



## ACQUISITION RESEARCH PROGRAM SPONSORED REPORT SERIES

---

### **Lean Six Sigma Analysis of Shipboard Audit Readiness on a U.S. Navy Destroyer**

December 2016

**LCDR Jonathon A. Lavery, USN**

**LCDR Robert J. Spracklin, USN**

Thesis Advisors: Steven Landry, Senior Lecturer  
Bryan Hudgens, Lecturer

Graduate School of Business & Public Policy

**Naval Postgraduate School**

Approved for public release; distribution is unlimited.

Prepared for the Naval Postgraduate School, Monterey, CA 93943.



The research presented in this report was supported by the Acquisition Research Program of the Graduate School of Business & Public Policy at the Naval Postgraduate School.

To request defense acquisition research, to become a research sponsor, or to print additional copies of reports, please contact any of the staff listed on the Acquisition Research Program website ([www.acquisitionresearch.net](http://www.acquisitionresearch.net)).



ACQUISITION RESEARCH PROGRAM  
GRADUATE SCHOOL OF BUSINESS & PUBLIC POLICY  
NAVAL POSTGRADUATE SCHOOL

## ABSTRACT

Over the last six years, the Department of the Defense (DOD) and Department of the Navy (DON) have ramped up efforts toward achieving financial audit readiness by dedicating additional resources and implementing new process changes in support of the DOD Financial Improvement Audit Readiness (FIAR) program. Despite increased emphasis on ensuring key supporting documentation availability during an audit, the DON still has issues regarding poor quality document submissions from lower-level units, which can ultimately lead to poor audit results. This project attempts to identify and improve upon root causes of quality defects in audit-related key supporting documentation onboard U.S. ships in the Pacific Surface Fleet using a Lean Six Sigma analysis. The recommendations provided in this study augment improvement processes currently in progress, and are sequenced to build momentum before addressing higher-risk priorities. The objective of this research is to develop a case study for use by DON FIAR that examines audit-related areas of improvement and the implementation of additional process changes at the unit level. The case study is meant to spur discussion on how the DON can benefit from Lean Six Sigma analysis to improve quality and mitigate the risk of audit failure.



THIS PAGE INTENTIONALLY LEFT BLANK



## ACKNOWLEDGMENTS

We would like to thank our advisors, Dr. Steven Landry and Professor Bryan Hudgens, whose subject-matter expertise in the fields of operations management and financial research provided the perfect mix of guidance and inspiration to carry out this Lean Six Sigma analysis.

We would also like to thank our project sponsors, Mr. John Begins from COMPACFLT, and Commander Christian Booth, Master Chief Kristopher Rains, Senior Chief La Dala, and Senior Chief Patricio Rubio from COMNAVSURFPAC.

Lastly, to our beautiful wives and daughters...Thank you for your encouragement, patience, and unwavering love and devotion during our time at the Naval Postgraduate School. You have made this journey possible.

Thank you Erlyn, Sophia, Alexis, and Emilia. –J.L.

Thank you Josell, Valerie, and Olivia. –R.S.



THIS PAGE INTENTIONALLY LEFT BLANK



## ABOUT THE AUTHORS

**Jonathon A. Lavery**, Lieutenant Commander, is a Magna Cum Laude graduate of Embry-Riddle Aeronautical University, where he earned his Bachelor of Science Degree in Professional Aeronautics. He received his commissioning through Officer Candidate School in June 2006. His Supply Corps Officer tours include: USS Ford (FFG 54) Disbursing and Ship Services Officer, Navy Supply Systems Command (NAVSUP) Operational Logistics/Transportation Intern, NATO Training Mission-Afghanistan (NTM-A) G4 Logistics Operations Officer, and Navy Cargo Handling Battalion One (NCHB-1) S7 Training Department Head and Detachment OIC. Jonathon has a wife, Erlyn, and three daughters, Sophia, Alexis, and Emilia. In his free time, he volunteers as SCORE Monterey Bay's Marketing Chair, mentoring small business owners, and instructing aspiring veteran entrepreneurs through the SBA's Boots to Business workshop. After graduation from the Naval Postgraduate School with his MBA in Financial Management, he will be reporting to the Fleet Logistics Center Norfolk as the Operation Support Officer.

**Robert J. Spracklin**, Lieutenant Commander, is originally from San Diego, California. He received his officer commission and bachelor's degree from the US Naval Academy in 2003. Following completion of Navy Nuclear Power Training in Charleston, SC, he laterally transferred to the Supply Corps in 2005. His supply related education includes the Supply Officer Basic Qualification Course and Supply Officer Department Head Course in Athens, GA. In 2015, he laterally transferred into the Navy Human Resources FTS Community. In 2005, he served onboard USS *STOUT* (DDG 55) based out of Norfolk, VA as the Disbursing/Sales Officer. On August 13, 2007, he checked-in on board Defense Distribution Depot, Yokosuka, Japan, (DDYJ) where he served as the Emergency Supply Operations Center Director and Material Processing Center Supervisor until August 2010. During this tour, he volunteered for an Individual Augmentation billet at CENTCOM Deployment and Distribution Operations Center, Camp Arifjan, Kuwait, and served as the Sustainment Division Operations Officer. He also extended his IA to work with the DLA Support Team, Camp Taji, Iraq where he assisted the Iraqi Army in maintaining their Class VIII/IX Warehouses. In October 2010, he served onboard USS *TORTUGA* (LSD 46) in Sasebo, Japan, as the Supply Department Head. From 2014-2015, he served as the N83 Financial Improvement Audit Readiness (FIAR) Team Lead at RESFOR. Lieutenant Commander Spracklin is married to the former Josell DeGuzman Mallari of Angeles City, Philippines. They have two children, Valerie (3) and Olivia (2). Following graduation from the Naval Postgraduate School, he will attend the Joint Forces Staff College to complete JPME II and will later report to the Pentagon to serve on the Office of the Chief of the Navy Reserve staff as the Deputy RPN Budget Director.



THIS PAGE INTENTIONALLY LEFT BLANK







## ACQUISITION RESEARCH PROGRAM SPONSORED REPORT SERIES

---

### **Lean Six Sigma Analysis of Shipboard Audit Readiness on a U.S. Navy Destroyer**

December 2016

**LCDR Jonathon A. Lavery, USN**

**LCDR Robert J. Spracklin, USN**

Thesis Advisors: Steven Landry, Senior Lecturer  
Bryan Hudgens, Lecturer

Graduate School of Business & Public Policy

**Naval Postgraduate School**

Disclaimer: The views represented in this report are those of the author and do not reflect the official policy position of the Navy, the Department of Defense, or the federal government.



THIS PAGE INTENTIONALLY LEFT BLANK



# TABLE OF CONTENTS

I.	INTRODUCTION .....	1
	A. RESEARCH QUESTION AND PURPOSE OF RESEARCH .....	1
	B. BENEFITS AND LIMITATIONS .....	1
	C. ORGANIZATION OF STUDY .....	2
II.	LITERATURE REVIEW .....	5
	A. BACKGROUND ON DEPARTMENT OF DEFENSE FINANCIAL REPORTING AND AUDIT READINESS .....	5
	1. Legislation.....	5
	2. FIAR Directorate .....	6
	B. NAVY APPLICATION OF FIAR POLICIES .....	9
	1. Navy Office of Financial Operations .....	9
	2. Commander, U.S. Pacific Fleet.....	9
	3. Commander, Naval Surface Force, U.S. Pacific Fleet.....	10
	4. MILSTRIP KSD Auditing on COMNAVSURFPAC Ships.....	11
	C. BACKGROUND ON CONTINUOUS PROCESS IMPROVEMENT .....	14
	1. Background on Lean Production .....	15
	2. Background on Six Sigma .....	16
	3. DOD Application of Lean Six Sigma for Continuous Process Improvement .....	17
	D. SUMMARY .....	21
III.	LEAN SIX SIGMA ANALYSIS OF SHIPBOARD AUDIT READINESS ON A U.S. NAVY DESTROYER—PART ONE .....	23
	A. DEFINE .....	23
	1. Project Charter .....	23
	2. SIPOC Table .....	25
	3. Project Plan .....	25
	B. MEASURE .....	27
	1. Direct Observation .....	27
	2. Personnel Interviews.....	33
	C. SUMMARY .....	41
IV.	LEAN SIX SIGMA ANALYSIS OF SHIPBOARD AUDIT READINESS ON A U.S. NAVY DESTROYER—PART TWO .....	43
	A. ANALYZE.....	43
	1. Potential Causes .....	43
	2. Cause-and-Effect Analysis.....	47



3.	Failure Mode and Effects Analysis.....	52
B.	IMPROVE.....	54
1.	Recommendations.....	54
2.	FMEA Tracking.....	58
3.	Quick Lean Fixes.....	60
4.	Improvements Currently in Process.....	61
5.	Future State Process.....	62
C.	CONTROL.....	63
1.	Process Control Charts.....	63
2.	Balanced Scorecard.....	64
V.	SUMMARY, CONCLUSIONS, AND AREAS OF FURTHER RESEARCH.....	67
A.	SUMMARY.....	67
B.	CONCLUSIONS.....	67
C.	AREAS OF FURTHER RESEARCH.....	68
	APPENDIX A. LEAN SIX SIGMA TEMPLATES.....	71
	APPENDIX B. OBSERVED FACET PROCESSES COMPARISON.....	79
	APPENDIX C. NAVY SUPPLY CORPS SCHOOL OFFICIAL STATEMENT ON FIAR AND FACET.....	93
	LIST OF REFERENCES.....	95



## LIST OF FIGURES

Figure 1.	DOD FIAR Strategy. Source: OUSD/CFO (2016, p. 12).....	7
Figure 2.	Basic Auditing Information. Source: Navy Personnel Command (2015). ..	8
Figure 3.	General Audit Response Timeline. Adapted from Navy Personnel Command (2015). .....	12
Figure 4.	MILSTRIP Shipboard Audit Process.....	14
Figure 5.	DOD CPI/LSS. Source: Sicilia (2008).....	18
Figure 6.	Project Draft Plan of Actions and Milestones (POAM) .....	26
Figure 7.	Current State Map .....	28
Figure 8.	Personnel Interview Form.....	34
Figure 9.	Historical FACET Document Count per Batch (October 2013 to July 2016) .....	36
Figure 10.	Frequency Distribution of Batch Document Count .....	37
Figure 11.	Current State Map (Revised) .....	45
Figure 12.	Cause-and-Effect (Fishbone) Diagram .....	47
Figure 13.	Risk Priority Number Tracking (Pareto) Chart.....	59
Figure 14.	Current State Map (with Improvements) .....	62
Figure 15.	Future State Map.....	63
Figure 16.	Process Control Chart Example. Source: OSD (2008). .....	64
Figure 17.	Example of S1 CMP Dashboard. Source: COMNAVSURFPAC (2008)..	65
Figure 18.	Potential Survey to Send to Supply Department Representatives .....	69
Figure 19.	Lean Six Sigma Tollgate. Source: DOD (2008). .....	71
Figure 20.	Project Charter Template. Adapted from DOD (2008). .....	72
Figure 21.	Project Plan of Actions and Milestones Template .....	73
Figure 22.	Process Flowchart. Adapted from Air War College (n.d.). .....	75
Figure 23.	Cause-and-Effect (Fishbone) Diagram. Adapted from Air War College (n.d.). .....	76
Figure 24.	FMEA Chart. Adapted from Rizk & Ratajczak (2012). .....	77



THIS PAGE INTENTIONALLY LEFT BLANK



## LIST OF TABLES

Table 1.	Lean Six Sigma Project Charter. Adapted from DOD (2008).	24
Table 2.	SIPOC Table	25
Table 3.	Time Study of FACET Process	33
Table 4.	LOGCOP Transaction File	36
Table 5.	FACET System Hardware and Software	40
Table 6.	FACET Process Analysis	46
Table 7.	Failure Mode and Effects Analysis (FMEA)	53
Table 8.	Risk Priority Number Ranking	60
Table 9.	SIPOC Table. Adapted from Office of the Secretary of Defense (2008).	74
Table 10.	FACET Process Comparison. Adapted from Premier Solutions HI, (2015).	79



THIS PAGE INTENTIONALLY LEFT BLANK





## LIST OF ACRONYMS AND ABBREVIATIONS

ADA	Anti-Deficiency Act
AFRS	Armed Forces Recipe Service
APC	Annual Price Change
ARMDEC	U.S. Army Aviation & Missile Research Development & Engineering Center
ARP	Acquisition Research Program
BQC	Basic Qualification Course
BSO	Budget Submission Office
CAP	Corrective Action Plan
CD-RW	Compact Disc—Rewritable
CFO	Chief Financial Officer
CG	Guided Missile Cruiser
CMP	Continuous Monitoring Program
CO	Commanding Officer
COMNAVAIRPAC	Commander, Naval Air Forces, U.S. Pacific Fleet
COMNAVSUBPAC	Commander, Naval Submarine Forces, U.S. Pacific Fleet
COMNAVSURFOR	Commander, Naval Surface Forces
COMNAVSURFPAC	Commander, Naval Surface Forces, U.S. Pacific Fleet
COMPACFLT	Commander, U.S. Pacific Fleet
COTS	Commercial Off-The-Shelf
CPI	Continuous Process Improvement
CS	Culinary Specialist
CTP	Critical to Process
CTQ	Critical to Quality
CYBERFOR	Navy Cyber Forces Command
DDG	Guided Missile Destroyer
DLA	Defense Logistics Agency
DLR	Depot Level Repairable
DMAIC	Define, Measure, Analyze, Improve, Control
DOD	Department of Defense
DON	Department of the Navy



DTO	Direct Turnover
FACET	Fleet Audit Compliance Enhancement Tool
FIAR	Financial Improvement Audit Readiness
FIP	Financial Improvement Plan
FLC	Fleet Logistics Center
FMEA	Failure Mode and Effects Analysis
FMO	Office of Financial Management
FSM	Food Service Management
FY	Fiscal Year
IPA	Independent Public Accountant
IRB	Institutional Review Board
KSD	Key Supporting Documentation
KTM	Kofax Transformation Module
LCS	Littoral Combat Ship
LOGCOP	Logistics Common Operating Picture
LS	Logistics Specialist
LSD	Dock Landing Ship
LSS	Lean Six Sigma
MILSTRIP	Military Standard Requisitioning and Issuing Procedures
NAVSUP	Navy Supply Systems Command
NDAA	National Defense Authorization Act
NECCPAC	Navy Expeditionary Combat Command (Pacific)
NPS	Naval Postgraduate School
NSCS	Navy Supply Corps School
NSN	National Stock Number
NVA	Non-Value Added
OB	Operational Budget
OJT	On the Job Training
O&M	Operations and Maintenance
OPTAR	Operational Target
POAM	Plan of Actions and Milestones
PV	Prime Vendor
QA	Quality Assurance



ROI	Return on Investment
RPN	Risk Priority Number
RPPO	Repair Parts Petty Officer
R-Supply	Relational Supply
S1	Supply Support Division
S2	Food Service Division
SIPOC	Suppliers-Inputs-Processes-Outputs-Customers
SODHC	Supply Officer Department Head School
TL	Transaction Ledger
TYCOM	Type Commander
UIC	Unit Identification Classification
VA	Value Added
VOC	Voice of the Customer
XO	Executive Officer



THIS PAGE INTENTIONALLY LEFT BLANK



## **I. INTRODUCTION**

The National Defense Authorization Act (NDAA) of 2010 mandates all military departments and defense agencies to present fully auditable financial statements by the end of fiscal year (FY) 2017. In anticipation of the Department of Defense (DOD) audit, each of the services have started a set of Financial Improvement Audit Readiness (FIAR) initiatives to identify and correct deficiencies in all current processes that affect financial statements. Due to its sustained forward presence and seagoing mission, the Department of the Navy (DON) faces unique challenges regarding the reporting of purchases and receipt of supplies, subsistence items, and equipment onboard afloat units. Most U.S. ships have implemented new processes to scan and retain audit-related documents into a central repository; however, major problems have been identified in the effectiveness of these processes which have led to an increased risk of audit failure.

### **A. RESEARCH QUESTION AND PURPOSE OF RESEARCH**

This research study attempts to answer the following question: Can the audit readiness and sustainment process on naval ships be improved through Lean Six Sigma; if yes, how can it be improved? Through answering this question, the research purpose is to examine various ways to improve current audit readiness processes onboard Navy ships in order to respond to auditor requests for unit level key supporting documents (KSDs). This research explores the main issues regarding the timely reporting and quality of KSDs, as they pertain to the Navy's ability to achieve and maintain audit readiness. Additionally, this research will develop comprehensive cost saving measures by utilizing the Lean Six Sigma methodology to streamline the current processes used by the surface fleet.

### **B. BENEFITS AND LIMITATIONS**

This research study provides recommendations on how the DON can improve the overall audit readiness of the U.S. naval fleet by applying Lean Six Sigma (LSS) principles to the current processes used to record and track KSDs. These principles, once applied and coupled with unit-level training, will significantly decrease the risk of audit sample rejections due to poor quality KSDs and/or late responses to KSD requests from the auditor.



Additionally, these recommendations will ultimately reduce redundant and unnecessary steps of the current process and conserve man-hours used for document retention practices onboard Navy ships.

The current document retention processes used by the DON are unable to provide the reasonable assurances that financial statements are presented fairly. During an audit, a requested KSD must be deemed correct and complete by meeting applicable standards and must be presented to the auditor within a specified amount of time (Office of the Under Secretary of Defense (Comptroller)/Chief Financial Officer [OUSD/CFO] , 2016). If either of these requirements is not fulfilled, the sample KSD will be labeled as an exemption, or failure. With too many sample exemptions, an auditor may conclude that the Navy's financial statements cannot be reasonably assured as fair and accurate. Auditors may also choose to expand the sample size and request more KSDs, which would further increase the workload of support personnel and the likelihood of finding additional sample exemptions. The recommendations in this study attempt to reduce the occurrences of poor quality KSDs, which could lead to late submissions, in order to improve the long-term sustainment effort toward full auditability of financial statements.

Due to time and scope limitations, this study has been narrowed to focus on a Lean Six Sigma analysis based on data collected onboard one guided missile destroyer (DDG) assigned by Commander, Naval Surface Force, U.S. Pacific Fleet (COMNAVSURFPAC). The analysis and conclusions are built around the limited amount of data that was collected on a single ship as a case study. Therefore, more research would be needed to substantiate and generalize the findings across the surface fleet.

### **C. ORGANIZATION OF STUDY**

This research consists of five chapters, including this introduction. Chapter II provides the background information in a literature review to explain the history of the FIAR program and the Navy's plan in preparation for the audit. The chapter concludes with the DOD's current Continuous Process Improvement initiative and a brief description of Lean Six Sigma and its methodology of Define, Measure, Analyze, Improve, and Control (DMAIC).



Chapter III examines the KSD data collected from an on-site visit to a U.S. Navy destroyer and provides details on the Define and Measure phases of LSS. Chapter IV examines the analyze, improve, and control phases of the DMAIC methodology. Chapter V reviews the findings of the LSS data analysis to answer the research question and provides recommendations on areas to research further.



THIS PAGE INTENTIONALLY LEFT BLANK





## **II. LITERATURE REVIEW**

This chapter reviews a collection of background literature on the Department of Defense (DOD) financial auditability, the Navy's application of these policies, and the evolution of process improvement within the DOD. The combination of these three topics provides an understanding of the current plans, policies, and processes that the DOD, and specifically the United States Navy Surface Force, have in place to achieve full financial statement auditability for FY 2018.

### **A. BACKGROUND ON DEPARTMENT OF DEFENSE FINANCIAL REPORTING AND AUDIT READINESS**

#### **1. Legislation**

Congress passed the Chief Financial Officers (CFOs) Act of 1990 in part to “provide for improvement, in each agency of the Federal Government, of systems of accounting, financial management, and internal controls to assure the issuance of reliable financial information and to deter fraud, waste, and abuse of Government resources.” This act mandated each of the 24 executive agencies in the federal government to accomplish the following:

1. establish a CFO and Deputy CFO position
2. prepare and submit financial statements that accurately reflect the agency's financial position, and which reconcile with budget reports
3. be audited in accordance with generally accepted government auditing standards (CFOs Act, 1990)

To date, the DOD is the only executive agency not to receive an audit opinion on its consolidated financial statements from an independent audit firm. The National Defense Authorization Acts (NDAA) for FYs 2002, 2010, 2012, and 2014 have progressively narrowed focus on the DOD's audit preparation process and have set stringent guidelines for the department to achieve auditability by the required deadline. These acts led to the creation of the DOD's Financial Improvement and Audit Readiness (FIAR) Plan, which mandates that military services and defense agencies correct financial management deficiencies, improve processes and controls, and modernize business systems to provide timely financial information that is both reliable and complete (OUSD/CFO, 2016).



## 2. FIAR Directorate

The Office of the Under Secretary of Defense (Comptroller) created the FIAR Directorate in 2005 to provide oversight of the DOD's FIAR Plan and to develop the department's FIAR strategy and guidance. This strategy has evolved over the years to adhere to legislative updates, and guidance identifies specific tasks for reporting entities<sup>1</sup> within the DOD.

Figure 1 depicts the DOD's FIAR strategy and the interim milestones, referred to as waves, required to become fully auditable by the end of FY 2017. Wave 1, now completed, demonstrated immediate progress for the department in FY 2013. Subsequently, the FIAR Directorate revised the remainder of waves to adhere to updated guidelines established in the NDAA for FY 2014, which require

- audit-ready financial statements by September 30, 2017, and
- a full audit conducted on FY 2018 financial statements with results submitted to Congress no later than March 31, 2019 (OUSD/CFO, 2016).

---

<sup>1</sup> FIAR Guidance defines a reporting entity as “an entity or fund within the Department of Defense that prepares stand-alone financial statements included in the DOD Agency-wide financial statements. All reporting entities are working to become audit ready or their financial statements are currently being audited” (OUSD/CFO, 2016, p. E-3).



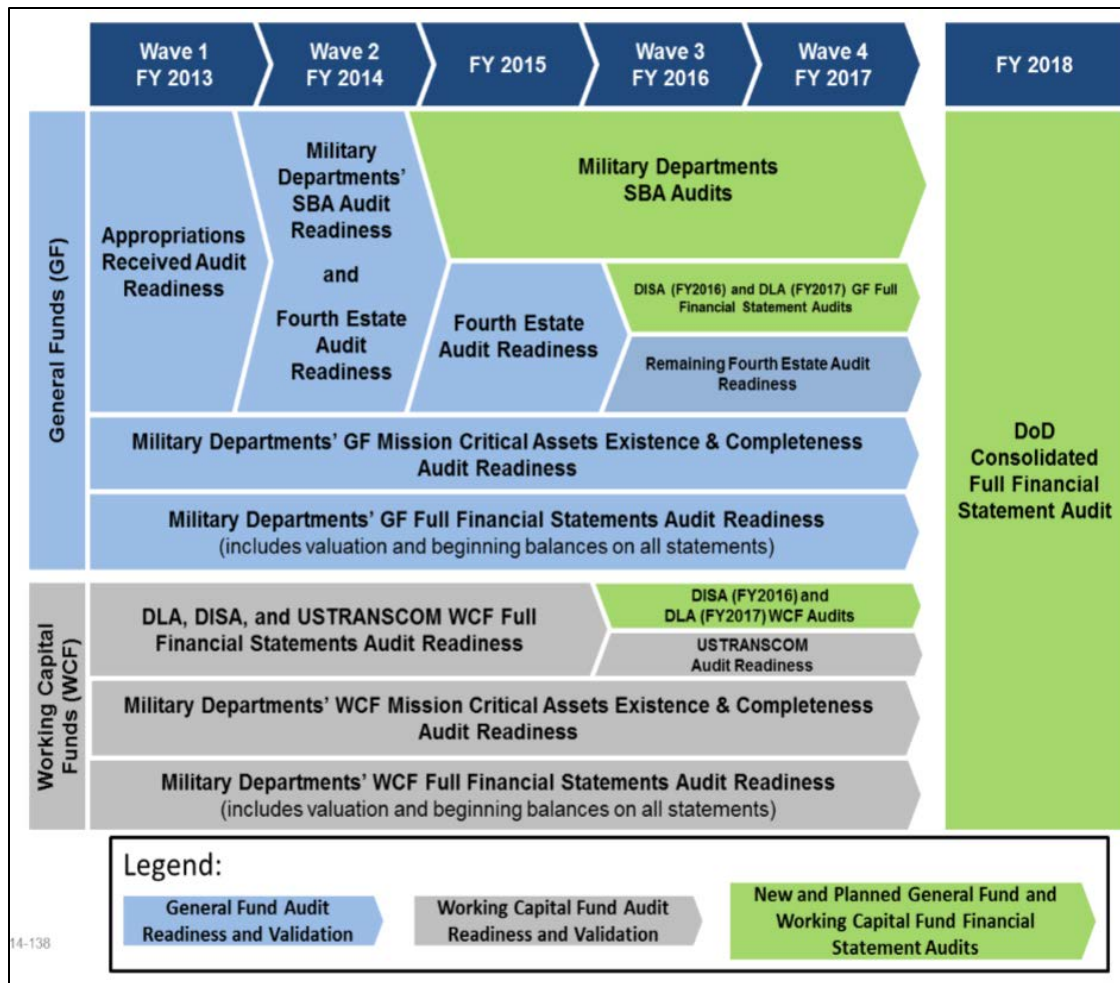


Figure 1. DOD FIAR Strategy. Source: OUSD/CFO (2016, p. 12).

In addition to the CFOs Act of 1990 and the NDAAs, the FIAR Directorate incorporated all applicable federal and DOD internal control regulations into the FIAR strategic guidance<sup>2</sup> and created a step-by-step methodology for reporting entities to follow in order to achieve audit readiness and ensure reliable financial information. This methodology is divided into five phases and contains key tasks to be uniformly applied across all reporting entity units, regardless of size:

1. **Discovery.** The reporting entity produces a Financial Improvement Plan (FIP), which consists of documented business processes and financial environment, risk analysis, control methods and test results, as well as

<sup>2</sup> These regulations include the Federal Financial Management Improvement Act of 1996 (FFMIA), GAO Standards for Internal Control in the Federal Government (Green Book), Office of Management and Budget (OMB) Circular A-123, and Managers' Internal Control Program Procedure (MICPP) (OUSD/CFO, 2016).

weaknesses and deficiencies uncovered in the testing process. The entity forwards the FIP to the FIAR Directorate for review and ongoing feedback.

2. **Corrective Action.** The reporting entity develops a corrective action plan (CAP) to resolve the previously reported deficiencies, develops budget estimates, and executes the plan. The FIAR Directorate reviews the CAP to ensure that deficiencies have been remediated and the reporting entity is audit-ready.
3. **Assertion/Evaluation.** The reporting entity solicits an independent auditor for an audit-readiness examination. Once completed, the entity creates additional CAPs to remediate the auditor’s identified discrepancies.
4. **Validation.** The reporting entity submits examination results with other documentation to the FIAR Directorate. The FIAR Directorate reviews the examination report and supporting documentation, and provides a final determination on the reporting entity’s audit-readiness state.
5. **Audit.** The reporting entity engages the auditor for a financial audit. Upon completion, the auditor issues the audit opinion (OUSD/CFO, 2016). Figure 2 provides the definition and possible outcomes of a financial audit.

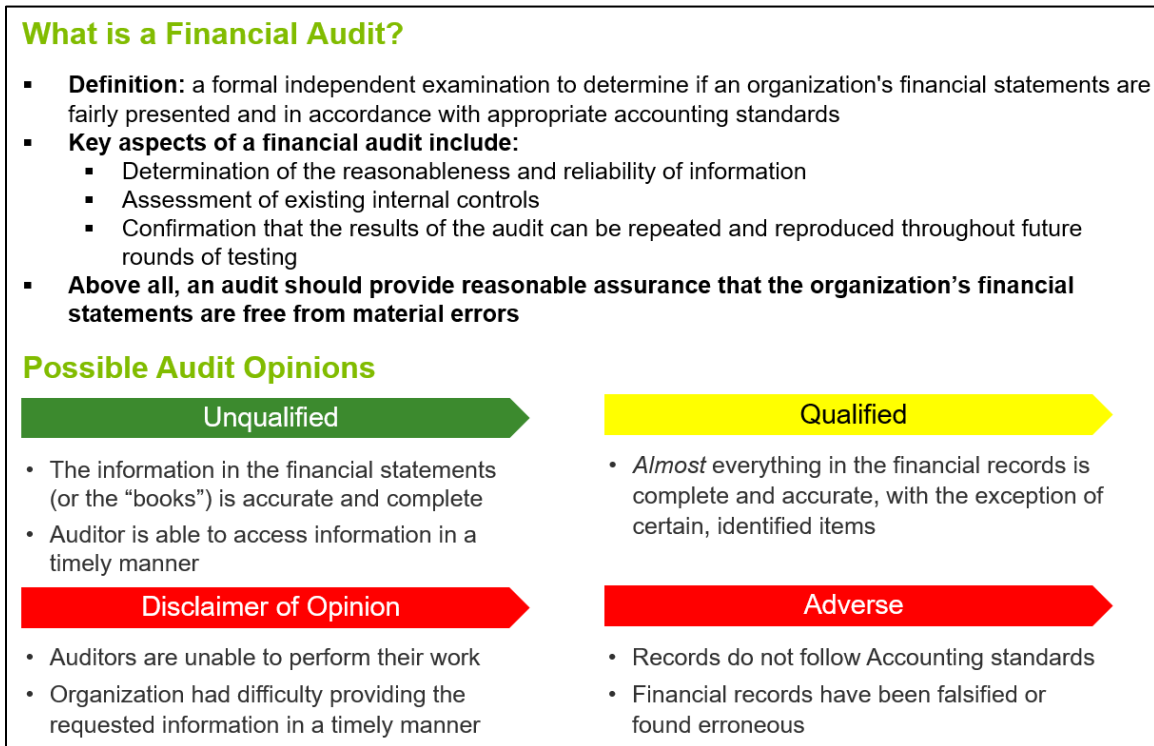


Figure 2. Basic Auditing Information. Source: Navy Personnel Command (2015).



## **B. NAVY APPLICATION OF FIAR POLICIES**

The dissemination of audit information follows a centralized hierarchy whereby auditors directly interact with the Navy Office of Financial Operations (FMO) to request samples during an audit. FMO manages all responses within the chain of command. This structure allows ease of information flowing up and down the organization structure for audit response.

### **1. Navy Office of Financial Operations**

Each military department within the DOD has been granted autonomy to prepare for independent public accountant (IPA) audits, as necessary. The DON follows the original FIAR guidance and methodology, and it has designated the FMO to coordinate and communicate with IPAs for audit engagement. Additionally, FMO oversees and directs the audit readiness operations for the DON's 20 Budget Submitting Offices (BSOs).

### **2. Commander, U.S. Pacific Fleet**

Commander, U.S. Pacific Fleet (COMPACFLT) is the BSO that represents surface, subsurface, and aviation units operating within the U.S. Navy's 7<sup>th</sup> and 3<sup>rd</sup> Fleets (West Pacific and East Pacific, respectively). These operational units are uniquely different from shore commands due to the challenges of physical distance, operational environment, and restricted communications with limited bandwidth. Because of these issues, PACFLT's finance policy is to restrict accounting and reporting efforts of these units to a minimum level, and to place financial reporting responsibility to the highest possible level (Navy Office of Financial Operations, 2015).

Financial accounting and reporting responsibility is delegated to PACFLT's Type Commanders (TYCOMs), who are granted both funding authority and Anti-Deficiency Act (ADA) responsibility. TYCOMs retain operational budgets (OBs), operational targets (OPTARs), and reimbursable orders at their level. They also issue portions of each directly to their operational units as mission dictates (Navy Office of Financial Operations, 2015). PACFLT's TYCOMS include Commander, Naval Air Force, U.S. Pacific Fleet (COMNAVAIRPAC); Commander, Naval Surface Force, U.S. Pacific Fleet



(COMNAVSURFPAC); Commander, Submarine Force, U.S. Pacific Fleet (COMNAVSUBPAC); Navy Expeditionary Combat Command (Pacific) (NECCPAC); and Commander, Navy Cyber Forces (CYBERFOR). The remainder of this chapter covers only the financial and reporting operations under PACFLT's surface ship TYCOM, COMNAVSURFPAC.

In 2013, COMPACFLT distributed a series of naval messages, titled "Military Standard Requisitioning and Issue Procedures (MILSTRIP) Segment of the Financial Improvement and Audit Readiness (FIAR) Program," which outline specific audit readiness tasks that subordinate operational forces must follow.<sup>3</sup> Specifically, these units must ensure

- A. The annual price change (APC) and monthly change notice are properly processed, ensuring obligations transmitted to ashore financial systems in a transaction ledger (TL) have the most accurate price available.
- B. Every requisition or stock issue (for Navy Working Capital Fund activities) for material, fuel, and provisions is approved before release or issue.
- C. Material, fuel, and provisions ordered are properly received and annotated. Complete/accurate receipt documents must be retained and retrievable.<sup>4</sup>

### **3. Commander, Naval Surface Force, U.S. Pacific Fleet**

COMNAVSURFPAC is the TYCOM for naval surface forces in the 3<sup>rd</sup> and 7<sup>th</sup> Fleets, including all guided missile destroyers (DDG), guided missile cruisers (CG), dock landing ships (LSD), littoral combat ships (LCS), and other small afloat units. The Fleet Audit Compliance Enhancement Tool (FACET) was developed to support PACFLT's MILSTRIP audit readiness objective to properly document complete and accurate receipt documentation for material, fuel, and provisions. The system was fielded to all COMNAVSURFPAC afloat units currently in service.

---

<sup>3</sup> Navy segments of the FIAR program are Military Pay, Civilian Pay, Transportation of People, Reimbursable Work Order, Contract/Vendor Pay, Financial Statement Compiling and Reporting, General Equipment, and MILSTRIP (Navy Personnel Command, 2015).

<sup>4</sup> COMPACFLT message to subordinate units: *Military standard requisitioning and issue procedures (MILSTRIP) segment of the Financial Improvement and Audit Readiness (FIAR) program - ser nr 01 - DTG 210142Z APR 13.*



FACET provides afloat commands with the ability to scan financial records for simplified indexing and classification in a centralized cloud-based repository. The scanned documents are easily retrievable to support IPA key supporting documentation (KSD) requests during an audit. Afloat commands with FACET installed are required to scan all documents related to MILSTRIP transactions from initial order to final receipt and acceptance of the material. The scans are then uploaded and retained in the Fleet Logistics Common Operating Picture (LOGCOP) data repository.<sup>5</sup>

KSDs are audited by an IPA to validate two types of transactions: (1) the disbursement of end use funds (i.e., OPTAR), and (2) the receipt and acceptance of purchased goods.<sup>6</sup> For ships with FACET installed, KSDs are required to be retained indefinitely, either within the FACET system, in the LOGCOP repository, or both. Ships experiencing prolonged connectivity issues that affect KSD uploads to LOGCOP must coordinate work-around procedures with COMNAVSURFPAC.

#### 4. MILSTRIP KSD Auditing on COMNAVSURFPAC Ships

An IPA audit consists of two types of testing: internal control and substantive.<sup>7</sup> This study only addresses the substantive portion of an IPA audit testing on MILSTRIP transactions. Upon the IPA's completion of the MILSTRIP process evaluation and internal control testing, a substantive end-to-end traceability audit of KSDs will commence for designated MILSTRIP transaction samples. All supporting documentation from requisition/obligation to receipt and payment will be evaluated for accuracy, timeliness, and completion. Accuracy of KSDs depends on whether the quantity of materials received is

---

<sup>5</sup> COMNAVSURFPAC message to subordinate units: *CNSP FACET compliance message* DTG 072035Z OCT 14.

<sup>6</sup> COMPACFLT message to subordinate units: *Military standard requisitioning and issue procedures (MILSTRIP) segment of the Financial Improvement and Audit Readiness (FIAR) program - ser nr 04 – receipt requirements* - DTG 230142Z MAY 13.

<sup>7</sup> In accordance with generally accepted auditing standards, AICPA provides definitions for the following terms:

**Test of controls.** An audit procedure designed to evaluate the operating effectiveness of controls in preventing, or detecting and correcting, material misstatements at the assertion level.

**Substantive procedure.** An audit procedure designed to detect material misstatements at the assertion level. Substantive procedures comprise (a) tests of details (classes of transactions, account balances, and disclosures) and (b) substantive analytical procedures (American Institute of Certified Public Accountants, 2015, p. 327).



annotated and circled; whether the document number, national stock number, unit of issue, and date of receipt are written on the document; and whether the receiver has provided a signature and printed name.<sup>8</sup> To pass the timeliness criteria, KSDs must be scanned within 72 hours of receipt or generation. In order for a sample transaction to be considered complete, administrative documents must be traceable along with receipt documents. These administrative documents include all letters of appointment, letters of designation, DD form 577, and all ethics, Defense Acquisition University, and Citibank training certificates.<sup>9</sup>

As Figure 3 and the following list portray, the audit response process begins with the IPA generating a sample list of MILSTRIP transactions within the designated timeframe. The IPA then forwards that list to FMO to provide the appropriate KSDs. From that point, all requested KSDs are required to be submitted to the IPA within 10 days; anything outside of that window is considered a sample exemption or failure.

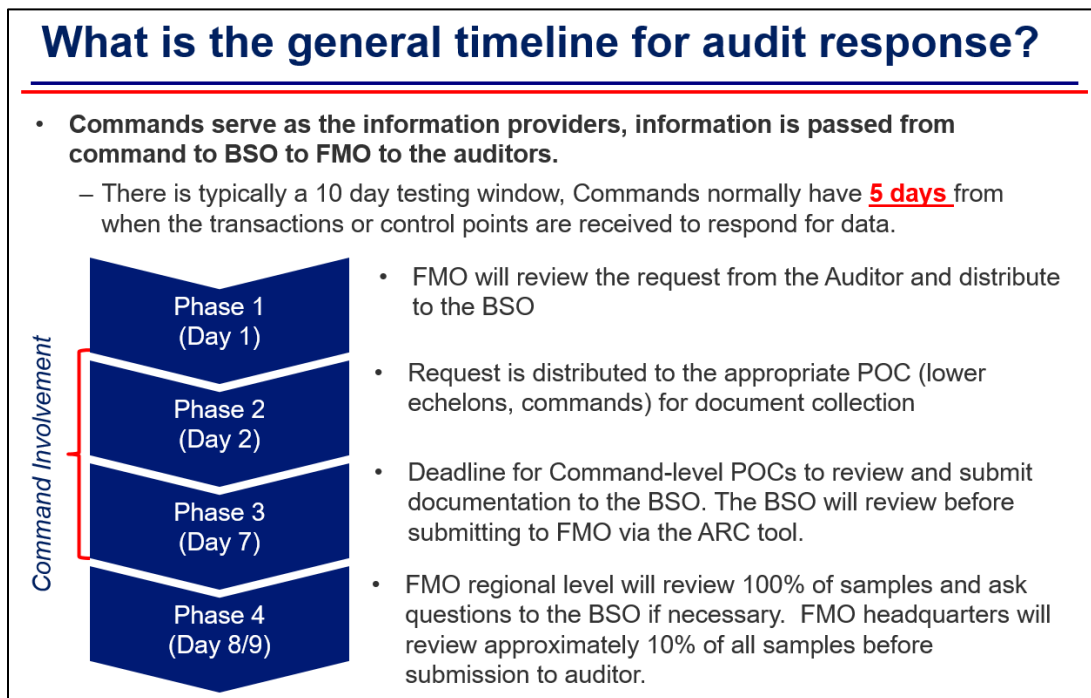


Figure 3. General Audit Response Timeline. Adapted from Navy Personnel Command (2015).

<sup>8</sup> COMPACFLT message to subordinate units: *Military standard requisitioning and issue procedures (MILSTRIP) segment of the Financial Improvement and Audit Readiness (FIAR) program - ser nr 04 – receipt requirements* - DTG 230142Z MAY 13.

<sup>9</sup> COMNAVSURFPAC message to subordinate units: *CNSP FACET compliance message* DTG 072035Z OCT 14.





- **Day one.** FMO distributes the transaction requests to the appropriate BSOs for document collection. In this instance, COMPACFLT (the BSO) attempts to retrieve all applicable KSDs from LOGCOP. If all documents pass quality assurance checks, the KSDs are forwarded back to FMO via the Audit Response Center (ARC) tool.<sup>10</sup> The KSD is then reviewed by FMO to be submitted to the auditor. All audit related sample requests and responses are communicated via the ARC tool for traceability. If a MILSTRIP sample has KSD issues (either quality or missing documentation), that sample request is forwarded to COMNAVSURFPAC to retrieve the required documents from the originating unit.
- **Days two through six.** Subordinate commands are normally given four days to research the MILSTRIP transaction and provide all KSDs.
- **Day seven.** COMPACFLT reviews all KSDs before submitting to FMO via the ARC tool.
- **Days eight and nine.** FMO's regional representative, FMO-53 in San Diego, reviews 100% of the samples submitted from subordinate commands, and coordinates with COMPACFLT for any additional required information or documents. FMO headquarters reviews approximately 10% of all samples before submission to the IPA.

Figure 4 outlines the MILSTRIP audit process for COMNAVSURFPAC ships. The left side, depicted in green, indicates the normal FACET operations onboard Navy ships detailed in section B.3 of this chapter. The right side, in blue, indicates the normal audit request process where shipboard KSD samples are pulled from LOGCOP for response to auditors, detailed in section B.4 of this chapter. The center portion of the figure, in red, indicates the rework process for both TYCOM and ships to resubmit corrected KSD samples, also detailed in section B.4 of this chapter.

---

<sup>10</sup> FMO Audit Response Center (ARC) can be found at <https://arc.portal.navy.mil/default.aspx>.



## MILSTRIP Shipboard Audit Process

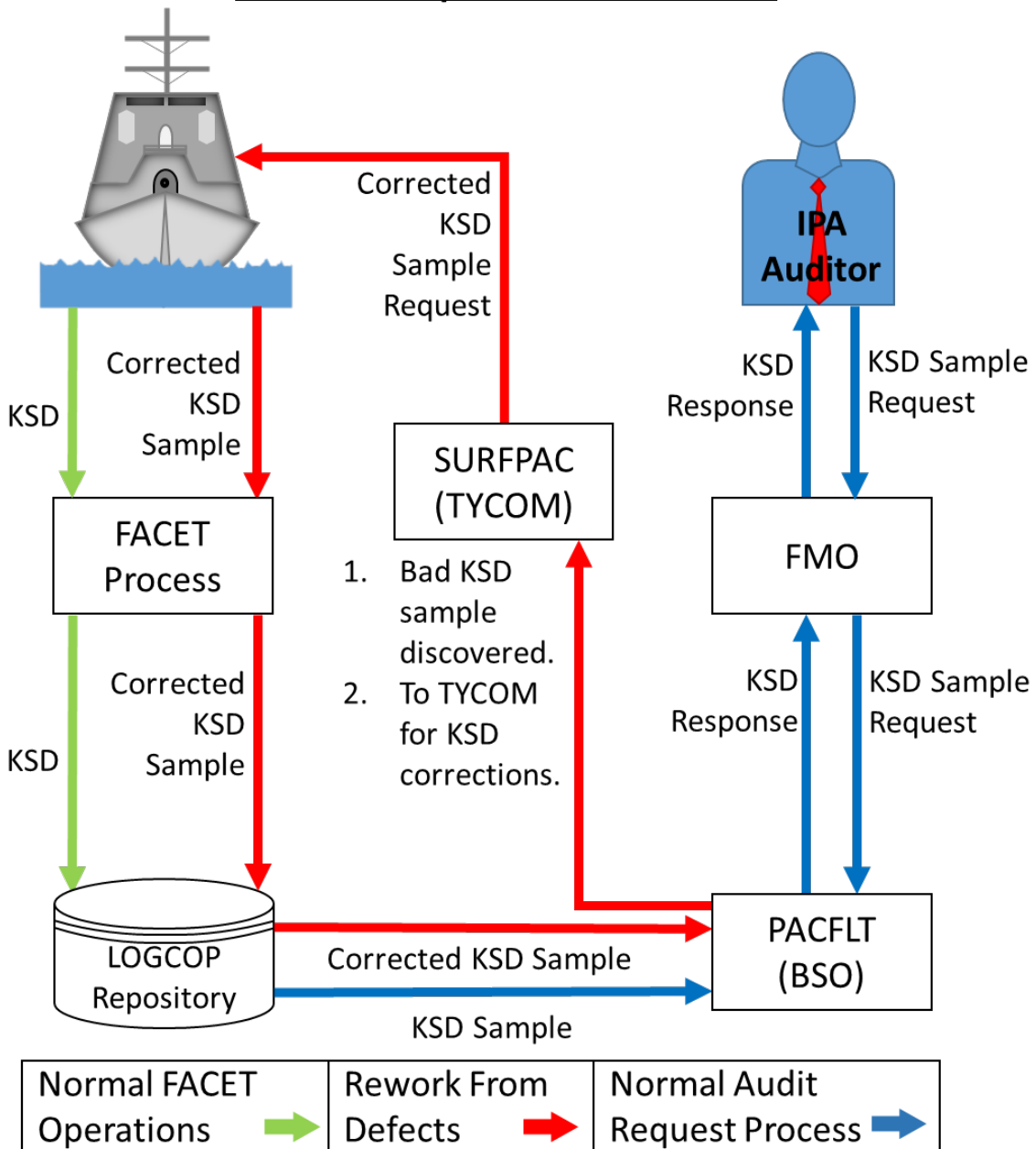


Figure 4. MILSTRIP Shipboard Audit Process

### C. BACKGROUND ON CONTINUOUS PROCESS IMPROVEMENT

Continuous process improvement (CPI) is an ongoing effort to enhance the effectiveness and efficiency of an organization through the improvement of processes. The DOD has embraced the concept of CPI to improve support for the warfighter customer, and has utilized both Lean and Six Sigma methodologies to become more efficient in resource

allocation and more effective in executing military operations. The remainder of this chapter focuses on the origins and background of Lean production, Six Sigma, and the DOD's utilization of the integrated Lean Six Sigma (LSS) methodology.

## 1. Background on Lean Production

In *The Machine that Changed the World*, Womack, Jones, and Roos (1990) describe the origin of the revolutionary Lean production process created by Eiji Toyoda and Taiichi Ohno of the Japanese Toyota Motor Company after World War II.<sup>11</sup> Their experimentation with production concepts throughout the 1940s and 1950s led to the discovery that, contrary to Ford Motor Company's production techniques at that time, the production of small batches provided significant benefits over mass production. The production of small batches eliminated the enormous inventory carrying costs that mass production required, and the faster assembly time enabled mistakes to be discovered and repaired almost instantly, thus shifting the focus from production to quality.

Toyota focused on the elimination of *muda*, or waste,<sup>12</sup> and on information-sharing throughout its entire supply chain; both the company and its suppliers achieved cost savings and efficiencies, including the refinement in parts flow throughout the production system. The delivery and storage of large quantities of inventory to support mass production changed to smaller and more frequent deliveries called *kanban*, with the intent to reduce inventories down to zero. It took two decades for Toyota to perfect this just-in-time (JIT) system, but its results provided competitive advantages in productivity, quality, and responsiveness to change within the automotive market.

---

<sup>11</sup> Womack et al. (1990) state that Toyoda and Ohno's production concept was originally known as the Toyota Production System, and subsequently coined as Lean Production by International Motor Vehicle Program researcher John Krafcick.

<sup>12</sup> Ohno defines *muda* as unnecessary steps in the process, transportation of parts, motion and waiting of personnel, excess inventory, overproduction, and defects of the final product or service. Womack and Jones (2003) add another form of waste: goods and services that do not meet the ultimate customer's needs.



In *Lean Thinking: Banish Waste and Create Wealth in Your Corporation*, Womack and Jones (2003) map out Lean principles that are built on Toyoda and Ohno's earlier teachings. These principles focus on converting waste into value through the following process:

- **Step 1: Specify value.** Only the ultimate customer can define what value is. It is up to the producer to provide the specific product or service, at the specific time, for the specific price.
- **Step 2: Identify the value stream.** The producer must accomplish three particular tasks to create the valued product or service that the ultimate customer has defined. First, the producer must solve the problem that the customer has defined through product or service design to production commencement. Second, information on order-taking, scheduling, and delivery must be managed. Third, raw materials must be transformed into a final good for the customer.
- **Step 3: Flow.** Waste must be eliminated, and the process must be reengineered to create activities that maximize value for the customer.
- **Step 4: Pull.** The preceding steps allow the company to respond quickly to customer demands. Customers can then pull the product or service that they desire, for the right price, and within the appropriate time frame.
- **Step 5: Pursue perfection.** Lean production introduces transparency into the value chain with waste reduction and information sharing between stakeholders. This feedback loop will continuously uncover waste and opportunities for improvement as customers pull more products through the system.

## 2. Background on Six Sigma

Quality control can be traced back as early as the late 1700s, when Eli Whitney assisted the U.S. government with the development of interchangeable musket parts. From there, quality control evolved from statistical sampling in Ford's Model-T assembly lines in 1913, to Walter Shewhart's use of control charts at Western Electric in 1924, and to W. Edward Deming and Joseph M. Juran's statistical efforts in the Japanese reconstruction after World War II (Folaron, 2003).

According to Harry and Schroeder (2005), Six Sigma methodology was born from Motorola's quest to improve the quality of its products, which in 1979, cost 5%–10% of revenues to correct poor quality. In 1985, an engineer at Motorola's Communications Sector named Bill Smith identified a correlation between defects in the manufacturing process and



early failure of the product in the field. His research concluded that a product would rarely fail early in the hands of the customer if it was manufactured error-free; thus, quality could be used proactively to anticipate problems and reduce both production time and costs.

Motorola targeted its level of quality at Six Sigma ( $6\sigma$ ), which refers to the reduction of variation to “no more than 3.4 defects per million products, customer services included”<sup>13</sup> (National Institute of Standards and Technology, n.d.). The company gained recognition, and spread the message of Six Sigma by beating out 66 other U.S. companies for the first annual Malcolm Baldrige National Quality Award in 1988<sup>14</sup>; afterwards, Motorola’s chief executive officer Robert W. Galvin ordered 10,000 of its suppliers to “join Motorola’s crusade ... or lose [the company] as a customer” (Hillkirk, 1989).

IBM, Allied Signal (now Honeywell), and General Electric were early adoptees of Motorola’s Six Sigma, and each corporation achieved different levels of success by using the Define, Measure, Analyze, Improve, and Control (DMAIC) methodology (Folaron, 2003).

### **3. DOD Application of Lean Six Sigma for Continuous Process Improvement**

The DOD has embraced CPI and the combined methodology Lean Six Sigma (LSS) as a means to enhance agility and to mitigate the risks associated with tightening fiscal policies and resource scarcity. LSS is endorsed by DOD leadership as a primary means to improve effectiveness and efficiency of support to the warfighter because its methods and tools have provided a significant return on investment (ROI) across multiple services and agencies over the last two decades. The DOD lists examples of successes as follows:

The Air Force applied CPI to reduce the repair cycle time for C-5 aircraft by 33 percent with an eventual goal to reduce total repair cycle time by over 50 percent. The Navy’s Surface Warfare Center carried out LSS projects in administrative, manufacturing, and research and development functions to net nearly \$9 million in savings over 3 fiscal years. The Army received tremendous payback because of LSS, saving \$30 million on its HMMWV line. The benefit was not only in cost savings, but also in the number of vehicles delivered to the soldiers who needed them. The Defense Logistics

---

<sup>13</sup> Although not directly stated in the article, Six Sigma also equates to a 99.9997% defect-free rate.

<sup>14</sup> National Institute of Standards and Technology (NIST) does not list participants of the Baldrige award, but Hillkirk (1989) identifies three other participants as Hewlett-Packard, IBM, and divisions from Kodak.



Agency (DLA) reduced interest payments and administrative lead times on a major support contract by 10 percent through lean and Six Sigma techniques. DLA is currently applying these techniques to improve Common Access Card (CAC) issuance rates. These successes, and many others like them, demonstrate the DOD's ability to apply world-class, best-of-breed practices to meet a wide range of operational requirements. (DOD, 2008, p. 1-1)

Figure 5 shows how proven CPI/LSS methodologies increase agility through uncertain environments, enhancing the DOD's effectiveness in executing complex missions. Lean methodologies eliminate waste and improve flow, improving the throughput of value added activities in a shorter time. Six Sigma reduces variation and improves quality of outputs, thus providing DOD leadership consistent products and services (Sicilia, 2008).



Figure 5. DOD CPI/LSS. Source: Sicilia (2008).

DOD LSS methodology follows the logical problem-solving path of DMAIC, and has been the answer for the DOD's CPI initiative since 2008. The following subsections present the combined LSS DMAIC steps.

***a. Define***

The purpose of the first phase of the DMAIC process, Define, is to identify the issue that is decreasing efficiency or effectiveness of a process, or to identify an opportunity for improving a process. This phase must also define the scope of the project, its mission, required resources, and team member roles (Defense Acquisition University, 2016).

The deliverables for this phase include (see Appendix A for templates)

- project charter development
- voice of the customer (VOC) research methods
- stakeholder identification
- project plan
- Suppliers-Inputs-Process-Outputs-Customers (SIPOC) table (DOD, 2008).

***b. Measure***

The purpose of the second phase of the DMAIC process, Measure, is to understand the current state of the process, to identify the critical to quality (CTQ) characteristics, to collect quantitative and qualitative data, and to validate the measurement system (Defense Acquisition University, 2016).

The deliverables for this phase include (see Appendix A for templates)

- current state process map
- data collection plan
- data display
- critical to quality (CTQ)/critical to process (CTP) key factors identified
- target versus actual output comparison (DOD, 2008).



***c. Analyze***

The purpose of the third phase of the DMAIC process, Analyze, is to determine the process capability, to establish cause-and-effect relationships within the process, and to identify sources of quality variation (Defense Acquisition University, 2016).

The deliverables for this phase include (see Appendix A for templates)

- potential and critical influencing factors
- root-cause analysis
- input (X) and output (Y) correlation (DOD, 2008).

***d. Improve***

The purpose of the fourth phase of the DMAIC process, Improve, is to conduct experiments, to determine relationships between variables, and to implement the approved corrective action (Defense Acquisition University, 2016).

The deliverables for this phase include (see Appendix A for templates)

- future state process map
- improvement strategy
- mistake-proofing review of improvement recommendations
- Failure Mode Effect Analysis (FMEA)
- risk analysis and mitigation plan (DOD, 2008).

***e. Control***

The purpose of the fifth phase of the DMAIC process, Control, is to monitor performance, to determine the new capability, and to validate mistake-proofing in the new process (Defense Acquisition University, 2016).

The deliverables for this phase include (see Appendix A for templates)

- transition plan
- quality control chart
- communication of new processes and business rules





- documentation close-out (DOD, 2008).

#### **D. SUMMARY**

The intent of this chapter is to provide the reader with a broad overview of both the DOD's audit readiness, as well as the department's implementation of CPI/LSS process improvement methodologies. The topic of audit readiness is narrowed from the DOD to the Navy's approach, and subsequently down to COMPACFLT's TYCOM of surface ships, COMNAVSURFPAC. The topic of Lean Six Sigma process improvement begins with the background on the DOD's CPI/LSS initiative and then shifts to the theory behind LSS.



THIS PAGE INTENTIONALLY LEFT BLANK



### **III. LEAN SIX SIGMA ANALYSIS OF SHIPBOARD AUDIT READINESS ON A U.S. NAVY DESTROYER—PART ONE**

This chapter describes the Lean Six Sigma (LSS) analysis conducted onboard a U.S. Navy guided-missile destroyer (DDG). Through the course of the project, researchers conducted both qualitative and quantitative analysis and only utilized the LSS tools that best fit this specific scenario. Not all process improvement or other analysis tools were used because it was determined that they were not the most efficient use of time and manpower for this project. Additionally, the identity of the ship and personnel are hidden to ensure confidentiality.

#### **A. DEFINE**

The sponsors of this project, Commander U.S. Pacific Fleet (COMPACFLT) and its subordinate Type Commander (TYCOM), Commander Naval Surface Force, U.S. Pacific Fleet (COMNAVSURFPAC), have identified both quality and timeliness issues with audit readiness onboard their surface vessels. This research attempts to identify ways to improve quality and timeliness through the following research question:

Can the audit readiness and sustainment process on naval ships be improved through Lean Six Sigma; if yes, how can it be improved?

In the Define phase, researchers used the project charter, suppliers-inputs-processes-outputs-customers (SIPOC) table, and plan of actions and milestones (POAM). These three tools were sufficient to identify the customer's issue and outputs that were critical to successfully accomplish the desired mission. Additionally, the scope of the project, schedule of events, and supporting organizations were agreed upon by all responsible parties.

#### **1. Project Charter**

The project charter shown in Table 1 was the first deliverable completed. It was developed based on information received through phone interviews with the project sponsors, as well as numerous emails for further clarification. The primary customer requirement of quality and timeliness were translated into the following measures: controls met, labor hours, and process cycle efficiency. It was agreed that these measurements were sufficient areas to focus research on.



Table 1. Lean Six Sigma Project Charter. Adapted from DOD (2008).

<b>Champion</b>	<b>Mr. John Begins COMPACFLT MILSTRIP FIAR Lead (N41B1)</b>		
<b>Sponsor(s)</b>	<b>COMPACFLT/COMNAVSURFPAC</b>		
<b>Project:</b>	<b>Lean Six Sigma Analysis on Shipboard Auditability of a U.S. Navy Destroyer</b>		
<b>Team members:</b>	<b>LCDR Robert Spracklin and Lcdr Jonathon Lavery</b>		
<b>Issue Date:</b>	<b>11 April 2016</b>		
<b>Project Evaluation Criteria</b>			
<b>1. Business Case:</b>	<p>This project seeks to improve the efficiency of audit readiness process used onboard U.S. Navy ships as a way to prepare for the DOD FY2018 financial statement audit. These improvements are aligned with the Financial Improvement Audit Readiness (FIAR) plan set forth by the DOD, which have set target objectives for all military services regarding audit readiness.</p> <p>This project uses Lean Six Sigma (LSS) methodology to identify steps to improve the quality of process outputs, remove causes for defects, and minimize variability in business processes in order to sustain audit readiness for surface forces.</p>		
<b>2. Problem Statement:</b>	<p>During a recent round of independent public accountant audit at PACFLT, 10 of 116 Notice of Findings and Recommendations were related to SURFPAC MILSTRIP processes. Discrepancies of these samples included quality and timeliness issues of key supporting documentation.</p>		
<b>3. Scope:</b>	<p>1<sup>st</sup> Step: LCPO QA inspection after receipt of goods and annotated on receipt. Last Step: Upload documentation into LOGCOP.</p>		
<b>4. Impact:</b>	<p>Poor quality scans, incorrect information, and timely recording of key supporting documents are diminishing the Navy's ability to become audit ready.</p>		
<b>5. Goal(s):</b>	<p>1. Successfully complete this Lean Six Sigma analysis by October 2016. 2. Perform a quantitative and qualitative analysis of current systems processes regarding FIAR compliance. 3. Provide recommendations to improve quality of outputs, remove causes for defects, and minimize variability to optimize surface forces audit readiness and sustainment.</p>		
<b>6. Customers:</b>	Sponsors, U.S. Navy, DOD		
<b>7. Stakeholders:</b>	<p>COMPACFLT: Provide IPA Examination data and internal test data COMNAVSURFPAC: Provide support in ship visit DDG: Assist with time study and personnel interviews</p>		
<b>8. Measurements:</b>	<b>Current</b>	<b>Goal</b>	<b>Improvement</b>
<b>Controls met</b>	Unknown at this time	Identify actual #	Provide recommendation
<b>Labor Hours</b>	Labor hours unknown at this time	Identify actual #	Provide recommendation
<b>Process Cycle Efficiency</b>	Unknown at this time	Identify actual #	Provide recommendation
<b>9. Schedule</b>	See Project Plan of Action & Milestone (POAM)		



## 2. SIPOC Table

A SIPOC table is a high-level map that begins with suppliers who provide key inputs or resources into the defined process and ends with customers who receive key outputs or deliverables from the process. The outputs provided in the process are identified as those that are critical to quality (CTQ) to the customer. This chart is used to outline the scope of the project as well as familiarize LSS team members with the process.

Researchers have identified the shipboard Supply Department personnel as the suppliers in the Fleet Audit Compliance Enhancement Tool (FACET) process because they handle the key supporting documents (KSDs) from start to finish, and deliver outputs that COMPACFLT deems as CTQ for shipboard audit readiness. During an audit, the Fleet Logistics Common Operating Picture (LOGCOP) repository would be a supplier of the retained KSDs to the auditors, and would have its own SIPOC table to outline that process. The scope of this research only covers the normal FACET processes onboard the DDG vice direct audit response through LOGCOP. Table 2 displays the SIPOC table for the FACET process.

Table 2. SIPOC Table

Suppliers	Inputs	Process	Output	Customer
Supply Dept. Personnel	1. Receipt (KSD) documentation 2. FACET system (scanner/laptop) 3. Media storage device	1. Prepare docs 2. QA docs 3. Transport docs 4. Power up hardware 5. Create batch file 6. Scan docs 7. Validate batch 8. Generate zip file 9. Upload to Cloud	1. Digital copy of receipt documents (KSD) 2. 72-hour timeline met 3. Audit timeline met	1. Echelon II (BSO) COMPACFLT 2. Echelon III COMNAV-SURFPAC

## 3. Project Plan

The project plan of actions and milestones (POAM) in Figure 6 covers all major events completed for this research project. The POAM shows the required tasks to be completed prior to conducting research at the Naval Postgraduate School (NPS), and includes requirements for data collection, travel funding, and project planning. Data collection methods were pre-approved by the Institutional Review Board (IRB) at NPS to ensure the



ethical and legal treatment of human subjects in this research. The Acquisition Research Program (ARP) provided funding for travel and lodging expenses and editing services. Finally, milestones for the LSS analysis were added.

Date Initiated:	5/16/2016	Pri POC Name:	LCDR Robert Spracklin					
Date Last Update:	9/19/2016	Pri POC Email:	<a href="mailto:rsprack@nps.edu">rsprack@nps.edu</a>					
Project Name:	<b>SURFPAC FIAR Project</b>	Sec POC Name:	LCDR Jonathon Lavery					
		Sec POC Phone:	<a href="mailto:jalavery@nps.edu">jalavery@nps.edu</a>					
Item	Type	Event	Date	Description	Support	Ref	Status	Comments
1	Admin	IRB Determination Form submission w/ Project proposal draft	5/18/2016	An IRB approval is necessary for this project due to the need for human interaction in the survey described in Phase II.	N/a		Submitted; Requires resubmission (pending)	Since no opinions are asked of participants in the survey, IRB approval expected. UPDATE: Board determined low risk Human Interaction involved. Resubmission of package required
2	Admin	Project Proposal Submission	5/20/2016	The project proposal will be submitted to the Primary/Secondary Thesis advisors for review and signature. Once finalized, the project can officially begin.	Thesis advisors, Program Sponsors		Submitted; Approved	
3	Logistics	Coordinate site visit.	6/1/2016	Project members will coordinate with program sponsor(s) to conduct Phase I. The following will be required:	SURFPAC, PACFLT		Completed	
				1) Prior approval from PACFLT/TYCOM to visit a ship in San Diego			Approved	
				2) Selection of a suitable ship to conduct site visit			Completed	
				3) Selected ship's CO & Dept Head approval to allow a site visit. Coordination required to adjust to ship's onboard schedule.			Approved	
				4) Ship POC (SUPPO recommended) for communication/coordination with project members.			Completed	
4	Thesis work	Chapter 2 – Literature Review	6/13/2016	The Literature Review involves extensive background information about FIAR and all the processes associated with this project	N/a		Completed	
5	Logistics	Coordinate travel and lodging	TBD	Submit travel approval forms through DTS and ARP. Request base lodging with rental car.			Completed	
6	Data collection	Observe the FACET process	7/13/2016-7/28/2016	San Diego ship will be visited while in port. Researchers will observe document scanning process			Completed	
7	Thesis work	Solution Development	8/22/2016-9/4/2016	Create charts, graphs, data analysis, develop recommendations			Completed	
8	Thesis work	MBA Project processing	9/5/2016-10/30/2016					
9	Admin	MBA Project completion/submission	10/31/2016		Thesis advisors			
10	Outbrief	COMNAVSURFPAC outbrief	TBD, November		SURFPAC, PACFLT			

Figure 6. Project Draft Plan of Actions and Milestones (POAM)



## **B. MEASURE**

Current performance of the FACET audit readiness process was measured in this phase. Team members collected quantitative data through direct observation of personnel directly involved in the FACET process. Interviews were conducted to obtain additional quantitative data, as well as qualitative information, to provide a more in-depth case study than any one method could do on its own.

### **1. Direct Observation**

Researchers directly observed two supply divisions complete different types of FACET scanning processes in real time and documented all observations. The Supply Support (S1) division is responsible for general supply and logistics operations on board the ship. The personnel in the division, called Logistics Specialists (LSs), are responsible for requisitioning parts and supplies, performing inventory, and recordkeeping. They also manage proper receipt, stowage, distribution and transportation of stores received, as well as tracking shipboard hazardous material. The transactions for S1 requisitions are maintained in a relational database called R-Supply. Food Service (S2) division is responsible for preparing healthy meals for the ship's crew and personnel on a daily basis. The Culinary Specialists (CSs) in the division are responsible for menu development, preparing entrees with Armed Forces Recipe Service (AFRS) instructions, ordering subsistence items, and tracking food inventory. The S2 food ordering and inventory functions are managed through a web-based program called Food Service Management (FSM) 3.0. The scope of this research starts after the receipt and acceptance of goods for both divisions and ends with the scanned KSD upload onto the LOGCOP database. The FACET processes observed for S1 were Direct Turnover (DTO) 1348-1A, Miscellaneous Stores, and Storeroom Issue receipts; the S2 processes observed was a combination of Prime Vendor, MILSTRIP, and Fleet Logistics Center (FLC) food receipts.

The direct observations enabled the researchers to map the current, or "as is," process and conduct a time study. Figure 7 shows the FACET audit readiness process in simplified terms. All of the processes observed shared common overall major steps; however, they



differed slightly in subordinate steps. The common process steps that were identified are as follows:

1. LCPO QA receipt inspection
2. Prepare documents
3. Physical transit to FACET system
4. Power up laptop/log on
5. Create batch
6. Scan
7. KTM server (automatic)
8. KTM validation
9. PDF generator (automatic) and export (automatic)
10. Retrieve/format CD-RW
11. FACET database—generate X71 and ZIP files
12. Transport CD-RW to CPU/log on to CPU
13. Log in to LOGCOP
14. Upload ZIP to LOGCOP-FACET (central ashore repository)

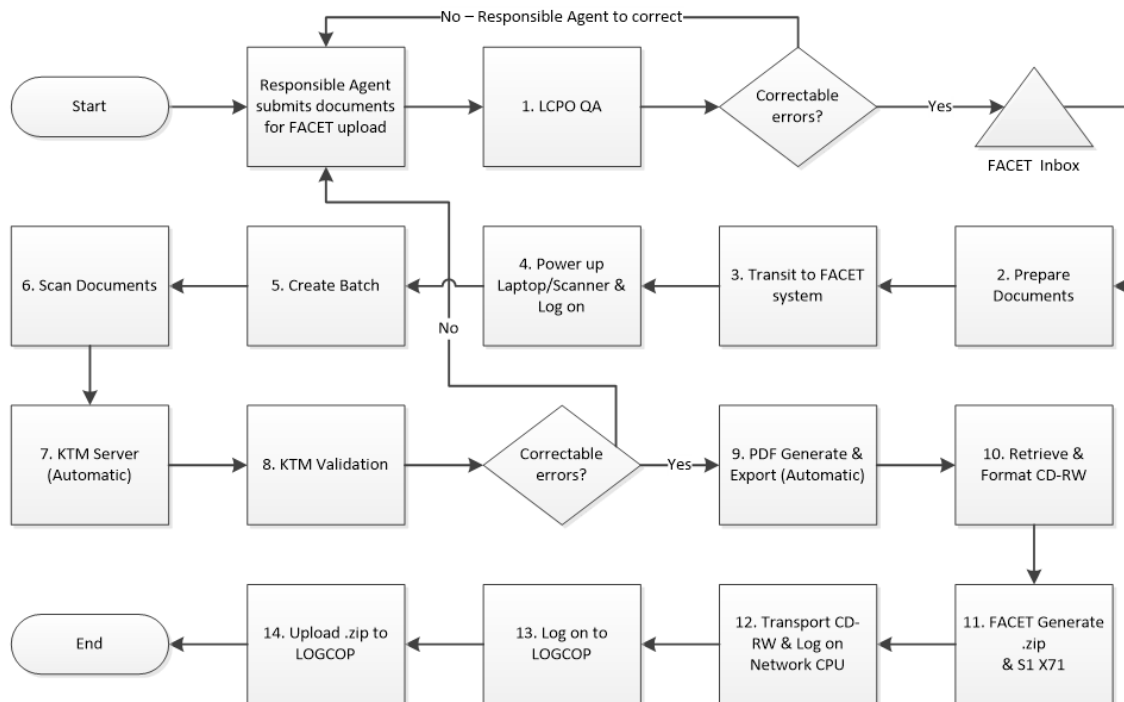


Figure 7. Current State Map



Due to time and operational constraints onboard the DDG, researchers only captured one iteration of each FACET process with a stop watch. Some steps were estimated because they were conducted prior to the start of the observation. Highlights of each step are presented in the following sections<sup>15</sup> and annotated in Table 3.

**a. LCPO QA Receipt Inspection**

This step was conducted prior to the researchers' observation on the DDG's FACET process. However, the LCPO provided an estimated time of two minutes (120 seconds) per document for the quality assurance inspection of KSDs. In order to pass inspection, each document was reviewed to ensure that it met the following standards:

- Quantity of supplies received circled, or if incorrect, the original quantity will be lined out and the correct quantity annotated next to it and circled
- Date received
- Document number
- Unit of issue
- National stock number
- Receiver's signature and name printed legibly
- Discrepancies (if applicable)

If any of this data were missing or uncorrectable, or if the receipt were missing altogether, an administrative/dummy receipt would have been required.<sup>16</sup> Once the receipts were reviewed and approved, the LCPO placed the documents in the appropriate inboxes. In this instance, the S1 FACET inboxes were DTO, Storeroom Issue, and Miscellaneous Stores; the food service receipts were placed in the S2 FACET inbox. After separation, each batch were placed in the appropriate inbox within the S1 and S2 divisional offices, and a sticky note was attached to each batch to notify the FACET coordinator that they were ready to be processed.

---

<sup>15</sup> A detailed breakdown of the FACET processes can be found in Appendix B.

<sup>16</sup> COMPACFLT message to subordinate units: *Military standard requisitioning and issue procedures (MILSTRIP) segment of the Financial Improvement and Audit Readiness (FIAR) program - ser nr 04 – receipt requirements* - DTG 230142Z MAY 13.



***b. Prepare Documents***

The FACET coordinators followed the daily and weekly divisional checklists as a trigger to begin document preparation for FACET. Both coordinators conducted a QA inspection on the receipts, removed staples, unfolded “dog-eared” corners, and flattened out wrinkles.

***c. Physical Transit to FACET System***

Once food service receipts were prepared in accordance with the FACET User’s Guide, the S2 FACET coordinator hand-carried the batch to the FACET system located in the S1 office.

***d. Power up Laptop/Log on***

The FACET laptop was powered on prior to researcher observation. The FACET coordinator provided the estimate of 60 seconds for this step, which researchers considered as a reasonable estimate.

***e. Create Batch***

All batches were prepared in a similar manner. However, the S2 Prime Vendor (PV) batch required a lengthy Excel import process of Fleet Logistics Center (FLC) transactions prior to batch creation in the Batch Manager program. Once the type of batch was selected, FACET coordinators manually entered the following information:

- Whether all forms were circled, signed, and dated
- If all names were also printed and legible
- Whom the supplies were received by
- Date received
- Click Save button and close program (Premier Solutions HI, 2015).



*f. Scan*

The scanning step was performed identically for all four process, but times varied slightly due to the condition and size of the receipts. The documents were loaded into the scanner, the scan button was selected in the Batch Manager program, scanned pages were reviewed for quality, and the batch was confirmed and then closed.

*g. KTM Server (Automatic)*

This step initiated after the batches were closed. The S1 FACET coordinator stated that although this program is automatic, the batch size positively correlates to the amount of time the program takes to complete the step.

*h. KTM Validation*

This step required manual entry of data fields and the update of incorrect auto-filled fields. For the S1 DTO batch, the FACET coordinator corrected three documents that FACET could not distinguish the correct data, which totaled 150 seconds. The S1 Miscellaneous Stores batch required the most time of all four batch types for the FACET coordinators, totaling 642 seconds; this delay was due to two vendor invoices that lacked the required national stock number and had to be researched, and another delay was caused by an invoice which had to be rescanned and revalidated.

*i. PDF Generator (Automatic) and Export (Automatic)*

This step initiated automatically upon completion of Step 8. Like Step 7, this batch size positively correlates to the amount of time to complete this step.

*j. Retrieve/Format CD-RW*

During two of the processes, the S1 FACET coordinator left the FACET system area to retrieve a CD-RW. In the second instance, the disk had to be formatted before being used; formatting took an additional 600 seconds after a new CD-RW was retrieve.



***k. FACET Database—Generate X71 and ZIP Files***

All four batches observed shared the same procedures for generating ZIP files. However, two batches required additional files to be generated as well. The S1 DTO batch required an X71 file to be generated for R-Supply, and the S2 PV batch required an additional file to be generated for FSM.

***l. Transport CD-RW to CPU/Log on to CPU***

There were no network-connected desktop computers that were allocated for FACET operations. The FACET coordinators ejected the CD-RW from the FACET laptop and transited across the S1 office to an open computer. Two of the batches required no additional time because the S1 FACET coordinator was already logged onto the network computer directly behind the FACET laptop.

***m. Log in to LOGCOP***

As previously mentioned, LOGCOP is a cloud-based repository for the storage of digitized KSDs, and the time for this step is negatively correlated with internet connectivity. During the observation, the ship was pierside with no degradation to connectivity.

***n. Upload ZIP to LOGCOP-FACET (Central Ashore Repository)***

Like Step 13, the time to complete this step is negatively correlated with ship connectivity, but it is also positively correlated with the batch size.



Table 3. Time Study of FACET Process

	<b>S1 - DTO RCPTS 1348-1A</b>	<b>S1 - MISC STORES</b>	<b>S1 - STORE- ROOM ISSUE</b>	<b>S2 - PV FOOD RCPTS</b>
<b>Batch Size (# KSDs)</b>	5	13	3	12
<b>FACET PROCESS STEPS (in Seconds)</b>				
<b>1. LCPO QA Receipt Inspection</b> <sup>17</sup>	600	1560	360	1440
<b>2. Prepare Documents</b>	100	48	58	52
<b>3. Physical Transit to FACET System</b>	0	0	0	57
<b>4. Power Up Laptop/Log On</b>	60	60	60	60
<b>5. Create Batch</b>	60	48	10	1800
<b>6. Scan</b>	120	164	137	120
<b>7. KTM Server (Automatic)</b>	30	66	15	45
<b>8. KTM Validation</b>	150	642	15	180
<b>9. PDF Generator (Automatic) and Export (Automatic)</b>	30	30	10	15
<b>10. Retrieve &amp; Format CD-RW</b>	60	720	0	0
<b>11. FACET Database—Generate X71 and ZIP Files</b>	110	60	30	105
<b>12. Transport CD-RW to CPU and Log On to CPU</b>	90	0	0	75
<b>13. Log In to LOGCOP</b>	26	26	30	30
<b>14. Upload ZIP to LOGCOP-FACET (Central Ashore Repository)</b>	46	47	5	60
<b>Total Process Time (seconds):</b>	1482	3471	730	4039

## 2. Personnel Interviews

Researchers conducted interviews with seven personnel within S1 and S2 that are directly involved in the DDG’s FACET audit readiness process. The interview questionnaire, Figure 8, was designed in accordance with Ishikawa’s cause-and-effect method to obtain qualitative and quantitative information to obtain causal factors of this auditability process.<sup>18</sup> This information is used in the Analyze phase to uncover root causes of waste and defects that may have been overlooked during the direct observation.

<sup>17</sup> The value for this step was estimated by multiplying 120 seconds per document and multiplied by the number of documents within the batch of the process.

<sup>18</sup> Ishikawa (1985) states that a process “does not refer merely to the manufacturing process. Work relating to design, purchasing, sales, personnel, and administration are all processes. ... [The] process, which is a collection of cause factors, must be controlled to obtain better products and effects” (p. 63).

His cause-and-effect method originally consisted of 5 Ms (material, machine, measurement, man, and method), but it has evolved over the years to suit different industries. This research paper uses 8 Ms (manpower, materials, measurements, methods, machines, mother nature/environment, money, and maintenance).



<b>Lean Six Sigma Analysis on Shipboard Audit Readiness—INTERVIEW FORM</b>	
Ship type: DDG                      Date:	
<b>1. MANPOWER:</b>	
1.a. Position:	1.b. Division:
1.c. How many Sailors are qualified to operate the FACET System?	
1.d. What positions are trained to operate FACET in your division?	
1.e. What type of training did you receive for FACET? When?	
<b>2. MATERIALS:</b>	
2.a. What are the materials used to support the FACET process?	
2.b. Were they purchased specifically for FIAR/FACET?	
<b>3. MEASUREMENTS:</b>	
3.a. How many documents are in a typical batch?	
3.b. How many batches are uploaded in a:	
Day?	Month?
Year?	Deployment Cycle?
<b>4. METHODS:</b>	
4.a. What guidance/standard operating procedures do you follow?	
4.b. Are there any procedures that you are currently unable to follow?	
<b>5. MACHINES:</b>	
5.a. What are the machines are used to support the FACET process?	
5.b. Were they purchased specifically for FIAR/FACET?	
<b>6. MOTHER NATURE/ENVIRONMENT:</b>	
6.a. What factors affect the process during deployment?	
6.b. What factors affect the process during pierside operations?	
<b>7. MONEY:</b>	
7.a. What are the direct/indirect costs (material, machines, overhead, etc.)?	
<b>8. MAINTENANCE:</b>	
8.a. What maintenance is performed on the equipment?	
8.b. Who performs this maintenance?	
8.c. What is the periodicity of the maintenance?	

Figure 8. Personnel Interview Form



**a. Manpower**

There are currently 10 Supply Department personnel trained to operate FACET onboard the DDG, but none have this designated as their primary duty. The roles in each division are as follows:

Supply Department:

1. Supply Officer
2. Supply Department Leading Chief Petty Officer

S1 Logistics Division:

1. Leading Petty Officer
2. HAZMAT Supervisor/FACET coordinator
3. Financial Logistics Specialist
4. Depot Level Repairable (DLR) manager
5. Tech Edit Logistics Specialist

S2 Food Service Division:

1. Bulk Storeroom Custodian/FACET coordinator
2. Recordskeeper #1
3. Recordskeeper #2

Training on the FACET system onboard this DDG consisted of on-the-job training (OJT) from previously trained personnel. The OJT process consisted of reviewing the FACET user's guide and completing a walk-through of the process. This included quality inspection (QA, scan, upload of documents, and LOGCOP review). Additionally, the FACET technical support representative from Premier Solutions HI, LLC, makes quarterly visits to provide refresher training and maintenance on the system.

**b. Materials**

General administrative supplies, such as rewriteable compact disks,<sup>19</sup> scissors, tape, pens, and staple removers are required to conduct the FACET process. Additionally, rubber

---

<sup>19</sup> Memory sticks are not authorized for use on government network computers.



stamps were procured for S1 personnel to reduce the occurrence of KSD defects as they accept and create key supporting documentation from the responsible agent.

*c. Measurements*

Table 4 shows the format of the aggregated information produced by LOGCOP. The computer name column is the command’s identification number for the system. Transmittal numbers ascend in sequential order as batches are uploaded to LOGCOP. The creation date column shows the date and time that the batches were created on the FACET system, and the load date column shows the dates and times that the .zip files were loaded onto LOGCOP.

Table 4. LOGCOP Transaction File

Computer Name	Transmittal Num	Creation Date	Load Date	DocNo Cnt	PDF Cnt
FACET000	000000	YYYYMMDD TIME	MM/DD/YYYY TIME	#	#

Upon the conclusion of the tour, the S1 FACET coordinator provided the DDG’s aggregate historical data for both S1 and S2 from LOGCOP. Figure 9 shows the system was not consistently used until December 2014. Therefore, the researchers consider the data prior to that point irrelevant to this analysis; the outlier of 881 uploaded documents from November 2014 is excluded in order to provide a more accurate estimation of future FACET batch sizes.

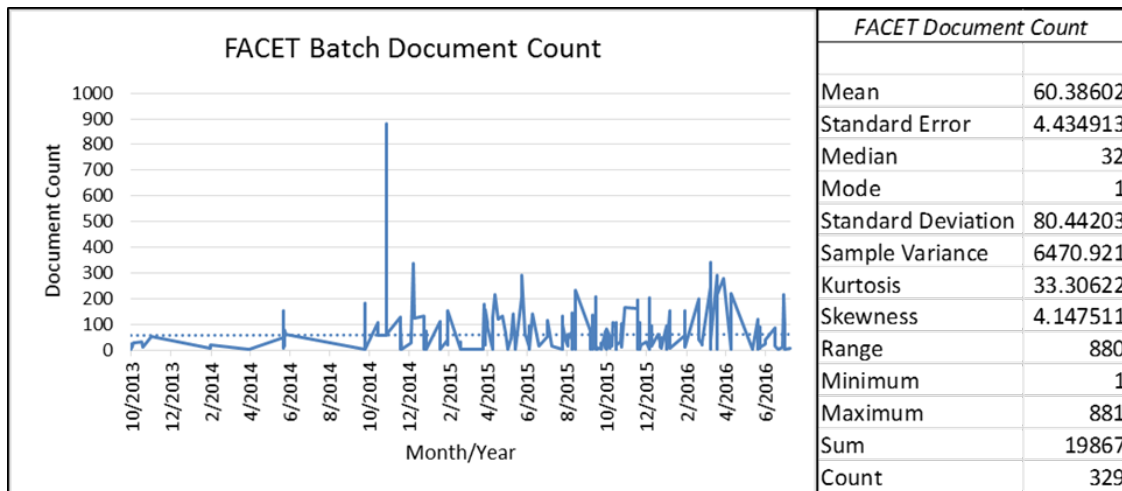


Figure 9. Historical FACET Document Count per Batch (October 2013 to July 2016)





The revised Figure 9 provides a more reasonable collection of the size and periodicity of FACET batch uploads to LOGCOP’s central repository. According to LOGCOP, the DDG scanned and uploaded 15,640 KSDs over the previous 20 months. The 264 batches that were uploaded over this period of time contained an average of 59.24242 KSDs per batch, with a standard deviation of 69.92126.

The positively skewed and unimodal histogram in Figure 10 shows that the 33% of batches scanned from December 2014 to July 2016 contain 10 or fewer documents. The significance of these 89 batches lies in the fact that each requires set-up, transfer, and other fixed times to support the FACET process.

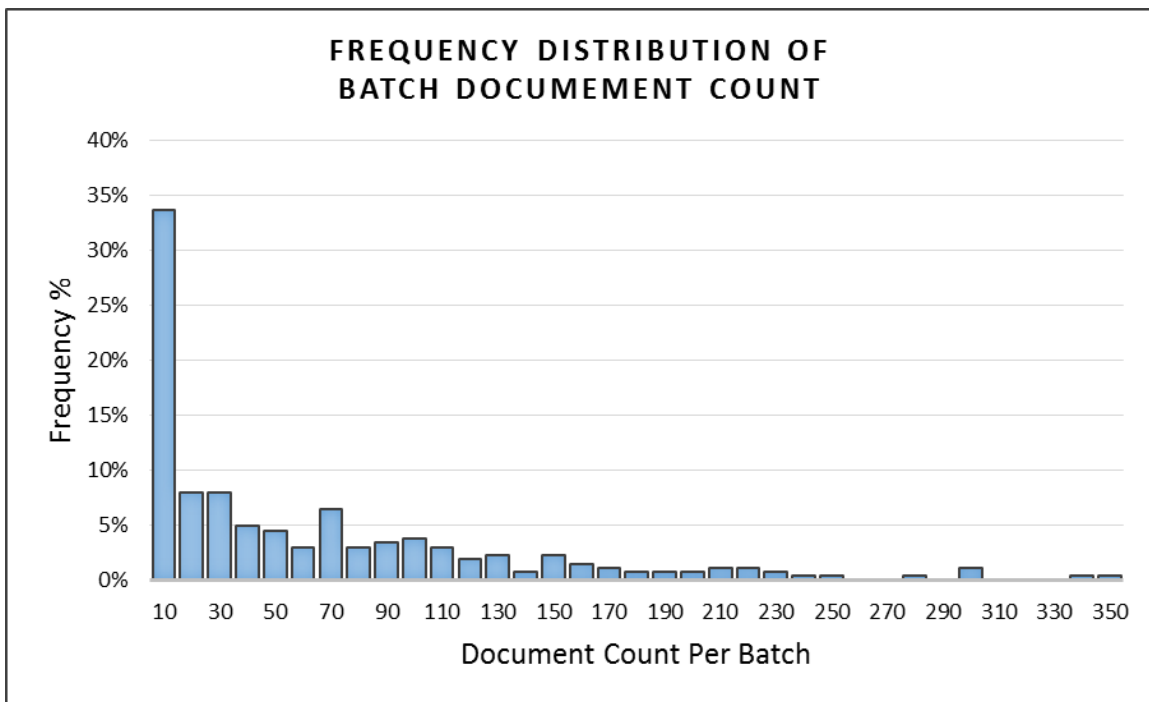


Figure 10. Frequency Distribution of Batch Document Count

**d. Methods**

COMNAVSURFPAC briefed the DDG’s senior leadership on Financial Improvement Audit Readiness (FIAR) as the ship entered into the Basic Phase of its Fleet Response Training Plan. The briefs occurred during extended in-port time where normal shipboard



operations were minimal.<sup>20</sup> This initial guidance was augmented with FIAR and FACET updates via COMPACFLT and COMNAVSURFPAC Naval messages, emails, and instructions. The FACET user's guide is revised as needed and provided electronically. Additionally, Naval Supply Systems Command (NAVSUP) provides FACET updates via its News Flashes.

Chapter II previously stated PACFLT's expectation that all KSDs be scanned within 72 hours of being received or generated.<sup>21</sup> The Supply Department onboard the DDG used weekly checklists as a control method to trigger administrative tasks, and FACET scanning was included. However, interviews with FACET personnel concluded that this 72-hour requirement was not known, nor was it directly enforced.

*e. Machines*

There is currently one FACET system onboard the DDG, which consists of one commercial off-the-shelf (COTS) laptop, one COTS scanner, and customized COTS software. This system was fielded in 2013, and it is located in S1 Division. A desktop computer with network access is also required to transmit .zip files to the cloud-based LOGCOP repository, but there was no specific computer assigned to conduct the FACET process.

There is no FACET system located in S2 Division, and S2 members must transit across the ship to the S1 office to scan and upload their food service KSDs on FACET. A sole-source request for a second FACET system has been submitted and, at the time of the researchers' visit, had been outstanding for seven months.

*f. Mother Nature/Environment*

The operational environment of the DDG directly affects the FACET process. Pierside operations provide stable connectivity, but working hours are generally limited to 10-hour workdays; workload must be allocated among conflicting priorities within that time

---

<sup>20</sup> The ship's briefing coincided with the ship leaving a maintenance availability in the shipyards and prior to the Supply Department's Supply Management Certification (SMC).

<sup>21</sup> COMNAVSURFPAC message to subordinate units: *CNSP FACET compliance message* DTG 072035Z OCT 14.



period. Underway operations offer extended working hours onboard, and range from 12 to 24 hours per day; however, the risk of connectivity issues increase as bandwidth is reallocated to other higher priority resources.

Because the research visit was conducted while the ship was pierside, Step 14: Upload ZIP to LOGCOP-FACET (Central Ashore Repository), was not inhibited by connectivity issues. However, KSD batch scanning and uploading had to be paused as shipboard personnel and researchers broke for lunch.

It was brought to the researchers' attention that the S1 Division was unable to upload to LOGCOP for 10 days during the previous underway period due to limited connectivity; thus the previously stated 72-hour scanning requirement was not accomplished in time. The S1 leading petty officer was not on board during that underway period, but stated in the interview that .zip files had been uploaded into the U.S. Army Aviation and Missile Research Development and Engineering Center website (ARMDEC Safe Access File Exchange) as a workaround procedure on other occasions.<sup>22</sup> No other personnel interviewed were familiar with this FACET workaround procedure.

***g. Money***

Materials and supplies are considered consumable and are purchased out of the DDG's operating target (OPTAR) budget. Because these supplies are common administrative items, negligible in cost, and are shared among multiple activities, there is no suitable way to allocate them to the FACET process. However, the COTS equipment and software listed in Table 5 are direct costs related to the FACET process. The first FACET system was provided at no cost to the DDG, but the second one that has been requested will be paid for out of the ship's OPTAR. Table 5 portrays the associated costs for the second system; however, additional support costs from Premier Solutions HI, LLC, if applicable, were not disclosed in the interview session.

---

<sup>22</sup> ARMDEC SAFE: <https://safe.amrdec.army.mil/safe/>



Table 5. FACET System Hardware and Software

<b>Manufacturer</b>	<b>Part #</b>	<b>Description</b>	<b>Qty</b>	<b>Estimated Price</b>
Hewlett Packard	F1M39UT#ABA	G2 Mobile Workstation	1 ea	\$1,699.00
Fujitsu	PA03670-B055	FI-7160 Document Scanner	1 ea	\$1547.00
Microsoft		Pro Plus 2013	1 ea	\$399.99
Kofax		Kofax Capture 10.0	1 ea	\$1,899.00
Total Cost:				\$5,544.99

***h. Maintenance***

Maintenance on hardware and software are completed per the manufacturer’s recommendations and not entered into the ship’s Maintenance and Material Management (3-M) System. The regional Premier Solutions HI, LLC FACET support technician visits the DDG and provides maintenance on a quarterly basis; shipboard personnel perform the manufacturer’s recommended maintenance on the laptop and scanner on an as-required basis, which depends on the amount of dust in the workspace and the type of documentation being scanned. The laptop requires external air dusting on an as-needed basis, and software requires monthly maintenance of backing up data, cleaning up existing backup files, and updating of software and passwords. The scanner requires rollers and sensors to be wiped down every 10,000 documents, but may require more frequent maintenance when the following documents are scanned:

- Smooth-faced documents such as coated paper
- Documents with printed text or graphics almost covering the entire surface
- Chemically treated documents such as carbonless paper
- Documents containing a large amount of calcium carbonate
- A large volume of documents written in pencil
- Documents on which the toner is not fused sufficiently (Premier Solutions HI, 2015, p. 681)



## C. SUMMARY

This chapter covered the Define and Measure phases of LSS. In the Define phase, the scope of the project and problem statement were clearly defined through the project charter SIPOC table and POAM statement. Additionally, the methods of data collection were identified and approved. In the Measure phase, the current processes were documented and primary metrics were identified for improvement, thus establishing performance baselines. These two phases set the position to make changes to the processes, which are covered in Chapter IV: Lean Six Sigma Analysis of Shipboard Audit Readiness on a U.S. Navy Destroyer—Part Two.



THIS PAGE INTENTIONALLY LEFT BLANK



## **IV. LEAN SIX SIGMA ANALYSIS OF SHIPBOARD AUDIT READINESS ON A U.S. NAVY DESTROYER—PART TWO**

This chapter describes the final three phases of Lean Six Sigma (LSS) analysis conducted onboard a U.S. Navy guided-missile destroyer (DDG). Analyze, improve, and control phases were used to identify the significant causes of quality defects in key supporting documents (KSDs), and to recommend improvements and controls to ensure sustained audit readiness on board the DDG.

### **A. ANALYZE**

The researchers used the information collected in the measurement phase to accomplish the following: determine the cause-and-effect relationship between audit document quality (Y) and causal factors (Xs), investigate the significance of those previously identified causes, and identify improvement opportunities.

#### **1. Potential Causes**

##### ***a. Rework from Quality Defects or Missing Documents***

Quality defects and missing documentation can be discovered by the LCPO, FACET coordinator, or other QA personnel onboard the ship, or from outside entities such as TYCOM or BSO. These rework actions contribute to added cycle time within the FACET process. Document rework can be controlled directly by shipboard personnel.

##### ***b. Process Bottleneck***

A noted outlier occurred in Step 10 (Retrieve and Rewrite CD-RW) of the S1 Miscellaneous Process, which resulted in a longer cycle time for that step than the other three observed processes. The data anomaly was caused by the removal of the CD-RW from the FACET system from a Sailor outside of the process, and it was not returned in time for the observation. Researchers consider the common bottleneck as Step 1 (LCPO QA), which was the longest step of all four FACET processes. This bottleneck sets the system capacity for KSD processing, and any quality issues with KSDs would directly impact total cycle time.



***c. Reduced Connectivity***

Reduced connectivity affects the bandwidth flow of incoming and outgoing data in the FACET process during underway operations. This is due to satellite restrictions and shipboard allocation of bandwidth. The ship may not be able to directly control the amount of bandwidth that it is allocated in each area of operation, but it does control how the bandwidth is allocated among each shipboard department. Times to complete steps 13 and 14 are directly affected by bandwidth allocated to the Supply Department, and any reduction of connectivity would result in a delay of completing the FACET process. Additionally, the timeliness of KSD sample requests from TYCOM could be negatively affected if connectivity is reduced.

***d. Step Variability***

FACET steps may be directly affected by the number of documents being processed within a batch (variable), or may remain constant within the relevant range of a batch (fixed). The quantity of documents within the batch being processed and linear design of the process both contribute to the added risk of cycle time delays. Step variability is an issue that cannot be controlled by shipboard personnel, and changes to process requirements, or the process itself, must come from SURFPAC, PACFLT, or higher.

***e. Value Consideration***

Each step may be considered as value added (VA) or non-value added (NVA). Steps that contribute directly to PACFLT's goal of digitizing and uploading of quality-KSDs to support audit readiness are considered VA, but those steps that do not directly contribute to PACFLT's goal are considered as NVA. Like step variability, step valuation is an issue that cannot be controlled by shipboard personnel; changes to process requirements, or the process itself, must come from SURFPAC, PACFLT, or higher.

Figure 11 shows the revised current state map with the common traits annotated.





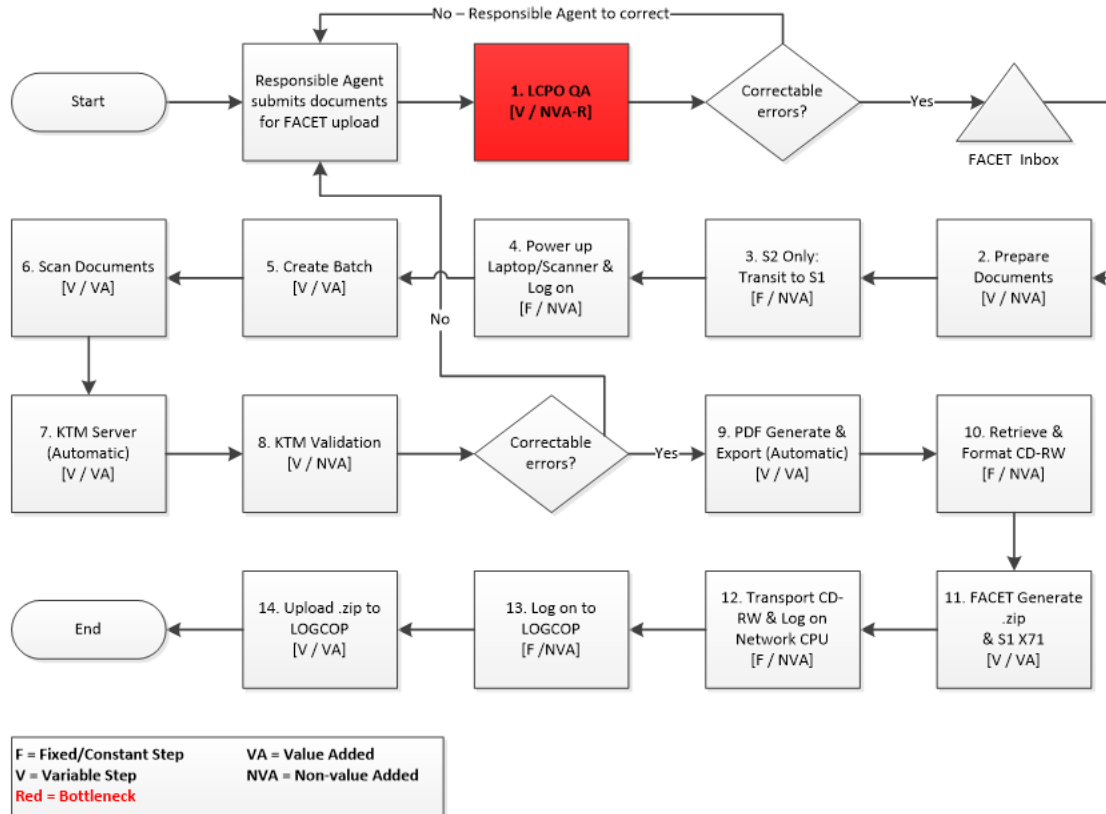


Figure 11. Current State Map (Revised)

Table 6 normalizes each process to a batch of one document, displays the throughput of each step, and identifies the processes efficiency of the FACET process onboard the DDG. Researchers concluded that six of the 14 steps are VA and contribute directly to the customer’s audit readiness goal; as such, the process efficiency of the current process is 42.9%.

Table 6. FACET Process Analysis

FACET PROCESS STEPS (in Seconds)		S1 – DTO RCPTS 1348-1A	S1 – MISC STORES	S1 – STORE ROOM ISSUE	S2 – PV FOOD RCPTS
1. LCPO QA Receipt Inspection [V/NVA-R <sup>23</sup> ]		120	120	120	120
2. Prepare Documents [V/NVA]		20	3.7	19.3	4.3
3. Transit from S2 Office to S1 Office [F/NVA]		N/A	N/A	N/A	57
4. Power Up Laptop/Log On [F/NVA]		60	60	60	60
5. Create Batch [V/VA]		12	3.7	3.3	150
6. Scan [V/NVA]		24	12.6	45.7	10
7. KTM Server (Automatic) [V/VA]		6	5.1	5	3.8
8. KTM Validation [V/NVA]		30	49.4	5	15
9. PDF Generator (Automatic) and Export (Automatic) [V/VA]		6	2.3	3.3	1.3
10. Retrieve & Format CD-RW [F/NVA]		60	720	N/A	N/A
11. FACET Database—Generate X71 and ZIP Files [V/VA]		22	4.6	10	8.8
12. Transport CD-RW to CPU/Log On to CPU [F/NVA]		90	N/A	N/A	75
13. Log In to LOGCOP [F/NVA]		26	26	30	30
14. Upload ZIP to LOGCOP-FACET (Central Ashore Repository) [V/VA]		9.2	3.6	1.7	5
Total Fixed Time $\sum F$ :		236	806	90	222
Total Variable Time/Document * 1 document $\sum V_i$ :		249.2	205	213.3	318.1
Total Cycle Time of Process $\sum T_i$ :		485.2	1011	303.3	540.1
Total VA Steps:	6	Total NVA Steps:	8	Process Efficiency (VA/Total Steps):	42.9%

The researchers ultimately concluded that quality defects of KSDs are the most significant issue to audit readiness onboard the DDG, which contribute to variability in risk of audit sample failure.

<sup>23</sup> Researchers consider Step 1 as a non-value added step if the process is free of defects. However, this step is required by COMPACFLT.



## 2. Cause-and-Effect Analysis

Researchers utilized a cause-and-effect (fishbone) diagram, shown in Figure 12, to identify the factors that are likely influencing quality defects in the FACET process. The 8Ms—manpower, materials, measurements, methods, machines, mother nature/environment, money, and maintenance—were previously used in the Measurement phase to establish a general understanding of the FACET process, and are used as categorized parameters to allow a methodological cause and effect analysis.

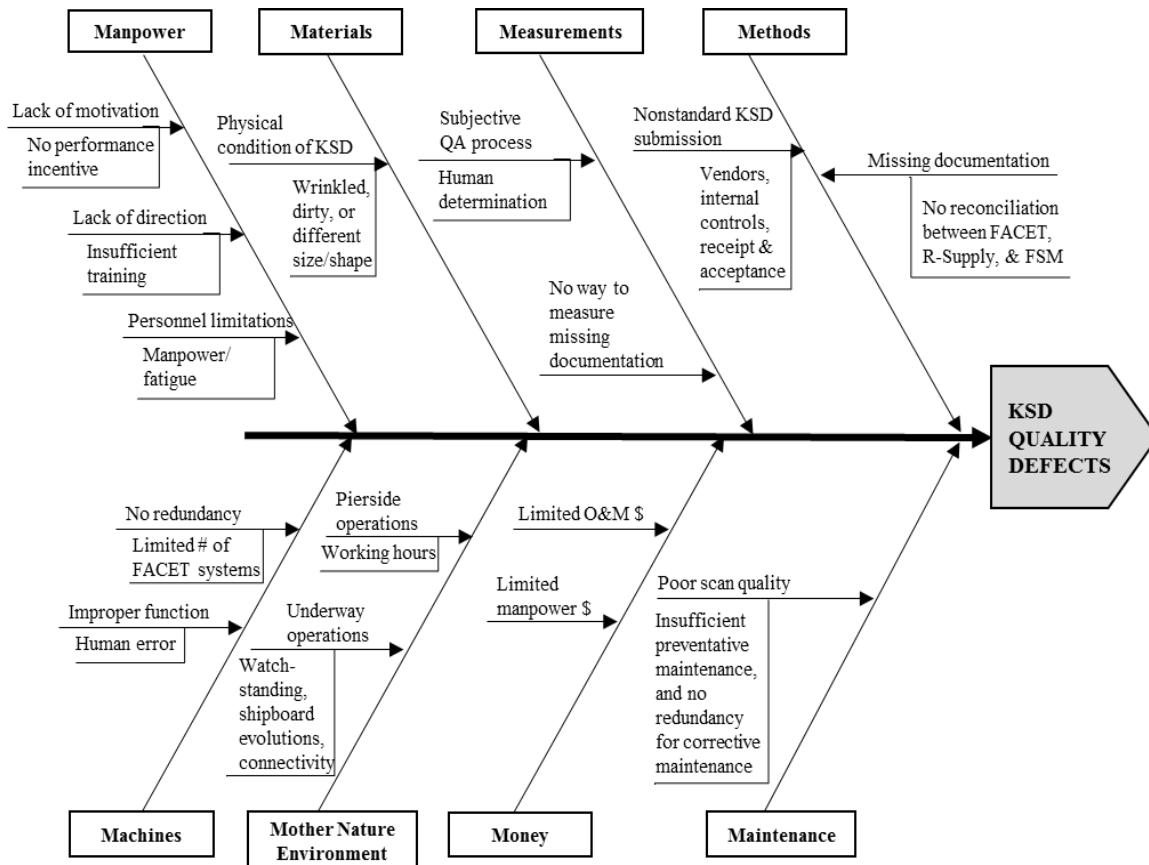


Figure 12. Cause-and-Effect (Fishbone) Diagram

### a. Manpower Causes of Quality Defects

#### (1) Lack of Motivation through Insufficient Performance Incentives

Current performance controls do not provide sufficient incentives to achieve the desired effect, KSDs that meet quality standards, consistently. While most Supply Department guidance has been updated with Financial Improvement Audit Readiness (FIAR)

and FACET objectives and procedures, the department's performance evaluation—referred to as the Supply Management Certification (SMC)—has not been revised to include audit readiness as a gradable factor. Additionally, responsible agents that are external to the Supply Department currently have no incentive to provide quality documentation.

(2) Lack of Direction through Insufficient Training

As previously mentioned, several Supply Department personnel interviewed stated that FACET training had only been conducted via on-the-job training (OJT). None of the personnel on board received classroom training with regards to FIAR or FACET. OJT is generally less costly than classroom training but lacks the standardized coverage of the topic.

(3) Personnel Limitations through Insufficient Manpower and Fatigue

Supply Department personnel involved in the FACET process do so as a collateral duty. Primary duties and shipboard evolutions limit the time available to accomplish tasks related to audit readiness, such as the FACET process. S2 Division personnel are faced with additional time constraints through ongoing trips to S1's Divisional office where the FACET system is located; additionally, S2 personnel are restricted in the ability to multitask while they are waiting on automatic steps of the FACET process in the S1 office.

***b. Materials Causes of Quality Defects***

(1) Poor Physical Conditions of KSDs

Poor physical conditions of KSDs adversely affect the FACET process. Wrinkled, dirty, or different sized documents increase the risk of a scanning malfunction, which could cause documents to be skipped or illegible once scanned into FACET. This would also add additional rework to correct and rescan KSDs, or may require an administrative/dummy receipt if the KSD cannot be corrected.

***c. Measurements Causes of Quality Defects***

(1) Subjective QA Process through Human Determination

In step one, the LCPO visually verifies the KSD quality prior to placing the documentation into one of the designated inboxes for the FACET coordinator. The LCPO



makes the initial determination that a KSD is not correctable and must be processed as an administrative/dummy receipt. The LCPO may also decide that the KSD has all the requisite information and can be processed as a batch of like-documentation but would still not know if FACET were going to require rework from the coordinator to manually input information.

(2) Inability to Measure Missing Documentation

There is currently no automated method on board to determine if a KSD is missing from LOGCOP. Transactions from FSM or RSUPPLY would require manual reconciliation with FACET or LOGCOP to identify missing documentation. If the original KSD could not be located, an administrative/dummy receipt must be created in FACET and uploaded to LOGCOP.

*d. Methods Causes of Quality Defects*

(1) Nonstandard KSD Submission from Vendor

As previously mentioned, the vendor-submitted KSDs scanned under the S1 Miscellaneous Stores batch were missing required information, such as national stock number (NSNs), unit identification code (UIC), and document numbers that match the DDG's purchase order or requisition number.

(2) Nonstandard KSD Submission due to Insufficient Internal Controls

Researchers observed several instances where effective internal controls should have prevented quality defects from moving through the FACET process. The S1 FACET coordinator corrected minor administrative defects during the observation, such as rewriting illegible printed names and researching NSNs for vendor invoices, which were defects that should have been discovered by the S1 recordskeeper or RPPO who passed the KSD on to the LCPO who conducted the QA inspection in step 1. Theoretically, no KSD with quality defects should have been placed in the FACET coordinator's inboxes.



- (3) Missing Documentation due to Lack of Reconciliation Process between FACET, R-Supply, and FSM

The root cause of missing documentation is the inability to automatically identify missing documentation onboard. The lack of an effective method results in the inability to measure missing documentation, as mentioned previously.

*e. Machine Causes of Quality Defects*

- (1) Manpower Fatigue and Human Error due to Limited Quantity of FACET Systems Onboard (No Redundancy)

The lack of a FACET system in the S2 office increases the risk that KSDs will be lost or damaged prior to scanning and uploading into LOGCOP. First, the S2 FACET coordinator must collect and sort food service KSDs. Next, those KSDs must be hand-carried across the DDG to the S1 office. Finally, the S2 FACET coordinator must wait until the FACET system is available before the food service KSDs can be scanned into FACET. These non-value-added steps require extra effort and movement for the S2 FACET coordinator, and may contribute to fatigue from completing primary and secondary duties.

- (2) System Malfunction due to Human Error

Improper sorting in step 2 or improper loading of the scanner in step 6 may cause poor quality or missing photos of KSDs.

*f. Mother Nature/Environment Causes of Quality Defects*

- (1) Pierside Working Environment Limited by Primary Duties

Quality defects in KSDs can be overlooked as personnel involved in the FACET process hasten to complete both primary and collateral duties within the limited working hours, which is normally a 10-hour work day.

- (2) Underway Working Environment Limited by Watchstanding, Shipboard Evolutions, Primary Duties, and Connectivity

Although working hours are normally extended from 10-hour work days to 12-hour shifts while underway, personnel involved in the FACET process face additional competing priorities. Personnel must still complete their primary and collateral duties, but do so between



shipboard training evolutions, shipboard operations, and watchstanding. Quality defects in KSDs can result as personnel hasten to complete these duties.

Time is also taken away from required duties when connectivity is reduced. Time is added to the FACET process while the FACET coordinator waits for LOGCOP or ARMDEC<sup>24</sup> websites to open, log in, and subsequently upload the FACET .zip files.

***g. Money Causes of Quality Defects***

- (1) Budgetary Restraints on Manpower and Operations and Maintenance (O&M) Funding

Limited manpower funding restricts the amount of personnel allocated to each ship, department, and billet. Shipboard training, watchstanding, and operational requirements do not generally change according to manpower levels, and an under-manning situation can lead to longer working hours or fatigue for personnel. Limited O&M funding can prevent the purchase of a second FACET system or replacement parts, which would add transit, wait time, and possibly fatigue for the S2 FACET coordinator. As mentioned above, fatigue can lead to cause personnel to overlook quality defects in KSDs.

***h. Maintenance Causes of Quality Defects***

- (1) Poor Scan Quality due to Insufficient Periodic Maintenance

An improperly maintained scanner can cause reduced quality of scanned KSDs or cause missing KSDs as documents stick together through the document feeder.

- (2) Poor Scan Quality due to No Redundancy for Corrective Maintenance

The inability to procure replacement or repair parts of damaged scanning components, such as sensors and rollers, can force the continued use of a scanner that may produce KSD batches that have poor resolution or missing documents.

---

<sup>24</sup> The leading petty officer of S1 mentioned that ARMDEC had been used as a workaround procedure. Refer back to the Measurement phase for more details.



### **3. Failure Mode and Effects Analysis**

Utilizing the information gleaned from the Fishbone diagram, researchers conducted further examination of the data using Failure Mode and Effects Analysis (FMEA). The purpose of FMEA is to recognize and evaluate the potential failure of a product or process and the effects of that failure. Additionally, a FMEA serves to identify actions that could eliminate or reduce the chance of the potential failure occurring. When developing an initial FMEA, identified risks are based on existing data from similar processes. As processes are implemented, new unforeseen risks and failures may show up and should be documented. In this research, the observed actual and potential failures of the FACET process were evaluated to assess the risk of failure during a financial audit on board the DDG. The FMEA was then utilized to identify possible action plans to improve the current controls or reduce the frequency of occurrence of the failure cause.

After reviewing the “as is” flowchart for KSD processing in great detail, the researchers had defined two key functions of FACET that could lead to unwanted effect of audit failure. These functions are (1) KSD uploads to LOGCOP and (2) KSD quality (see Table 7). The potential failure modes, or manners in which a process step or product component could fail to perform its intended function, are taken from the determinations made in the cause-and-effect analysis. Additionally, the potential failure effect and their causes were placed into the FMEA chart under the appropriate function.





Table 7. Failure Mode and Effects Analysis (FMEA)

Function	Potential failure mode	Potential failure effect	Severity rating (S)	Potential causes of failure	Occurrence rating (O)	Current process controls	Detection rating (D)	Risk Priority Number (RPN)	Risk ID
QA KSDs	Missing information on original KSD	Rework to research, correct, and resubmit KSDs during an audit	9	Poor quality KSDs from Vendor	9	None	2	162	1
	Unreadable or illegible handwriting on KSD			Human Fatigue	7	Supervisor oversight	5	315	2
	Incorrect information on KSD			Human subjectivity for QA determination	6	2 person visual verification	6	324	3
	KSD is missing			Cannot reconcile all transactions with KSDs	8	Manual verification	9	648	4
Upload KSDs to LOGCOP	Shipboard connectivity failure	KSDs are not uploaded to LOGCOP	8	Shipboard/pierside COMMS operations	2	None	3	48	5
				IT systems down	1	None	3	24	6
				Lack of machine redundancy	10	None	3	240	7
				Limited number of FACET machines	10	None	3	240	8
	FACET machine failure	Upload poor quality KSDs	5	Lack of maintenance	1	None	3	15	9

There are three ratings used in FMEA to quantify and evaluate the potential failure of a process/product. Each rating is subjectively determined by the researchers, based on previous LSS analysis and observations, and is based on a 1–10 scale. The severity rating (S) corresponds to each effect the failure mode can cause. The occurrence rating (O) relates to the likelihood or frequency at which the cause can occur. Finally, the detection rating (D) corresponds to the ability to detect the occurrence of the failure mode. When all three ratings have been determined, the risk priority number (RPN) can be calculated with the following formula:  $S \times O \times D = RPN$ . The RPN represents a numerical value for each cause of failure by combining all three ratings, which can later be used to prioritize the actions to be taken to reduce the risk. (Munro, et al. 2008) The higher the RPN, the greater the risk:

S → Severity of failure effect

O → Frequency of failure cause

D → Detection of failure mode

RPN → Process or product failure risk

## **B. IMPROVE**

The researchers have developed a comprehensive set of recommendations based on the LSS analysis performed on the data and observations. When taken to action, these recommendations will greatly improve the KSD QA and upload functions in FACET to reduce the risk of audit failure.

### **1. Recommendations**

While future studies would undoubtedly offer greater clarity, our admittedly tentative study suggests some possible improvements. The following are researcher-developed recommendations to implement in the Navy fleet to improve the FACET system process with LSS techniques.

#### ***a. Quarterly Commanding Officer QA Checks***

As an added quality control measure, the commanding officer (CO) or executive officer (XO) should perform periodic checks on the receipt documents in the FACET system.



FIAR has been regarded as a Navy-wide priority with more emphasis on leadership engagement to ensure proper “tone at the top” and compliance with FIAR directives. On a U.S. Navy ship, the Supply Department manages and controls the FACET system independently from all other departments. The CO is responsible for ensuring that the ship is maintaining the audit readiness standards in case the ship needs to respond to an audit. Therefore, the CO has a vested interest in ensuring that the FACET users are performing their duties as required. Allowing the CO or XO the ability to check on periodic FACET scans would not only serve as a control mechanism to observe FIAR directly, but also set the right “tone” for the crew to understand the importance of audit readiness on his/her ship.

***b. Require All Vendors to Provide a Standardized Receipt with All Order Deliveries***

According to FIAR requirements, every receipt document must include the document number, NSN (if applicable), unit of issue, circled quantity, signature, legibly printed name, date received, and any discrepancies in order to substantiate an order transaction. In some cases, the vendor receipt does not contain some of the required information, which leads to additional work for FACET users to conduct research, sometimes requiring contacting the vendors directly. Missing invoice information is one of the few non-controllable factors that lead to delays and increases the risk of audit sample failure.

The problem with missing information on receipts can be easily remedied by enforcing stricter rules regarding meeting the invoice requirements during contract negotiations with the vendors. The Navy could implement a general instruction to require all vendors to only use one type of form, called the DD-1348, with all order deliveries. The 1348 is a KSD approved for audit purposes and has all the necessary information needed for an audit. Making 1348s mandatory for all orders, and threatening to cut ties with the vendor for non-compliance, would ensure that all KSDs are submitted in the correct format and would not need to be corrected. If making DD-1348 mandatory is not possible, the material receiving process can be changed so that vendors who do not send DD-1348s with their deliveries will not receive payment until one is provided. When a material order arrives, the receiving unit would reach back to the vendor and request for them to fill out a blank DD-



1348 to complete the order. The vendors would be incentivized to always include the correct KSDs in order to avoid delayed payments for orders.

***c. Require Two FACET Systems on All Navy Ships with an Additional Spare Onboard***

As discovered in this case study research, only one FACET system could be found on the ship, and it was located in the S1 office. Consequently, S2 had to share the use of the FACET laptop/scanner with S1. Sharing one computer makes it more difficult to utilize the system efficiently, leading to more wasted manpower time. For instance, the S2 FACET coordinator would need to wait on S1 to finish their KSD uploads before he/she could start using the system.

Another reason to install a second FACET system is to have a backup system ready in case one fails. This would ensure continuity of FACET scanning even with one system down. Currently, only one FACET machine on a ship is a “single point of failure” and would cause a major lag in KSD upload capability until the inoperable system is fixed or replaced.

***d. Contingency Plan for Reduced/Loss of Shipboard Connectivity for LOGCOP***

Connectivity while underway could cause problems for a ship’s ability to upload KSDs to LOGCOP under normal operations or during an audit sample request. Many times, the ship may be without communication for days at a time due to operations. During this “down” period, a ship may need to respond quickly to an auditor’s request for KSDs but would not be able to transmit the necessary information to LOGCOP without internet connectivity. Failure to respond to a sample request would lead to an automatic sample failure during an audit, and would reflect poorly on the ship’s ability to demonstrate an adequate audit response.

The solution to this problem would be to purchase an internet-capable satellite phone that has the ability to connect the FACET system to the internet when shipboard connectivity is down. The FACET user would be able to conduct the KSD upload unimpeded by a shipboard loss of connectivity. Another solution to shipboard connectivity issues, in which internet use is restricted to key personnel with bandwidth restrictions, is to require FACET



users to utilize the ARMDEC SAFE site to upload KSDs during the upload process. Under normal operations, a KSD upload could take potentially large amounts of internet bandwidth with large file attachments. By using the ARMDEC SAFE site, the gradual upload of data would not cause bandwidth disruption or limitations. A COMNAVSURFPAC or Premier Solutions HI, LLC representative could then upload the .zip files to LOGCOP from their location.

*e. FIAR/FACET Training*

Many of the sailors on board Navy ships have not received formal training on the proper use and maintenance of the FACET system. Nearly all personnel involved with FACET have only received OJT as a “pass down” from previous FACET users. Additionally, very few individuals have had training on FIAR in general and are not aware of the importance and reasoning behind the implementation of FACET for audit readiness.

The way to generate the proper mindset for FIAR and FACET use would be to ensure new personnel are adequately educated in these areas prior to reporting to a ship. Therefore, FIAR/FACET training should start at LS/CS A-schools for enlisted, and BQC for prospective supply officers. Additionally, all unit prospective Commanding Officers (COs) should have a more robust understanding of the importance of FIAR and would need to have a dedicated curriculum for them at P-CO school. There should also be a plan in place to bridge the training gap until audit readiness curriculum is fully implemented.

*f. R-Supply/FSM and FACET System Interface*

The Unit Level Relational Supply (R-Supply) database is the afloat logistics application used on all Navy ships for online logistics, inventory, and financial management functions. All MILSTRIP orders are placed, tracked, and received through RSupply, and all transactions are reconciled periodically with ashore units who monitor financial activity. In food service, the Food Service Management (FSM) program orders, tracks, and receives food items, and all orders are continually monitored by food service personnel. The FACET system does not currently communicate information with RSupply or FSM because it is a stand-alone system and the software is not compatible between the different systems. When



supply or food items are received, stored, or issued, RSupply/FSM is used first to capture the transaction in the normal database, then the KSDs are processed on the stand-alone FACET system.

When KSDs from order deliveries are missing, the Supply Department is required to perform research on the missing documents to reconcile orders with deliveries in the RSupply or FSM system. Since orders are constantly checked against receipts in both RSupply and FSM, there is a reconciliation oversight over the transactions before the KSDs are scanned into FACET. There is a possibility that KSDs can be lost or missing in between transaction captures. One possible solution to the problem of potentially missed documents would be to make the FACET system and software backward compatible with RSupply and FSM so that all transactions can be flagged if a corresponding KSD is not uploaded to LOGCOP. This would greatly reduce the chance that a missing or lost document would become overlooked.

***g. Stamps for Receipt Documents***

When a part is issued to a workcenter from S1, the person receiving the item must sign for the item directly on the KSD so that the receiver name and signature are legible. Many times, the name written on the KSD is illegible and would result in a poor quality KSD that is not auditable and causes an audit sample failure.

The solution to this problem would be to require all receiving agents to have their own name/signature stamp which can easily show the name of the receiver. A ship's Supply Department could use its own funds to purchase these stamps for the designated receivers on the ship. The issue of illegible handwritten names would be solved and lead to a decrease in the possibility of QA failure during an audit.

**2. FMEA Tracking**

FMEA is a powerful tool to use in an improvement project; however, it requires leadership and management commitment to be effective. An action plan to improve current controls or reduce the frequency of the occurrence of the cause will have an enormous impact on reducing the risk of failure during an audit. A FMEA action plan will typically fail due to



lack of management support, conflicting priorities, lack of resources, and lack of team leadership. The best way to keep track of an action plan is to manage the plan effectively and to periodically review and update it as necessary. (Munro, et al. 2008)

A simple way to determine which risks to address first as a priority for action would be to sort RPNs in descending order in a rank order chart, also known as a Pareto chart. The bar graph in Figure 13 shows which RPNs are the highest value and therefore determines which risks to mitigate first since they have high severity, occurrence, and detection ratings. The first three large RPN items are Risk ID 4, then 3, then 2. The majority of concern would be eliminated by addressing these relatively few, but very potent, top items.

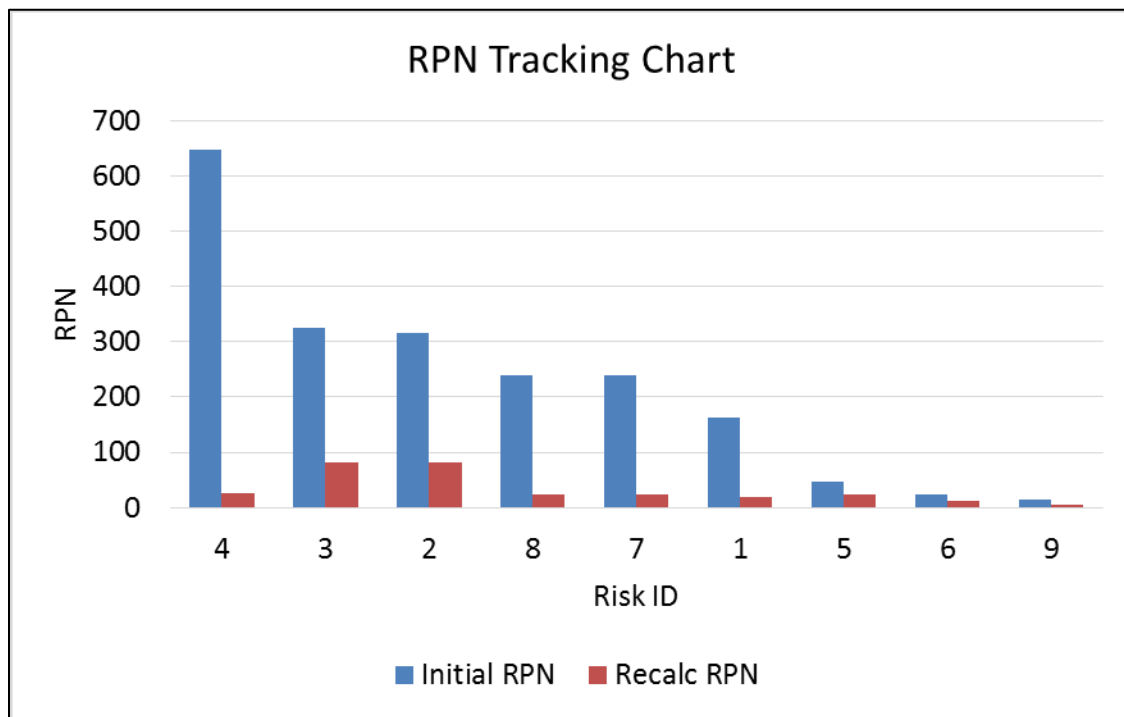


Figure 13. Risk Priority Number Tracking (Pareto) Chart

For the FACET process improvement, all researcher-suggested actions would lead to a major reduction in the RPN, as calculated in Table 8. For instance, when a back-up FACET is purchased, Risk ID 7 (Lack of machine redundancy) would have a lower RPN because the occurrence rating would drop from 10 to 1. These are judgmental values in RPN for after taking action. In reality, an RPN recalculation would be assessed later based on evidence such as testing and other observations.

Table 8. Risk Priority Number Ranking

Before taking action					After taking action					
Risk ID	S	O	D	Initial RPN	Risk ID	S	O	D	Recalc RPN	Delta
4	9	8	9	648	4	9	1	3	27	-621
3	9	6	6	324	3	9	3	3	81	-243
2	9	7	5	315	2	9	3	3	81	-234
8	8	10	3	240	8	8	1	3	24	-216
7	8	10	3	240	7	8	1	3	24	-216
1	9	9	2	162	1	9	2	1	18	-144
5	8	2	3	48	5	4	2	3	24	-24
6	8	1	3	24	6	4	1	3	12	-12
9	5	1	3	15	9	5	1	1	5	-10

### 3. Quick Lean Fixes

While setting failure risk priorities based on RPN value for process improvement is favorable, a great deal of progress can be achieved by making quick and easy changes from the start. Once an action begins, which creates immediate results, the momentum for process improvement builds for easy adoption on the part of the process users.

One of the critical features of lean techniques is immediate feedback. The improvement team and the whole workforce should be able to see things changing before their eyes. This is essential to creating the psychological sense of flow in the workforce and the momentum for change within your organization. (Womack & Jones, 2003, p. 253)

According to FMEA, the three highest value RPNs are also the highest priority risks to improve in the FACET process and would be the first tasks to accomplish when developing an action plan. In many cases, resources are not immediately available to implement from the start. For instance, Risk ID 4 (KSD reconciliation) has the highest RPN value in this research. However, the recommended action to integrate three different software systems into one would take many years to develop and could prove very costly for the Navy. The action is still a high priority, but results would not be immediate.

The best quick Lean fix in the FACET process is to purchase the personal name stamps for all designated receivers. This would be a relatively inexpensive fix that could be





implemented immediately to reduce the failure occurrence rating in Risk ID 3 (Human subjectivity for QA determination). All names on a signed document would be easily read without the need to correct illegible handwriting.

#### **4. Improvements Currently in Process**

Three organizations that have already initiated improvement projects that directly affect the FACET process are COMPACFLT, COMNAVSURFPAC, and the Navy Supply Corps School. These efforts, once fully implemented, will complement the recommendations that this research study has made. Many of the projects are near completion, while others are still in the development phase, waiting for final approval from the chain of command.

##### ***a. COMPACFLT***

COMPACFLT has initiated the approval process to make FACET an authorized system to be installed on the shipboard network. Once approved, FACET process step 10 (retrieve and format CD-RW) and step 12 (transport CD-RW to CPU/log on to CPU) will be eliminated.

##### ***b. COMNAVSURFPAC***

COMNAVSURFPAC has drafted changes into the Supply Management Certification (SMC) checklist to include FIAR and FACET criteria as “pulse points.” By classifying FIAR/FACET-related data points as “pulse points,” Supply Department personnel now have an incentive to maintain audit readiness on board or they may risk disqualification from the Logistics Management Excellence Award (Blue “E”).

##### ***c. Navy Supply Corps School***

The Navy Supply Corps School (NSCS), located in Newport, RI, provides continued training throughout the course of a Supply Corps officer’s career. The schoolhouse has implemented a FIAR basic introduction module into both the Basic Qualification Course (BQC) and Supply Officer Department Head Course (SODHC). Additionally, NSCS is in the process of implementing a hands-on FACET module into both BQC and SODHC, which is



expected to become operational in early FY 2017. See Appendix C for NSCS’ official FIAR and FACET statement.

## 5. Future State Process

The conclusion of the Improvement phase is the revision of the FACET process map, as well as the updated process efficiency calculation. Figure 14 shows the elimination of steps 3, 10, and 12, which were associated with the recommendations and improvements that are already in process. Figure 15 shows the Future State Map, the “to be” process with the reduced number of steps, which equate to a process efficiency increase from 42.9% to 64.2%.

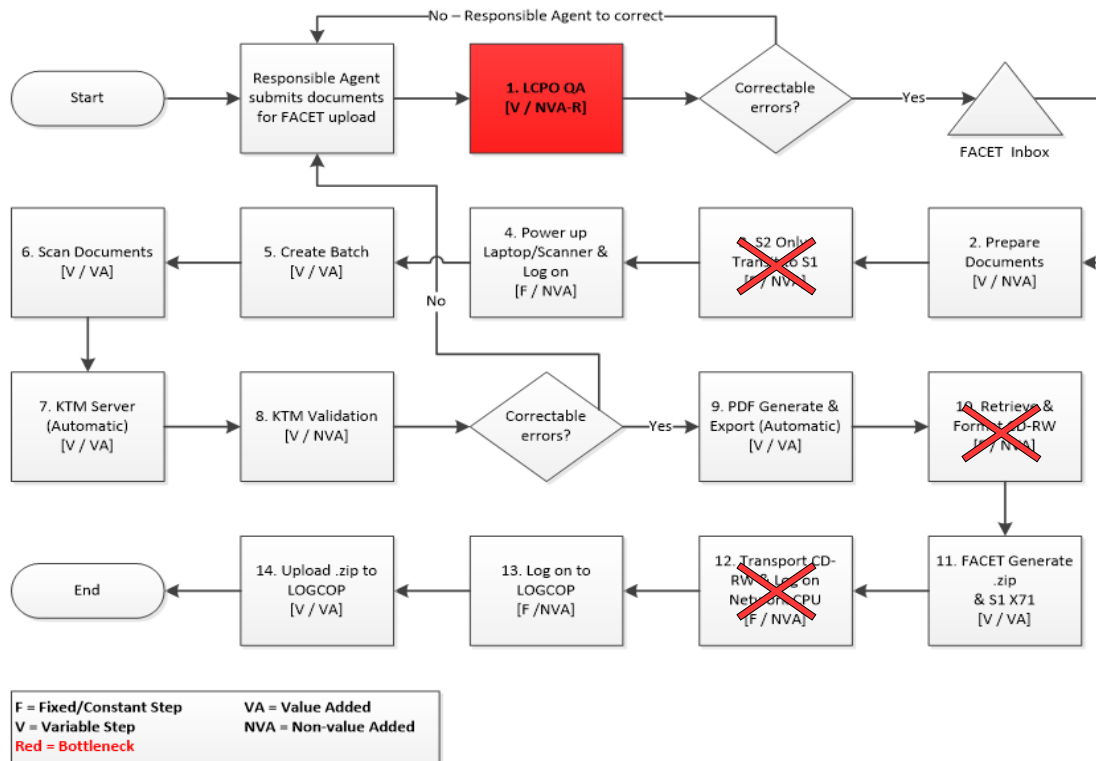


Figure 14. Current State Map (with Improvements)

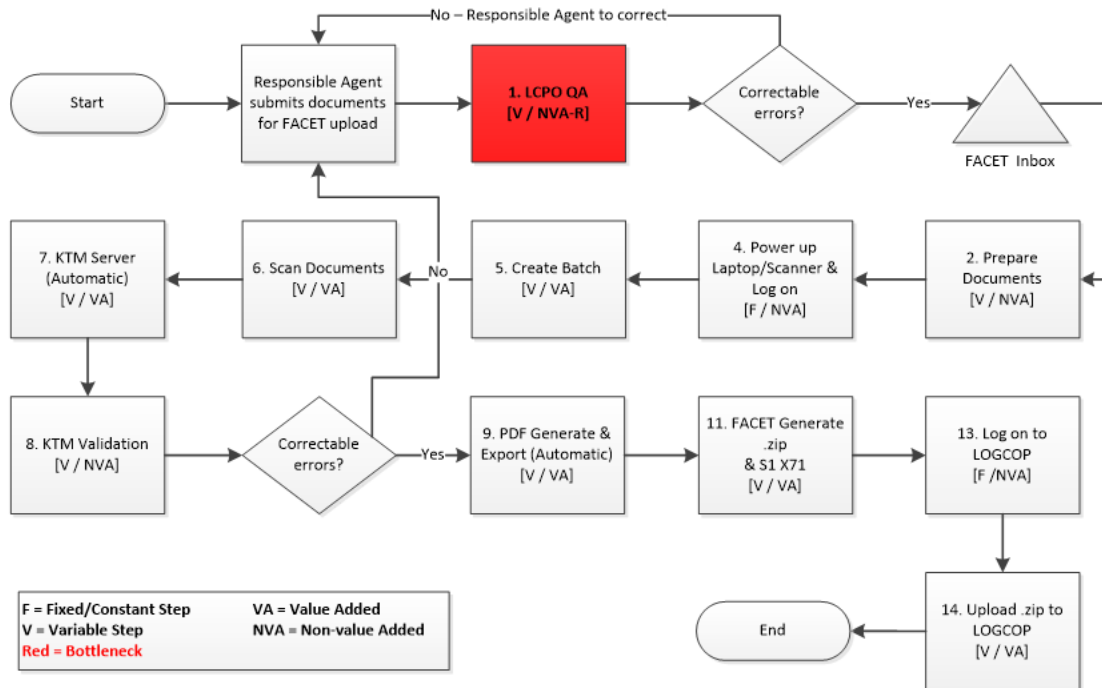


Figure 15. Future State Map

## C. CONTROL

Traditional LSS projects are concluded with a transition plan that is agreed upon by LSS project team members and process stakeholders, including employees responsible for executing the revised process. This case study is limited to only providing recommendations that the DDG and higher echelons can use to control the revised process. Process control charts and balanced scorecards can be used at each level to ensure continued process improvement success.

### 1. Process Control Charts

Over time, historical data will be gathered as the recommendations of this report are implemented. This data can be used to create process control charts to monitor the stability of the revised process and to visually identify process trends that may increase risk of failure. The process average is the centerline of the chart, and data measurements will either fall at, above, or below this line. Upper and lower control limits will visually display the quality threshold of three sigmas above and below the average, or mean, of the process. Data that falls outside of these control limits are considered as non-random variation and should be

investigated if a trend is detected. Both shipboard leadership and higher echelons can utilize these charts to focus on future improvement opportunities.

See Figure 16 for an example of a process control chart.

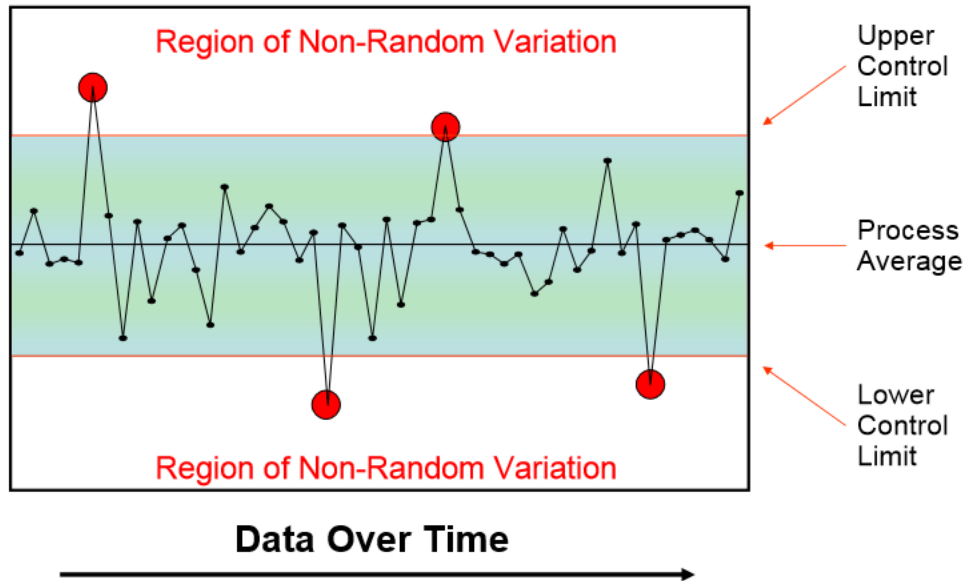


Figure 16. Process Control Chart Example. Source: OSD (2008).

## 2. Balanced Scorecard

COMNAVSURFPAC uses the Continuous Monitoring Program (CMP) as a means to monitor performance of the surface ships under the organization's control. This program is used as a balanced scorecard, which enables managers to look at shipboard operations from important perspectives while minimizing information overload (Kaplan & Norton, 1995). Once the SMC checklist revision with FIAR and FACET "pulse points" is finalized, FIAR and FACET metrics should be added to CMP for continued monitoring. See Figure 17 for an example of the S1 CMP scorecard, or dashboard; colors are used as a visual cue to focus the user's attention.

<b>External MOF</b>				<b>ARRCS</b>	<b>0</b>	Green
<b>DIO</b>	<b>113</b>		Red	Invalid ARRCs	0	
<b>STOCK</b>	<b>839</b>		Red	Valid ARRCs	9	
	<b>DIO</b>	<b>STK</b>		Total Linut Flags	354	
Total records > 10 days old	307	274		Total Inventory Flags in SRF	0	
AO/AT > 10 days and no status	188	213				
AE BM with TD > 10 days	0	0		<b>SIM Zero Balance</b>	<b>21</b>	Yellow
AE BD with ESD > 10 days (Ex NUV)	1	1		SIM Items with Zero Onhand	21	
AE BF, BS, Invalid Status	0	0		<b>Effectiveness - Previous Month</b>		
AE BB,BV,BC,BP with ESD > 10 days	12	15		<b>Gross</b>	<b>0.00</b>	Red
AB/AE BZ with ESD > 30 days	30	1		<b>Net</b>	<b>100</b>	Green
AE BA, BN w/ESD > 60 days (90 OCONUS)	7	5		Total NIS Demands for SIM	0	
AS with ESD > 60 days (90 OCONUS)	45	15		Total NIS Demands for NonSIM	0	
AU with ESD > 60 days (90 OCONUS)	0	0		Total Number of NC	4	
AE B5 with TD > 10 days and exp ESD	1	1		Number of SIM Issues	0	
AN with passed due date	1	0		Number of NonSIM Issues	0	
AO with R9 and TD > 45 days	0	0		Four Month Average Gross	13.00	
				Four Month Average Net	19.00	
<b>Internal MOV</b>	<b>97.14</b>		Yellow	12 Month Average Gross	38.00	
Total Valid Reqs		136		12 Month Average Net	51.00	
Total Invalid Reqs (Closed JCNs)		4		<b>Effectiveness - Current Month</b>		
<b>Reorder Review</b>				<b>Gross</b>	<b>100</b>	Green
Flagged for Inventory (All Cosal Types)		0		<b>Net</b>	<b>100</b>	Green
Flagged for Inventory SIM		0		Total NIS Demands for SIM	0	
<b>HME Dollar Value</b>	<b>\$2,177.97</b>		Yellow	Total NIS Demands for NonSIM	0	
<b>HME Total Line Items</b>	<b>5</b>		Green	Total Number of NC	0	
Def to RO %		0.09		Number of SIM Issues	0	
Range %		98.00		Number of NonSIM Issues	0	
Depth %		94.74		<b>Average Customer Wait Time (Onboard Issues)- Previous Month</b>	<b>0.00</b>	Green
<b>MAMs Dollar Value</b>	<b>\$451,728.26</b>		Red	Number of Issues	0	
<b>MAMs Total Line Items</b>	<b>136</b>		Red	Number of Issues without JCNs	0	
<b>SRF Maintenance</b>	<b>0</b>		Green	<b>Average Customer Wait Time (Onboard Issues)- Current Month</b>	<b>42.00</b>	Red
Invalid SRF Records		0		Number of Issues	1	
Total SRF Records		15,086		Number of Issues without JCNs	0	

Figure 17. Example of S1 CMP Dashboard. Source: COMNAVSURFPAC (2008).



THIS PAGE INTENTIONALLY LEFT BLANK



## **V. SUMMARY, CONCLUSIONS, AND AREAS OF FURTHER RESEARCH**

### **A. SUMMARY**

The Department of the Navy (DON) has made great strides toward achieving audit readiness by implementing major changes in the way naval warships conduct business and retain documentation. These changes are designed to facilitate the retrieval of key supporting documents (KSDs) in support of future financial statement audits—requiring quick responses to auditor requests, specifically shipboard order requisition documentation, that are “correct and complete.” As with many new system processes, deviations from the standard procedure are expected to occur, leading to system inefficiencies as a whole. This case study research observed various Fleet Audit Compliance Enhancement Tool (FACET)–related processes on a single ship to conduct a Lean Six Sigma (LSS) analysis for process improvement.

### **B. CONCLUSIONS**

The FACET process has been a tremendous step in the right direction for DON audit readiness. The system is able to record KSDs into a “cloud” network which can then be retrieved by higher level echelons for audit-related responses without directly requesting documents from the ships. An audit could, in theory, go unnoticed at the unit level while Budget Submitting Offices (BSOs) respond as required to auditor requests.

The major flaw with this setup is that when KSDs are either missing or poor quality, the BSO/Type Commander (TYCOM) will need to reach out to the ship to try to correct the deficiency as the audit occurs. In many instances, when reaching back to the ship, the original uploaded KSDs were poor quality because of illegible handwritten names confirming receipt and acceptance of materials. This research has determined that there are many flaws in the process which have led to (1) unnecessary poor-quality KSD uploads to the cloud network and (2) slow response times for the re-submission of corrected KSDs. The FACET process times, from KSD receipt to final upload, can be shortened on board the ship using LSS methodology; however, the study has concluded that an overall improvement can be made by enforcing steps that reduce the occurrences of KSD defects prior to upload. As



discussed in Chapter IV, making small improvements can have a large impact on the greater effort of audit readiness for the naval fleet.

### **C. AREAS OF FURTHER RESEARCH**

As mentioned, this case study is limited in scope because the research was conducted on a single ship with one observation of four processes available at the time of the study. All time trial values were sampled with the assumption that the time would be the same in all instances of document uploads. With further research, the time it takes to conduct a step for each process could be accurately measured and all LSS analysis values would subsequently change. The following are general areas regarding FACET that could be looked at for further research:

**Conduct a fleetwide survey on other types of ships and generalize the data for benchmarking and further cost benefit analyses.**

Future researchers could create a survey, much like the following Figure 18, to be sent to all supply department personnel involved with FACET. The purpose of this survey is to collect data from multiple sources without direct observations, which would be too tedious and cumbersome. The survey responses can be analyzed further to create a database of process times to be used for other manpower-related cost analyses. Researchers may find it beneficial to use close-ended, multiple-choice questions, where choices are separated as bins of ascending times (such as 0–5 seconds, 6–10 seconds, 11–15 seconds, etc.), instead of open-ended questions, where survey respondents provide their own answers. By doing so, researchers provide survey respondents with simple choices, which could also reduce the chances of erroneous answers.





Please fill out the survey as completely and accurately as possible.	
1. What class of ship are you on?	CG, DDG, LCS, LSD, LPD, LHD, LHA, MCM
2. What division in the Supply Department do you work in?	S1-S8
3. What is your rank?	E-1 through O-6
4. Please select your primary position:	Supply Department Head, Dept LCPO, Division Officer, Div LCPO, Div LPO, Recordskeeper, none of the above.
The following questions relate directly to FIAR/FACET accountability.	
5. Please annotate the typical size of a single batch of documentation that is uploaded in FACET.	ABCDE
6. Please select the letter that best describes the amount of time used to complete each step. Mark <i>only</i> the steps that apply directly to you (either perform directly or waiting), otherwise select N/A.	
6.1. Preparation of a single batch of documentation <i>a) Remove all staples, unfold “dog eared” corners, and cut double printed receipts in half. b) Verify circle, sign, and date on every receipt.</i>	ABCDE
6.2. QA review of a single batch of documentation <i>Per FIAR requirements, every receipt document must include the document number, NSN (if applicable), unit of issue, circled quantity, signature, legibly printed name and date received, and any discrepancies noted.</i>	ABCDE
6.3. Time to carry a single batch of documentation from your office over to the FACET system	ABCDE
6.4. Powering up hardware, and creating a batch file in FACET	ABCDE
6.5. Scanning a single batch of documentation into FACET	ABCDE
6.6. Wait time for KTM/recognition server	ABCDE
6.7. Validation of a single batch (review & index)	ABCDE
6.8. Wait time for .pdf generation, export, and zip file generation	ABCDE
6.9. Time to upload zip file to LOGCOP	ABCDE

Figure 18. Potential Survey to Send to Supply Department Representatives

**Conduct a “mock” audit on a ship.**

Much of this research case study looks at the “day-to-day” operations on board a ship under normal circumstances. To better understand how a ship would react to an actual auditor request, it would be necessary to perform audit testing using the same testing criteria of the auditor. The responses and data coming from the ship would be a better representation of an actual encounter of KSD resubmission.



THIS PAGE INTENTIONALLY LEFT BLANK



## APPENDIX A. LEAN SIX SIGMA TEMPLATES

Define	Measure	Analyze	Improve	Control
<input type="checkbox"/> <b>Project Charter</b> <ul style="list-style-type: none"> <li>▪ Clear Problem Statement</li> <li>▪ Business Case justified</li> <li>▪ Goals/Benefits identified</li> <li>▪ Realistic scope</li> </ul>	<input type="checkbox"/> <b>“As Is” Process Map</b> <ul style="list-style-type: none"> <li>▪ Swim lanes identified</li> <li>▪ All steps documented</li> </ul>	<input type="checkbox"/> <b>Likely Influencing Factors (Potential Xs)</b> <ul style="list-style-type: none"> <li>▪ Clearly identified</li> <li>▪ Related to problem</li> </ul>	<input type="checkbox"/> <b>“To Be” Process Map</b> <ul style="list-style-type: none"> <li>▪ Swim lanes identified</li> <li>▪ Optimal flow</li> <li>▪ Value-added steps</li> </ul>	<input type="checkbox"/> <b>Transition Plan</b> <ul style="list-style-type: none"> <li>▪ Documented handoff from Project Lead to Process Owner</li> <li>▪ Finalized SOPs and business rules</li> </ul>
<input type="checkbox"/> <b>Measurable Output (Y)</b> <ul style="list-style-type: none"> <li>▪ Known Target/Goal</li> <li>▪ Voice of the Customer (VOC) expectations identified</li> <li>▪ ID Existing/Necessary metrics</li> </ul>	<input type="checkbox"/> <b>Data Collection Plan</b> <ul style="list-style-type: none"> <li>▪ Data Collected</li> <li>▪ Sample size identified</li> <li>▪ ID Data categorizing methods</li> </ul>	<input type="checkbox"/> <b>Most Influential Factors (Critical Xs)</b> <ul style="list-style-type: none"> <li>▪ Clearly identified</li> <li>▪ Related to problem</li> </ul>	<input type="checkbox"/> <b>Improvement Strategy</b> <ul style="list-style-type: none"> <li>▪ List improvement steps</li> <li>▪ Draft SOPs and business rules</li> </ul>	<input type="checkbox"/> <b>Quality Control Chart</b> <ul style="list-style-type: none"> <li>▪ Charts that monitor process performance with defined boundaries</li> </ul>
<input type="checkbox"/> <b>Key Players identified</b> <ul style="list-style-type: none"> <li>▪ Champion</li> <li>▪ Sponsor</li> <li>▪ Process Owner</li> <li>▪ Team Members/Belts</li> </ul>	<input type="checkbox"/> <b>Data Display</b> <ul style="list-style-type: none"> <li>▪ Shows range, frequency, standard deviation</li> <li>▪ Shows basic nature of the problem</li> </ul>	<input type="checkbox"/> <b>Required Data Display</b> <ul style="list-style-type: none"> <li>▪ Pareto Chart</li> <li>▪ Fish Bone Diagram</li> <li>▪ Histogram</li> </ul>	<input type="checkbox"/> <b>Mistake Proofing</b> <ul style="list-style-type: none"> <li>▪ Identify processes or procedures that don't allow error</li> </ul>	<input type="checkbox"/> <b>Communication</b> <ul style="list-style-type: none"> <li>▪ Announcing new processes and business rules to the organization</li> </ul>
<input type="checkbox"/> <b>Project Timeline</b> <ul style="list-style-type: none"> <li>▪ Completion dates each phase</li> <li>▪ Realistic</li> </ul>	<input type="checkbox"/> <b>Identified CTQs/CTPs</b> <ul style="list-style-type: none"> <li>▪ Key factors Critical to Quality</li> <li>▪ Key factors Critical to Process</li> </ul>	<input type="checkbox"/> <b>Optional Data Display</b> <ul style="list-style-type: none"> <li>▪ Descriptive Statistics</li> <li>▪ Time Series Plots</li> <li>▪ Control Charts</li> </ul>	<input type="checkbox"/> <b>FMEA</b> <ul style="list-style-type: none"> <li>▪ Failure Mode Effect Analysis</li> <li>▪ Prioritize most significant steps that can fail</li> </ul>	<input type="checkbox"/> <b>Project Documentation</b> <ul style="list-style-type: none"> <li>▪ Ensures complete documentation of all phases of project</li> <li>▪ Required for Belt certification</li> </ul>
<input type="checkbox"/> <b>SIPOC Diagram</b> <ul style="list-style-type: none"> <li>▪ Identifies correct Suppliers, Input, Process, Output and Customers</li> </ul>	<input type="checkbox"/> <b>Output Target (Y)</b> <ul style="list-style-type: none"> <li>▪ Show actual performance as compared to desired target</li> </ul>	<input type="checkbox"/> <b>XY Matrix</b> <ul style="list-style-type: none"> <li>▪ Correlation among factors</li> <li>▪ Weighted values</li> </ul>	<input type="checkbox"/> <b>Risk Analysis and Risk Mitigation Plan</b> <ul style="list-style-type: none"> <li>▪ Understanding and managing factors that influence risk</li> </ul>	

Figure 19. Lean Six Sigma Tollgate. Source: DOD (2008).

<b>Champion</b>							
<b>Sponsor(s)</b>							
<b>Project:</b>							
<b>Team members:</b>							
<b>Issue Date:</b>							
<b>Project Evaluation Criteria</b>							
<b>1. Business Case:</b>	<i>Describe how completing this project will improve organizational goals. In addition, state how completion of this project is in alignment with organizational objectives.</i>						
<b>2. Problem Statement:</b>	<i>Describe the nature of the problem in quantifiable terms.</i>						
<b>3. Scope:</b>	<i>Describe parameters and key leverage points within the process.</i>						
<b>4. Impact:</b>	<i>Define the impact the problem is having on the organization and business.</i>						
<b>5. Goal(s):</b>	<i>Describe the goal of the project in quantifiable terms.</i>						
<b>6. Customers:</b>	<i>Describe the person(s) or organization that will benefit (directly and indirectly) from the project.</i>						
<b>7. Stakeholders:</b>	<i>Stakeholder is any person, organization, or function having an interest (positive and negative) in the project.</i>						
<b>8. Measurements:</b>	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 33%; text-align: center;">Current</th> <th style="width: 33%; text-align: center;">Goal</th> <th style="width: 33%; text-align: center;">Improvement</th> </tr> </thead> <tbody> <tr> <td style="vertical-align: top;"><i>Critical to Quality (CTQ) Characteristics: Quality, Cost, Schedule, and/or Risk</i></td> <td></td> <td></td> </tr> </tbody> </table>	Current	Goal	Improvement	<i>Critical to Quality (CTQ) Characteristics: Quality, Cost, Schedule, and/or Risk</i>		
Current	Goal	Improvement					
<i>Critical to Quality (CTQ) Characteristics: Quality, Cost, Schedule, and/or Risk</i>							
<b>9. Schedule</b>	<i>Can be included in the project charter or as a separate document.</i>						

Figure 20. Project Charter Template. Adapted from DOD (2008).



Date Initiated:		Pri	POC					
Date Last Updated:		Pri	POC	-				
Project Name:				Sec	POC			
				Sec	POC	-		
<b>Item</b>	<b>Type</b>	<b>Event</b>	<b>Date</b>	<b>Description</b>	<b>Support</b>	<b>Ref</b>	<b>Status</b>	<b>Comments</b>

Figure 21. Project Plan of Actions and Milestones Template



Table 9. SIPOC Table. Adapted from Office of the Secretary of Defense (2008).

<b>SIPOC Steps</b>				
<p>Step 1: Name the Process. <i>Agree on beginning and end (boundaries).</i></p> <p>Step 2: Specify primary <u>O</u>utputs and the <u>C</u>ustomers receiving them. <i>Use nouns for outputs (e.g., Intel report, training, etc.).</i> <i>Use adjectives for CTQs (e.g., timely, knowledgeable, accurate, etc.).</i></p> <p>Step 3: Document the steps in the <u>P</u>rocess. <i>Brainstorm with the whole team.</i> <i>Write each process step on a separate Post-It note and post on wall.</i> <i>Begin all steps with a verb.</i> <i>Don't try to establish order yet.</i> <i>Don't get lost in the details of each step.</i></p> <p>Step 4: Identify critical <u>I</u>nputs which affect the quality of the process.</p> <p>Step 5: Identify the <u>S</u>upplier who provides each input.</p> <p>Step 6: Validate that the map represent how things <u>a</u>ctually work today. <i>Not how you think it is.</i> <i>Not how it should be.</i></p>				
<b>Suppliers</b>	<b>Inputs</b>	<b>Process</b>	<b>Outputs</b>	<b>Customers</b>
<i>A person or organization that provides the inputs to the process.</i>	<i>Resources, materials, and data required to execute the process.</i>	<i>Activities that collect inputs and creates outputs that are valued by the customer.</i>	<i>Products or services created by the process which are valued by the customer.</i>	<i>Internal or external person or organization that receives the outputs of the process.</i>



### Keys to Success

- Start with the big picture • Observe the current process • Record process steps
- Arrange the sequence of steps • Draw the Flowchart

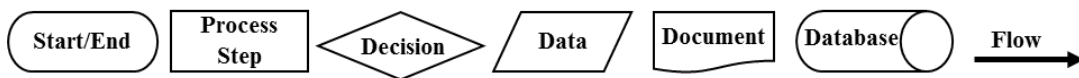
### Interpreting Your Flowchart

- Determine who is involved • Form theories about root causes • Identify ways to simplify and refine
- Determine how to implement changes • Locate cost-added-only steps • Provide training

### Interpretation Steps

- Step 1: Examine each process step. *Bottlenecks? Weak links? Poorly defined steps? Cost-added-only steps?*
- Step 2: Examine each decision symbol. *Can this step be eliminated?*
- Step 3: Examine each rework loop. *Can it be shortened or eliminated?*
- Step 4: Examine each activity symbol. *Does the step add value for the end-user?*

### Symbols Used in Flowcharts



### Levels of Flowcharts (example)

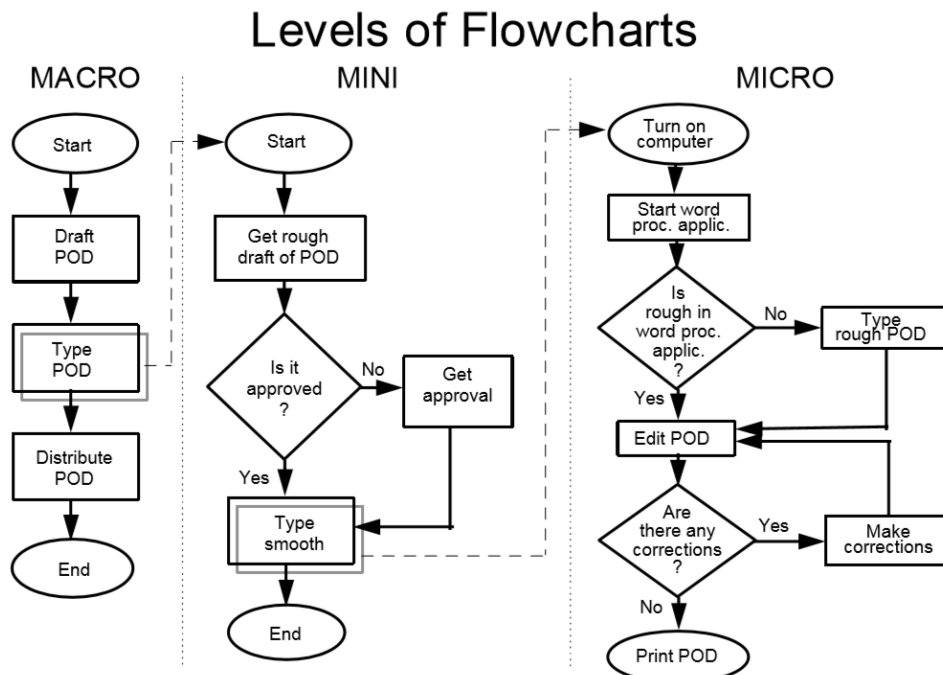


Figure 22. Process Flowchart. Adapted from Air War College (n.d.).

### Cause-and-Effect (Fishbone) Steps

- Step 1: Identify and define the effect.  
*Decide on the effect to examine, use operational definitions, and phrase the effect as a positive (an objective) or negative (a problem).*
- Step 2: Draw the spine and effect.
- Step 3: Identify the main causes contributing to the effect.  
*These are labels for the major branches of your diagram and become categories under which to list the many causes related to the categories.*
- Step 4: Identify specific factors which may be causes under each category branch.
- Step 5: Identify more detailed levels of causes within each category branch.  
*This can be done by asking a series of “why” questions.*
- Step 6: Analyze the diagram.  
*Root-causes may appear repeatedly throughout different branches. Identify and circle the causes that you can take action on.*

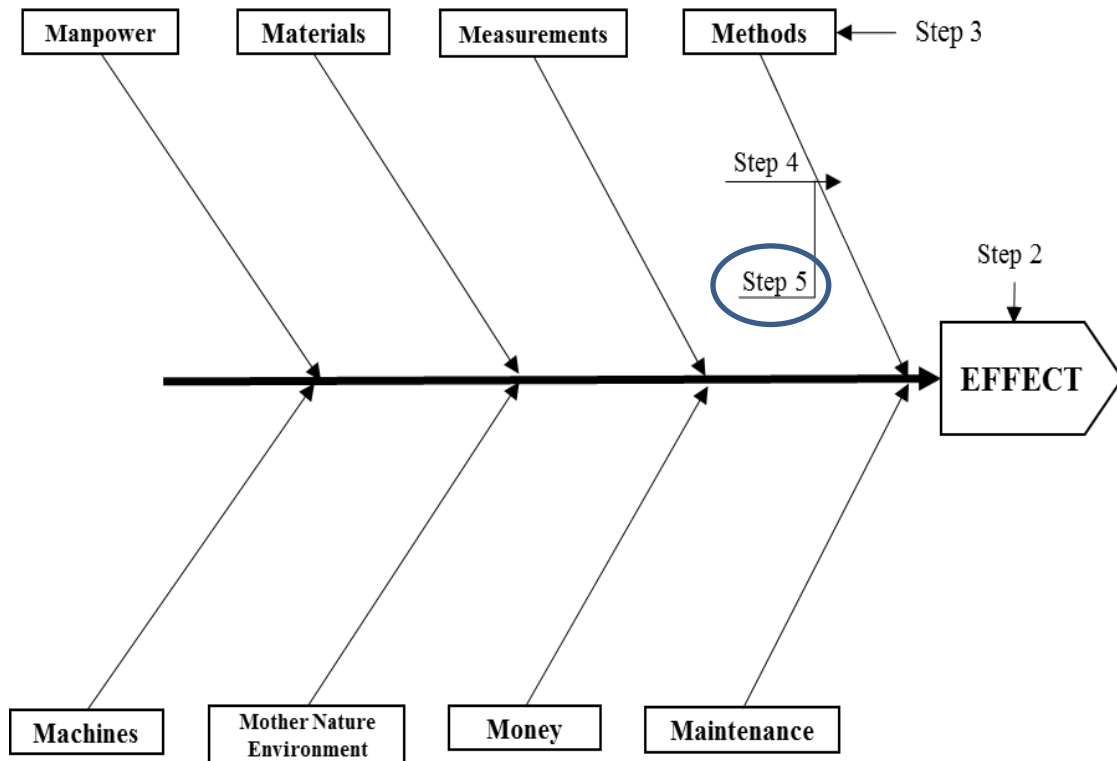


Figure 23. Cause-and-Effect (Fishbone) Diagram. Adapted from Air War College (n.d.).



<b>Failure Modes Effects Analysis (FMEA) Steps</b>	
	<p>Step 1: Understand how things work in order to find the ways it can fail. <i>Use proven, thorough approaches to describe all the elements of the process. Tools that describe how products function, or how processes work, turn complex things into elemental steps.</i></p> <p>Step 2: Execute the analysis and discover the potential failures and effects, their causes, and improvement recommendations.</p> <p>Step 3: Take action where needed. <i>Prioritize improvements based on mission priority and resource availability. Some improvements may eliminate multiple causes.</i></p>
<b>Function Mode</b>	<b>Potential Failure Mode</b>
<b>Potential Failure Effect</b>	<b>Severity Rating (S)</b>
<b>Potential Causes of Failure</b>	<b>Occurrence Rating (O)</b>
<b>Current Process Control</b>	<b>Detection Rating (D)</b>
<b>Risk Priority Number (RPN)</b>	<b>Recommended Actions</b>
<b>After Action (S)</b>	<b>After Action (O)</b>
<b>After Action (D)</b>	<b>After Action (RPN)</b>
<i>The action or step in the process to be analyzed.</i>	<i>What can go wrong?</i>
<i>What is the result of the potential failure?</i>	<i>How severe will the failure be? I = low I O = high</i>
<i>What are the causes of the failure?</i>	<i>What is the probability that the failure could occur? I = low I - = high</i>
<i>What controls are currently in place?</i>	<i>What is the probability that the failure will be detected? I = low I - = high</i>
<i>S * O * D = RPN</i>	<i>How can we improve the process to eliminate the cause or mitigate the effect of the failure?</i>
<i>How severe will it be after improvements are made?</i>	<i>What is the probability that the failure will occur after improvements are made?</i>
<i>What is the probability that the failure will be detected after improvements are made?</i>	<i>After action (S * O * D) = After action RPN</i>

Figure 24. FMEA Chart. Adapted from Rizk & Ratajczak (2012).

THIS PAGE INTENTIONALLY LEFT BLANK



## APPENDIX B. OBSERVED FACET PROCESSES COMPARISON

Table 10 displays the comparison between the observed FACET steps with the actual FACET System Quick Reference Guide steps. Column (1) displays the common steps among the four types of process, as observed in the direct observation onboard the DDG. Columns (2) through (5) display the actual FACET User Guide steps, but are aligned in rows to differentiate various aspects of each process. Some processes have additional steps, such as S2 – PV Food Receipts, which require transit from S2 to S1, but are not specifically addressed in the user guide.

Table 10. FACET Process Comparison. Adapted from Premier Solutions HI, (2015).

Column (1)	Column (2)	Column (3)	Column (4)	Column (5)
<b>OBSERVED STEPS</b>	<b>S1 - MATERIAL RECEIPTS 1348-1A</b>	<b>S1 – MISC. STORES</b>	<b>S1 - STOREROOM ISSUE</b>	<b>S2 – PV FOOD RECEIPTS</b>
<b>LPO/LCPO QA Receipt Inspection</b>	Verify circle, sign, and date on every receipt.	Verify circle, sign, and date on every receipt.	Verify circle, sign, and date on every receipt.	Verify circle, sign, and date on every receipt.
<b>Prepare Documents</b>	a) Create separate stacks for DTO receipts and STOCK receipts (Do not include “Administrative” receipts). DTO and STOCK receipts must each be scanned in a separate Batch.			a) Place a patch code separator sheet in front of each set of receipts for a single FSM order.
	b) Remove all staples, unfold “dog eared”	a) Remove all staples, unfold “dog eared”	a) Remove all staples, unfold “dog eared”	b) Remove all staples, unfold “dog eared”



Column (1)	Column (2)	Column (3)	Column (4)	Column (5)
<b>OBSERVED STEPS</b>	<b>S1 - MATERIAL RECEIPTS 1348-1A</b>	<b>S1 – MISC. STORES</b>	<b>S1 - STOREROOM ISSUE</b>	<b>S2 – PV FOOD RECEIPTS</b>
	corners, and cut double printed receipts in half.	corners, and fix wrinkled pages.	corners, and fix wrinkled pages.	corners, and cut double printed receipts in half.
	c) Verify circle, sign, and date on every receipt.	b) Verify circle, sign, and date on every receipt.	b) Verify circle, sign, and date on every receipt.	c) Verify circle, sign, and date of each line item on each receipt.
	d) Add a smudge mark to the upper left hand corner of a receipt if you have a change in quantity received or any other exception to manually validate. See “Examples of Exception Documents for “Material Rcpts - DD1348-1A” in the FACET User Guide for more details	c) Place a patch code separator sheet (link to file is on FACET Desktop if needed for printing) in front of every document. The separator sheet tells the scanning software where a new document begins.	c) ONLY IF THE ACTIVITY IS A NAVY WORKING CAPITAL FUND ACTIVITY: Make sure all receipts are circled, signed and printed, and dated. Per FIAR requirements, every receipt document must include the document number, NSN, unit of issue, circled quantity, a legible signature, the date received, and any other discrepancies noted.	
<b>Transit from S2 Office to S1 Office</b>				
<b>Power up</b>				



Column (1)	Column (2)	Column (3)	Column (4)	Column (5)
<b>OBSERVED STEPS</b>	<b>S1 - MATERIAL RECEIPTS 1348-1A</b>	<b>S1 – MISC. STORES</b>	<b>S1 - STOREROOM ISSUE</b>	<b>S2 – PV FOOD RECEIPTS</b>
<b>Laptop/Log on</b>				
<b>Create Batch</b>				Import Excel Sent Order Reports
				a) Open the FACET database (double click the link on the Desktop).
				b) Click the Subsistence tab.
				c) Click the Import EXCEL Sent Order Reports link.
				d) Click the Browse button and select the Excel file(s).
				e) Click the Import button (confirmation screen showing PO data will appear).
				f) Close the FACET database (big red X in upper right corner).
	a) Open Batch Manager (double click on the Batch Manager shortcut on the Desktop).	a) Open Batch Manager (double click on the Batch Manager shortcut on the Desktop).	a) Open Batch Manager (double click on the Batch Manager shortcut on the Desktop).	g) Open Batch Manager (double click on the Batch Manager shortcut on the Desktop).
	b) Click Create button.	b) Click Create button.	b) Click Create button.	h) Click Create button.



<b>Column (1)</b>	<b>Column (2)</b>	<b>Column (3)</b>	<b>Column (4)</b>	<b>Column (5)</b>
<b>OBSERVED STEPS</b>	<b>S1 - MATERIAL RECEIPTS 1348-1A</b>	<b>S1 – MISC. STORES</b>	<b>S1 - STOREROOM ISSUE</b>	<b>S2 – PV FOOD RECEIPTS</b>
	c) Complete the following fields:	c) Complete the following fields:	c) Complete the following fields:	i) Complete the following fields:
	Batch Class: Choose “Material Rcpts - DD1348-1A”	Batch Class: Select “MISC Stores”	Batch Class: Select “Storeroom Issues (X31) DD1348-1A”	Batch Class: Select “Food Receipts - Prime Vendor”
	Multi-activity systems only: UIC: Pick the appropriate UIC value	Multi-activity systems only: UIC: Pick the appropriate UIC value	Multi-activity systems only: UIC: Pick the appropriate UIC value	Multi-activity systems only: UIC: Pick the appropriate UIC value
	Receipt Type: Choose “DTO” or “STOCK” accordingly	Document Type: Choose the appropriate value (only one type of document can be scanned per Batch)	RIC Default: Enter a valid RIC to be used as a default value	
			Working Capital Fund systems only:	
	Are all forms Circled, Signed, and Dated?: Choose “Yes”	Are all forms Circled, Signed, and Dated?: Choose “Yes”	Are all forms Circled, Signed, and Dated?: Choose “Yes”	Are all forms Circled, Signed, and Dated?: Choose “Yes”
	Are all names also printed and legible?: Choose “Yes”	Are all names also printed and legible?: Choose “Yes”	Are all names also printed and legible?: Choose “Yes”	Are all names also printed and legible?: Choose “Yes”
	Received By: Defaults to current user, modify if needed	Received By: Defaults to current user, modify if needed	Received By: Defaults to current user, modify if needed	Received By: Defaults to current user, modify if needed
	Date Received (no future dates): Enter calendar date in	Date Received (no future dates): Enter calendar date in	Date Received (no future dates): Enter calendar date in	Date Received (no future dates): Enter calendar date in



Column (1)	Column (2)	Column (3)	Column (4)	Column (5)
<b>OBSERVED STEPS</b>	<b>S1 - MATERIAL RECEIPTS 1348-1A</b>	<b>S1 – MISC. STORES</b>	<b>S1 - STOREROOM ISSUE</b>	<b>S2 – PV FOOD RECEIPTS</b>
	M/D/YYYY format.	M/D/YYYY format.	M/D/YYYY format.	M/D/YYYY format.
	d) Click Save button once (Batch gets created in the background).	d) Click Save button once (Batch gets created in the background).	d) Click Save button once (Batch gets created in the background).	d) Click Save button once (Batch gets created in the background).
	e) Click Close button.	e) Click Close button.	e) Click Close button.	e) Click Close button.
<b>Scan</b>	a) In Batch Manager, click Process button once (wait for Scan program to open).	a) In Batch Manager, click Process button once (wait for Scan program to open).	a) In Batch Manager, click Process button once (wait for Scan program to open).	a) In Batch Manager, click Process button once (wait for Scan program to open).
	b) Place stack of documents in the scanner’s feed tray FACE DOWN	b) Place stack of documents in the scanner’s feed tray FACE DOWN	b) Place stack of documents in the scanner’s feed tray FACE DOWN	b) Place stack of documents in the scanner’s feed tray FACE DOWN
	c) Click the Scan All button (scanner will start in a few seconds).	c) Click the Scan All button (scanner will start in a few seconds).	c) Click the Scan All button (scanner will start in a few seconds).	c) Click the Scan All button (scanner will start in a few seconds).
	d) Click Cancel to “Out of Paper” scanner error message after all pages have been scanned.	d) Click Cancel to “Out of Paper” scanner error message after all pages have been scanned.	d) Click Cancel to “Out of Paper” scanner error message after all pages have been scanned.	d) Click Cancel to “Out of Paper” scanner error message after all pages have been scanned.
	e) Review each scanned page for quality and fix as needed (See Stores User Guide).	e) Review each scanned page for quality and fix as needed (See Stores User Guide).	e) Review each scanned page for quality and fix as needed (See Stores User Guide).	e) Review each scanned page for quality and fix as needed (See Stores User Guide).
	f) Click Close	f) Click Close	f) Click Close	f) Click Close



Column (1)	Column (2)	Column (3)	Column (4)	Column (5)
<b>OBSERVED STEPS</b>	<b>S1 - MATERIAL RECEIPTS 1348-1A</b>	<b>S1 – MISC. STORES</b>	<b>S1 - STOREROOM ISSUE</b>	<b>S2 – PV FOOD RECEIPTS</b>
	button.	button.	button.	button.
	g) Click Yes to confirm to close Batch.	g) Click Yes to confirm to close Batch.	g) Click Yes to confirm to close Batch.	g) Click Yes to confirm to close Batch.
<b>KTM Server (Automatic)</b>	a) In Batch Manager, wait for the “Queue” value of the Batch to change from “KTM Server” to “KTM Validation” (press F5 to refresh manually) and then go to the next step.	a) In Batch Manager, wait for the “Queue” value of the Batch to change from “KTM Server” to “KTM Validation” (press F5 to refresh manually) and then go to the next step.	a) In Batch Manager, wait for the “Queue” value of the Batch to change from “KTM Server” to “KTM Validation” (press F5 to refresh manually) and then go to the next step.	a) In Batch Manager, wait for the “Queue” value of the Batch to change from “KTM Server” to “KTM Validation” (press F5 to refresh manually) and then go to the next step.
<b>KTM Validation</b>	a) In Batch Manager, click Process button once (wait for Validation program to open).	a) In Batch Manager, click Process button once (wait for Validation program to open).	a) In Batch Manager, click Process button once (wait for Validation program to open).	a) In Batch Manager, click Process button once (wait for Validation program to open).
	b) Enter data in fields if prompted (press Enter on keyboard after entering any data; click Yes to save document data changes when prompted).	b) Enter values (or update any auto-filled values) for each document (press Enter on the keyboard after completing each field).	b) Enter data in fields if prompted (press Enter on keyboard after entering any data; click Yes to save document data changes when prompted).	b) If cursor is on “PO Number” field, type in or look up the PO number value and press Enter on the keyboard. Line item records will then be displayed.





Column (1)	Column (2)	Column (3)	Column (4)	Column (5)
<b>OBSERVED STEPS</b>	<b>S1 - MATERIAL RECEIPTS 1348-1A</b>	<b>S1 – MISC. STORES</b>	<b>S1 - STOREROOM ISSUE</b>	<b>S2 – PV FOOD RECEIPTS</b>
		c) Once all fields have been completed, click Yes when prompted to save the current document and to automatically move to the next document.		c) Enter any quantities for line items where the quantity received is different than ordered. Enter zero for any items that were not received and any comments per line item.
				d) Go to “Comments” field and enter any values if needed. Press Enter on the keyboard.
				e) Select Yes (or enter “1”) in the “Completed?” field and press Enter on the keyboard.
				f) Click Yes when prompted to save the document and continue to next document until all documents have been validated. "Administratively separate vendors"
	c) After completing the last document, click OK when	d) After completing the last document, click OK when	c) After completing the last document, click OK when	g) After completing the last document, click OK when



Column (1)	Column (2)	Column (3)	Column (4)	Column (5)
<b>OBSERVED STEPS</b>	<b>S1 - MATERIAL RECEIPTS 1348-1A</b>	<b>S1 – MISC. STORES</b>	<b>S1 - STOREROOM ISSUE</b>	<b>S2 – PV FOOD RECEIPTS</b>
	prompted to close the Batch.	prompted to close the Batch.	prompted to close the Batch.	prompted to close the Batch.
<b>PDF Generator (Automatic) and Export (Automatic)</b>	a) In Batch Manager, wait for the Batch to disappear (press F5 to refresh manually).	a) In Batch Manager, wait for the Batch to disappear (press F5 to refresh manually).	a) In Batch Manager, wait for the Batch to disappear (press F5 to refresh manually).	a) In Batch Manager, wait for the Batch to disappear (press F5 to refresh manually).
	b) Close Batch Manager.	b) Close Batch Manager.	b) Close Batch Manager.	b) Close Batch Manager.
<b>Retrieve/Format CD-RW</b>				
<b>FACET Database – Generate X71 and ZIP Files</b>	a) Open the FACET database (double click the link on the Desktop). Click on the Material Receipts button. Validate the data.	a) Open the FACET database (double click the link on the Desktop).	a) Open the FACET database (double click the link on the Desktop).	a) Open the FACET database (double click the link on the Desktop).
	b) Click on the Export to X71 button.	b) OPTIONAL Click on the All Stores Documents button to view these documents.	b) Optional Click on Material 1348-1A Forms... button or All Documents link to view the documents.	b) Click on the Subsistence tab > Subsistence Receipts button and validate the data.



Column (1)	Column (2)	Column (3)	Column (4)	Column (5)
<b>OBSERVED STEPS</b>	<b>S1 - MATERIAL RECEIPTS 1348-1A</b>	<b>S1 – MISC. STORES</b>	<b>S1 - STOREROOM ISSUE</b>	<b>S2 – PV FOOD RECEIPTS</b>
	c) Click Yes to confirm. X71 file opens in Notepad (except if all DTO receipts on CY04 RSupply system – no X71 gets generated). If no X71 was generated, proceed to next step. If X71 was generated, save file to FACET CD-RW (if provided with FACET system) or to TYCOM approved media (Click File > Save As > Select DVD RW Drive). Close Notepad.			c) Click on the Export to FSM button. Click Yes to confirm. FSM receipt file opens in Notepad.
	d) In FACET database, review items shown in “Worklist - New Items” screen.			d) Save file to FACET CD-RW (if provided with FACET system) or to TYCOM approved media (Click File > Save As > Select DVD RW Drive). Close Notepad.
	e) Close the FACET database (big red X in upper	c) Close the FACET database (big red X in upper	c) Close the FACET database (big red X in upper	e) Close the FACET database (big red X in upper right



Column (1)	Column (2)	Column (3)	Column (4)	Column (5)
<b>OBSERVED STEPS</b>	<b>S1 - MATERIAL RECEIPTS 1348-1A</b>	<b>S1 – MISC. STORES</b>	<b>S1 - STOREROOM ISSUE</b>	<b>S2 – PV FOOD RECEIPTS</b>
	right corner). If prompted about items in the Worklist, click appropriate button.	right corner). If prompted about items in the Worklist, click appropriate button.	right corner).	corner).
	f) Click OK to first Export Transmittal message about starting export transmittal process.	d) Click OK to first Export Transmittal message about starting export transmittal process.	d) Click OK to first Export Transmittal message about starting export transmittal process.	f) Click OK to first Export Transmittal message about starting export transmittal process.
	g) Click OK to second Export Transmittal message after noting file count details. Folder containing ZIP file will open automatically.	e) Click OK to second Export Transmittal message after noting file count details. Folder containing ZIP file will open automatically.	e) Click OK to second Export Transmittal message after noting file count details. Folder containing ZIP file will open automatically.	g) Click OK to second Export Transmittal message after noting file count details. Folder containing ZIP file will open automatically.
	h) Double click on ZIP file and confirm that it has one CSV file, one Excel file, and the appropriate number of PDF files in the contents shown.	f) Double click on ZIP file and confirm that it has one CSV file, one Excel file, and the appropriate number of PDF files in the contents shown.	f) Double click on ZIP file and confirm that it has one CSV file, one Excel file, and the appropriate number of PDF files in the contents shown.	h) Double click on ZIP file and confirm that it has one CSV file, one Excel file, and the appropriate number of PDF files in the contents shown.
	i) Save ZIP file to FACET CD-RW or to TYCOM approved media, based on the following:	g) Save ZIP file to FACET CD-RW or to TYCOM approved media, based on the following:	g) Save ZIP file to FACET CD-RW or to TYCOM approved media, based on the following:	i) Save ZIP file to FACET CD-RW or to TYCOM approved media, based on the following:



<b>Column (1)</b>	<b>Column (2)</b>	<b>Column (3)</b>	<b>Column (4)</b>	<b>Column (5)</b>
<b>OBSERVED STEPS</b>	<b>S1 - MATERIAL RECEIPTS 1348-1A</b>	<b>S1 – MISC. STORES</b>	<b>S1 - STOREROOM ISSUE</b>	<b>S2 – PV FOOD RECEIPTS</b>
	If ZIP file opened in WinZip in previous step, close WinZip and then right click on the ZIP file in Windows Explorer > Send To > DVD RW Drive (or other approved external media).	If ZIP file opened in WinZip in previous step, close WinZip and then right click on the ZIP file in Windows Explorer > Send To > DVD RW Drive (or other approved external media).	If ZIP file opened in WinZip in previous step, close WinZip and then right click on the ZIP file in Windows Explorer > Send To > DVD RW Drive (or other approved external media).	If ZIP file opened in WinZip in previous step, close WinZip and then right click on the ZIP file in Windows Explorer > Send To > DVD RW Drive (or other approved external media).
	If ZIP file opened in Windows Explorer in previous step, click Back button and then right click on the ZIP file in Windows Explorer > Send To > DVD RW Drive (or other approved external media).	If ZIP file opened in Windows Explorer in previous step, click Back button and then right click on the ZIP file in Windows Explorer > Send To > DVD RW Drive (or other approved external media).	If ZIP file opened in Windows Explorer in previous step, click Back button and then right click on the ZIP file in Windows Explorer > Send To > DVD RW Drive (or other approved external media).	If ZIP file opened in Windows Explorer in previous step, click Back button and then right click on the ZIP file in Windows Explorer > Send To > DVD RW Drive (or other approved external media).
	j) Verify that CD/TYCOM approved media contains the ZIP file and the X71 file that were created in the previous steps. Eject CD/TYCOM approved media.	h) Verify that CD/TYCOM approved media contains the ZIP file that was created in the previous steps. Eject CD/TYCOM approved media.	h) Verify that CD/TYCOM approved media contains the ZIP file that was created in the previous steps. Eject CD/TYCOM approved media.	j) Verify that CD/TYCOM approved media contains the ZIP file that was created in the previous steps. Eject CD/TYCOM approved media.
	*Log off the	*Log off the	*Log off the	*Log off the



Column (1)	Column (2)	Column (3)	Column (4)	Column (5)
<b>OBSERVED STEPS</b>	<b>S1 - MATERIAL RECEIPTS 1348-1A</b>	<b>S1 – MISC. STORES</b>	<b>S1 - STOREROOM ISSUE</b>	<b>S2 – PV FOOD RECEIPTS</b>
	FACET laptop	FACET laptop	FACET laptop	FACET laptop
<b>Transport CD-RW to CPU/Log on to CPU</b>				
<b>Log in to LOGCOP</b>				
<b>Upload ZIP to LOGCOP-FACET (Central Ashore Repository)</b>	a) On networked computer, insert the CD/ TYCOM approved media used in the previous step.	a) On networked computer, insert the CD/ TYCOM approved media used in the previous step.	a) On networked computer, insert the CD/ TYCOM approved media used in the previous step.	a) On networked computer, insert the CD/ TYCOM approved media used in the previous step.
	b) Open LOGCOP-FACET webpage and click on Upload FACET Afloat Files link.	b) Open LOGCOP-FACET webpage and click on Upload FACET Afloat Files link.	b) Open LOGCOP-FACET webpage and click on Upload FACET Afloat Files link.	b) Open LOGCOP-FACET webpage and click on Upload FACET Afloat Files link.
	c) Click Browse button and select the ZIP file produced by the FACET database (from CD/TYCOM approved media). Click Upload button.	c) Click Browse button and select the ZIP file produced by the FACET database (from CD/TYCOM approved media). Click Upload button.	c) Click Browse button and select the ZIP file produced by the FACET database (from CD/TYCOM approved media). Click Upload button.	c) Click Browse button and select the ZIP file produced by the FACET database (from CD/TYCOM approved media). Click Upload button.
	d) In the upload confirmation message, verify that the “PDF Cnt” value	d) In the upload confirmation message, verify that the “PDF Cnt” value	d) In the upload confirmation message, verify that the “PDF Cnt” value	d) In the upload confirmation message, verify that the “PDF Cnt” value



<b>Column (1)</b>	<b>Column (2)</b>	<b>Column (3)</b>	<b>Column (4)</b>	<b>Column (5)</b>
<b>OBSERVED STEPS</b>	<b>S1 - MATERIAL RECEIPTS 1348-1A</b>	<b>S1 – MISC. STORES</b>	<b>S1 - STOREROOM ISSUE</b>	<b>S2 – PV FOOD RECEIPTS</b>
	shown matches the number of PDFs in the ZIP file.	shown matches the number of PDFs in the ZIP file.	shown matches the number of PDFs in the ZIP file.	shown matches the number of PDFs in the ZIP file.
	e) Eject the CD/TYCOM approved media from the computer.	e) Eject the CD/TYCOM approved media from the computer.	e) Eject the CD/TYCOM approved media from the computer.	e) Eject the CD/TYCOM approved media from the computer.



THIS PAGE INTENTIONALLY LEFT BLANK





## **APPENDIX C. NAVY SUPPLY CORPS SCHOOL OFFICIAL STATEMENT ON FIAR AND FACET**

This statement was received via email from NSCS Academic Director Adam Hamilton, LCDR, SC, USN (personal communication, September 22, 2016):

### **BACKGROUND**

At the Navy Supply Corps School (NSCS), Basic Qualification Course (BQC) students and Supply Officer Department Head Course (SODHC) students are exposed to the fundamental concepts of Financial Improvement and Audit Readiness (FIAR). Through a combination of instructor-led lectures, discussion, and guest speakers, students at NSCS receive a basic indoctrination to FIAR. In particular, the concepts of FIAR are tied to their roles as afloat Supply Officers; because these students will be reporting to sea duty after NSCS, they are educated on FIAR and how it applies to their particular positions afloat.

### **METHODOLOGY**

**BQC:** BQC students, all of which are new officers, are provided with a two-hour lesson on fundamental FIAR concepts. The students are given a brief explanation as to FIAR's purpose, background, and application to their roles as Supply Officers. Students are taught how their responsibilities afloat align with FIAR's expectations on the "Commander's Checklist," to include the execution of general business processes, purchase of goods and services, payment of people, and asset management. Specifically, students are exposed to the systems, processes, and practices that they will encounter as Division Officers afloat in which FIAR impacts. Instructors provide specific examples of audit readiness and highlight best practices for aligning an afloat division with FIAR's standards. We also host various guest speakers who touch on FIAR and the responsibilities of Supply Officers.

**SODHC:** Similar to the BQC, SODHC students are provided with a two-hour, foundational lesson on FIAR, to include purpose, background, and application to their roles as Supply Officers. As future Department Heads, SODHC students are ranked from O-1 to O-3; thus, the classroom discussion about FIAR is more extensive and complex. SODHC students are taught about the "Commander's Checklist" and how their roles and responsibilities as Department Heads afloat must be nested with FIAR's standards. SODHC also emphasizes the importance of FIAR as a supplementary topic during other lessons. Some examples include lessons on the Government Purchase Card, Off-ship Bill Pay, and Inventory Management. In addition to classroom instruction, the topic of FIAR is also briefed by guest speakers. Guest speakers, including the Chief of the Supply Corps, and representatives from the Afloat Training Group and Naval Supply Systems Command, stress the importance of FIAR and how its standards must align with the duties of a Department Head afloat.



## CONCLUSION

All BQC and SODHC students are introduced to FIAR and are taught its fundamental concepts. As generally more seasoned officers, SODHC students discuss the importance of FIAR and how it applies to other course lessons, and they are also given the opportunity to engage with external speakers on the topic of FIAR.

Ultimately, NSCS' goal is to introduce FIAR to BQC and SODHC students, while stressing the importance of audit readiness, precise business information, and realizing organizational efficiencies as they enter the Fleet as afloat Supply Officers

## FACET

NSCS is in the process of implementing hands-on FACET training for BQC and SODHC students. We have a system onboard and are scheduled to implement hands-on training beginning next FY.



## LIST OF REFERENCES

- Air War College. (n.d.). *Handbook for basic process improvement*. Retrieved November 14, 2016, from [http://www.au.af.mil/au/awc/awcgate/navy/bpi\\_manual/handbook.htm](http://www.au.af.mil/au/awc/awcgate/navy/bpi_manual/handbook.htm)
- American Institute of Certified Public Accountants. (2015, October 14). *AU-C Section 330: Performing audit procedures in response to assessed risks and evaluating the audit evidence obtained*. Retrieved from <http://www.aicpa.org/research/standards/auditattest/downloadabledocuments/au-c-00330.pdf>
- Chief Financial Officers Act of 1990, Pub. L. 101-576 104 Stat. 2838 (1990). Retrieved from <https://www.gpo.gov/fdsys/pkg/STATUTE-104/pdf/STATUTE-104-Pg2838.pdf>
- Commander, Naval Surface Forces. (2008, August 25). *Surface Force supply procedures* (COMNAVSURFOR Instruction 4400.1). Retrieved from <http://navybmr.com/study%20material/COMNAVSURFORINST%204400.1.pdf>
- Defense Acquisition University. (2016). *Lean-6 Sigma for manufacturing* [Defense Acquisition University Course CLE 007].
- Department of Defense. (2008, July 1). *Continuous process improvement/Lean Six Sigma guidebook* (Rev. 1). Retrieved from [http://www.au.af.mil/au/awc/awcgate/dod/cpi\\_leansixsigma\\_hdbk2008.pdf](http://www.au.af.mil/au/awc/awcgate/dod/cpi_leansixsigma_hdbk2008.pdf)
- Folaron, J. (2003, August). *The evolution of Six Sigma*. Retrieved from [http://asq.org/pub/sixsigma/past/vol2\\_issue4/folaron.html](http://asq.org/pub/sixsigma/past/vol2_issue4/folaron.html)
- Harry, M. J., & Schroeder, R. R. (2005). *Six Sigma: The breakthrough management strategy revolutionizing the world's top corporations*. New York, NY: Doubleday.
- Hillkirk, J. (1989, March 28). *Motorola jumps ahead; top quality is behind comeback*. *USA Today*. Retrieved from <http://libproxy.nps.edu/login?url=http://search.proquest.com/docview/306189884?accountid=12702>
- Ishikawa, K. (1985). *What is total quality control? The Japanese way*. Upper Saddle River, NJ: Prentice-Hall.
- Kaplan, R. S., & Norton, D. P. (1995). *Putting the balanced scorecard to work*. Retrieved from [http://www.trt3.jus.br/gestaoestrategica/download/biblioteca/the\\_bsc.pdf](http://www.trt3.jus.br/gestaoestrategica/download/biblioteca/the_bsc.pdf)
- Munro, R. A., Maio, M. J., Nawaz, M. B., Ramu, G., & Zrymiak, D. J. (2008). *The certified Six Sigma green belt handbook*. Milwaukee, WI: Pearson Education.



National Institute of Standards and Technology. (n.d.). Malcolm Baldrige National Quality Award 1988 recipient Motorola Inc. Retrieved November 14, 2016 from [http://patapsco.nist.gov/Award\\_Recipients/PDF\\_files/1988\\_Motorola\\_Inc.pdf](http://patapsco.nist.gov/Award_Recipients/PDF_files/1988_Motorola_Inc.pdf)

Navy Office of Financial Operations. (2015, January 22). BSO portfolio presentation on U.S. Pacific Fleet (PACFLT). Auditor Indoctrination Classroom Training.

Navy Personnel Command. (2015, March 1). *Navy audit preparation and response* [Navy Audit 101 training]. Retrieved from [http://www.public.navy.mil/bupers-npc/organization/bupers/FIAR/Documents/Navy\\_Audit\\_101\\_March\\_2015.pdf](http://www.public.navy.mil/bupers-npc/organization/bupers/FIAR/Documents/Navy_Audit_101_March_2015.pdf)

Office of the Secretary of Defense. (2008, November 26). *DoD LSS green belt training materials*. Retrieved from <https://acc.dau.mil/adl/en-US/248939/file/39376/3-OSD%20GB%20Content%20%2026%20Aug%2008a.pdf>

Office of the Under Secretary of Defense (Comptroller)/Chief Financial Officer (OUSD/CFO). (2016, April 1). *FIAR guidance*. Retrieved from [http://comptroller.defense.gov/Portals/45/documents/fiar/FIAR\\_Guidance.pdf](http://comptroller.defense.gov/Portals/45/documents/fiar/FIAR_Guidance.pdf)

Premier Solutions HI. (2015). *Financial Audit Compliance Enhancement Tool (FACET) user guide*. Honolulu, HI: Author.

Rizk, K., & Ratajczak, G. (2012, June 14). *Failure Mode and Effects Analysis (FMEA) introductory overview* [Briefing charts]. Retrieved from <http://www.dtic.mil/docs/citations/ADA562215>

Sicilia, J. D. (2008, September 23). *Department of Defense Lean Six Sigma deployment presentation*. Retrieved from <http://www.asq509.org/ht/a/GetDocumentAction/i/32692>

Womack, J. P., & Jones, D. T. (2003). *Lean thinking: Banish waste and create wealth in your corporation*. New York, NY: Simon and Schuster.

Womack, J. P., Jones, D. T., & Roos, D. (1990). *The machine that changed the world*. New York, NY: Simon and Schuster.







ACQUISITION RESEARCH PROGRAM  
GRADUATE SCHOOL OF BUSINESS & PUBLIC POLICY  
NAVAL POSTGRADUATE SCHOOL  
555 DYER ROAD, INGERSOLL HALL  
MONTEREY, CA 93943

[www.acquisitionresearch.net](http://www.acquisitionresearch.net)