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THESIS

EVALUATION OF A CONTINUOUS PROCESS IMPROVEMENT PILOT PROGRAM TO REDUCE OR ELIMINATE TRIDENT II D5 LAUNCHER PROCESSING AUTHORITY DOCUMENTATION AT THE STRATEGIC WEAPONS FACILITY, ATLANTIC

by

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September 2008

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The Pilot Program achieved a 20% reduction in man-hours using the modified TFIRR process, demonstrated a more efficient workflow and reduced the total third level repair cycle time.

Recommendations for reducing or eliminating excessive processing authority documentation at SWFLANT for the TRIDENT II D5 launcher sub-system include accepting and implementing the CI Pilot Program results for reducing and eliminating TFIRR processing authority documentation as permanent changes to the SSP operational procedures and establishing additional CI process reviews to identify opportunities for documentation and repair cycle time reductions.

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LIST OF ACRONYMS AND ABBREVIATIONS

AWS	Attack Weapon System
CI	Continuous Improvement
CNO	Chief of Naval Operations
COG	Cognizant
D.C.	District of Columbia
DIRSSP	Director, Strategic Systems Programs
DoD	Department of Defense
Encl.	Enclosure
FBM	Fleet Ballistic Missile
GA	Georgia
GOCO	Government Owned-Contractor Operated
HEMF	Handling Equipment Maintenance Facility
IM	Inventory Manager
LEPB	Launcher Explosive Processing Building
LOM	Launcher Operations Manual
MARS	Maintenance and Repair System
MG	Maintenance Guide
NAVSEA	Naval Sea Systems Command
NGES-MS	Northrop Grumman Electronic Systems - Marine Systems
MRL	Master Repairable List
OD	Ordnance Document
OPNAVINST	Operational Navy Instruction
OSD	Office of the Secretary of Defense
PSA	Program Support Activity
R&R	Return and Repair
RFI	Ready-For-Issue
SPALT	Strategic Systems Programs Alterations
SP22	Strategic Systems Programs Launcher Branch
SPF70	Strategic Systems Programs Flight Code 70
SRD	Standard Repair Documentation
SSP	Strategic Systems Programs
SSPINST	Strategic Systems Programs Instruction
SSPO	Strategic Systems Project Office
SWFLANT	Strategic Weapons Facility, Atlantic
SWFPAC	Strategic Weapons Facility, Pacific

SWS	Strategic Weapon System
TFR	Trouble Failure Report
TFIRR	Trouble Failure Inspection/Rejection Reports
US	United States
VA	Virginia

EXECUTIVE SUMMARY

Strategic Weapons Facility, Atlantic (SWFLANT) launcher third level repair cycle requires extensive Trouble Failure Inspection/Rejection Report (TFIRR) processing authority documentation that results in a loss of contractor man-hours and third level repair cycle time. Strategic Systems Programs (SSP) is using Continuous Improvement (CI) events to optimize repair efforts to free manpower and facility resources to meet increasing repair demands. This thesis evaluated the SSP approved CI Pilot Program to reduce or eliminate TRIDENT II D5 launcher TFIRR processing authority documentation and reduce third level repair cycle times at the Northrop Grumman Electronic Systems-Marine Systems (NGES-MS) facilities at SWFLANT.

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I. INTRODUCTION

A. BACKGROUND

1. OHIO Class Fleet Ballistic Missile (FBM) Submarines

The OHIO Class submarine is the "sea-based leg" of the strategic triad whose purpose is to provide the most effective strategic deterrent to global war (Fleck, 2000). Of the eighteen Fleet Ballistic Missile (FBM) submarines delivered to the Navy, fourteen are configured to carry the TRIDENT II-D5 ballistic missiles. Six east coast TRIDENT II D5 submarines are based at Strategic Weapon Facility, Atlantic (SWFLANT), located at Kings Bay, Georgia (GA). The remaining eight TRIDENT II D5 submarines are based at the west coast Strategic Weapon Facility, Pacific (SWFPAC), located at Bangor, Washington.

The United States (US) Navy's TRIDENT II D5 submarines are the country's critical strategic assets designed to provide an underwater mobile missile platform for the Strategic Weapon System (SWS) which includes the D5 Missile (BAE, 2005). The SWS is a system of systems, "composed of seven major subsystems; navigation, fire control, missile, guidance, launcher, ship support and data recording" (Northrop Grumman Marine Systems, Electronic Sensors and System Division, 1996, p. 4-1). All of these complex subsystems must be interoperable with the other subsystems, and maintained to the highest standards of readiness and reliability to ensure operational requirements are achieved in support of national defense. This thesis will focus on the launcher SWS subsystem and the associated launcher shore based support equipment.

2. TRIDENT Submarine Deployment Phase

The east coast based TRIDENT II D5 submarines deploy from Kings Bay, GA. The deployment cycle consists of "two alternating periods, patrol and availability" (BAE, 2005, p. INT-6). The patrol period is the at-sea period when the submarine operates independently, fulfilling the strategic operational requirements. After completing the

patrol, the submarine returns to Kings Bay, GA to begin the availability period. During the availability period, the submarine undergoes equipment repair, crew change, SWS testing, Strategic Systems Programs Alterations (SPALTs) and maintenance, as required (BAE, 2005). Highly refined and specialized shore-side support equipment and SWS unique tools are used on the submarine at pier side to assist in the removal, inspection, repair and re-installation of SWS equipment (BAE, 2005).

3. SWFLANT Third Level Repair Requirements

Maintaining the Navy's TRIDENT II D5 strategic launcher system is a complicated process dealing with the repair of complex equipment, subcomponents and piece parts and requiring specialized repair procedures and documentation. When an east coast based TRIDENT II D5 submarine requires a launcher SWS repair or shore side support equipment fails, the items are returned to SWFLANT for repair. There are four levels of repair. First level repair is accomplished by the submarine crew and is limited to those skills, parts and tools onboard the submarine and can be performed either at-sea or pier side. Second level repairs are performed by the SWS operational maintenance facilities and are limited to skills, documentation and tools available in the facility. Third level repair is depot level repair performed at Government Owned-Contractor Operated (GOCO) facilities at SWFLANT (Strategic Systems Programs Instruction (SSPINST) 4700.5A, 1982). If equipment cannot be repaired at the third level facility, it will be delivered to the fourth level repair depot located at the original vendor facilities (SSPINST 4700.5A, 1982).

SWFLANT is tasked by the Director, Strategic Systems Programs (DIRSSP) to use "both contractor and government operated facilities" to store and deliver guidance and launcher subsystem components and provide third level repair facilities to support Strategic Systems Programs (SSP's) requirements (SSPINST 5450.22A, 2006, Enclosure (Encl.) 1, p. 1). DIRSSP assigned the launcher SWS subsystem and associated shore based support equipment to the Strategic Systems Program Launcher Branch (SP22) (SSPINST 4423.47C, 1997).

4. SP22 Launcher SWS & Support Equipment Third Level Repair Requirements

SWFLANT and the SP22 contractor, Northrop Grumman Electronic Systems – Marine Systems (NGES-MS), are responsible for repair, preventative maintenance, corrective maintenance, inspection, and alterations of launcher SWS and shore side support equipment in support of the TRIDENT II D5 submarine activities (Naval Sea Systems Command (NAVSEA) Ordnance Document (OD) 55512D, 2006). NGES-MS designed and produced the TRIDENT II D5 launcher SWS and associated support equipment at program inception. NGES-MS provides on-site third level repair in the SWFLANT GOCO facilities designated as the Handling Equipment Maintenance Facility (HEMF) and the Launcher Explosive Processing Building (LEPB) (NAVSEA OD 55512D, 2006).

5. Third Level Repair Processing Issues

The TRIDENT II D5 SWS and shore side support equipment are part of an aging system where ever increasing numbers of items are required to go through the third level repair cycle. The program does not have the depth of spares in the supply system to routinely replace broken or worn parts with new ones. It is imperative to repair critical SWS components and support equipment and return them back to the supply system as a Ready-For-Issue (RFI) asset to maintain the program's high levels of strategic readiness. Initially, there was no ceiling on the production, modification or repair costs for strategic assets, but today in the era of decreasing defense budgets, SSP is using Continuous Improvement (CI) events to optimize modernization and maintenance efforts to reduce costs and realign efforts to remain an affordable program (SSPINST 5000.15, 2006). Reducing third level repair cycle time will increase the availability of manpower and facility resources to meet increasing repair demands. Cycle time is defined as "the amount of time required for the Department of Defense (DoD) component to accept a current or future customer demand (normally the war fighter) and provide the requested capability" (Deputy Secretary of Defense, 2006, p. 2-1).

Due to the strategic nature and high level of readiness requirements of the TRIDENT launcher SWS and associated support equipment, rigorous processing authority documentation requirements are instilled upon the third level maintenance process. When the equipment fails and cannot be repaired by first or second level facilities, it is transferred to the third level repair facility. The NGES-MS technicians who affect repairs operate under strict procedural compliance to the approved technical repair documentation and are monitored by NGES-MS engineering and SWFLANT government personnel for quality assurance.

The repair processing authority documentation includes the SSP Trouble Failure Inspection/Rejection Reports (TFIRRs) to document equipment hardware trouble and failure reporting at the SWFs (SSP OD 45459, 2005). The current SWFLANT launcher third level repair cycle requires extensive TFIRR processing authority documentation that results in a loss of third level repair cycle time while waiting for government approval to begin repairs (Pilot Program Plan, 2008).

6. Continuous Improvement Event

To continue to meet the high readiness and operational requirements for the launcher SWS and support equipment, the SWFLANT government and contractor team held a continuous process improvement event and established an alternate process for the development and execution of a streamlined third level TFIRR program. The Continuous Improvement team reviewed third level repair requirements including TFIRR processing documentation, mapped the current third level repair process flows and developed an alternate process. The team determined that in several cases, unnecessary and redundant government concurrence on a TFIRR is required prior to the start of repair, even though there are government approved repair procedures in place. The team challenged that the time the contractors had to wait on the government to concur with the TFIRRs before beginning repairs was excessive and valuable repair processing time was lost. The team identified two TFIRR processes that could be streamlined and modified with low risk to the program, the induction TFIRRs and the TFIRRs based on Standard Repair Documentation (SRD) (Pilot Program Plan, 2008).

An induction TFIRR involves repairable launcher equipment returned from fleet or shore activities to SWFLANT. The equipment is inducted from the government supply system and transported to the NGES-MS third level maintenance facility. The DD1348 form transfers custody of the equipment from the government to the contractor for repair. The NGES-MS receiving engineer performs incoming inspection and troubleshoots the equipment to determine repair procedures. The engineer will identify the repair that is to be performed and write an induction TFIRR referencing the government approved repair procedures in accordance with SSP OD 59281 for the HEMF or SSP OD 60285 for the LEPB (SSP OD 57034, 2007). Prior to the start of repair, the government must concur with the TFIRR increasing the repair cycle time.

A Standard Repair Document TFIRR, referred to as an SRD TFIRR, is written for the repair of operational equipment. For example, when equipment supporting waterfront operations fails, it requires inspection and repair. The government writes and approves a TFIRR and transports the equipment to the NGES-MS contractor who will repair the items in the HEMF or LEPB. If another issue is discovered during equipment repair and requires additional repair, another TFIRR must be written referencing the government approved repair procedures in accordance with SSP OD 59281 for the HEMF or SSP OD 60285 for the LEPB. Prior to the start of repair, the government must concur with the TFIRR, increasing repair cycle time. After repair, the equipment is returned to the waterfront. In this case, there is no equipment custody transfer from government to contractor, the equipment remains in government custody through the repair cycle until it is returned to the waterfront or to support other operational requirements.

The resulting action from the CI event was to establish a Pilot Program to implement the modified TFIRR process to reduce excessive processing authority documentation, duplication of effort, and third level repair cycle time in the NGES-MS facilities at SWFLANT. With the modified TFIRR process in place, the Pilot Program is expected to demonstrate a more efficient workflow and a reduction in third level cycle time and man-hours per item which will allow an increased repair capacity. The Pilot Program was conducted over a period of twelve weeks in 2008. The first two weeks

were used to train personnel on the new process, eight weeks for pilot plan execution and data gathering and two weeks to analyze the data, complete the report and provide it to SSP for consideration (Pilot Program Plan, 2008).

B. PURPOSE

The focus of this thesis is the evaluation of the continuous improvement Pilot Program approved by SSP in March, 2008 to reduce or eliminate TRIDENT II D5 Launcher Trouble Failure Inspection/Rejection Reports (TFIRRs) processing authority documentation and reduce third level repair cycle times at the NGES-MS facilities at SWFLANT. The SWFLANT launcher third level repair cycle requires extensive TFIRR processing authority documentation that results in a loss of contractor man-hours and third level repair cycle time while waiting for government approval to begin repairs, even though there are government approved repair procedures in place.

Reducing third level repair cycle time will free manpower and increase facility capacity allowing the program to meet the increasing repair demands. The TFIRRs that will be specifically addressed in this thesis are the induction TFIRRs and the SRD TFIRRs.

A literature review was conducted to identify and document the overarching SWFLANT requirements for the current third level launcher repair processing requirements. The pilot program results will form the analysis portion of this thesis and determine the actual reduction in equipment third level repair cycle time and associated man-hour savings. The recommendations included herein provide guidance for additional candidate areas that may benefit from similar Pilot Programs to further reduce excessive processing authority documentation, reduce third level maintenance cycle times and increase repair capacity at the facility.

C. RESEARCH QUESTIONS

This research addresses the following questions:

- What are the requirements for the current Trident II D5 Launcher third level maintenance processing authority documentation at SWFLANT?
- What are the problems and challenges in the current system?
- What are the proposed changes to the Trident II D5 Launcher third level maintenance processing authority documentation?
- Did the Pilot Program analysis show a reduction in time and costs?
- What are the resulting cycle time and cost savings?
- What are the lessons learned from this Pilot Program and how can the lessons learned be applied to other Trident II D5 third level processing areas?

D. BENEFITS OF STUDY

This study identifies key areas for reducing or eliminating Trident II D5 launcher third level maintenance processing authority documentation and reducing repair cycle time at SWFLANT. The pilot program results may be used to encourage further continuous improvement studies and identify additional TFIRR processing documentation and repair cycle time reductions.

E. SCOPE, METHODOLOGY & LIMITATIONS

1. Scope

This thesis focuses on the reduction or elimination of SWFLANT third level processing documentation, specifically the induction TFIRRs and the SRD TFIRRs at the third level NGES-MS GOCO facilities at SWFLANT. The analysis is dependent on the Pilot Program results

2. Methodology

The methodology includes: 1) a literature review of the DoD and SSP Trident II D5 third level repair requirements documents for the launcher GOCO facilities controlled

by NGES-MS at SWFLANT, 2) a review of the current SWFLANT third level issues, documentation and process flow, 3) a review the continuous improvement modified process flow and the Pilot Program, 4) analysis of the Pilot Program results, 5) the recommendations to permanently incorporate the pilot program results in the SWFLANT documentation and provide recommendations for further study.

3. Limitations.

This thesis is limited to the examination of third level repair to the TRIDENT II-D5 launcher SWS and shore-based support equipment. Due to the sensitive nature of the TRIDENT II D5 system, several of the Strategic Systems Programs Instructions (SSPINSTs) and Ordnance Documents (ODs) which provide the foundation for the repair documentation are not be publicly available and will be summarized where appropriate.

F. ORGANIZATION OF THESIS

In Chapter I, the reader is introduced to the Trident II D5 launcher SWS and third level repair at SWFLANT. The purpose is established, followed by the thesis research questions, and intended research benefits. An overview is provided that describes how the research was conducted. Chapter II documents the results of the literature research for the Trident II D5 third level repair requirements. Chapter III discusses the current third level repair issues and presents the current process for third level repair processing authority documentation. Chapter IV discusses the development of an alternative process and the subsequent Pilot Program implemented to initiate the alternative process and the method of data collection to validate the alternate process. Chapter V provides analysis of the Pilot Program results. Chapter VI concludes with a summary of findings and provides recommendations for further areas of study.

II. LITERATURE REVIEW

A. INTRODUCTION

Strategic Weapons Facility, Atlantic, (SWFLANT) and the Strategic Systems Programs (SSP) Launcher Branch (SP22) contractor, Northrop Grumman Electronic Systems-Marine Systems (NGES-MS), are responsible for repair, preventative maintenance, corrective maintenance, inspection, and alterations of launcher Strategic Weapon System (SWS) and shore side support equipment in support of the TRIDENT II D5 submarine activities (NAVSEA OD 55512, 2006). NGES-MS, provides on-site third level repair in the SWFLANT Government Owned-Contractor Operated (GOCO) facilities, designated the Handling Equipment Maintenance Facility (HEMF) and the Launcher Explosive Processing Building (LEPB). The organizations involved in the repair and documentation process are SSP, SP22, Strategic Systems Programs Flight Code 70 (SPF70), NGES-MS, and SWFLANT government personnel.

To continue to meet the high readiness and operational requirements for the launcher SWS and support equipment, the SWFLANT government and contractor team held a Continuous Process Improvement event and established a process for the development and execution of a streamlined third level Trouble Failure Inspection/Rejection Report (TFIRR) documentation resulting in a reduction in third level repair cycle time. The current SWFLANT Trident II D5 launcher third level repair process requires extensive TFIRR documentation resulting in a loss of both man-hours and repair cycle time while waiting for government approval of documented repair procedures. Reducing the third level repair cycle time will free manpower and facility resources to meet increasing repair demands.

A key component in planning a possible process change is to identify the environment and requirements in which the organizational entities currently operate. Research into this area of the thesis comes from Operational Navy Instructions (OPNAVINSTs), Department of Defense (DoD) Directives, and SSP Instructions (SSPINSTs) and Ordnance Documents (ODs).

B. REQUIREMENTS FOR THE CURRENT TRIDENT II D5 LAUNCHER THIRD LEVEL MAINTENANCE PROCESSING AUTHORITY DOCUMENTATION AT SWFLANT

1. TRIDENT II D5 SSP Overarching Requirements

The Chief of Naval Operations (CNO) tasked the Director, Strategic Systems Programs (DIRSSP) with overall support of the TRIDENT missile SWS and shore-based support equipment throughout its life cycle. DIRSSP is responsible for the field activities that support this effort (OPNAVINST 5450.223A, 1991). Charged with this requirement, DIRSSP established the SSP policy for repairing the SWS equipment and assigned the responsibility for launcher SWS and associated support equipment to the Program Support Activity (PSA), SP22. The launcher Inventory Manager (IM) responsibility is assigned to SPF70 (SSPINST 4423.47C, 1997). IM assistance is provided by the launcher contractor, NGES-MS.

2. Continuous Improvement Requirements

Department of Defense Directive Number 4151.18 policy states that maintenance programs for DoD material should "adopt business practices and quality management processes to continuously improve maintenance operations and maintenance production, achieve cost savings and avoidance, and realize process cycle time reduction" (DoD Directive 4151.18, 2004, p. 3). The Directive charges that the programs should be structured and linked "to strategic and contingency planning" allowing maintenance programs the ability to provide readiness for national defense and contingency requirements, and optimize technologies and organizations (DoD Directive 4151.18, 2004, p. 2).

The Deputy Secretary of Defense Continuous Process Improvement Transformation Guidebook Memorandum states that Continuous Improvement (CI) is an "important tool for improving operational effectiveness" (Deputy Secretary of Defense, 2006, Memorandum). DoD organizations need to become more effective in order to

support the war fighter given wartime demands and fiscal realities. The CI efforts should improve system reliability and reduce repair cycle times (Deputy Secretary of Defense, 2006).

In the spirit of DoD's quest to promote CI, DIRSSP promulgated CI policies and procedures within the SSP organization. The SSP CI process assures high quality systems "delivered to the fleet on time and within budget" stressing that it is now necessary "better this performance to achieve more with greater efficiency to free resources to address emergent needs" (SSPINST 5000.15, 2006, p. 1). The goal of CI is to improve "effectiveness and efficiency" while reducing or eliminating non-value-added work (SSPINST 5000.15, 2006, p. 3).

3. Third Level Requirements

The mission, function and requirements assigned to SWFLANT are described in SSPINST Number 5450.22A**.** The document directs SWFLANT to use "both contractor and government operated facilities and resources" to store the launcher subsystem components and deliver them to the fleet and "other specified commands and activities to support authorized Strategic Systems Programs' requirements" (SSPINST 5450.22A, 2006, Enclosure 1, p. 1). SWFLANT is directed to provide the capability of processing and maintaining the D5 launcher equipment. As stated in Chapter I, this thesis will be limited to the SWFLANT third level maintenance capabilities for both the TRIDENT II D5 Launcher system and its associated shore-based support equipment.

The program plan for TRIDENT II D5 operations at SWFLANT is contained in NAVSEA OD Number 55512D. The document defines SSP's plans for government and SWS contractor operations for the program and describes the government and SWS contractor's functions and organizational responsibility for the operation of SWFLANT. The SP22 contractor is responsible for performing support equipment repair from supply through the repair cycle and back into supply (NAVSEA OD 55512D, 2006). The SP22 contractor, NGES-MS, will operate in the HEMF, LEPB and perform repair on SP22 equipment (NAVSEA OD 55512D, 2006). The launcher equipment is owned by the government. When the equipment is inducted into supply for repair at the NGES-MS

facility, custody of the equipment is transferred from the government to the contractor for repair. The equipment is repaired and remains in contractor custody until the government re-accepts the item. The equipment is then transferred from the contractor back to the government and returned to the supply system.

NAVSEA OD Number 55512D is the baseline for the development of SSP OD 57034, the SP22 Launcher Branch Operations Plan for SWFLANT. This document defines the NGES-MS responsibilities and the requirements under which they must operate. Third level repair is assigned to the NGES-MS for SP22 equipment (SSP OD 57034, 2007).

Launcher equipment repair procedures are defined in SSP OD 59281, Missile Handling and Maintenance Equipment Third-Level Maintenance for the HEMF and SSP OD 60829, TRIDENT II Launcher Expendables Third Level Maintenance Refurbishment Requirements for the LEPB. The HEMF is the location for third level non-ordnance repair and the LEPB is the location for third level ordnance repair. NGES-MS conducts third level maintenance in accordance with SSPINST 4423.39, the Fleet Ballistic Missile Weapon System/Strategic Weapon System Repairable Program Requirements and Procedures.

NGES-MS published the Launcher Operations Manual (LOM) which describes the operating instructions for the launcher contractor and the procedures necessary to support launcher equipment processing (NGES-MS, 2006).

The policy for SWS maintenance support, which includes the launcher subsystem and support equipment, is contained in SSPINST 4700.5A. The document defines maintenance as “All actions necessary for retaining an item in or restoring it to a specified condition” (SSPINST 4700.5A, 1982, Encl. 1, p. 1). The document describes three types of maintenance; preventative, corrective and progressive. Preventative maintenance is routine maintenance that identifies and corrects problems before they arise. Corrective maintenance corrects or repairs a specific item so that it can be returned

to operational status. Progressive maintenance is a number of scheduled maintenance processes that could include repair, calibration, test and alterations (SSPINST 4700.5A, 1982).

The SSPINST directs maintenance planning for all equipment and describes the four levels of maintenance which are authorized by the Strategic Systems Projects Office (SSPO). Third level maintenance or depot level maintenance for launcher equipment is performed at the GOCO facilities at SWFLANT. The document invokes the Trouble and Failure Reporting (TFR) program, as described below, for all SWS material. The TFR program is defined in SSPINST 3100.1J and is the method of communicating equipment trouble and failures and the associated corrective action between the SWS activities (SSPINST 4700.5A, 1982).

4. Trouble and Failure Reporting Requirements.

There are additional documentation requirements imposed on third level repair. The Strategic Weapon System (SWS)/Attack Weapon System (AWS) Trouble and Failure Report Program, SSPINST 3100.1J, establishes the "TFR Program as the primary method of communicating trouble and failures with respect to third level repair and associated corrective action at the SWF's" (SSPINST 3100.1J, 2005, p. iii). The SWFs prepare TFIRRs "to report on inspection, test and repair of SWS/AWS material" (SSPINST 3100.1J, 2005, p. 6-7).

SSP OD 45459 describes the TFR program requirements at Strategic Weapons Facilities (SWFs). SSP OD 45459 was developed from SSPINST 3100.1J and provides the TFR requirements and implementation at SWFLANT. The TFIRR "provides information which satisfies the SWF's information needs and the TFR Program reporting requirements" serving "the same purpose as a TFR for the SWF industrial facilities" (OD45459, 2005, p. 1-1).

A TFIRR is written to document deficiencies, safety issues, defects, malfunctions damage, unauthorized parts, and poor workmanship on SWS or shore-based support equipment. TFIRRs must be signed by the government representative prior to repair and signed by the government inspector after completion of the repair (SSP OD 45459, 2005).

The Standard Repair Disposition (SRD) is the use of SSP approved equipment repair documentation procedures for the HEMF contained in SSP OD5 9281 and LEPB contained in SSP OD 60829. The NGES-MS engineer performs an evaluation of the equipment to ensure the repair is contained within one of these two documents. If the repair is not contained in one of those approved procedures, a TFIRR must be written and resolved through a waiver or deviation process that allows the equipment to be restored to original configuration (SSP OD 45459, 2005).

C. CHAPTER SUMMARY

This chapter covered the DoD and SSP requirements for third level repair and the associated TFIRR documentation. Understanding the requirements is the first step in mapping the current third level repair process and identifying areas that can be targeted to reduce or eliminate excessive launcher TFIRR processing authority documentation and ultimately reduce third level repair cycle time.

III. CURRENT TROUBLE FAILURE INSPECTION/REJECTION REPORTS (TFIRR) PROCESSES

A. INTRODUCTION

The focus of this thesis is the evaluation of the Continuous Improvement (CI) Pilot Program approved by Strategic Systems Programs (SSP) in March, 2008 to reduce or eliminate TRIDENT II D5 Launcher Trouble Failure Inspection/Rejection Reports (TFIRRs) processing authority documentation and reduce third level repair cycle times at the NGES-MS facilities at the Strategic Weapons Facility, Atlantic (SWFLANT). The SWFLANT launcher third level repair cycle requires extensive TFIRR processing authority documentation that results in a loss of contractor man-hours and third level repair cycle time while waiting for government approval to begin repairs. The SWFLANT government and contractor team held a CI event to reduce or eliminate TFIRR processing authority documentation. Reducing third level repair cycle time can free manpower and other facility resources to better manage increasing repair demands (Pilot Program Plan, 2008). The TFIRRs that will be specifically addressed in this thesis are the induction TFIRRs and the Standard Repair Documentation (SRD) TFIRRs.

The CI team mapped and analyzed the current third level repair process flows for the induction TFIRR and SRD TFIRR processes, focusing on repairs performed per government approved repair procedures. During the analysis, the team identified value added and no value added processes, and made recommendations to modify the existing documentation that form the basis of the alternate processes. These documentation modifications and the alternate processes formed the foundation for the Pilot Program Plan discussed in Chapter IV.

B. CURRENT PROCESS FOR INDUCTION TFIRRS

An induction TFIRR is written on launcher equipment returned from fleet or shore activities to SWFLANT and inducted into the supply system for third level repair. The Master Repairable List (MRL) designates the SWFLANT Handling Equipment

Maintenance Facility (HEMF) or Launcher Explosive Processing Building (LEPB) as the third level repair facility. The government supply system receives the equipment and stores it in a government supply building (SSP OD 57034, 2007).

The equipment is inducted from the government supply system and transported to the NGES-MS third level maintenance facility. The DD1348 form transfers custody of the equipment from the government to the NGES-MS contractor for the purpose of repair (SSP OD 57034, 2007).

The NGES-MS receiving engineer performs the incoming inspection and troubleshoots the equipment to determine repair procedures. The Maintenance and Repair System (MARS) is the program used to create the repair Maintenance Guides (MGs) used for third level "repair processing in accordance with applicable SSP approved documents" (Pilot Program Plan, 2008, p. 3). After determining the required repair, the engineer prepares the induction TFIRR and the MG, referencing the government approved repair procedures in accordance with OD59281 for the HEMF or OD 60285 for the LEPB (SSP OD57034, 2007). The MG is the local electronic documentation "used for third level repair of equipment" and provides technicians step by step repair instructions from government approved repair procedures (Pilot Program Plan, 2008, p. 3). The MG captures the "discrepancies and material used to accomplish the repair/rework" (Pilot Program Plan, 2008, p. 3). The MG requires government acceptance of the repairs after work has been completed (Pilot Program Plan, 2008).

Before repairs can begin, the government must concur with the TFIRR. After induction TFIRR government concurrence, the NGES-MS technicians can start equipment repair in accordance with the MG. After the repair has been completed, the MG is signed by the NGES-MS technician. The NGES-MS engineer verifies the work is completed and signs the MG.

The government performs the final inspection of the repairs. The NGES-MS technicians, engineer and the government sign and close the TFIRR. After closing the TFIRR, the government signs and closes the MG which can only be closed after the induction TFIRR is closed.

A DD1348 form is prepared to transfer the custody of the equipment from the NGES-MS contractor back to the government. The government returns the equipment to the supply system. Figure 1 provides the current induction TFIRR process flow diagram.

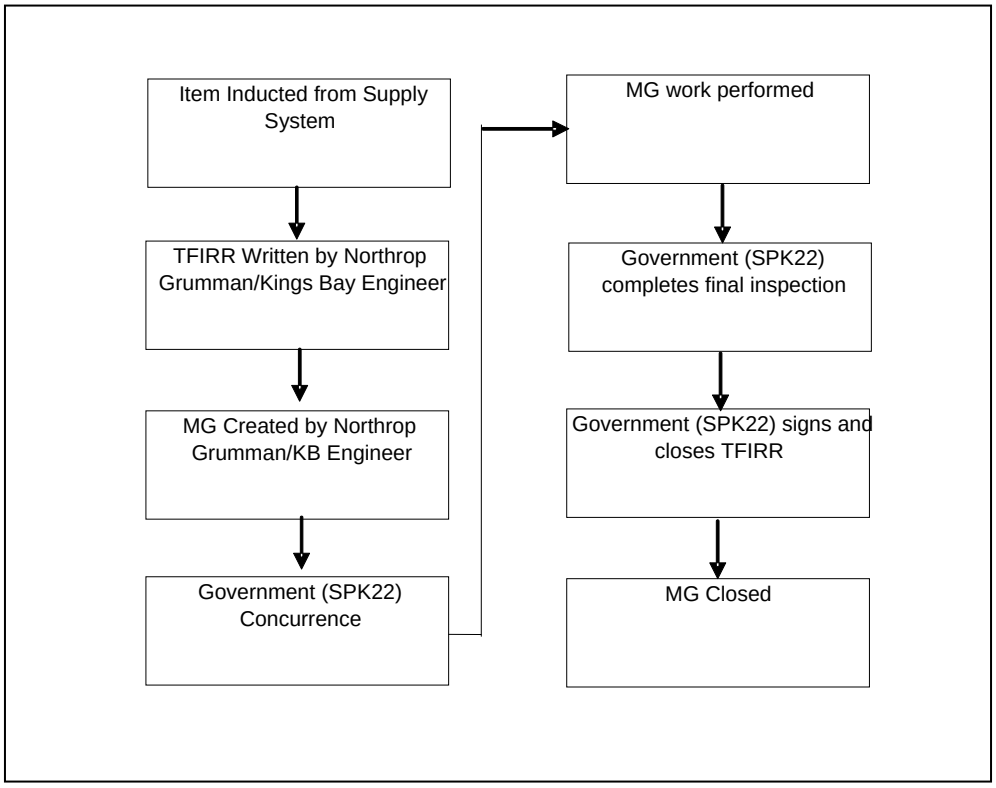

Figure 1. Current Induction TFIRR Process Flow Diagram (From: Pilot Program Plan, 2008, p. 6)

1. Current Induction TFIRR Process Problems

The NGES-MS engineer is required to prepare both the induction TFIRR and the MG. Government concurrence on the TFIRR is required before the NGES-MS technicians can begin repairs even though the MG contains step by step repair instructions per government approved repair procedures. The team noted that there is redundancy in the documentation process as both the TFIRR and MG capture the same information. The time it takes to prepare the documentation wastes time for the engineer and increases third level repair cycle time waiting for government concurrence on the TFIRR (Pilot Program Plan, 2008).

2. Induction TFIRR Process Analysis and Recommendations

The CI team determined that the MG identifies the repair procedure and the government acceptance of the equipment, capturing the same data as the induction TFIRR. The induction TFIRR was identified as a no-value-added process. If the induction TFIRR is eliminated, the NGES-MS technicians could begin repairing the equipment immediately after the MG is developed. The MG would document the repair and government acceptance of the equipment. Manpower efficiencies in both labor and time could be gained, the NGES-MS engineer would not have to prepare the induction TFIRR, and the NGES-MS technicians could begin repair on the equipment after receiving the MG, i.e., reducing third level repair cycle time (Pilot Program Plan, 2008). These recommendations will be incorporated into the alternate induction TFIRR process flow discussed in Chapter IV.

C. CURRENT PROCESS FOR STANDARD REPAIR DOCUMENTATION (SRD) TFIRRS

A SRD TFIRR is written for the repair of equipment supporting operational requirements. The equipment remains in government custody through the entire cycle including the repair cycle. After repair, the equipment is returned to support operational requirements. For example, when equipment supporting waterfront operations fails and requires repair, the government writes and approves a TFIRR and transports the equipment to the NGES-MS contractor facility for repair.

During the initial repair, if another problem is identified requiring additional repair, another TFIRR and MG must be written by NGES-MS engineering. The TFIRR and MG both reference the government approved repair procedures. The government must concur with the TFIRR prior to the start of repair. This wait for concurrence increases repair cycle time.

After government concurrence on the TFIRR, NGES-MS technicians repair the equipment in accordance with approved repair procedures in the MG. When the repairs are completed, NGES-MS technicians and engineer sign the MG. The government

performs the equipment inspection and closes the TFIRR and the MG. After the TFIRR and the MG are closed, the equipment is returned to the waterfront. Figure 2 shows the current SRD TFIRR Process Flow Diagram.

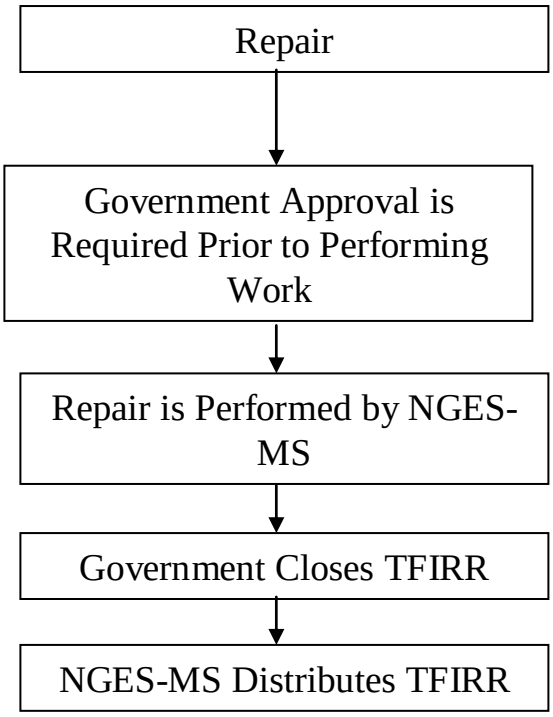

Figure 2. Current SRD TFIRR Process Flow Diagram (From: Pilot Program Plan, 2008)

1. Current SRD TFIRR Process Problems

When additional issues are discovered during the initial repair, the NGES-MS engineer must write another TFIRR and MG and seek government concurrence on the TFIRR before technicians can begin repairs. This is true even though the MG contains the documented government approved repair procedure. The consequence is an increase in repair cycle time (Pilot Program Plan, 2008).

2. SRD TFIRR Process Analysis and Recommendations.

The CI team determined that the SRD TFIRR is still a value added process. The NGES-MS engineer will still prepare a TFIRR and the MG however, if government approved repair procedures exist for the equipment, technicians will not have to wait for

government concurrence of the TFIRR to begin repairs. The wait for government concurrence to begin repairs is a no value added process and increases repair cycle time. The government approved repair procedure is documented in the MG. Government concurrence for the TFIRR is still required, but concurrence can occur anytime during the repair. Efficiencies can be gained by the technicians starting repair after the generation of the MG, reducing third level repair cycle time (Pilot Program Plan, 2008).

D. CHAPTER SUMMARY

The CI team developed and analyzed the current Induction TFIRR and the SRD TFIRR process flow diagrams to reduce unnecessary TFIRR requirements for repairs that have government approved repair procedures. The team identified value added and no value added areas and provided recommendations for streamlining the TFIRR processing authority documentation. The objective is to reduce third level repair cycle time. These recommendations will be used to develop the alternate process flows and the Pilot Program Plan in Chapter IV.

IV. DEVELOPMENT OF ALTERNATIVE PROCESSES

A. INTRODUCTION

In Chapter III the current induction and Standard Repair Documentation (SRD) Trouble Failure Inspection/Rejection Report (TFIRR) documentation process flows were introduced and analyzed, problems and challenges with each process were identified, and recommendations were developed for process modifications. The purpose of this thesis is the evaluation of the Continuous Improvement (CI) Pilot Program approved by Strategic Systems Programs (SSP) in March 2008 to reduce or eliminate TRIDENT II D5 Launcher Trouble Failure Inspection/Rejection Reports (TFIRRs) processing authority documentation and reduce third level repair cycle times at the Northrop Grumman Electronic Systems-Marine Systems (NGES-MS) facilities at the Strategic Weapons Facility, Atlantic (SWFLANT).

In this chapter, data from the current process analysis is used to develop the alternate TFIRR process flows and risk assessments as proposed by the Pilot Program Plan. Also identified are documentation requirements that need modification or elimination including reducing the TFIRR processing authority when government approved repair procedures exist. Analyses of the alternate process flows allow the initial estimation of the potential TFIRR processing time savings for both the government and contractor. Substantial man-hours could likely be saved if the recommended modifications are implemented. Potential savings are the primary catalyst that inspired the continuous improvement (CI) team to develop the Pilot Program Plan, e.g., to demonstrate efficiencies. The alternate process flows and recommended document modifications formed the basis of the Pilot Program Plan (2008).

The Pilot Program Plan was developed to implement the modified Trouble Failure Inspection/Rejection Report (TFIRR) processes in order to reduce excessive documentation and third level repair cycle time in the Northrop Grumman Electronic Systems-Marine Systems (NGES-MS) facilities at the Strategic Weapons Facility, Atlantic (SWFLANT). Reducing man-hours associated with writing the TFIRRs and

reducing contractor wait time for government concurrence can allow more items to be processed. Increasing facility repair capacity could also help compensate for projected future increases in the numbers of repairs. SSP concurred with the Pilot Program Plan in March 2008.

B. ALTERNATE INDUCTION TFIRR PROCESS

1. Discussion

In Chapter III, the current induction TFIRR process was introduced and analyzed. The NGES-MS engineer is required to prepare both the induction TFIRR and the Maintenance Guide (MG). The TFIRR requires government concurrence before the NGES-MS technicians can begin repairs even though the MG contains step by step repair instructions in accordance with documented government approved repair procedures. Third level repair cycle time is increased both in the preparation of the TFIRR and the wait for government concurrence prior to the start of the repair (Pilot Program Plan, 2008).

The CI team determined that the induction TFIRR was a no-value-added process. The MG identifies the repair procedure and the government acceptance of the equipment, capturing the same data as the induction TFIRR. In the alternate process, the induction TFIRR is eliminated and the NGES-MS technicians can begin equipment repairs post-development. The MG documents both the repair and the government acceptance of the equipment. The alternate process eliminates the requirement for the TFIRR preparation and the wait-time for government concurrence before beginning repairs, reducing third level repair cycle time (Pilot Program Plan, 2008).

2. Process Flow

As mentioned in Chapter III, an induction TFIRR involves launcher equipment returned from fleet or shore activities to SWFLANT for repair. The Master Repairable List (MRL) designates the SWFLANT Handling Equipment Maintenance Facility

(HEMF) or Launcher Explosive Processing Building (LEPB) as the third level repair facility. The government supply system receives the equipment and stores it in a SWFLANT supply building (SSP OD 57034, 2007).

The launcher equipment is inducted from the government supply system and transported to the NGES-MS third level maintenance facility. The DD1348 form transfers custody of the equipment from the government to the contractor for the repair purposes (SSP OD 57034, 2007).

The NGES-MS receiving engineer performs the incoming inspection and troubleshoots the equipment to determine repair procedures. The Maintenance and Repair System (MARS) is the program used to create the repair Maintenance Guides (MGs) used for third level "repair processing in accordance with applicable SSP approved documents" (Pilot Program Plan, 2008, p. 3).

If the equipment cannot be repaired with approved government procedures a TFIRR will be required and the normal TFIRR process will be used (not covered in this thesis).

In the proposed alternative induction process, if the repair can be performed with existing government approved repair procedures, the NGES-MS engineer will not be required to prepare a TFIRR but will prepare the MG, referencing the government approved repair procedures. The MG documents the step by step repair instructions from government approved repair procedures and the government acceptance of the repairs (Pilot Program Plan, 2008). This allows the technicians to begin repairs upon receipt of the MG. There is no cycle time lost waiting for government concurrence. After the repair has been completed, the MG is signed by the NGES-MS technician and the engineer. The government performs the final inspection of the equipment and closes the MG. The MG is entered into the repair database capturing the information for trend analysis. The alternate induction TFIRR process flow is presented in Figure 3.

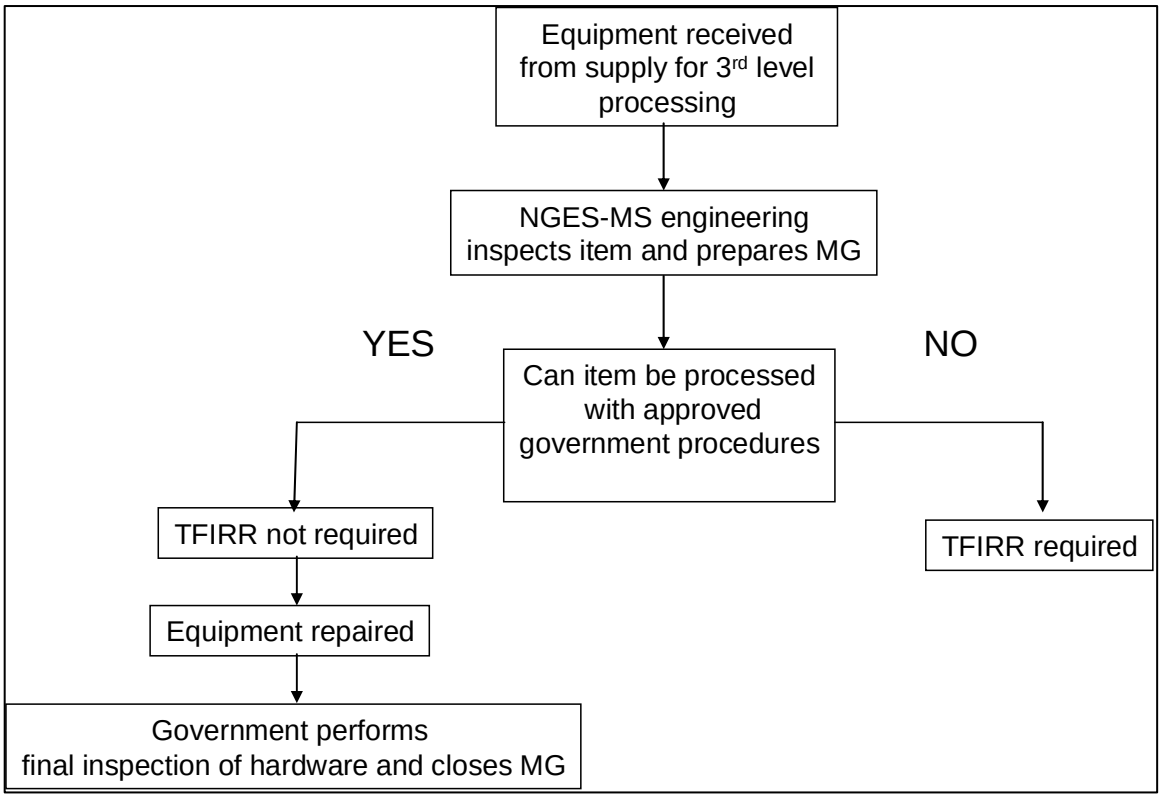

Figure 3. Alternate Induction TFIRR Process Flow Diagram (From: Pilot Program Plan, 2008)

3. Risks and Mitigation

Risk: If the existing TFIRR process is not followed deficiencies and acceptance may not be documented.

Mitigation: The MG is local electronic paperwork used for third level repair. It also defines the selection and order of government approved standard repair and alteration procedures by task for the repairs and government acceptance after work completion. The MG captures discrepancies and material used to accomplish the repair. The MG is included in the repair database capturing information for trend analysis (Pilot Program Plan, 2008).

Risk: The equipment can not be repaired in accordance with the MG or the technician comes across additional issues whose repair is not in a government approved repair procedure.

Mitigation: If the procedure to repair the equipment deviates from the MG, the procedure will be modified, and the NGES-MS engineer is required to write a TFIRR. The same is true if an additional problem is discovered that cannot be repaired with a government approved repair procedure, the engineer is required to prepare a TFIRR.

C. ALTERNATE STANDARD REPAIR DISPOSITION (SRD) TFIRR PROCESS

1. Discussion

As defined in the previous chapter, the SRD TFIRR is written for the repair of equipment supporting shore-side operational requirements. The equipment remains in government custody through the entire cycle including the repair cycle. After repair, the equipment is returned to shore-side to support operational requirements.

2. Process Flow

When a piece of launcher equipment supporting waterfront operations fails and requires repair, the government writes and approves a TFIRR and transports the equipment to the NGES-MS contractor facility for repair. During the initial repair, if another problem is identified requiring additional repair, another TFIRR and MG must be written by NGES-MS engineering. Both the initial and each subsequent TFIRR and MG must reference government approved repair procedures.

In the alternative process, the NGES-MS repair technicians will be allowed to go to work as soon as the MG is developed. No government concurrence is immediately necessary for TFIRRs whose repair is contained in government approved documentation. Government approval of the TIFFR can occur anytime during the repair process. The government will still be required to close out the TFIRR and the MG at repair

completion. The TFIRR will be posted and distributed in the database and used for equipment trend analysis. Figure 4 contains the Alternate SRD TFIRR Process Flow Diagram.

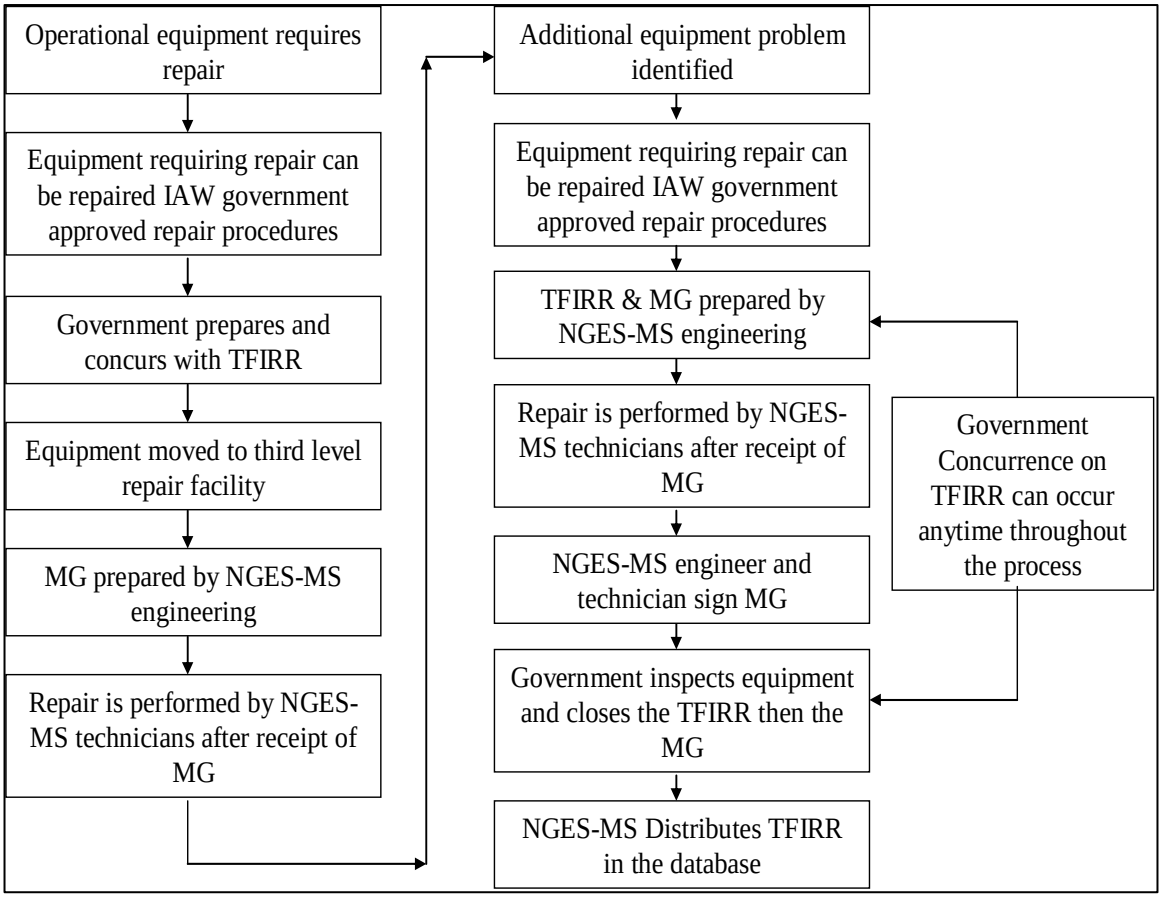

Figure 4. Alternate SRD TFIRR Process Flow Diagram (From: Pilot Program Plan, 2008)

3. Risks and Mitigation

Risk: The TFIRR will not be approved prior to the start of third level repair.

Mitigation: The TFIRR will still be required, however, if approved repair procedures exist, and there is no reason to wait for government approval. The government can approve the TFIRR anytime throughout the repair process. The government inspections and TFIRR approval will still be required prior to the equipment being returned to support operational requirements.

If the procedure to repair or rework the item deviates from the approved repair procedures, a TFIRR will be required. The resolution of the TFIRRs that do not have government approved repair procedures are not discussed in this thesis.

D. PROPOSED CHANGES TO THIRD LEVEL PROCESSING AUTHORITY DOCUMENTATION

Based on the analyses of the alternate process flows for both the induction TFIRR and SRD TFIRR, the following SSP documentation changes are proposed and discussed in Tables 1 and 2 below.

SSP OD 40825	Current	Proposed Changes
Define "equivalent technical analysis"	Not defined	Equivalent technical analysis. A thorough analysis performed by the design agent to determine the appropriate procedure to be used to rework/repair the item.

Table 1. SSP OD 40825B Excerpt of Alternate Processing Proposed Changes (From: Pilot Program Plan, 2008)

SSP OD 45459	Current	Proposed Changes
Modify paragraph 1.3.1	During processing, TFIRRs shall be prepared to document and/or report all Strategic Weapon System (SWS)/Attack Weapon System (AWS) hardware troubles and failures, except for those cosmetic defects that are repaired in accordance with SSP approved repair documentation discussed in paragraph 1.3.6.	During processing, TFIRRs shall be prepared to document and/or report all SWS/AWS hardware troubles and failures, except with the following exceptions: Defects that are repaired in accordance with SP approved repair documentation discussed in paragraph 1.3.6. Items inducted for 3rd level processing through the supply system and processed in accordance with SSP approved documentation.
Deletion	1.3.1 – See above. 1.3.6 – Standard Repair Disposition (SRD) or Equivalent (Reference Chapter 5) – The SRD or an SSP approved equivalent is used at SWFs to document standardized repair of	Delete the word "cosmetic" from paragraphs 1.3.1, 1.3.6, 5.1 and 5.1.3.

	cosmetic defects to weapon system hardware in accordance with SSP approved repair documentation. Before an SRD or equivalent is established to accomplish repair of cosmetic defects, the conditions of Chapter 5 must be met. 5.1 – The SRD or an SSP approved equivalent is used at the SWFs to document standardized repair of cosmetic defects to weapon systems hardware in accordance with SSP approved repair documentation. Before an SRD or equivalent is established to accomplish repair of cosmetic defects, the following conditions shall be satisfied: 5.1.3 – Repair of cosmetic defects will be permitted only to the extent that is appropriately based on facility capabilities. Repairs using SRDs or equivalent are permitted only to the extent that is specifically authorized by SSP.	

Table 2. SSP OD 45459 Excerpt of Alternate Processing Proposed Changes (From: Pilot Program Plan, 2008)

E. ESTIMATED THIRD LEVEL PROCESSING CYCLE TIME SAVINGS

The CI team estimated average TFIRR processing times for both government and NGES-MS based on the 2006 induction TFIRR and SRD TFIRR data and determined that minor changes could yield substantial man-hour savings.

In 2006, there were 350 induction TFIRRs and 236 SRD TFIRRs, totaling 586 TFIRRs, as shown in Table 3.

Calendar Year 2006 Number of Induction TFIRRs	Calendar Year 2006 Number of SRD TFIRRs	2006 Total
350	236	586

Table 3. Calendar Year 2006 Total Induction and SRD TFIRRs for NGES-MS (From:

SWFLANT Continuous Improvement Charter, 2007)

Table 4 contains the estimated average government TFIRR processing time in man-hours. The totals contain both the TFIRR concurrence, and the final inspection and closeout times.

Government TFIRR Processing Times (man-hours, average)	
	Engineer
Government Concurrence	0.5
Final Inspection & Closeout	0.5
Total	1.0

Table 4. Estimated Average Government TFIRR Processing Times (From: SWFLANT Continuous Improvement Charter, 2007)

Table 5 presents the estimated average NGES-MS TFIRR processing times for TFIRR preparation based on the technician wait-time for government concurrence before beginning repairs, the final inspection and TFIRR closeout and the data capture.

NGES-MS TFIRR Processing Times (man-hours, average)			
	Engineer	Technician	Total
TFIRR Preparation	1.0	0.0	1.0
Government Concurrence Wait Time	0.5	2 x 0.5	1.5
Final Inspection & Closeout	0.5	2 x 0.5	1.5
Data Capture	1.0	0.0	1.0
		Total	5.0

Table 5. Estimated Average NGES-MS TFIRR Processing Times (From: SWFLANT Continuous Improvement Charter, 2007)

The total estimated yearly man-hour savings for both government and NGES-MS are shown in Table 6. Estimates for induction TFIRRs elimination are 350 hours for the government and 1,750 hours for NGES-MS. Estimated government processing time for the SRD TFIRRs is 118 hours. The estimated processing time is 354 hours for NGES-MS. The savings can be reapplied to address additional future repair demands. The total estimated man-hour savings reflect the relevance of the Pilot Program Plan.

	Number of TFIRRs	**Government TFIRR Processing Time (Hours)**	**Government Total (Hours)**	**NGES-MS TFIRR Processing Time (Hours)**	**NGES-MS Total (Hours)**
Elimination of Induction TFIRRs	350	1.0	350.0	5.0	1,750.0
Reduction in SRD TFIRRs	236	0.5	118.0	1.5	354.0
Estimated Yearly Man-Hour Savings			468.0		2,104.0

Table 6. Estimated Yearly Government and Contractor Man-Hour Savings (From: SWFLANT Continuous Improvement Charter, 2007)

F. PILOT PLAN APPROVAL AND IMPLEMENTATION.

The Pilot Program Plan was the direct result of the CI event developed by the SWFLANT government and contractor team. The plan implements the modified TFIRR process described in the alternate processes for the purpose of reducing or eliminating the third level launcher TFIRRs processing authority documentation and third level repair cycle times. With the modified TFIRR process in place, the Pilot Program can demonstrate a more efficient workflow and a reduction in third level cycle time and man-hours per item. Reducing the man-hours associated with writing the TFIRRs and reducing the wait time for government concurrence can allow more equipment to be processed. Increasing facility repair capacity can help compensate for projected future increases in numbers of repairs. The purpose of the plan was to demonstrate the efficiencies of the proposed alternate processes, collect and analyze data, and provide the results to SSP, who approved the Pilot Program Plan in March 2008 (Pilot Program Plan, 2008).

The Pilot Program was conducted over a period of 12 weeks to demonstrate the results of the proposed documentation changes. The first two weeks of the period were devoted to the training and distribution of the alternate process flow. The modified process and data collection was executed over the next eight weeks. The final two weeks were used to analyze the data and develop the report that was provided to SSP for review. After the eight week implementation period, the current process will resume until SSP evaluates the results and determines whether to permanently implement the proposed changes (Pilot Program Plan, 2008).

During the Pilot Program SWFLANT government continued to operate per SSP OD 45459 and SSP OD 40825B with the following exceptions:

- TIFRRS will not be "generated for equipment inducted from Supply into HEMF and LEPB for third level maintenance. The Northrop Grumman Maintenance Guide (MG) will continue to be utilized for the rework of inducted equipment and to capture government acceptance of the hardware" (Pilot Program Plan, 2008, p. 7).

- Local government will not be required "to provide concurrence prior to Northrop Grumman performing the repair/rework when invoking Standard Repair Dispositions in accordance with OD45459" (Pilot Program Plan, 2008, p. 7).

If the repair deviated from the SSP approved documentation, a TFIRR would be processed in accordance with SSP OD 45459, Trouble and Failure Report Program for Strategic Weapons System Missile Processing Facilities.

1. Data Collection

The Pilot Program Plan required data collected for the "number of occurrence of each process" (Pilot Program Plan, 2008, p. 8). The average number of saved man-hours for each process was documented. The total man-hour savings was determined by "multiplying the number of incident by the average man-hour savings resulting in the total man-hours that will be utilized for additional processing. Man-Hours resulting from rework for government rejections at final acceptance, that would have been identified by the government under the regular process flow, will be deducted from the total" (Pilot Program Plan, 2008, p. 8). The data analysis and results of the Pilot Program are in Chapter V.

2. Metrics Requirements

The Pilot Program Plan identified metrics in accordance with the following requirements:

- The "number of TFIRRs not required to be written and concurred with" (Pilot Program Plan, 2008, p. 8).
- "Average Induction TFIRR times from previous records for the items inducted during the eight week test period" (Pilot Program Plan, 2008, p. 8).
- "Man-hours resulting from rework that would have been identified by the government under the current process flow" (Pilot Program Plan, 2008, p. 8).

NGES-MS was tasked to report the results at the conclusion of the eight week implementation program.

3. Documentation

NGES-MS was assigned responsibility for maintaining the electronic data. Third level equipment maintenance and repair was documented by the MGs developed in the Maintenance and Repair System (MARS) program. The government personnel can review the contractor developed MGs in the MARS system. Repairs outside the SSP approved documentation will be documented by TFIRR in accordance with SSP OD 45459 and SSP OD 40825B and the NGES-MS Launcher Operations Manual (LOM). The Pilot Program Plan recommended permanent changes to approved SSP documentation and are listed in Tables 1 and 2 (Pilot Program Plan, 2008).

G. CHAPTER SUMMARY

The government contractor CI team developed the alternate process flow diagrams for both the Induction TFIRR and the SRD TFIRR processes. Alternate process program risks were identified and mitigated, and recommendations for documentation changes were identified and proposed for SSP OD 45459 and SSP OD 40825B. Associated third level repair man-hour yearly savings were estimated at 2,104 for NGES-MS and 468 for the government (SWFLANT Continuous Improvement Charter, 2007).

The government NGES-MS CI team developed the Pilot Program Plan to implement the modified alternate TFIRR process. The purpose of the plan was to reduce or eliminate TFIRR processing authority documentation and third level repair cycle time. The Pilot Program Plan included requirements and procedures for processing TFIRRs associated with third level maintenance at all facilities/buildings operated by NGES-MS at SWFLANT. The modifications to current requirements are: (1) no TFIRRs will be written for the third level repair of SP22 cognizant equipment inducted for repair; and (2) no local government concurrence is necessary for SRD TFIRR's in which repairs are contained in government approved documentation. NGES-MS technicians can begin working on the item after the MG is developed. The MG will serve the same documentation purpose as the TFIRR. The resulting modifications should demonstrate a more efficient workflow and a reduction in third level cycle time and man-hours per item which increases repair capacity. The Pilot Program Plan was provided to SSP for

approval and in March 2008 for the recommended 12 week period to demonstrate the results of the proposed process changes. SWFLANT government and NGES-MS are tasked to submit the results to SSP for review and consideration before making the permanent changes (Pilot Program Plan, 2008).

V. DATA ANALYSIS

A. INTRODUCTION

Strategic Systems Programs (SSP) authorized an eight week pilot program in 2008 to evaluate a modified Trouble Failure Inspection/Rejection Report (TFIRR) process to reduce launcher third level repair cycle time and associated man hours at the Northrop Grumman Electronic Systems-Marine Systems (NGES-MS) facilities at Strategic Weapons Facility, Atlantic (SWFLANT). The modified TFIRR process eliminated both the requirement for an induction TFIRR and the requirement for government concurrence for the Standard Requirements Documentation (SRD) TFIRR's, as long as the repairs were contained in government approved documentation (Pilot Program Completion Report, 2008). During the eight week period, data was collected from the facilities and analyzed. The results are included in this chapter.

B. DATA COLLECTION METHODOLOGY

The Pilot Program eliminated steps from both TFIRR processes. Prior to the Pilot Program implementation, the team captured induction and SRD TFIRR data to establish the metrics for the average processing time that would be applied to data collected during the Pilot Program. The data for both scenarios captures the time to complete the repair by the NGES-MS engineer, the NGES-MS technician and the government. Several pre-Pilot Program repairs were not completed during the data collection period. The data points that were not completed were left blank and not counted in the total averages. In order to compensate for the outlying data points, the highest and lowest values for each column were deleted from the totals. To find the average time to complete, the times were totaled for each column and divided by the number of data points. Appendices A, B, C and D contain the detailed data spreadsheets and explanations (Pilot Program Completion Report, 2008).

Appendices A and B were used to develop the averages for the induction and SRD TFIRRs. The average induction TFIRR minutes for the NGES-MS engineer and technicians were calculated at 34.20 and 20.10 man-minutes respectively. The average time for government concurrence was approximately 47.45 man-minutes. The SRD TFIRR average times for the NGES-MS technician was calculated at 20.02 man-minutes. The NGES-MS engineer would still be required to prepare a TFIRR for this process so his time was not captured. The average time for government concurrence for this process was 33.48 man-minutes. These averages will be used during the Pilot Program to determine cycle time and the man-hour savings. The average personnel man-minutes by the participants and the TFIRR processing times are presented in Table 7 below (Pilot Program Completion Report, 2008).

PILOT PROGRAM AVERAGE MAN-MINUTES BY TASK AND PERSONNEL

Task			
	NGES-MS Eng	**NGES-MS Tech**	**Government Concurrence**
Induction TFIRR (Minutes)	34.20	20.10	47.45
SRD TFIRR (Minutes)	N/A*	20.02	33.48

* TFIRR is required.

Table 7. Pilot Program Average Man-Minutes by Task and Personnel (From: Pilot Program Completion Report, 2008)

C. ANALYSIS

1. Induction TFIRR Results

The Pilot Program was executed over a period of eight weeks. During this period 67 Maintenance Guides (MGs) were prepared with no induction TFIRRs required to begin repairs. The induction TFIRR Pilot Program results are computed for the NGES-

MS engineer, technician and government personnel. Taking the average man-minutes computed in Appendix A, and presented in Table 7, multiplied by the number of MGs for induction in Appendix C, provides the estimated minutes and hours saved during the Pilot Program. The Pilot Program showed savings of 7.58 man-days for NGES-MS and 6.62 man-days for the government. Converting the Pilot Program estimates for one year potentially yields substantial savings of 49.26 NGES-MS man-days that are available for additional third level repair efforts. The government would save 43.03 days previously designated to concurrence and could make themselves available to address the additional repair processing and inspection efforts. The results are presented in Table 8 (Pilot Program Completion Report, 2008).

Pilot Program Induction TFIRR Results

	Average Man-Minutes by Task	Number of Induction TFIRRs During Pilot Program	Minutes Saved During Pilot Program (8 Weeks)	Man-Hour Savings During Pilot Program (8 Weeks)	Man-Day Savings During Pilot Program (8 Weeks)	Estimated Man-Hour Savings For 1 Year (52 Weeks)	Estimated Man-Day Savings For 1 Year (52 Weeks)
NGES-MS Engineer	34.20	67.00	2,291.40	38.19	4.77	248.24	31.00
NGES-MS Technician	20.10	67.00	1,346.70	22.45	2.81	145.93	18.26
Government Concurrence	47.45	67.00	3,179.15	52.99	6.62	344.44	43.03
Total			6,817.25	113.62	14.20	738.61	92.29

Table 8. Pilot Program Induction TFIRR Results (From: Pilot Program Completion Report, 2008)

Comparing the 350 induction TFIRR estimated man-hour savings presented in Chapter IV, to the Pilot Program average man-minutes per task, the government and contractor initial estimates were higher. The average man-minutes by task from Table 8 above were multiplied by the initial induction TFIRR estimate of 350 and converted into hours (Pilot Program Completion Report, 2008). The initial induction TFIRR estimates compared to the Pilot Program projected estimates are presented in Table 9 below.

Elimination of Induction TFIRRs		
	Government Man Hours	NGES-MS Man Hours
Initial Estimates (350)	350.00	1750.00
Pilot Program Projected Estimates Average Man Minutes per Task (x 350)	276.79	316.75

Table 9. Elimination of Induction TFIRRs, Initial Estimates vs. Pilot Program Projected Estimate Comparison (From: Pilot Program Completion Report, 2008)

2. SRD TFIRRs

During the Pilot Program, a total of 15 SRD TFIRRs were prepared. The SRD TFIRR Pilot Program results are computed for the NGES-MS engineer, technician and government personnel. The average man-minutes computed in Appendix C were multiplied by the number of SRD TFIRRs to provide the minutes and hours saved during the Pilot Program presented in Appendix D. The Pilot Program showed savings of 0.63 man-days for NGES-MS and approximately 1.05 man-days for the government. The Pilot Program Converting the Pilot Program estimate for one year yields a savings of 4.07 NGES-MS man-days that are available for additional third level repair efforts. The government would save 6.80 days previously designated to concurrence (Pilot Program Completion Report). The results are presented in Table 10.

Pilot Program SRD TFIRR Results

	Average Man-Minutes by Task	Number of SRD TFIRRs During Pilot Program	Minutes Saved During Pilot Program (8 Weeks)	Man-Hour Savings During Pilot Program (8 Weeks)	Man-Day Savings During Pilot Program (8 Weeks)	Estimated Man-Hour Savings For 1 Year (52 Weeks)	Estimated Man-Day Savings For 1 Year (52 Weeks)
NGES-MS Technician	20.02	15.00	300.30	5.01	0.63	32.53	4.07
Government Concurrence	33.48	15.00	502.20	8.37	1.05	54.40	6.80
Total			802.50	13.38		86.93	10.87

Table 10. Pilot Program SRD TFIRR Results (From: Pilot Program Completion Report, 2008)

Compared to the SRD TFIRR initial estimated man-hour savings presented in Chapter IV, the contractor estimates were higher when compared to the Pilot Program results for the average man-minutes per task and multiplied by the initial SRD TFIRRs estimate of 236. However, Pilot Program projected estimates for government man-hours are higher than the initial estimates. The initial SRD TFIRR estimates compared to the Pilot Program projected estimates are presented in Table 11 below.

SRD TFIRR Modification		
	Government Man Hours	**NGES-MS Man Hours**
Initial Estimates (236)	118.00	354.00
Pilot Program Projected Estimates Average Man Minutes per Task (x236)	131.68	78.74

Table 11. SRD TFIRR Initial Estimates vs. Pilot Program Projected Estimate Comparison (From: Pilot Program Completion Report, 2008)

D. DATA LIMITATIONS

Because of the pre-Pilot Program time limitations, the data points collected that were used to estimate the average induction and SRD TFIRR times were not all completed due to the length of time of the equipment in the repair cycle. This created blanks in the data and varied the number of data points.

Additionally, the government concurrence times vary due to the security measures that are implemented during operational events. The government also supports several other contractor repair and rework efforts located in various facilities.

The actual Pilot Program data collection period lasted only eight weeks, a relatively short period of time in the life of third level equipment repair. The data calculations used the number of instances multiplied by the average rate. Those results were then multiplied to make a yearly projection of man-hours that could be saved.

E. PILOT PROGRAM RESULTS

The Pilot Program covered a period of 12 weeks, eight of which were dedicated to data collection. The data analysis results demonstrate a reduction in man-hours and third level repair cycle time using the modified TFIRR processing plan is feasible. The government saved 7.67 man-days of effort and NGES-MS saved 8.21 days resulting in a 20% reduction in man-days, demonstrating a more efficient work flow and reducing the total third level repair cycle time. The results are shown in Table 12 below.

Projected Pilot Program Savings (8 Weeks)		
	Government Estimated Man-Day Savings for 8 Weeks	NGES-MS Estimated Man-Day Savings for 8 Weeks
No Induction TFIRRs	6.62	7.58
SRD TFIRR	1.05	0.63
Total Man-Hour Savings	7.67	8.21

Table 12. Pilot Program Total Man-Day Savings (From Pilot Program Completion Report, 2008)

When projecting the estimate over one year, the government could potentially save 49.85 days and NGES-MS 53.34 processing days, which could allow an increased repair capacity through the facilities to address future requirements. The results are presented in Table 13.

Projected Pilot Program Savings (1 Year)		
	Government Estimated Man-Day Savings for 1 Year	NGES-MS Estimated Man-Day Savings for 1 Year
No Induction TFIRRs	43.03	49.26
SRD TFIRR	6.80	4.07
Total Man-Day Savings	49.83	53.33

Table 13. Projected Pilot Program Total Man-Day Savings (From Pilot Program Completion Report, 2008)

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VI. CONCLUSIONS, KEY POINTS AND RECOMMENDATIONS

A. CONCLUSIONS

This thesis evaluated a Continuous Improvement (CI) Pilot Program to reduce or eliminate TRIDENT II D5 Launcher Trouble Failure Inspection/Rejection Reports (TFIRRs) processing authority documentation and reduce third level repair cycle times at the Northrop Grumman Engineering Systems-Marine Systems (NGES-MS) facilities at the Strategic Weapons Facility, Atlantic (SWFLANT). The results from the data collected during the 12 week Pilot Program resulted in a 20% reduction in man-hours with the modified TFIRR process, demonstrated a more efficient work flow and reduced the total third level repair cycle time.

B. KEY POINTS

Changing the requirements for a strategic program whose processes have been well documented and operates with mandatory procedural compliance is a daunting challenge. To propose changes to these processes, the CI team followed several important steps to ensure that the Pilot Program would be a carefully conceived and controlled process. The success of the program and demonstrated repair cycle time savings would subsequently allow the proposed documentation changes to be permanently implemented.

1. Encouragement to Make Changes

Strategic Systems Programs (SSP) encourages the use of the CI process to "to achieve more with greater efficiency and to free resources to address emergent needs" (SSPINST 5000.15, 2006, p. 1). In this case, the CI process was used successfully; and identifiable results were realized and demonstrated in the Pilot Program.

2. CI Team Composition

The SWFLANT CI team was composed of several individuals who were knowledgeable, motivated and empowered to develop the alternative processes. The team identified areas requiring changes and the subsequent risks and risk mitigation. The team proposed a new documentation process and crafted a Pilot Program to validate their assumptions.

3. Requirements Review

The team realized that a complete understanding of the TFIRR documentation requirements is a critical step in the mapping of the current third level repair processes and the development of the alternative processes.

4. Value Stream Mapping

The development of the current TFIRR process documentation allowed the team to identify value-added and no-value-added areas. This information enabled the team to: (1) identify target areas for the reduction and elimination of the excessive launcher TFIRR processing documentation; (2) develop the alternate process flows for both TFIRR processes; and (3) recommend modifications to the current documentation.

5. Risk Identification and Mitigation

The CI team identified and mitigated the program and technical risks for the alternate TFIRR processes, another critical step in gaining SSP approval for the Pilot Program demonstration.

6. Pilot Program Plan

The team developed the Pilot Program Plan to implement the alternate TFIRR process. The Pilot Program was a temporary test run to demonstrate the results of the proposed documentation changes and to ensure all risks had been identified and mitigated. Over an eight week period, data was gathered and analyzed and the results were provided to SSP for permanent documentation change consideration.

7. Quantifiable Results

The results of the Pilot Program data analysis indicated that both the government and contractor saved approximately eight man-days during the eight week period, demonstrating a more efficient workflow. The 20% reduction in man-hours reduced the overall third level repair cycle time. Projecting the data over one year, the government could potentially save 49 man-days and NGES-MS 53.34 processing man-days, which allows an increased repair capacity through the facilities to address future repair requirements.

C. RECOMMENDATIONS FOR FURTHER STUDY

The continuous improvement event and the subsequent pilot program success provides the foundation and guidance for additional process reviews at SWFLANT to further reduce excessive processing authority documentation, reduce third level maintenance cycle times and increase repair capacity at the facility.

Based on the success from this study, a continuous improvement event is scheduled for the Strategic Weapons Facility, Pacific (SWFPAC) in October 2008. The team will use the lessons learned from the pilot program and apply them to reduce or eliminate excessive third documentation processing authority to reduce the third level repair cycle time.

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APPENDIX A. PILOT PROGRAM AVERAGE INDUCTION TROUBLE FAILURE INSPECTION/REJECTION REPORT (TFIRR) TIME

The data for calculating the average induction TFIRR times were recorded prior to the start of the Pilot Program and were used to determine the average TFIRR processing times. Some of the repairs were not completed prior to the start of the pilot program. The data points for repairs that were not completed were left blank and not counted in the total averages. In order to compensate for the outlying data points, the highest and lowest values for each column were deleted from the totals. To find the average time to complete, the times were totaled for each column and divided by the number of data points (Pilot Program Completion Report, 2008).

As a result of this effort, the NGES-MS Engineer takes an average of 14 minutes to write the TFIRR, government TFIRR concurrence time delays took an average of 47 minutes. The NGES-MS technicians and engineers spent an average of 9 minutes closing the TFIRR. The technicians lost an average of 12 minutes of production time waiting for the government to close the TFIRR. The average time for the engineer to file the TFIRR in the database is 11 minutes (Pilot Program Completion Report, 2008).

Pilot Program Average Induction TFIRR Time (Minutes)										
Date	**TFIRR Number**	**TFIRR Type**	**TFIRR Development Time (NGES-MS Eng) (Minutes)**	**TFIRR Concurrence Time Delay (Minutes)**	**Technician Lost Production Time (Minutes)**	**TFIRR Closure Time (NGES-MS Tech) (Minutes)**	**TFIRR Closure Time (NGES-MS Eng) (Minutes)**	**TFIRR Closure Lost Production Time (Minutes)**	**TFIRR Closure Time Delay (Minutes)**	**TFIRR Filing Time (PDF) (Minutes)**
39525.00	3825265.00	Induction	15.00	180.00	0.00	15.00	15.00	30.00	15.00	15.00
39525.00	3825266.00	Induction	15.00	180.00	0.00	15.00	15.00	30.00	15.00	15.00
39525.00	3825267.00	Induction	15.00	180.00	0.00	15.00	15.00	30.00	15.00	15.00
39525.00	3825268.00	Induction	15.00	180.00	0.00	15.00	15.00	30.00	15.00	15.00
39531.00	3825269.00	Induction	15.00	30.00	0.00					
39531.00	3825270.00	Induction	15.00	30.00	0.00					
39531.00	3825271.00	Induction	15.00	30.00	0.00					
39531.00	3825272.00	Induction	15.00	30.00	0.00					
39531.00	3825273.00	Induction	15.00	30.00	0.00					
39531.00	3825274.00	Induction	15.00	30.00	0.00					
39531.00	3825275.00	Induction	15.00	30.00	0.00					
39531.00	3825276.00	Induction	15.00	30.00	0.00					
39531.00	3825277.00	Induction	15.00	30.00	0.00					
39531.00	3825278.00	Induction	15.00	30.00	0.00					
39531.00	3825279.00	Induction	15.00	30.00	0.00					
39531.00	3825280.00	Induction	15.00	30.00	0.00	15.00	15.00	0.00	180.00	15.00
39549.00	3825237.00	Induction	30.00	60.00	0.00	15.00	15.00	0.00	180.00	15.00
39556.00	3825291.00	Induction	30.00	60.00	0.00					
39548.00	3836535.00	Induction	6.00	4.00	0.00	2.00	3.00	5.00	4.00	7.00
39548.00	3836536.00	Induction	6.00	4.00	0.00	2.00	3.00	5.00	4.00	7.00
39548.00	3836537.00	Induction	6.00	4.00	0.00	2.00	3.00	5.00	4.00	7.00
39548.00	3836538.00	Induction	6.00	4.00	0.00	2.00	3.00	5.00	4.00	7.00
39560.00	3836552.00	Induction	8.00	4.00	0.00	2.00	4.00	6.00	7.00	6.00
39560.00	3836553.00	Induction	12.00	8.00	0.00	2.00	2.00	4.00	14.00	8.00
Subtotal (Minutes)			344.00	1228.00	0.00	102.00	108.00	150.00	457.00	132.00
Eliminate High and Low Data Points			**-36.00**	**-184.00**	**0.00**	**-17.00**	**-17.00**	**-34.00**	**-184.00**	**-21.00**
Total (Minutes)			**308.00**	**1044.00**	**0.00**	**85.00**	**91.00**	**116.00**	**273.00**	**111.00**
Total Time (Hours)			5.13	17.40	0.00	1.42	1.52	1.93	4.55	1.85
# Data Points			22.00	22.00	22.00	10.00	10.00	10.00	10.00	10.00
Average (Minutes)			14.00	47.45	0.00	8.50	9.10	11.60	27.30	11.10

Table 14. Pilot Program Average Induction TFIRR Time (From: Pilot Program Completion Report, 2008)

APPENDIX B. PILOT PROGRAM AVERAGE STANDARD REPAIR (SRD) DOCUMENTATION TROUBLE FAILURE INSPECTION/REJECTION (TFIRR) REPORT TIME

The data for calculating the average SRD TFIRR times were recorded prior to the start of the Pilot Program and were used to determine the average SRD TFIRR processing times. Some of the repairs were not completed prior to the start of the pilot program. The data points for repairs that were not completed were left blank and not counted in the total averages. In order to compensate for the outlying data points, the highest and lowest values for each column were deleted from the totals. To find the average time to complete, the times were totaled for each column and divided by the number of data points (Pilot Program Completion Report, 2008).

As a result of this effort, the NGES-MS Engineer is required to write the TFIRR. TFIRR government concurrence delays took an average of 33 minutes. The technicians lost an average of 20 minutes of production time due to waiting for TFIRR concurrence (Pilot Program Completion Report, 2008).

Pilot Program Average SRD TFIRR Time (Minutes)										
Date	TFIRR Number	TFIRR Type	TFIRR Development Time (NGES-MS Eng)(Minutes)	TFIRR Concurrence Time Delay (Minutes)	Technician Lost Production Time (Minutes)	TFIRR Closure Time (NGES-MS Tech) (Minutes)	TFIRR Closure Time (NGES-MS Eng) (Minutes)	TFIRR Closure Lost Production Time (NGES-MS Tech) (Minutes)	TFIRR Closure Time Delay (Minutes)	TFIRR Filing Time (NGES-MS Eng) (PDF) (Minutes)
3/11/2008	3825262	Defect	0.00	60.00	60.00	0.00	0.00	0.00	0.00	15.00
3/11/2008	3825263	Defect	0.00	60.00	60.00	0.00	0.00	0.00	0.00	15.00
3/11/2008	3825264	Defect	0.00	60.00	60.00	0.00	0.00	0.00	0.00	15.00
3/24/2008	3824885	Defect	15.00	20.00	20.00					
3/24/2008	3825281	Defect	45.00	60.00						
3/24/2008	3825282	Defect	30.00	15.00	15.00	15.00	15.00	0.00	20.00	15.00
3/24/2008	3825283	Defect	30.00	15.00	15.00	15.00	15.00	0.00	20.00	15.00
3/31/2008	3825285	Defect	45.00	60.00	60.00	15.00	15.00		20.00	15.00
4/1/2008	3825286	Defect	30.00	60.00	60.00	15.00	15.00	0.00	180.00	15.00
4/2/2008	3825287	Defect	30.00	60.00	60.00					
4/14/2008	3825288	Defect	30.00	60.00	60.00	15.00	15.00	0.00	60.00	15.00
4/15/2008	3825289	Defect	30.00	60.00	60.00	15.00	15.00	0.00	30.00	15.00
4/17/2008	3825290	Defect	30.00	60.00	60.00					
3/26/2008	3836496	Defect	0.00	10.00	0.00	15.00	5.00	0.00	10.00	10.00
3/29/2008	3836498	Defect	0.00	10.00	0.00	15.00	5.00	0.00	10.00	0.00
3/31/2008	3836511	Defect	0.00	10.00	10.00	15.00	5.00	0.00	0.00	0.00
4/23/2008	3836555	Defect	0.00	10.00	10.00	5.00	5.00	5.00	15.00	15.00
4/23/2008	3836556	Defect	0.00	10.00	10.00	5.00	5.00	5.00	15.00	15.00
3/19/2008	3836490	Defect	20.00	18.00	20.00	2.00	3.00	10.00	18.00	14.00
3/20/2008	3836491	Defect	25.00	10.00	10.00					
4/3/2008	3836514	Defect	25.00	4.00	20.00	2.00	3.00	4.00	6.00	8.00
4/3/2008	3836515	Defect	25.00	4.00	20.00	2.00	3.00	4.00	6.00	8.00
4/3/2008	3836516	Defect	20.00	4.00	20.00	2.00	3.00	4.00	6.00	8.00
4/3/2008	3836517	Defect	20.00	4.00	20.00	2.00	3.00	4.00	6.00	8.00
4/3/2008	3836520	Defect	20.00	4.00	20.00	2.00	3.00	4.00	6.00	8.00
4/3/2008	3836522	Defect	20.00	4.00	20.00	2.00	3.00	4.00	6.00	8.00
4/3/2008	3836525	Defect	20.00	4.00	20.00	2.00	3.00	4.00	6.00	8.00
4/3/2008	3836526	Defect	18.00	8.00	25.00	2.00	3.00	8.00	6.00	15.00
4/10/2008	3836534	Defect	4.00	4.00	0.00	2.00	3.00	5.00	4.00	7.00
4/11/2008	3836540	Defect	20.00	7.00	15.00	2.00	3.00	10.00	4.00	8.00
4/11/2008	3836541	Defect	14.00	5.00	15.00	2.00	3.00	6.00	3.00	8.00
4/24/2008	3836559	Defect	8.00	8.00	16.00	2.00	7.00	3.00	4.00	5.00
4/24/2008	3836560	Defect	12.00	14.00	20.00	2.00	5.00	2.00	7.00	6.00
4/24/2008	3836561	Defect	8.00	8.00	8.00	2.00	3.00	6.00	4.00	6.00
4/24/2008	3836562	Defect	6.00	5.00	11.00	2.00	7.00	8.00	9.00	7.00
4/24/2008	3836563	Defect	9.00	8.00	9.00	2.00	1.00	4.00	3.00	6.00
4/24/2008	3836564	Defect	7.00	3.00	10.00	2.00	4.00	6.00	4.00	5.00
4/24/2008	3836565	Defect	5.00	2.00	7.00	2.00	3.00	5.00	6.00	5.00
3/20/2008	3836491	Defect	25.00	160.00	130.00					
3/20/2008	3836491 Rev1	Defect	15.00	5.00	20.00					
3/21/2008	3836491 Rev2	Defect	30.00	15.00	45.00		10.00		10.00	
4/4/2008	3836527	Defect	25.00	15.00	40.00		10.00		10.00	
4/9/2008	3825534	Defect			0.00		10.00		10.00	
4/9/2008	3825535	Defect	25.00	30.00	0.00		10.00		10.00	
4/9/2008	3825536	Defect	25.00	30.00	0.00					
4/9/2008	3825537	Defect	30.00	15.00	0.00		25.00		25.00	
4/9/2008	3825538	Defect	30.00	15.00	0.00		10.00		10.00	
4/9/2008	3825539	Defect	30.00	15.00	0.00		10.00		10.00	
4/9/2008	3829300	Defect	20.00	15.00	0.00					
4/11/2008	3836539	Defect	30.00	15.00	0.00					
	3825040	Defect				0.00	0.00	0.00	20.00	
	3824585	Defect							20.00	
	3825157	Defect							20.00	
4/21/2008	3836548	Defect	30.00		0.00				20.00	
4/24/2008	3836558	Defect	35.00	60.00	30.00				20.00	
	3835572	Defect	30.00	120.00	0.00					
	FDTF	Defect	25.00	360.00	0.00					
5/1/2008	3836574	Defect	40.00	360.00	0.00					
5/2/2008	3836575	Defect	25.00	45.00	0.00					
Subtotal (Minutes)			1091.00	2103.00	1191.00	183.00	266.00	111.00	679.00	323.00
Eliminate High and Low Data			-49.00	-362.00	-130.00	-15.00	-20.00	-10.00	-180.00	-15.00
Total (Minutes)			1042.00	1741.00	1061.00	168.00	246.00	101.00	499.00	308.00
Total Time (Hours)			17.37	29.02	17.68	2.80	4.10	1.68	8.32	5.13
# Data Points			45.00	52.00	53.00	32.00	39.00	31.00	43.00	31.00
Average (Minutes)			23.16	33.48	20.02	5.25	6.31	3.26	11.60	9.94

Table 15. Pilot Program Average SRD TFIRR Times (Pilot Program Completion Report, 2008)

APPENDIX C. INDUCTION TFIRRS NOT PROCESS DURING PILOT PROGRAM

During the Pilot Program a total of 67 MGs were developed. No induction TFIRRs were required in accordance with the Pilot Program requirements. The averages from the data in Appendix A were multiplied by 67 to determine the total estimated number of hours saved not having to write TFIRRs.

		Number of Induction TFIRRS Not Processed During Pilot Program (Hours and Minutes)								
Date	TFIRR Number	TFIRR Type	Induction TFIRR Development Time (NGC Eng)(Minutes)	TFIRR Concurrence Time Delay (Minutes)	Technician Lost Production Time (Minutes)	TFIRR Closure Time (NGC Tech) (Minutes)	TFIRR Closure Time (NGC Eng) (Minutes)	TFIRR Closure Lost Production Time (Minutes)	TFIRR Closure Time Delay (Minutes)	TFIRR Filing Time (PDF) (Minutes)
5/14/2008	PCR 5193	Induction	14.00	47.45	0.00	8.50	9.10	11.60	27.30	11.10
5/14/2008	PCR 5194	Induction	14.00	47.45	0.00	8.50	9.10	11.60	27.30	11.10
5/14/2008	PCR 5197	Induction	14.00	47.45	0.00	8.50	9.10	11.60	27.30	11.10
5/14/2008	PCR 5198	Induction	14.00	47.45	0.00	8.50	9.10	11.60	27.30	11.10
5/15/2008	PCR 5199	Induction	14.00	47.45	0.00	8.50	9.10	11.60	27.30	11.10
5/19/2008	PCR 5200	Induction	14.00	47.45	0.00	8.50	9.10	11.60	27.30	11.10
5/21/2008	PCR 5201	Induction	14.00	47.45	0.00	8.50	9.10	11.60	27.30	11.10
5/21/2008	PCR 5211	Induction	14.00	47.45	0.00	8.50	9.10	11.60	27.30	11.10
5/21/2008	PCR 5212	Induction	14.00	47.45	0.00	8.50	9.10	11.60	27.30	11.10
5/21/2008	PCR 5213	Induction	14.00	47.45	0.00	8.50	9.10	11.60	27.30	11.10
5/21/2008	PCR 5214	Induction	14.00	47.45	0.00	8.50	9.10	11.60	27.30	11.10
5/21/2008	PCR 5215	Induction	14.00	47.45	0.00	8.50	9.10	11.60	27.30	11.10
5/28/2008	PCR 5217	Induction	14.00	47.45	0.00	8.50	9.10	11.60	27.30	11.10
5/28/2008	PCR 5218	Induction	14.00	47.45	0.00	8.50	9.10	11.60	27.30	11.10
5/28/2008	PCR 5219	Induction	14.00	47.45	0.00	8.50	9.10	11.60	27.30	11.10
5/28/2008	PCR 5220	Induction	14.00	47.45	0.00	8.50	9.10	11.60	27.30	11.10
5/28/2008	PCR 5221	Induction	14.00	47.45	0.00	8.50	9.10	11.60	27.30	11.10
5/28/2008	PCR 5222	Induction	14.00	47.45	0.00	8.50	9.10	11.60	27.30	11.10
5/28/2008	PCR 5223	Induction	14.00	47.45	0.00	8.50	9.10	11.60	27.30	11.10
5/28/2008	PCR 5224	Induction	14.00	47.45	0.00	8.50	9.10	11.60	27.30	11.10
5/28/2008	PCR 5225	Induction	14.00	47.45	0.00	8.50	9.10	11.60	27.30	11.10
5/28/2008	PCR 5226	Induction	14.00	47.45	0.00	8.50	9.10	11.60	27.30	11.10
5/28/2008	PCR 5227	Induction	14.00	47.45	0.00	8.50	9.10	11.60	27.30	11.10
5/28/2008	PCR 5228	Induction	14.00	47.45	0.00	8.50	9.10	11.60	27.30	11.10
6/5/2008	PCR 5263	Induction	14.00	47.45	0.00	8.50	9.10	11.60	27.30	11.10
6/10/2008	PCR 5264	Induction	14.00	47.45	0.00	8.50	9.10	11.60	27.30	11.10
6/13/2008	PCR 5269	Induction	14.00	47.45	0.00	8.50	9.10	11.60	27.30	11.10
6/13/2008	PCR 5270	Induction	14.00	47.45	0.00	8.50	9.10	11.60	27.30	11.10
6/13/2008	PCR 5271	Induction	14.00	47.45	0.00	8.50	9.10	11.60	27.30	11.10
6/13/2008	PCR 5272	Induction	14.00	47.45	0.00	8.50	9.10	11.60	27.30	11.10
6/16/2008	PCR 5273	Induction	14.00	47.45	0.00	8.50	9.10	11.60	27.30	11.10
6/17/2008	PCR 5274	Induction	14.00	47.45	0.00	8.50	9.10	11.60	27.30	11.10
6/19/2008	PCR 5280	Induction	14.00	47.45	0.00	8.50	9.10	11.60	27.30	11.10
6/23/2008	PCR 5283	Induction	14.00	47.45	0.00	8.50	9.10	11.60	27.30	11.10
6/23/2008	PCR 5284	Induction	14.00	47.45	0.00	8.50	9.10	11.60	27.30	11.10
6/23/2008	PCR 5285	Induction	14.00	47.45	0.00	8.50	9.10	11.60	27.30	11.10
6/23/2008	PCR 5286	Induction	14.00	47.45	0.00	8.50	9.10	11.60	27.30	11.10
6/23/2008	PCR 5287	Induction	14.00	47.45	0.00	8.50	9.10	11.60	27.30	11.10
6/25/2008	PCR 5288	Induction	14.00	47.45	0.00	8.50	9.10	11.60	27.30	11.10
6/25/2008	PCR 5291	Induction	14.00	47.45	0.00	8.50	9.10	11.60	27.30	11.10
6/25/2008	PCR 5292	Induction	14.00	47.45	0.00	8.50	9.10	11.60	27.30	11.10
6/25/2008	PCR 5293	Induction	14.00	47.45	0.00	8.50	9.10	11.60	27.30	11.10
6/25/2008	PCR 5294	Induction	14.00	47.45	0.00	8.50	9.10	11.60	27.30	11.10
6/25/2008	PCR 5295	Induction	14.00	47.45	0.00	8.50	9.10	11.60	27.30	11.10
6/25/2008	PCR 5296	Induction	14.00	47.45	0.00	8.50	9.10	11.60	27.30	11.10
6/27/2008	PCR 5299	Induction	14.00	47.45	0.00	8.50	9.10	11.60	27.30	11.10
6/27/2008	PCR 5300	Induction	14.00	47.45	0.00	8.50	9.10	11.60	27.30	11.10
6/27/2008	PCR 5301	Induction	14.00	47.45	0.00	8.50	9.10	11.60	27.30	11.10
6/27/2008	PCR 5302	Induction	14.00	47.45	0.00	8.50	9.10	11.60	27.30	11.10
6/27/2008	PCR 5303	Induction	14.00	47.45	0.00	8.50	9.10	11.60	27.30	11.10
6/27/2008	PCR 5304	Induction	14.00	47.45	0.00	8.50	9.10	11.60	27.30	11.10
6/27/2008	PCR 5305	Induction	14.00	47.45	0.00	8.50	9.10	11.60	27.30	11.10
6/27/2008	PCR 5306	Induction	14.00	47.45	0.00	8.50	9.10	11.60	27.30	11.10
6/27/2008	PCR 5307	Induction	14.00	47.45	0.00	8.50	9.10	11.60	27.30	11.10
6/27/2008	PCR 5308	Induction	14.00	47.45	0.00	8.50	9.10	11.60	27.30	11.10
6/27/2008	PCR 5309	Induction	14.00	47.45	0.00	8.50	9.10	11.60	27.30	11.10
6/27/2008	PCR 5310	Induction	14.00	47.45	0.00	8.50	9.10	11.60	27.30	11.10
6/27/2008	PCR 5311	Induction	14.00	47.45	0.00	8.50	9.10	11.60	27.30	11.10
6/27/2008	PCR 5312	Induction	14.00	47.45	0.00	8.50	9.10	11.60	27.30	11.10
6/27/2008	PCR 5313	Induction	14.00	47.45	0.00	8.50	9.10	11.60	27.30	11.10
6/27/2008	PCR 5314	Induction	14.00	47.45	0.00	8.50	9.10	11.60	27.30	11.10
6/27/2008	PCR 5315	Induction	14.00	47.45	0.00	8.50	9.10	11.60	27.30	11.10
6/27/2008	PCR 5316	Induction	14.00	47.45	0.00	8.50	9.10	11.60	27.30	11.10
6/27/2008	PCR 5317	Induction	14.00	47.45	0.00	8.50	9.10	11.60	27.30	11.10
6/27/2008	PCR 5318	Induction	14.00	47.45	0.00	8.50	9.10	11.60	27.30	11.10
6/27/2008	PCR 5319	Induction	14.00	47.45	0.00	8.50	9.10	11.60	27.30	11.10
6/27/2008	PCR 5320	Induction	14.00	47.45	0.00	8.50	9.10	11.60	27.30	11.10
# data points	67									
Total Minutes			938.00	3179.15	0.00	569.50	609.70	777.20	1829.10	743.70
Total Time (Hours)			15.63	52.99	0.00	9.49	10.16	12.95	30.49	12.40

Table 16. Induction TFIRRs Not Processed During Pilot Program (Pilot Program Completion Report, 2008)

APPENDIX D. SRD TFIRRS PROCESSED DURING PILOT PROGRAM

During the Pilot Program a total of 15 SRD TFIRRs were developed. No induction TFIRRs were required in accordance with the Pilot Program requirements. The averages from the data in Appendix B were multiplied by 15 to determine the total estimated number of hours saved not having to wait for the government to concur with the TFIRRs.

SRD TFIRRS Processed During Pilot Program (Hours and Minutes)

Date	TFIRR Number	TFIRR Type	SRD TFIRR Development Time (NGES-MS Eng) (Minutes)	TFIRR Concurrence Time Delay (Minutes)	Technician Lost Production Time (Minutes)	TFIRR Closure Time (NGES-MS Tech) (Minutes)	TFIRR Closure Time (NGES-MS Eng) (Minutes)	TFIRR Closure Lost Production Time (Minutes)	TFIRR Closure Time Delay (Minutes)	TFIRR Filing Time (PDF) (Minutes)
5/13/2008	3836582	Defect	0	33.48	20.02	0	0	0	0	0
5/13/2008	3836583	Defect	0	33.48	20.02	0	0	0	0	0
6/3/2008	3835805	Defect	0	33.48	20.02	0	0	0	0	0
6/5/2008	3835809	Defect	0	33.48	20.02	0	0	0	0	0
6/9/2008	3835810	Defect	0	33.48	20.02	0	0	0	0	0
6/10/2008	3825294	Defect	0	33.48	20.02	0	0	0	0	0
6/10/2008	3825295	Defect	0	33.48	20.02	0	0	0	0	0
6/10/2008	3825296	Defect	0	33.48	20.02	0	0	0	0	0
6/10/2008	3825297	Defect	0	33.48	20.02	0	0	0	0	0
6/10/2008	3825298	Defect	0	33.48	20.02	0	0	0	0	0
6/12/2008	3825819	Defect	0	33.48	20.02	0	0	0	0	0
6/19/2008	3825827	Defect	0	33.48	20.02	0	0	0	0	0
6/26/2008	3836604	Defect	0	33.48	20.02	0	0	0	0	0
6/26/2008	3836604A	Defect	0	33.48	20.02	0	0	0	0	0
6/26/2008	3836604B	Defect	0	33.48	20.02	0	0	0	0	0
Total Minutes				502.20	300.30					
# data points	15									
Total Time (Hours)			0*	8.37	5.01	0*	0*	0*	0*	0*
								Total time to date (H		13.38)
* Task are still needed to be performed regardless therefore time savings is zero.										

Table 17. SRD TFIRRs Processed During Pilot Program (Pilot Program Completion Report, 2008)

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