers who manage the funds associated with their specific business function. Units within the D-level (functional) are referred to as “supporting units”.
- **Depot Regional:** D-level (regional) consists of Bases, or large units that perform Base-like functions, such as large training centers. Units designated in D-level serve as “Regional Support Nodes” with each having a Funds Manager (formerly titled Comptroller), an Administrative Management Officer who oversees both human resources and property, and a contracting officer (KO). Regional Support Nodes are a one-stop-shop for units within their area of responsibility (AOR) and serve as the face, or “front-end” of mission support with a focus on customer service. They also facilitate customer access to D-level (functional) or “back-end” support interactions on behalf of the units they support. To ensure coverage over wide geographic areas, Regional Support Nodes will provide oversight to Regional Support Detachments. Regional Support Detachments will be physically located at “supported units” that are too remote from a Regional Support Node to ensure customer service, but will reside in the Regional Support Node’s chain of command. Units within the D-level (regional) are also referred to as “supporting units”. These entities are also responsible for providing FM and business operations reporting, and internal control monitoring and assurance to the S&P Level.
- **Organization:** The O-level is comprised primarily of operational units and field commands. O-level units are “supported units” receiving day-to-day FM support and services from the D-level. O-Level units provide support requirements and feedback on support services to their supporting D-Level partners. These requirements include both requests for support and direction on the prioritization of funds purposed for that O-Level unit.

#### 5.1.2. Relationships and Responsibilities

- **“Above the Line” Responsibilities:** In collaboration with S&P level Assistant Commandants and HQ Directors, the CFO monitors and manages the overall

distribution and execution of funds, and serves as the financial strategist for the Service. Any re-engineering or redesign of FM processes, systems or structures should not interfere with or supersede the CFO's ability to perform these functions.

- **S&P Level Responsibilities:** Similar to the CFO, Assistant Commandants and HQ Directors (e.g. accountable officials) in the S&P level have certain responsibilities and functions that should not be impacted by consolidation. These responsibilities include developing strategies and policies, determining initial resource allocation based on stakeholder inputs, monitoring budgeted versus actual spending, directing execution changes or reallocations of resources based on emerging needs, monitoring and assessing program performance, and managing program resources at the strategic level.. From a distribution perspective, the S&P level monitors funds execution through business operations staffs, but do not actually execute funds. For the most part, they are a pass-through to the D-level units who perform these "transactional" type activities. S&P level units will have business managers, or business operations staffs, to support these functions. DCMS, DCO, CG-8 and CG-2 will retain resource management offices to support these functions and to provide high-level support to business managers. S&P level units will receive their own day-to-day financial support from the D-level (e.g. Headquarters' offices are supported by Base NCR).
- **D-level Responsibilities:** Budget authority and obligation authority is consolidated at the D-level. D-level (functional) Field Comptrollers at LC/SCs will execute funds based on policy and budget models provided by the S&P level and will provide direct support to D-level (regional) Funds Managers. D-level (regional) Funds Managers, specifically at Regional Support Nodes, will provide direct support to units within their AOR. D-level supporting units will meet the performance standards established in their service level agreements with supported units.
- **O-level Responsibilities** O-level units receive direct support from D-level (regional) Funds Managers at Regional Support Nodes. They usually have request and receive responsibilities only, but will retain a limited purchasing capability for exigent circumstances (Note: this capability does not include the obligation of funds via the FMA). O-level supported units will receive support as established in their service level agreements with supporting units.
- **Operational Commander Control**  
Operational commanders retain the authority and responsibility for the allocation and prioritization of funds. Additionally, operational commanders, along with mission support providers and S&P level officials, work collaboratively to establish and adjudicate service-wide budgets and spend

plans through a “POP” board process. Operational commanders will have business managers, or business operations staffs, to support these functions. LANT and PAC will retain resource management offices to support these functions and to provide high-level support to business managers.

- **Service Level Agreement (SLA)**  
The numerous supporting and supported unit relationships will be governed by a series of standard, binding service level agreements (SLAs). SLAs will detail the types of support both in normal and contingency operations, the performance measures required for that support, processes for requesting and receiving support, and the process for adjudicating support-related problems and exceptions.

5.2. **Integrated Standard Financial Management Processes**

This component of the CGBM is comprised of two steps: standardization of mission support activities into business lines that align the Coast Guard “back office” functions with the Federal Enterprise Architecture; and integrating into these business lines the standardized FM processes delivered via a COTS FMA.

5.2.1. **Business Line Standardization**

All mission support activities with a financial management component were identified and categorized by object class code into business functions, which align with the higher order business lines of Business Reference Model. Figure 5.2 displays the relationship between Business Lines, Business Functions, and Product/Service Lines.

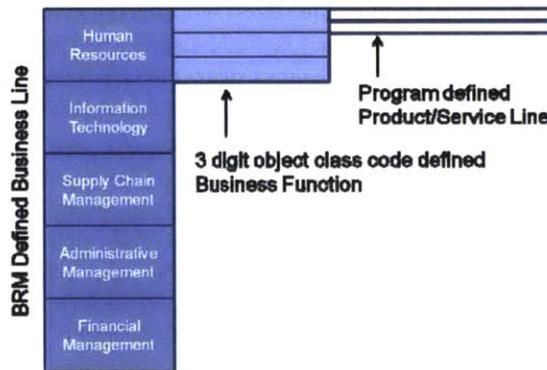


Figure 5.2: Relationship of Business Lines, Business Functions, and Product/Service Lines

- **Business Line (LOB):** Describes the primary function of a group of object class code defined business functions. Business lines are owned by Assistant Commandant and HQ Director organizations.

- **Business Function:** Activities described by a three digit object code. Business Functions cannot belong to more than one LOB and must be “owned” by a single S&P level program.
- **Product/Service Line:** Management function executed within a business function to improve service or control by increasing expertise and focus. Service/Product lines are created by Business Function owners and are described by the object class code digits following the first three.

LOBs are established in the CGBM by assigning responsibilities and authorities to the appropriate level of the organization (and by position):

- S&P level is assigned policy control of a LOB and all the subordinate Business Functions and Service/Product lines.
- D-level (functional) is assigned process control of one or more Business Functions and the subordinate Service/Product lines.
- D-level (regional) is assigned customer service responsibilities to provide/facilitate customer access to Business Functions and Service/Product lines.
- O-level is assigned customer requirement responsibilities.

Because the Assistant Commandants/Directors with responsibilities for Coast Guard business areas do not map directly to the LOBs listed in the BRM, a crosswalk will be required. However, potential co-ownership of LOBs does not impact the effectiveness of this model, since Business Functions will still have distinct owners and will still cleanly map to government-wide recognized LOBs. This co-ownership of LOBs will, however, require cooperation in strategy development between Assistant Commandants and HQ Directors.

5.2.2. **Financial Management Process Standardization**

Within business functions, FM processes are standardized in a two step concept. Responsibility for standard process steps is first assigned to appropriate levels of the organization based on business function responsibilities. In Figure 5.1, this is demonstrated by the assignment of the FSIO “request and receive” steps to the O-level, and the “certify, commit, and obligate” steps to the D level. Detailed process flows for all standard FSIO “To Be” processes are included in Appendix L. The standard FSIO processes are also embedded into business functions by tying the inherently financial steps in the business function process to the analogous FSIO step. This standardizes how a certain financial process step is completed across the different business functions, while restricting where and by whom the step can be performed. Figure 5.3 provides an example using operational travel.

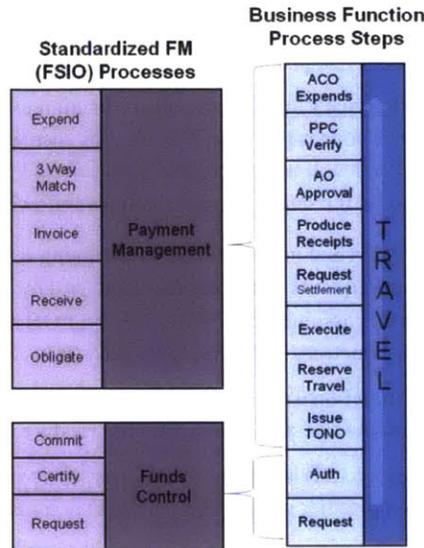


Figure 5.3: Example of FSIO Process Steps Imbedded in Operational Travel Process Steps

5.3. Aligned Funds Distribution, Technical Authority and Internal Control

Through the creation of LOBs executing Business Functions and Product/Service Lines with standardized FM processes, the Coast Guard can strengthen funds control and accountability, internal controls, and the reach of technical authority. Central to this concept is the alignment of expertise and authorities, specifically to certify and obligate funds, at D-level entities, distribution of budgetary authority (funds) to D-level entities within Business Functions, and designation of D-level entities, that meet certain thresholds, as assessable units.

5.3.1. Alignment of Responsibility, Authority, and Accountability

Aligned responsibility, authority, and accountability include execution of business function or product/service line policies and processes in accordance with the direction of the proper Technical Authority, management and execution of funds associated with that business function, and assertion of the adequacy of internal controls and accuracy of information pertaining to that business function. In order to accomplish this objective, D-level entities have the following characteristics:

- D-level entities have procurement, funds management and administrative capabilities, creating single points of accountability. This includes a COCO/KO, Comptroller/Business Manager, and Administrative

Management Officer to maintain accountability of Business Function related assets (people and property). These positions are accountable to the D-level commander for performance of duties and customer service, and to the Business Line Technical Authority for adherence to law and policy.

- D-level entities, who meet certain thresholds, are designated as assessable units. Assessable units are the lowest level of the Coast Guard required to provide assurance of funds stewardship and internal controls.
- Funds distribution follows LOBs and Business Functions. Funds are allotted or allowed past the D-level (i.e. all funds are managed and executed by assessable units).
- D-level entities manage and execute funds in accordance with policies and processes of the appropriate Technical Authority.

#### 5.4. Business Intelligence, Reporting, Assessment and Assurance

To ensure transparency and visibility of funds, business activities and performance measurements, the CGBM establishes a hierarchy of reporting and monitoring capabilities, activities and requirements. As any single operating program will likely encompass multiple LOBs, business intelligence will provide visibility into program resources across a full spectrum of LOBs.

##### 5.4.1. Analytical Reports

S&P level and D-level (primarily at the D-level (functional)) financial and business managers are responsible for producing analytical reports from the FMA or via warehoused data to enable LOB oversight and strategic decision making.

##### 5.4.2. Standardized Push Reports

Standardized SLAs will detail the minimum required information and frequency that all D-level entities will create and distribute FM and business operations reports to their customers. This could be modeled after the existing, proven DCMS Watch push reports provided to operational commanders.

##### 5.4.3. Supported Unit Ad Hoc or On-Demand Reports

Coast Guard Business Intelligence (CGBI) reports and data cubes will be the source for ad hoc, on-demand, or customized view reports for supported units. CGBI will be fed high-quality financial transaction data by a data warehouse which will enable visibility of unit-level financial data with a frequency and level of customization suitable to the needs of the supported unit commanders.

##### 5.4.4. Internal 3<sup>rd</sup> Party Assessment

Entities designated as assessable units will be evaluated on at least an annual basis by an independent, internal Coast Guard assessment team that will grade

compliance with applicable laws, regulations, policies, processes, procedures, Technical Authority guidance and performance measures. Performance on these assessments should be included in command evaluations, SLA modifications, and Statements of Assurance produced and signed by LOB owners.

**5.4.5. Statements of Assurance (SoA)**

As discussed above, all D-level entities designated as assessable units are required to provide written assurance of the accuracy of FM data and the sufficiency of internal controls. Internal controls assurance includes both Internal Controls Over Financial Reporting (ICOFR) and Internal Controls Over Operations (ICOOP) requirements. Statements of Assurance will “roll up” along Business Functions to Assistant Commandant/Director Business Line owners who will be required to provide signature assurance for the Business Functions under their control.

**5.5. Uniform and Focused Contingency Business Operations**

Business support to contingency operations should be uniform and adaptable. To accomplish this, the CGBM leverages the capabilities developed in the model described above in a pre-scripted contingency response posture that includes the following characteristics:

- Director of Operational Logistics (DOL) is responsible for developing and maintaining plans related to business support to contingency operations.
- DOL will pre-establish specific contingency integration relationships with operational commanders. Pre-established procedures to shift TACON of D-level Regional Support Nodes and integration of mission support personnel on operational commander contingency Watch Quarter and Station Bill (WQSB)) will focus the mission support enterprise on the contingency response.
- DOL-8 Field Comptroller and DOL-9 COCO will be the primary FM support to Area-level contingency operations.
- Base Funds Managers and KOs will be the primary support to District-level contingency operations.
- Base Funds Managers and KOs will be the primary support to Sector-level contingencies when Sectors and Bases are co-located, and Base Detachments will be the primary support to Sectors when Sectors and Bases are not co-located. The level of service in both cases will be the same.
- DOL-8 will coordinate requirements for long-term support if contingency operations exceed specified time limits.
- All contingency operations levels of support will be governed by standard SLAs that will be jointly established by DOL, LANT, PAC and CG-8.

6. Recommendations

Coast Guard FM, a key element of mission support, has not kept pace with a modern Coast Guard. By re-designing and re-engineering FM to align with the Mission Support (MS) Business Model, the Coast Guard can develop and implement the overarching Coast Guard Business Model (CGBM) outlined in Section 5. The FM BPR recommends implementation of the CGBM incorporating all elements of the “Red” COA. Taking this COA will drive:

- Compliance through governance, internal controls and standardization
- Consolidation through D-level support and product/service line management
- Harmonization through a unified CGBM and alignment with the rest of government

6.1. Recommendation 1: Adopt CGBM Organizational Level Designations

Right now, Coast Guard FM and the DCMS organization, the two key elements of mission support, are structurally misaligned. In addition, The Mission Support Enterprise has not fully adopted the MS Business Model, and although tremendous progress has been made, inconsistencies exist in several LOBs. The FM BPR recommends these actions:

Action: Coast Guard adopts and formally assigns/stratifies all units into the following standard organization levels according to the definitions in Section 5:

- Strategy & Policy
- Depot level (functional)
- Depot level (regional)
- Organizational

6.2. Recommendation 2: Establish Business Lines (LOBs), Business Functions, and Service/Product Lines with Associated Functional Owners at Each CGBM Organizational Level

The MS Business Model establishes several well-defined product lines for the support and maintenance of physical assets and IT systems. However, it does not provide equal and sufficient guidance for the numerous processes and services, including FM, that are also critical to MS and the establishment of an overarching CGBM. The Federal Enterprise Architecture (FEA) Business Reference Model (BRM) establishes a framework to do this. Existing Coast Guard structure aligns well with the FEA BRM, but lacks formal establishment of key product/service lines, responsibilities and authorities. The FM BPR recommends these actions:

Action: Formally establish LOBs, business functions and service/product lines to align the FEA BRM with associated, assigned, responsibility and authority at each organizational level of the CGBM, to include FM processes. The FM BPR proposes a notional business line authority and responsibility matrix in Appendix O.

**6.3. Recommendation 3: Integrate Financial Management Processes into Business Functions and Consolidate Budget Authority and Obligation Authority at the D-level**

Under the Coast Guard's current financial system, budget authority and obligation authority is widely-disseminated thus burdening operational units with administrative responsibilities and reducing the visibility and efficiency of funds execution. Additionally, some units are not well-structured to properly execute funds and some business functions do not explicitly identify where funds are obligated. Both of these situations increase organizational risk. The FM BPR recommends the following actions:

**Action:** Mandate that budget authority must be held at the same level of delegation as obligation authority within Business Functions, which is the essence of the product line's single point of accountability concept. Further, mandate that budget authority and obligation authority can be delegated no lower than the D-level.

**Action:** Embed standard financial processes into Business Functions.

**Action:** Configure the new FMA and FADS structure to mirror the LOBs and support delivery organization recommended in the CGBM as proposed in Appendix L.

**6.4. Recommendation 4: Align Funds Distribution with Business Lines (LOBs)**

Under the Coast Guard's current financial system, funds distribution is inconsistent across LOBs. For example, D-level maintenance funds are distributed to and managed by the appropriate product lines in CG-4 and CG-6. However, military pay and civilian pay funds are held in CG-8 and managed via a unique relationship with the Pay and Personnel Center. CG-1 does not have a clear role in managing these funds. Misalignment of funds management and LOBs decreases transparency, hampers decision making, and creates inefficiencies. The FM BPR recommends these actions:

**Action:** Establish a funds distribution and management scheme to align funds with their intended LOBs and Business Functions to the maximum extent possible while maintaining visibility into resource associations with specific programs across LOBs. The FM BPR proposes a notional funds distribution and management scheme in Figure 6.1.

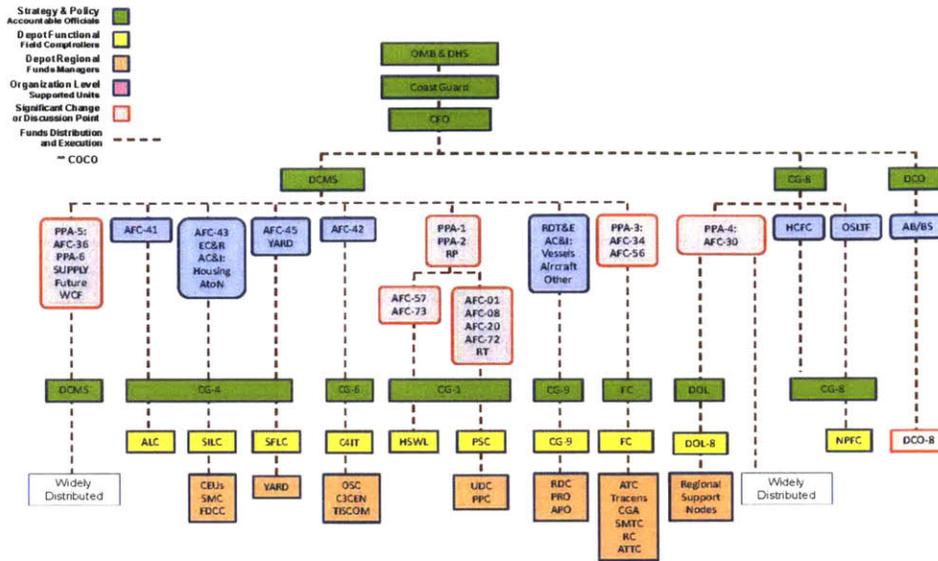


Figure 6.1: Notional Funds Distribution and Execution Scheme

6.5. Recommendation 5: Align the Comptroller Evaluation and Delegation Chain with the COCO Evaluation and Delegation Chain to Create a FM “Chain of Command”

Under the Coast Guard’s current financial system, where FM professionals’ evaluation chains often start and end with operational commanders, the evaluated performance of FM professionals is often based solely on customer satisfaction, and does not adequately weigh technical proficiency. This imbalance weakens CFO technical authority and creates potential for natural ethical dilemmas. The FM BPR recommends these actions:

Action: Revamp the titles of FM professionals in the field and assign Field Comptrollers to designated D-level (functional) units and assign Funds Managers to designated D-level (regional) units.

Action: Employ a FM authority delegation structure that aligns FM governance with the CGBM and the existing COCO evaluation and delegation chain as depicted in Figure 6.2. Field Comptrollers and Funds Managers are embedded in their unit structure and are evaluated for leadership and customer service (e.g. SLA compliance) by their unit’s command cadre and for technical performance by the financial entity that granted their technical authority.

Action: Establish DOL-8 as a Field Comptroller with technical support and supervisory responsibilities over Funds Managers at Bases.

Action: Establish a matrix of standard FM responsibilities and authorities to align with the FM roles at functional D-Level units, including Logistics and Service Centers

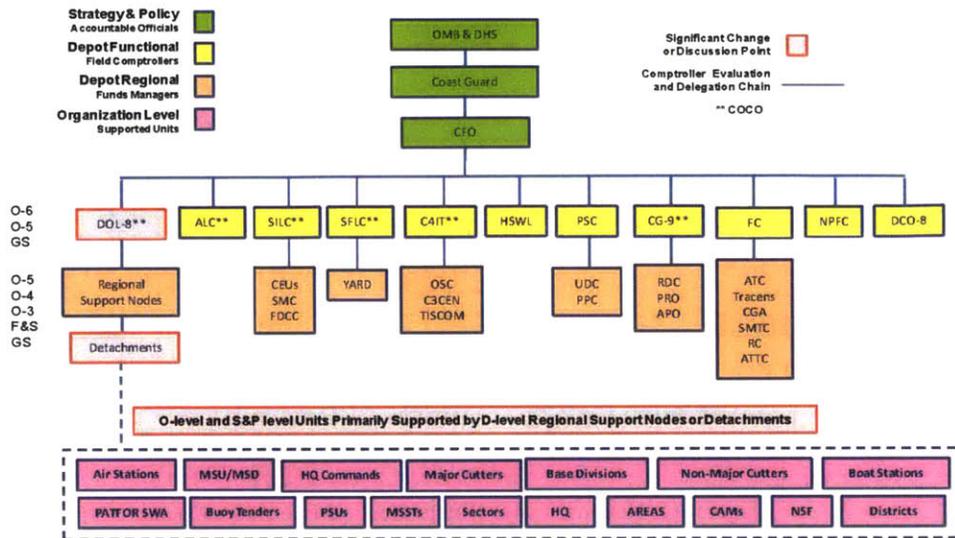


Figure 6.2: Notional Comptroller Evaluation and Delegation Scheme

6.6. Recommendation 6: Develop an Expanded System of Internal Controls (IC) Including D-level Assessable Units and Increased 3<sup>rd</sup> Party Inspections/Audits

Under the Coast Guard’s current, decentralized financial system, FM responsibilities are often assigned as collateral duties and FM is often overshadowed by performance in operations. Additionally, IC policies, systems and procedures are not well-known and pervasive across the Coast Guard. As a result, IC and oversight of FM are insufficient. Assistant Commandants often assert to their state of IC with inadequate information. In order to confidently sign Statements of Assurance (SoA), Assistant Commandant’s need reliable input on Internal Controls Over Financial Reporting (ICOFR), Internal Controls Over Operations (ICOOP), and compliance with laws and regulations. Currently, these inputs are not being produced or received. Without a more-robust system to assess IC, the Coast Guard remains at risk. The FM BPR recommends these actions:

Action: Coast Guard Office of Internal Controls (CG-85) issue standard, specific guidelines on how these inputs are generated and provide resource requirements to ensure units are properly staffed and responsible/reportable positions are identified and documented.

Action: Designate all D-level units, meeting certain thresholds, as assessable units with SoA responsibilities that roll up via LOBs established in the CGBM.

Action: S&P level officials with SoA responsibilities establish business operations staffs to provide ICOOP assurances and oversee the internal third party assessment program for the associated LOB.

Action: Coast Guard develop capabilities and protocols at the functional D-Level to conduct annual 3rd party FM assessments of all assessable units with reports sent via the chain of command.

6.7. Recommendation 7: Develop a Uniform and Focused FM Contingency Operations Response Capability that Aligns with the CGBM

Existing FM contingency response policy and capability is inconsistent across Coast Guard LOB's. During the most recent major contingency, Hurricane SANDY, DOL shifted TACON to the Atlantic Area Commander and provided a high level of focused, effective response. However, because DOL has no FM staff, inconsistencies emerged in FM support. Much of the FM capability remained in the hands of the O-Level units most impacted by the storm. The FM BPR recommends these actions:

Action: Develop a uniform, pre-established FM capability to immediately detail to support contingency operations as described in Section 5.5. This FM capability should be centrally managed by a "to be" DOL-8 staff that would also provide strategic FM contingency oversight if DOL shifts TACON as it did during Hurricane Sandy.

6.8. Recommendation 8: Develop a Robust Knowledge Management Capability and Expanded Business Intelligence System

The Coast Guard's current FM analysis capability is hampered by disparate financial systems and a lack of integrated business intelligence tools. Base budget reviews lack the necessary fidelity to produce significant insights. Strategic decisions are often made without a complete cost picture. As a result, Coast Guard FM has numerous "off-the-cuff" analytical tools, data-related audit concerns and a lack of trust amongst key stakeholders due to a lack of resource visibility. Implementing a new FMA and adopting FADS will significantly improve the quality and utility of Coast Guard FM data and allow for greater knowledge management and business intelligence. Using this data, and robust, integrated software tools, Coast Guard will be able to radically improve its activity-based costing capability and improve transparency of FM data. It will also be able to develop systems to monitor all facets of FM operations and compliance with SLAs. The FM BPR recommends these actions:

Action: Coast Guard fully integrate a modern, robust CGBI with the new FMA to provide key stakeholders with complete visibility of planned funds distribution, actual funds distribution, balances, and obligations in near real-time (e.g. level of distribution detail akin to current AFC-30 budget model).

## Appendix B

The following pages include the data export from SafetyHAT for the STPA conducted on the USCG FM system:

ACC_NO	ACCIDENT	HAZ_NO	HAZARD	UCA_NO	COMPONENT_NAME	UNSAFE_CONTROL_ACTION	UCA_DESC	CAUSAL_FACT_NO	CF_DESC	CF_USER_DESC	FROM_COMP	TO_COMP	CATEGORY
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	1	Procurement Request Manager	Provided, but the intensity is incorrect (too much or too little)	The product/service requested is incorrect--i.e. wrong vendor, incorrect funding level, wrong quantity, incorrect unit cost or total amount, or incorrect accounting information.	129	Process model or calibration incomplete or incorrect	Lack of training, poor job performance, improper prioritization of tasks, or lack of feedback regarding the status of the system caused the PR manager to introduce errors into the procurement request.	Procurement Request Manager		Controller
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	1	Procurement Request Manager	Provided, but the intensity is incorrect (too much or too little)	The product/service requested is incorrect--i.e. wrong vendor, incorrect funding level, wrong quantity, incorrect unit cost or total amount, or incorrect accounting information.	133	External disturbances	Excessive workload, job pressure, or some form of distraction caused the PR manager to inaccurately make the request--i.e. introduction of errors.	Procurement Request Manager		Controller
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	1	Procurement Request Manager	Provided, but the intensity is incorrect (too much or too little)	The product/service requested is incorrect--i.e. wrong vendor, incorrect funding level, wrong quantity, incorrect unit cost or total amount, or incorrect accounting information.	210	Controlled component failure, change over time	A CAS system error prevents the commitment from being accurately recorded.	Core Accounting System (CP)		Controlled Process
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	1	Procurement Request Manager	Provided, but the intensity is incorrect (too much or too little)	The product/service requested is incorrect--i.e. wrong vendor, incorrect funding level, wrong quantity, incorrect unit cost or total amount, or incorrect accounting information.	259	Actuator inadequate operation, change over time	A system error caused the introduction of errors as the request progressed through subsequent stages of the approval process.	Request in CAS (A)		Actuator
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	2	Procurement Request Manager	Provided, but executed incorrectly	The request was initiated in the financial management system, but contained data errors, or possibly incorrect routing for transmittal to the level.	127	External disturbances	Excessive workload, job pressure, or some form of distraction caused the PR manager to inaccurately make the request--i.e. introduce errors.	Procurement Request Manager		Controller
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	2	Procurement Request Manager	Provided, but executed incorrectly	The request was initiated in the financial management system, but contained data errors, or possibly incorrect routing for transmittal to the level.	129	Process model or calibration incomplete or incorrect	Lack of training, poor job performance, improper prioritization of tasks, or lack of feedback regarding the status of the system caused the PR manager to introduce errors into the procurement request.	Procurement Request Manager		Controller
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	2	Procurement Request Manager	Provided, but executed incorrectly	The request was initiated in the financial management system, but contained data errors, or possibly incorrect routing for transmittal to the level.	210	Controlled component failure, change over time	A CAS system error prevents the commitment from being accurately recorded.	Core Accounting System (CP)		Controlled Process
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	2	Procurement Request Manager	Provided, but executed incorrectly	The request was initiated in the financial management system, but contained data errors, or possibly incorrect routing for transmittal to the level.	257	Sensor inadequate operation, change over time	Information regarding the status of the transaction was not available to be sent to the PR manager regarding the errors in the system.	Request Notification in CAS (S)		Sensor
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	2	Procurement Request Manager	Provided, but executed incorrectly	The request was initiated in the financial management system, but contained data errors, or possibly incorrect routing for transmittal to the level.	258	Actuator inadequate operation, change over time	A financial system problem caused the introduction of errors after it was initiated by the procurement request manager.	Request in CAS (A)		Actuator
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	3	Procurement Request Manager	Provided, but the starting time is too soon or too late	The procurement request manager initiated the procurement request too late, which delayed its progress through the financial management system.	1	External control input or information wrong or missing	The requirements of the operating unit were not correctly interpreted/explained, resulting in a time lag in the process.	Procurement Request Manager		Controller
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	3	Procurement Request Manager	Provided, but the starting time is too soon or too late	The procurement request manager initiated the procurement request too late, which delayed its progress through the financial management system.	2	Process model or calibration incomplete or incorrect	Lack of training, poor job performance, improper prioritization of tasks, or lack of feedback regarding the status of the system prevented the service from being ordered (and thereby delivered) within the required time.	Procurement Request Manager		Controller
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	3	Procurement Request Manager	Provided, but the starting time is too soon or too late	The procurement request manager initiated the procurement request too late, which delayed its progress through the financial management system.	114	External disturbances	Excessive workload, job pressure, or some form of distraction prevented the PR manager from initiating the request in a timely manner.	Procurement Request Manager		Controller
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	3	Procurement Request Manager	Provided, but the starting time is too soon or too late	The procurement request manager initiated the procurement request too late, which delayed its progress through the financial management system.	116	Hazardous interaction with other components in the rest of the vehicle	Miscommunication or communication among individual PR managers could confuse who is responsible (or lead) for initiating the procurement on behalf of the operating unit.	Procurement Request Manager		Controller
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	3	Procurement Request Manager	Provided, but the starting time is too soon or too late	The procurement request manager initiated the procurement request too late, which delayed its progress through the financial management system.	250	Actuator inadequate operation, change over time	A CAS system error prevented the PR manager from making the request to the next component (e.g. funds manager) and delayed the process.	Request in CAS (A)		Actuator

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1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies or lacks qualification	6	Operating Unit	Provided, but executed incorrectly	The operating unit transmits the incorrect request information (vendor, product, quantity, type, etc.), or makes the request to the incorrect PR manager. This action prevents the transaction from being properly initiated by the PR manager.	243	Sensor inadequate operation, change over time	The operating unit does not have adequate feedback or input that enables them to provide the necessary information regarding the expected product or service that is to be provided by the vendor at the front-end of the process.	Notification of Product/Service (S)		Sensor
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies or lacks qualification	6	Operating Unit	Provided, but executed incorrectly	The operating unit transmits the incorrect request information (vendor, product, quantity, type, etc.), or makes the request to the incorrect PR manager. This action prevents the transaction from being properly initiated by the PR manager.	246	Actuator inadequate operation, change over time	A missing or ineffective means to provide the request to the procurement manager prevents the process from being accurately or completely initiated.	Transmit Request (A)		Actuator
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies or lacks qualification	7	Operating Unit	Provided, but the starting time is too soon or too late	The operating unit is unable to transmit/provide all of the required request information within prescribed lead-time requirements, which prevents the product/service from being procured and delivered within the required timeframe.	96	External disturbances	Excessive workload or distractions could prevent the operating unit from conveying the request in a timely manner.	Operating Unit		Controller
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies or lacks qualification	7	Operating Unit	Provided, but the starting time is too soon or too late	The operating unit is unable to transmit/provide all of the required request information within prescribed lead-time requirements, which prevents the product/service from being procured and delivered within the required timeframe.	97	Process model or calibration incomplete or incorrect	Lack of feedback regarding the status of the system (and specifically, the status of the pending request for a product or service) could inhibit the operating unit from submitting the request for products or services. The operating unit cannot obtain the necessary information required to initiate the request, or the operating unit does not have an accurate account balance(s) due to erroneous system reporting. The erroneous reporting may be the result of other unsafe control actions.	Operating Unit		Controller
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies or lacks qualification	8	Operating Unit	Not provided when needed to maintain safety	The operating unit does not initiate the request to the procurement request manager, which prevented the product/service from being delivered.	109	External control input or information wrong or missing	Excessive workload or distractions could prevent the operating unit from initiating the request in a timely manner.	Operating Unit		Controller
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies or lacks qualification	8	Operating Unit	Not provided when needed to maintain safety	The operating unit does not initiate the request to the procurement request manager, which prevented the product/service from being delivered.	110	External disturbances	Excessive workload or distractions could prevent the operating unit from initiating the request in a timely manner.	Operating Unit		Controller
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies or lacks qualification	8	Operating Unit	Not provided when needed to maintain safety	The operating unit does not initiate the request to the procurement request manager, which prevented the product/service from being delivered.	111	Process model or calibration incomplete or incorrect	Lack of feedback regarding the status of the system could inhibit the operating unit from submitting the request for products or services.	Operating Unit		Controller
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies or lacks qualification	8	Operating Unit	Not provided when needed to maintain safety	The operating unit does not initiate the request to the procurement request manager, which prevented the product/service from being delivered.	240	Actuator inadequate operation, change over time	A missing or ineffective means to provide the request to the procurement manager prevents the initiation of the process to procure the required products or services.	Transmit Request (A)		Actuator
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies or lacks qualification	9	Funds Manager	Provided, but executed incorrectly	The funds manager reviews and approves the commitment, but it contains errors or inaccurate information that prevents the procurement from progressing through the financial management system.	211	Output of controlled process contributes to system hazard	Inaccurate information that originated from prior financial transactions causes the funds manager to subsequently approve the obligation with inaccurate information present.	Core Accounting System (CP)		Controlled Process
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies or lacks qualification	9	Funds Manager	Provided, but executed incorrectly	The funds manager reviews and approves the commitment, but it contains errors or inaccurate information that prevents the procurement from progressing through the financial management system.	220	External disturbances	Excessive workload, job pressure, or distraction could prevent the funds manager from approving an accurate or correct commitment.	Funds Manager		Controller
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies or lacks qualification	9	Funds Manager	Provided, but executed incorrectly	The funds manager reviews and approves the commitment, but it contains errors or inaccurate information that prevents the procurement from progressing through the financial management system.	221	Process model or calibration incomplete or incorrect	The funds manager did not accurately record/approve the commitment. The error could be the result from lack of training, poor job performance, distraction, or missing feedback regarding the status of the system.	Funds Manager		Controller
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies or lacks qualification	9	Funds Manager	Provided, but executed incorrectly	The funds manager reviews and approves the commitment, but it contains errors or inaccurate information that prevents the procurement from progressing through the financial management system.	223	Sensor inadequate operation, change over time	Inaccurate financial information that originated from prior step in the process is transmitted to the funds manager.	Request Notification in CAS (S)		Sensor
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies or lacks qualification	9	Funds Manager	Provided, but executed incorrectly	The funds manager reviews and approves the commitment, but it contains errors or inaccurate information that prevents the procurement from progressing through the financial management system.	224	Actuator inadequate operation, change over time	A CAS system error prevented the commitment from being accurately recorded, including the introduction of data errors. These errors prevent the commitment from progressing further in the financial management system. The funds manager did not record the obligation in a timely manner due to lack of training, poor job performance, improper prioritization of workload, or missing feedback regarding the status of the system.	Record in CAS (A)		Actuator
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies or lacks qualification	11	Funds Manager	Provided, but the starting time is too soon or too late	The funds manager reviews, verifies and approves the procurement request too late which prevents the request from progressing through the financial management system within acceptable limits.	66	Process model or calibration incomplete or incorrect		Funds Manager		Controller

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1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	11	Funds Manager	Provided, but the starting time is too soon or too late	The funds manager reviews, verifies and approves the procurement request too late which prevents the request from progressing through the financial management system within acceptable limits.	85	Actuator inadequate operation, change over time	A CAS system error prevented the commitment from being recorded in a timely manner, which delays the procurement and delivery of the products or services to the delayed start for follow-on financial management or procurement activities.	Record in CAS (A)		Actuator
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	11	Funds Manager	Provided, but the starting time is too soon or too late	The funds manager reviews, verifies and approves the procurement request too late which prevents the request from progressing through the financial management system within acceptable limits.	225	External disturbances	Excessive workload, job pressure, or distraction could prevent the funds manager from completing the necessary steps in a timely manner.	Funds Manager		Controller
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	11	Funds Manager	Provided, but the starting time is too soon or too late	The funds manager reviews, verifies and approves the procurement request too late which prevents the request from progressing through the financial management system within acceptable limits.	228	Controlled component failure, change over time	A CAS system error prevents the commitment from being completed in a timely manner.	Core Accounting System (CP)		Controlled Process
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	11	Funds Manager	Provided, but the starting time is too soon or too late	The funds manager reviews, verifies and approves the procurement request too late which prevents the request from progressing through the financial management system within acceptable limits.	230	Sensor inadequate operation, change over time	Information regarding the status of the transaction was not available to be sent to the funds manager.	Request Notification in CAS (S)		Sensor
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	15	Funds Manager	Provided, but the starting time is too soon or too late	The funds manager records the committed obligation too late, which prevents the procurement from progressing through the financial management system.	65	External disturbances	Excessive workload, job pressure, or distraction could prevent the funds manager from recording the obligation in CAS in a timely manner.	Funds Manager		Controller
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	15	Funds Manager	Provided, but the starting time is too soon or too late	The funds manager records the committed obligation too late, which prevents the procurement from progressing through the financial management system.	66	Process model or calibration incomplete or incorrect	The funds manager did not record the obligation in a timely manner due to lack of training, poor job performance, improper prioritization of workload, or missing feedback regarding the status of the system.	Funds Manager		Controller
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	15	Funds Manager	Provided, but the starting time is too soon or too late	The funds manager records the committed obligation too late, which prevents the procurement from progressing through the financial management system.	67	Conflicting control action	Input from a different funds manager override or delayed recording the obligation in CAS.	Core Accounting System (CP)		Controlled Process
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	15	Funds Manager	Provided, but the starting time is too soon or too late	The funds manager records the committed obligation too late, which prevents the procurement from progressing through the financial management system.	205	Sensor inadequate operation, change over time	Lack of information from CAS regarding the status of the system could delay the funds manager from approving the obligation.	Award Notification in CAS (S)		Sensor
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	15	Funds Manager	Provided, but the starting time is too soon or too late	The funds manager records the committed obligation too late, which prevents the procurement from progressing through the financial management system.	206	Actuator inadequate operation, change over time	The funds manager attempted to record the obligation, but a system error prevented the action from being completed in a timely manner.	Record Obligation in CAS (A)		Actuator
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	15	Funds Manager	Provided, but the starting time is too soon or too late	The funds manager records the committed obligation too late, which prevents the procurement from progressing through the financial management system.	209	Controlled component failure, change over time	A CAS system prevents the obligation from being completed and recorded in a timely manner, which delays the acquisition of the product or service.	Core Accounting System (CP)		Controlled Process
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	16	Funds Manager	Not provided when needed to maintain safety	The funds manager did not approve the obligation, which delays subsequent steps in procurement process from occurring.	50	External disturbances	Excessive workload, job pressure, or distraction could prevent the funds manager from recording the obligation in CAS.	Funds Manager		Controller
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	16	Funds Manager	Not provided when needed to maintain safety	The funds manager did not approve the obligation, which delays subsequent steps in procurement process from occurring.	51	Actuator inadequate operation, change over time	The funds manager attempted to record the obligation, but the action was not communicated to the core accounting system.	Record Obligation in CAS (A)		Actuator
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	16	Funds Manager	Not provided when needed to maintain safety	The funds manager did not approve the obligation, which delays subsequent steps in procurement process from occurring.	53	Input to controlled process missing or wrong	The information that should have been provided by the funds manager is missing, which results in incomplete or inaccurate information in the core accounting system.	Core Accounting System (CP)		Controlled Process
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	16	Funds Manager	Not provided when needed to maintain safety	The funds manager did not approve the obligation, which delays subsequent steps in procurement process from occurring.	54	Output of controlled process contributes to system hazard	Missing information results in errors within CAS prevents accurate reporting of financial management information.	Core Accounting System (CP)		Controlled Process

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1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	3	Procurement Request Manager	Provided, but the starting time is too soon or too late	The procurement request manager initiated the procurement request too late, which delayed its progress through the financial management system.	251	Controlled component failure, change over time	A CAS system prevents the commitment request from being recorded, and delays the process.	Core Accounting System (CP)		Controlled Process
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	4	Procurement Request Manager	Not provided when needed to maintain safety	The procurement request manager did not initiate the procurement request which prevented the product/service from progressing through the financial management system.	118	External control input or information wrong or missing	The requirements of the operating unit were not correctly interrupted/explained, so the PR manager did not take appropriate action to initiate the request.	Procurement Request Manager		Controller
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	4	Procurement Request Manager	Not provided when needed to maintain safety	The procurement request manager did not initiate the procurement request which prevented the product/service from progressing through the financial management system.	119	External disturbances	Excessive workload, job pressure, or some form of distraction prevented the PR manager from initiating the request.	Procurement Request Manager		Controller
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	4	Procurement Request Manager	Not provided when needed to maintain safety	The procurement request manager did not initiate the procurement request which prevented the product/service from progressing through the financial management system.	121	Process model or calibration incomplete or incorrect	Lack of training, poor job performance, improper prioritization of tasks, or lack of feedback regarding the status of the system prevented the service from being ordered.	Procurement Request Manager		Controller
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	4	Procurement Request Manager	Not provided when needed to maintain safety	The procurement request manager did not initiate the procurement request which prevented the product/service from progressing through the financial management system.	123	Hazardous interaction with other components in the rest of the vehicle	Miscommunication or communication among individual PR managers could confuse who is responsible (or lead) for initiating the procurement on behalf of the operating unit, so it was never initiated.	Procurement Request Manager		Controller
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	4	Procurement Request Manager	Not provided when needed to maintain safety	The procurement request manager did not initiate the procurement request which prevented the product/service from progressing through the financial management system.	252	Actuator inadequate operation, change over time	A system error prevented the PR manager from making the request to the next component (e.g. funds manager).	Request in CAS (A)		Actuator
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	5	Operating Unit	Provided, but the intensity is incorrect (too much or too little)	The operating unit does not provide all of the required request information to accurately initiate the procurement process.	104	External control input or information wrong or missing	The operating unit obtains incomplete information (regarding the product or service) from a source external to the system, which is transmitted to the procurement request manager for action. Also, the operating unit may not be aware of all the requirements necessary for the procurement manager to initiate their transaction.	Operating Unit		Controller
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	5	Operating Unit	Provided, but the intensity is incorrect (too much or too little)	The operating unit does not provide all of the required request information to accurately initiate the procurement process.	105	External disturbances	Excessive workload or distractions could prevent the operating unit from conveying all of the required information relating to the request in a timely manner.	Operating Unit		Controller
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	5	Operating Unit	Provided, but the intensity is incorrect (too much or too little)	The operating unit does not provide all of the required request information to accurately initiate the procurement process.	107	Process model or calibration incomplete or incorrect	Lack of feedback regarding the status of the system (and specifically, the status of the pending request for a product or service) could inhibit the operating unit from providing all of the information required to initiate the procurement process. The operating unit may also not be aware of the requirement to provide information.	Operating Unit		Controller
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	5	Operating Unit	Provided, but the intensity is incorrect (too much or too little)	The operating unit does not provide all of the required request information to accurately initiate the procurement process.	108	Actuator inadequate operation, change over time	A missing or ineffective means to communicate the request to the procurement manager prevents the initiation of the process to procure the required products or services.	Transmit Request (A)		Actuator
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	6	Operating Unit	Provided, but executed incorrectly	The operating unit transmits the incorrect request information (vendor, product, quantity, type, etc.), or makes the request to the incorrect PR manager. This action prevents the transaction from being properly initiated by the PR manager.	99	Process model or calibration incomplete or incorrect	Lack of feedback regarding the status of the system (and specifically, missing details regarding the request, or status, for the product or service) could be the cause for submitting the incorrect information. The operating unit obtains incorrect or incompatible information (regarding the product or service) from a source external to the system, which is transmitted to the procurement request manager for action. The errors or information incompatibility prevents the transaction from being initiated by the PR manager.	Operating Unit		Controller
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	6	Operating Unit	Provided, but executed incorrectly	The operating unit transmits the incorrect request information (vendor, product, quantity, type, etc.), or makes the request to the incorrect PR manager. This action prevents the transaction from being properly initiated by the PR manager.	102	External control input or information wrong or missing	The operating unit obtains incorrect or incompatible information (regarding the product or service) from a source external to the system, which is transmitted to the procurement request manager for action. The errors or information incompatibility prevents the transaction from being initiated by the PR manager.	Operating Unit		Controller
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	6	Operating Unit	Provided, but executed incorrectly	The operating unit transmits the incorrect request information (vendor, product, quantity, type, etc.), or makes the request to the incorrect PR manager. This action prevents the transaction from being properly initiated by the PR manager.	242	External disturbances	Excessive pressure, distraction, or workload could cause the operating unit to transmit or submit incorrect information.	Operating Unit		Controller

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1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	16	Funds Manager	Not provided when needed to maintain safety	The funds manager did not approve the obligation, which delays subsequent steps in procurement process from occurring.	55	Sensor inadequate operation, change over time	The funds manager is not aware that action is required to record the obligation in CAS.	Award Notification in CAS (\$)		Sensor
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	16	Funds Manager	Not provided when needed to maintain safety	The funds manager did not approve the obligation, which delays subsequent steps in procurement process from occurring.	199	Process model or calibration incomplete or incorrect	The funds manager did not approve the obligation due to lack of training, poor job performance, improper prioritization of workload, or missing feedback regarding the status of the system.	Funds Manager		Controller
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	16	Funds Manager	Not provided when needed to maintain safety	The funds manager did not approve the obligation, which delays subsequent steps in procurement process from occurring.	231	Hazardous interaction with other components in the rest of the vehicle	The funds manager did not take action on the request because of confusion or conflicting guidance regarding responsibility for completing the action with another funds manager.	Funds Manager		Controller
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	19	Acquisition Manager	Provided, but the starting time is too soon or too late	For External: The acquisition manager performs the acquisition process, but it occurs too late and results in an unacceptable delay in processing the order and consequently the delivery of products/services from the vendor to the operating unit.	26	External control input or information wrong or missing	The delay could be caused by a delay in input from another controller--i.e. the funds manager.	Acquisition Manager		Controller
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	19	Acquisition Manager	Provided, but the starting time is too soon or too late	For External: The acquisition manager performs the acquisition process, but it occurs too late and results in an unacceptable delay in processing the order and consequently the delivery of products/services from the vendor to the operating unit.	29	External disturbances	External disturbances in the form of excessive workload, job stress, or other distraction could cause a delay or lag in the acquisition manager's action.	Acquisition Manager		Controller
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	19	Acquisition Manager	Provided, but the starting time is too soon or too late	For External: The acquisition manager performs the acquisition process, but it occurs too late and results in an unacceptable delay in processing the order and consequently the delivery of products/services from the vendor to the operating unit.	30	Process model or calibration incomplete or incorrect	The process model of the acquisition manager initiates them from making the award to the vendor in a timely manner. This could be caused by lack of training, sub-par job performance, improper prioritization, or lack of feedback regarding the state of the system and action that the acquisition manager performs the acquisition	Acquisition Manager		Controller
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	19	Acquisition Manager	Provided, but the starting time is too soon or too late	For External: The acquisition manager performs the acquisition process, but it occurs too late and results in an unacceptable delay in processing the order and consequently the delivery of products/services from the vendor to the operating unit.	157	Actuator inadequate operation, change over time	process, but a system error (SWS, CAS) causes a delay in transmittal to the vendor. The time lag results in the inability for the vendor to provide the service to the operating unit in a timely	Award Notification External (A)		Actuator
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	19	Acquisition Manager	Provided, but the starting time is too soon or too late	For External: The acquisition manager performs the acquisition process, but it occurs too late and results in an unacceptable delay in processing the order and consequently the delivery of products/services from the vendor to the operating unit.	158	Process input supplier inadequate operation, change over time	The vendor does not receive the order notification in a timely manner from the acquisition manager.	Vendor/Service Provider (CP)		Controlled Process
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	20	Acquisition Manager	Not provided when needed to maintain safety	For External: The acquisition manager does not complete the acquisition process, which results in an unacceptable delay in the delivery of the requested products/services from the vendor to the operating unit.	25	External disturbances	The acquisition manager does not make the award notification to the vendor due to excessive workload, job pressure, or other form of distraction.	Acquisition Manager		Controller
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	20	Acquisition Manager	Not provided when needed to maintain safety	For External: The acquisition manager does not complete the acquisition process, which results in an unacceptable delay in the delivery of the requested products/services from the vendor to the operating unit.	26	Process model or calibration incomplete or incorrect	The acquisition manager does not make the award to the vendor due to lack of training, task prioritization, sub-par job performance, or lacks sense of urgency to complete the transaction/order the product or service.	Acquisition Manager		Controller
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	20	Acquisition Manager	Not provided when needed to maintain safety	For External: The acquisition manager does not complete the acquisition process, which results in an unacceptable delay in the delivery of the requested products/services from the vendor to the operating unit.	160	External control input or information wrong or missing	The acquisition manager does not make the award because input from another system component is missing or not received by the AM.	Acquisition Manager		Controller
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	20	Acquisition Manager	Not provided when needed to maintain safety	For External: The acquisition manager does not complete the acquisition process, which results in an unacceptable delay in the delivery of the requested products/services from the vendor to the operating unit.	164	Actuator inadequate operation, change over time	A system error prevents the AM from completing the acquisition process and initiating the notification to the vendor.	Award Notification External (A)		Actuator
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	20	Acquisition Manager	Not provided when needed to maintain safety	For External: The acquisition manager does not complete the acquisition process, which results in an unacceptable delay in the delivery of the requested products/services from the vendor to the operating unit.	166	Controlled component failure, change over time	The vendor's requirements for receiving orders have changed, or they are new and unfamiliar. Consequently, the order is not received by the vendor.	Vendor/Service Provider (CP)		Controlled Process
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	20	Acquisition Manager	Not provided when needed to maintain safety	For External: The acquisition manager does not complete the acquisition process, which results in an unacceptable delay in the delivery of the requested products/services from the vendor to the operating unit.	232	Hazardous interaction with other components in the rest of the vehicle	The acquisition manager does not take action due to confusion or conflicting guidance regarding which acquisition manager has the responsibility for completing the acquisition process.	Acquisition Manager		Controller



ACC_NO	ACCIDENT	HAZ_NO HAZARD	UCA_NO COMPONENT_NAME	UNSAFE_CONTROL_ACTION	UCA_DESC	CAUSAL_FACT_NO	CF_DESC	CF_USER_DESC	FROM_COMP	TO_COMP	CATEGORY
1	Operating Unit cannot meet operational requirements or commitments	2	22	Acquisition Manager	Provided, but the starting time is too soon or too late	CAS: The acquisition manager performs the acquisition process, but the delayed action prevents the procurement process from being completed within time limits.	190	Controlled component failure, change over time	A CAS system error prevents the acquisition process from being completed in a timely manner.	Core Accounting System (CP)	Controlled Process
1	Operating Unit cannot meet operational requirements or commitments	2	22	Acquisition Manager	Provided, but the starting time is too soon or too late	CAS: The acquisition manager performs the acquisition process, but the delayed action prevents the procurement process from being completed within time limits.	191	Sensor inadequate operation, change over time	The acquisition manager does not receive a status output regarding the status of the acquisition process from the CAS. As a result, the process is delayed.	Award Notification in CAS (S)	Sensor
1	Operating Unit cannot meet operational requirements or commitments	2	22	Acquisition Manager	Provided, but the starting time is too soon or too late	CAS: The acquisition manager performs the acquisition process, but the delayed action prevents the procurement process from being completed within time limits.	213	Sensor inadequate operation, change over time	Input received from a prior financial transaction initiated by another controller is not received, contains inaccurate information, and creates a system hazard.	Commitment Notification in CAS (S)	Sensor
1	Operating Unit cannot meet operational requirements or commitments	2	23	Acquisition Manager	Not provided when needed to maintain safety	CAS: The acquisition manager does not perform the acquisition process which results in delays in the procurement of the goods or services.	16	Process model or calibration incomplete or incorrect	The acquisition manager does not make the award in CAS due to lack of training, improper prioritization of workload, sub-par job performance, or no feedback on the status of the system (e.g. follow-up notification or reminder to perform the task).	Acquisition Manager	Controller
1	Operating Unit cannot meet operational requirements or commitments	2	23	Acquisition Manager	Not provided when needed to maintain safety	CAS: The acquisition manager does not perform the acquisition process which results in delays in the procurement of the goods or services.	176	External disturbances	Excessive workload or pressure prevents the acquisition manager from completing acquisition process.	Acquisition Manager	Controller
1	Operating Unit cannot meet operational requirements or commitments	2	23	Acquisition Manager	Not provided when needed to maintain safety	CAS: The acquisition manager does not perform the acquisition process which results in delays in the procurement of the goods or services.	180	Actuator inadequate operation, change over time	A CAS error prevents the acquisition process from being completed.	Award Notification in CAS (A)	Actuator
1	Operating Unit cannot meet operational requirements or commitments	2	23	Acquisition Manager	Not provided when needed to maintain safety	CAS: The acquisition manager does not perform the acquisition process which results in delays in the procurement of the goods or services.	213	Sensor inadequate operation, change over time	Input received from a prior financial transaction initiated by another controller is not received, contains inaccurate information, and creates a system hazard.	Commitment Notification in CAS (S)	Sensor
1	Operating Unit cannot meet operational requirements or commitments	2	23	Acquisition Manager	Not provided when needed to maintain safety	CAS: The acquisition manager does not perform the acquisition process which results in delays in the procurement of the goods or services.	232	Hazardous interaction with other components in the rest of the vehicle	The acquisition manager does not take action due to confusion or conflicting guidance regarding which acquisition manager has the responsibility for completing the acquisition process.	Acquisition Manager	Controller
1	Operating Unit cannot meet operational requirements or commitments	2	24	Funds Manager	Not provided when needed to maintain safety	The funds manager received the request, but did not review, verify and/or approve the commitment, which prevented the request for products or services from progressing through the financial management system within acceptable limits.	93	External disturbances	Excessive workload, job pressure, or distraction could prevent the funds manager from taking action to review, verify and approve the procurement request.	Funds Manager	Controller
1	Operating Unit cannot meet operational requirements or commitments	2	24	Funds Manager	Not provided when needed to maintain safety	The funds manager received the request, but did not review, verify and/or approve the commitment, which prevented the request for products or services from progressing through the financial management system within acceptable limits.	231	Hazardous interaction with other components in the rest of the vehicle	The funds manager did not take action on the request because of confusion or conflicting guidance regarding responsibility for completing the action with another funds manager.	Funds Manager	Controller
1	Operating Unit cannot meet operational requirements or commitments	2	24	Funds Manager	Not provided when needed to maintain safety	The funds manager received the request, but did not review, verify and/or approve the commitment, which prevented the request for products or services from progressing through the financial management system within acceptable limits.	234	Process model or calibration incomplete or incorrect	The funds manager did not take action regarding the request due to lack of training, poor job performance, and/or improper prioritization of workload.	Funds Manager	Controller
1	Operating Unit cannot meet operational requirements or commitments	2	24	Funds Manager	Not provided when needed to maintain safety	The funds manager received the request, but did not review, verify and/or approve the commitment, which prevented the request for products or services from progressing through the financial management system within acceptable limits.	235	Actuator inadequate operation, change over time	A CAS system error prevented the commitment from being approved.	Record in CAS (A)	Actuator
1	Operating Unit cannot meet operational requirements or commitments	2	24	Funds Manager	Not provided when needed to maintain safety	The funds manager received the request, but did not review, verify and/or approve the commitment, which prevented the request for products or services from progressing through the financial management system within acceptable limits.	237	Controlled component failure, change over time	A CAS system prevents the commitment from being completed and recorded.	Core Accounting System (CP)	Controlled Process

ACC_NO	ACCIDENT	HAZ_NO	HAZARD	UCA_NO	COMPONENT_NAME	UNSAFE_CONTROL_ACTION	UCA_DESC	CAUSAL_FACT_NO	CF_DESC	CF_USER_DESC	FROM_COMP	TO_COMP	CATEGORY
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies or lacks qualification	26	Acquisition Manager	Provided, but the intensity is incorrect (too much or too little)	CAS: The acquisition manager performs the acquisition process, but it is incorrect (i.e. contains wrong vendor, incorrect funding level, wrong quantity, incorrect unit cost or total amount, and/or incorrect accounting information) which results in erroneous obligations being recorded in CAS. This action will likely delay the procurement process and introduce financial errors in CAS.	163	External disturbances	External disturbances in the form of excessive workload, job stress, or other distraction could the acquisition manager's to not execute process correctly in CAS.	Acquisition Manager		Controller
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies or lacks qualification	26	Acquisition Manager	Provided, but the intensity is incorrect (too much or too little)	CAS: The acquisition manager performs the acquisition process, but it is incorrect (i.e. contains wrong vendor, incorrect funding level, wrong quantity, incorrect unit cost or total amount, and/or incorrect accounting information) which results in erroneous obligations being recorded in CAS. This action will likely delay the procurement process and introduce financial errors in CAS.	184	Process model or calibration incomplete or incorrect	The acquisition manager does not make the award correctly in CAS due to lack of training, sub-par job performance.	Acquisition Manager		Controller
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies or lacks qualification	26	Acquisition Manager	Provided, but the intensity is incorrect (too much or too little)	CAS: The acquisition manager performs the acquisition process, but it is incorrect (i.e. contains wrong vendor, incorrect funding level, wrong quantity, incorrect unit cost or total amount, and/or incorrect accounting information) which results in erroneous obligations being recorded in CAS. This action will likely delay the procurement process and introduce financial errors in CAS.	166	Actuator inadequate operation, change over time	A CAS system error prevents the award transaction from being correctly recorded in CAS.	Award Notification in CAS (A)		Actuator
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies or lacks qualification	26	Acquisition Manager	Provided, but the intensity is incorrect (too much or too little)	wrong vendor, incorrect funding level, wrong quantity, incorrect unit cost or total amount, and/or incorrect accounting information) which results in erroneous obligations being recorded in CAS. This action will likely delay the procurement process and introduce financial errors in CAS. For External: The acquisition manager performs the acquisition process, but it is incorrect (i.e. contains wrong vendor, incorrect funding level, wrong quantity, incorrect unit cost or total amount, and/or incorrect accounting information) which results in erroneous obligations being recorded in CAS.	215	Controlled component failure, change over time	A CAS system error prevents the acquisition/award from being accurately recorded or notifying the acquisition manager of a pending problem with the acquisition.	Care Accounting System (CP)		Controlled Process
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies or lacks qualification	27	Acquisition Manager	Provided, but the intensity is incorrect (too much or too little)	wrong vendor, incorrect funding level, wrong quantity, incorrect unit cost or total amount, and/or incorrect accounting information) which results in an incorrect order being prepared for the vendor. This action will likely delay the procurement process and introduce financial errors in CAS. For External: The acquisition manager performs the acquisition process, but it is incorrect (i.e. contains wrong vendor, incorrect funding level, wrong quantity, incorrect unit cost or total amount, and/or incorrect accounting information) which results in an incorrect order being prepared for the vendor.	25	External disturbances	The acquisition manager does not make the award notification to the vendor due to excessive workload, job pressure, or other form of distraction.	Acquisition Manager		Controller
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies or lacks qualification	27	Acquisition Manager	Provided, but the intensity is incorrect (too much or too little)	wrong vendor, incorrect funding level, wrong quantity, incorrect unit cost or total amount, and/or incorrect accounting information) which results in an incorrect order being prepared for the vendor. This action will likely delay the procurement process and introduce financial errors in CAS. For External: The acquisition manager performs the acquisition process, but it is incorrect (i.e. contains wrong vendor, incorrect funding level, wrong quantity, incorrect unit cost or total amount, and/or incorrect accounting information) which results in an incorrect order being prepared for the vendor.	142	Process model or calibration incomplete or incorrect	The acquisition manager makes an incorrect order due to lack of training, task prioritization, sub-par job performance, or lacks a sense of urgency to complete the transaction/order the product or service.	Acquisition Manager		Controller
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies or lacks qualification	27	Acquisition Manager	Provided, but the intensity is incorrect (too much or too little)	wrong vendor, incorrect funding level, wrong quantity, incorrect unit cost or total amount, and/or incorrect accounting information) which results in an incorrect order being prepared for the vendor. This action will likely delay the procurement process and introduce financial errors in CAS. For External: The acquisition manager performs the acquisition process, but it is incorrect (i.e. contains wrong vendor, incorrect funding level, wrong quantity, incorrect unit cost or total amount, and/or incorrect accounting information) which results in an incorrect order being prepared for the vendor.	213	Sensor inadequate operation, change over time	Input received from a prior financial transaction initiated by another controller is not received, contains inaccurate information, and creates a system hazard.	Commitment Notification in CAS (S)		Sensor
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies or lacks qualification	27	Acquisition Manager	Provided, but the intensity is incorrect (too much or too little)	wrong vendor, incorrect funding level, wrong quantity, incorrect unit cost or total amount, and/or incorrect accounting information) which results in an incorrect order being prepared for the vendor. This action will likely delay the procurement process and introduce financial errors in CAS.	293	Actuator inadequate operation, change over time	A system error prevents the AM from completing the acquisition process accurately.	Award Notification External (A)		Actuator

ACC_NO	ACCIDENT	HAZ_NO	HAZARD	UCA_NO	COMPONENT_NAME	UNSAFE_CONTROL_ACTION	UCA_DESC	CAUSAL_FACT_NO	CF_DESC	CF_USER_DESC	FROM_COMP	TO_COMP	CATEGORY
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies or lacks qualification	29	Acquisition Manager	Provided, but executed incorrectly	For External: The acquisition manager performs the acquisition process, but all of the steps required to place the order to the vendor are not completed, or are made out of sequence. These conditions could result in delays and/or cause the vendor to provide the incorrect product or service to the operating unit as originally requested. The action could also violate USCG financial management or procurement regulations. For External: The acquisition manager performs the acquisition process, but all of the steps required to place the order to the vendor are not completed, or are made out of sequence. These conditions could result in delays and/or cause the vendor to provide the incorrect product or service to the operating unit as originally requested. The action could also violate USCG financial management or procurement regulations.	147	External disturbances	A disturbance caused by job stress, excessive workload, or other distraction could contribute to the AM not completing the order correctly.	Acquisition Manager		Controller
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies or lacks qualification	29	Acquisition Manager	Provided, but executed incorrectly	For External: The acquisition manager performs the acquisition process, but all of the steps required to place the order to the vendor are not completed, or are made out of sequence. These conditions could result in delays and/or cause the vendor to provide the incorrect product or service to the operating unit as originally requested. The action could also violate USCG financial management or procurement regulations. For External: The acquisition manager performs the acquisition process, but all of the steps required to place the order to the vendor are not completed, or are made out of sequence. These conditions could result in delays and/or cause the vendor to provide the incorrect product or service to the operating unit as originally requested. The action could also violate USCG financial management or procurement regulations.	148	Process model or calibration incomplete or incorrect	This acquisition manager does not properly execute the transaction due to a process model problem. Potential causes: lack of training, poor job performance, or no feedback mechanism regarding the status of the system or vendor specific requirements necessary to properly complete the acquisition process.	Acquisition Manager		Controller
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies or lacks qualification	29	Acquisition Manager	Provided, but executed incorrectly	For External: The acquisition manager performs the acquisition process, but all of the steps required to place the order to the vendor are not completed, or are made out of sequence. These conditions could result in delays and/or cause the vendor to provide the incorrect product or service to the operating unit as originally requested. The action could also violate USCG financial management or procurement regulations. For External: The acquisition manager performs the acquisition process, but all of the steps required to place the order to the vendor are not completed, or are made out of sequence. These conditions could result in delays and/or cause the vendor to provide the incorrect product or service to the operating unit as originally requested. The action could also violate USCG financial management or procurement regulations.	150	Actuator inadequate operation, change over time	The means to transmit the order to the vendor does not exist, so the process is not completed.	Award Notification External (A)		Actuator
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies or lacks qualification	29	Acquisition Manager	Provided, but executed incorrectly	For External: The acquisition manager performs the acquisition process, but all of the steps required to place the order to the vendor are not completed, or are made out of sequence. These conditions could result in delays and/or cause the vendor to provide the incorrect product or service to the operating unit as originally requested. The action could also violate USCG financial management or procurement regulations. For External: The acquisition manager performs the acquisition process, but all of the steps required to place the order to the vendor are not completed, or are made out of sequence. These conditions could result in delays and/or cause the vendor to provide the incorrect product or service to the operating unit as originally requested. The action could also violate USCG financial management or procurement regulations.	152	Controlled component failure, change over time	The vendor's requirements for taking orders have changed, or new and unfamiliar information is required.	Vendor/Service Provider (CP)		Controlled Process
2	Violation of USCG Financial Management Laws and/or policies	4	Commitments or obligations are recorded in excess of funding limitations	10	Funds Manager	Provided, but the intensity is incorrect (too much or too little)	Funds manager approves the procurement request (commitment) for an amount that exceeds the level of funds available in the system.	62	External disturbances	Excessive workload, job pressure, or distraction could cause the funds manager to record a commitment that exceeds the level of funding available. The funds manager recorded the excessive commitment due to lack of training, poor job performance, improper prioritization of workload, or due to an effective feedback mechanism regarding the status of the system.	Funds Manager		Controller
2	Violation of USCG Financial Management Laws and/or policies	4	Commitments or obligations are recorded in excess of funding limitations	10	Funds Manager	Provided, but the intensity is incorrect (too much or too little)	Funds manager approves the procurement request (commitment) for an amount that exceeds the level of funds available in the system.	63	Process model or calibration incomplete or incorrect	A CAS system error could cause the funds manager to record a commitment that exceeds the level of available funding.	Funds Manager		Controller
2	Violation of USCG Financial Management Laws and/or policies	4	Commitments or obligations are recorded in excess of funding limitations	10	Funds Manager	Provided, but the intensity is incorrect (too much or too little)	Funds manager approves the procurement request (commitment) for an amount that exceeds the level of funds available in the system.	84	Actuator inadequate operation, change over time	A CAS system error could cause the funds manager to record a commitment that exceeds the level of available funding.	Record in CAS (A)		Actuator
2	Violation of USCG Financial Management Laws and/or policies	4	Commitments or obligations are recorded in excess of funding limitations	10	Funds Manager	Provided, but the intensity is incorrect (too much or too little)	Funds manager approves the procurement request (commitment) for an amount that exceeds the level of funds available in the system.	236	Output of controlled process contributes to system hazard	Inaccurately reported information reported from, or stored in, CAS causes the funds manager to approve the request even though it exceeds the level of available funds.	Core Accounting System (CP)		Controlled Process
2	Violation of USCG Financial Management Laws and/or policies	4	Commitments or obligations are recorded in excess of funding limitations	10	Funds Manager	Provided, but the intensity is incorrect (too much or too little)	Funds manager approves the procurement request (commitment) for an amount that exceeds the level of funds available in the system.	239	Sensor inadequate operation, change over time	The funds manager is not made aware of that the approved amount exceeds the level of available funding.	Commitment Notification in CAS (S)		Sensor
2	Violation of USCG Financial Management Laws and/or policies	4	Commitments or obligations are recorded in excess of funding limitations	13	Funds Manager	Provided, but the intensity is incorrect (too much or too little)	Following the award in CAS, the Funds manager approves the obligation for an amount that exceeds the level of available funding in the system or makes a duplicate entry in the financial management system.	56	External disturbances	Excessive workload, job pressure, or distraction could cause the funds manager to approve the improper obligation in CAS.	Funds Manager		Controller
2	Violation of USCG Financial Management Laws and/or policies	4	Commitments or obligations are recorded in excess of funding limitations	13	Funds Manager	Provided, but the intensity is incorrect (too much or too little)	Following the award in CAS, the Funds manager approves the obligation for an amount that exceeds the level of available funding in the system or makes a duplicate entry in the financial management system.	57	Process model or calibration incomplete or incorrect	The funds manager recorded the excessive obligation due to lack of training, poor job performance, improper prioritization of workload, or missing feedback regarding the status of the system.	Funds Manager		Controller
2	Violation of USCG Financial Management Laws and/or policies	4	Commitments or obligations are recorded in excess of funding limitations	13	Funds Manager	Provided, but the intensity is incorrect (too much or too little)	Following the award in CAS, the Funds manager approves the obligation for an amount that exceeds the level of available funding in the system or makes a duplicate entry in the financial management system.	58	Actuator inadequate operation, change over time	A system error caused the funds manager inadvertently enter a transaction in CAS that exceeded the level of available funding.	Record Obligation in CAS (A)		Actuator

ACC_NO	ACCIDENT	HAZ_NO	HAZARD	UCA_NO	COMPONENT_NAME	UNSAFE_CONTROL_ACTION	UCA_DESC	CAUSAL_FACT_NO	CF_DESC	CF_USER_DESC	FROM_COMP	TO_COMP	CATEGORY
2	Violation of USCG Financial Management Laws and/or policies	4	Commitments or obligations are recorded in excess of funding limitations	13	Funds Manager	Provided, but the intensity is incorrect (too much or too little)	Following the award in CAS, the Funds manager approves the obligation for an amount that exceeds the level of available funding in the system or makes a duplicate entry in the financial management system.	61	Sensor inadequate operation, change over time	The funds manager is not made aware of the excessive obligation in a manner that prevents it from being recorded in the system.	Award Notification in CAS (S)		Sensor
2	Violation of USCG Financial Management Laws and/or policies	4	Commitments or obligations are recorded in excess of funding limitations	13	Funds Manager	Provided, but the intensity is incorrect (too much or too little)	Following the award in CAS, the Funds manager approves the obligation for an amount that exceeds the level of available funding in the system or makes a duplicate entry in the financial management system.	195	Sensor inadequate operation, change over time	Information regarding the excessive obligation is not reported in a timely manner from CAS.	Obligation Notification in CAS (S)		Sensor
2	Violation of USCG Financial Management Laws and/or policies	4	Commitments or obligations are recorded in excess of funding limitations	13	Funds Manager	Provided, but the intensity is incorrect (too much or too little)	Following the award in CAS, the Funds manager approves the obligation for an amount that exceeds the level of available funding in the system or makes a duplicate entry in the financial management system.	197	Conflicting control action	Input from a different funds manager could provide conflicting information that results in the excessive obligation being approved and recorded in the CAS financial system.	Core Accounting System (CP)		Controlled Process
2	Violation of USCG Financial Management Laws and/or policies	4	Commitments or obligations are recorded in excess of funding limitations	13	Funds Manager	Provided, but the intensity is incorrect (too much or too little)	Following the award in CAS, the Funds manager approves the obligation for an amount that exceeds the level of available funding in the system or makes a duplicate entry in the financial management system.	217	Controlled component failure, change over time	A CAS system error allows the obligation to be approved for an amount that exceeds the amount of funds available.	Core Accounting System (CP)		Controlled Process
2	Violation of USCG Financial Management Laws and/or policies	6	Financial commitments or obligations are inaccurately or improperly recorded in the financial system	9	Funds Manager	Provided, but executed incorrectly	The funds manager reviews and approves the commitment, but it contains errors or inaccurate information that prevents the procurement from progressing through the financial management system.	211	Output of controlled process contributes to system hazard	Inaccurate information that originated from prior financial transactions causes the funds manager to subsequently approve the obligation with inaccurate information present.	Core Accounting System (CP)		Controlled Process
2	Violation of USCG Financial Management Laws and/or policies	6	Financial commitments or obligations are inaccurately or improperly recorded in the financial system	9	Funds Manager	Provided, but executed incorrectly	The funds manager reviews and approves the commitment, but it contains errors or inaccurate information that prevents the procurement from progressing through the financial management system.	220	External disturbances	Excessive workload, job pressure, or distraction could prevent the funds manager from approving an accurate or correct commitment.	Funds Manager		Controller
2	Violation of USCG Financial Management Laws and/or policies	6	Financial commitments or obligations are inaccurately or improperly recorded in the financial system	9	Funds Manager	Provided, but executed incorrectly	The funds manager reviews and approves the commitment, but it contains errors or inaccurate information that prevents the procurement from progressing through the financial management system.	221	Process model or calibration incomplete or incorrect	The funds manager did not accurately record/approve the commitment. The error could be the result from lack of training, poor job performance, distraction, or missing feedback regarding the status of the system.	Funds Manager		Controller
2	Violation of USCG Financial Management Laws and/or policies	6	Financial commitments or obligations are inaccurately or improperly recorded in the financial system	9	Funds Manager	Provided, but executed incorrectly	The funds manager reviews and approves the commitment, but it contains errors or inaccurate information that prevents the procurement from progressing through the financial management system.	223	Sensor inadequate operation, change over time	Inaccurate financial information that originated from prior step in the process is transmitted to the funds manager.	Request Notification in CAS (S)		Sensor
2	Violation of USCG Financial Management Laws and/or policies	6	Financial commitments or obligations are inaccurately or improperly recorded in the financial system	9	Funds Manager	Provided, but executed incorrectly	The funds manager reviews and approves the commitment, but it contains errors or inaccurate information that prevents the procurement from progressing through the financial management system.	224	Actuator inadequate operation, change over time	A CAS system error prevented the commitment from being accurately recorded, including the introduction of data errors. These errors prevent the commitment from progressing further in the financial management system.	Record in CAS (A)		Actuator
2	Violation of USCG Financial Management Laws and/or policies	6	Financial commitments or obligations are inaccurately or improperly recorded in the financial system	14	Funds Manager	Provided, but executed incorrectly	The funds manager approves the committed obligation, but the obligation contains inaccurate information that creates errors in the core accounting system.	56	External disturbances	Excessive workload, job pressure, or distraction could cause the funds manager to approve the improper obligation in CAS.	Funds Manager		Controller
2	Violation of USCG Financial Management Laws and/or policies	6	Financial commitments or obligations are inaccurately or improperly recorded in the financial system	14	Funds Manager	Provided, but executed incorrectly	The funds manager approves the committed obligation, but the obligation contains inaccurate information that creates errors in the core accounting system.	72	Process model or calibration incomplete or incorrect	The funds manager did not accurately record the obligation. The error could be the result from lack of training, poor job performance, distraction, or missing feedback regarding the status of the system.	Funds Manager		Controller
2	Violation of USCG Financial Management Laws and/or policies	6	Financial commitments or obligations are inaccurately or improperly recorded in the financial system	14	Funds Manager	Provided, but executed incorrectly	The funds manager approves the committed obligation, but the obligation contains inaccurate information that creates errors in the core accounting system.	73	Actuator inadequate operation, change over time	A CAS system error prevented the obligation from being accurately recorded, including the introduction of data errors.	Record in CAS (A)		Actuator
2	Violation of USCG Financial Management Laws and/or policies	6	Financial commitments or obligations are inaccurately or improperly recorded in the financial system	14	Funds Manager	Provided, but executed incorrectly	The funds manager approves the committed obligation, but the obligation contains inaccurate information that creates errors in the core accounting system.	77	Sensor inadequate operation, change over time	Lack of information regarding the status of the system could cause the funds manager to record the inaccurate obligation in the CAS.	Award Notification in CAS (S)		Sensor
2	Violation of USCG Financial Management Laws and/or policies	6	Financial commitments or obligations are inaccurately or improperly recorded in the financial system	14	Funds Manager	Provided, but executed incorrectly	The funds manager approves the committed obligation, but the obligation contains inaccurate information that creates errors in the core accounting system.	210	Controlled component failure, change over time	A CAS system error prevents the commitment from being accurately recorded.	Core Accounting System (CP)		Controlled Process
2	Violation of USCG Financial Management Laws and/or policies	6	Financial commitments or obligations are inaccurately or improperly recorded in the financial system	14	Funds Manager	Provided, but executed incorrectly	The funds manager approves the committed obligation, but the obligation contains inaccurate information that creates errors in the core accounting system.	211	Output of controlled process contributes to system hazard	Inaccurate information that originated from prior financial transactions causes the funds manager to subsequently approve the obligation with inaccurate information present.	Core Accounting System (CP)		Controlled Process

ACC_NO	ACCDNT	HAZ_NO	HAZARD	UCA_NO	COMPONENT_NAME	UNSAFE_CONTROL_ACTION	UCA_DESC	CAUSAL_FACT_NO	CF_DESC	CF_USER_DESC	FROM_COMP	TO_COMP	CATEGORY
2	Violation of USCG Financial Management Laws and/or policies	6	Financial commitments or obligations are inaccurately or improperly recorded in the financial system	26	Acquisition Manager	Provided, but the intensity is incorrect (too much or too little)	CAS: The acquisition manager performs the acquisition process, but it is incorrect (i.e. contains wrong vendor, incorrect funding level, wrong quantity, incorrect unit cost or total amount, and/or incorrect accounting information) which results in erroneous obligations being recorded in CAS. This action will likely delay the procurement process and introduce financial errors in CAS.	183	External disturbances	External disturbances in the form of excessive workload, job stress, or other distraction could the acquisition manager's to not execute process correctly in CAS.	Acquisition Manager		Controller
2	Violation of USCG Financial Management Laws and/or policies	6	Financial commitments or obligations are inaccurately or improperly recorded in the financial system	26	Acquisition Manager	Provided, but the intensity is incorrect (too much or too little)	CAS: The acquisition manager performs the acquisition process, but it is incorrect (i.e. contains wrong vendor, incorrect funding level, wrong quantity, incorrect unit cost or total amount, and/or incorrect accounting information) which results in erroneous obligations being recorded in CAS. This action will likely delay the procurement process and introduce financial errors in CAS.	184	Process model or calibration incomplete or incorrect	The acquisition manager does not make the award correctly in CAS due to lack of training, sub-par job performance.	Acquisition Manager		Controller
2	Violation of USCG Financial Management Laws and/or policies	6	Financial commitments or obligations are inaccurately or improperly recorded in the financial system	26	Acquisition Manager	Provided, but the intensity is incorrect (too much or too little)	CAS: The acquisition manager performs the acquisition process, but it is incorrect (i.e. contains wrong vendor, incorrect funding level, wrong quantity, incorrect unit cost or total amount, and/or incorrect accounting information) which results in erroneous obligations being recorded in CAS. This action will likely delay the procurement process and introduce financial errors in CAS.	186	Actuator inadequate operation, change over time	A CAS system error prevents the award transaction from being correctly recorded in CAS.	Award Notification in CAS (A)		Actuator
2	Violation of USCG Financial Management Laws and/or policies	6	Financial commitments or obligations are inaccurately or improperly recorded in the financial system	26	Acquisition Manager	Provided, but the intensity is incorrect (too much or too little)	CAS: The acquisition manager performs the acquisition process, but it is incorrect (i.e. contains wrong vendor, incorrect funding level, wrong quantity, incorrect unit cost or total amount, and/or incorrect accounting information) which results in erroneous obligations being recorded in CAS. This action will likely delay the procurement process and introduce financial errors in CAS.	215	Controlled component failure, change over time	A CAS system error prevents the acquisition/awards from being accurately recorded or notifying the acquisition manager of a pending problem with the acquisition.	Core Accounting System (CP)		Controlled Process
2	Violation of USCG Financial Management Laws and/or policies	7	Commitments or obligations are not in line with USCG financial policy, spend plans, or congressional intent	21	Acquisition Manager	Provided, but executed incorrectly	CAS: The acquisition manager performs the acquisition process, but the transaction is not executed properly and cannot be completed (i.e. incorrect financial information, wrong vendor, insufficient procurement authority) which delays the procurement process and/or violates USCG policies. The process can also be performed out of sequence with other actions, which could be a violation of financial management or procurement regulations.	169	External disturbances	A disturbance caused by job stress, excessive workload, or other distraction could contribute to the acquisition process from being improperly performed.	Acquisition Manager		Controller
2	Violation of USCG Financial Management Laws and/or policies	7	Commitments or obligations are not in line with USCG financial policy, spend plans, or congressional intent	21	Acquisition Manager	Provided, but executed incorrectly	CAS: The acquisition manager performs the acquisition process, but the transaction is not executed properly and cannot be completed (i.e. incorrect financial information, wrong vendor, insufficient procurement authority) which delays the procurement process and/or violates USCG policies. The process can also be performed out of sequence with other actions, which could be a violation of financial management or procurement regulations.	170	Process model or calibration incomplete or incorrect	This acquisition manager does not properly complete the acquisition process due to a process model problem. Potential causes: lack of training, poor job performance, or no feedback mechanism regarding the status of the system.	Acquisition Manager		Controller
2	Violation of USCG Financial Management Laws and/or policies	7	Commitments or obligations are not in line with USCG financial policy, spend plans, or congressional intent	21	Acquisition Manager	Provided, but executed incorrectly	CAS: The acquisition manager performs the acquisition process, but the transaction is not executed properly and cannot be completed (i.e. incorrect financial information, wrong vendor, insufficient procurement authority) which delays the procurement process and/or violates USCG policies. The process can also be performed out of sequence with other actions, which could be a violation of financial management or procurement regulations.	172	Actuator inadequate operation, change over time	A system error in CAS prevents the acquisition process from being accurately completed, and possibly introduces corrupt data into the procurement process.	Award Notification in CAS (A)		Actuator
2	Violation of USCG Financial Management Laws and/or policies	7	Commitments or obligations are not in line with USCG financial policy, spend plans, or congressional intent	21	Acquisition Manager	Provided, but executed incorrectly	CAS: The acquisition manager performs the acquisition process, but the transaction is not executed properly and cannot be completed (i.e. incorrect financial information, wrong vendor, insufficient procurement authority) which delays the procurement process and/or violates USCG policies. The process can also be performed out of sequence with other actions, which could be a violation of financial management or procurement regulations.	173	Controlled component failure, change over time	A CAS system prevents the acquisition process from being completed and recorded.	Core Accounting System (CP)		Controlled Process

ACC_NO	ACCIDENT	HAZ_NO	HAZARD	UCA_NO	COMPONENT_NAME	UNSAFE_CONTROL_ACTION	UCA_DESC	CAUSAL_FACT_NO	CF_DESC	OF_USER_DESC	FROM_COMP	TO_COMP	CATEGORY
2	Violation of USCG Financial Management Laws and/or policies	7	Commitments or obligations are not in line with USCG financial policy, spend plans, or congressional intent	21	Acquisition Manager	Provided, but executed incorrectly	CAS: The acquisition manager performs the acquisition process, but the transaction is not executed properly and cannot be completed (i.e. incorrect financial information, wrong vendor, insufficient procurement authority) which delays the procurement process and/or violates USCG policies. The process can also be performed out of sequence with other actions, which could be a violation of financial management or procurement regulations. CAS: The acquisition manager performs the acquisition process, but the transaction is not executed properly and cannot be completed (i.e. incorrect financial information, wrong vendor, insufficient procurement authority) which delays the procurement process and/or violates USCG policies. The process can also be performed out of sequence with other actions, which could be a violation of financial management or procurement regulations. CAS: The acquisition manager performs the acquisition process, but the transaction is not executed properly and cannot be completed (i.e. incorrect financial information, wrong vendor, insufficient procurement authority) which delays the procurement process and/or violates USCG policies. The process can also be performed out of sequence with other actions, which could be a violation of financial management or procurement regulations.	174	Sensor inadequate operation, change over time	The acquisition manager does not receive a status output regarding the status of the acquisition process from the CAS.	Award Notification in CAS (S)		Sensor
2	Violation of USCG Financial Management Laws and/or policies	7	Commitments or obligations are not in line with USCG financial policy, spend plans, or congressional intent	21	Acquisition Manager	Provided, but executed incorrectly	CAS: The acquisition manager performs the acquisition process, but the transaction is not executed properly and cannot be completed (i.e. incorrect financial information, wrong vendor, insufficient procurement authority) which delays the procurement process and/or violates USCG policies. The process can also be performed out of sequence with other actions, which could be a violation of financial management or procurement regulations. For External: The acquisition manager performs the acquisition process, but it is incorrect (i.e. contains wrong vendor, incorrect funding level, wrong quantity, incorrect unit cost or total amount, and/or incorrect accounting information) which results in an incorrect order being prepared for the vendor. This action will likely delay the procurement process and introduce financial errors in CAS. For External: The acquisition manager performs the acquisition process, but it is incorrect (i.e. contains wrong vendor, incorrect funding level, wrong quantity, incorrect unit cost or total amount, and/or incorrect accounting information) which results in an incorrect order being prepared for the vendor. This action will likely delay the procurement process and introduce financial errors in CAS.	213	Sensor inadequate operation, change over time	Input received from a prior financial transaction initiated by another controller is not received, contains inaccurate information, and creates a system hazard.	Commitment Notification in CAS (S)		Sensor
2	Violation of USCG Financial Management Laws and/or policies	7	Commitments or obligations are not in line with USCG financial policy, spend plans, or congressional intent	27	Acquisition Manager	Provided, but the intensity is incorrect (too much or too little)	wrong vendor, incorrect funding level, wrong quantity, incorrect unit cost or total amount, and/or incorrect accounting information) which results in an incorrect order being prepared for the vendor. This action will likely delay the procurement process and introduce financial errors in CAS. For External: The acquisition manager performs the acquisition process, but it is incorrect (i.e. contains wrong vendor, incorrect funding level, wrong quantity, incorrect unit cost or total amount, and/or incorrect accounting information) which results in an incorrect order being prepared for the vendor. This action will likely delay the procurement process and introduce financial errors in CAS.	25	External disturbances	The acquisition manager does not make the award notification to the vendor due to excessive workload, job pressure, or other form of distraction.	Acquisition Manager		Controller
2	Violation of USCG Financial Management Laws and/or policies	7	Commitments or obligations are not in line with USCG financial policy, spend plans, or congressional intent	27	Acquisition Manager	Provided, but the intensity is incorrect (too much or too little)	wrong vendor, incorrect funding level, wrong quantity, incorrect unit cost or total amount, and/or incorrect accounting information) which results in an incorrect order being prepared for the vendor. This action will likely delay the procurement process and introduce financial errors in CAS. For External: The acquisition manager performs the acquisition process, but it is incorrect (i.e. contains wrong vendor, incorrect funding level, wrong quantity, incorrect unit cost or total amount, and/or incorrect accounting information) which results in an incorrect order being prepared for the vendor. This action will likely delay the procurement process and introduce financial errors in CAS.	142	Process model or calibration incomplete or incorrect	The acquisition manager makes an incorrect order due to lack of training, task prioritization, sub-par job performance, or lacks a sense of urgency to complete the transaction/order the product or service.	Acquisition Manager		Controller
2	Violation of USCG Financial Management Laws and/or policies	7	Commitments or obligations are not in line with USCG financial policy, spend plans, or congressional intent	27	Acquisition Manager	Provided, but the intensity is incorrect (too much or too little)	wrong vendor, incorrect funding level, wrong quantity, incorrect unit cost or total amount, and/or incorrect accounting information) which results in an incorrect order being prepared for the vendor. This action will likely delay the procurement process and introduce financial errors in CAS. For External: The acquisition manager performs the acquisition process, but it is incorrect (i.e. contains wrong vendor, incorrect funding level, wrong quantity, incorrect unit cost or total amount, and/or incorrect accounting information) which results in an incorrect order being prepared for the vendor. This action will likely delay the procurement process and introduce financial errors in CAS.	213	Sensor inadequate operation, change over time	Input received from a prior financial transaction initiated by another controller is not received, contains inaccurate information, and creates a system hazard.	Commitment Notification in CAS (S)		Sensor
2	Violation of USCG Financial Management Laws and/or policies	7	Commitments or obligations are not in line with USCG financial policy, spend plans, or congressional intent	27	Acquisition Manager	Provided, but the intensity is incorrect (too much or too little)	wrong vendor, incorrect funding level, wrong quantity, incorrect unit cost or total amount, and/or incorrect accounting information) which results in an incorrect order being prepared for the vendor. This action will likely delay the procurement process and introduce financial errors in CAS. CAS: The acquisition manager performs the acquisition process, but the transaction is not executed properly and cannot be completed (i.e. incorrect financial information, wrong vendor, insufficient procurement authority) which delays the procurement process and/or violates USCG policies. The process can also be performed out of sequence with other actions, which could be a violation of financial management or procurement regulations.	299	Actuator inadequate operation, change over time	A system error prevents the AM from completing the acquisition process accurately.	Award Notification External (A)		Actuator
2	Violation of USCG Financial Management Laws and/or policies	8	USCG contracts are executed prior to sufficient funds being appropriated or committed	21	Acquisition Manager	Provided, but executed incorrectly	CAS: The acquisition manager performs the acquisition process, but the transaction is not executed properly and cannot be completed (i.e. incorrect financial information, wrong vendor, insufficient procurement authority) which delays the procurement process and/or violates USCG policies. The process can also be performed out of sequence with other actions, which could be a violation of financial management or procurement regulations. CAS: The acquisition manager performs the acquisition process, but the transaction is not executed properly and cannot be completed (i.e. incorrect financial information, wrong vendor, insufficient procurement authority) which delays the procurement process and/or violates USCG policies. The process can also be performed out of sequence with other actions, which could be a violation of financial management or procurement regulations.	169	External disturbances	A disturbance caused by job stress, excessive workload, or other distraction could contribute to the acquisition process from being improperly performed.	Acquisition Manager		Controller
2	Violation of USCG Financial Management Laws and/or policies	8	USCG contracts are executed prior to sufficient funds being appropriated or committed	21	Acquisition Manager	Provided, but executed incorrectly	CAS: The acquisition manager performs the acquisition process, but the transaction is not executed properly and cannot be completed (i.e. incorrect financial information, wrong vendor, insufficient procurement authority) which delays the procurement process and/or violates USCG policies. The process can also be performed out of sequence with other actions, which could be a violation of financial management or procurement regulations.	170	Process model or calibration incomplete or incorrect	This acquisition manager does not properly complete the acquisition process due to a process model problem. Potential causes: lack of training, poor job performance, or no feedback mechanism regarding the status of the system.	Acquisition Manager		Controller



ACC_NO	ACCIDENT	HAZ_NO	HAZARD	UCA_NO	COMPONENT_NAME	UNSAFE_CONTROL_ACTION	UCA_DESC	CAUSA_FACT_NO	CF_DESC	CF_USER_DESC	FROM_COMP	TO_COMP	CATEGORY
2	Violation of USCG Financial Management Laws and/or policies	8	USCG contracts are executed prior to sufficient funds being appropriated or committed	29	Acquisition Manager	Provided, but executed incorrectly	For External: The acquisition manager performs the acquisition process, but all of the steps required to place the order to the vendor are not completed, or are made out of sequence. These conditions could result in delays and/or cause the vendor to provide the incorrect product or service to the operating unit as originally requested. The action could also violate USCG financial management or procurement regulations.	152	Controlled component failure, change over time	The vendor's requirements for taking orders have changed, or new and unfamiliar information is required.	Vendor/Service Provider (CP)		Controlled Process
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	1	Procurement Request Manager	Provided, but the intensity is incorrect (too much or too little)	The product/service requested is incorrect -i.e. wrong vendor, incorrect funding level, wrong quantity, incorrect unit cost or total amount, or incorrect accounting information.	260	Actuation delivered incorrectly or inadequately: Hardware faulty	Information/data relating to the request submitted by the PR manager is corrupted as it is conveyed to the CAS system.	Request in CAS (A)	Core Accounting System (CP)	Actuator-Controlled Process
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	1	Procurement Request Manager	Provided, but the intensity is incorrect (too much or too little)	The product/service requested is incorrect -i.e. wrong vendor, incorrect funding level, wrong quantity, incorrect unit cost or total amount, or incorrect accounting information.	261	Controller to actuator signal ineffective, missing, or delayed: Hardware open, short, missing, intermittent faulty	The procurement request manager does not enter the correct information in CAS, which is a foundational early step in the financial and procurement processes.	Procurement Request Manager	Request in CAS (A)	Controller-Actuator
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	2	Procurement Request Manager	Provided, but executed incorrectly	The request was initiated in the financial management system, but contained data errors, or possibly incorrect routing for transmission to the level.	256	Sensor to controller signal inadequate, missing, or delayed: incorrect connection	The request was made, but is mistakenly sent to an incorrect funds manager, which will prevent or delay the request from advancing through subsequent stages in the system.	Request Notification in CAS (S)	Funds Manager	Sensor-Controller
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	3	Procurement Request Manager	Provided, but the starting time is too soon or too late	The procurement request manager initiated the procurement request too late, which delayed its progress through the financial management system.	249	Controller to actuator signal ineffective, missing, or delayed: Hardware open, short, missing, intermittent faulty	Systems required by the PR manager to initiate the request are not available, which delays the process.	Procurement Request Manager	Request in CAS (A)	Controller-Actuator
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	4	Procurement Request Manager	Not provided when needed to maintain safety	The procurement request manager did not initiate the procurement request which prevented the product/service from progressing through the financial management system.	253	Controller to actuator signal ineffective, missing, or delayed: Hardware open, short, missing, intermittent faulty	Systems required by the PR manager to initiate the request are not available, which prevents the process from being completed.	Procurement Request Manager	Request in CAS (A)	Controller-Actuator
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	4	Procurement Request Manager	Not provided when needed to maintain safety	The procurement request manager did not initiate the procurement request which prevented the product/service from progressing through the financial management system.	254	Actuation delivered incorrectly or inadequately: Hardware faulty	A missing or ineffective means to convey the request to the funds manager prevents request from being initiated in CAS.	Request in CAS (A)	Core Accounting System (CP)	Actuator-Controlled Process
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	5	Operating Unit	Provided, but the intensity is incorrect (too much or too little)	The operating unit does not provide all of the required request information to accurately initiate the procurement process.	241	Actuation delivered incorrectly or inadequately: Hardware faulty	Not all of the required information is conveyed from the operating unit to the procurement request manager, which prevents or delays the request from proceeding in a timely manner.	Transmit Request (A)	Procurement Request Manager	Actuator-Controlled Process
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	5	Operating Unit	Provided, but the intensity is incorrect (too much or too little)	The operating unit does not provide all of the required request information to accurately initiate the procurement process.	247	Controller to actuator signal ineffective, missing, or delayed: Hardware open, short, missing, intermittent faulty	The operating unit does not obtain all of the information required to make the request, is not aware of what procedures or steps to follow, or who/where the request should be made to.	Operating Unit	Transmit Request (A)	Controller-Actuator
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	6	Operating Unit	Provided, but executed incorrectly	The operating unit transmits the incorrect request information (vendor, product, quantity, type, etc.), or makes the request to the incorrect PR manager. This action prevents the transaction from being properly initiated by the PR manager.	244	Controller to actuator signal ineffective, missing, or delayed: Hardware open, short, missing, intermittent faulty	A missing or ineffective means to make the request to the procurement manager delays or prevents the submission of an accurate request to the PR manager, and the procurement is therefore not initiated.	Operating Unit	Transmit Request (A)	Controller-Actuator

ACC_NO	ACCIDENT	HAZ_NO	HAZARD	UCA_NO	COMPONENT_NAME	UNSAFE_CONTROL_ACTION	UCA_DESC	CAUSAL_FACT_NO	CF_DESC	CF_USER_DESC	FROM_COMP	TO_COMP	CATEGORY
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	6	Operating Unit	Provided, but executed incorrectly	The operating unit transmits the incorrect request information (vendor, product, quantity, type, etc.), or makes the request to the incorrect PR manager. This action prevents the transaction from being properly initiated by the PR manager.	245	Actuation delivered incorrectly or inadequately; Hardware faulty	Information is incorrect or missing as it is conveyed from the operating unit to the procurement request manager, which prevents or delays the request from proceeding in a timely manner.	Transmit Request (A)	Procurement Request Manager	Actuator-Controlled Process
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	7	Operating Unit	Provided, but the starting time is too soon or too late	The operating unit is unable to transmit/provide all of the required request information within prescribed lead-time requirements, which prevents the product/service from being procured and delivered within the required timeframe.	95	Controller to actuator signal ineffective, missing, or delayed; Hardware open, short, missing, intermittent faulty	A missing or ineffective means to communicate the request to the procurement manager ultimately delays or prevents the delivery of the required products or services.	Operating Unit	Transmit Request (A)	Controller-Actuator
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	7	Operating Unit	Provided, but the starting time is too soon or too late	The operating unit is unable to transmit/provide all of the required request information within prescribed lead-time requirements, which prevents the product/service from being procured and delivered within the required timeframe.	241	Actuation delivered incorrectly or inadequately; Hardware faulty	Not all of the required information is conveyed from the operating unit to the procurement request manager, which prevents or delays the request from proceeding in a timely manner.	Transmit Request (A)	Procurement Request Manager	Actuator-Controlled Process
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	8	Operating Unit	Not provided when needed to maintain safety	The operating unit does not initiate the request to the procurement request manager, which prevented the product/service from being delivered.	112	Controller to actuator signal ineffective, missing, or delayed; Hardware open, short, missing, intermittent faulty	A missing or ineffective means to communicate the request to the procurement manager prevents initiation of the procurement process, and ultimately delivery of the required products or services.	Operating Unit	Transmit Request (A)	Controller-Actuator
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	8	Operating Unit	Not provided when needed to maintain safety	The operating unit does not initiate the request to the procurement request manager, which prevented the product/service from being delivered.	248	Actuation delivered incorrectly or inadequately; Incorrect connection	The operating unit does not make the request to the correct procurement request manager, so it is rejected.	Transmit Request (A)	Procurement Request Manager	Actuator-Controlled Process
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	9	Funds Manager	Provided, but executed incorrectly	The funds manager reviews and approves the commitment, but it contains errors or inaccurate information that prevents the procurement from progressing through the financial management system.	222	Sensor to controller signal inadequate, missing, or delayed; Hardware open, short, missing, intermittent faulty	Inaccurate financial information that originated from a different controller's prior action is conveyed to the funds manager.	Request Notification in CAS (S)	Funds Manager	Sensor-Controller
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	11	Funds Manager	Provided, but the starting time is too soon or too late	The funds manager reviews, verifies and approves the procurement request too late which prevents the request from progressing through the financial management system within acceptable limits.	226	Sensor to controller signal inadequate, missing, or delayed; Hardware open, short, missing, intermittent faulty	Timely notification of the requirement to perform the action was not received by the funds manager.	Request Notification in CAS (S)	Funds Manager	Sensor-Controller
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	11	Funds Manager	Provided, but the starting time is too soon or too late	The funds manager reviews, verifies and approves the procurement request too late which prevents the request from progressing through the financial management system within acceptable limits.	227	Controller to actuator signal ineffective, missing, or delayed; Hardware open, short, missing, intermittent faulty	Systems required by the funds manager to approve the commitment were not available, which delayed the action.	Funds Manager	Record in CAS (A)	Controller-Actuator
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	15	Funds Manager	Provided, but the starting time is too soon or too late	The funds manager records the committed obligation too late, which prevents the procurement from progressing through the financial management system.	207	Controller to actuator signal ineffective, missing, or delayed; Hardware open, short, missing, intermittent faulty	The unavailability of a system prevented the funds manager from approving the obligation in a timely manner.	Funds Manager	Record Obligation in CAS (A)	Controller-Actuator

ACC_NO	ACCIDENT	HAZ_NO	HAZARD	UCA_NO	COMPONENT_NAME	UNSAFE_CONTROL_ACTION	UCA_DESC	CAUSAL_FACT_NO	CF_DESC	CF_USER_DESC	FROM_COMP	TO_COMP	CATEGORY
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies or lacks qualification	15	Funds Manager	Provided, but the starting time is too soon or too late	The funds manager records the committed obligation too late, which prevents the procurement from progressing through the financial management system.	208	Sensor to controller signal inadequate, missing, or delayed; Hardware open, short, missing, intermittent faulty	The funds manager is not aware made aware of the requirement to approve the obligation, which delays the process.	Award Notification in CAS (S)	Funds Manager	Sensor-Controller
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies or lacks qualification	16	Funds Manager	Not provided when needed to maintain safety	The funds manager did not approve the obligation, which delays subsequent steps in procurement process from occurring.	200	Controller to actuator signal ineffective, missing, or delayed; Hardware open, short, missing, intermittent faulty	The unavailability of a system prevented the funds manager from approving the obligation.	Funds Manager	Record Obligation in CAS (A)	Controller-Actuator
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies or lacks qualification	16	Funds Manager	Not provided when needed to maintain safety	The funds manager did not approve the obligation, which delays subsequent steps in procurement process from occurring.	203	Sensor to controller signal inadequate, missing, or delayed; Hardware open, short, missing, intermittent faulty	The funds manager does not receive feedback regarding the need to approve the obligation.	Award Notification in CAS (S)	Funds Manager	Sensor-Controller
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies or lacks qualification	16	Funds Manager	Not provided when needed to maintain safety	The funds manager did not approve the obligation, which delays subsequent steps in procurement process from occurring.	218	Sensor to controller signal inadequate, missing, or delayed; Hardware open, short, missing, intermittent faulty	The funds manager does not receive feedback regarding the state of the system and that the obligation has not yet been approved.	Obligation Notification in CAS (S)	Funds Manager	Sensor-Controller
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies or lacks qualification	19	Acquisition Manager	Provided, but the starting time is too soon or too late	For External: The acquisition manager performs the acquisition process, but it occurs too late and results in an unacceptable delay in processing the order and consequently the delivery of products/services from the vendor to the operating unit.	156	Controller to actuator signal ineffective, missing, or delayed; Hardware open, short, missing, intermittent faulty	The AM is not able to perform the acquisition process because the required systems are not available, so the action is delayed.	Acquisition Manager	Award Notification External (A)	Controller-Actuator
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies or lacks qualification	19	Acquisition Manager	Provided, but the starting time is too soon or too late	For External: The acquisition manager performs the acquisition process, but it occurs too late and results in an unacceptable delay in processing the order and consequently the delivery of products/services from the vendor to the operating unit.	159	Actuation delivered incorrectly or inadequately; Actuation delayed	A delay in the means of transmittal (mail, electronic, other) causes a delay in the delivery of the order to the vendor. This in turn causes a delay in the vendor receiving and completing the order to the operational unit.	Award Notification External (A)	Vendor/Service Provider (CP)	Actuator-Controlled Process
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies or lacks qualification	20	Acquisition Manager	Not provided when needed to maintain safety	For External: The acquisition manager does not complete the acquisition process, which results in an unacceptable delay in the delivery of the requested products/services from the vendor to the operating unit.	161	Controller to actuator signal ineffective, missing, or delayed; Hardware open, short, missing, intermittent faulty	The systems required by the AM to complete the acquisition process are not available, or the AM does not perform the acquisition process.	Acquisition Manager	Award Notification External (A)	Controller-Actuator
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies or lacks qualification	20	Acquisition Manager	Not provided when needed to maintain safety	For External: The acquisition manager does not complete the acquisition process, which results in an unacceptable delay in the delivery of the requested products/services from the vendor to the operating unit.	165	Actuation delivered incorrectly or inadequately; Hardware faulty	The means of delivering the notification to the vendor does not exist, so the acquisition process is not completed. The vendor does not receive the order, nor deliver a product or service to the operating unit.	Award Notification External (A)	Vendor/Service Provider (CP)	Actuator-Controlled Process
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies or lacks qualification	20	Acquisition Manager	Not provided when needed to maintain safety	For External: The acquisition manager does not complete the acquisition process, which results in an unacceptable delay in the delivery of the requested products/services from the vendor to the operating unit.	167	Sensor to controller signal inadequate, missing, or delayed; Hardware open, short, missing, intermittent faulty	There is no means for the vendor to contact or communicate information to the AM, including what's required to complete the order. Therefore, the order is not completed.	Notification of Product/Service (S)	Acquisition Manager	Sensor-Controller

ACC_NO	ACCIDENT	HAZ_NO	HAZARD	UCA_NO	COMPONENT_NAME	UNSAFE_CONTROL_ACTION	UCA_DESC	CAUSAL_FACT_NO	CF_DESC	CF_USER_DESC	FROM_COMP	TO_COMP	CATEGORY
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	21	Acquisition Manager	Provided, but executed incorrectly	CAS: The acquisition manager performs the acquisition process, but the transaction is not executed properly and cannot be completed (i.e. incorrect financial information, wrong vendor, insufficient procurement authority) which delays the procurement process and/or violates USCG policies. The process can also be performed out of sequence with other actions, which could be a violation of financial management or procurement regulations. CAS: The acquisition manager performs the acquisition process, but the transaction is not executed properly and cannot be completed (i.e. incorrect financial information, wrong vendor, insufficient procurement authority) which delays the procurement process and/or violates USCG policies. The process can also be performed out of sequence with other actions, which could be a violation of financial management or procurement regulations.	175	Sensor to controller signal inadequate, missing, or delayed; Hardware open, short, missing, intermittent faulty	The acquisition manager is not alerted to an improper operation in CAS, which prevents the acquisition process from being completed.	Award Notification in CAS (S)	Acquisition Manager	Sensor-Controller
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	21	Acquisition Manager	Provided, but executed incorrectly	CAS: The acquisition manager performs the acquisition process, but the transaction is not executed properly and cannot be completed (i.e. incorrect financial information, wrong vendor, insufficient procurement authority) which delays the procurement process and/or violates USCG policies. The process can also be performed out of sequence with other actions, which could be a violation of financial management or procurement regulations. CAS: The acquisition manager performs the acquisition process, but the transaction is not executed properly and cannot be completed (i.e. incorrect financial information, wrong vendor, insufficient procurement authority) which delays the procurement process and/or violates USCG policies. The process can also be performed out of sequence with other actions, which could be a violation of financial management or procurement regulations.	181	Sensor measurement incorrect or missing	The status of award notification in the CAS is not available to the acquisition manager.	Core Accounting System (CP)	Award Notification in CAS (S)	Controlled Process-Sensor
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	21	Acquisition Manager	Provided, but executed incorrectly	CAS: The acquisition manager performs the acquisition process, but the transaction is not executed properly and cannot be completed (i.e. incorrect financial information, wrong vendor, insufficient procurement authority) which delays the procurement process and/or violates USCG policies. The process can also be performed out of sequence with other actions, which could be a violation of financial management or procurement regulations.	214	Sensor to controller signal inadequate, missing, or delayed; Hardware open, short, missing, intermittent faulty	The acquisition manager does not receive timely notification of the requirement to perform the acquisition process.	Commitment Notification in CAS (S)	Acquisition Manager	Sensor-Controller
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	22	Acquisition Manager	Provided, but the starting time is too soon or too late	CAS: The acquisition manager performs the acquisition process, but the delayed action prevents the procurement process from being completed within time limits.	189	Controller to actuator signal ineffective, missing, or delayed; Hardware open, short, missing, intermittent faulty	The CAS system is unavailable, so the AM cannot perform the acquisition process, which delays the award transaction.	Acquisition Manager	Award Notification in CAS (A)	Controller-Actuator
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	22	Acquisition Manager	Provided, but the starting time is too soon or too late	CAS: The acquisition manager performs the acquisition process, but the delayed action prevents the procurement process from being completed within time limits.	192	Sensor to controller signal inadequate, missing, or delayed; Hardware open, short, missing, intermittent faulty	The acquisition manager is not alerted to the required action in CAS, which prevents the acquisition process from being performed in a timely manner.	Award Notification in CAS (S)	Acquisition Manager	Sensor-Controller
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	22	Acquisition Manager	Provided, but the starting time is too soon or too late	CAS: The acquisition manager performs the acquisition process, but the delayed action prevents the procurement process from being completed within time limits.	214	Sensor to controller signal inadequate, missing, or delayed; Hardware open, short, missing, intermittent faulty	The acquisition manager does not receive timely notification of the requirement to perform the acquisition process.	Commitment Notification in CAS (S)	Acquisition Manager	Sensor-Controller
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	23	Acquisition Manager	Not provided when needed to maintain safety	CAS: The acquisition manager does not perform the acquisition process which results in delays in the procurement of the goods or services.	176	Controller to actuator signal ineffective, missing, or delayed; Hardware open, short, missing, intermittent faulty	The CAS system is unavailable, so the AM cannot perform the acquisition process.	Acquisition Manager	Award Notification in CAS (A)	Controller-Actuator
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	23	Acquisition Manager	Not provided when needed to maintain safety	CAS: The acquisition manager does not perform the acquisition process which results in delays in the procurement of the goods or services.	181	Sensor measurement incorrect or missing	The status of award notification in the CAS is not available to the acquisition manager.	Core Accounting System (CP)	Award Notification in CAS (S)	Controlled Process-Sensor

ACC_NO	ACCIDENT	HAZ_NO	HAZARD	UCA_NO	COMPONENT_NAME	UNSAFE_CONTROL_ACTION	UCA_DESC	CAUSAL_FACT_NO	CF_DESC	CF_USER_DESC	FROM_COMP	TO_COMP	CATEGORY
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	23	Acquisition Manager	Not provided when needed to maintain safety	CAS: The acquisition manager does not perform the acquisition process which results in delays in the procurement of the goods or services.	192	Sensor to controller signal inadequate, missing, or delayed; Hardware open, short, missing, intermittent faulty	The acquisition manager is not alerted to the required action in CAS, which prevents the acquisition process from being performed.	Award Notification in CAS(S)	Acquisition Manager	Sensor-Controller
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	23	Acquisition Manager	Not provided when needed to maintain safety	CAS: The acquisition manager does not perform the acquisition process which results in delays in the procurement of the goods or services.	214	Sensor to controller signal inadequate, missing, or delayed; Hardware open, short, missing, intermittent faulty	The acquisition manager does not receive timely notification of the requirement to perform the acquisition process.	Commitment Notification in CAS(S)	Acquisition Manager	Sensor-Controller
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	24	Funds Manager	Not provided when needed to maintain safety	The funds manager received the request, but did not review, verify and/or approve the commitment, which prevented the request for products or services from progressing through the financial management system within acceptable limits.	236	Controller to actuator signal ineffective, missing, or delayed; Hardware open, short, missing, intermittent faulty	Systems required by the funds manager to approve the commitment were not available, which prevented them from taking action.	Funds Manager	Record in CAS (A)	Controller-Actuator
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	26	Acquisition Manager	Provided, but the intensity is incorrect (too much or too little)	CAS: The acquisition manager performs the acquisition process, but it is incorrect (i.e. contains wrong vendor, incorrect funding level, wrong quantity, incorrect unit cost or total amount, and/or incorrect accounting information) which results in erroneous obligations being recorded in CAS. This action will likely delay the procurement process and introduce financial errors in CAS. For External: The acquisition manager performs the acquisition process, but all of the steps required to place the order to the vendor are not completed, or are made out of sequence. These conditions could result in delays and/or cause the vendor to provide the incorrect product or service to the operating unit as originally requested. The action could also violate USCG financial management or procurement regulations.	188	Sensor to controller signal inadequate, missing, or delayed; Hardware open, short, missing, intermittent faulty	The acquisition manager is not alerted to an improper operation in CAS, which prevents the acquisition process from being executed properly.	Award Notification in CAS(S)	Acquisition Manager	Sensor-Controller
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	29	Acquisition Manager	Provided, but executed incorrectly	For External: The acquisition manager performs the acquisition process, but all of the steps required to place the order to the vendor are not completed, or are made out of sequence. These conditions could result in delays and/or cause the vendor to provide the incorrect product or service to the operating unit as originally requested. The action could also violate USCG financial management or procurement regulations.	149	Controller to actuator signal ineffective, missing, or delayed; Hardware open, short, missing, intermittent faulty	The systems required by the AM to complete the acquisition process are not available.	Acquisition Manager	Award Notification External (A)	Controller-Actuator
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	29	Acquisition Manager	Provided, but executed incorrectly	For External: The acquisition manager performs the acquisition process, but all of the steps required to place the order to the vendor are not completed, or are made out of sequence. These conditions could result in delays and/or cause the vendor to provide the incorrect product or service to the operating unit as originally requested. The action could also violate USCG financial management or procurement regulations.	151	Actuation delivered incorrectly or inadequately; Incorrect connection	The order is transmitted to the incorrect vendor.	Award Notification External (A)	Vendor/Service Provider (CP)	Actuator-Controlled Process
1	Operating Unit cannot meet operational requirements or commitments	2	Operating unit has missing and/or inoperable equipment, services, supplies; or lacks qualification	29	Acquisition Manager	Provided, but executed incorrectly	For External: The acquisition manager performs the acquisition process, but all of the steps required to place the order to the vendor are not completed, or are made out of sequence. These conditions could result in delays and/or cause the vendor to provide the incorrect product or service to the operating unit as originally requested. The action could also violate USCG financial management or procurement regulations.	166	Sensor to controller signal inadequate, missing, or delayed; Hardware open, short, missing, intermittent faulty	There is no means for the vendor to contact or communicate information to the AM, including what's required to complete the order.	Notification of Product/Service (S)	Acquisition Manager	Sensor-Controller
2	Violation of USCG Financial Management Laws and/or policies	4	Commitments or obligations are recorded in excess of funding limitations	13	Funds Manager	Provided, but the intensity is incorrect (too much or too little)	Following the award in CAS, the Funds manager approves the obligation for an amount that exceeds the level of available funding in the system or makes a duplicate entry in the financial management system.	194	Sensor to controller signal inadequate, missing, or delayed; Hardware open, short, missing, intermittent faulty	The funds manager does not receive feedback regarding the excessive obligation, or possibly the existence of a duplicate entry.	Obligation Notification in CAS(S)	Funds Manager	Sensor-Controller



ACC_NO	ACCIDENT	HAZ_NO	HAZARD	UCA_NO	COMPONENT_NAME	UNSAFE_CONTROL_ACTION	UCA_DESC	CAUSAL_FACT_NO	CF_DESC	CF_USER_DESC	FROM_COMP	TO_COMP	CATEGORY
2	Violation of USCG Financial Management Laws and/or policies	8	USCG contracts are executed prior to sufficient funds being appropriated or committed	21	Acquisition Manager	Provided, but executed incorrectly	CAS: The acquisition manager performs the acquisition process, but the transaction is not executed properly and cannot be completed (i.e. incorrect financial information, wrong vendor, insufficient procurement authority) which delays the procurement process and/or violates USCG policies. The process can also be performed out of sequence with other actions, which could be a violation of financial management or procurement regulations. For External: The acquisition manager performs the acquisition process, but all of the steps required to place the order to the vendor are not completed, or are made out of sequence. These conditions could result in delays and/or cause the vendor to provide the incorrect product or service to the operating unit as originally requested. The action could also violate USCG financial management or procurement regulations.	214	Sensor to controller signal inadequate, missing, or delayed; Hardware open, short, missing, intermittent faulty	The acquisition manager does not receive timely notification of the requirement to perform the acquisition process.	Commitment Notification in CAS (\$)	Acquisition Manager	Sensor-Controller
2	Violation of USCG Financial Management Laws and/or policies	8	USCG contracts are executed prior to sufficient funds being appropriated or committed	29	Acquisition Manager	Provided, but executed incorrectly	CAS: The acquisition manager performs the acquisition process, but all of the steps required to place the order to the vendor are not completed, or are made out of sequence. These conditions could result in delays and/or cause the vendor to provide the incorrect product or service to the operating unit as originally requested. The action could also violate USCG financial management or procurement regulations. For External: The acquisition manager performs the acquisition process, but all of the steps required to place the order to the vendor are not completed, or are made out of sequence. These conditions could result in delays and/or cause the vendor to provide the incorrect product or service to the operating unit as originally requested. The action could also violate USCG financial management or procurement regulations.	149	Controller to actuator signal ineffective, missing, or delayed; Hardware open, short, missing, intermittent faulty	The systems required by the AM to complete the acquisition process are not available.	Acquisition Manager	Award Notification External (A)	Controller-Actuator
2	Violation of USCG Financial Management Laws and/or policies	8	USCG contracts are executed prior to sufficient funds being appropriated or committed	29	Acquisition Manager	Provided, but executed incorrectly	CAS: The acquisition manager performs the acquisition process, but all of the steps required to place the order to the vendor are not completed, or are made out of sequence. These conditions could result in delays and/or cause the vendor to provide the incorrect product or service to the operating unit as originally requested. The action could also violate USCG financial management or procurement regulations. For External: The acquisition manager performs the acquisition process, but all of the steps required to place the order to the vendor are not completed, or are made out of sequence. These conditions could result in delays and/or cause the vendor to provide the incorrect product or service to the operating unit as originally requested. The action could also violate USCG financial management or procurement regulations.	151	Actuation delivered incorrectly or inadequately; Incorrect connection	The order is transmitted to the incorrect vendor.	Award Notification External (A)	Vendor/Service Provider (CP)	Actuator-Controlled Process
2	Violation of USCG Financial Management Laws and/or policies	8	USCG contracts are executed prior to sufficient funds being appropriated or committed	29	Acquisition Manager	Provided, but executed incorrectly	CAS: The acquisition manager performs the acquisition process, but all of the steps required to place the order to the vendor are not completed, or are made out of sequence. These conditions could result in delays and/or cause the vendor to provide the incorrect product or service to the operating unit as originally requested. The action could also violate USCG financial management or procurement regulations. For External: The acquisition manager performs the acquisition process, but all of the steps required to place the order to the vendor are not completed, or are made out of sequence. These conditions could result in delays and/or cause the vendor to provide the incorrect product or service to the operating unit as originally requested. The action could also violate USCG financial management or procurement regulations.	168	Sensor to controller signal inadequate, missing, or delayed; Hardware open, short, missing, intermittent faulty	There is no means for the vendor to contact or communicate information to the AM, including what's required to complete the order.	Notification of Product/Service (\$)	Acquisition Manager	Sensor-Controller

## Appendix C

The following is a summary of the Vensim System Dynamics Model Variables and Input Values, obtained using the Vensim Documentation feature:

(01) Backlog Building Effect on Accuracy([(0,0)-(10,1)],(0.01,1),(2.44648,0.745614), (3.60856,0.70614),(4.77064,0.666667),(9.90826,0.5)) Units: Dimensionless Accounts for inaccurate transactions processed, base on the rate of request submission and backlog.

(02) Backlog Influence on Accuracy=Backlog Building Effect on Accuracy (Effect of Backlog Building Rate) Units: Dimensionless

(03) Dampening Effect on Workflow Variation=0.1 Units: Dimensionless Smooths the effect of the ordering variations on the FM workforce. Initial set at .1

(04) Degree of Inaccuracy= Inaccurate Transactions Completed/Procurement Requests Completed Units: Dimensionless Provides a ratio and relationship between the total work completed, and the number of inaccurate transactions that occurred for future structure and analysis.

(05) Degree of Inaccuracy Effect on Productivity([(0,0.5)-(1,1)],(0.01,0.9),(0.318043,0.885965), (0.397554,0.631579),(0.987768,0.513158))

Units: Dimensionless Look up table for the degree of the backlog and the corresponding effect on worker productivity

(06) Effect of Backlog Building Rate=Operating Unit Request Rate/Procurement Request Accomplishment Rate Units: Requests

(07) FINAL TIME = 100Units: Week The final time for the simulation.

(08) Inaccuracy Impact on Productivity= Degree of Inaccuracy Effect on Productivity(Degree of Inaccuracy) Units: Dimensionless Accounts for a the loss of productivity created by causal factors-- distractions, mental models, disruptions, work environment.

(09) Inaccurate Processing Rate= (1-Backlog Influence on Accuracy)\*Procurement Request Accomplishment Rate Units: Requests/Week The rate at which inaccurate transactions are created in the system.

(10) Inaccurate Transactions Completed= INTEG (Inaccurate Processing Rate, 0.1)

Units: Requests Represents the number of inaccurate transactions (orders) that were processed that requires additional work. Possibly a future audit liability.

(11) Initial Operating Unit Request Rate=6 Units: Requests/Week Initial value (rate) of requests made by the operating unit. Set at 6 for the baseline.

(12) INITIAL TIME = 0 Units: Week The initial time for the simulation.

(13) Maximum Processing Rate Based on Pending Requests= Procurement Requests Made/Minimum Time to Process a Request Units: Requests/Week The maximum rate requests can be processed based on the number of request that are made.

(14) Minimum Time to Process a Request= 1 Units: Week Represents the minimum time it requires a system controller to process a request. Scalar.

(15) New Work Due To Inaccurate Transaction=0.25\*Inaccurate Transactions Completed Units: Requests Accounts for the approximated introduction of "new work" added the system based on prior incomplete transactions.

(16) Noise Start Time=1 Units: Week Start time for the random input.

(17) Operating Unit Request Rate = MAX(Initial Operating Unit Request Rate\*Request Workflow Variation\*1.25,0) Units: Requests/Week Operating unit order rate is exogenous. A variety of test inputs which allows for different patterns, including a step, pulse, sine wave, and random noise.

(18) Pending Request Backlog = MAX(Procurement Requests Made-Procurement Requests Completed,0) Units: Requests Backlog represents the difference between the number of request made and the number of request completed at a particular point in time.

(19) Pink Noise= INTEG (0,0) Units: Dimensionless Pink Noise is first-order auto-correlated noise. Pink noise provides a realistic noise input to models in which the next random shock depends in part on the previous shocks. The user can specify the correlation time. The mean is 0 and the standard deviation is specified by the user.

(20) Potential Processing Rate Based on Workforce= Workforce Productivity\*Workforce Size\*(MAX(Request Workflow Variation\*Dampening Effect on Workflow Variation ,1)) Units: Requests/Week Represents the rate the workforce can process work requests relating to the procurement of products or services.

(21) Procurement Request Accomplishment Rate= MIN(Maximum Processing Rate Based on Pending Requests, Potential Processing Rate Based on Workforce ) Units: Requests/Week The rate at which procurement requests are accomplished based on inputs and other variables.

(22) Procurement Requests Completed= INTEG (Procurement Request Accomplishment Rate,0.1) Units: Requests The total number of request completed in the system.

(23) Procurement Requests Made= INTEG (Procurement Request Accomplishment Rate + Operating Unit Request Rate, New Work Due To Inaccurate Transaction) Units: Requests The number of request made by the operating unit.

(24) Pulse Quantity= 0 Units: Dimensionless\*Week The quantity to be injected to customer orders, as a fraction of the base value of Input. For example, to pulse in a quantity equal to 50% of the current value of input, set to .50.

(25) Pulse Time= 45 Units: Week Time at which the pulse in Input occurs.

(26) Ramp End Time=1e+009 Units: Week End time for the ramp input.

(27) Ramp Slope= 0 Units: 1/Week Slope of the ramp input, as a fraction of the base value (per week).

(28) Ramp Start Time=5 Units: Week Start time for the ramp input.

(29) Request Workflow Variation=  $1 + \text{STEP}(\text{Step Height}, \text{Step Time}) + (\text{Pulse Quantity} / \text{TIME STEP}) * \text{PULSE}(\text{Pulse Time}, \text{TIME STEP}) + \text{RAMP}(\text{Ramp Slope}, \text{Ramp Start Time}, \text{Ramp End Time}) + \text{Sine Amplitude} * \text{SIN}(2 * 3.14159 * \text{Time} / \text{Sine Period}) + \text{STEP}(1, \text{Noise Start Time}) * \text{Pink Noise}$  Units: Dimensionless Input is a dimensionless variable which provides a variety of test input patterns, including a step, pulse, sine wave, and random noise used to evaluate the performance of the system. This variable shapes the input of the request made by the operating unit.

(30) SAVEPER = TIME STEP Units: Week [0,?] The frequency with which output is stored.

(31) Sine Amplitude=3 Units: Dimensionless Amplitude of sine wave in OU requests (fraction of mean). Initial value of 2.5.

(32) Sine Period= 13 Units: Weeks Period of sine wave in customer demand. Set initially to 13 weeks (1 qtr).

(33) Step Height= 0 Units: Dimensionless Height of step input to customer orders, as fraction of initial value.

(34) Step Time= 15 Units: Week Time for the step input.

(35) TIME STEP = 0.125 Units: Week [0,?] The time step for the simulation.

(36) Workforce Productivity= Inaccuracy Impact on Productivity Units: Requests/(Week\*Person) Represents the productivity of an employee. A 1.0 productivity measures represents the individual or entity is fully productive. 0.9 would represent a 10% loss in productivity.

(37) Workforce Size= 7 Units: Person The size of the workforce. The initial workforce size (capacity) is related to the steady-state condition where work request can be processed at full efficiency without the creation of a backlog, or excess capacity in the system. Initial value of 6.