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SMALL TACTICAL UNMANNED AERIAL SYSTEM (STUAS) RAPID INTEGRATION AND FIELDING PROCESS (RAIN)

by

Team RAIN
Cohort 311-101A4/121A4

September 2013

Thesis Advisor:	Rama Gehris
Co-Advisor:	Bonnie Young

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The Department of the Navy (DoN) maintains an inventory of Small Tactical Unmanned Aircraft Systems (STUAS). These systems are designed for payload modularity to support user selection of multiple mission configurations in order to meet any unique mission need. Numerous mission ready payloads have been developed for each system, and only need to be integrated in order to become part of the fielded unmanned aerial system (UAS) configuration. Unfortunately, the DoN does not have a method that maintains sufficient systems engineering (SE) discipline to rapidly integrate and field new mission configurations to the fleet in support of aggressive schedules and urgent user needs. The typical fielding time frame can range from 24 to 36 months, instead of the desired 6 to 18 months. Furthermore, without a sufficient SE approach, risk to mission success is not well understood. This paper captures all applicable requirements for fielding a new capability onto an existing UAS, and using an SE approach, outlines a process to rapidly integrate payloads DoN system. The process identified provides a comprehensive list of integration requirements; a cost, schedule, and performance trade-off analysis; technical risk associated with each tradeoff option; and recommendations on how to best support a rapid fielding timeline.

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Team RAIN/Cohort 311–101A4/121A4

Christopher Ironhill   Frederick Lancaster   Diana Ly
Bryan Otis   Angel Perez   Nam Tran

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Lead editor: Frederick Lancaster

Reviewed by:
Dr. Rama Gehris   Bonnie Young
Capstone Project Advisor   Project Advisor

Accepted by:
Dr. Clifford Whitcomb
Systems Engineering Department

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ABSTRACT

The Department of the Navy (DoN) maintains an inventory of Small Tactical Unmanned Aircraft Systems (STUAS). These systems are designed for payload modularity to support user selection of multiple mission configurations in order to meet any unique mission need. Numerous mission ready payloads have been developed for each system, and only need to be integrated in order to become part of the fielded unmanned aerial system (UAS) configuration. Unfortunately, the DoN does not have a method that maintains sufficient systems engineering (SE) discipline to rapidly integrate and field new mission configurations to the fleet in support of aggressive schedules and urgent user needs. The typical fielding time frame can range from 24 to 36 months, instead of the desired 6 to 18 months. Furthermore, without a sufficient SE approach, risk to mission success is not well understood. This paper captures all applicable requirements for fielding a new capability onto an existing UAS, and using an SE approach, outlines a process to rapidly integrate payloads DoN system. The process identified provides a comprehensive list of integration requirements; a cost, schedule, and performance trade-off analysis; technical risk associated with each tradeoff option; and recommendations on how to best support a rapid fielding timeline.

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LIST OF ACRONYMS AND ABBREVIATIONS

ACAT	Acquisition Category
ANSI	American National Standards Institute
AoA	Analysis of Alternatives
APEO	Assistant Program Executive Office
APMSE	Assistant Program Manager for Systems Engineering
ASD	Assistant Secretary of Defense
ASI	Air-Ship Integration
ASN	Assistant Secretary of the Navy
A&T	Acquisition and Technology
AT	Anti-Tamper
ATEA	Anti-Tamper Executive Agent
ATO	Authorization to Operate
AV	Air Vehicle
B&F	Blanchard & Fabrycky
BE	Bandwidth Efficient
BL	Baseline
BDA	Intelligence, Battle Damage Assessment
C2	Command and Control
C&A	Certification and Accreditation
CCA	Clinger-Cohen Act
CCP	Corrosion Control Plan
CDL	Common Data Link
CDRL	Contract Data Requirements List
CF	Consequence Factor
CFR	Code of Federal Regulations
CIO	Chief Information Officer
CLP	Combat Logistics Patrols

CM	Configuration Management
CMC	Commandant of the Marine Corps
CMP	Configuration Management Plan
CNO	Chief of Naval Operations
COE	Center of Excellence
CONOPS	Concept of Operations
COT	Commercial-off-the-shelf
CPC	Corrosion Prevention and Control
CPI	Critical Program Information
DAA	Designated Accrediting Authority
DCO	Defense Connect Online
DCMA	Defense Contract Management Agency
DIACAP	DoD Information Assurance Certification and Accreditation Process
DoD	Department of Defense
DoDAF	Department of Defense Architecture Framework
DoN	Department of the Navy
DRM	Design Reference Mission
DT/OT	Developmental Test/Operational Test
DT&E	Developmental Test and Evaluation
DUSD	Deputy Undersecretary of Defense
E3	Electromagnetic Environmental Effects
E3/SS	Electromagnetic Environmental Effects/Spectrum Supportability
E3IAR	E3 Integration Analysis Report
EL-CID	Equipment Location-Certification Information Database
EMC	Electromagnetic Compatibility
EME	Electromagnetic Environment
EMI	Electromagnetic Interference
EMP	Electromagnetic Pulse

EMV	Electromagnetic Vulnerability
EP	Electronic Protection
ESD	Electrostatic Discharge
ESOH	Environmental, Safety, and Occupational Health
ESSM	Enhanced Sea Sparrow Missile
EW	Electronic Warfare
FFBD	Functional Flow Block Diagram
FMECA	Failure Mode Effects and Criticality Analysis
GCS	Ground Control Stations
GDT	Ground Data Terminals
GPS	Global Positioning System
GPSD	GPS Directorate
GWOT	Global War on Terror
HAE	Host Application Equipment
HERF	Hazards of Electromagnetic Radiation to Fuel
HERO	Hazards of Electromagnetic Radiation to Ordnance
HERP	Hazards of Electromagnetic Radiation to Personnel
HMMP	Hazardous Materials Management Plan
HMMVV	High Mobility Multipurpose Wheeled Vehicles
HPM	High-power Microwave
IA	Information Assurance
IATO	Interim Approval to Operate
IATT	Interim Authority to Test
IAW	In Accordance With
ICD	Interface Control Document
IDEF0	Integration DEFinition for Function Modeling
IED	Improvised Explosive Devices
IEEE	Institute of Electronics and Electrical Engineers
IFF	Identification Friend-or-Foe

IFC	Interim Flight Clearance
IM	Information Management
IOC	Initial Operational Capability
IPR	Interim Program (or Project) Review
IPT	Integrated Product Team
IRTR	Intermediate Risk Timeline Reduction
IS	Information System
ISR	Intelligence, Surveillance, and Reconnaissance
IT	Information Technology
JITC	Joint Interoperability Test Command
LOS	Line-of-sight
LRTR	Low Risk Timeline Reduction
LSRB	Laser Safety Review Board
M&S	Modeling & Simulation
MCO	Marine Corps Order
MDA	Milestone Decision Authority
MDAP	Major Defense Acquisition Program
MEF	Marine Expeditionary Force
MIL-STD	Military Standard
MOE	Measures of Effectiveness
MOP	Measures of Performance
MRTFB	Major Range and Test Facility Bases
MSDS	Material Safety Data Sheet
MUAV	Micro Unmanned Aerial Vehicle
NAS	Naval Air Station
NAVAIR	Naval Air Systems Command
NAVAIRINST	Naval Air Systems Command Instruction
NAVSEAINST	Naval Sea Systems Command Instruction
NAWCAD	Naval Air Warfare Aircraft Division

NECC	Navy Expeditionary Combat Command
NOSSA	Naval Ordnance Safety & Security Activity
NSS	Network Security Services
NSW	Navy Special Warfare
NSWC	Naval Surface Warfare Center
NTIA	National Telecommunications and Information Administration
OCO	Overseas Contingency Operations
ODAA	Operational Designated Accrediting Authority
OEF	Operation Enduring Freedom
OEM	Original Equipment Manufacturer
OMB	Office of Management and Budget
OSD	Office of the Secretary of Defense
OT	Operational Test
OT&E	Operational Test & Evaluation
PEO	Program Executive Office
PESHE	Programmatic Environmental, Safety, and Health Evaluation
PIF	Performance Impact Factor
PM	Project Manager
PMA	Program Manager, Air
PMP	Project Management Plan
POC	Point of Contact
RADHAZ	Radiation Hazard
RAIN	RApid INtegration
RCP	Route Clearance Platoons
RDA	Research Development and Acquisition
RF	Radio Frequency
RMP	Risk Management Plan
RSO	Range Safety Officers
RSTA	Reconnaissance, Surveillance, and Target Acquisition

RTP	Rapid Transition Process
SAASM	Selective Availability Anti-Spoofing Module
SAR	Synthetic Aperture Radar
SE	Systems Engineering
SECNAVINST	Secretary of the Navy Instruction
SEP	Systems Engineering Plan
SETR	Systems Engineering Technical Review
SIF	Schedule Impact Factor
SM	Standard Missile
SME	Subject Matter Expert
SPS	Spectrum Planning Subcommittee
SSRA	System Safety Risk Assessment
STUAS	Small Tactical Unmanned Arial System
SWAP	Size, Weight, and, Power
T&E	Test and Evaluation
TAE	Technical Authority Expert
TCDL	Tactical Common Data Link
TPM	Technical Performance Measures
TRL	Technology Readiness Level
TYCOM	Type Command
UAS	Unmanned Aerial System
UAV	Unmanned Aerial Vehicle
UCAS-D	Unmanned Combat Air Systems-Demonstration
UNS	Universal Need Statement
USAF	United States Air Force
USC	United States Code
USMC	United States Marine Corps
USN	United States Navy
U&W	Unmanned & Weapons

V&V	Verification & Validation
WSESRB	Weapons Systems Explosive Safety Review Board

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EXECUTIVE SUMMARY

The Department of the Navy (DoN) does not have a method that maintains sufficient systems engineering (SE) discipline to rapidly integrate and field new mission configurations into its fleet of Small Tactical Unmanned Aerial Systems (STUAS) in support of aggressive schedules and urgent user needs. Furthermore, without a sufficient SE approach, risk to mission success is not well understood. The DoN Small Tactical Unmanned Aerial Systems (STUAS) are designed for payload modularity to support user-selection of multiple mission configurations in order to meet any unique mission needs. Numerous mission ready payloads have been developed for each system, and only need to be integrated in order to become part of the fielded UAS configuration. The typical fielding time frame of a new payload can range from 24 to 36 months, instead of the desired 6 to 18 months.

This paper captures all applicable requirements for fielding a new capability onto an existing UAS, and using a SE approach, outlines a process to rapidly integrate payloads. An outcome of this report was the creation of a new Rapid Transition Process (RTP) that can be used in the transition of any new technology. NAVAIR has a lot of separate procedures which apply to the fielding and transition of technologies to the fleet or warfighter, but a process to bring all of the procedures together in an orderly and efficient manner does not exist. To determine the best implementation of this process a detailed SE analysis was conducted of the current payload integration process. This analysis resulted in a stream lined integration process, identified in Figure that provides stakeholders the ability to trade cost schedule and performance, while managing risk, in order to meet mission objectives.

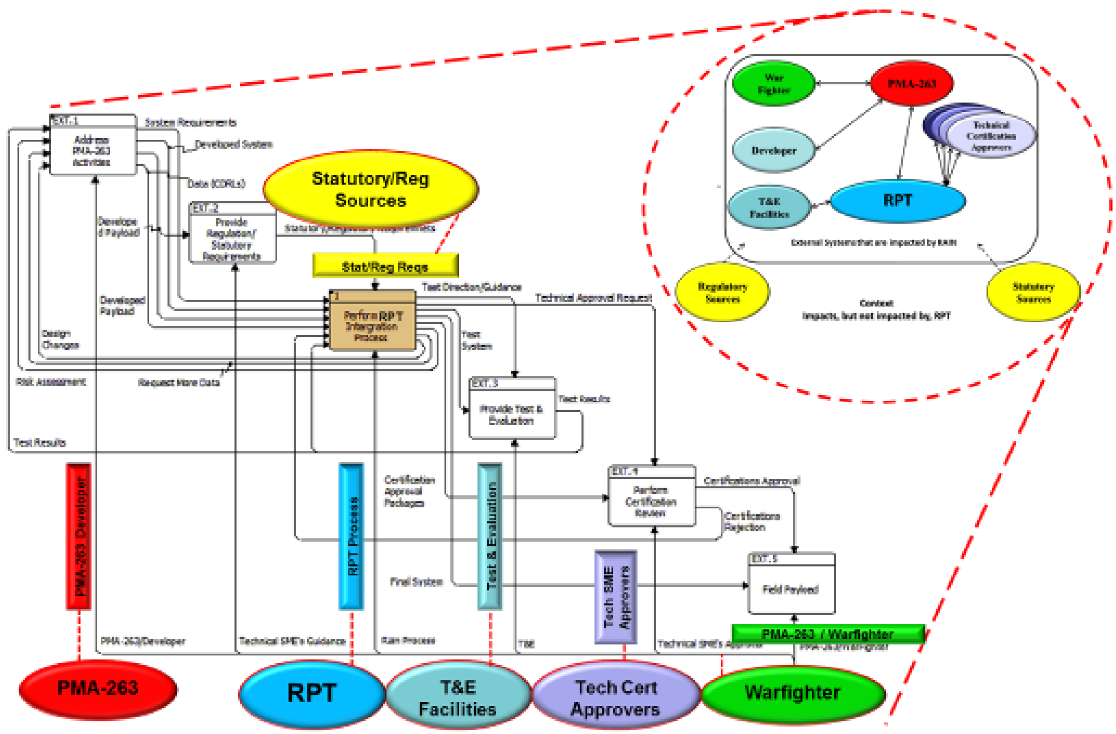

Figure 1: RAIN Project Rapid Transition Process Streamlined Integration

The process provides a comprehensive list of system level integration requirements, a cost, schedule, and performance trade off analysis, risk assessments associated with each tradeoff option, and a recommendation on to how best support a rapid fielding timeline. The options are to pursue full certifications, pursue certification subjected to a low risk timeline reduction (LRTR) strategy, and pursue certifications subject to an intermediate risk timeline reduction (IRTR) strategy. The LRTR strategy involves using previously certified subsystems in the payload to bypass certifications that drive the schedule, CAT 3 flight certification, and joint DT and OT. The IRTR strategy involves the use of interim certifications for the ones among the schedule drivers that allow them, a CAT 3 flight certification, and shifting OT to initial fielding. During the tradeoff analysis three potential payloads where reviewed, a LASER Designator payload, a Passive Electronic Warfare payload, and an Active Electronic Warfare payload. The requirements for each payload were identified, and can be seen in Figure 1. The tradeoff analysis identified three options to execute payload integration, complex payload integration, simple payload integration, and highly mature payload integration. Under each option three scenarios where modeled, to include full certification (BL), low risk timeline reduction (LRTR), and intermediate risk timeline reduction (IRTR), details are shown in Figure 3. Based on these options and scenarios, a range of rapid integration possibilities has been identified. Each possibility provides an assessment of risk acceptance, allowing tailoring of a detailed SE process to fit cost and schedule constraints, while maintaining sufficient SE

The RTP was designed to streamline the current disjointed integration approach employed by the PMA in fielding a new payload combination on a modular STUAS through early identification of the complete set of required certifications. It will also support a rapid fielding decision by providing the steps needed to pursue full or interim certifications. This was done by performing the RTP functions show in Figure 2 with the assistance of physical components in the form of checklists; certification requirements listings by system type; timeline reduction options listings, descriptions, and ratings; simulation results for cost and schedule for following certification baseline or timeline reduction strategies and was comprised of the seven (7) steps that follow Figure 2.

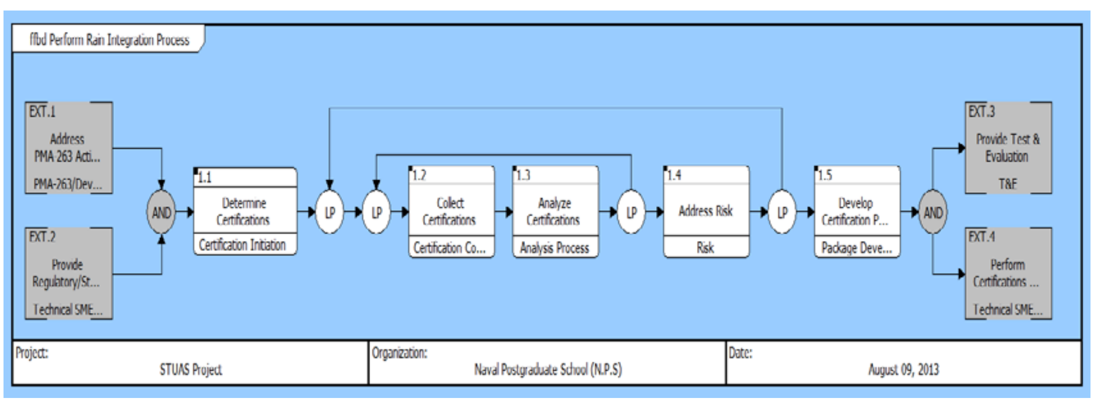

Figure 2: Rapid Transition Process Functional Flow

Step 1: Initiation of the RTP by the PMA

Step 2: Determine Certifications to Pursue

Step 3: Collect Certification Data: Perform iteratively with analyzing the certification data.

Step 4: Analyze Certification Data: Perform iteratively with collecting the certification data.

Step 5: Address Risk

Step 6: Develop Certification Package for Decision Maker

RTP Conclusion

The RTP ends when fielding decision package is judged to be complete by the decision maker, and a fielding decision is made.

Requirments		LASER Designator			Passive EW			Active EW / Comm-Data Relay / RADAR		
Level 1	Level 2	Run 1 (Simple Integration)	Run 2 (Complex Integration)	Run 3 (Highly Mature Payload)	Run 1 (Simple Integration)	Run 2 (Complex Integration)	Run 3 (Highly Mature Payload)	Run 1 (Simple Integration)	Run 2 (Complex Integration)	Run 3 (Highly Mature Payload)
CDL		N	N	N	Y	N	Done	Y	N	Done
Airworthiness (IFC)	Risk Assessment Questionnaire	Y	Y	Done	Y	Y	Done	Y	Y	Done
	HPOL	Y	Y	Y	Y	Y	Y	Y	Y	Y
	EDRAP	Y	Y	Done	Y	Y	Done	Y	Y	Done
	Risks	Y	Y	Y	Y	Y	Y	Y	Y	Y
E3 (Electromagnetic Environmental Effects)	E3IAR	Y	Y	Done	Y	Y	Done	Y	Y	Done
	EMC (Intra-system)	Y	Y	Done	Y	Y	Done	Y	Y	Done
	EMI	Y	Y	Done	Y	Y	Done	Y	Y	Done
	EMP	N	N	N	N	N	Done	N	N	Done
	EMV (Inter-system EMC)	Y	Y	Done	Y	Y	Done	Y	Y	Done
	ESD	Y	N	Done	Y	N	Done	Y	N	Done
	HERO Testing	N	N	Done	Y	N	Done	Y	N	Done
	RADHAZ	N	N	Done	Y	N	Done	Y	Y	Done
	HERF	N	N	Done	Y	N	Done	Y	Y	Done
	HERO	N	N	Done	Y	N	Done	Y	Y	Done
	HERP	N	N	Done	Y	N	Done	Y	Y	Done
	Bonding & grounding	Y	N	Done	Y	N	Done	Y	N	Done
	Lightning	N	N	N	N	N	N	N	N	N
	P-Static	N	N	N	N	N	N	N	N	N
Environmental Qualification	MIL-STD-810G tests with 24 hour sa	Y	Y	Done	Y	Y	Done	Y	Y	Done
LASER Saftey Review	LSRB Review of below	Y	Y	Y	N	N	N	N	N	N
	Laser radiation hazard evaluation	Y	Y	Done	N	N	N	N	N	N
	Laser design checklist	Y	Y	Y	N	N	N	N	N	N
	FDA mil-exempt letter	Y	Y	Done	N	N	N	N	N	N
Battery Approval	Product spec for battery cell	Y	N	N	Y	N	N	Y	N	N
	Battery schematic (cell & control boar	Y	N	N	Y	N	N	Y	N	N
	CONOPS	Y	N	N	Y	N	N	Y	N	N
	Operator's Manual	Y	N	N	Y	N	N	Y	N	N
	Battery safety data package	Y	N	N	Y	N	N	Y	N	N
	Request letter	Y	N	N	Y	N	N	Y	N	N
IA (Information Assurance)		Y	Y	Y	Y	Y	Y	Y	Y	Y
AT (Anti-Tamper)		Y	Y	Y	Y	Y	Y	Y	Y	Y
CCA (Clinger-Cohen Act)		Y	Y	Y	Y	Y	Y	Y	Y	Y
Spectrum	1. Equipment Spectrum Certification	N	N	N	Y	N	N	Y	Y	Y
	2. Assignments	N	N	N	Y	N	N	Y	Y	Y
System Safety Approval		Y	Y	Y	Y	Y	Y	Y	Y	Y
T&E	Range Safety Approval	Y	Y	Y	Y	Y	Y	Y	Y	Y
	DT	Y	Y	Done	Y	Y	Done	Y	Y	Done
	OT	Y	Y	Y	Y	Y	Y	Y	Y	Y
WSESRB Approval		N	N	N	Y	N	N	Y	N	N
JITC		Y	N	Done	Y	N	Done	Y	N	Done
Selective Availability Anti-Spoofing Module (SAASM)	Security Approval for SAASM Host	N	N	N	Y	N	Done	Y	N	Done
	SAASM Design Requirements for HA	N	N	N	Y	N	Done	Y	N	Done

Figure 3: STUAS Payload Requirements
(Red=Certification Required, Green/Blue=Certification Not Required)

The results of the trade study produced a number of possible options for payload integration. Each options risk was identified, allowing stakeholders to make an educated decision, as to whether a specific option can meet timelines, while maintaining sufficient SE rigor to ensure risks are understood and mitigated. The summary of the results can be seen in Figure 4, Figure 5, Figure 6 and Figure 7 based on risk tolerance levels if this processes was utilized a payload integration can be conducted to meet a range of users needs with a sound cost, schedule, and performance balance.

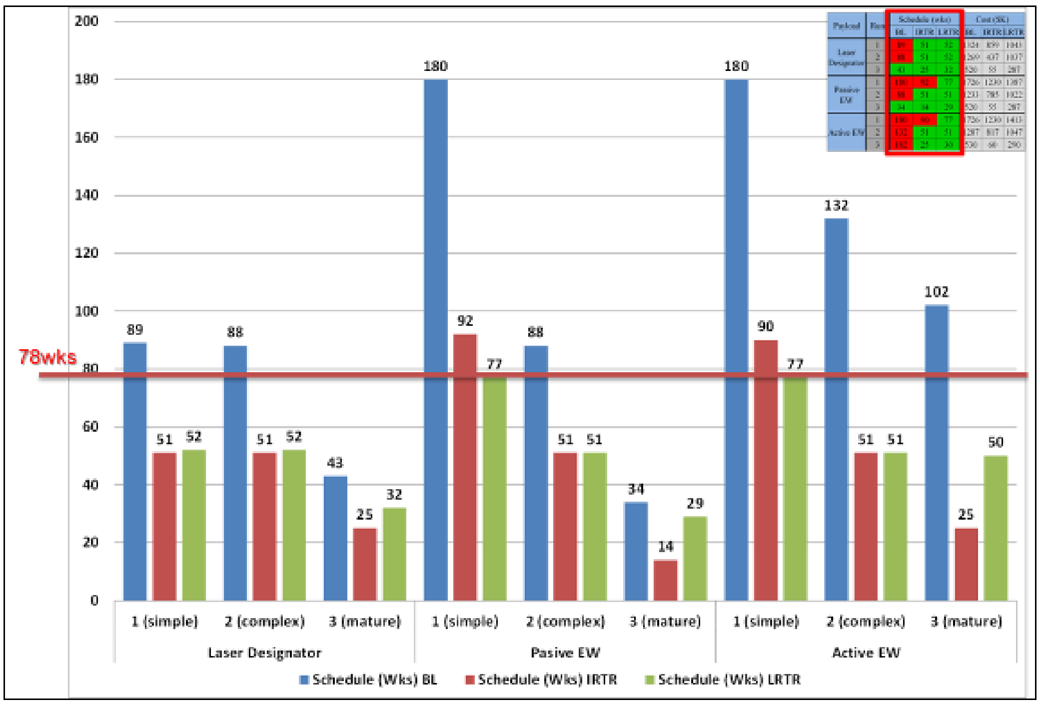

Figure 4: Schedule Summary Results

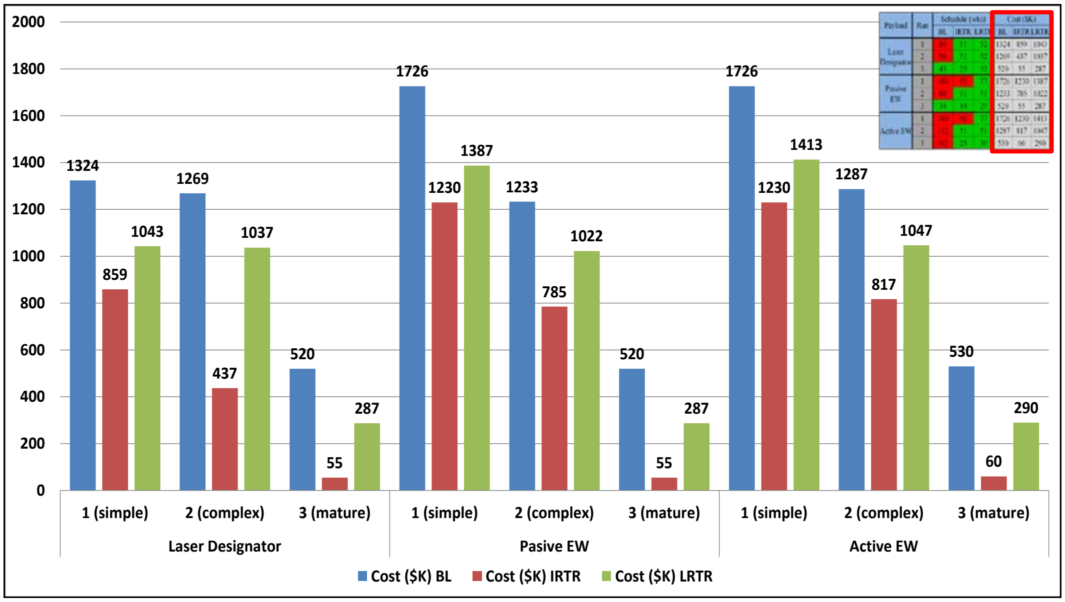

Figure 5: Cost Summary Results

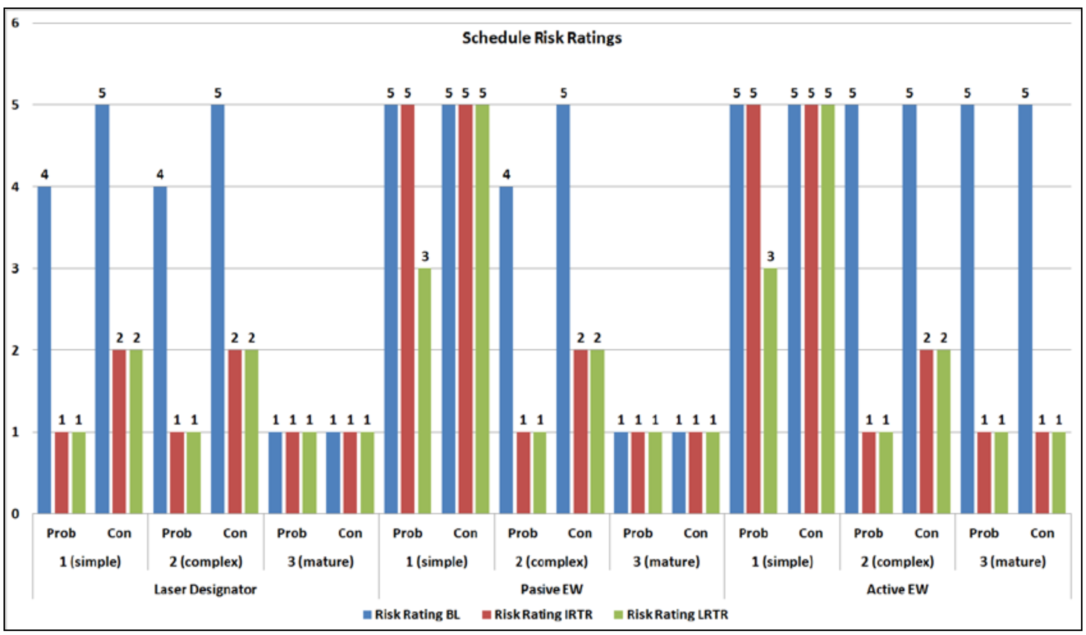

Figure 6: Schedule Risk Rating Summary Results

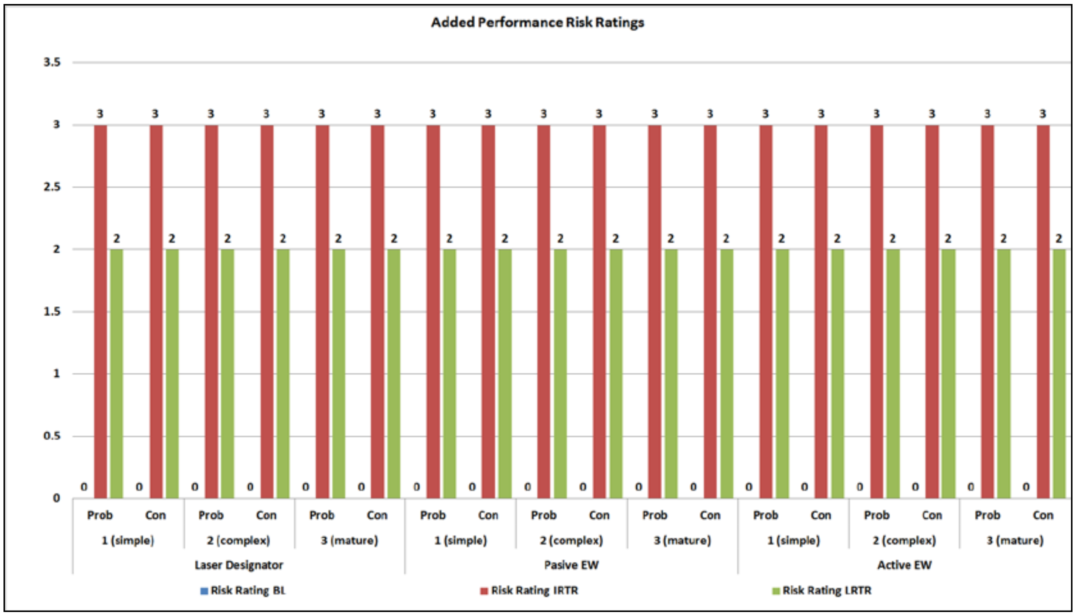

Figure 7: Added Performance Risk Rating Summary Results

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I. INTRODUCTION AND BACKGROUND

A. INTRODUCTION

1. Problem Background

The Department of the Navy (DoN) maintains a relatively small inventory of Small Tactical Unmanned Aerial Systems (STUAS). These systems are designed to be highly modular and support multiple configurations, allowing for user selection of payloads based on unique mission needs. This modularity reduces the necessity for multiple unique Unmanned Aerial Systems (UAS) platforms and their associated life cycle costs, while still providing mission flexibility. Technology developers are successful in designing new payloads which integrate into the UAS platform and meet mission requirements. This provides a payload technology that is at a suitable Technology Readiness Level (TRL); meets all technical requirements of the applicable UAS Interface Control Document(s) (ICD); and size, weight, and power (SWAP) requirements. Typically, while the requirements with regard to the specific payload-vehicle interface are met, the payload developers do not address the DoN System-level requirements for integration and fielding.

It is the responsibility of the system's integrator to ensure that the platform, with its new payload, meets all regulatory and statutory requirements for deployment to the fleet. This is done by obtaining the necessary technical certifications (e.g., laser, Li battery, airworthiness approvals, for instance) imposed by regulatory requirements on the systems. An example of a statutory requirement placed on UAVs that must be addressed for successful integration is H.R1815 National Defense Authorization Act for Fiscal Year 2006 (HR Bill 2005), which states all data links used by a UAV must use the government-developed Tactical Common Data Link (TCDL). This particular example has caused challenges in the past because some payloads are developed with their own Command and Control (C2) data links so they do not have to integrate with the existing UAS data links, reducing the complexity of payload level integration. Unfortunately, not meeting the TCDL requirement requires re-engineering of the payload to complete systems-level integration, causing delays in fielding.

2. UAS History

The early history of Unmanned Aerial Systems (UAS) began with Perley's aerial bomber in 1863 and Eddy's surveillance kite in 1898. During the American Civil War the inventor Charles Perley obtained a patent for his design of a hot air balloon known as the unmanned aerial bomber which could carry a heavy load of explosives with a timer. Because weather conditions and air currents made it hard to estimate the time to set the fuse his design proved to be inaccurate and unreliable. By 1898 the first military aerial surveillance photos were taken during the Spanish-American War using a kite with a long string attached to the shutter release of the camera.

Although those two (2) early inventions, using primitive Unmanned Aerial Vehicle (UAV) technology, achieved very limited success, they had attracted attention because of their promise for wartime applications in covering areas considered to be too dangerous and inaccessible to be overflown by manned reconnaissance aircraft. Growing from original concepts, flying bombs and pilotless drone aircraft such as the Kettering Aerial Torpedo

Figure 1) built in the 1910s during World War I became the precursors to modern-day cruise missiles. Most of them were jet-propelled and low- flying, mostly gliding to the intended target. In some cases they were guided to its target by a simple on-board computer. The development of such weaponry brought UAV technology to the next level of sophistication (Hughes 1993).

Figure 1: Kettering Aerial Torpedo in the 1910s (18 NOVA 2013)

By World War II, numerous unmanned craft were built around the world. However, it was not until the 1930s that the U.S. Navy started its initial experiments with unmanned aerial aircraft controlled by radio signals. One outcome of these endeavors was the Curtiss N2C-2 biplane drone, which flew for the first time without a pilot in late 1937. During the last days of the Second World War, Germany's invention of the V-1 flying bomb (also known as buzz bomb or doodlebug) made new progress in UAV history by demonstrating its significant potential during combat. This pilotless monoplane carrying a 2000-pound warhead was a pulse-jet-powered predecessor of the modern cruise missiles and rockets launched from the ground (ground-to-air missiles). It was not radio-controlled, but pre-programmed to fly 150 miles before dropping its bomb, causing catastrophic damage (18 NOVA 2013). The development of such a deadly weapon convinced the U.S. military to lay more extensive groundwork on post-war UAV programs (Bone and Bolkcom 2003).

During the Vietnam and Korean wars, UAVs gained more credibility and made further inroads into American and allied military programs. The American armed forces became more involved in maturing their own technology and influenced their allies to do so as well. Investing time, knowledge, and money in high-technology weapons became a trend in the international community (11 Wikipedia 2013). By the late 1950s, military aircraft were already capable of travelling at speeds of Mach 2. Building upon the success of UAVs as targets, the U.S. military started to take increasing advantage of UAS potential to achieve other previously unachievable and hazardous missions. This expansion brought about the development of the UAVs with the capability to accomplish missions through remote control.

In 1960 the U.S. Air Force launched its first stealth-technology aircraft and began modifying the war-fighting UAVs to achieve a new mission: reconnaissance. The earlier jet-propelled, subsonic target drone BQM-34A (formerly designated Q-2C Firebee) was turned into the AQM-34L reconnaissance drone for long-range reconnaissance, undercover surveillance, and leaflet-dropping missions in Vietnam and other parts of Southeast Asia. One of the most critical surveillance missions of Firebee was radar detection of surface-to-air missiles over China and North Vietnam (18 NOVA 2013). Because of its accomplishment, Firebee received further attention and recognition for national security in the armed forces. Military strategists discovered the UAV's flexibility and started searching for ways to maximize its potential. Ultimately, the Firebee was reformed to deliver payloads, conducting its very first flight test on December 20th, 2002 as an armed UAV (Bone and Bolkcom 2003).

In 1965, the single high-speed and ultra-stealth D-21 UAV developed for photographic aerial reconnaissance by Lockheed with a maximum range of 3,000 miles, to operate at a height of 80,000 feet and the ability to follow a preprogrammed path. This Mach-4 aircraft was carried on the back of a manned Lockheed M-12 Blackbird variant aircraft and considered to be the fastest UAV developed to date. However, the D-21 project was shelved because of its catastrophic failures (18 NOVA 2013) in all of the four (4) operational missions. The failures prompted the U.S. military to develop new UAVs suited for intelligence gathering at high altitude and out of range of hostile missiles, resulting in the invention of the Ryan Special Purpose Aircraft or SPA 147 (18 NOVA 2013).

In the late 1970s the Israelis developed several UAVs, such as the Scout, which were eventually operated in Lebanon in 1982. With its low radar signature and small size, the Scout was almost impossible to shoot down. This new successful UAV technology impressed U.S. observers, causing them to establish a joint development of UAVs and marked the beginning of the evolution of experimental projects into actual acquisition programs (Bone and Bolkcom 2003). A rocket-boosted UAV that took off from runways on land or carrier flight decks known as Pioneer (Figure 2) was one of the resultant joint developments. To this day Pioneer is still being utilized to confirm high priority mobile targets using the Synthetic Aperture Radar (SAR) from other aircraft (18 NOVA 2013).

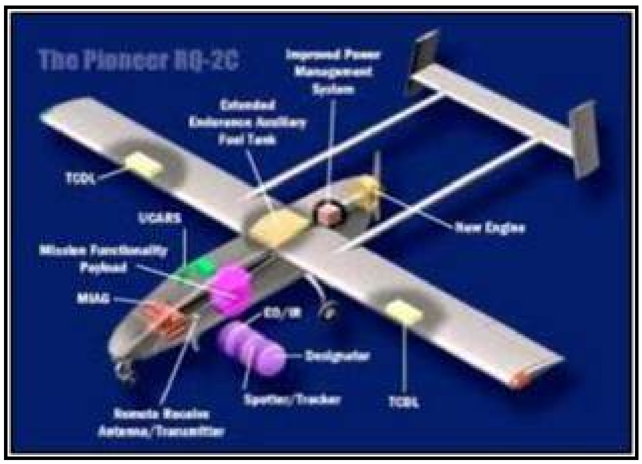

Figure 2: Pioneer and its parts (From Pioneer UAV 2002)

After recognizing the significance of UAVs, several countries, with the U.S. in the forefront, ushered in a proliferation of UAV innovations in the 1990s, including many impressive capabilities that were far more advanced than their precursors. This led to the development of the General Atomics MQ-1 Predator (Figure 3), a medium-altitude, long-endurance UAV, is probably one of the most sophisticated in the U.S. military arsenal. The Predators were innovative as they were able to be configured to complete multiple missions from a single platform. By carrying cameras, sensors, and munitions, the primary capabilities of Predator are conducting armed reconnaissance and fulfilling forward observation roles such as surveillance and target acquisition (13 U.S. Air Force).

Figure 3: RQ-1/MQ-1 Predator (18 NOVA 2013)

Over the last 100 years, manned canvas-over-wood biplane aircraft have turned into entirely autonomous advanced aerial systems with the capabilities of achieving all types of battlefield roles, including but not limited to: cargo transportation, at-sea or in-flight replenishment, surveillance, data and photo collection, and target acquisition and engagement. Instead of using manned aircraft, those missions are now mostly accomplished around the world through both fixed-wing, and more recently, rotary-wing aircraft UAVs. The size and capabilities of the systems range from large vehicles that can carry offensive weapons to a miniature system used for surveillance that can be carried in a backpack. With existing technology, a UAV can be operated as a stand-alone unit or as part of a system of systems known as a UAS. For instance, the RQ-7 Shadow UAS is comprised of four (4) unmanned aerial (UAS), two (2) Ground Control Stations (GCSs), a portable GCS, a Launcher, two Ground Data Terminals (GDTs), a portable GDT, a Remote Video Terminal, and other related equipment. In addition, military units are also fielded with a maintenance support vehicle.

Anxious to take advantage of incredible potential of such weapons systems, countries around the world are continually pouring in resources, money, and technological investments into UAS-related programs. Currently, the five (5) most common UAVs of the United States Department of Defense are: Predator and Global Hawk of the Air Force; Pioneer of the Navy and Marine Corps; and Hunter and Shadow of the Army (Bone and Bolkcom 2003). The countries known to possess UAVs are China, France, Germany, Greece, India, Israel, Iran, Italy, Japan, Jordan, Pakistan, South Africa, Russia, Switzerland, Turkey, United Kingdom, and the United States (Multiple and Wikipedia). Only recently have UASs expanded their critical nature in combat missions, not only because of technological sophistication but also due to perceived military requirements to fulfill national objectives. International crises are believed to be the driving forces for enhancement of war-fighting capabilities. In the future it is anticipated that UASs will play a crucial role in the world's conflicts.

B. CURRENT INTEGRATION PROCESS FOR MODULAR PAYLOADS

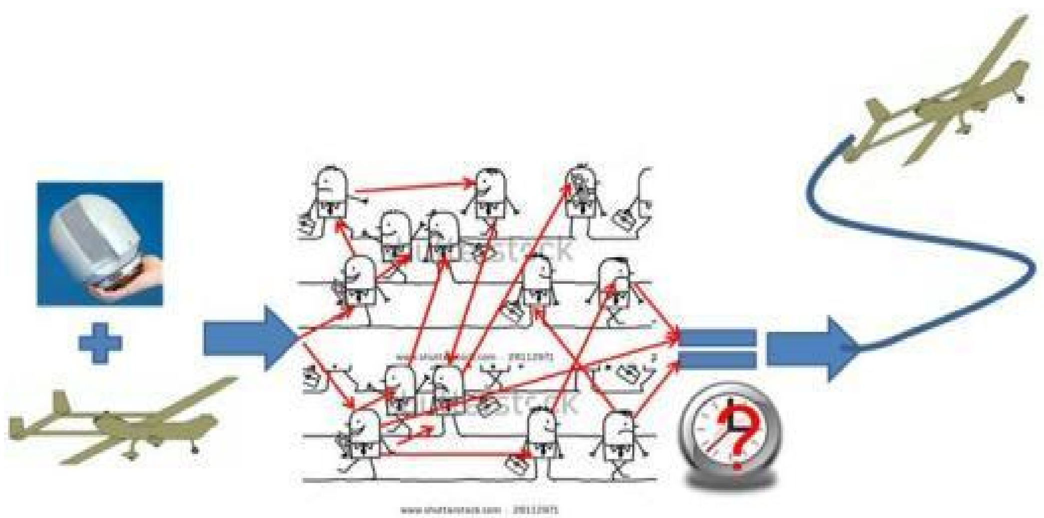

Figure 4: Current Operational View (Before the RTP process)

The transition process between integration of the payload into the target platform and its ultimate integration into the encompassing DoN System is not well-defined. Each DoN System level requirement is handled independently by a different organization within the government where the knowledge of that particular process and its associated requirements is typically self-contained. To date, little effort has been made to take a system level approach to bridge those lines of communication between organizations (as shown in Figure 4) and collect all the information regarding certifications and regulations into one readily accessible repository and create a defined system of processes.

The lack of a system-level approach to integration elongates the timeline because certifications captured later in the process no longer have the ability to be pursued in parallel with, and may delay others. For example, during the review of an Airworthiness Certification request, the Electrical Power subject matter expert (SME) may require a Battery Certification. If this is not pursued in conjunction during the data collection effort, the Airworthiness Certification will be delayed until the Battery Certification is obtained. Technical challenges arise when interim approvals or waivers for these emergent certifications are obtained to satisfy the rigid fielding schedule without fully understanding the consequences of those decisions. For example, a full Battery Certification may take six (6) weeks to obtain. An interim approval may be obtained within a matter of weeks but may deploy a thermal battery with unknown operating restrictions and potentially dangerous consequences (e.g., explosive hazard).

With the current undefined process, once a payload is delivered, it takes between 24 and 36 months, depending on complexity of the effort, to thoroughly satisfy all the applicable statutory and regulatory requirements before the system can be integrated into the DoN inventory. This timeframe is unacceptable in supporting the rapidly evolving environment to which our war-fighters are exposed. For the sake of expediency the integration timeline is often shortened by waiving or inadvertently overlooking the systems-level requirements without an understanding of technical risk generated by these decisions, This often results in a rapidly-fielded system which may be technically insufficient to meet mission needs and could pose substantial risks to the warfighters in the future. To address these technical challenges and reduce the integration timeline, systems engineers must provide leadership with the information to balance cost, schedule, and performance risk to the program when obtaining interim approvals or waivers.

C. PROBLEM STATEMENT

The DoN does not have a documented process that maintains sufficient Systems Engineering (SE) discipline to rapidly integrate and field new mission configurations for their inventory of modular STUAS to the fleet to support aggressive schedules and urgent user needs in a timeframe of 6 to 18 months instead of the typical 24 to 36 months while minimizing technical risk to mission success. The requirements for whether or not to perform each certification (sub process) in the current process are not well understood and are often addressed in a reactive fashion, sometimes when identified as the entry criteria for a different certification or approval

1. Objectives

The objective of this project was to create and document a comprehensive process for the integration of new capabilities of modular UAS into the DoN System, then conduct a SE trade study, similar to an Analysis of Alternatives (AoA), to address the UAS systems integration challenges outlined above. The trade study's goal was to find the best way to rapidly integrate new configurations, meet technical requirements, balance technical risk, and produce options for a rigorous SE process that can be tailored to meet program needs.

2. Project Intention

The purpose of this project was to conduct a trade study of a comprehensive SE plan to address payload integration of DoN System requirements onto Program Manager Air (PMA)-263 STUAS platforms. To complete this study, a documented process of the procedures to facilitate integration and fielding of new capabilities was developed. The documented process was used for modeling and simulation (M and S) of integration into the DoN System. The trade study allowed a tailoring of DoN System-level requirements to support the rapid integration and fielding of UAS capabilities.

In the trade study, three (3) different integration situations were applied to the payload types to which the project was constrained:

- Simple – The payload operates almost independently and requires minimal integration with the host platform. It cannot leverage off the existing certifications, but must pursue separate ones for its own sub-components.
- Complex – The payload must be fully integrated with the host platform, utilizing existing sub-components that already have the required certifications (e.g. Laser, battery). Only the payload sub-components will need to pursue certification.
- Mature – The payload has been integrated and certified for operation on a different platform. The remaining certifications to be pursued are those required for a new configuration of an existing platform (e.g. Airworthiness, Interoperability).

In addition to pursuing full certifications, two strategies were implemented during each of these integration situations to reduce the overall certification timeline:

- Full Certification – All applicable certifications are pursued for full approval.
- Intermediate risk timeline reduction (IRTR) – Interim approvals were pursued for the applicable certifications that have long durations.
- Low risk timeline reduction (LRTR) – The payload was composed of sub-components that have existing certifications (e.g. Spectrum, CDL).

3. Research Questions

The following questions were identified by the RAIN Project Team as topics that the ultimate user of the developed process should understand prior to its implementation:

- Which requirements are applicable to each specific type of payload?
- What are the dependencies between certifications? Which certifications must be done sequentially? Which can be done in parallel (i.e., are some prerequisites for others)?
- What was a typical timeline (or range) for each certification?
- Can a method be identified to integrate and field a new capability within 18 months?

- Which requirements, applicable to the payload, can be waived or granted interim approval?
- Where applicable, what does a waiver or interim approval authorize for each certification?
- Which trade-offs (full certification, interim approvals, or use of previously-certified components) can be done to support a compressed timeline?
- Can the compressed timeline be achieved without the pursuit of waivers?
- Can the compressed timeline be achieved without the pursuit of interim approvals?
- For each certification that drives the schedule with available timeline reduction options, what are the risks if an interim approval was obtained?

D. PROBLEM SCOPE

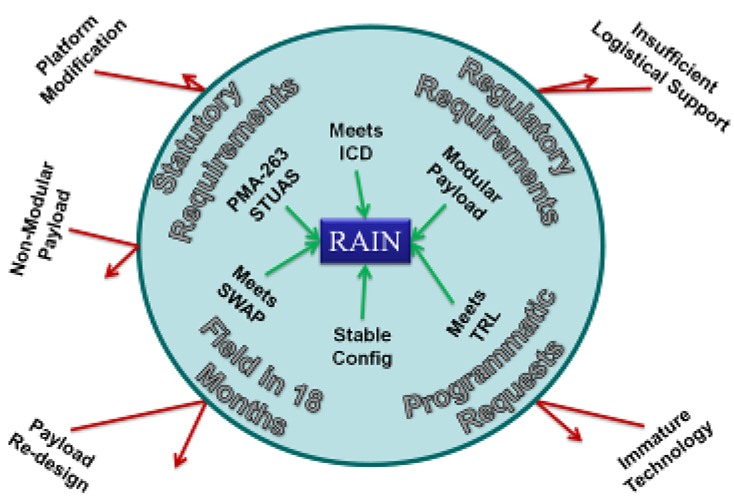

Figure 5: RAIN Project Problem Scope

The scope of this project, shown in Figure 5, was limited to new capabilities that can be integrated into modular STUAS in the existing PMA 263 inventory. The candidate payloads were limited to those that meet the technical requirements of the platform's ICD and would not require re-design of the UAS or modification of the current airframe.

1. Assumptions

The following assumptions were applied as the entrance criteria to the RAIN project:

- Capability satisfies technical requirements of platform (ICD and SWAP) for which it was developed
- Capability satisfies TRL requirements for which the technology developer was applying
- Capability has sufficient logistical support (spares and repairs) from developer
- Capability has stable configuration that requires no further changes, except those identified as needed by integration process
- Capability does not require modification of airframe for successful platform integration
- Existing certifications for the platform automatically applies to the payload that fits within the system (i.e., Air-Ship Integration and Transportability)

2. Constraints

The following constraints were applied to the RAIN project:

- Statutory and Regulatory requirements for UASs must be addressed
- Timeline must support fielding within 18 months
- Some requirements cannot be waived or granted interim approval
- Detailed certification analysis
- Timeline reductions were aggregated into two (2) types of strategies for the purposes of conducting simulation and analysis.
  - The effects of reducing the time to address a single certification by itself was not investigated or subjected to simulation.

- Payload types typically integrated onto PMA 263 platforms:
  - Laser designator
  - Electronic Warfare (EW) signal collection (Passive)
  - Active EW
  - Communications / Data Relay
  - RADAR Imaging

E. STAKEHOLDERS

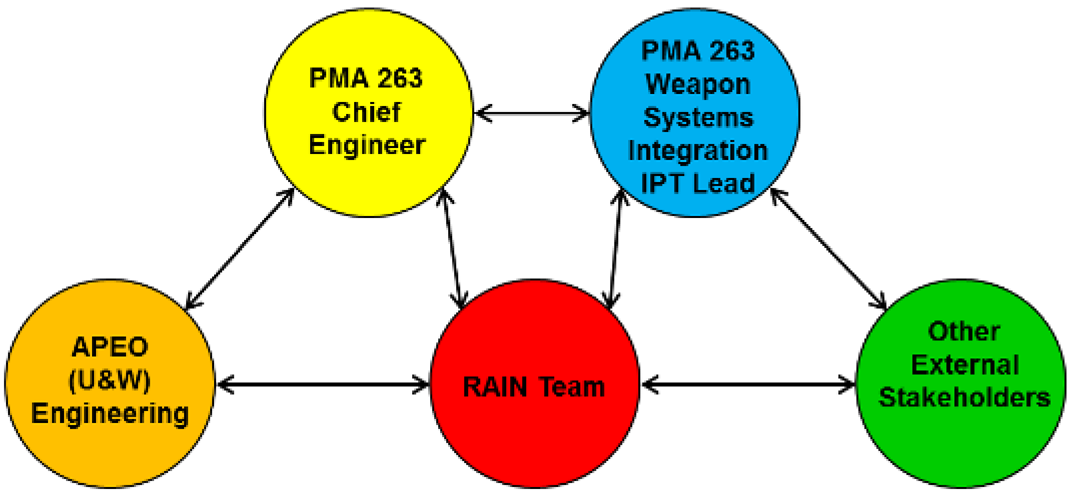

Figure 6: RAIN Project Stakeholders

The project stakeholders are identified in the list below and shown in Figure 6. Project stakeholders interface with each other and the RAIN Team to help guide and scope the project, subject to RAIN advisors' concurrence. The stakeholders can be broken down in to three (3) main groups, as listed below, and are further decomposed in Figure 7. While main stakeholders exist, when categorized into three (3) groups, each group's interests were the same. The RAIN Team's primary interest was in completing a Capstone project that showed the students' mastery of SE while producing a useful product to other stakeholders. PMA-263's primary interest was to implement a rapid system integration process while maintaining SE rigor. The external stakeholders' primary interest was in rapidly fielding new technology while reducing risk to technical challenges.

- RAIN Team
    - Students
    - Advisors
- PMA 263:
    - Chief Engineer
    - Weapon Systems Integration Integrated Product Team (IPT) Lead
        - Configuration Manager
- External Stakeholders:
    - APEO (U and W) Engineering
    - Warfighters
    - Requirements Officers
    - Technology developer

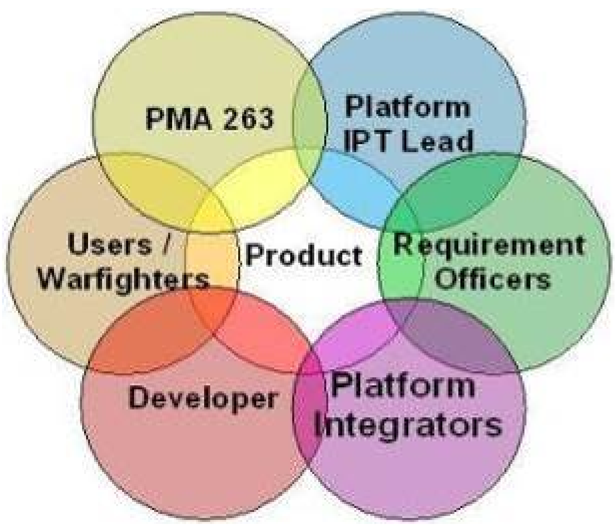

Figure 7: RAIN External Stakeholders

External stakeholders, identified in the list below, all hold interest in the results of this project's trade study analysis. Stakeholder interactions with the RAIN Team and each other are conceptualized in a cloud formation in Figure 7. PMA-263 was interested in the risks generated by different implementation options of the SE process to complete capabilities integration. Individual platform IPT leads were interested in what options they have when implementing an integration effort, and how their decisions would affect a systems engineer's ability to maintain rigor while executing a program plan. The Requirements Officers and end users' stake in this project revolved around delivering the end product. The technology developer's interest was the ability to rapidly integrate and deliver their products, while maintaining SE rigor to reduce risk of future technical challenges.

- PMA 263
- Platform IPT Lead
- Requirements Officers
- Platform Integrators
- Technology developers
- Warfighters/End Users

F. TECHNICAL APPROACH

1. Systems Engineering Process

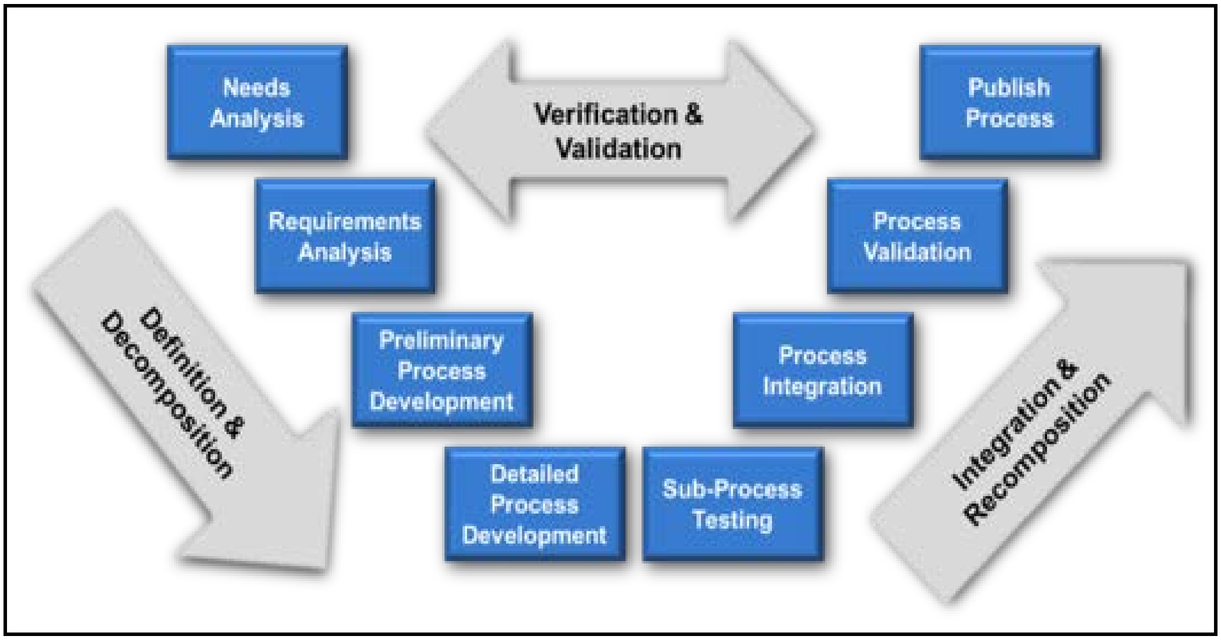

Figure 8: RAIN Tailored Systems Engineering Process (FHA 2013)

The RAIN Team utilized a tailored "Vee" model, as shown in Figure 8 to outline the method used by the Team to develop a rapid transition process (RTP), which was one of the end products of the Capstone effort. In the Definition and Decomposition phase, the initial analysis of stakeholders' needs to formulate the top-level requirements was conducted. Assessment of these requirements served as the foundation of the preliminary integration process, which led to further analysis in developing the detailed process. In the Integration and Re-composition phase, a model was established to simulate execution of the developed process, examine options that reduce process implementation time, and identify viable alternatives as an outcome.

2. Requirements Development Process

The Team performed the following steps for the operational phase to identify the requirements necessary to develop the RTP. This was further detailed in the Operational Requirements Document in Appendix E.

- Define the operational concept of the RTP System.
- Define the system boundary by identifying what will be created or changed by the RTP System. In addition, identify what systems will provide inputs and/or accept outputs from the RTP.
- Establish the objectives the RTP was intended to meet and decompose them into sub-objectives that can be allocated to functions and components.
- Develop, analyze, and refine the requirements.
- Ensure that there was a feasible design to meet the requirements.
- Define the qualification requirements to verify and validate the resulting RTP.
- Obtain approval of the developed requirements from the stakeholders .

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II. REQUIREMENTS ANALYSIS

A. REQUIREMENTS DEVELOPMENT

Through discussions with the stakeholders, the Team identified the following top-level requirements that need to be satisfied for a successful payload integration process:

1. Mission Requirement

Develop a process that facilitates comprehensive integration of a new payload into the DoN System within 18 months.

2. Stakeholder/User Requirement

Develop a process that addresses all applicable statutory and regulatory requirements needed to integrate into the DoN System.

3. System Requirement

Develop a process that addresses the following requirements applicable to the payload that needs to be integrated into the DoN System:

- Safety
- Security
- Interoperability
- Compatibility

B. DESIGN REFERENCE MISSION

1. Operational Concept

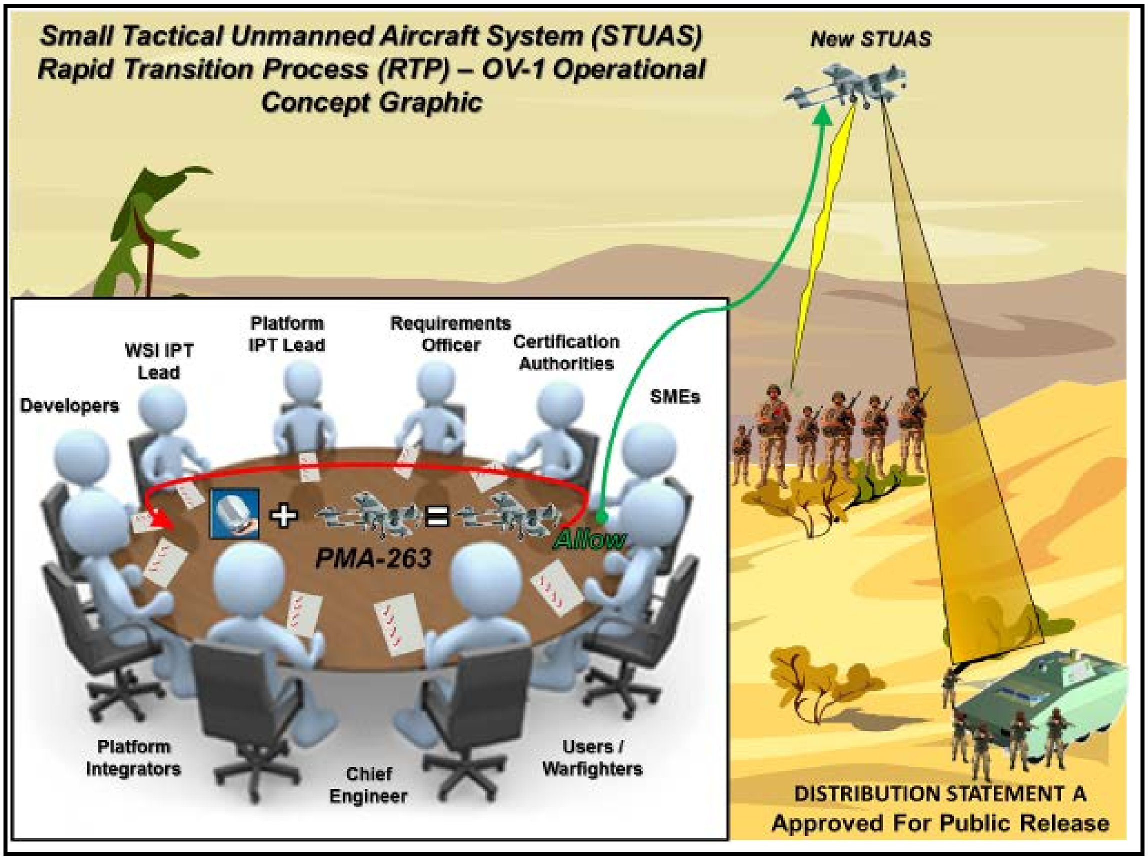

Figure 9: RTP High Level Operational View (After)

The RTP was intended to help ensure that the applicable statutory and regulatory requirements necessary for comprehensive integration of new payloads into the DoN System are addressed by the System Integrator with SE rigor. When a technology developer delivers a new payload to the System Integrator, required certifications are identified using the RTP. The individual certification processes are then implemented to collect the necessary information. If a data package was determined to be insufficient to obtain full certification and no further information was available or can be obtained within the required schedule, the applicable interim approval process documented by the

RTP will be utilized. The associated RTP risk assessment for pursuing an interim approval for the applicable certification will be provided to ensure the System Integrator was aware of the potential risks to the program. Upon compilation of the required data package, the certification application for full or interim approval was presented to the approval authority for review and ultimate endorsement. A graphic view of the operational concept is shown Figure 9.

2. Rapid Transition Process (RTP)

The RTP was designed to streamline the current disjointed integration approach employed by the PMA in fielding a new payload combination on a modular STUAS through early identification of the complete set of required certifications. It also supports a rapid fielding decision by providing the steps needed to pursue full or interim certifications. This was done by performing the RTP functions show in Figure 10 with the assistance of physical components in the form of checklists; certification requirements listings by system type; timeline reduction options listings, descriptions, and ratings; simulation results for cost and schedule for following certification baseline or timeline reduction strategies.

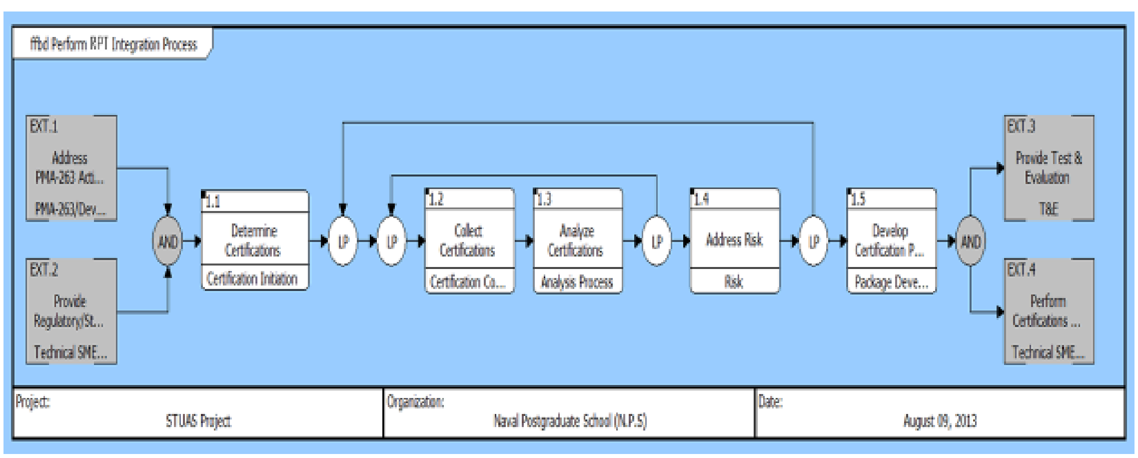

Figure 10: RTP Functional Flow

a. Initiation

The PMA initiates the RTP to support integration and fielding once the following have occurred: A payload developer delivers a new payload to the PMA; the developer provides data results from the tests it conducted; the PMA analyzes the data to determine if the payload meets SWAP requirements; the PMA analyzes the data to determine if it meets the ICD requirements for the intended STUAS; the PMA conducts a fit check and operational tests with satisfactory results; and all results are satisfactory.

b. Determine Certifications to Pursue

- Compare description of system of interest to the DRM archetypes studied / listed.
- Pick baseline required certifications list of the archetype that matches the system of interest.
- Use DRM Scenarios certifications listing in Figure 12, Figure 13, Figure 14, and Figure 22 or Table 1 to determine which certifications apply to your system and integration type.
- Compare the projected (baseline) certifications schedule and cost (Figure and Figure) against the program requirements.
- Decide whether schedule reduction was needed.
- Compare potential schedule reductions from IRTR and LRTR in Figure along with the associated cost in Figure and risks in Figure 32, Figure 33, and Figure 34 against the program requirements. Table 2 lists which certifications are addressed differently for IRTR and LRTR and indicates the modification. Additional detail on the risks and descriptions of the options that comprise both IRTR and LRTR are in the Timeline Reduction Options in "Section C Subsection 2 Project Intention" of this paper.
- Decide which timeline reduction strategy best fits the program requirements.

- Use the certification checklist from Appendix H to mark which certifications are applicable and which are not for the chosen strategy.
- Use the certification process model flow diagram for the chosen strategy (generic, IRTR, or LRTR) to guide through the next steps in Appendix F.

c. *Collect Certification Data*

Perform iteratively with analyzing the certification data.

- Follow the order shown in the certification process model flow diagram for the chosen strategy.
- From data provided by the developer: Follow certification authorities POC's guidance on data needed from the developers data package. Certification authorities and guidance information on each certification can be found in the Component Analysis and Attribute Investigation section in Appendix H.
- From T and E: Conduct test and evaluation as directed by the certification authorities and SMEs to collect the data missing from the developers TDP.

d. *Analyze Certification Data*

Perform iteratively with collecting the certification data.

- Follow the same order as used for data collection.
- From data provided by the developer: Have the collected data analyzed by the appropriate PMA SMEs and certification authorities POCs for completeness to determine what additional data was needed for the listed certifications. If the data wasa incomplete return to the collect data step and either request more data from the developer or conduct T and E.

- From T and E: Analyze the data from test and evaluation for completeness. If incomplete return to the collect data step and conduct additional T and E.
- From analysis: Have the collected data analyzed against the certifications' requirements. Depending on the certification this may need to be done the certification authority or a qualified third party.
- Submit favorable results to the certification technical approval authority for approval.
- Unfavorable results may require waivers or design changes in order for the system to be acceptable for field use. Research this with the PMA SMEs and certification approval authority POCs.
- Document the findings and proceed to addressing residual risk.

e. Address Risk

- Have the analysis findings reviewed for program risk.
- Where the findings are not clear conduct addition analysis or discussions with the certification technical authority's SMEs.
- Provide the risk assessment to the fielding decision maker and to the certification package.

f. Develop Certification Package for Decision Maker

- Detail the certifications attempted and the results; approved, waived, or not.
- Explanation why only those certifications were needed.
- Collect and attach the signed approvals, along with any statements of residual risk or limited operational boundaries.
- Attach the risk assessment.
- Provide to the system fielding decision maker in PMA-263.

g. RTP Conclusion

The RTP ends when the fielding decision package was judged to be complete by the decision maker, and a fielding decision was made.

3. Projected Operational Environment

a. Operating Environment

The projected environment in which the RTP was expected to perform was one of finite resources.

- Manpower availability will be limited due to the need for personnel to support multiple PMAs simultaneously.
- Government labs and ranges will also provide similar limitations due to the inflexibility of their schedules.
- Fixed review board schedules for the approval authority may have limited ability to add extra convening dates for data package presentation.

b. Potential Payload

The payload that will initiate the RTP process may have one or more of the following attributes:

- Insufficient information to support prompt and/or full endorsement by the approval authority.
- Procured in response to an Urgent Need Statement, thus requiring rapid fielding.
- A commercial-off-the-shelf (COTS) payload, such that additional data or redesign was not contractually feasible.
- The types of payloads that will be integrated.

4. Mission Success Requirements

For the mission to be considered a success, the RTP must address all applicable statutory and regulatory requirements to support the fielding decision of the new payload into the DoN System within 18 months. To accomplish this, the process must identify the necessary certifications and the information required to obtain full authorization. The RTP must also identify in what sequence the applicable certifications must be pursued to support the system integrator's 18-month schedule requirement. If interim approvals are required due to cost, performance, or schedule constraints, RTP will provide an applicable risk assessment to ensure the system integrator was cognizant of the potential impacts of not obtaining a full certification.

5. Mission Execution

a. Operational Activities

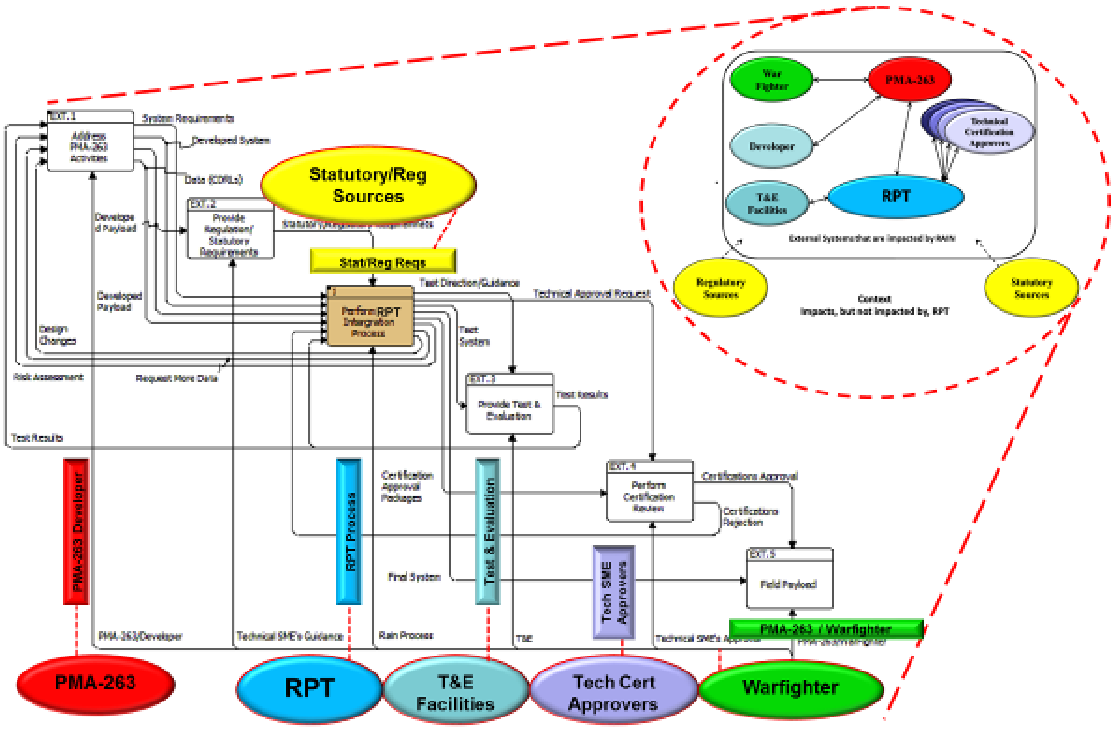

Figure 11: RPT External Systems IDEF0 (Integration DEFinition for Function Modeling)

The operational activities required to comprehensively field a new payload into the DON System are shown in Figure 11 and described in the following:

- Address programmatic activities needed to field a new capability
- Obtain the statutory and regulatory requirements that must be satisfied to field a new capability on an existing platform within the PMA inventory.
- Perform the payload integration process - RTP
- Perform testing on the new capability
- Obtain certification approvals
- Field the new capability

b. Operational Situations/Mission Scenarios

The RTP was assessed through modeling and simulation against three (3) potential mission scenarios.

(1) Full Certification for All Applicable Requirements

The data initially collected from the Original Equipment Manufacturer (OEM) is reviewed by the NAVAIR SMEs and deemed to be sufficient to support full certification of the payload. This scenario was depicted in Figure 12 and described below:

- Technology developer delivers the payload to PMA-263
- PMA-263 determines the applicable certification and collects data from the developer
- Technology developer provides requested data
- PMA-263 forwards data to SMEs for review
- SMEs determine that data is sufficient
- PMA-263 develops a data package to support the certification application and forwards to the Approval Authority
- Approval Authority certifies the payload
- PMA-263 fields the platform with the new payload

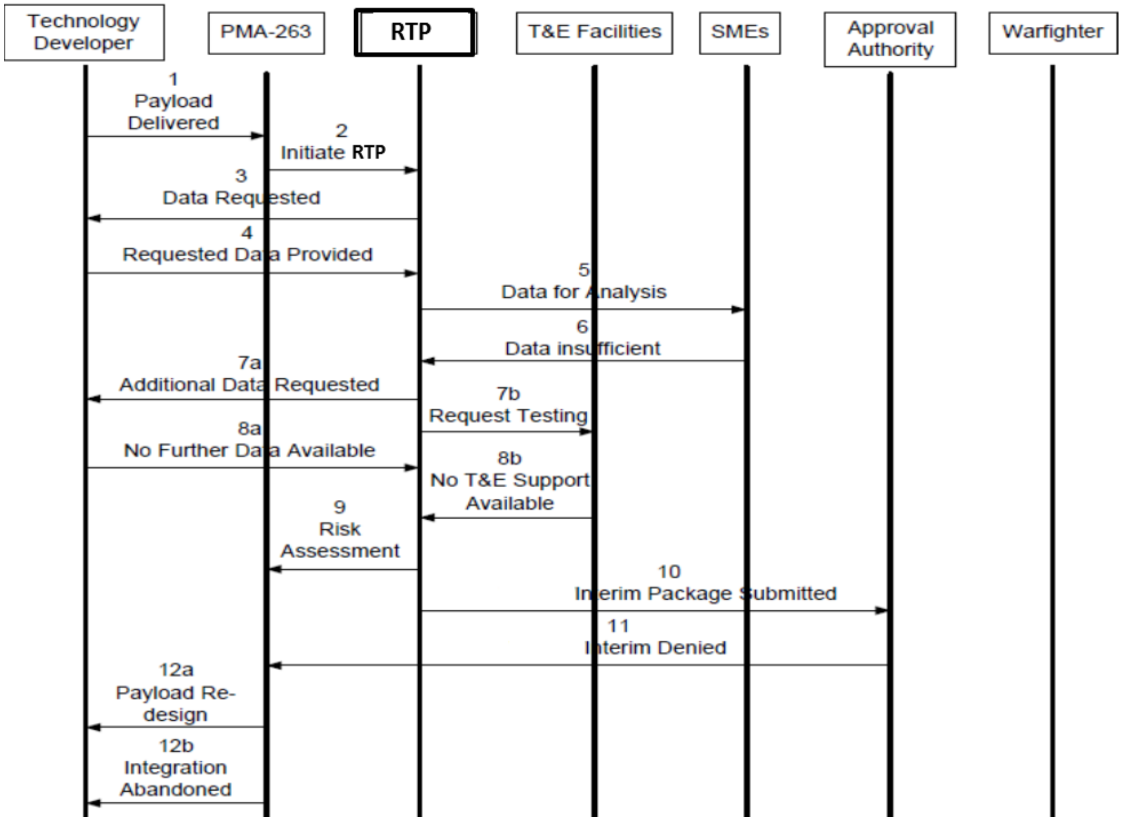

Figure 12: Full Certification Use-Case

(2) Additional Testing Required For At Least One Requirement

The data initially collected from the OEM is reviewed by the NAVAIR SMEs and deemed to be insufficient to submit a certification request package. The PMA requests the OEM provide additional data and/or T and E facilities conduct tests to obtain required information. The tests are conducted and/or additional data is received from the technology developer to supplement the inadequate data packages. This scenario was shown in Figure 13 and described below:

- Technology developer delivers the payload to PMA-263

- PMA-263 determines the applicable certification and collects data from the developer
- Technology developer provides requested data
- PMA-263 forwards data to SMEs for review
- SMEs determine that data is insufficient and additional data/testing will be required
- PMA-263requests more data from the technology developer
- PMA-263 requests T and E facilities to conduct tests to collect more data
- Technology developer provides additional data
- T and E facilities provide test reports
- PMA-263 forwards additional data to SMEs for review
- Repeat Steps 5–8 until SMEs determine that data is sufficient
- PMA-263 develops a data package to support the certification application and forwards to the Approval Authority
- Approval Authority certifies the payload
- PMA-263 fields the platform with the new payload

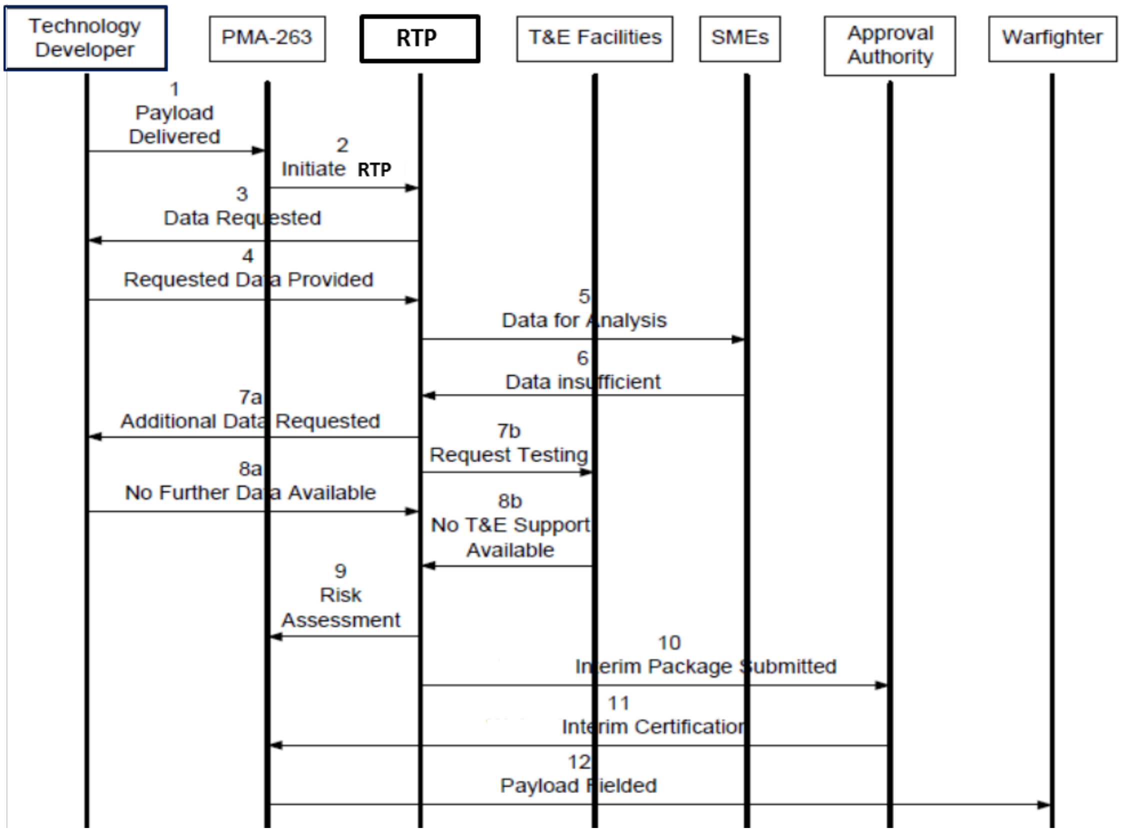

Figure 13: Additional Testing Use-Case

(3) Interim Approval Requested For At Least One Requirement

The data initially collected from the OEM is reviewed by the NAVAIR SMEs and deemed to be insufficient. Due to schedule constraints, the PMA decides to forego additional testing and pursues a waiver or interim certification. This scenario was shown in Figure 14 and described below:

- Technology developer delivers the payload to PMA-263
- PMA-263 determines the applicable certification and collects data from the developer

- Technology developer provides requested data
- PMA-263 forwards data to SMEs for review
- SMEs determine that data is insufficient and additional data/testing will be required
- PMA-263requests more data from the technology developer
- No additional data available without further testing
- PMA-263 deems that the compressed schedule cannot support further testing, so waivers/interim approvals will be necessary. PMA-263 develops a data package to support the waiver/interim certification application and forwards to the Waiver/Approval Authority
- Waiver/Approval Authority waives or provides interim certification of the payload
- PMA-263 fields the platform with the new payload

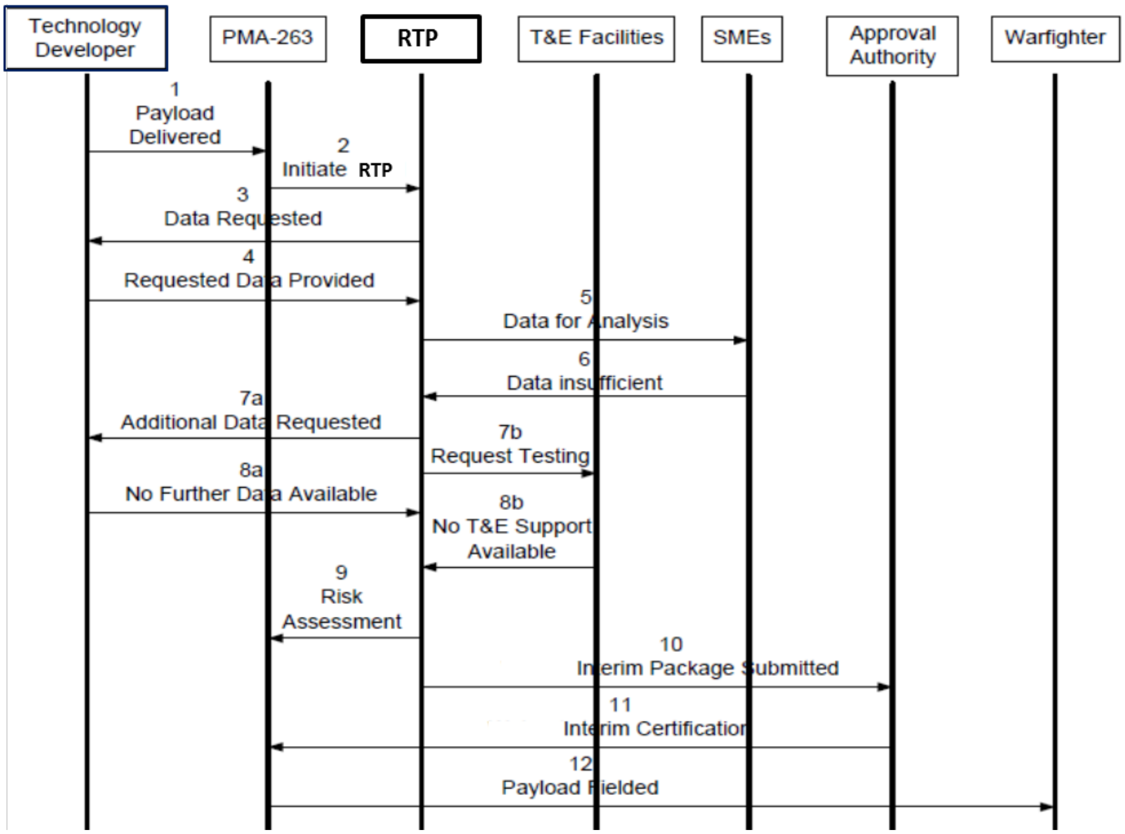

Figure 14: Interim Certification Use-Case

C. FUNDAMENTAL OBJECTIVES HIERARCHY

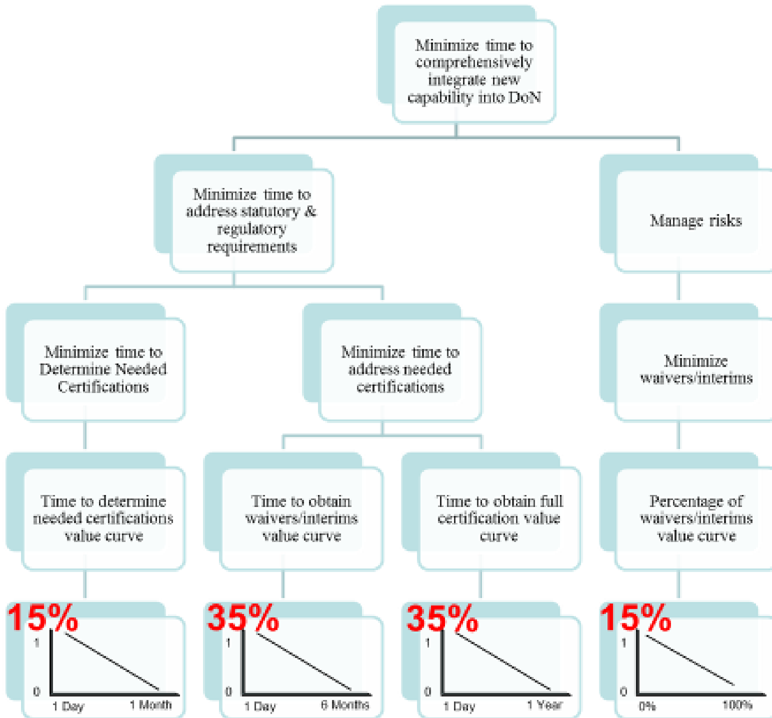

Figure 15: RTP Fundamental Objective Hierarchy

The core purpose of the system was to reduce the time it takes to obtain fielding approval of a new payload and STUAS combination. Currently, the main obstacle was ensuring that all statutory and regulatory requirements have been addressed while still meeting the required fielding timeline. These requirements exist to reduce the performance, safety, and cost risk involved in fielding a weapon system or air platform into the DoN inventory. Any effort to reduce the time taken to prepare for and make a fielding decision must include identifying risks associated with interim approvals and balancing the benefits with the risks. The fundamental objective was decomposed into progressively more concrete objectives until they formed the measures of effectiveness and the system technical performance measures. The fundamental objectives are detailed below and shown in Figure 15.

- Minimize time to comprehensively integrate new capability into DoN
    - Minimize time to address statutory and regulatory requirements
        - Minimize time to Determine Needed Certifications
            - Time to determine needed certifications value curve
        - Minimize time to address needed certifications, including time to collect additional data.
            - Time to process waivers/interim value curve
            - Time to obtain full certification value curve
    - Minimize risks
        - Minimize interim approvals
            - Percentage of interim approvals value curve

1. Value Curves

At the bottom of the fundamental objectives hierarchy are the value curves that capture the PMA's normalized weighting of the utility value of each of the bottom level objectives. They are represented by both stand-alone functions that describe usefulness on a continuum from most utility to no utility, and normalizing weighting factors. The weighting factors defined the importance of each bottom-level objective to achieving the PMA's goal. Together, the utility values and weights formed value products that, when summed, allowed the direct comparison of different system designs.

Because the importance of starting with the end in mind (Covey 2004 95) for planning the execution of a complex set of certifications and approvals, along with the conviction that a well-formed system should easily expedite planning, the time to determine needed certifications was weighted at 15%. The relative impact of risk due to interim approvals was determined to also be 15%. The main source of delay, and currently the driving force in accepting unidentified risk, has been the time it takes to address the required certifications and approvals. The time to obtain interim approvals and the time to obtain full certifications were both set at 35%. This weighting strongly favored strategies that utilize payloads comprised of components that have already been certified and approved.

The primary objective of the RTP was to quickly integrate a new capability into the DoN System. Because of this, the process became less attractive as more time passed the capability can be fielded. This resulted in value curves with a linear shape and weightings obtained from the PMA, as depicted in Figure 15.

2. Measures of Success

Analysis of the fundamental objectives expressed by the stakeholders in section 2.3 resulted in the identification of measures of effectiveness (MOE) and performance (MOP) by the RAIN Team.

a. MOE

To encourage utilization of the designed product, it was important to identify the users' ultimate objective: rapidly field a new payload. For this project, the mission to be accomplished was the fielding of a new capability to the warfighter. To successfully support this objective, the RAIN project developed a process that was able to facilitate comprehensive integration of a new payload into the DoN System. This resulted in the following MOE:

- MOE: Probability of addressing all statutory and regulatory requirements to enable fielding of a new payload to the warfighter in 18 months.

b. MOP

The identified MOE identified above was decomposed into the following MOPs and subsequent Technical Performance Measures (TPM).

- MOP: Number of interim Technical Certifications
    - TPM - % requirements that need interim approval

- MOP: Median time to gain approval to field a new capability

- o TPM - Number of months from platform integration of new capability until approval to field newly configured STUAS

D. ARCHITECTURE DEVELOPMENT

The RTP architecture section was an overview of the RTP structure. Appendix C provides the complete RTP architecture, which consists of component structure, Functional Flow Block Diagram (FFBD), and Integration Definition for Function Modeling (IDEF0) for the entire system function.

The proposed RTP system baseline architecture was designed allowing payload integration to be a flexible and adaptable SE process. The CORE® architecture development program by Vitech® was utilized to plan the system architecture, creating a top-down design to identify the new payload integration process.

The RTP baseline architecture was developed from an evaluation of the functional requirements derived from the problem statement and scope. This design was analyzed and compared against the system's architecture needs to identify tradeoffs between the functional requirements and the desired integration and fielding timeline. The current PMA-263 UAS certification process was used to determine the additional architectural components needed to support the RTP functional and operational capabilities.

The functional architecture defines the logic of what will be done by the system. According to Buede, not only does it contain "…a hierarchical model of the functions performed by the system…" (Buede 2009 194–211, 213), but its development must comply with exit criteria that require "…the coherent matching of the input/output requirements with the functions and items in the functional architecture…in increasing layers of detail, so the exit criterion…will be applied with each completion of a layer of detail." (Buede 2009 194–211, 213). This starts with leveraging the concept of operations to define the system boundaries and interfaces with external systems, and continues to decompose the system until sufficient detail was obtained to be able to design the system components.

The physical architecture defines what will perform the functions detailed in the functional architecture. A RTP physical architecture was not fully developed, or utilized, because the system was primarily logical and would employ simple forms and diagrams as the physical components.

1. System Boundary

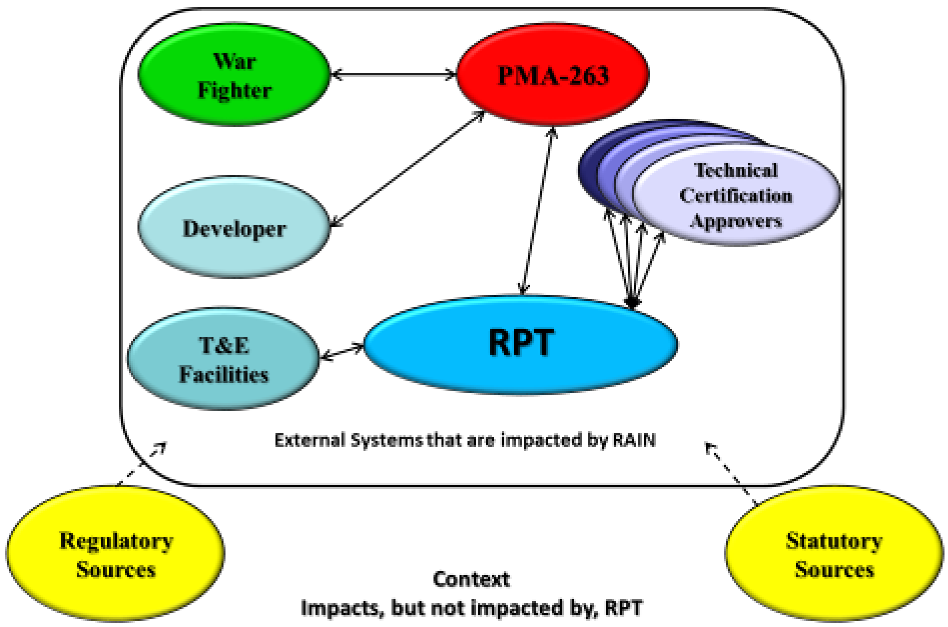

Figure 16: RTP External Systems Diagram

The RTP External Systems Diagram, shown in Figure 16, shows the external system interfaces utilized by the RTP. The systems located within the box are those impacted by the RTP. The environment outside of the box is composed of systems that impact, but are not affected, by the RTP. The out-going arrows identify systems that are impacted by the RTP, while those that impact the RTP are identified with in-coming arrows.

The RTP architecture was the product of an iterative process of definition, decomposition, and refinement. The RTP External Interfaces Diagram (Figure 11) was the result of extensive analysis of the requirements, concept of operations, fundamental objectives, and system boundary interfaces. The diagram shows that the RAIN Project will have to interact with PMA-263 for system-related requirements and in developing the RTP to provide them with the fielding decision support package; certification technical authorities, for both direction on the statutory and regulatory requirements and for certification reviews for approval; and the T and E facilities to determine the performance of the system relative to certification requirements. The RPT inputs, outputs, triggers, and mechanisms, more clearly shown in Figure 17, which was used extensively during the functional decomposition.

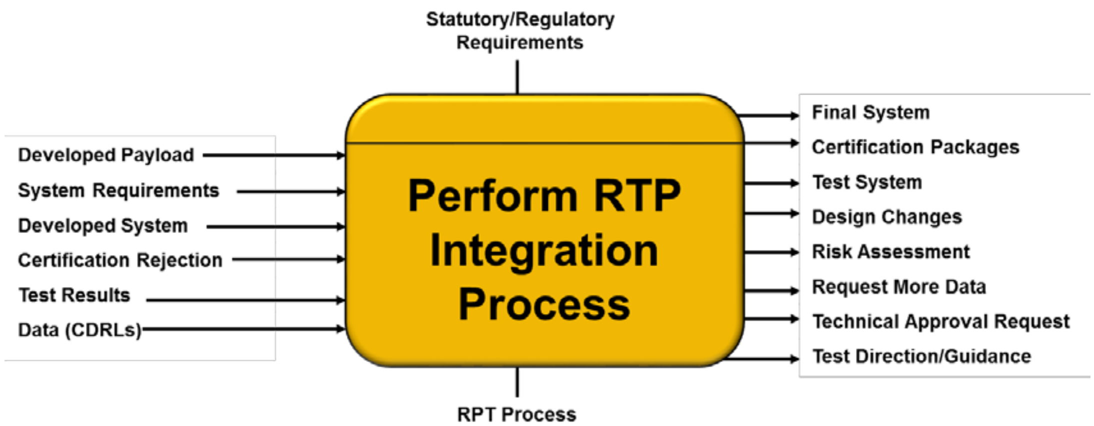

Figure 17: RTP Inputs/Outputs with External Systems

2. Architecture Design

The RTP was designed to obtain a fielding decision approval within 18 months, while managing the risk of meeting a rapid timeline. RTP supports and brings order to the process of integrating a new payload combination on a modular STUAS by determining the complete set of required certifications; and identifying the options and risks to pursuing full certifications, interim certifications, or a combination of the two (2). The RTP involves the following steps:

- Determining which certifications are required for the payload of interest.

- Collecting the required support documentation and analyzing for completeness
- Employing T and E as needed to answer all open questions
- Identifying and addressing the residual risks
- Assembling data packages
- Developing certification request packages
- Requesting full or interim approval for each required certification

3. RTP Functional Architecture

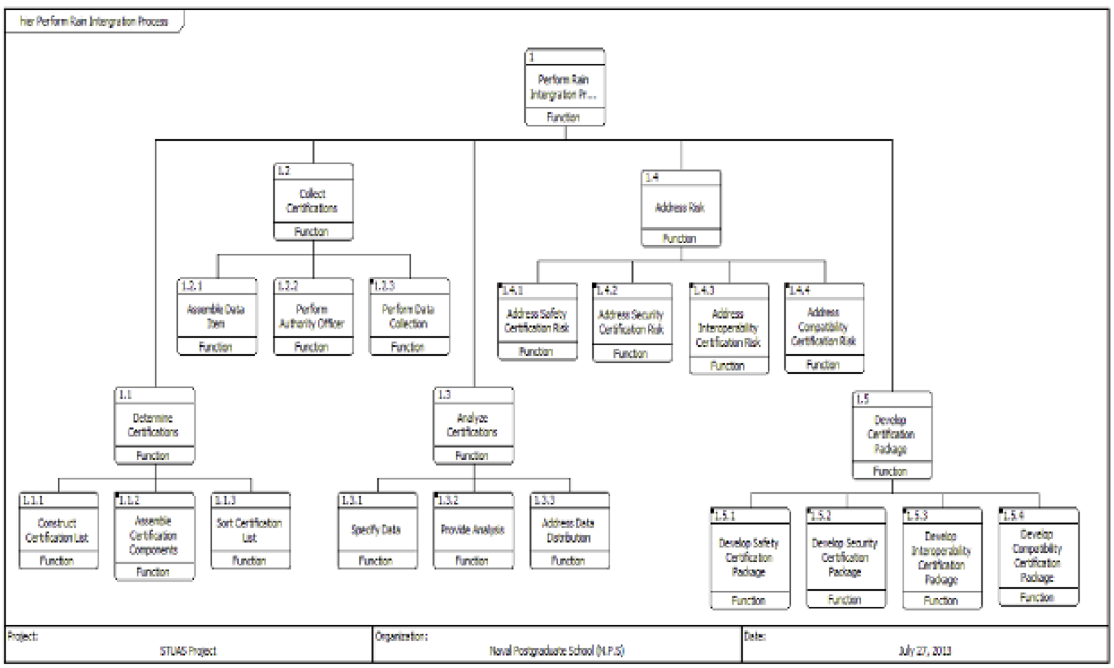

Figure 18: RTP Functional Hierarchy

The RTP Functional Hierarchy in Figure 18 was produced following the clear definition of the system boundaries and interfaces during the functional decomposition. This functional hierarchy was extended to a sufficient level of detail to construct the schedule, cost models, and user tools; including check lists and flow diagrams. The useful hierarchy depth was decomposed to three (3) levels and shows the decomposition relationships of the five (5) basic functions Figure 19 of the RTP system, and details the sub-functions.

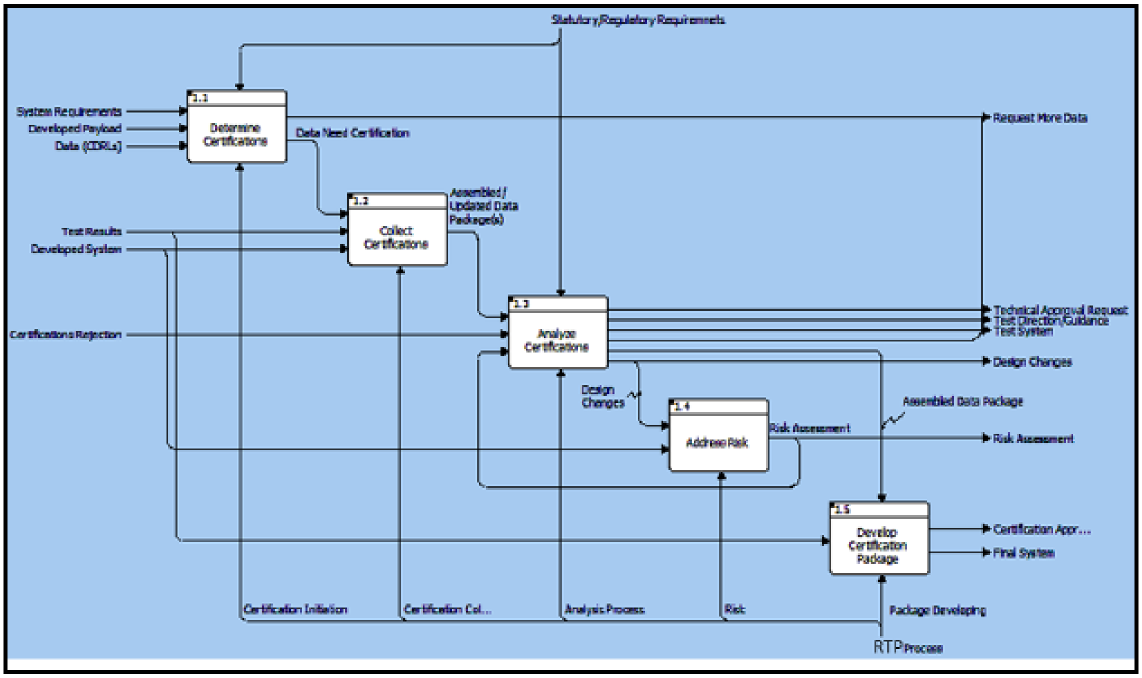

Figure 19: RTP Top Level Functions (IDEF0)

The top-level functions were determined by analysis of the top level input, output, interface, and functional requirements, as well as the fundamental objectives and system boundary interfaces. The requirements were derived from the functional objective hierarchy, system boundary and interface definitions, and the concept of operations.

Once the first level of functions (including inputs, outputs, triggers, and mechanisms) were defined, the next levels were determined through logical decomposition and analysis of the top level requirements, and analysis of the fundamental objectives hierarchy. In each level, the requirements were allocated to functions to ensure that all requirements were met and needed. This was continued until sufficient detail was developed to build the simulation models and user tools.

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III. COMPONENT ATTRIBUTE INVESTIGATION

The Team's research into the statutory and regulatory requirements resulted in the identification of potential certifications, as shown in Figure 20 that would need to be obtained prior to fielding a new payload. The RTP shall satisfy the necessary DoN System requirements by obtaining the applicable certification(s).

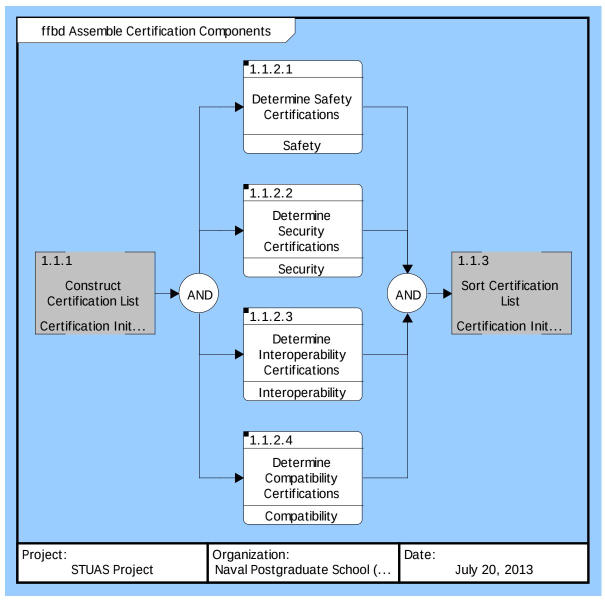

Figure 20: Applicable Certification Categories

The certifications were separated into four (4) categories, in accordance with the System Requirements identified earlier:

- Safety
    - Airworthiness
    - System Safety
    - Laser
    - Weapon
    - Battery

    - Range Safety
    - E3
- Security
    - Information Assurance (IA)
    - Anti-Tamper (AT)
    - Selective Availability Anti-Spoofing Module (SAASM)
    - Clinger-Cohen Act (CCA)
- Interoperability
    - Spectrum
    - Common Datalink (CDL)
    - Interoperability
- Compatibility
    - Environmental
    - Test and Evaluation (T and E)

A brief overview of each certification with details of the artifacts needed for a complete data package is provided in Appendix H.

A. RESEARCH MATRIX

The RAIN project research matrix shown in Figure 21 and further detailed in Appendix D, was a living document used to capture and summarize information about the statutory and regulatory requirements required to support a fielding decision. The gray and blue fields contain the name of each certification and, where applicable, each sub-certification; the person assigned to conduct the research; whether it was in scope; the type of requirement (statutory or regulatory); the top level actively-used guiding instruction and supporting guidance(s); the approving authority office or organization; whether interim approval or waivers were allowed; what office could grant waivers or interim approvals; a listing of the required documentation; whether testing was required to support the certification approval; the best case (Low), most likely case (Med) and worst case (High) values for cost, lead-time, and certification activity duration; and explanatory notes. Below the summary data fields is the table of multipliers used for converting point estimates into triangular distributions for the model (based on the SME's assessment of the risk associated with the estimate) (Raymond 1999, 147–156). The un-shaded fields to the right of the summary data detailed the "Risk Simulator" models for the all-inclusive generic cost, as well as the time reduction strategy costs for each DRM use case. The green and brown fields hold the reference data for the triangular input distributions and the tan fields hold the summation expressions as well as the reference data for the statistical output collection.

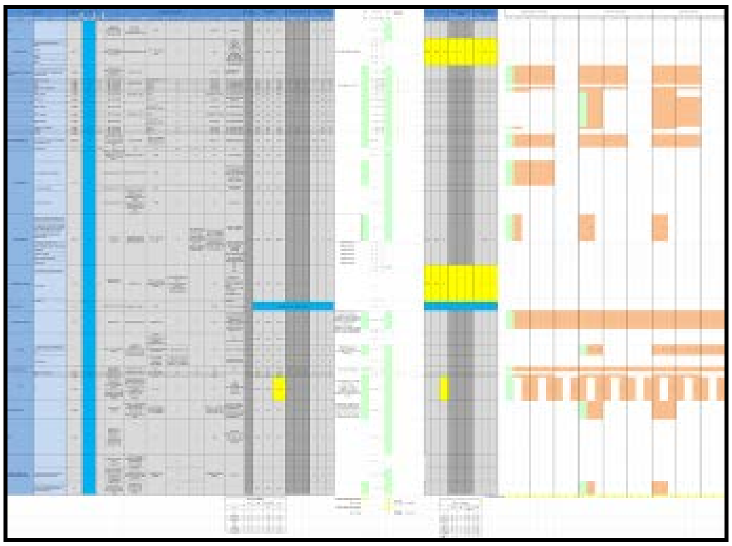

Figure 21: RAIN Research Matrix and Cost Model Snapshot (Detail Shown in Appendix D)

B. PREREQUISITE CERTIFICATIONS

During the investigation of the above components, the RAIN Team discovered that all certifications could not be pursued concurrently; some certifications require the completion of others before they can be obtained. The following certifications were identified as having prerequisites, with specific relationships documented in a tailored schedule in Appendix I:

- T and E
- Airworthiness
- WSERB
- IA
- Safety
- E3

Figure 22 provides a graphical representation of the order in which the applicable certifications should be pursued:

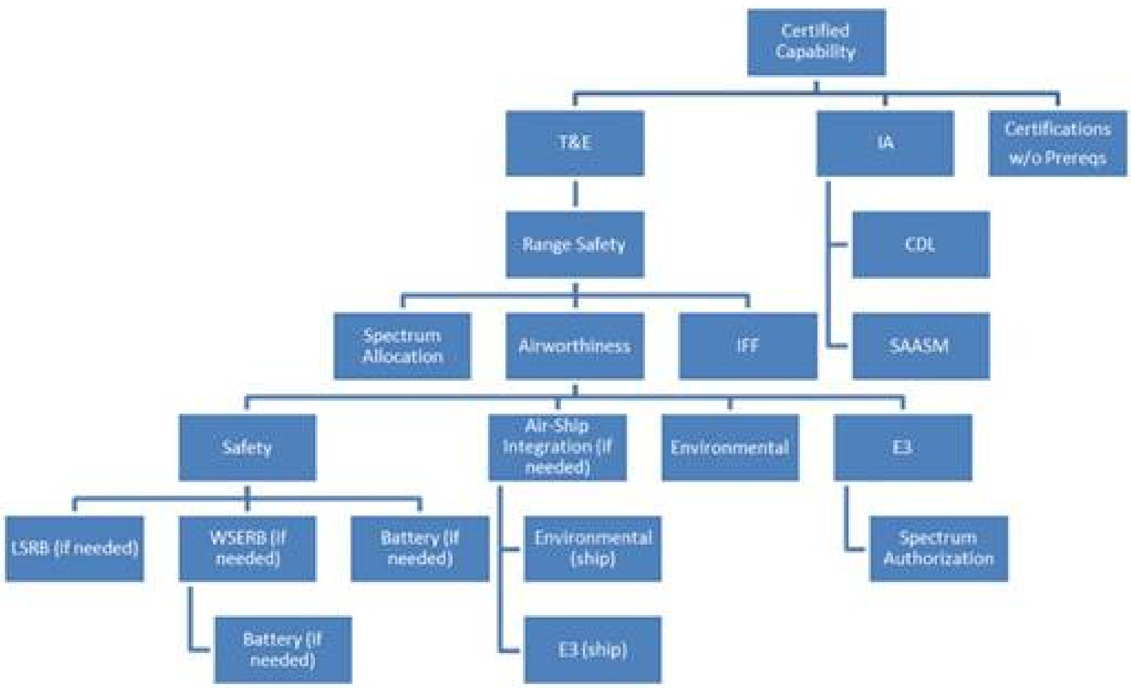

Figure 22: Prerequisite Certifications

For example, Airworthiness certification cannot be issued until Safety, Air-Ship Integration (if applicable), Environmental, and E3 are first obtained.

IV. PROCESS TRADE STUDY

A. MODELING AND SIMULATION (M AND S) OVERVIEW

"All models are bad, but some are useful" (Box, G. E., Draper, N. R 1987). Because of the complicated interactions between the sub-processes involved in approving the integration of a new payload onto a STUAS and approving the use of the new system, M and S was used to represent and test the overall integration approval process schedule and associated cost. Models assisted in understanding the current sub-processes of individual certifications, the generic process of addressing all certifications, the impact of tailoring to match the DRMs, and the RTP timeline reduction options. The simulations were used to verify the model of the generic process and to project the performance of it, as tailored to match the DRMs, and as tailored to implement timeline reduction strategy options. For each DRM of payload type and run the desired process would be one that addresses all required certifications or accreditations within the desired schedule without incurring unacceptable risk. In the event that more than one process met these provisions, then the one most closely optimized the criteria from the fundamental objectives hierarchy (Figure 27) would be chosen. The DRM scenarios were chosen by PMA-263 to cover the most likely upcoming payload and STUAS integrations. The Team's work elicited from SMEs the probable schedule, cost, and risks the program manager would need to understand to make an informed decision regarding the available options presented. The available options included varying the order the certifications were addressed, within the constraints of the order dependency prerequisites; and implementing or not implementing timeline reduction strategies of subsystem interim or previous certifications. The results were used to show the relationship between schedule compression and cost, associated with the application of timeline reduction strategies to the process. Risk expansion related to schedule compression was examined further in the Risk Section of this paper

B. GENERIC MODEL DEVELOPMENT

The time model was built in iGrafx® because of how well it represents process flows and utilized data gathered in the required certifications research matrix (Appendix D). This data was used to model each certification sub-process cost and schedule as simple triangular distributions (Following (Raymond 1999 147–156)). In order to explore the theoretical upper and lower bounds on the time required to complete all of the certifications models were built for pursuing certifications in an all serial flow and in an all parallel flow. These obviously produced results that were outside of what would either be allowed (all parallel) or desired (all serial). Prior to the iterative corrections involved in building the final generic model; an all serial flow took a mean of 109 months and an all parallel flow took a mean of 16 months (reference the first four slides in Appendix F). The dependency prerequisite relationships among the various certifications, discussed earlier, were used to build and order the generic model from the individual 'building block' certification sub-process model representations. The final generic model used parallel flows where ever possible, and not proscribed by dependency prerequisite relationships, instead of serial in order to minimize overall schedule time to address all of the certifications. Additional SME input was used to iteratively refine the generic model until it appropriately captured the flow, prerequisite relationships, and durations, as shown in. Figure 23.

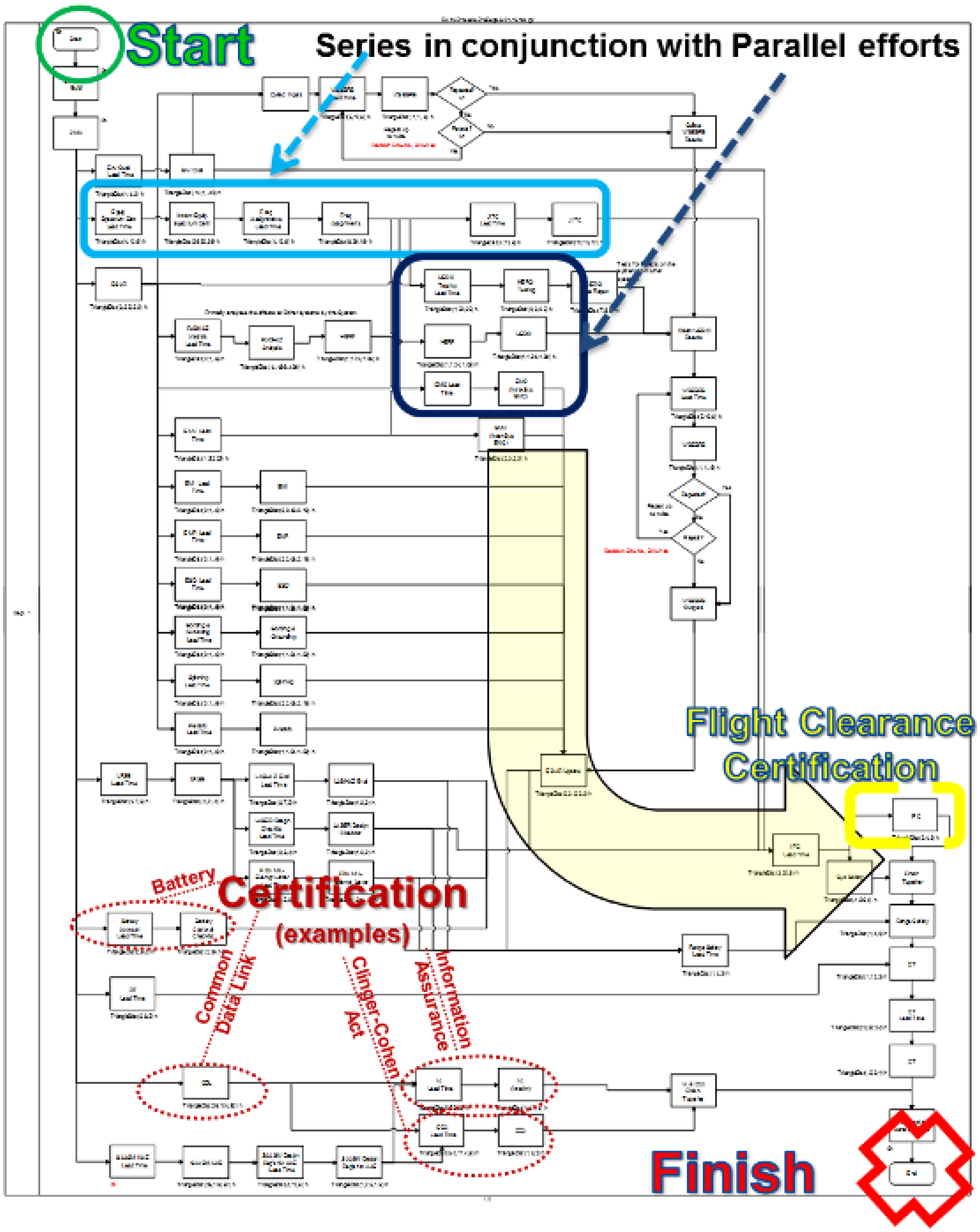

Figure 23: Generic RTP certifications process flow model for cycle time (for LASER Designator Run Number 1).

The generic cost model was built in Excel alongside the Research Matrix (Appendix D). The cost ranges of Low, Most Likely, and High were used as parameters to form triangular distribution inputs in Risk Simulator® (Figure 24). The cost model was built in Risk Simulator® because, as a Microsoft Excel® add-on, it allowed the cost model to be built fairly quickly and outputted nearly complete statistical representations of the results, including histograms, which required very little additional work for analysis. The output for the generic model was defined as the sum of all the costs from each of the individual distributions, and contained the control tests for successful completion.

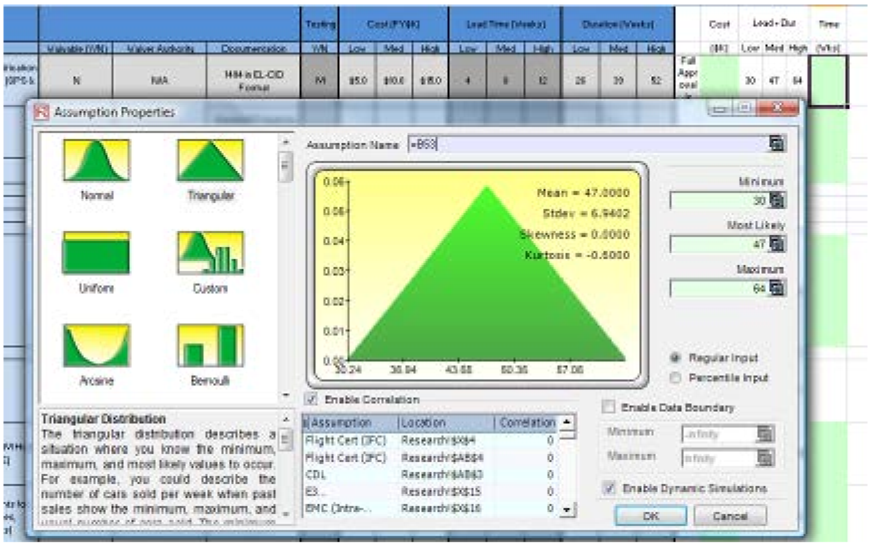

Figure 24: Cost Model Simulation Input Distribution example.

The generic model represented the case where all possible certifications and approvals were required. This was used to simulate the time involved in the worst case successful single start approval process. The results of simulating the process with the generic all inclusive model showed that despite being built from inputs of triangular distributions the output was approximately normal, as shown in Figure 25 and Figure 26. This reflected the assertion of the central limit theorem which states that for independent and identically distributed real variables (RV) the distributions for the sum of the variables, and also the mean of the RVs, are approximately normal when the number of samples (n) is large enough (> 30) (Devore J.L 2008, Sect. 5.4). The real values in this case came from 43 independent triangular value distributions. The normal distribution results facilitated communication with SMEs about the models.

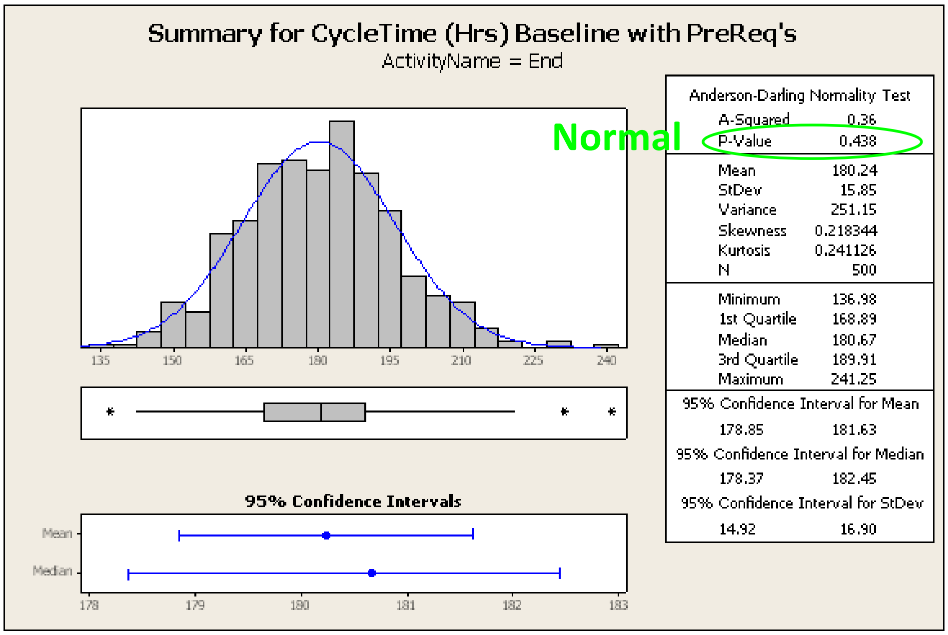

Figure 25: Graphical Statistical Summary of Generic Model overall cycle time.

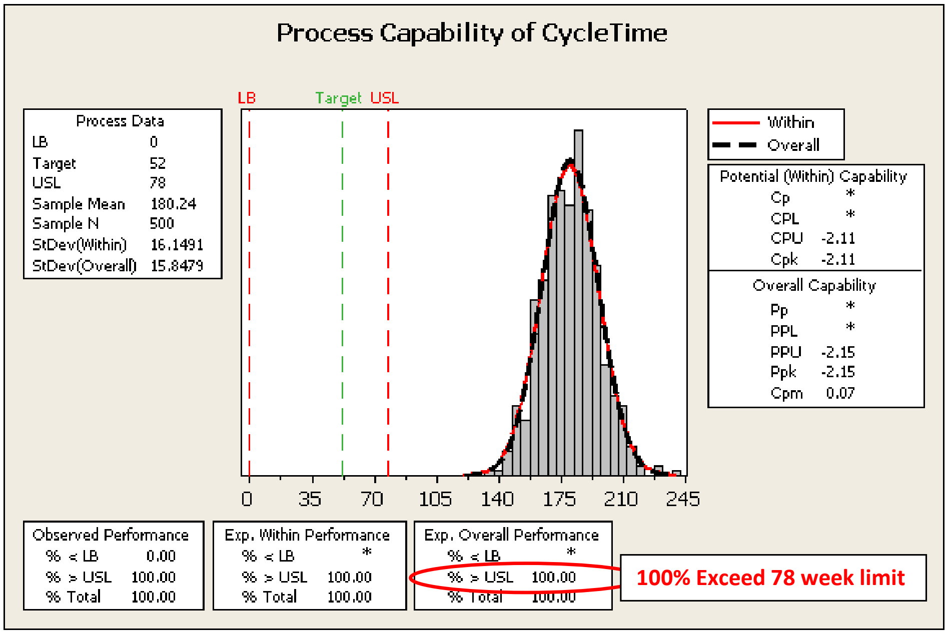

Figure 26: Capability Analysis Chart for Generic Model
(with upper specification limit of 78 weeks.)

The mean cycle time of the worst case scenario is well above the desired cycle time upper limit of 78 weeks, with a mean cost (Figure 27) of $1.8M. Expert opinion verified these results, confirming that the model accurately represented the process. This led to the development of the proposed "to-be" baseline process models (Dam 2006) for each DRM scenario.

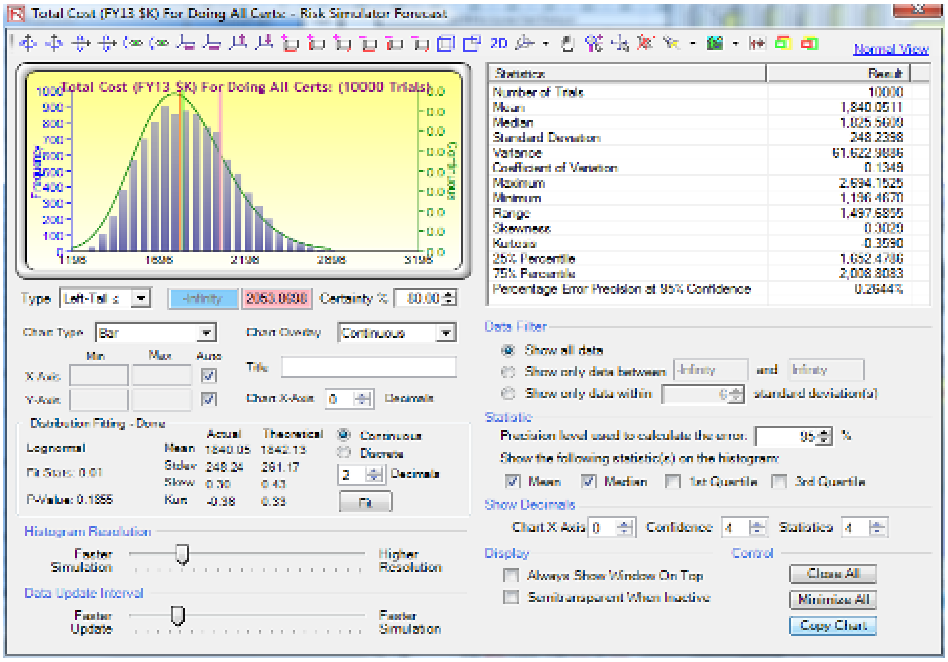

Figure 27: Cost Statistical Analysis for Generic Model

C. MODELS DEFINTIONS – RAIN PROJECT CASE STUDIES

Although five (5) payloads were earlier identified as components typically integrated by PMA-263, the identical required certifications for RADAR, Communications/Data Relay, and Active EW enabled their consolidation into one. The remaining DRMs of LASER Designator, Passive EW, and Active EW payloads were determined by PMA-263 representatives to require the certifications identified in Table 1. For each certification Green means the certification was required, while Red or Blue means the certification was not.

Three (3) scenarios with different integration complexity were utilized for each DRM payload: Simple, Complex, and Mature Payload. In a Simple Integration, the payload has little interface with the platform; all components needed for operation were self-contained within the payload. In a Complex Integration, the payload interfaces with the platform, requiring the use of the existing components (e.g., battery, datalinks, etc.).

In a Mature Payload Integration, the payload was delivered with the majority of the required certifications already obtained.

Models for each of the DRM payloads were then formed from the generic model by removing unneeded certification sub-processes.

Requirments		LASER Designator			Passive EW			Active EW / Comm-Data Relay / RADAR		
Level 1	Level 2	Run 1 (Simple Integration)	Run 2 (Complex Integration)	Run 3 (Highly Mature Payload)	Run 1 (Simple Integration)	Run 2 (Complex Integration)	Run 3 (Highly Mature Payload)	Run 1 (Simple Integration)	Run 2 (Complex Integration)	Run 3 (Highly Mature Payload)
CDL		N	N	N	Y	N	Done	Y	N	Done
Airworthiness (IFC)	Risk Assessment Questionnaire	Y	Y	Done	Y	Y	Done	Y	Y	Done
	HPOL	Y	Y	Y	Y	Y	Y	Y	Y	Y
	EDRAP	Y	Y	Done	Y	Y	Done	Y	Y	Done
	Risks	Y	Y	Y	Y	Y	Y	Y	Y	Y
E3 (Electromagnetic Environmental Effects)	E3IAR	Y	Y	Done	Y	Y	Done	Y	Y	Done
	EMC (Intra-system)	Y	Y	Done	Y	Y	Done	Y	Y	Done
	EMI	Y	Y	Done	Y	Y	Done	Y	Y	Done
	EMP	N	N	N	N	N	Done	N	N	Done
	EMV (Inter-system EMC)	Y	Y	Done	Y	Y	Done	Y	Y	Done
	ESD	Y	N	Done	Y	N	Done	Y	N	Done
	HERO Testing	N	N	Done	Y	N	Done	Y	N	Done
	RADHAZ	N	N	Done	Y	N	Done	Y	Y	Done
	HERF	N	N	Done	Y	N	Done	Y	Y	Done
	HERO	N	N	Done	Y	N	Done	Y	Y	Done
	HERP	N	N	Done	Y	N	Done	Y	Y	Done
	Bonding & grounding	Y	N	Done	Y	N	Done	Y	N	Done
	Lightning	N	N	N	N	N	N	N	N	N
	P-Static	N	N	N	N	N	N	N	N	N
Environmental Qualification	MIL-STD-810G tests with 24 hour sa	Y	Y	Done	Y	Y	Done	Y	Y	Done
LASER Saftey Review	LSRB Review of below	Y	Y	Y	N	N	N	N	N	N
	Laser radiation hazard evaluation	Y	Y	Done	N	N	N	N	N	N
	Laser design checklist	Y	Y	Y	N	N	N	N	N	N
	FDA mil-exempt letter	Y	Y	Done	N	N	N	N	N	N
Battery Approval	Product spec for battery cell	Y	N	N	Y	N	N	Y	N	N
	Battery schematic (cell & control boar	Y	N	N	Y	N	N	Y	N	N
	CONOPS	Y	N	N	Y	N	N	Y	N	N
	Operator's Manual	Y	N	N	Y	N	N	Y	N	N
	Battery safety data package	Y	N	N	Y	N	N	Y	N	N
	Request letter	Y	N	N	Y	N	N	Y	N	N
IA (Information Assurance)		Y	Y	Y	Y	Y	Y	Y	Y	Y
AT (Anti-Tamper)		Y	Y	Y	Y	Y	Y	Y	Y	Y
CCA (Clinger-Cohen Act)		Y	Y	Y	Y	Y	Y	Y	Y	Y
Spectrum	1. Equipment Spectrum Certification	N	N	N	Y	N	N	Y	Y	Y
	2. Assignments	N	N	N	Y	N	N	Y	Y	Y
System Safety Approval		Y	Y	Y	Y	Y	Y	Y	Y	Y
T&E	Range Safety Approval	Y	Y	Y	Y	Y	Y	Y	Y	Y
	DT	Y	Y	Done	Y	Y	Done	Y	Y	Done
	OT	Y	Y	Y	Y	Y	Y	Y	Y	Y
WSESRB Approval		N	N	N	Y	N	N	Y	N	N
JITC		Y	N	Done	Y	N	Done	Y	N	Done
Selective Availability Anti-Spoofing Module (SAASM)	Security Approval for SAASM Host	N	N	N	Y	N	Done	Y	N	Done
	SAASM Design Requirements for HA	N	N	N	Y	N	Done	Y	N	Done

Table 1: DRM Run Definitions
(Red= Certification Required, Green/Blue=Certification Not Required)

Timeline reduction strategies were formulated to exploit the allowance for some of the certifications to be either interim or previously completed and are summarized in Table 2. While the RTP starts after the delivery of a properly operating payload, the PMA-263 decides which payloads are developed and can insist that certain subsystems in the payload be ones that were previously certified in order to negate the need for the certifications that would drive the fielding decision beyond 18 months. Whether this was done would be in the payload design description data provided with the payload. This was a subset of the benefits realized by using standard parts, but may not be realizable on a regular basis until the industrial base for the required small and ruggedized subsystems becomes more mature. Due to the undesired nature of waivers, the option of using previously certified sub-systems or components to bypass some of the long duration certifications was introduced instead of considering waivers. The time distributions for all of the full certifications are in the research matrix (Appendix D columns Q through V) and are the sums of the lead time from request to start of work on the certification and the duration to actually process and provide findings (approval/rejection). The time distribution changes for each timeline reduction strategy are listed in Appendix G section 1, and represent significant reductions from the baseline full certification values.

The individual options for shortening the certification timelines were aggregated into two (2) alternative strategies: intermediate risk timeline reduction (IRTR) and low risk timeline reduction (LRTR). This could have been done for any combination full, interim, previous, or waived certifications by simply changing the time distribution in the definition of the certification(s) of interest, rerunning the simulation, exporting the data Minitab®, conducting statistical analysis, capturing the new flow diagram (showing the new distribution values), capturing the statistical analysis results, and organizing into a brief. All this takes about 20 minutes for each model change. This was not done for expediency reasons since we were already up to 27 runs (9 hours) from the three DRMs of three runs each and three different strategies. If it had been done we would be 20 minutes x 3 DRMs x 3 runs x a minimum of (12+1) simple individual changes (Appendix G Table 2) = 39 hours to just collect the data. The use of Minitab® and DOE could be used in the future to extend our work to optimize the RTP for specific DRMs and run types. The IRTR strategy was composed of pursuing interim certification or approvals for Battery, IA, Spectrum, and JITC; and a Category 3 IFC, while shifting OT during initial fielding. Interim approvals accept more risk than full certifications or using previously certified subsystems, but less risk than skipping it altogether, leading to this strategy being called “Intermediate Risk Timeline Reduction.” The LRTR strategy was comprised of using previously certified or approved data links, batteries, transmitters, and GPS receivers while pursuing a Category Three (3) IFC and conducting a combined DT/OT.

In comparison to using unproven subsystems, using a previously certified item is low risk, thus the name "Low Risk Timeline Reduction." A summary of the strategies are in Table 2; 'FULL' means full certification is pursued, 'Interim' means a interim certification is pursued, 'Previous Cert' means that certification was completed previous to the triggering subsystem being used in this payload. These strategies were then applied to the baseline model of full certifications for each DRM run cases.

CERTIFICATION	IRTR	LRTR
CDL	FULL	Previous Cert
IFC	CAT 3	CAT 3
Battery	Interim	Previous Cert
IA	Interim	FULL
Spectrum	Interim	Previous Cert
T and E	OT in fielding	Joint DT OT
JTIC	Interim	FULL
SAASM	FULL	Previous Cert

Table 2: Timeline Reduction Strategies Sub-Process (Changes Summary)

D. RTP MODELING AND SIMULATION RESULTS

The baseline (BL) processes were found to take longer than 78 weeks (18 months) on average for most of the DRM scenario runs, as shown in Table 3. The two (2) timeline reduction strategies (IRTR and LRTR) were then applied to each baseline run definition from each DRM. Simulation showed that both strategies brought the mean time to complete all of the required certifications to less than 78 weeks in almost all runs, with the associated risk of exceeding the time limit determined through statistical analysis. These satisfactory results, summarized in Table 3, reinforced the Team's resolve to not use waiver because of the corresponding increase in risk.

Payload	Run	Schedule (wks)			Chance to Exceed 78 wks (%)			Cost ($K)		
		BL	IRTR	LRTR	BL	IRTR	LRTR	BL	IRTR	LRTR
Laser Designator	1	89	51	52	80	1.2	0.8	1324	859	1043
	2	88	51	52	78	1.2	1	1269	437	1037
	3	43	25	32	0	0	0	520	55	287
Passive EW	1	180	92	77	100	87.1	45.9	1726	1230	1387
	2	88	51	51	77	1.3	1	1233	785	1022
	3	34	14	29	0	0	0	520	55	287
Active EW	1	180	90	77	100	84.4	45.9	1726	1230	1413
	2	132	51	51	100	1.1	1	1287	817	1047
	3	102	25	30	99.5	0	0	530	60	290

Table 3: Mean Simulation Results

The source statistics for Table 3 came from the statistical analysis charts generated in Minitab® for all 27 scenarios. Examples of these charts, shown in Figure 28, Figure 29, and Figure 30, show the cycle time statistics resulting from the application of IRTR to run 2 for the Passive Electronic Warfare payload. The full collection of the statistical analysis charts for all scenarios is collected in Appendix H. Because the number of different certifications involved in the 27 scenarios shown in Table 3 varied from a high of 36 down to a low of 8, the effects of the central limit theorem varied as well. This variance manifested in the distributions for schedule appearing to be normal in a few cases, log normal in several cases, and triangular in a few cases; in proportion to the number of certifications involved in the process.

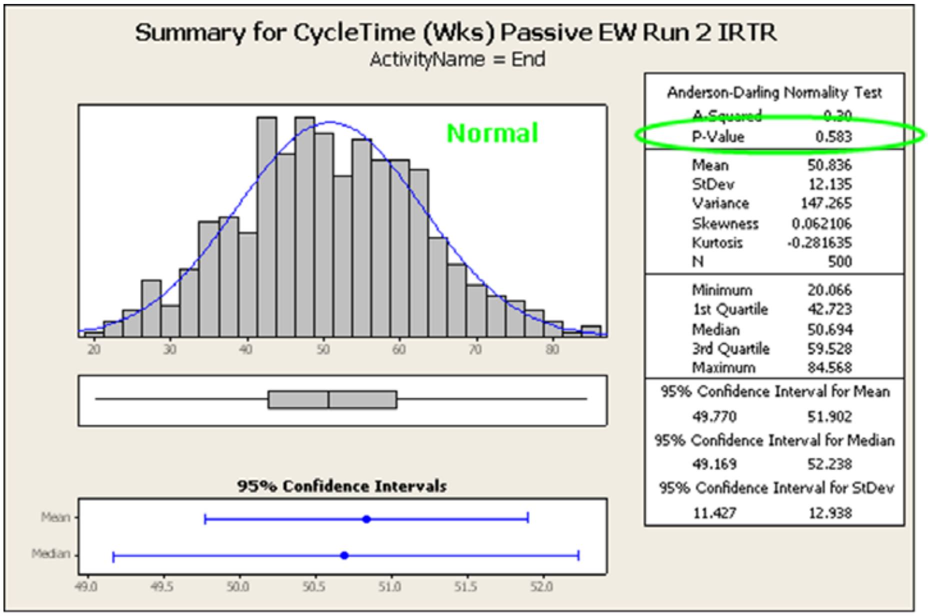

Figure 28: Graphic Statistical Summary of overall certification cycle time (for Passive Electronic Warfare Run 2 with IRTR applied.)

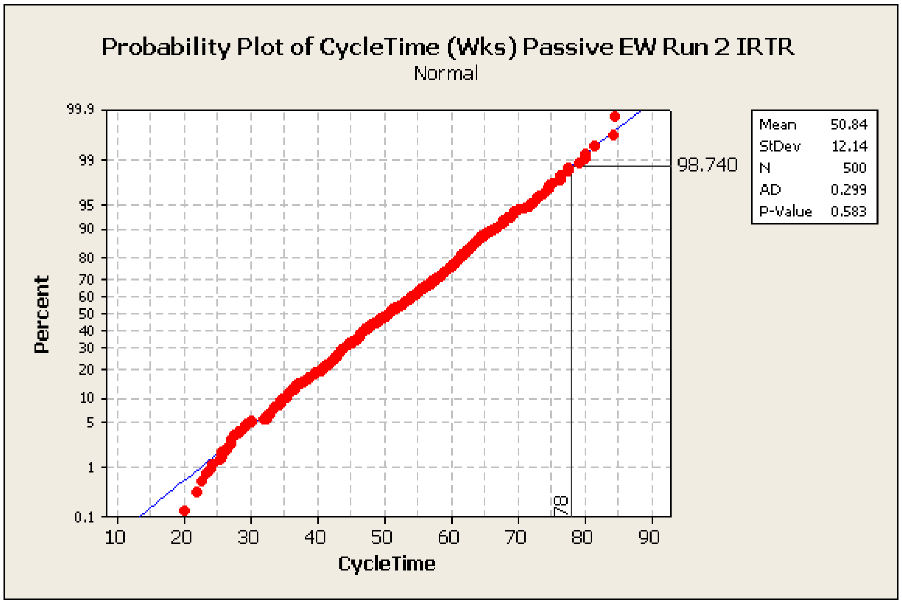

Figure 29: Normality Test with percentile below 78 weeks (for Passive Electronic Warfare Run 2 with IRTR applied.)

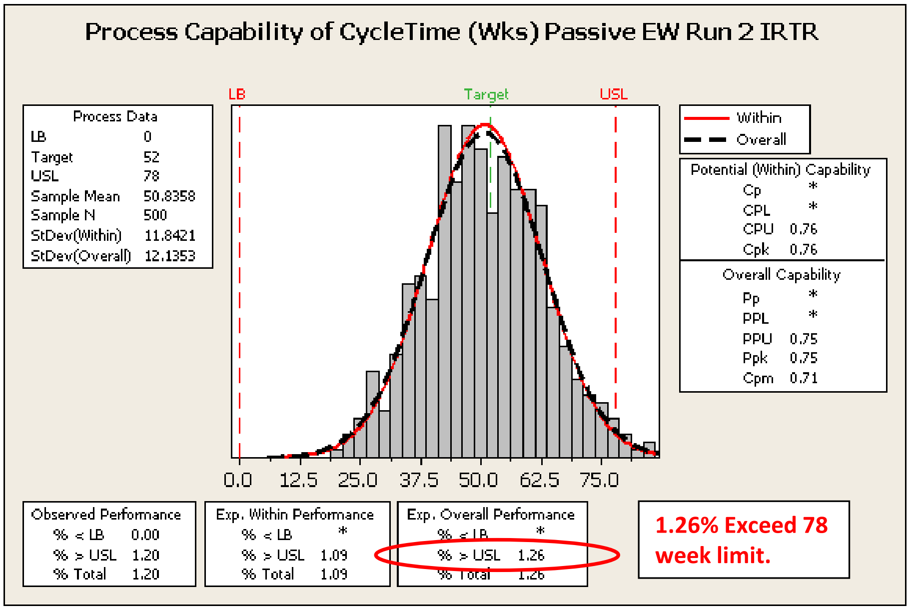

Figure 30: Capability Analysis chart with upper specification limit of 78 Weeks (for Passive Electronic Warfare Run 2 with IRTR applied.)

1. Cost Analysis

Figure 31 shows the cost models for all of the DRM scenarios. A much larger and more readable version of this can be found in Appendix F at the beginning of the RTP Cost Simulation section. The basic triangular cost distribution model for each certification is described in the gray fields on the left side of the figure, with each model in a single labeled column. The green and brown fields indicate the costs included in that model. Numbers in (or next to) the colored field are multipliers applied to the basic triangular distribution from the gray fields. The fractional multipliers, such as 0.5 and 0.25, account for the fact that interim approvals require less work than the full certifications. The integer multipliers, such as 4 or 2, represent the number of times that WSESRB is usually repeated in the modeled scenario. The light tan fields at the bottom hold the summation logic and the reference to the Risk Simulator® data collection and statistical analysis charts. Further detail on the cost analysis can be found in Appendix F. The cost distributions varied from normal, to log normal, and to triangular in proportion to the number of cost RVs in the cost summation varying from 36 to 8; as predicted by the central limit theorem.

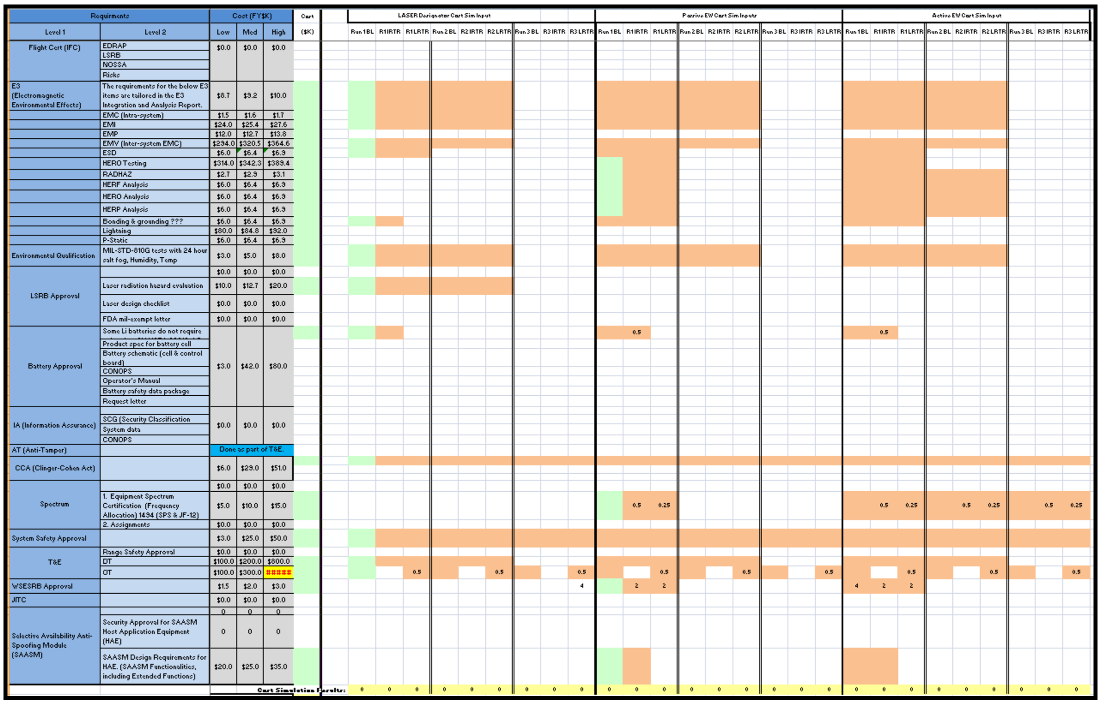

Figure 31: Cost Models for all Scenarios

The cost results from the simulations are summarized in Table 4, which shows that the cost generally goes down with decreased work. The LRTR strategy was not the lowest cost option because it retains OT as a partial cost certification, which was relatively expensive, and the IRTR strategy moves OT to preliminary fielding. Also, the IRTR strategy results in less cost variability because OT, which has relatively high cost variability, was conducted before fielding.

Payload	Run	Mean Cost ($K)			Max Cost ($K)			Max - Mean ($K)		
		BL	IRTR	LRTR	BL	IRTR	LRTR	BL	IRTR	LRTR
LASER Designator	1	1,324	859	1,043	2,210	1,332	1,694	886	473	651
	2	1,269	437	1,037	2,156	509	1,687	887	72	650
	3	520	55	287	1,058	97	568	538	42	281
Passive EW	1	1,726	1,230	1,387	2,617	1,689	2,040	891	459	653
	2	1,233	785	1,022	2,124	1,239	1,674	891	454	652
	3	520	55	287	1,058	97	568	538	42	281
Active EW	1	1,726	1,230	1,413	2,617	1,689	2,063	891	459	650
	2	1,287	817	1,047	2,183	1,297	1,698	896	480	651
	3	530	60	290	1,069	100	570	539	40	280

Table 4: Simulation Results for Costs

E. MODELING AND SIMULATION SUMMARY

Modeling and simulation was used to explore the costs and schedule times associated with different designs of the RTP. Modeling and simulation was conducted using both Risk Simulator® (an Excel add-on) for cost and in iGrafx® for the time to complete certifications. The time to collect and present the results of the certifications to the fielding decision maker was considered to be insignificant and was excluded from the model. Modeling started with conducting all certifications all in parallel, then all series, and then as a generic series-parallel hybrid constrained by the certification dependency prerequisite requirements. Simulation with these models defined the outer edges of schedule performance when pursuing all possible certifications. The generic model was then tailored to only include the certifications required for nine different DRM run cases. Each of the DRM models were then modified to create separate models that reflected the application of both the IRTR and LRTR timeline reduction strategies to each of the DRM run cases.

Simulation with an early model with all certification conducted in series showed the upper mean time to complete at approximately 109 months. Simulation with an early model that conducted all certifications in parallel showed that lower mean time to complete was approximately 16 months. With the understanding that there were several dependency prerequisite relationships, this indicated that it was unlikely we could complete all possible certifications within 18 months without some certifications be removed or reduced. Simulation with the generic prerequisite constrained series-parallel hybrid model of conducting all possible certifications the mean time to complete was 45 months. Completing all possible certifications in less than 18 months was only possible if all certifications were done in a very highly parallel manner, and the required dependency prerequisite relationships prevented this.

Simulation with models based on the generic model but tailored to reflect only the certifications required by each DRM run case show that the mean (baseline) completion time for all required certifications was only less than 18 months for mature (Run 3) DRM run cases for LASER Designator and Passive Electronic Warfare payloads; timeline reduction strategies would be required for all other DRM run cases.

Simulation with the two timeline reduction strategies (IRTR and LRTR) applied to all DRM run cases showed that the mean time to complete the required certification could be brought to less than 18 months in most cases through the application of either timeline reduction strategies, as detailed in Table 3. The exceptions were the DRM run cases for both Passive EW and Active EW which only the LRTR strategy reduced the mean completion time to less than 18 months.

Cost simulation was conducted to understand the impact the various DRM run cases and timeline reduction strategies had on cost and to support budget planning. The cost results for the simulations are listed in the left most column of Table 3 and in Table 4. The baseline full certifications process consistently costs more due to the timeline reduction strategies reducing the work involved. While the application of the IRTR strategy consistently cost the least, it was at a higher performance risk, as detailed in the upcoming Risk analysis section, because OT was pushed out to initial fielding.

V. RAIN RISK ANALYSIS

A. OVERVIEW OF RISKS

Risk analysis takes the information at hand and compares it to previously defined criteria to determine the potential impact and likelihood of that event occurring. In the RTP cost and schedule data and statistics were derived from simulations with models. The risks to schedule are centered on the impact and likelihood of exceeding 78 weeks (18 months). The increased performance risks associated with each task's timeline reduction strategies are direct SME opinions on the nature of the increased impact, and the increased likelihood of it occurring given that the given strategy was implemented. The Baseline cases were assumed to have no additional performance risk.

B. SCHEDULE AND PERFORMANCE RISK

The statistical results from running the schedule model simulation 500 times were used to calculate the maximum number of weeks the schedule might exceed 78 weeks and the likelihood of exceeding that threshold for each of the 27 scenarios. Once calculated, the values were entered into summary tables, with one table for each DRM base scenario. Both the calculations and the summary tables can be found in Appendix G. The schedule risk ratings were determined by comparing the percent likelihood against the rating value definitions in Table 5 and the impact values against the impact rating value definitions in Table 6. For each scenario and run the corresponding risk ratings were then used to mark the risk cube (Table 7) with the initials for the risk type and run number; i.e., S1 stands for Schedule risk for run 1.

What is the likelihood the risk will happen?		
Level	Likelihood	Probability of Occurrence
1	Not Likely	~10%...will effectively avoid or mitigate this risk based on standard practices.
2	Low Likelihood	~30% …have usually mitigated this type of risk with minimal oversight in similar cases.
3	Likely	~50% …may mitigate this risk, but workarounds will be required.
4	Highly Likely	~70%...cannot mitigate this risk, new approach and/or workaround will be required.
5	Near Certainty	~90%...cannot mitigate this risk, no known processes or workarounds are available.

Table 5: Risk Likelihood Definitions

Given the risk is realized, what would be the magnitude of the impact.		
Level	Performance	Schedule
1	Minimal or no consequence to performance.	Minimal or no impact
2	Minor reduction in performance or supportability can be tolerate with little or no impact on program, same approach retained.	Additional resources required, able to meet key dates. **Slip < 2 months**
3	Moderate reduction in performance or supportability with limited impact on program objectives, workarounds available.	Minor schedule slip, no impact to key milestones. **Slip < 4 months**
4	Significant degradation in performance or major shortfall in supportability, may jeopardize program success; workarounds may not be available or may have negative consequences.	Program critical path affected, all schedule float associated with key milestone exhausted. **Slip < 6 months**
5	Severe degradation in performance; cannot meet KPP or key technical/supportability threshold; will jeopardize program success; no workarounds available.	Cannot meet key program milestones. **Slip > 6 months**

Table 6: Risk Impact Definitions for Performance and Schedule

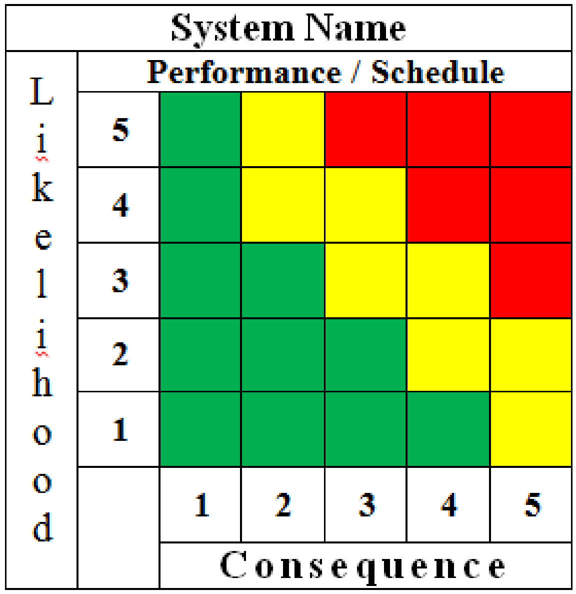

Table 7: Generic Risk Cube Diagram

Similarly, the statistical results from 10,000 simulation runs with the cost model were used to determine the maximum amount, in $K, that the cost might exceed the mean and the likelihood of doing so for each of the 27 scenarios. The mean was used for cost because that was the most common amount used for budgeting. These values were then entered in the same summary table with schedule values, found in Appendix G.

Performance risk estimates were determined based on timeline reduction options, performance risk value definitions in Table 6, and likelihood value definitions in Table 5. Once determined, the risk rating values were recorded directly in the risk rating tables.

C. RISK ANALYSIS SUMMARY

The values in the risk rating tables (Table 8, Table 9, and Table 10) were used to mark the risk level in the corresponding risk cubes (Figure 32, Figure 33, and Figure 34). The risk analysis took the statistical data derived from simulation with the models for the various DRM run cases and information elicited from the PMA-263 SMEs and compared them to the risk definitions in Tables 5 and 6 to determine risk ratings. Schedule Risk ratings were determined for the Baseline (full certifications) and both timeline reduction strategies. Added performance risk ratings were only determined for the timeline reduction strategies.

As expected, the IRTR and LRTR strategies applied to mature payloads had the lowest schedule risks because of the liberal use of interim approvals and pre-certified components. For each payload type, the Simple Integration Baseline had the highest schedule risks because all applicable certifications had to be pursued for full approval. This can be mitigated through early implementation of the RTP checklist (Appendix H) and tailor-able schedule (Appendix I) to identify which certifications and their associated data requirements are needed.

No performance risks were assessed against the Baseline strategy because thorough analysis was expected during the pursuit of full certification. The LRTR option offered the lowest performance risks because previously certified components would have had sufficient analysis/testing prior to authorization. The IRTR strategy had moderate performance risks because interim approvals are granted due to operational needs and limited data availability, resulting in potentially unknown hazards. To mitigate this risk level, early identification of the required data and testing should be provided to the technology developer to support a more comprehensive certification request package. In this situation, an interim approval would only be necessary to provide the certification authority time to generate the formal authorization.

Use Case	Laser Designator	Performance		Schedule	
Scenario 1	**Baseline-Full Certification**	Likelihood	Consequence	Likelihood	Consequence
1	Simple Integration	N/A	N/A	4	5
2	Complex Integration	N/A	N/A	4	5
3	Highly Mature Payload Integration	N/A	N/A	1	1
Scenario 2	**Intermediate Risk Timeline Reduction (IRTR)**				
1	Simple Integration	3	3	1	2
2	Complex Integration	3	3	1	2
3	Highly Mature Payload Integration	3	3	1	1
Scenario 3	**Low Risk Time Reduction (LRTR)**				
1	Simple Integration	2	2	1	2
2	Complex Integration	2	2	1	2
3	Highly Mature Payload Integration	2	2	1	1

Table 8: LASER Designator Risk Table

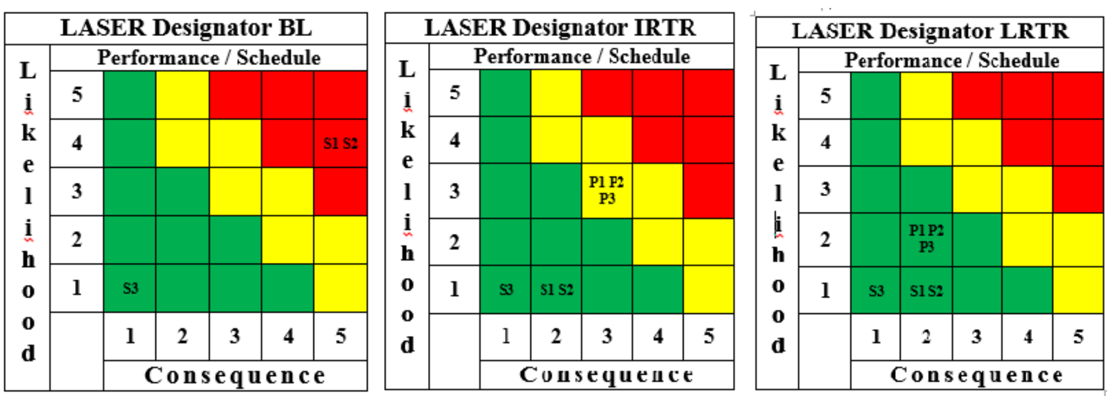

Figure 32: LASER Designator Risk Cubes

Use Case	Passive EW	Performance		Schedule	
Scenario 1	**Baseline-Full Certification**	Likelihood	Consequence	Likelihood	Consequence
1	Simple Integration	N/A	N/A	5	5
2	Complex Integration	N/A	N/A	4	5
3	Highly Mature Payload Integration	N/A	N/A	1	1
Scenario 2	**Intermediate Risk Timeline Reduction (IRTR)**				
1	Simple Integration	3	3	5	5
2	Complex Integration	3	3	1	2
3	Highly Mature Payload Integration	3	3	1	1
Scenario 3	**Low Risk Time Reduction (LRTR)**				
1	Simple Integration	2	2	3	5
2	Complex Integration	2	2	1	2
3	Highly Mature Payload Integration	2	2	1	1

Table 9: Passive EW Risk Table

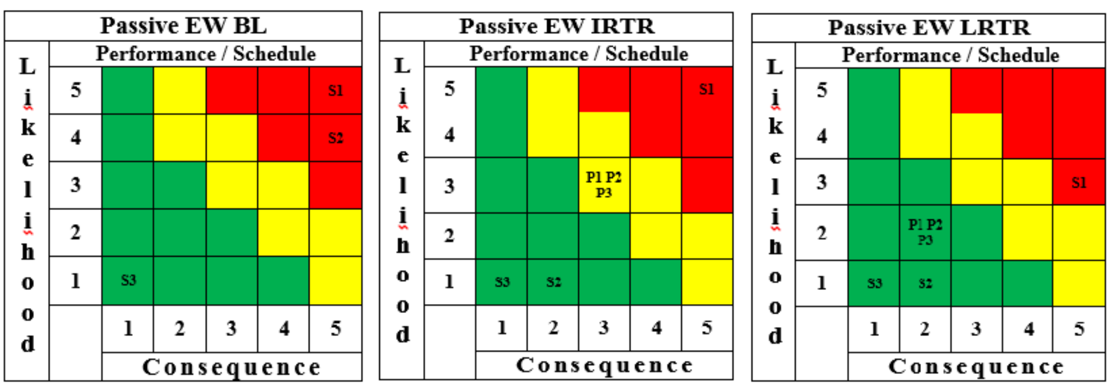

Figure 33: Passive EW Risk Cubes

Use Case	Active EW	Performance		Schedule	
Scenario 1	Baseline-Full Certification	Likelihood	Consequence	Likelihood	Consequence
1	Simple Integration	N/A	N/A	5	5
2	Complex Integration	N/A	N/A	5	5
3	Highly Mature Payload Integration	N/A	N/A	5	5
Scenario 2	Intermediate Risk Timeline Reduction (IRTR)				
1	Simple Integration	3	3	5	5
2	Complex Integration	3	3	1	2
3	Highly Mature Payload Integration	3	3	1	1
Scenario 3	Low Risk Time Reduction (LRTR)				
1	Simple Integration	2	2	3	5
2	Complex Integration	2	2	1	2
3	Highly Mature Payload Integration	2	2	1	1

Table 10: Active EW Risk Tables

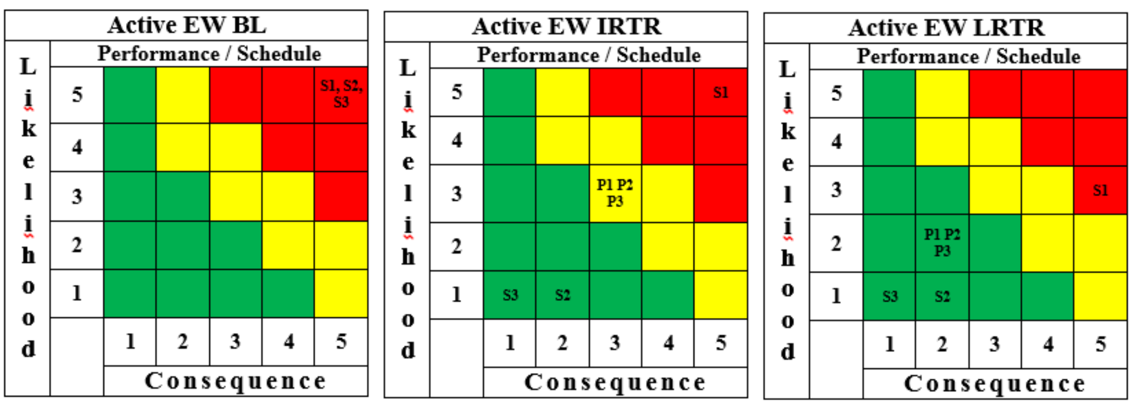

Figure 34: Active EW Risk Cubes

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VI. CONCLUSIONS AND RECOMMENDATIONS

A. CONCLUSIONS

The RAIN Team successfully consolidated individual procedures currently employed independently by the responsible NAVAIR competencies into the systematic RTP process that efficiently satisfies the applicable Statutory and Regulatory requirements needed to successfully integrate a new capability into the DoN System. Having a process enabled the use of modeling and simulation and through the modeling and simulation of payload types most commonly installed on PMA-263 platforms, the Team determined that full certification of the modified system using the developed process can take between 34 and 180 weeks. This schedule also depends on integration complexity and use of already-certified components.

In addition to improved efficiencies, the RTP further demonstrated its effectiveness by meeting the project's MOE, Probability of addressing all statutory and regulatory requirements to enable fielding of a new payload to the warfighter in 18 months. The Team identified the certifications that caused elongation of the fielding timeline and examined alternative options that would also satisfy the project's MOPs. MOP 1, Number of interim technical certifications, was achieved by using components that already had some of the required certifications. MOP 2, Median time to gain approval to field a new capability, was achieved by a reduction in the timeline through interim certifications, as described in the IRTR and LRTR strategies, resulting in integration within 14 to 92 weeks. Because a sufficient decrease in the schedule was obtained through interim approvals, the effects and risks of waivers from the applicable certifications were determined to be unnecessary, and therefore not incorporated into the timeline reduction strategies.

B. TIMELINE REDUCTION OPTIONS

The RTP, through use of the Payload Integration Checklist (Appendix H) and the Payload Integration Schedule (Appendix I), can achieve comprehensive integration of a new capability. But some certifications could delay fielding due to the workload and extensive reviews conducted by external agencies. The Team identified the following applicable options (along with associated risks) to expedite the certification process:

Spectrum

Options

1) Operate on a temporary frequency assignment. If a system operates on an "interim" stage three (3) frequency authorization, they can request local spectrum on a "not-to-interfere" basis. The stage 3 SPS submittal number will allow the user to obtain authorization to operate. It takes one (1) to two (2) months to get an SPS number; and one (1) to two (2) months to get local spectrum allocation.
2) Limit payload selection to those that already have an SPS number or full spectrum authorization (J/F 12). Only a frequency allocation needs to be obtained and the time frame will shorten to one (1) to two (2) months.

Risk

1) Temporary frequency assignment. A "not-to-interfere" basis may limit the system's operational availability, and thus, usefulness to the user.
2) Limit payload selection. This may limit capabilities and cause potential integration issues. It may also reduce competition and increase system cost.

CDL

Options

1. Limit payload selection to payloads that already have a CDL or use the existing communications architecture in the target platform. This automatically addresses the CDL requirement and time goes to zero (0).

Risk

1) This may limit capabilities and cause potential integration issues. It may also reduce competition and increase system cost.

GPS

Options

1) Limit payload selection to payloads that already have a SAASM GPS or use the existing navigation architecture in the target platform. This automatically addresses the SAASM GPS requirement and time goes to zero (0).

Risk

1) This may limit capabilities and cause potential integration issues. It may also reduce competition and increase system cost.

T and E

Options

1) Conduct joint DT/OT. This will eliminate the lead-time between DT and OT. The OT testing time goes to zero (0)
2) Conduct OT during a preliminary system fielding. Have users evaluate the system during operations. This will eliminate the OT lead time and testing time.

Risk

1) Joint DT / OT. The time to address any problems typically discovered in DT is removed. If an issue arises, it cannot be fixed before OT.
2) Preliminary fielding OT. A problem may be discovered in the field or while on mission. Depending on the severity of the issue, the system may be useless or engineers may have to be sent into theater to investigate and fix the issue on site.

JITC

Options

1) Obtain a limited JITC while conducting Tand E and training activities to support preliminary fielding. Full JITC certification is required for Initial Operational Capability (IOC), but not necessary for preliminary fielding. This will reduce the timeline to zero for JITC in the fielding path, allowing it to run parallel but independent of the rest of the certification work.

Risk

1) Operating without JITC certification limits the operation of the equipment. The system may not be allowed to connect to certain systems, and interoperability with other systems cannot be assured.

Information Assurance

Options

1) Obtain an Interim Authority To Operate (IATO). This is a temporary authorization to operate a system under the conditions or constraints enumerated in the accreditation decision while managing IA security weaknesses. An IATO is only good for 180 days from the authorization date and can be obtained within 30 days.

Risk

1) The system may have insufficient security protection and may be susceptible to compromise by an unauthorized user.

Battery

Options

1) Limit payload selection to payloads that already have a NOSSA approval. This automatically addresses the battery certification and time goes to zero (0).
2) Obtain an interim approval to operate the subject battery for a limited amount of time. This will authorize fielding of the payload while NOSSA conducts its testing/analysis in parallel.

Risk

1) Limited payload selection. This may limit capabilities and cause potential integration issues. It may also reduce competition and increase system cost.
2) Interim approval. The battery may be utilized in a manner that could be harmful to personnel and equipment within its vicinity. The battery may fail certification and have to be retrofitted in the field. There is also the possibility of decreased availability and increased maintenance due to battery failures in the field, driving up life cycle cost.

Airworthiness

Options

1) Obtain a Cat III interim flight clearance (IFC). This reduces the amount of data needed prior to issuing an airworthiness certification and can be released within 30 days.

Risk

1) Without sufficient data/documentation, an IFC can be released with very stringent limitations and restrictions, creating a relatively small envelope in which the system can be operated. This would limit the warfighter's ability to complete the mission. Expanding the operating envelope without sufficient testing could result in injury to personnel or loss of life/property.

C. RECOMMENDATIONS

The trade study looked for ways to optimize and balance the three (3) pillars of SE, maintain SE discipline, and meet rapid integration timelines. The RAIN Team recommends the IRTR strategy as the best option to meet a rapid fielding decision timeline. Three (3) integration strategies were analyzed based on the timeline reduction options outlined in Section B above. The first strategy, Baseline, focused on a purely technical solution and pursued full certifications for all applicable requirements. The second strategy, LRTR, focused on an optimal schedule with the shortest timeline possible. The third strategy, IRTR, looked at applying balance of the systems engineering pillars. Each strategy was summarized for all of the scenario combinations in Figure 35.

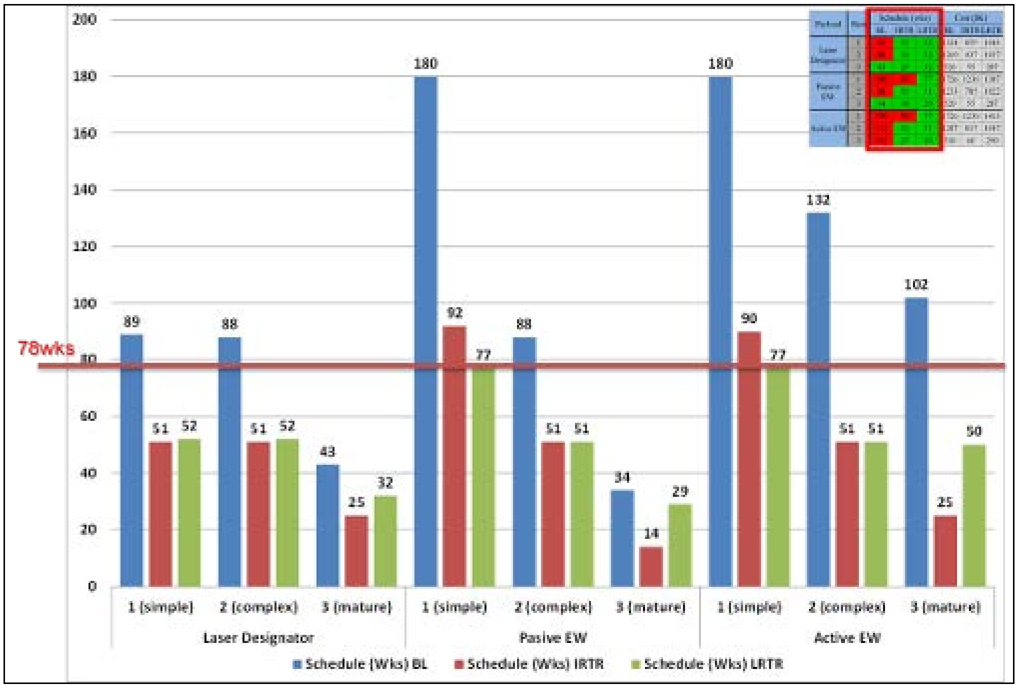

Figure 35: (Risk) Schedule Summary Results

The Baseline option was rejected based on its inability to meet a feilding decision timeline of 18 months despite offering the least ammount of technical risk. The LRTR option was identified as a suitable option to meet timelines while minimizing technical risk; however, it was also rejected as the optimal solution because it overly sacrificed technical capability through the inflexible payload options for schedule optimizations. But in extremely compressed situations, the LRTR strategy may be a viable, yet restrictive option.

The IRTR stratagy was determined to be the optimal SE approach because it balanced the three (3) pillars of SE and supported a fielding decision timeline inside 18 months in a majority (7 or 9) of the scenarios. This stratagy significantly reduced the average cost and schedule to integrate and field a new payload, while still managing technical risk. While this strategy does not provide the fastest option, it does provide a suitable fielding timeline for reasonable cost and acceptably mitigating technical and operational risk. From a practical aspect this is also the most realistic scenairo.

D. AREAS OF FUTURE STUDY

Although the scope of this project was limited to modular payloads for existing PMA-263 UAS inventory, the applicability of the RTP can be expanded further. The RTP can be implemented on the certification of entire platforms and payloads that require modification of the current system configuration. In addition, the Team identified the following areas that could benefit from additional investigation:

- Applicability of RTP to other areas of NAVAIR. This could be applied in other PEOs or competencies, where technologies need to be fielded rapidly or more efficiently to minimize schedule or costs.
- Research the individual certification processes to identify areas for efficiencies in terms of cost and schedule. Apply the RTP to each of the certifications for better implementation.
- Update the model and simulation to provide results for pursuing waivers instead of full or interim certifications.
- Build a tool that takes the users responses to questions about the system and produces an ordered list of certifications to complete, and an 80^{th} percentile plan for schedule and cost.
- The same process can be expanded to include logistical support.
- Implementation on actual payload integration efforts needs to be conducted to validate the RTP.

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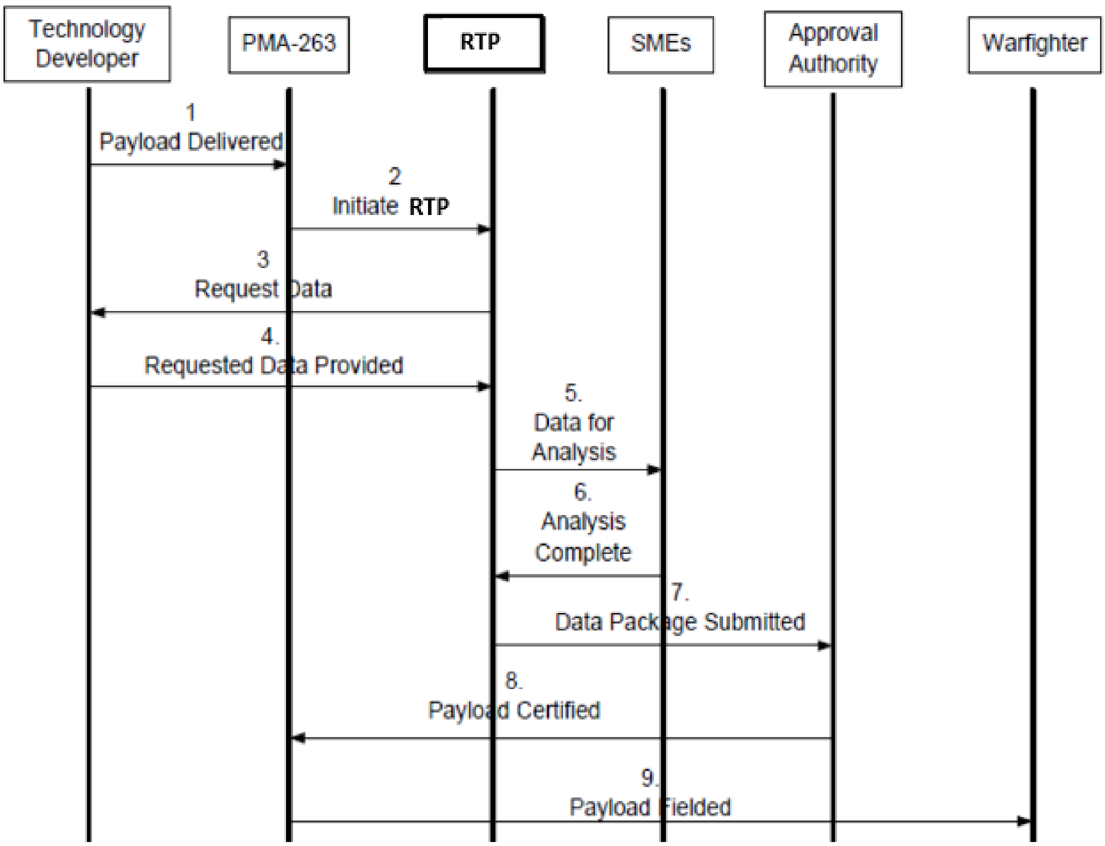
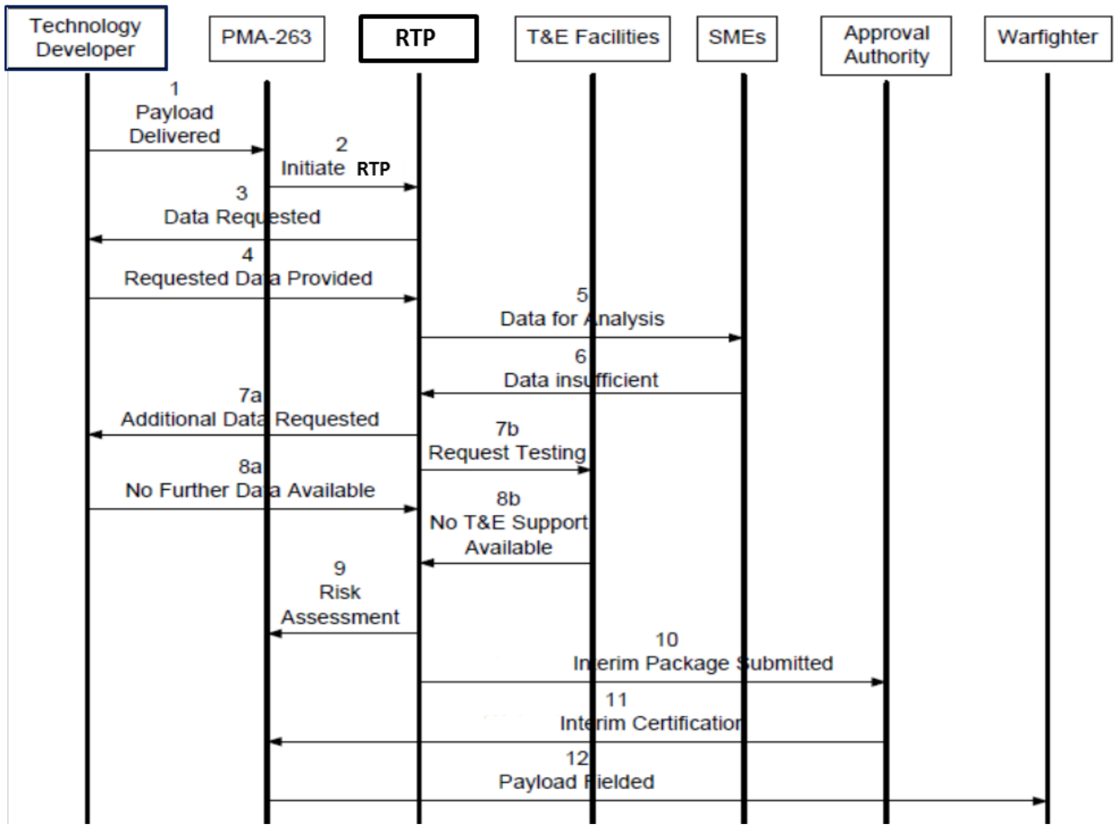
APPENDIX A. MISSION PROFILES

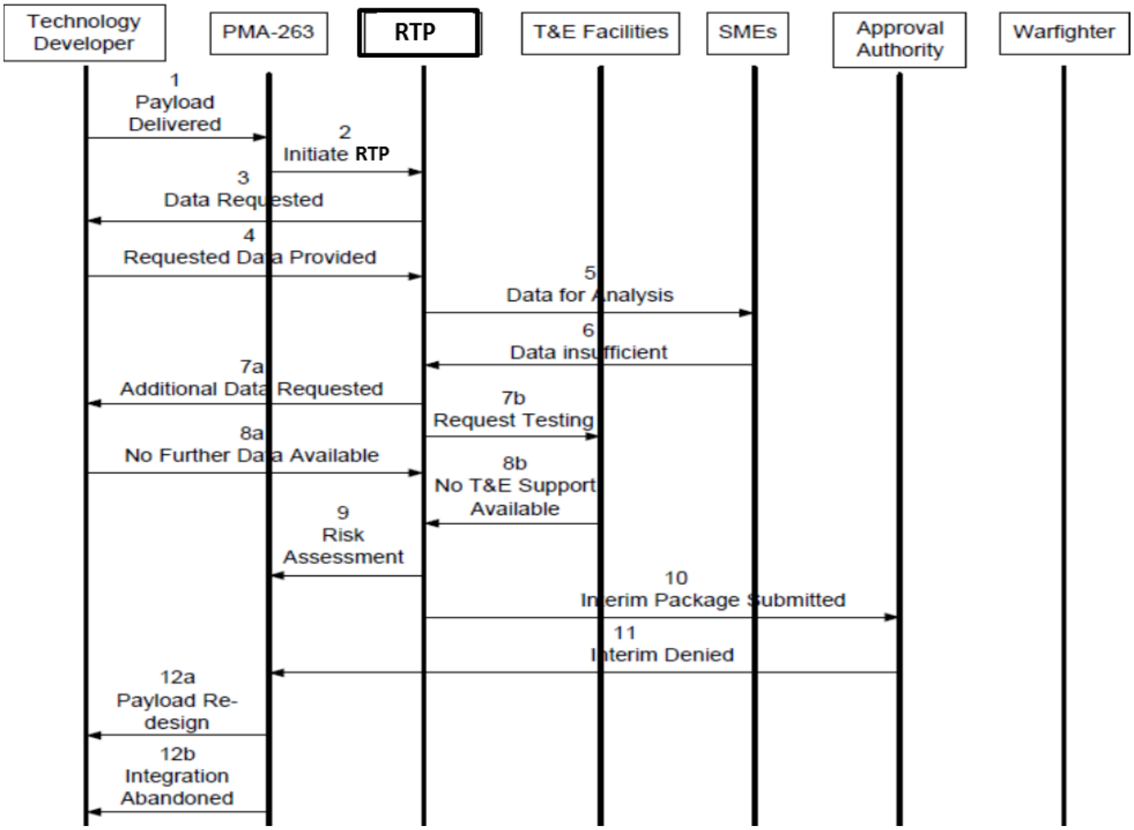
Design Reference Missions
Full Certification
Waiver or Interim Certification
Waiver or Interim Certification Denied



Design Reference Mission: Full Certification



Design Reference Mission: Interim Certification



Design Reference Mission: Interim Certification Denied

APPENDIX B. ARCHITECTURE AND DEVELOPMENT

Number	Name	Description	refines	refined by	basis of
0	REQUIREMENTS CONTEXT	These are the requirements for the system architecture. The system is the solution under development or analysis. This will cover inside and outside the system boundary (may be a System of Systems). The higher level requirements trace back to the capabilities. Requirements are decomposed from high level solution-neutral capabilities and requirements all the way down to solution-oriented system specifications.		1 INPUT/OUTPUT REQUIREMENTS 2 TECHNOLOGY & SYSTEM-WIDE REQUIREMENTS 3 TRADE-OFF REQUIREMENTS 4 QUALIFICATION REQUIREMENTS	0 STUAS System
1	INPUT/OUTPUT REQUIREMENTS	The system shall input and output all data required in this section to support integration and fielding of payloads on STUAS.	0 REQUIREMENTS CONTEXT	1.1 INPUT 1.2 OUTPUT 1.3 EXTERNAL INTERFACE 1.4 FUNCTIONAL REQUIREMENTS	1.1 Determine Certifications 1.2 Collect Certifications 1.3 Analyze Certifications 1.4 Address Risk 1.5 Develop Certification Package
1.1	INPUT	The system shall input all data required in this sections below to support integration and fielding of payloads on STUAS at the Mission, Stakeholder, System, Component, and Configuration levels.	1 INPUT/OUTPUT REQUIREMENTS	1.1.1 Payload 1.1.2 Technical Data Package 1.1.3 Technical Guidance from Certification Authority 1.1.4 Payload Returned from Testing 1.1.5 T&E Results Summary 1.1.6 Packages from Technical Certification	1.2.1 Assemble Data Item 1.2.2 Perform Authority Officer 1.2.3 Perform Data Collection

Number	Name	Description	refines	refined by	basis of
				Authorities 1.1.7 System Requirements	
1.1.1	Payload	The system shall input all payload data.	1.1 INPUT		1 Perform Rain Integration Process 1.1 Determine Certifications
1.1.2	Technical Data Package	The system shall input Technical Data Packages to support certification	1.1 INPUT	1.1.2.1 Design Description 1.1.2.2 Payload Data	1.2.3 Perform Data Collection 1.2.3.1 Collect Safety Certification Data 1.2.3.2 Collect Security Certification Data 1.2.3.3 Collect Interoperability Certification Data 1.2.3.4 Collect Compatibility Certification Data
1.1.2.1	Design Description	A technical description of the payload covering fit, form, function, and how it interfaces.	1.1.2 Technical Data Package	1.1.2.1.1 System Trigger	1.2.3.1.1 Collect Airworthiness Certifications Data 1.2.3.1.2 Collect Battery Certifications Data 1.2.3.1.3 Collect Laser Certifications Data 1.2.3.1.4 Collect Weapon Certifications Data 1.2.3.1.5 Collect System Safety Certifications Data 1.2.3.1.6 Collect Range Safety Certification Data

Number	Name	Description	refines	refined by	basis of
					1.2.3.1.7 Collect E3 Certification Data 1.2.3.2.1 Collect IA Certifications Data 1.2.3.2.2 Collect Anti-Tamper Certifications Data 1.2.3.2.3 Collect SAASM Certifications Data 1.2.3.2.4 Collect Clinger-Cohen Act Certifications Data 1.2.3.3.1 Collect Spectrum Certifications Data 1.2.3.3.2 Collect CDL Certifications Data 1.2.3.3.3 Collect JITC Certifications Data 1.2.3.4.1 Collect Environmental Certifications Data 1.2.3.4.2 Collect T&E Certifications Data
1.1.2.1.1	System Trigger	The system shall be initiated by the receipt of a first article and design description.	1.1.2.1 Design Description		1 Perform Rain Integration Process
1.1.2.2	Payload Data	The data about the payload that is needed for certification.	1.1.2 Technical Data Package	1.1.2.2.1 Data for Each Type of Certification	1.2.3.1 Collect Safety Certification Data 1.2.3.2 Collect Security Certification Data 1.2.3.3 Collect Interoperability Certification Data

Number	Name	Description	refines	refined by	basis of
					1.2.3.4 Collect Compatibility Certification Data
1.1.2.2.1	Data for Each Type of Certification	The system shall support inputting all data for each certification.	1.1.2.2 Payload Data	1.1.2.2.1.1 Data for Individual Certification	1.2.3.1.1 Collect Airworthiness Certifications Data 1.2.3.1.2 Collect Battery Certifications Data 1.2.3.1.3 Collect Laser Certifications Data 1.2.3.1.4 Collect Weapon Certifications Data 1.2.3.1.5 Collect System Safety Certifications Data 1.2.3.1.6 Collect Range Safety Certification Data 1.2.3.1.7 Collect E3 Certification Data 1.2.3.2.1 Collect IA Certifications Data 1.2.3.2.2 Collect Anti-Tamper Certifications Data 1.2.3.2.3 Collect SAASM Certifications Data 1.2.3.2.4 Collect Clinger-Cohen Act Certifications Data 1.2.3.3.1 Collect Spectrum Certifications Data 1.2.3.3.2 Collect CDL Certifications Data

Number	Name	Description	refines	refined by	basis of
					1.2.3.3.3 Collect JITC Certifications Data 1.2.3.4.1 Collect Environmental Certifications Data 1.2.3.4.2 Collect T&E Certifications Data
1.1.2.2.1.1	Data for Individual Certification	The system shall input all data for each certification required for specific payload integration and fielding as identified by the certification authority.	1.1.2.2.1 Data for Each Type of Certification		1.2.3.1.1 Collect Airworthiness Certifications Data 1.2.3.1.2 Collect Battery Certifications Data 1.2.3.1.3 Collect Laser Certifications Data 1.2.3.1.4 Collect Weapon Certifications Data 1.2.3.1.5 Collect System Safety Certifications Data 1.2.3.1.6 Collect Range Safety Certification Data 1.2.3.1.7 Collect E3 Certification Data 1.2.3.2.1 Collect IA Certifications Data 1.2.3.2.2 Collect Anti-Tamper Certifications Data 1.2.3.2.3 Collect SAASM Certifications Data 1.2.3.2.4 Collect Clinger-Cohen Act Certifications Data

Number	Name	Description	refines	refined by	basis of
					1.2.3.3.1 Collect Spectrum Certifications Data 1.2.3.3.2 Collect CDL Certifications Data 1.2.3.3.3 Collect JITC Certifications Data 1.2.3.4.1 Collect Environmental Certifications Data 1.2.3.4.2 Collect T&E Certifications Data
1.1.3	Technical Guidance from Certification Authority	The system shall input data from each technical certification authority to identify payload specific data and certification applicability.	1.1 INPUT		1.1.1 Construct Certification List 1.1.2 Assemble Certification Components 1.1.2.1 Determine Safety Certifications 1.1.2.1.1 Address Airworthiness Certifications 1.1.2.1.2 Address Battery Certifications 1.1.2.1.3 Address Laser Certifications 1.1.2.1.4 Address Weapon Certifications 1.1.2.1.5 Address System Safety Certifications 1.1.2.1.6 Address Range Safety Certifications 1.1.2.1.7 Address E3

Number	Name	Description	refines	refined by	basis of
					Certifications 1.1.2.2 Determine Security Certifications 1.1.2.2.1 Address IA Certifications 1.1.2.2.2 Address Anti-Tamper Certifications 1.1.2.2.3 Address SAASM Certifications 1.1.2.2.4 Address Clinger-Cohen Act Certifications 1.1.2.3 Determine Interoperability Certifications 1.1.2.3.1 Address Spectrum Certifications 1.1.2.3.2 Address CDL Certifications 1.1.2.3.3 Address JITC Certifications 1.1.2.4 Determine Compatibility Certifications 1.1.2.4.1 Address Environmental Certifications 1.1.2.4.2 Address T&E Certifications 1.3 Analyze Certifications 1.3.1 Specify Data

Number	Name	Description	refines	refined by	basis of
					1.3.2 Provide Analysis 1.3.2.1 Analyze Safety Certification Data 1.3.2.1.1 Analyze Airworthiness Certifications Data 1.3.2.1.2 Analyze Battery Certifications Data 1.3.2.1.3 Analyze Laser Certifications Data 1.3.2.1.4 Analyze Weapon Certifications Data 1.3.2.1.5 Analyze System Safety Certifications Data 1.3.2.1.6 Analyze Range Safety Certifications Data 1.3.2.1.7 Analyze E3 Certification Data 1.3.2.2 Analyze Security Certifications Data 1.3.2.2.1 Analyze IA Certifications Data 1.3.2.2.2 Analyze Anti-Tamper Certifications Data 1.3.2.2.3 Analyze SAASM Certifications Data 1.3.2.2.4 Analyze Clinger-Cohen Act Certifications Data 1.3.2.3 Analyze Interoperability

Number	Name	Description	refines	refined by	basis of
					Certifications Data 1.3.2.3.1 Analyze Spectrum Certifications Data 1.3.2.3.2 Analyze CDL Certifications Data 1.3.2.3.3 Analyze JITC Certifications Data 1.3.2.4 Analyze Compatibility Certification Data 1.3.2.4.1 Analyze Environmental Certifications Data 1.3.2.4.2 Analyze T&E Certifications Data
1.1.4	Payload Returned from Testing	The system shall input technical data captured during all testing	1.1 INPUT		1.3.2 Provide Analysis 1.3.2.1 Analyze Safety Certification Data 1.3.2.1.1 Analyze Airworthiness Certifications Data 1.3.2.1.2 Analyze Battery Certifications Data 1.3.2.1.3 Analyze Laser Certifications Data 1.3.2.1.4 Analyze Weapon Certifications Data 1.3.2.1.5 Analyze System Safety Certifications Data 1.3.2.1.6 Analyze Range

Number	Name	Description	refines	refined by	basis of
					Safety Certifications Data 1.3.2.1.7 Analyze E3 Certification Data 1.3.2.2 Analyze Security Certifications Data 1.3.2.2.1 Analyze IA Certifications Data 1.3.2.2.2 Analyze Anti-Tamper Certifications Data 1.3.2.2.3 Analyze SAASM Certifications Data 1.3.2.2.4 Analyze Clinger-Cohen Act Certifications Data 1.3.2.3 Analyze Interoperability Certifications Data 1.3.2.3.1 Analyze Spectrum Certifications Data 1.3.2.3.2 Analyze CDL Certifications Data 1.3.2.3.3 Analyze JITC Certifications Data 1.3.2.4 Analyze Compatibility Certification Data 1.3.2.4.1 Analyze Environmental Certifications Data 1.3.2.4.2 Analyze T&E Certifications Data

Number	Name	Description	refines	refined by	basis of
					1.3.3 Address Data Distribution
1.1.5	T&E Results Summary	The summary of the test and evaluation results.	1.1 INPUT	1.1.5.1 Collection of Test Reports	1.3 Analyze Certifications
1.1.5.1	Collection of Test Reports	The collection of all test reports.	1.1.5 T&E Results Summary	1.1.5.1.1 Test Reports for Each Area	1.3.1 Specify Data 1.3.2 Provide Analysis 1.3.3 Address Data Distribution
1.1.5.1.1	Test Reports for Each Area	The system shall support inputting all test reports for each certification.	1.1.5.1 Collection of Test Reports	1.1.5.1.1.1 Test Reports for Each Certification (as applicable)	1.3.2.1 Analyze Safety Certification Data 1.3.2.2 Analyze Security Certifications Data 1.3.2.3 Analyze Interoperability Certifications Data 1.3.2.4 Analyze Compatibility Certification Data
1.1.5.1.1.1	Test Reports for Each Certification (as applicable)	The system shall input all test reports for each certification required for specific payload integration and fielding as identified by the certification authority.	1.1.5.1.1 Test Reports for Each Area		1.3.2.1.1 Analyze Airworthiness Certifications Data 1.3.2.1.2 Analyze Battery Certifications Data 1.3.2.1.3 Analyze Laser Certifications Data 1.3.2.1.4 Analyze Weapon Certifications Data 1.3.2.1.5 Analyze System Safety Certifications Data 1.3.2.1.6 Analyze Range Safety Certifications Data

Number	Name	Description	refines	refined by	basis of
					1.3.2.1.7 Analyze E3 Certification Data 1.3.2.2.1 Analyze IA Certifications Data 1.3.2.2.2 Analyze Anti-Tamper Certifications Data 1.3.2.2.3 Analyze SAASM Certifications Data 1.3.2.2.4 Analyze Clinger-Cohen Act Certifications Data 1.3.2.3.1 Analyze Spectrum Certifications Data 1.3.2.3.2 Analyze CDL Certifications Data 1.3.2.3.3 Analyze JITC Certifications Data 1.3.2.4.1 Analyze Environmental Certifications Data 1.3.2.4.2 Analyze T&E Certifications Data
1.1.6	Packages from Technical Certification Authorities	The complete set of results from the technical certification authorities for all sought certifications along with a summary of the results.	1.1 INPUT	1.1.6.1 Collection of Certification Results	1.3 Analyze Certifications
1.1.6.1	Collection of Certification Results	The system shall input the results of each certification request.	1.1.6 Packages from Technical Certification Authorities	1.1.6.1.1 Certification Results for Each Area	1.3.1 Specify Data 1.3.2 Provide Analysis 1.3.3 Address Data Distribution

Number	Name	Description	refines	refined by	basis of
1.1.6.1.1	Certification Results for Each Area	The system shall input overall Safety, Security, Interoperability, and Compatibility.	1.1.6.1 Collection of Certification Results	1.1.6.1.1.1 Certification Results for Each Type	1.3.2.1 Analyze Safety Certification Data 1.3.2.2 Analyze Security Certifications Data 1.3.2.3 Analyze Interoperability Certifications Data 1.3.2.4 Analyze Compatibility Certification Data
1.1.6.1.1.1	Certification Results for Each Type	The system shall input all certification results for each certification required for specific payload integration and fielding as identified by the certification authority.	1.1.6.1.1 Certification Results for Each Area	1.1.6.1.1.1.1 Individual Certification Result	1.3.2.1.1 Analyze Airworthiness Certifications Data 1.3.2.1.2 Analyze Battery Certifications Data 1.3.2.1.3 Analyze Laser Certifications Data 1.3.2.1.4 Analyze Weapon Certifications Data 1.3.2.1.5 Analyze System Safety Certifications Data 1.3.2.1.6 Analyze Range Safety Certifications Data 1.3.2.1.7 Analyze E3 Certification Data 1.3.2.2.1 Analyze IA Certifications Data 1.3.2.2.2 Analyze Anti-Tamper Certifications Data 1.3.2.2.3 Analyze SAASM Certifications Data

Number	Name	Description	refines	refined by	basis of
					1.3.2.2.4 Analyze Clinger-Cohen Act Certifications Data 1.3.2.3.1 Analyze Spectrum Certifications Data 1.3.2.3.2 Analyze CDL Certifications Data 1.3.2.3.3 Analyze JITC Certifications Data 1.3.2.4.1 Analyze Environmental Certifications Data 1.3.2.4.2 Analyze T&E Certifications Data
1.1.6.1.1.1.1	Individual Certification Result	The results from an individual certification effort and request.	1.1.6.1.1.1 Certification Results for Each Type		1.3.2.1.1 Analyze Airworthiness Certifications Data 1.3.2.1.2 Analyze Battery Certifications Data 1.3.2.1.3 Analyze Laser Certifications Data 1.3.2.1.4 Analyze Weapon Certifications Data 1.3.2.1.5 Analyze System Safety Certifications Data 1.3.2.1.6 Analyze Range Safety Certifications Data 1.3.2.1.7 Analyze E3 Certification Data 1.3.2.2.1 Analyze IA

Number	Name	Description	refines	refined by	basis of
					Certifications Data 1.3.2.2.2 Analyze Anti-Tamper Certifications Data 1.3.2.2.3 Analyze SAASM Certifications Data 1.3.2.2.4 Analyze Clinger-Cohen Act Certifications Data 1.3.2.3.1 Analyze Spectrum Certifications Data 1.3.2.3.2 Analyze CDL Certifications Data 1.3.2.3.3 Analyze JITC Certifications Data 1.3.2.4.1 Analyze Environmental Certifications Data 1.3.2.4.2 Analyze T&E Certifications Data
1.1.7	System Requirements	The system shall input the payload mission requirements.	1.1 INPUT		1.1 Determine Certifications 1.2 Collect Certifications 1.3 Analyze Certifications 1.4 Address Risk 1.5 Develop Certification Package
1.2	OUTPUT	The system shall output all data required in this sections below to support integration and fielding of payloads on STUAS at the Mission, Stakeholder, System, Component, and	1 INPUT/OUTPUT REQUIREMENTS	1.2.1 Fielding Decision Support Package 1.2.2 T&E Supplies	1.4 Address Risk 1.5 Develop Certification Package

Number	Name	Description	refines	refined by	basis of
		Configuration levels.		1.2.3 Design Guidance to Developer 1.2.4 Request for More Data to Developer 1.2.5 Certification Approval Request 1.2.6 Packages for Certification (Initial & Update) 1.2.7 Risk Assessment	
1.2.1	Fielding Decision Support Package	Documentation that shows that the payload works as intended; lists all required certifications; shows that the listed certifications and approvals have been granted in full, or as interims, or have been waived by suitable authority. This is composed of an overarching summary with details attached as appendices.	1.2 OUTPUT		1.4 Address Risk 1.5 Develop Certification Package
1.2.2	T&E Supplies	Materials and labor that RAIN needs to supply to the T&E facilities and organizations.	1.2 OUTPUT	1.2.2.1 T&E Support Request	1.3 Analyze Certifications
1.2.2.1	T&E Support Request	The system shall output a T&E support request.	1.2.2 T&E Supplies	1.2.2.1.1 Payload to T&E	1.3.2 Provide Analysis
1.2.2.1.1	Payload to T&E	The system shall provide an integrated payload, with necessary certifications to support testing.	1.2.2.1 T&E Support Request	1.2.2.1.1.1 Direction to T&E	1.3.2.1 Analyze Safety Certification Data 1.3.2.2 Analyze Security Certifications Data 1.3.2.3 Analyze Interoperability Certifications Data 1.3.2.4 Analyze Compatibility Certification Data

Number	Name	Description	refines	refined by	basis of
1.2.2.1.1.1	Direction to T&E	The system shall output the needed testing data to develop test plans.	1.2.2.1.1 Payload to T&E		1.3.2.1.1 Analyze Airworthiness Certifications Data 1.3.2.1.2 Analyze Battery Certifications Data 1.3.2.1.3 Analyze Laser Certifications Data 1.3.2.1.4 Analyze Weapon Certifications Data 1.3.2.1.5 Analyze System Safety Certifications Data 1.3.2.1.6 Analyze Range Safety Certifications Data 1.3.2.1.7 Analyze E3 Certification Data 1.3.2.2.1 Analyze IA Certifications Data 1.3.2.2.2 Analyze Anti-Tamper Certifications Data 1.3.2.2.3 Analyze SAASM Certifications Data 1.3.2.2.4 Analyze Clinger-Cohen Act Certifications Data 1.3.2.3.1 Analyze Spectrum Certifications Data 1.3.2.3.2 Analyze CDL Certifications Data 1.3.2.3.3 Analyze JITC Certifications Data 1.3.2.4.1 Analyze

Number	Name	Description	refines	refined by	basis of
					Environmental Certifications Data 1.3.2.4.2 Analyze T&E Certifications Data
1.2.3	Design Guidance to Developer	The system shall output the needed design changes to meet certifications.	1.2 OUTPUT		1.3 Analyze Certifications
1.2.4	Request for More Data to Developer	The system shall output additional data need to complete certifications.	1.2 OUTPUT		1.1 Determine Certifications 1.2 Collect Certifications 1.3 Analyze Certifications 1.4 Address Risk 1.5 Develop Certification Package
1.2.5	Certification Approval Request	The system shall output the request to the certification approval authority when all technical data has been provided.	1.2 OUTPUT		1.5 Develop Certification Package 1.5.1 Develop Safety Certification Package 1.5.1.1 Develop Airworthiness Certifications Package 1.5.1.2 Develop Battery Certifications Package 1.5.1.3 Develop Laser Certifications Package 1.5.1.4 Develop Weapon Certifications Package 1.5.1.5 Develop System Safety Certifications Package 1.5.1.6 Develop Range Safety Certifications

Number	Name	Description	refines	refined by	basis of
					Package 1.5.1.7 Develop E3 Certification Package 1.5.2 Develop Security Certifications Package 1.5.2.1 Develop IA Certifications Package 1.5.2.2 Develop Anti-Tamper Certifications Package 1.5.2.3 Develop SAASM Certifications Package 1.5.2.4 Develop Clinger-Cohen Act Certifications Package 1.5.3 Develop Interoperability Certification Package 1.5.3.1 Develop Spectrum Certifications Package 1.5.3.2 Develop CDL Certifications Package 1.5.3.3 Develop JITC Certifications Package 1.5.4 Develop Compatibility Certifications Package 1.5.4.1 Develop Environmental Certifications Package 1.5.4.2 Develop T&E Certifications Package

Number	Name	Description	refines	refined by	basis of
1.2.6	Packages for Certification (Initial & Update)	The collection of documentation needed to apply for and support the required certifications.	1.2 OUTPUT	1.2.6.1 Initial Data Package for Certification 1.2.6.2 Updated Data Package for Certification	1.5 Develop Certification Package
1.2.6.1	Initial Data Package for Certification	The system shall output data packages to the certification approval authority for initial certification request.	1.2.6 Packages for Certification (Initial & Update)		1.5.1 Develop Safety Certification Package 1.5.2 Develop Security Certifications Package 1.5.3 Develop Interoperability Certification Package 1.5.4 Develop Compatibility Certifications Package
1.2.6.2	Updated Data Package for Certification	The system shall output data packages updates to the certification approval authority as required and upon request.	1.2.6 Packages for Certification (Initial & Update)		1.5.1.1 Develop Airworthiness Certifications Package 1.5.1.2 Develop Battery Certifications Package 1.5.1.3 Develop Laser Certifications Package 1.5.1.4 Develop Weapon Certifications Package 1.5.1.5 Develop System Safety Certifications Package 1.5.1.6 Develop Range Safety Certifications Package 1.5.1.7 Develop E3 Certification Package 1.5.2.1 Develop IA

Number	Name	Description	refines	refined by	basis of
					Certifications Package 1.5.2.2 Develop Anti-Tamper Certifications Package 1.5.2.3 Develop SAASM Certifications Package 1.5.2.4 Develop Clinger-Cohen Act Certifications Package 1.5.3.1 Develop Spectrum Certifications Package 1.5.3.2 Develop CDL Certifications Package 1.5.3.3 Develop JITC Certifications Package 1.5.4.1 Develop Environmental Certifications Package 1.5.4.2 Develop T&E Certifications Package
1.2.7	Risk Assessment	The assessment of the residual risk including performance, cost, schedule, and safety.	1.2 OUTPUT		1.4 Address Risk 1.4.1 Address Safety Certifications Risk 1.4.1.1 Address Airworthiness Certifications Risk 1.4.1.2 Address Battery Certifications Risk 1.4.1.3 Address Laser Certifications Risk 1.4.1.4 Address Weapon

Number	Name	Description	refines	refined by	basis of
					Certifications Risk 1.4.1.5 Address System Safety Certifications Risk 1.4.1.6 Address Range Safety Certifications Risk 1.4.1.7 Address E3 Certifications Risk 1.4.2 Address Security Certifications Risk 1.4.2.1 Address IA Certifications Risk 1.4.2.2 Address Anti-Tamper Certifications Risk 1.4.2.3 Address SAASM Certifications Risk 1.4.2.4 Address Clinger-Cohen Act Certifications Risk 1.4.3 Address Interoperability Certification Risk 1.4.3.1 Address Spectrum Certifications Risk 1.4.3.2 Address CDL Certifications Risk 1.4.3.3 Address JITC Certifications Risk 1.4.4 Address Compatibility Certification Risk 1.4.4.1 Address Environmental

Number	Name	Description	refines	refined by	basis of
					Certifications Risk 1.4.4.2 Address T&E Certifications Risk
1.3	EXTERNAL INTERFACE	The system shall interface with all external entities need for payload intergration, certification and fielding.	1 INPUT/OUTPUT REQUIREMENTS	1.3.1 PMA-263 1.3.2 T&E 1.3.3 Certification Authorities 1.3.4 Developer	0 STUAS System 1 Perform Rain Integration Process EXT.1 Address PMA-263 Activities EXT.1.1 Define User Needs EXT.2 Provide Regulatory/Statutory Requirements EXT.3 Provide Test & Evaluation EXT.4 Perform Certifications Review EXT.5 Field Payload
1.3.1	PMA-263	The system shall interface with PMA-263 representatives.	1.3 EXTERNAL INTERFACE		EXT.1 Address PMA-263 Activities EXT.1.2 Address Requirements EXT.1.3 Develop Payload EXT.1.4 Provide System Integration EXT.5 Field Payload
1.3.2	T&E	The system shall interface with T&E representatives.	1.3 EXTERNAL INTERFACE		EXT.3 Provide Test & Evaluation
1.3.3	Certification Authorities	The system shall interface with all representatives required for system	1.3 EXTERNAL INTERFACE	1.3.3.1 Internal Certification SME's	EXT.2 Provide Regulatory/Statutory

Number	Name	Description	refines	refined by	basis of
		certification.			Requirements EXT.4 Perform Certifications Review
1.3.3.1	Internal Certification SME's	The system shall interface with NAVAIR and DoD SMEs as need for certification.	1.3.3 Certification Authorities		EXT.4 Perform Certifications Review
1.3.4	Developer	The system shall interface with payload and platform developers.	1.3 EXTERNAL INTERFACE		EXT.1 Address PMA-263 Activities EXT.5 Field Payload
1.4	FUNCTIONAL REQUIREMENTS	The system shall support the payload meeting all functional requirements outlined below for certification and operation.	1 INPUT/OUTPUT REQUIREMENTS	1.4.1 Show Payload Is Ready to be Fielded	1 Perform Rain Integration Process
1.4.1	Show Payload Is Ready to be Fielded	The system shall provide a means to show a payload is ready to be fielded.	1.4 FUNCTIONAL REQUIREMENTS	1.4.1.1 Comply Payload with Statutes and Regulations 1.4.1.2 Provide Information Needed to Prove Interoperability 1.4.1.3 Provide Information Needed to Prove Safety 1.4.1.4 Provide Information Needed to Prove Security 1.4.1.5 Provide Information Needed to Prove Environmental Compatibility	1.4 Address Risk 1.5 Develop Certification Package
1.4.1.1	Comply Payload with Statutes and Regulations	The system shall provide a means to have the payload comply with statutes and regulations.	1.4.1 Show Payload Is Ready to be Fielded	1.4.1.1.1 Determine Certifications Needed 1.4.1.1.2 Collect Data to Support Certification 1.4.1.1.3 Evaluate Pre-Submission Certification Data Package 1.4.1.1.4 Means to Use to	1.5 Develop Certification Package

Number	Name	Description	refines	refined by	basis of
				Interface with Tech Cert Authorities	
1.4.1.1.1	Determine Certifications Needed	The system shall provide a means to determine the certifications needed based on the capabilities of the new payload.	1.4.1.1 Comply Payload with Statutes and Regulations	1.4.1.1.1.1 Provide Means to Track That All Certifications Are Addressed	1.1 Determine Certifications
1.4.1.1.1.1	Provide Means to Track That All Certifications Are Addressed	The system shall provide a means to track that all certifications are addressed.	1.4.1.1.1 Determine Certifications Needed		1.1.1 Construct Certification List 1.1.2 Assemble Certification Components 1.1.3 Sort Certification List
1.4.1.1.2	Collect Data to Support Certification	The system shall provide a means to collect the data needed to support each of the required certifications.	1.4.1.1 Comply Payload with Statutes and Regulations		1.2.3 Perform Data Collection 1.2.3.1 Collect Safety Certification Data 1.2.3.2 Collect Security Certification Data 1.2.3.3 Collect Interoperability Certification Data 1.2.3.4 Collect Compatibility Certification Data
1.4.1.1.3	Evaluate Pre-Submission Certification Data Package	The system shall provide a means to evaluate the pre-submission data package for each technical certification for adequacy.	1.4.1.1 Comply Payload with Statutes and Regulations		1.3.2 Provide Analysis 1.3.2.1 Analyze Safety Certification Data 1.3.2.1.1 Analyze Airworthiness Certifications Data 1.3.2.1.2 Analyze Battery Certifications Data

Number	Name	Description	refines	refined by	basis of
					1.3.2.1.3 Analyze Laser Certifications Data 1.3.2.1.4 Analyze Weapon Certifications Data 1.3.2.1.5 Analyze System Safety Certifications Data 1.3.2.1.6 Analyze Range Safety Certifications Data 1.3.2.1.7 Analyze E3 Certification Data 1.3.2.2 Analyze Security Certifications Data 1.3.2.2.1 Analyze IA Certifications Data 1.3.2.2.2 Analyze Anti-Tamper Certifications Data 1.3.2.2.3 Analyze SAASM Certifications Data 1.3.2.2.4 Analyze Clinger-Cohen Act Certifications Data 1.3.2.3 Analyze Interoperability Certifications Data 1.3.2.3.1 Analyze Spectrum Certifications Data 1.3.2.3.2 Analyze CDL Certifications Data 1.3.2.3.3 Analyze JITC Certifications Data 1.3.2.4 Analyze

Number	Name	Description	refines	refined by	basis of
					Compatibility Certification Data 1.3.2.4.1 Analyze Environmental Certifications Data 1.3.2.4.2 Analyze T&E Certifications Data
1.4.1.1.4	Means to Use to Interface with Tech Cert Authorities	The system shall provide the means of interfacing with the technical certification authorities.	1.4.1.1 Comply Payload with Statutes and Regulations	1.4.1.1.4.1 Provide Process for Complying with Tech Cert Authority Guidance	1.5 Develop Certification Package 1.5.1 Develop Safety Certification Package 1.5.2 Develop Security Certifications Package 1.5.3 Develop Interoperability Certification Package 1.5.4 Develop Compatibility Certifications Package
1.4.1.1.4.1	Provide Process for Complying with Tech Cert Authority Guidance	The system shall provide the process for complying with the guidance from the technical certification authority.	1.4.1.1.4 Means to Use to Interface with Tech Cert Authorities 2.2.1.1.4 Aggregated Risk Level from Use of Waiver & Interim Approvals		1.5.1.1 Develop Airworthiness Certifications Package 1.5.1.2 Develop Battery Certifications Package 1.5.1.3 Develop Laser Certifications Package 1.5.1.4 Develop Weapon Certifications Package 1.5.1.5 Develop System Safety Certifications Package 1.5.1.6 Develop Range

Number	Name	Description	refines	refined by	basis of
					Safety Certifications Package 1.5.1.7 Develop E3 Certification Package 1.5.2.1 Develop IA Certifications Package 1.5.2.2 Develop Anti-Tamper Certifications Package 1.5.2.3 Develop SAASM Certifications Package 1.5.2.4 Develop Clinger-Cohen Act Certifications Package 1.5.3.1 Develop Spectrum Certifications Package 1.5.3.2 Develop CDL Certifications Package 1.5.3.3 Develop JITC Certifications Package 1.5.4.1 Develop Environmental Certifications Package 1.5.4.2 Develop T&E Certifications Package
1.4.1.2	Provide Information Needed to Prove Interoperability	The system shall provide the information needed to prove Interoperability.	1.4.1 Show Payload Is Ready to be Fielded		1.1.2.3 Determine Interoperability Certifications 1.1.2.3.1 Address Spectrum Certifications 1.1.2.3.2 Address CDL

Number	Name	Description	refines	refined by	basis of
					Certifications
					1.1.2.3.3 Address JITC Certifications
					1.2.3.3 Collect Interoperability Certification Data
					1.2.3.3.1 Collect Spectrum Certifications Data
					1.2.3.3.2 Collect CDL Certifications Data
					1.2.3.3.3 Collect JITC Certifications Data
					1.3.2.3 Analyze Interoperability Certifications Data
					1.3.2.3.1 Analyze Spectrum Certifications Data
					1.3.2.3.2 Analyze CDL Certifications Data
					1.3.2.3.3 Analyze JITC Certifications Data
					1.4.3 Address Interoperability Certification Risk
					1.4.3.1 Address Spectrum Certifications Risk
					1.4.3.2 Address CDL Certifications Risk
					1.4.3.3 Address JITC Certifications Risk
					1.5.3 Develop

Number	Name	Description	refines	refined by	basis of
					Interoperability Certification Package 1.5.3.1 Develop Spectrum Certifications Package 1.5.3.2 Develop CDL Certifications Package 1.5.3.3 Develop JITC Certifications Package
1.4.1.3	Provide Information Needed to Prove Safety	The system shall provide the information needed to prove Safety.	1.4.1 Show Payload Is Ready to be Fielded		1.1.2.1 Determine Safety Certifications 1.1.2.1.1 Address Airworthiness Certifications 1.1.2.1.2 Address Battery Certifications 1.1.2.1.3 Address Laser Certifications 1.1.2.1.4 Address Weapon Certifications 1.1.2.1.5 Address System Safety Certifications 1.2.3.1 Collect Safety Certification Data 1.2.3.1.1 Collect Airworthiness Certifications Data 1.2.3.1.2 Collect Battery Certifications Data 1.2.3.1.3 Collect Laser Certifications Data 1.2.3.1.4 Collect Weapon

Number	Name	Description	refines	refined by	basis of
					Certifications Data 1.2.3.1.5 Collect System Safety Certifications Data 1.3.2.1 Analyze Safety Certification Data 1.3.2.1.1 Analyze Airworthiness Certifications Data 1.3.2.1.2 Analyze Battery Certifications Data 1.3.2.1.3 Analyze Laser Certifications Data 1.3.2.1.4 Analyze Weapon Certifications Data 1.3.2.1.5 Analyze System Safety Certifications Data 1.4.1 Address Safety Certifications Risk 1.4.1.1 Address Airworthiness Certifications Risk 1.4.1.2 Address Battery Certifications Risk 1.4.1.3 Address Laser Certifications Risk 1.4.1.4 Address Weapon Certifications Risk 1.4.1.5 Address System Safety Certifications Risk 1.5.1 Develop Safety Certification Package

Number	Name	Description	refines	refined by	basis of
					1.5.1.1 Develop Airworthiness Certifications Package 1.5.1.2 Develop Battery Certifications Package 1.5.1.3 Develop Laser Certifications Package 1.5.1.4 Develop Weapon Certifications Package 1.5.1.5 Develop System Safety Certifications Package
1.4.1.4	Provide Information Needed to Prove Security	The system shall provide the information needed to prove Security.	1.4.1 Show Payload Is Ready to be Fielded		1.1.2.2 Determine Security Certifications 1.1.2.2.1 Address IA Certifications 1.1.2.2.2 Address Anti-Tamper Certifications 1.1.2.2.3 Address SAASM Certifications 1.1.2.2.4 Address Clinger-Cohen Act Certifications 1.2.3.2 Collect Security Certification Data 1.2.3.2.1 Collect IA Certifications Data 1.2.3.2.2 Collect Anti-Tamper Certifications Data 1.2.3.2.3 Collect SAASM Certifications Data 1.2.3.2.4 Collect Clinger-

Number	Name	Description	refines	refined by	basis of
					Cohen Act Certifications Data 1.3.2.2 Analyze Security Certifications Data 1.3.2.2.1 Analyze IA Certifications Data 1.3.2.2.2 Analyze Anti-Tamper Certifications Data 1.3.2.2.3 Analyze SAASM Certifications Data 1.3.2.2.4 Analyze Clinger-Cohen Act Certifications Data 1.4.2 Address Security Certifications Risk 1.4.2.1 Address IA Certifications Risk 1.4.2.2 Address Anti-Tamper Certifications Risk 1.4.2.3 Address SAASM Certifications Risk 1.4.2.4 Address Clinger-Cohen Act Certifications Risk 1.5.2 Develop Security Certifications Package 1.5.2.1 Develop IA Certifications Package 1.5.2.2 Develop Anti-Tamper Certifications Package 1.5.2.3 Develop SAASM

Number	Name	Description	refines	refined by	basis of
					Certifications Package 1.5.2.4 Develop Clinger-Cohen Act Certifications Package
1.4.1.5	Provide Information Needed to Prove Environmental Compatibility	The system shall provide the information needed to prove Environmental Compatibility.	1.4.1 Show Payload Is Ready to be Fielded		1.1.2.4 Determine Compatibility Certifications 1.1.2.4.1 Address Environmental Certifications 1.1.2.4.2 Address T&E Certifications 1.2.3.4 Collect Compatibility Certification Data 1.2.3.4.1 Collect Environmental Certifications Data 1.3.2.4 Analyze Compatibility Certification Data 1.3.2.4.1 Analyze Environmental Certifications Data 1.3.2.4.2 Analyze T&E Certifications Data 1.4.4 Address Compatibility Certification Risk 1.4.4.1 Address Environmental Certifications Risk 1.4.4.2 Address T&E

Number	Name	Description	refines	refined by	basis of
					Certifications Risk 1.5.4 Develop Compatibility Certifications Package 1.5.4.1 Develop Environmental Certifications Package 1.5.4.2 Develop T&E Certifications Package
2	TECHNOLOGY & SYSTEM-WIDE REQUIREMENTS	The system shall include system Technology; Suitability and Quality; Cost; Schedule to support RAIN Process.	0 REQUIREMENTS CONTEXT	2.1 TECHNOLOGY CONSTRAINTS 2.2 SUITABILITY & QUALITY 2.3 COST REQUIERMENTS 2.4 SCHEDULE REQUIREMENTS	1 Perform Rain Integration Process
2.1	TECHNOLOGY CONSTRAINTS	The system shall support the following technology requirements.	2 TECHNOLOGY & SYSTEM-WIDE REQUIREMENTS	2.1.1 NMCI 2.1.2 Email 2.1.3 MS Office 2.1.4 PMA-263 Database(s)	1 Perform Rain Integration Process
2.1.1	NMCI	the computer network based information exchange shall operate within the limits of what the NMCI will allow or support.	2.1 TECHNOLOGY CONSTRAINTS		1 Perform Rain Integration Process
2.1.2	Email	Written communication of the system information shall be through DoD approved encrypted email	2.1 TECHNOLOGY CONSTRAINTS		1 Perform Rain Integration Process
2.1.3	MS Office	The system documentation shall be limited to being in MS Office formats (MS Word 2003, MS Excel 2003, or MS Power Point 2003 formats).	2.1 TECHNOLOGY CONSTRAINTS		1 Perform Rain Integration Process

Number	Name	Description	refines	refined by	basis of
2.1.4	PMA-263 Database(s)	File sharing shall be limited to PMA-263 and DoD approved contractor databases.	2.1 TECHNOLOGY CONSTRAINTS		1 Perform Rain Integration Process
2.2	SUITABILITY & QUALITY	The system shall support the following suitability and quality requirements for operation.	2 TECHNOLOGY & SYSTEM-WIDE REQUIREMENTS	2.2.1 Produces Complete Decision Package 2.2.2 Produces Accurate Decision Package	1 Perform Rain Integration Process
2.2.1	Produces Complete Decision Package	The system shall produce complete fielding decision packages	2.2 SUITABILITY & QUALITY	2.2.1.1 Addresses All Relevant Statutes and Regulations 2.2.1.2 Justifies Omitted Statutes or Regulations	1.1 Determine Certifications 1.4 Address Risk 1.5 Develop Certification Package
2.2.1.1	Addresses All Relevant Statutes and Regulations	The system shall address all relevant statutes and regulations.	2.2.1 Produces Complete Decision Package	2.2.1.1.1 Tailored List of Required Certs by Payload System Type 2.2.1.1.2 Certifications, Approvals, Letter, or Waiver for All Required Statutes & Regulations 2.2.1.1.3 Instructions on The Order & Start Times for Each Cert 2.2.1.1.4 Aggregated Risk Level from Use of Waiver & Interim Approvals	1.1.2.1 Determine Safety Certifications 1.1.2.2 Determine Security Certifications 1.1.2.3 Determine Interoperability Certifications 1.1.2.4 Determine Compatibility Certifications 1.4.1 Address Safety Certifications Risk 1.4.2 Address Security Certifications Risk 1.4.3 Address Interoperability Certification Risk 1.4.4 Address Compatibility Certification Risk

Number	Name	Description	refines	refined by	basis of
					1.5.1 Develop Safety Certification Package 1.5.2 Develop Security Certifications Package 1.5.3 Develop Interoperability Certification Package 1.5.4 Develop Compatibility Certifications Package
2.2.1.1.1	Tailored List of Required Certs by Payload System Type	The system shall provide a tailored list of required certs by payload system type.	2.2.1.1 Addresses All Relevant Statutes and Regulations		1.1.2.1.1 Address Airworthiness Certifications 1.1.2.1.2 Address Battery Certifications 1.1.2.1.3 Address Laser Certifications 1.1.2.1.4 Address Weapon Certifications 1.1.2.1.5 Address System Safety Certifications 1.1.2.1.6 Address Range Safety Certifications 1.1.2.1.7 Address E3 Certifications 1.1.2.2.1 Address IA Certifications 1.1.2.2.2 Address Anti-Tamper Certifications 1.1.2.2.3 Address SAASM Certifications

Number	Name	Description	refines	refined by	basis of
					1.1.2.2.4 Address Clinger-Cohen Act Certifications 1.1.2.3.1 Address Spectrum Certifications 1.1.2.3.2 Address CDL Certifications 1.1.2.3.3 Address JITC Certifications 1.1.2.4.1 Address Environmental Certifications 1.1.2.4.2 Address T&E Certifications
2.2.1.1.2	Certifications, Approvals, Letter, or Waiver for All Required Statutes & Regulations	The system shall provide the Certifications, approvals, letter, or waiver for all required statutes and regulations.	2.2.1.1 Addresses All Relevant Statutes and Regulations		1.5.1.1 Develop Airworthiness Certifications Package 1.5.1.2 Develop Battery Certifications Package 1.5.1.3 Develop Laser Certifications Package 1.5.1.4 Develop Weapon Certifications Package 1.5.1.5 Develop System Safety Certifications Package 1.5.1.6 Develop Range Safety Certifications Package 1.5.1.7 Develop E3 Certification Package 1.5.2.1 Develop IA

Number	Name	Description	refines	refined by	basis of
					Certifications Package 1.5.2.2 Develop Anti-Tamper Certifications Package 1.5.2.3 Develop SAASM Certifications Package 1.5.2.4 Develop Clinger-Cohen Act Certifications Package 1.5.3.1 Develop Spectrum Certifications Package 1.5.3.2 Develop CDL Certifications Package 1.5.3.3 Develop JITC Certifications Package 1.5.4.1 Develop Environmental Certifications Package 1.5.4.2 Develop T&E Certifications Package
2.2.1.1.3	Instructions on The Order & Start Times for Each Cert	The system shall provide instructions on the order and relative start times for each certification.	2.2.1.1 Addresses All Relevant Statutes and Regulations		1.1.2.1.1 Address Airworthiness Certifications 1.1.2.1.2 Address Battery Certifications 1.1.2.1.3 Address Laser Certifications 1.1.2.1.4 Address Weapon Certifications 1.1.2.1.5 Address System Safety Certifications

Number	Name	Description	refines	refined by	basis of
					1.1.2.1.6 Address Range Safety Certifications 1.1.2.1.7 Address E3 Certifications 1.1.2.2.1 Address IA Certifications 1.1.2.2.2 Address Anti-Tamper Certifications 1.1.2.2.3 Address SAASM Certifications 1.1.2.2.4 Address Clinger-Cohen Act Certifications 1.1.2.3.1 Address Spectrum Certifications 1.1.2.3.2 Address CDL Certifications 1.1.2.3.3 Address JITC Certifications 1.1.2.4.1 Address Environmental Certifications 1.1.2.4.2 Address T&E Certifications
2.2.1.1.4	Aggregated Risk Level from Use of Waiver & Interim Approvals	The system shall provide aggregated risk level analysis from the use of the waiver and interim approvals.	2.2.1.1 Addresses All Relevant Statutes and Regulations	1.4.1.1.4.1 Provide Process for Complying with Tech Cert Authority Guidance	1.4.1.1 Address Airworthiness Certifications Risk 1.4.1.2 Address Battery Certifications Risk 1.4.1.3 Address Laser Certifications Risk 1.4.1.4 Address Weapon

Number	Name	Description	refines	refined by	basis of
					Certifications Risk 1.4.1.5 Address System Safety Certifications Risk 1.4.1.6 Address Range Safety Certifications Risk 1.4.1.7 Address E3 Certifications Risk 1.4.2.1 Address IA Certifications Risk 1.4.2.2 Address Anti-Tamper Certifications Risk 1.4.2.3 Address SAASM Certifications Risk 1.4.2.4 Address Clinger-Cohen Act Certifications Risk 1.4.3.1 Address Spectrum Certifications Risk 1.4.3.2 Address CDL Certifications Risk 1.4.3.3 Address JITC Certifications Risk 1.4.4.1 Address Environmental Certifications Risk 1.4.4.2 Address T&E Certifications Risk
2.2.1.1.4.1	Instructions on The Risks of Using Waivers or Interim Approvals	The system shall provide instructions on the risks level of using waivers or interim approvals.			1.4.1.1 Address Airworthiness Certifications Risk 1.4.1.2 Address Battery

Number	Name	Description	refines	refined by	basis of
					Certifications Risk 1.4.1.3 Address Laser Certifications Risk 1.4.1.4 Address Weapon Certifications Risk 1.4.1.5 Address System Safety Certifications Risk 1.4.1.6 Address Range Safety Certifications Risk 1.4.1.7 Address E3 Certifications Risk 1.4.2.1 Address IA Certifications Risk 1.4.2.2 Address Anti-Tamper Certifications Risk 1.4.2.3 Address SAASM Certifications Risk 1.4.2.4 Address Clinger-Cohen Act Certifications Risk 1.4.3.1 Address Spectrum Certifications Risk 1.4.3.2 Address CDL Certifications Risk 1.4.3.3 Address JITC Certifications Risk 1.4.4.1 Address Environmental Certifications Risk 1.4.4.2 Address T&E Certifications Risk

Number	Name	Description	refines	refined by	basis of
2.2.1.2	Justifies Omitted Statutes or Regulations	The system shall provide the justification for omitted certifications (statutes and/or regulations certifications).	2.2.1 Produces Complete Decision Package		1.1 Determine Certifications 1.1.1 Construct Certification List 1.1.2 Assemble Certification Components 1.1.3 Sort Certification List
2.2.2	Produces Accurate Decision Package	The system shall produce complete accurate fielding decision packages.	2.2 SUITABILITY & QUALITY		1 Perform Rain Integration Process 1.1 Determine Certifications 1.2 Collect Certifications 1.3 Analyze Certifications 1.4 Address Risk 1.5 Develop Certification Package
2.3	COST REQUIERMENTS	The costs requirements are detailed in the lower level requirements.	2 TECHNOLOGY & SYSTEM-WIDE REQUIREMENTS	2.3.1 Same or Lower Than Current Cost est<$2M	1 Perform Rain Integration Process
2.3.1	Same or Lower Than Current Cost est<$2M	The system shall incur the same or lower costs as the current processes used to fully support payload fielding decisions. to less than $2Million.	2.3 COST REQUIERMENTS		1 Perform Rain Integration Process
2.4	SCHEDULE REQUIREMENTS	The schedule requirements are detailed in the lower level requirements.	2 TECHNOLOGY & SYSTEM-WIDE REQUIREMENTS	2.4.1 Less Than 18 Mths to Produce The Fielding Decision Package	1 Perform Rain Integration Process
2.4.1	Less Than 18 Mths to Produce The Fielding Decision Package	The system shall provide an option to take 18 months or less to produce the fielding decision package.	2.4 SCHEDULE REQUIREMENTS		1 Perform Rain Integration Process
3	TRADE-OFF	The system shall address the fundamental	0 REQUIREMENTS	3.1 PERFORMANCE	1 Perform Rain Integration

Number	Name	Description	refines	refined by	basis of
	REQUIREMENTS	objectives hierarchy indicate the weighted values for each bottom level objective for use in trading off features used during operations, but implemented during development and manufacturing.	CONTEXT	TRADE-OFF 3.2 COST TRADE-OFF 3.3 COST-PERFORMANCE TRADE-OFF	Process
3.1	PERFORMANCE TRADE-OFF	The system shall perform a trade-off analysis based on the factors identified in The systems fundamental objectives hierarchy.	3 TRADE-OFF REQUIREMENTS	3.1.1 Minimize Time to Address Statutory & Regulatory Requirements for Fielding 3.1.2 Provide Means to Manage Risks	1 Perform Rain Integration Process
3.1.1	Minimize Time to Address Statutory & Regulatory Requirements for Fielding	The system shall minimize time to address statutory and regulatory requirements for fielding.	3.1 PERFORMANCE TRADE-OFF	3.1.1.1 Minimize Time to Determine Certifications Required to Pursue 3.1.1.2 Minimize Time to Address Required Certifications	1 Perform Rain Integration Process
3.1.1.1	Minimize Time to Determine Certifications Required to Pursue	The system shall minimize time to determine certifications required to be pursued.	3.1.1 Minimize Time to Address Statutory & Regulatory Requirements for Fielding	3.1.1.1.1 Time to Determine Needed Certifications Value Curve Is Linear with a Value of 1 at One Day or Less & Zero at One Year	1 Perform Rain Integration Process
3.1.1.1.1	Time to Determine Needed Certifications Value Curve Is Linear with a Value of 1 at One Day or Less & Zero at One Year	The system shall value the time to determine needed certifications with a value curve that is linear with a value of 1 at one day or less and zero at one year.	3.1.1.1 Minimize Time to Determine Certifications Required to Pursue	3.1.1.1.1.1 Weight 15% for Minimize Time to Determine Certifications	1 Perform Rain Integration Process
3.1.1.1.1.1	Weight 15% for Minimize Time to Determine Certifications	The system shall apply a trade weight of 15% to minimizing the time to determine required certifications when de-conflicting with other trade-off requirements.	3.1.1.1.1 Time to Determine Needed Certifications Value Curve Is Linear with a Value of 1 at One Day or Less & Zero		1 Perform Rain Integration Process

Number	Name	Description	refines	refined by	basis of
			at One Year		
3.1.1.2	Minimize Time to Address Required Certifications	The system shall minimize time to address required certifications.	3.1.1 Minimize Time to Address Statutory & Regulatory Requirements for Fielding	3.1.1.2.1 Time to obtain waivers/interim approvals value curve is linear with a value of 1 at one day or less and zero at one year. 3.1.1.2.2 Time to obtain full certification approvals value curve is linear with a value of 1 at one day or less and zero at one year.	1 Perform Rain Integration Process
3.1.1.2.1	Time to obtain waivers/interim approvals value curve is linear with a value of 1 at one day or less and zero at one year.	The system shall value the time to obtain waivers/interim approvals with a value curve that is linear with a value of 1 at one day or less and zero at one year.	3.1.1.2 Minimize Time to Address Required Certifications	3.1.1.2.1.1 Weight 35% for Minimize Time to Obtain Waiver/Interim Approvals.	1 Perform Rain Integration Process
3.1.1.2.1.1	Weight 35% for Minimize Time to Obtain Waiver/Interim Approvals.	The system shall apply a trade weight of 35% to minimizing the time to obtain waivers/interim approvals when de-conflicting with other trade-off requirements.	3.1.1.2.1 Time to obtain waivers/interim approvals value curve is linear with a value of 1 at one day or less and zero at one year.		1 Perform Rain Integration Process
3.1.1.2.2	Time to obtain full certification approvals value curve is linear with a value of 1 at one day or less and zero at one year.	The system shall value the time to obtain full certification approvals with value curve that is linear with a value of 1 at one day or less and zero at one year.	3.1.1.2 Minimize Time to Address Required Certifications	3.1.1.2.2.1 Weight 35% for Minimize Time to Obtain Full Certification Approval	1 Perform Rain Integration Process
3.1.1.2.2.1	Weight 35% for Minimize Time to Obtain Full	The system shall apply a trade weight of 35% to minimizing the time to obtain full certification approvals when de-conflicting with	3.1.1.2.2 Time to obtain full certification		1 Perform Rain Integration Process

Number	Name	Description	refines	refined by	basis of
	Certification Approval	other trade-off requirements.	approvals value curve is linear with a value of 1 at one day or less and zero at one year.		
3.1.2	Provide Means to Manage Risks	The system shall provide a means to manage risks.	3.1 PERFORMANCE TRADE-OFF	3.1.2.1 Minimize waivers and interim approvals	1 Perform Rain Integration Process
3.1.2.1	Minimize waivers and interim approvals	The system shall minimize waivers and interim approvals.	3.1.2 Provide Means to Manage Risks	3.1.2.1.1 Percentage of waivers/interims value cure is linear with value of 1 at 0% and 0 at 100%.	1 Perform Rain Integration Process
3.1.2.1.1	Percentage of waivers/interims value cure is linear with value of 1 at 0% and 0 at 100%.	The system shall value the percentage of waivers/interims with a value cure that is linear with value of 1 at 0% and 0 at 100%.	3.1.2.1 Minimize waivers and interim approvals	3.1.2.1.1.1 Weight 15% Percentage of Waivers/Interims Approvals	1 Perform Rain Integration Process
3.1.2.1.1.1	Weight 15% Percentage of Waivers/Interims Approvals	The system shall apply a trade weight of 15% to minimizing the percentage of waivers/interims when deconfliction with other trade-off requirements.	3.1.2.1.1 Percentage of waivers/interims value cure is linear with value of 1 at 0% and 0 at 100%.		1 Perform Rain Integration Process
3.2	COST TRADE-OFF	The first phase of this systems development shall not address this phase.	3 TRADE-OFF REQUIREMENTS	3.2.1 Cost	1 Perform Rain Integration Process
3.2.1	Cost	N/A.	3.2 COST TRADE-OFF		1 Perform Rain Integration Process
3.3	COST-PERFORMANCE TRADE-OFF	The first phase of this systems development shall not address this phase.	3 TRADE-OFF REQUIREMENTS	3.3.1 Cost-Performance	1 Perform Rain Integration Process
3.3.1	Cost-Performance	N/A.	3.3 COST-PERFORMANCE TRADE-OFF		1 Perform Rain Integration Process
4	QUALIFICATION	Requirements on observing and collecting data from tests, how the collected data will be used	0 REQUIREMENTS	4.1 OBSERVANCE	1 Perform Rain Integration

Number	Name	Description	refines	refined by	basis of
	REQUIREMENTS	to verify the RAIN works as specified, how RAIN will be validated to meet user needs, and how RAIN will be determined to be acceptable.	CONTEXT	REQUIREMENTS 4.2 VERIFICATION REQUIREMENTS 4.3 VALIDATION REQUIREMENTS 4.4 ACCEPTANCE REQUIREMENTS	Process
4.1	OBSERVANCE REQUIREMENTS	Data on the performance of the RAIN system shall be collected per the lower lever requirements.	4 QUALIFICATION REQUIREMENTS	4.1.1 Verification tests by development team 4.1.2 Validation tests by user representatives	1 Perform Rain Integration Process
4.1.1	Verification tests by development team	The system verification testing shall be conducted by members of the system development team	4.1 OBSERVANCE REQUIREMENTS		1 Perform Rain Integration Process
4.1.2	Validation tests by user representatives	The system validation testing shall be conducted by PMA-263 user representatives.	4.1 OBSERVANCE REQUIREMENTS		1 Perform Rain Integration Process
4.2	VERIFICATION REQUIREMENTS	Verification of the performance of the RAIN system shall be in accordance with these sub-requirements.	4 QUALIFICATION REQUIREMENTS	4.2.1 Verify features against req doc	1 Perform Rain Integration Process
4.2.1	Verify features against req doc	The system shall be verified by comparing the system's features against this requirements document.	4.2 VERIFICATION REQUIREMENTS	4.2.1.1 Verified when all requirements are met	1 Perform Rain Integration Process
4.2.1.1	Verified when all requirements are met	The system shall be verified as being complete if it meets all the requirements listed in the operations phase of this requirements document.	4.2.1 Verify features against req doc		1 Perform Rain Integration Process
4.3	VALIDATION REQUIREMENTS	Validation of the performance of the RAIN system shall be in accordance with these sub-requirements.	4 QUALIFICATION REQUIREMENTS	4.3.1 Validate system functions against user needs	1 Perform Rain Integration Process
4.3.1	Validate system functions against user needs	The system shall be validated as being correct by operating system and comparing its abilities against what the user needs.	4.3 VALIDATION REQUIREMENTS	4.3.1.1 Validated when all user needs are met	1 Perform Rain Integration Process

Number	Name	Description	refines	refined by	basis of
4.3.1.1	Validated when all user needs are met	The system shall be verified as being complete if it meets all the requirements listed in the operations phase of this requirements document.	4.3.1 Validate system functions against user needs		1 Perform Rain Integration Process
4.4	ACCEPTANCE REQUIREMENTS	Acceptance of the RAIN system shall be in accordance with the lower level requirements.	4 QUALIFICATION REQUIREMENTS	4.4.1 Acceptable if validation indicates needs are me	1 Perform Rain Integration Process
4.4.1	Acceptable if validation indicates needs are me	The system shall be considered acceptable when the results of the validation testing indicate all user needs are addressed.	4.4 ACCEPTANCE REQUIREMENTS	4.4.1.1 Suggestions for improvements bound needs will be remanded for future projects	1 Perform Rain Integration Process
4.4.1.1	Suggestions for improvements bound needs will be remanded for future projects	Suggestions for improving ease of use or speed of use of the system shall be recorded and remanded for future projects.	4.4.1 Acceptable if validation indicates needs are me		1 Perform Rain Integration Process

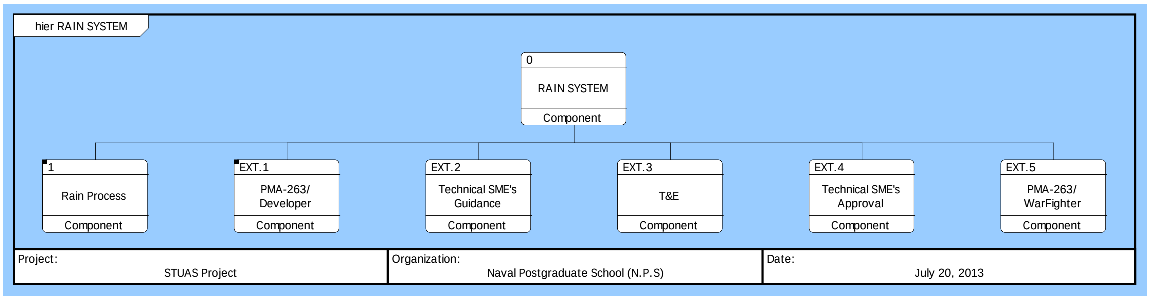
APPENDIX C. ARCHITECTURE

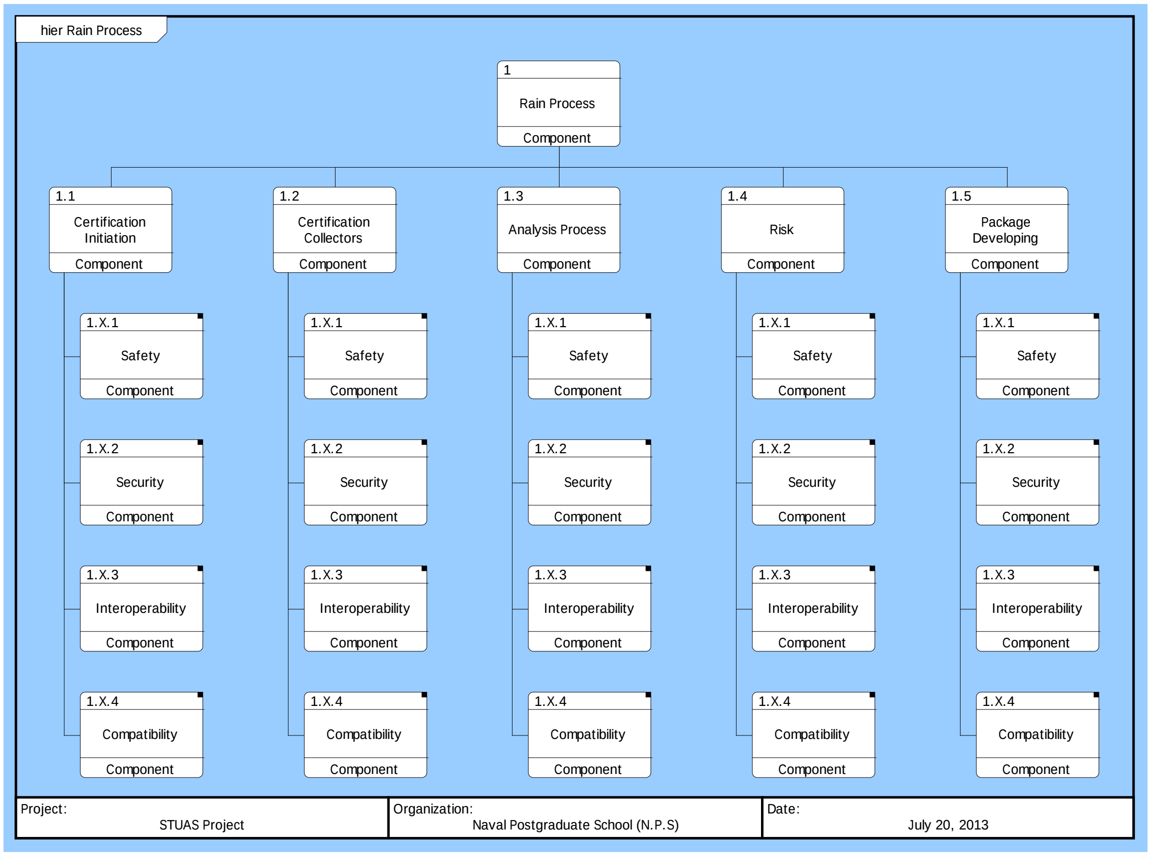
Component Section

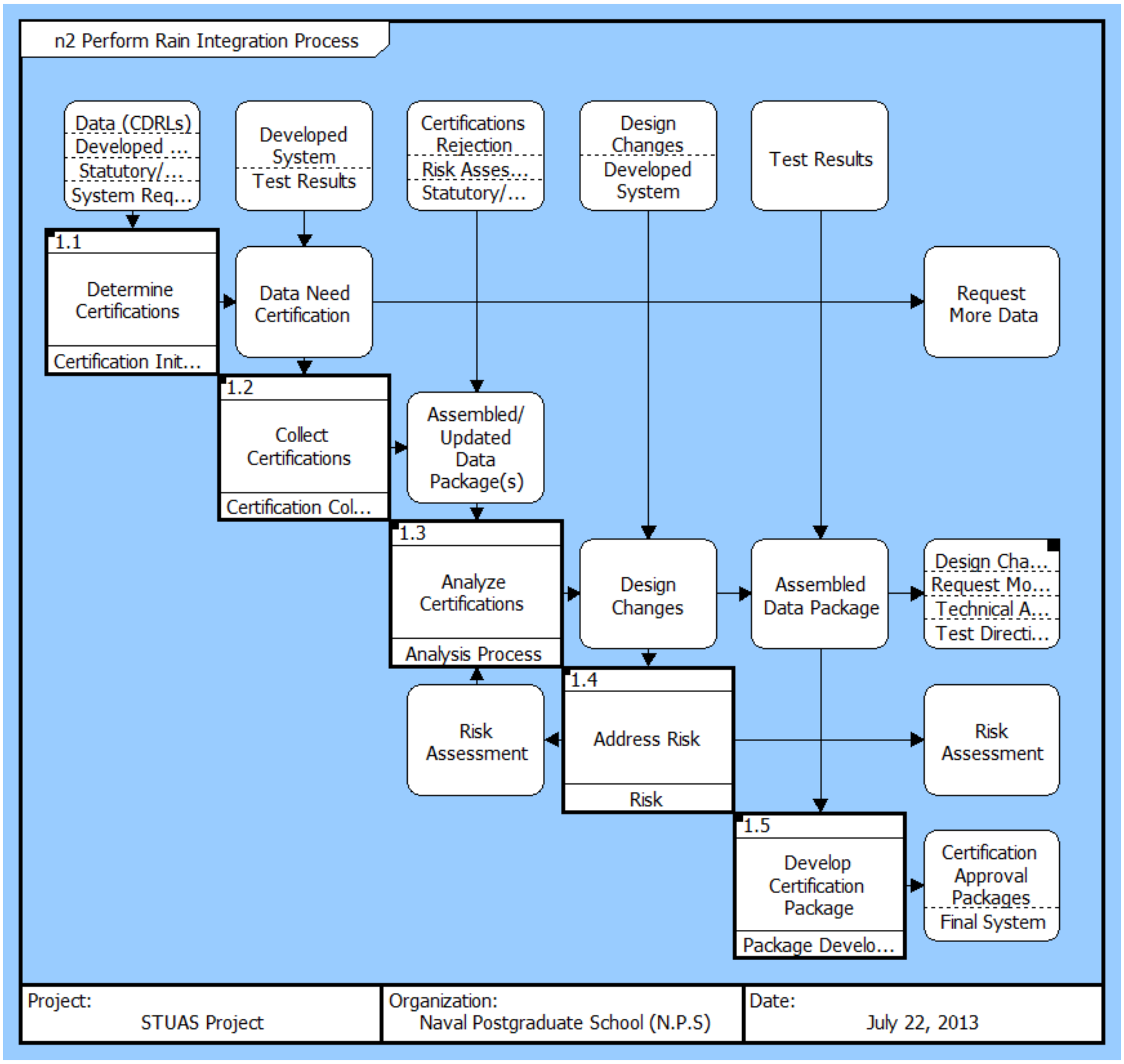
IDEF0 Section

FFBD Section

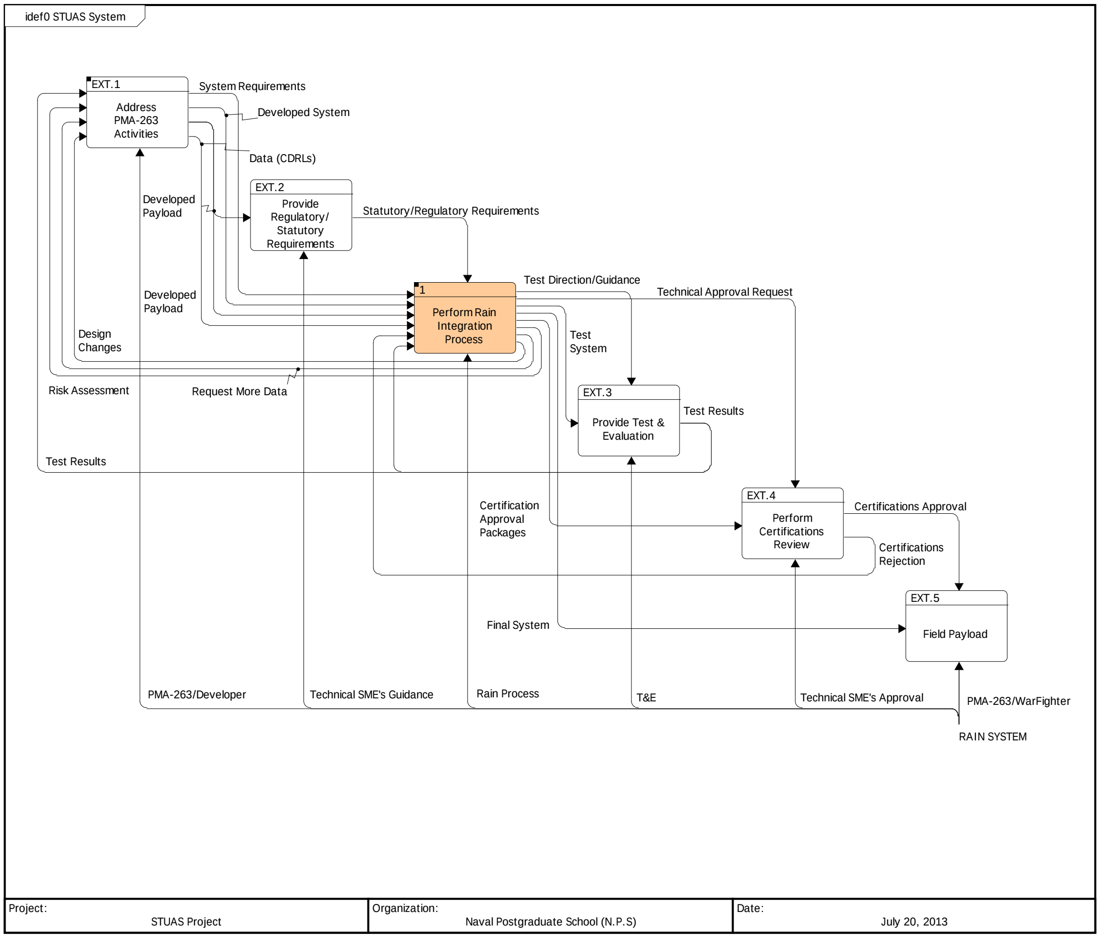
COMPONENT SECTION

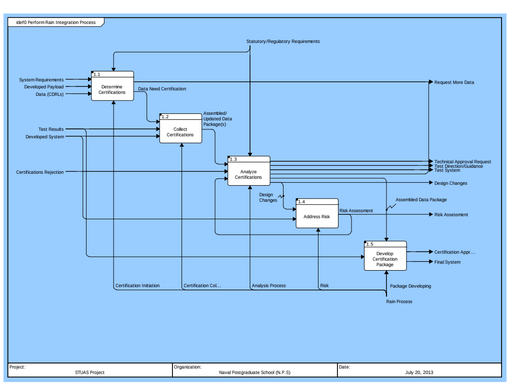


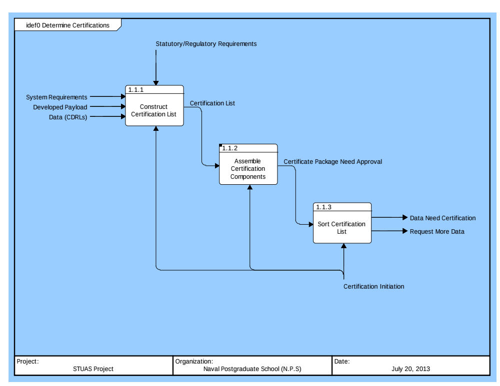


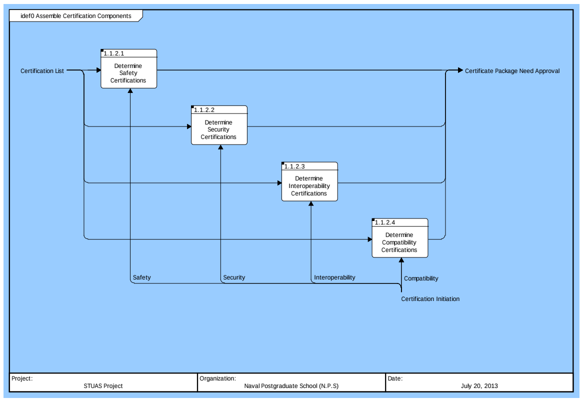

n2 Perform Rain Integration Process
Data (CDRLs)
Developed ...
Statutory/...
System Req...
Developed System
Test Results
Certifications Rejection
Risk Asses...
Statutory/...
Design Changes
Developed System
Test Results
1.1
Determine Certifications
Certification Init...
Data Need Certification
Request More Data
1.2
Collect Certifications
Certification Col...
Assembled/ Updated Data Package(s)
1.3
Analyze Certifications
Analysis Process
Design Changes
Assembled Data Package
Design Cha...
Request Mo...
Technical A...
Test Directi...
Risk Assessment
1.4
Address Risk
Risk
Risk Assessment
1.5
Develop Certification Package
Package Develo...
Certification Approval Packages
Final System
Project:
STUAS Project
Organization:
Naval Postgraduate School (N.P.S)
Date:
July 22, 2013

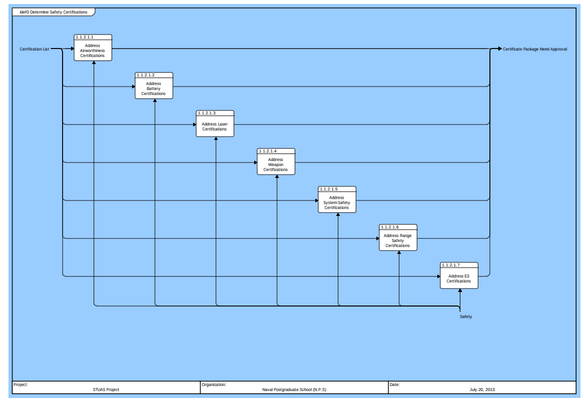
RAIN IDEF0 SECTION

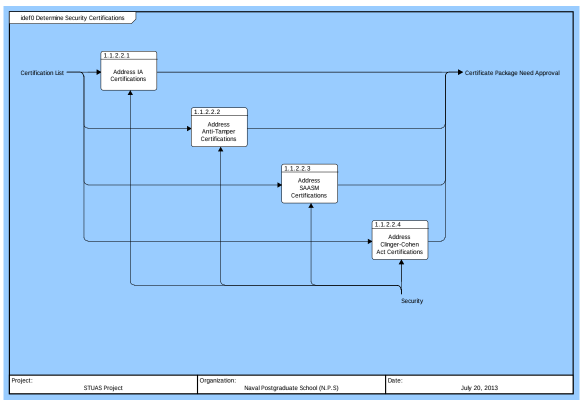







idef0 Assemble Certification Components
1.1.2.1
Determine Safety Certifications
1.1.2.2
Determine Security Certifications
1.1.2.3
Determine Interoperability Certifications
1.1.2.4
Determine Compatibility Certifications
Certification List
Certificate Package Need Approval
Safety
Security
Interoperability
Compatibility
Certification Initiation
Project:
STUAS Project
Organization:
Naval Postgraduate School (N.P.S)
Date:
July 20, 2013


idef0 Determine Safety Certifications
1.1.2.1.1
Address Airworthiness Certifications
1.1.2.1.2
Address Battery Certifications
1.1.2.1.3
Address Laser Certifications
1.1.2.1.4
Address Weapon Certifications
1.1.2.1.5
Address System Safety Certifications
1.1.2.1.6
Address Range Safety Certifications
1.1.2.1.7
Address E3 Certifications
Certification List
Certificate Package Need Approval
Safety
Project:
STUAS Project
Organization:
Naval Postgraduate School (N.P.S)
Date:
July 20, 2013


idef0 Determine Security Certifications
1.1.2.2.1
Address IA Certifications
1.1.2.2.2
Address Anti-Tamper Certifications
1.1.2.2.3
Address SAASM Certifications
1.1.2.2.4
Address Clinger-Cohen Act Certifications
Certification List
Certificate Package Need Approval
Security
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STUAS Project
Organization:
Naval Postgraduate School (N.P.S)
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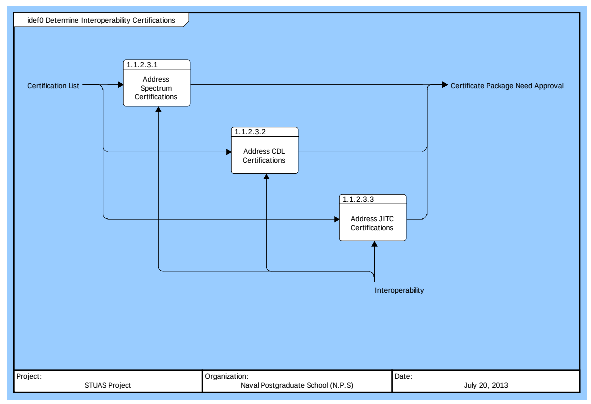
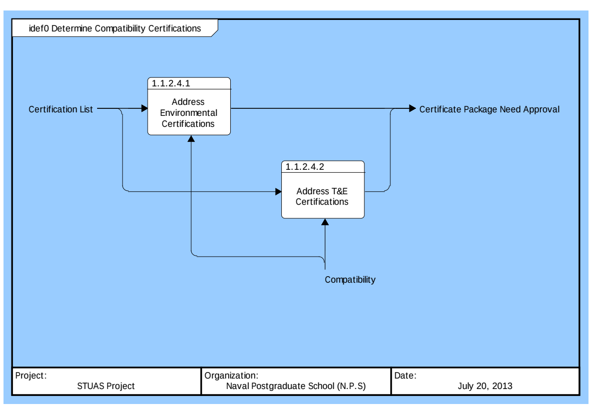
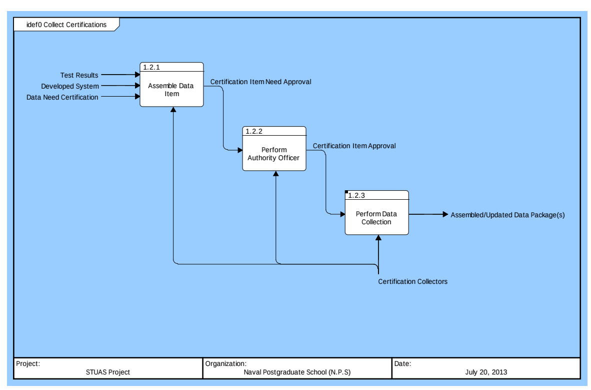
July 20, 2013


idef0 Determine Interoperability Certifications
1.1.2.3.1
Address Spectrum Certifications
1.1.2.3.2
Address CDL Certifications
1.1.2.3.3
Address JITC Certifications
Certification List
Certificate Package Need Approval
Interoperability
Project:
STUAS Project
Organization:
Naval Postgraduate School (N.P.S)
Date:
July 20, 2013


idef0 Determine Compatibility Certifications
1.1.2.4.1
Address Environmental Certifications
1.1.2.4.2
Address T&E Certifications
Certification List
Certificate Package Need Approval
Compatibility
Project:
STUAS Project
Organization:
Naval Postgraduate School (N.P.S)
Date:
July 20, 2013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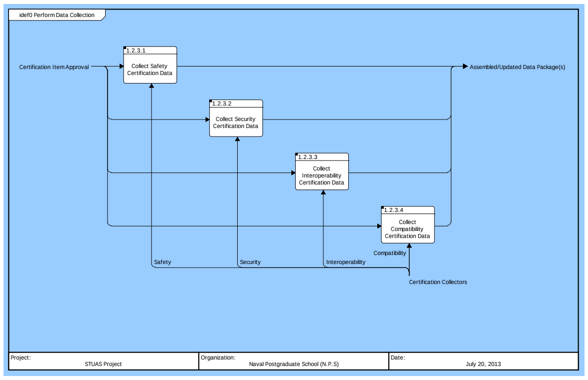
Test Results
Developed System
Data Need Certification
1.2.1
Assemble Data Item
Certification Item Need Approval
1.2.2
Perform Authority Officer
Certification Item Approval
1.2.3
Perform Data Collection
Assembled/Updated Data Package(s)
Certification Collectors
Project:
STUAS Project
Organization:
Naval Postgraduate School (N.P.S)
Date:
July 20, 2013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1.2.3.1
Collect Safety Certification Data
1.2.3.2
Collect Security Certification Data
1.2.3.3
Collect Interoperability Certification Data
1.2.3.4
Collect Compatibility Certification Data
Certification Item Approval
Assembled/Updated Data Package(s)
Safety
Security
Interoperability
Compatibility
Certification Collectors
Project:
STUAS Project
Organization:
Naval Postgraduate School (N.P.S)
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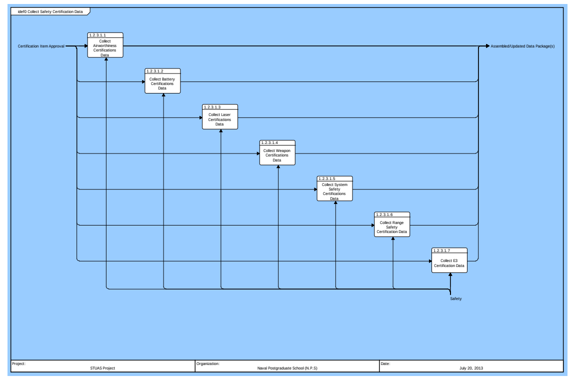
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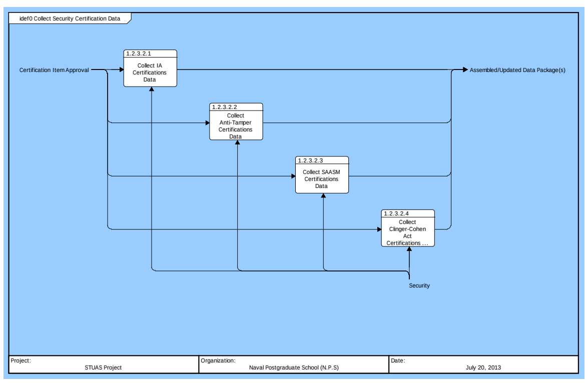
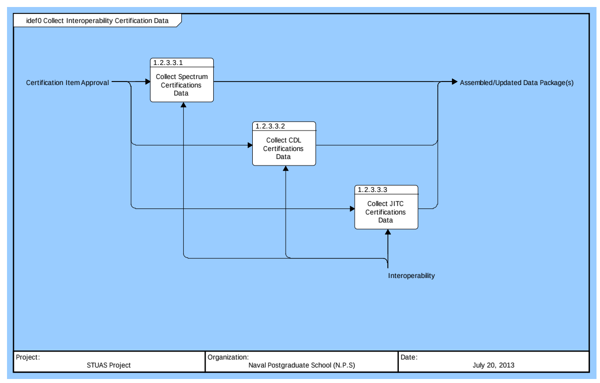
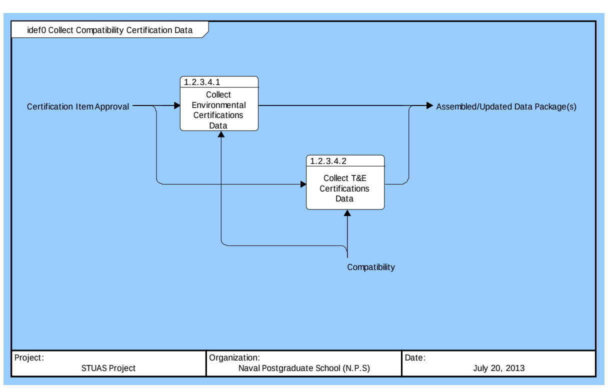
1.2.3.1.1
Collect Airworthiness Certifications Data
1.2.3.1.2
Collect Battery Certifications Data
1.2.3.1.3
Collect Laser Certifications Data
1.2.3.1.4
Collect Weapon Certifications Data
1.2.3.1.5
Collect System Safety Certifications Data
1.2.3.1.6
Collect Range Safety Certification Data
1.2.3.1.7
Collect E3 Certification Data
Certification Item Approval
Assembled/Updated Data Package(s)
Safety
Project:
STUAS Project
Organization:
Naval Postgraduate School (N.P.S)
Date:
July 20, 2013


idef0 Collect Security Certification Data
1.2.3.2.1
Collect IA Certifications Data
1.2.3.2.2
Collect Anti-Tamper Certifications Data
1.2.3.2.3
Collect SAASM Certifications Data
1.2.3.2.4
Collect Clinger-Cohen Act Certifications
Certification Item Approval
Assembled/Updated Data Package(s)
Security
Project:
STUAS Project
Organization:
Naval Postgraduate School (N.P.S)
Date:
July 20, 2013


idef0 Collect Interoperability Certification Data
1.2.3.3.1
Collect Spectrum Certifications Data
1.2.3.3.2
Collect CDL Certifications Data
1.2.3.3.3
Collect JITC Certifications Data
Certification Item Approval
Assembled/Updated Data Package(s)
Interoperability
Project:
STUAS Project
Organization:
Naval Postgraduate School (N.P.S)
Date:
July 20, 2013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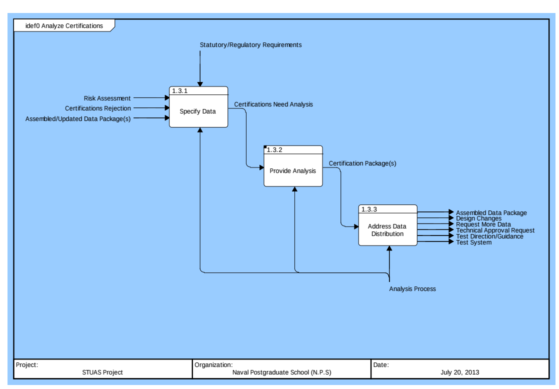
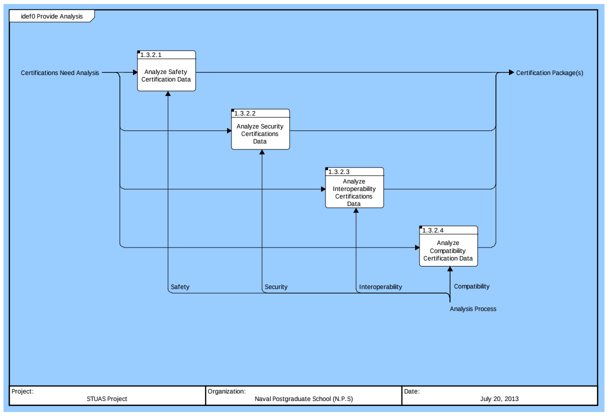
1.2.3.4.1
Collect Environmental Certifications Data
1.2.3.4.2
Collect T&E Certifications Data
Certification Item Approval
Assembled/Updated Data Package(s)
Compatibility
Project:
STUAS Project
Organization:
Naval Postgraduate School (N.P.S)
Date:
July 20, 2013


idef0 Analyze Certifications
Statutory/Regulatory Requirements
1.3.1
Specify Data
Risk Assessment
Certifications Rejection
Assembled/Updated Data Package(s)
Certifications Need Analysis
1.3.2
Provide Analysis
Certification Package(s)
1.3.3
Address Data Distribution
Assembled Data Package
Design Changes
Request More Data
Technical Approval Request
Test Direction/Guidance
Test System
Analysis Process
Project:
STUAS Project
Organization:
Naval Postgraduate School (N.P.S)
Date:
July 20, 2013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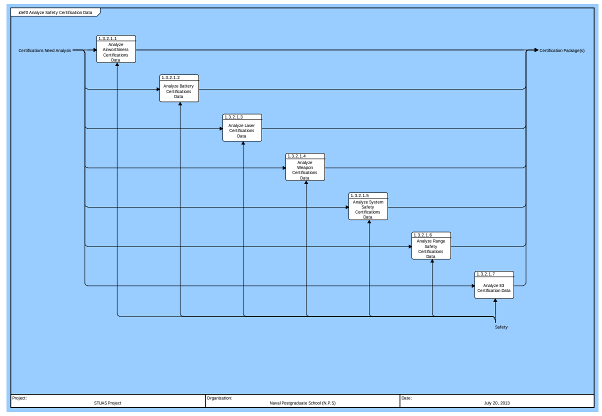
Certifications Need Analysis
1.3.2.1
Analyze Safety Certification Data
1.3.2.2
Analyze Security Certifications Data
1.3.2.3
Analyze Interoperability Certifications Data
1.3.2.4
Analyze Compatibility Certification Data
Certification Package(s)
Safety
Security
Interoperability
Compatibility
Analysis Process
Project:
STUAS Project
Organization:
Naval Postgraduate School (N.P.S)
Date:
July 20, 2013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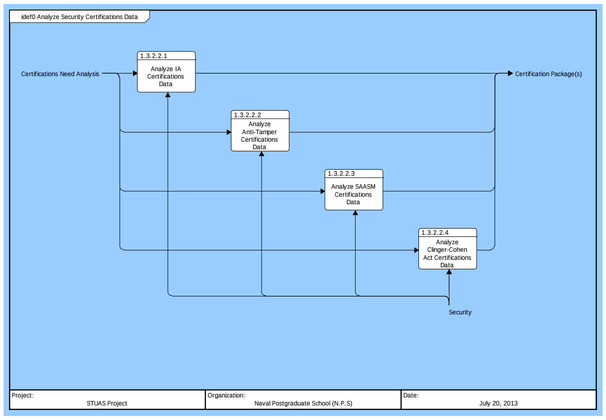
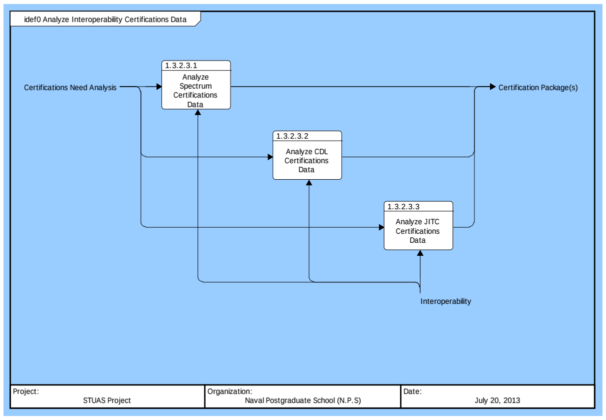
Certifications Need Analysis
1.3.2.1.1
Analyze Airworthiness Certifications Data
1.3.2.1.2
Analyze Battery Certifications Data
1.3.2.1.3
Analyze Laser Certifications Data
1.3.2.1.4
Analyze Weapon Certifications Data
1.3.2.1.5
Analyze System Safety Certifications Data
1.3.2.1.6
Analyze Range Safety Certifications Data
1.3.2.1.7
Analyze E3 Certification Data
Certification Package(s)
Safety
Project:
STUAS Project
Organization:
Naval Postgraduate School (N.P.S)
Date:
July 20, 2013


idef0 Analyze Security Certifications Data
Certifications Need Analysis
1.3.2.2.1
Analyze IA Certifications Data
1.3.2.2.2
Analyze Anti-Tamper Certifications Data
1.3.2.2.3
Analyze SAASM Certifications Data
1.3.2.2.4
Analyze Clinger-Cohen Act Certifications Data
Certification Package(s)
Security
Project:
STUAS Project
Organization:
Naval Postgraduate School (N.P.S)
Date:
July 20, 2013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Certifications Need Analysis
1.3.2.3.1
Analyze Spectrum Certifications Data
1.3.2.3.2
Analyze CDL Certifications Data
1.3.2.3.3
Analyze JITC Certifications Data
Certification Package(s)
Interoperability
Project:
STUAS Project
Organization:
Naval Postgraduate School (N.P.S)
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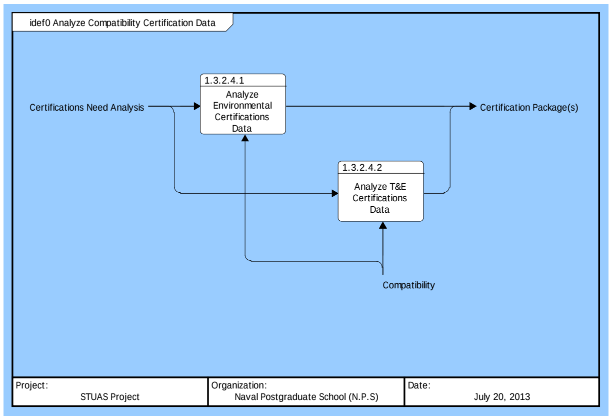
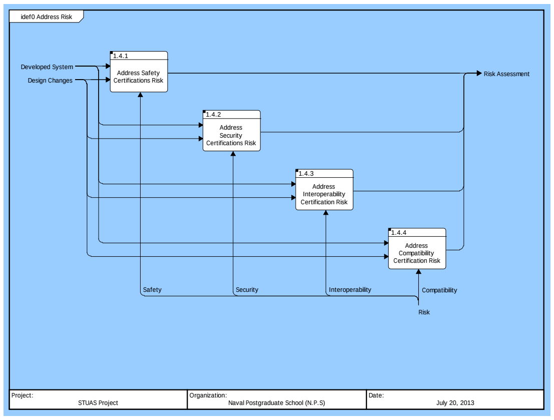

idef0 Analyze Compatibility Certification Data
Certifications Need Analysis
1.3.2.4.1
Analyze Environmental Certifications Data
1.3.2.4.2
Analyze T&E Certifications Data
Certification Package(s)
Compatibility
Project:
STUAS Project
Organization:
Naval Postgraduate School (N.P.S)
Date:
July 20, 2013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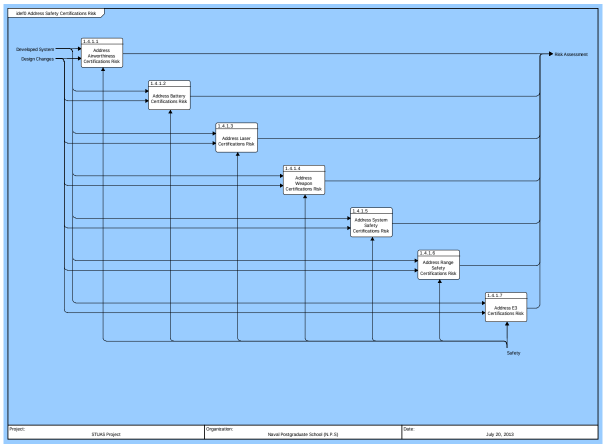
Developed System
Design Changes
1.4.1
Address Safety Certifications Risk
1.4.2
Address Security Certifications Risk
1.4.3
Address Interoperability Certification Risk
1.4.4
Address Compatibility Certification Risk
Risk Assessment
Safety
Security
Interoperability
Compatibility
Risk
Project:
STUAS Project
Organization:
Naval Postgraduate School (N.P.S)
Date:
July 20, 2013


idef0 Address Safety Certifications Risk
1.4.1.1
Address Airworthiness Certifications Risk
1.4.1.2
Address Battery Certifications Risk
1.4.1.3
Address Laser Certifications Risk
1.4.1.4
Address Weapon Certifications Risk
1.4.1.5
Address System Safety Certifications Risk
1.4.1.6
Address Range Safety Certifications Risk
1.4.1.7
Address E3 Certifications Risk
Developed System
Design Changes
Risk Assessment
Safety
Project:
STUAS Project
Organization:
Naval Postgraduate School (N.P.S)
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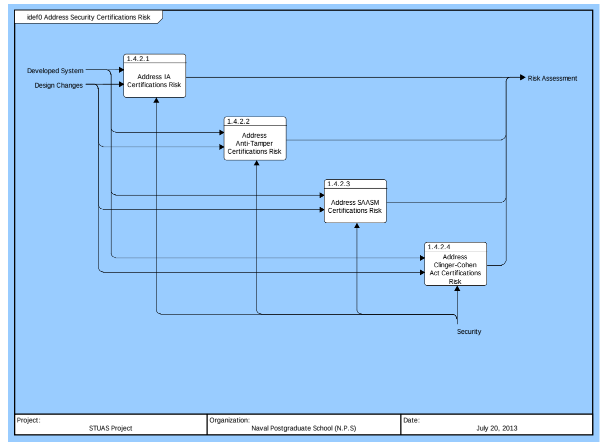
July 20, 2013


idef0 Address Security Certifications Risk
1.4.2.1
Address IA Certifications Risk
1.4.2.2
Address Anti-Tamper Certifications Risk
1.4.2.3
Address SAASM Certifications Risk
1.4.2.4
Address Clinger-Cohen Act Certifications Risk
Developed System
Design Changes
Risk Assessment
Security
Project:
STUAS Project
Organization:
Naval Postgraduate School (N.P.S)
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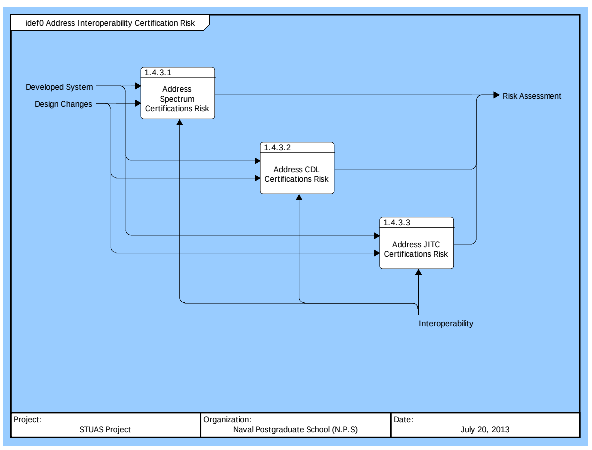
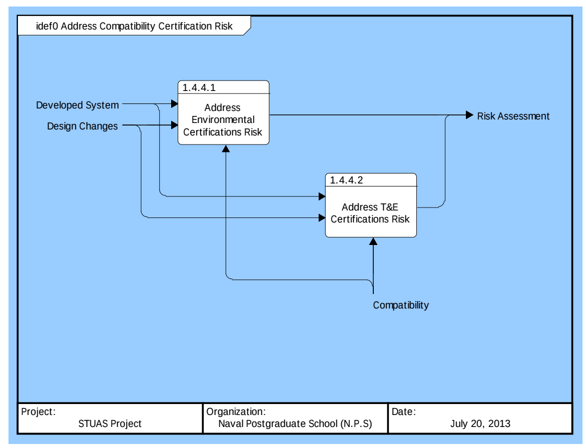

idef0 Address Interoperability Certification Risk
1.4.3.1
Address Spectrum Certifications Risk
1.4.3.2
Address CDL Certifications Risk
1.4.3.3
Address JITC Certifications Risk
Developed System
Design Changes
Risk Assessment
Interoperability
Project:
STUAS Project
Organization:
Naval Postgraduate School (N.P.S)
Date:
July 20, 2013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1.4.4.1
Address Environmental Certifications Risk
1.4.4.2
Address T&E Certifications Risk
Developed System
Design Changes
Risk Assessment
Compatibility
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Organization:
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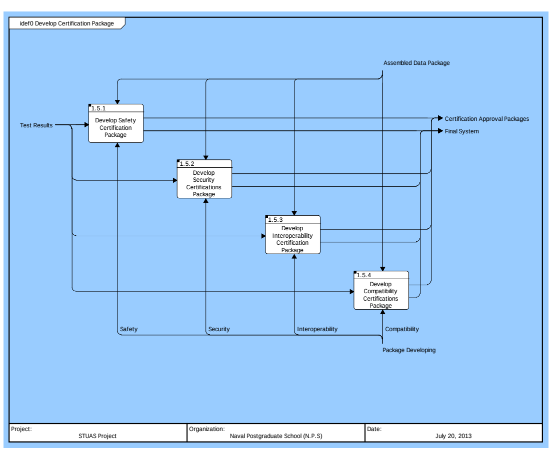
idef0 Develop Certification Package
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Develop Safety Certification Package
1.5.2
Develop Security Certifications Package
1.5.3
Develop Interoperability Certification Package
1.5.4
Develop Compatibility Certifications Package
Test Results
Assembled Data Package
Certification Approval Packages
Final System
Safety
Security
Interoperability
Compatibility
Package Developing
Project:
STUAS Project
Organization:
Naval Postgraduate School (N.P.S)
Date:
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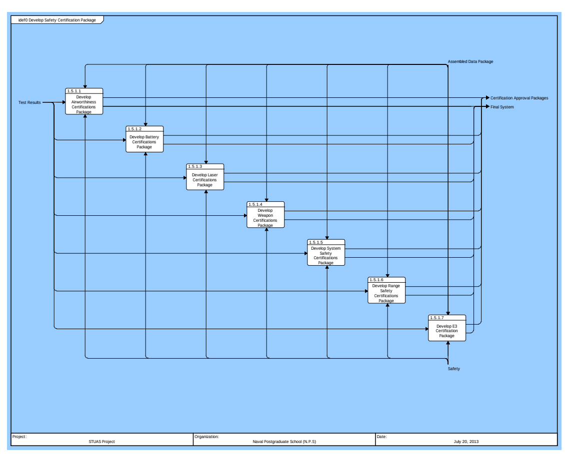
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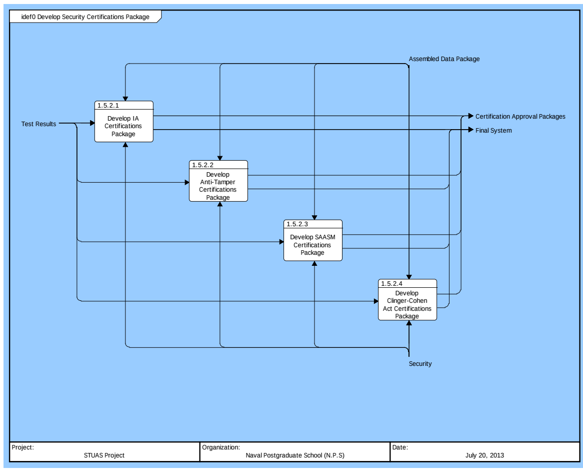
1.5.1.1
Develop Airworthiness Certifications Package
1.5.1.2
Develop Battery Certifications Package
1.5.1.3
Develop Laser Certifications Package
1.5.1.4
Develop Weapon Certifications Package
1.5.1.5
Develop System Safety Certifications Package
1.5.1.6
Develop Range Safety Certifications Package
1.5.1.7
Develop E3 Certification Package
Test Results
Assembled Data Package
Certification Approval Packages
Final System
Safety
Project:
STUAS Project
Organization:
Naval Postgraduate School (N.P.S)
Date:
July 20, 2013



idef0 Develop Security Certifications Package
Assembled Data Package
Test Results
1.5.2.1
Develop IA Certifications Package
1.5.2.2
Develop Anti-Tamper Certifications Package
1.5.2.3
Develop SAASM Certifications Package
1.5.2.4
Develop Clinger-Cohen Act Certifications Package
Certification Approval Packages
Final System
Security
Project:
STUAS Project
Organization:
Naval Postgraduate School (N.P.S)
Date:
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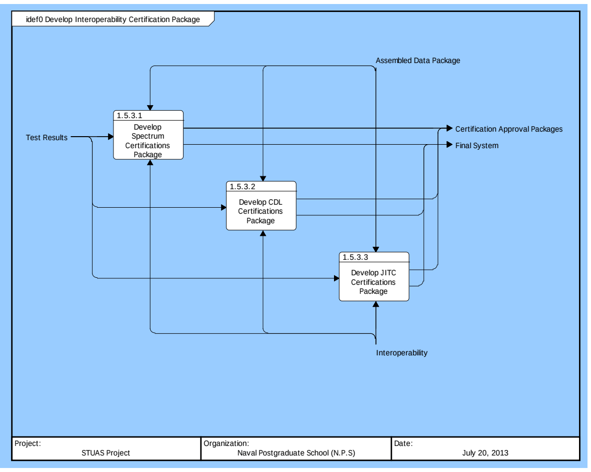
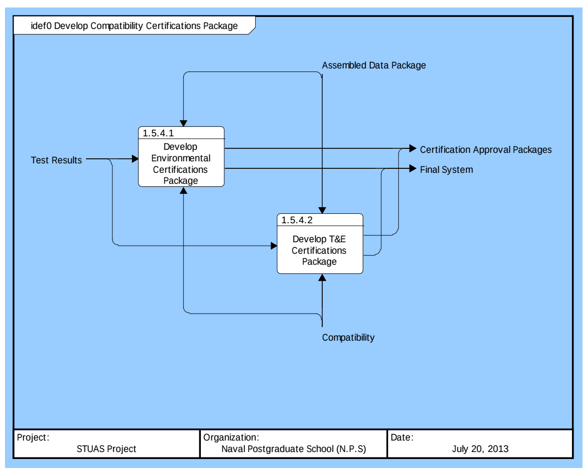


idef0 Develop Interoperability Certification Package
Assembled Data Package
Test Results
1.5.3.1
Develop Spectrum Certifications Package
1.5.3.2
Develop CDL Certifications Package
1.5.3.3
Develop JITC Certifications Package
Certification Approval Packages
Final System
Interoperability
Project:
STUAS Project
Organization:
Naval Postgraduate School (N.P.S)
Date:
July 20, 2013



idef0 Develop Compatibility Certifications Package
Assembled Data Package
Test Results
1.5.4.1
Develop Environmental Certifications Package
1.5.4.2
Develop T&E Certifications Package
Certification Approval Packages
Final System
Compatibility
Project:
STUAS Project
Organization:
Naval Postgraduate School (N.P.S)
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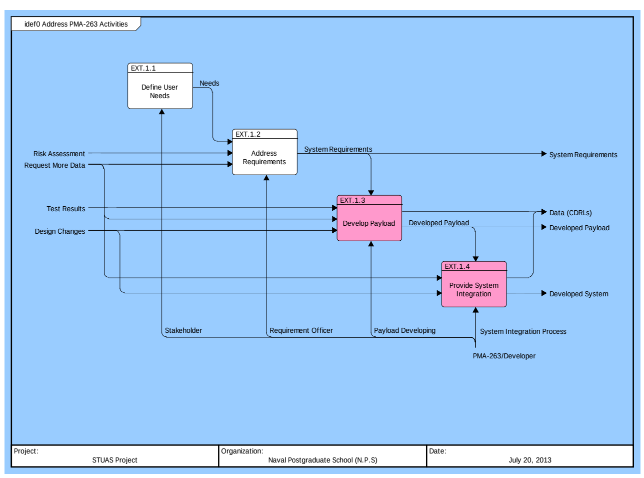

idef0 Address PMA-263 Activities
EXT.1.1
Define User Needs
Needs
EXT.1.2
Address Requirements
Risk Assessment
Request More Data
System Requirements
System Requirements
Test Results
Design Changes
EXT.1.3
Develop Payload
Developed Payload
Data (CDRLs)
Developed Payload
EXT.1.4
Provide System Integration
Developed System
Stakeholder
Requirement Officer
Payload Developing
System Integration Process
PMA-263/Developer
Project:
STUAS Project
Organization:
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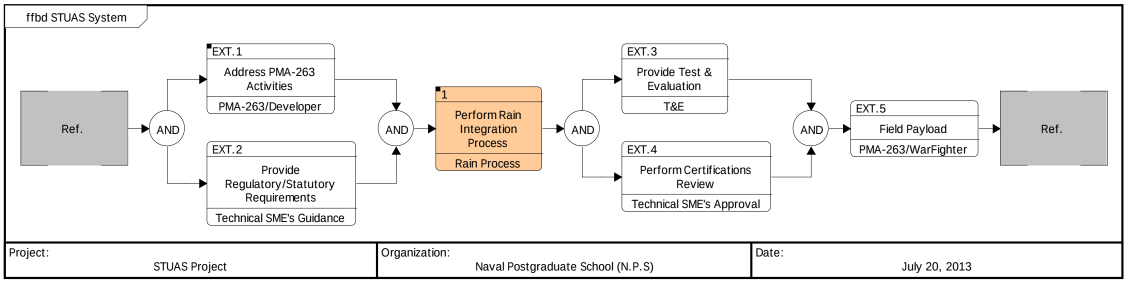
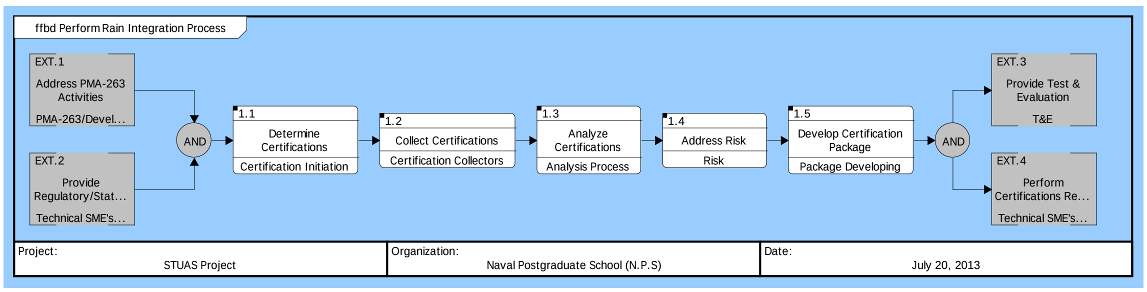
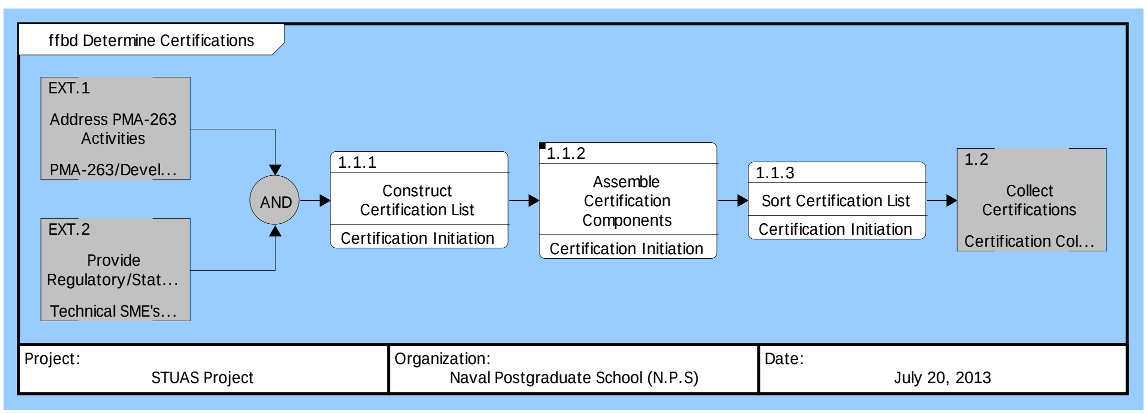
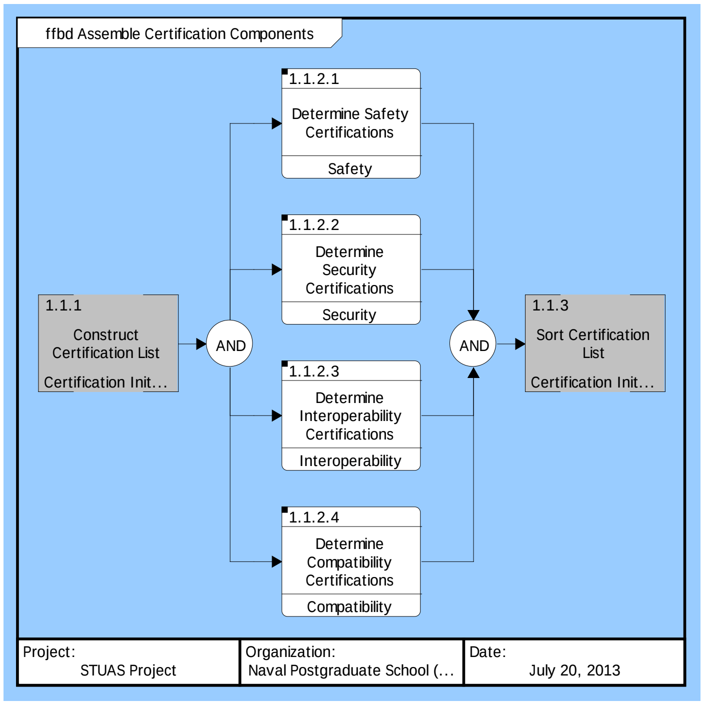
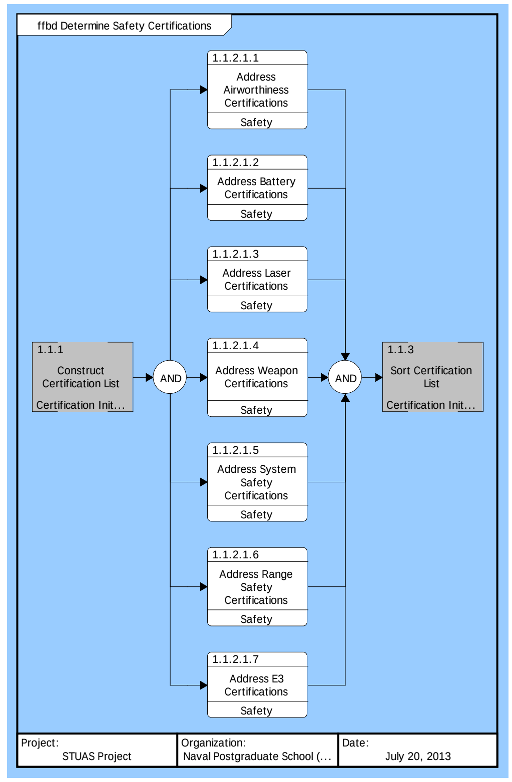
RAIN FFBD Decomposition Section

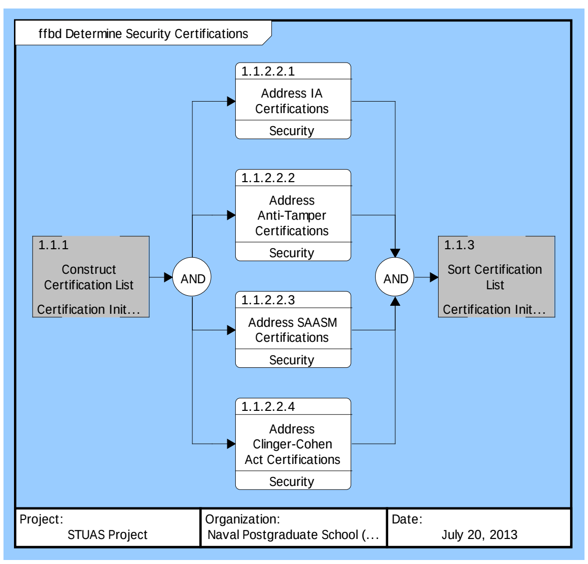







ffbd Assemble Certification Components
1.1.1
Construct Certification List
Certification Init...
AND
1.1.2.1
Determine Safety Certifications
Safety
1.1.2.2
Determine Security Certifications
Security
1.1.2.3
Determine Interoperability Certifications
Interoperability
1.1.2.4
Determine Compatibility Certifications
Compatibility
AND
1.1.3
Sort Certification List
Certification Init...
Project:
STUAS Project
Organization:
Naval Postgraduate School (...
Date:
July 20, 2013


ffbd Determine Safety Certifications
1.1.1
Construct Certification List
Certification Init...
AND
1.1.2.1.1
Address Airworthiness Certifications
Safety
1.1.2.1.2
Address Battery Certifications
Safety
1.1.2.1.3
Address Laser Certifications
Safety
1.1.2.1.4
Address Weapon Certifications
Safety
1.1.2.1.5
Address System Safety Certifications
Safety
1.1.2.1.6
Address Range Safety Certifications
Safety
1.1.2.1.7
Address E3 Certifications
Safety
AND
1.1.3
Sort Certification List
Certification Init...
Project:
STUAS Project
Organization:
Naval Postgraduate School (...
Date:
July 20, 2013


ffbd Determine Security Certifications
1.1.1
Construct Certification List
Certification Init...
AND
1.1.2.2.1
Address IA Certifications
Security
1.1.2.2.2
Address Anti-Tamper Certifications
Security
1.1.2.2.3
Address SAASM Certifications
Security
1.1.2.2.4
Address Clinger-Cohen Act Certifications
Security
AND
1.1.3
Sort Certification List
Certification Init...
Project:
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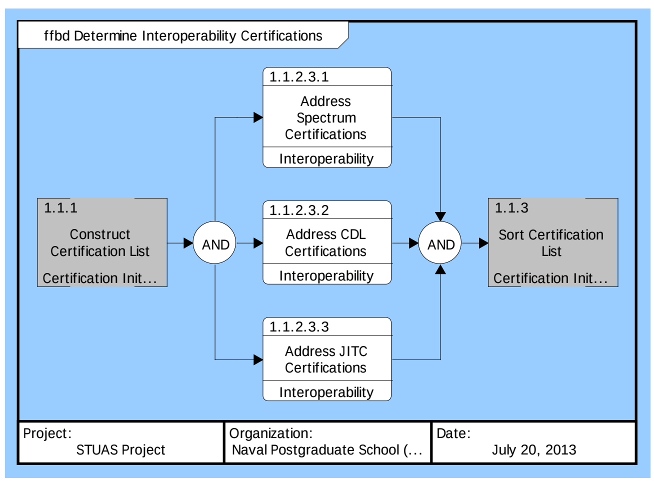
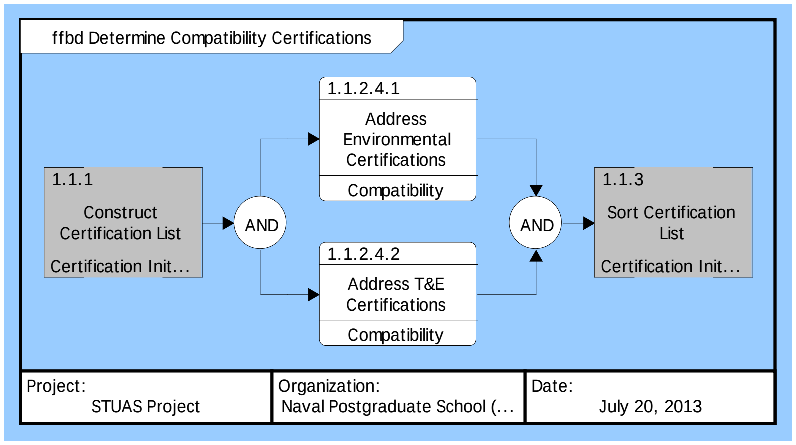

ffbd Determine Interoperability Certifications
1.1.1
Construct Certification List
Certification Init...
AND
1.1.2.3.1
Address Spectrum Certifications
Interoperability
1.1.2.3.2
Address CDL Certifications
Interoperability
1.1.2.3.3
Address JITC Certifications
Interoperability
AND
1.1.3
Sort Certification List
Certification Init...
Project:
STUAS Project
Organization:
Naval Postgraduate School (...
Date:
July 20, 2013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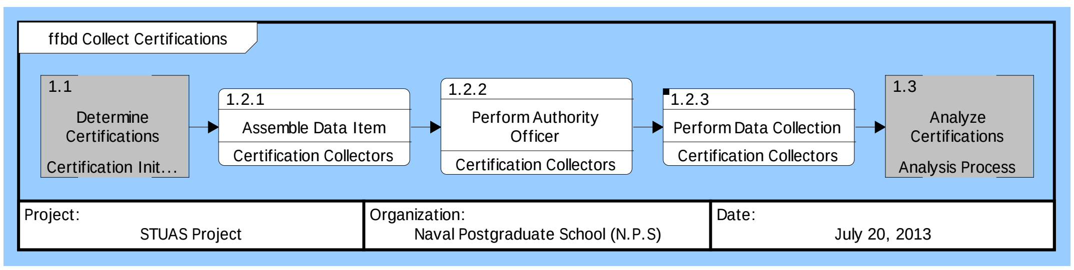
1.1.1
Construct Certification List
Certification Init...
AND
1.1.2.4.1
Address Environmental Certifications
Compatibility
1.1.2.4.2
Address T&E Certifications
Compatibility
AND
1.1.3
Sort Certification List
Certification Init...
Project:
STUAS Project
Organization:
Naval Postgraduate School (...
Date:
July 20, 2013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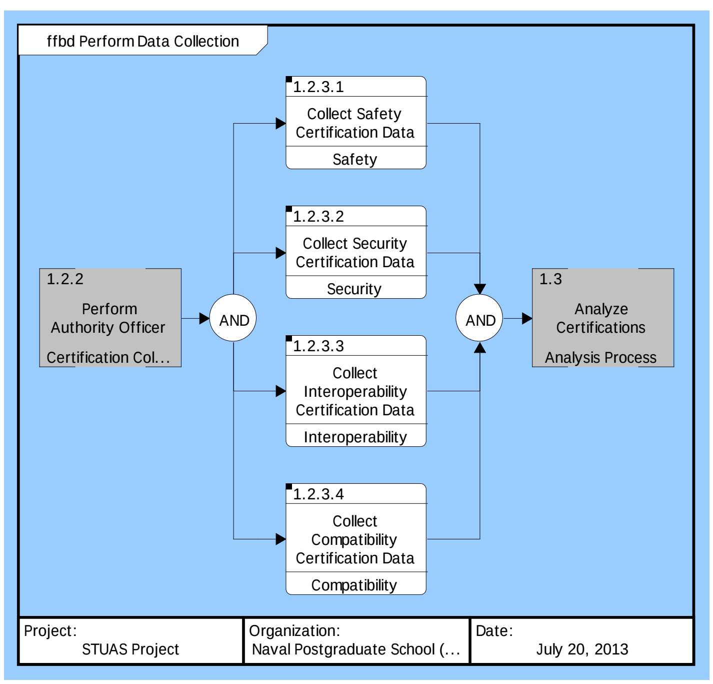
1.1
Determine Certifications
Certification Init...
1.2.1
Assemble Data Item
Certification Collectors
1.2.2
Perform Authority Officer
Certification Collectors
1.2.3
Perform Data Collection
Certification Collectors
1.3
Analyze Certifications
Analysis Process
Project:
STUAS Project
Organization:
Naval Postgraduate School (N.P.S)
Date:
July 20, 2013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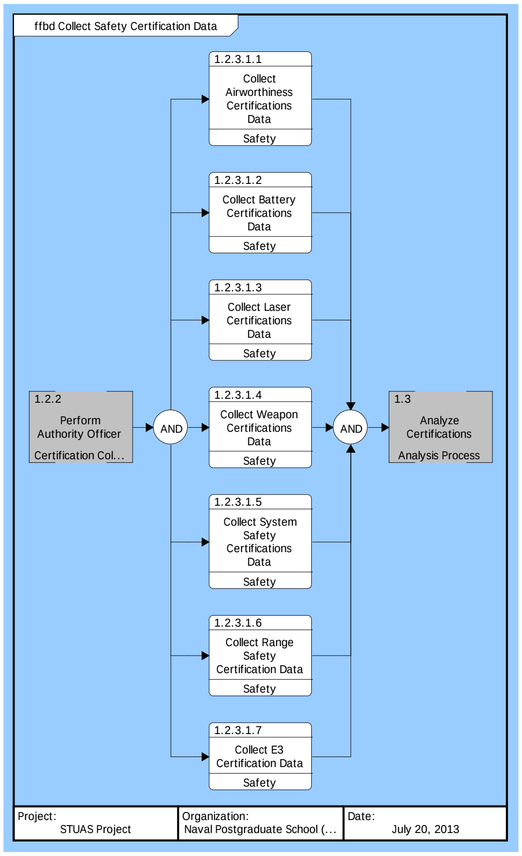
1.2.2
Perform Authority Officer
Certification Col...
AND
1.2.3.1
Collect Safety Certification Data
Safety
1.2.3.2
Collect Security Certification Data
Security
1.2.3.3
Collect Interoperability Certification Data
Interoperability
1.2.3.4
Collect Compatibility Certification Data
Compatibility
AND
1.3
Analyze Certifications
Analysis Process
Project:
STUAS Project
Organization:
Naval Postgraduate School (...
Date:
July 20, 2013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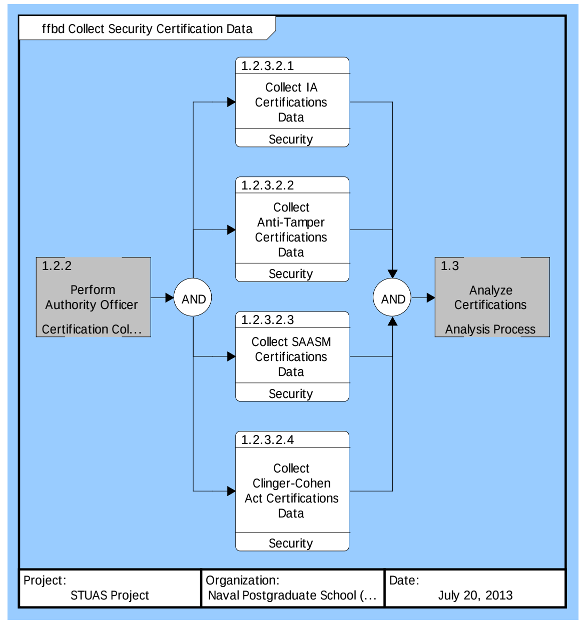
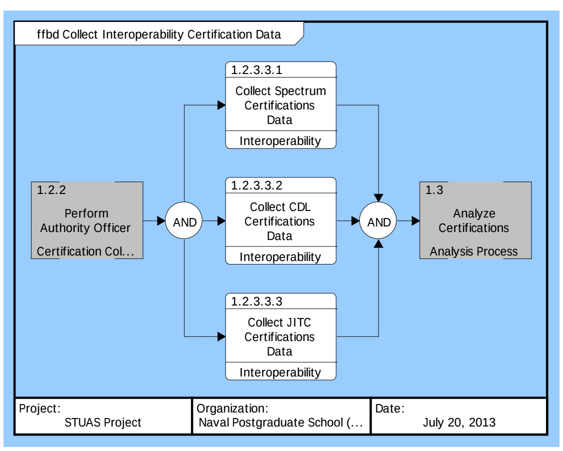
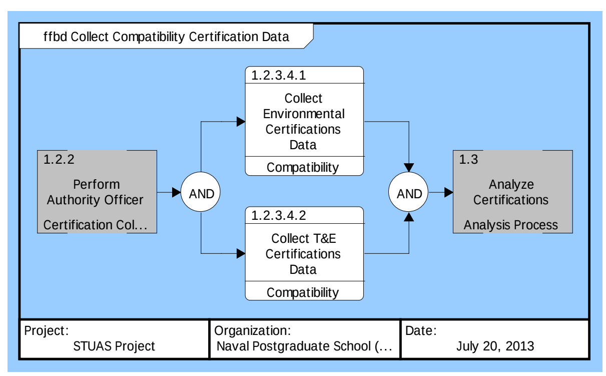
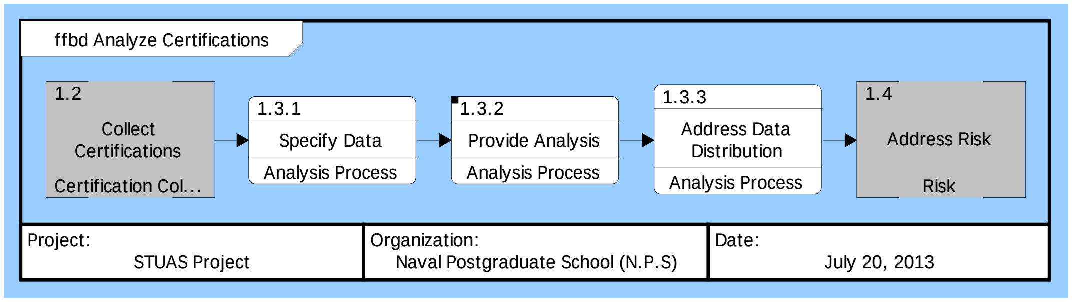
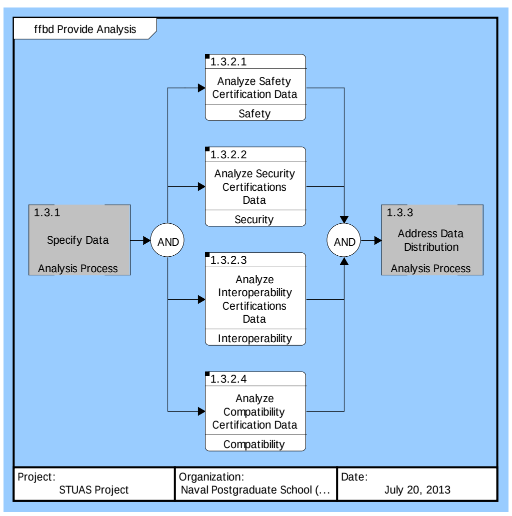
1.2.2
Perform Authority Officer Certification Col...
AND
1.2.3.1.1
Collect Airworthiness Certifications Data
Safety
1.2.3.1.2
Collect Battery Certifications Data
Safety
1.2.3.1.3
Collect Laser Certifications Data
Safety
1.2.3.1.4
Collect Weapon Certifications Data
Safety
1.2.3.1.5
Collect System Safety Certifications Data
Safety
1.2.3.1.6
Collect Range Safety Certification Data
Safety
1.2.3.1.7
Collect E3 Certification Data
Safety
AND
1.3
Analyze Certifications
Analysis Process
Project:
STUAS Project
Organization:
Naval Postgraduate School (...
Date:
July 20, 2013

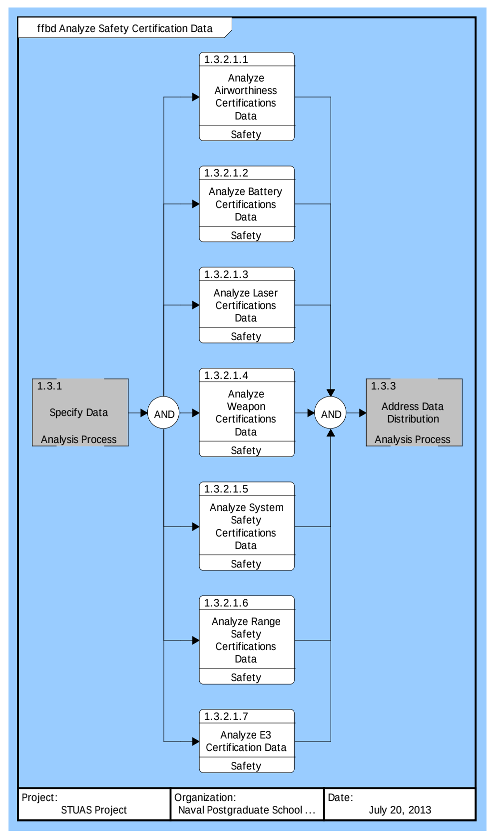

ffbd Collect Security Certification Data
1.2.2
Perform Authority Officer
Certification Col...
AND
1.2.3.2.1
Collect IA Certifications Data
Security
1.2.3.2.2
Collect Anti-Tamper Certifications Data
Security
1.2.3.2.3
Collect SAASM Certifications Data
Security
1.2.3.2.4
Collect Clinger-Cohen Act Certifications Data
Security
AND
1.3
Analyze Certifications
Analysis Process
Project:
STUAS Project
Organization:
Naval Postgraduate School (...
Date:
July 20, 2013

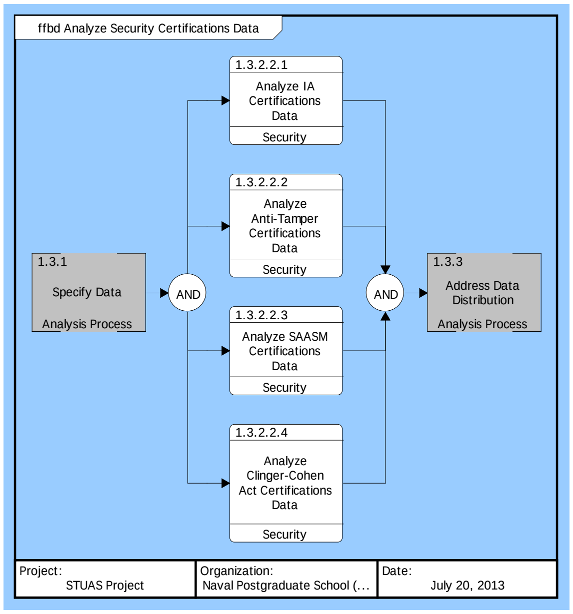

ffbd Collect Interoperability Certification Data
1.2.2
Perform Authority Officer
Certification Col...
AND
1.2.3.3.1
Collect Spectrum Certifications Data
Interoperability
1.2.3.3.2
Collect CDL Certifications Data
Interoperability
1.2.3.3.3
Collect JITC Certifications Data
Interoperability
AND
1.3
Analyze Certifications
Analysis Process
Project:
STUAS Project
Organization:
Naval Postgraduate School (...
Date:
July 20, 2013

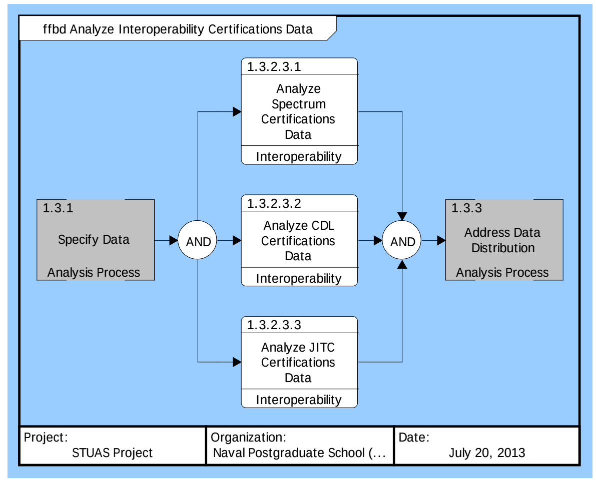

ffbd Collect Compatibility Certification Data
1.2.2
Perform Authority Officer
Certification Col...
AND
1.2.3.4.1
Collect Environmental Certifications Data
Compatibility
1.2.3.4.2
Collect T&E Certifications Data
Compatibility
AND
1.3
Analyze Certifications
Analysis Process
Project:
STUAS Project
Organization:
Naval Postgraduate School (...
Date:
July 20, 2013

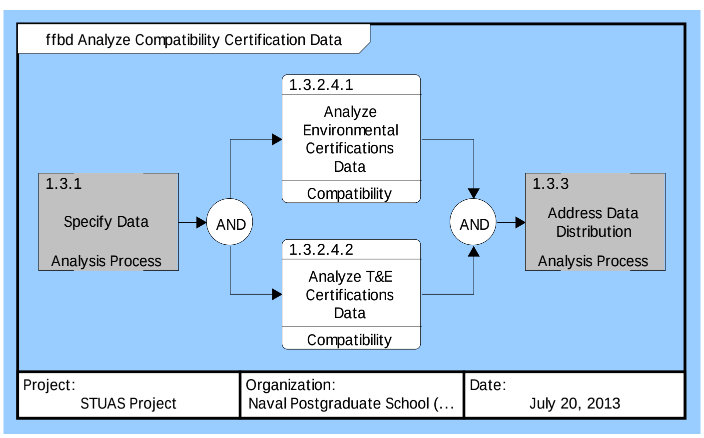

ffbd Analyze Certifications
1.2
Collect Certifications
Certification Col...
1.3.1
Specify Data
Analysis Process
1.3.2
Provide Analysis
Analysis Process
1.3.3
Address Data Distribution
Analysis Process
1.4
Address Risk
Risk
Project:
STUAS Project
Organization:
Naval Postgraduate School (N.P.S)
Date:
July 20, 2013

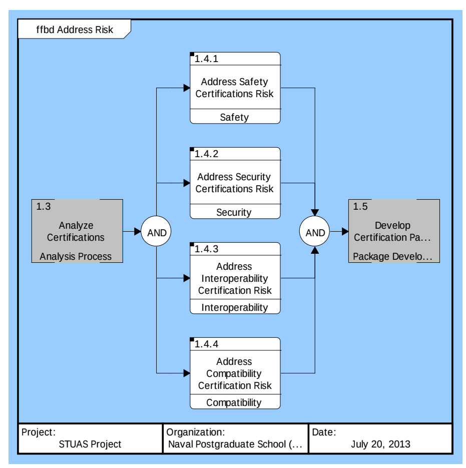

ffbd Provide Analysis
1.3.2.1
Analyze Safety Certification Data
Safety
1.3.2.2
Analyze Security Certifications Data
Security
1.3.1
Specify Data
Analysis Process
AND
AND
1.3.3
Address Data Distribution
Analysis Process
1.3.2.3
Analyze Interoperability Certifications Data
Interoperability
1.3.2.4
Analyze Compatibility Certification Data
Compatibility
Project:
STUAS Project
Organization:
Naval Postgraduate School (...
Date:
July 20, 2013


ffbd Analyze Safety Certification Data
1.3.2.1.1
Analyze Airworthiness Certifications Data
Safety
1.3.2.1.2
Analyze Battery Certifications Data
Safety
1.3.2.1.3
Analyze Laser Certifications Data
Safety
1.3.1
Specify Data
Analysis Process
AND
1.3.2.1.4
Analyze Weapon Certifications Data
Safety
AND
1.3.3
Address Data Distribution
Analysis Process
1.3.2.1.5
Analyze System Safety Certifications Data
Safety
1.3.2.1.6
Analyze Range Safety Certifications Data
Safety
1.3.2.1.7
Analyze E3 Certification Data
Safety
Project:
STUAS Project
Organization:
Naval Postgraduate School ...
Date:
July 20, 2013


ffbd Analyze Security Certifications Data
1.3.1
Specify Data
Analysis Process
AND
1.3.2.2.1
Analyze IA Certifications Data
Security
1.3.2.2.2
Analyze Anti-Tamper Certifications Data
Security
1.3.2.2.3
Analyze SAASM Certifications Data
Security
1.3.2.2.4
Analyze Clinger-Cohen Act Certifications Data
Security
AND
1.3.3
Address Data Distribution
Analysis Process
Project:
STUAS Project
Organization:
Naval Postgraduate School (...
Date:
July 20, 2013


ffbd Analyze Interoperability Certifications Data
1.3.1
Specify Data
Analysis Process
AND
1.3.2.3.1
Analyze Spectrum Certifications Data
Interoperability
1.3.2.3.2
Analyze CDL Certifications Data
Interoperability
1.3.2.3.3
Analyze JITC Certifications Data
Interoperability
AND
1.3.3
Address Data Distribution
Analysis Process
Project:
STUAS Project
Organization:
Naval Postgraduate School (...
Date:
July 20, 2013


ffbd Analyze Compatibility Certification Data
1.3.1
Specify Data
Analysis Process
AND
1.3.2.4.1
Analyze Environmental Certifications Data
Compatibility
1.3.2.4.2
Analyze T&E Certifications Data
Compatibility
AND
1.3.3
Address Data Distribution
Analysis Process
Project:
STUAS Project
Organization:
Naval Postgraduate School (...
Date:
July 20, 2013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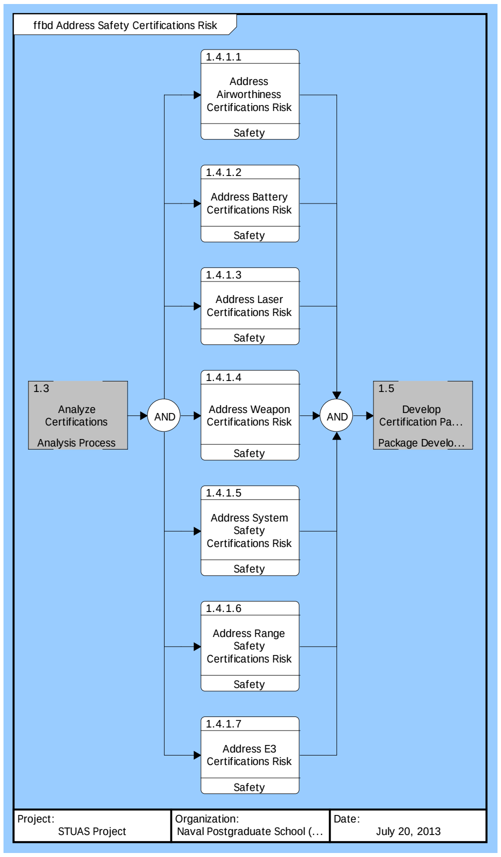
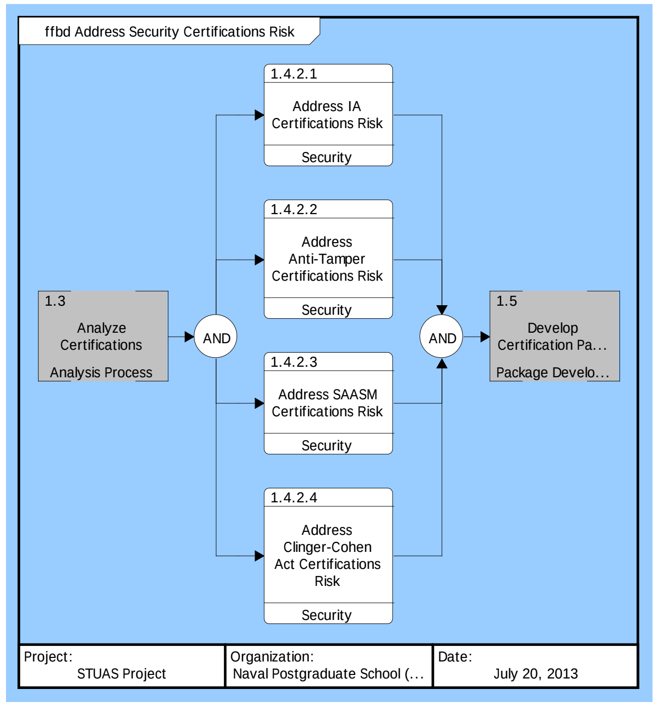
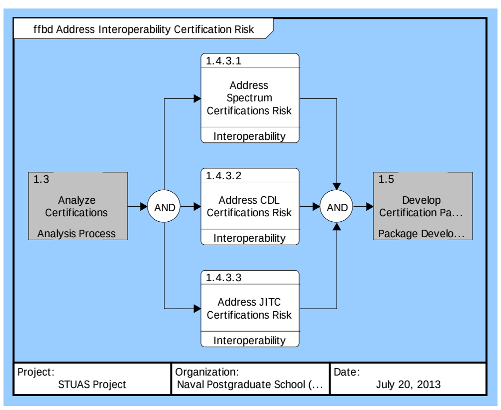
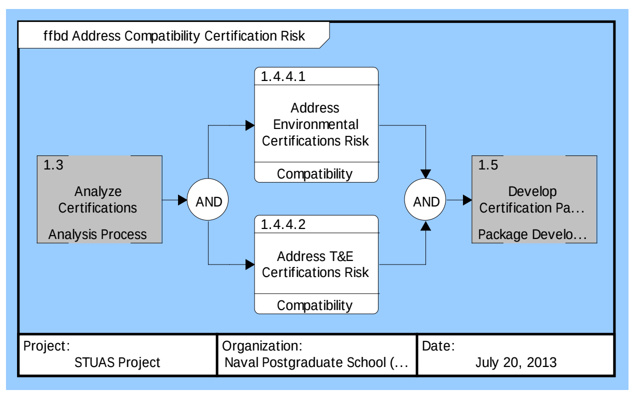
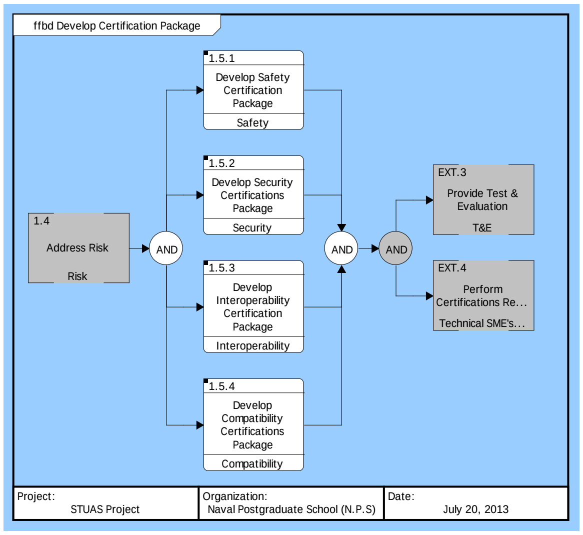
1.3
Analyze Certifications
Analysis Process
AND
1.4.1
Address Safety Certifications Risk
Safety
1.4.2
Address Security Certifications Risk
Security
1.4.3
Address Interoperability Certification Risk
Interoperability
1.4.4
Address Compatibility Certification Risk
Compatibility
AND
1.5
Develop Certification Pa...
Package Develo...
Project:
STUAS Project
Organization:
Naval Postgraduate School (...
Date:
July 20, 2013


ffbd Address Safety Certifications Risk
1.3
Analyze Certifications
Analysis Process
AND
1.4.1.1
Address Airworthiness Certifications Risk
Safety
1.4.1.2
Address Battery Certifications Risk
Safety
1.4.1.3
Address Laser Certifications Risk
Safety
1.4.1.4
Address Weapon Certifications Risk
Safety
1.4.1.5
Address System Safety Certifications Risk
Safety
1.4.1.6
Address Range Safety Certifications Risk
Safety
1.4.1.7
Address E3 Certifications Risk
Safety
AND
1.5
Develop Certification Pa…
Package Develo…
Project: STUAS Project
Organization: Naval Postgraduate School (…
Date: July 20, 2013


ffbd Address Security Certifications Risk
1.3
Analyze Certifications
Analysis Process
AND
1.4.2.1
Address IA Certifications Risk
Security
1.4.2.2
Address Anti-Tamper Certifications Risk
Security
1.4.2.3
Address SAASM Certifications Risk
Security
1.4.2.4
Address Clinger-Cohen Act Certifications Risk
Security
AND
1.5
Develop Certification Pa…
Package Develo…
Project: STUAS Project
Organization: Naval Postgraduate School (…
Date: July 20, 2013


ffbd Address Interoperability Certification Risk
1.3
Analyze Certifications
Analysis Process
AND
1.4.3.1
Address Spectrum Certifications Risk
Interoperability
1.4.3.2
Address CDL Certifications Risk
Interoperability
1.4.3.3
Address JITC Certifications Risk
Interoperability
AND
1.5
Develop Certification Pa…
Package Develo…
Project: STUAS Project
Organization: Naval Postgraduate School (…
Date: July 20, 2013


ffbd Address Compatibility Certification Risk
1.3
Analyze Certifications
Analysis Process
AND
1.4.4.1
Address Environmental Certifications Risk
Compatibility
1.4.4.2
Address T&E Certifications Risk
Compatibility
AND
1.5
Develop Certification Pa…
Package Develo…
Project: STUAS Project
Organization: Naval Postgraduate School (…
Date: July 20, 2013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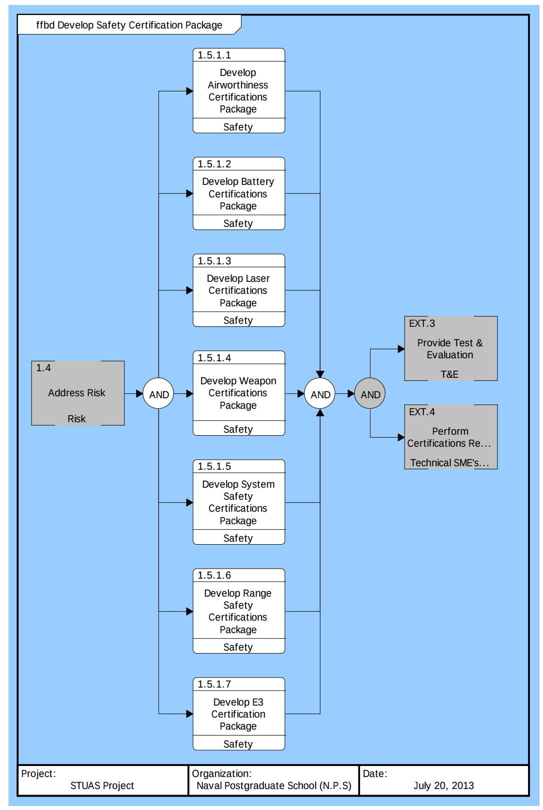
1.4
Address Risk
Risk
AND
1.5.1
Develop Safety Certification Package
Safety
1.5.2
Develop Security Certifications Package
Security
1.5.3
Develop Interoperability Certification Package
Interoperability
1.5.4
Develop Compatibility Certifications Package
Compatibility
AND
AND
EXT.3
Provide Test & Evaluation
T&E
EXT.4
Perform Certifications Re...
Technical SME's...
Project:
STUAS Project
Organization:
Naval Postgraduate School (N.P.S)
Date:
July 20, 2013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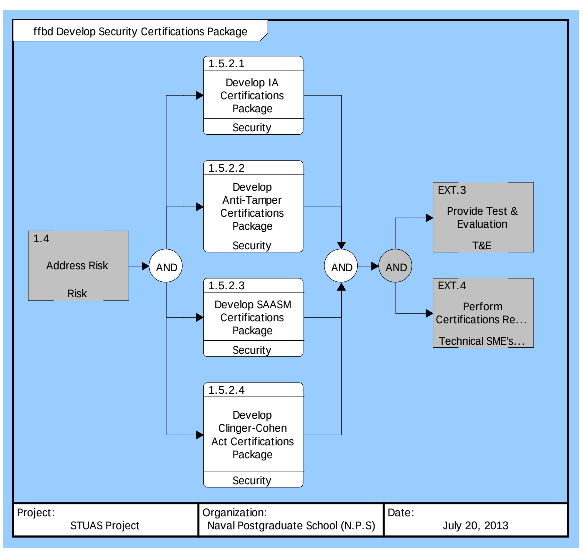
1.4
Address Risk
Risk
AND
1.5.1.1
Develop Airworthiness Certifications Package
Safety
1.5.1.2
Develop Battery Certifications Package
Safety
1.5.1.3
Develop Laser Certifications Package
Safety
1.5.1.4
Develop Weapon Certifications Package
Safety
1.5.1.5
Develop System Safety Certifications Package
Safety
1.5.1.6
Develop Range Safety Certifications Package
Safety
1.5.1.7
Develop E3 Certification Package
Safety
AND
AND
EXT.3
Provide Test & Evaluation
T&E
EXT.4
Perform Certifications Re...
Technical SME's...
Project:
STUAS Project
Organization:
Naval Postgraduate School (N.P.S)
Date:
July 20, 2013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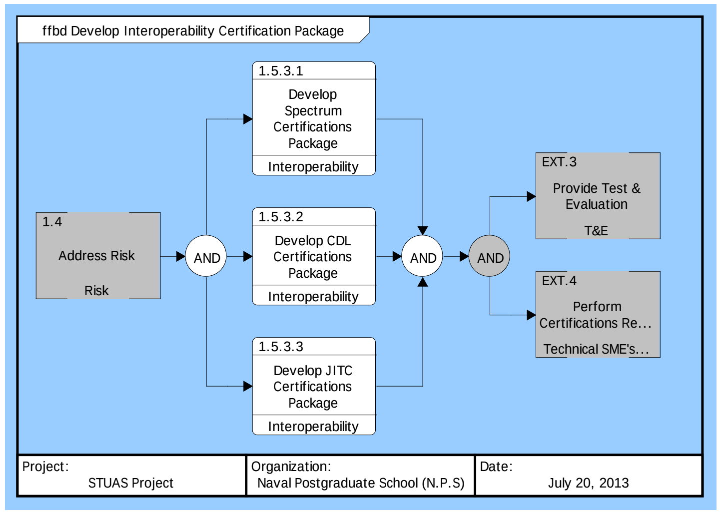
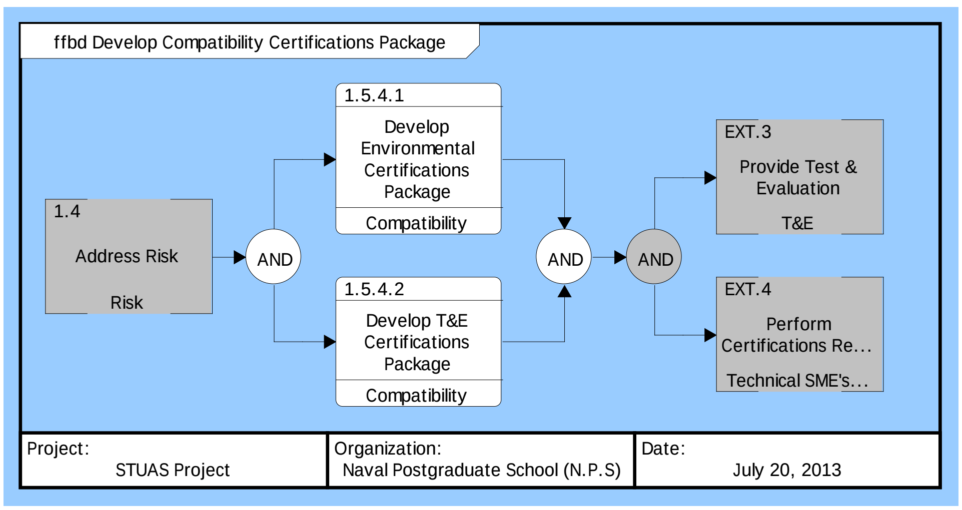
1.4
Address Risk
Risk
AND
1.5.2.1
Develop IA Certifications Package
Security
1.5.2.2
Develop Anti-Tamper Certifications Package
Security
1.5.2.3
Develop SAASM Certifications Package
Security
1.5.2.4
Develop Clinger-Cohen Act Certifications Package
Security
AND
AND
EXT.3
Provide Test & Evaluation
T&E
EXT.4
Perform Certifications Re...
Technical SME's...
Project:
STUAS Project
Organization:
Naval Postgraduate School (N.P.S)
Date:
July 20, 2013


ffbd Develop Interoperability Certification Package
1.5.3.1
Develop Spectrum Certifications Package
Interoperability
1.5.3.2
Develop CDL Certifications Package
Interoperability
1.5.3.3
Develop JITC Certifications Package
Interoperability
1.4
Address Risk
Risk
AND
AND
AND
EXT.3
Provide Test & Evaluation
T&E
EXT.4
Perform Certifications Re…
Technical SME's…
Project:
STUAS Project
Organization:
Naval Postgraduate School (N.P.S)
Date:
July 20, 2013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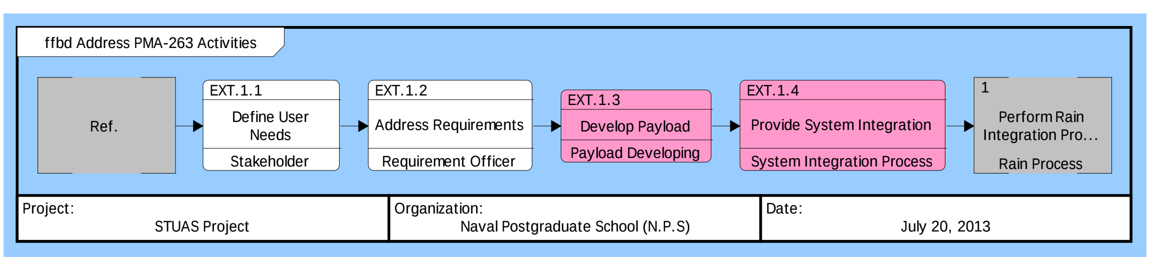
1.5.4.1
Develop Environmental Certifications Package
Compatibility
1.5.4.2
Develop T&E Certifications Package
Compatibility
1.4
Address Risk
Risk
AND
AND
AND
EXT.3
Provide Test & Evaluation
T&E
EXT.4
Perform Certifications Re…
Technical SME's…
Project:
STUAS Project
Organization:
Naval Postgraduate School (N.P.S)
Date:
July 20, 2013


ffbd Address PMA-263 Activities
Ref.
EXT.1.1
Define User Needs
Stakeholder
EXT.1.2
Address Requirements
Requirement Officer
EXT.1.3
Develop Payload
Payload Developing
EXT.1.4
Provide System Integration
System Integration Process
1
Perform Rain Integration Pro…
Rain Process
Project:
STUAS Project
Organization:
Naval Postgraduate School (N.P.S)
Date:
July 20, 2013

APPENDIX D. RESEARCH

Certification Research Information
Cost Model Research Information

Requirments		Assigned To	In Scope		Requirements Tracability							Testing
Level 1	Level 2		(Y/N)	S/R	Guiding Instruction	Sub Instruction	Approval Authority	Interim Approval (Y/N)	Waivable (Y/N)	Waiver Authority	Documentation	Y/N
CDL		3	Y	S	H.R.1815 National Defense Authorization Act for Fiscal Year 2006	ASD Memo Dec 30 2005 Subject DoD CDL Pilicy	MDA	N	Y	DoD CIO	Tech data	N
Flight Cert (IFC)		Perez	Y	S	Title 49 USC, Sec 40103 - Sovereignty and use of airspace	NAVAIRINST 13034.1D	4.0P - Airworthiness Office	N	N	N/A	IFC	N
	Risk Assessment Questionnaire										RCC 323	
	HPOL										HPOL	
	EDRAP										completed data requirements pkg spreadsheet	
	LSRB										laser certification	
	NOSSA										battery certification	
	Risks										SSRA (System Safety Risk Assessment)	
E3 (Electromagnetic Environmental Effects)	The requirements for the below E3 items are tailored in the E3 Integration and Analysis Report.	Ironhill	Y		SECNAVINST 5000.2D, OPNAVINST 2400.20F & NAVAIRINST 2400.1	MIL-STD-464C				CNO (N6)	E3 Integration and Analysis Report	N
	EMC (Intra-system)	Ironhill	Y	R	MIL-STD-464C		E3 Division (AIR-4.1.13)	N	Y	CNO (N6)	E3 Verification Report	Y
	EMI	Ironhill	Y	R	MIL-STD-464C	MIL-STD-461F	AIR-4.1.13	N	Y	CNO (N6)	E3 Verification	Y
	EMP	Ironhill	Y	R	MIL-STD-464C		AIR-4.1.13	N	Y	CNO (N6)	E3 Verification	Y
	EMV (Inter-system EMC)	Ironhill	Y	R	MIL-STD-464C		AIR-4.1.13	N	Y	CNO (N6)	E3 Verification	Y
	ESD	Ironhill	Y	R	MIL-STD-464C		AIR-4.1.13	N	Y	CNO (N6)	E3 Verification	Y
	HERO Testing	Ironhill	Y	R	MIL-STD-464C	NAVAIR 16-1-529	NOSSA	N	Y	WSESRB & NOSSA	E3 Verification Report	Y
	RADHAZ	Ironhill	Y	R	MIL-STD-464C		AIR-4.1.13	N	Y	CNO (N6)	RADHAZ Analysis for HERF/O/P	N
	HERF Analysis	Ironhill	Y	R	MIL-STD-464C		Aircraft - AIR-4.1.13 Ship & Shore - NOSSA	N	Y	CNO (N6)	E3 Verification Report	N
	HERO Analysis	Ironhill	Y	R	MIL-STD-464C	NAVAIR 16-1-529	NOSSA	N	Y	WSESRB & NOSSA	E3 Verification Report	Y
	HERP Analysis	Ironhill	Y	R	MIL-STD-464C		Aircraft - AIR-4.1.13 Ship & Shore - NOSSA	N	Y	CNO (N6)	E3 Verification Report	N
	Bonding & grounding ???	Ironhill	Y	R	MIL-STD-464C		AIR-4.1.13	N	Y	CNO (N6)	E3 Verification	Y
	Lightning	Ironhill	Y	R	MIL-STD-464C		AIR-4.1.13	N	Y	CNO (N6)	E3 Verification	Y
	P-Static	Ironhill	Y	R	MIL-STD-464C		AIR-4.1.13	N	Y	CNO (N6)	E3 Verification	N
Environmental Qualification	MIL-STD-810G tests with 24 hour salt fog, Humidity, Temp	Lancaster	Y	S	SECNAVINST 5000.2 Corrosion Control Plan for Air Vehicle /PMA-263	MIL-STD-810G	AIR-4.3.4 Materials Division, AIR- 4.3.4.6 Corrosion & Wear	N	Y	AIR 4.3.4	Certified Lab Report(s)	Y

Certification Research Matrix Detail 1 of 6

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Requirments		Assigned To	In Scope		Requirements Tracability							Testing
2	Level 1	Level 2		(Y/N)	S/R	Guiding Instruction	Sub Instruction	Approval Authority	Interim Approval (Y/N)	Waivable (Y/N)	Waiver Authority	Documentation	Y/N
33		Disposal Plan	NA	N	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0
34					S	Title 21, Code of Federal Regulations (CFR), Parts 1040, 1040.10, and 1040.11	DoD Instruction 6055.15	LSRB	Y	N	NA	Laser Certification	Y
35	LSRB Approval	Laser radiation hazard evaluation	Otis	Y	R	DoD Instruction 6055.15	OPNAVINST 5100.27B	LSRB	N	N	NA	LASER Characterization Test Report (ANSI Z136.4, Recommended Practice for Laser Safety Measurements for Hazard Evaluation)	Y
36		Laser design checklist			R	DoD Instruction 6055.15	OPNAVINST 5100.27B	LSRB	N	N	NA	Design Checklist 5100.27B	N
37		FDA mil-exempt letter			R	DoD Instruction 6055.15	Exemption No. 76EL-01DOD, Letter of Exemption from the Food and Drug Administration (FDA) for DoD Exemption from Provisions of 21 CFR 1040	LSRB	N	N	NA	Exemption Leter	N
38	Battery Approval	Some Li batteries do not require safety (see NAVSEA S9310-AQ-SAF-010 for details), but a safety assessment must be completed. The NOSSA Technical Agent will determine the level of 9310 safety testing required based on the documentation provided with the approval request.	Tran	Y	R	NAVSEAINST 9310.1B	All sub instruction are contained in NAVSEA S9310-AQ-SAF-010	NOSSA/NAVAIR 4.4.5.2	Y	NO, NOSSA will not issue a waiver for 9310 safety requirements, but may issue a interim approval to operate the subject battery for a limited amount of time.	NOSSA and NAVAIR (4.4.5.2): Although waivers are not granted, an interim approval may be granted, but the NOSSA and NAVAIR 4.4.5.2 must concur with the interim approval.	Battery certification Battery exemption	Y
39		Product spec for battery cell										battery cell drawing	
40		Battery schematic (cell & control board)										battery schematic drawing	
41		CONOPS										CONOPS	
42		Operator's Manual										payload technical manual	
43		Battery safety data package										safety data package	
44		Request letter										Request letter signed by PMA	
45												ATO	
46		SCG (Security Classification Guide)										SCG	
47	IA (Information Assurance)	System data	Tran	Y	S	DODD 8500.01E DODI 8500.2	DODI 8510.01	ODAA (Operational Designated Accrediting Authority)	Y: IATT (Interim Authority to Test) IATO (Interim Authority to Operate) By DAA (Designated Accrediting Authority)	N	N/A	- Configuration & architecture description - Network architecture diagram - Ports & protocols list - HW/SW list - vulnerabilities scan	Y
48		CONOPS										CONOPS	
49	AT (Anti-Tamper)		Tran	Y	S	DODI 5000.2, 5200.39	AT Guidelines Version 2	AT EA	Y	N	AT EA	AT Plan, CPI Assesment	Y

Certification Research Matrix Detail 2 of 6

	A	B	D	E	F	G	H	I	J	K	L	M
1	**Requirments**		**In Scope**	**Requirements Tracability**								**Testing**
2	Level 1	Level 2	(Y/N)	S/R	Guiding Instruction	Sub Instruction	Approval Authority	Interim Approval (Y/N)	Waivable (Y/N)	Waiver Authority	Documentation	Y/N
50 51 52	CCA (Clinger-Cohen Act)		Y	S	DoDI 5000.2	SECNAVINST 5000.2	Cognizant CIO	N	N	N/A	CCA Comliance Table populated with MDA specified program governing documentation and an Acquisition Information Assurance Strategy (Note 1)	N
53	Spectrum		Y	S	Title 47 US Code §305, §901-904	47 CFR 300 DoD 4650.01 SECNAVINST 2400.1 OPNAVINST 2400.20F NAVAIR INST 2400.1	National Telecommunications and Information Administration		N	N/A	JF-12 Note to Holder (NTH)	N
54		1. Equipment Spectrum Certification (Frequency Allocation) 1494 (SPS & JF-12)					NTIA Spectrum Planning Subcommittee	Y - with submission to SPS			1494 in EL-CID Format	M
55		2. Assignments					NTIA Frequency Assignment Subcommittee	Y - Temporary Assignments based on SPS submission or local NTIA 7.11 Authority			Standard Frequency Action Format (SFAF)	N
56	System Safety Approval		Y	S	MIL-STD 882 DODI 5000.02	NAVAIRINST 5100.11	PMA	N	N	N/A	SSRA	Y
57	T&E	Range Safety Approval	Y	S	DODD 3200.15	OPNAVINST 3550.1A	Range Safty Officer	N	N	N/A		N
58		DT	Y	S	DoD Directive 5000.1, Defense Acquisition Systems (DAS) DoD Instruction 5000.02, Operation of the DAS CJCSI 3170.01, Joint Capabilities Intergration & Development System (JCIDS)	SECNAVINST 5000.2, Department of the Navy (DON) Implementation & Operation of the DAS & the JCIDS NAVAIRINST 3960.2, Acquisition Test & Evalustion	Air 5.0	Y	Y	PMA	TEMP Test Plan Test Supportability Plan Test Cards Test Reports	Y
59		OT	Y	S			VX - XX	N	N	N/A		Y
60	WSESRB Approval		Y	R	NAVSEAINST 8020.6D	Enclosure (1) Membership, Responsibilities and Procedures of the Navy's Weapon System Explosives Safety Review Board	Recommendations to PM, CNO, and MDA by the WSESRB.	N	Y	High Risk = ASN(RDA) Serious Risk = PEO Mod/Low Risk = PM	Entry: Review request from PM to WSESRB secretariat member. Technical data packages. Exit: WSESRB findings / recommendations.	N
61	JITC		Y	R	DODD 4630.5 DODI 4630.8 DODI 5000.1 DODI 5000.2 CJCSI6212.01D CJCSI3170.01F CJCSM3710.01C		J-6	Y	N	N/A	ICEP/ITP DODAF Views: STV-1, SV-6 or OV-3, SV-4, SV-1, & SV-2 at a minimum.	M
64	Selective Availability Anti-Spoofing Module (SAASM)		Y	R	DoD GPS Security Policy 04 April 2006	2007 CJCS Master Positioning, Navigation, And Timing Plan CJCSI 6130.01D 13 April 2007	GPS Directorate (GPSD)	N	Y	Assistant Secretary of Defense	Tech Data	Y
65		Security Approval for SAASM Host Application Equipment (HAE)			2007 CJCS Master Positioning, Navigation, And Timing Plan CJCSI 6130.01D 13 April 2007	GPU-09-105 Security Approval Review Process Reqt Doc for GPS SAASM HAE		N	N			Y
66		SAASM Design Requirements for HAE. (SAASM Functionalities, including Extended Functions)			GPU-09-105 Security Approval Review Process Reqt Doc for GPS SAASM HAE	ICD-GPS-227 GPS HAE Design Requirements with SAASM		N	N			Y

Certification Research Matrix Detail 3 of 6

	A	B	N	O	P	Q	R	S	T	U	V
1	Requirments		Cost (FY$K)			Lead Time (Weeks)			Duration (Weeks)		
2	Level 1	Level 2	Low	Med	High	Low	Med	High	Low	Med	High
3	CDL		$0.0	$0.0	$0.0	0	0	0	26	52	104
4	Flight Cert (IFC)										
5		Risk Assessment Questionnaire									
6		HPOL									
7		EDRAP	$0.0	$0.0	$0.0	3	8	20	2	3	4
8		LSRB									
9		NOSSA									
10		Risks									
15	E3 (Electromagnetic Environmental Effects)	The requirements for the below E3 items are tailored in the E3 Integration and Analysis Report.	$8.7	$9.2	$10.0	0	0	0	2	2.18	2.48
16		EMC (Intra-system)	$1.5	$1.6	$1.7	0	0.6	1	0.2	0.218	0.248
17		EMI	$24.0	$25.4	$27.6	0	0.6	1	2	2.18	2.48
18		EMP	$12.0	$12.7	$13.8	0	0.6	1	2	2.18	2.48
19		EMV (Inter-system EMC)	$294.0	$320.5	$364.6	1	25	52	2	2.5	3
20		ESD	$6.0	$6.4	$6.9	0	0.6	1	1	1.09	1.24
21		HERO Testing	$314.0	$342.3	$389.4	1	25	52	2	2.5	3
22		RADHAZ	$2.7	$2.9	$3.1	0	0.6	1	0.4	0.436	0.496
23		HERF Analysis	$6.0	$6.4	$6.9	0	0	0	1	1.09	1.24
24		HERO Analysis	$6.0	$6.4	$6.9	0	0	0	1	1.09	1.24
25		HERP Analysis	$6.0	$6.4	$6.9	0	0	0	1	1.09	1.24
26		Bonding & grounding ???	$6.0	$6.4	$6.9	0	0.6	1	1	1.09	1.24
27		Lightning	$80.0	$84.8	$92.0	0	0.6	1	2	2.18	2.48
28		P-Static	$6.0	$6.4	$6.9	0	0.6	1	1	1.09	1.24
29	Environmental Qualification	MIL-STD-810G tests with 24 hour salt fog, Humidity, Temp	$3.0	$5.0	$8.0	1	2	4	0.14	0.42	1

Certification Research Matrix Detail 4 of 6

Requirments		Cost (FY$K)			Lead Time (Weeks)			Duration (Weeks)		
Level 1	Level 2	Low	Med	High	Low	Med	High	Low	Med	High
	Disposal Plan	0	0	0	0	0	0	0	0	0
LSRB Approval		$0.0	$0.0	$0.0	3	5	7	0.2	0.4	2
	Laser radiation hazard evaluation	$10.0	$12.7	$20.0	3	5	7	1	2	3
	Laser design checklist	$0.0	$0.0	$0.0	2	4	8	1	2	3
	FDA mil-exempt letter	$0.0	$0.0	$0.0	1	3	5	0.2	0.4	1
Battery Approval	Some Li batteries do not require safety (see NAVSEA S9310-AQ-SAF-010 for details), but a safety assessment must be completed. The NOSSA Technical Agent will determine the level of 9310 safety testing required based on the documentation provided with the approval request.	$3.0	$42.0	$80.0	0	4	8	2	14	26
	Product spec for battery cell									
	Battery schematic (cell & control board)									
	CONOPS									
	Operator's Manual									
	Battery safety data package									
	Request letter									
IA (Information Assurance)										
	SCG (Security Classification Guide)									
	System data	$0.0	$0.0	$0.0	0	24	52	1	4	4.1
	CONOPS									
AT (Anti-Tamper)		Done as part of T&E. Esp. Evaluation.								

Certification Research Matrix Detail 5 of 6

	A	B	N	O	P	Q	R	S	T	U	V
1	Requirments		Cost (FY$K)			Lead Time (Weeks)			Duration (Weeks)		
2	Level 1	Level 2	Low	Med	High	Low	Med	High	Low	Med	High
50 51 52	CCA (Clinger-Cohen Act)		$6.0	$29.0	$51.0	5.4	9	11.4	1	2	3
53	Spectrum		$0.0	$0.0	$0.0	0	0	0	0	0	0
54		1. Equipment Spectrum Certification (Frequency Allocation) 1494 (SPS & JF-12)	$5.0	$10.0	$15.0	4	8	12	26	39	52
55		2. Assignments	$0.0	$0.0	$0.0	4	8	12	9	18	26
56	System Safety Approval		$3.0	$25.0	$50.0	Shared with IFC lead time.			0.1	4	26
57	T&E	Range Safety Approval	$0.0	$0.0	$0.0	1	3	4	1	3	4
58		DT	$100.0	$200.0	$800.0	2	5	8	1	3	12
59		OT	$100.0	$300.0	$1,000.0	20	24	32	0.5	1	2
60	WSESRB Approval		$1.5	$2.0	$3.0	5	8	12	0.1	0.6	1
61	JITC		$0.0	$0.0	$0.0	4	8	12	10	12	13
64	Selective Availability Anti-Spoofing Module (SAASM)		0	0	0	0	0	0	0	0	0
65		Security Approval for SAASM Host Application Equipment (HAE)	0	0	0	0	0	0	26	52	104
66		SAASM Design Requirements for HAE. (SAASM Functionalities, including Extended Functions)	$20.0	$25.0	$35.0	4	8	12	1	1.5	2.5

Certification Research Matrix Detail 6 of 6

Requirments		Cost (FY$K)			Cert
Level 1	Level 2	Low	Med	High	($K)
Flight Cert (IFC)	EDRAP	$0.0	$0.0	$0.0	
	LSRB				
	NOSSA				
	Risks				
E3 (Electromagnetic Environmental Effects)	The requirements for the below E3 items are tailored in the E3 Integration and Analysis Report.	$8.7	$9.2	$10.0	
	EMC (Intra-system)	$1.5	$1.6	$1.7	
	EMI	$24.0	$25.4	$27.6	
	EMP	$12.0	$12.7	$13.8	
	EMV (Inter-system EMC)	$294.0	$320.5	$364.6	
	ESD	$6.0	$6.4	$6.9	
	HERO Testing	$314.0	$342.3	$389.4	
	RADHAZ	$2.7	$2.9	$3.1	
	HERF Analysis	$6.0	$6.4	$6.9	
	HERO Analysis	$6.0	$6.4	$6.9	
	HERP Analysis	$6.0	$6.4	$6.9	
	Bonding & grounding ???	$6.0	$6.4	$6.9	
	Lightning	$80.0	$84.8	$92.0	
	P-Static	$6.0	$6.4	$6.9	
Environmental Qualification	MIL-STD-810G tests with 24 hour salt fog, Humidity, Temp	$3.0	$5.0	$8.0	
LSRB Approval		$0.0	$0.0	$0.0	
	Laser radiation hazard evaluation	$10.0	$12.7	$20.0	
	Laser design checklist	$0.0	$0.0	$0.0	
	FDA mil-exempt letter	$0.0	$0.0	$0.0	
Battery Approval	Some Li batteries do not require	$3.0	$42.0	$80.0	
	Product spec for battery cell				
	Battery schematic (cell & control board)				
	CONOPS				
	Operator's Manual				
	Battery safety data package				
	Request letter				
IA (Information Assurance)		$0.0	$0.0	$0.0	
	SCG (Security Classification				
	System data				
	CONOPS				
AT (Anti-Tamper)		Done as part of T&E.			
CCA (Clinger-Cohen Act)		$6.0	$29.0	$51.0	
Spectrum		$0.0	$0.0	$0.0	
	1. Equipment Spectrum Certification (Frequency Allocation) 1494 (SPS & JF-12)	$5.0	$10.0	$15.0	
	2. Assignments	$0.0	$0.0	$0.0	
System Safety Approval		$3.0	$25.0	$50.0	
T&E	Range Safety Approval	$0.0	$0.0	$0.0	
	DT	$100.0	$200.0	$800.0	
	OT	$100.0	$300.0	#####	
WSESRB Approval		$1.5	$2.0	$3.0	
JITC		$0.0	$0.0	$0.0	
Selective Availability Anti-Spoofing Module (SAASM)		0	0	0	
	Security Approval for SAASM Host Application Equipment (HAE)	0	0	0	
	SAASM Design Requirements for HAE. (SAASM Functionalities, including Extended Functions)	$20.0	$25.0	$35.0	

Requirement	LASER Designator Cert Sim Input									Passive EW Cert Sim Inputs									Active EW Cert Sim Input								
	Run 1 BL	R1 IRTR	R1 LRTR	Run 2 BL	R2 IRTR	R2 LRTR	Run 3 BL	R3 IRTR	R3 LRTR	Run 1 BL	R1 IRTR	R1 LRTR	Run 2 BL	R2 IRTR	R2 LRTR	Run 3 BL	R3 IRTR	R3 LRTR	Run 1 BL	R1 IRTR	R1 LRTR	Run 2 BL	R2 IRTR	R2 LRTR	Run 3 BL	R3 IRTR	R3 LRTR
Some Li batteries do not require											0.5									0.5							
1. Equipment Spectrum Certification (Frequency Allocation) 1494 (SPS & JF-12)											0.5	0.25								0.5	0.25		0.5	0.25		0.5	0.25
OT			0.5			0.5			0.5			0.5			0.5			0.5			0.5			0.5			0.5
WSESRB Approval									4		2	2							4	2	2						
Cert Simulation Results:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Figure 36: Cost Model Research Matrix

APPENDIX E. OPERATIONAL REQUIREMENTS DOCUMENT

RAIN Operational Requirements Document

Contents

Blue Highlights need to be confirmed / corrected.
Red Highlights are tentatively marked for deletion.
Yellow Highlights indicate missing or incomplete sections.
Pink Highlights are the same as yellow but different to stand out.

1 Input / Output Requirements for Operations

The system shall input and output all data required in this section to support integration and fielding of payloads on STUAS.

1.1 Input Requirements for Operations

The system shall input all data required in this sections below to support integration and fielding of payloads on STUAS at the Mission, Stakeholder, System, Component, and Configuration levels.

1.1.1 Payload

The system shall accept the payload as an input.

1.1.2 Technical Data Package (TDP)

The system shall input Technical Data Packages to support certification.

1.1.2.1 Design Description

The system input the payload design description.

1.1.2.1.1 System start trigger

The system shall be initiated by the receipt of a first article and design description

1.1.2.2 Payload Data

The system shall collect data on the performance of the payload.

1.1.2.2.1 Data for each type of certification

The system shall support inputting all data for each certification

1.1.2.2.1.1 Data for each individual certification

The system shall input all data for each certification required for specific payload integration and fielding as identified by the certification authority.

1.1.3 Technical Guidance from Certification Authority

The system shall input data from each technical certification authority to identify payload specific data and certification applicability.

1.1.4 Payload Returned from Testing

The system shall collect the payload after T&E is completed.

1.1.5 T&E Summary

1.1.5.1 Collection of Test Reports

1.1.5.1.1 Test Reports for each area

The system shall support inputting all test reports for each certification

1.1.5.1.1.1 Test Report for each cert (as applicable)

The system shall input all test reports for each certification required for specific payload integration and fielding as identified by the certification authority

1.1.6 Packages from Technical Certification Authorities

1.1.6.1 Collection of certification results

The system shall input the results of each certification request.

1.1.6.1.1 Cert results for each area

The system shall input overall Safety, Security, Interoperability, and Compatibility.

1.1.6.1.1.1 Cert results for each type

The system shall input all certification results for each certification required for specific payload integration and fielding as identified by the certification authority

1.1.7 System Requirements

The system shall input the payload mission requirements.

1.2 Output Requirements for Operations

The system shall output all data required in this sections below to support integration and fielding of payloads on STUAS at the Mission, Stakeholder, System, Component, and Configuration levels.

1.2.1 Fielding decision support package

The system shall provide the Program Manager with a fielding options decision support package.

1.2.2 T&E

1.2.2.1 T&E Support Request

The system shall output a T&E support request

1.2.2.2 Payload to T&E

The system shall provide an integrated payload, with necessary certification to support testing.

1.2.2.3 Direction to T&E

The system shall output the needed testing data to develop test plans.

1.2.3 Design Guidance

The system shall output the needed design changes to meet certifications.

1.2.4 Request for more data to Developer

The system shall output requests for additional data needed to complete certifications.

1.2.5 Certification Approval Request

The system shall output the request to the certification approval authority when all technical data has been provided.

1.2.5.1 Initial Data Package for certification

The system shall output data packages to the certification approval authority for initial certification request.

1.2.5.2 Updated Data Package for certification

The system shall output data packages updates to the certification approval authority as required and upon request.

1.3 External Interface Requirements for Operations

The system shall interface with all external entities needed for payload intergration, certification and fielding.

1.3.1 PMA-263

The system shall interface with PMA-263 representatives.

1.3.2 T&E

The system shall interface with T&E representatives.

1.3.3 Certification Authorities

The system shall interface with all representatives required for system certification.

1.3.3.1 PMA Internal Certification SME's

The system shall interface with NAVAIR and DoD SMEs as need for certification.

1.3.4 Developer

The system shall interface with payload and platform developers.

1.4 Functional Requirements for Operations

The system shall support the payload meeting all functional requirements outlined below for certification and operation.

1.4.1 Payload Maturity

The system shall provide a means to show a payload is ready to be fielded.

1.4.1.1 Regulatory and Statutory Compliance

The system shall provide a means to have the payload comply with statutes and regulations.

1.4.1.1.1 Determine Required Certifications

The system shall provide a means to determine the certifications needed based on the capabilities of the new payload.

1.4.1.1.1.1 Certification Tracking

The system shall provide a means to track that all certifications are addressed.

1.4.1.1.2 Certification Data Collection

The system shall provide a means to collect the data needed to support each of the required certifications.

1.4.1.1.3 Certification Data Package Evaluation

The system shall provide a means to evaluate the pre-submission data package for each technical certification for adequacy.

1.4.1.1.4 Interface with Certification Authorities

The system shall provide the means of interfacing with the technical certification authorities.

1.4.1.1.4.1 Compliance Process

The system shall provide the process for complying with the guidance from the technical certification authority.

1.4.1.2 Interoperability

The system shall provide the information needed to prove Interoperability.

1.4.1.3 Safety

The system shall provide the information needed to prove Safety.

1.4.1.4 Security

The system shall provide the information needed to prove Security.

1.4.1.5 Suitability

The system shall provide the information needed to prove Suitability.

1.4.1.6 Environmental Compatibility

The system shall provide the information needed to prove Environmental Compatibility.

2 System-wide / Technology Requirements for Operations

2.1 Technology Requirements for Operations

The system shall be constrained by the following technology requirements.

2.1.1 Documentation

The system documentation shall be limited to being in MS Office formats (MS Word 2003, MS Excel 2003, or MS Power Point 2003 formats).

2.1.2 Computer Networks

The system Computer network based information exchange shall operate within the limits of what the NMCI will allow or support.

2.1.3 Written Communication

Written communication of the system information shall be through DoD approved encrypted e-Mail.

2.1.4 File Sharing

File sharing shall be limited to PMA-263 and DoD approved contractor databases

2.2 Suitability and Quality Requirements for Operations

The system shall support the following suitability and quality requirements for operation.

2.2.1 Complete Fielding Decision Packages

The system shall produce complete fielding decision packages.

2.2.1.1 The system shall address all relevant statutes and regulations.

2.2.1.1.1 The system shall provide a tailored list of required certifications by payload system type.

2.2.1.1.2 The system shall provide the Certifications, approvals, letter, or waiver for all required statutes and regulations.

2.2.1.1.3 The system shall provide instructions on the order and relative start times for each certification.

2.2.1.1.4 The system shall provide aggregated risk level analysis from the use of the waiver and interim approvals.

2.2.1.1.4.1 The system shall provide instructions on the risks level of using waivers or interim approvals.

2.2.1.2 The system shall provide the justification for omitted certifications (statutes and/or regulations certifications).

2.2.2 Accurate Fielding Decision Packages

The system shall produce complete accurate fielding decision packages.

2.3 Cost Requirements for Operations

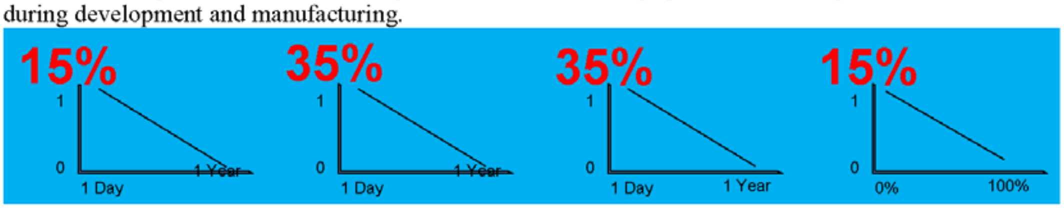
The system shall incur the same or lower costs as the current processes used to fully support payload fielding decisions.

2.4 Schedule Requirements for Operations

The system shall provide an option to take 18 months or less to produce the fielding decision package.

3 Trade-off Requirement for Operations

The below fundamental objectives hierarchy indicate the weighted values for each bottom level objective for use in trading off features used during operations, but implemented during development and manufacturing.



3.1 Performance Trade-off Requirements for Operations

The system shall perform a trade-off analysis based on the factors identified in the systems fundamental objectives hierarchy.

3.1.1 Time to Address Statutory & Regulatory Requirement

The system shall minimize time to address statutory and regulatory requirements for fielding.

3.1.1.1 The system shall minimize time to determine certifications required to be pursued.

3.1.1.1.1 The system shall value the time to determine needed certifications with a value curve that is linear with a value of 1 at one day or less and zero at one month.

3.1.1.1.1.1 The system shall apply a trade weight of 15% to minimizing the time to determine required certifications when de-conflicting with other trade-off requirements.

3.1.1.2 The system shall minimize time to address required certifications.

3.1.1.2.1 The system shall value the time to obtain waivers/interim approvals with a value curve that is linear with a value of 1 at one day or less and zero at six months.

3.1.1.2.1.1 The system shall apply a trade weight of 35% to minimizing the time to obtain waivers/interim approvals when de-conflicting with other trade-off requirements.

3.1.1.2.2 The system shall value the time to obtain full certification approvals with value curve that is linear with a value of 1 at one day or less and zero at one year.

3.1.1.2.2.1 The system shall apply a trade weight of 35% to minimizing the time to obtain full certification approvals when de-conflicting with other trade-off requirements.

3.1.2 Manage Risks

The system shall provide a means to manage risks.

3.1.2.1 The system shall minimize waivers and interim approvals.

3.1.2.1.1 The system shall value the percentage of waivers/interims with a value cure that is linear with value of 1 at 0% and 0 at 100%.

3.1.2.1.1.1 The system shall apply a trade weight of 15% to minimizing the percentage of waivers/interims when de-conflicting with other trade-off requirements.

3.2 Cost Tradeoff for Operations

The first phase of this systems development shall not address this phase.

3.3 Cost-Performance Trade-off for Operations

The first phase of this systems development shall not address this phase.

4 Qualification Requirement for Operations

4.1 Observance Requirements for Operations

4.1.1 Verification by Development Team

The system verification testing shall be conducted by members of the system development team.

4.1.2 Validation by User Reps

The system validation testing shall be conducted by PMA-263 user representatives.

4.2 Verification Plan Requirements for Operations

4.2.1 Verify requirements met by features

The system shall be verified by comparing the system features against this requirements document.

4.2.1.1 The system shall be verified as being complete if it meets all the requirements listed in the operations phase of this requirements document.

4.3 Validation Plan Requirements for Operations

4.3.1 Validate System Operation Meets User Needs

The system shall be validated as being correct by operating system and comparing its abilities against what the user needs.

4.3.1.1 The system shall be verified as being complete if it meets all the requirements listed in the operations phase of this requirements document.

4.4 Acceptance Plan Requirements for Operations

4.4.1 Acceptable when Validated

The system shall be considered acceptable when the results of the validation testing indicate all user needs are addressed.

4.4.1.1 Suggestions for improving ease of use or speed of use of the system shall be recorded and remanded for future projects.

5 System Improvement / Upgrade Phase Requirements

The first phase of this systems development shall not address this phase.

6 Retirement Phase Requirements

The first phase of this systems development shall not address this phase.

7 Overall Trade-Off Requirements

This section is to address comparisons across life-cycle phases in order to enable coherent evaluations of design options.

N/A, the non-operational life-cycle phases are being conducted by Naval Postgraduate School students as part of their Capstone Project

8 Appendix A. Operational Concepts by Phase

A text table format is used to describe the operational concepts and scenarios for all of the life-cycle phases. For the operations life-cycle phase sequence diagrams are also used.

Operational Concept for the **Development Phase**

#	Operational Concept Scenario	Scenario Type
1	The development phase will start with the assignment of the team members to a pitched project.	• System initialization
2	The team will work together to research and draft a project management plan (PMP).	• Normal steady state
3	In the event that PMA-263 or NPS staff or other stakeholders cannot respond quickly the team will continue with development under the assumption that the current plan is correct enough.	• Extremes of operations due to due to high and low peaks of the external systems in each standard operating mode in each context
4	N/A	• Standard maintenance modes of the system
5	N/A	• Standard resupply modes of the system
6	Lack of, or slow, response from stakeholders or SME's in PMA-263 will be addressed by our team members in PMA-263 who will act as response expatiators.	• Reaction to failure modes of other systems
7	Missing team members will be compensated for by having more than one team member up to speed on each task.	• Failure modes due to internal problems, providing as much graceful degradation of the meta-system as possible

Operational Concept for the **Production Phase**
(Make the templates, SEP, checklists, etc.)

#	Operational Concept Scenario	Scenario Type
1	System design will commence with the initial prototype which will commence upon completion of requirements research.	• System initialization
2	The system itself will be designed through the use of evolutionary prototyping, where models are used to refine requirements and then the model is iteratively refined and expanded until the system is complete.	• Normal steady state
3	N/A	• Extremes of operations due to due to high and low peaks of the external systems in each standard operating mode in each context

4	N/A	• Standard maintenance modes of the system
5	N/A	• Standard resupply modes of the system
6	Rejection of our drafts of the project deliverables will be countered with additional research to understand where the stakeholder's needs were not addressed. Lack of response from the PMA-263 will be addressed by our team members in PMA-263 who will act as response expatiators. Lack of response from NPS will be addressed by our facility advisors who will act as response expatiators.	• Reaction to failure modes of other systems
7	Disagreements within the team will be addressed through the use of consensus building discussions; but if consensus cannot be achieved then multi-voting will be used to make decisions base on a simple majority.	• Failure modes due to internal problems, providing as much graceful degradation of the meta-system as possible

Operational Concept for the **Deployment Phase**
(Install / Provide to the Stakeholders)

#	Operational Concept Scenario	Scenario Type
1	Upon completion of the system build and verification and validation testing the system will enter the deployment phase.	• System initialization
2	Describe how the deployment of the new the system will be rolled out to users / stakeholders. The documentation of the system processes, forms, and templates will be sent to Ops for proper formatting on letterhead and then routed for final signature. Ops will then assign a document number for local PMA-263 instructions. CM will then log it accordingly. The document will then be routed to the IPTs within PMA-263.	• Normal steady state
3	N/A	• Extremes of operations due to due to high and low peaks of the external systems in each standard operating mode in each context
4	N/A	• Standard maintenance modes of the system
5	N/A	• Standard resupply modes of the system
6	N/A	• Reaction to failure modes of other external systems
7	Describe how we will address not being ready for deployment. Deployment will be delayed.	• Failure modes due to internal problems, providing

		as much graceful degradation of the meta-system as possible.

Operational Concept for the **Training Phase**
(Train the users on how to use the tools and follow the process)
This is outside the scope of the project, but will be attempted on a best effort if time allows.

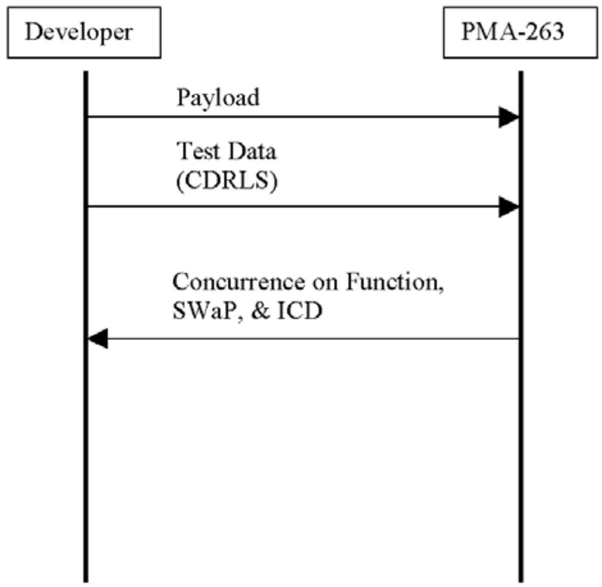
#	Operational Concept Scenario	Scenario Type
1	Describe preparation that will be done. Instructions are sent out from the PMA.	• System initialization
2	Describe how training will be conducted. Questions answered as they come up and directed back to the PMA.	• Normal steady state
3	N/A	• Extremes of operations due to due to high and low peaks of the external systems in each standard operating mode in each context
4	N/A	• Standard maintenance modes of the system
5	N/A	• Standard resupply modes of the system
6	N/A	• Reaction to failure modes of other systems
7	N/A	• Failure modes due to internal problems, providing as much graceful degradation of the meta-system as possible

Operational Concept for the **Operations Phase**
(This is the meat of the new process and life-cycle. Not sure which is better here just the text table, or the sequence diagram, or both.)

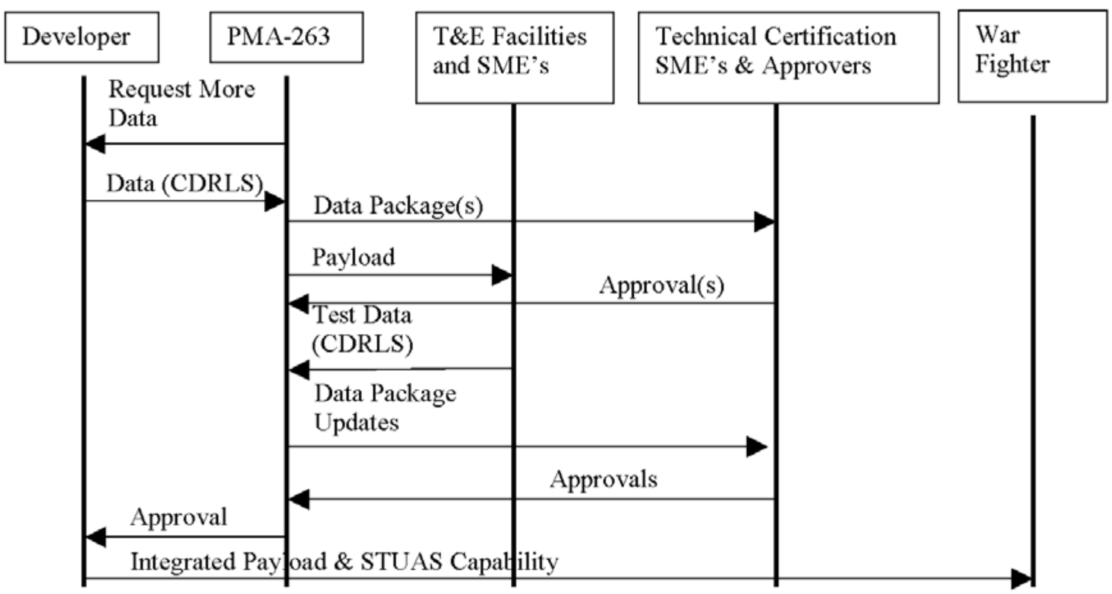
#	Operational Concept Scenario	Scenario Type
1	A payload developer delivers a new payload to the PMA, the developer provides data results from the tests it conducted, the PMA analyzes the data to determine if the payload meets SWAP requirements, the PMA analyzes the data to determine if it meets the ICD requirements for the intended STUAS, the PMA conducts a fit check and operational test, the PMA initiates the integration and fielding process.	• System initialization
2	The PMA collects data from the OEM, the PMA develops a data package for each technical certification, NAVAIR SME's review the data packages, the SME's determine that some data packages are sufficient and others are not sufficient, the sufficient data packages are presented to their approval authorities for technical certifications, additional testing is scheduled to supplement the data in the insufficient data packages, the additional tests are conducted, the insufficient data packages are updated, the NAVAIR SME's review the data packages, the SME's find the updated data packages to be sufficient, the updated data packages are presented to their approval authorities for technical certifications, the data packages are reviewed by the approval authority for each technical certification, the approval authority for each technical certification provides approval to the PMA, the PMA determines that all certifications have been sufficiently satisfied, the new SoS of payload and STUAS is fielded to the war fighter.	• Normal steady state • Assumptions: ○ The OEM has conducted some of the needed tests. ○ The Navy needs to conduct additional tests in order provide all the data needed to support all required technical certifications.
3	The PMA collects data from the OEM, the PMA develops a data package for each technical certification, NAVAIR SME's review the data packages the SME's determine the data packages are sufficient, the data packages are presented to the approval authority for each technical certification, the data package is reviewed by the approval authority for each technical certification, the approval authority for each technical certification provides approval to the PMA, the PMA determines that all certifications have been sufficiently satisfied, the new SoS of payload and STUAS is fielded to the war fighter.	• Extremely quick operations • Assumptions: ○ The OEM has conducted all tests needed to provide all the data needed to support all required technical certifications.
4	The PMA collects data from the OEM, the PMA develops a data package for each technical certification, NAVAIR SME's review the data packages, the SME's determine that some data packages are sufficient and	• Extremely quick operations • Assumptions: ○ The OEM has conducted some of the needed tests.

	others are not sufficient, the sufficient data packages are presented to their approval authorities for technical certifications, NAVAIR submits waiver requests for the technical certifications with insufficient data packages, the data packages and waiver requests are reviewed by the approval authority for each technical certification, the approval authority for each technical certification provides approval to the PMA, the PMA determines that all certifications have been sufficiently satisfied or properly waived, the new SoS of payload and STUAS is fielded to the war fighter.	○ NAVAIR has some technical certifications waived instead of conducting additional tests.
5	The PMA collects data from the OEM, the PMA develops a data package for each technical certification, NAVAIR SME's review the data packages, the SME's determine that some data packages are sufficient and others are not sufficient, the sufficient data packages are presented to their approval authorities for technical certifications, NAVAIR submits waiver requests for the technical certifications with insufficient data packages, the data packages and waiver requests are reviewed by the approval authority for each technical certification, the approval authority for one or more of the waivers rejects the requests, additional testing is scheduled to supplement the data in the insufficient data packages, the additional tests are conducted, the insufficient data packages are updated, the NAVAIR SME's review the data packages, the SME's find the updated data packages to be sufficient, the updated data packages are presented to their approval authorities for technical certifications, the data packages are reviewed by the approval authority for each technical certification, the approval authority for each technical certification provides approval to the PMA, the PMA determines that all certifications have been sufficiently satisfied or properly waived, the new SoS of payload and STUAS is fielded to the war fighter.	• Extremely slow operations • Assumptions: ○ The OEM has conducted some of the needed tests. ○ NAVAIR seeks but is denied waivers on some technical certifications.
		•
6	N/A	• Standard maintenance modes of the system
7	N/A	• Standard resupply modes of the system
8	A failure by one of the technical certification approval authorities to render a verdict will be followed up by the PMA until a the issue is resolved and a decision is rendered.	• Reaction to failure modes of other systems
9	The PMA collects data from the OEM, the PMA develops a data package for each technical certification,	• Failure leading to Extremely slow operations

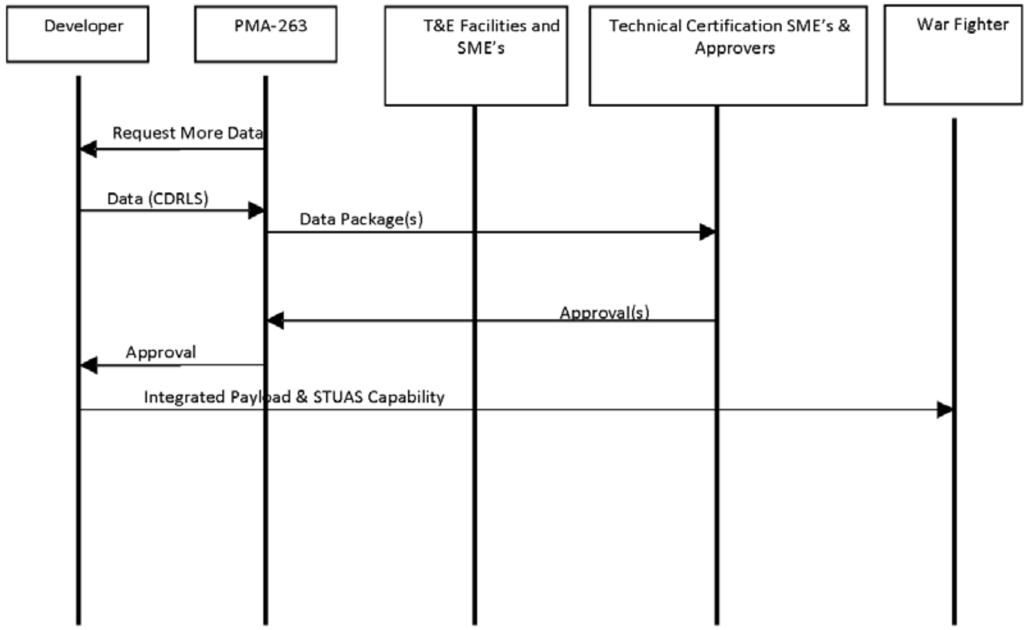
Operations – System Initialization Scenario



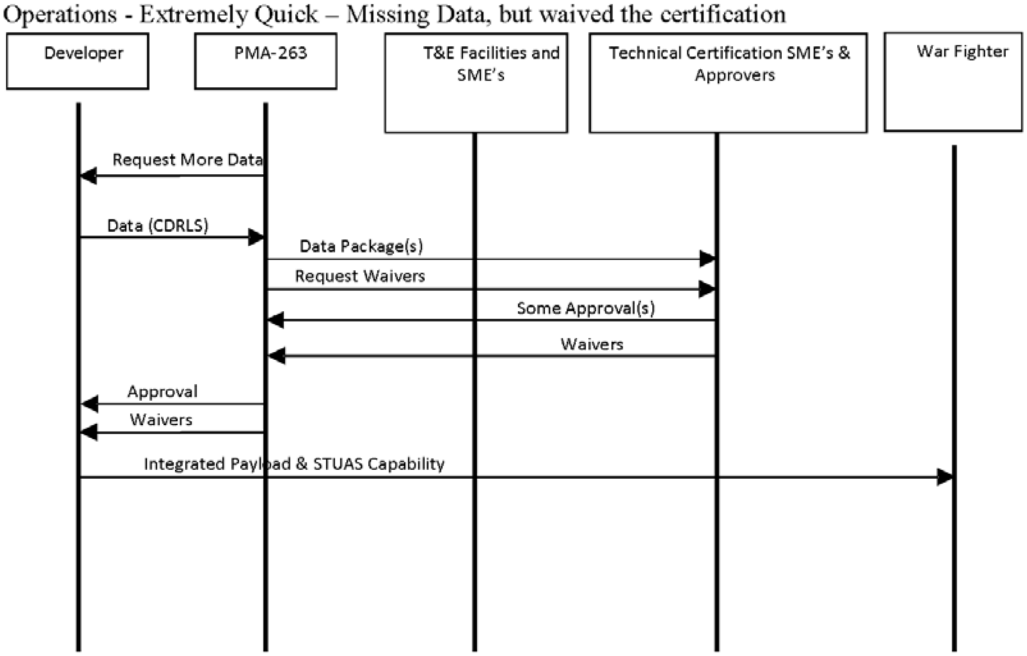
Operations - Normal Steady State Scenario



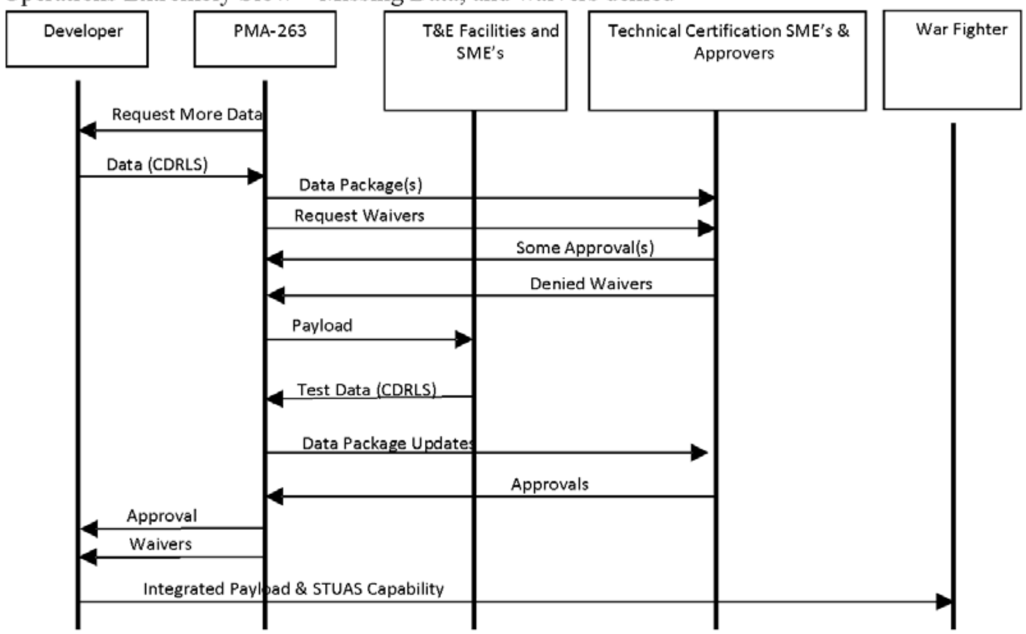
Operations - Extremely Quick – All Data Available



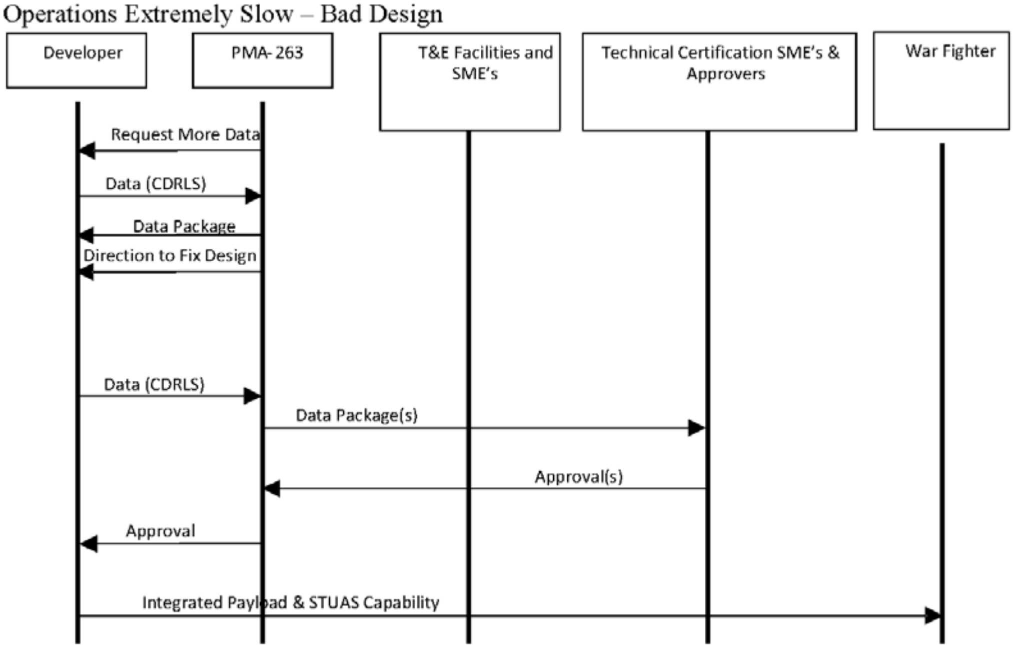
Operations - Extremely Quick – Missing Data, but waived the certification



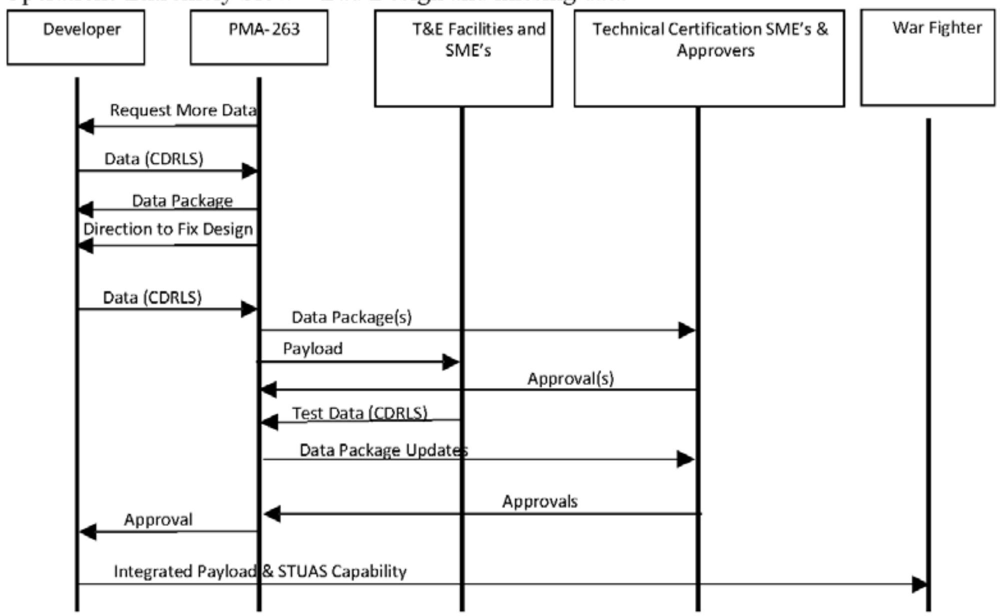
Operations Extremely Slow – Missing Data, and waivers denied



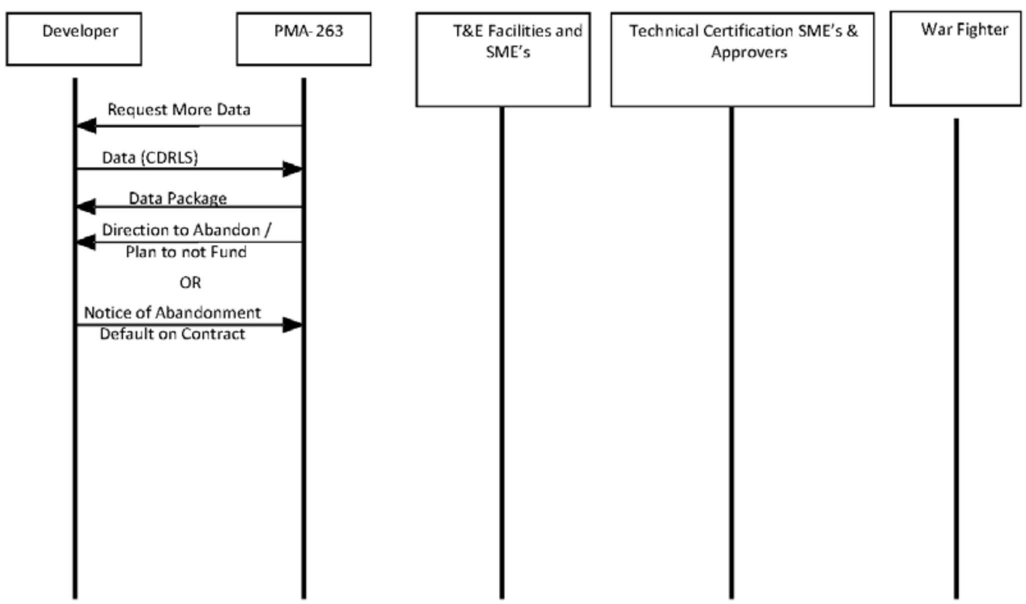
Operations Extremely Slow – Bad Design



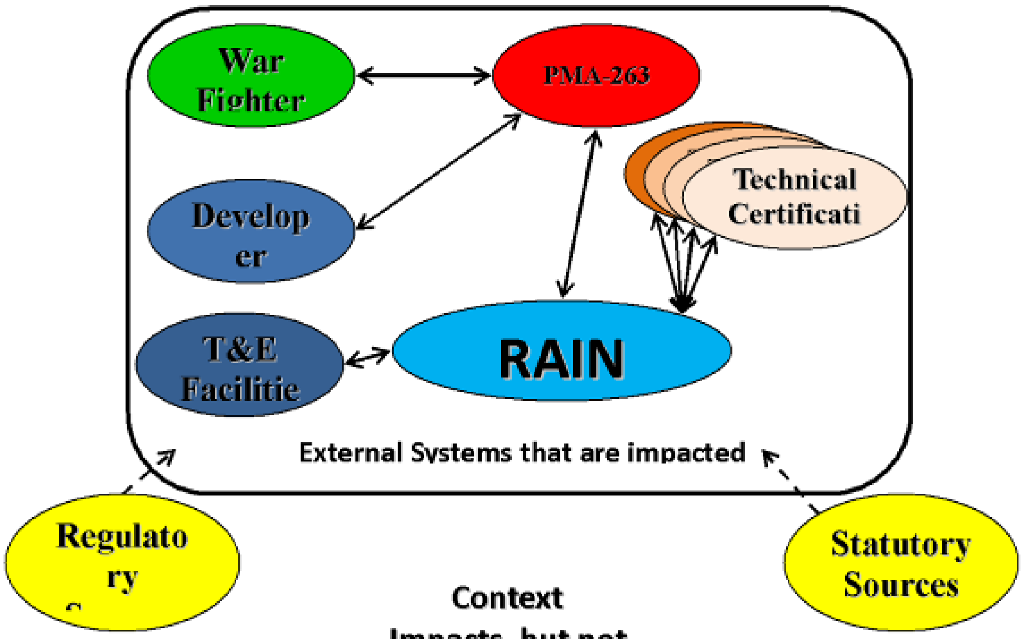
Operations Extremely Slow – Bad Design and missing data

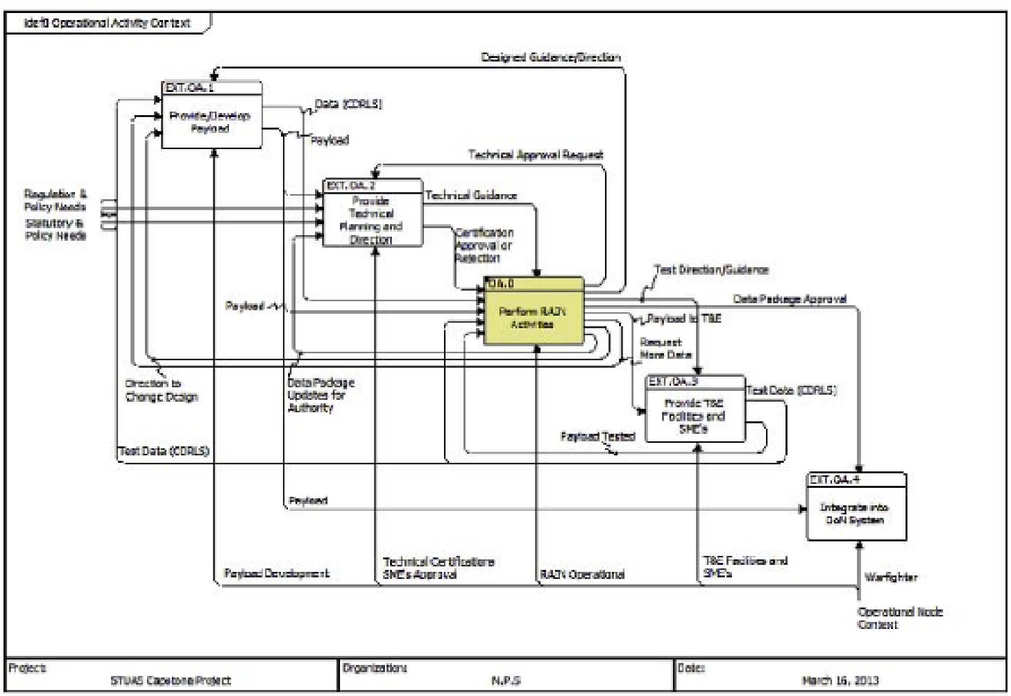


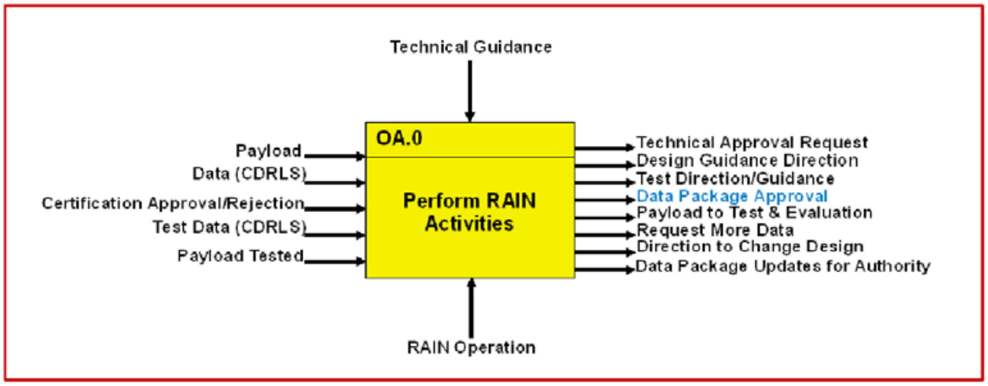
Operations Abandoned – Bad Design and Data Indicates Unacceptable Performance / Risk



9 Appendix B. External Systems Diagrams






Technical Guidance
OA.0
Perform RAIN Activities
Payload
Data (CDRLS)
Certification Approval/Rejection
Test Data (CDRLS)
Payload Tested
Technical Approval Request
Design Guidance Direction
Test Direction/Guidance
Data Package Approval
Payload to Test & Evaluation
Request More Data
Direction to Change Design
Data Package Updates for Authority
RAIN Operation

APPENDIX F. MODELING AND SIMULATION

RAIN Simulation Results

Theoretical upper and lower bounds on completing all possible certifications for a STUAS payload

- Serial Risk Simulator® and iGrafx®
- Parallel Risk Simulator® and iGrafx®

Baseline Simulations

- LASER Designator Runs 1 though 3
- Passive EW Runs 1 though 3
- Active EW Runs 1 though 3

Lead-time Reduction Simulations

LASER Designator Timeline Reductions Runs 1 though 3

- Low Risk Timeline Reduction (LRTR)
- Intermediate Risk Timeline Reduction (IRTR)

Passive EW Timeline Reductions Runs 1 though 3

- Low Risk Timeline Reduction (LRTR)
- Intermediate Risk Timeline Reduction (IRTR)

Active EW Timeline Reductions Runs 1 though 3

- Low Risk Timeline Reduction (LRTR)
- Intermediate Risk Timeline Reduction (IRTR)

Cost Simulations

LASER Designator Runs 1 though 3

- Baseline (BL)
- Intermediate Risk Timeline Reduction (IRTR)
- Low Risk Timeline Reduction (LRTR)

Passive EW Runs 1 though 3

- Baseline (BL)
- Intermediate Risk Timeline Reduction (IRTR)
- Low Risk Timeline Reduction (LRTR)

Active EW Runs 1 though 3

- Baseline (BL)
- Intermediate Risk Timeline Reduction (IRTR)
- Low Risk Timeline Reduction (LRTR)

1st Build of the Simulation: All Certifications in Series

Risk Simulator®

- Triangular distribution for each certification duration.
- 34 Certifications

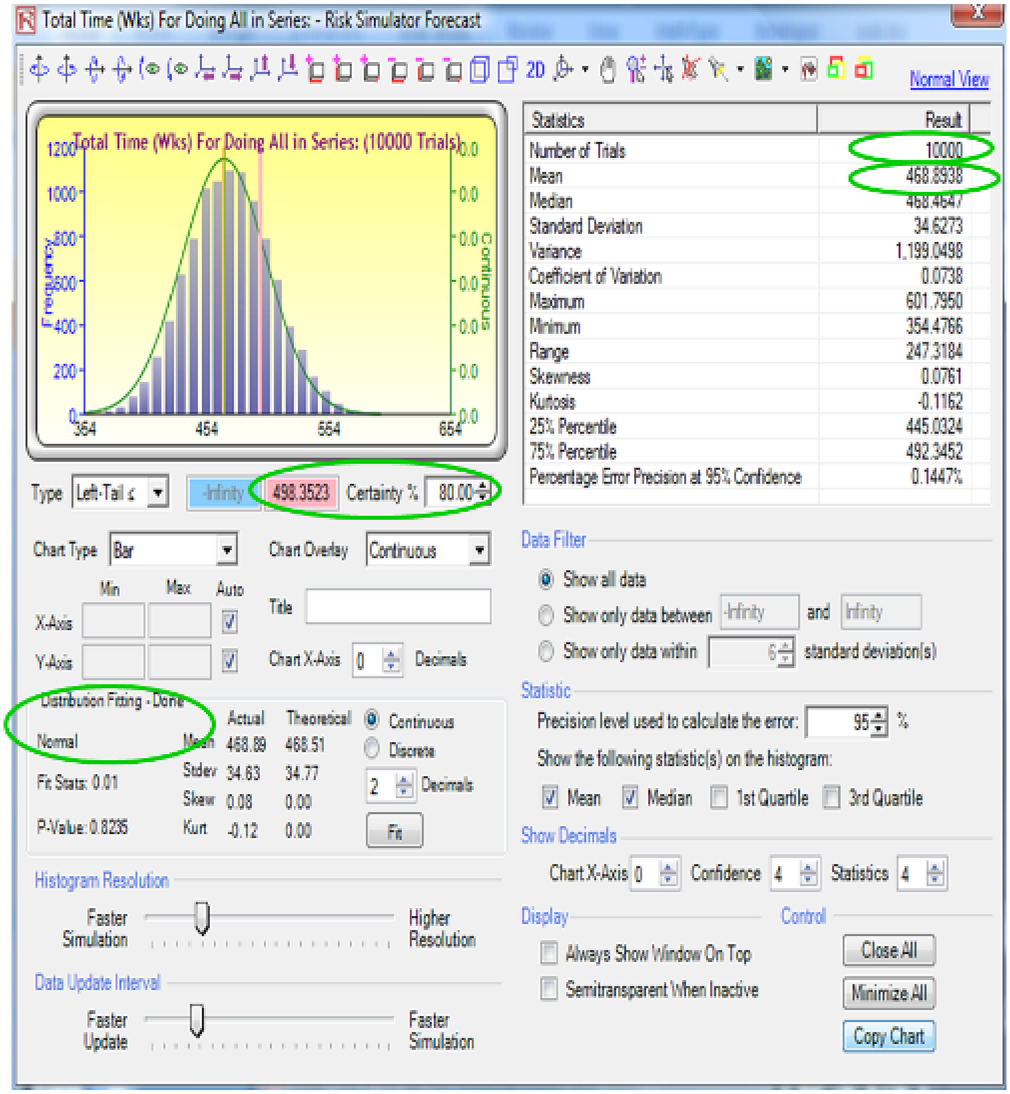
Mean = 469 weeks

- 109.4 months

80th % = 498 weeks

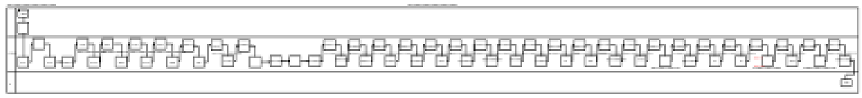
- 116.2 months

All in series is Very Unlikely


Total Time (Wks) For Doing All in Series: - Risk Simulator Forecast
Normal View
Total Time (Wks) For Doing All in Series: (10000 Trials)
Frequency
Continuous
364
454
564
654
Statistics
Result
Number of Trials
10000
Mean
468.8938
Median
Standard Deviation
34.6273
Variance
1,199.0498
Coefficient of Variation
0.0738
Maximum
601.7950
Minimum
354.4766
Range
247.3184
Skewness
0.0761
Kurtosis
-0.1162
25% Percentile
445.0324
75% Percentile
492.3452
Percentage Error Precision at 95% Confidence
0.1447%
Type
Left-Tail ≤
-Infinity
498.3523
Certainty %
80.00
Chart Type
Bar
Chart Overlay
Continuous
Min
Max
Auto
X-Axis
Y-Axis
Title
Chart X-Axis
Decimals
Distribution Fitting - Done
Normal
Actual
Theoretical
Mean
468.89
468.51
Stdev
34.63
34.77
Skew
0.08
0.00
Kurt
-0.12
0.00
Fit Stats: 0.01
P-Value: 0.8235
Continuous
Discrete
Decimals
Fit
Histogram Resolution
Faster Simulation
Higher Resolution
Data Update Interval
Faster Update
Faster Simulation
Data Filter
Show all data
Show only data between
-Infinity
and
Infinity
Show only data within
standard deviation(s)
Statistic
Precision level used to calculate the error:
95
%
Show the following statistic(s) on the histogram:
Mean
Median
1st Quartile
3rd Quartile
Show Decimals
Chart X-Axis
Confidence
Statistics
Display
Control
Always Show Window On Top
Semitransparent When Inactive
Close All
Minimize All
Copy Chart

1st Build of the Simulation: All Certifications in Series

iGrafx® Simulator



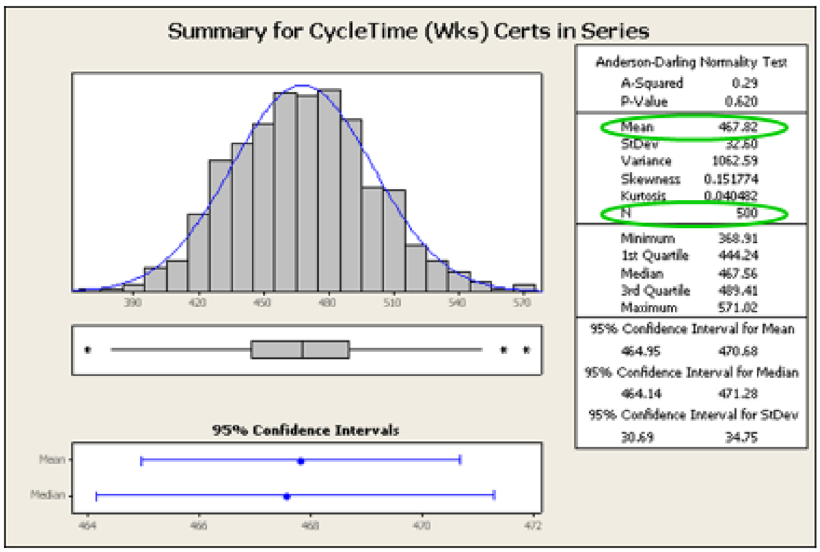
Mean: 468 weeks

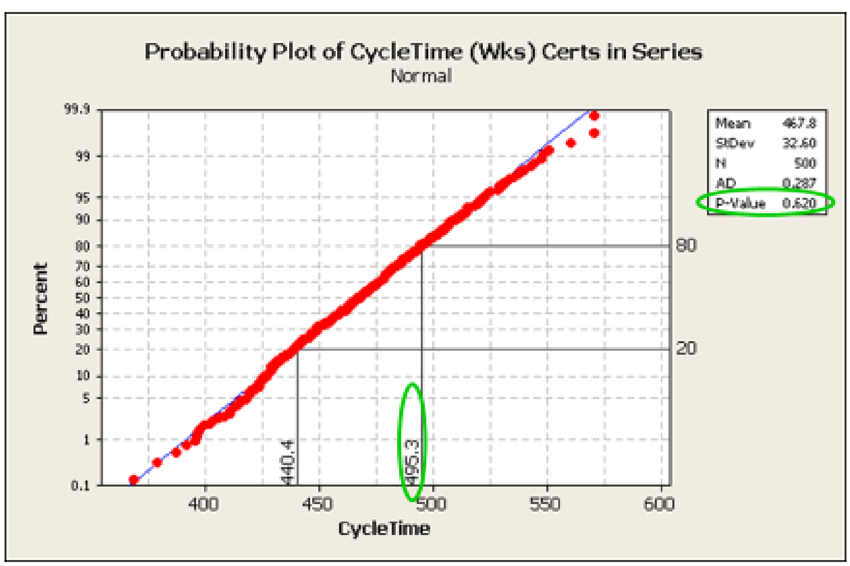
- 109.2 months

80th % = 495 weeks

- 115.5 months

Normal Distribution





2nd Build of the Simulation: All Certifications in Series

Risk Simulator®

- Triangular distribution for each certification duration.
- 34 Certifications.

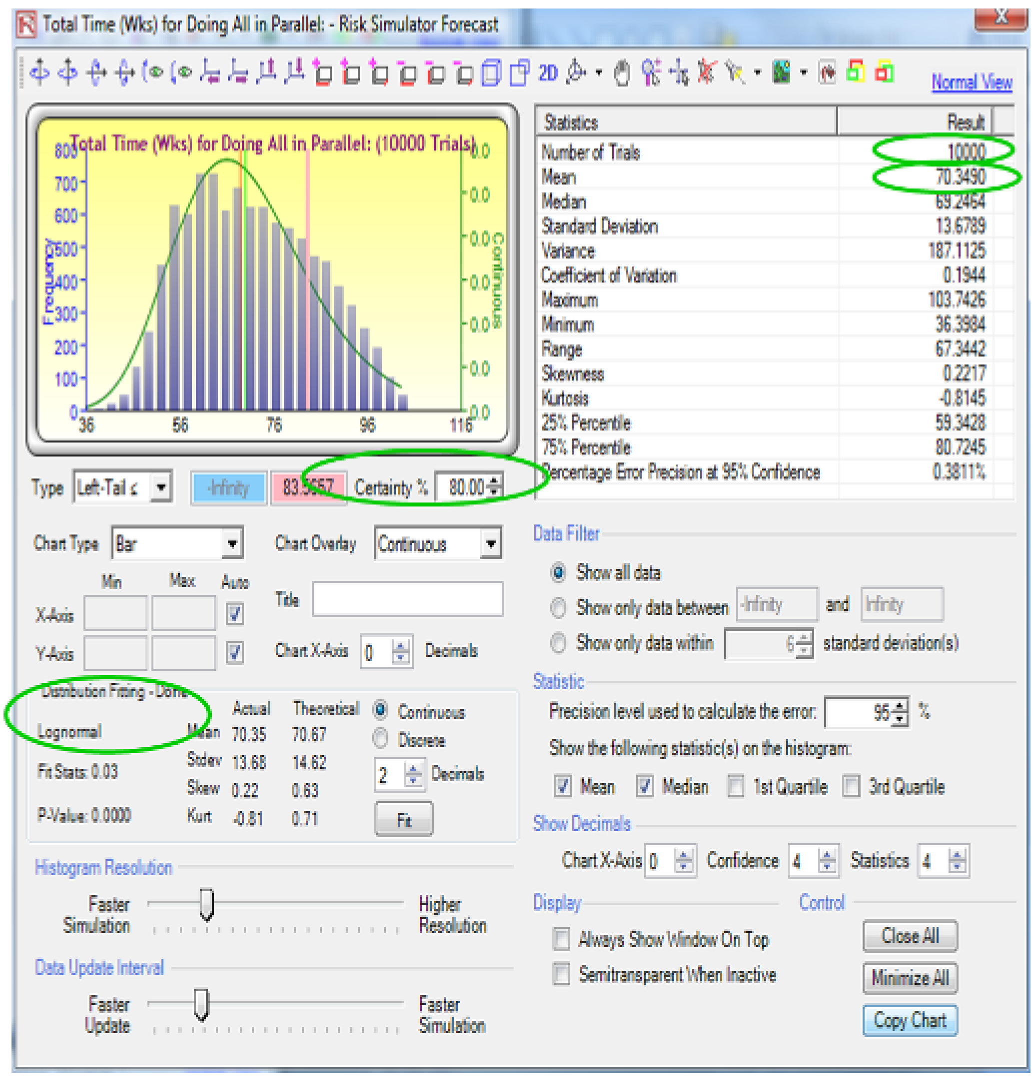
Mean = 70 weeks

- 16.2 months

80th % = 84 weeks

- 19.4 months

All in Parallel is Very Unlikely



2nd Build of the Simulation: All Certifications in Series

iGrafx® Simulator

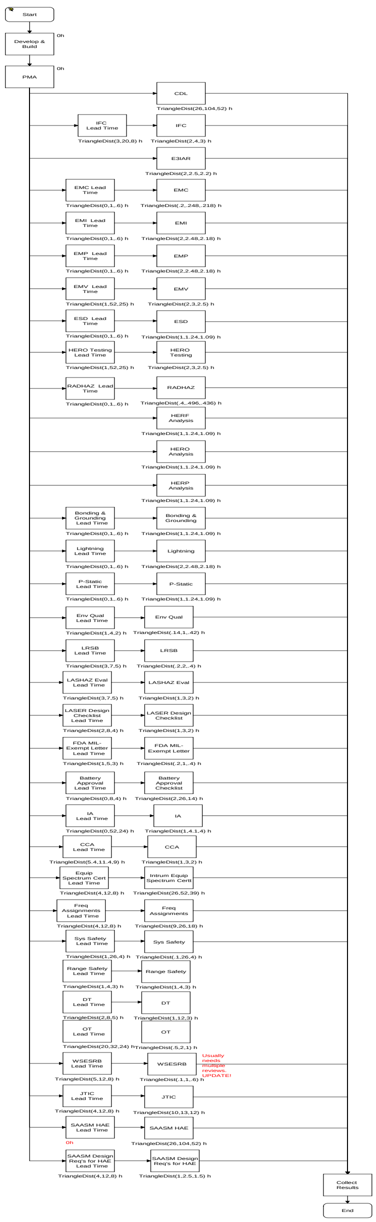
Mean: 70 weeks

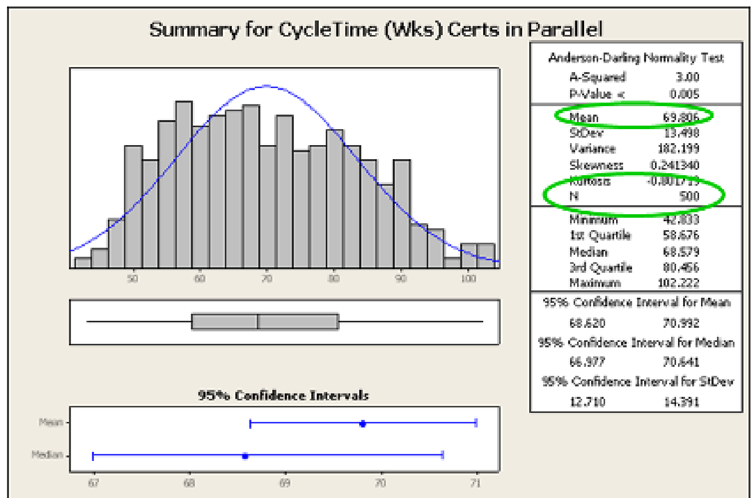
- 16.2 months

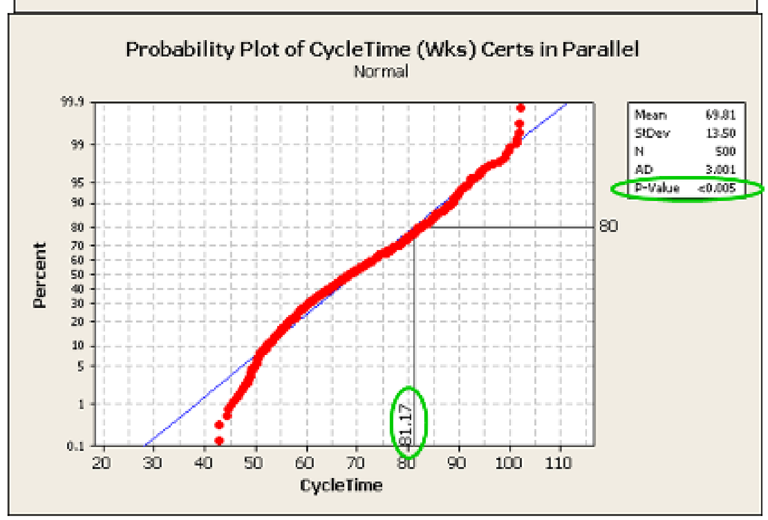
80th % = 81 weeks

- 18.7 months

Non-Normal Distribution P<0.005







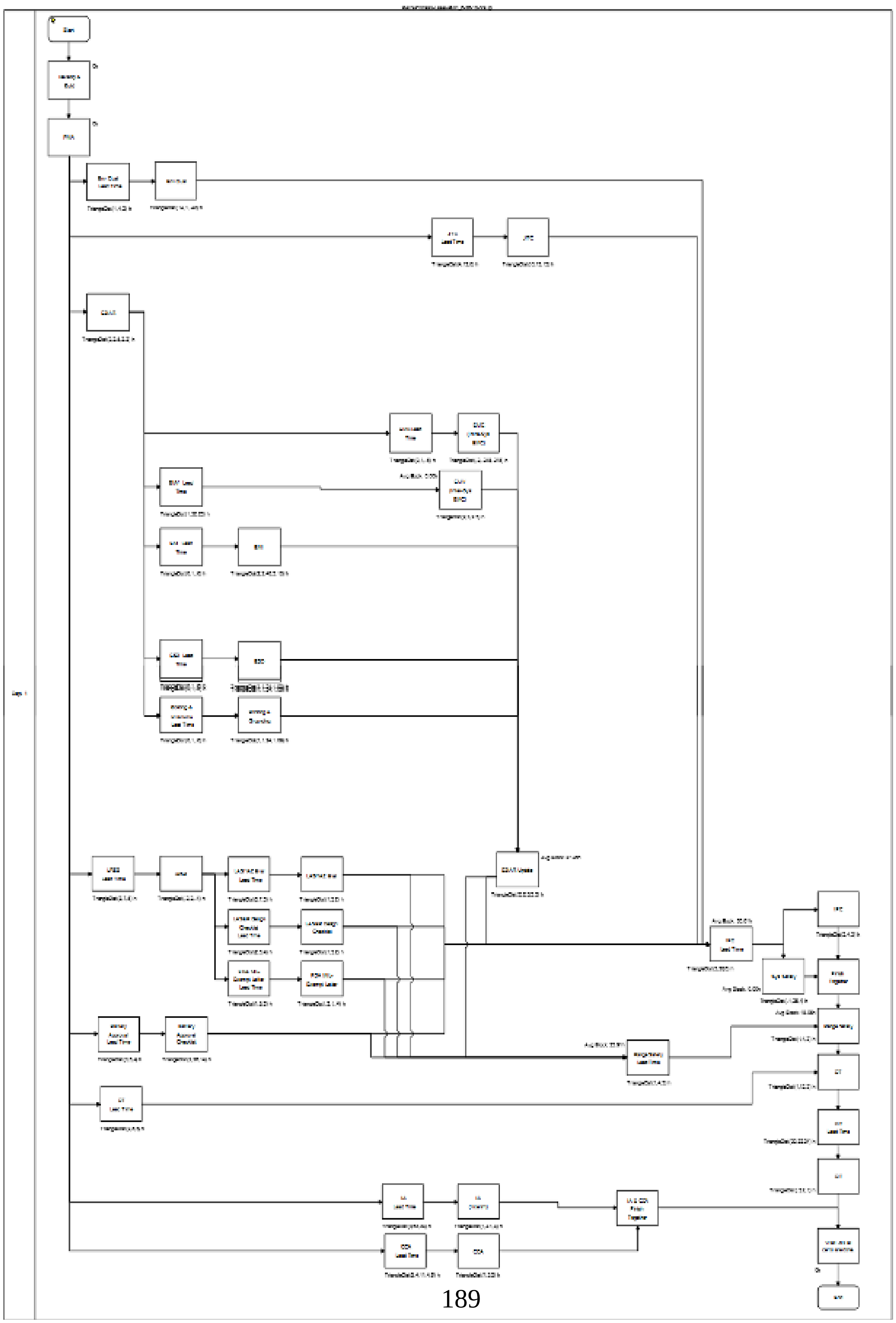
Baseline Simulations

LASER Designator Runs 1 though 3
Passive EW Runs 1 though 3
Active EW Runs 1 though 3

LASER Designator Runs 1 through 3 Baseline

Requirements		LASER Designator		
Level 1	Level 2	Run 1 (Simple Integration)	Run 2 (Complex Integration)	Run 3 (Highly Mature Payload)
CDL		N	N	N
Airworthiness (IPC)	Risk Assessment Questionnaire	Y	Y	Done
	HPOC	Y	Y	Y
	RDSAP	Y	Y	Done
	Risks	Y	Y	Y
E3 (Electromagnetic Environmental Effects)	ESLAR	Y	Y	Done
	EMC (Intra-system)	Y	Y	Done
	EME	Y	Y	Done
	EMP	N	N	N
	EMV (Inter-system EMC)	Y	Y	Done
	ESD	Y	N	Done
	HERO Testing	N	N	Done
	RADHAZ	N	N	Done
	HERF	N	N	Done
	HERO	N	N	Done
	HERP	N	N	Done
	Bonding & grounding	Y	N	Done
	Lightning	N	N	N
	P-Static	N	N	N
Environmental Qualification	MIL-STD-810G tests with 24 hour soaking, Humidity, Temp	Y	Y	Done
LASER Safety Review	LSRB Review of below	Y	Y	Y
	Laser radiation hazard evaluation	Y	Y	Done
	Laser design checklist	Y	Y	Y
	FDA red-exempt letter	Y	Y	Done
Battery Approval	Product spec for battery cell	Y	N	N
	Battery schematic (cell & control board)	Y	N	N
	CONOPS	Y	N	N
	Operator's Manual	Y	N	N
	Battery safety data package	Y	N	N
	Request letter	Y	N	N
IA (Information Assurance)		Y	Y	Y
AT (Anti-Tamper)		Y	Y	Y
CCA (Clinger-Cohen Act)		Y	Y	Y
Spectrum	1. Equipment Spectrum Certification (Frequency Allocation) 1494 (SPS & JF-12)	N	N	N
	2. Assignments	N	N	N
System Safety Approval		Y	Y	Y
T&E	Range Safety Approval	Y	Y	Y
	DT	Y	Y	Done
	OT	Y	Y	Y
WSESRB Approval		N	N	N
ITC		Y	N	Done
Selective Availability Anti-Spoofing Module (SAASM)	Security Approval for SAASM Host Application Equipment (HAE)	N	N	N
	SAASM Design Requirements for HAE (SAASM Functionalities, Including Extended Functions)	N	N	N

LASER Designator Runs 1 through 3 Baseline



LASER Designator Run Baseline Model

Elapsed Time in Weeks

44266.10

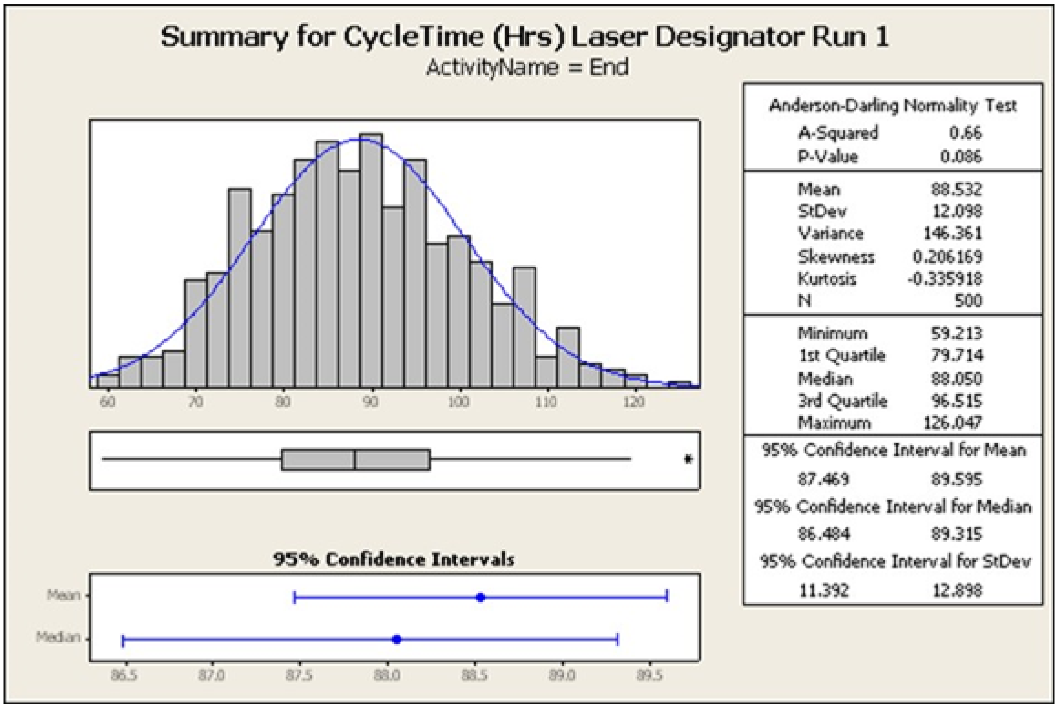
Activity Statistics In Weeks (Hours)

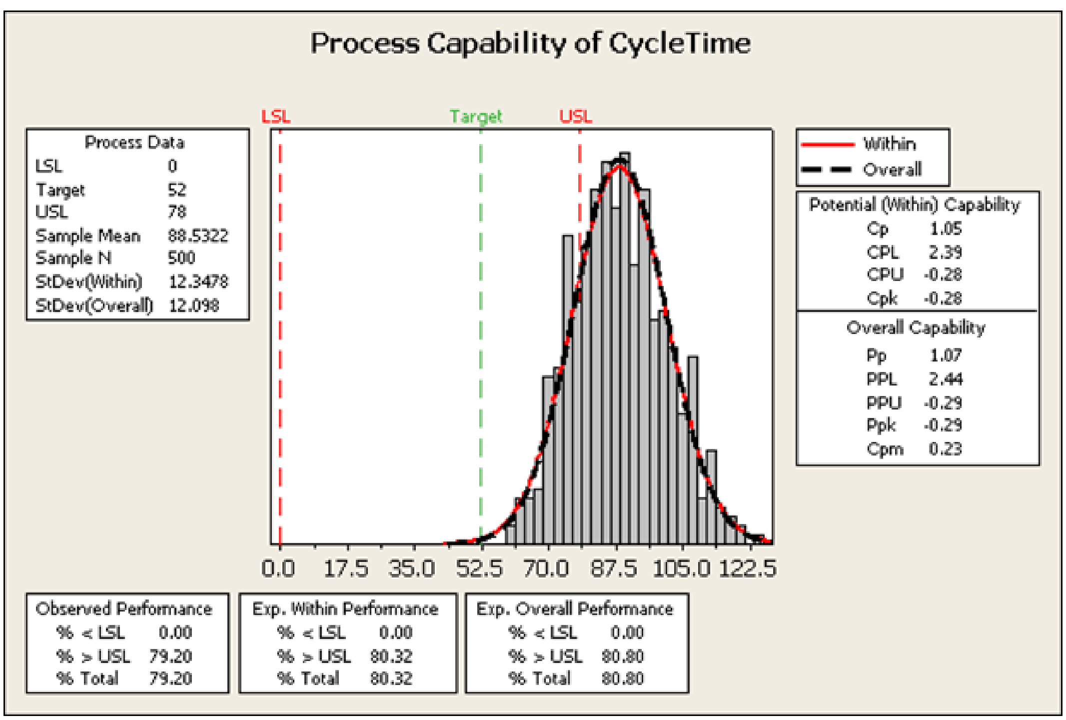
Count	Avg Cycle	Avg Serv	Avg Block	Avg Work
500	88.53	88.53	0.00	88.53

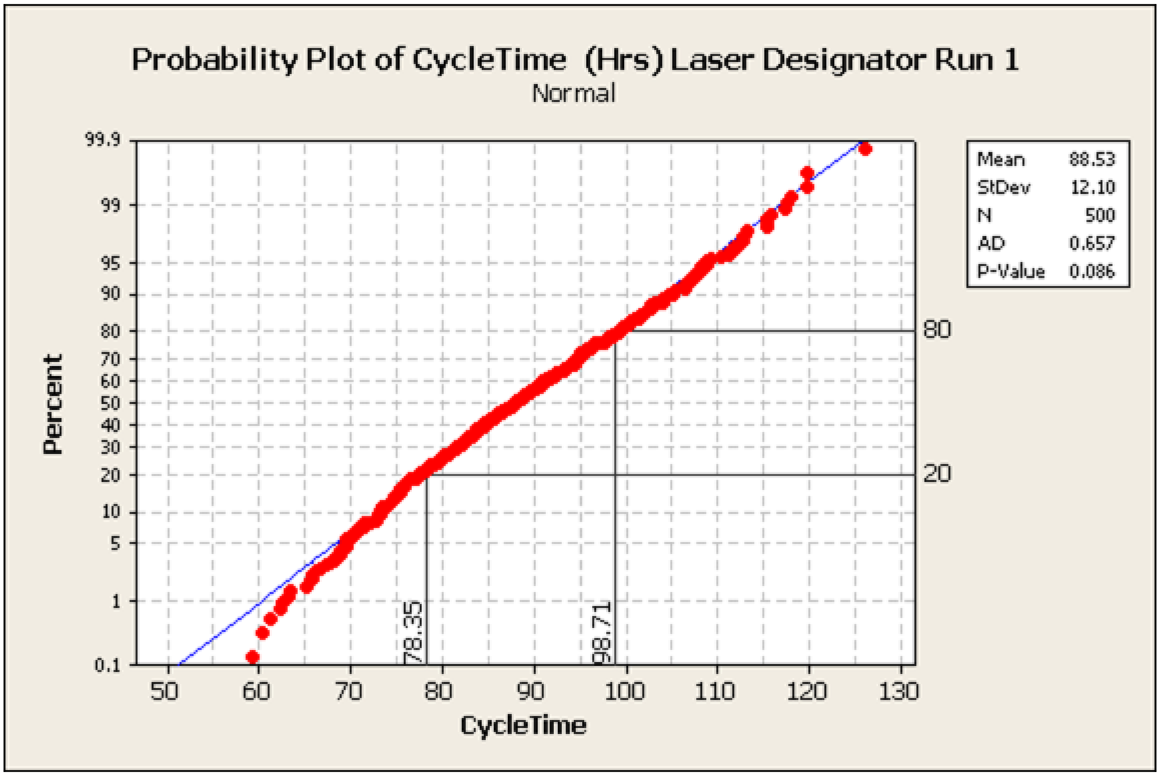
Activity Statistics In Weeks (Hours)

	Count	Avg Cycle	Avg Serv	Avg Block	Avg Work
Wait until all certs are done	500	59.67	59.67	59.67	0.00
DT	500	57.10	57.10	51.70	5.40
IFC Lead Time	1000	41.05	41.05	30.61	10.44
E3IAR Update	1000	29.68	29.68	27.45	2.23
Range Safety Lead Time	500	26.58	26.58	23.91	2.67
IA & CCA Finish Together	500	18.43	18.43	18.43	0.00
Range Safety	500	20.76	20.76	18.08	2.68
Finish Together	500	7.23	7.23	7.23	0.00
EMC Load Time	500	0.54	0.54	0.00	0.54
EMI Lead Time	500	0.53	0.53	0.00	0.53
EMV Lead Time	500	25.72	25.72	0.00	25.72
ESD Load Time	500	0.53	0.53	0.00	0.53
ESD	500	1.11	1.11	0.00	1.11
Bonding & Grounding Lead Time	500	0.52	0.52	0.00	0.52
Bonding & Grounding	500	1.11	1.11	0.00	1.11
Env Qual Lead Time	500	2.31	2.31	0.00	2.31
Env Qual	500	0.53	0.53	0.00	0.53
LRSB Lead Time	500	5.02	5.02	0.00	5.02
LRSB	1500	0.89	0.89	0.00	0.89
LASHAZ Eval Lead Time	500	4.88	4.88	0.00	4.88
LASHAZ Eval	1000	1.99	1.99	0.00	1.99
LASER Design Checklist Lead Time	500	4.65	4.65	0.00	4.65
LASER Design Checklist	1000	2.06	2.06	0.00	2.06
FDA MIL-Exempt Letter Lead Time	500	2.99	2.99	0.00	2.99
FDA MIL-Exempt Letter	1000	0.53	0.53	0.00	0.53
Battery Approval Lead Time	500	3.98	3.98	0.00	3.98
Battery Approval Checklist	1000	14.28	14.28	0.00	14.28
IA Lead Time	500	25.71	25.71	0.00	25.71
IA (Interim)	500	3.02	3.02	0.00	3.02
CCA Lead Time	500	8.59	8.59	0.00	8.59
CCA	500	1.97	1.97	0.00	1.97
Sys Safety	500	10.02	10.02	0.00	10.02
PMA	4000	0.00	0.00	0.00	0.00
Start	500	0.00	0.00	0.00	0.00
OT	500	1.18	1.18	0.00	1.18
Develop & Build	500	0.00	0.00	0.00	0.00
End	500	0.00	0.00	0.00	0.00
DT Load Time	500	4.98	4.98	0.00	4.98
IFC	500	2.99	2.99	0.00	2.99
E3IAR	2500	2.23	2.23	0.00	2.23
OT Lead Time	500	25.27	25.27	0.00	25.27
JITC Lead Time	500	7.87	7.87	0.00	7.87
EMC (Intra-Sys EMC)	500	0.22	0.22	0.00	0.22
EMI	500	2.22	2.22	0.00	2.22
EMV (Inter-Sys EMC)	500	2.49	2.49	0.00	2.49
JITC	500	11.66	11.66	0.00	11.66

LASER Designator Run Baseline Output Data

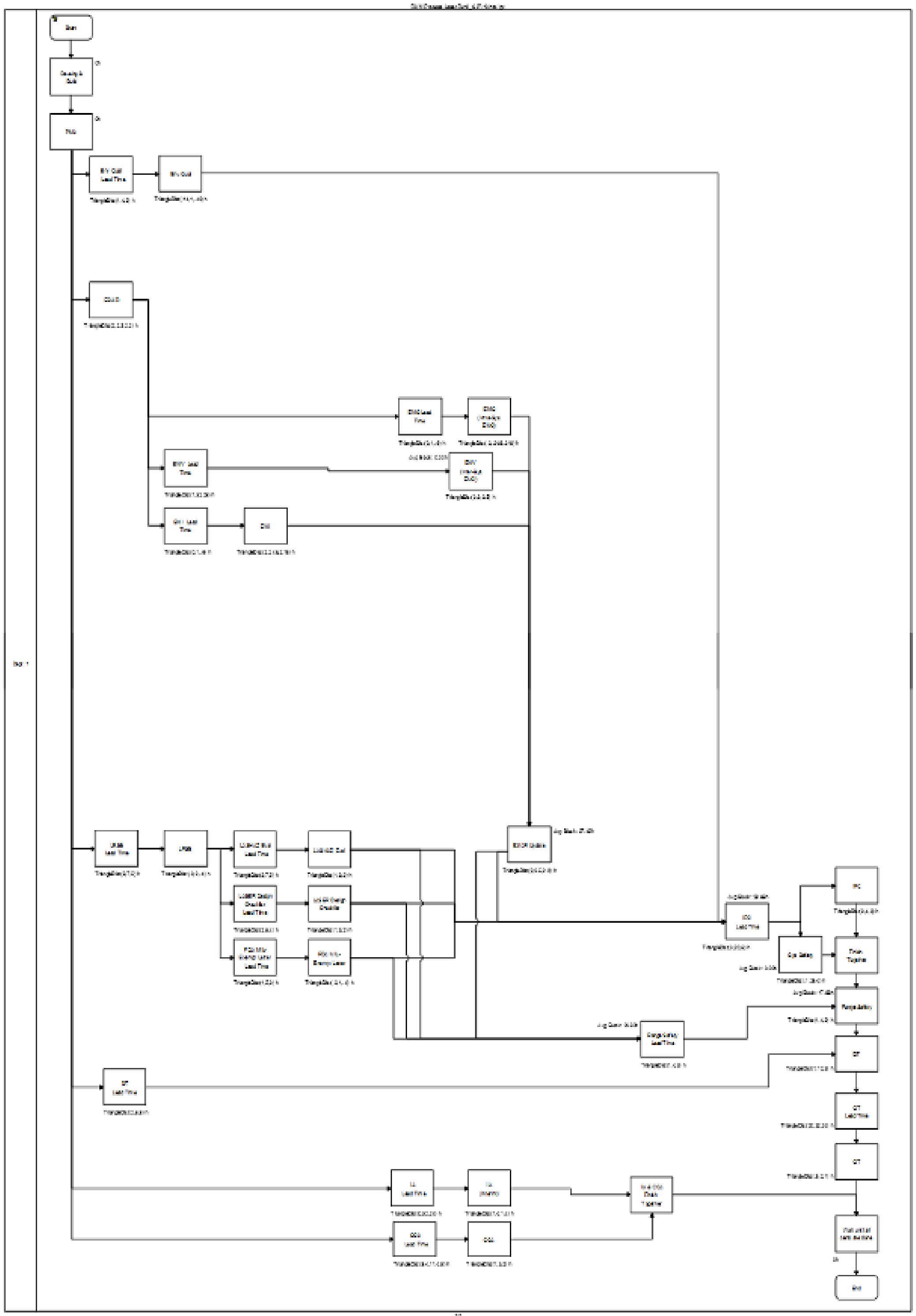






Probability Plot of CycleTime (Hrs) Laser Designator Run 1
Normal
Mean 88.53
StDev 12.10
N 500
AD 0.657
P-Value 0.086
Percent
CycleTime
78.35
98.71
80
20

LASER Designator Run 2 Baseline



Elapsed Time in Weeks

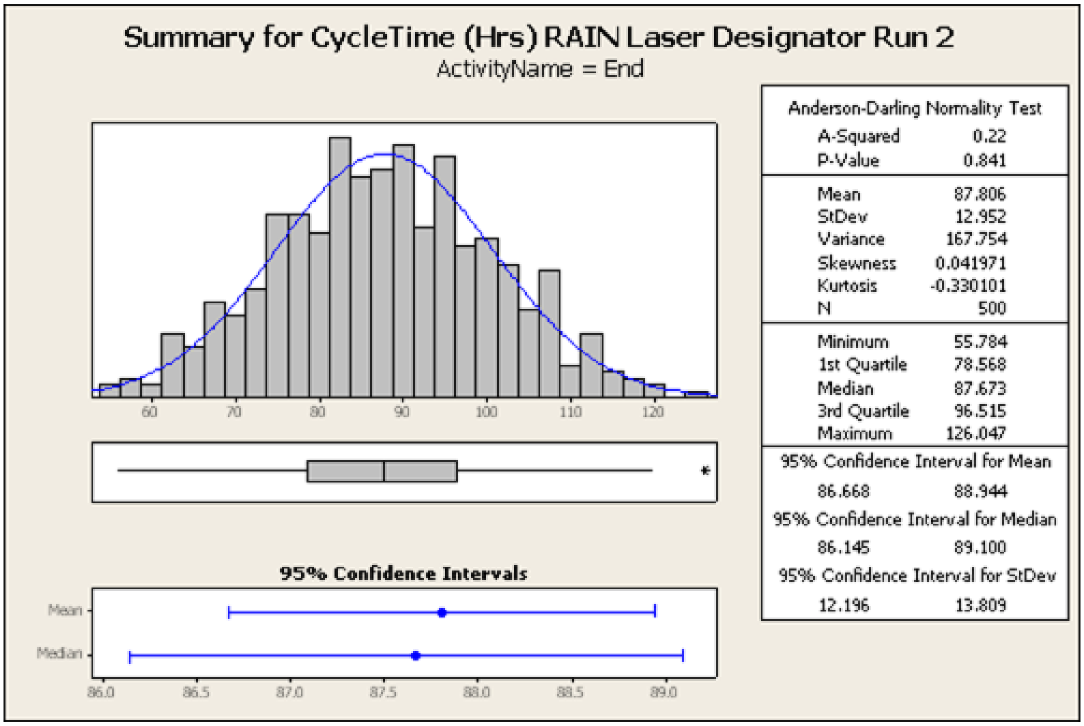
43903.10

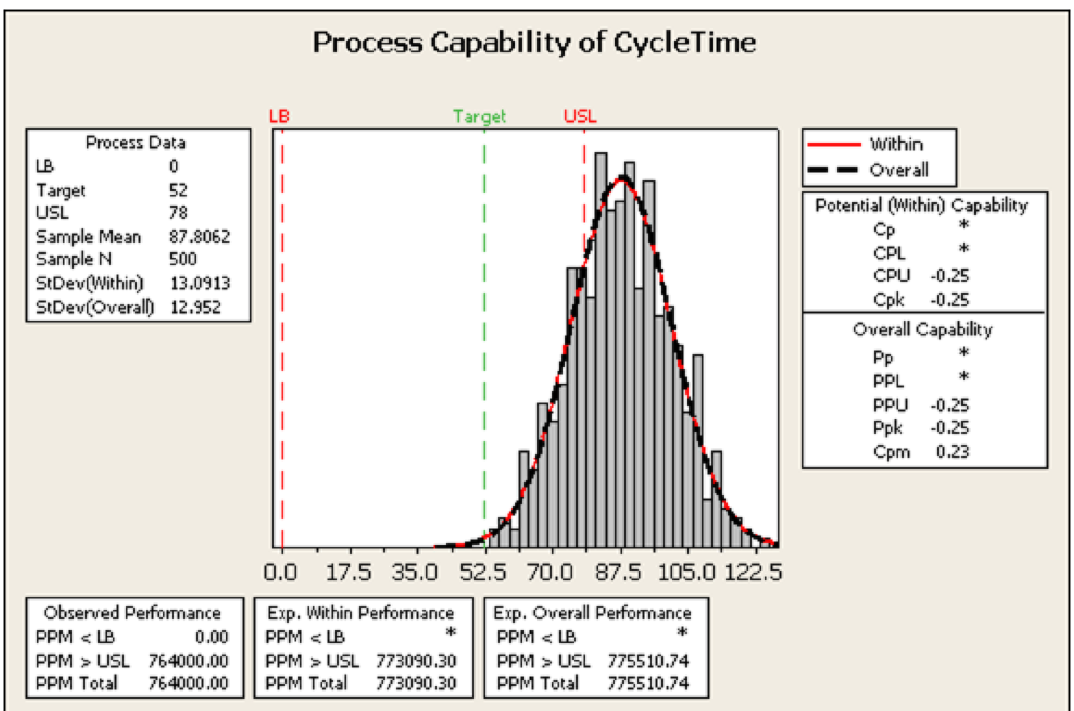
Activity Statistics In Weeks (Hours)

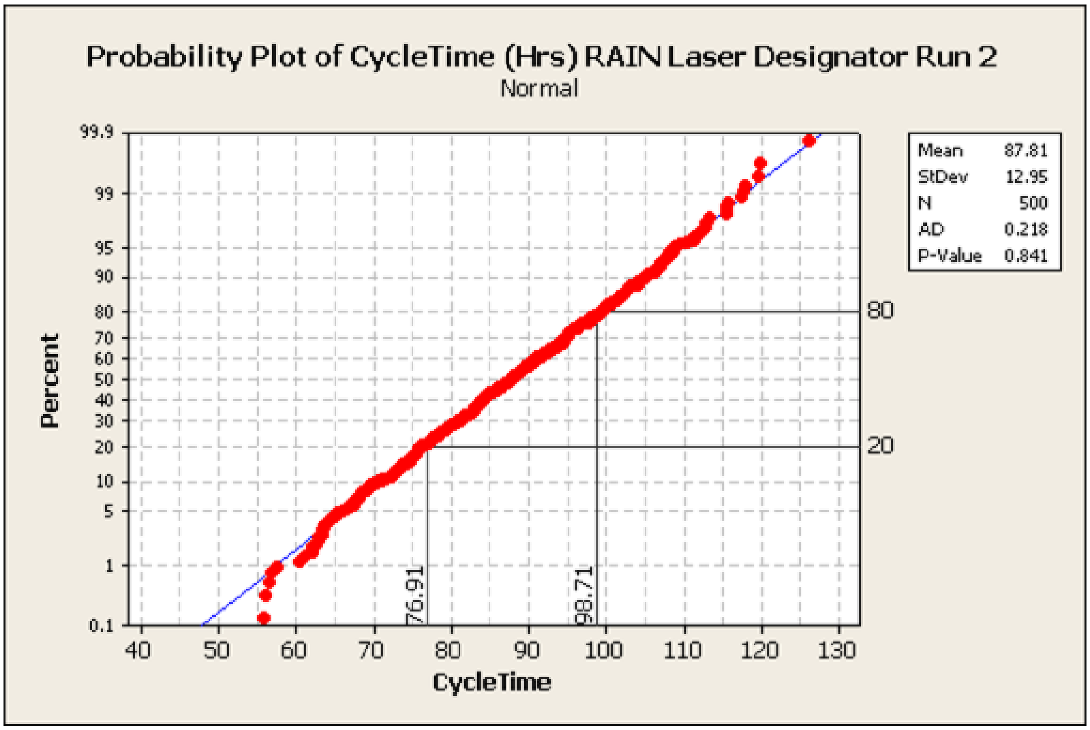
Count	Avg Cycle	Avg Serv	Avg Block	Avg Work
500	87.81	87.81	0.00	87.81

Activity Statistics In Weeks (Hours)

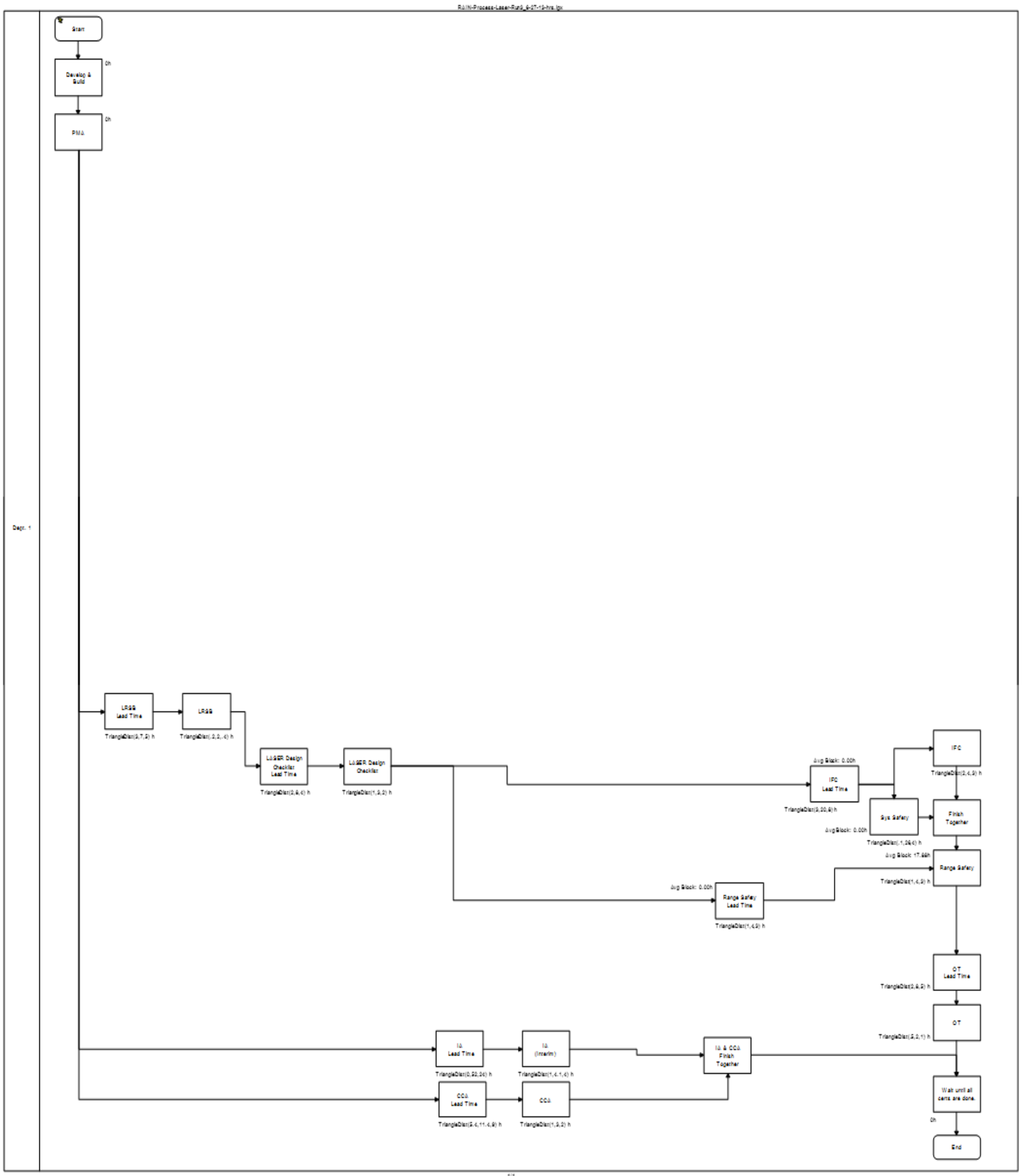
	Count	Avg Cycle	Avg Serv	Avg Block	Avg Work
Wait until all certs are done.	500	58.94	58.94	58.94	0.00
DT	500	56.37	56.37	50.97	5.40
IFC Lead Time	1000	40.32	40.32	29.88	10.44
E3IAR Update	1000	29.68	29.68	27.45	2.23
Range Safety Lead Time	500	25.97	25.97	23.30	2.67
IA & CCA Finish Together	500	18.43	18.43	18.43	0.00
Range Safety	500	20.56	20.56	17.88	2.68
Finish Together	500	7.23	7.23	7.23	0.00
EMC Lead Time	500	0.54	0.54	0.00	0.54
EMI Lead Time	500	0.53	0.53	0.00	0.53
EMV Lead Time	500	25.72	25.72	0.00	25.72
Env Qual Lead Time	500	2.31	2.31	0.00	2.31
Env Qual	500	0.53	0.53	0.00	0.53
LRSB Lead Time	500	5.02	5.02	0.00	5.02
LRSB	1500	0.89	0.89	0.00	0.89
LASHAZ Eval Lead Time	500	4.98	4.98	0.00	4.98
LASHAZ Eval	1000	1.99	1.99	0.00	1.99
LASER Design Checklist Lead Time	500	4.65	4.65	0.00	4.65
LASER Design Checklist	1000	2.06	2.06	0.00	2.06
Develop & Build	500	0.00	0.00	0.00	0.00
FDA MIL-Exempt Letter	1000	0.53	0.53	0.00	0.53
IA Lead Time	500	25.71	25.71	0.00	25.71
IA (Interim)	500	3.02	3.02	0.00	3.02
CCA Lead Time	500	8.59	8.59	0.00	8.59
CCA	500	1.97	1.97	0.00	1.97
Sys Safety	500	10.02	10.02	0.00	10.02
PMA	3000	0.00	0.00	0.00	0.00
Start	500	0.00	0.00	0.00	0.00
OT	500	1.18	1.18	0.00	1.18
OT Lead Time	500	25.27	25.27	0.00	25.27
End	500	0.00	0.00	0.00	0.00
DT Lead Time	500	4.98	4.98	0.00	4.98
IFC	500	2.99	2.99	0.00	2.99
E3IAR	1500	2.23	2.23	0.00	2.23
EMC (Intra-Sys EMC)	500	0.22	0.22	0.00	0.22
EMI	500	2.22	2.22	0.00	2.22
EMV (Inter-Sys EMC)	500	2.49	2.49	0.00	2.49
FDA MIL-Exempt Letter Lead Time	500	2.99	2.99	0.00	2.99


Summary for CycleTime (Hrs) RAIN Laser Designator Run 2
ActivityName = End
Anderson-Darling Normality Test
A-Squared 0.22
P-Value 0.841
Mean 87.806
StDev 12.952
Variance 167.754
Skewness 0.041971
Kurtosis -0.330101
N 500
Minimum 55.784
1st Quartile 78.568
Median 87.673
3rd Quartile 96.515
Maximum 126.047
95% Confidence Interval for Mean
86.668 88.944
95% Confidence Interval for Median
86.145 89.100
95% Confidence Interval for StDev
12.196 13.809
95% Confidence Intervals
Mean
Median


Process Capability of CycleTime
LB
Target
USL
Process Data
LB 0
Target 52
USL 78
Sample Mean 87.8062
Sample N 500
StDev(Within) 13.0913
StDev(Overall) 12.952
Within
Overall
Potential (Within) Capability
Cp *
CPL *
CPU -0.25
Cpk -0.25
Overall Capability
Pp *
PPL *
PPU -0.25
Ppk -0.25
Cpm 0.23
0.0 17.5 35.0 52.5 70.0 87.5 105.0 122.5
Observed Performance
PPM < LB 0.00
PPM > USL 764000.00
PPM Total 764000.00
Exp. Within Performance
PPM < LB *
PPM > USL 773090.30
PPM Total 773090.30
Exp. Overall Performance
PPM < LB *
PPM > USL 775510.74
PPM Total 775510.74


Probability Plot of CycleTime (Hrs) RAIN Laser Designator Run 2
Normal
Mean 87.81
StDev 12.95
N 500
AD 0.218
P-Value 0.841
Percent
CycleTime
76.91
98.71
80
20

LASER Designator Run 3 Baseline



RAIN-Process-Laser-Run3_6-27-13-hrs.igx

Elapsed Time in Weeks

21511.07

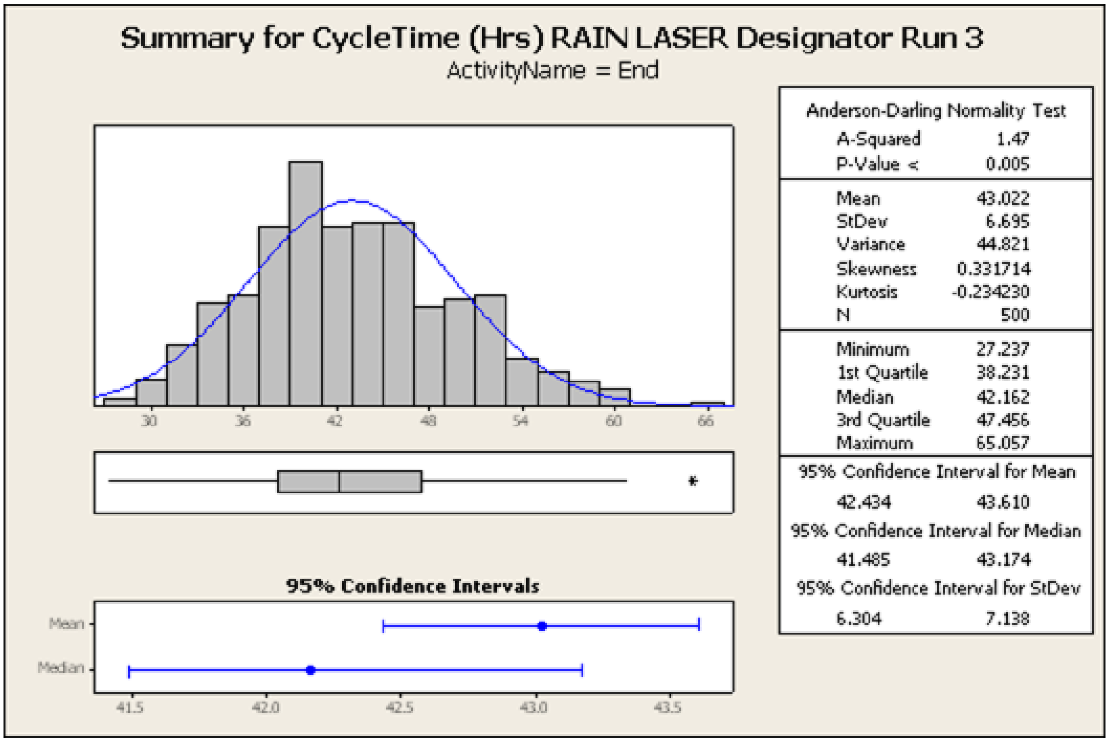
Activity Statistics In Weeks (Hours)

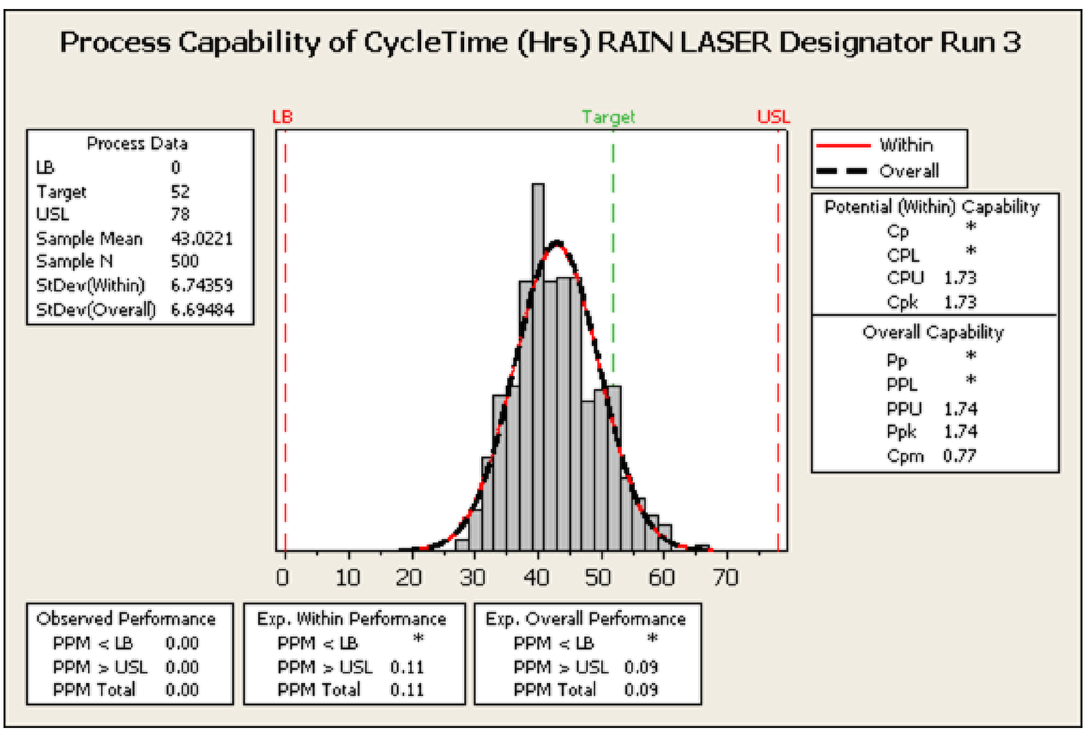
Count	Avg Cycle	Avg Serv	Avg Block	Avg Work
500	43.02	43.02	0.00	43.02

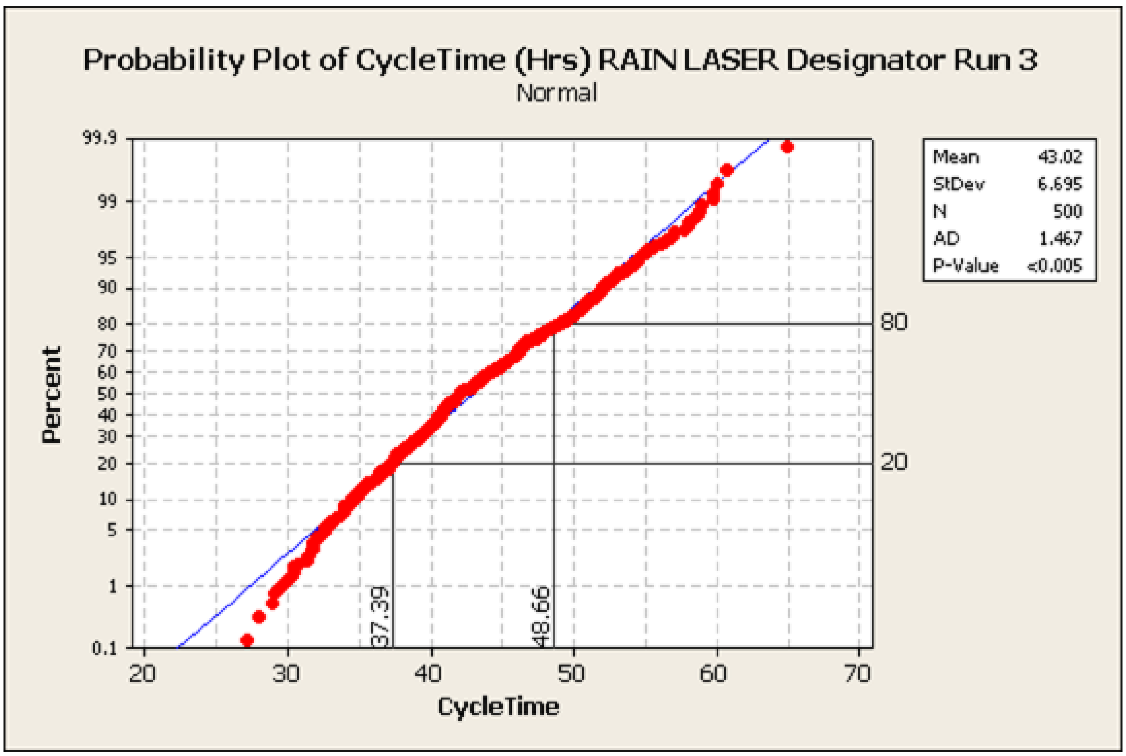
Activity Statistics in Weeks (Hours)

	Count	Avg Cycle	Avg Serv	Avg Block	Avg Work
IA & CCA Finish Together	500	18.43	18.43	18.43	0.00
Range Safety	500	20.56	20.56	17.88	2.68
Wait until all certs are done.	500	15.18	15.18	15.18	0.00
Finish Together	500	7.23	7.23	7.23	0.00
Develop & Build	500	0.00	0.00	0.00	0.00
End	500	0.00	0.00	0.00	0.00
IFC	500	2.99	2.99	0.00	2.99
IFC Lead Time	1000	10.44	10.44	0.00	10.44
LRSB Lead Time	500	5.02	5.02	0.00	5.02
LRSB	500	0.89	0.89	0.00	0.89
LASER Design Checklist Lead Time	500	4.65	4.65	0.00	4.65
LASER Design Checklist	1000	2.06	2.06	0.00	2.06
IA Lead Time	500	25.71	25.71	0.00	25.71
IA (Interim)	500	3.02	3.02	0.00	3.02
CCA Lead Time	500	8.59	8.59	0.00	8.59
CCA	500	1.97	1.97	0.00	1.97
Sys Safety	500	10.02	10.02	0.00	10.02
PMA	1500	0.00	0.00	0.00	0.00
Start	500	0.00	0.00	0.00	0.00
OT	500	1.18	1.18	0.00	1.18
OT Lead Time	500	4.97	4.97	0.00	4.97
Range Safety Lead Time	500	2.67	2.67	0.00	2.67

1/1


Summary for CycleTime (Hrs) RAIN LASER Designator Run 3
ActivityName = End
Anderson-Darling Normality Test
A-Squared 1.47
P-Value < 0.005
Mean 43.022
StDev 6.695
Variance 44.821
Skewness 0.331714
Kurtosis -0.234230
N 500
Minimum 27.237
1st Quartile 38.231
Median 42.162
3rd Quartile 47.456
Maximum 65.057
95% Confidence Interval for Mean
42.434 43.610
95% Confidence Interval for Median
41.485 43.174
95% Confidence Interval for StDev
6.304 7.138
95% Confidence Intervals
Mean
Median


Process Capability of CycleTime (Hrs) RAIN LASER Designator Run 3
LB
Target
USL
Process Data
LB 0
Target 52
USL 78
Sample Mean 43.0221
Sample N 500
StDev(Within) 6.74359
StDev(Overall) 6.69484
Within
Overall
Potential (Within) Capability
Cp *
CPL *
CPU 1.73
Cpk 1.73
Overall Capability
Pp *
PPL *
PPU 1.74
Ppk 1.74
Cpm 0.77
Observed Performance
PPM < LB 0.00
PPM > USL 0.00
PPM Total 0.00
Exp. Within Performance
PPM < LB *
PPM > USL 0.11
PPM Total 0.11
Exp. Overall Performance
PPM < LB *
PPM > USL 0.09
PPM Total 0.09

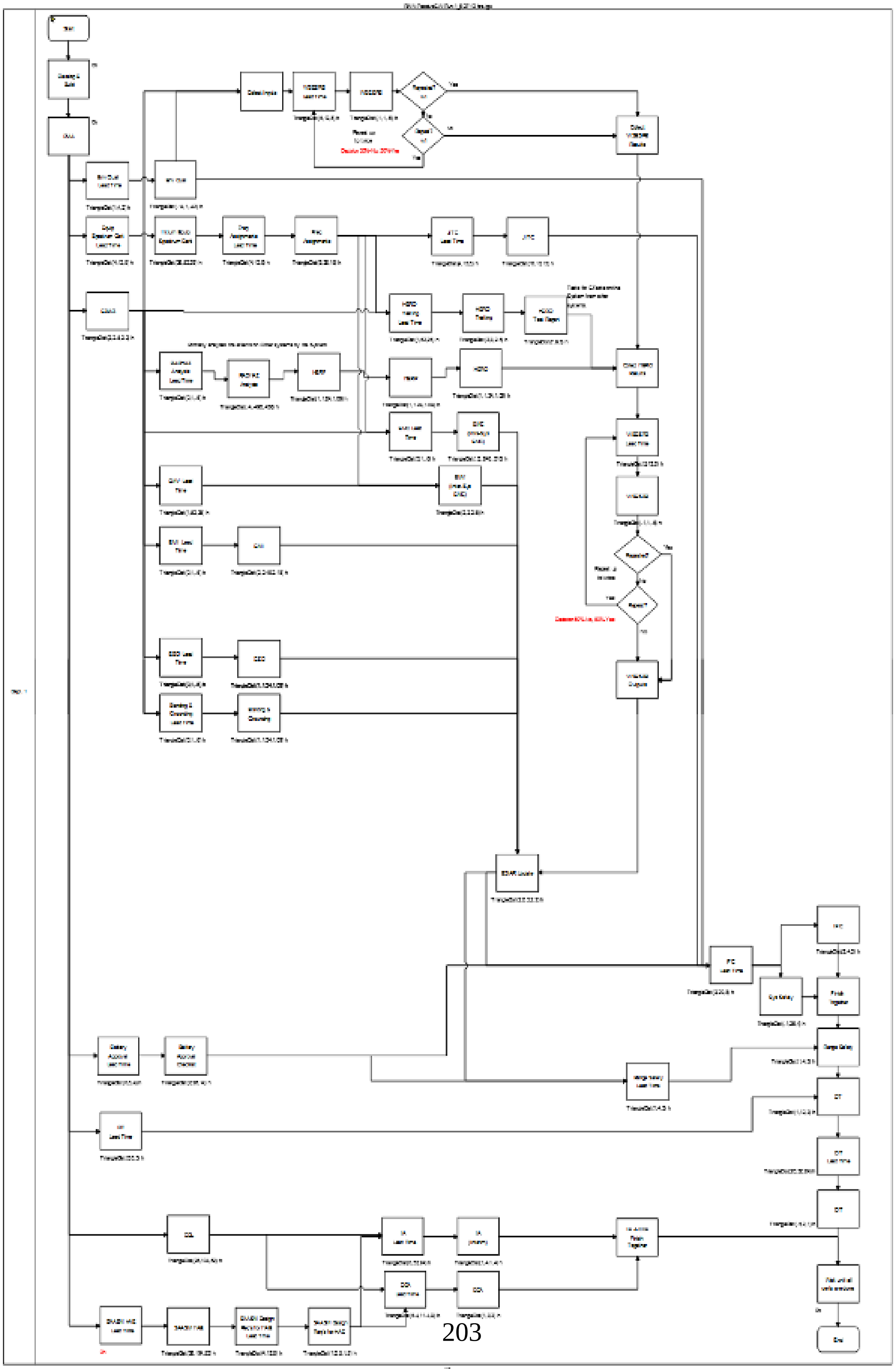


Probability Plot of CycleTime (Hrs) RAIN LASER Designator Run 3
Normal
Percent
CycleTime
Mean 43.02
StDev 6.695
N 500
AD 1.467
P-Value <0.005
37.39
48.66
80
20

Passive EW Runs 1 through 3 Baseline

Requirements		Passive EW		
Level 1	Level 2	Run 1 (Simple Integration)	Run 2 (Complex Integration)	Run 3 (Highly Mature Payload)
CDL		Y	N	Done
Airworthiness (IPD)	Risk Assessment Questionnaire	Y	Y	Done
	HOL	Y	Y	Y
	SOCAP	Y	Y	Done
	Risks	Y	Y	Y
E3 (Electromagnetic Environmental Effects)	EMAK	Y	Y	Done
	EMC (intra-system)	Y	Y	Done
	EMI	Y	Y	Done
	EMP	N	N	Done
	EMV (inter-system EMC)	Y	Y	Done
	ESD	Y	N	Done
	HERO Testing	Y	N	Done
	RADHAZ	Y	N	Done
	HERP	Y	N	Done
	HERO	Y	N	Done
	HERF	Y	N	Done
	Bonding & grounding	Y	N	Done
	Lightning	N	N	N
	P-Static	N	N	N
Environmental Qualification	MIL-STD-810G tests with 24 hour soak leg, Humidity, Temp	Y	Y	Done
LASER Safety Review	LSRB Review of Safety	N	N	N
	Laser radiation hazard evaluation	N	N	N
	Laser design checklist	N	N	N
	FDA mil-exempt letter	N	N	N
Safety Approval	Product spec for battery cell	Y	N	N
	Battery schematic (cell & control board)	Y	N	N
	CONOPS	Y	N	N
	Operator's Manual	Y	N	N
	Battery safety data package	Y	N	N
	Request letter	Y	N	N
IA (Information Assurance)		Y	Y	Y
AT (Anti-Tamper)		Y	Y	Y
CCA (Clinger-Cohen Act)		Y	Y	Y
Spectrum	1. Equipment Spectrum Certification (Frequency Allocation) 1494 (SPS & JT-12)	Y	N	N
	2. Assignments	Y	N	N
System Safety Approval		Y	Y	Y
T&E	Range Safety Approval	Y	Y	Y
	DT	Y	Y	Done
	OT	Y	Y	Y
WSESRB Approval		Y	N	N
ITC		Y	N	Done
Selective Availability Anti-Spoofing Module (SAASM)	Security Approval for SAASM Host Application Equipment (HAE)	Y	N	Done
	SAASM Design Requirements for HAE (SAASM Functionalities, including Extended Functions)	Y	N	Done

Passive EW Run 1 Baseline



Elapsed Time in Weeks

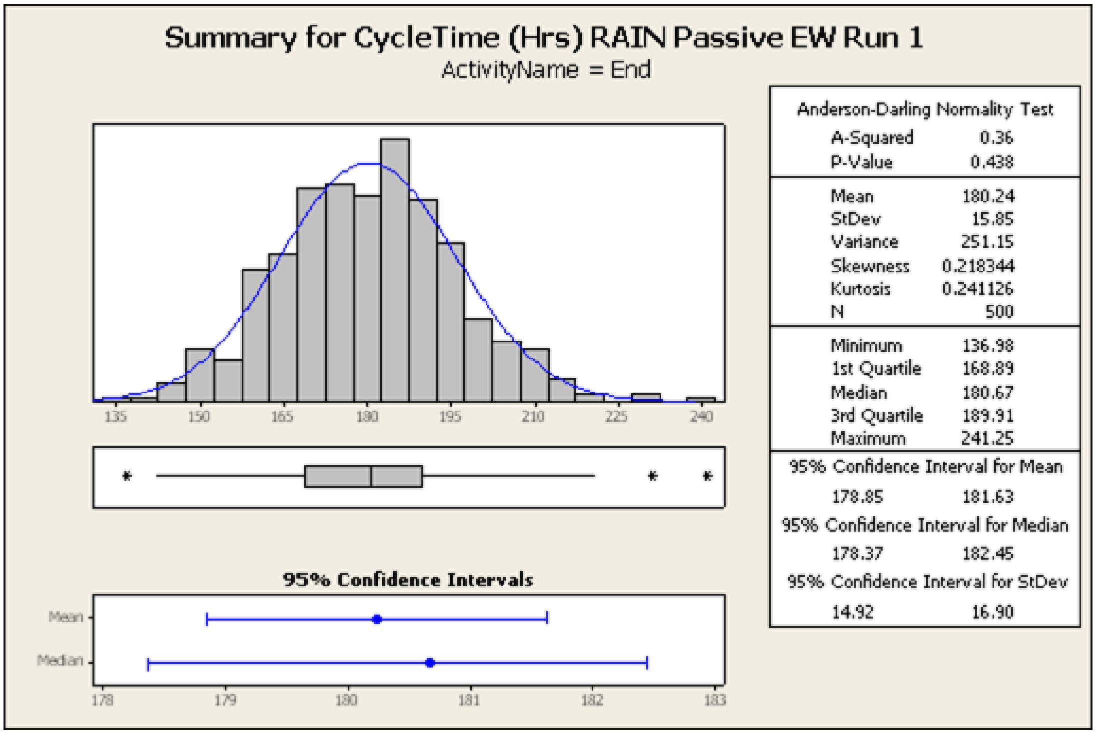
90120.11

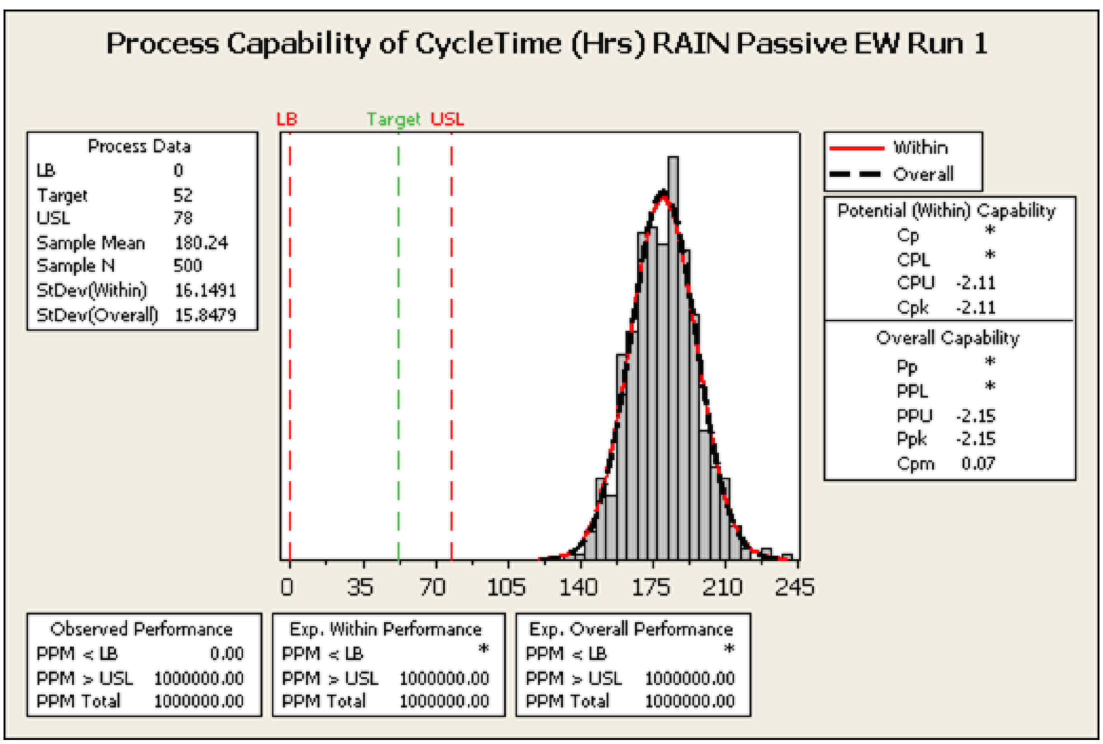
Transaction Statistics In Weeks (Hours)

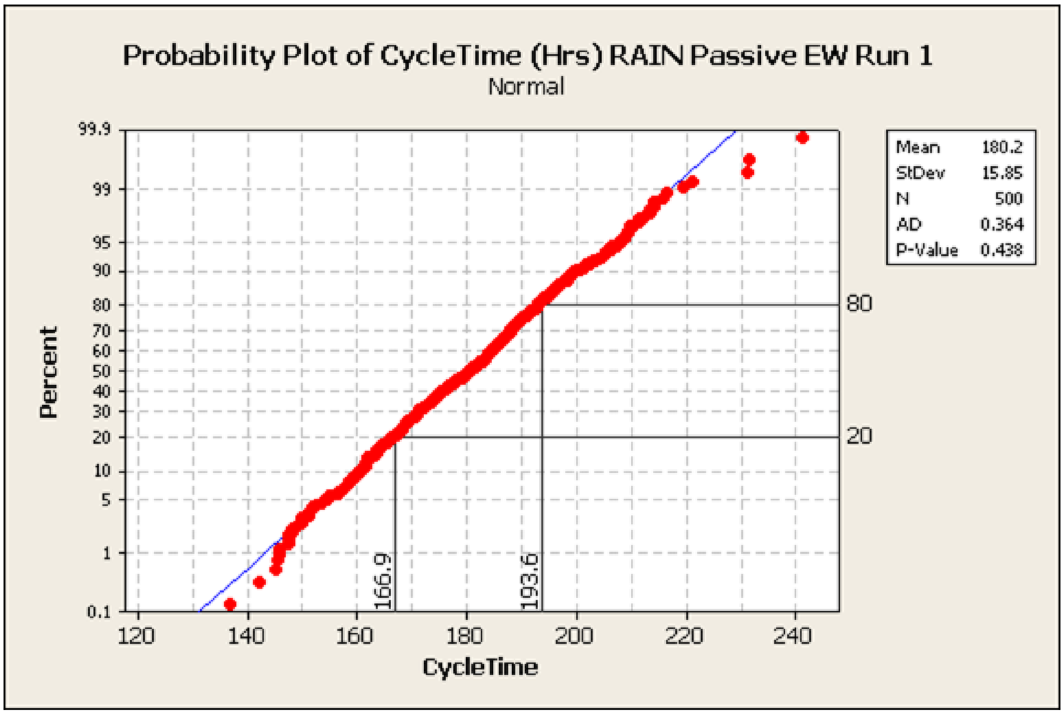
Count	Avg Cycle	Avg Serv	Avg Block	Avg Work
500	180.24	180.24	0.00	180.24

Activity Statistics In Weeks (Hours)

	Count	Avg Cycle	Avg Serv	Avg Block	Avg Work
CDL	1000	60.50	60.50	0.00	60.50
SAASM HAE	500	59.94	59.94	0.00	59.94
Intrum Equip Spectrum Cert	500	39.14	39.14	0.00	39.14
HERO Testing Lead Time	500	96.80	96.80	70.82	25.99
EMV Lead Time	500	25.72	25.72	0.00	25.72
IA Lead Time	500	45.83	45.83	20.11	25.71
OT Lead Time	500	25.27	25.27	0.00	25.27
Freq Assignments	2000	17.90	17.90	0.00	17.90
Battery Approval Checklist	1000	14.28	14.28	0.00	14.28
JITC	500	11.66	11.66	0.00	11.66
IFC Lead Time	1000	132.75	132.75	122.31	10.44
Sys Safety	500	10.02	10.02	0.00	10.02
CCA Lead Time	500	28.70	28.70	20.11	8.59
WSESRB Lead Time	750	8.33	8.33	0.00	8.33
WSESRB Lead Time	750	8.30	8.30	0.00	8.30
SAASM Design Req's for HAE Lead Time	500	8.06	8.06	0.00	8.06
HERO Test Report	500	8.03	8.03	0.00	8.03
Freq Assignments Lead Time	500	8.03	8.03	0.00	8.03
Equip Spectrum Cert Lead Time	500	7.99	7.99	0.00	7.99
JITC Lead Time	500	7.87	7.87	0.00	7.87
DT	500	148.81	148.81	143.40	5.40
DT Lead Time	500	4.98	4.98	0.00	4.98
Battery Approval Lead Time	500	3.98	3.98	0.00	3.98
IA (Interim)	500	3.02	3.02	0.00	3.02
IFC	500	2.99	2.99	0.00	2.99
Range Safety	500	20.56	20.56	17.88	2.68
Range Safety Lead Time	500	109.58	109.58	106.91	2.67
HERO Testing	**500**	**2.51**	**2.51**	**0.00**	**2.51**
EMV (Inter-Sys EMC)	**500**	**47.60**	**47.60**	**45.10**	**2.49**
Env Qual Lead Time	**500**	**2.31**	**2.31**	**0.00**	**2.31**
E3IAR	4000	2.23	2.23	0.00	2.23
E3IAR Update	1000	121.41	121.41	119.18	2.23
EMI	500	2.22	2.22	0.00	2.22
CCA	500	1.97	1.97	0.00	1.97
SAASM Design Req's for HAE	1000	1.69	1.69	0.00	1.69
OT	500	1.18	1.18	0.00	1.18
Bonding & Grounding	500	1.11	1.11	0.00	1.11
HERP	500	1.11	1.11	0.00	1.11
HERO	500	1.11	1.11	0.00	1.11
ESD	500	1.11	1.11	0.00	1.11
HERF	500	1.11	1.11	0.00	1.11
WSESRB	750	0.57	0.57	0.00	0.57
WSESRB	750	0.56	0.56	0.00	0.56
RADHAZ Analysis Lead Time	500	0.55	0.55	0.00	0.55
EMC Lead Time	500	71.36	71.36	70.82	0.54
EMI Lead Time	500	0.53	0.53	0.00	0.53
Env Qual	1000	0.53	0.53	0.00	0.53
ESD Lead Time	500	0.53	0.53	0.00	0.53
Bonding & Grounding Lead Time	500	0.52	0.52	0.00	0.52
RADHAZ Analysis	500	0.44	0.44	0.00	0.44
EMC (Intra-Sys EMC)	500	0.22	0.22	0.00	0.22
PMA	3500	0.00	0.00	0.00	0.00
Start	500	0.00	0.00	0.00	0.00
End	500	0.00	0.00	0.00	0.00
Wait until all certs are done.	500	76.23	76.23	76.23	0.00
SAASM HAE Lead Time	500	0.00	0.00	0.00	0.00
Develop & Build	500	0.00	0.00	0.00	0.00
Repeat?	500	0.00	0.00	0.00	0.00
Repeated?	750	0.00	0.00	0.00	0.00
Repeated? w1	750	0.00	0.00	0.00	0.00
Repeat? w1	500	0.00	0.00	0.00	0.00
Collect Inputs	500	0.73	0.73	0.73	0.00
Collect HERO Results	500	103.03	103.03	103.03	0.00
Collect WSESRB Results	500	0.00	0.00	0.00	0.00
IA & CCA Finish Together	500	18.43	18.43	18.43	0.00
WSESRB Outputs	500	0.00	0.00	0.00	0.00
Finish Together	500	7.23	7.23	7.23	0.00

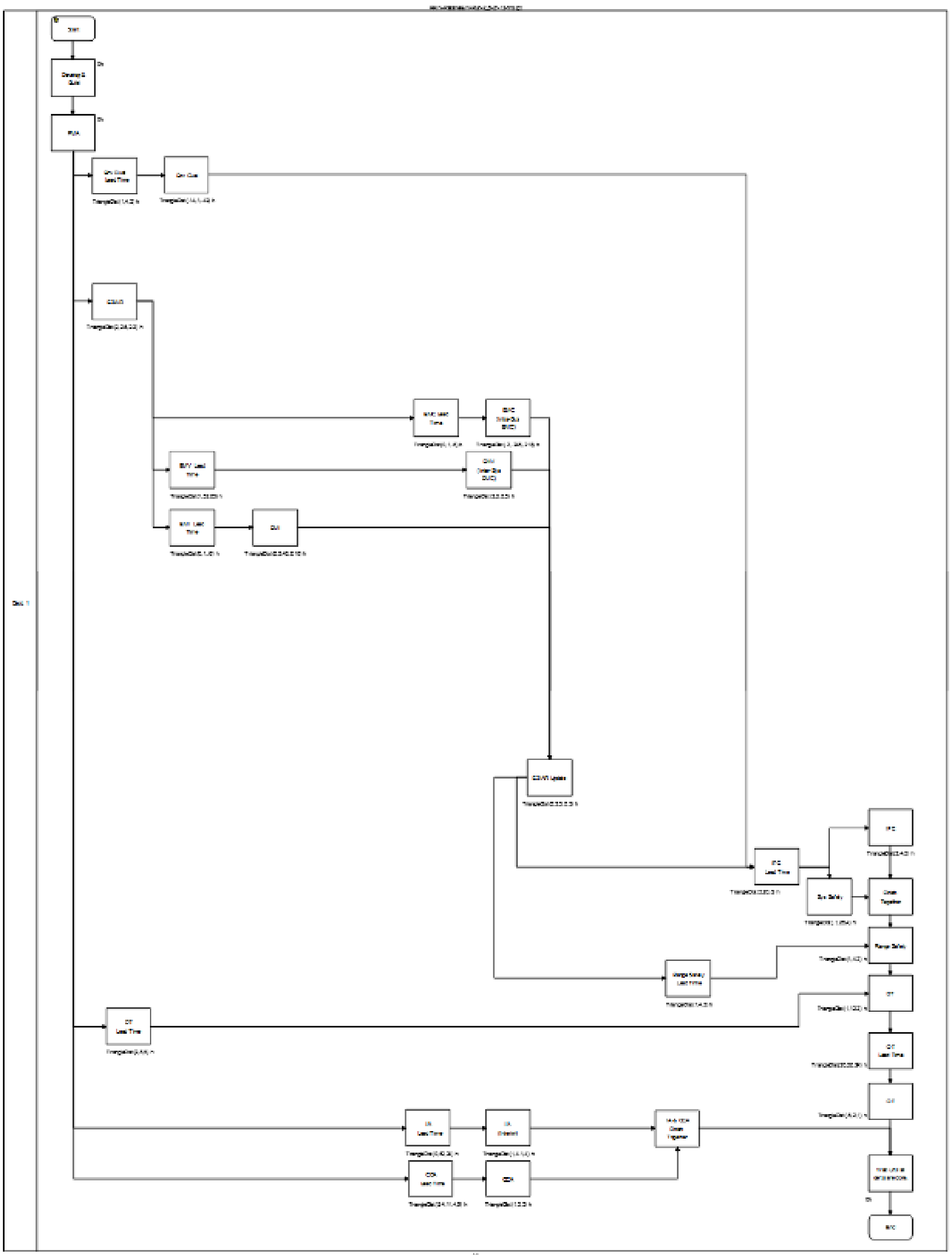

Summary for CycleTime (Hrs) RAIN Passive EW Run 1
ActivityName = End
Anderson-Darling Normality Test
A-Squared 0.36
P-Value 0.438
Mean 180.24
StDev 15.85
Variance 251.15
Skewness 0.218344
Kurtosis 0.241126
N 500
Minimum 136.98
1st Quartile 168.89
Median 180.67
3rd Quartile 189.91
Maximum 241.25
95% Confidence Interval for Mean
178.85 181.63
95% Confidence Interval for Median
178.37 182.45
95% Confidence Interval for StDev
14.92 16.90
95% Confidence Intervals
Mean
Median


Process Capability of CycleTime (Hrs) RAIN Passive EW Run 1
Process Data
LB 0
Target 52
USL 78
Sample Mean 180.24
Sample N 500
StDev(Within) 16.1491
StDev(Overall) 15.8479
LB
Target
USL
Within
Overall
Potential (Within) Capability
Cp *
CPL *
CPU -2.11
Cpk -2.11
Overall Capability
Pp *
PPL *
PPU -2.15
Ppk -2.15
Cpm 0.07
0 35 70 105 140 175 210 245
Observed Performance
PPM < LB 0.00
PPM > USL 1000000.00
PPM Total 1000000.00
Exp. Within Performance
PPM < LB *
PPM > USL 1000000.00
PPM Total 1000000.00
Exp. Overall Performance
PPM < LB *
PPM > USL 1000000.00
PPM Total 1000000.00



Probability Plot of CycleTime (Hrs) RAIN Passive EW Run 1
Normal
Mean 180.2
StDev 15.85
N 500
AD 0.364
P-Value 0.438
Percent
CycleTime
80
20
166.9
193.6

Passive EW Run 2 Baseline



Elapsed Time in Weeks

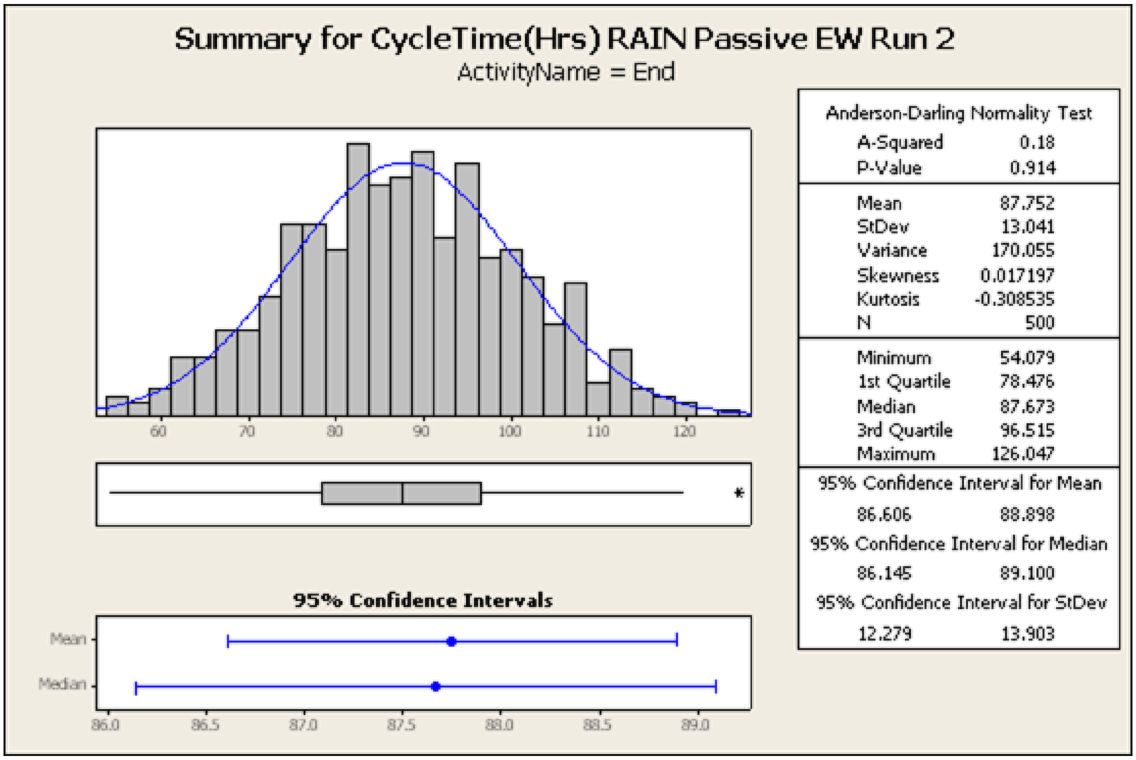
43875.98

Transaction Statistics In Weeks (Hours)

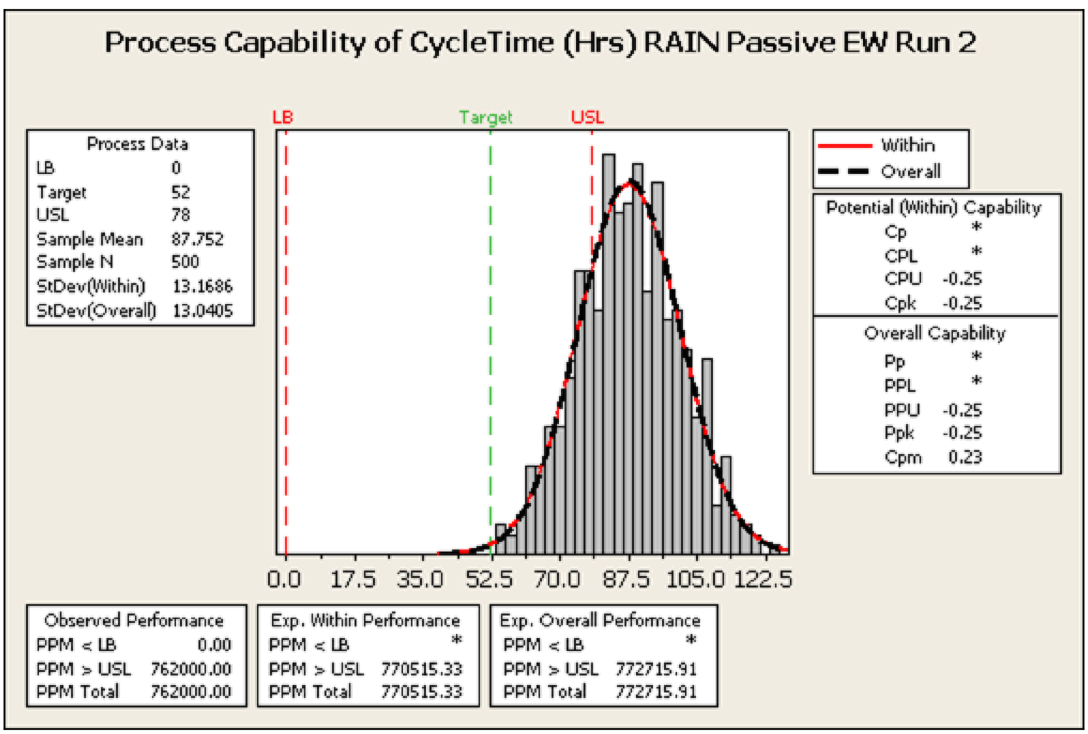
Count	Avg Cycle	Avg Serv	Avg Block	Avg Work
500	87.75	87.75	0.00	87.75

Activity Statistics In Weeks (Hours)

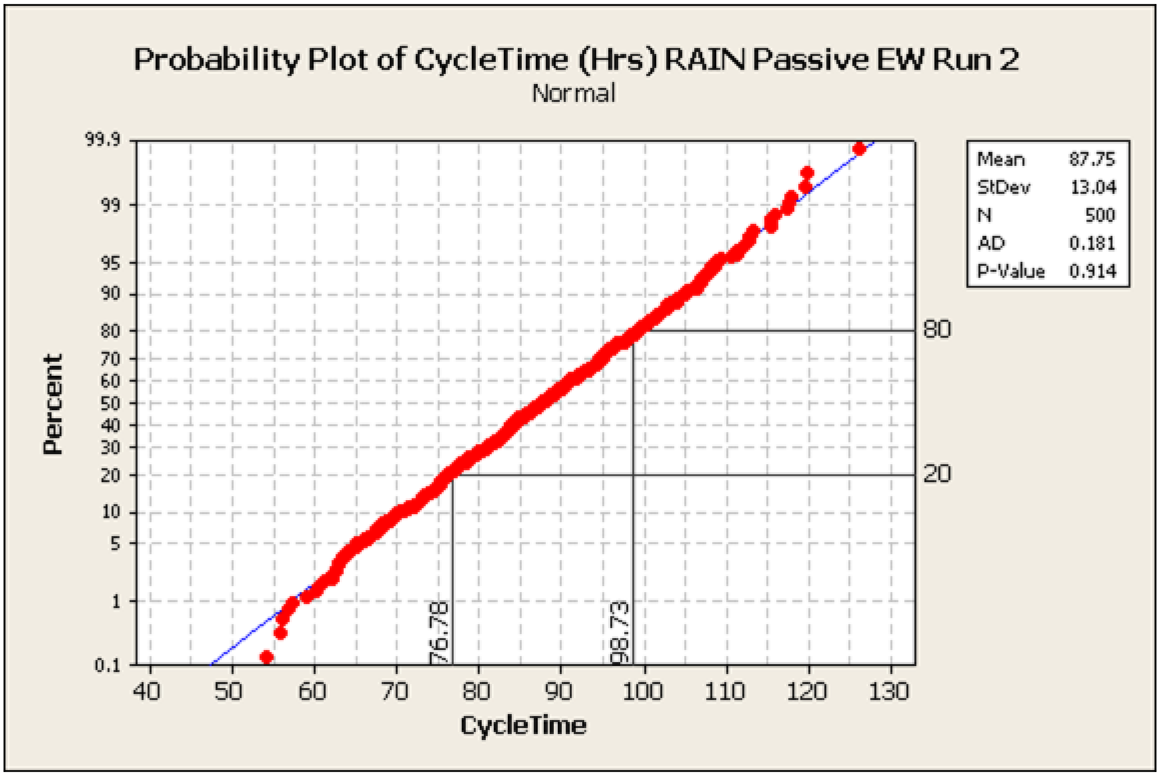
	Count	Avg Cycle	Avg Serv	Avg Block	Avg Work
EMV Lead Time	500	25.72	25.72	0.00	25.72
IA Lead Time	500	25.71	25.71	0.00	25.71
OT Lead Time	500	25.27	25.27	0.00	25.27
IFC Lead Time	1000	40.26	40.26	29.83	10.44
Sys Safety	500	10.02	10.02	0.00	10.02
CCA Lead Time	500	8.59	8.59	0.00	8.59
DT	500	56.32	56.32	50.92	5.40
DT Lead Time	500	4.98	4.98	0.00	4.98
IA (Interim)	500	3.02	3.02	0.00	3.02
IFC	500	2.99	2.99	0.00	2.99
Range Safety	**500**	**20.56**	**20.56**	**17.88**	**2.68**
Range Safety Lead TIme	500	2.67	2.67	0.00	2.67
EMV (Inter-Sys EMC)	500	2.49	2.49	0.00	2.49
Env Qual Lead Time	500	2.31	2.31	0.00	2.31
E3IAR	1500	2.23	2.23	0.00	2.23
E3IAR Update	1000	29.68	29.68	27.45	2.23
EMI	500	2.22	2.22	0.00	2.22
CCA	500	1.97	1.97	0.00	1.97
OT	500	1.18	1.18	0.00	1.18
EMC Lead Time	500	0.54	0.54	0.00	0.54
EMI Lead Time	500	0.53	0.53	0.00	0.53
Env Qual	500	0.53	0.53	0.00	0.53
EMC (Intra-Sys EMC)	500	0.22	0.22	0.00	0.22
Develop & Build	500	0.00	0.00	0.00	0.00
End	500	0.00	0.00	0.00	0.00
PMA	2500	0.00	0.00	0.00	0.00
Start	500	0.00	0.00	0.00	0.00
Wait until all certs are done.	500	58.89	58.89	58.89	0.00
IA & CCA Finish Together	500	18.43	18.43	18.43	0.00
Finish Together	500	7.23	7.23	7.23	0.00



Summary for CycleTime(Hrs) RAIN Passive EW Run 2
ActivityName = End
Anderson-Darling Normality Test
A-Squared 0.18
P-Value 0.914
Mean 87.752
StDev 13.041
Variance 170.055
Skewness 0.017197
Kurtosis -0.308535
N 500
Minimum 54.079
1st Quartile 78.476
Median 87.673
3rd Quartile 96.515
Maximum 126.047
95% Confidence Interval for Mean
86.606 88.898
95% Confidence Interval for Median
86.145 89.100
95% Confidence Interval for StDev
12.279 13.903
60 70 80 90 100 110 120
95% Confidence Intervals
Mean
Median
86.0 86.5 87.0 87.5 88.0 88.5 89.0

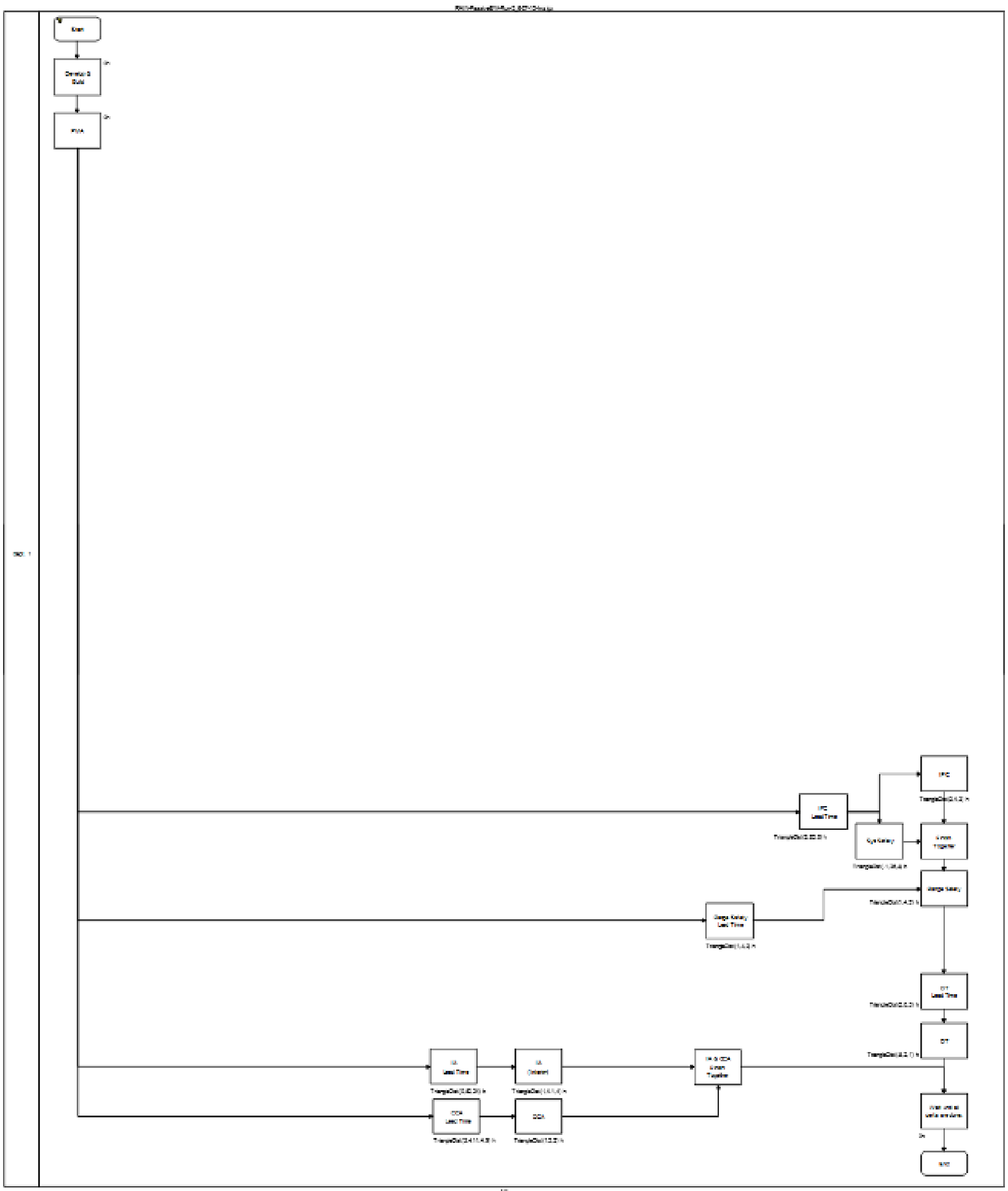


Process Capability of CycleTime (Hrs) RAIN Passive EW Run 2
Process Data
LB 0
Target 52
USL 78
Sample Mean 87.752
Sample N 500
StDev(Within) 13.1686
StDev(Overall) 13.0405
LB
Target
USL
Within
Overall
Potential (Within) Capability
Cp *
CPL *
CPU -0.25
Cpk -0.25
Overall Capability
Pp *
PPL *
PPU -0.25
Ppk -0.25
Cpm 0.23
0.0 17.5 35.0 52.5 70.0 87.5 105.0 122.5
Observed Performance
PPM < LB 0.00
PPM > USL 762000.00
PPM Total 762000.00
Exp. Within Performance
PPM < LB *
PPM > USL 770515.33
PPM Total 770515.33
Exp. Overall Performance
PPM < LB *
PPM > USL 772715.91
PPM Total 772715.91



Probability Plot of CycleTime (Hrs) RAIN Passive EW Run 2
Normal
Percent
CycleTime
Mean 87.75
StDev 13.04
N 500
AD 0.181
P-Value 0.914
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
40
50
60
70
80
90
100
110
120
130
80
20
76.78
98.73

Passive EW Run 3 Baseline



RAIN-PassiveEW-Run-3_6-27-13-hrs.igx

Elapsed Time in Weeks

17138.72

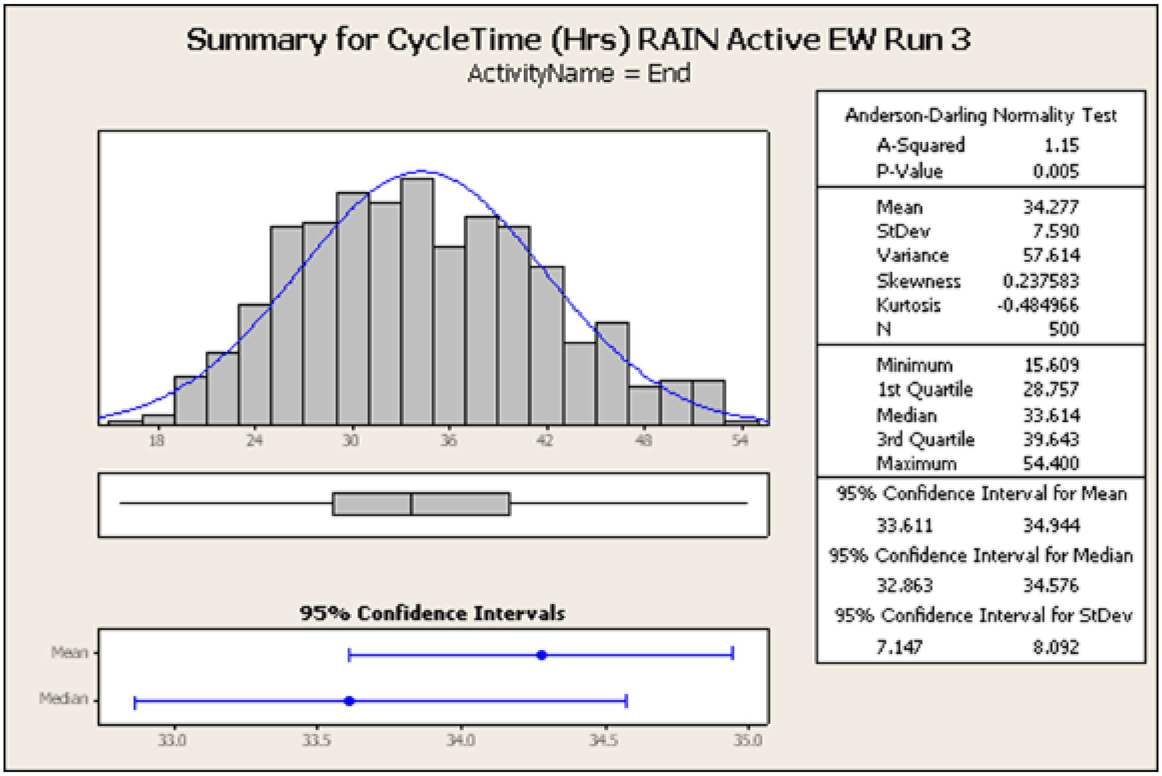
Transaction Statistics In Weeks (Hours)

Count	Avg Cycle	Avg Serv	Avg Block	Avg Work
500	34.28	34.28	0.00	34.28

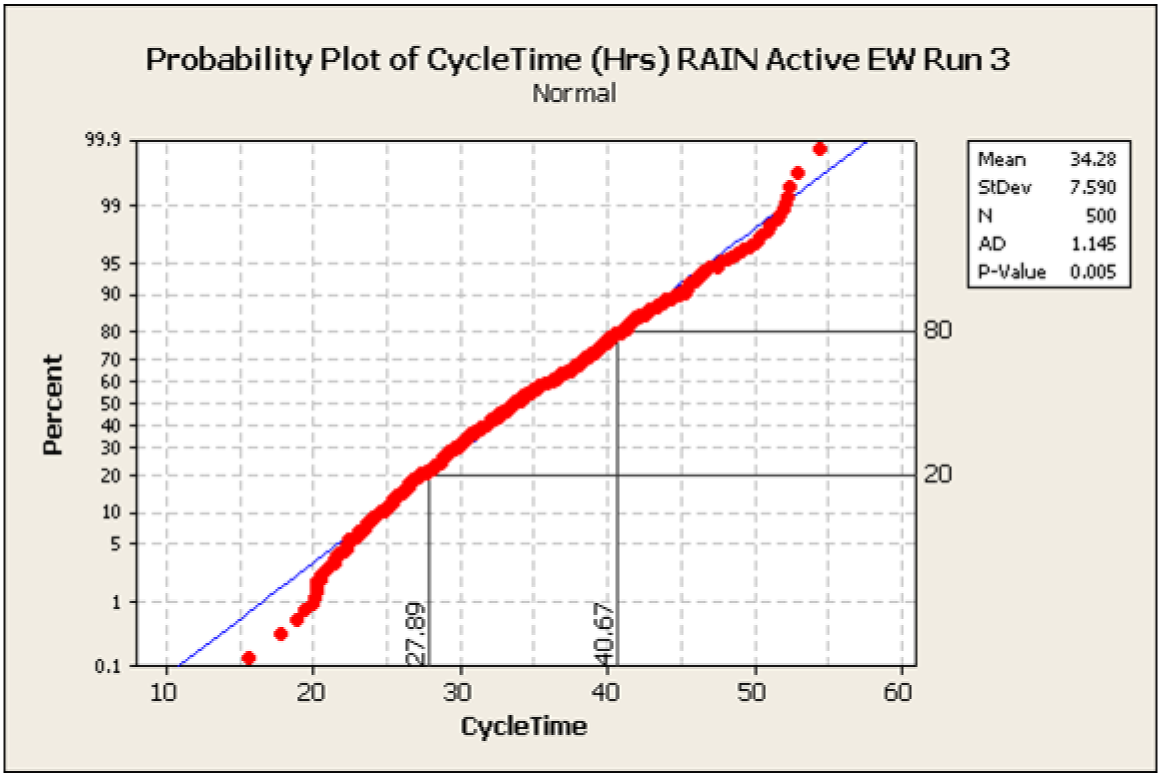
Activity Statistics In Weeks (Hours)

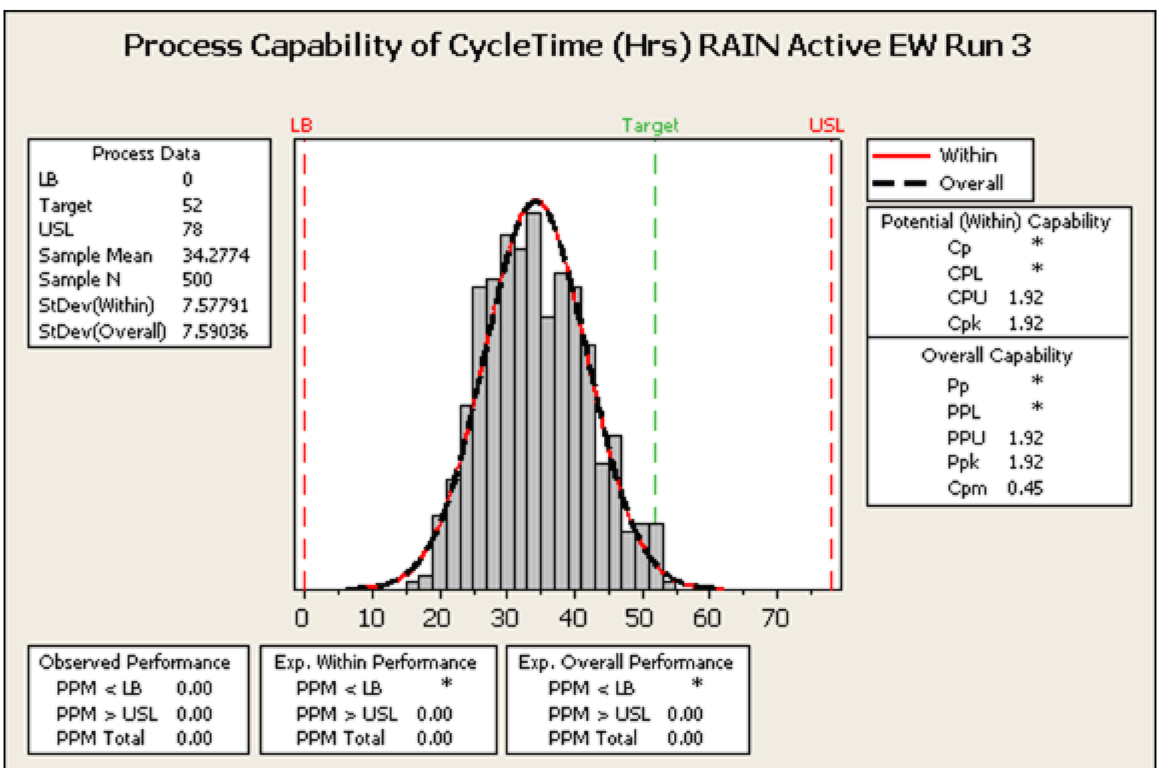
	Count	Avg Cycle	Avg Serv	Avg Block	Avg Work
IA Lead Time	500	25.71	25.71	0.00	25.71
IFC Lead Time	1000	10.44	10.44	0.00	10.44
Sys Safety	500	10.02	10.02	0.00	10.02
CCA Lead Time	500	8.59	8.59	0.00	8.59
OT Lead Time	500	4.97	4.97	0.00	4.97
IA (Interim)	**500**	**3.02**	**3.02**	**0.00**	**3.02**
IFC	500	2.99	2.99	0.00	2.99
Range Safety	500	20.56	20.56	17.88	2.68
Range Safety Lead Time	500	2.67	2.67	0.00	2.67
CCA	500	1.97	1.97	0.00	1.97
OT	500	1.18	1.18	0.00	1.18
Develop & Build	500	0.00	0.00	0.00	0.00
End	500	0.00	0.00	0.00	0.00
PMA	2000	0.00	0.00	0.00	0.00
Start	500	0.00	0.00	0.00	0.00
Wait until all certs are done.	500	10.31	10.31	10.31	0.00
IA & CCA Finish Together	500	18.43	18.43	18.43	0.00
Finish Together	500	7.23	7.23	7.23	0.00

1/1



Summary for CycleTime (Hrs) RAIN Active EW Run 3
ActivityName = End
Anderson-Darling Normality Test
A-Squared 1.15
P-Value 0.005
Mean 34.277
StDev 7.590
Variance 57.614
Skewness 0.237583
Kurtosis -0.484966
N 500
Minimum 15.609
1st Quartile 28.757
Median 33.614
3rd Quartile 39.643
Maximum 54.400
95% Confidence Interval for Mean
33.611 34.944
95% Confidence Interval for Median
32.863 34.576
95% Confidence Interval for StDev
7.147 8.092
18
24
30
36
42
48
54
95% Confidence Intervals
Mean
Median
33.0
33.5
34.0
34.5
35.0

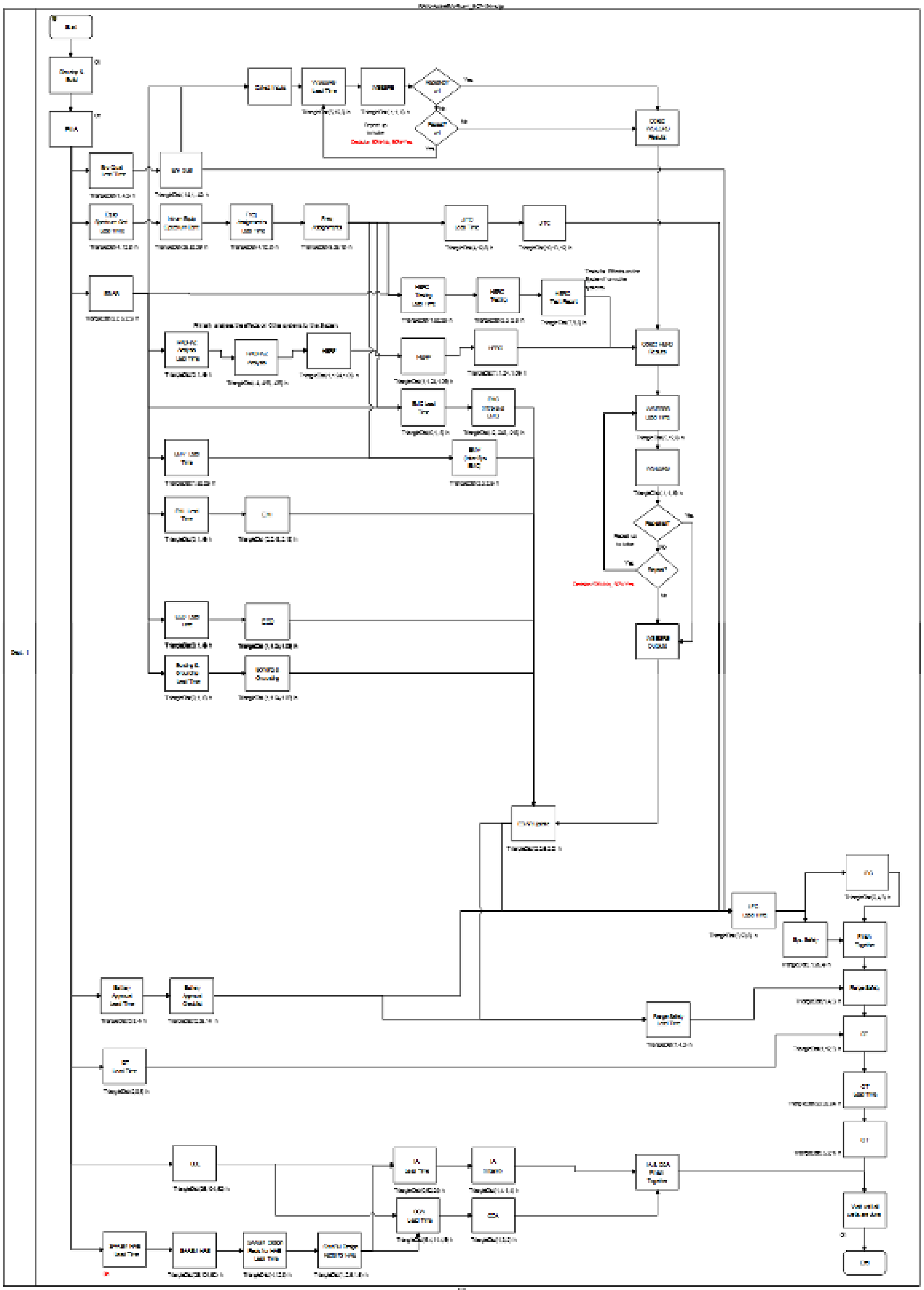

Probability Plot of CycleTime (Hrs) RAIN Active EW Run 3
Normal
Percent
CycleTime
Mean 34.28
StDev 7.590
N 500
AD 1.145
P-Value 0.005
80
20
27.89
40.67


Process Capability of CycleTime (Hrs) RAIN Active EW Run 3
LB
Target
USL
Process Data
LB 0
Target 52
USL 78
Sample Mean 34.2774
Sample N 500
StDev(Within) 7.57791
StDev(Overall) 7.59036
Within
Overall
Potential (Within) Capability
Cp *
CPL *
CPU 1.92
Cpk 1.92
Overall Capability
Pp *
PPL *
PPU 1.92
Ppk 1.92
Cpm 0.45
Observed Performance
PPM < LB 0.00
PPM > USL 0.00
PPM Total 0.00
Exp. Within Performance
PPM < LB *
PPM > USL 0.00
PPM Total 0.00
Exp. Overall Performance
PPM < LB *
PPM > USL 0.00
PPM Total 0.00

Active EW Runs 1 through 3 Baseline

Requirements		Active EW		
Level 1	Level 2	Run 1 (Simple Integration)	Run 2 (Complex Integration)	Run 3 (Highly Mature Payload)
CDL		Y	N	Done
Airworthiness (IFC)	Risk Assessment Questionnaire	Y	Y	Done
	HPOL	Y	Y	Y
	IDRAP	Y	Y	Done
	Risks	Y	Y	Y
E3 (Electromagnetic Environmental Effects)	E3HAR	Y	Y	Done
	EMC (intra-system)	Y	Y	Done
	EMI	Y	Y	Done
	EMP	N	N	Done
	EMV (Inter-system EMC)	Y	Y	Done
	ESD	Y	N	Done
	HERO Testing	Y	N	Done
	RADHAZ	Y	Y	Done
	HERF	Y	Y	Done
	HERO	Y	Y	Done
	HERP	Y	Y	Done
	Bonding & grounding	Y	N	Done
	Lightning	N	N	N
	P-Static	N	N	N
Environmental Qualification	MIL-STD-810G tests with 24 hour soaking, Humidity, Temp	Y	Y	Done
LASER Safety Review	LSSRB Review of below	N	N	N
	Laser radiation hazard evaluation	N	N	N
	Laser design checklist	N	N	N
	FDA self-exempt letter	N	N	N
Battery Approval	Product spec for battery cell	Y	N	N
	Battery schematic (cell & control board)	Y	N	N
	CONOPS	Y	N	N
	Operator's Manual	Y	N	N
	Battery safety data package	Y	N	N
	Request letter	Y	N	N
IA (Information Assurance)		Y	Y	Y
AT (Anti-Tamper)		Y	Y	Y
CCA (Clinger-Cohen Act)		Y	Y	Y
Spectrum	1. Equipment Spectrum Certification (Frequency Allocation) 1494 (SPS & IF-12)	Y	Y	Y
	2. Assignments	Y	Y	Y
System Safety Approval		Y	Y	Y
T&E	Range Safety Approval	Y	Y	Y
	DT	Y	Y	Done
	OT	Y	Y	Y
WSESRB Approval		Y	N	N
XTC		Y	N	Done
Selective Availability Anti-Spoofing Module (SAASM)	Security Approval for SAASM Host Application Equipment (HAE)	Y	N	Done
	SAASM Design Requirements for HAE (SAASM Functionalities, including Extended Functions)	Y	N	Done

Active EW Run 1 Baseline



Elapsed Time in Weeks

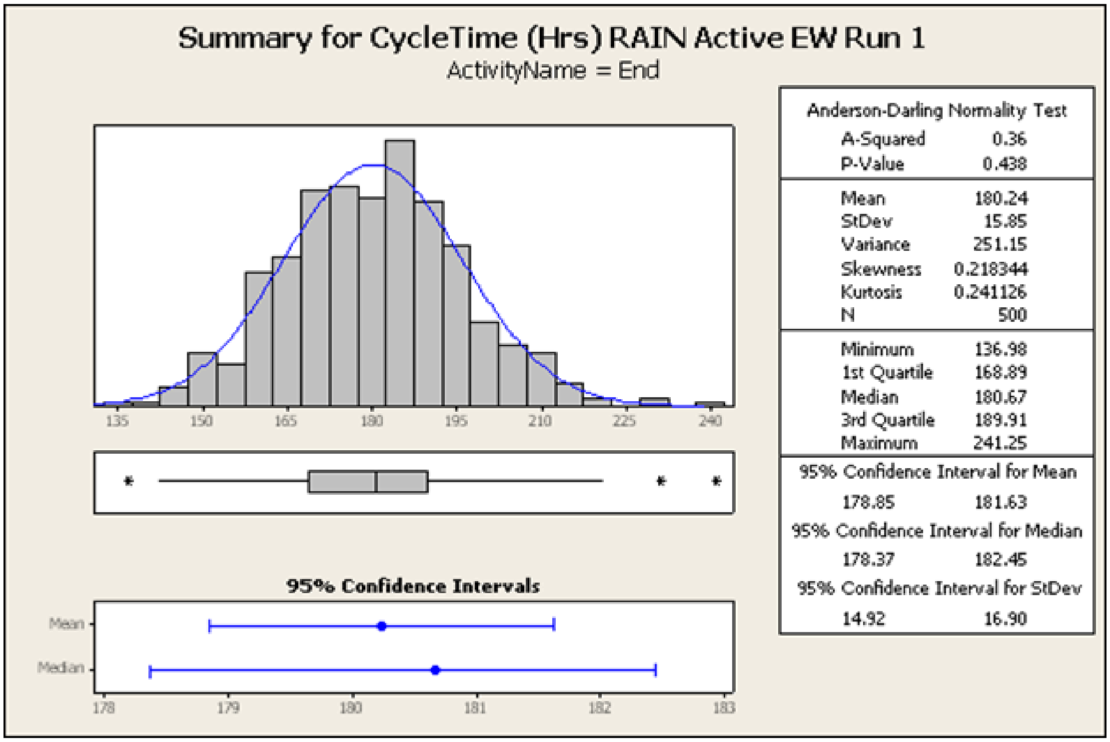
90120.11

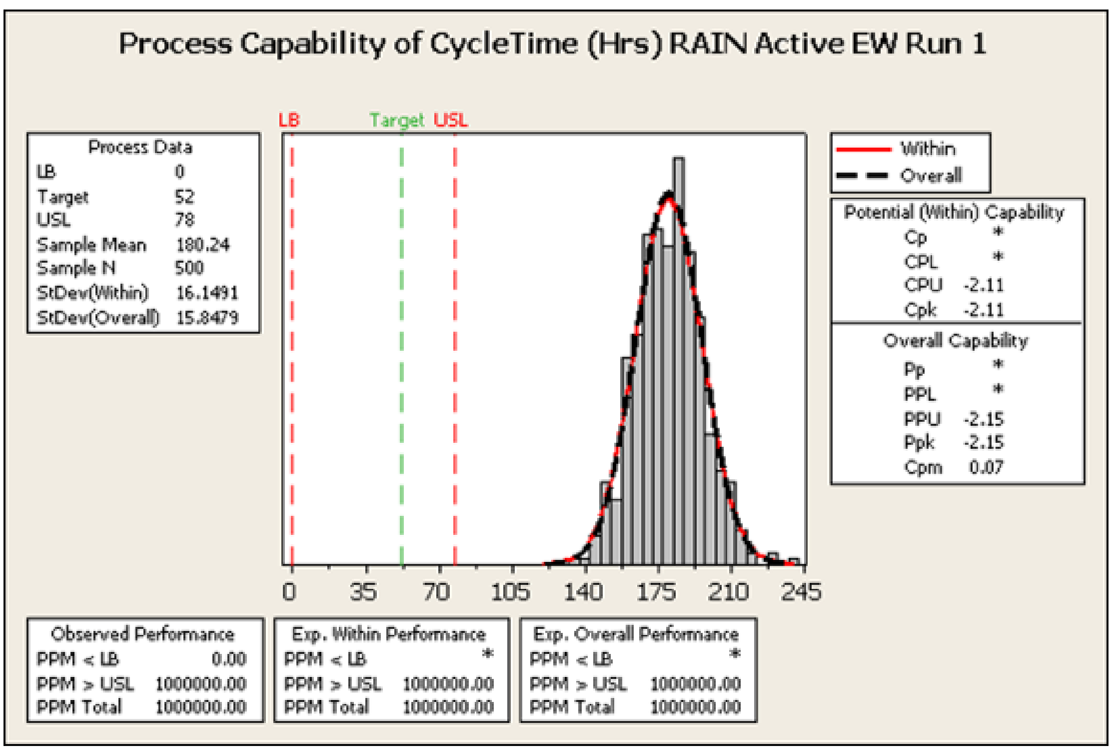
Transaction Statistics In Weeks (Hours)

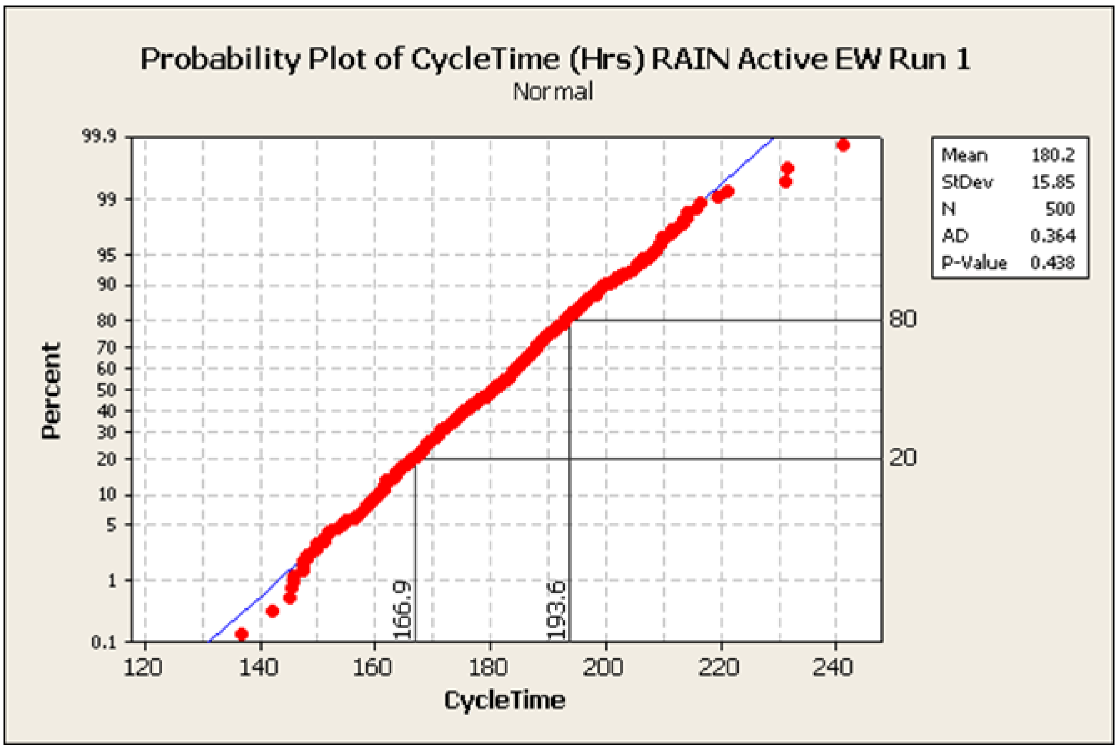
Count	Avg Cycle	Avg Serv	Avg Block	Avg Work
500	180.24	180.24	0.00	180.24

Activity Statistics In Weeks (Hours)

	Count	Avg Cycle	Avg Serv	Avg Block	Avg Work
CDL	1000	60.50	60.50	0.00	60.50
SAASM HAE	500	59.94	59.94	0.00	59.94
Intrum Equip Spectrum Certt	500	39.14	39.14	0.00	39.14
HERO Testing Lead Time	500	96.80	96.80	70.82	25.99
EMV Lead Time	500	25.72	25.72	0.00	25.72
IA Lead Time	500	45.03	45.03	20.11	25.71
OT Lead Time	500	25.27	25.27	0.00	25.27
Freq Assignments	2000	17.90	17.90	0.00	17.90
Battery Approval Checklist	1000	14.28	14.28	0.00	14.28
JITC	500	11.66	11.66	0.00	11.66
IFC Lead Time	1000	132.75	132.75	122.31	10.44
Sys Safety	500	10.02	10.02	0.00	10.02
CCA Lead Time	500	28.70	28.70	20.11	8.59
WSESRB Lead Time	750	8.33	8.33	0.00	8.33
WSESRB Lead Time	750	8.30	8.30	0.00	8.30
SAASM Design Req'sfor HAE Lead Time	500	8.06	8.06	0.00	8.06
HERO Test Report	500	8.03	8.03	0.00	8.03
Freq Assignments Lead Time	500	8.03	8.03	0.00	8.03
Equip Spectrum Cert Lead Time	500	7.99	7.99	0.00	7.99
JITC Lead Time	500	7.87	7.87	0.00	7.87
DT	500	148.81	148.81	143.40	5.40
DT Lead Time	500	4.98	4.98	0.00	4.98
Battery Approval Lead Time	500	3.98	3.98	0.00	3.98
IA (Interim)	500	3.02	3.02	0.00	3.02
IFC	500	2.99	2.99	0.00	2.99
Range Safety	500	20.56	20.56	17.88	2.68
Range Safety Lead Time	500	109.58	109.58	106.91	2.67
HERO Testing	**500**	**2.51**	**2.51**	**0.00**	**2.51**
EMV (Inter-SysEMC)	**500**	**47.60**	**47.60**	**45.10**	**2.49**
Env Qual Lead Time	**500**	**2.31**	**2.31**	**0.00**	**2.31**
E3IAR	4000	2.23	2.23	0.00	2.23
E3IAR Update	1000	121.41	121.41	119.18	2.23
EMI	500	2.22	2.22	0.00	2.22
CCA	500	1.97	1.97	0.00	1.97
SAASM Design Req'sfor HAE	1000	1.69	1.69	0.00	1.69
OT	500	1.18	1.18	0.00	1.18
Bonding & Grounding	500	1.11	1.11	0.00	1.11
HERP	500	1.11	1.11	0.00	1.11
HERO	500	1.11	1.11	0.00	1.11
ESD	500	1.11	1.11	0.00	1.11
HERF	500	1.11	1.11	0.00	1.11
WSESRB	750	0.57	0.57	0.00	0.57
WSESRB	750	0.56	0.56	0.00	0.56
RADHAZ Analysis Lead Time	500	0.55	0.55	0.00	0.55
EMC Lead Time	500	71.36	71.36	70.82	0.54
EMI Lead Time	500	0.53	0.53	0.00	0.53
Env Qual	1000	0.53	0.53	0.00	0.53
ESD Lead Time	500	0.53	0.53	0.00	0.53
Bonding & Grounding Lead Time	500	0.52	0.52	0.00	0.52
RADHAZ Analysis	500	0.44	0.44	0.00	0.44
EMC (Intra-SysEMC)	500	0.22	0.22	0.00	0.22
PMA	3500	0.00	0.00	0.00	0.00
Start	500	0.00	0.00	0.00	0.00
End	500	0.00	0.00	0.00	0.00
Wait until all certsare done	500	76.23	76.23	76.23	0.00
SAASM HAE Lead Time	500	0.00	0.00	0.00	0.00
Develop & Build	500	0.00	0.00	0.00	0.00
Repeat?	500	0.00	0.00	0.00	0.00
Repeated?	750	0.00	0.00	0.00	0.00
Repeated? w1	750	0.00	0.00	0.00	0.00
Repeat? w1	500	0.00	0.00	0.00	0.00
Collect Inputs	500	0.73	0.73	0.73	0.00
Collect HERO Results	500	103.03	103.03	103.03	0.00
Collect WSESRB Results	500	0.00	0.00	0.00	0.00
IA & CCA Finish Together	500	18.43	18.43	18.43	0.00
WSESRB Outputs	500	0.00	0.00	0.00	0.00
Finish Together	500	7.23	7.23	7.23	0.00

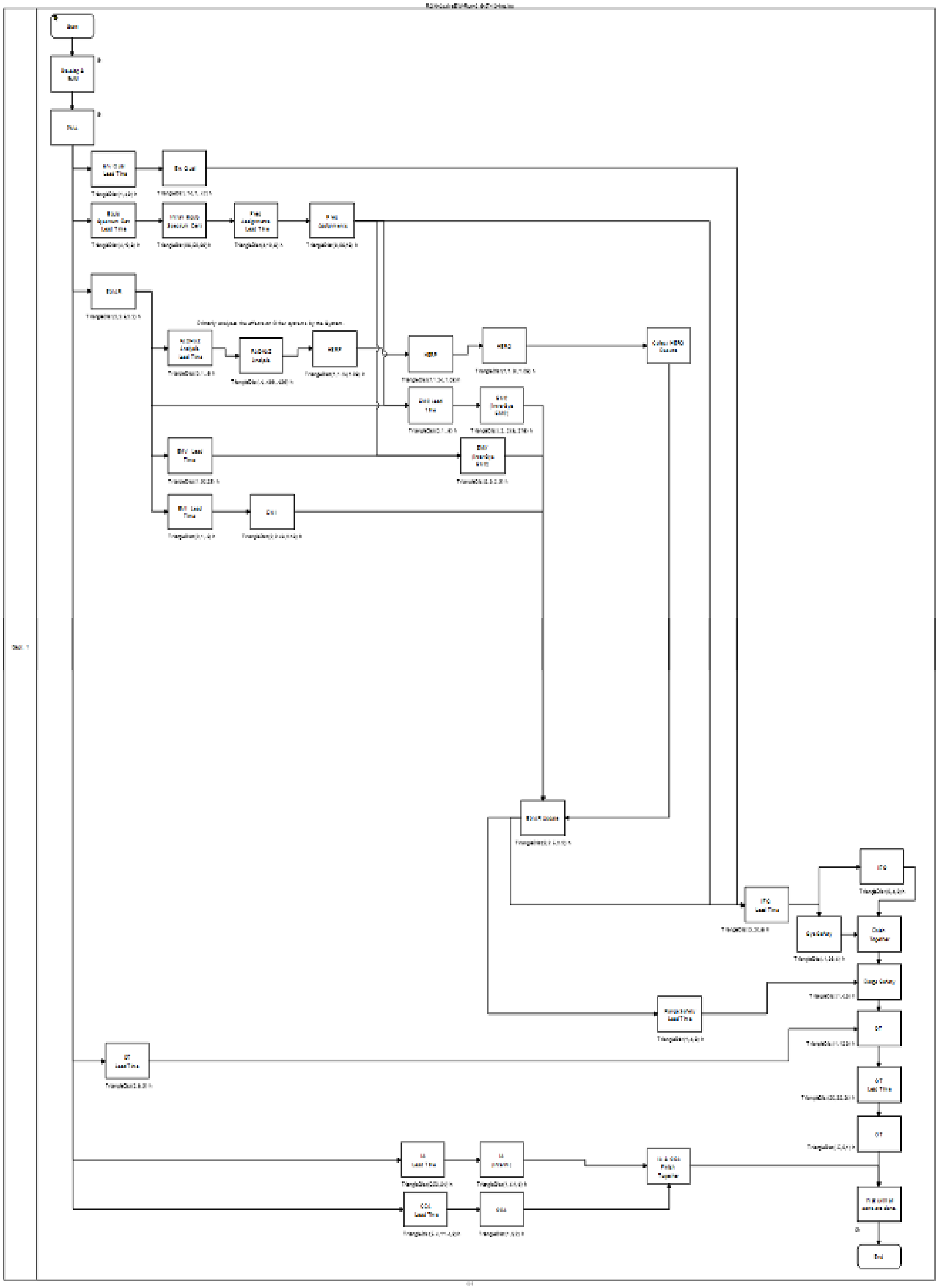

Summary for CycleTime (Hrs) RAIN Active EW Run 1
ActivityName = End
Anderson-Darling Normality Test
A-Squared 0.36
P-Value 0.438
Mean 180.24
StDev 15.85
Variance 251.15
Skewness 0.218344
Kurtosis 0.241126
N 500
Minimum 136.98
1st Quartile 168.89
Median 180.67
3rd Quartile 189.91
Maximum 241.25
95% Confidence Interval for Mean
178.85 181.63
95% Confidence Interval for Median
178.37 182.45
95% Confidence Interval for StDev
14.92 16.90
95% Confidence Intervals
Mean
Median


Process Capability of CycleTime (Hrs) RAIN Active EW Run 1
Process Data
LB 0
Target 52
USL 78
Sample Mean 180.24
Sample N 500
StDev(Within) 16.1491
StDev(Overall) 15.8479
LB Target USL
Within
Overall
Potential (Within) Capability
Cp *
CPL *
CPU -2.11
Cpk -2.11
Overall Capability
Pp *
PPL *
PPU -2.15
Ppk -2.15
Cpm 0.07
Observed Performance
PPM < LB 0.00
PPM > USL 1000000.00
PPM Total 1000000.00
Exp. Within Performance
PPM < LB *
PPM > USL 1000000.00
PPM Total 1000000.00
Exp. Overall Performance
PPM < LB *
PPM > USL 1000000.00
PPM Total 1000000.00



Probability Plot of CycleTime (Hrs) RAIN Active EW Run 1
Normal
Percent
CycleTime
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
120
140
160
180
200
220
240
166.9
193.6
80
20
Mean 180.2
StDev 15.85
N 500
AD 0.364
P-Value 0.438

Active EW Run 2 Baseline



Elapsed Time in Weeks

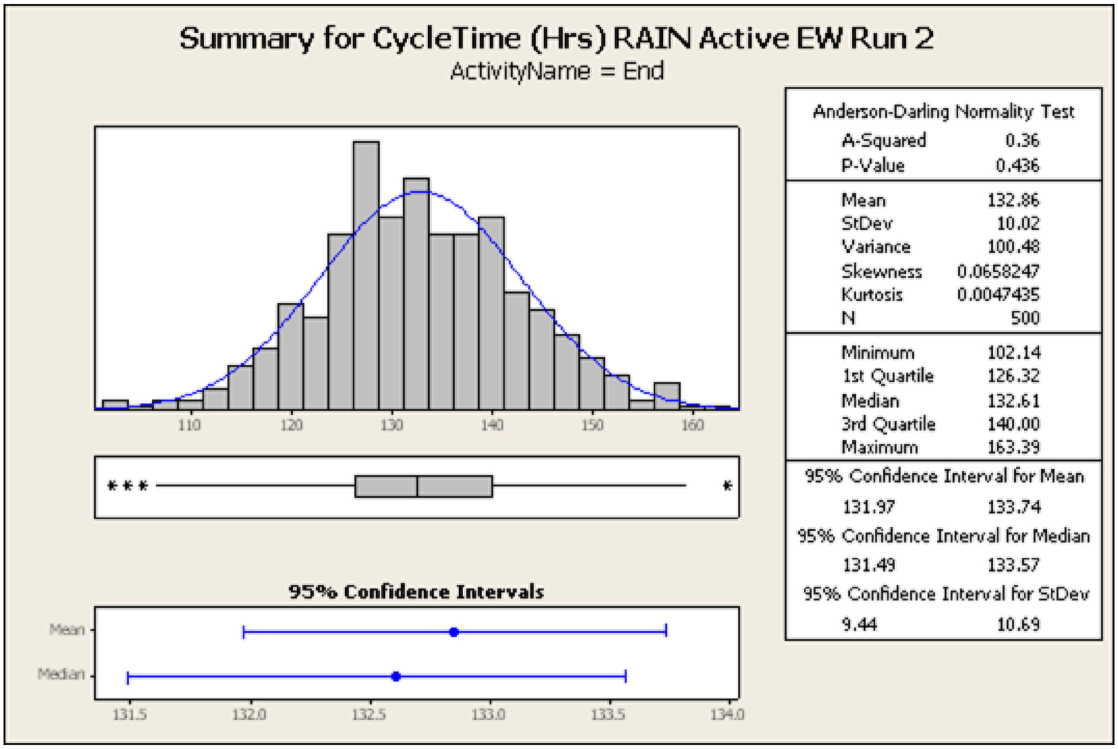
66427.69

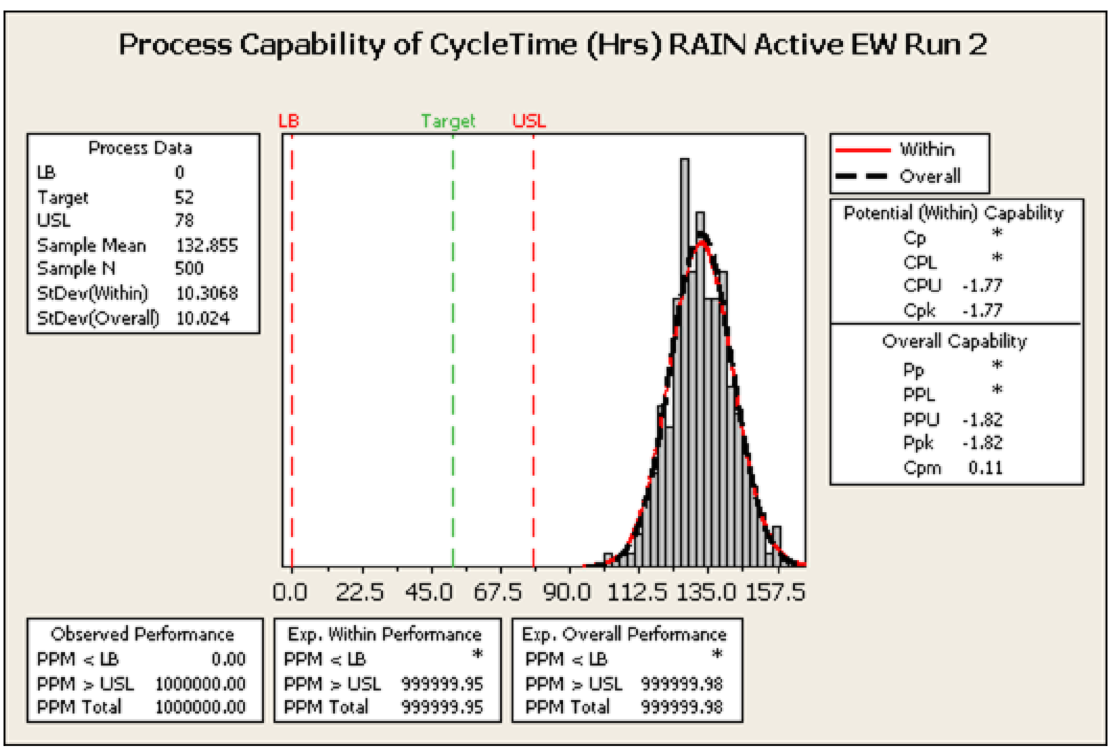
Transaction Statistics In Weeks (Hours)

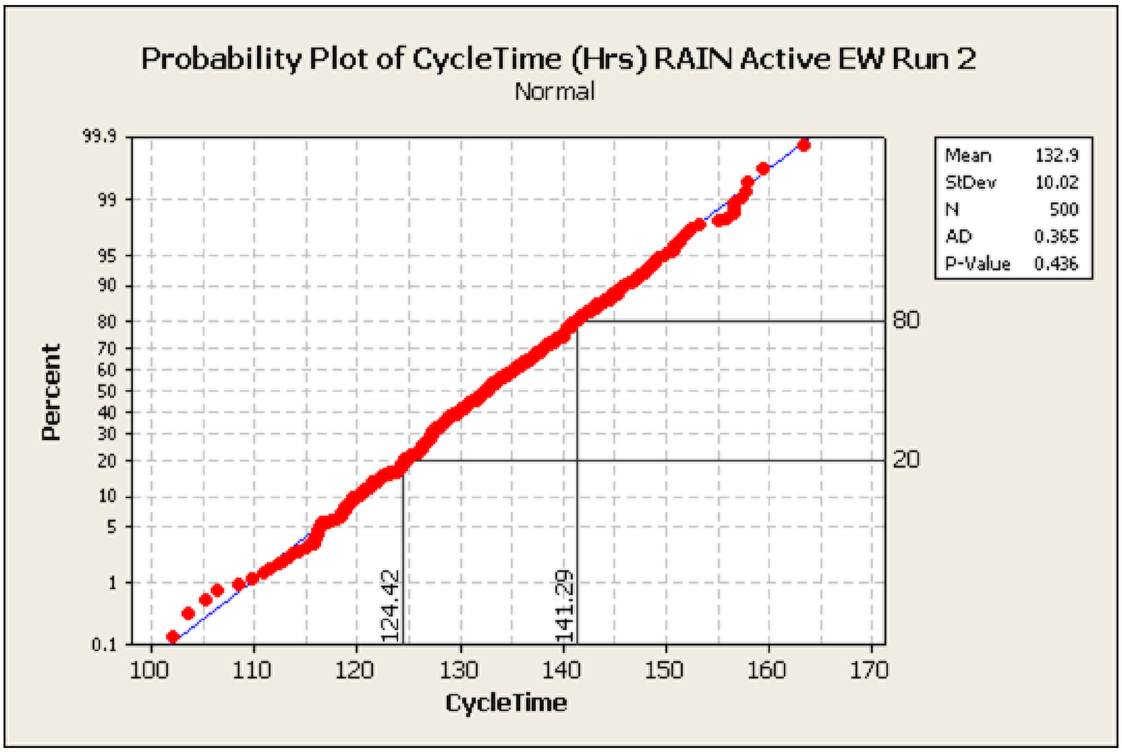
Count	Avg Cycle	Avg Serv	Avg Block	Avg Work
500	132.86	132.86	0.00	132.86

Activity Statistics In Weeks (Hours)

	Count	Avg Cycle	Avg Serv	Avg Block	Avg Work
Intrum Equip Spectrum Certt	500	39.14	39.14	0.00	39.14
EMV Lead Time	500	25.72	25.72	0.00	25.72
IA Lead Time	500	25.71	25.71	0.00	25.71
OT Lead Time	500	25.27	25.27	0.00	25.27
Freq Assignments	1500	17.90	17.90	0.00	17.90
IFC Lead Time	1000	85.37	85.37	74.93	10.44
Sys Safety	500	10.02	10.02	0.00	10.02
CCA Lead Time	500	8.59	8.59	0.00	8.59
Freq Assignments Lead Time	500	8.03	8.03	0.00	8.03
Equip Spectrum Cert Lead Time	500	7.99	7.99	0.00	7.99
DT	500	101.42	101.42	96.02	5.40
DT Lead Time	500	4.98	4.98	0.00	4.98
IA (Interim)	500	3.02	3.02	0.00	3.02
IFC	500	2.99	2.99	0.00	2.99
Range Safety	500	20.56	20.56	17.88	2.68
Range Safety Lead Time	500	2.67	2.67	0.00	2.67
EMV (Inter-Sys EMC)	500	47.60	47.60	45.10	2.49
Env Qual Lead Time	500	2.31	2.31	0.00	2.31
E3IAR	2000	2.23	2.23	0.00	2.23
E3IAR Update	1000	72.79	72.79	70.56	2.23
EMI	500	2.22	2.22	0.00	2.22
CCA	500	1.97	1.97	0.00	1.97
OT	500	1.18	1.18	0.00	1.18
HERP	500	1.11	1.11	0.00	1.11
HERO	500	1.11	1.11	0.00	1.11
HERF	500	1.11	1.11	0.00	1.11
RADHAZ Analysis Lead Time	500	0.55	0.55	0.00	0.55
EMC Lead Time	500	71.36	71.36	70.82	0.54
EMI Lead Time	500	0.53	0.53	0.00	0.53
Env Qual	500	0.53	0.53	0.00	0.53
RADHAZ Analysis	500	0.44	0.44	0.00	0.44
EMC (Intra-Sys EMC)	500	0.22	0.22	0.00	0.22
Develop & Build	500	0.00	0.00	0.00	0.00
End	500	0.00	0.00	0.00	0.00
Wait until all certs are done.	500	103.99	103.99	103.99	0.00
PMA	3000	0.00	0.00	0.00	0.00
Start	500	0.00	0.00	0.00	0.00
Collect HERO Results	500	0.00	0.00	0.00	0.00
IA & CCA Finish Together	500	18.43	18.43	18.43	0.00
Finish Together	500	7.23	7.23	7.23	0.00

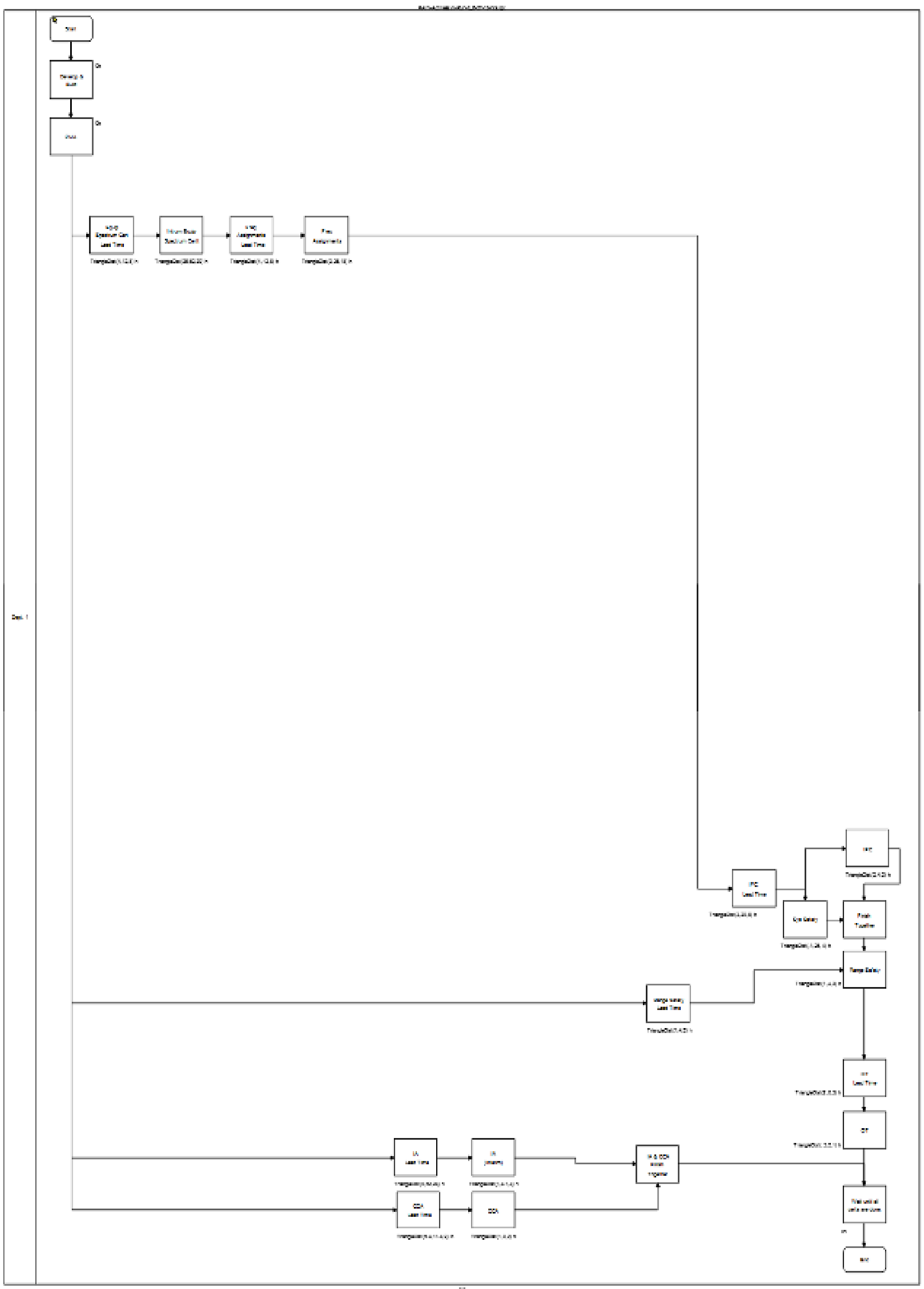

Summary for CycleTime (Hrs) RAIN Active EW Run 2
ActivityName = End
Anderson-Darling Normality Test
A-Squared 0.36
P-Value 0.436
Mean 132.86
StDev 10.02
Variance 100.48
Skewness 0.0658247
Kurtosis 0.0047435
N 500
Minimum 102.14
1st Quartile 126.32
Median 132.61
3rd Quartile 140.00
Maximum 163.39
95% Confidence Interval for Mean
131.97 133.74
95% Confidence Interval for Median
131.49 133.57
95% Confidence Interval for StDev
9.44 10.69
110 120 130 140 150 160
95% Confidence Intervals
Mean
Median
131.5 132.0 132.5 133.0 133.5 134.0


Process Capability of CycleTime (Hrs) RAIN Active EW Run 2
LB
Target
USL
Process Data
LB 0
Target 52
USL 78
Sample Mean 132.855
Sample N 500
StDev(Within) 10.3068
StDev(Overall) 10.024
Within
Overall
Potential (Within) Capability
Cp *
CPL *
CPU -1.77
Cpk -1.77
Overall Capability
Pp *
PPL *
PPU -1.82
Ppk -1.82
Cpm 0.11
0.0 22.5 45.0 67.5 90.0 112.5 135.0 157.5
Observed Performance
PPM < LB 0.00
PPM > USL 1000000.00
PPM Total 1000000.00
Exp. Within Performance
PPM < LB *
PPM > USL 999999.95
PPM Total 999999.95
Exp. Overall Performance
PPM < LB *
PPM > USL 999999.98
PPM Total 999999.98



Probability Plot of CycleTime (Hrs) RAIN Active EW Run 2
Normal
Percent
CycleTime
Mean 132.9
StDev 10.02
N 500
AD 0.365
P-Value 0.436
124.42
141.29
80
20

Active EW Run 3 Baseline



RAIN-ActiveEW-Run-3_6-27-13-hrs.igx

Elapsed Time in Weeks

51217.77

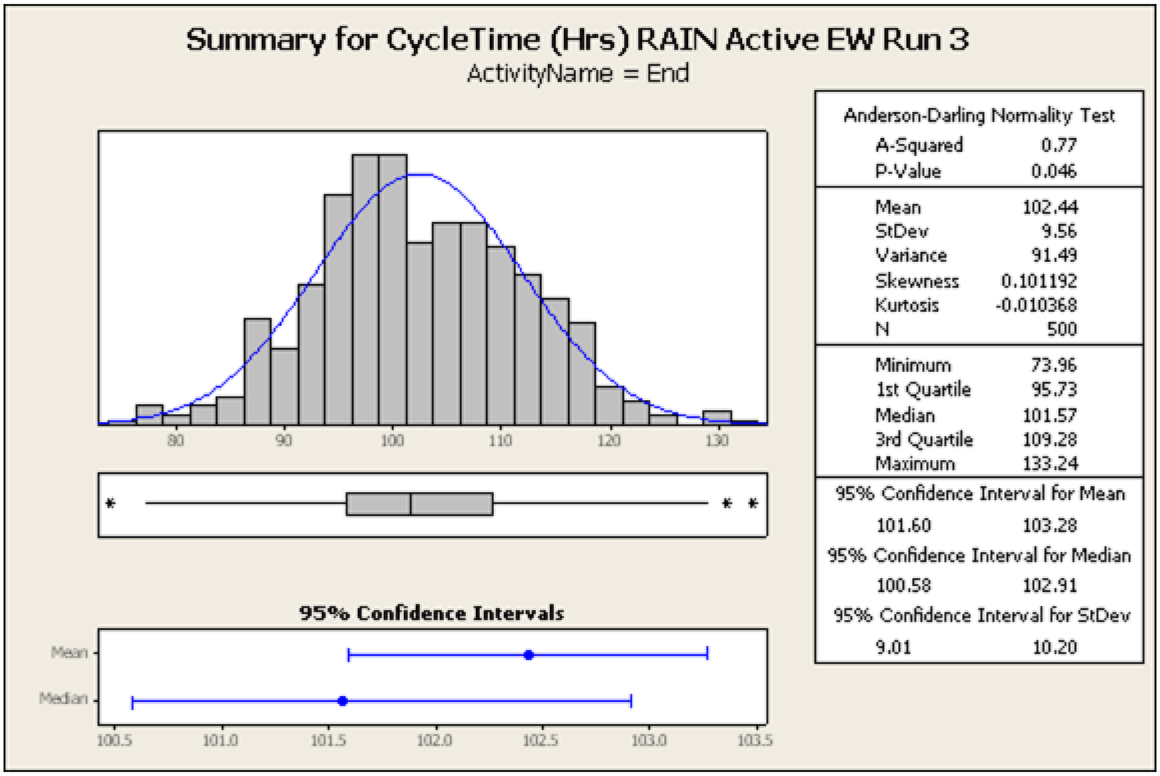
Transaction Statistics In Weeks (Hours)

Count	Avg Cycle	Avg Serv	Avg Block	Avg Work
500	102.44	102.44	0.00	102.44

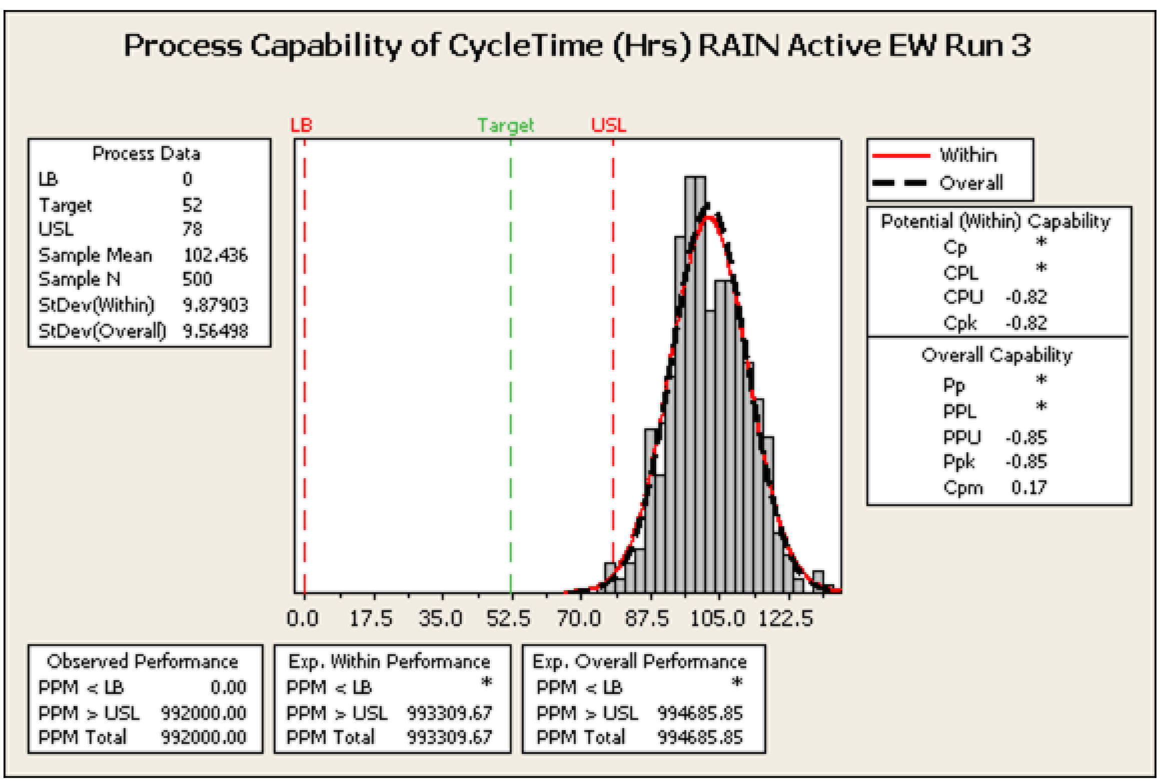
Activity Statistics In Weeks (Hours)

	Count	Avg Cycle	Avg Serv	Avg Block	Avg Work
Intrum Equip Spectrum Certt	500	39.14	39.14	0.00	39.14
IA Lead Time	500	25.71	25.71	0.00	25.71
Freq Assignments	500	17.90	17.90	0.00	17.90
IFC Lead Time	1000	10.44	10.44	0.00	10.44
Sys Safety	500	10.02	10.02	0.00	10.02
CCA Lead Time	500	8.59	8.59	0.00	8.59
Freq Assignments Lead Time	**500**	**8.03**	**8.03**	**0.00**	**8.03**
Equip Spectrum Cert Lead Time	500	7.99	7.99	0.00	7.99
OT Lead Time	500	4.97	4.97	0.00	4.97
IA (Interim)	500	3.02	3.02	0.00	3.02
IFC	500	2.99	2.99	0.00	2.99
Range Safety	500	93.61	93.61	90.94	2.68
Range Safety Lead Time	500	2.67	2.67	0.00	2.67
CCA	500	1.97	1.97	0.00	1.97
OT	500	1.18	1.18	0.00	1.18
Develop & Build	500	0.00	0.00	0.00	0.00
End	500	0.00	0.00	0.00	0.00
PMA	2000	0.00	0.00	0.00	0.00
Start	500	0.00	0.00	0.00	0.00
Wait until all certs are done.	500	73.57	73.57	73.57	0.00
IA & CCA Finish Together	500	18.43	18.43	18.43	0.00
Finish Together	500	7.23	7.23	7.23	0.00

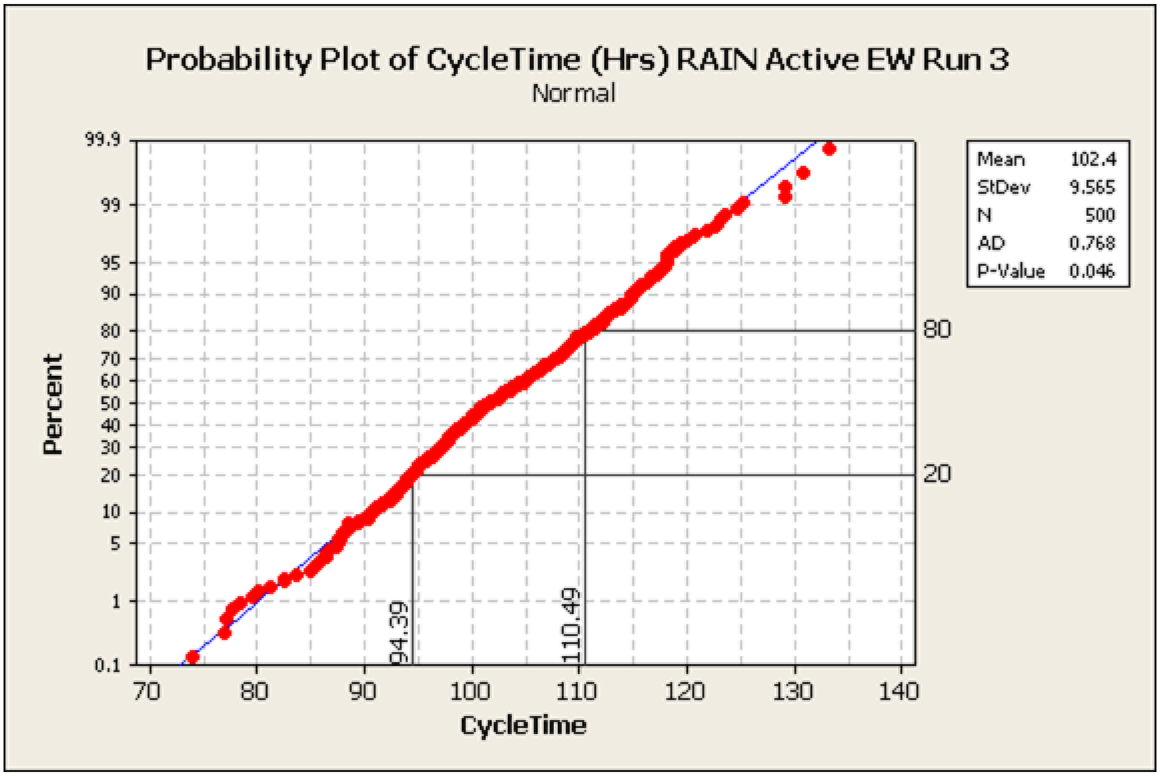
1/1



Summary for CycleTime (Hrs) RAIN Active EW Run 3
ActivityName = End
Anderson-Darling Normality Test
A-Squared 0.77
P-Value 0.046
Mean 102.44
StDev 9.56
Variance 91.49
Skewness 0.101192
Kurtosis -0.010368
N 500
Minimum 73.96
1st Quartile 95.73
Median 101.57
3rd Quartile 109.28
Maximum 133.24
95% Confidence Interval for Mean
101.60 103.28
95% Confidence Interval for Median
100.58 102.91
95% Confidence Interval for StDev
9.01 10.20
95% Confidence Intervals
Mean
Median
80 90 100 110 120 130
100.5 101.0 101.5 102.0 102.5 103.0 103.5



Process Capability of CycleTime (Hrs) RAIN Active EW Run 3
Process Data
LB 0
Target 52
USL 78
Sample Mean 102.436
Sample N 500
StDev(Within) 9.87903
StDev(Overall) 9.56498
LB
Target
USL
Within
Overall
Potential (Within) Capability
Cp *
CPL *
CPU -0.82
Cpk -0.82
Overall Capability
Pp *
PPL *
PPU -0.85
Ppk -0.85
Cpm 0.17
0.0 17.5 35.0 52.5 70.0 87.5 105.0 122.5
Observed Performance
PPM < LB 0.00
PPM > USL 992000.00
PPM Total 992000.00
Exp. Within Performance
PPM < LB *
PPM > USL 993309.67
PPM Total 993309.67
Exp. Overall Performance
PPM < LB *
PPM > USL 994685.85
PPM Total 994685.85


Probability Plot of CycleTime (Hrs) RAIN Active EW Run 3
Normal
Mean 102.4
StDev 9.565
N 500
AD 0.768
P-Value 0.046
Percent
CycleTime
94.39
110.49
80
20
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
70
80
90
100
110
120
130
140

Lead-time Reduction Simulations

LASER Designator Timeline Reductions Runs 1 through 3

- Intermediate Risk Timeline Reduction (IRTR)
- Low Risk Timeline Reduction (LRTR)

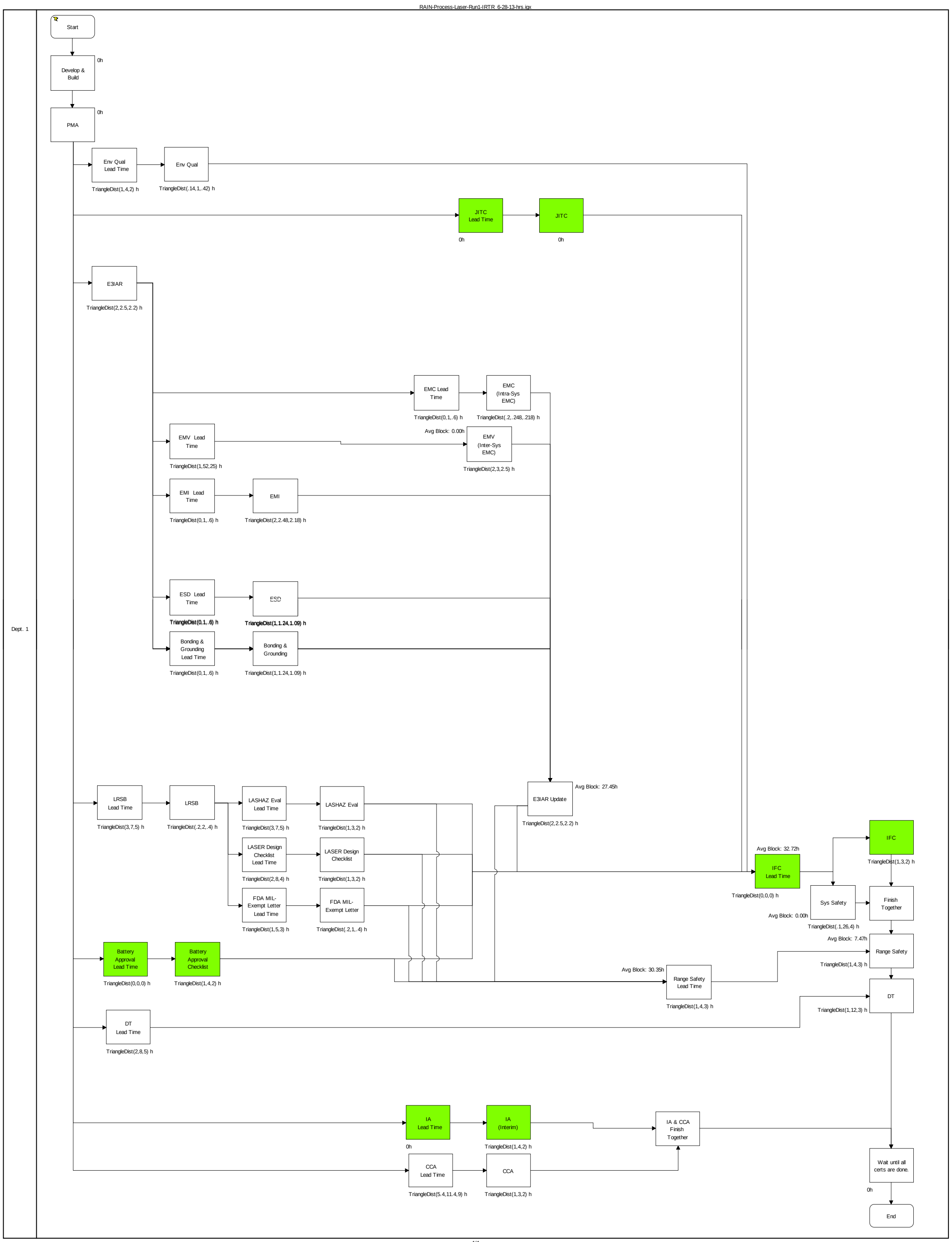
Passive EW Timeline Reductions

- Low Risk Timeline Reduction (LRTR) Runs 1 though 3
- Intermediate Risk Timeline Reduction (IRTR) Runs 1 though 3

Active EW Timeline Reductions

- Low Risk Timeline Reduction (LRTR) Runs 1 though 3
- Intermediate Risk Timeline Reduction (IRTR) Runs 1 though 3

LASER Designator Run 1
Intermediate Risk Timeline Reduction (IRTR)



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Elapsed Time in Weeks

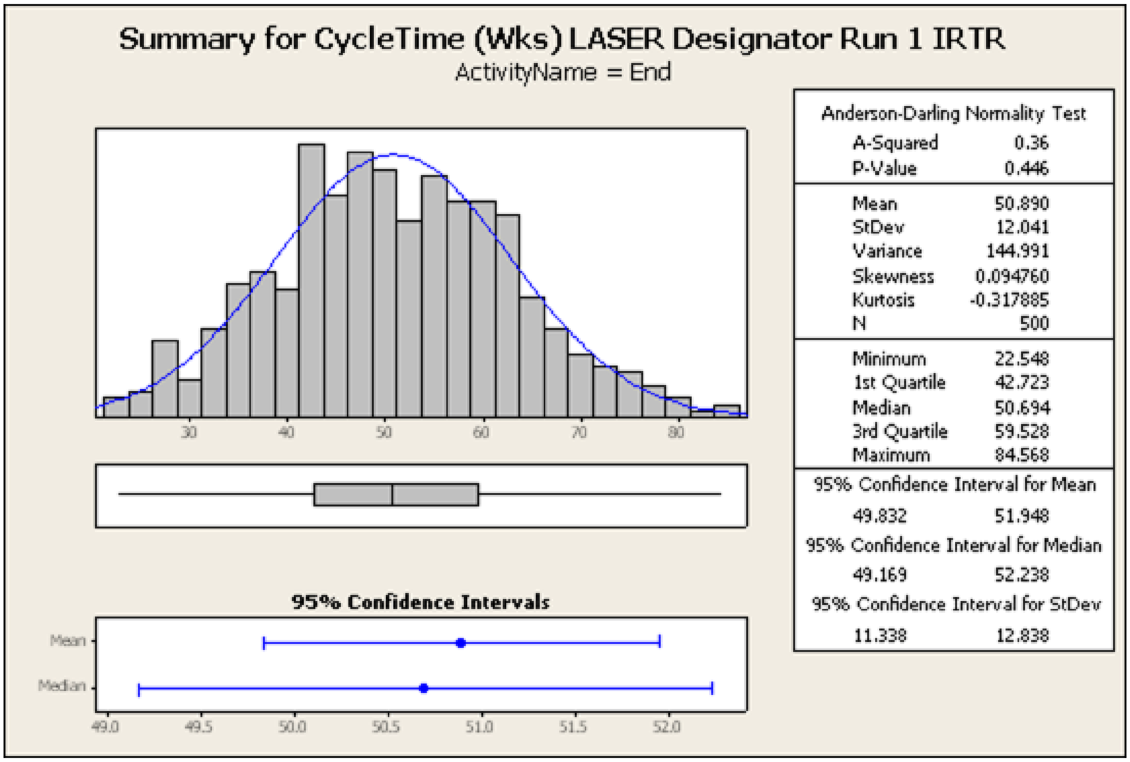
25445.03

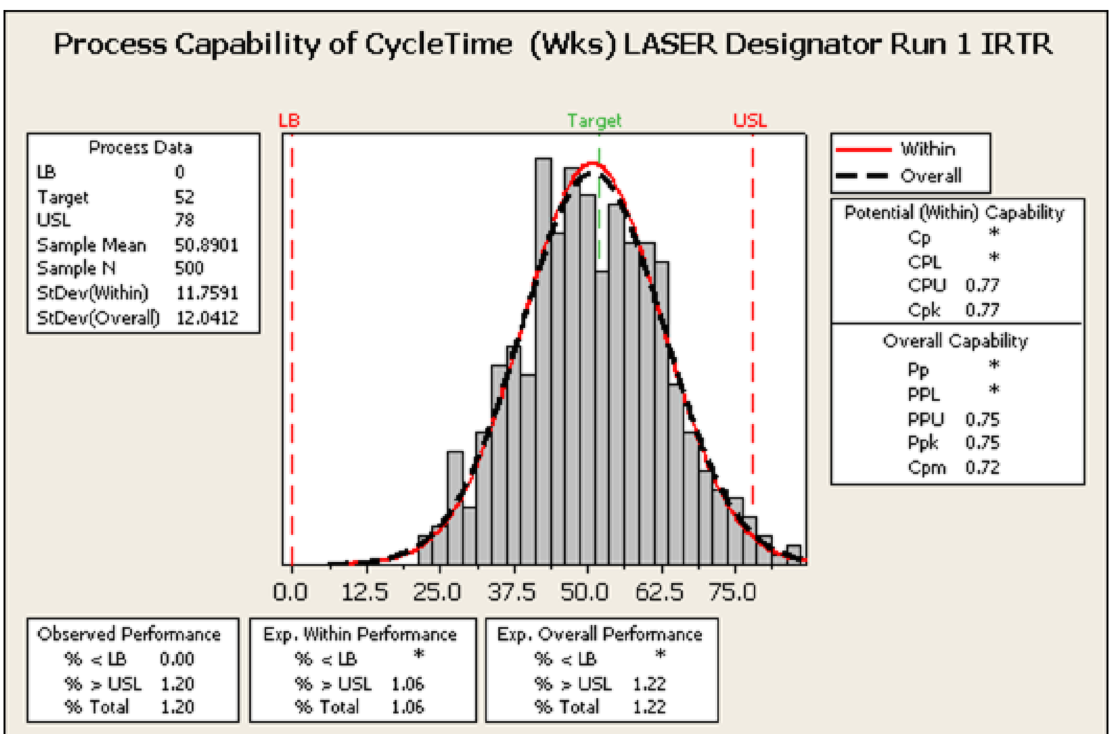
Activity Statistics In Weeks (Hours)

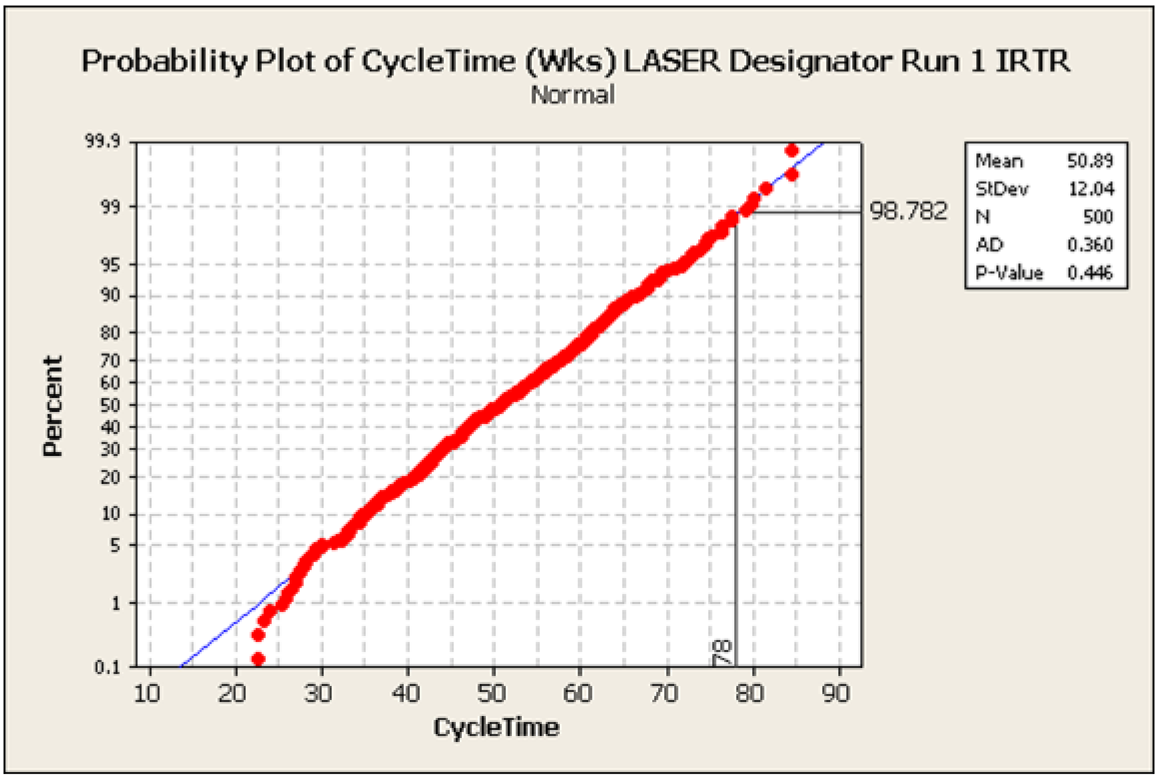
Count	Avg Cycle	Avg Serv	Avg Block	Avg Work
500	50.89	50.89	0.00	50.89

Activity Statistics in Weeks (Hours)

	Count	Avg Cycle	Avg Serv	Avg Block	Avg Work
DT	500	45.91	45.91	40.51	5.40
Wait until all certs are done.	500	40.33	40.33	40.33	0.00
IFC Lead Time	1000	32.72	32.72	32.72	0.00
Range Safety Lead Time	500	33.02	33.02	30.35	2.67
E3IAR Update	1000	29.68	29.68	27.45	2.23
IA & CCA Finish Together	500	8.24	8.24	8.24	0.00
Finish Together	500	8.08	8.08	8.08	0.00
Range Safety	500	10.14	10.14	7.47	2.68
EMC Lead Time	500	0.54	0.54	0.00	0.54
EMI Lead Time	500	0.53	0.53	0.00	0.53
EMV Lead Time	500	25.72	25.72	0.00	25.72
ESD Lead Time	500	0.53	0.53	0.00	0.53
ESD	500	1.11	1.11	0.00	1.11
Bonding & Grounding Lead Time	500	0.52	0.52	0.00	0.52
Bonding & Grounding	500	1.11	1.11	0.00	1.11
Env Qual Lead Time	500	2.31	2.31	0.00	2.31
Env Qual	**500**	**0.53**	**0.53**	**0.00**	**0.53**
LRSB Lead Time	**500**	**5.02**	**5.02**	**0.00**	**5.02**
LRSB	1500	0.89	0.89	0.00	0.89
LASHAZ Eval Lead Time	500	4.98	4.98	0.00	4.98
LASHAZ Eval	1000	1.99	1.99	0.00	1.99
LASER Design Checklist Lead Time	500	4.65	4.65	0.00	4.65
LASER Design Checklist	1000	2.06	2.06	0.00	2.06
FDA MIL-Exempt Letter Lead Time	500	2.99	2.99	0.00	2.99
FDA MIL-Exempt Letter	1000	0.53	0.53	0.00	0.53
Battery Approval Lead Time	500	0.00	0.00	0.00	0.00
Battery Approval Checklist	1000	2.37	2.37	0.00	2.37
IA Lead Time	500	0.00	0.00	0.00	0.00
IA (Interim)	500	2.32	2.32	0.00	2.32
CCA Lead Time	500	8.59	8.59	0.00	8.59
CCA	500	1.97	1.97	0.00	1.97
Sys Safety	500	10.02	10.02	0.00	10.02
PMA	4000	0.00	0.00	0.00	0.00
Develop & Build	500	0.00	0.00	0.00	0.00
End	500	0.00	0.00	0.00	0.00
DT Lead Time	500	4.98	4.98	0.00	4.98
IFC	500	1.99	1.99	0.00	1.99
E3IAR	2500	2.23	2.23	0.00	2.23
Start	500	0.00	0.00	0.00	0.00
JITC Lead Time	500	0.00	0.00	0.00	0.00
EMC (Intra-Sys EMC)	500	0.22	0.22	0.00	0.22
EMI	500	2.22	2.22	0.00	2.22
EMV (Inter-Sys EMC)	500	2.49	2.49	0.00	2.49
JITC	500	0.00	0.00	0.00	0.00

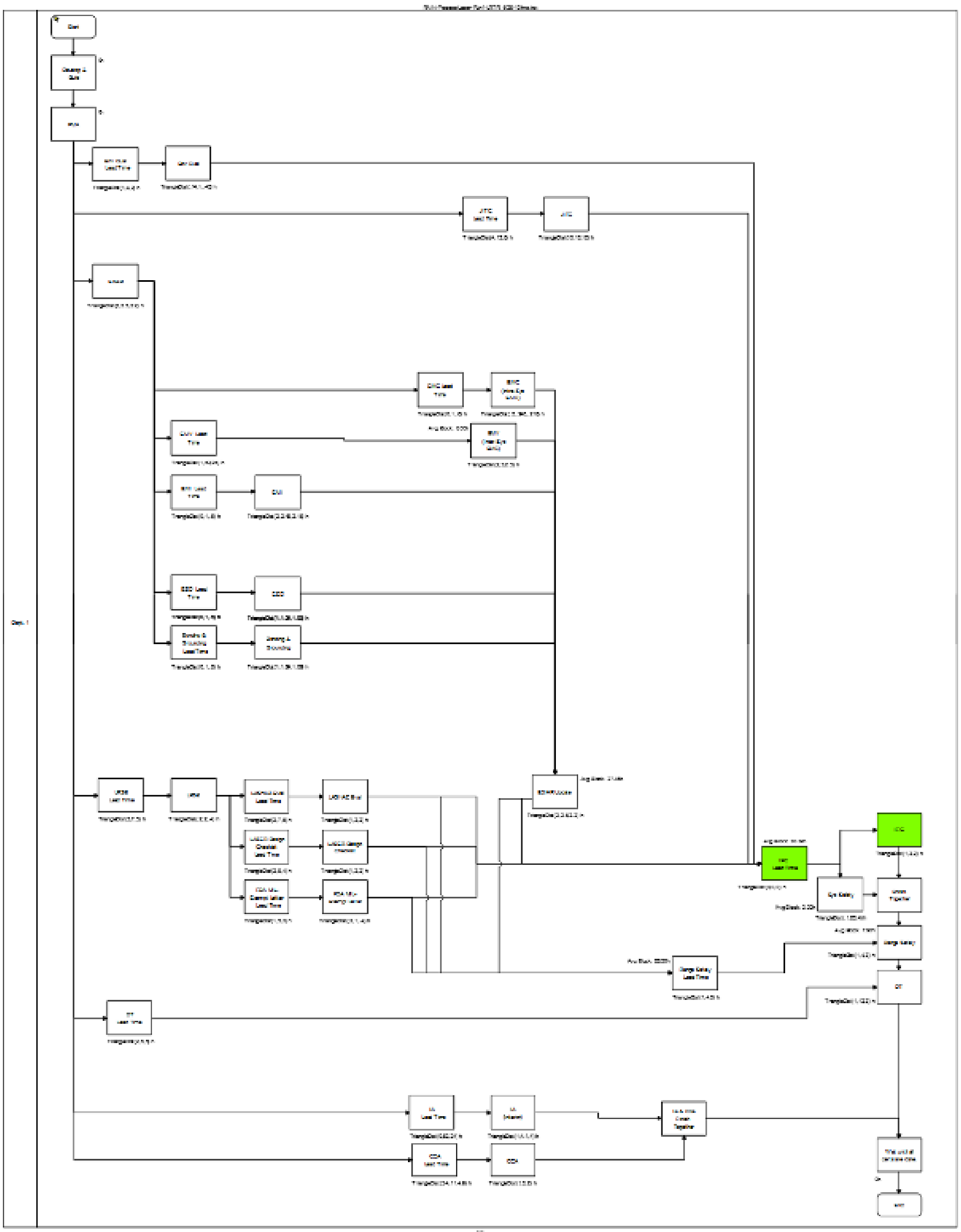

Summary for CycleTime (Wks) LASER Designator Run 1 IRTR
ActivityName = End
Anderson-Darling Normality Test
A-Squared 0.36
P-Value 0.446
Mean 50.890
StDev 12.041
Variance 144.991
Skewness 0.094760
Kurtosis -0.317885
N 500
Minimum 22.548
1st Quartile 42.723
Median 50.694
3rd Quartile 59.528
Maximum 84.568
95% Confidence Interval for Mean
49.832 51.948
95% Confidence Interval for Median
49.169 52.238
95% Confidence Interval for StDev
11.338 12.838
95% Confidence Intervals
Mean
Median
30 40 50 60 70 80
49.0 49.5 50.0 50.5 51.0 51.5 52.0


Process Capability of CycleTime (Wks) LASER Designator Run 1 IRTR
Process Data
LB 0
Target 52
USL 78
Sample Mean 50.8901
Sample N 500
StDev(Within) 11.7591
StDev(Overall) 12.0412
LB
Target
USL
Within
Overall
Potential (Within) Capability
Cp *
CPL *
CPU 0.77
Cpk 0.77
Overall Capability
Pp *
PPL *
PPU 0.75
Ppk 0.75
Cpm 0.72
0.0 12.5 25.0 37.5 50.0 62.5 75.0
Observed Performance
% < LB 0.00
% > USL 1.20
% Total 1.20
Exp. Within Performance
% < LB *
% > USL 1.06
% Total 1.06
Exp. Overall Performance
% < LB *
% > USL 1.22
% Total 1.22



Probability Plot of CycleTime (Wks) LASER Designator Run 1 IRTR
Normal
Percent
CycleTime
98.782
78
Mean 50.89
StDev 12.04
N 500
AD 0.360
P-Value 0.446

LASER Designator Run 1
Low Risk Timeline Reduction (LRTR)



Elapsed Time in Weeks

25916.69

Activity Statistics In Weeks (Hours)

Count	Avg Cycle	Avg Serv	Avg Block	Avg Work
500	51.83	51.83	0.00	51.83

Activity Statistics in Weeks (Hours)

	Count	Avg Cycle	Avg Serv	Avg Block	Avg Work
DT	500	46.35	46.35	40.95	5.40
IFC Lead Time	1000	30.32	30.32	30.32	0.00
E3IAR Update	1000	29.68	29.68	27.45	2.23
Wait until all certs are done.	500	23.48	23.48	23.48	0.00
Range Safety Lead Time	500	25.97	25.97	23.30	2.67
IA & CCA Finish Together	500	18.43	18.43	18.43	0.00
Finish Together	500	8.08	8.08	8.08	0.00
Range Safety	500	10.58	10.58	7.90	2.68
EMC Lead Time	500	0.54	0.54	0.00	0.54
EMI Lead Time	500	0.53	0.53	0.00	0.53
EMV Lead Time	500	25.72	25.72	0.00	25.72
ESD Lead Time	500	0.53	0.53	0.00	0.53
ESD	500	1.11	1.11	0.00	1.11
Bonding & Grounding Lead Time	500	0.52	0.52	0.00	0.52
Bonding & Grounding	500	1.11	1.11	0.00	1.11
Env Qual Lead Time	500	2.31	2.31	0.00	2.31
Env Qual	**500**	**0.53**	**0.53**	**0.00**	**0.53**
LRSB Lead Time	500	5.02	5.02	0.00	5.02
LRSB	1500	0.89	0.89	0.00	0.89
LASHAZ Eval Lead Time	500	4.98	4.98	0.00	4.98
LASHAZ Eval	1000	1.99	1.99	0.00	1.99
LASER Design Checklist Lead Time	500	4.65	4.65	0.00	4.65
LASER Design Checklist	1000	2.06	2.06	0.00	2.06
FDA MIL-Exempt Letter Lead Time	500	2.99	2.99	0.00	2.99
FDA MIL-Exempt Letter	1000	0.53	0.53	0.00	0.53
IA Lead Time	500	25.71	25.71	0.00	25.71
IA (Interim)	500	3.02	3.02	0.00	3.02
CCA Lead Time	500	8.59	8.59	0.00	8.59
CCA	500	1.97	1.97	0.00	1.97
Sys Safety	500	10.02	10.02	0.00	10.02
PMA	3500	0.00	0.00	0.00	0.00
Develop & Build	500	0.00	0.00	0.00	0.00
End	500	0.00	0.00	0.00	0.00
DT Lead Time	500	4.98	4.98	0.00	4.98
IFC	500	1.99	1.99	0.00	1.99
E3IAR	2500	2.23	2.23	0.00	2.23
Start	500	0.00	0.00	0.00	0.00
JITC Lead Time	500	7.87	7.87	0.00	7.87
EMC (Intra-Sys EMC)	500	0.22	0.22	0.00	0.22
EMI	500	2.22	2.22	0.00	2.22
EMV (Inter-Sys EMC)	500	2.49	2.49	0.00	2.49
JITC	500	11.66	11.66	0.00	11.66

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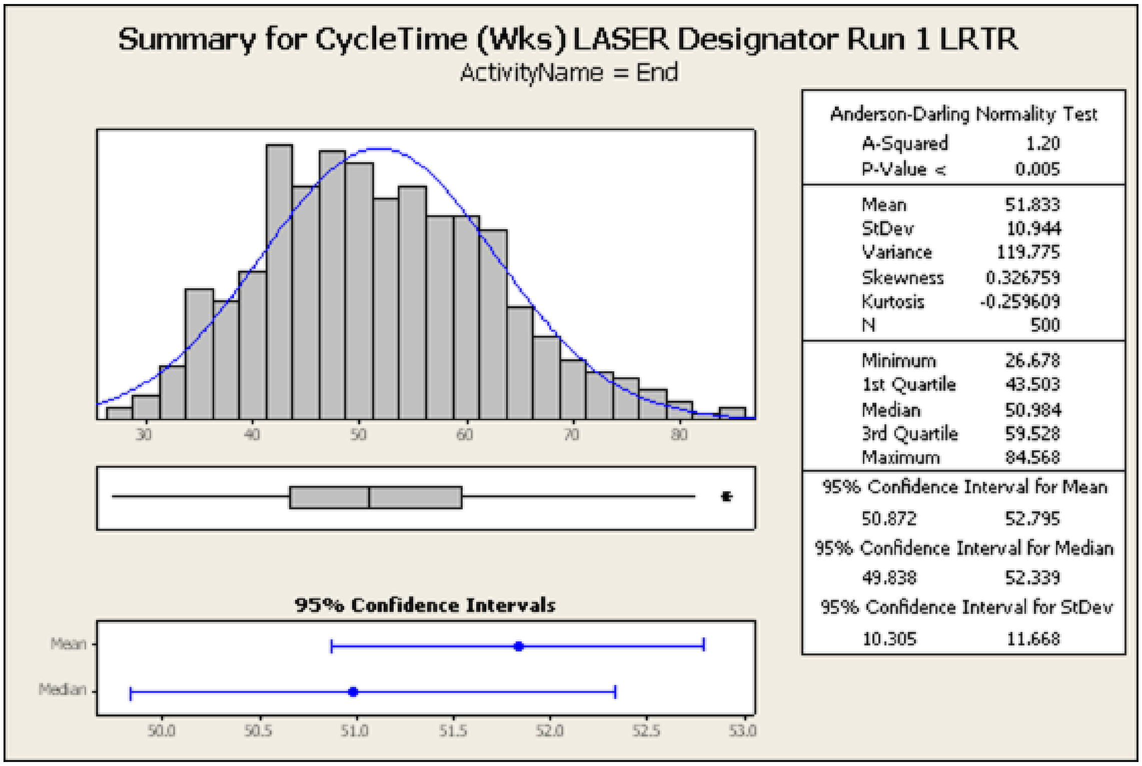
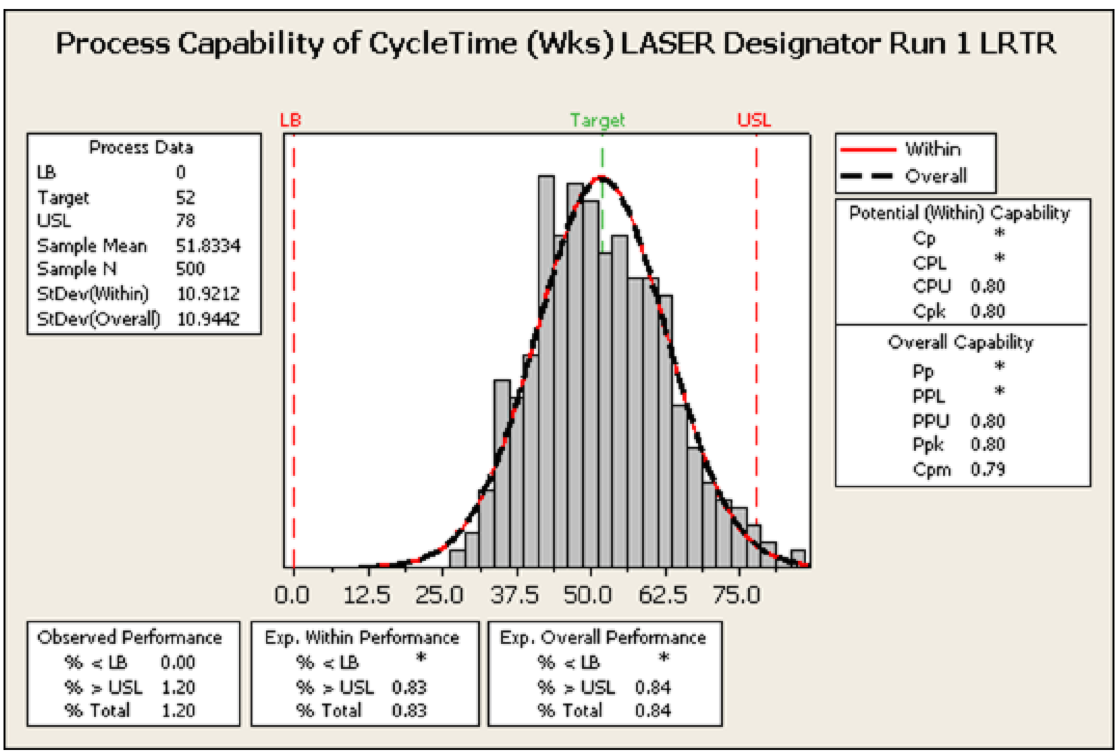
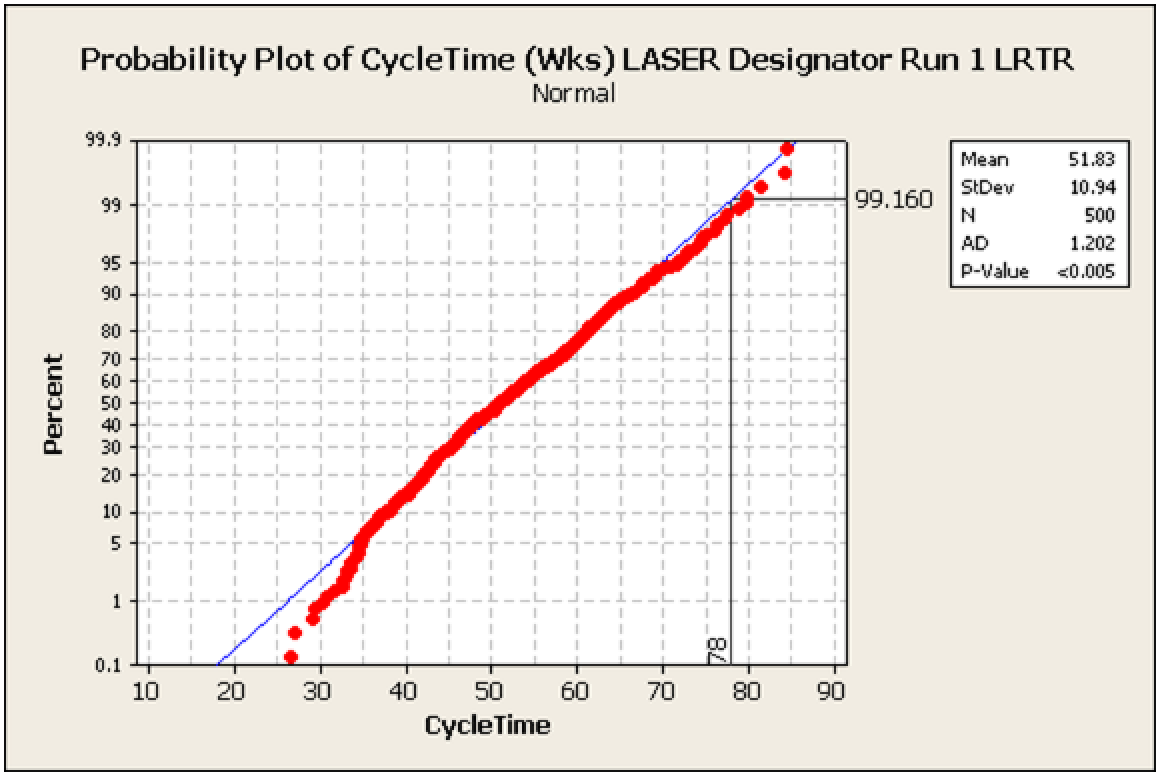


Summary for CycleTime (Wks) LASER Designator Run 1 LRTR
ActivityName = End
Anderson-Darling Normality Test
A-Squared 1.20
P-Value < 0.005
Mean 51.833
StDev 10.944
Variance 119.775
Skewness 0.326759
Kurtosis -0.259609
N 500
Minimum 26.678
1st Quartile 43.503
Median 50.984
3rd Quartile 59.528
Maximum 84.568
95% Confidence Interval for Mean
50.872 52.795
95% Confidence Interval for Median
49.838 52.339
95% Confidence Interval for StDev
10.305 11.668
95% Confidence Intervals
Mean
Median

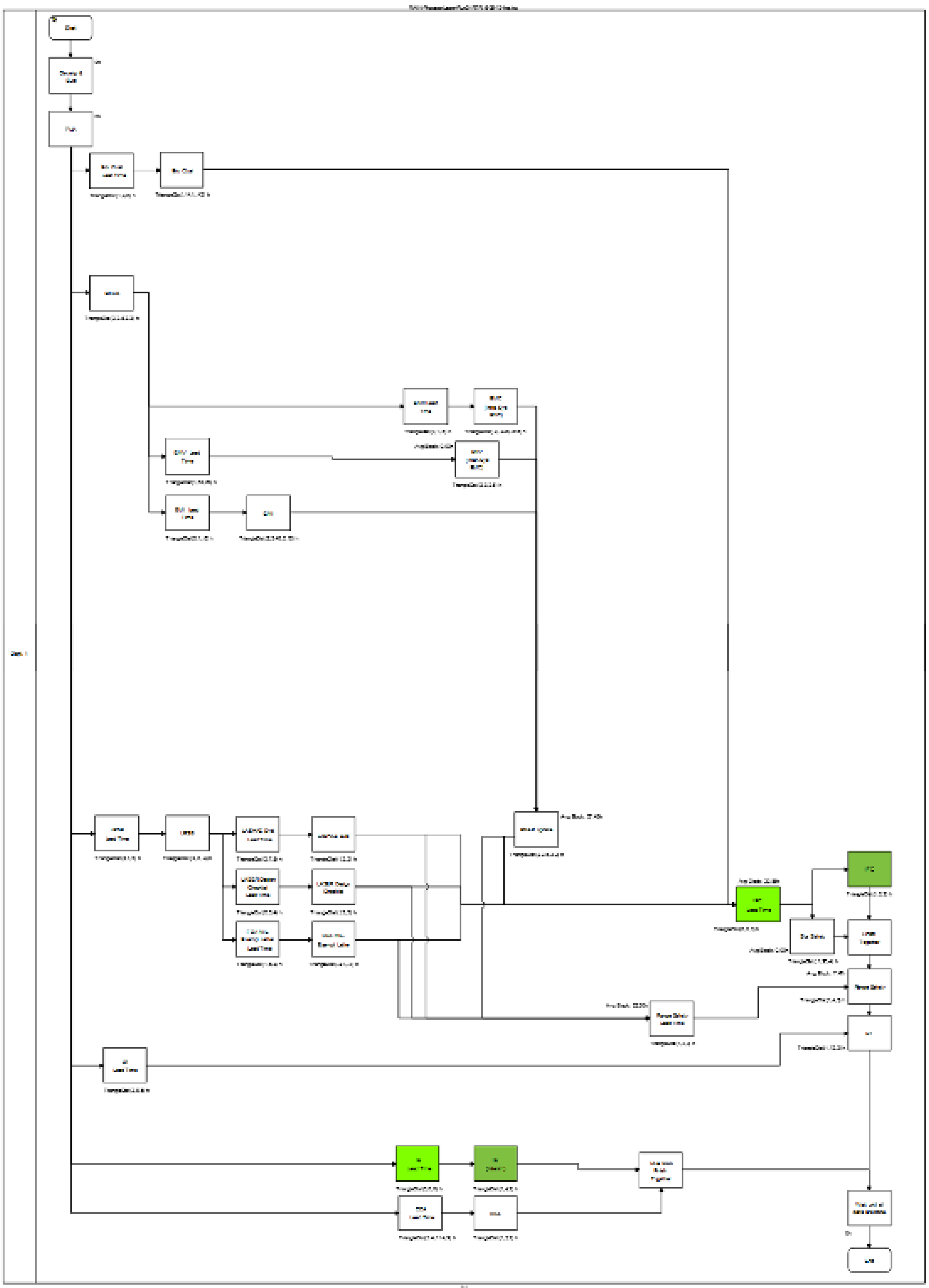


Process Capability of CycleTime (Wks) LASER Designator Run 1 LRTR
Process Data
LB 0
Target 52
USL 78
Sample Mean 51.8334
Sample N 500
StDev(Within) 10.9212
StDev(Overall) 10.9442
LB
Target
USL
Within
Overall
Potential (Within) Capability
Cp *
CPL *
CPU 0.80
Cpk 0.80
Overall Capability
Pp *
PPL *
PPU 0.80
Ppk 0.80
Cpm 0.79
Observed Performance
% < LB 0.00
% > USL 1.20
% Total 1.20
Exp. Within Performance
% < LB *
% > USL 0.83
% Total 0.83
Exp. Overall Performance
% < LB *
% > USL 0.84
% Total 0.84



Probability Plot of CycleTime (Wks) LASER Designator Run 1 LRTR
Normal
Percent
CycleTime
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
10
20
30
40
50
60
70
80
90
78
99.160
Mean 51.83
StDev 10.94
N 500
AD 1.202
P-Value <0.005

LASER Designator Run 2
Intermediate Risk Timeline Reduction (IRTR)



Elapsed Time in Weeks

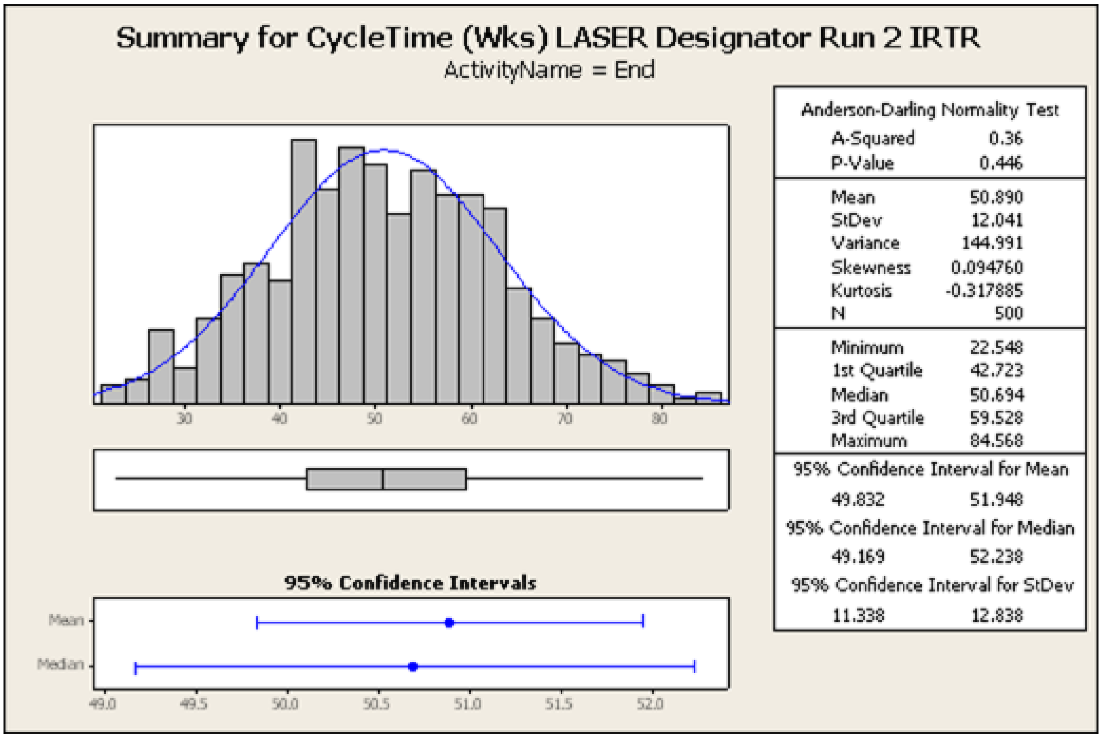
25445.03

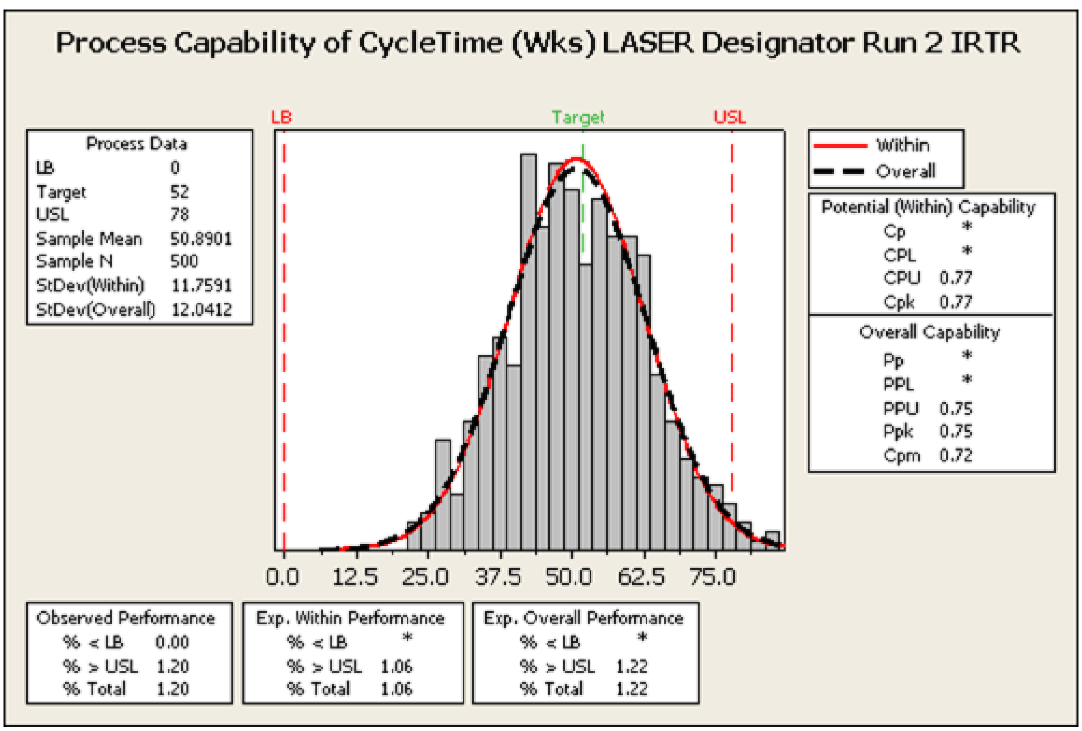
Activity Statistics In Weeks (Hours)

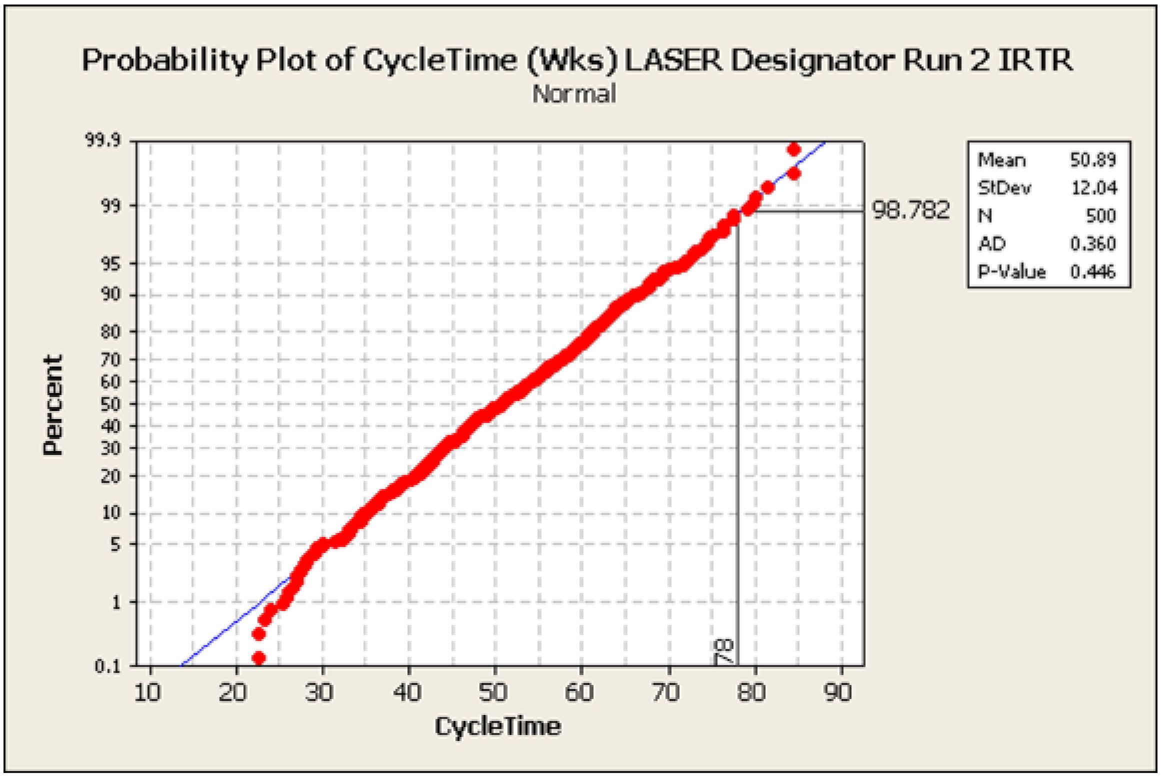
Count	Avg Cycle	Avg Work	Avg Serv	Avg Block
500	50.89	50.89	50.89	0.00

Activity Statistics in Weeks (Hours)

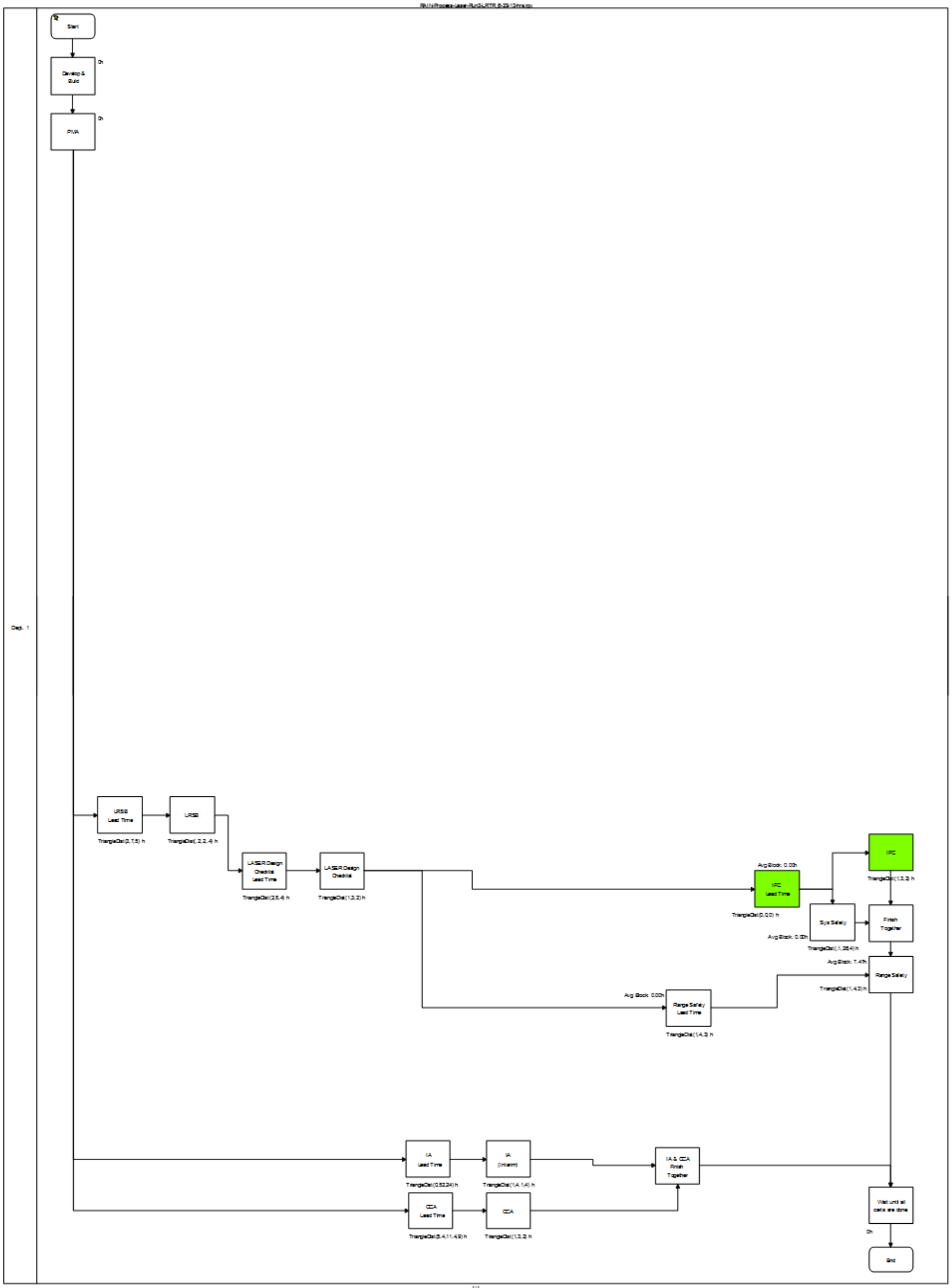
	Count	Avg Cycle	Avg Serv	Avg Block	Avg Work
DT	500	45.91	45.91	40.51	5.40
Wait until all certs are done.	500	40.33	40.33	40.33	0.00
IFC Lead Time	1000	29.88	29.88	29.88	0.00
E3IAR Update	1000	29.68	29.68	27.45	2.23
Range Safety Lead Time	500	25.97	25.97	23.30	2.67
IA & CCA Finish Together	500	8.24	8.24	8.24	0.00
Finish Together	500	8.08	8.08	8.08	0.00
Range Safety	500	10.14	10.14	7.47	2.68
EMC Lead Time	500	0.54	0.54	0.00	0.54
EMI Lead Time	500	0.53	0.53	0.00	0.53
EMV Lead Time	500	25.72	25.72	0.00	25.72
Env Qual Lead Time	500	2.31	2.31	0.00	2.31
Env Qual	500	0.53	0.53	0.00	0.53
LRSB Lead Time	**500**	**5.02**	**5.02**	**0.00**	**5.02**
LRSB	1500	0.89	0.89	0.00	0.89
LASHAZ Eval Lead Time	500	4.98	4.98	0.00	4.98
LASHAZ Eval	1000	1.99	1.99	0.00	1.99
LASER Design Checklist Lead Time	500	4.65	4.65	0.00	4.65
Develop & Build	500	0.00	0.00	0.00	0.00
FDA MIL-Exempt Letter Lead Time	500	2.99	2.99	0.00	2.99
FDA MIL-Exempt Letter	1000	0.53	0.53	0.00	0.53
IA Lead Time	500	0.00	0.00	0.00	0.00
IA (Interim)	500	2.32	2.32	0.00	2.32
CCA Lead Time	500	8.59	8.59	0.00	8.59
CCA	500	1.97	1.97	0.00	1.97
Sys Safety	500	10.02	10.02	0.00	10.02
PMA	3000	0.00	0.00	0.00	0.00
Start	500	0.00	0.00	0.00	0.00
End	500	0.00	0.00	0.00	0.00
DT Lead Time	500	4.98	4.98	0.00	4.98
IFC	500	1.99	1.99	0.00	1.99
E3IAR	1500	2.23	2.23	0.00	2.23
EMC (Intra-Sys EMC)	500	0.22	0.22	0.00	0.22
EMI	500	2.22	2.22	0.00	2.22
EMV (Inter-Sys EMC)	500	2.49	2.49	0.00	2.49
LASER Design Checklist	1000	2.06	2.06	0.00	2.06


Summary for CycleTime (Wks) LASER Designator Run 2 IRTR
ActivityName = End
Anderson-Darling Normality Test
A-Squared 0.36
P-Value 0.446
Mean 50.890
StDev 12.041
Variance 144.991
Skewness 0.094760
Kurtosis -0.317885
N 500
Minimum 22.548
1st Quartile 42.723
Median 50.694
3rd Quartile 59.528
Maximum 84.568
95% Confidence Interval for Mean
49.832 51.948
95% Confidence Interval for Median
49.169 52.238
95% Confidence Interval for StDev
11.338 12.838
95% Confidence Intervals
Mean
Median


Process Capability of CycleTime (Wks) LASER Designator Run 2 IRTR
Process Data
LB 0
Target 52
USL 78
Sample Mean 50.8901
Sample N 500
StDev(Within) 11.7591
StDev(Overall) 12.0412
LB
Target
USL
Within
Overall
Potential (Within) Capability
Cp *
CPL *
CPU 0.77
Cpk 0.77
Overall Capability
Pp *
PPL *
PPU 0.75
Ppk 0.75
Cpm 0.72
0.0 12.5 25.0 37.5 50.0 62.5 75.0
Observed Performance
% < LB 0.00
% > USL 1.20
% Total 1.20
Exp. Within Performance
% < LB *
% > USL 1.06
% Total 1.06
Exp. Overall Performance
% < LB *
% > USL 1.22
% Total 1.22


Probability Plot of CycleTime (Wks) LASER Designator Run 2 IRTR
Normal
Percent
CycleTime
Mean 50.89
StDev 12.04
N 500
AD 0.360
P-Value 0.446
98.782
78
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
10
20
30
40
50
60
70
80
90

LASER Designator Run 2
Low Risk Timeline Reduction (LRTR)



Elapsed Time in Weeks

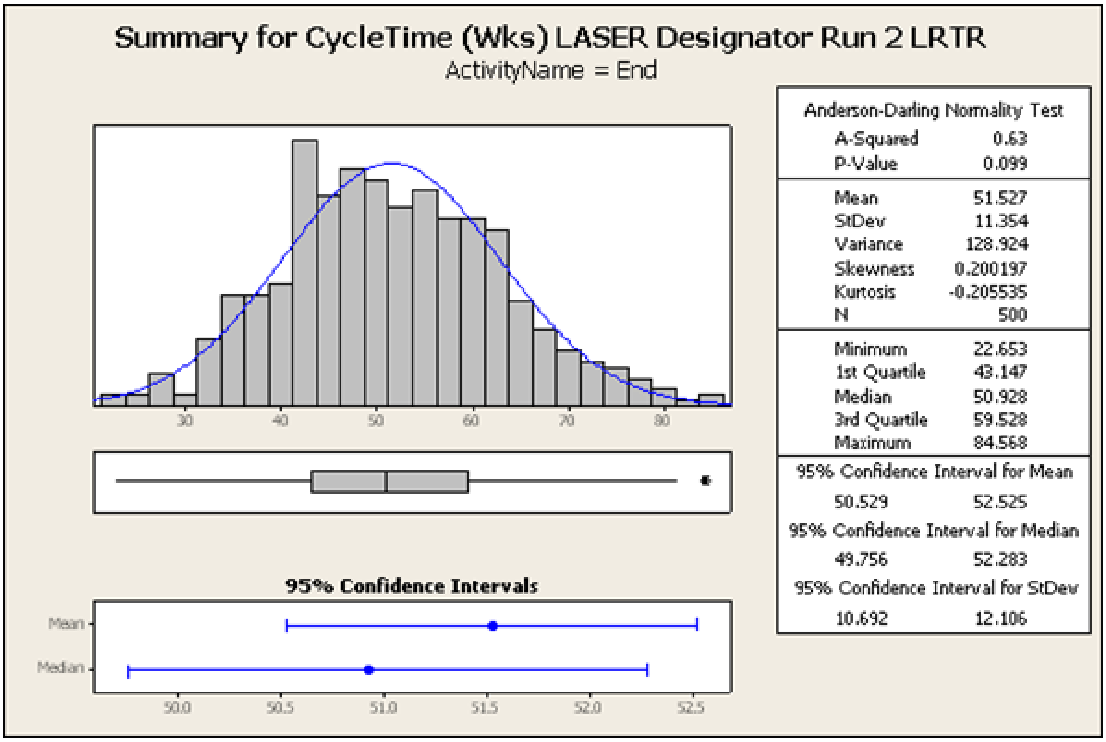
25763.55

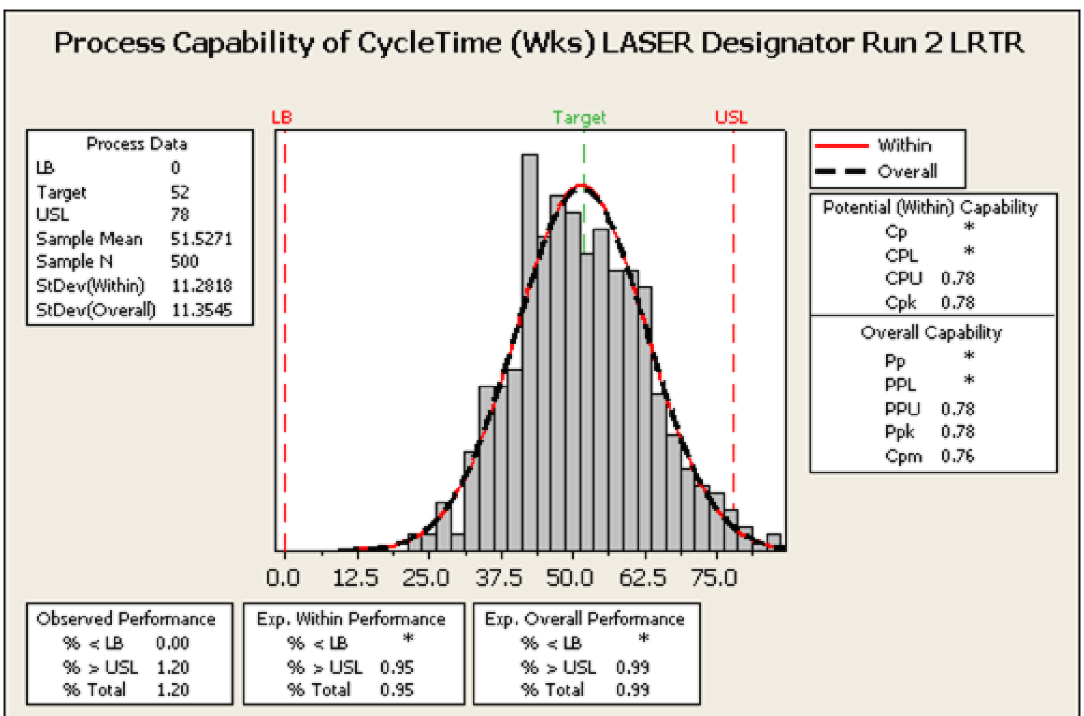
Activity Statistics In Weeks (Hours)

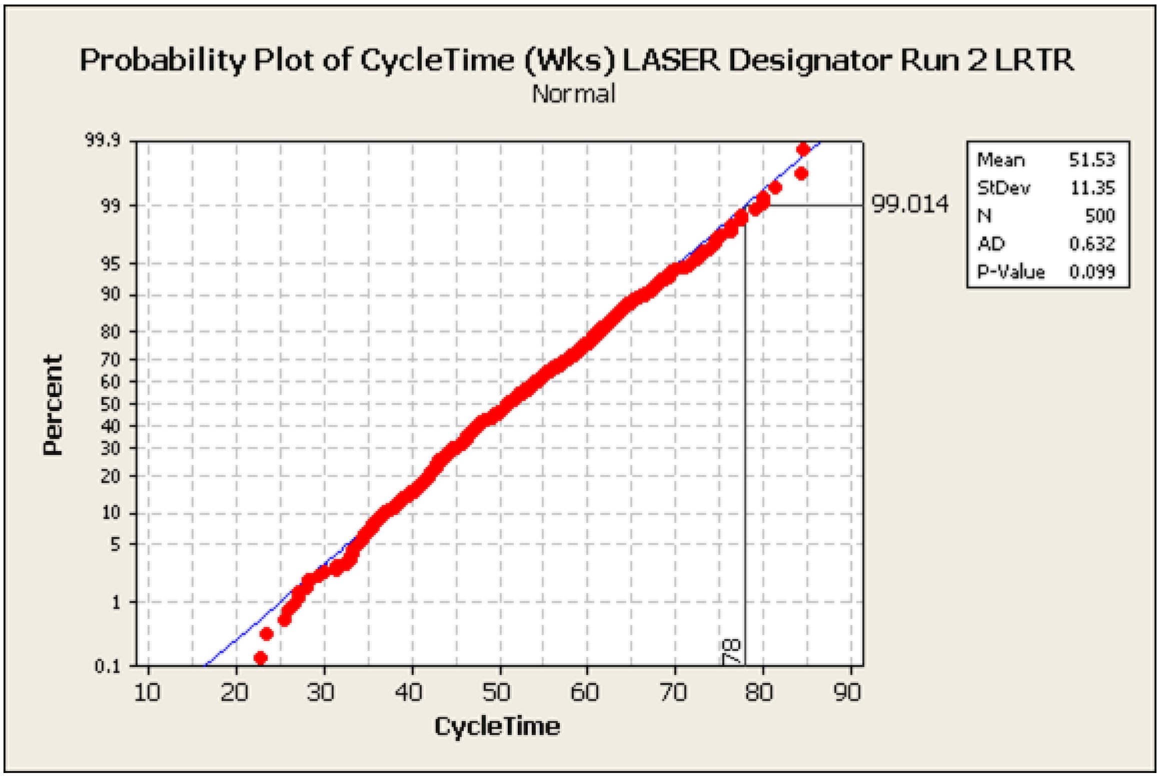
Count	Avg Cycle	Avg Serv	Avg Block	Avg Work
500	51.53	51.53	0.00	51.53

Activity Statistics in Weeks (Hours)

	Count	Avg Cycle	Avg Serv	Avg Block	Avg Work
DT	500	45.91	45.91	40.51	5.40
IFC Lead Time	1000	29.88	29.88	29.88	0.00
E3IAR Update	1000	29.68	29.68	27.45	2.23
Wait until all certs are done.	500	23.30	23.30	23.30	0.00
Range Safety Lead Time	500	25.97	25.97	23.30	2.67
IA & CCA Finish Together	500	18.43	18.43	18.43	0.00
Finish Together	500	8.08	8.08	8.08	0.00
Range Safety	500	10.14	10.14	7.47	2.68
EMC Lead Time	500	0.54	0.54	0.00	0.54
EMI Lead Time	500	0.53	0.53	0.00	0.53
EMV Lead Time	500	25.72	25.72	0.00	25.72
Env Qual Lead Time	500	2.31	2.31	0.00	2.31
Env Qual	500	0.53	0.53	0.00	0.53
LRSB Lead Time	**500**	**5.02**	**5.02**	**0.00**	**5.02**
LRSB	1500	0.89	0.89	0.00	0.89
LASHAZ Eval Lead Time	500	4.98	4.98	0.00	4.98
LASHAZ Eval	1000	1.99	1.99	0.00	1.99
LASER Design Checklist Lead Time	500	4.65	4.65	0.00	4.65
Develop & Build	500	0.00	0.00	0.00	0.00
FDA MIL-Exempt Letter Lead Time	500	2.99	2.99	0.00	2.99
FDA MIL-Exempt Letter	1000	0.53	0.53	0.00	0.53
IA Lead Time	500	25.71	25.71	0.00	25.71
IA (Interim)	500	3.02	3.02	0.00	3.02
CCA Lead Time	500	8.59	8.59	0.00	8.59
CCA	500	1.97	1.97	0.00	1.97
Sys Safety	500	10.02	10.02	0.00	10.02
PMA	3000	0.00	0.00	0.00	0.00
Start	500	0.00	0.00	0.00	0.00
End	500	0.00	0.00	0.00	0.00
DT Lead Time	500	4.98	4.98	0.00	4.98
IFC	500	1.99	1.99	0.00	1.99
E3IAR	1500	2.23	2.23	0.00	2.23
EMC (Intra-Sys EMC)	500	0.22	0.22	0.00	0.22
EMI	500	2.22	2.22	0.00	2.22
EMV (Inter-Sys EMC)	500	2.49	2.49	0.00	2.49
LASER Design Checklist	1000	2.06	2.06	0.00	2.06


Summary for CycleTime (Wks) LASER Designator Run 2 LRTR
ActivityName = End
Anderson-Darling Normality Test
A-Squared 0.63
P-Value 0.099
Mean 51.527
StDev 11.354
Variance 128.924
Skewness 0.200197
Kurtosis -0.205535
N 500
Minimum 22.653
1st Quartile 43.147
Median 50.928
3rd Quartile 59.528
Maximum 84.568
95% Confidence Interval for Mean
50.529 52.525
95% Confidence Interval for Median
49.756 52.283
95% Confidence Interval for StDev
10.692 12.106
95% Confidence Intervals
Mean
Median

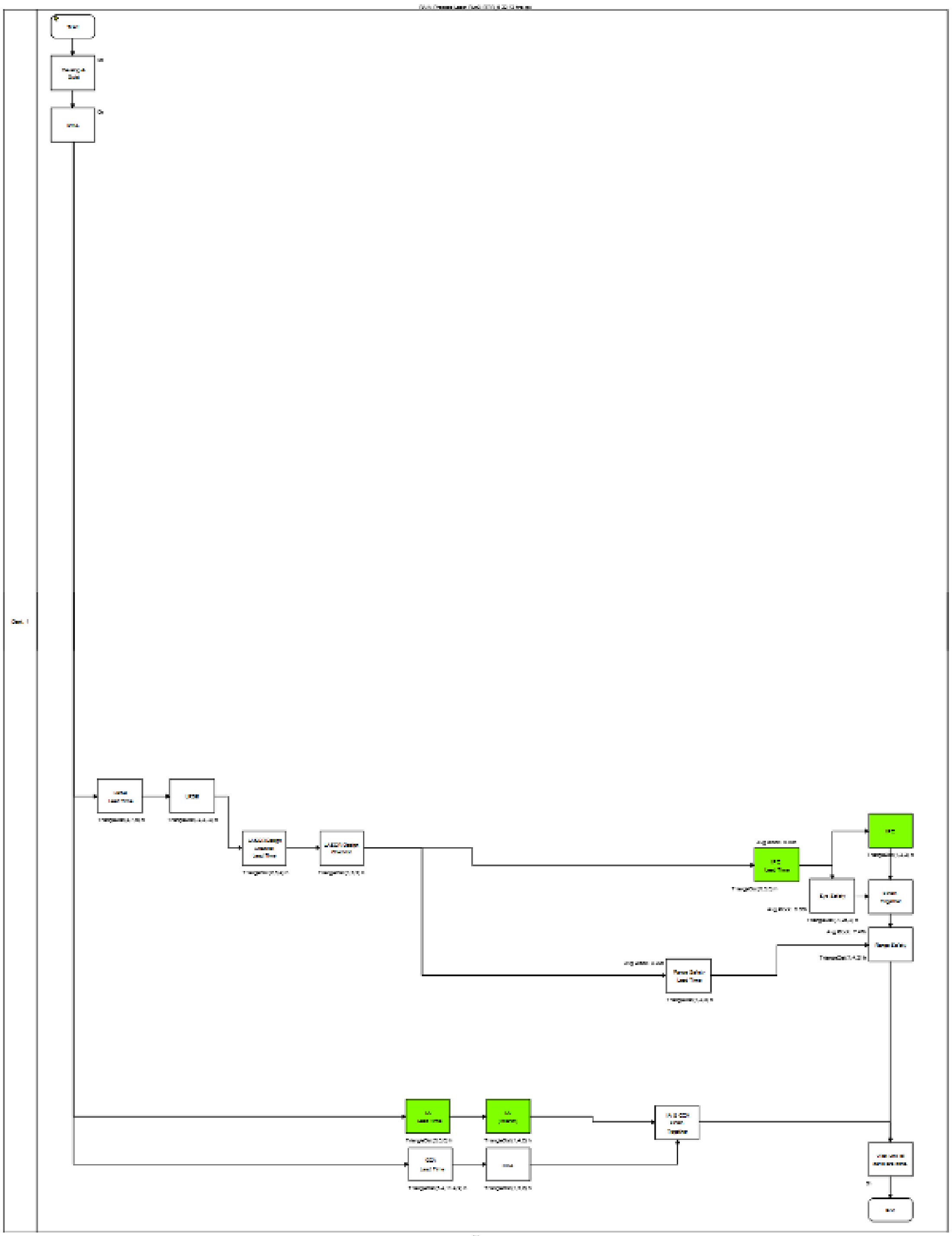

Process Capability of CycleTime (Wks) LASER Designator Run 2 LRTR
Process Data
LB 0
Target 52
USL 78
Sample Mean 51.5271
Sample N 500
StDev(Within) 11.2818
StDev(Overall) 11.3545
LB
Target
USL
Within
Overall
Potential (Within) Capability
Cp *
CPL *
CPU 0.78
Cpk 0.78
Overall Capability
Pp *
PPL *
PPU 0.78
Ppk 0.78
Cpm 0.76
0.0 12.5 25.0 37.5 50.0 62.5 75.0
Observed Performance
% < LB 0.00
% > USL 1.20
% Total 1.20
Exp. Within Performance
% < LB *
% > USL 0.95
% Total 0.95
Exp. Overall Performance
% < LB *
% > USL 0.99
% Total 0.99



Probability Plot of CycleTime (Wks) LASER Designator Run 2 LRTR
Normal
Percent
CycleTime
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
10
20
30
40
50
60
70
80
90
99.014
78
Mean 51.53
StDev 11.35
N 500
AD 0.632
P-Value 0.099

LASER Designator Run 3

Intermediate Risk Timeline Reduction (IRTR)



Elapsed Time in Weeks

12693.39

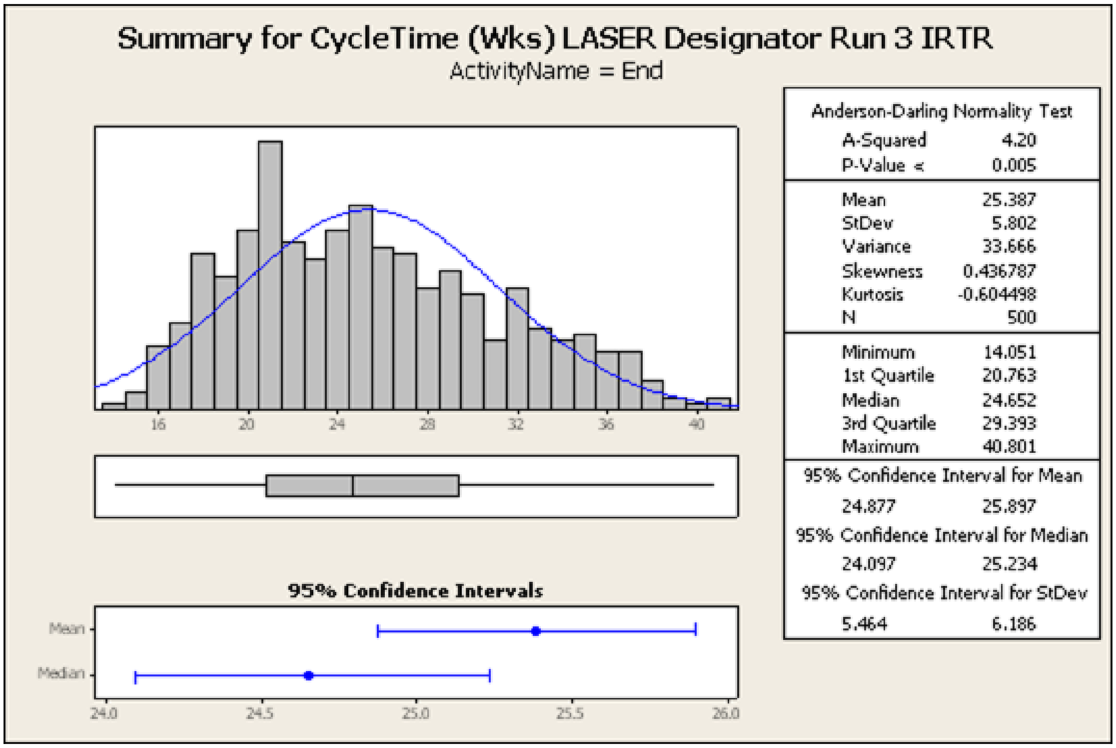
Activity Statistics In Weeks (Hours)

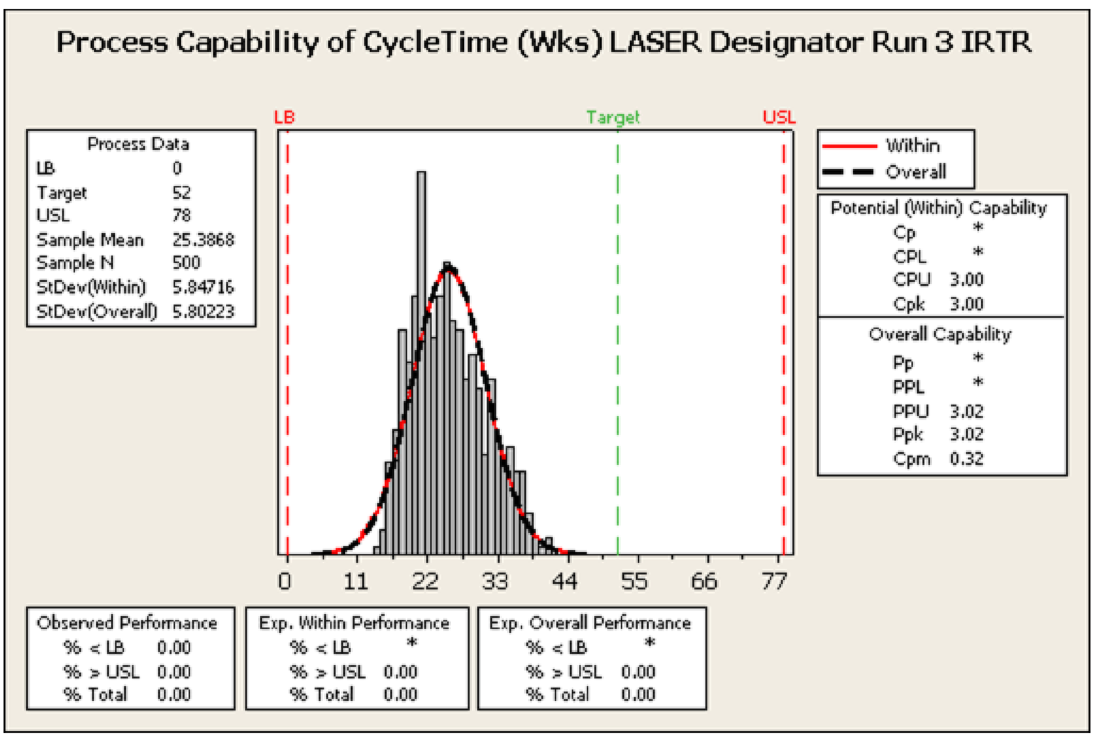
Count	Avg Cycle	Avg Serv	Avg Block	Avg Work
500	25.39	25.39	0.00	25.39

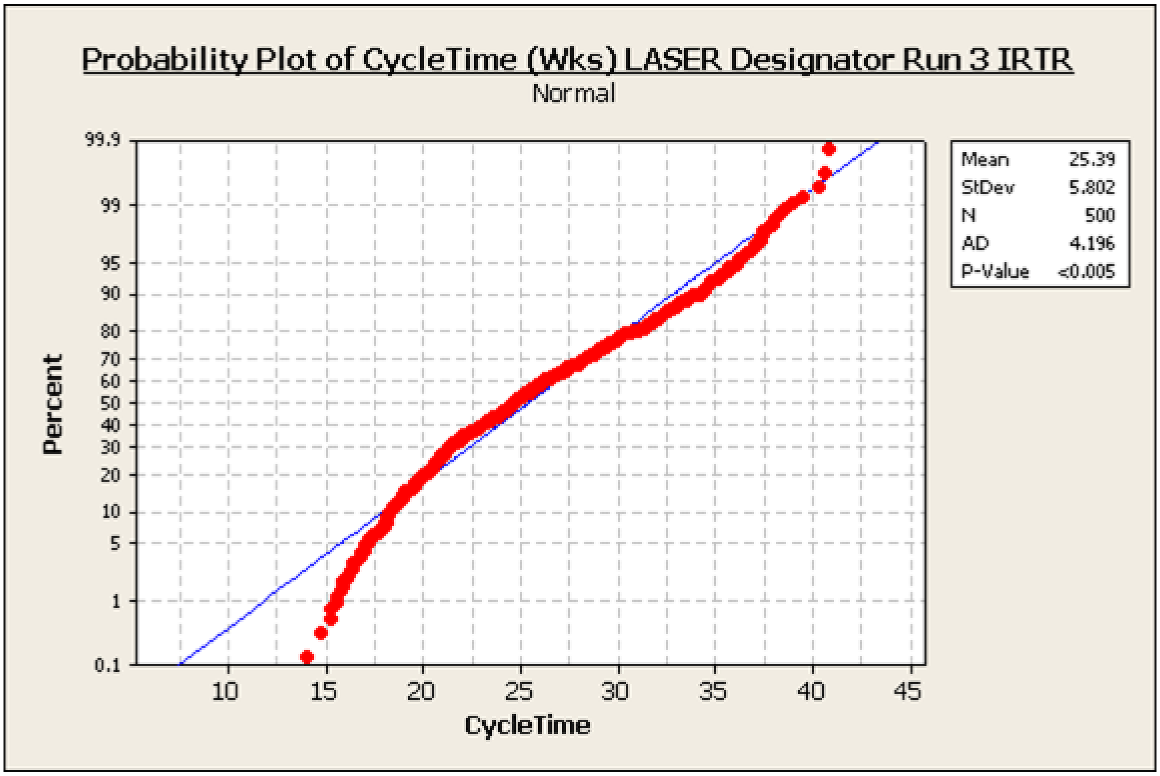
Activity Statistics in Weeks (Hours)

	Count	Avg Cycle	Avg Serv	Avg Block	Avg Work
Wait until all certs are done.	500	14.83	14.83	14.83	0.00
IA & CCA Finish Together	500	8.24	8.24	8.24	0.00
Finish Together	500	8.08	8.08	8.08	0.00
Range Safety	500	10.14	10.14	7.47	2.68
Develop & Build	500	0.00	0.00	0.00	0.00
End	500	0.00	0.00	0.00	0.00
IFC	500	1.99	1.99	0.00	1.99
IFC Lead Time	1000	0.00	0.00	0.00	0.00
LRSB Lead Time	500	5.02	5.02	0.00	5.02
LRSB	500	0.89	0.89	0.00	0.89
LASER Design Checklist Lead Time	500	4.65	4.65	0.00	4.65
LASER Design Checklist	1000	2.06	2.06	0.00	2.06
IA Lead Time	500	0.00	0.00	0.00	0.00
IA (Interim)	500	2.32	2.32	0.00	2.32
CCA Lead Time	500	8.59	8.59	0.00	8.59
CCA	500	1.97	1.97	0.00	1.97
Sys Safety	500	10.02	10.02	0.00	10.02
PMA	1500	0.00	0.00	0.00	0.00
Start	500	0.00	0.00	0.00	0.00
Range Safety Lead Time	500	2.67	2.67	0.00	2.67

1/1

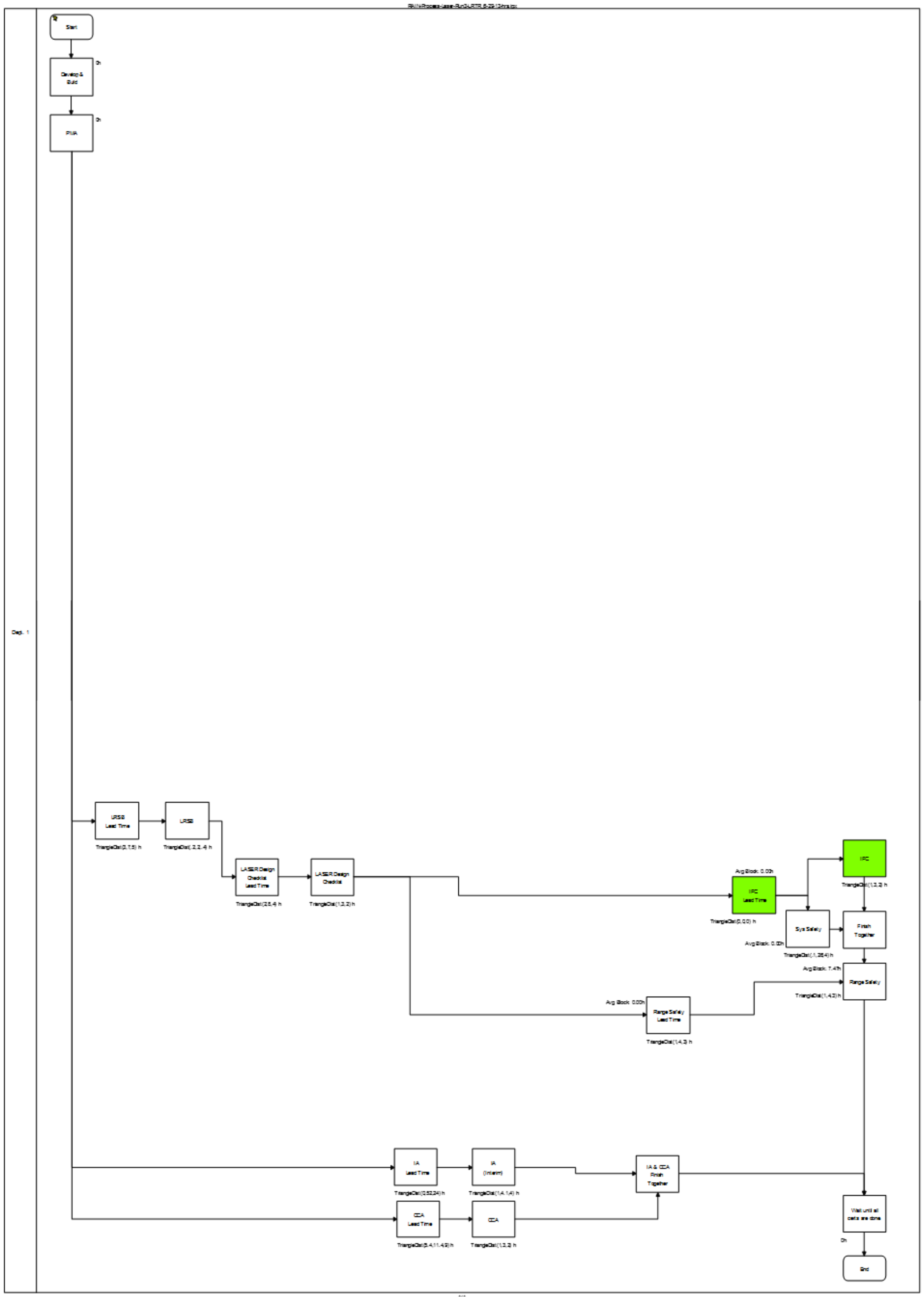

Summary for CycleTime (Wks) LASER Designator Run 3 IRTR
ActivityName = End
Anderson-Darling Normality Test
A-Squared 4.20
P-Value < 0.005
Mean 25.387
StDev 5.802
Variance 33.666
Skewness 0.436787
Kurtosis -0.604498
N 500
Minimum 14.051
1st Quartile 20.763
Median 24.652
3rd Quartile 29.393
Maximum 40.801
95% Confidence Interval for Mean
24.877 25.897
95% Confidence Interval for Median
24.097 25.234
95% Confidence Interval for StDev
5.464 6.186
95% Confidence Intervals
Mean
Median
16 20 24 28 32 36 40
24.0 24.5 25.0 25.5 26.0


Process Capability of CycleTime (Wks) LASER Designator Run 3 IRTR
Process Data
LB 0
Target 52
USL 78
Sample Mean 25.3868
Sample N 500
StDev(Within) 5.84716
StDev(Overall) 5.80223
LB
Target
USL
Within
Overall
Potential (Within) Capability
Cp *
CPL *
CPU 3.00
Cpk 3.00
Overall Capability
Pp *
PPL *
PPU 3.02
Ppk 3.02
Cpm 0.32
0 11 22 33 44 55 66 77
Observed Performance
% < LB 0.00
% > USL 0.00
% Total 0.00
Exp. Within Performance
% < LB *
% > USL 0.00
% Total 0.00
Exp. Overall Performance
% < LB *
% > USL 0.00
% Total 0.00



Probability Plot of CycleTime (Wks) LASER Designator Run 3 IRTR
Normal
Percent
CycleTime
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
10
15
20
25
30
35
40
45
Mean 25.39
StDev 5.802
N 500
AD 4.196
P-Value <0.005

LASER Designator Run 3
Low Risk Timeline Reduction (LRTR)



RAIN-Process-Laser-Run3-LRTR_6-29-13-hrs.igx

Elapsed Time in Weeks

16068.65

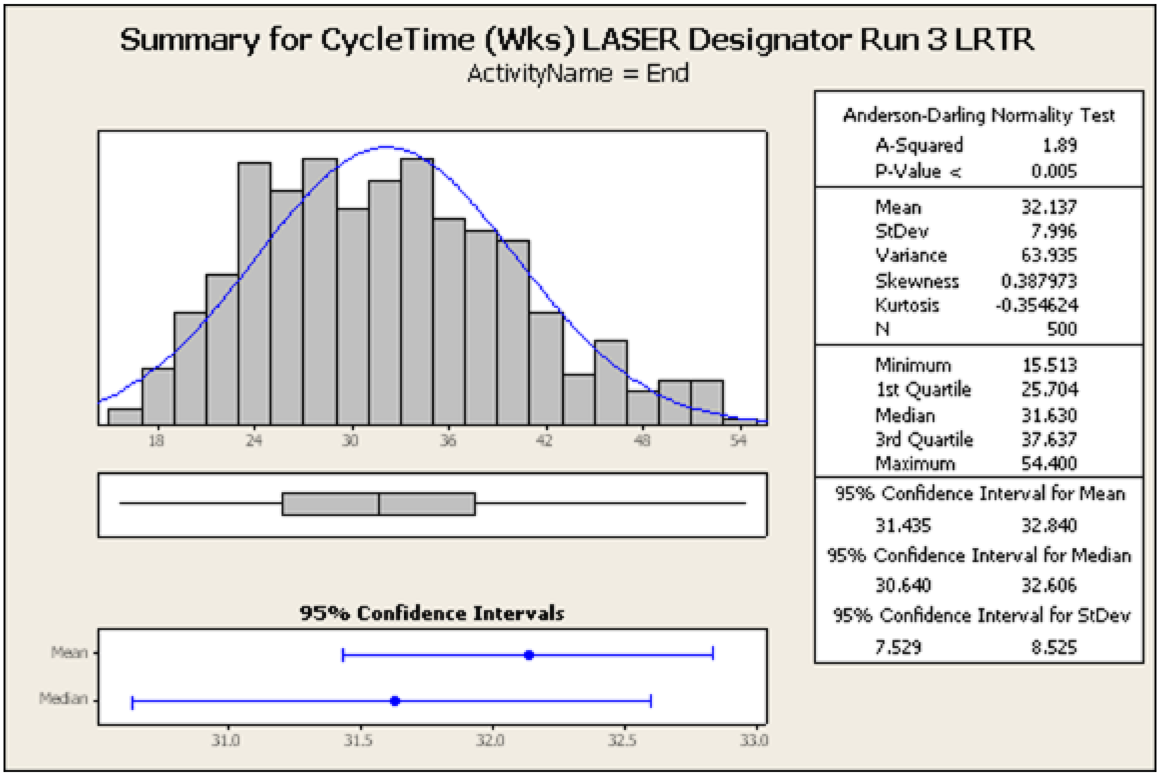
Activity Statistics In Weeks (Hours)

Count	Avg Cycle	Avg Serv	Avg Block	Avg Work
500	32.14	32.14	0.00	32.14

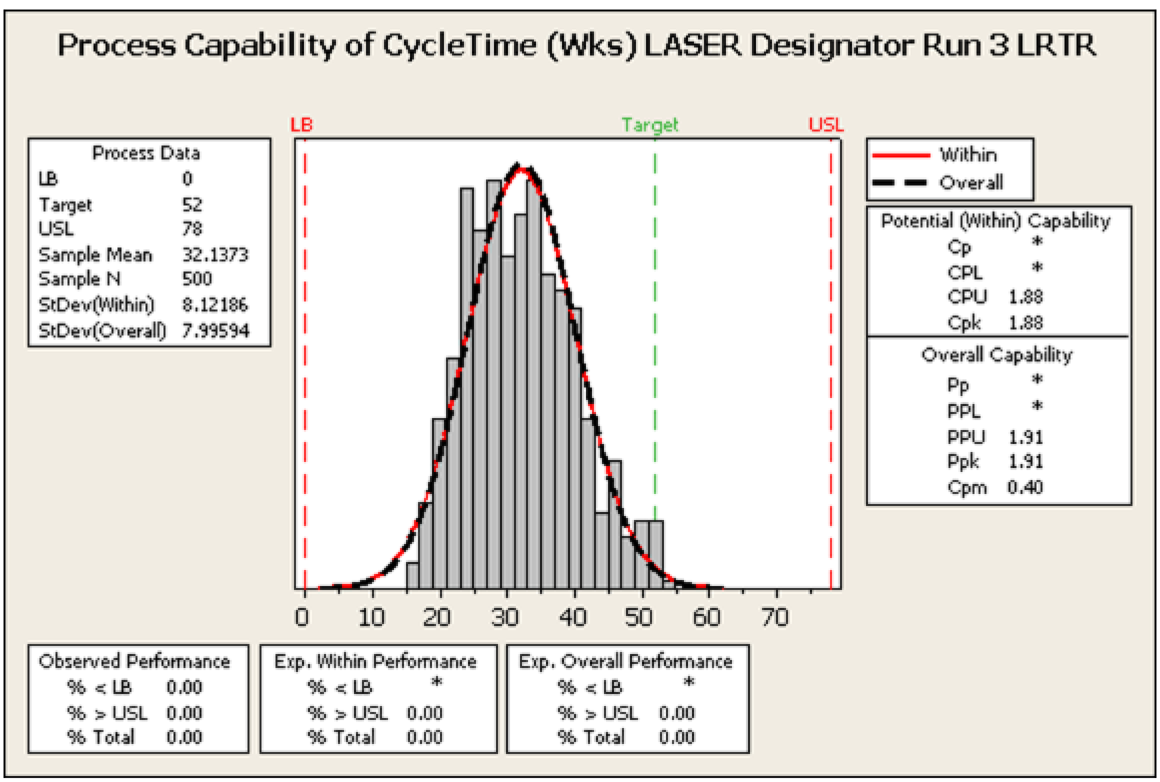
Activity Statistics in Weeks (Hours)

	Count	Avg Cycle	Avg Serv	Avg Block	Avg Work
IA & CCA Finish Together	500	18.43	18.43	18.43	0.00
Wait until all certs are done.	500	10.03	10.03	10.03	0.00
Finish Together	500	8.08	8.08	8.08	0.00
Range Safety	500	10.14	10.14	7.47	2.68
Develop & Build	500	0.00	0.00	0.00	0.00
End	500	0.00	0.00	0.00	0.00
IFC	500	1.99	1.99	0.00	1.99
IFC Lead Time	1000	0.00	0.00	0.00	0.00
LRSB Lead Time	500	5.02	5.02	0.00	5.02
LRSB	500	0.89	0.89	0.00	0.89
LASER Design Checklist Lead Time	500	4.65	4.65	0.00	4.65
LASER Design Checklist	1000	2.06	2.06	0.00	2.06
IA Lead Time	500	25.71	25.71	0.00	25.71
IA (Interim)	500	3.02	3.02	0.00	3.02
CCA Lead Time	500	8.59	8.59	0.00	8.59
CCA	500	1.97	1.97	0.00	1.97
Sys Safety	500	10.02	10.02	0.00	10.02
PMA	1500	0.00	0.00	0.00	0.00
Start	500	0.00	0.00	0.00	0.00
Range Safety Lead Time	500	2.67	2.67	0.00	2.67

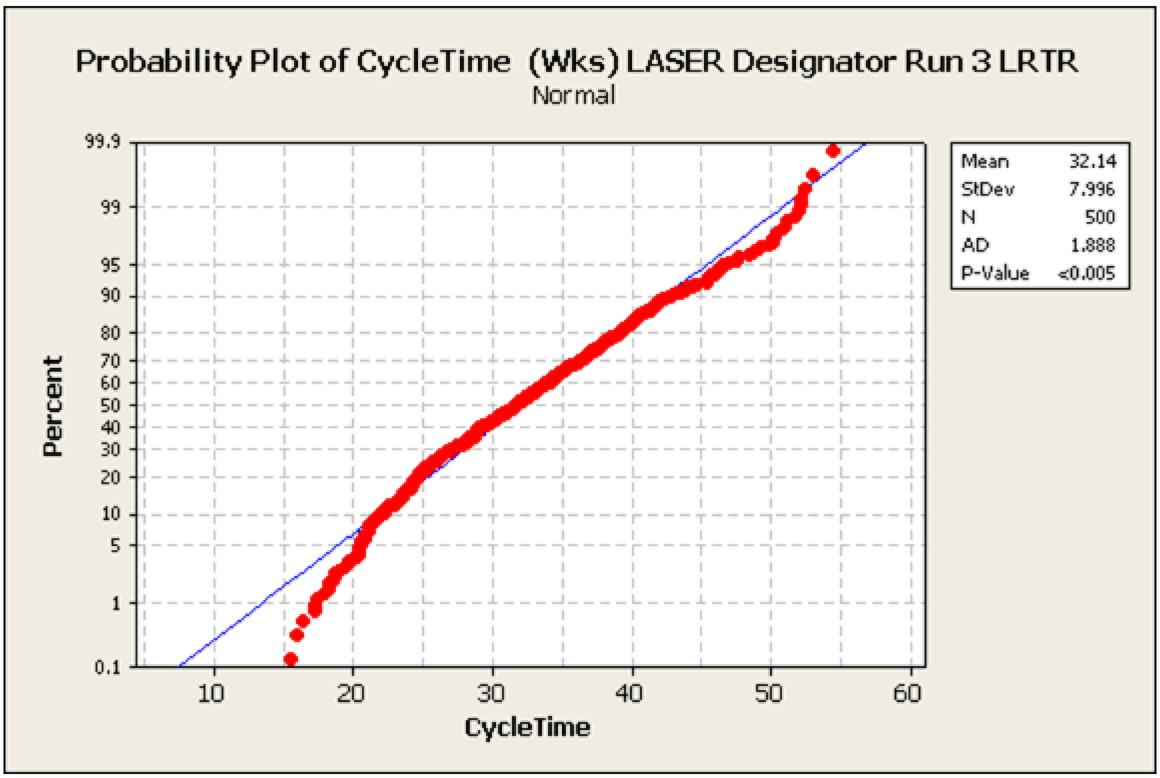
1/1



Summary for CycleTime (Wks) LASER Designator Run 3 LRTR
ActivityName = End
Anderson-Darling Normality Test
A-Squared 1.89
P-Value < 0.005
Mean 32.137
StDev 7.996
Variance 63.935
Skewness 0.387973
Kurtosis -0.354624
N 500
Minimum 15.513
1st Quartile 25.704
Median 31.630
3rd Quartile 37.637
Maximum 54.400
95% Confidence Interval for Mean
31.435 32.840
95% Confidence Interval for Median
30.640 32.606
95% Confidence Interval for StDev
7.529 8.525
95% Confidence Intervals
Mean
Median
18 24 30 36 42 48 54
31.0 31.5 32.0 32.5 33.0

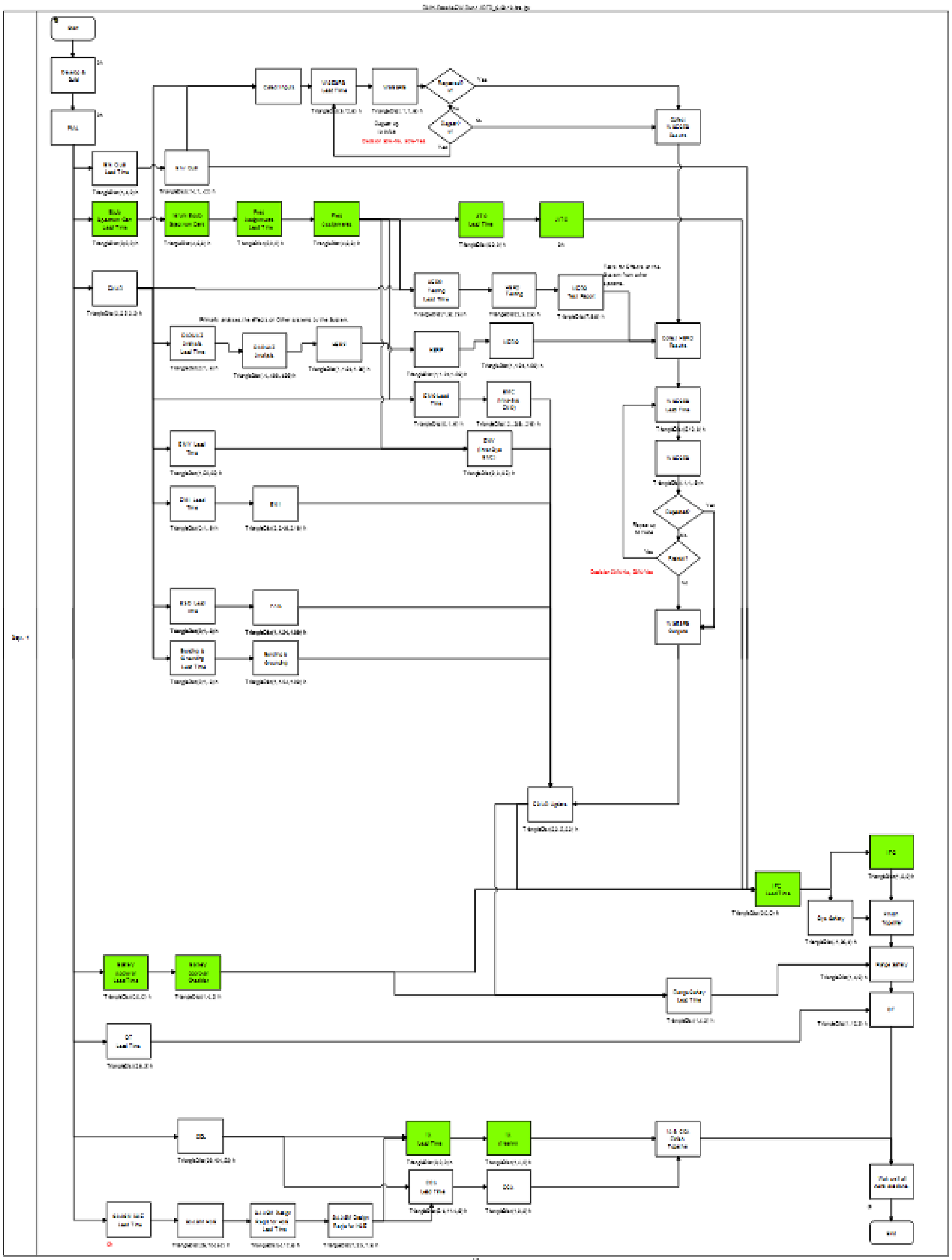


Process Capability of CycleTime (Wks) LASER Designator Run 3 LRTR
LB
Target
USL
Process Data
LB 0
Target 52
USL 78
Sample Mean 32.1373
Sample N 500
StDev(Within) 8.12186
StDev(Overall) 7.99594
Within
Overall
Potential (Within) Capability
Cp *
CPL *
CPU 1.88
Cpk 1.88
Overall Capability
Pp *
PPL *
PPU 1.91
Ppk 1.91
Cpm 0.40
0 10 20 30 40 50 60 70
Observed Performance
% < LB 0.00
% > USL 0.00
% Total 0.00
Exp. Within Performance
% < LB *
% > USL 0.00
% Total 0.00
Exp. Overall Performance
% < LB *
% > USL 0.00
% Total 0.00



Probability Plot of CycleTime (Wks) LASER Designator Run 3 LRTR
Normal
Percent
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
10
20
30
40
50
60
CycleTime
Mean 32.14
StDev 7.996
N 500
AD 1.888
P-Value <0.005

Passive Electronic Warfare (EW) Run 1
Intermediate Risk Timeline Reduction (IRTR)



Elapsed Time in Weeks

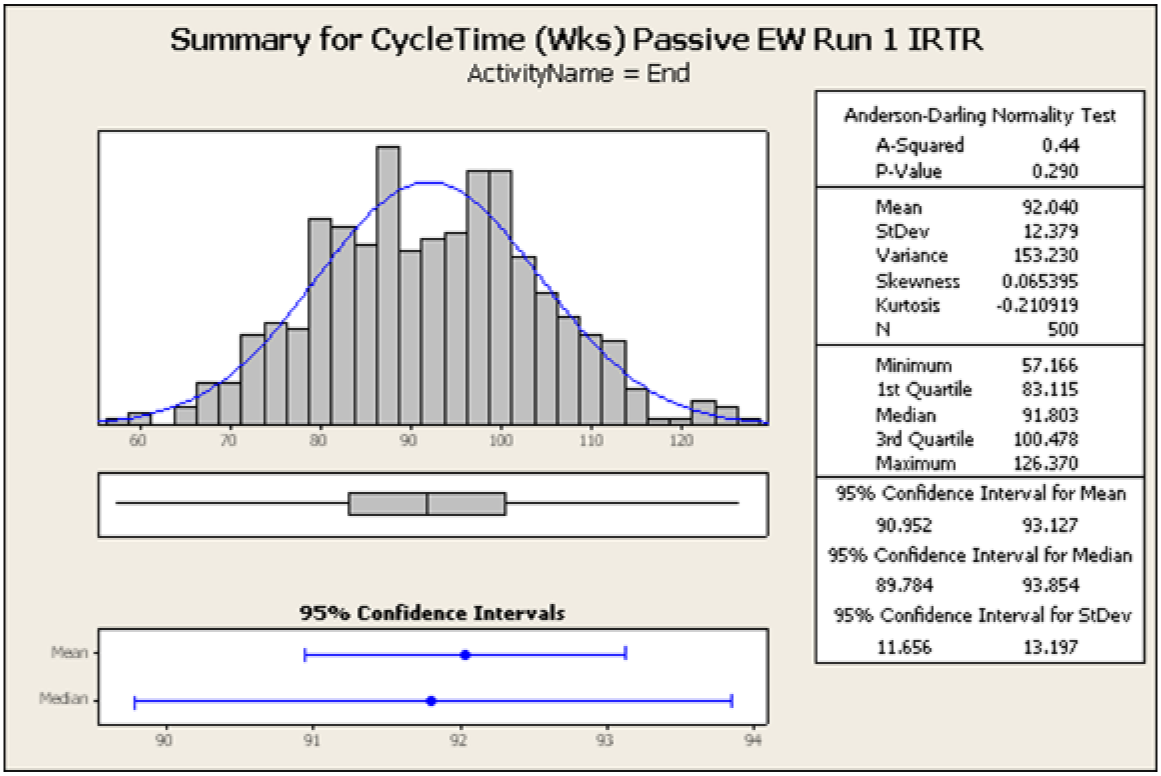
46019.83

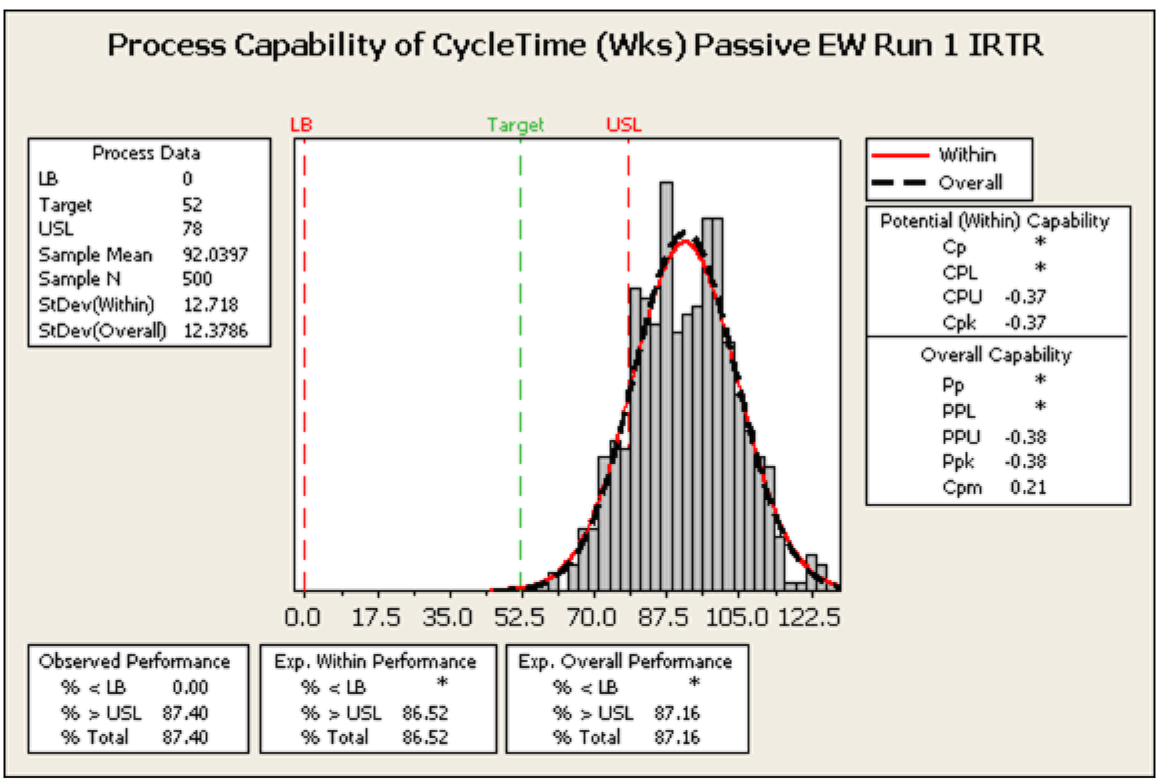
Transaction Statistics In Weeks (Hours)

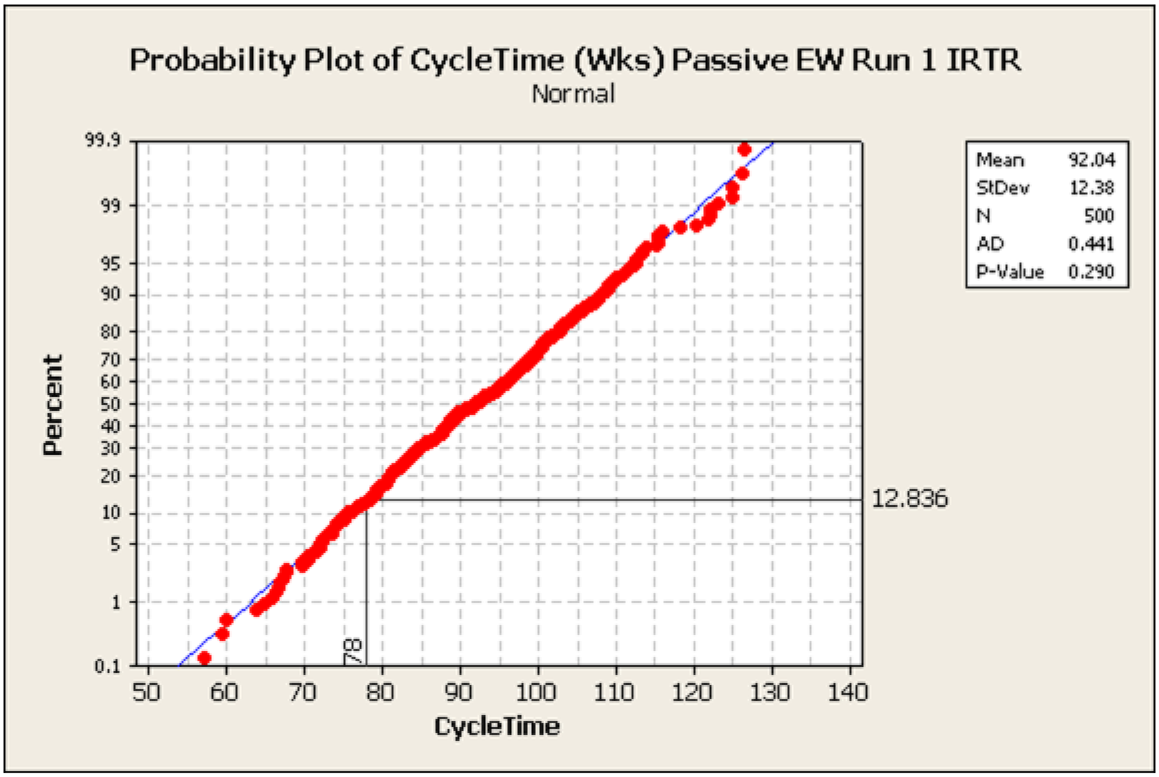
Count	Avg Cycle	Avg Serv	Avg Block	Avg Work
500	92.04	92.04	0.00	92.04

Activity Statistics In Weeks (Hours)

	Count	Avg Cycle	Avg Serv	Avg Block	Avg Work
CDL	1000	60.50	60.50	0.00	60.50
SAASM HAE	500	59.94	59.94	0.00	59.94
HERO Testing Lead Time	500	35.83	35.83	9.84	25.99
EMV Lead Time	500	25.72	25.72	0.00	25.72
Sys Safety	500	10.02	10.02	0.00	10.02
CCA Lead Time	500	28.70	28.70	20.11	8.59
WSESRB Lead Time	750	8.33	8.33	0.00	8.33
WSESRB Lead Time	750	8.30	8.30	0.00	8.30
SAASM Design Req's for HAE Lead Time	500	8.06	8.06	0.00	8.06
HERO Test Report	500	8.03	8.03	0.00	8.03
Freq Assignments	2000	6.05	6.05	0.00	6.05
Intrum Equip Spectrum Certt	500	6.02	6.02	0.00	6.02
DT	500	77.47	77.47	72.07	5.40
DT Lead Time	500	4.98	4.98	0.00	4.98
Range Safety	500	10.14	10.14	7.47	2.68
Range Safety Lead Time	500	64.58	64.58	61.92	2.67
HERO Testing	500	2.51	2.51	0.00	2.51
EMV (Inter-Sys EMC)	500	18.81	18.81	16.32	2.49
Battery Approval Checklist	1000	2.37	2.37	0.00	2.37
IA (Interim)	500	2.32	2.32	0.00	2.32
Env Qual Lead Time	500	2.31	2.31	0.00	2.31
E3IAR	4000	2.23	2.23	0.00	2.23
E3IAR Update	1000	60.54	60.54	58.31	2.23
EMI	500	2.22	2.22	0.00	2.22
IFC	500	1.99	1.99	0.00	1.99
CCA	500	1.97	1.97	0.00	1.97
SAASM Design Req's for HAE	**1000**	**1.69**	**1.69**	**0.00**	**1.69**
Bonding & Grounding	**500**	**1.11**	**1.11**	**0.00**	**1.11**
HERP	**500**	**1.11**	**1.11**	**0.00**	**1.11**
HERO	500	1.11	1.11	0.00	1.11
ESD	500	1.11	1.11	0.00	1.11
HERF	500	1.11	1.11	0.00	1.11
WSESRB	750	0.57	0.57	0.00	0.57
WSESRB	750	0.56	0.56	0.00	0.56
RADHAZ Analysis Lead Time	500	0.55	0.55	0.00	0.55
EMC Lead Time	500	10.38	10.38	9.84	0.54
EMI Lead Time	500	0.53	0.53	0.00	0.53
Env Qual	1000	0.53	0.53	0.00	0.53
ESD Lead Time	500	0.53	0.53	0.00	0.53
Bonding & Grounding Lead Time	500	0.52	0.52	0.00	0.52
RADHAZ Analysis	500	0.44	0.44	0.00	0.44
EMC (Intra-Sys EMC)	500	0.22	0.22	0.00	0.22
Start	500	0.00	0.00	0.00	0.00
End	500	0.00	0.00	0.00	0.00
Develop & Build	500	0.00	0.00	0.00	0.00
IFC Lead Time	1000	62.09	62.09	62.09	0.00
IA Lead Time	500	20.11	20.11	20.11	0.00
JITC	500	0.00	0.00	0.00	0.00
SAASM HAE Lead Time	500	0.00	0.00	0.00	0.00
Wait until all certs are done.	500	15.92	15.92	15.92	0.00
Equip Spectrum Cert Lead Time	500	0.00	0.00	0.00	0.00
Battery Approval Lead Time	500	0.00	0.00	0.00	0.00
Freq Assignments Lead Time	500	0.00	0.00	0.00	0.00
Repeat?	500	0.00	0.00	0.00	0.00
Repeated?	750	0.00	0.00	0.00	0.00
PMA	3500	0.00	0.00	0.00	0.00
JITC Lead Time	500	0.00	0.00	0.00	0.00
Repeated? w 1	750	0.00	0.00	0.00	0.00
Repeat? w 1	500	0.00	0.00	0.00	0.00
Collect Inputs	500	0.73	0.73	0.73	0.00
Collect HERO Results	500	42.05	42.05	42.05	0.00
Collect WSESRB Results	500	0.00	0.00	0.00	0.00
IA & CCA Finish Together	500	8.24	8.24	8.24	0.00
WSESRB Outputs	500	0.00	0.00	0.00	0.00
Finish Together	500	8.08	8.08	8.08	0.00


Summary for CycleTime (Wks) Passive EW Run 1 IRTR
ActivityName = End
Anderson-Darling Normality Test
A-Squared 0.44
P-Value 0.290
Mean 92.040
StDev 12.379
Variance 153.230
Skewness 0.065395
Kurtosis -0.210919
N 500
Minimum 57.166
1st Quartile 83.115
Median 91.803
3rd Quartile 100.478
Maximum 126.370
95% Confidence Interval for Mean
90.952 93.127
95% Confidence Interval for Median
89.784 93.854
95% Confidence Interval for StDev
11.656 13.197
95% Confidence Intervals
Mean
Median

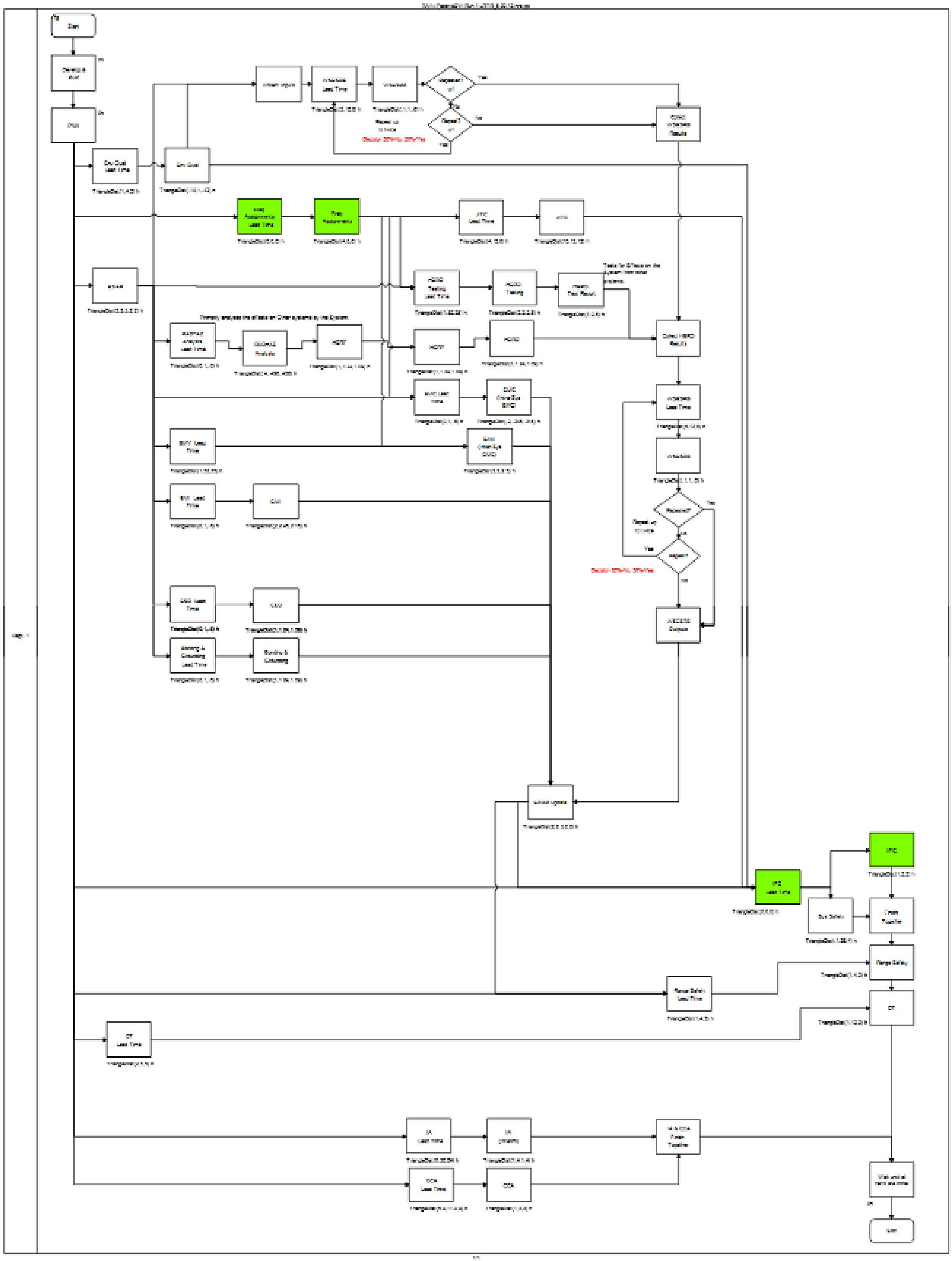

Process Capability of CycleTime (Wks) Passive EW Run 1 IRTR
LB
Target
USL
Process Data
LB 0
Target 52
USL 78
Sample Mean 92.0397
Sample N 500
StDev(Within) 12.718
StDev(Overall) 12.3786
Within
Overall
Potential (Within) Capability
Cp *
CPL *
CPU -0.37
Cpk -0.37
Overall Capability
Pp *
PPL *
PPU -0.38
Ppk -0.38
Cpm 0.21
0.0 17.5 35.0 52.5 70.0 87.5 105.0 122.5
Observed Performance
% < LB 0.00
% > USL 87.40
% Total 87.40
Exp. Within Performance
% < LB *
% > USL 86.52
% Total 86.52
Exp. Overall Performance
% < LB *
% > USL 87.16
% Total 87.16



Probability Plot of CycleTime (Wks) Passive EW Run 1 IRTR
Normal
Percent
CycleTime
Mean 92.04
StDev 12.38
N 500
AD 0.441
P-Value 0.290
12.836
78

Passive Electronic Warfare (EW) Run 1

Intermediate Risk Timeline Reduction (LRTR)



Elapsed Time in Weeks

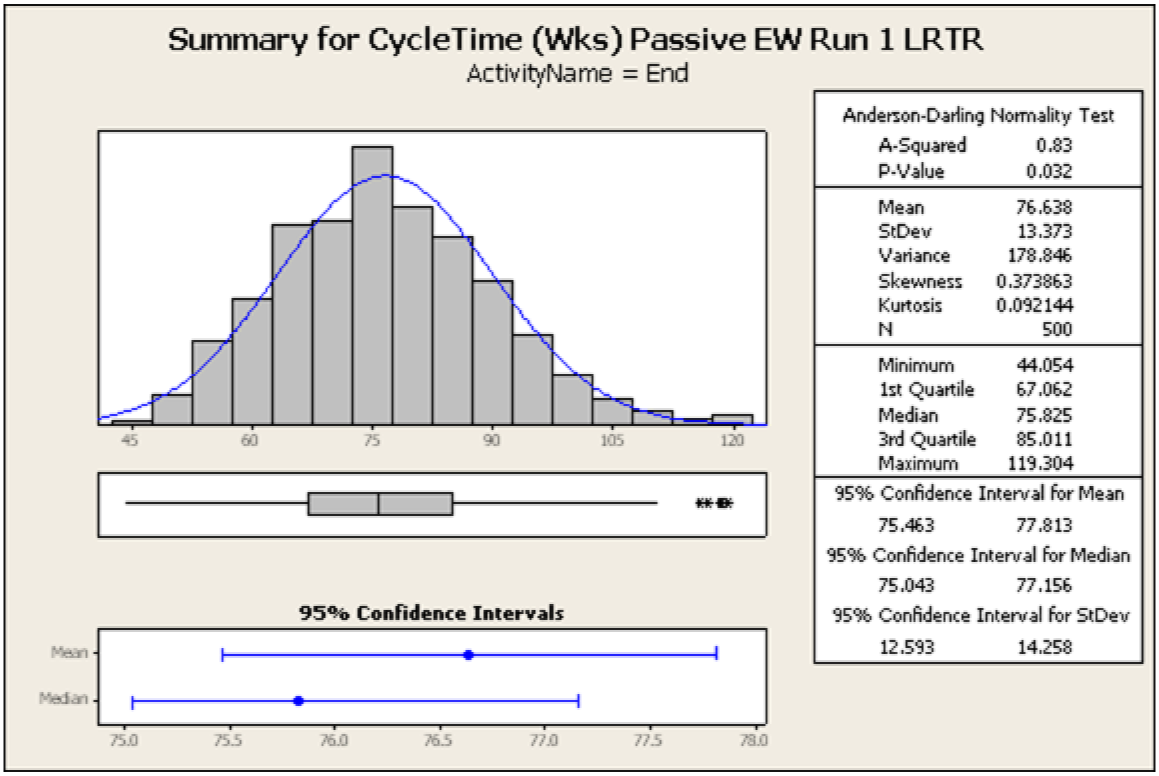
38318.92

Transaction Statistics In Weeks (Hours)

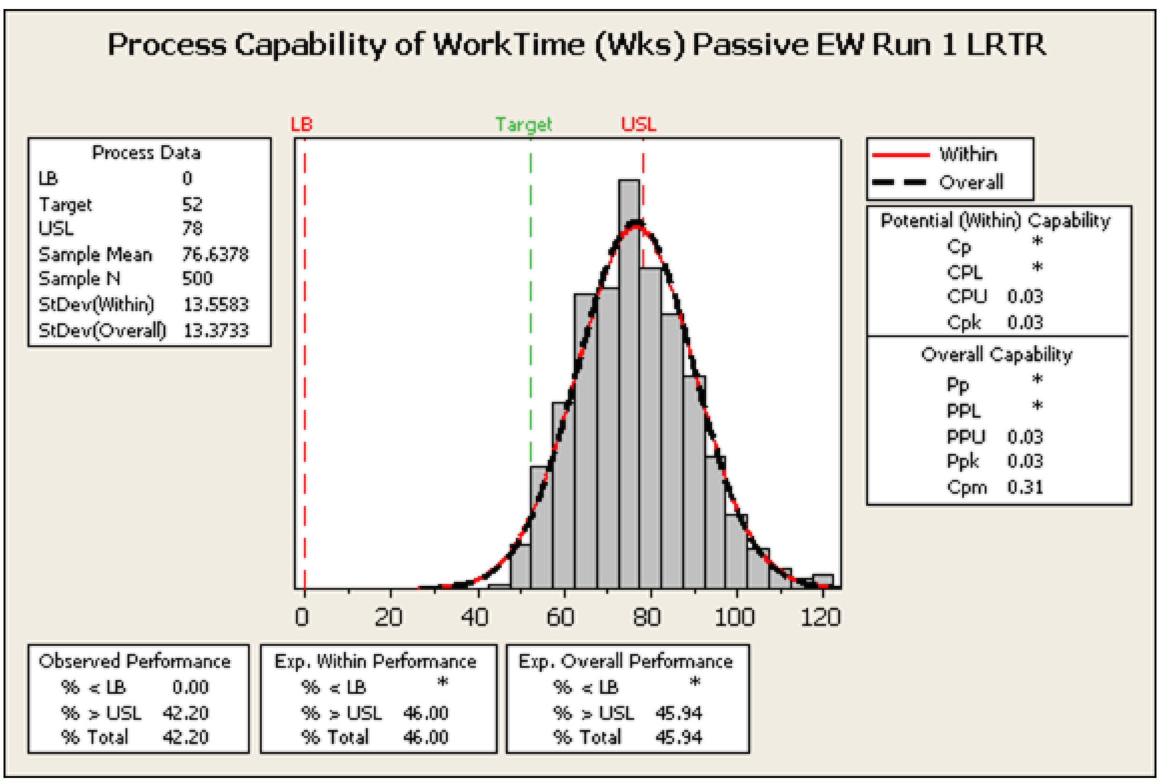
Count	Avg Cycle	Avg Serv	Avg Block	Avg Work
500	76.64	76.64	0.00	76.64

Activity Statistics In Weeks (Hours)

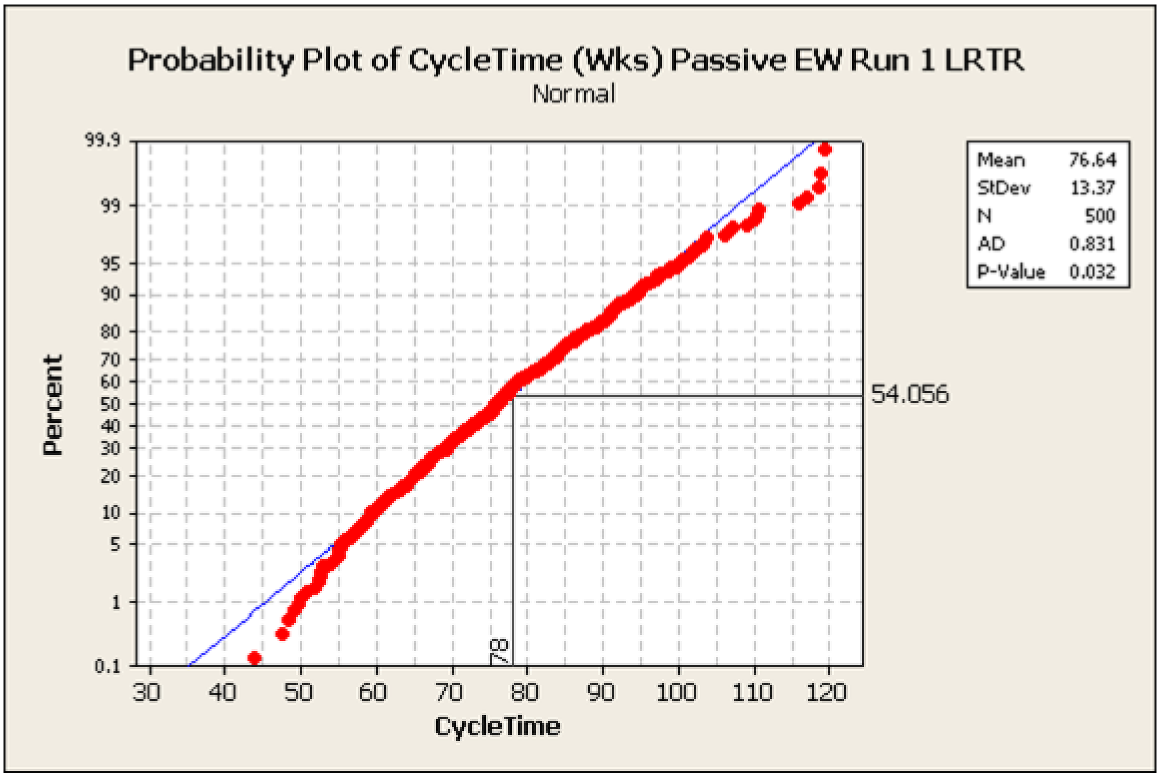
	Count	Avg Cycle	Avg Serv	Avg Block	Avg Work
HERO Testing Lead Time	500	29.81	29.81	3.82	25.99
EMV Lead Time	500	25.72	25.72	0.00	25.72
IA Lead Time	500	25.71	25.71	0.00	25.71
JITC	500	11.66	11.66	0.00	11.66
Sys Safety	500	10.02	10.02	0.00	10.02
CCA Lead Time	500	8.59	8.59	0.00	8.59
WSESRB Lead Time	750	8.33	8.33	0.00	8.33
WSESRB Lead Time	750	8.30	8.30	0.00	8.30
HERO Test Report	500	8.03	8.03	0.00	8.03
JITC Lead Time	500	7.87	7.87	0.00	7.87
Freq Assignments	2000	6.05	6.05	0.00	6.05
DT	500	71.65	71.65	66.25	5.40
DT Lead Time	500	4.98	4.98	0.00	4.98
IA (Interim)	500	3.02	3.02	0.00	3.02
Range Safety	500	10.14	10.14	7.47	2.68
Range Safety Lead Time	500	61.14	61.14	58.47	2.67
HERO Testing	500	2.51	2.51	0.00	2.51
EMV (Inter-Sys EMC)	500	24.39	24.39	21.90	2.49
Env Qual Lead Time	500	2.31	2.31	0.00	2.31
E3IAR	4000	2.23	2.23	0.00	2.23
E3IAR Update	1000	54.72	54.72	52.50	2.23
EMI	500	2.22	2.22	0.00	2.22
IFC	**500**	**1.99**	**1.99**	**0.00**	**1.99**
CCA	**500**	**1.97**	**1.97**	**0.00**	**1.97**
Bonding & Grounding	**500**	**1.11**	**1.11**	**0.00**	**1.11**
HERP	500	1.11	1.11	0.00	1.11
HERO	500	1.11	1.11	0.00	1.11
ESD	500	1.11	1.11	0.00	1.11
HERF	500	1.11	1.11	0.00	1.11
WSESRB	750	0.57	0.57	0.00	0.57
WSESRB	750	0.56	0.56	0.00	0.56
RADHAZ Analysis Lead Time	500	0.55	0.55	0.00	0.55
EMC Lead Time	500	4.36	4.36	3.82	0.54
EMI Lead Time	500	0.53	0.53	0.00	0.53
Env Qual	1000	0.53	0.53	0.00	0.53
ESD Lead Time	500	0.53	0.53	0.00	0.53
Bonding & Grounding Lead Time	500	0.52	0.52	0.00	0.52
RADHAZ Analysis	500	0.44	0.44	0.00	0.44
EMC (Intra-Sys EMC)	500	0.22	0.22	0.00	0.22
Start	500	0.00	0.00	0.00	0.00
Wait until all certs are done.	500	47.78	47.78	47.78	0.00
Develop & Build	500	0.00	0.00	0.00	0.00
End	500	0.00	0.00	0.00	0.00
IFC Lead Time	1000	58.47	58.47	58.47	0.00
Repeat?	500	0.00	0.00	0.00	0.00
Repeated?	750	0.00	0.00	0.00	0.00
Freq Assignments Lead Time	500	0.00	0.00	0.00	0.00
PMA	4000	0.00	0.00	0.00	0.00
Repeated? w1	750	0.00	0.00	0.00	0.00
Repeat? w1	500	0.00	0.00	0.00	0.00
Collect Inputs	500	0.73	0.73	0.73	0.00
Collect HERO Results	500	36.05	36.05	36.05	0.00
Collect WSESRB Results	500	0.00	0.00	0.00	0.00
IA & CCA Finish Together	500	18.43	18.43	18.43	0.00
WSESRB Outputs	500	0.00	0.00	0.00	0.00
Finish Together	500	8.08	8.08	8.08	0.00



Summary for CycleTime (Wks) Passive EW Run 1 LRTR
ActivityName = End
Anderson-Darling Normality Test
A-Squared 0.83
P-Value 0.032
Mean 76.638
StDev 13.373
Variance 178.846
Skewness 0.373863
Kurtosis 0.092144
N 500
Minimum 44.054
1st Quartile 67.062
Median 75.825
3rd Quartile 85.011
Maximum 119.304
95% Confidence Interval for Mean
75.463 77.813
95% Confidence Interval for Median
75.043 77.156
95% Confidence Interval for StDev
12.593 14.258
95% Confidence Intervals
Mean
Median

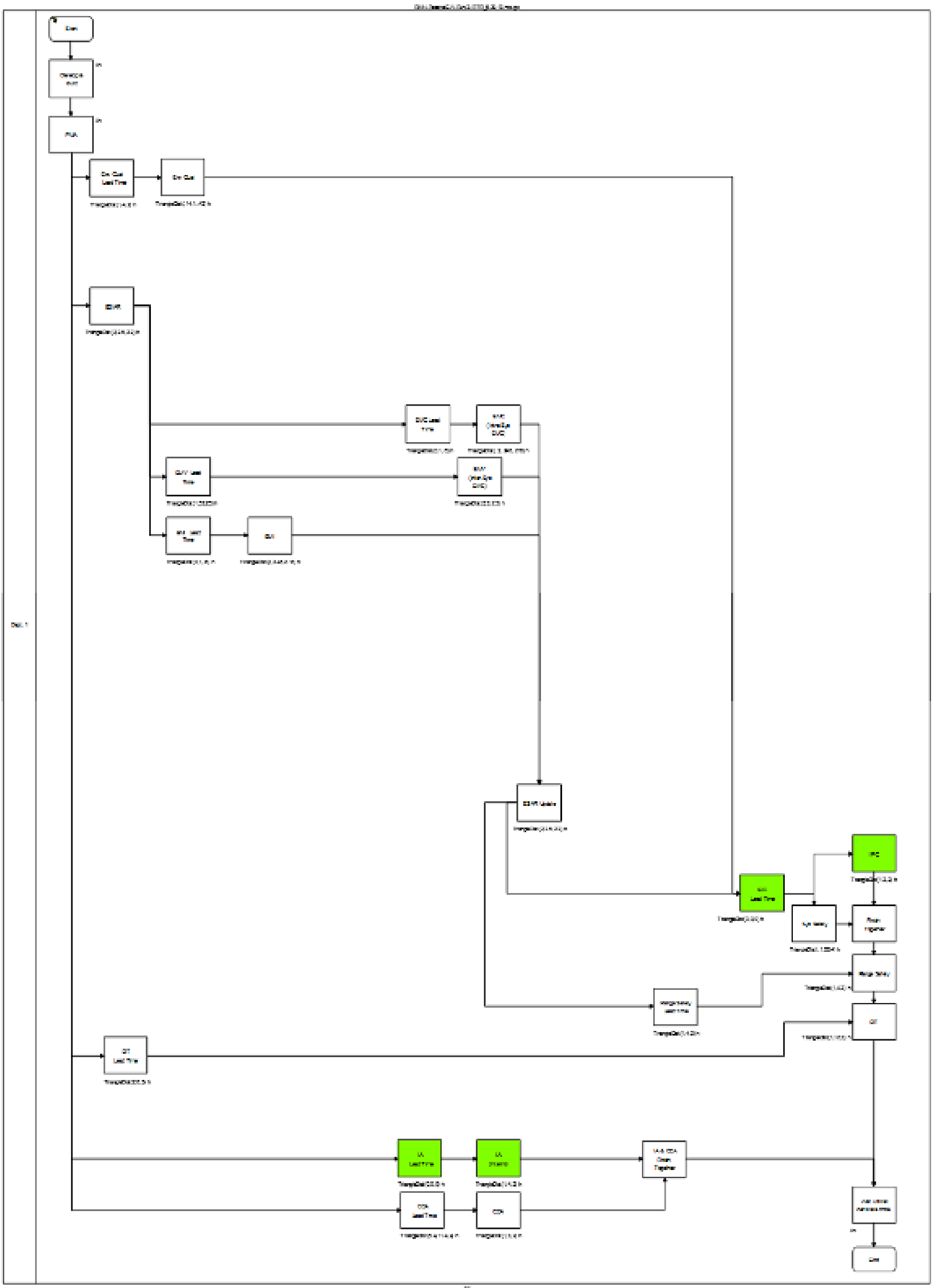


Process Capability of WorkTime (Wks) Passive EW Run 1 LRTR
Process Data
LB 0
Target 52
USL 78
Sample Mean 76.6378
Sample N 500
StDev(Within) 13.5583
StDev(Overall) 13.3733
LB
Target
USL
Within
Overall
Potential (Within) Capability
Cp *
CPL *
CPU 0.03
Cpk 0.03
Overall Capability
Pp *
PPL *
PPU 0.03
Ppk 0.03
Cpm 0.31
0 20 40 60 80 100 120
Observed Performance
% < LB 0.00
% > USL 42.20
% Total 42.20
Exp. Within Performance
% < LB *
% > USL 46.00
% Total 46.00
Exp. Overall Performance
% < LB *
% > USL 45.94
% Total 45.94



Probability Plot of CycleTime (Wks) Passive EW Run 1 LRTR
Normal
Percent
CycleTime
Mean 76.64
StDev 13.37
N 500
AD 0.831
P-Value 0.032
54.056
78

Passive Electronic Warfare (EW) Run 2
Intermediate Risk Timeline Reduction (IRTR)



Elapsed Time in Weeks

25417.91

Transaction Statistics In Weeks (Hours)

Count	Avg Cycle	Avg Serv	Avg Block	Avg Work
500	50.84	50.84	0.00	50.84

Activity Statistics In Weeks (Hours)

	Count	Avg Cycle	Avg Serv	Avg Block	Avg Work
EMV Lead Time	500	25.72	25.72	0.00	25.72
Sys Safety	500	10.02	10.02	0.00	10.02
CCA Lead Time	500	8.59	8.59	0.00	8.59
DT	500	45.85	45.85	40.45	5.40
DT Lead Time	500	4.98	4.98	0.00	4.98
Range Safety	500	10.14	10.14	7.47	2.68
Range Safety Lead Time	500	2.67	2.67	0.00	2.67
EMV (Inter-Sys EMC)	500	2.49	2.49	0.00	2.49
IA (Interim)	500	2.32	2.32	0.00	2.32
Env Qual Lead Time	**500**	**2.31**	**2.31**	**0.00**	**2.31**
E3IAR	1500	2.23	2.23	0.00	2.23
E3IAR Update	1000	29.68	29.68	27.45	2.23
EMI	500	2.22	2.22	0.00	2.22
IFC	500	1.99	1.99	0.00	1.99
CCA	500	1.97	1.97	0.00	1.97
EMC Lead Time	500	0.54	0.54	0.00	0.54
EMI Lead Time	500	0.53	0.53	0.00	0.53
Env Qual	500	0.53	0.53	0.00	0.53
EMC (Intra-Sys EMC)	500	0.22	0.22	0.00	0.22
Develop & Build	500	0.00	0.00	0.00	0.00
End	500	0.00	0.00	0.00	0.00
IFC Lead Time	1000	29.83	29.83	29.83	0.00
IA Lead Time	500	0.00	0.00	0.00	0.00
PMA	2500	0.00	0.00	0.00	0.00
Start	500	0.00	0.00	0.00	0.00
Wait until all certs are done.	500	40.28	40.28	40.28	0.00
IA & CCA Finish Together	500	8.24	8.24	8.24	0.00
Finish Together	500	8.08	8.08	8.08	0.00

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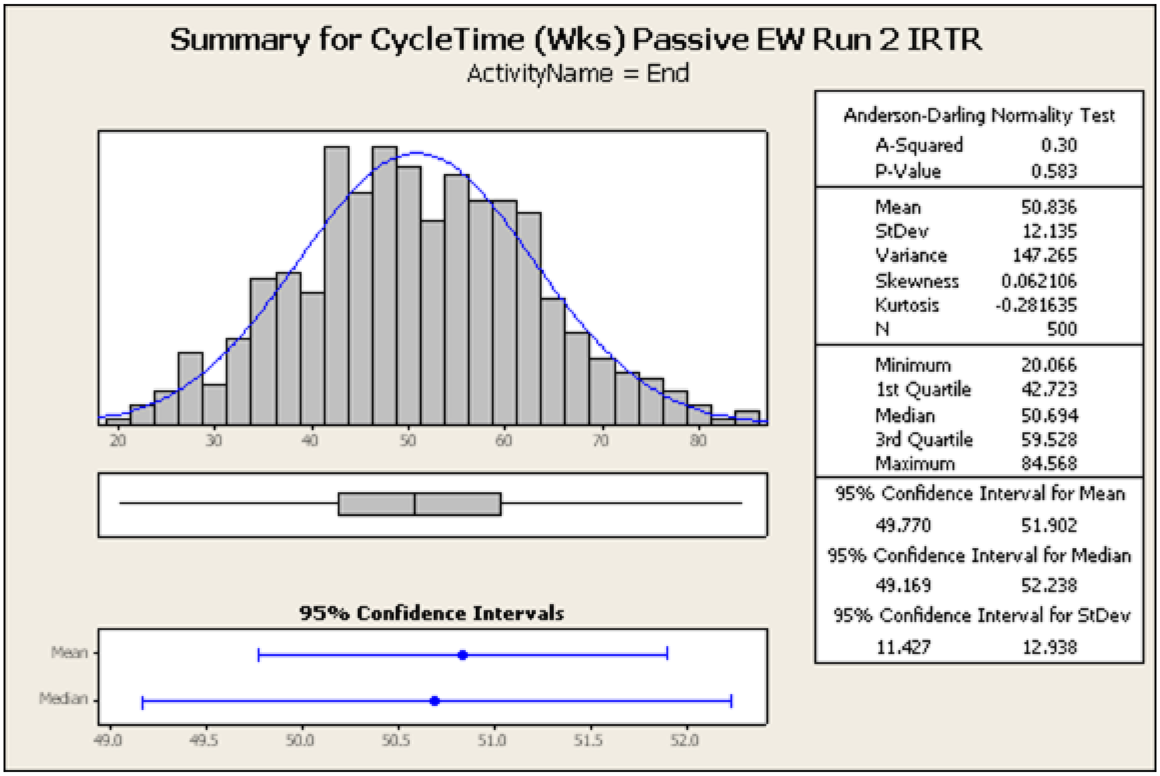
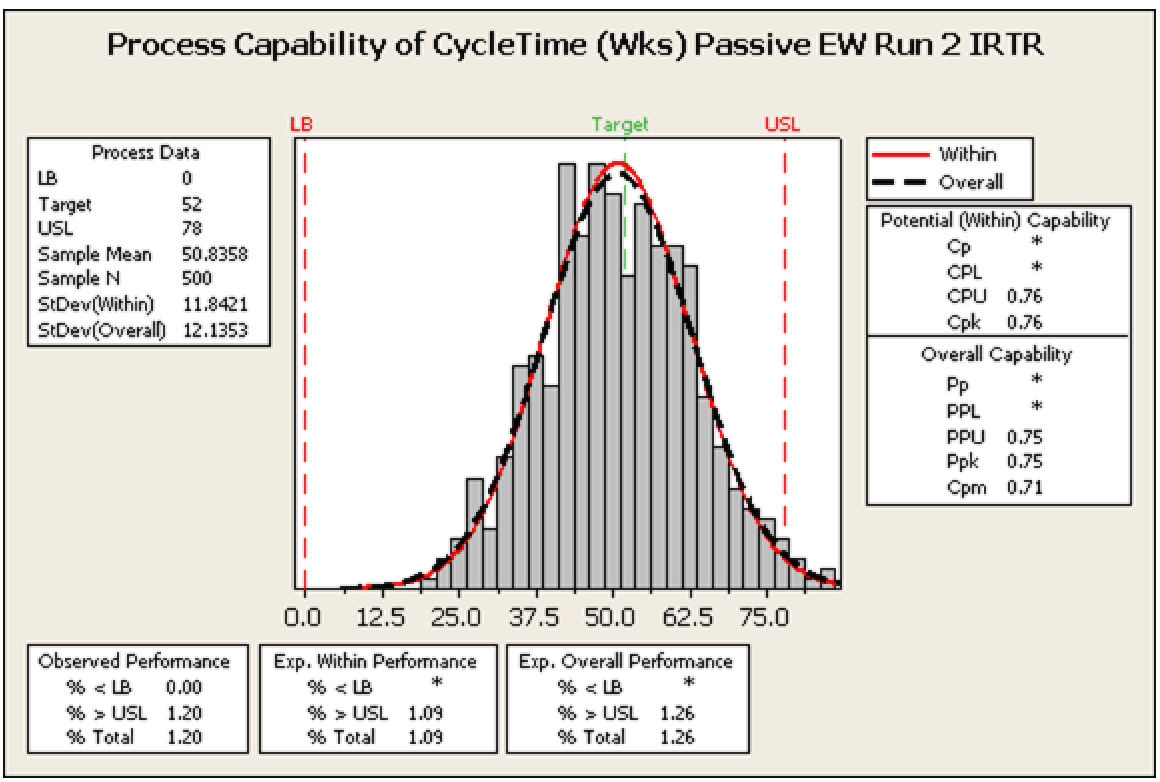
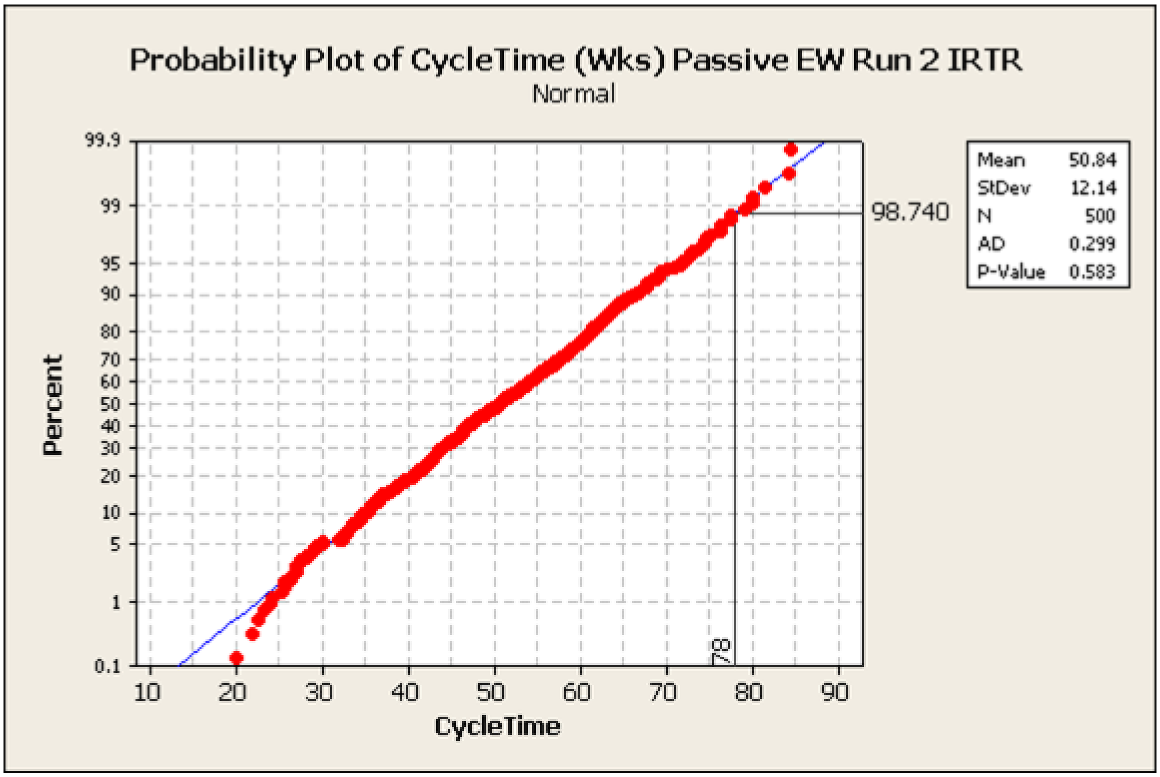
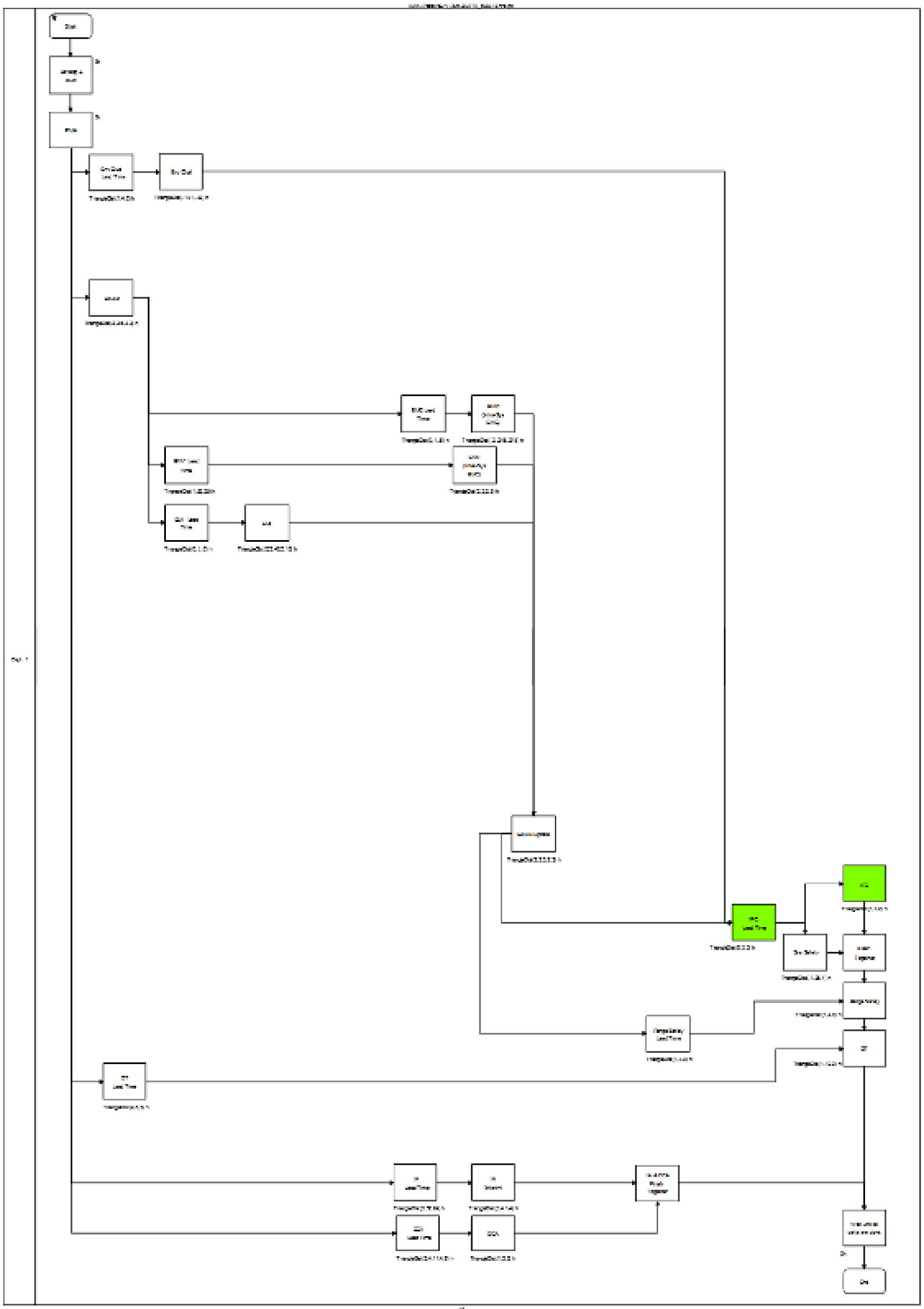

Summary for CycleTime (Wks) Passive EW Run 2 IRTR
ActivityName = End
Anderson-Darling Normality Test
A-Squared 0.30
P-Value 0.583
Mean 50.836
StDev 12.135
Variance 147.265
Skewness 0.062106
Kurtosis -0.281635
N 500
Minimum 20.066
1st Quartile 42.723
Median 50.694
3rd Quartile 59.528
Maximum 84.568
95% Confidence Interval for Mean
49.770 51.902
95% Confidence Interval for Median
49.169 52.238
95% Confidence Interval for StDev
11.427 12.938
95% Confidence Intervals
Mean
Median


Process Capability of CycleTime (Wks) Passive EW Run 2 IRTR
LB
Target
USL
Process Data
LB 0
Target 52
USL 78
Sample Mean 50.8358
Sample N 500
StDev(Within) 11.8421
StDev(Overall) 12.1353
Within
Overall
Potential (Within) Capability
Cp *
CPL *
CPU 0.76
Cpk 0.76
Overall Capability
Pp *
PPL *
PPU 0.75
Ppk 0.75
Cpm 0.71
0.0 12.5 25.0 37.5 50.0 62.5 75.0
Observed Performance
% < LB 0.00
% > USL 1.20
% Total 1.20
Exp. Within Performance
% < LB *
% > USL 1.09
% Total 1.09
Exp. Overall Performance
% < LB *
% > USL 1.26
% Total 1.26


Probability Plot of CycleTime (Wks) Passive EW Run 2 IRTR
Normal
Percent
CycleTime
98.740
78
Mean 50.84
StDev 12.14
N 500
AD 0.299
P-Value 0.583

Passive Electronic Warfare (EW) Run 2

Low Risk Timeline Reduction (LRTR)



RAIN-PassiveEW-Run-2-LRTR_6-29-13-hrs.igx

Elapsed Time in Weeks

25745.50

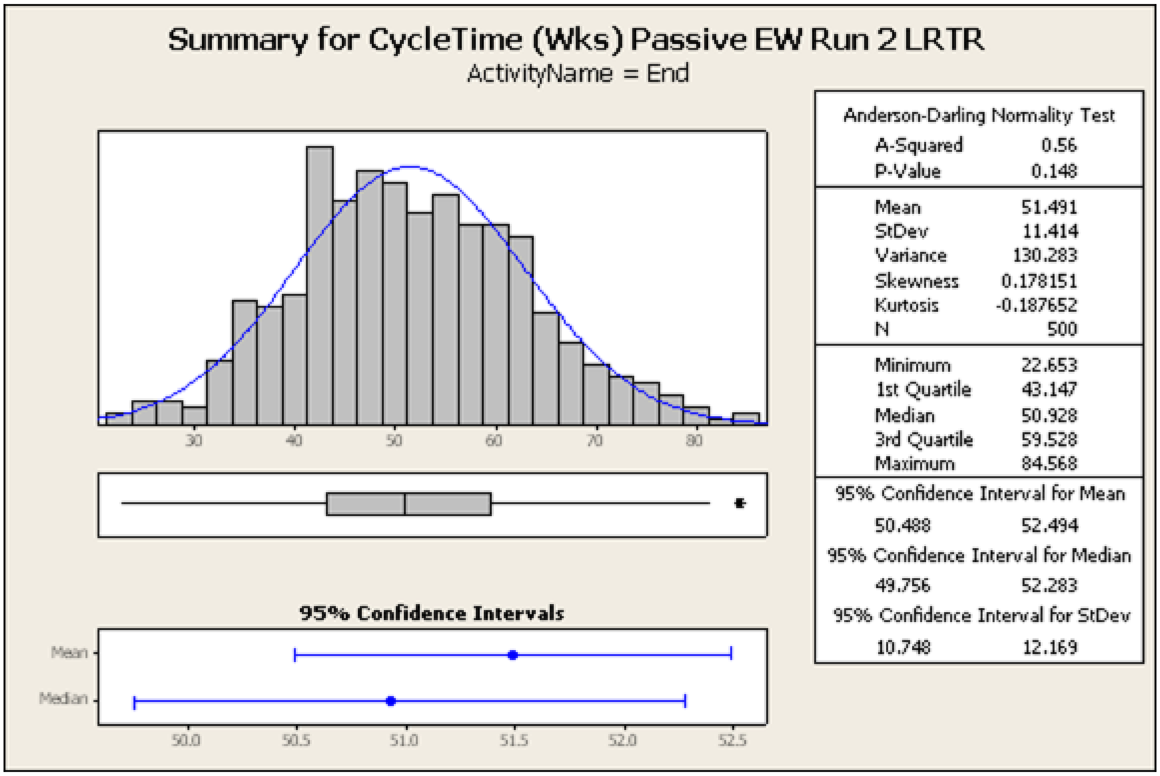
Transaction Statistics In Weeks (Hours)

Count	Avg Cycle	Avg Serv	Avg Block	Avg Work
500	51.49	51.49	0.00	51.49

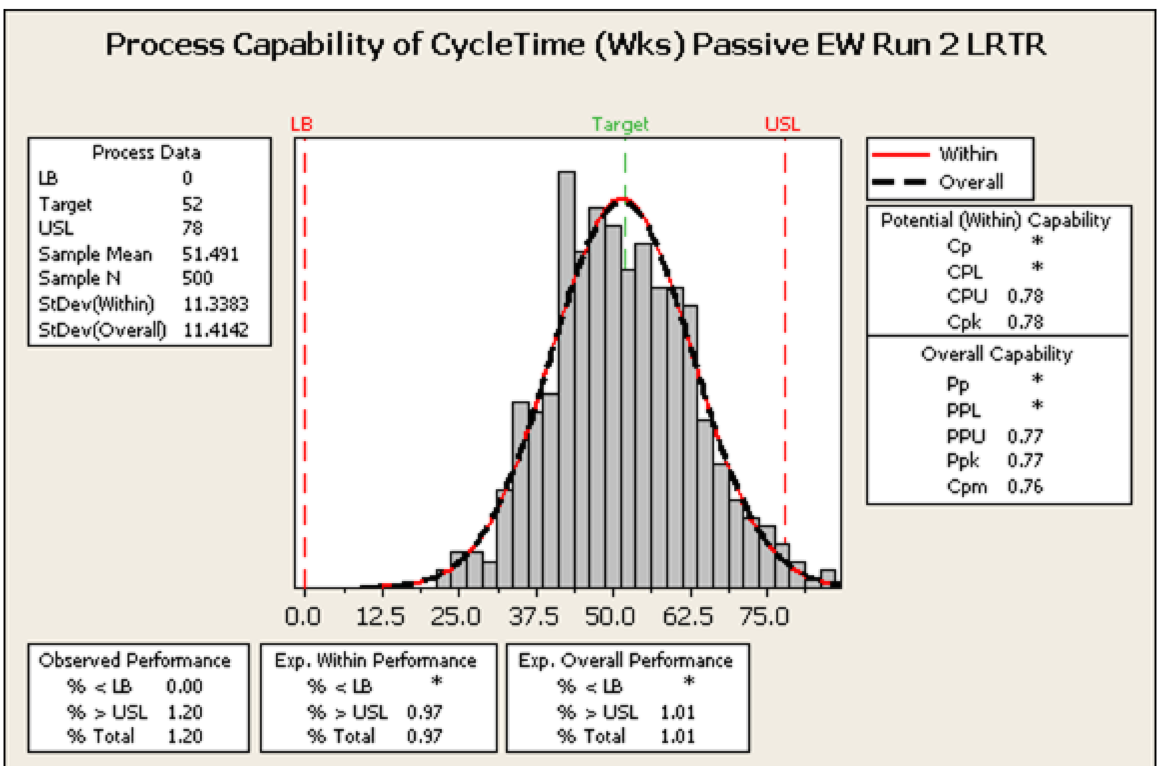
Activity Statistics In Weeks (Hours)

	Count	Avg Cycle	Avg Serv	Avg Block	Avg Work
EMV Lead Time	500	25.72	25.72	0.00	25.72
IA Lead Time	500	25.71	25.71	0.00	25.71
Sys Safety	500	10.02	10.02	0.00	10.02
CCA Lead Time	500	8.59	8.59	0.00	8.59
DT	500	45.85	45.85	40.45	5.40
DT Lead Time	500	4.98	4.98	0.00	4.98
IA (Interim)	500	3.02	3.02	0.00	3.02
Range Safety	500	10.14	10.14	7.47	2.68
Range Safety Lead Time	500	2.67	2.67	0.00	2.67
EMV (Inter-Sys EMC)	500	2.49	2.49	0.00	2.49
Env Qual Lead Time	500	2.31	2.31	0.00	2.31
E3IAR	1500	2.23	2.23	0.00	2.23
E3IAR Update	1000	29.68	29.68	27.45	2.23
EMI	500	2.22	2.22	0.00	2.22
IFC	500	1.99	1.99	0.00	1.99
CCA	500	1.97	1.97	0.00	1.97
EMC Lead Time	500	0.54	0.54	0.00	0.54
EMI Lead Time	500	0.53	0.53	0.00	0.53
Env Qual	500	0.53	0.53	0.00	0.53
EMC (Intra-Sys EMC)	500	0.22	0.22	0.00	0.22
Develop & Build	500	0.00	0.00	0.00	0.00
End	500	0.00	0.00	0.00	0.00
IFC Lead Time	1000	29.83	29.83	29.83	0.00
PMA	2500	0.00	0.00	0.00	0.00
Start	500	0.00	0.00	0.00	0.00
Wait until all certs are done.	500	23.28	23.28	23.28	0.00
IA & CCA Finish Together	500	18.43	18.43	18.43	0.00
Finish Together	500	8.08	8.08	8.08	0.00

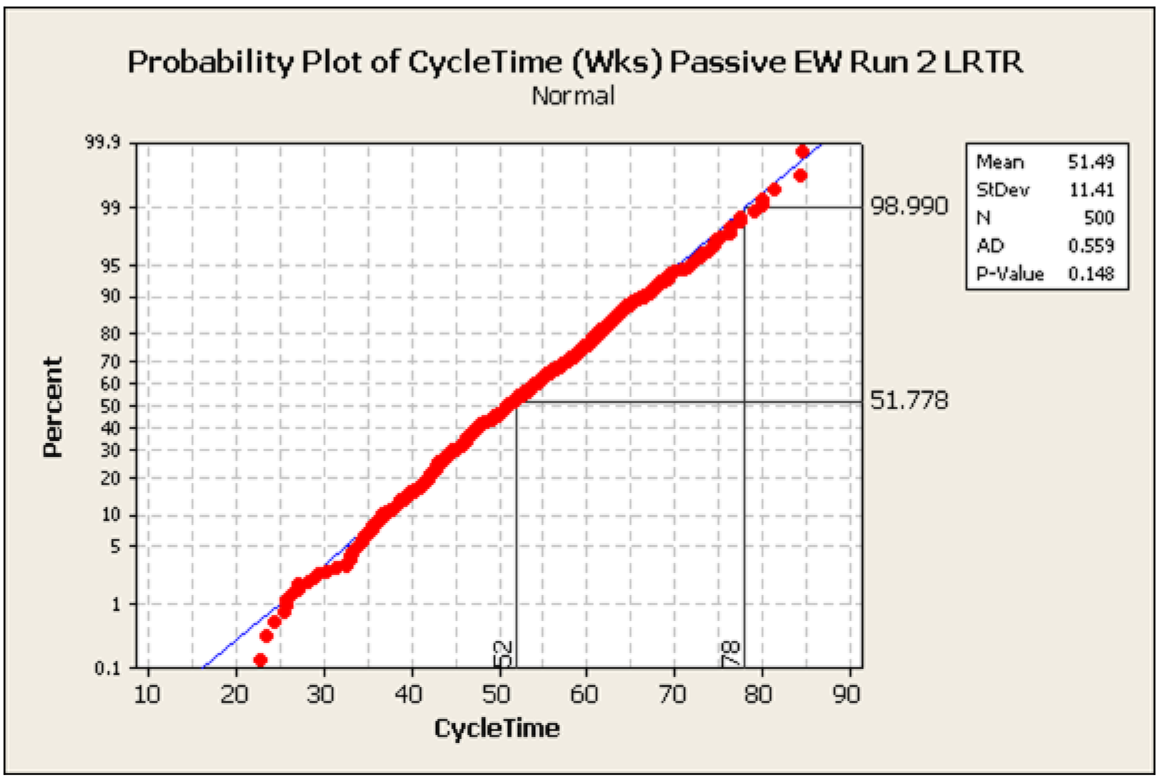
1/1



Summary for CycleTime (Wks) Passive EW Run 2 LRTR
ActivityName = End
Anderson-Darling Normality Test
A-Squared 0.56
P-Value 0.148
Mean 51.491
StDev 11.414
Variance 130.283
Skewness 0.178151
Kurtosis -0.187652
N 500
Minimum 22.653
1st Quartile 43.147
Median 50.928
3rd Quartile 59.528
Maximum 84.568
95% Confidence Interval for Mean
50.488 52.494
95% Confidence Interval for Median
49.756 52.283
95% Confidence Interval for StDev
10.748 12.169
95% Confidence Intervals
Mean
Median
30 40 50 60 70 80
50.0 50.5 51.0 51.5 52.0 52.5

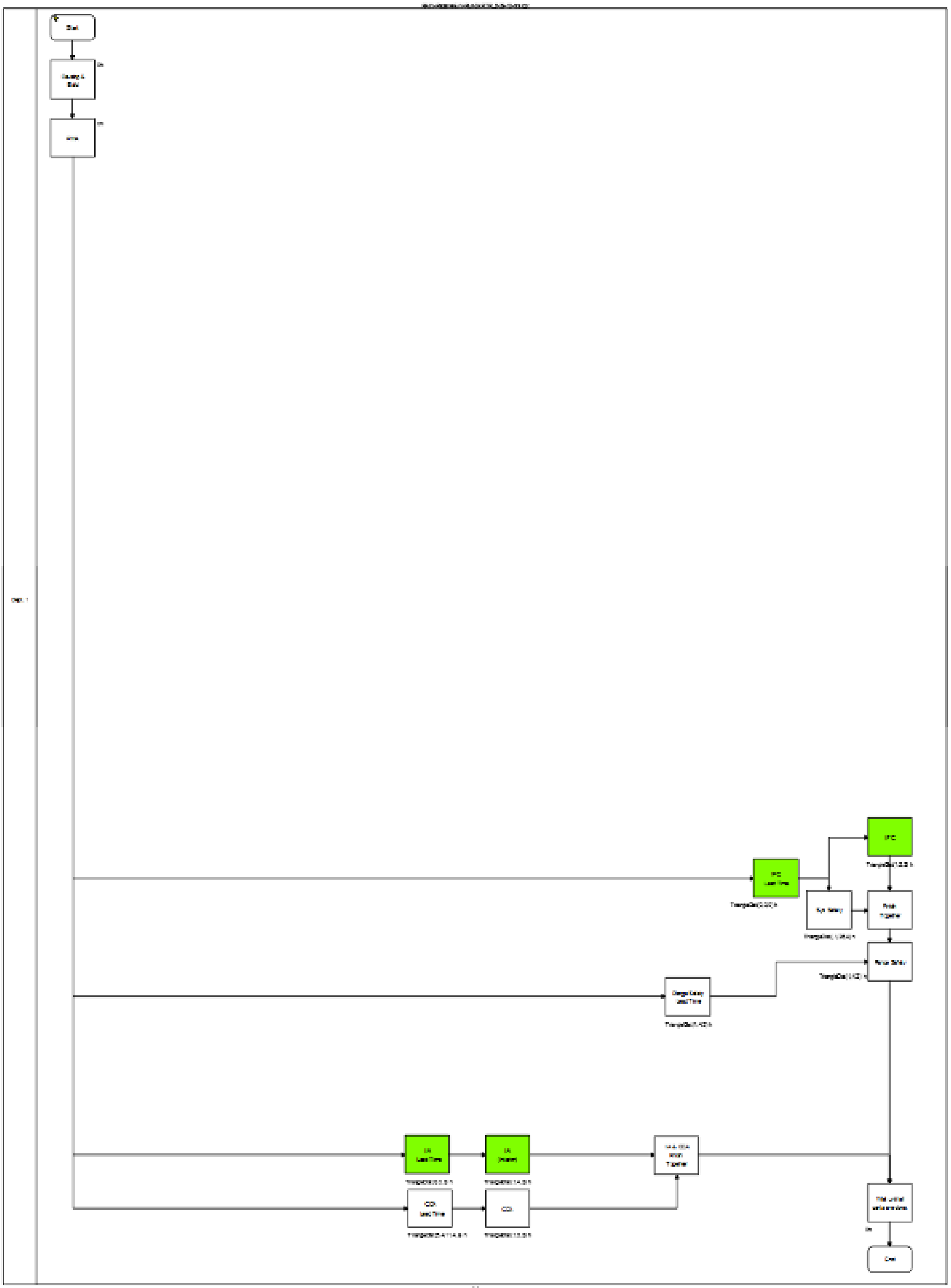


Process Capability of CycleTime (Wks) Passive EW Run 2 LRTR
Process Data
LB 0
Target 52
USL 78
Sample Mean 51.491
Sample N 500
StDev(Within) 11.3383
StDev(Overall) 11.4142
LB
Target
USL
Within
Overall
Potential (Within) Capability
Cp *
CPL *
CPU 0.78
Cpk 0.78
Overall Capability
Pp *
PPL *
PPU 0.77
Ppk 0.77
Cpm 0.76
0.0 12.5 25.0 37.5 50.0 62.5 75.0
Observed Performance
% < LB 0.00
% > USL 1.20
% Total 1.20
Exp. Within Performance
% < LB *
% > USL 0.97
% Total 0.97
Exp. Overall Performance
% < LB *
% > USL 1.01
% Total 1.01



Probability Plot of CycleTime (Wks) Passive EW Run 2 LRTR
Normal
Percent
CycleTime
Mean 51.49
StDev 11.41
N 500
AD 0.559
P-Value 0.148
98.990
51.778
52
78

Passive Electronic Warfare (EW) Run 3
Low Risk Timeline Reduction (IRTR)



RAIN-PassiveEW-Run-3-IRTR_6-29-13-hrs.igx

Elapsed Time in Weeks

7063.84

Transaction Statistics In Weeks (Hours)

Count	Avg Cycle	Avg Serv	Avg Block	Avg Work
500	14.13	14.13	0.00	14.13

Activity Statistics In Weeks (Hours)

	Count	Avg Cycle	Avg Serv	Avg Block	Avg Work
Sys Safety	500	10.02	10.02	0.00	10.02
CCA Lead Time	500	8.59	8.59	0.00	8.59
Range Safety	500	10.14	10.14	7.47	2.68
Range Safety Lead Time	500	2.67	2.67	0.00	2.67
IA (Interim)	500	2.32	2.32	0.00	2.32
IFC	500	1.99	1.99	0.00	1.99
CCA	500	1.97	1.97	0.00	1.97
Develop & Build	500	0.00	0.00	0.00	0.00
End	500	0.00	0.00	0.00	0.00
IFC Lead Time	1000	0.00	0.00	0.00	0.00
IA Lead Time	500	0.00	0.00	0.00	0.00
PMA	2000	0.00	0.00	0.00	0.00
Start	500	0.00	0.00	0.00	0.00
Wait until all certs are done.	500	4.93	4.93	4.93	0.00
IA & CCA Finish Together	500	8.24	8.24	8.24	0.00
Finish Together	500	8.08	8.08	8.08	0.00

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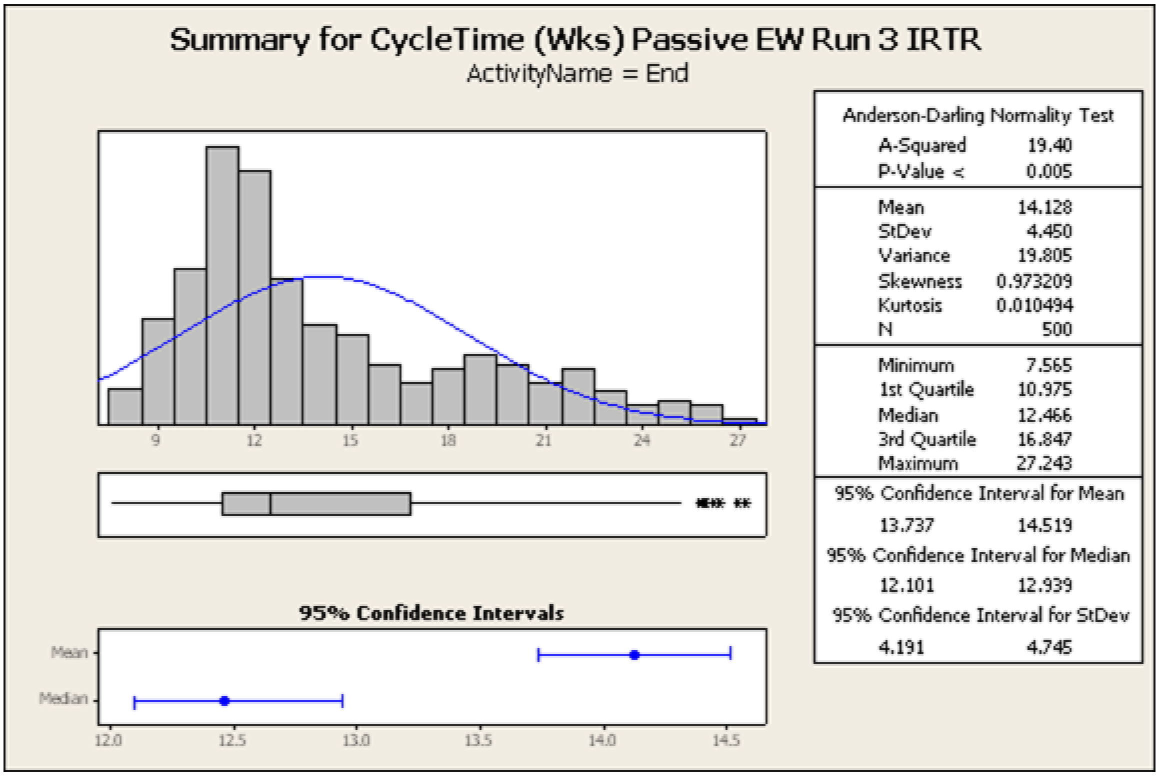
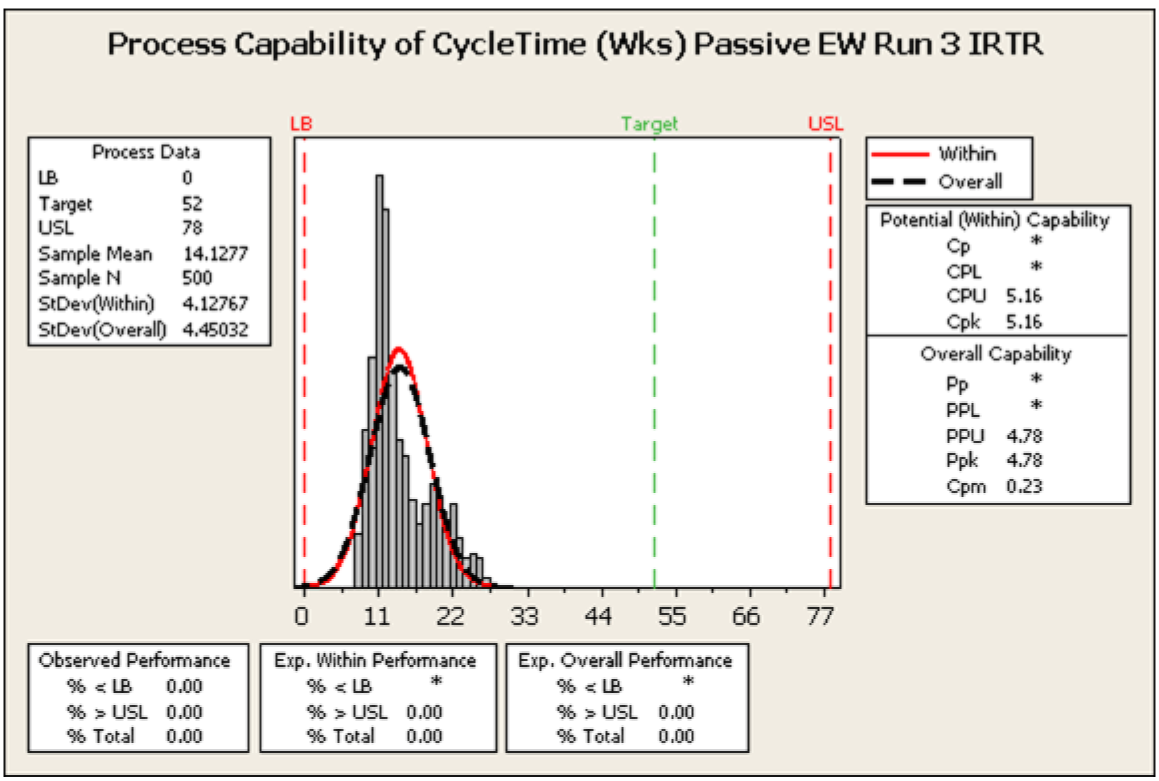
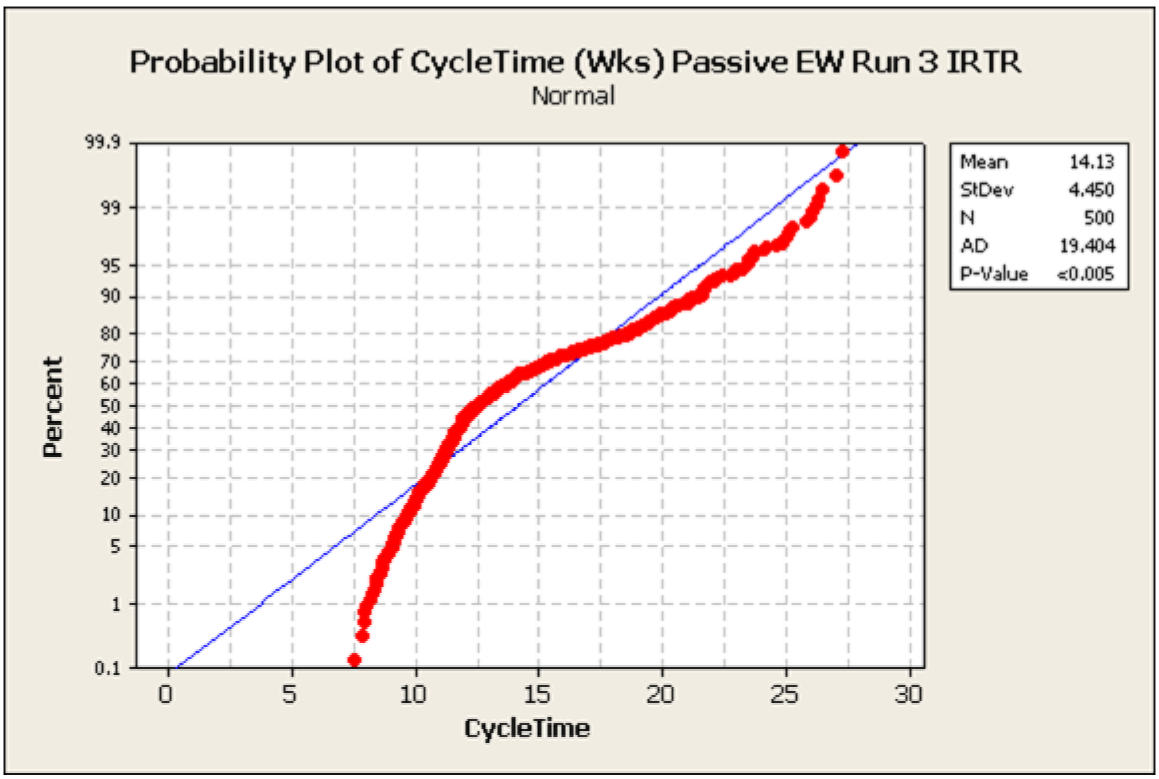

Summary for CycleTime (Wks) Passive EW Run 3 IRTR
ActivityName = End
Anderson-Darling Normality Test
A-Squared 19.40
P-Value < 0.005
Mean 14.128
StDev 4.450
Variance 19.805
Skewness 0.973209
Kurtosis 0.010494
N 500
Minimum 7.565
1st Quartile 10.975
Median 12.466
3rd Quartile 16.847
Maximum 27.243
95% Confidence Interval for Mean
13.737 14.519
95% Confidence Interval for Median
12.101 12.939
95% Confidence Interval for StDev
4.191 4.745
95% Confidence Intervals
Mean
Median

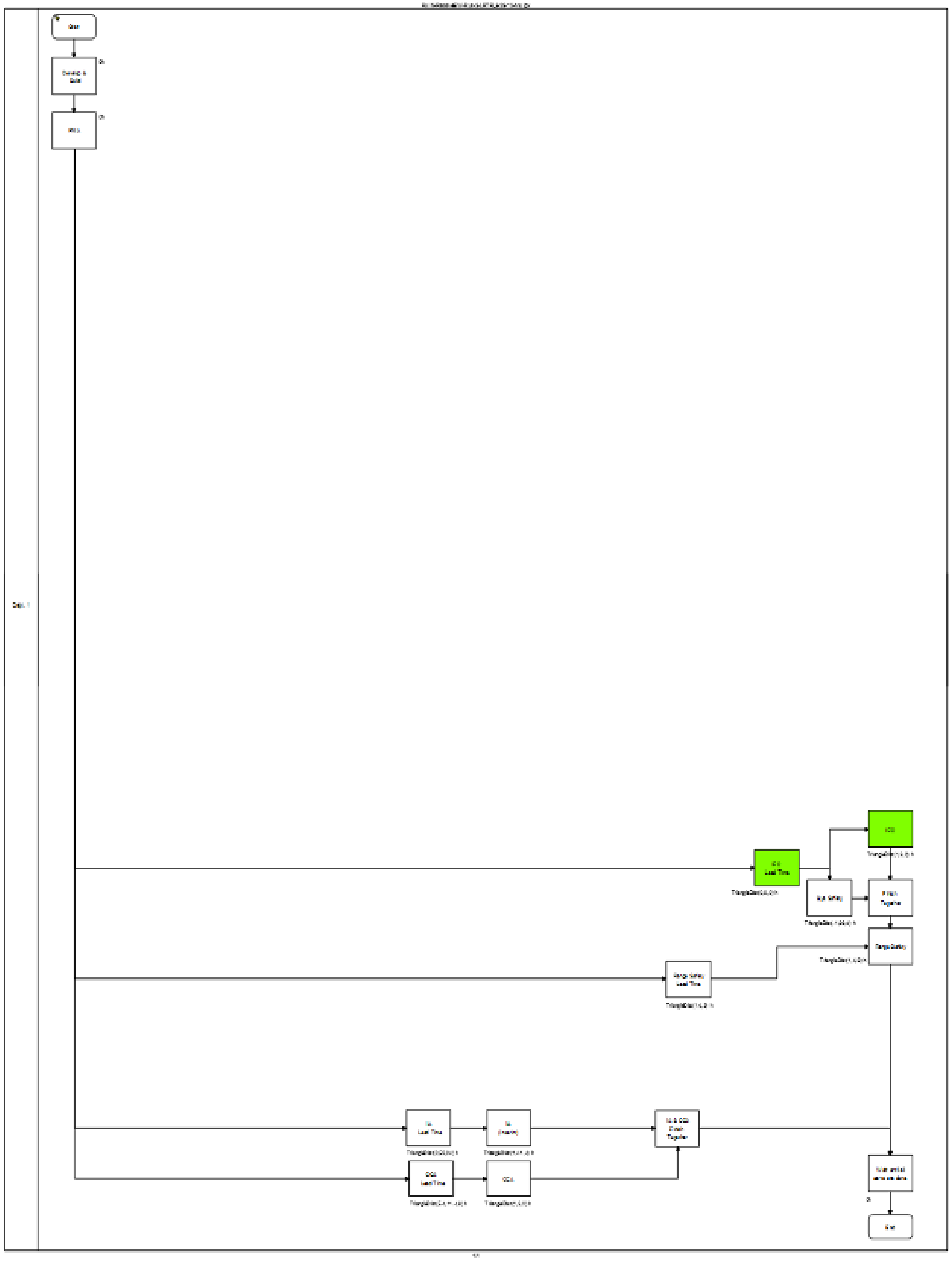

Process Capability of CycleTime (Wks) Passive EW Run 3 IRTR
LB
Target
USL
Process Data
LB 0
Target 52
USL 78
Sample Mean 14.1277
Sample N 500
StDev(Within) 4.12767
StDev(Overall) 4.45032
Within
Overall
Potential (Within) Capability
Cp *
CPL *
CPU 5.16
Cpk 5.16
Overall Capability
Pp *
PPL *
PPU 4.78
Ppk 4.78
Cpm 0.23
Observed Performance
% < LB 0.00
% > USL 0.00
% Total 0.00
Exp. Within Performance
% < LB *
% > USL 0.00
% Total 0.00
Exp. Overall Performance
% < LB *
% > USL 0.00
% Total 0.00



Probability Plot of CycleTime (Wks) Passive EW Run 3 IRTR
Normal
Percent
CycleTime
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
0
5
10
15
20
25
30
Mean 14.13
StDev 4.450
N 500
AD 19.404
P-Value <0.005

Passive Electronic Warfare (EW) Run 3

Low Risk Timeline Reduction (LRTR)



RAIN-PassiveEW-Run-3-LRTR_6-29-13-hrs.igx

Elapsed Time in Weeks

14631.38

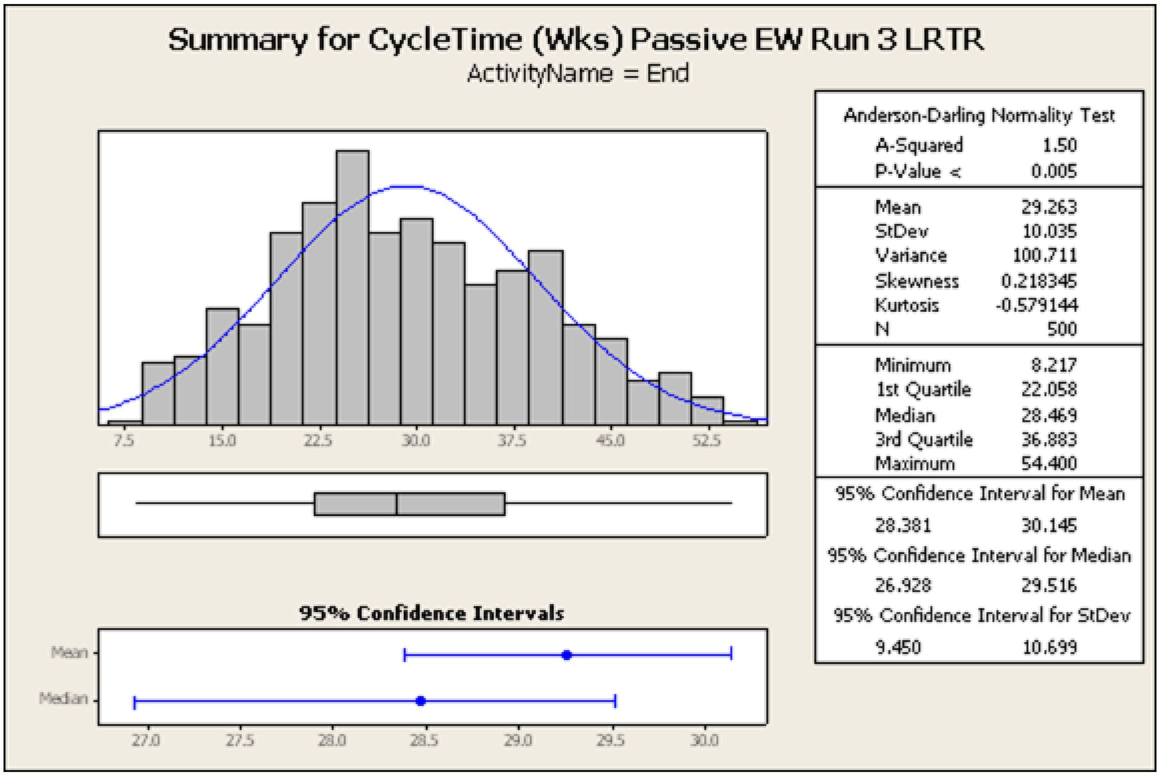
Transaction Statistics In Weeks (Hours)

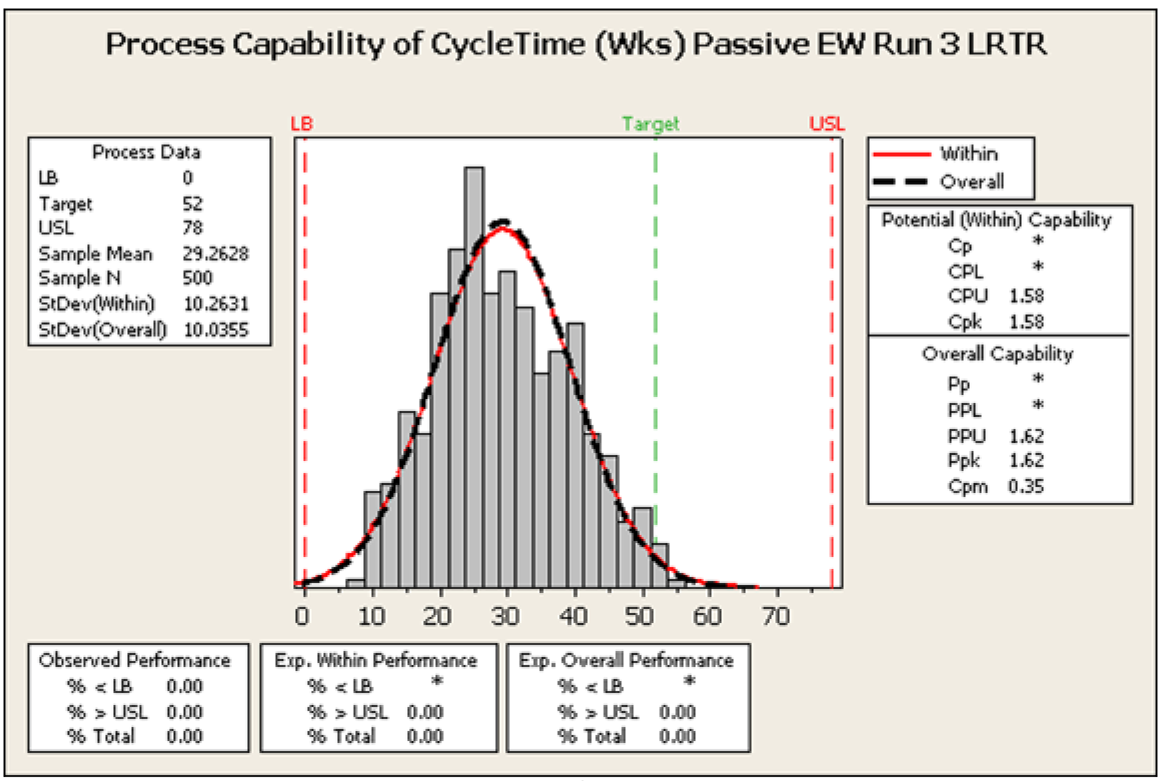
Count	Avg Cycle	Avg Serv	Avg Block	Avg Work
500	29.26	29.26	0.00	29.26

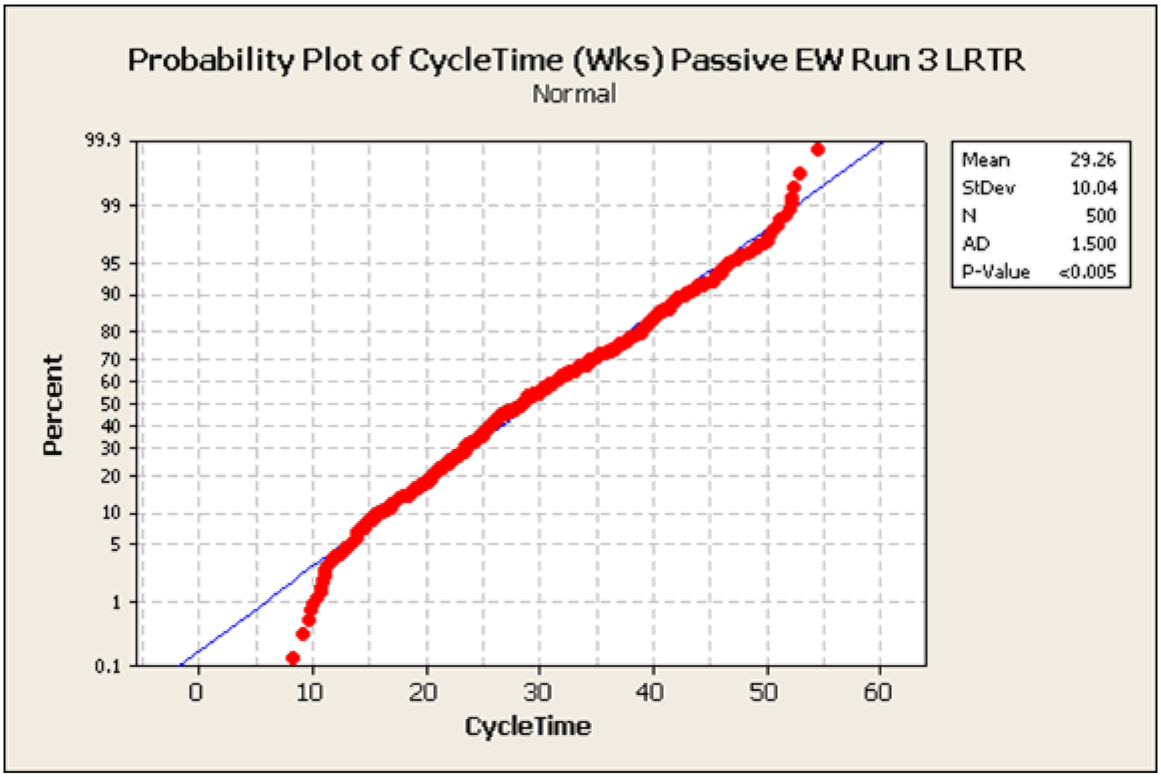
Activity Statistics In Weeks (Hours)

	Count	Avg Cycle	Avg Serv	Avg Block	Avg Work
IA Lead Time	500	25.71	25.71	0.00	25.71
Sys Safety	500	10.02	10.02	0.00	10.02
CCA Lead Time	500	8.59	8.59	0.00	8.59
IA (Interim)	500	3.02	3.02	0.00	3.02
Range Safety	500	10.14	10.14	7.47	2.68
Range Safety Lead Time	**500**	**2.67**	**2.67**	**0.00**	**2.67**
IFC	500	1.99	1.99	0.00	1.99
CCA	500	1.97	1.97	0.00	1.97
Develop & Build	500	0.00	0.00	0.00	0.00
End	500	0.00	0.00	0.00	0.00
IFC Lead Time	1000	0.00	0.00	0.00	0.00
PMA	2000	0.00	0.00	0.00	0.00
Start	500	0.00	0.00	0.00	0.00
Wait until all certs are done.	500	16.90	16.90	16.90	0.00
IA & CCA Finish Together	500	18.43	18.43	18.43	0.00
Finish Together	500	8.08	8.08	8.08	0.00

1/1

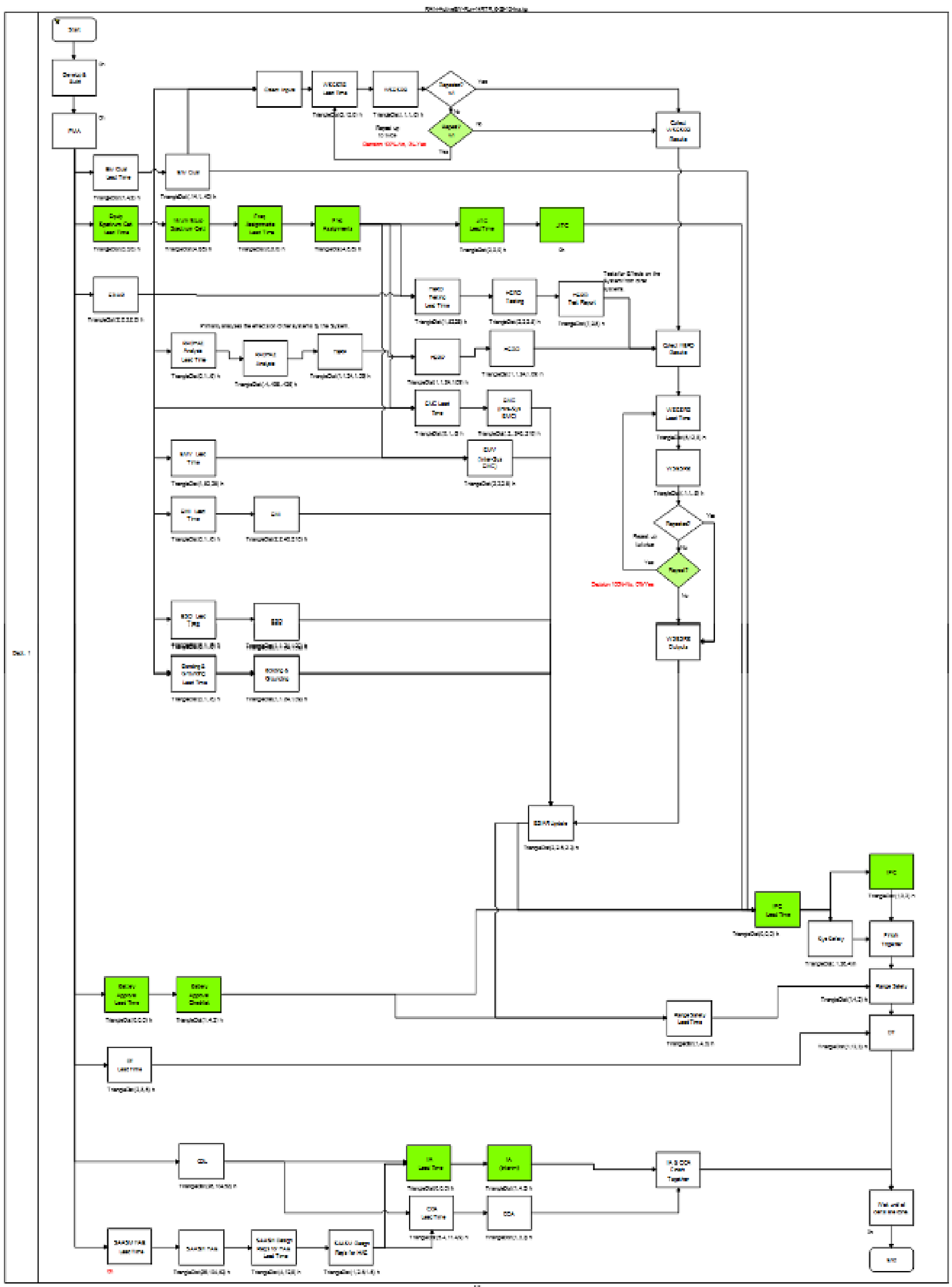

Summary for CycleTime (Wks) Passive EW Run 3 LRTR
ActivityName = End
Anderson-Darling Normality Test
A-Squared 1.50
P-Value < 0.005
Mean 29.263
StDev 10.035
Variance 100.711
Skewness 0.218345
Kurtosis -0.579144
N 500
Minimum 8.217
1st Quartile 22.058
Median 28.469
3rd Quartile 36.883
Maximum 54.400
95% Confidence Interval for Mean
28.381 30.145
95% Confidence Interval for Median
26.928 29.516
95% Confidence Interval for StDev
9.450 10.699
95% Confidence Intervals
Mean
Median


Process Capability of CycleTime (Wks) Passive EW Run 3 LRTR
LB
Target
USL
Process Data
LB 0
Target 52
USL 78
Sample Mean 29.2628
Sample N 500
StDev(Within) 10.2631
StDev(Overall) 10.0355
Within
Overall
Potential (Within) Capability
Cp *
CPL *
CPU 1.58
Cpk 1.58
Overall Capability
Pp *
PPL *
PPU 1.62
Ppk 1.62
Cpm 0.35
Observed Performance
% < LB 0.00
% > USL 0.00
% Total 0.00
Exp. Within Performance
% < LB *
% > USL 0.00
% Total 0.00
Exp. Overall Performance
% < LB *
% > USL 0.00
% Total 0.00



Probability Plot of CycleTime (Wks) Passive EW Run 3 LRTR
Normal
Percent
CycleTime
Mean 29.26
StDev 10.04
N 500
AD 1.500
P-Value <0.005

Active Electronic Warfare (EW) Run 1
Intermediate Risk Timeline Reduction
(IRT



R)

Elapsed Time in Weeks

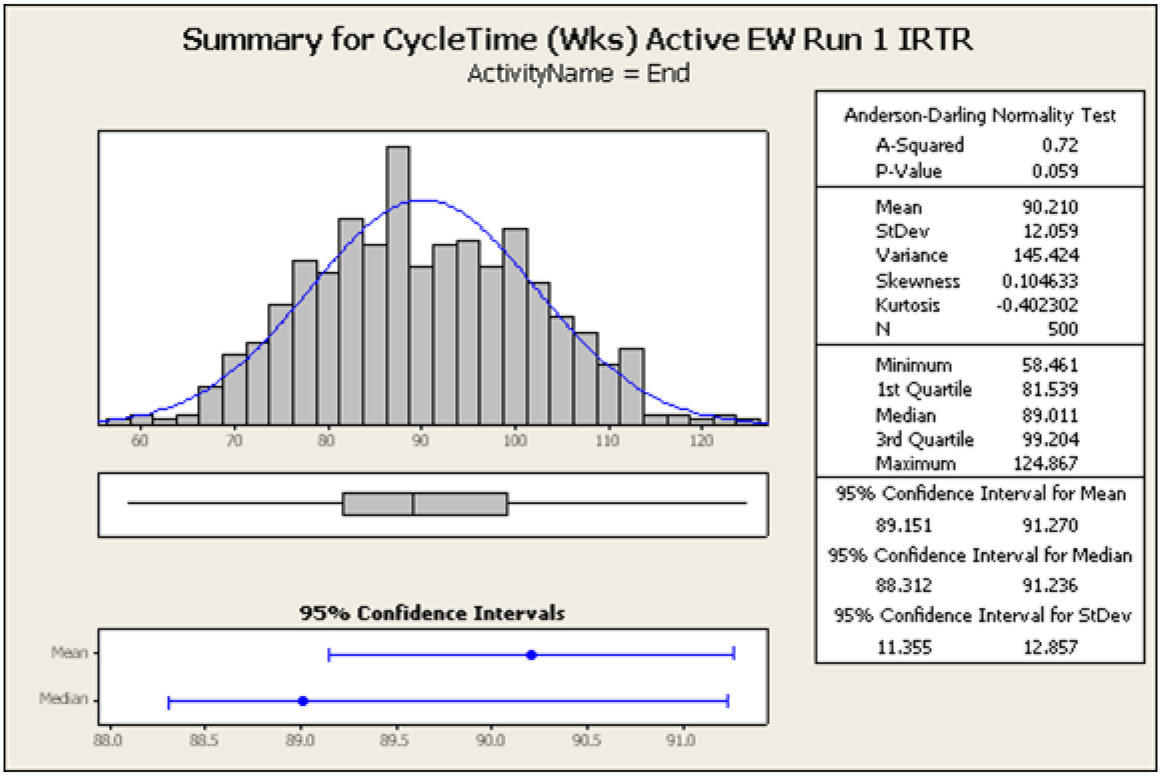
46019.83

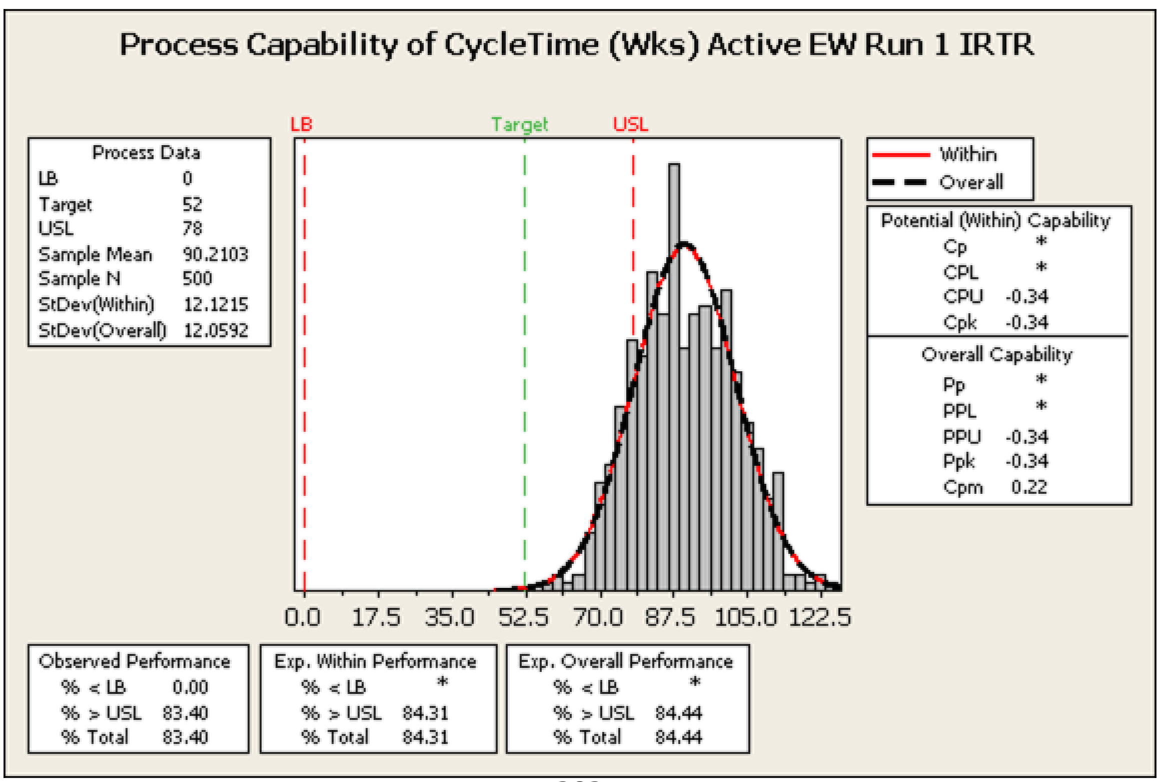
Transaction Statistics In Weeks (Hours)

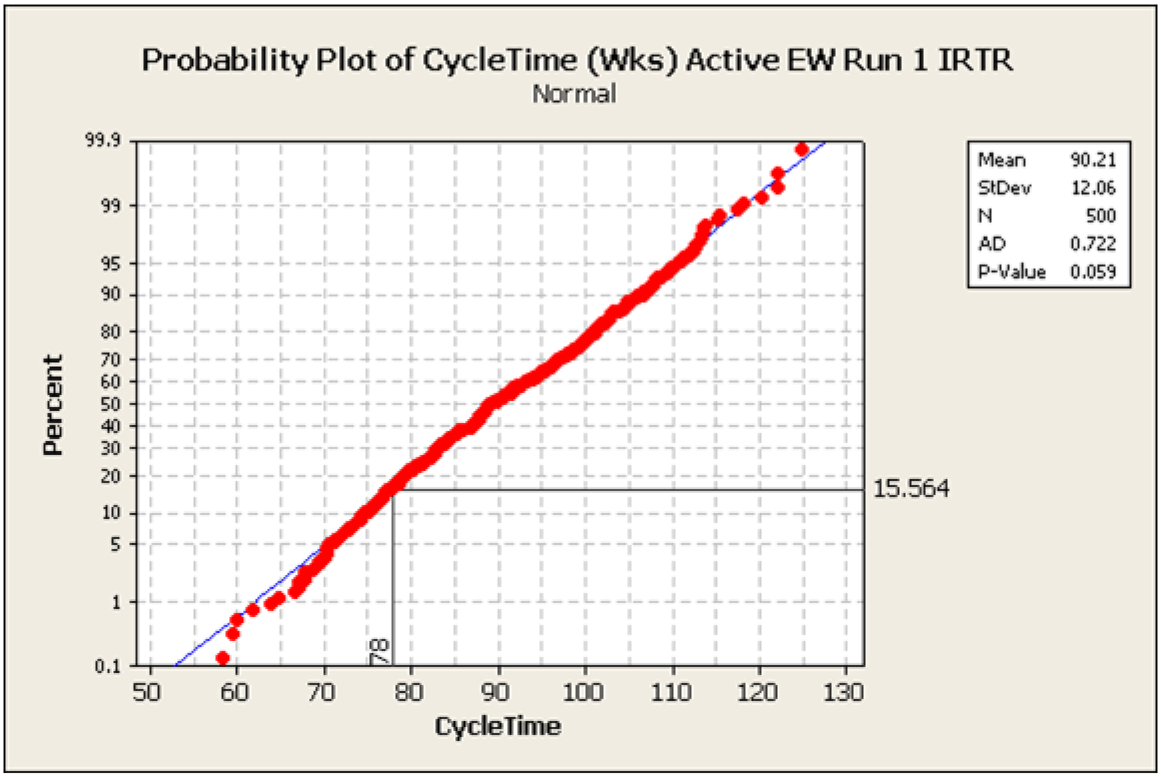
Count	Avg Cycle	Avg Serv	Avg Block	Avg Work
500	92.04	92.04	0.00	92.04

Activity Statistics In Weeks (Hours)

	Count	Avg Cycle	Avg Serv	Avg Block	Avg Work
CDL	1000	60.50	60.50	0.00	60.50
SAASM HAE	500	59.94	59.94	0.00	59.94
HERO Testing Lead Time	500	35.83	35.83	9.84	25.99
EMV Lead Time	500	25.72	25.72	0.00	25.72
Sys Safety	500	10.02	10.02	0.00	10.02
CCA Lead Time	500	28.70	28.70	20.11	8.59
WSESRB Lead Time	750	8.33	8.33	0.00	8.33
WSESRB Lead Time	750	8.30	8.30	0.00	8.30
SAASM Design Req's for HAE Lead Time	500	8.06	8.06	0.00	8.06
HERO Test Report	500	8.03	8.03	0.00	8.03
Freq Assignments	2000	6.05	6.05	0.00	6.05
Intrum Equip Spectrum Certt	500	6.02	6.02	0.00	6.02
DT	500	77.47	77.47	72.07	5.40
DT Lead Time	500	4.98	4.98	0.00	4.98
Range Safety	500	10.14	10.14	7.47	2.68
Range Safety Lead Time	500	64.58	64.58	61.92	2.67
HERO Testing	500	2.51	2.51	0.00	2.51
EMV (Inter-Sys EMC)	500	18.81	18.81	16.32	2.49
Battery Approval Checklist	1000	2.37	2.37	0.00	2.37
IA (Interim)	500	2.32	2.32	0.00	2.32
Env Qual Lead Time	500	2.31	2.31	0.00	2.31
E3IAR	4000	2.23	2.23	0.00	2.23
E3IAR Update	1000	60.54	60.54	58.31	2.23
EMI	500	2.22	2.22	0.00	2.22
IFC	500	1.99	1.99	0.00	1.99
CCA	500	1.97	1.97	0.00	1.97
SAASM Design Req's for HAE	**1000**	**1.69**	**1.69**	**0.00**	**1.69**
Bonding & Grounding	**500**	**1.11**	**1.11**	**0.00**	**1.11**
HERP	**500**	**1.11**	**1.11**	**0.00**	**1.11**
HERO	500	1.11	1.11	0.00	1.11
ESD	500	1.11	1.11	0.00	1.11
HERF	500	1.11	1.11	0.00	1.11
WSESRB	750	0.57	0.57	0.00	0.57
WSESRB	750	0.56	0.56	0.00	0.56
RADHAZ Analysis Lead Time	500	0.55	0.55	0.00	0.55
EMC Lead Time	500	10.38	10.38	9.84	0.54
EMI Lead Time	500	0.53	0.53	0.00	0.53
Env Qual	1000	0.53	0.53	0.00	0.53
ESD Lead Time	500	0.53	0.53	0.00	0.53
Bonding & Grounding Lead Time	500	0.52	0.52	0.00	0.52
RADHAZ Analysis	500	0.44	0.44	0.00	0.44
EMC (Intra-Sys EMC)	500	0.22	0.22	0.00	0.22
Start	500	0.00	0.00	0.00	0.00
End	500	0.00	0.00	0.00	0.00
Develop & Build	500	0.00	0.00	0.00	0.00
IFC Lead Time	1000	62.09	62.09	62.09	0.00
IA Lead Time	500	20.11	20.11	20.11	0.00
JITC	500	0.00	0.00	0.00	0.00
SAASM HAE Lead Time	500	0.00	0.00	0.00	0.00
Wait until all certs are done.	500	15.92	15.92	15.92	0.00
Equip Spectrum Cert Lead Time	500	0.00	0.00	0.00	0.00
Battery Approval Lead Time	500	0.00	0.00	0.00	0.00
Freq Assignments Lead Time	500	0.00	0.00	0.00	0.00
Repeat?	500	0.00	0.00	0.00	0.00
Repeated?	750	0.00	0.00	0.00	0.00
PMA	3500	0.00	0.00	0.00	0.00
JITC Lead Time	500	0.00	0.00	0.00	0.00
Repeated? w 1	750	0.00	0.00	0.00	0.00
Repeat? w 1	500	0.00	0.00	0.00	0.00
Collect Inputs	500	0.73	0.73	0.73	0.00
Collect HERO Results	500	42.05	42.05	42.05	0.00
Collect WSESRB Results	500	0.00	0.00	0.00	0.00
IA & CCA Finish Together	500	8.24	8.24	8.24	0.00
WSESRB Outputs	500	0.00	0.00	0.00	0.00
Finish Together	500	8.08	8.08	8.08	0.00


Summary for CycleTime (Wks) Active EW Run 1 IRTR
ActivityName = End
Anderson-Darling Normality Test
A-Squared 0.72
P-Value 0.059
Mean 90.210
StDev 12.059
Variance 145.424
Skewness 0.104633
Kurtosis -0.402302
N 500
Minimum 58.461
1st Quartile 81.539
Median 89.011
3rd Quartile 99.204
Maximum 124.867
95% Confidence Interval for Mean
89.151 91.270
95% Confidence Interval for Median
88.312 91.236
95% Confidence Interval for StDev
11.355 12.857
95% Confidence Intervals
Mean
Median

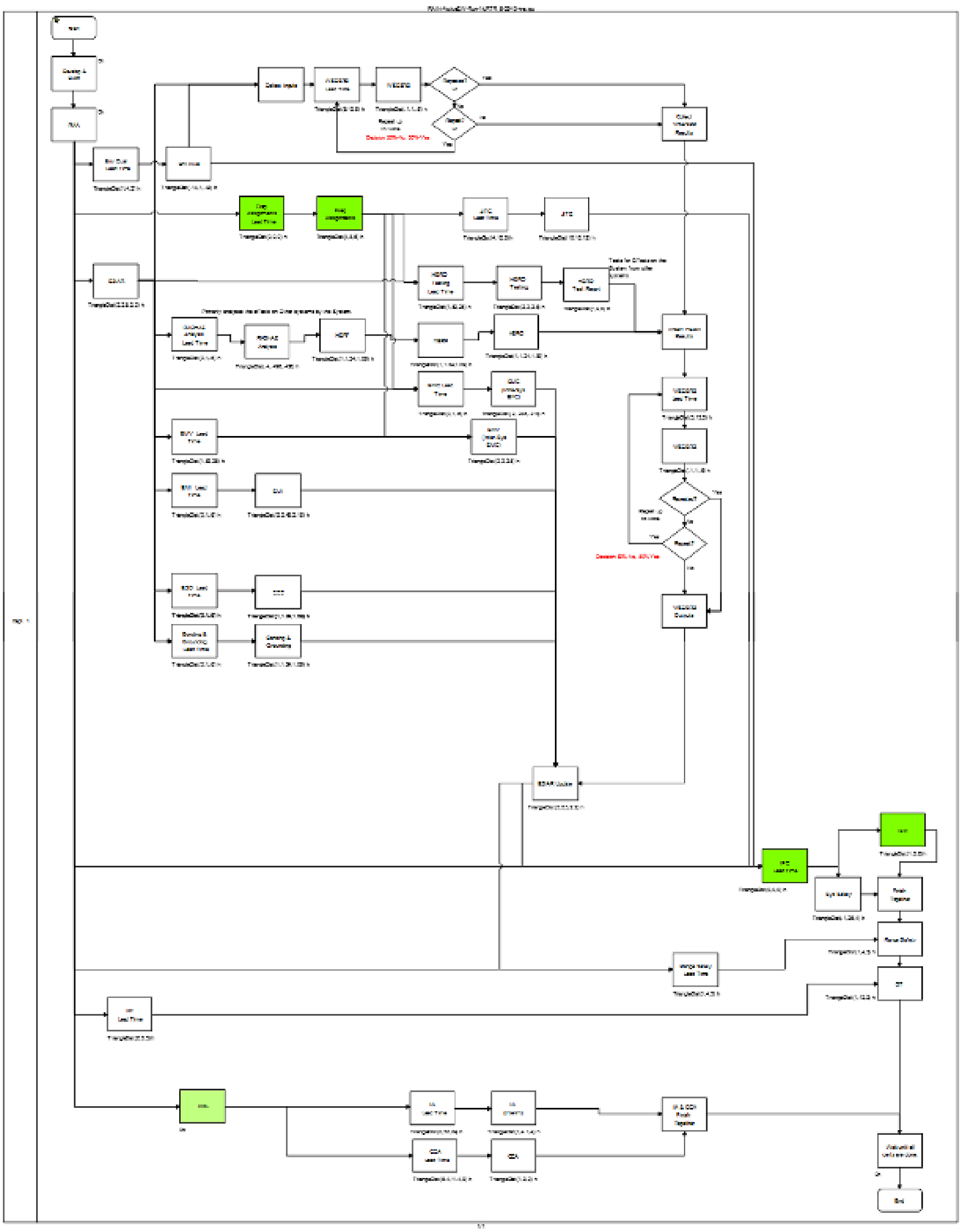

Process Capability of CycleTime (Wks) Active EW Run 1 IRTR
LB
Target
USL
Process Data
LB 0
Target 52
USL 78
Sample Mean 90.2103
Sample N 500
StDev(Within) 12.1215
StDev(Overall) 12.0592
Within
Overall
Potential (Within) Capability
Cp *
CPL *
CPU -0.34
Cpk -0.34
Overall Capability
Pp *
PPL *
PPU -0.34
Ppk -0.34
Cpm 0.22
0.0 17.5 35.0 52.5 70.0 87.5 105.0 122.5
Observed Performance
% < LB 0.00
% > USL 83.40
% Total 83.40
Exp. Within Performance
% < LB *
% > USL 84.31
% Total 84.31
Exp. Overall Performance
% < LB *
% > USL 84.44
% Total 84.44



Probability Plot of CycleTime (Wks) Active EW Run 1 IRTR
Normal
Percent
CycleTime
Mean 90.21
StDev 12.06
N 500
AD 0.722
P-Value 0.059
15.564
78

Active Electronic Warfare (EW) Run 1

Low Risk Timeline Reduction (LRTR)



Elapsed Time in Weeks

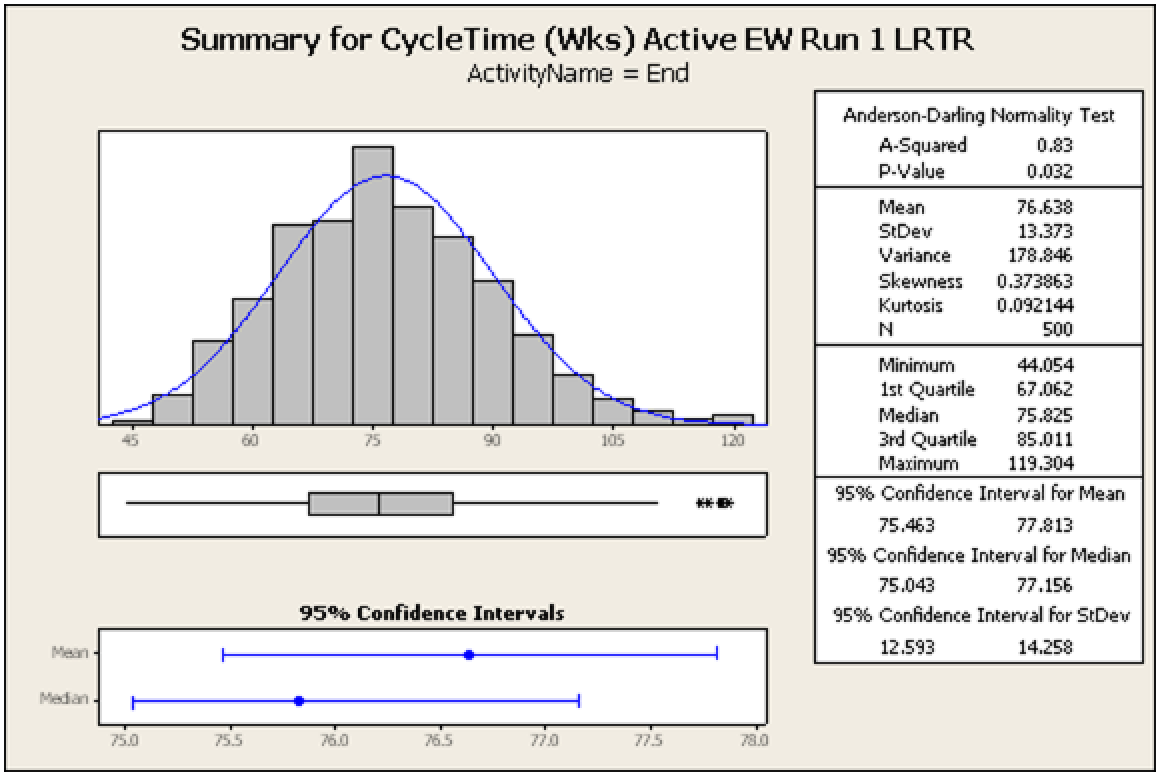
38318.92

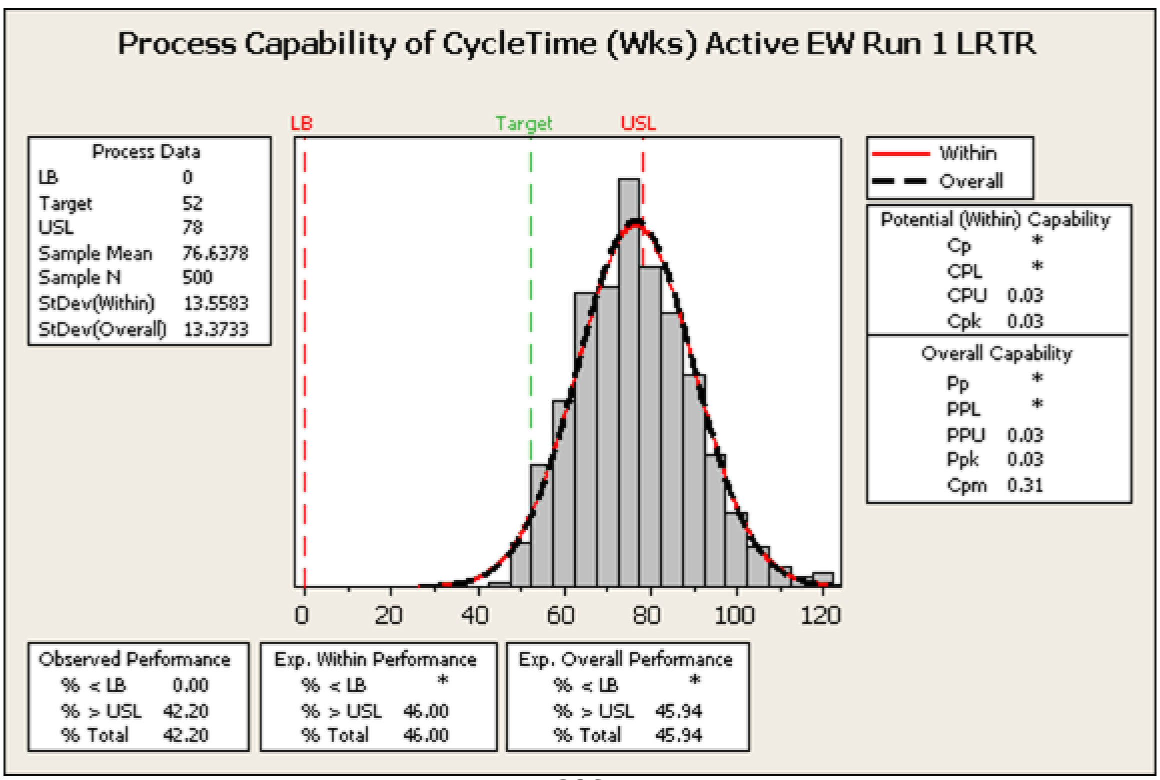
Transaction Statistics In Weeks (Hours)

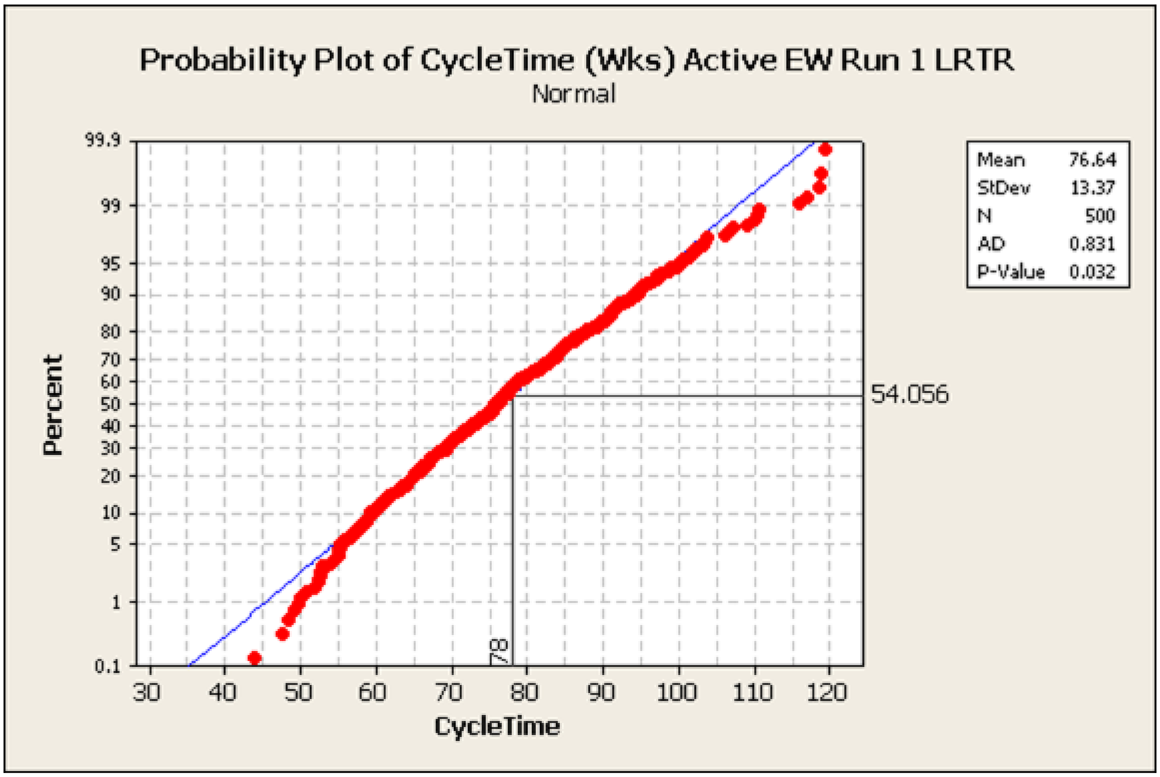
Count	Avg Cycle	Avg Serv	Avg Block	Avg Work
500	76.64	76.64	0.00	76.64

Activity Statistics In Weeks (Hours)

	Count	Avg Cycle	Avg Serv	Avg Block	Avg Work
HERO Testing Lead Time	500	29.81	29.81	3.82	25.99
EMV Lead Time	500	25.72	25.72	0.00	25.72
IA Lead Time	500	25.71	25.71	0.00	25.71
JITC	500	11.66	11.66	0.00	11.66
Sys Safety	500	10.02	10.02	0.00	10.02
CCA Lead Time	500	8.59	8.59	0.00	8.59
WSESRB Lead Time	750	8.33	8.33	0.00	8.33
WSESRB Lead Time	750	8.30	8.30	0.00	8.30
HERO Test Report	500	8.03	8.03	0.00	8.03
JITC Lead Time	500	7.87	7.87	0.00	7.87
Freq Assignments	2000	6.05	6.05	0.00	6.05
DT	500	71.65	71.65	66.25	5.40
DT Lead Time	500	4.98	4.98	0.00	4.98
IA (Interim)	500	3.02	3.02	0.00	3.02
Range Safety	500	10.14	10.14	7.47	2.68
Range Safety Lead Time	500	61.14	61.14	58.47	2.67
HERO Testing	500	2.51	2.51	0.00	2.51
EMV (Inter-Sys EMC)	500	24.39	24.39	21.90	2.49
Env Qual Lead Time	500	2.31	2.31	0.00	2.31
E3IAR	4000	2.23	2.23	0.00	2.23
E3IAR Update	1000	54.72	54.72	52.50	2.23
EMI	500	2.22	2.22	0.00	2.22
IFC	500	1.99	1.99	0.00	1.99
CCA	500	1.97	1.97	0.00	1.97
Bonding & Grounding	500	1.11	1.11	0.00	1.11
HERP	500	1.11	1.11	0.00	1.11
HERO	500	1.11	1.11	0.00	1.11
ESD	500	1.11	1.11	0.00	1.11
HERF	500	1.11	1.11	0.00	1.11
WSESRB	750	0.57	0.57	0.00	0.57
WSESRB	750	0.56	0.56	0.00	0.56
RADHAZ Analysis Lead Time	500	0.55	0.55	0.00	0.55
EMC Lead Time	500	4.36	4.36	3.82	0.54
EMI Lead Time	500	0.53	0.53	0.00	0.53
Env Qual	1000	0.53	0.53	0.00	0.53
ESD Lead Time	500	0.53	0.53	0.00	0.53
Bonding & Grounding Lead Time	500	0.52	0.52	0.00	0.52
RADHAZ Analysis	500	0.44	0.44	0.00	0.44
EMC (Intra-Sys EMC)	500	0.22	0.22	0.00	0.22
Develop & Build	500	0.00	0.00	0.00	0.00
PMA	3500	0.00	0.00	0.00	0.00
Start	500	0.00	0.00	0.00	0.00
Freq Assignments Lead Time	500	0.00	0.00	0.00	0.00
IFC Lead Time	1000	58.47	58.47	58.47	0.00
Wait until all certs are done.	500	47.78	47.78	47.78	0.00
End	500	0.00	0.00	0.00	0.00
CDL	1000	0.00	0.00	0.00	0.00
Repeat?	500	0.00	0.00	0.00	0.00
Repeated?	750	0.00	0.00	0.00	0.00
Repeated? w1	750	0.00	0.00	0.00	0.00
Repeat? w1	500	0.00	0.00	0.00	0.00
Collect Inputs	500	0.73	0.73	0.73	0.00
Collect HERO Results	500	36.05	36.05	36.05	0.00
Collect WSESRB Results	500	0.00	0.00	0.00	0.00
IA & CCA Finish Together	500	18.43	18.43	18.43	0.00
WSESRB Outputs	500	0.00	0.00	0.00	0.00
Finish Together	500	8.08	8.08	8.08	0.00


Summary for CycleTime (Wks) Active EW Run 1 LRTR
ActivityName = End
Anderson-Darling Normality Test
A-Squared 0.83
P-Value 0.032
Mean 76.638
StDev 13.373
Variance 178.846
Skewness 0.373863
Kurtosis 0.092144
N 500
Minimum 44.054
1st Quartile 67.062
Median 75.825
3rd Quartile 85.011
Maximum 119.304
95% Confidence Interval for Mean
75.463 77.813
95% Confidence Interval for Median
75.043 77.156
95% Confidence Interval for StDev
12.593 14.258
95% Confidence Intervals
Mean
Median

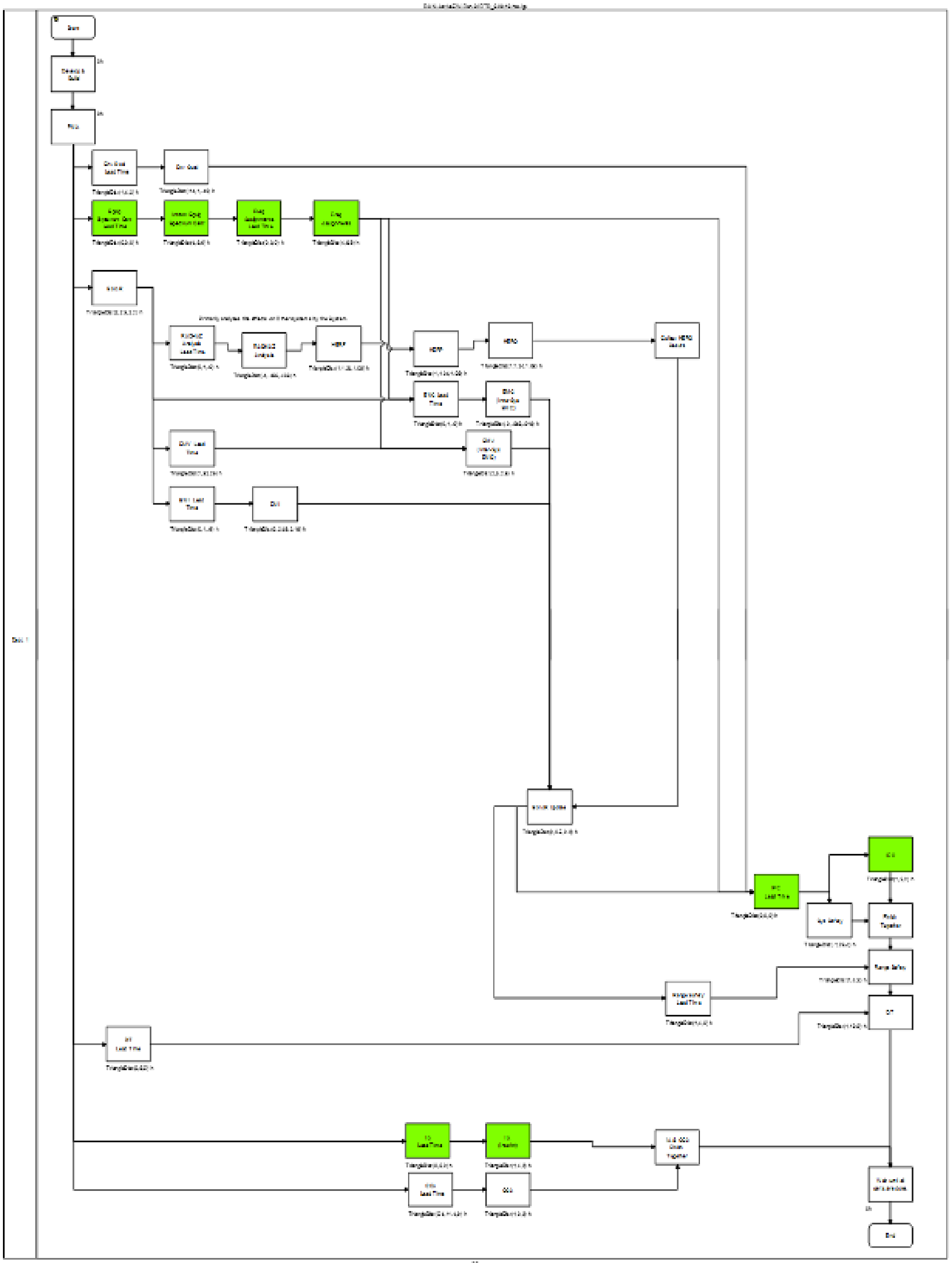

Process Capability of CycleTime (Wks) Active EW Run 1 LRTR
Process Data
LB 0
Target 52
USL 78
Sample Mean 76.6378
Sample N 500
StDev(Within) 13.5583
StDev(Overall) 13.3733
LB
Target
USL
Within
Overall
Potential (Within) Capability
Cp *
CPL *
CPU 0.03
Cpk 0.03
Overall Capability
Pp *
PPL *
PPU 0.03
Ppk 0.03
Cpm 0.31
Observed Performance
% < LB 0.00
% > USL 42.20
% Total 42.20
Exp. Within Performance
% < LB *
% > USL 46.00
% Total 46.00
Exp. Overall Performance
% < LB *
% > USL 45.94
% Total 45.94



Probability Plot of CycleTime (Wks) Active EW Run 1 LRTR
Normal
Percent
CycleTime
Mean 76.64
StDev 13.37
N 500
AD 0.831
P-Value 0.032
54.056
78
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
30
40
50
60
70
80
90
100
110
120

Active Electronic Warfare (EW) Run 2

Intermediate Risk Timeline Reduction (IRTR)



Elapsed Time in Weeks

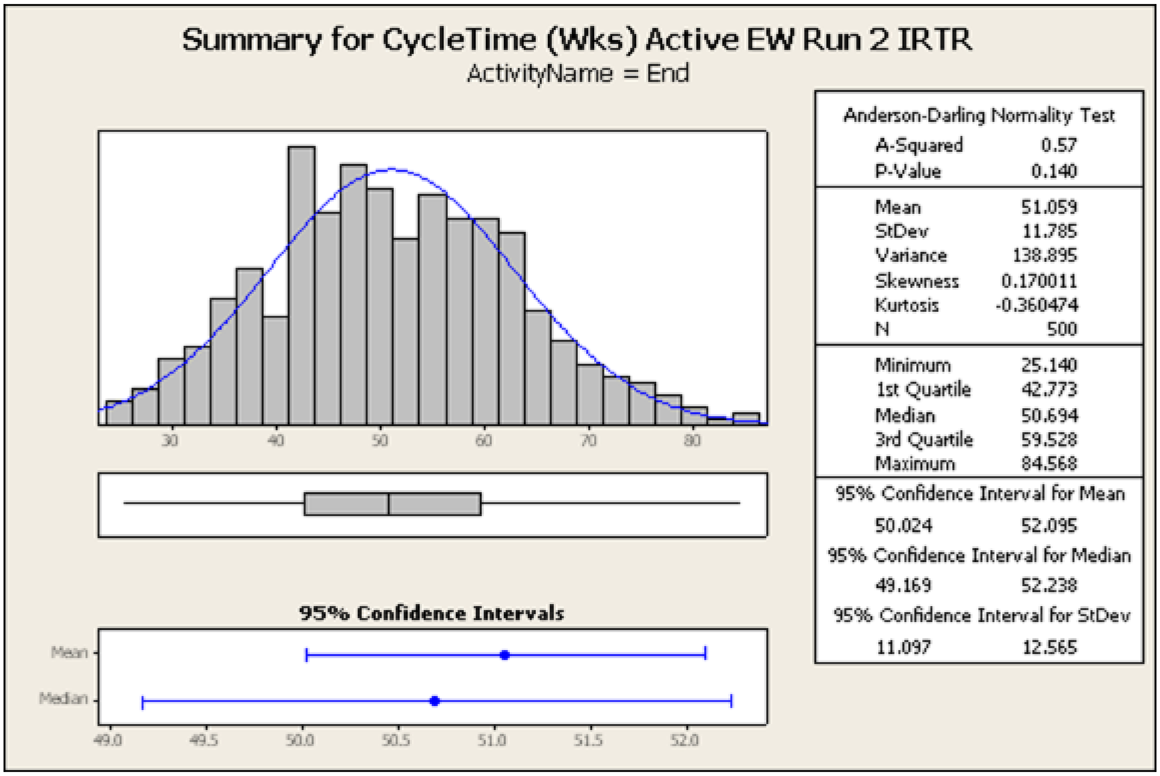
25417.91

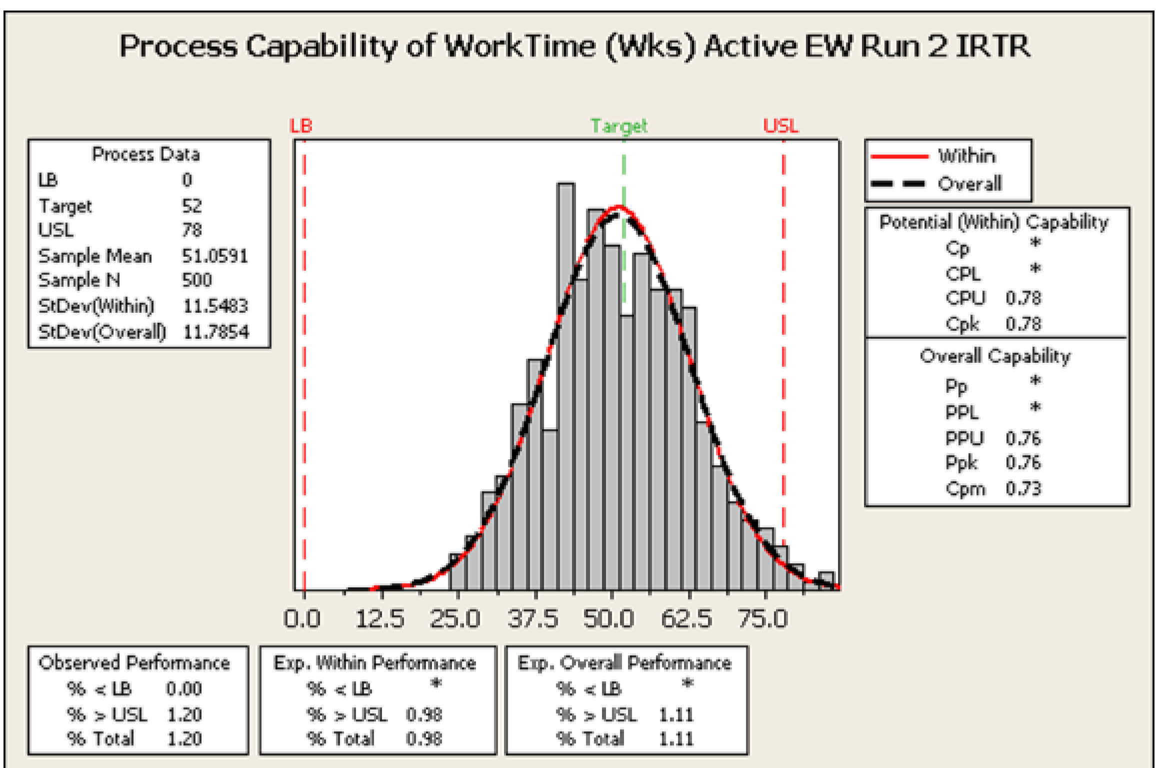
Transaction Statistics In Weeks (Hours)

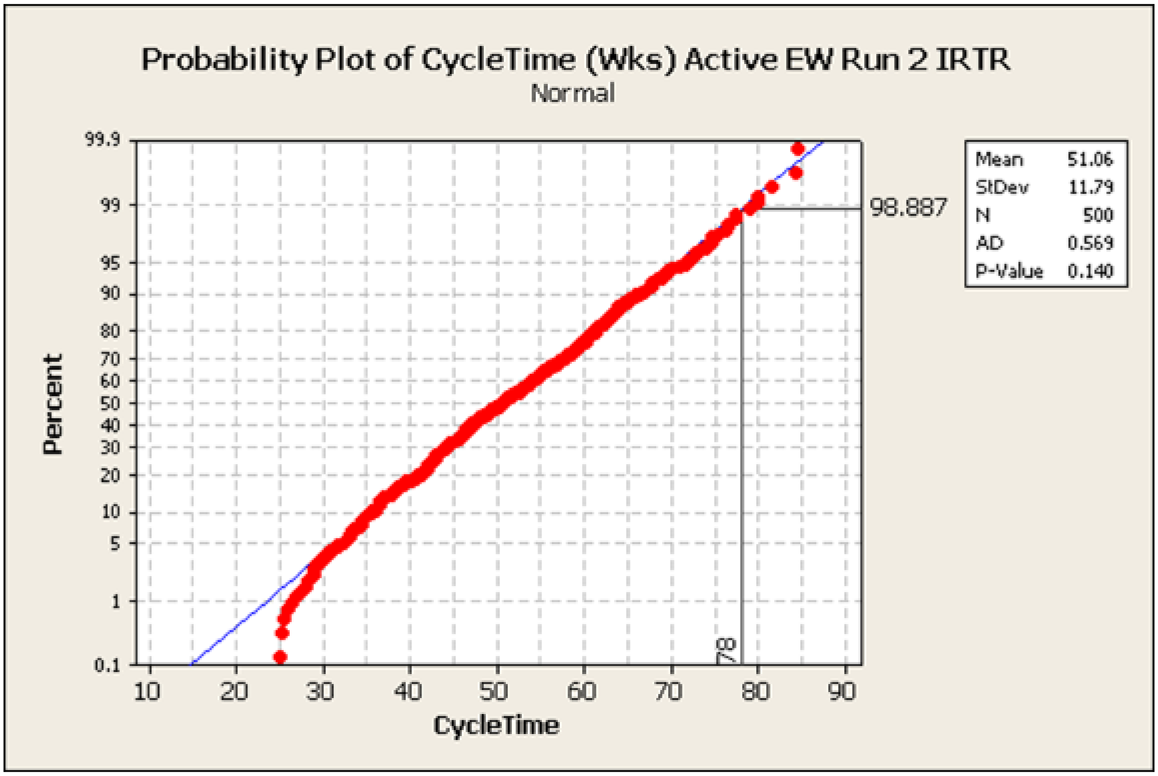
Count	Avg Cycle	Avg Serv	Avg Block	Avg Work
500	50.84	50.84	0.00	50.84

Activity Statistics In Weeks (Hours)

	Count	Avg Cycle	Avg Serv	Avg Block	Avg Work
EMV Lead Time	500	25.72	25.72	0.00	25.72
Sys Safety	500	10.02	10.02	0.00	10.02
CCA Lead Time	500	8.59	8.59	0.00	8.59
DT	500	45.85	45.85	40.45	5.40
DT Lead Time	500	4.98	4.98	0.00	4.98
Range Safety	500	10.14	10.14	7.47	2.68
Range Safety Lead Time	500	2.67	2.67	0.00	2.67
EMV (Inter-Sys EMC)	500	2.49	2.49	0.00	2.49
IA (Interim)	500	2.32	2.32	0.00	2.32
Env Qual Lead Time	500	2.31	2.31	0.00	2.31
E3IAR	1500	2.23	2.23	0.00	2.23
E3IAR Update	1000	29.68	29.68	27.45	2.23
EMI	500	2.22	2.22	0.00	2.22
IFC	500	1.99	1.99	0.00	1.99
CCA	500	1.97	1.97	0.00	1.97
EMC Lead Time	500	0.54	0.54	0.00	0.54
EMI Lead Time	500	0.53	0.53	0.00	0.53
Env Qual	500	0.53	0.53	0.00	0.53
EMC (Intra-Sys EMC)	500	0.22	0.22	0.00	0.22
Develop & Build	500	0.00	0.00	0.00	0.00
End	500	0.00	0.00	0.00	0.00
IFC Lead Time	1000	29.83	29.83	29.83	0.00
IA Lead Time	500	0.00	0.00	0.00	0.00
PMA	2500	0.00	0.00	0.00	0.00
Start	500	0.00	0.00	0.00	0.00
Wait until all certs are done.	500	40.28	40.28	40.28	0.00
IA & CCA Finish Together	500	8.24	8.24	8.24	0.00
Finish Together	500	8.08	8.08	8.08	0.00


Summary for CycleTime (Wks) Active EW Run 2 IRTR
ActivityName = End
Anderson-Darling Normality Test
A-Squared 0.57
P-Value 0.140
Mean 51.059
StDev 11.785
Variance 138.895
Skewness 0.170011
Kurtosis -0.360474
N 500
Minimum 25.140
1st Quartile 42.773
Median 50.694
3rd Quartile 59.528
Maximum 84.568
95% Confidence Interval for Mean
50.024 52.095
95% Confidence Interval for Median
49.169 52.238
95% Confidence Interval for StDev
11.097 12.565
95% Confidence Intervals
Mean
Median

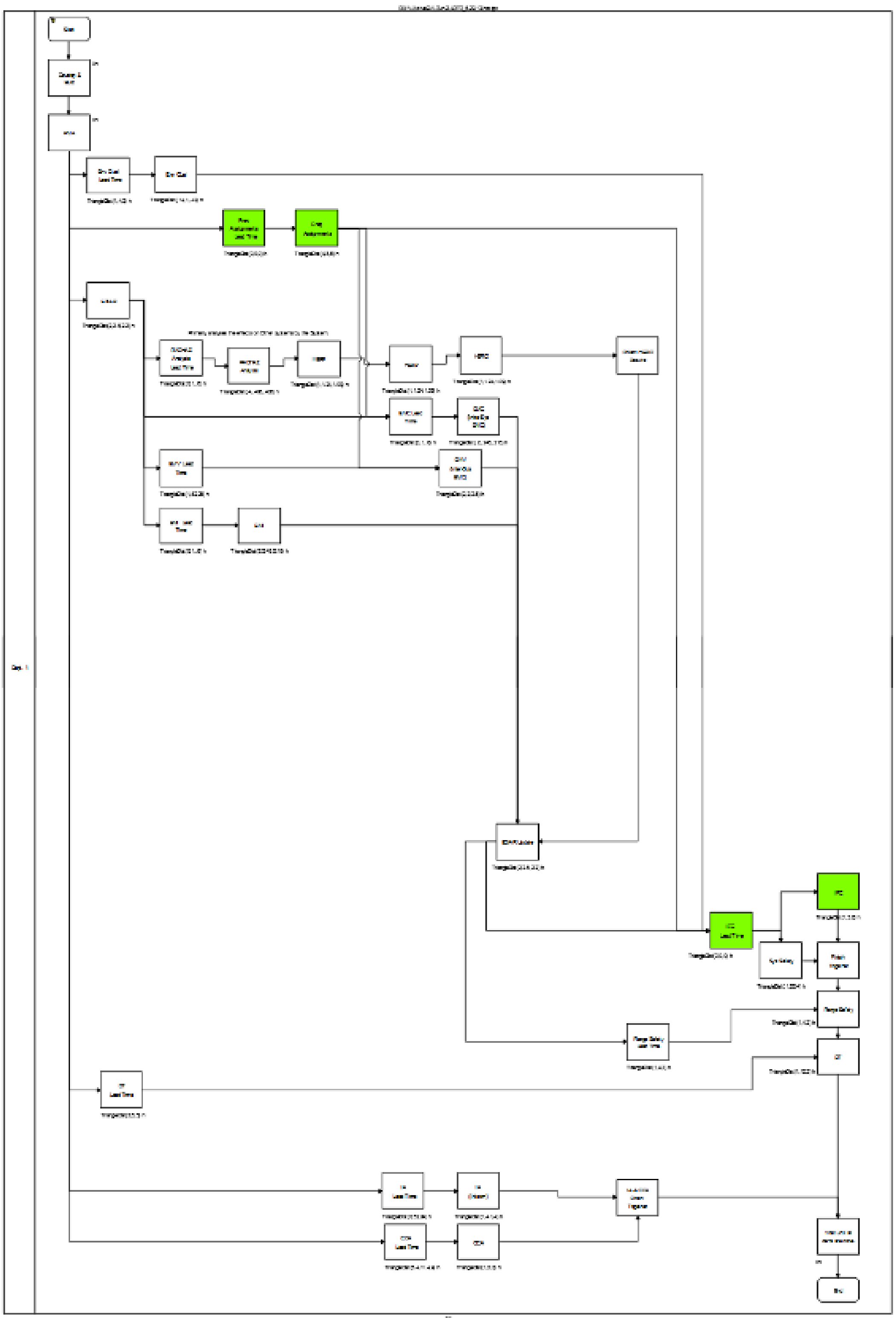

Process Capability of WorkTime (Wks) Active EW Run 2 IRTR
LB
Target
USL
Process Data
LB 0
Target 52
USL 78
Sample Mean 51.0591
Sample N 500
StDev(Within) 11.5483
StDev(Overall) 11.7854
Within
Overall
Potential (Within) Capability
Cp *
CPL *
CPU 0.78
Cpk 0.78
Overall Capability
Pp *
PPL *
PPU 0.76
Ppk 0.76
Cpm 0.73
0.0 12.5 25.0 37.5 50.0 62.5 75.0
Observed Performance
% < LB 0.00
% > USL 1.20
% Total 1.20
Exp. Within Performance
% < LB *
% > USL 0.98
% Total 0.98
Exp. Overall Performance
% < LB *
% > USL 1.11
% Total 1.11



Probability Plot of CycleTime (Wks) Active EW Run 2 IRTR
Normal
Percent
CycleTime
98.887
78
Mean 51.06
StDev 11.79
N 500
AD 0.569
P-Value 0.140

Active Electronic Warfare (EW) Run 2

Low Risk Timeline Reduction (LRTR)



Elapsed Time in Weeks

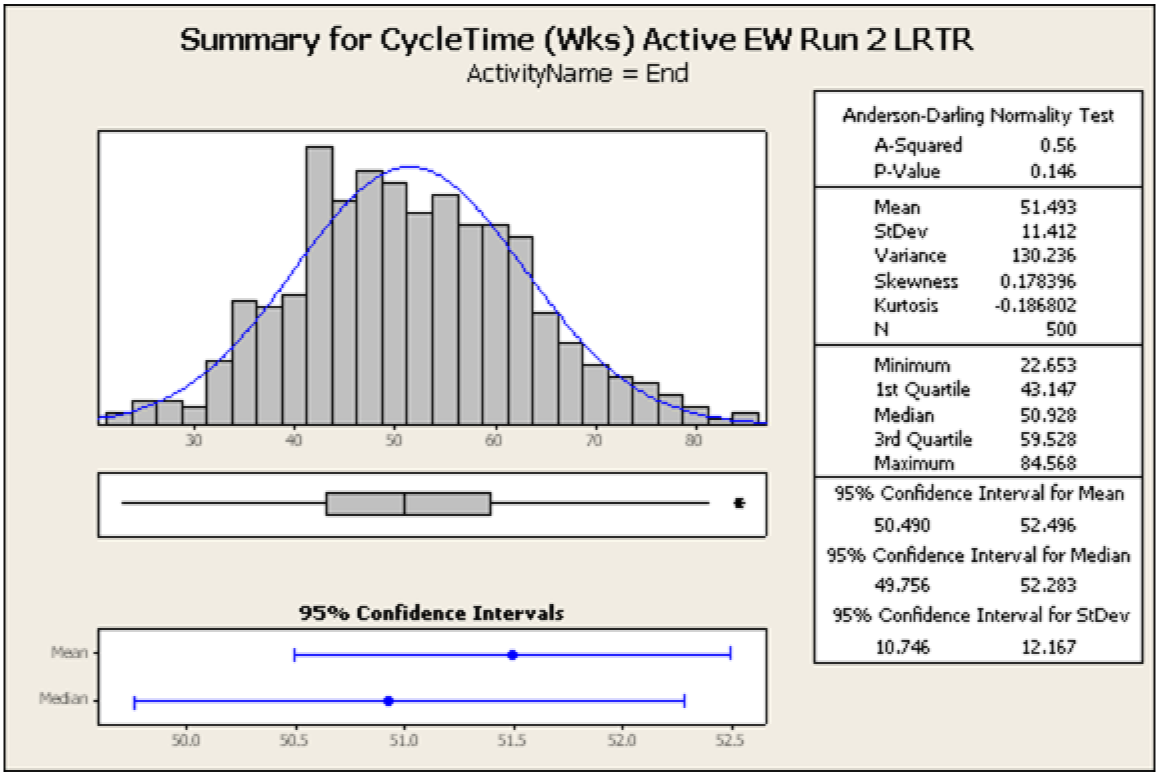
25746.41

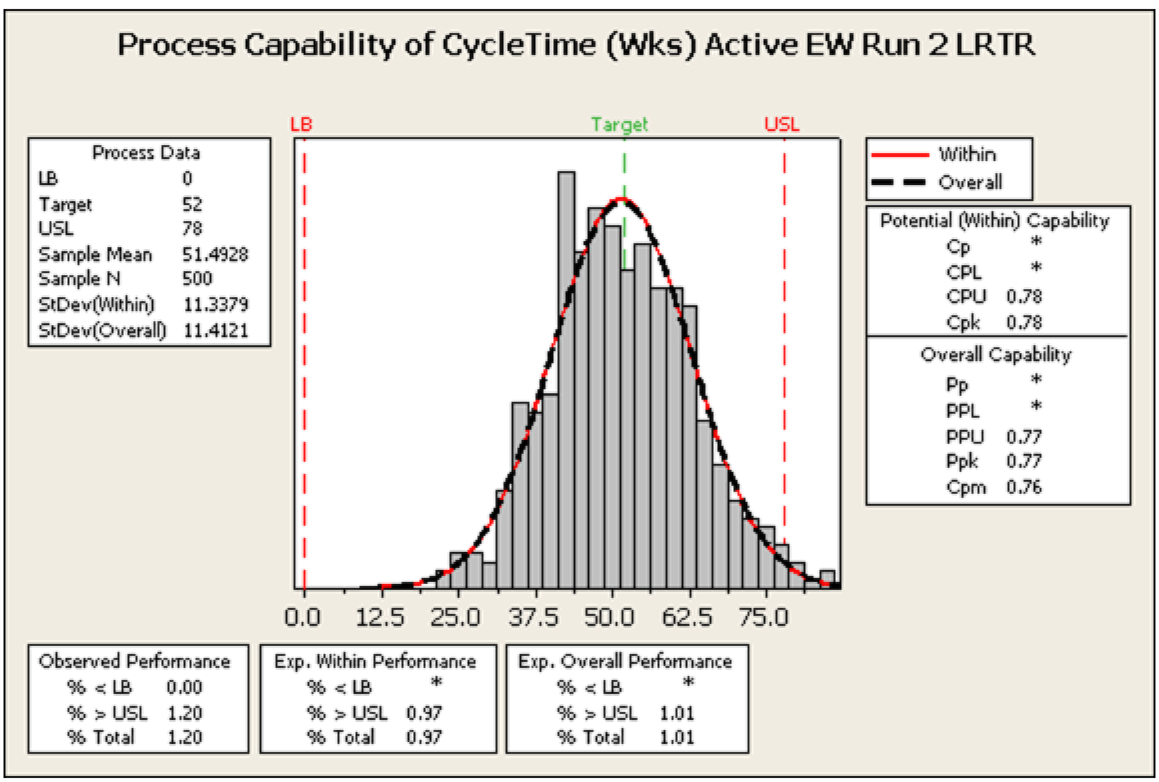
Transaction Statistics In Weeks (Hours)

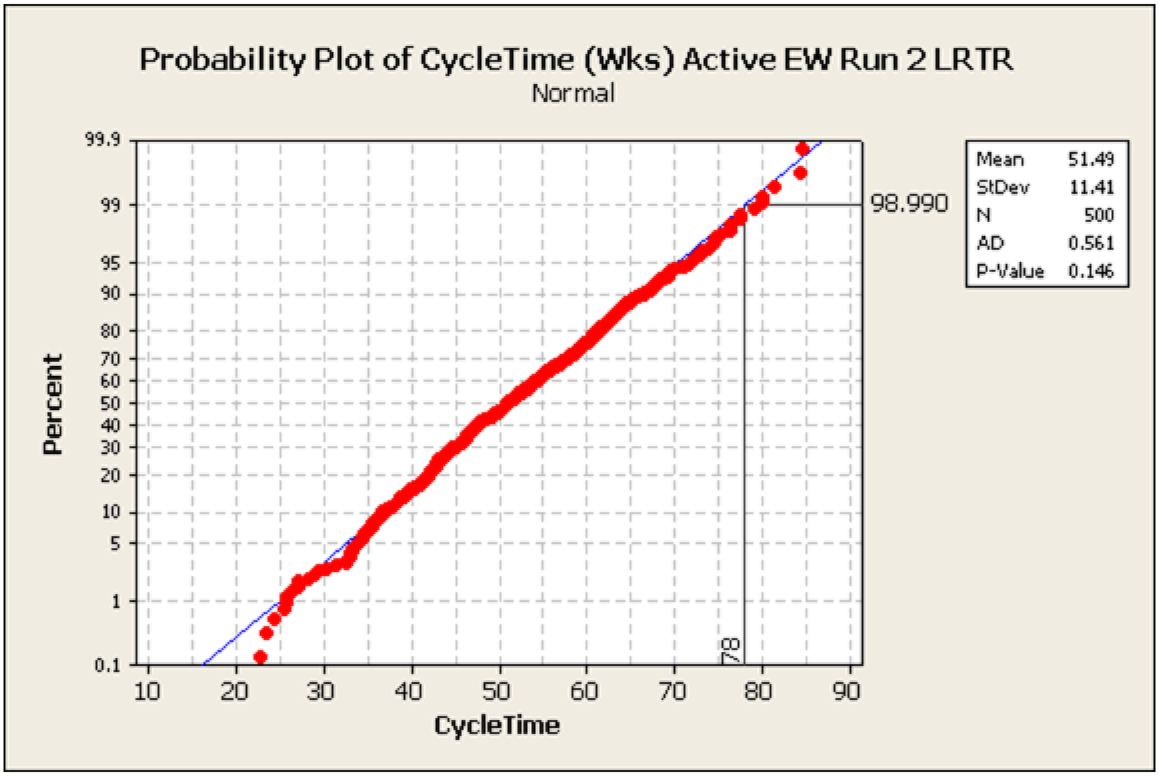
Count	Avg Cycle	Avg Serv	Avg Block	Avg Work
500	51.49	51.49	0.00	51.49

Activity Statistics In Weeks (Hours)

	Count	Avg Cycle	Avg Serv	Avg Block	Avg Work
EMV Lead Time	500	25.72	25.72	0.00	25.72
IA Lead Time	500	25.71	25.71	0.00	25.71
Sys Safety	500	10.02	10.02	0.00	10.02
CCA Lead Time	500	8.59	8.59	0.00	8.59
Freq Assignments	1500	6.05	6.05	0.00	6.05
DT	500	45.86	45.86	40.46	5.40
DT Lead Time	500	4.98	4.98	0.00	4.98
IA (Interim)	500	3.02	3.02	0.00	3.02
Range Safety	500	10.14	10.14	7.47	2.68
Range Safety Lead Time	500	2.67	2.67	0.00	2.67
EMV (Inter-Sys EMC)	500	24.39	24.39	21.90	2.49
Env Qual Lead Time	500	2.31	2.31	0.00	2.31
E3IAR	2000	2.23	2.23	0.00	2.23
E3IAR Update	1000	27.70	27.70	25.47	2.23
EMI	500	2.22	2.22	0.00	2.22
IFC	500	1.99	1.99	0.00	1.99
CCA	500	1.97	1.97	0.00	1.97
HERP	500	1.11	1.11	0.00	1.11
HERO	500	1.11	1.11	0.00	1.11
HERF	500	1.11	1.11	0.00	1.11
RADHAZ Analysis Lead Time	500	0.55	0.55	0.00	0.55
EMC Lead Time	500	4.36	4.36	3.82	0.54
EMI Lead Time	500	0.53	0.53	0.00	0.53
Env Qual	500	0.53	0.53	0.00	0.53
RADHAZ Analysis	500	0.44	0.44	0.00	0.44
EMC (Intra-Sys EMC)	500	0.22	0.22	0.00	0.22
IFC Lead Time	1000	29.83	29.83	29.83	0.00
Freq Assignments Lead Time	500	0.00	0.00	0.00	0.00
Develop & Build	500	0.00	0.00	0.00	0.00
End	500	0.00	0.00	0.00	0.00
Wait until all certs are done.	500	23.29	23.29	23.29	0.00
PMA	3000	0.00	0.00	0.00	0.00
Start	500	0.00	0.00	0.00	0.00
Collect HERO Results	500	0.00	0.00	0.00	0.00
IA & CCA Finish Together	500	18.43	18.43	18.43	0.00
Finish Together	500	8.08	8.08	8.08	0.00

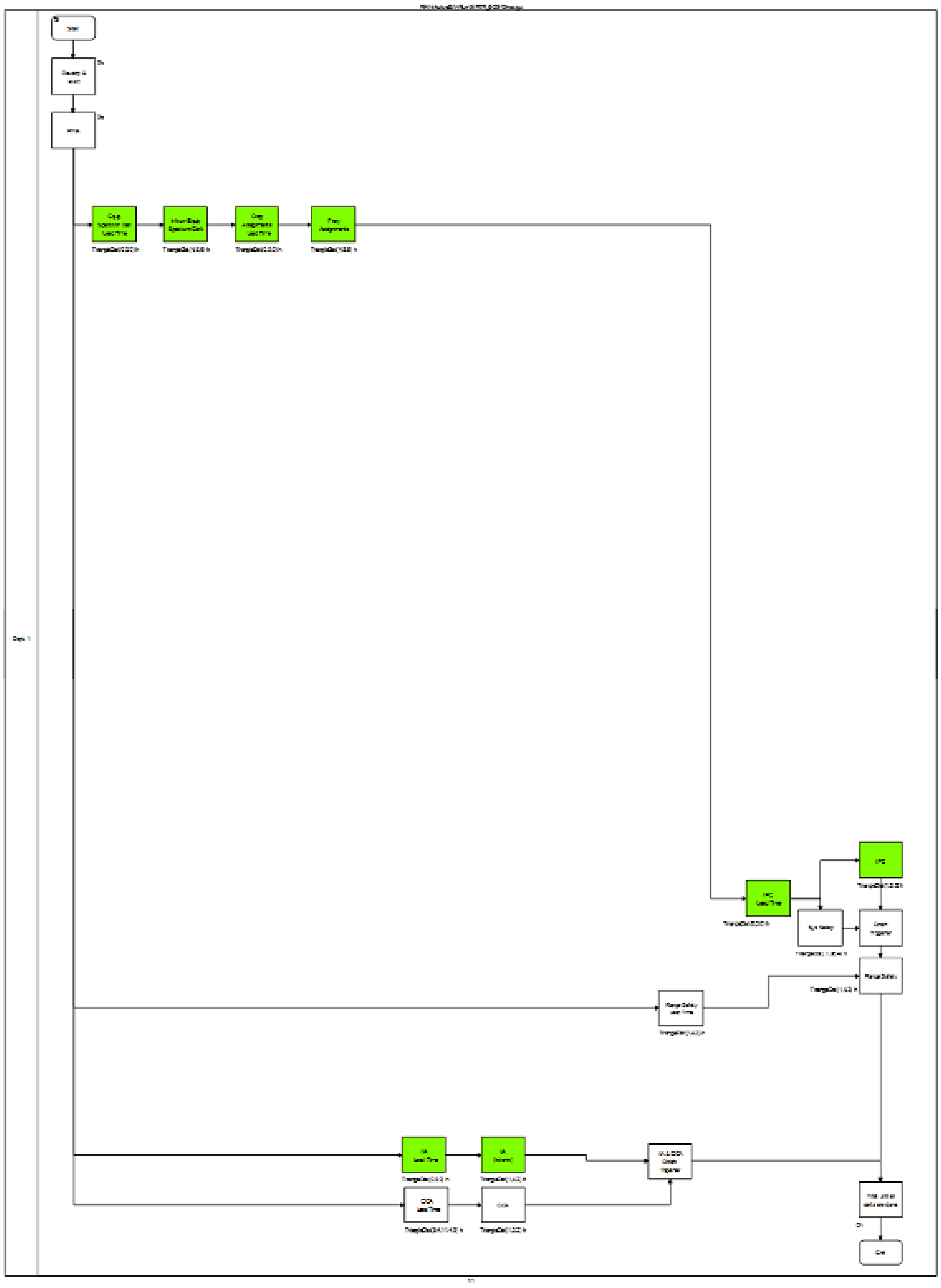

Summary for CycleTime (Wks) Active EW Run 2 LRTR
ActivityName = End
Anderson-Darling Normality Test
A-Squared 0.56
P-Value 0.146
Mean 51.493
StDev 11.412
Variance 130.236
Skewness 0.178396
Kurtosis -0.186802
N 500
Minimum 22.653
1st Quartile 43.147
Median 50.928
3rd Quartile 59.528
Maximum 84.568
95% Confidence Interval for Mean
50.490 52.496
95% Confidence Interval for Median
49.756 52.283
95% Confidence Interval for StDev
10.746 12.167
30 40 50 60 70 80
95% Confidence Intervals
Mean
Median
50.0 50.5 51.0 51.5 52.0 52.5


Process Capability of CycleTime (Wks) Active EW Run 2 LRTR
LB
Target
USL
Process Data
LB 0
Target 52
USL 78
Sample Mean 51.4928
Sample N 500
StDev(Within) 11.3379
StDev(Overall) 11.4121
Within
Overall
Potential (Within) Capability
Cp *
CPL *
CPU 0.78
Cpk 0.78
Overall Capability
Pp *
PPL *
PPU 0.77
Ppk 0.77
Cpm 0.76
0.0 12.5 25.0 37.5 50.0 62.5 75.0
Observed Performance
% < LB 0.00
% > USL 1.20
% Total 1.20
Exp. Within Performance
% < LB *
% > USL 0.97
% Total 0.97
Exp. Overall Performance
% < LB *
% > USL 1.01
% Total 1.01


Probability Plot of CycleTime (Wks) Active EW Run 2 LRTR
Normal
Percent
CycleTime
Mean 51.49
StDev 11.41
N 500
AD 0.561
P-Value 0.146
98.990
78
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
10
20
30
40
50
60
70
80
90

Active Electronic Warfare (EW) Run 3

Intermediate Risk Timeline Reduction (IRTR)



Elapsed Time in Weeks

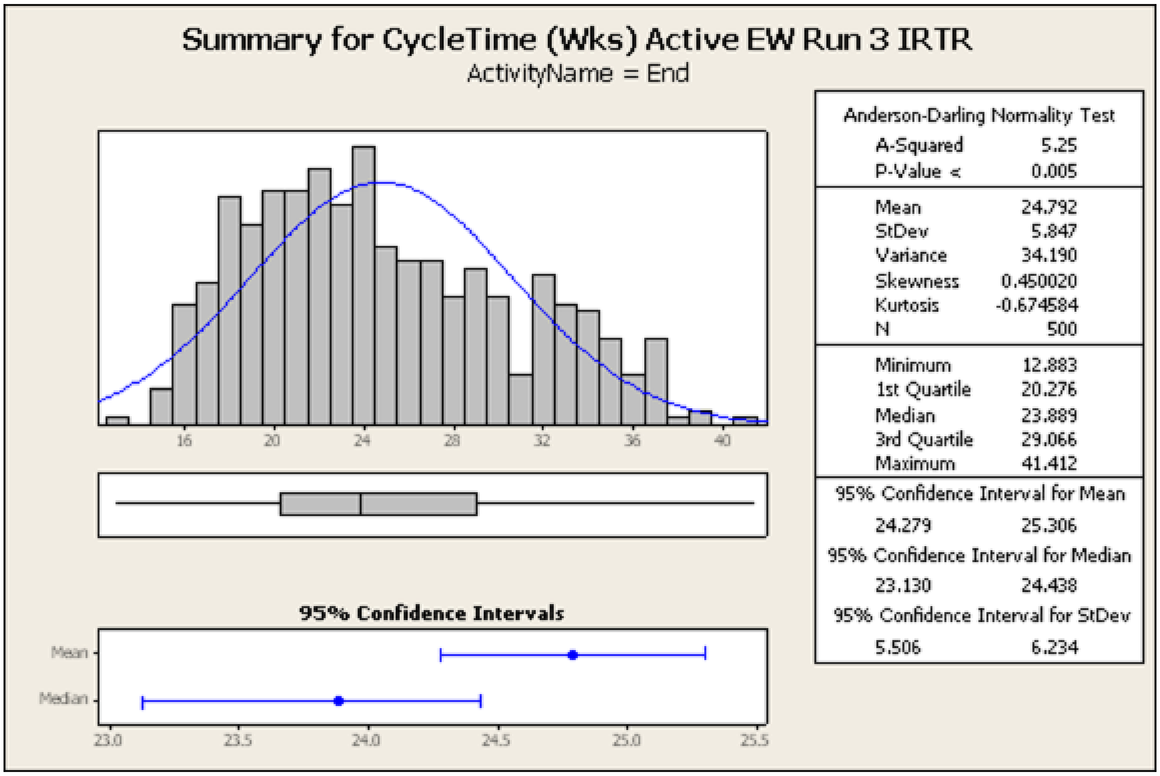
12396.22

Transaction Statistics In Weeks (Hours)

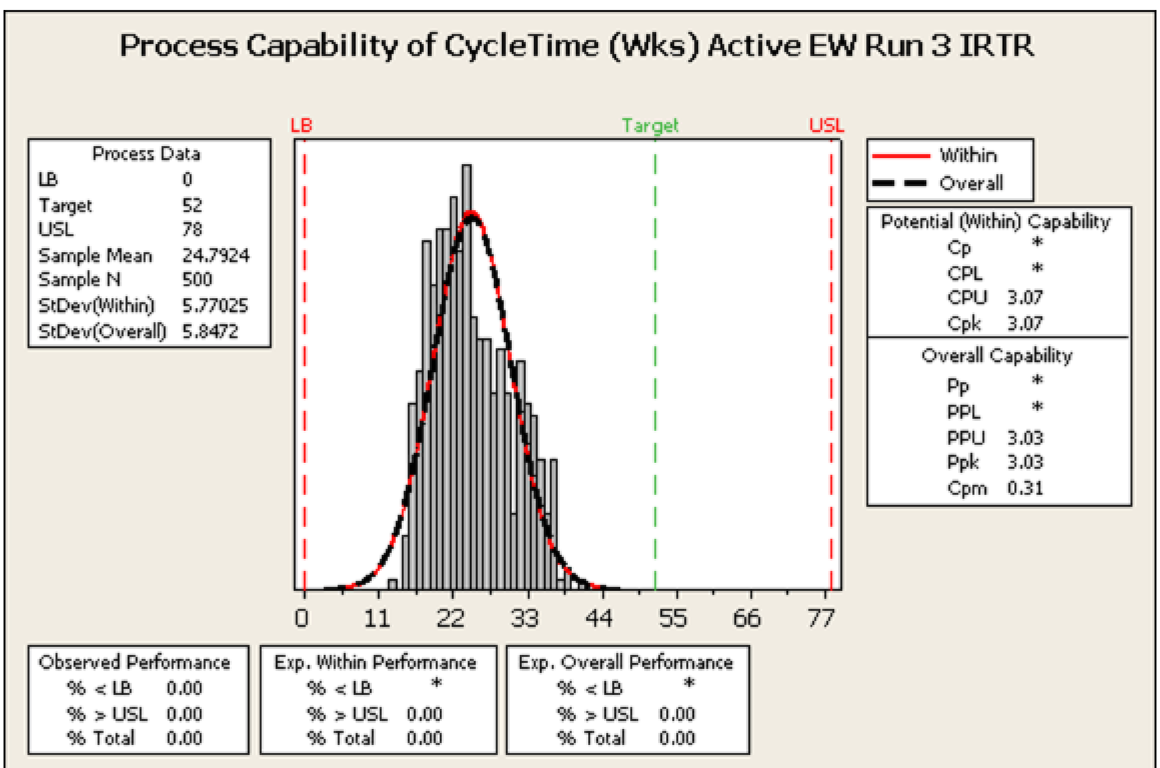
Count	Avg Cycle	Avg Serv	Avg Block	Avg Work
500	24.79	24.79	0.00	24.79

Activity Statistics In Weeks (Hours)

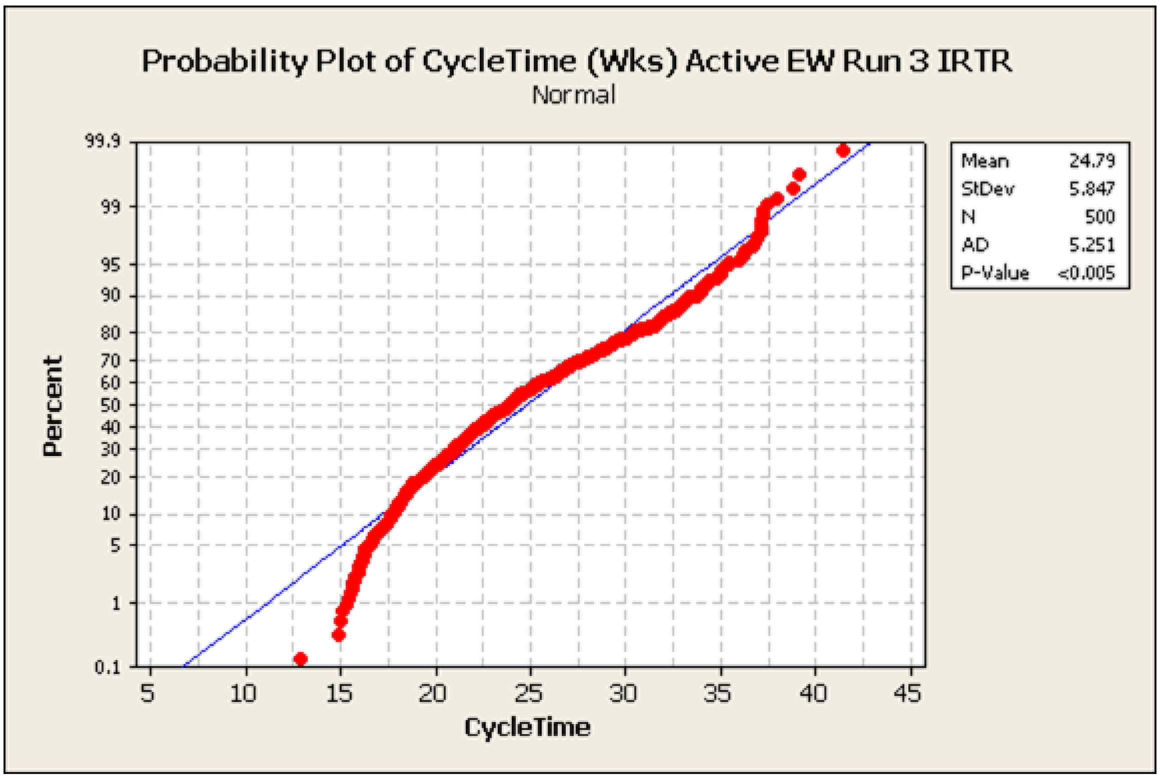
	Count	Avg Cycle	Avg Serv	Avg Block	Avg Work
Sys Safety	500	10.02	10.02	0.00	10.02
CCA Lead Time	500	8.59	8.59	0.00	8.59
Freq Assignments	500	6.05	6.05	0.00	6.05
Intrum Equip Spectrum Certt	500	6.02	6.02	0.00	6.02
Range Safety	500	22.12	22.12	19.45	2.68
Range Safety Lead Time	500	2.67	2.67	0.00	2.67
IA (Interim)	500	2.32	2.32	0.00	2.32
IFC	500	1.99	1.99	0.00	1.99
CCA	500	1.97	1.97	0.00	1.97
Develop & Build	500	0.00	0.00	0.00	0.00
End	500	0.00	0.00	0.00	0.00
IFC Lead Time	1000	0.00	0.00	0.00	0.00
IA Lead Time	500	0.00	0.00	0.00	0.00
Equip Spectrum Cert Lead Time	500	0.00	0.00	0.00	0.00
Freq Assignments Lead Time	500	0.00	0.00	0.00	0.00
PMA	2000	0.00	0.00	0.00	0.00
Start	500	0.00	0.00	0.00	0.00
Wait until all certs are done.	500	14.23	14.23	14.23	0.00
IA & CCA Finish Together	500	8.24	8.24	8.24	0.00
Finish Together	500	8.08	8.08	8.08	0.00



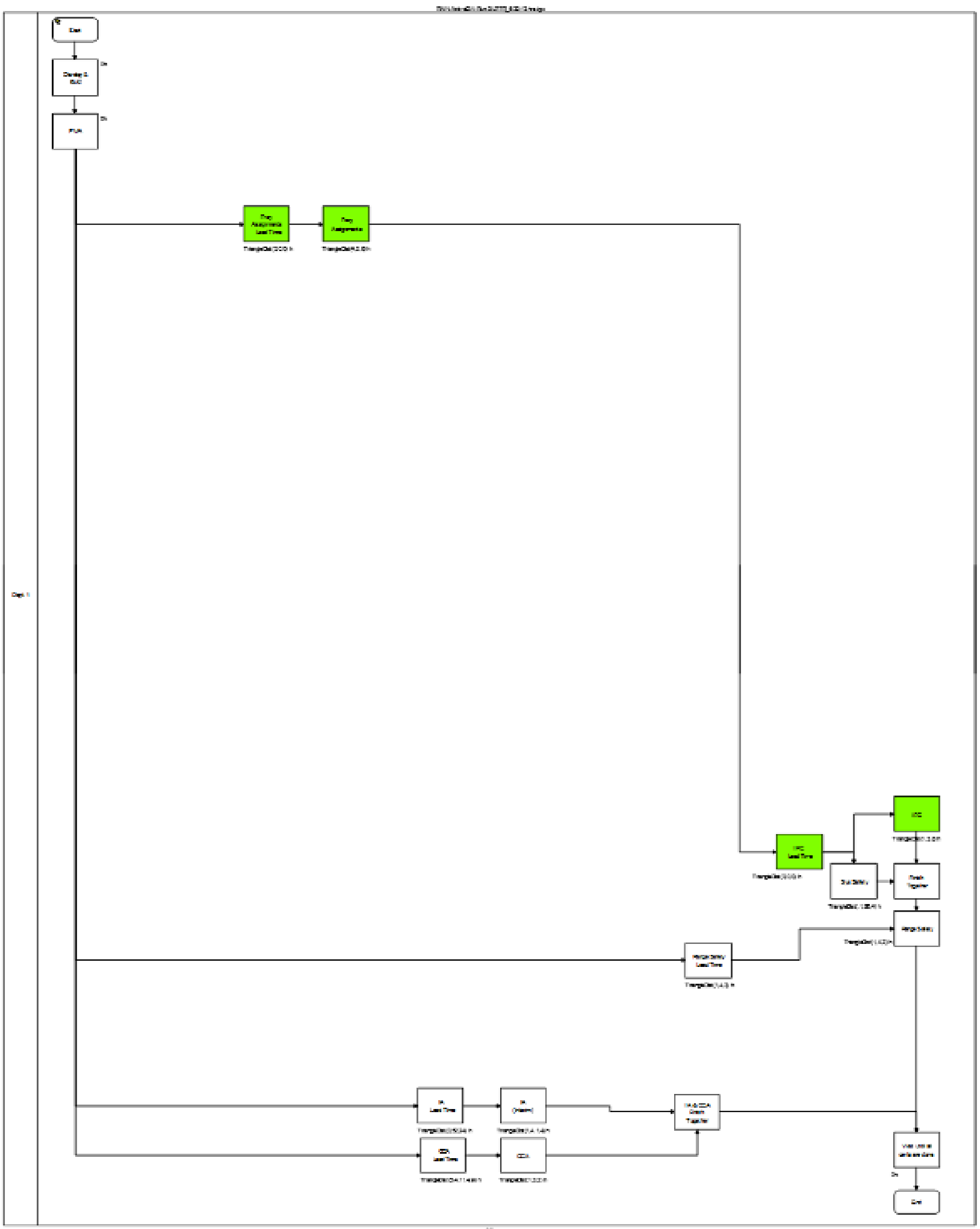
Summary for CycleTime (Wks) Active EW Run 3 IRTR
ActivityName = End
Anderson-Darling Normality Test
A-Squared 5.25
P-Value < 0.005
Mean 24.792
StDev 5.847
Variance 34.190
Skewness 0.450020
Kurtosis -0.674584
N 500
Minimum 12.883
1st Quartile 20.276
Median 23.889
3rd Quartile 29.066
Maximum 41.412
95% Confidence Interval for Mean
24.279 25.306
95% Confidence Interval for Median
23.130 24.438
95% Confidence Interval for StDev
5.506 6.234
95% Confidence Intervals
Mean
Median
16 20 24 28 32 36 40
23.0 23.5 24.0 24.5 25.0 25.5



Process Capability of CycleTime (Wks) Active EW Run 3 IRTR
LB
Target
USL
Process Data
LB 0
Target 52
USL 78
Sample Mean 24.7924
Sample N 500
StDev(Within) 5.77025
StDev(Overall) 5.8472
Within
Overall
Potential (Within) Capability
Cp *
CPL *
CPU 3.07
Cpk 3.07
Overall Capability
Pp *
PPL *
PPU 3.03
Ppk 3.03
Cpm 0.31
0 11 22 33 44 55 66 77
Observed Performance
% < LB 0.00
% > USL 0.00
% Total 0.00
Exp. Within Performance
% < LB *
% > USL 0.00
% Total 0.00
Exp. Overall Performance
% < LB *
% > USL 0.00
% Total 0.00


Probability Plot of CycleTime (Wks) Active EW Run 3 IRTR
Normal
Percent
CycleTime
Mean 24.79
StDev 5.847
N 500
AD 5.251
P-Value <0.005

Active Electronic Warfare (EW) Run 3
Low Risk Timeline Reduction (LRTR)



RAIN-ActiveEW-Run-3-LRTR_6-29-13-hrs.igx

Elapsed Time in Weeks

15096.99

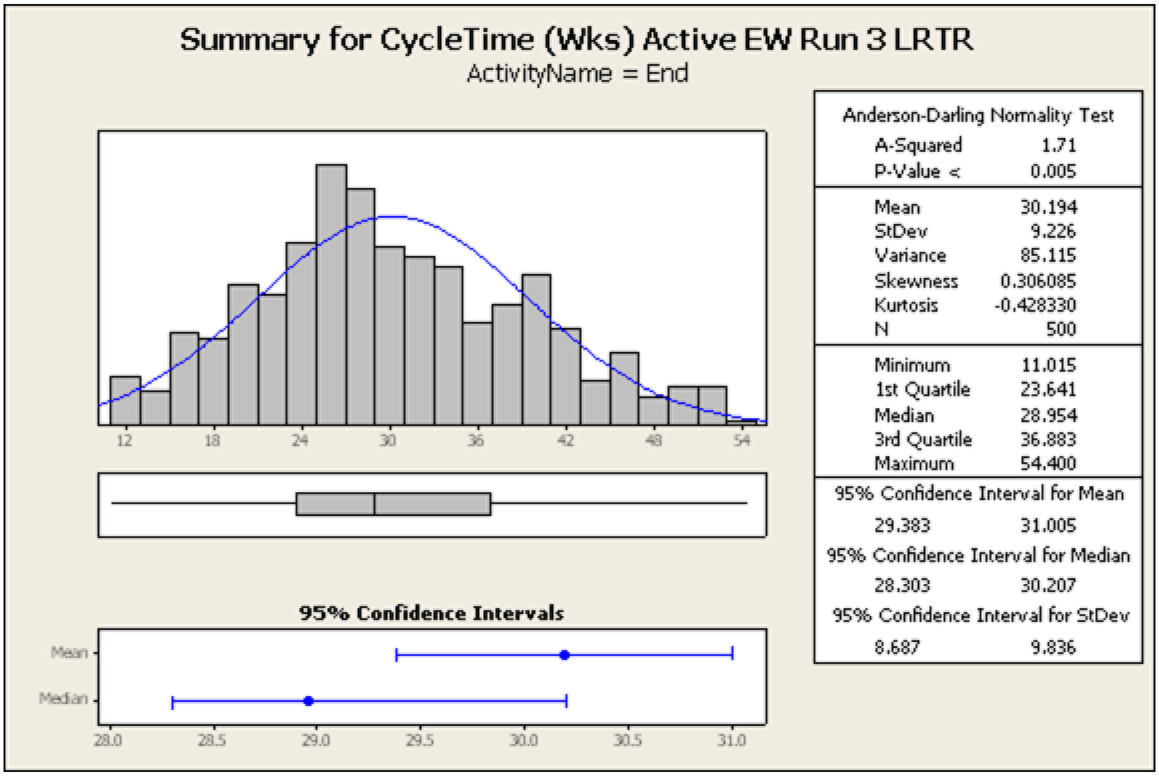
Transaction Statistics In Weeks (Hours)

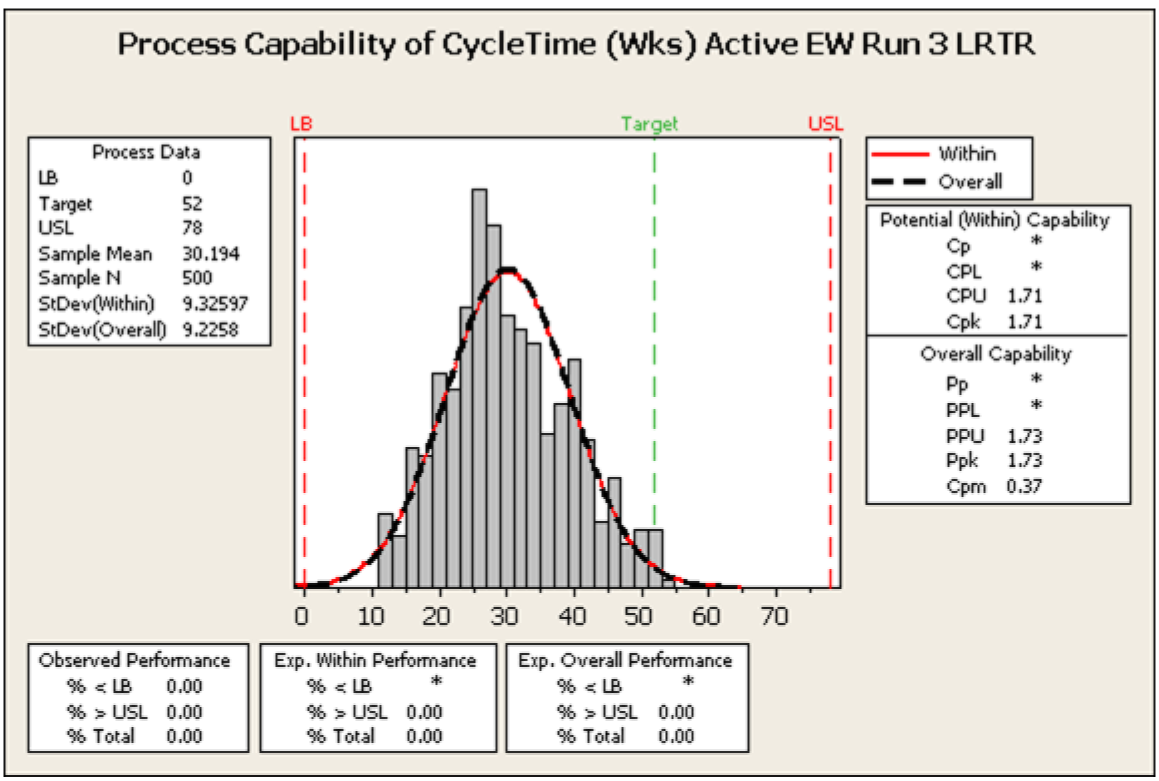
Count	Avg Cycle	Avg Serv	Avg Block	Avg Work
500	30.19	30.19	0.00	30.19

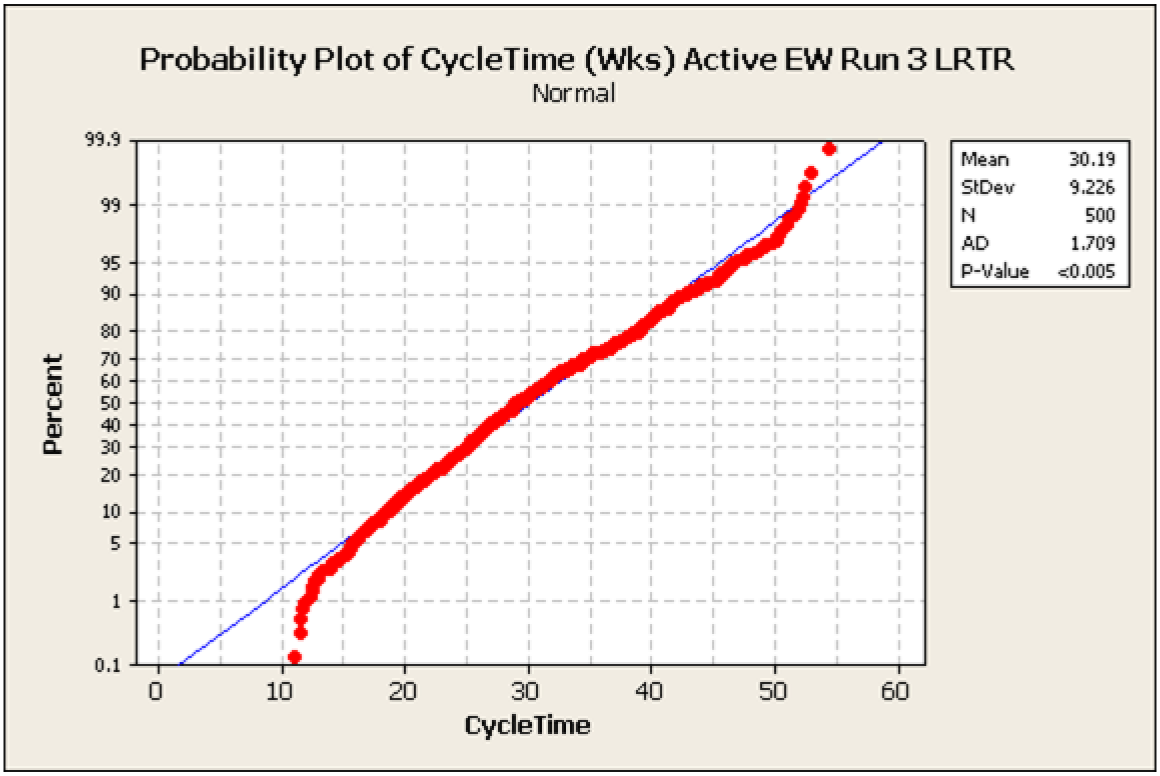
Activity Statistics In Weeks (Hours)

	Count	Avg Cycle	Avg Serv	Avg Block	Avg Work
IA Lead Time	500	25.71	25.71	0.00	25.71
Sys Safety	500	10.02	10.02	0.00	10.02
CCA Lead Time	500	8.59	8.59	0.00	8.59
Freq Assignments	500	6.05	6.05	0.00	6.05
IA (Interim)	500	3.02	3.02	0.00	3.02
Range Safety	500	16.10	16.10	13.43	2.68
Range Safety Lead Time	500	2.67	2.67	0.00	2.67
IFC	500	1.99	1.99	0.00	1.99
CCA	500	1.97	1.97	0.00	1.97
Develop & Build	500	0.00	0.00	0.00	0.00
End	500	0.00	0.00	0.00	0.00
IFC Lead Time	1000	0.00	0.00	0.00	0.00
Freq Assignments Lead Time	500	0.00	0.00	0.00	0.00
PMA	2000	0.00	0.00	0.00	0.00
Start	500	0.00	0.00	0.00	0.00
Wait until all certs are done.	500	12.76	12.76	12.76	0.00
IA & CCA Finish Together	500	18.43	18.43	18.43	0.00
Finish Together	500	8.08	8.08	8.08	0.00

1/1


Summary for CycleTime (Wks) Active EW Run 3 LRTR
ActivityName = End
Anderson-Darling Normality Test
A-Squared 1.71
P-Value < 0.005
Mean 30.194
StDev 9.226
Variance 85.115
Skewness 0.306085
Kurtosis -0.428330
N 500
Minimum 11.015
1st Quartile 23.641
Median 28.954
3rd Quartile 36.883
Maximum 54.400
95% Confidence Interval for Mean
29.383 31.005
95% Confidence Interval for Median
28.303 30.207
95% Confidence Interval for StDev
8.687 9.836
12 18 24 30 36 42 48 54
95% Confidence Intervals
Mean
Median
28.0 28.5 29.0 29.5 30.0 30.5 31.0


Process Capability of CycleTime (Wks) Active EW Run 3 LRTR
LB
Target
USL
Process Data
LB 0
Target 52
USL 78
Sample Mean 30.194
Sample N 500
StDev(Within) 9.32597
StDev(Overall) 9.2258
Within
Overall
Potential (Within) Capability
Cp *
CPL *
CPU 1.71
Cpk 1.71
Overall Capability
Pp *
PPL *
PPU 1.73
Ppk 1.73
Cpm 0.37
0 10 20 30 40 50 60 70
Observed Performance
% < LB 0.00
% > USL 0.00
% Total 0.00
Exp. Within Performance
% < LB *
% > USL 0.00
% Total 0.00
Exp. Overall Performance
% < LB *
% > USL 0.00
% Total 0.00



Probability Plot of CycleTime (Wks) Active EW Run 3 LRTR
Normal
Percent
CycleTime
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
0
10
20
30
40
50
60
Mean 30.19
StDev 9.226
N 500
AD 1.709
P-Value <0.005

RAIN Cost Simulations

Cost of Doing All Certifications
Cost Matrices 1–3
LASER Designator Runs 1 though 3

- Baseline (BL)
- Intermediate Risk Timeline Reduction (IRTR)
- Low Risk Timeline Reduction (LRTR)

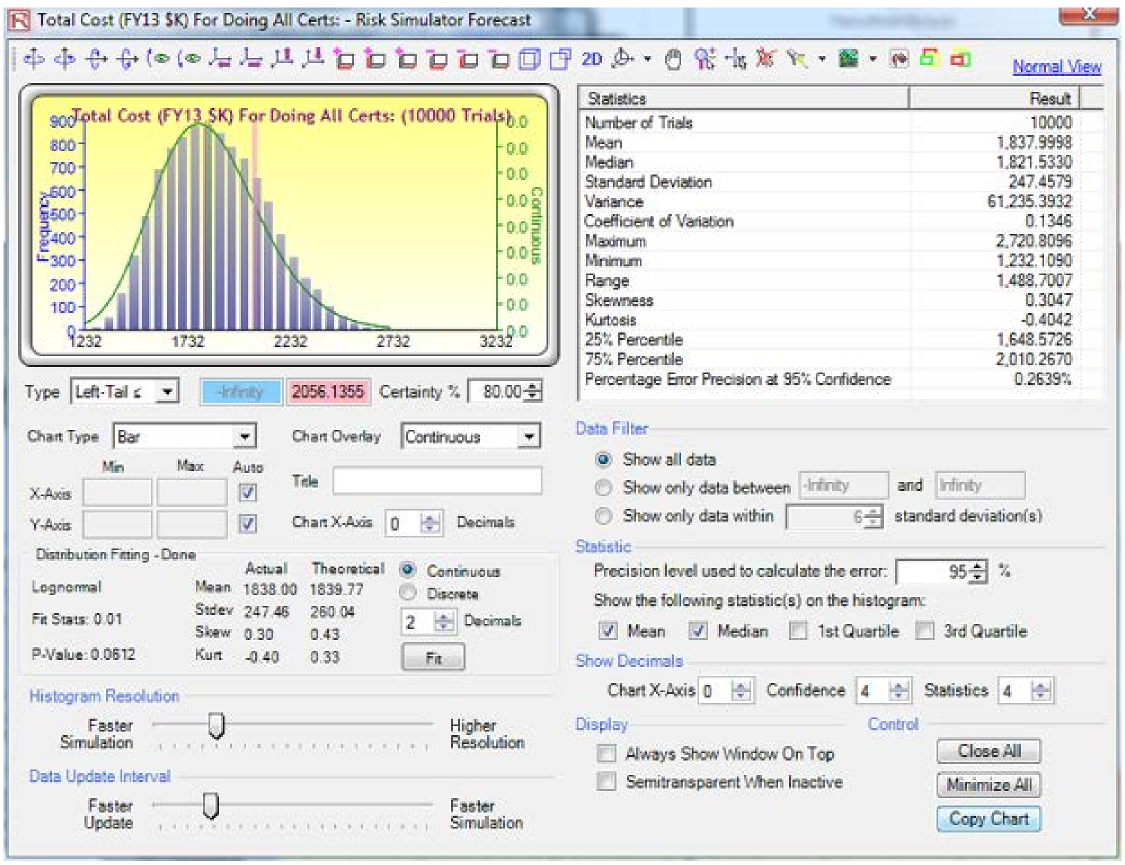
Passive EW Runs 1 though 3

- Baseline (BL)
- Intermediate Risk Timeline Reduction (IRTR)
- Low Risk Timeline Reduction (LRTR)

Active EW Runs 1 though 3

- Baseline (BL)
- Intermediate Risk Timeline Reduction (IRTR)
- Low Risk Timeline Reduction (LRTR)

Cost of Doing All Certifications



Requirements: Level 1	Requirements: Level 2	Cost (FY1K) Low	Cost (FY1K) Med	Cost (FY1K) High
CDL		$0.0	$0.0	$0.0
Flight Cert (IFC)		$0.0	$0.0	$0.0
	Risk Assessment Questionnaire			
	HPOL			
	EDRAP			
	LSRB			
	NOSSA			
	Risks			
E3 (Electromagnetic Environmental Effects)	The requirements for the below E3 items are tailored in the E3 Integration and Analysis Report.	$8.7	$9.2	$10.0
	EMC (Intra-system)	$1.5	$1.6	$1.7
	EMI	$24.0	$25.4	$27.6
	EMP	$12.0	$12.7	$13.8
	EMV (Inter-system EMC)	$294.0	$320.5	$364.6
	ESD	$6.0	$6.4	$6.9
	HERO Testing	$314.0	$342.3	$389.4
	RADHAZ	$2.7	$2.9	$3.1
	HERF Analysis	$6.0	$6.4	$6.9
	HERO Analysis	$6.0	$6.4	$6.9
	HERP Analysis	$6.0	$6.4	$6.9
	Bonding & grounding ???	$6.0	$6.4	$6.9
	Lightning	$80.0	$84.8	$92.0
	P-Static	$6.0	$6.4	$6.9
Environmental Qualification	MIL-STD-810G tests with 24 hour salt fog, Humidity, Temp	$3.0	$5.0	$8.0
LSRB Approval		$0.0	$0.0	$0.0
	Laser radiation hazard evaluation	$10.0	$12.7	$20.0
	Laser design checklist	$0.0	$0.0	$0.0
	FDA mil-exempt letter	$0.0	$0.0	$0.0
	Some Li batteries do not require			

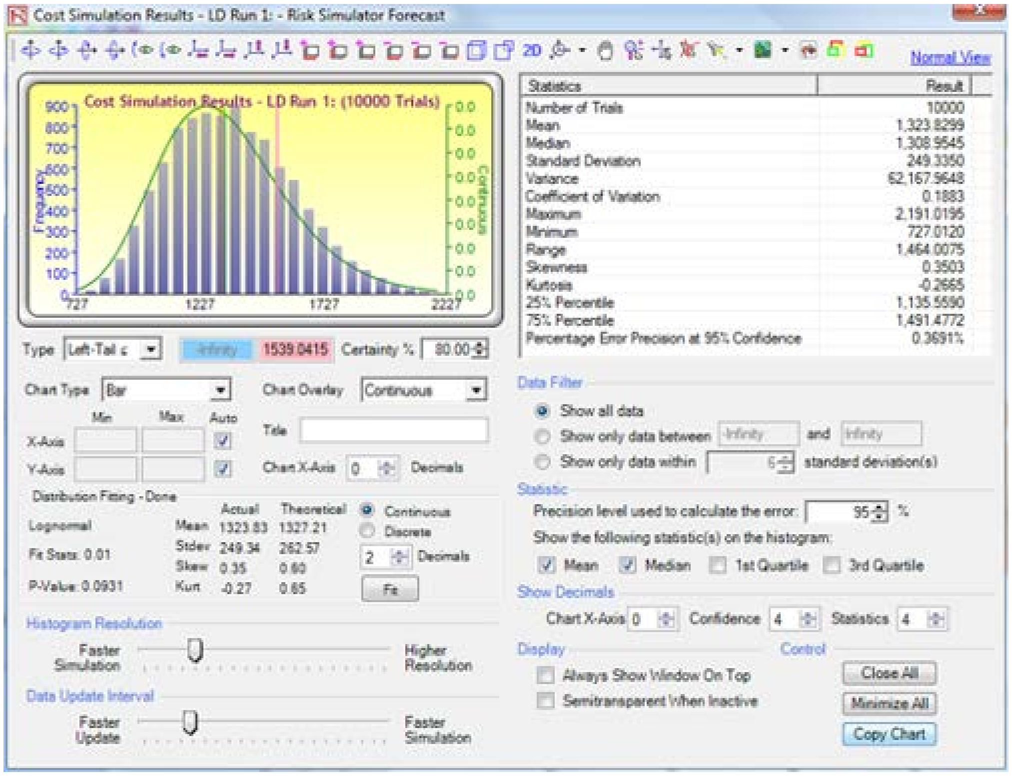
2nd of 3 Cost Run Matrices

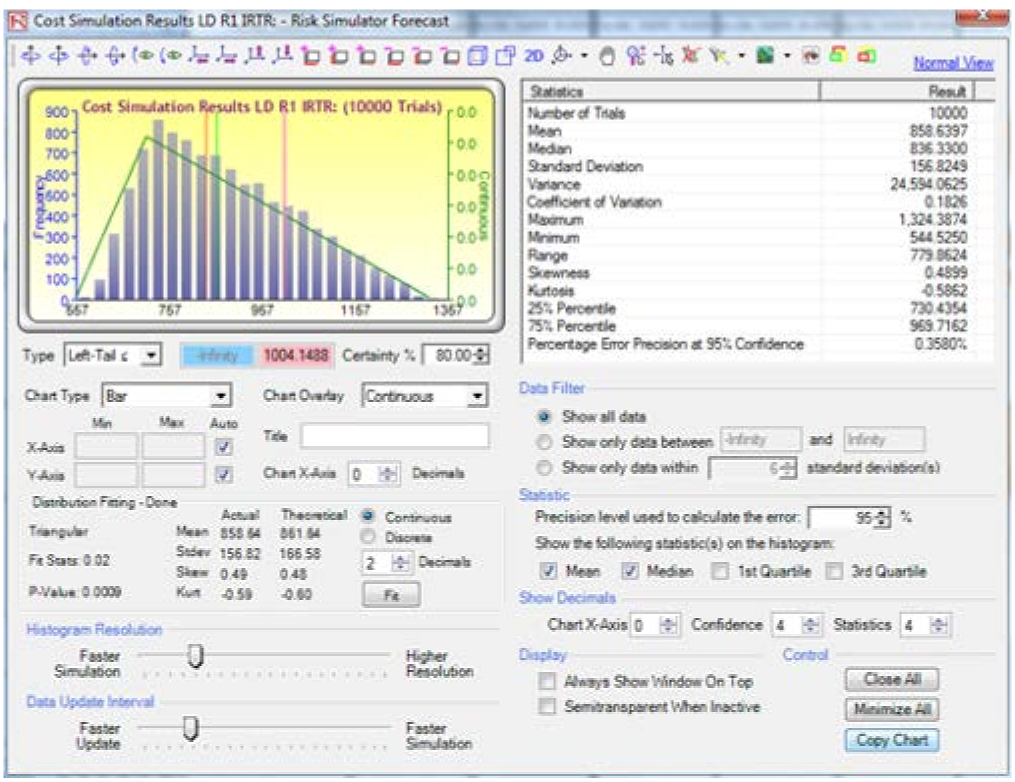
Row	Requirements Level 1	Requirements Level 2	Cost (FY$K) Low	Cost (FY$K) Mid	Cost (FY$K) High
38	Battery Approval	Some Li batteries do not require safety (see NAVSEA S9310-AQ-SAF-010 for details), but a safety assessment must be completed. The NOSSA Technical Agent will determine the level of 9310 safety testing required based on the documentation provided with the approval request.	$3.0	$142.0	$180.0
39		Product spec for battery cell			
40		Battery schematic (cell & control board)			
41		CONOPS			
42		Operator's Manual			
43		Battery safety data package			
44		Request letter			
45	IA (Information Assurance)		$0.0	$0.0	$0.0
46		SCG (Security Classification			
47		System data			
48		CONOPS			
49	AT (Anti-Tamper)		Done as part of T&E, Exp. Evaluation.		
50	CCA (Clinger-Cohen Act)		$6.0	$29.0	$51.0
51					
52					
53	Spectrum		$0.0	$0.0	$0.0
54		1. Equipment Spectrum Certification (Frequency Allocation) 1494 (SPS & JF-12)	$5.0	$10.0	$15.0
55		2. Assignments	$0.0	$0.0	$0.0
56	System Safety Approval		$3.0	$25.0	$50.0

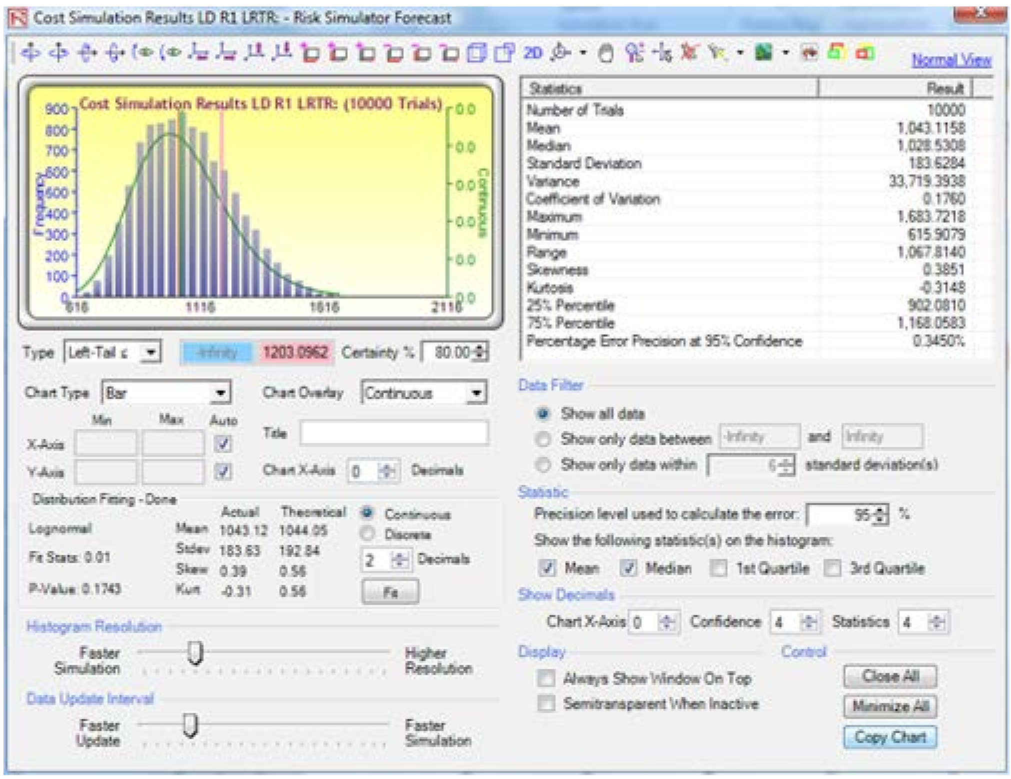
Row	LASER Designator Cost Sim Input									Passive EW Cost Sim Inputs									Active EW Cost Sim Input								
	Run 1 BL	R1 HRTR	R1 LRTR	Run 2 BL	R2 HRTR	R2 LRTR	Run 3 BL	R3 HRTR	R3 LRTR	Run 1 BL	R1 HRTR	R1 LRTR	Run 2 BL	R2 HRTR	R2 LRTR	Run 3 BL	R3 HRTR	R3 LRTR	Run 1 BL	R1 HRTR	R1 LRTR	Run 2 BL	R2 HRTR	R2 LRTR	Run 3 BL	R3 HRTR	R3 LRTR
38											0.5									0.5							
54											0.5	0.25								0.5	0.25		0.5	0.25		0.5	0.25

	A	B	N	O	P	AO	AP	AQ	AR	AS	AT	AU	AV	AW	AX	AY	AZ	BA	BB	BC	BD	BE	BF	BG	BH	BI	BJ	BK	BL	BM	BN	BO	BP
1	Requirements		Cost (FY$K)				LASER Designator Cost Sim Input									Passive EW Cost Sim Inputs									Active EW Cost Sim Input								
2	Level 1	Level 2	Low	Med	High		Run 1 BL	R1HRTR	R1LRTR	Run 2 BL	R2HRTR	R2LRTR	Run 3 BL	R3HRTR	R3LRTR	Run 1 BL	R1HRTR	R1LRTR	Run 2 BL	R2HRTR	R2LRTR	Run 3 BL	R3HRTR	R3LRTR	Run 1 BL	R1HRTR	R1LRTR	Run 2 BL	R2HRTR	R2LRTR	Run 3 BL	R3HRTR	R3LRTR
51																																	
52																																	
53	Spectrum		$0.0	$0.0	$0.0																												
54		1. Equipment Spectrum Certification (Frequency Allocation) 1494 (SPS & JF-12)	$5.0	$10.0	$15.0												0.5	0.25								0.5	0.25		0.5	0.25		0.5	0.25
55		2. Assignments	$0.0	$0.0	$0.0																												
56	System Safety Approval		$3.0	$25.0	$50.0																												
57	T&E	Range Safety Approval	$0.0	$0.0	$0.0																												
58		DT	$100.0	$200.0	$300.0																												
59		OT	$100.0	$300.0	#####				0.5			0.5			0.5			0.5			0.5			0.5			0.5			0.5			0.5
60	WSESRB Approval		$1.5	$2.0	$3.0										4		2	2							4	2	2						
63	JITC		$0.0	$0.0	$0.0																												
64	Selective Availability Anti-Spoofing Module (SAASM)		0	0	0																												
65		Security Approval for SAASM Host Application Equipment (HAE)	0	0	0																												
66		SAASM Design Requirements for HAE. (SAASM Functionalities, including Extended Functions)	$20.0	$25.0	$35.0																												
67			Cost Simulation Results:				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

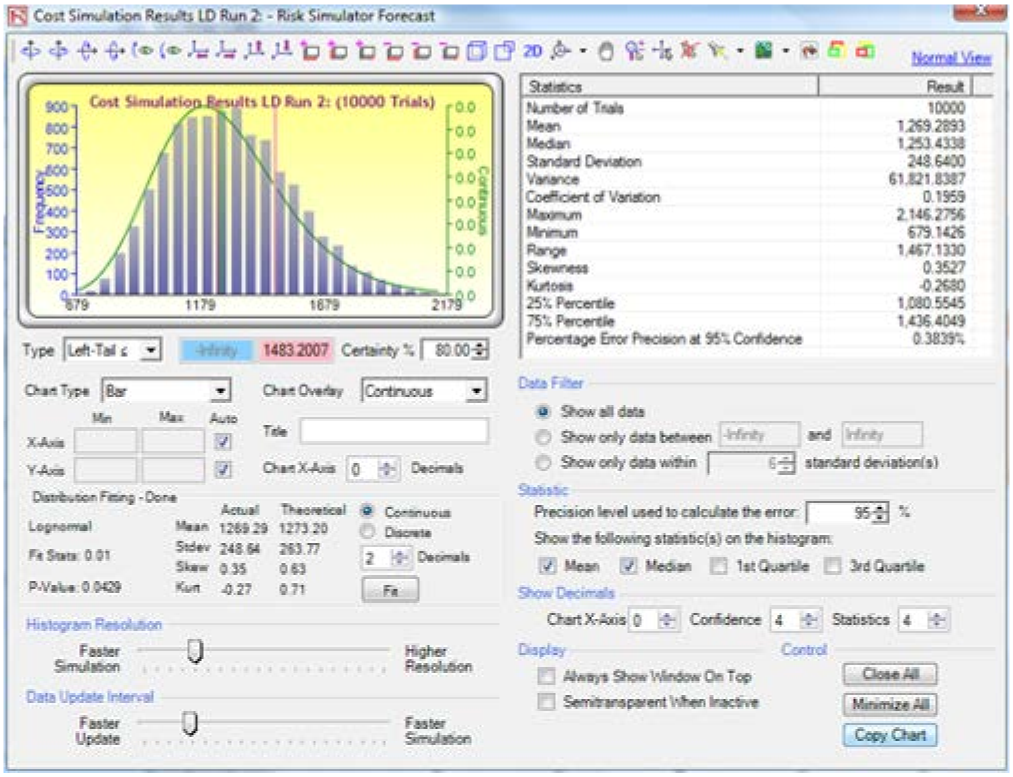
LASER Designator Run 1

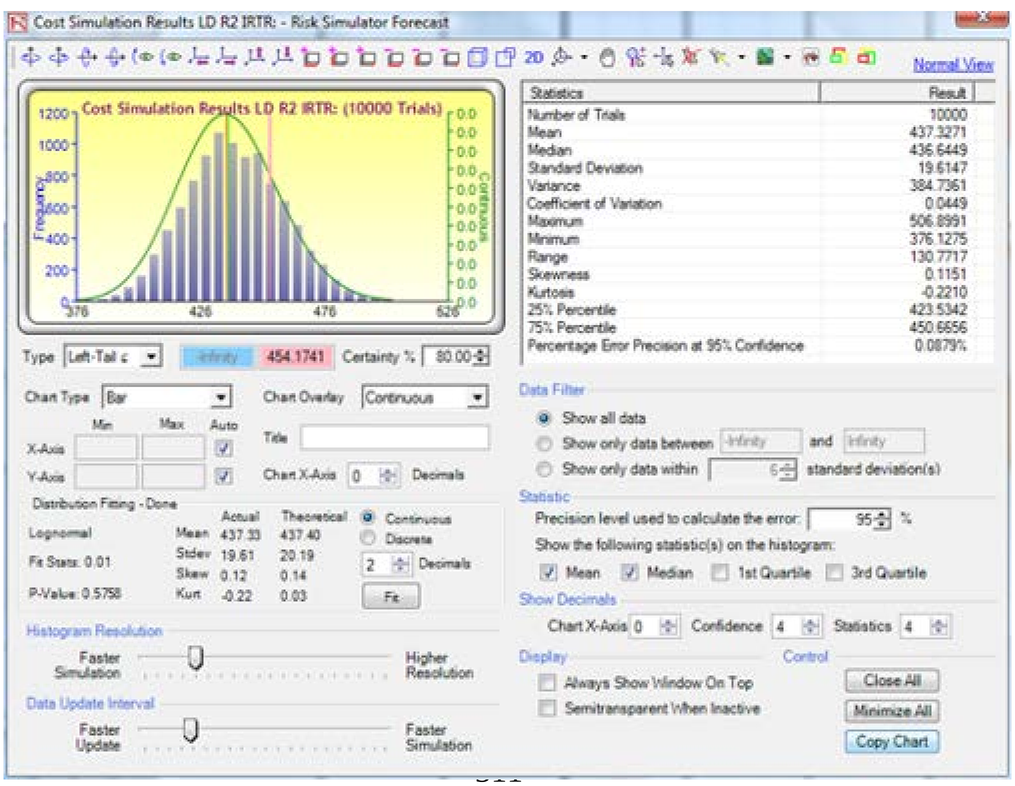


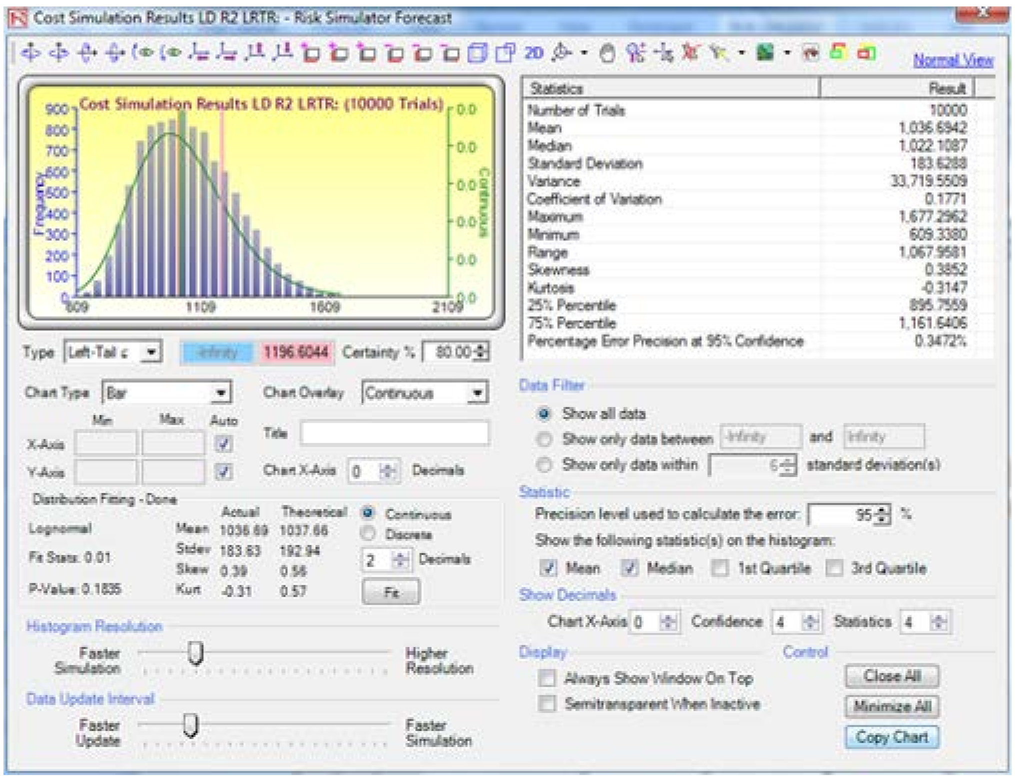



Cost Simulation Results LD R1 LRTR: - Risk Simulator Forecast
Normal View
Cost Simulation Results LD R1 LRTR: (10000 Trials)
Frequency
Continuous
Statistics
Result
Number of Trials
10000
Mean
1,043.1158
Median
1,028.5308
Standard Deviation
183.6284
Variance
33,719.3938
Coefficient of Variation
0.1760
Maximum
1,683.7218
Minimum
615.9079
Range
1,067.8140
Skewness
0.3851
Kurtosis
-0.3148
25% Percentile
902.0810
75% Percentile
1,168.0583
Percentage Error Precision at 95% Confidence
0.3450%
Type
-Infinity
1203.0962
Certainty %
80.00
Chart Type
Bar
Chart Overlay
Continuous
Distribution Fitting - Done
Lognormal
Fit Stats: 0.01
P-Value: 0.1743
Actual
Theoretical
Mean 1043.12 1044.05
Stdev 183.63 192.84
Skew 0.39 0.56
Kurt -0.31 0.56
Histogram Resolution
Data Update Interval
Data Filter
Show all data
Show only data between
and
Show only data within
standard deviation(s)
Statistic
Precision level used to calculate the error:
Show the following statistic(s) on the histogram:
Mean
Median
1st Quartile
3rd Quartile
Show Decimals
Display
Control
Always Show Window On Top
Semitransparent When Inactive
Close All
Minimize All
Copy Chart

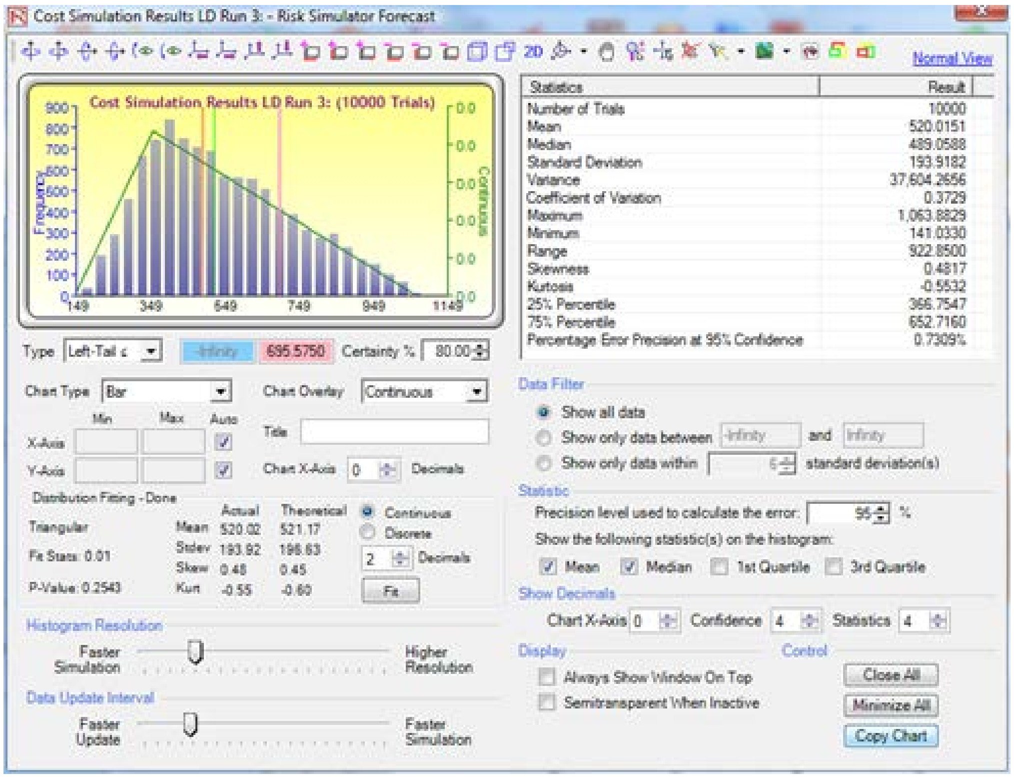
LASER Designator Run 2

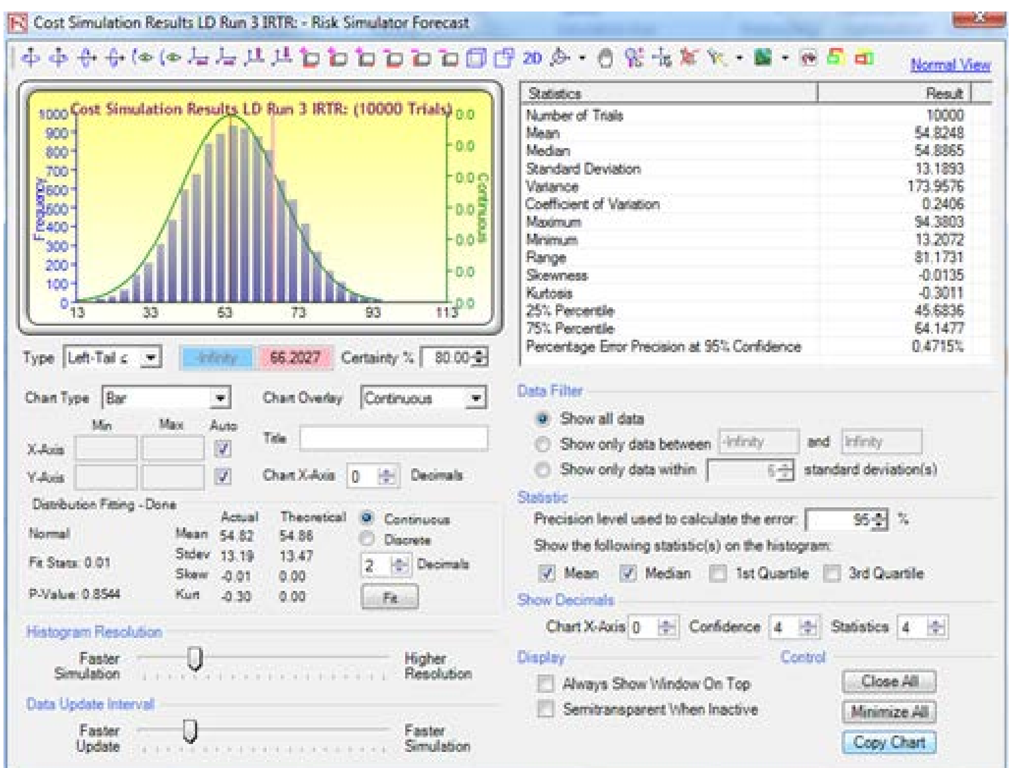


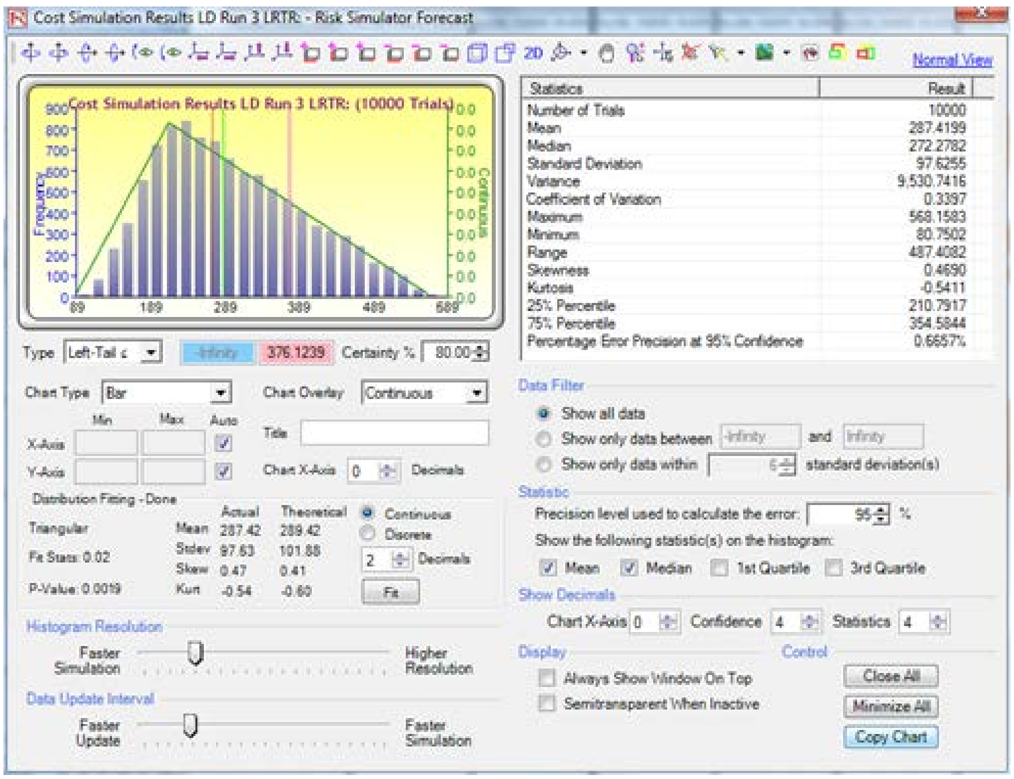



Cost Simulation Results LD R2 LRTR: - Risk Simulator Forecast
Normal View
Cost Simulation Results LD R2 LRTR: (10000 Trials)
Frequency
Continuous
Statistics
Result
Number of Trials
10000
Mean
1,036.6942
Median
1,022.1087
Standard Deviation
183.6288
Variance
33,719.5509
Coefficient of Variation
0.1771
Maximum
1,677.2962
Minimum
609.3380
Range
1,067.9581
Skewness
0.3852
Kurtosis
-0.3147
25% Percentile
895.7559
75% Percentile
1,161.6406
Percentage Error Precision at 95% Confidence
0.3472%
Type
Left-Tail
Infinity
1196.6044
Certainty %
80.00
Chart Type
Bar
Chart Overlay
Continuous
Title
Chart X-Axis
Decimals
Distribution Fitting - Done
Lognormal
Fit Stats: 0.01
P-Value: 0.1835
Actual
Theoretical
Mean 1036.69 1037.66
Stdev 183.63 192.94
Skew 0.39 0.56
Kurt -0.31 0.57
Continuous
Discrete
Fit
Histogram Resolution
Faster Simulation
Higher Resolution
Data Update Interval
Faster Update
Faster Simulation
Data Filter
Show all data
Show only data between
and
Show only data within
standard deviation(s)
Statistic
Precision level used to calculate the error:
Show the following statistic(s) on the histogram:
Mean
Median
1st Quartile
3rd Quartile
Show Decimals
Chart X-Axis
Confidence
Statistics
Display
Control
Always Show Window On Top
Semitransparent When Inactive
Close All
Minimize All
Copy Chart

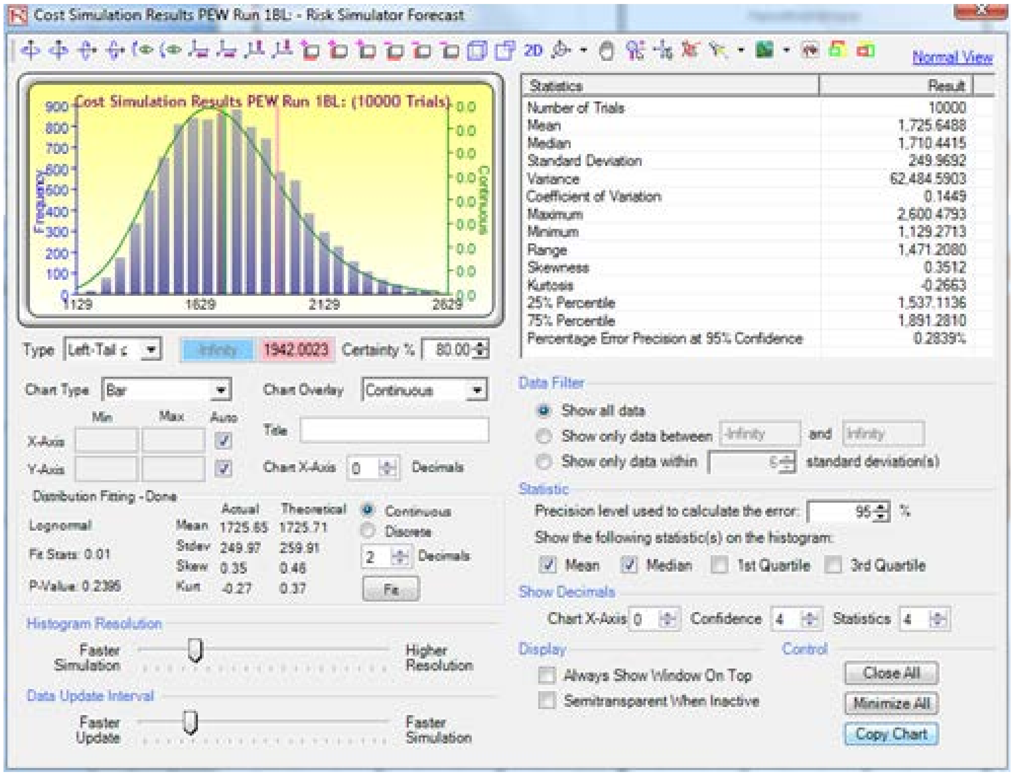
LASER Designator Run 3

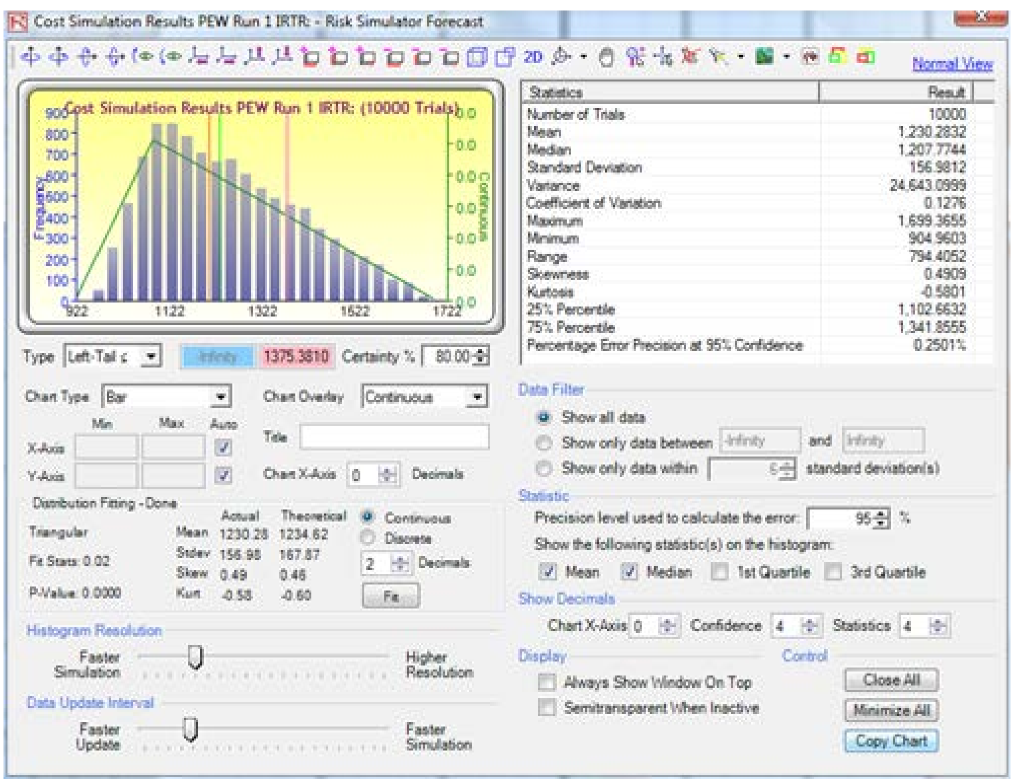


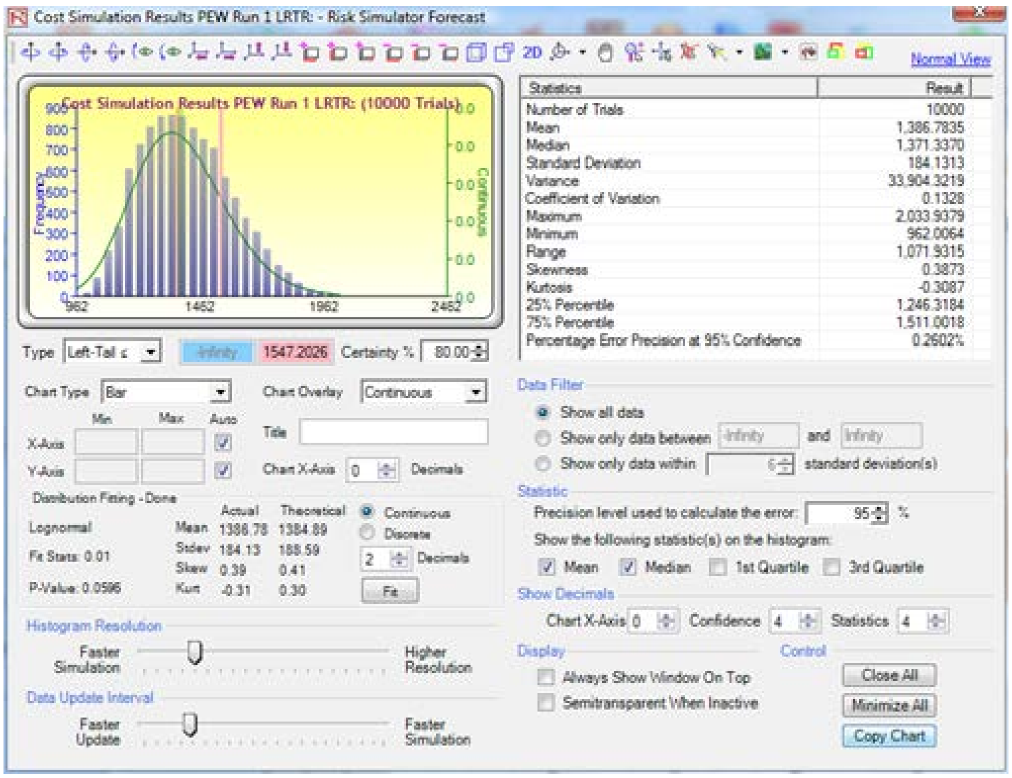



Cost Simulation Results LD Run 3 LRTR: - Risk Simulator Forecast
Normal View
Cost Simulation Results LD Run 3 LRTR: (10000 Trials)
Frequency
Continuous
Type Left-Tail
-Infinity
376.1239
Certainty % 80.00
Statistics Result
Number of Trials 10000
Mean 287.4199
Median 272.2782
Standard Deviation 97.6255
Variance 9,530.7416
Coefficient of Variation 0.3397
Maximum 568.1583
Minimum 80.7502
Range 487.4082
Skewness 0.4690
Kurtosis -0.5411
25% Percentile 210.7917
75% Percentile 354.5844
Percentage Error Precision at 95% Confidence 0.6657%
Chart Type Bar
Chart Overlay Continuous
Distribution Fitting - Done
Triangular
Fit Stats: 0.02
P-Value: 0.0019
Actual Theoretical
Mean 287.42 289.42
Stdev 97.63 101.88
Skew 0.47 0.41
Kurt -0.54 -0.60
Data Filter
Show all data
Show only data between -Infinity and Infinity
Show only data within 6 standard deviation(s)
Statistic
Precision level used to calculate the error: 95 %
Show the following statistic(s) on the histogram:
Mean Median 1st Quartile 3rd Quartile
Show Decimals
Chart X-Axis 0 Confidence 4 Statistics 4
Histogram Resolution
Faster Simulation
Higher Resolution
Data Update Interval
Faster Update
Faster Simulation
Display
Always Show Window On Top
Semitransparent When Inactive
Control
Close All
Minimize All
Copy Chart

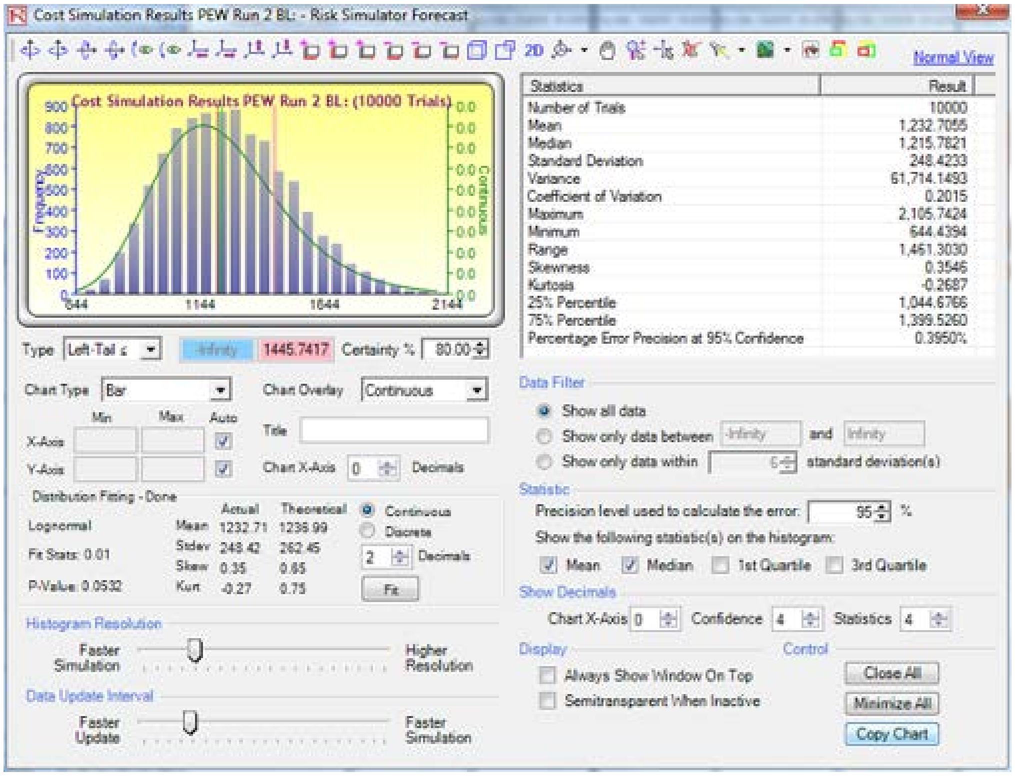
Passive EW Run 1

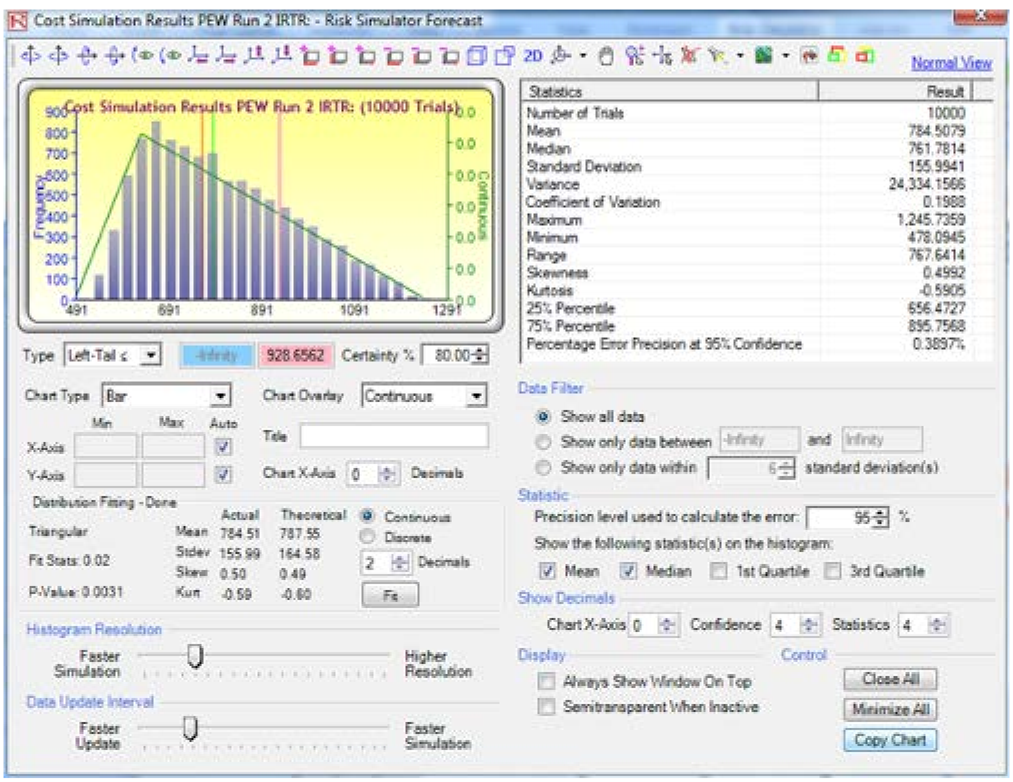


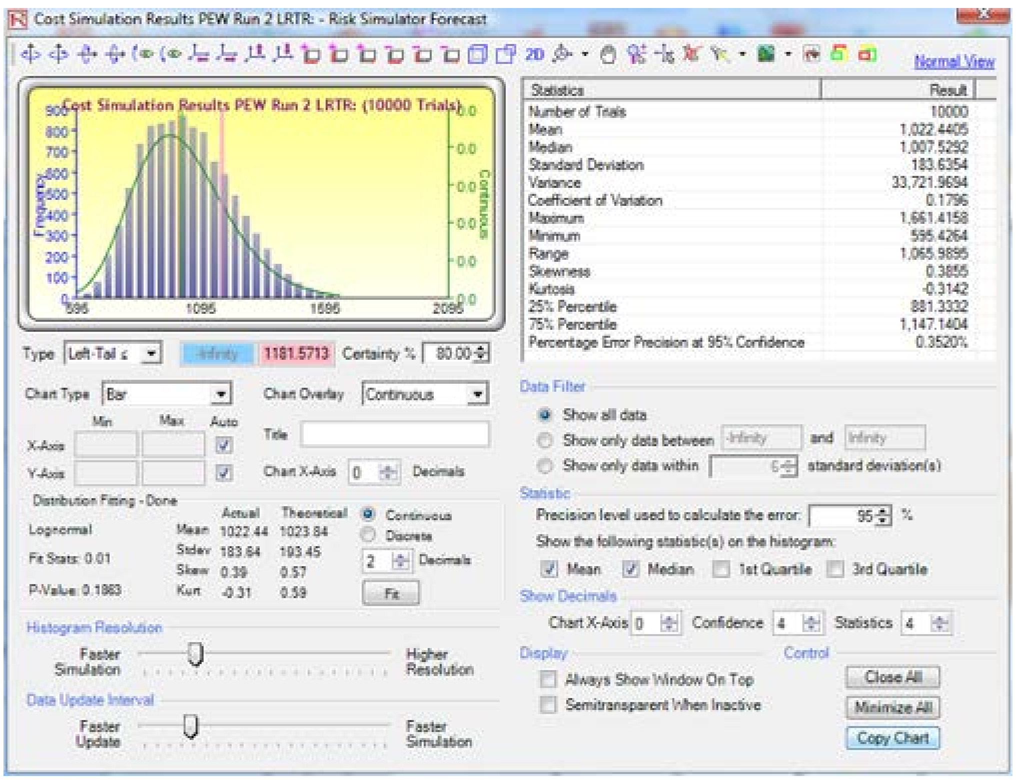



Cost Simulation Results PEW Run 1 LRTR: - Risk Simulator Forecast
Normal View
Cost Simulation Results PEW Run 1 LRTR: (10000 Trials)
Frequency
Continuous
962
1462
1962
2462
Statistics
Result
Number of Trials
10000
Mean
1,386.7835
Median
1,371.3370
Standard Deviation
184.1313
Variance
33,904.3219
Coefficient of Variation
0.1328
Maximum
2,033.9379
Minimum
962.0064
Range
1,071.9315
Skewness
0.3873
Kurtosis
-0.3087
25% Percentile
1,246.3184
75% Percentile
1,511.0018
Percentage Error Precision at 95% Confidence
0.2602%
Type Left-Tail ≤
-Infinity
1547.2026
Certainty % 80.00
Chart Type Bar
Chart Overlay Continuous
Title
Chart X-Axis 0 Decimals
Distribution Fitting - Done
Lognormal
Fit Stats: 0.01
P-Value: 0.0596
Actual Theoretical
Mean 1386.78 1384.89
Stdev 184.13 188.59
Skew 0.39 0.41
Kurt -0.31 0.30
Continuous
Discrete
2 Decimals
Fit
Histogram Resolution
Faster Simulation
Higher Resolution
Data Update Interval
Faster Update
Faster Simulation
Data Filter
Show all data
Show only data between -Infinity and Infinity
Show only data within 6 standard deviation(s)
Statistic
Precision level used to calculate the error: 95 %
Show the following statistic(s) on the histogram:
Mean
Median
1st Quartile
3rd Quartile
Show Decimals
Chart X-Axis 0
Confidence 4
Statistics 4
Display
Always Show Window On Top
Semitransparent When Inactive
Control
Close All
Minimize All
Copy Chart

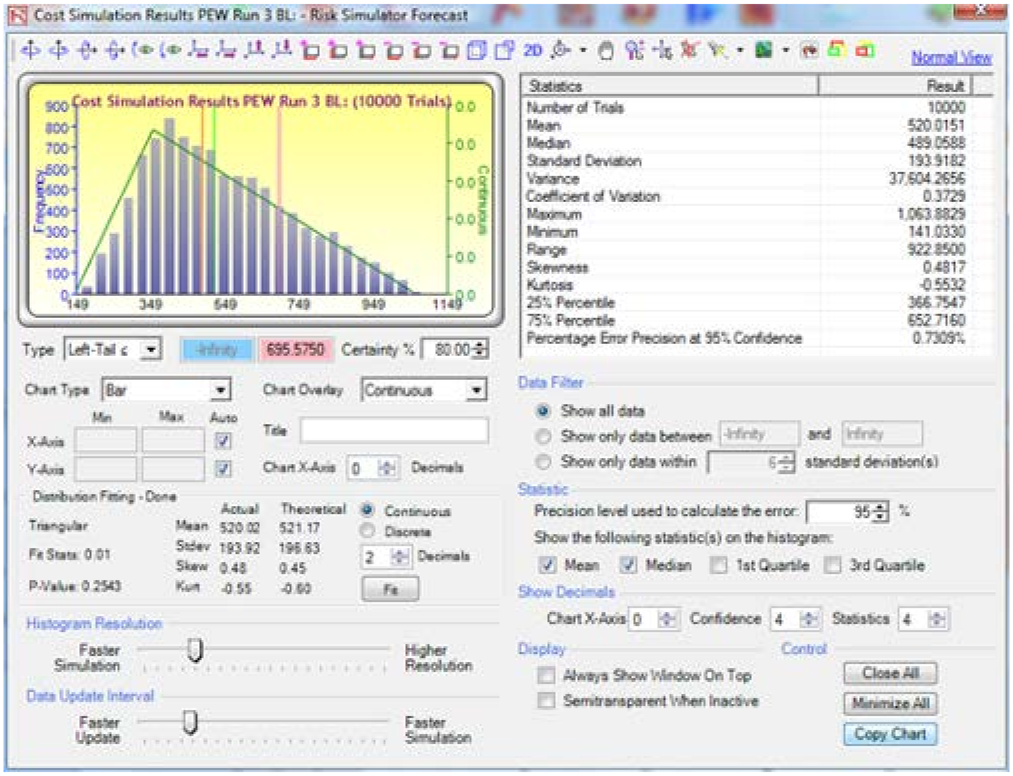
Passive EW Run 2

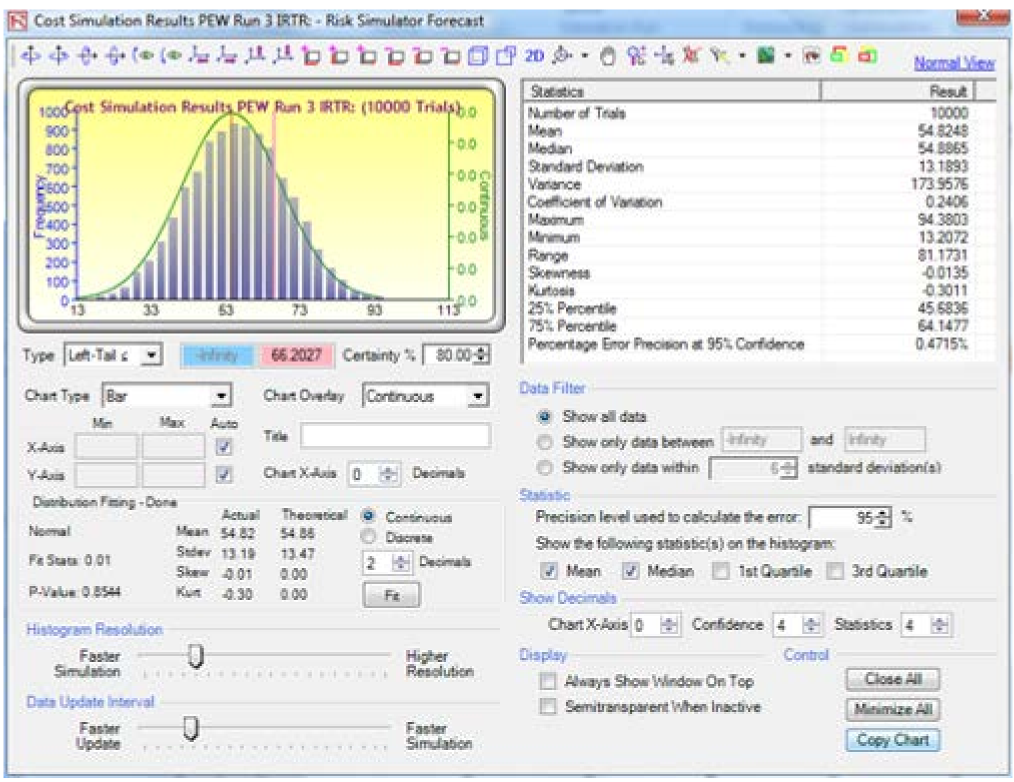


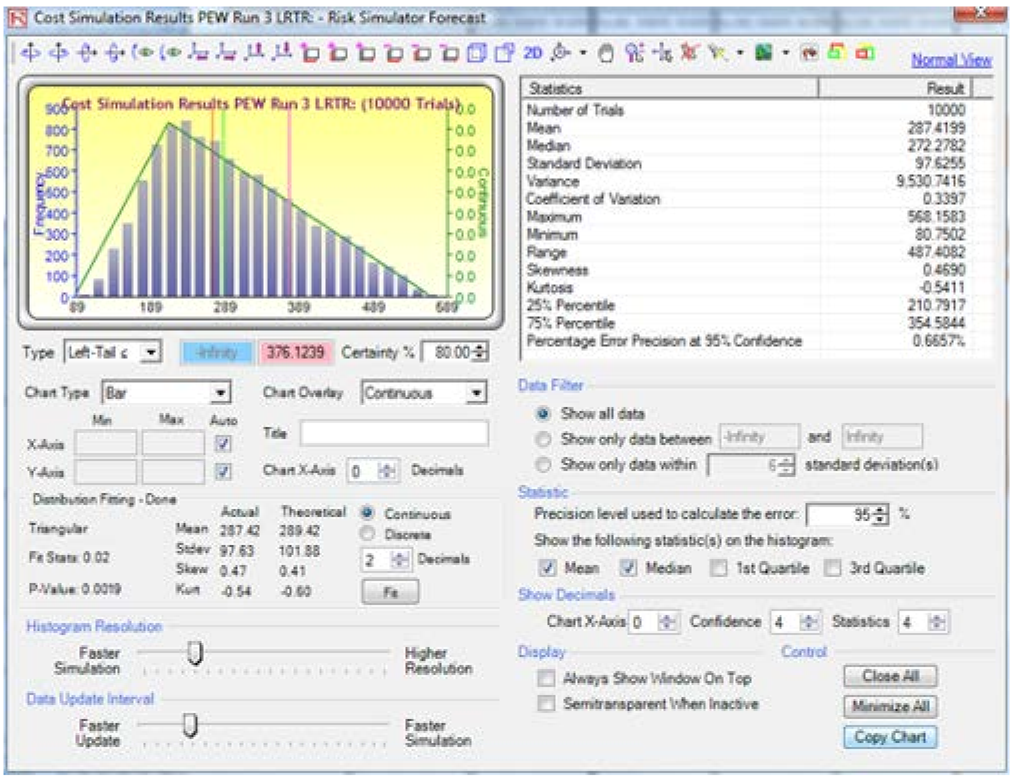



Cost Simulation Results PEW Run 2 LRTR: - Risk Simulator Forecast
Normal View
Cost Simulation Results PEW Run 2 LRTR: (10000 Trials)
Frequency
Continuous
Statistics
Result
Number of Trials 10000
Mean 1,022.4405
Median 1,007.5292
Standard Deviation 183.6354
Variance 33,721.9694
Coefficient of Variation 0.1796
Maximum 1,661.4158
Minimum 595.4264
Range 1,065.9895
Skewness 0.3855
Kurtosis -0.3142
25% Percentile 881.3332
75% Percentile 1,147.1404
Percentage Error Precision at 95% Confidence 0.3520%
Type Left-Tail ≤ -Infinity 1181.5713 Certainty % 80.00
Chart Type Bar
Chart Overlay Continuous
Data Filter
Show all data
Show only data between -Infinity and Infinity
Show only data within 6 standard deviation(s)
Distribution Fitting - Done
Lognormal
Fit Stats: 0.01
P-Value: 0.1863
Actual Theoretical
Mean 1022.44 1023.84
Stdev 183.64 193.45
Skew 0.39 0.57
Kurt -0.31 0.59
Continuous
Discrete
Decimals
Fit
Statistic
Precision level used to calculate the error: 95 %
Show the following statistic(s) on the histogram:
Mean Median 1st Quartile 3rd Quartile
Histogram Resolution
Faster Simulation
Higher Resolution
Show Decimals
Chart X-Axis 0 Confidence 4 Statistics 4
Display
Always Show Window On Top
Semitransparent When Inactive
Control
Close All
Minimize All
Copy Chart
Data Update Interval
Faster Update
Faster Simulation

Passive EW Run 3

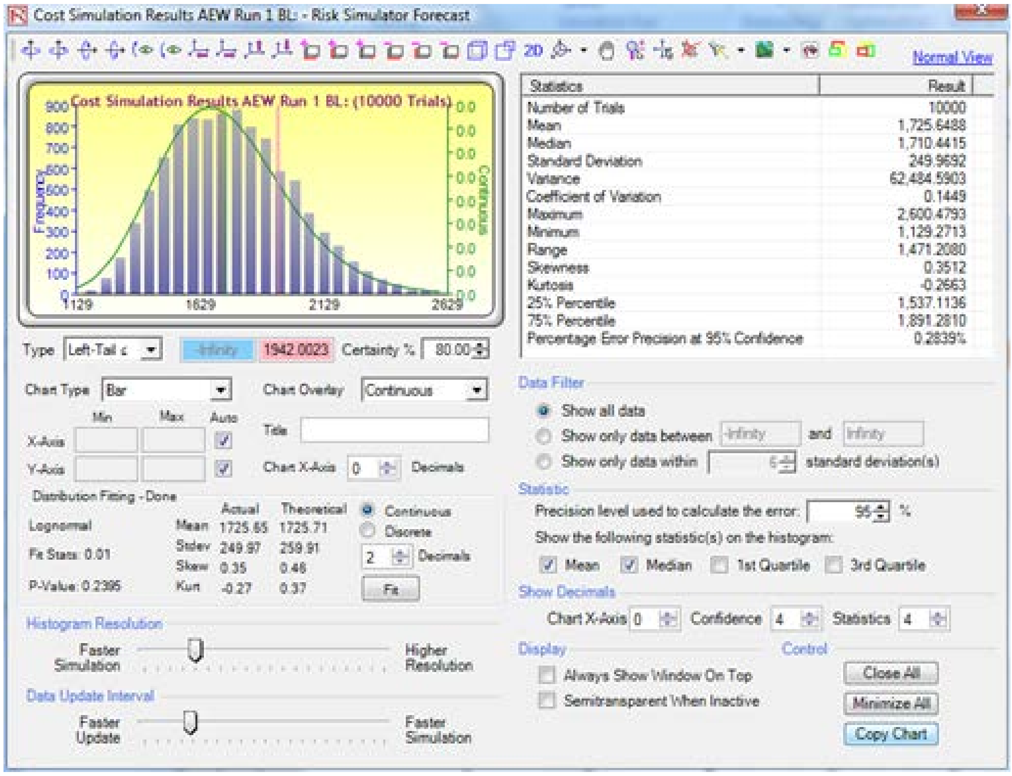


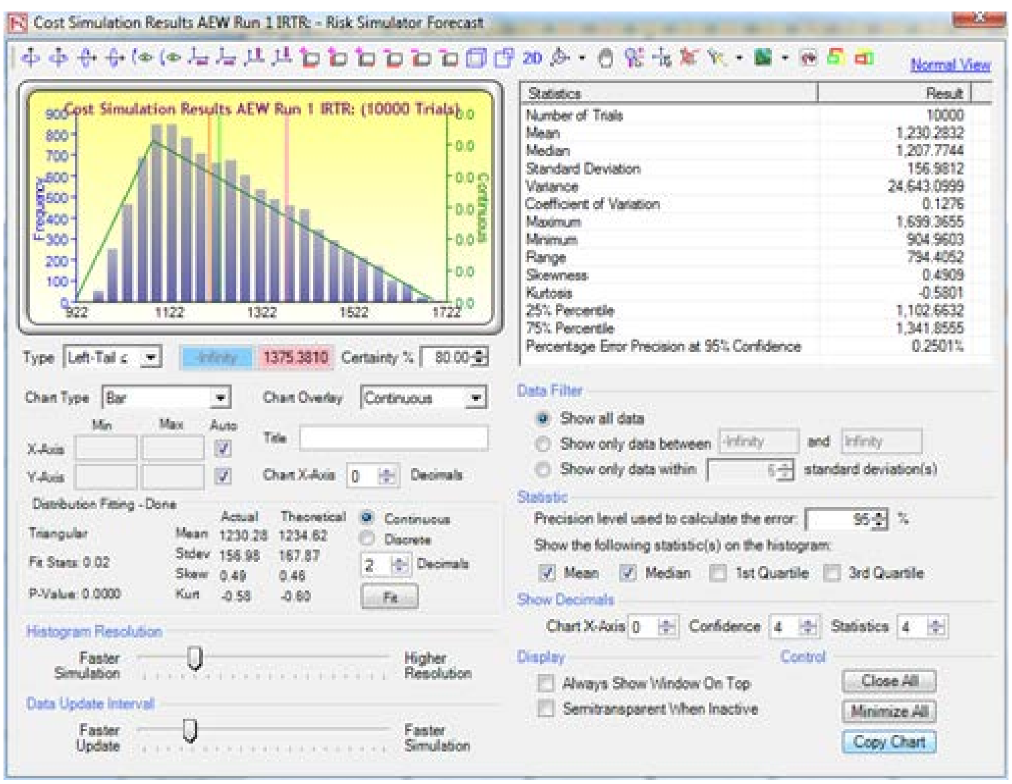


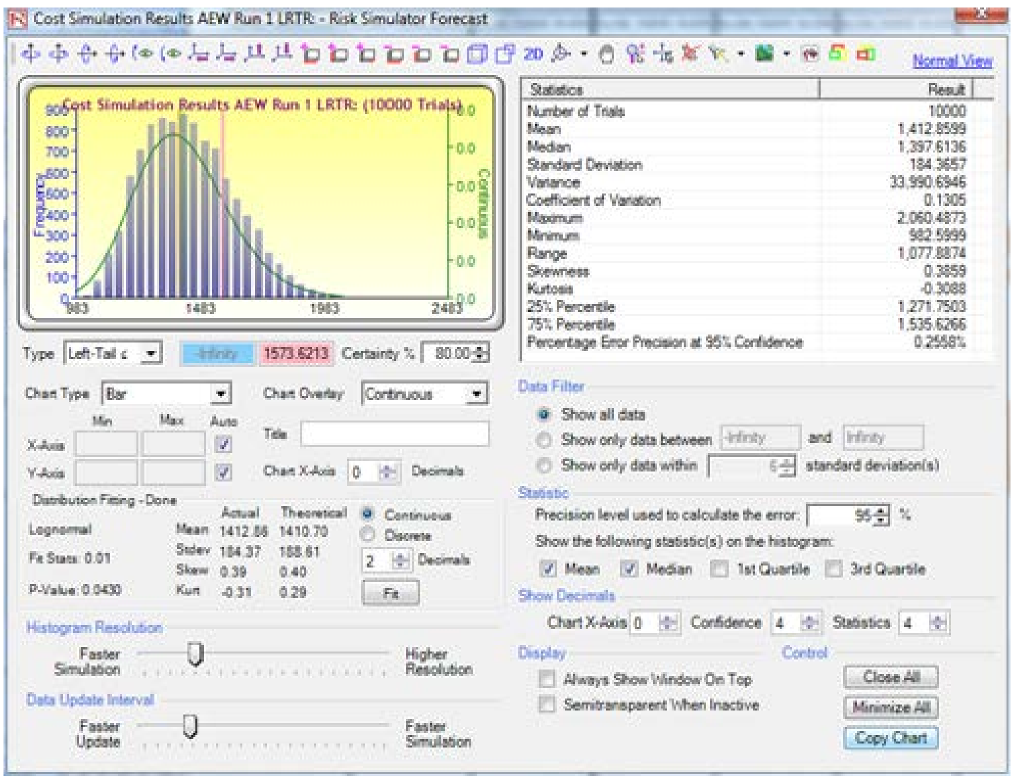


Cost Simulation Results PEW Run 3 LRTR: - Risk Simulator Forecast
Normal View
Cost Simulation Results PEW Run 3 LRTR: (10000 Trials)
Frequency
Continuous
Statistics | Result
Number of Trials 10000
Mean 287.4199
Median 272.2782
Standard Deviation 97.6255
Variance 9,530.7416
Coefficient of Variation 0.3397
Maximum 568.1583
Minimum 80.7502
Range 487.4082
Skewness 0.4690
Kurtosis -0.5411
25% Percentile 210.7917
75% Percentile 354.5844
Percentage Error Precision at 95% Confidence 0.6657%
Type Left-Tail ≤ -Infinity 376.1239 Certainty % 80.00
Chart Type Bar
Chart Overlay Continuous
Title
Chart X-Axis 0 Decimals
Distribution Fitting - Done
Triangular
Fit Stats: 0.02
P-Value: 0.0019
Actual Theoretical
Mean 287.42 289.42
Stdev 97.63 101.88
Skew 0.47 0.41
Kurt -0.54 -0.60
Continuous
Discrete
2 Decimals
Fit
Histogram Resolution
Faster Simulation
Higher Resolution
Data Update Interval
Faster Update
Faster Simulation
Data Filter
Show all data
Show only data between -Infinity and Infinity
Show only data within 6 standard deviation(s)
Statistic
Precision level used to calculate the error: 95 %
Show the following statistic(s) on the histogram:
Mean Median 1st Quartile 3rd Quartile
Show Decimals
Chart X-Axis 0 Confidence 4 Statistics 4
Display
Always Show Window On Top
Semitransparent When Inactive
Control
Close All
Minimize All
Copy Chart

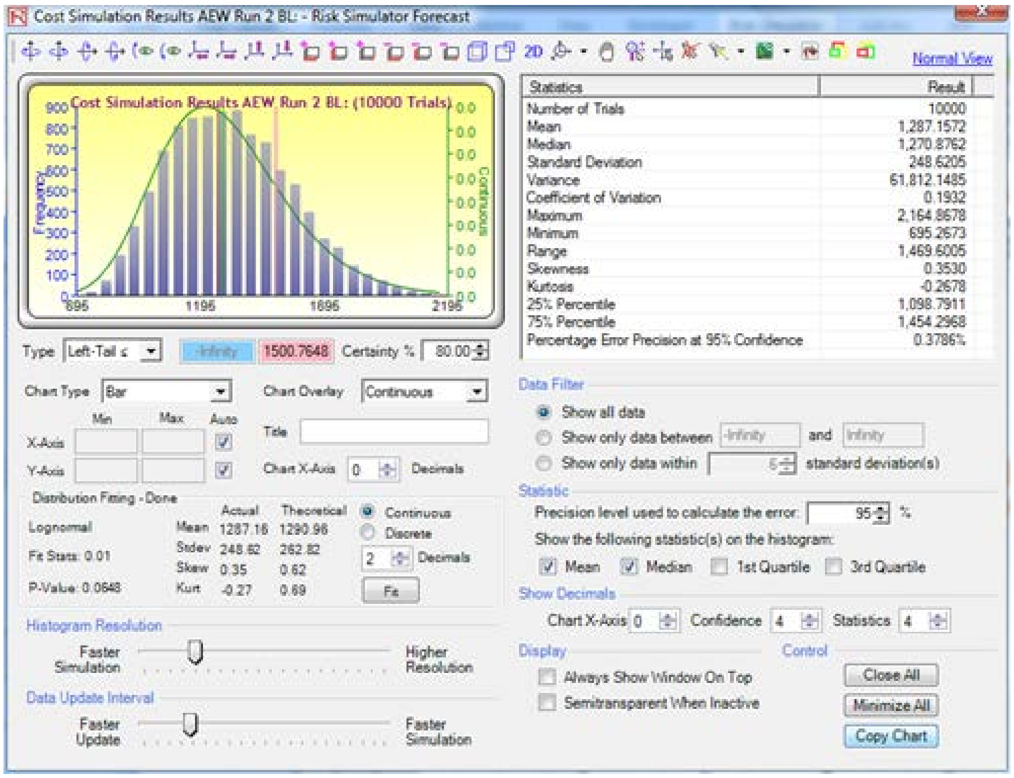
Active EW Run 1

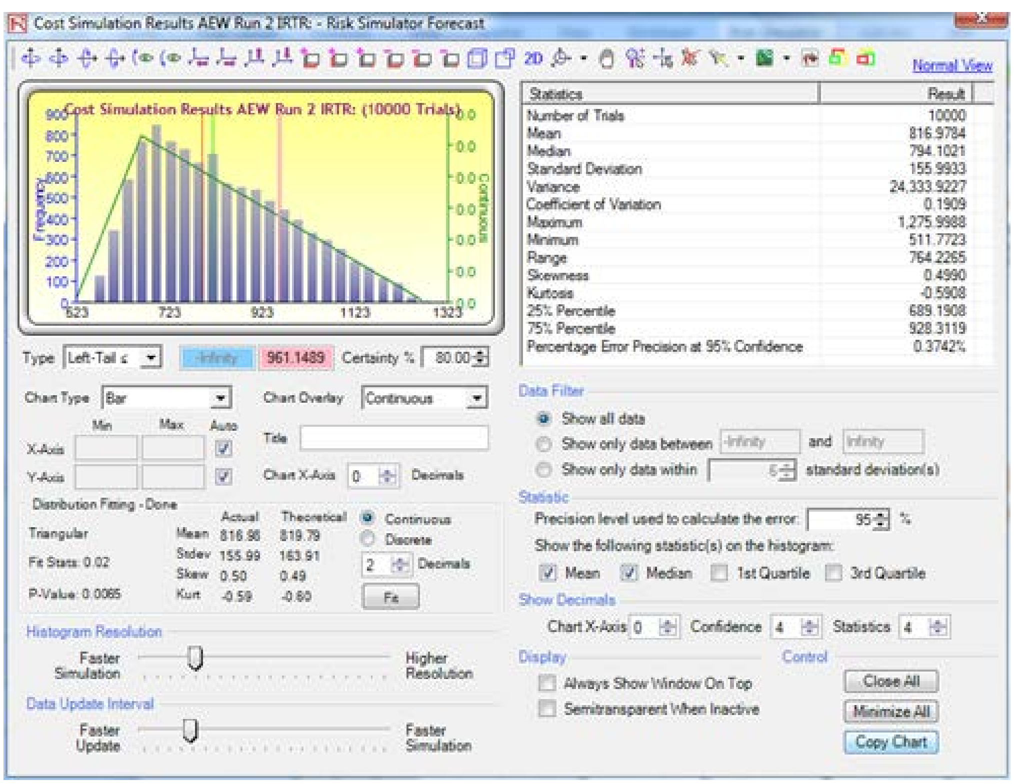


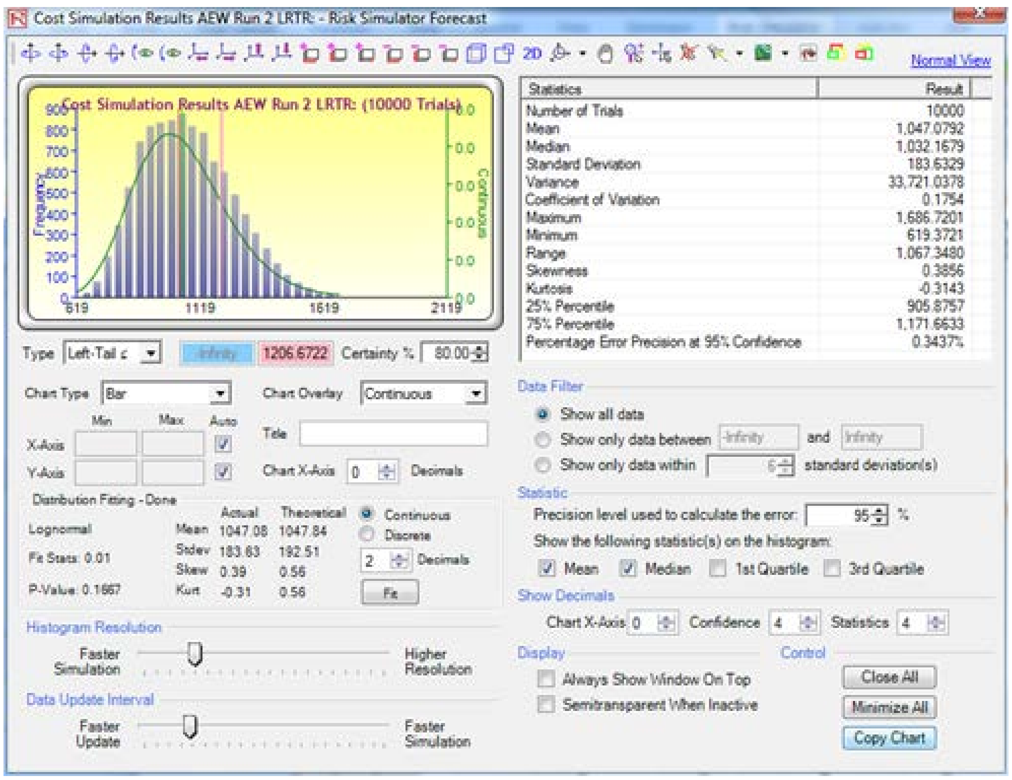



Cost Simulation Results AEW Run 1 LRTR: - Risk Simulator Forecast
Normal View
Cost Simulation Results AEW Run 1 LRTR: (10000 Trials)
Frequency
Continuous
983
1483
1983
2483
Statistics
Result
Number of Trials
10000
Mean
1,412.8599
Median
1,397.6136
Standard Deviation
184.3657
Variance
33,990.6946
Coefficient of Variation
0.1305
Maximum
2,060.4873
Minimum
982.5999
Range
1,077.8874
Skewness
0.3859
Kurtosis
-0.3088
25% Percentile
1,271.7503
75% Percentile
1,535.6266
Percentage Error Precision at 95% Confidence
0.2558%
Type
Left-Tail
-Infinity
1573.6213
Certainty %
80.00
Chart Type
Bar
Chart Overlay
Continuous
Min
Max
Auto
Title
X-Axis
Y-Axis
Chart X-Axis
Decimals
Distribution Fitting - Done
Actual
Theoretical
Continuous
Discrete
Lognormal
Mean 1412.86 1410.70
Stdev 184.37 188.61
Skew 0.39 0.40
Kurt -0.31 0.29
Fit Stats: 0.01
P-Value: 0.0430
Decimals
Fit
Histogram Resolution
Faster Simulation
Higher Resolution
Data Update Interval
Faster Update
Faster Simulation
Data Filter
Show all data
Show only data between
and
Show only data within
standard deviation(s)
Statistic
Precision level used to calculate the error:
95
%
Show the following statistic(s) on the histogram:
Mean
Median
1st Quartile
3rd Quartile
Show Decimals
Chart X-Axis
Confidence
Statistics
Display
Control
Always Show Window On Top
Semitransparent When Inactive
Close All
Minimize All
Copy Chart

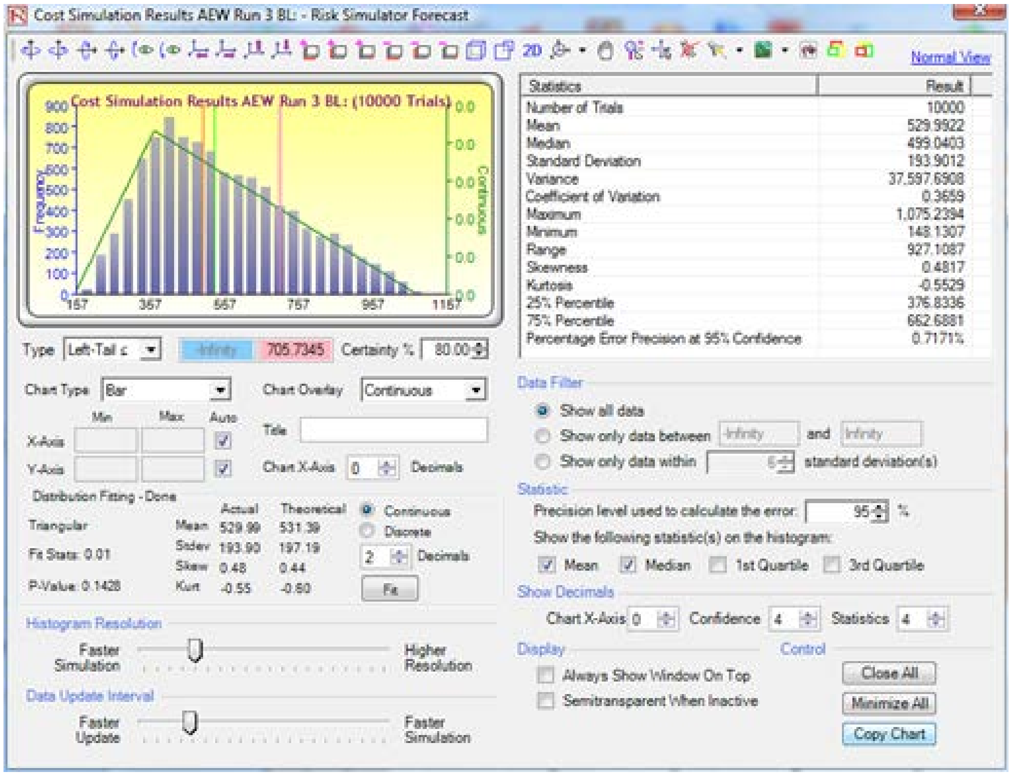
Active EW Run 2

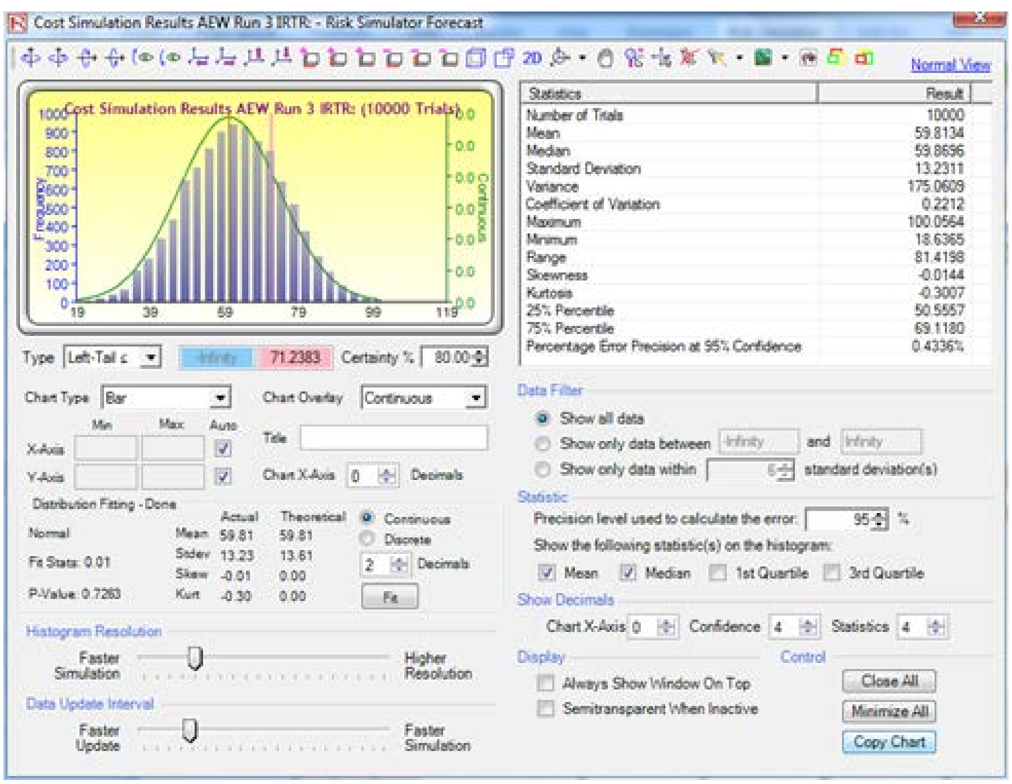


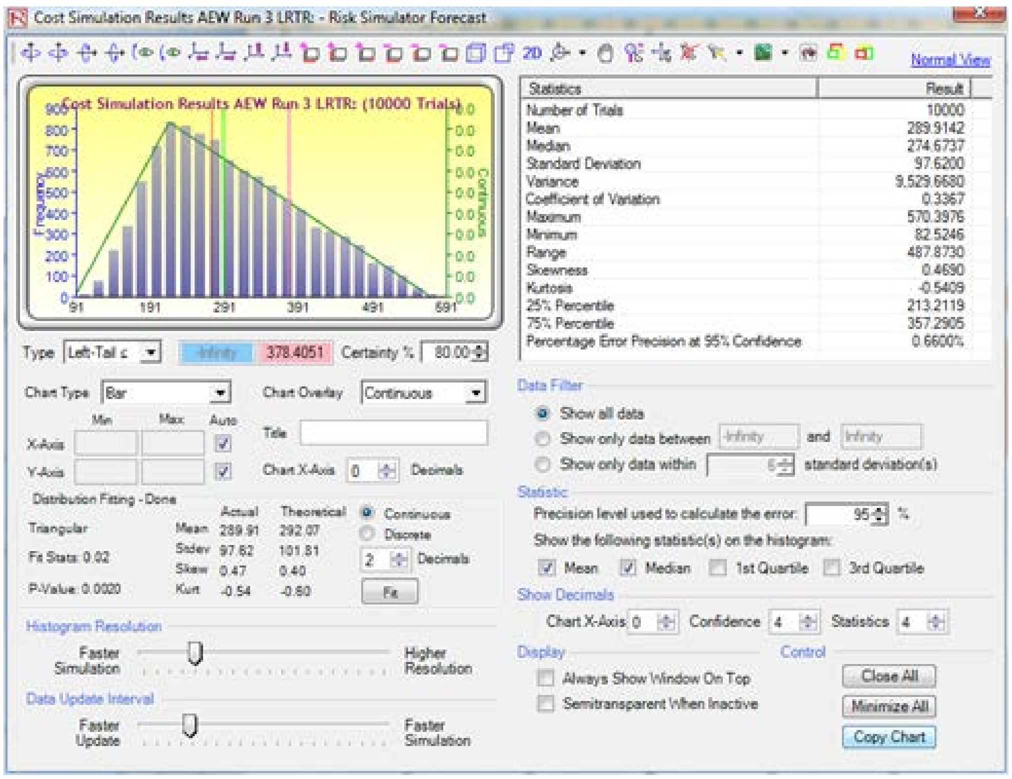



Cost Simulation Results AEW Run 2 LRTR: - Risk Simulator Forecast
Normal View
Cost Simulation Results AEW Run 2 LRTR: (10000 Trials)
Frequency
Continuous
619
1119
1619
2119
Statistics
Result
Number of Trials 10000
Mean 1,047.0792
Median 1,032.1679
Standard Deviation 183.6329
Variance 33,721.0378
Coefficient of Variation 0.1754
Maximum 1,686.7201
Minimum 619.3721
Range 1,067.3480
Skewness 0.3856
Kurtosis -0.3143
25% Percentile 905.8757
75% Percentile 1,171.6633
Percentage Error Precision at 95% Confidence 0.3437%
Type Left-Tail
-Infinity
1206.6722
Certainty % 80.00
Chart Type Bar
Chart Overlay Continuous
Distribution Fitting - Done
Lognormal
Actual Theoretical
Mean 1047.08 1047.84
Stdev 183.63 192.51
Skew 0.39 0.56
Kurt -0.31 0.56
Fit Stats: 0.01
P-Value: 0.1667
Continuous
Discrete
Decimals
Fit
Histogram Resolution
Faster Simulation
Higher Resolution
Data Update Interval
Faster Update
Faster Simulation
Data Filter
Show all data
Show only data between
and
Show only data within
standard deviation(s)
Statistic
Precision level used to calculate the error: 95 %
Show the following statistic(s) on the histogram:
Mean
Median
1st Quartile
3rd Quartile
Show Decimals
Chart X-Axis 0
Confidence 4
Statistics 4
Display
Always Show Window On Top
Semitransparent When Inactive
Control
Close All
Minimize All
Copy Chart

Active EW Run 3







Cost Simulation Results AEW Run 3 LRTR: - Risk Simulator Forecast
Normal View
Cost Simulation Results AEW Run 3 LRTR: (10000 Trials)
Frequency
Continuous
Statistics
Result
Number of Trials 10000
Mean 289.9142
Median 274.6737
Standard Deviation 97.6200
Variance 9,529.6680
Coefficient of Variation 0.3367
Maximum 570.3976
Minimum 82.5246
Range 487.8730
Skewness 0.4690
Kurtosis -0.5409
25% Percentile 213.2119
75% Percentile 357.2905
Percentage Error Precision at 95% Confidence 0.6600%
Type Left-Tail
-Infinity 378.4051 Certainty % 80.00
Chart Type Bar
Chart Overlay Continuous
Distribution Fitting - Done
Triangular
Fit Stats: 0.02
P-Value: 0.0020
Actual Theoretical
Mean 289.91 292.07
Stdev 97.62 101.81
Skew 0.47 0.40
Kurt -0.54 -0.60
Data Filter
Show all data
Statistic
Precision level used to calculate the error: 95 %
Histogram Resolution
Data Update Interval
Show Decimals
Display
Control
Close All
Minimize All
Copy Chart

APPENDIX G. RISK ASSESSMENT

Risk Simulation Runs

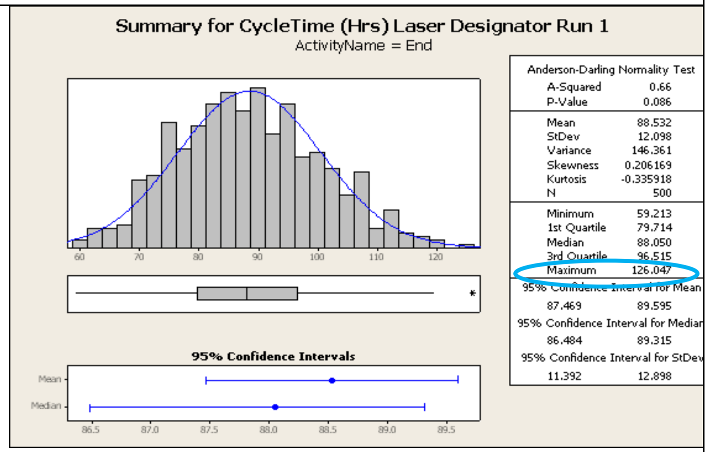
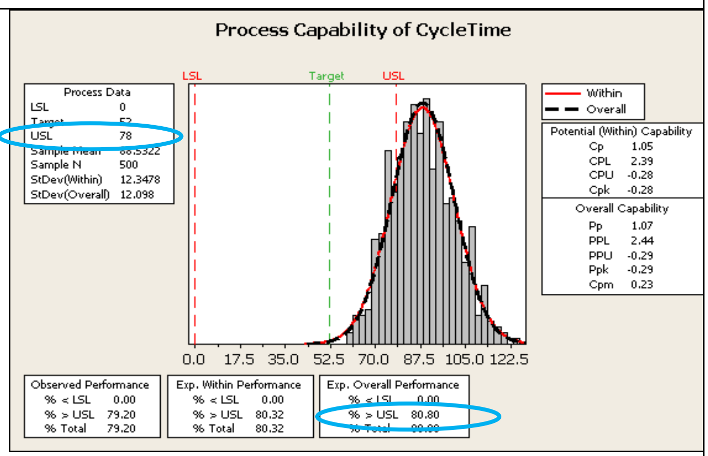
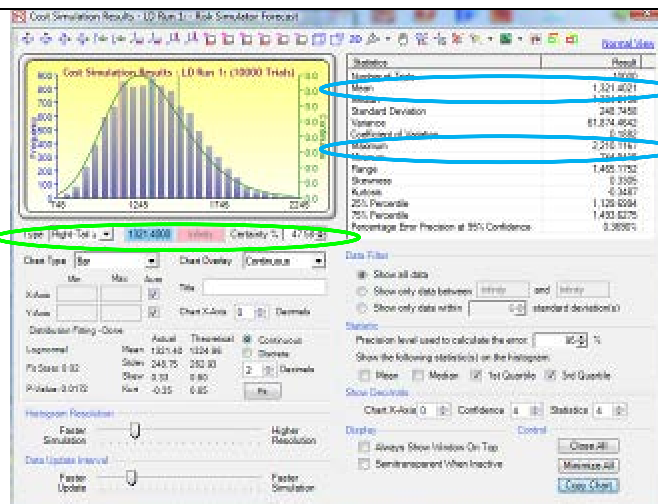
Risk Definitions
Schedule Risk
Impact = Max number of weeks that the simulation predicts the schedule to exceed 78 weeks.
Likelihood = % chance of exceeding 78 weeks.

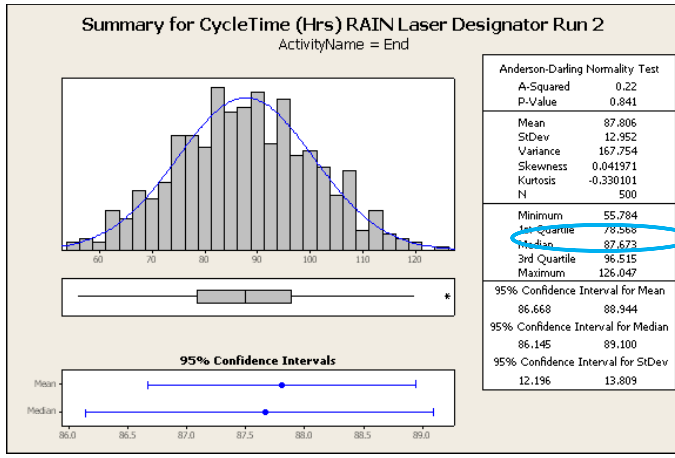
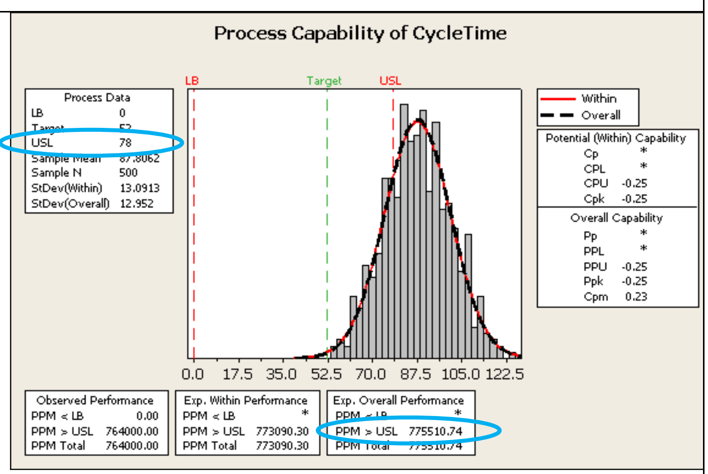
Cost Risk
Impact = Max predicted cost minus the mean cost.
Likelihood = Chance of cost exceeding the mean cost.

Performance Risk
Impact = From the timeline reduction scenario document for the week of June 27th 2013 and discussions with PMA-263 representatives.
Likelihood = Chance of impact occurring - TBD discussions with PMA-263 representatives.

	New Certification Cycle Times	
Certification	IRTR (Interim)	LRTR (Already Have)
CDL	No Change	0
IFC	1,3,2	1,3,2
Battery	1,4,2	0
IA	1,4,2	No Change
Spectrum	4,8,6 4,8,6	4,8,6
T&E	OT in fielding	Joint DT OT
JTIC	0	No Change
SAASM	No Change	0

Table 2: Timeline Reduction Strategies Sub-Process Changes Summary

Laser Designator Payload Run 1	Chart size = 2.3”H x 3.7”W
Baseline LD R1 Schedule Risk Impact = 126 Wks – 78 Wks = 48 Wks From Baseline Run 1 Simulation	
Baseline LD R1 Schedule Risk Likelihood = 80.80% There is a 80.80% chance that the schedule will exceed 78 weeks by as much as 48 weeks.	
Baseline LD R1 Cost Risk Impact = Max – Mean = $2,210K – $1,321K = $889K Baseline LD R1 Cost Risk Likelihood = Right tail chance of exceeding the mean = 47.58% There is a 47.58% chance that the cost will exceed the mean by $889K.	

Baseline LD R1 Increased Performance Risk Impact	**N/A**
Baseline LD R1 Increased Performance Risk Likelihood	**N/A**
Laser Designator Payload Run 2	
Baseline LD R2 Schedule Risk Impact = 126 Wks – 78 Wks = 48 Wks	
Baseline LD R2 Schedule Risk Likelihood = 775510 ppm = 77.55% There is a 77.55% chance that the schedule will exceed 78 weeks by as much of 48 weeks.	

<table>
<tr>
<td>

Baseline LD R2 Cost Risk Impact

= Max – Mean

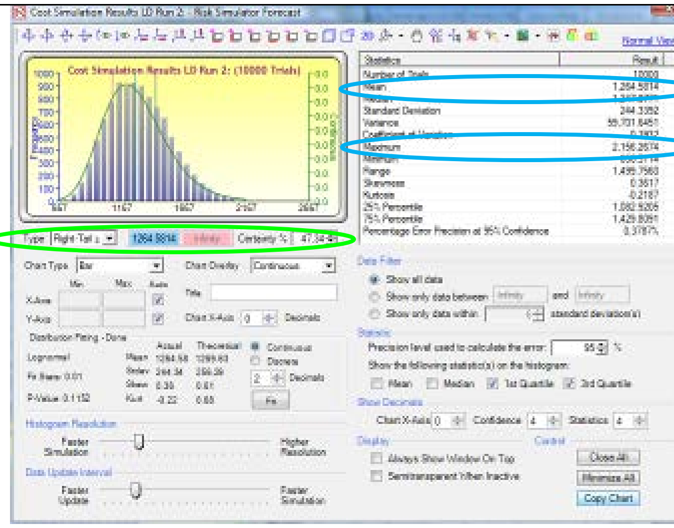
= $2,156K – $1,265K = $891K

Baseline LD R2 Cost Risk Likelihood

= Right tail chance of exceeding the mean = 47.34%

There is a 47.34% chance that the cost will exceed the mean by $891K.

</td>
<td>

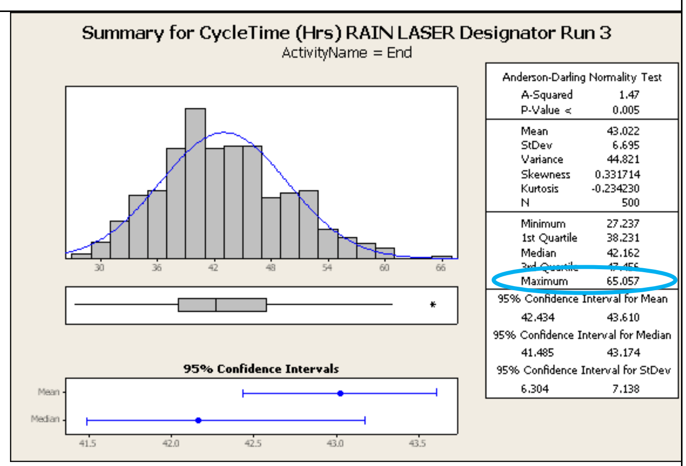


</td>
</tr>
<tr>
<td>Baseline LD R2 Increased Performance Risk Impact</td>
<td>N/A</td>
</tr>
<tr>
<td>Baseline LD R2 Increased Performance Risk Likelihood</td>
<td>N/A</td>
</tr>
<tr>
<td>Laser Designator Payload Run 3</td>
<td></td>
</tr>
<tr>
<td>

Baseline LD R3 Schedule Risk Impact

= 65 Wks – 78 Wks = -13 Wks

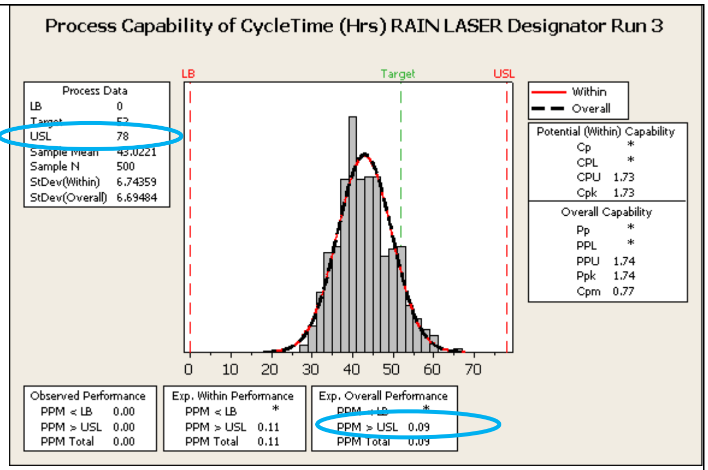
</td>
<td>



</td>
</tr>
</table>

<table>
<tr><td>Baseline LD R3 Schedule Risk Likelihood

= 0.000009%

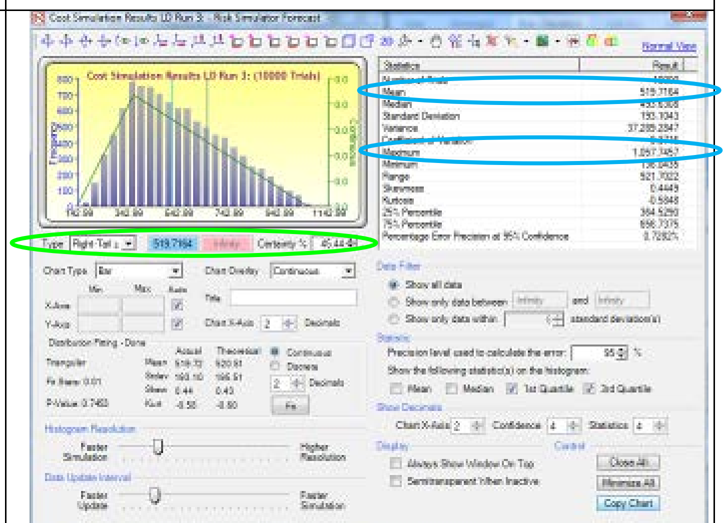
There is a 0.000009% chance that the schedule will exceed 78 weeks.</td><td>
</td></tr>
<tr><td>Baseline LD R3 Cost Risk Impact

= Max – Mean

= $1058K – $520K = $538K

Baseline LD R3 Cost Risk Likelihood

= Right tail chance of exceeding the mean = 45.44%

There is a 45.44% chance that the cost will exceed the mean by $538K.</td><td>
</td></tr>
<tr><td>Baseline LD R3 Increased Performance Risk Impact</td><td>N/A</td></tr>
<tr><td>Baseline LD R3 Increased Performance Risk Likelihood</td><td>N/A</td></tr>
<tr><td>IRTR Laser Designator Run 1</td><td></td></tr>
</table>

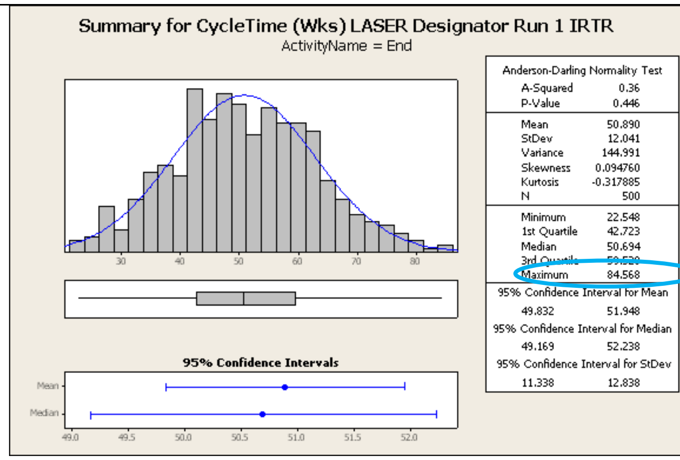
<table>
<tr><td>

IRTR LD R1 Schedule Risk Impact

= 85 Wks – 78 Wks

= 7 Wks

</td><td>



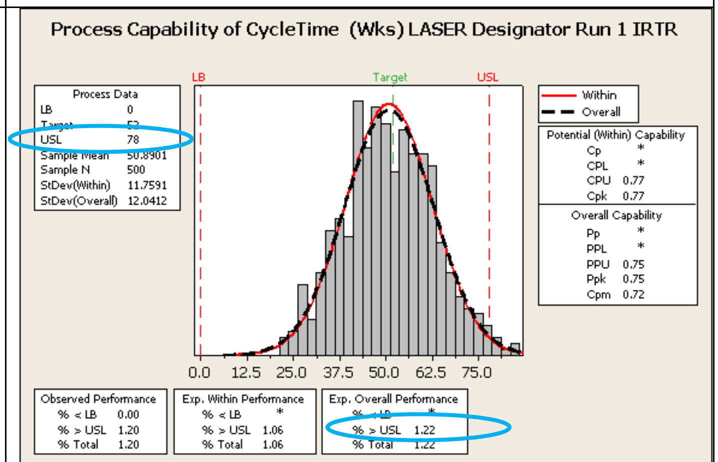
</td></tr>
<tr><td>

IRTR LD R1 Schedule Risk Likelihood

= 1.22%

There is a 1.22% chance that the schedule will exceed 78 weeks by as much of 7 weeks.

</td><td>



</td></tr>
<tr><td>

IRTR LD R1 Cost Risk Impact

= Max – Mean

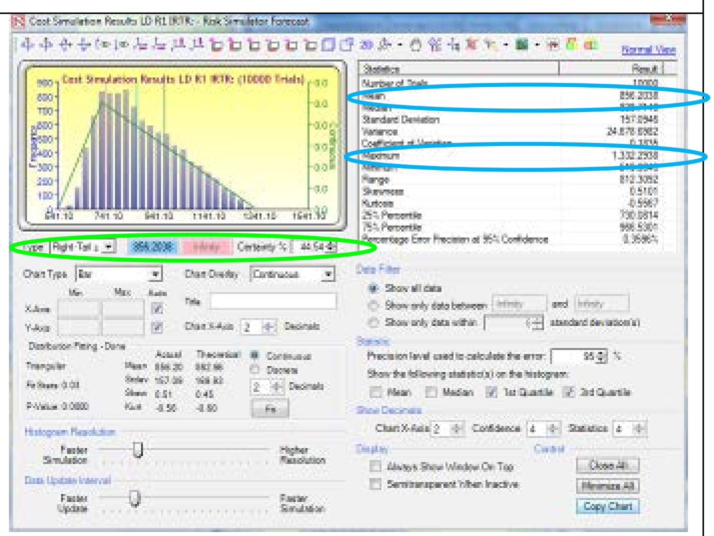
= $1332K – $856K = $476K

IRTR LD R1 Cost Risk Likelihood

= Right tail chance of exceeding the mean = 44.54%

There is a 44.54% chance that the cost will exceed the mean by $476K.

</td><td>



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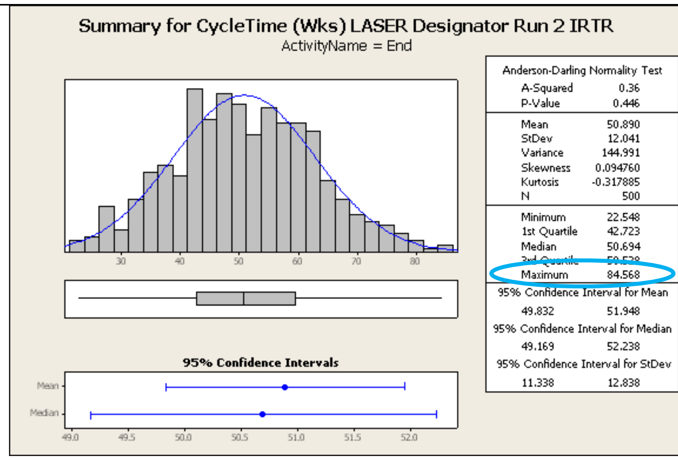
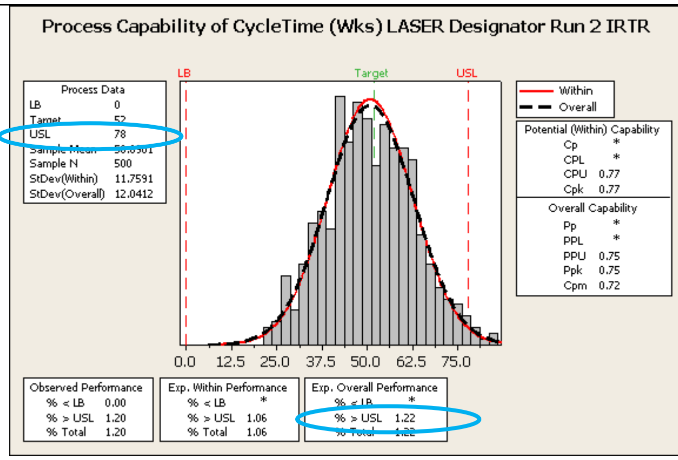
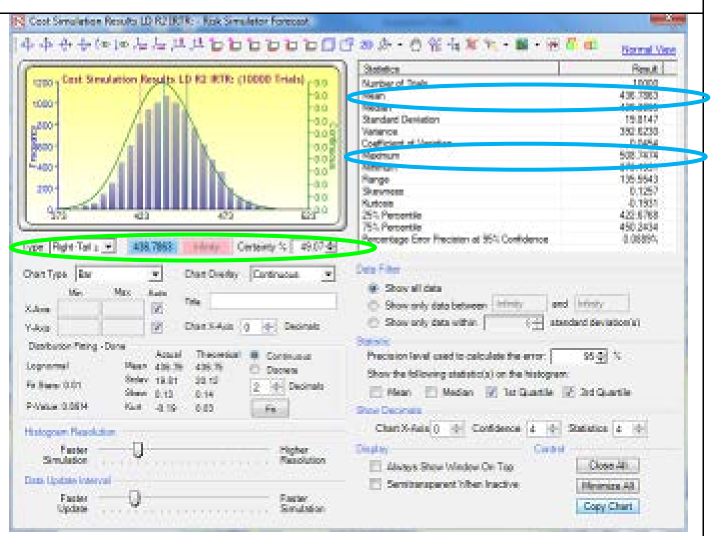
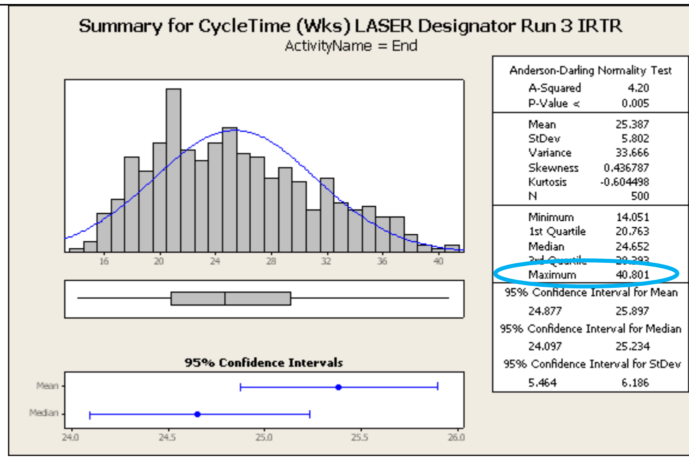
<tr><td>IRTR LD R1 Increased Performance Risk Impact</td><td>TBD</td></tr>
<tr><td>IRTR LD R1 Increased Performance</td><td>TBD</td></tr>
</table>

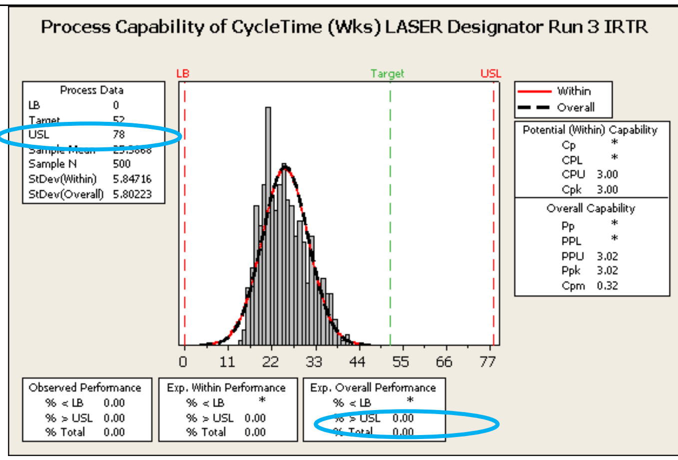
Risk Likelihood	
IRTR Laser Designator Run 2	
IRTR LD R2 Schedule Risk Impact = 85 Wks – 78 Wks = 7 Wks	
IRTR LD R2 Schedule Risk Likelihood = 1.22% There is a 1.22% chance that the schedule will exceed 78 weeks by as much of 7 weeks.	
IRTR LD R2 Cost Risk Impact = Max – Mean = \$509K – \$437K = \$72K IRTR LD R2 Cost Risk Likelihood = Right tail chance of exceeding the mean = 49.07% There is a 49.07% chance that the cost will exceed the mean by \$849K.	

<table>
<tr><td>IRTR LD R2 Increased Performance Risk Impact</td><td>TBD</td></tr>
<tr><td>IRTR LD R2 Increased Performance Risk Likelihood</td><td>TBD</td></tr>
<tr><td>IRTR Laser Designator Run 3</td><td></td></tr>
<tr><td>IRTR LD R3 Schedule Risk Impact

= 41 Wks – 78 Wks

= -37 Wks</td><td>
</td></tr>
<tr><td>IRTR LD R3 Schedule Risk Likelihood

= 0.0%

There is a 0% chance that the schedule will exceed 78 weeks.</td><td>
</td></tr>
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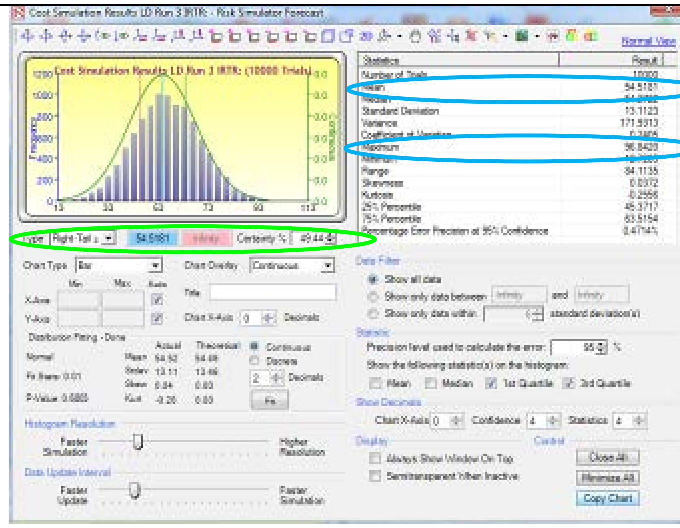
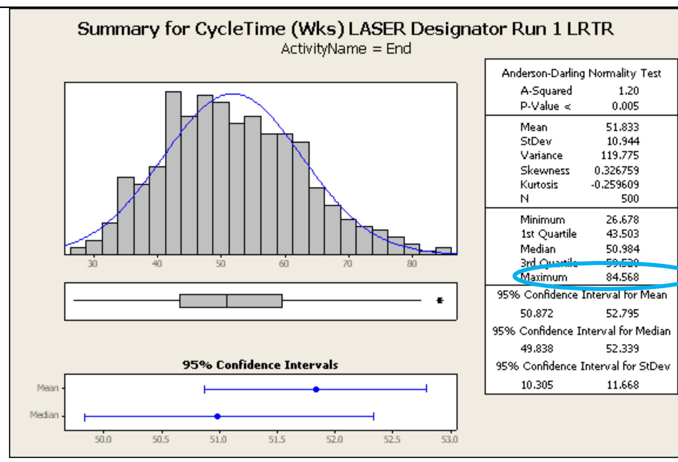
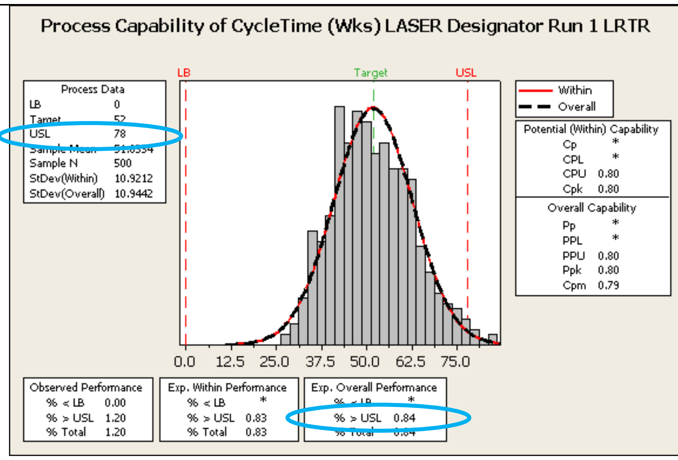
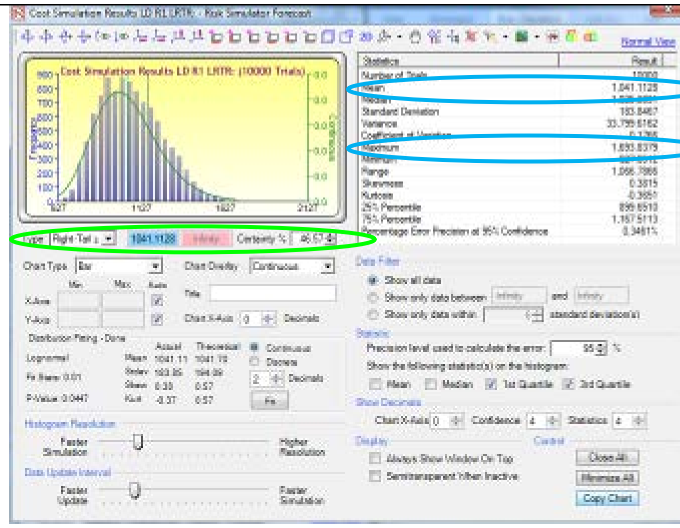
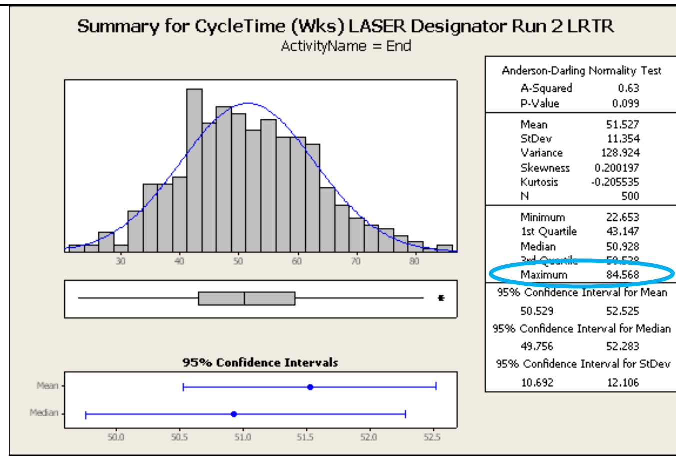
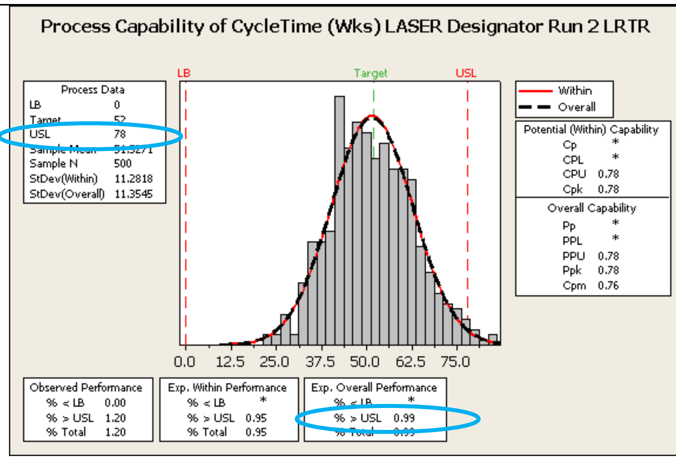
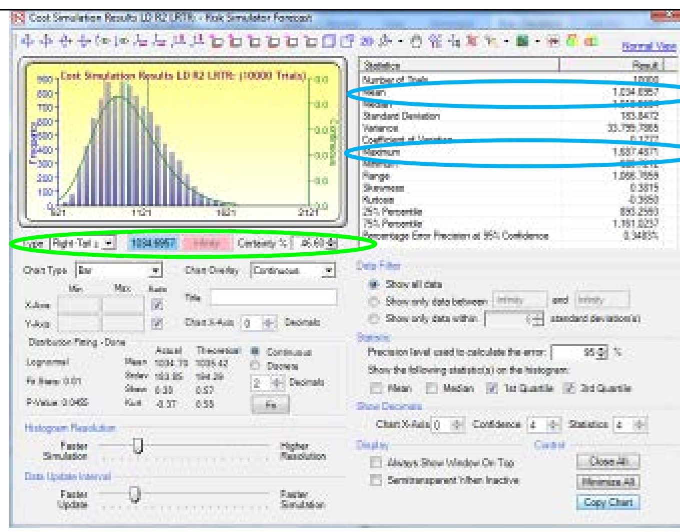
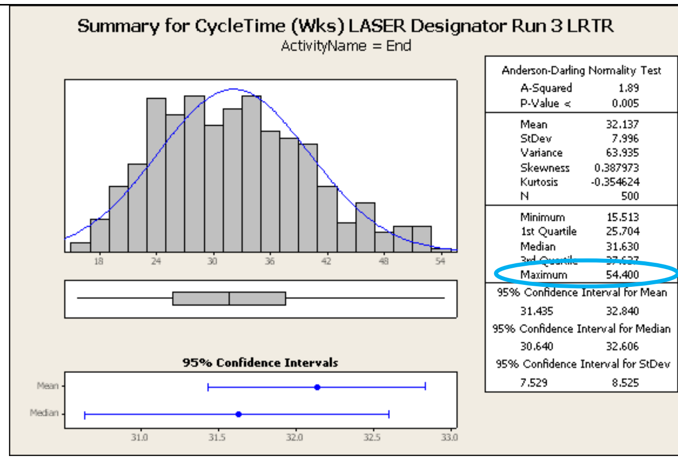
IRTR LD R3 Cost Risk Impact = Max – Mean = \$97K – \$55K = \$42K IRTR LD R3 Cost Risk Likelihood = Right tail chance of exceeding the mean = 49.44% There is a 49.44% chance that the cost will exceed the mean by \$42K.	
IRTR LD R3 Increased Performance Risk Impact	**TBD**
IRTR LD R3 Increased Performance Risk Likelihood	**TBD**
LRTR Laser Designator Run 1	
LRTR LD R1 Schedule Risk Impact = 85 Wks – 78 Wks = 7 Wks	

LRTR LD R1 Schedule Risk Likelihood = 0.84% There is a 0.84% chance that the schedule will exceed 78 weeks by as much of 7 weeks.	
LRTR LD R1 Cost Risk Impact = Max – Mean = $1,694K – $1,041K = $653K LRTR LD R1 Cost Risk Likelihood = Right tail chance of exceeding the mean = 46.57% There is a 46.57% chance that the cost will exceed the mean by $653K.	
LRTR LD R1 Increased Performance Risk Impact	**TBD**
LRTR LD R1 Increased Performance Risk Likelihood	**TBD**
LRTR Laser Designator Run 2	

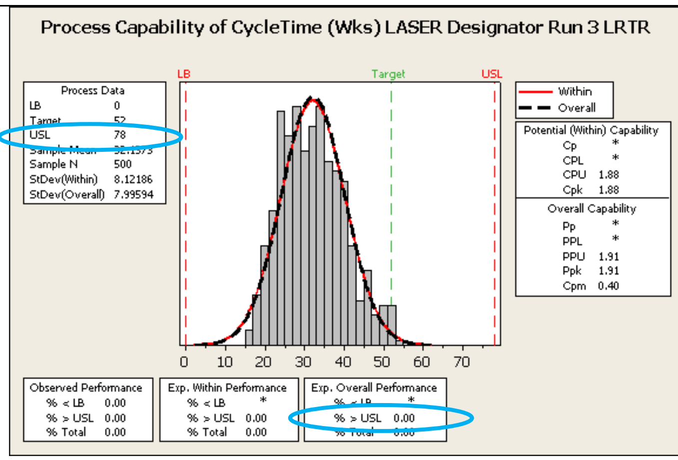
LRTR LD R2 Schedule Risk Impact = 85 Wks – 78 Wks = 7 Wks	
LRTR LD R2 Schedule Risk Likelihood = 0.99% There is a 0.99% chance that the schedule will exceed 78 weeks by as much of 7 weeks.	
LRTR LD R2 Cost Risk Impact = Max – Mean = $1687K – $1,035K = $652K LRTR LD R2 Cost Risk Likelihood = Right tail chance of exceeding the mean = 46.60% There is a 46.60% chance that the cost will exceed the mean by $652K.	
LRTR LD R2 Increased Performance Risk Impact	**TBD**
LRTR LD R2 Increased Performance	**TBD**

<table>
<tr><td>Risk Likelihood</td><td></td></tr>
<tr><td>LRTR Laser Designator Run 3</td><td></td></tr>
<tr><td>LRTR LD R3 Schedule Risk Impact

= 54 Wks – 78 Wks

= -24 Wks</td><td>
</td></tr>
<tr><td>LRTR LD R3 Schedule Risk Likelihood

= 0.0%

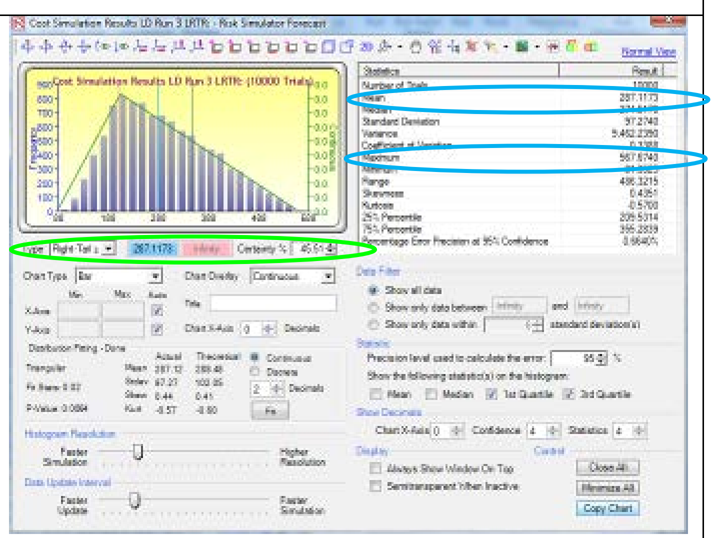
There is a 0% chance that the schedule will exceed 78 weeks by as much of 48 weeks.</td><td>
</td></tr>
<tr><td>LRTR LD R3 Cost Risk Impact

= Max – Mean

= $568K – $287K = $281K

LRTR LD R3 Cost Risk Likelihood

= Right tail chance of exceeding the mean = 45.51%

There is a 45.51% chance that the cost will exceed the mean by $281K.</td><td>
</td></tr>
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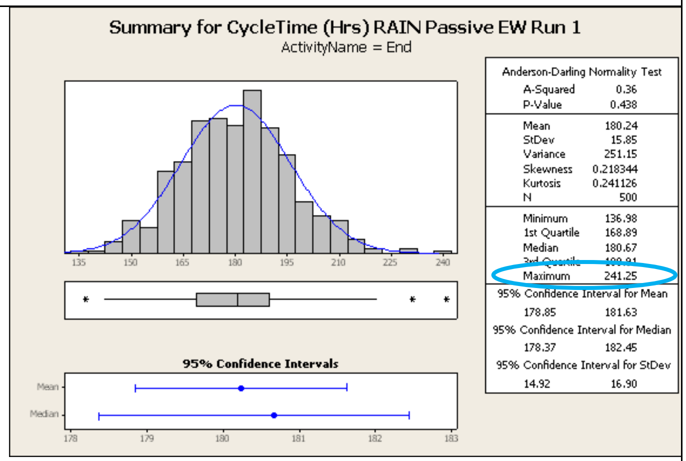
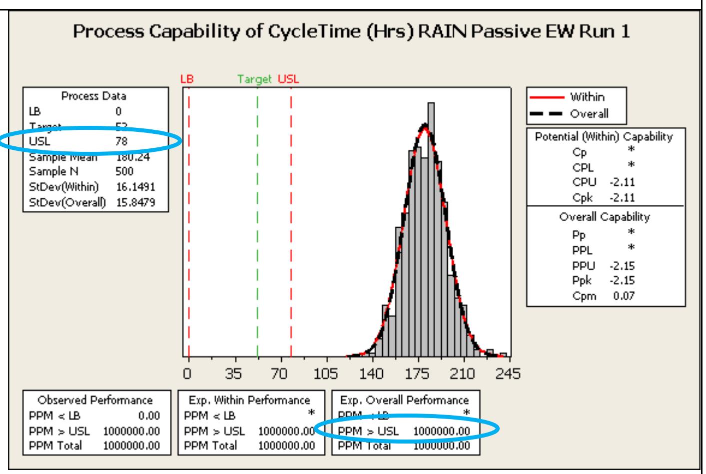
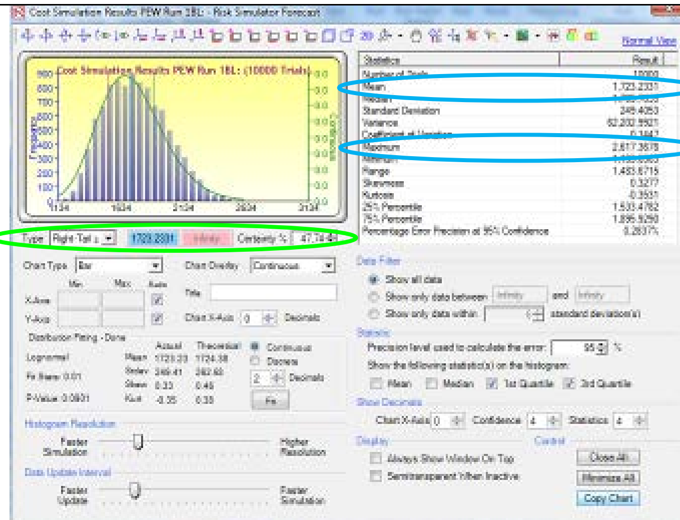
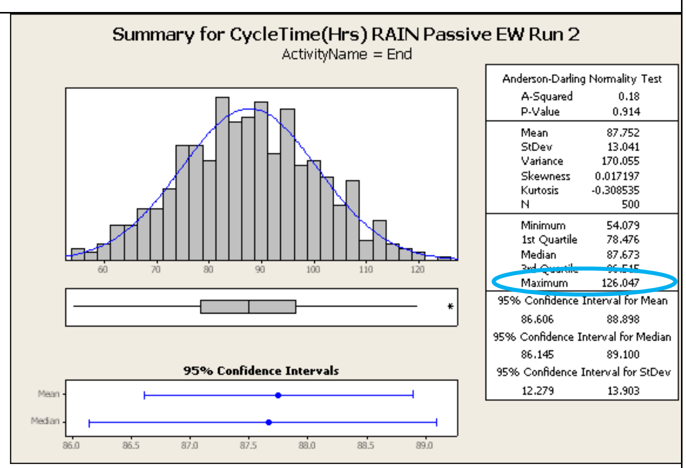
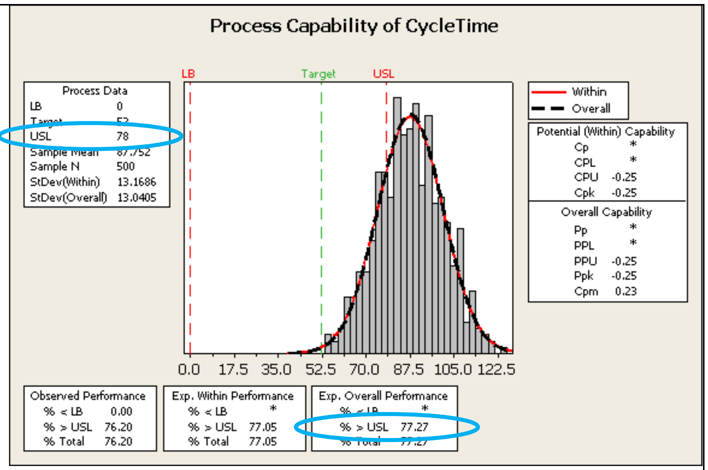
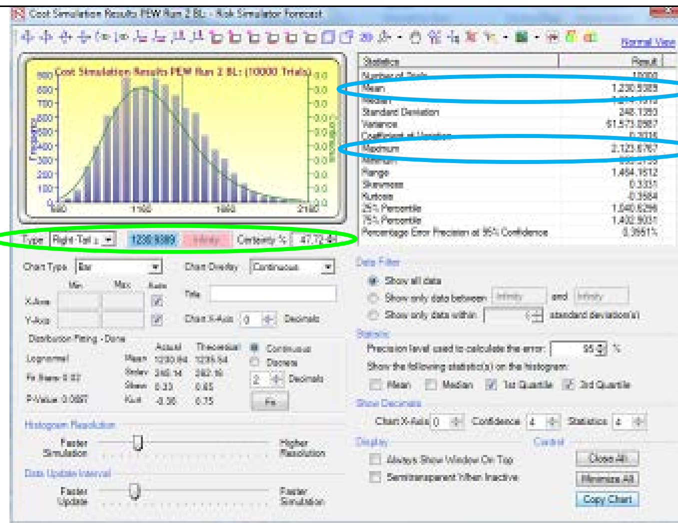
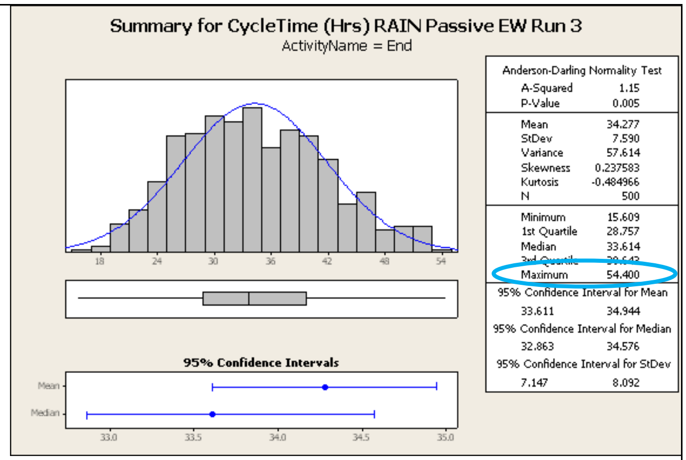
LRTR LD R3 Increased Performance Risk Impact	**TBD**
LRTR LD R3 Increased Performance Risk Likelihood	**TBD**
Passive EW Run 1	
Baseline Passive EW R1 Schedule Risk Impact = 241 Wks – 78 Wks = 163 Wks	
Baseline Passive EW R1 Schedule Risk Likelihood = 1000000.00 PPM = 100% There is a 100% chance that the schedule will exceed 78 weeks.	

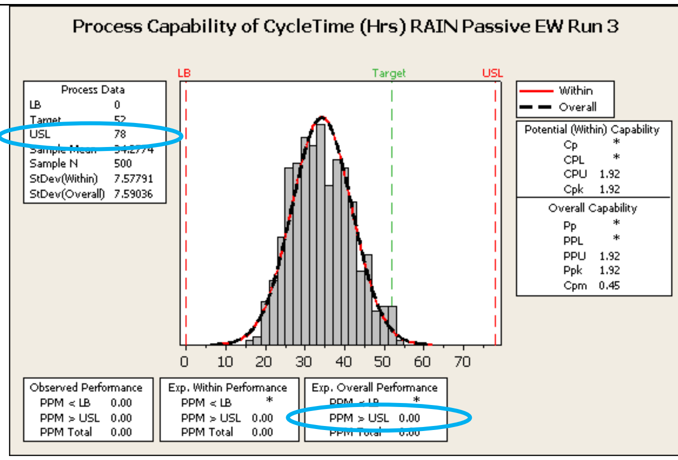
Baseline Passive EW R1 Cost Risk Impact = Max – Mean = \$2,617K – \$1,723K = \$894K Baseline Passive EW R1 Cost Risk Likelihood = Right tail chance of exceeding the mean = 47.74% There is a 47.74% chance that the cost will exceed the mean by \$894K.	
Baseline Passive EW R1 Increased Performance Risk Impact	**N/A**
Baseline Passive EW R1 Increased Performance Risk Likelihood	**N/A**
Passive EW Run 2	
Baseline Passive EW R2 Schedule Risk Impact = 126 Wks – 78 Wks = 48 Wks	

Baseline Passive EW R2 Schedule Risk Likelihood = 77.27% There is a 77.27% chance that the schedule will exceed 78 weeks.	
Baseline Passive EW R2 Cost Risk Impact = Max – Mean = \$2,124K – \$1,231K = \$893K Baseline Passive EW R2 Cost Risk Likelihood = Right tail chance of exceeding the mean = 47.72% There is a 47.72% chance that the cost will exceed the mean by \$893K.	
Baseline Passive EW R2 Increased Performance Risk Impact	**N/A**
Baseline Passive EW R2 Increased Performance Risk Likelihood	**N/A**
Passive EW Run 3	

<table>
<tr>
<td>Baseline Passive EW R3 Schedule Risk Impact

= 54 Wks – 78 = -24 Wks</td>
<td>
</td>
</tr>
<tr>
<td>Baseline Passive EW R3 Schedule Risk Likelihood

= 0.0%

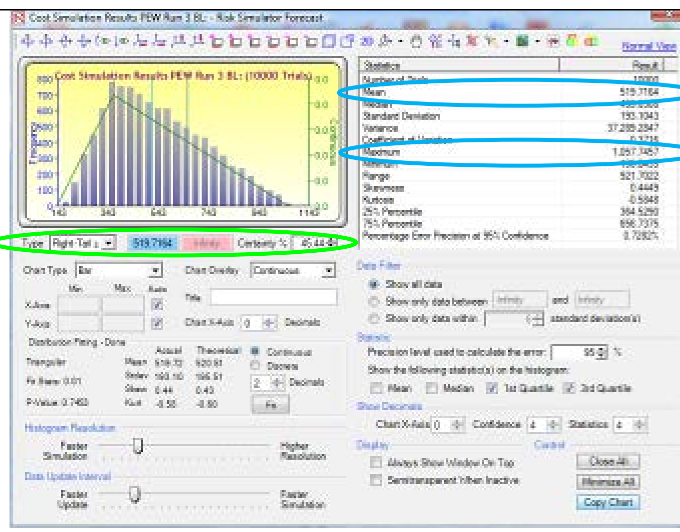
There is a 0% chance that the schedule will exceed 78 weeks.</td>
<td>
</td>
</tr>
<tr>
<td>Baseline Passive EW R3 Cost Risk Impact

= Max – Mean

= $1058K – $520K = $538K

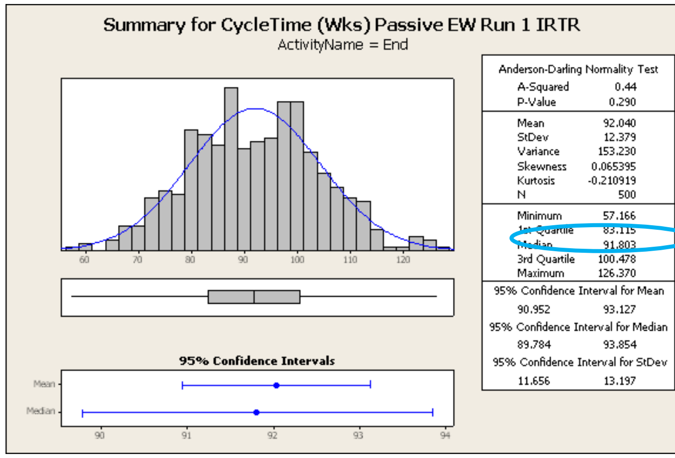
Baseline Passive EW R3 Cost Risk Likelihood

= Right tail chance of exceeding the mean = 45.44%

There is a 45.44% chance that the cost will exceed the mean by $538K.</td>
<td>
</td>
</tr>
<tr>
<td>Baseline Passive EW R3 Increased Performance Risk Impact</td>
<td>N/A</td>
</tr>
</table>

<table>
<tr><td>Baseline Passive EW R3 Increased Performance Risk Likelihood</td><td>N/A</td></tr>
<tr><td>IRTR Passive EW Run 1</td><td></td></tr>
<tr><td>IRTR PEW R1 Schedule Risk Impact

= 126 Wks – 78 Wks

= 48 Wks</td><td>


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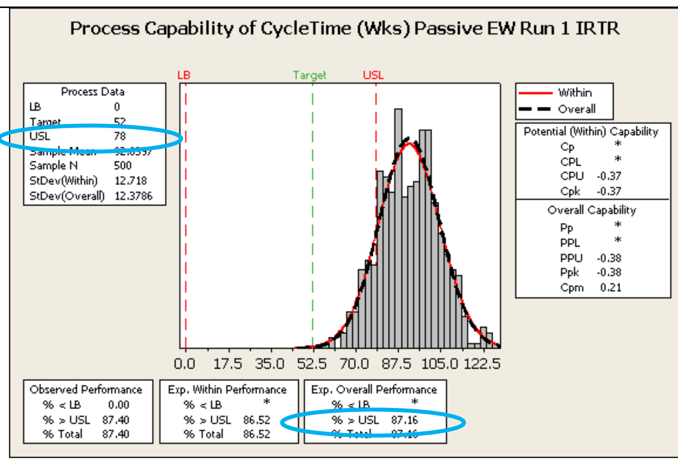
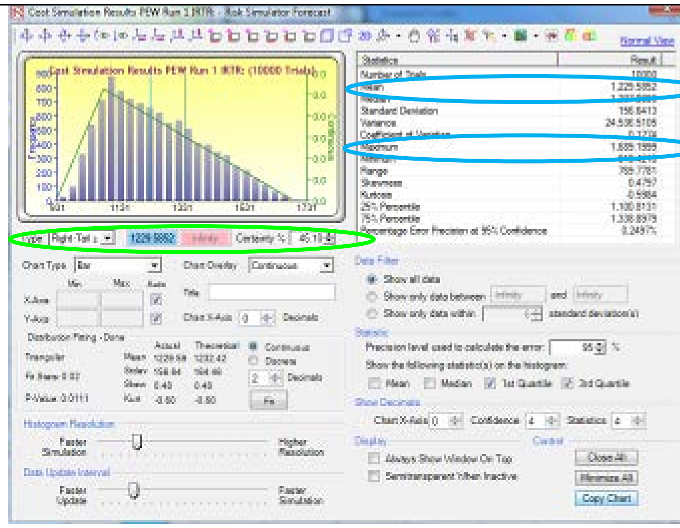
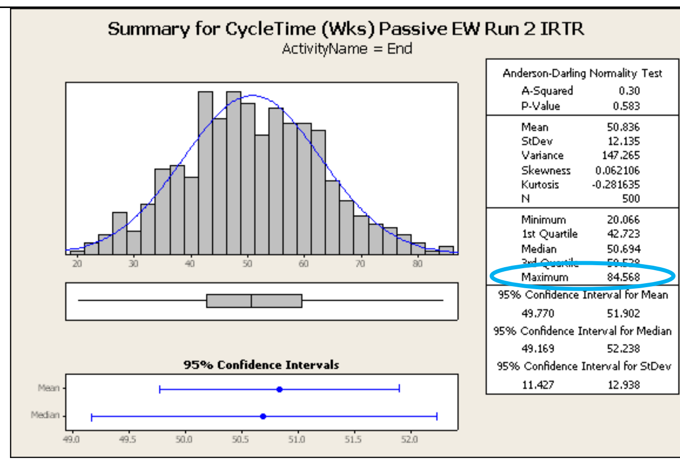
<tr><td>IRTR PEW R1 Schedule Risk Likelihood

= 87.16%

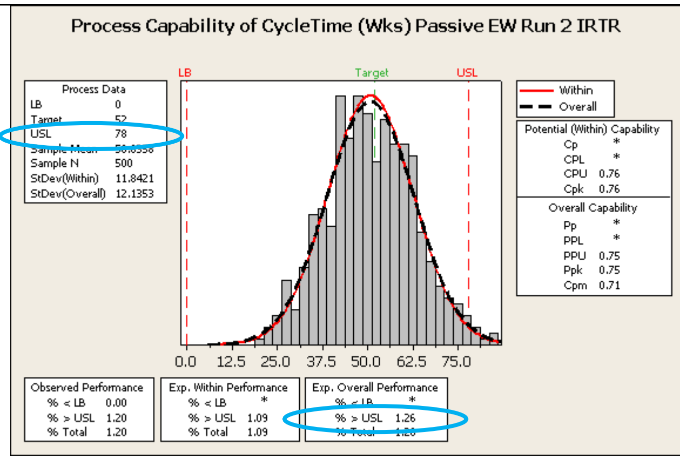
There is a 87.16% chance that the schedule will exceed 78 weeks by as much of 48 weeks.</td><td>


</td></tr>
</table>

IRTR PEW R1 Cost Risk Impact = Max – Mean = \$1,689K – \$1,230K = \$459K IRTR PEW R1 Cost Risk Likelihood = Right tail chance of exceeding the mean = 45.10% There is a 45.10% chance that the cost will exceed the mean by \$459K.	
IRTR PEW R1 Increased Performance Risk Impact	**TBD**
IRTR PEW R1 Increased Performance Risk Likelihood	**TBD**
IRTR Passive EW Run 2	
IRTR PEW R2 Schedule Risk Impact = 85 Wks – 78 Wks = 7 Wks	

<table>
<tr>
<td>IRTR PEW R2 Schedule Risk Likelihood

= 1.26%

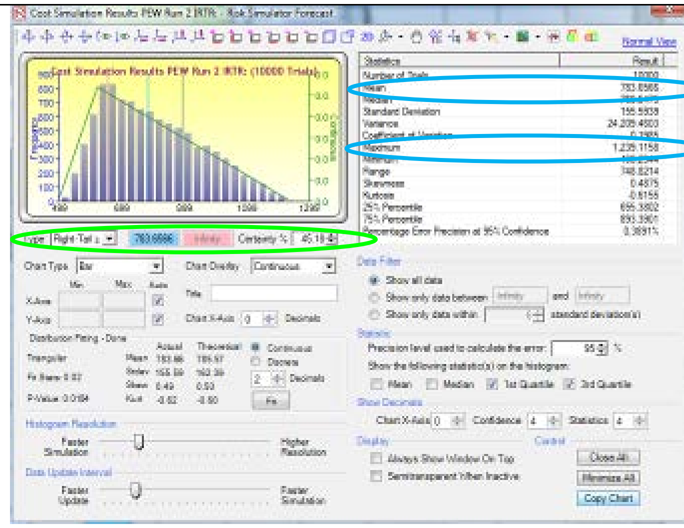
There is a 1.26% chance that the schedule will exceed 78 weeks by as much of 48 weeks.</td>
<td>
</td>
</tr>
<tr>
<td>IRTR PEW R2 Cost Risk Impact

= Max – Mean

= $1,239K – $784K = $455K

IRTR PEW R2 Cost Risk Likelihood

= Right tail chance of exceeding the mean = 45.18%

There is a 45.18% chance that the cost will exceed the mean by $455K.</td>
<td>
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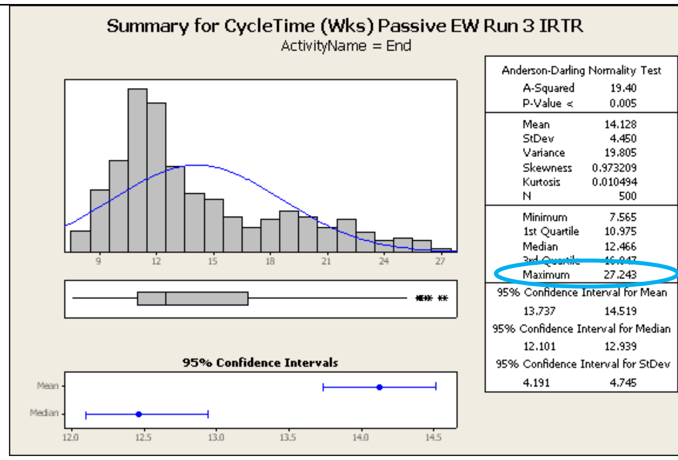
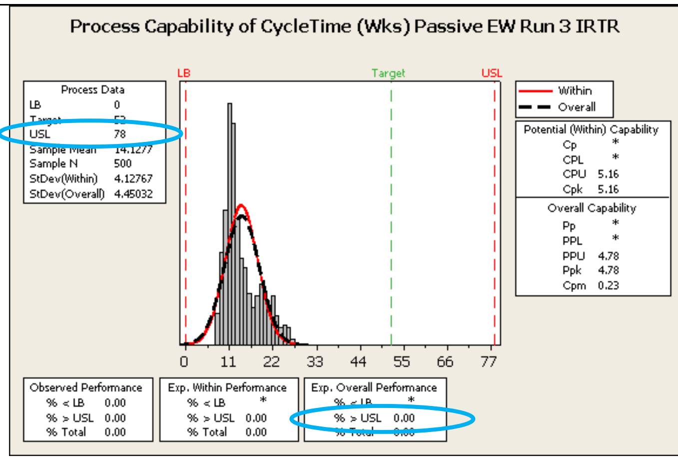
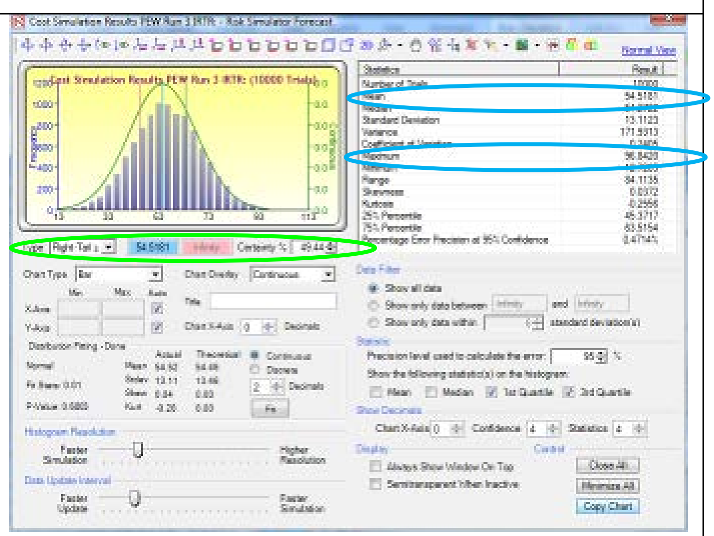
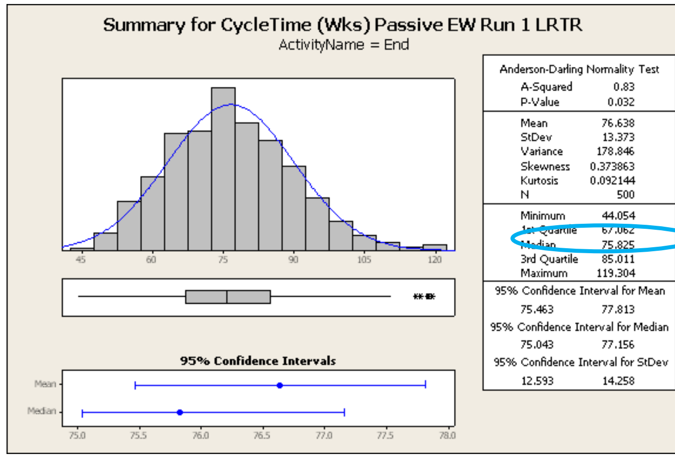
<tr>
<td>IRTR PEW R2 Increased Performance Risk Impact</td>
<td>TBD</td>
</tr>
<tr>
<td>IRTR PEW R2 Increased Performance Risk Likelihood</td>
<td>TBD</td>
</tr>
<tr>
<td>IRTR Passive EW Run 3</td>
<td></td>
</tr>
</table>

IRTR PEW R3 Schedule Risk Impact = 27 Wks – 78 Wks = -51 Wks	
IRTR PEW R3 Schedule Risk Likelihood = 0.0% There is a 0% chance that the schedule will exceed 78 weeks by as much of 48 weeks.	
IRTR PEW R3 Cost Risk Impact = Max – Mean = \$97K – \$55K = \$42K IRTR PEW R3 Cost Risk Likelihood = Right tail chance of exceeding the mean = 49.44% There is a 49.44% chance that the cost will exceed the mean by \$42K.	
IRTR PEW R3 Increased Performance Risk Impact	**TBD**
IRTR PEW R3 Increased	**TBD**

<table>
<tr><td>Performance Risk Likelihood</td><td></td></tr>
<tr><td>LRTR Passive EW Run 1</td><td></td></tr>
<tr><td>LRTR PEW R1 Schedule Risk Impact

= 119 Wks – 78 Wks

= 41 Wks</td><td>
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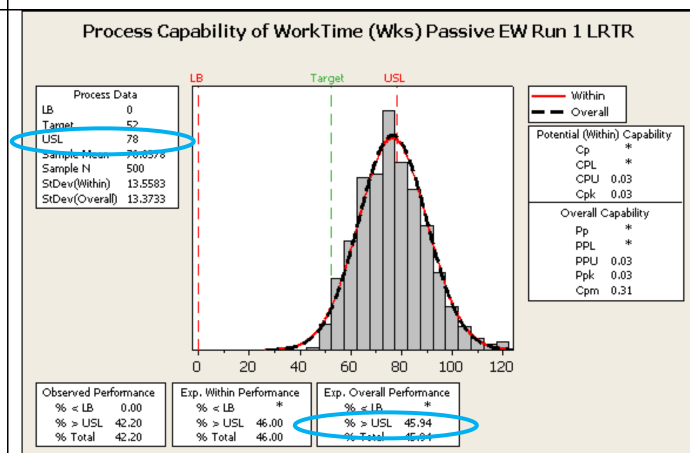
<tr><td>LRTR PEW R1 Schedule Risk Likelihood

= 45.94%

There is a 45.94% chance that the schedule will exceed 78 weeks by as much of 41 weeks.</td><td>
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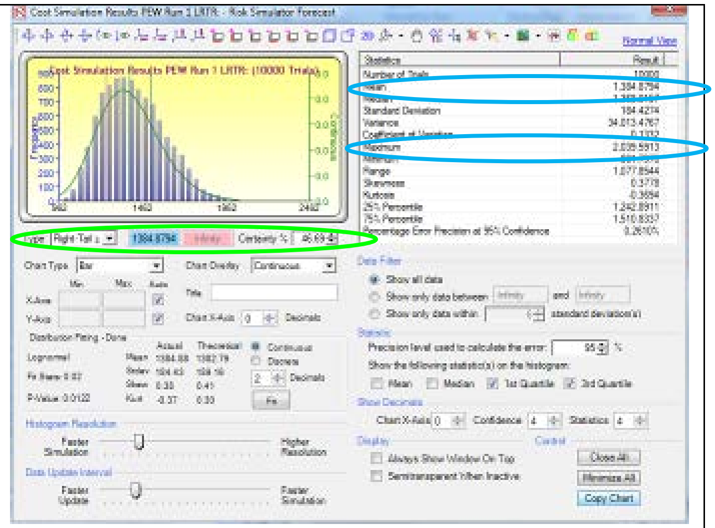
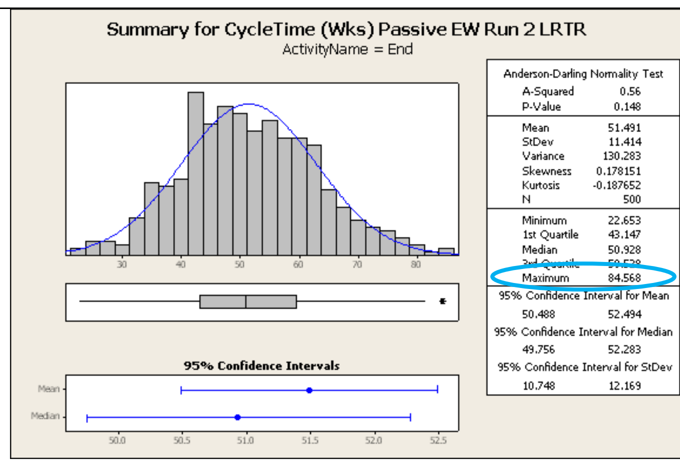
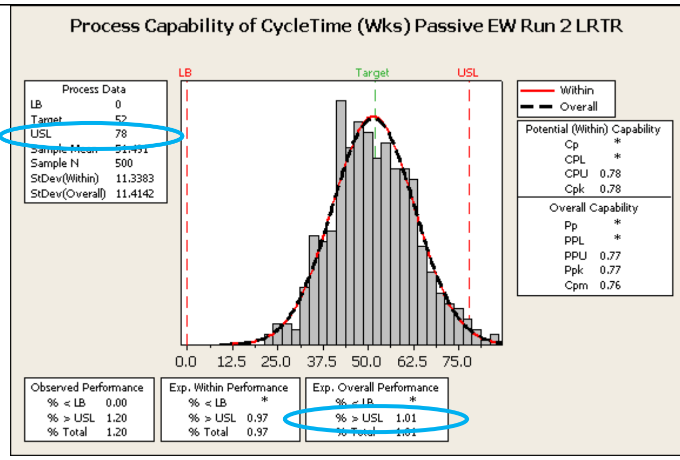
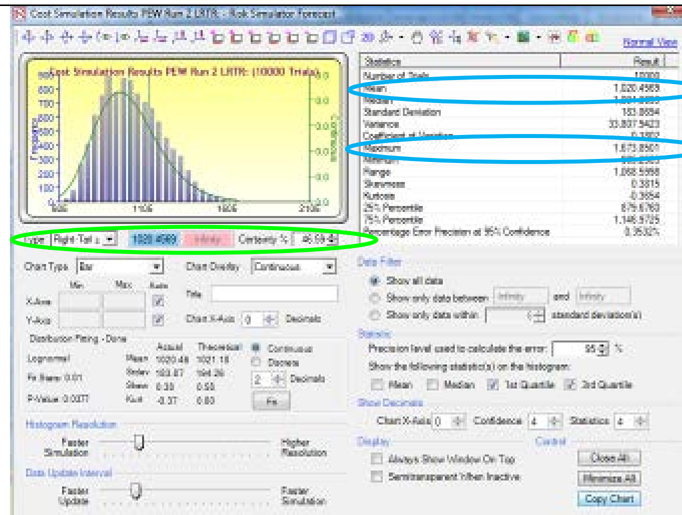
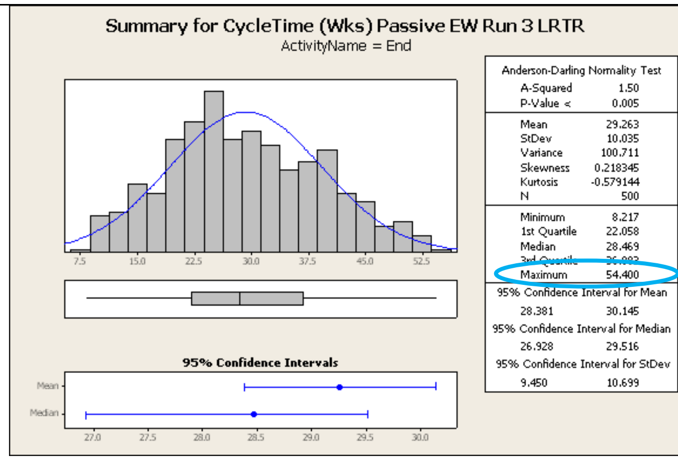
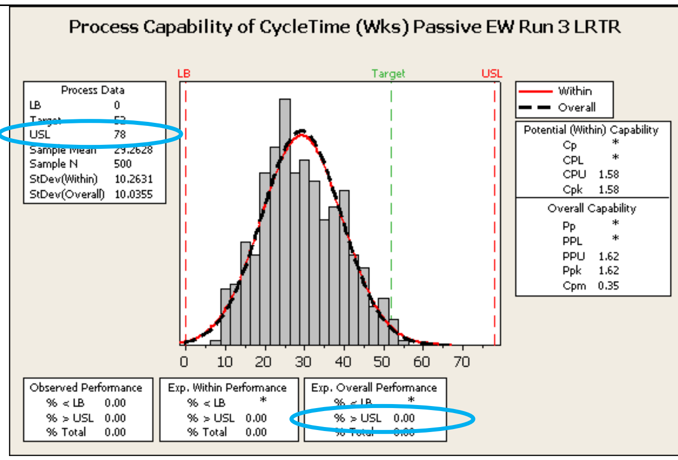
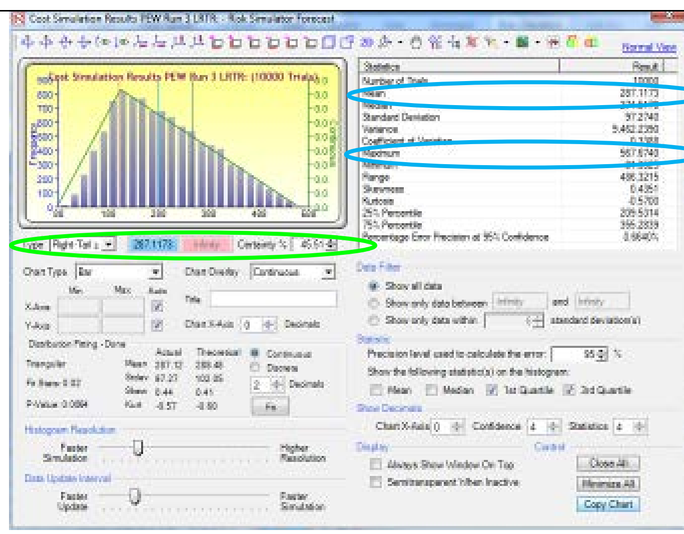
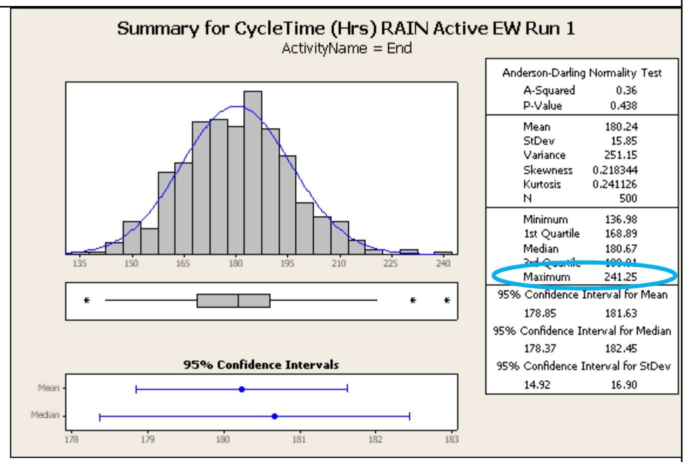
LRTR PEW R1 Cost Risk Impact = Max – Mean = \$2,040K – \$1,385K = \$655K LRTR PEW R1 Cost Risk Likelihood = Right tail chance of exceeding the mean = 46.69% There is a 46.69% chance that the cost will exceed the mean by \$655K.	
LRTR PEW R1 Increased Performance Risk Impact	**TBD**
LRTR PEW R1 Increased Performance Risk Likelihood	**TBD**
LRTR Passive EW Run 2	
LRTR PEW R2 Schedule Risk Impact = 85 Wks – 78 Wks = 7 Wks	

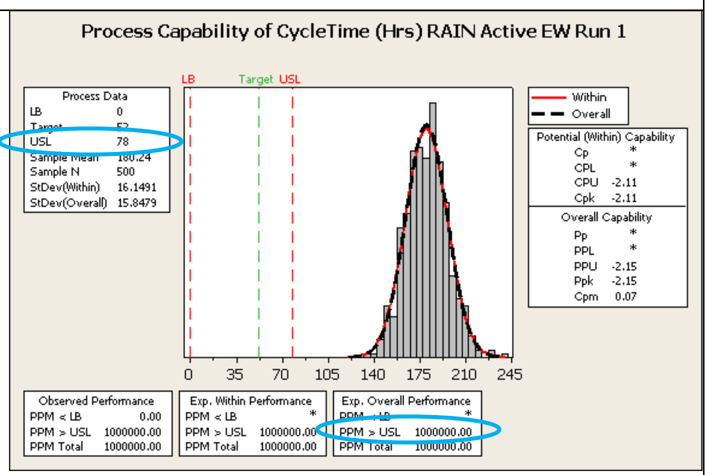
LRTR PEW R2 Schedule Risk Likelihood = 1.01% There is a 1.01% chance that the schedule will exceed 78 weeks by as much of 7 weeks.	
LRTR PEW R2 Cost Risk Impact = Max – Mean = $1,674K – $1,020K = $654K LRTR PEW R2 Cost Risk Likelihood = Right tail chance of exceeding the mean = 46.59% There is a 46.59% chance that the cost will exceed the mean by $654K.	
LRTR PEW R2 Increased Performance Risk Impact	**TBD**
LRTR PEW R2 Increased Performance Risk Likelihood	**TBD**
LRTR Passive EW Run 3	

LRTR PEW R3 Schedule Risk Impact = 54 Wks – 78 Wks = -24 Wks	
LRTR PEW R3 Schedule Risk Likelihood = 0.0% There is a 0% chance that the schedule will exceed 78 weeks.	
LRTR PEW R3 Cost Risk Impact = Max – Mean = \$568K – \$287K = \$281K LRTR PEW R3 Cost Risk Likelihood = Right tail chance of exceeding the mean = 45.51% There is a 45.51% chance that the cost will exceed the mean by \$281K.	
LRTR PEW R3 Increased Performance Risk Impact	**TBD**
LRTR PEW R3 Increased	**TBD**

<table>
<tr><td>Performance Risk Likelihood</td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td>Active EW Run 1</td><td></td></tr>
<tr><td>Baseline Active EW R1 Schedule Risk Impact

= 241 Wks – 78 Wks = 163 Wks</td><td>
</td></tr>
<tr><td>Baseline Active EW R1 Schedule Risk Likelihood

= 1000000.00 PPM = 100%

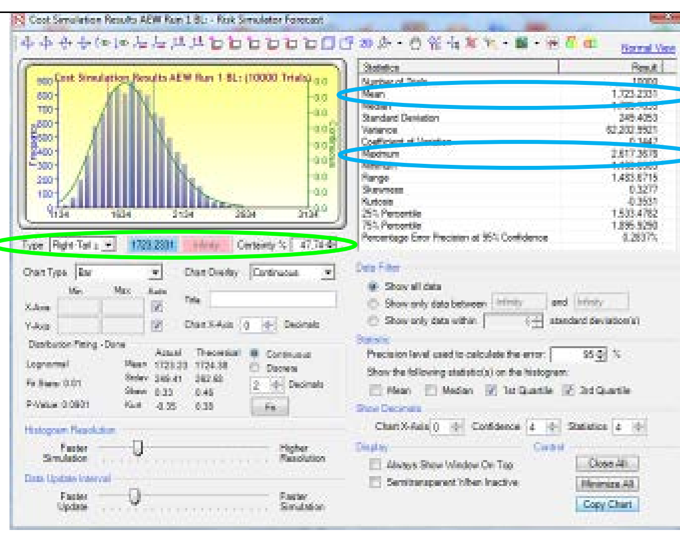
There is a 100% chance that the schedule will exceed 78 weeks.</td><td>
</td></tr>
<tr><td>Baseline Active EW R1 Cost Risk Impact

= Max – Mean

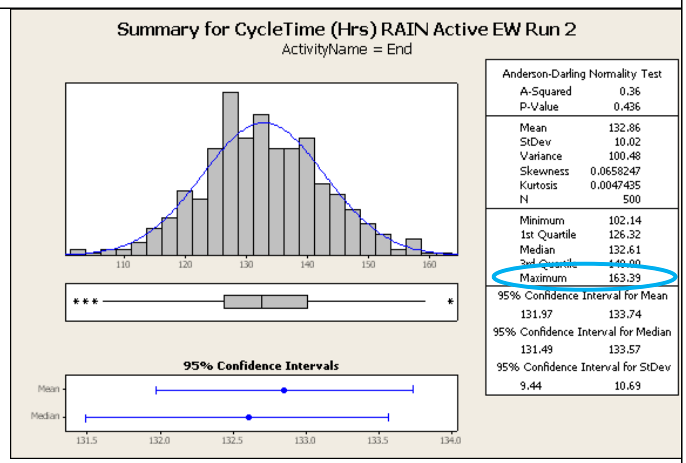
= $2,617K – $1,723K = $894K

Baseline Active EW R1 Cost Risk Likelihood

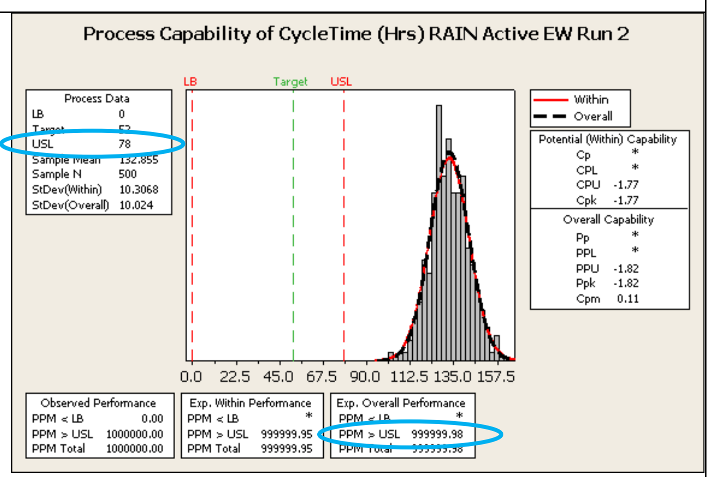
= Right tail chance of exceeding the mean = 47.74%

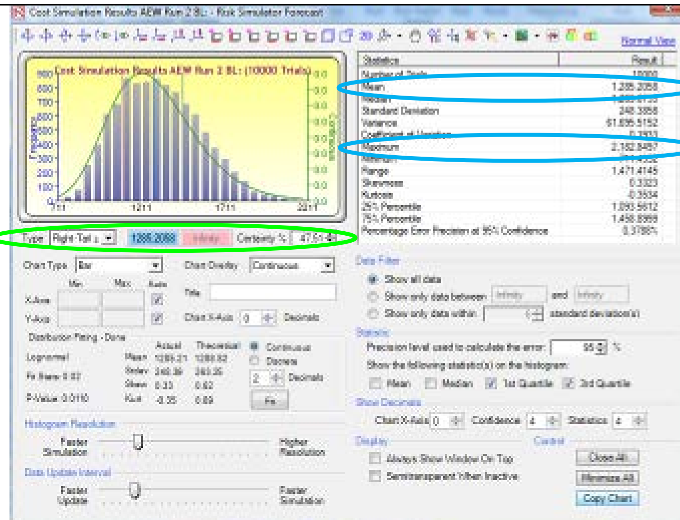
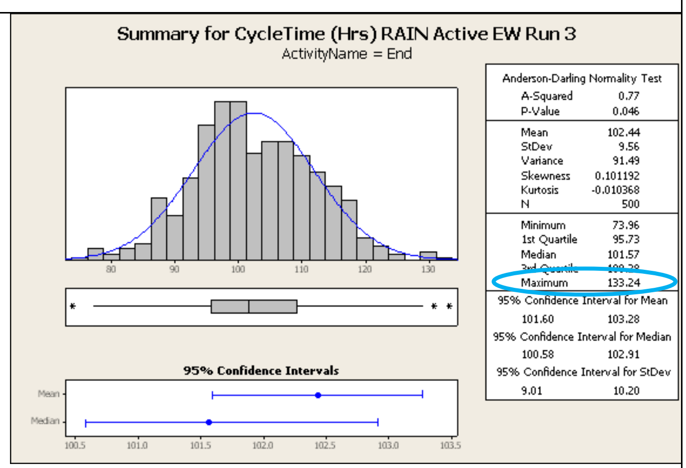
There is a 47.74% chance that the</td><td></td></tr>
</table>

<table>
<tr><td>cost will exceed the mean by $894K.</td><td></td></tr>
<tr><td>Baseline Active EW R1 Increased Performance Risk Impact</td><td>N/A</td></tr>
<tr><td>Baseline Active EW R1 Increased Performance Risk Likelihood</td><td>N/A</td></tr>
<tr><td>Active EW Run 2</td><td></td></tr>
<tr><td>Baseline Active EW R2 Schedule Risk Impact

= 163 Wks – 78 Wks = 85 Wks</td><td>
</td></tr>
<tr><td>Baseline Active EW R2 Schedule Risk Likelihood

= 999999.98 PPM = 99.99%

There is a 99.99% chance that the schedule will exceed 78 weeks.</td><td>
</td></tr>
</table>

Baseline Active EW R2 Cost Risk Impact = Max – Mean = $2,183K – $1,285K = $898K Baseline Active EW R2 Cost Risk Likelihood = Right tail chance of exceeding the mean = 47.51% There is a 47.51% chance that the cost will exceed the mean by $898K.	
Baseline Active EW R2 Increased Performance Risk Impact	**N/A**
Baseline Active EW R2 Increased Performance Risk Likelihood	**N/A**
Active EW Run 3	
Baseline Active EW R3 Schedule Risk Impact = 133 Wks – 78 Wks = 55 Wks	

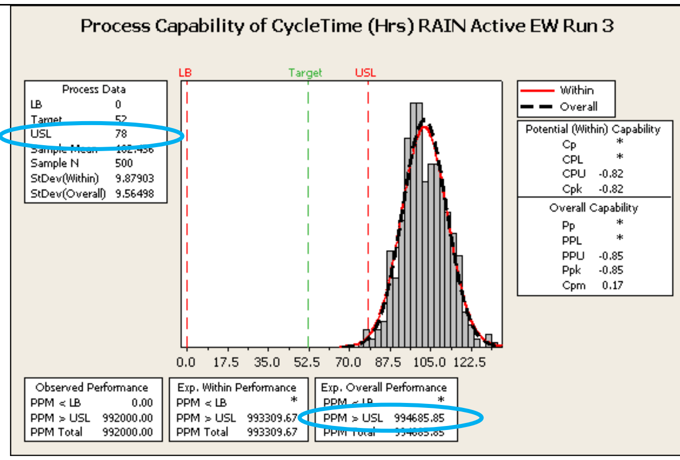
<table>
<tr><td>

Baseline Active EW R3 Schedule Risk Likelihood

= 994685.85 PPM = 99.47%

There is a 99.47% chance that the schedule will exceed 78 weeks.

</td><td>



</td></tr>
<tr><td>

Baseline Active EW R3 Cost Risk Impact

= Max – Mean

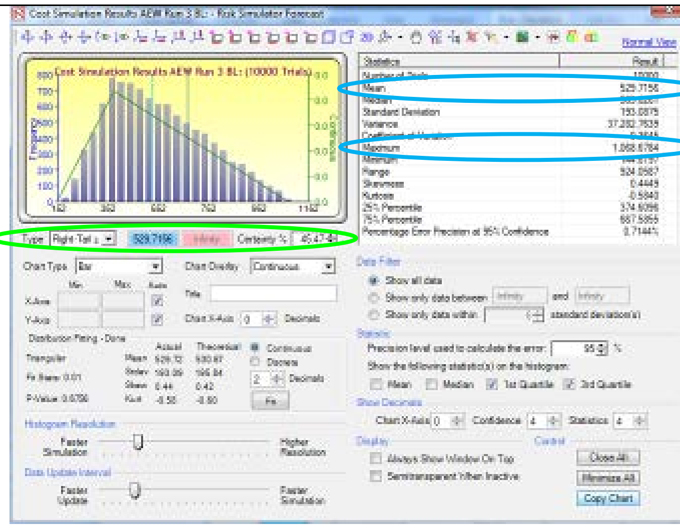
= $1069K – $530K = $539K

Baseline Active EW R3 Cost Risk Likelihood

= Right tail chance of exceeding the mean = 45.47%

There is a 45.47% chance that the cost will exceed the mean by $539K.

</td><td>



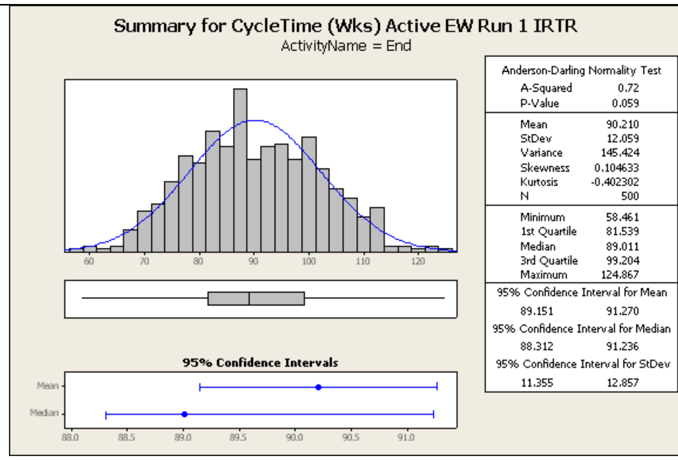
</td></tr>
<tr><td>Baseline Active EW R3 Increased Performance Risk Impact</td><td>N/A</td></tr>
<tr><td>Baseline Active EW R3 Increased Performance Risk Likelihood</td><td>N/A</td></tr>
<tr><td></td><td></td></tr>
<tr><td>IRTR Active EW Run 1</td><td></td></tr>
<tr><td>

IRTR AEW R1 Schedule Risk Impact

= 124 Wks – 78 Wks

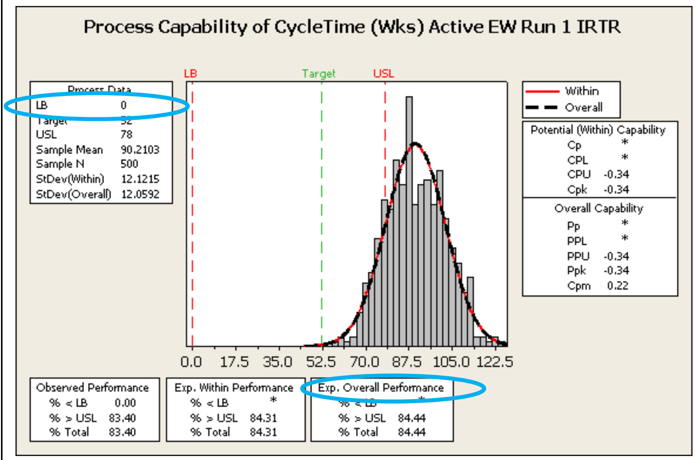
= 46 Wks

</td><td></td></tr>
</table>

<table>
<tr><td></td><td>


</td></tr>
<tr><td>IRTR AEW R1 Schedule Risk Likelihood

= 84.44%

There is a 84.44% chance that the schedule will exceed 78 weeks by as much of 46 weeks.</td><td>


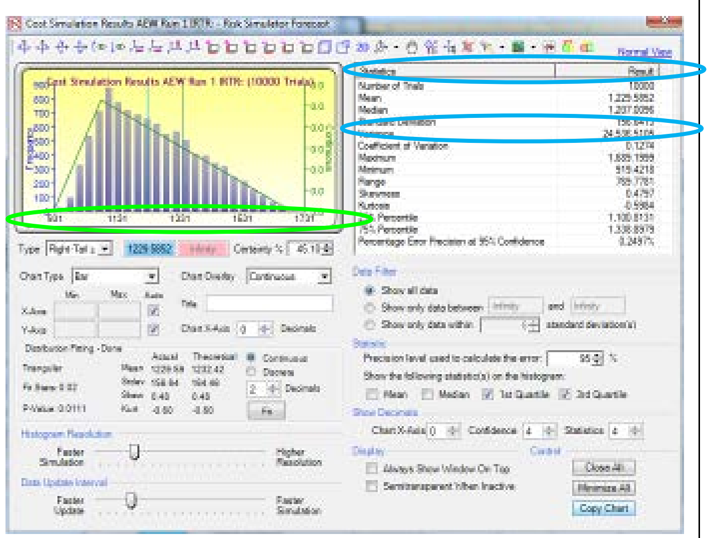
</td></tr>
<tr><td>IRTR AEW R1 Cost Risk Impact

= Max – Mean

= $1,689K – $1,230K = $459K

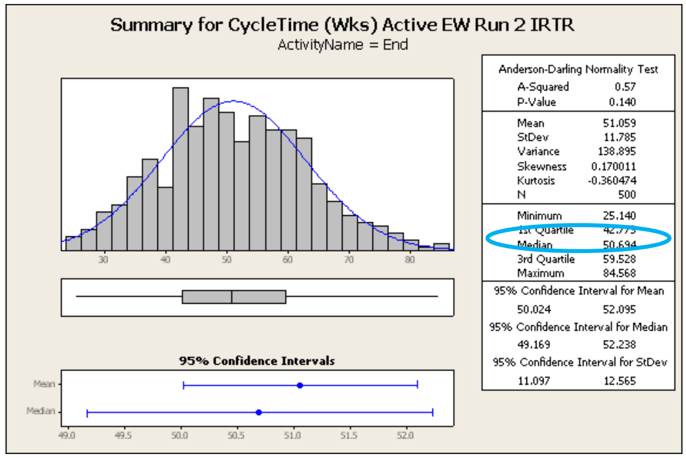
IRTR AEW R1 Cost Risk Likelihood

= Right tail chance of exceeding the mean = 45.10%

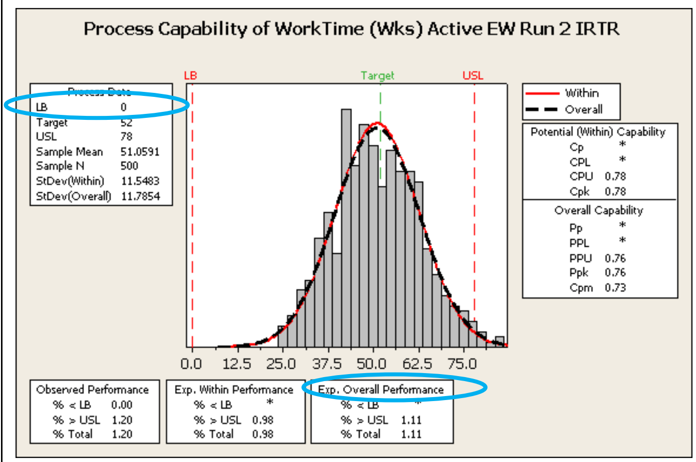
There is a 45.10% chance that the cost will exceed the mean by $459K.</td><td>

</td></tr>
<tr><td>IRTR AEW R1 Increased Performance Risk Impact</td><td>TBD</td></tr>
</table>

<table>
<tr><td>IRTR AEW R1 Increased Performance Risk Likelihood</td><td>TBD</td></tr>
<tr><td>IRTR Active EW Run 2</td><td></td></tr>
<tr><td>IRTR AEW R2 Schedule Risk Impact

= 85 Wks – 78 Wks

= 7 Wks</td><td>
</td></tr>
<tr><td>IRTR AEW R2 Schedule Risk Likelihood

= 1.11%

There is a 1.11% chance that the schedule will exceed 78 weeks by as much of 7 weeks.</td><td>
</td></tr>
<tr><td>IRTR AEW R2 Cost Risk Impact

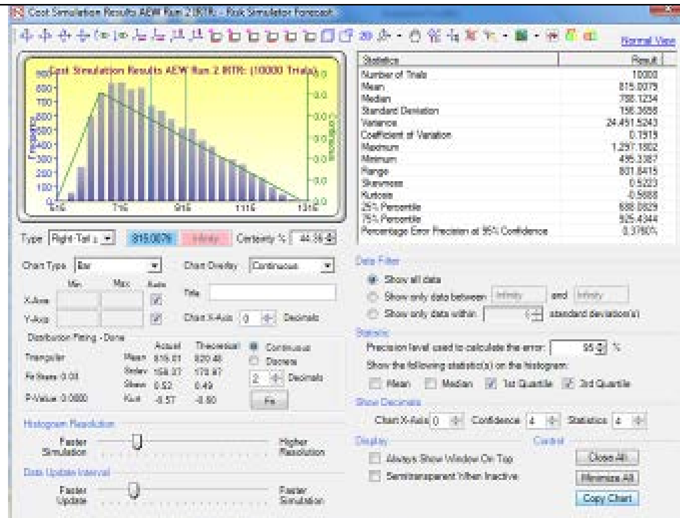
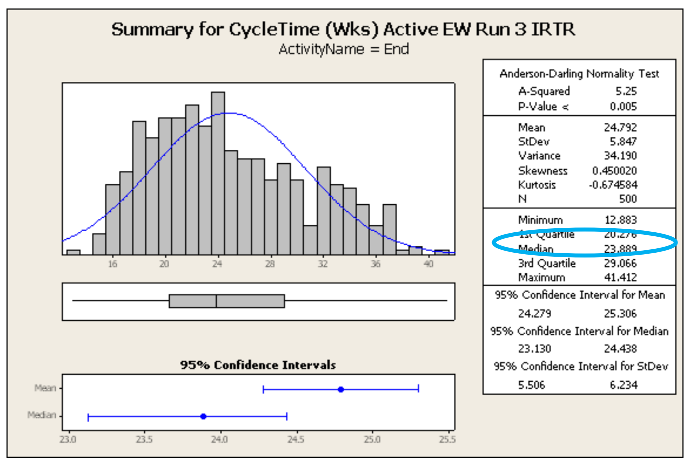
= Max – Mean

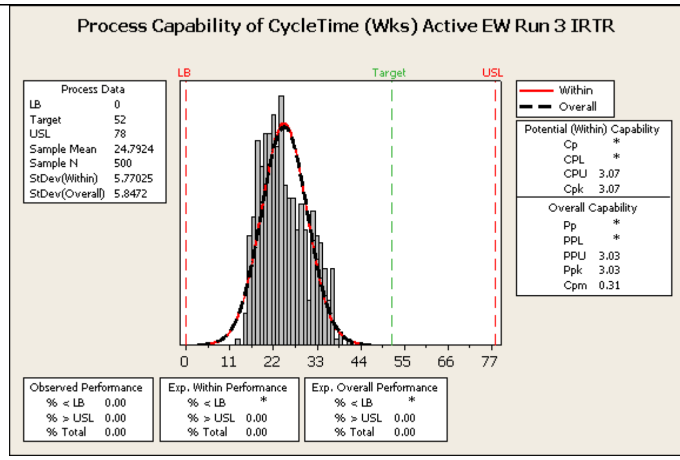
= $1297K – $815K = $482K

IRTR AEW R2 Cost Risk Likelihood

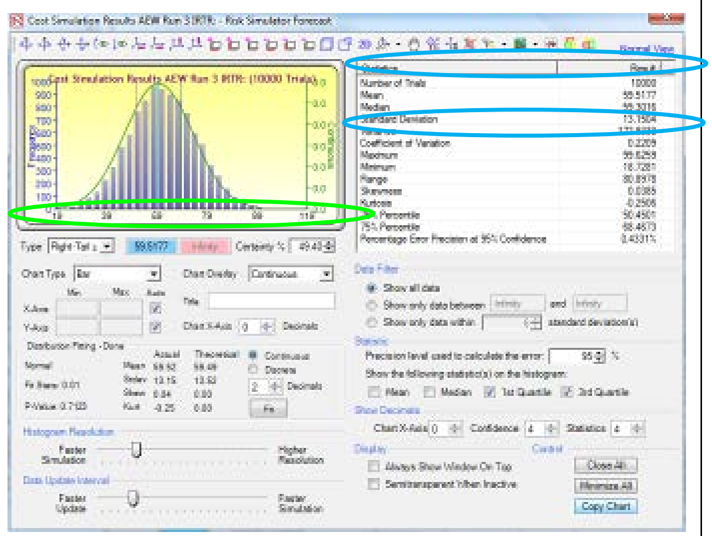
= Right tail chance of exceeding the mean = 44.36%

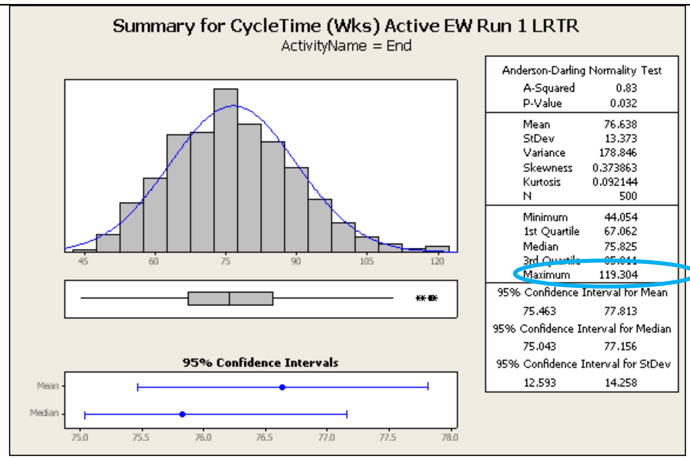
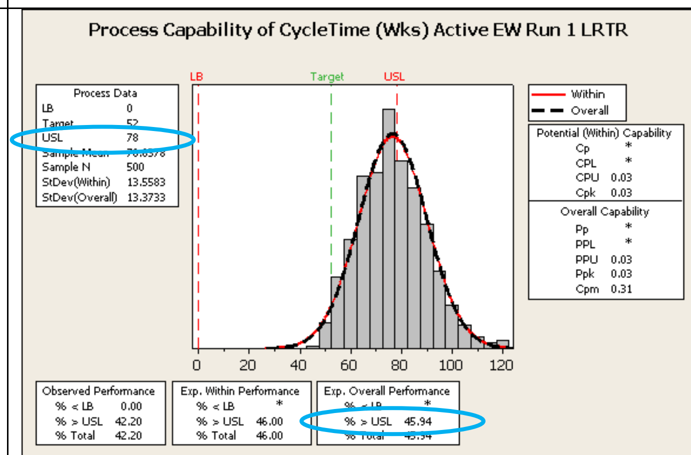
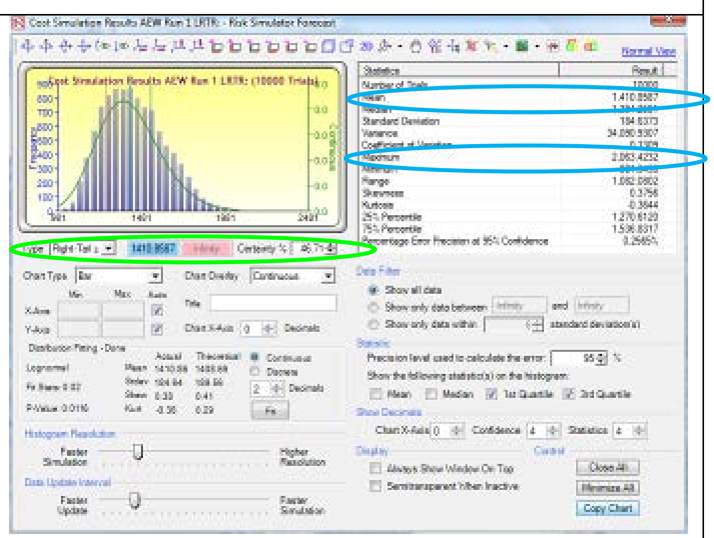
There is a 44.36% chance that the cost will exceed the mean by $482K.</td><td></td></tr>
</table>

	
IRTR AEW R2 Increased Performance Risk Impact	**TBD**
IRTR AEW R2 Increased Performance Risk Likelihood	**TBD**
IRTR Active EW Run 3	
IRTR AEW R3 Schedule Risk Impact = 41 Wks – 78 Wks = -37 Wks	
IRTR AEW R3 Schedule Risk Likelihood = 0.0% There is a 0% chance that the schedule will exceed 78 weeks.	

<table>
<tr><td></td><td>
</td></tr>
<tr><td>IRTR AEW R3 Cost Risk Impact
= Max – Mean
= $100K – $60K = $40K

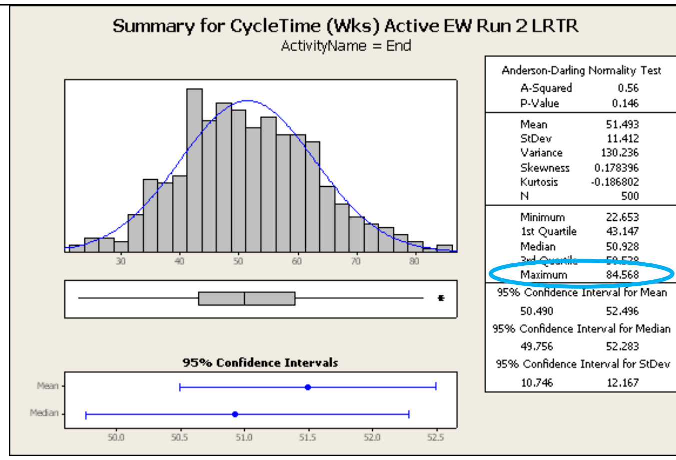
IRTR AEW R3 Cost Risk Likelihood
= Right tail chance of exceeding the mean = 49.40%

There is a 49.40% chance that the cost will exceed the mean by $40K.</td><td>
</td></tr>
<tr><td>IRTR AEW R3 Increased Performance Risk Impact</td><td>TBD</td></tr>
<tr><td>IRTR AEW R3 Increased Performance Risk Likelihood</td><td>TBD</td></tr>
<tr><td></td><td></td></tr>
<tr><td>LRTR Active EW Run 1</td><td></td></tr>
</table>

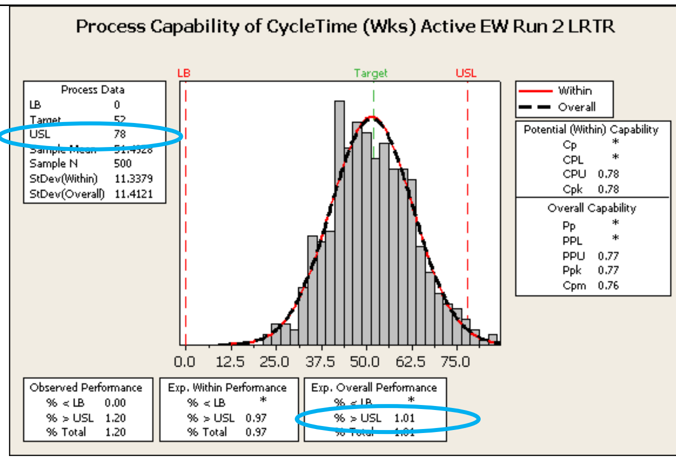
LRTR AEW R1 Schedule Risk Impact = 119 Wks – 78 Wks = 41 Wks	
LRTR AEW R1 Schedule Risk Likelihood = 45.94% There is a 45.94% chance that the schedule will exceed 78 weeks by as much of 41 weeks.	
LRTR AEW R1 Cost Risk Impact = Max – Mean = \$2,063K – \$1,411K = \$652K LRTR AEW R1 Cost Risk Likelihood = Right tail chance of exceeding the mean = 46.71% There is a 46.71% chance that the cost will exceed the mean by \$652K.	
LRTR AEW R1 Increased Performance Risk Impact	**TBD**
LRTR AEW R1 Increased	**TBD**

<table>
<tr><td>Performance Risk Likelihood</td><td></td></tr>
<tr><td>LRTR Active EW Run 2</td><td></td></tr>
<tr><td>LRTR AEW R2 Schedule Risk Impact

= 85 Wks – 78 Wks

= 7 Wks</td><td>
</td></tr>
<tr><td>LRTR AEW R2 Schedule Risk Likelihood

= 1.01%

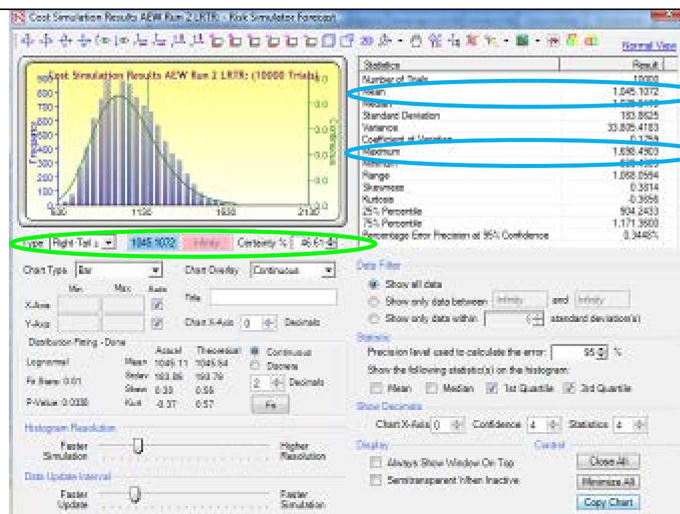
There is a 1.01% chance that the schedule will exceed 78 weeks by as much of 7 weeks.</td><td>
</td></tr>
<tr><td>LRTR AEW R2 Cost Risk Impact

= Max – Mean

= $1,698K – $1,045K = $653K

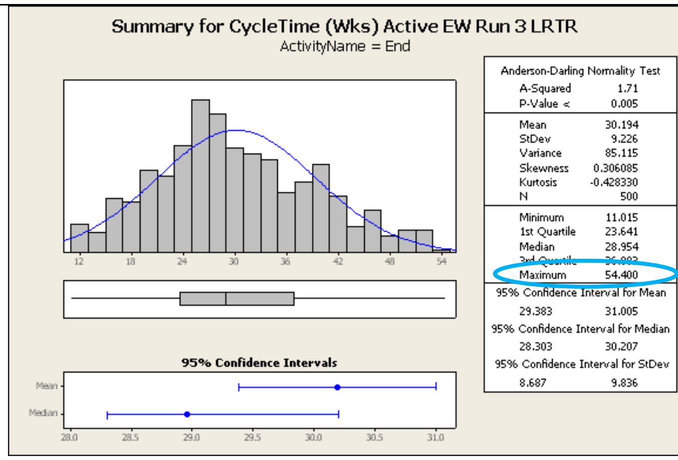
LRTR AEW R2 Cost Risk Likelihood

= Right tail chance of exceeding the mean = 46.61%

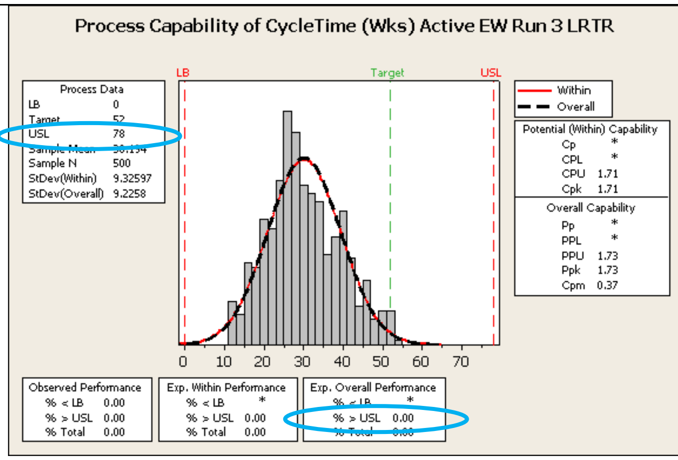
There is a 46.61% chance that the cost will exceed the mean by $653K.</td><td>
</td></tr>
</table>

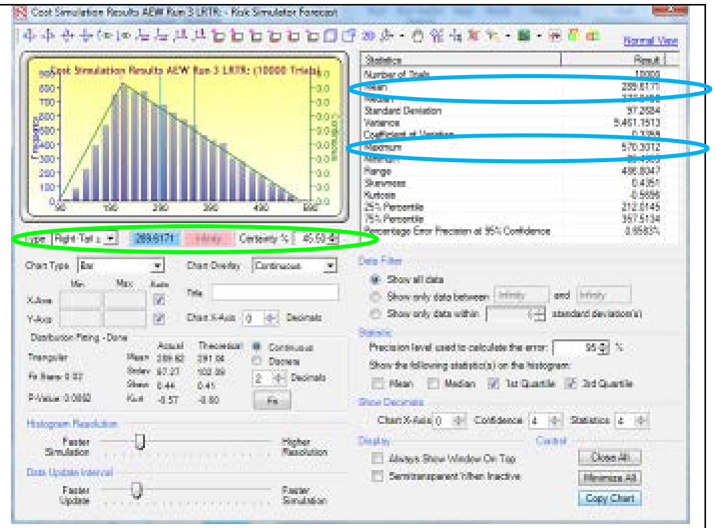
<table>
<tr><td>LRTR AEW R2 Increased Performance Risk Impact</td><td>TBD</td></tr>
<tr><td>LRTR AEW R2 Increased Performance Risk Likelihood</td><td>TBD</td></tr>
<tr><td>LRTR Active EW Run 3</td><td></td></tr>
<tr><td>LRTR AEW R3 Schedule Risk Impact

= 54 Wks – 78 Wks

= -24 Wks</td><td>
</td></tr>
<tr><td>LRTR AEW R3 Schedule Risk Likelihood

= 0.0%

There is a 0% chance that the schedule will exceed 78 weeks.</td><td>
</td></tr>
</table>

LRTR AEW R3 Cost Risk Impact = Max – Mean = \$570K – \$290K = \$280K LRTR AEW R3 Cost Risk Likelihood = Right tail chance of exceeding the mean = 45.50% There is a 45.50% chance that the cost will exceed the mean by \$280K.	
LRTR AEW R3 Increased Performance Risk Impact	**TBD**
LRTR AEW R3 Increased Performance Risk Likelihood	**TBD**

Laser Designator Payload

Baseline (BL)

	R1 Simple	R2 Complex	R3 Mature
Schedule Risk Impact	48 Wks	48Wks	0 Wks (-13Wks)
Schedule Risk Likelihood	80.80%	77.55%	0.000009%
Cost Risk Impact	$889K	$891K	$538K
Cost Risk Likelihood	47.58%	47.34%	45.44%
Performance Risk Impact	N/A	N/A	N/A
Performance Risk Likelihood	N/A	N/A	N/A

Intermediate Risk Timeline Reduction (IRTR)

	R1 Simple	R2 Complex	R3 Mature
Schedule Risk Impact	7 Wks	7 Wks	0 Wks (-37Wks)
Schedule Risk Likelihood	1.22%	1.22%	0%
Cost Risk Impact	$476K	$72K	$42K
Cost Risk Likelihood	44.54%	49.07%	49.44%
Performance Risk Impact	TBD	TBD	TBD
Performance Risk Likelihood	TBD	TBD	TBD

Low Risk Timeline Reduction (LRTR)

	R1 Simple	R2 Complex	R3 Mature
Schedule Risk Impact	7 Wks	7 Wks	0 Wks (-24Wks)
Schedule Risk Likelihood	0.84%	0.99%	0%
Cost Risk Impact	$653K	$652K	$281K
Cost Risk Likelihood	46.57%	46.60%	45.51%
Performance Risk Impact	TBD	TBD	TBD
Performance Risk Likelihood	TBD	TBD	TBD

Passive Electronic Warfare Payload

Baseline (BL)

	R1 Simple	R2 Complex	R3 Mature
Schedule Risk Impact	163 Wks	48 Wks	0 Wks (-24 Wks)
Schedule Risk Likelihood	100%	77.27%	0%
Cost Risk Impact	$894K	$893K	$538K
Cost Risk Likelihood	47.74%	47.72%	45.44%
Performance Risk Impact	N/A	N/A	N/A
Performance Risk Likelihood	N/A	N/A	N/A

Intermediate Risk Timeline Reduction (IRTR)

	R1 Simple	R2 Complex	R3 Mature
Schedule Risk Impact	48 Wks	7 Wks	-51 Wks
Schedule Risk Likelihood	87.16%	1.26%	0%
Cost Risk Impact	$459K	$455K	$42k
Cost Risk Likelihood	45.10%	45.18%	49.44%
Performance Risk Impact	TBD	TBD	TBD
Performance Risk Likelihood	TBD	TBD	TBD

Low Risk Timeline Reduction (LRTR)

	R1 Simple	R2 Complex	R3 Mature
Schedule Risk Impact	41 Wks	7 Wks	0 Wks (-24 Wks)
Schedule Risk Likelihood	45.94%	1.01%	0%
Cost Risk Impact	$655K	$654K	$281K
Cost Risk Likelihood	46.69%	46.59%	45.51%
Performance Risk Impact	TBD	TBD	TBD
Performance Risk Likelihood	TBD	TBD	TBD

Active Electronic Warfare Payload (Also Data Com and RADAR)

Baseline (BL)

	R1 Simple	R2 Complex	R3 Mature
Schedule Risk Impact	163 Wks	85 Wks	55 Wks
Schedule Risk Likelihood	100%	99.99%	99.47%
Cost Risk Impact	$894K	$898K	$539K
Cost Risk Likelihood	47.74%	47.51%	45.47%
Performance Risk Impact	N/A	N/A	N/A
Performance Risk Likelihood	N/A	N/A	N/A

Intermediate Risk Timeline Reduction (IRTR)

	R1 Simple	R2 Complex	R3 Mature
Schedule Risk Impact	46 Wks	7 Wks	0 Wks (-37 Wks)
Schedule Risk Likelihood	84.44%	1.11%	0%
Cost Risk Impact	$459K	$482K	$40K
Cost Risk Likelihood	45.10%	44.36%	49.40%
Performance Risk Impact	TBD	TBD	TBD
Performance Risk Likelihood	TBD	TBD	TBD

Low Risk Timeline Reduction (LRTR)

	R1 Simple	R2 Complex	R3 Mature
Schedule Risk Impact	41 Wks	7 Wks	0 Wks (-24 Wks)
Schedule Risk Likelihood	45.94%	1.01%	0%
Cost Risk Impact	$652K	$653K	$280K
Cost Risk Likelihood	46.71%	46.61%	45.50%
Performance Risk Impact	TBD	TBD	TBD
Performance Risk Likelihood	TBD	TBD	TBD

Performance Risk Matrices

(Refer to Tables; Table 5: Risk Likelihood Definitions and Table 6: Risk Impact Definitions for Performance and Schedule for Impact Risk and Risk Probability ratings scale.)

Generic Matrices IRTR & LRTR Strategies

GENERIC				
IRTR Strategy	Change	Impact Risk Cf	Risk Prob Pf	
CDL	No change			
IFC	Fast-track IFC with limited operation envelope.	2	2	
Battery	Interim approval. Battery could be used in dangerous manner.	2	2	
IA	Interim approval (IATO). Risk of compromise by unauthorized user.	2	2	
Spectrum	Interim approval - Not to interfere basis assignments	3	2	
T&E	OT in fielding. No time to fix problems before fielding.	4	3	
JTIC	Obtain a limited JITC in T&E, with full cert during preliminary fielding.	3	2	
SAASM	No change			
	Overall Risk Ratings:	3	3	
	Mean (excluding zeros)	*2.666666667*	*2.166666667*	
	Max	*4*	*3*	
LRTR Strategy	Change	Impact Risk Cf	Risk Prob Pf	
CDL	Use CDL or air platform data link. Limits payloads and competition.	1	1	
IFC	Fast-track IFC with limited operation envelope.	2	2	
Battery	Use previously certified battery. Limits payloads and competition.	1	1	
IA	No Change			
Spectrum	Use previously certified transmitters. Limits payloads and competition.	1	1	?
T&E	Joint DT and OT. No time to fix problems before OT, but can fix before fielding.	2	2	?
JTIC	No Change			
SAASM	Use previously certified GPS receivers. Limits payloads and competition.	1	1	
	Overall Risk Ratings:	2	2	
	Mean (excluding zeros)	*1.333333333*	*1.333333333*	
	Max	*2*	*2*	

Laser Designator Runs 1, 2, & 3 Matrices IRTR & LRTR Strategies

LASER DESIGNATOR RUN 1			
IRTR Strategy	Change	Impact Risk Cf	Risk Prob Pf
IFC	Fast-track IFC with limited operation envelope.	2	2
Battery	Interim approval. Battery could be used in dangerous manner.	2	2
IA	Interim approval (IATO). Risk of compromise by unauthorized user.	2	2
T&E	OT in fielding. No time to fix problems before fielding.	4	3
JTIC	Obtain a limited JITC in T&E, with full cert during preliminary fielding.	3	2
	Overall Risk Ratings:	3	3
	Mean (excluding zeros)	*2.6*	*2.2*
	Max	*4*	*3*
LRTR Strategy	Change	Impact Risk Cf	Risk Prob Pf
IFC	Fast-track IFC with limited operation envelope.	2	2
Battery	Use previously certified battery. Limits payloads and competition.	1	1
IA	No Change		
T&E	Joint DT and OT. No time to fix problems before OT, but can fix before fielding.	2	2
JTIC	No Change		
	Overall Risk Ratings:	2	2
	Mean (excluding zeros)	*1.666666667*	*1.666666667*
	Max	*2*	*2*

LASER DESIGNATOR RUN 2			
IRTR Strategy	Change	Impact Risk Cf	Risk Prob Pf
IFC	Fast-track IFC with limited operation envelope.	2	2
IA	Interim approval (IATO). Risk of compromise by unauthorized user.	2	2
T&E	OT in fielding. No time to fix problems before fielding.	4	3
	Overall Risk Ratings:	3	3
	Mean (excluding zeros)	*2.666666667*	*2.33333333*
	Max	*4*	*3*
LRTR Strategy	Change	Impact Risk Cf	Risk Prob Pf
IFC	Fast-track IFC with limited operation envelope.	2	2
IA	No Change		
T&E	Joint DT and OT. No time to fix problems before OT, but can fix before fielding.	2	2
	Overall Risk Ratings:	2	2
	Mean (excluding zeros)	*2*	*2*
	Max	*2*	*2*

LASER DESIGNATOR RUN 3			
IRTR Strategy	Change	Impact Risk Cf	Risk Prob Pf
IFC	Fast-track IFC with limited operation envelope. Only HPOL and Risks needed.	2	2
IA	Interim approval (IATO). Risk of compromise by unauthorized user.	2	2
T&E	OT in fielding. No time to fix problems before fielding.	4	3
	Overall Risk Ratings:	3	3
	Mean (excluding zeros)	*2.666666667*	*2.33333333*
	Max	*4*	*3*
LRTR Strategy	Change	Impact Risk Cf	Risk Prob Pf
IFC	Fast-track IFC with limited operation envelope. Only HPOL and Risks needed.	2	2
IA	No Change		
T&E	Joint DT and OT. No time to fix problems before OT, but can fix before fielding.	2	2
	Overall Risk Ratings:	2	2
	Mean (excluding zeros)	*2*	*2*
	Max	*2*	*2*

Passive EW Runs 1, 2, & 3 Matrices IRTR & LRTR Strategies

PASSIVE EW RUN 1			
IRTR Strategy	Change	Impact Risk Cf	Risk Prob Pf
CDL	No change		
IFC	Fast-track IFC with limited operation envelope.	2	2
Battery	Interim approval. Battery could be used in dangerous manner.	2	2
IA	Interim approval (IATO). Risk of compromise by unauthorized user.	2	2
Spectrum	Interim approval - Not to interfere basis assignments	3	2
T&E	OT in fielding. No time to fix problems before fielding.	4	3
JTIC	Obtain a limited JITC in T&E, with full cert during preliminary fielding.	3	2
SAASM	No change		
	Overall Risk Ratings:	3	3
	Mean (excluding zeros)	*2.666666667*	*2.16666667*
	Max	*4*	*3*
LRTR Strategy	Change	Impact Risk Cf	Risk Prob Pf
CDL	Use CDL or air platform data link. Limits payloads and competition.	1	1
IFC	Fast-track IFC with limited operation envelope.	2	2
Battery	Use previously certified battery. Limits payloads and competition.	1	1
IA	No Change		
Spectrum	Use previously certified transmitters. Limits payloads and competition.	1	1
T&E	Joint DT and OT. No time to fix problems before OT, but can fix before fielding.	2	2
JTIC	No Change		
SAASM	Use previously certified GPS receivers. Limits payloads and competition.	1	1
	Overall Risk Ratings:	2	2
	Mean (excluding zeros)	*1.333333333*	*1.33333333*
	Max	*2*	*2*

PASSIVE EW RUN 2			
IRTR Strategy	Change	Impact Risk Cf	Risk Prob Pf
IFC	Fast-track IFC with limited operation envelope.	2	2
IA	Interim approval (IATO). Risk of compromise by unauthorized user.	2	2
T&E	OT in fielding. No time to fix problems before fielding.	4	3
	Overall Risk Ratings:	3	3
	Mean (excluding zeros)	*2.666666667*	*2.33333333*
	Max	*4*	*3*
LRTR Strategy	Change	Impact Risk Cf	Risk Prob Pf
IFC	Fast-track IFC with limited operation envelope.	2	2
IA	No Change		
T&E	Joint DT and OT. No time to fix problems before OT, but can fix before fielding.	2	2
	Overall Risk Ratings:	2	2
	Mean (excluding zeros)	*2*	*2*
	Max	*2*	*2*

PASSIVE EW RUN 3			
IRTR Strategy	Change	Impact Risk Cf	Risk Prob Pf
IFC	Fast-track IFC with limited operation envelope. HPOL and Risks only.	2	2
IA	Interim approval (IATO). Risk of compromise by unauthorized user.	2	2
T&E	OT in fielding. No time to fix problems before fielding.	4	3
	Overall Risk Ratings:	3	3
	Mean (excluding zeros)	*2.666666667*	*2.33333333*
	Max	*4*	*3*
LRTR Strategy	Change	Impact Risk Cf	Risk Prob Pf
IFC	Fast-track IFC with limited operation envelope. HPOL and Risks only.	2	2
IA	No Change		
T&E	Joint DT and OT. No time to fix problems before OT, but can fix before fielding. **Run 3 has NO DT so no OT.** No time to fix problems before fielding.	2	2
	Overall Risk Ratings:	2	2
	Mean (excluding zeros)	*2*	*2*
	Max	*2*	*2*

Active EW Runs 1, 2, & 3 Matrices IRTR & LRTR Strategies

Active EW RUN 1			
IRTR Strategy	Change	Impact Risk Cf	Risk Prob Pf
CDL	No change		
IFC	Fast-track IFC with limited operation envelope.	2	2
Battery	Interim approval. Battery could be used in dangerous manner.	2	2
IA	Interim approval (IATO). Risk of compromise by unauthorized user.	2	2
Spectrum	Interim approval - Not to interfere basis assignments	3	2
T&E	OT in fielding. No time to fix problems before fielding.	4	3
JTIC	Obtain a limited JITC in T&E, with full cert during preliminary fielding.	3	2
SAASM	No change		
	Overall Risk Ratings:	3	3
	Mean (excluding zeros)	*2.666666667*	*2.166666667*
	Max	*4*	*3*
LRTR Strategy	Change	Impact Risk Cf	Risk Prob Pf
CDL	Use CDL or air platform data link. Limits payloads and competition.	1	1
IFC	Fast-track IFC with limited operation envelope.	2	2
Battery	Use previously certified battery. Limits payloads and competition.	1	1
IA	No Change		
Spectrum	Use previously certified transmitters. Limits payloads and competition.	1	1
T&E	Joint DT and OT. No time to fix problems before OT, but can fix before fielding.	2	2
JTIC	No Change		
SAASM	Use previously certified GPS receivers. Limits payloads and competition.	1	1
	Overall Risk Ratings:	2	2
	Mean (excluding zeros)	*1.333333333*	*1.333333333*
	Max	*2*	*2*

Active EW RUN 2			
IRTR Strategy	Change	Impact Risk Cf	Risk Prob Pf
IFC	Fast-track IFC with limited operation envelope.	2	2
IA	Interim approval (IATO). Risk of compromise by unauthorized user.	2	2
Spectrum	Interim approval - Not to interfere basis assignments	3	2
T&E	OT in fielding. No time to fix problems before fielding.	4	3
	Overall Risk Ratings:	3	3
	Mean (excluding zeros)	*2.75*	*2.25*
	Max	*4*	*3*
LRTR Strategy	Change	Impact Risk Cf	Risk Prob Pf
IFC	Fast-track IFC with limited operation envelope.	2	2
IA	No Change		
Spectrum	Use previously certified transmitters. Limits payloads and competition.	1	1
T&E	Joint DT and OT. No time to fix problems before OT, but can fix before fielding.	2	2
	Overall Risk Ratings:	2	2
	Mean (excluding zeros)	*1.666666667*	*1.6666667*
	Max	*2*	*2*

Active EW RUN 2			
IRTR Strategy	Change	Impact Risk Cf	Risk Prob Pf
IFC	Fast-track IFC with limited operation envelope. HPOL and Risks only.	2	2
IA	Interim approval (IATO). Risk of compromise by unauthorized user.	2	2
Spectrum	Interim approval - Not to interfere basis assignments	3	2
T&E	OT in fielding. No time to fix problems before fielding.	4	3
	Overall Risk Ratings:	3	3
	Mean (excluding zeros)	*2.75*	*2.25*
	Max	*4*	*3*
LRTR Strategy	Change	Impact Risk Cf	Risk Prob Pf
IFC	Fast-track IFC with limited operation envelope. HPOL and Risks only.	2	2
IA	No Change		
Spectrum	Use previously certified transmitters. Limits payloads and competition.	1	1
T&E	Joint DT and OT. No time to fix problems before OT, but can fix before fielding. **Run 3 has NO DT so no OT.** No time to fix problems before fielding.	2	2
	Overall Risk Ratings:	2	2
	Mean (excluding zeros)	*1.666666667*	*1.6666667*
	Max	*2*	*2*

APPENDIX H. RAPID PAYLOAD INTEGRATION CHECKLIST

Section 1: The Rapid Payload Integration Checklist is a product of the RAIN Team Research and is a deliverable item to PMA-265 for future integration projects.

Section 2: Component Analyses and Attribute Investigation: Certification Justification of Payload Integration Checklist

PMA-263 Payload Integration Checklist

Description: The Integration Checklist provides a detailed list of all system-level SE work that needs to be addressed to properly integrate a new capability. Each item in the list addresses the applicability, responsible NAVAIR competency, guiding instructions, approval authority, and documentation. The goal of this list is to capture the systems-level requirements for certification of a new/modified payload. This list provides a technology developer the information needed to scope and execute comprehensive integration of their payload to support timely fielding.

Safety Components

Airworthiness – Interim Flight Clearance (IFC)

[] Applicable   [] Not Applicable

1. Applicability: All air vehicles and aircraft systems owned or leased by any DON entity or component. An IFC is required for standard and new/modified aircraft system configurations, including hardware, firmware, and software; flight envelopes; and operation. This includes stores and store suspension equipment, Aviation Life Support Systems, and airborne-/surface-based components.
2. NAVAIR Competency: AIR 4.0P – Airworthiness Office
3. Instructions
   a. Guiding : Title 49 USC, Sec 40103 – Sovereignty and Use of Airspace
   b. Sub: NAVAIRINST 13034.1D
4. Approval Authority
   a. Full certification – NAVAIR 4.0P
   b. Waiver – N/A
   c. Interim – N/A
5. Required documentation

√	Delivered on Date (dd/mo/yr)	Document
	/ /	Interim Flight Clearance (IFC) Data Requirements Spreadsheet
	/ /	RCC 323-99 Range Safety Criteria for UAV's Risk Assessment Questionnaire
	/ /	Higher Probability of Loss (HPOL)
	/ /	Navy Type Command (TYCOM) Concurrence
	/ /	Laser Safety Review Board (LSRB) Approval [Laser]
	/ /	Naval Ordnance Safety & Security Activity (NOSSA) Approval [Battery]
	/ /	Weapons Systems Explosive Safety Review Board (WSESRB) Approval [Weapons]
	/ /	System Safety Risk Assessment (SSRA)

Battery

[] Applicable [] Not Applicable

1. Applicability: All lithium (Li) battery-powered devices intended for use or transportation on Navy facilities, submarines, ships, vessels, and aircraft. This includes all primary (non-rechargeable) and secondary (rechargeable), active, thermal and reserve Li batteries, including Li-ion batteries and all equipment power3ed by Li electrochemical power source(s) through all phases of the life of such systems.
2. NAVAIR Competency: AIR 4.4 - Propulsion & Power
3. Instructions
   a. Guiding :
      1) NAVSEAINST 9310.1B
   b. Sub:
      1) NAVSEA S9310-AQ-SAF-010
4. Approval Authority
   a. Full certification –
      1) NOSSA
   b. Waiver – N/A
      NOTE: NOSSA will not issue a waiver for 9310 safety requirements, but may issue an interim approval to operate the subject battery for a limited amount of time.
   c. Interim – N/A
      NOTE: NOSSA and NAVAIR (4.4.5.2): Although waivers are not granted, an interim approval may be granted, but the NOSSA and NAVAIR 4.4.5.2 must concur with the interim approval.
5. Required documentation

√	Delivered on Date (dd/mo/yr)	Document
	/ /	Battery Exemption
	/ /	Battery Cell Drawing
	/ /	Battery Schematic Drawing
	/ /	CONOPS
	/ /	Payload Technical Manual
	/ /	Battery Safety Data Package
	/ /	Request Letter Signed by PMA

Note: Some Li batteries do not require safety (see NAVSEA S9310-AQ-SAF-010 for details), but a safety assessment must be completed. The NOSSA Technical Agent will determine the level of 9310 safety testing required based on the documentation provided with the approval request.

Laser

[] Applicable [] Not Applicable

1. Applicability: Class 3B and 4 lasers used in optical fiber communications systems, all DON lasers used in combat, combat training, or classified in the interest of national security and all laser systems capable of exceeding Class 3 R levels, except those planned solely for industrial, construction, medical, or indoor experimental lab use.
2. NAVAIR Competency: AIR 4.6 – Human Systems
3. Instructions
   a. Guiding :
      1) Title 21, Code of Federal Regulations (CFR), Parts 1040, 1040.10, and 1040.11
      2) DoD Instruction 6055.15
   b. Sub:
      1) DoD Instruction 6055.15
      2) OPNAVINST 5100.27B
         3) Exemption No. 76EL-01DOD, Letter of Exemption from the Food and Drug Administration (FDA) for DoD Exemption from Provisions of 21 CFR 1040, July 29, 19761
4. Approval Authority
   a. Full certification – LASER Safety Review Board (LSRB)
   b. Waiver –N/A
   c. Interim – N/A
5. Required documentation

√	Delivered on Date (dd/mo/yr)	Document
	/ /	LASER Characterization Test Report (ANSI Z136.4, Recommended Practice for Laser Safety Measurements for Hazard Evaluation)
	/ /	Design Checklist 5100.27B
	/ /	Military Exemption Letter

Weapons System Explosives Safety Review Board (WSESRB) (Weapons Certification)

[] Applicable [] Not Applicable

1. Applicability: Any system that requires the use of ANY explosive(s) to complete its mission. Such as all ordnance items; explosives systems; weapon systems; related fire control systems; conventional components of nuclear weapons containing energetic materials, weapon devices, ignition devices (squibs), bolts, release mechanisms, or systems. This includes demonstration firings, evaluations, or foreign comparative testing, regardless of country of origin, military service prepotency, design source, or manufacturing source when their use or stowage will be aboard a Navy-owned or contracted vessel or aircraft.
2. NAVAIR Competency: AIR 4.1.6 (National NAVAIR competency for system safety)
3. Instructions

   a. Guiding : NAVSEAINST 8020.6E (2008)
   b. Sub: Paragraph 6.b.2.
4. Approval Authority
   a. Full certification – Recommendations to PM, CNO, and MDA by the WSESRB
   b. Waiver: Yes, High Risk is delegated to ASN (RDA), Serious Risk is delegated to the PEO, and Moderate to Low Risk is delegated to the Program Manager level with concurrence of residual risk by the WSESRB.
   c. Interim – N/A
5. Required documentation

√	Delivered on Date (dd/mo/yr)	Document
	/ /	Review request from PM to WSESRB secretariat member.
	/ /	Technical Data Packages

System Safety

[] Applicable [] Not Applicable

1. Applicability: All systems to identify and assess ESOH hazards, as well as mitigate ESOH risks.
2. NAVAIR Competency: AIR 4.1.6 – System Safety
3. Instructions
   a. Guiding :
      1) SECNAVINST 5000.2D
      2) MIL-STD-882
   b. Sub: NAVAIRINST 5100.11
4. Approval Authority
   a. Full certification – System Safety
   b. Waiver – N/A
   c. Interim – N/A
5. Required documentation

√	Delivered on Date (dd/mo/yr)	Document
	/ /	ESOH Hazards Analysis
	/ /	System Safety Engineering Plan (SSEP)
	/ /	Operator and Maintainer manuals
	/ /	Hazardous Materials Management Plan (HMMP)
	/ /	Programmatic Environmental, Safety, and Health Evaluation (PESHE)
	/ /	Failure Mode Effects and Criticality Analysis (FMECA)
	/ /	Hazards of Electromagnetic Radiation to Personnel (HERP)
	/ /	Hazards of Electromagnetic Radiation to Fuel (HERF) calculations
	/ /	NOSSA approval of lithium batteries
	/ /	Material Safety Data Sheet (MSDS),Temperature Change

Range Safety

[] Applicable   [] Not Applicable

1. Applicability: Any system that requires the use of any Navy and Marine Corps air-to-ground range installations with the confines of the United States, its territories, trusts, and possessions.
2. NAVAIR Competency: AIR 5.2 - NAVAIR Range Department
3. Instructions
   a. Guiding : NAVAIRINST 3200.3
   b. Sub: OPNAVINST 3550.1A
4. Approval Authority
   a. Full certification – concurrence of the Range Safety Officer
   b. Waiver –N/A
   c. Interim – N/A
5. Required documentation-N/A

√	Delivered on Date (dd/mo/yr)	Document
	/ /	Signed Test Plan
	/ /	Airworthiness Certificate
	/ /	JF-12
	/ /	LSRB approval with an assigned Laser Safety Officer (LSO)
	/ /	WSESRB Approval
	/ /	Range Scheduling Information

Electromagnetic Environmental Effects (E3)

[] Applicable   [] Not Applicable

1. Applicability: All NAVAIR platforms, weapon systems, Aircraft Launch and Recovery Equipment (ALRE) systems, Air Traffic Control (ATC) and landing systems, networks, facilities, sensors, electric or electronic equipment, ordnance, and support equipment developed, procured, acquired, leased, operated, modified or maintained by NAVAIR, including commercial off the shelf (COTS) items and non-developmental items (NDI).
2. NAVAIR Competency: AIR 4.1.13 - Electromagnetic Environmental Effects (E3) Division
3. Instructions
   a. Guiding :
      1) SECNAVINST 5000.2D
      2) OPNAVINST 2400.20F
      3) NAVAIRINST 2400.1
   b. Sub:
      1) MIL-STD-464C
      2) MIL-STD-461F
      3) NAVAIR 16-1-529
4. Approval Authority
   a. Full certification –
      1) AIR- 4.1.13 (E3 Division) – Aircraft

2) NOSSA – HERO, HERF Ship & Shore, HERP Ship & Shore

b. Waiver

1) CNO (N6)

2) WSESRB & NOSSA - Hazards of Electromagnetic Radiation to Ordnance (HERO)

c. Interim – N/A

5. Required documentation

√	Delivered on Date (dd/mo/yr)	Document
	/ /	E3 Integration and Analysis Report (E3IAR) as a minimum.
	/ /	E3 Verification Report – (Up to twelve different ones may be required as detailed the E3IAR)
	/ /	RADHAZ Analysis for HERO/F/P as required in the E3IAR.

Security Components

Information Assurance (IA)

[] Applicable   [] Not Applicable

1. Applicability: DON-owned or-controlled Information Systems that receive, process, store, display, or transmit DOD information, regardless of classification or sensitivity.
2. NAVAIR Competency: AIR 7.2.6 – Information Assurance
3. Instructions
    a. Guiding :
        1) DODD 8500.01E
        2) DODI 8500.2
    b. Sub:
        1) DODI 8510.01
4. Approval Authority
    a. Full certification –Operational Designated Accrediting Authority (ODAA), NAVAIR Chief Information Officer (CIO)
    b. Waiver – N/A
    c. Interim – Yes, IATT (Interim Authority to Test), IATO (Interim Authority to Operate) by DAA (Designated Accrediting Authority) for a limited time
5. Required documentation

√	Delivered on Date (dd/mo/yr)	Document
	/ /	Security Classification Guide (SCG)
	/ /	Configuration and Architecture Description
	/ /	Network Architecture Diagram
	/ /	Ports and Protocols List
	/ /	Hardware/Software (HW/SW) list
	/ /	Vulnerabilities Scan

Anti-Tamper

[] Applicable   [] Not Applicable

1. Applicability: DON-owned or –operated systems that require the protection of critical program information (CPI).
2. NAVAIR Competency: AIR 4.1.14 - Anti Tamper Executive Agent (ATEA)
3. Instructions
    a. Guiding :
        1) DODI 5000.2
        2) DODI 5200.39
    b. Sub:
        1) AT Guidelines Version 2
4. Approval Authority

   a. Full certification – ATEA, AIR- 4.1.14
   b. Waiver –N/A
   c. Interim – Yes, Interim Authority to Test (IATT) may be issued by the Designated Accrediting Authority (DAA) (NAVAIR CIO), and Interim Authority to Operate (IATO) may be issued for use of the system for a limited time prior to obtain the certification.
5. Required documentation

√	Delivered on Date (dd/mo/yr)	Document
	/ /	Anti-Tamper (AT) Plan
	/ /	Critical Program Information (CPI) Assessment

Selective Availability Anti-Spoofing Module (SAASM) Global Positioning System (GPS)

[] Applicable [] Not Applicable

1. Applicability: Any system or air vehicle equipped with DoD GPS systems.
2. NAVAIR Competency: AIR 4.5 - Avionics
3. Instructions
   a. Guiding :
      1) DOD GPS Security Policy 04 April 2006
      2) 2007 CJCS Master Positioning, Navigation, and Timing Plan CJCSI 6130.01D
      3) GPU-09-105 Security Approval Review Process Requirement Doc for GPS SAASM HAE
   b. Sub:
      1) 2007 CJCS Master Positioning, Navigation, and Timing Plan CJCSI 6130.01D 13 April 2007.
      2) GPU-09-105 Security Approval Review Process Requirement Doc for GPS SAASM HAE
      3) ICD- GPS-227 GPS HAE Design Requirements with SAASM
4. Approval Authority
   a. Full certification – GPSD
   b. Waiver – Assistant Secretary of Defense
   c. Interim – N/A
5. Required documentation

√	Delivered on Date (dd/mo/yr)	Document
	/ /	Technical Data

Clinger-Cohen Act

[] Applicable [] Not Applicable

1. Applicability: Any system or system that requires the use of, acquires, or manages Information Technology resources.
2. NAVAIR Competency: AIR 7.2.6 – Clinger-Cohen Act (CCA) Center of Excellence (COE)
3. Instructions
   a. Guiding : DoDI 5000.2
   b. Sub: SECNAVINST 5000.2
4. Approval Authority
   a. Full certification – Cognizant Chief Information Officer (CIO)
   b. Waiver – N/A
   c. Interim – N/A
5. Required documentation

√	Delivered on Date (dd/mo/yr)	Document
	/ /	CCA Compliance Table populated with MDA specified program governing documentation
	/ /	Acquisition Information Assurance Strategy.

Interoperability

Joint Interoperability (JITC)

[] Applicable [] Not Applicable

1. Applicability: All Information Technology (IT) acquired, procured (systems or services), or operated by any DoD component that exchange and use information to enable units or forces to operate in joint, combined, coalition, and interagency operations.
2. Competency: PMA with the JITC Representative
3. Instructions
   a. Guiding :
      1) DODD 4630.5
      2) DODI 4630.8
      3) DODI 5000.1
      4) DODI 5000.2
      5) CJCSI6212.01D
      6) CJCSI3170.01F
      7) CJCSM3710.01C
   b. Sub: N/A
4. Approval Authority
   a. Full certification – Joint Staff J-6
   b. Waiver – N/A
   c. Interim – Yes
5. Required documentation

√	Delivered on Date (dd/mo/yr)	Document
	/ /	ICEP/ITP (Interoperability Certification Evaluation Plan/Interoperability Test Plan)
	------------	At a minimum the DODAF Views as follows:
	/ /	STV-1
	/ /	SV-6 or OV-3
	/ /	SV-4
	/ /	SV-1
	/ /	SV-2
	/ /	(Additional Views please add)

Spectrum

[] Applicable   [] Not Applicable

1. Applicability: All NAVAIR platforms, weapon systems, Aircraft Launch and Recovery Equipment (ALRE) systems, Air Traffic Control (ATC) and landing systems, networks, facilities, sensors, electric or electronic equipment, ordnance, and support equipment developed, procured, acquired, leased, operated, modified or maintained by NAVAIR, including commercial off the shelf (COTS) items and non-developmental items (NDI).
2. NAVAIR Competency: AIR 4.1.M – E3 Engineering and Spectrum Support
3. Instructions
   a. Guiding: Title 47 US Code §305, §901-904
   b. Sub:
      1) 47 CFR 30
      2)DoD 4650.01
      3)SECNAVINST 2400.1
      4)OPNAVINST 2400.20F
      5)NAVAIR INST 2400.1
4. Approval Authority
   a. Full Certification –
      1) National Telecommunications and Information Administration (NTIA)
      2) NTIA Spectrum Planning Subcommittee
   b. Waiver – N/A
   c. Interim – N/A (exception: interim ATO granted with submission to SPS or local NTIA 7.11 Authority for limited duration)
5. Required documentation

√	Delivered on Date (dd/mo/yr)	Document
	/ /	JF-12 Note to Holder (NTH)
	/ /	1494 in EL-CID Format
	/ /	Standard Frequency Action Format (SFAF)

Common Data Link (CDL)

[] Applicable [] Not Applicable

1. Applicability: All systems utilizing a radio frequency data or communications link.
2. NAVAIR Competency: AIR 4.5 - Avionics
3. Instructions
   c. Guiding : H.R. 1815 National Defense Authorization Act for FY 2006
   d. Sub: ASD memo DoD CDL Policy, 30 Dec 2005
4. Approval Authority
   e. Full certification – Milestone Decision Authority (MDA)
   f. Waiver – DoD CIO
   g. Interim – N/A
5. Required documentation

√	Delivered on Date (dd/mo/yr)	Document
	/ /	Technical Data

Identification Friend or Foe (AIMS – part of Air Platform)

[] Applicable [] Not Applicable

1. Applicability: All air vehicles or aircraft that need to differentiate or be differentiated for either being a friendly force or a foe/enemy.
2. NAVAIR Competency: AIR 4.5 - Avionics
3. Instructions
   a. Guiding :
      1) DoD International AIMS Program Management Plan, dated 21 October 2010,
      2) DoD International AIMS Steering Committee Charter, dated 29 April 1977,
      3) USAF Program Management Directive (PMD) 8233(6)/PE63724F, dated 15 July 2002.
   b. Sub: none
4. Approval Authority
   a. Full certification – Air Traffic Control Radar Beacon System, Identification Friend or Foe, Mark XII/Mark XIIA, Systems (AIMS) (AIMS PO, Warner Robins AFB, GA)
   b. Waiver – N/A
   c. Interim – Yes
5. Required documentation

√	Delivered on Date (dd/mo/yr)	Document
	/ /	Technical Data

Identification Friend or Foe (NMSC)

[] Applicable   [] Not Applicable

1. Applicability: All air vehicles or aircraft that need to differentiate or be differentiated for either being a friendly force or a foe/enemy.
2. NAVAIR Competency: AIR 4.1.M – E3 Engineering and Spectrum Support
3. Instructions
    c. Guiding : OPNAVINST 2400.20F
    d. Sub: none
4. Approval Authority
    d. Full certification - Navy-Marine Corps Spectrum Center (NMSC)
    e. Waiver – N/A
    f. Interim – Yes
5. Required documentation

√	Delivered on Date (dd/mo/yr)	Document
	/ /	Technical Data

Compatibility Components

Environmental

[] Applicable [] Not Applicable

1. Applicability: All systems consisting of aviation materials, structures, electronics, subassemblies and components that are exposed directly to the environment in order to fulfill a mission.
2. NAVAIR Competency: AIR 4.3.4 - Aerospace Materials Division
3. Instructions
   a. Guiding :
      1) Corrosion Prevention Control Plan (CPCP) PMA-263
      2) SECNAVINST 5000.2E
   b. Sub:
      1) MIL-STD-810
4. Approval Authority
   a. Full certification – AIR -4.3.4.6 (Corrosion & Wear Branch) – Materials Engineering Division
   b. Waiver- AIR-4.3.4 Senior Materials Engineer
   c. Interim – AIR- 4.3.4.6 (Corrosion & Wear Branch) – Materials Engineering Division AIR- 4.3.4
5. Required documentation

√	Delivered on Date (dd/mo/yr)	Document
	/ /	Laboratory reports from a certified test laboratory for applicable MIL-STD-810 tests as outlined in the CCP (examples as below)
	/ /	Humidity
	/ /	Salt Atmosphere (acidified & non-acidified)
	/ /	Dust Test
	/ /	Rain Test
	/ /	High Temperature Operational & Non-Operational
	/ /	Internal Operational Temperature
	/ /	Low Temperature Operational & Non-Operational
	/ /	Temperature Change
	/ /	Shock per MIL-STD -810G Methods for flight, launch, recovery, & transportation, equipment/payload per MIL-S-901D
	/ /	Vibration per MIL-STD-810G Methods for flight, launch, recovery & transportation, equipment/payload per MIL-STD-167-1A

Test & Evaluation

[] Applicable [] Not Applicable

1. Applicability: All air vehicles and payloads that require developmental/operational test and evaluation to prove out mission capabilities.
2. NAVAIR Competency: AIR 5.0 – Test Directorate
3. Instructions
   a. Guiding :
      1) DoD Directive 5000.1, Defense Acquisition Systems (DAS)
      2) DoD Instruction 5000.02, Operation of the DAS CJCSI 3170.01,
      3) Joint Capabilities Integration & Development System (JCIDS)
   b. Sub:
      1) SECNAVINST 5000.2,
      2) Department of the Navy (DON) Implementation & Operation of the DAS & the JCIDS
      3) NAVAIRINST 3960.2,
      4) Acquisition Test & Evaluation
4. Approval Authority
   a. Full certification – AIR 5.0, Air Test and Evaluation Squadron (VX-XX)
   b. Waiver –N/A
   c. Interim – N/A
5. Required documentation

√	Delivered on Date (dd/mo/yr)	Document
	/ /	Completed PMA-263 Test Project Worksheet
	/ /	TEMP (Test and Evaluation Master Plan)
	/ /	Test Plan
	/ /	Test Supportability Plan
	/ /	Test Cards
	/ /	Test Reports

Citations for the Payload Integration Checklist

Page 1
(United States Congress/United States Government 1958, 2012), (United States Navy 2010)

Page 2
(United States Navy 2004), (United States Navy 2009b),

Page 3
(United States Food and Drug Administration 2013a),(United States Food and Drug Administration 2013c),(United States Food and Drug Administration 2013b),(United States Food and Drug Administration 1976), (United States Navy 2002), (United States Department of Defense 2007b),

Page 4
(United States Navy 2008, Paragraph 6.b.2.),(United States Navy 2005), (United States Navy 2011), (United States Department of Defense 2000)

Page 5
(United States Navy 2008),(United States Navy 2006a), (United States Navy 2009a), (United States Navy 2011),(United States Navy 2006b) , (United States Air Force 2010), (United States Air Force 2007)

Page 6
None

Page 7
(United States Department of Defense 2003)(United States Department of Defense 2007a),(United States Department of Defense 2008a), (United States Department of Defense 2010a)

Page 8
(United States Department of Defense 2008b), (United States Department of Defense 2010a)

Page 9
(United States Navy 2011), (United States Department of Defense 2008a), (United States Congress/United States Government 1996)

Page 10
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(United States Navy 2009a), (United States Navy 2006b), (United States Navy 2006c), (United States Department of Defense 2009), (United States Congress/United States Government , 901–904)

Page 12
(United States Congress/United States Government 2006) , (United States Department of Defense 2005),(United States Air Force 2002),(United States Department of Defense 2010b),(United States Department of Defense 1977),

Page 13
(United States Navy 2006b),

Page 14
(INSITU - Michael Tucker 2011), (United States Navy 2011), (United States Department of Defense 2008c)

Page 15
(United States Department of Defense 2008b),(United States Navy 2011), (United States Navy 1998),(United States Department of Defense 2008a)(United States Navy 2011)

SAFETY COMPONENTS

The following certifications, as shown in Figure 37, satisfy the Safety system requirements:

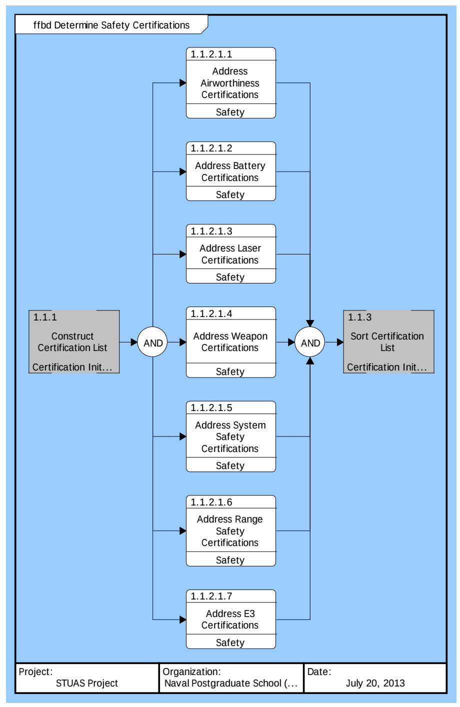

Figure 37: Safety Certifications

<u>Airworthiness Certification</u>

Statutory/Regulatory Airworthiness Requirement

Airspace, regardless of sovereignty or elevation, will always be expected to be shared among a variety of aircraft (public, civil, and private). Because of this, steps must be taken to ensure the safe operation of aircraft that navigate through the same airspace and to protect property/personnel on the ground. This is imposed through a statutory requirement, Title 49 United States Code (USC), Sec 40103 – Sovereignty and Use of Airspace.

NAVAIR Airworthiness Certification Process

For aircraft (manned and unmanned) that is owned/ and/or operated by or for the U.S. Navy, this is satisfied by an accomplished through a NAVAIR airworthiness certification called a Flight Clearance per NAVAIRINST 13034.1D. This document is designed to ensure that operation of the specifically-configured system can be performed within acceptable standards of loss of life and/or damage to property or the environment. It is developed by the PMA, in coordination with the applicable SMEs and NAVAIR's Airworthiness Office (Air 4.0P).

RAIN is concerned with payloads affected by rapidly-changing UAS technologies. This requires an airworthiness certification process that is flexible and can quickly incorporate new capabilities. A NAVAIR interim flight clearance (IFC) is well-suited to this requirement because it can be generated in as little as a few weeks or up to 20 weeks, depending on complexity of the system. There is no cost for this certification since the labor hours are already included in the PMA budget. It is developed by the platform's Assistant Program Manager for Systems Engineering (APMSE), in coordination with the applicable SMEs, and approved for release by NAVAIR's Airworthiness Office (Air 4.0P).

Airworthiness Waivers/Interim Approval Request

No waivers are authorized for airworthiness certifications; but IFCs can be released to obtain additional data in support of relaxing previous operating limitations and restrictions.

<u>Battery Certification</u>

Statutory/Regulatory Battery Requirement

Lithium (Li)-ion batteries are utilized in a variety of equipment throughout the U.S. Navy due to their ability to provide high voltage and long life. Unfortunately, these inherent attractive characteristics also make these batteries highly susceptible to overheating, which could cause ruptures and explosions. This has resulted in the establishment of the Navy's Lithium Battery Safety Program, as per NAVSEAINST 9310.1B, to mitigate the dangers associated with the utilization of these particular power sources.

NAVAIR Battery Certification Process

Through this program, any Li-ion battery that will be employed in any U.S. Navy equipment must be certified by NOSSA prior to initial fielding. This certification process will be conducted by the PMA, in coordination with NAVAIR's Propulsion and Power competency (AIR 4.4.5.2). If no testing is required, a battery can be certified for installation into a specific platform within a couple of weeks and at a cost of $3K for documentation expenses. A lack of OEM data will require complex testing, thus increasing the certification process duration to 26 weeks and costing the PMA $80K.

Battery Waivers/Interim Approval Request

No waivers are authorized for a battery certification; but interim approvals may be granted for limited duration. For these interim approval requests, documentation (e.g., Universal Need Statement (UNS)) must be provided that justifies the need to operate with uncertified batteries before NOSSA completes their analysis.

<u>Laser Certification</u>

Statutory/Regulatory Laser Requirement

The Department of Navy uses a variety of LASERs to complete its mission. The use of LASERs are regulated under Title 21, Code of Federal Regulations (CFR), Parts 1040, 1040.10, and 1040.11. These regulations dictate both how LASERs can be built and used, and are focused at the civilian sectors. For the military to effectively use its LASERs, the CFR Regulations are further decomposed and refined by DoD Instruction 6055.15, which is further decomposed by OPNAVINST 5100.27B. Since DoD LASER employments are significantly different from, and potentially more dangerous than, the civilian sector, the DoN has established the Navy Laser Hazards Control Program.

NAVAIR Laser Certification Process

There are three (3) basic parts to the Navy LASER certification process. The process is controlled by the LASER Safety Review Board (LSRB), which holds final certification authority within the Navy and USMC. The first phase of an LSRB approval is to issue a Military Exemption Letter to the manufacturer for the specific laser being procured. Once this letter is obtained a LASER radiation hazard evaluation must be completed in accordance with the LASER Characterization Test Report (ANSI Z136.4, Recommended Practice for Laser Safety Measurements for Hazard Evaluation), this test is usually conducted by a DoD lab, with a cost ranging from $10K to $20K. Including lead times, the characterization should take between four (4) and 10 weeks. Upon successful completion of the LASER characterization a Design Checklist 5100.27B for the LASER system should be completed, based on the characterization of the LASER, a system safety measure, and the user mission. Although the LSRB meets once a month, requests to present LASERs for certification must be submitted two (2) months in advance. The LSRB review and subsequent approval letter can be completed in two (2) to four (4) weeks.

Laser Waivers/Interim Approval Request

LSRB waivers are not authorized, but interim approvals can be obtained during system development. These interim approvals follow the standard certification process, but are designed to allow incremental increases in LASER use to support testing and safely develop the system.

<u>Weapon Certification (Weapons System Explosives Safety Review Board-WESRB)</u>

Statutory/Regulatory Weapon Requirement

The WSESRB was created via regulation in 1968 in response to explosives related mishaps aboard aircraft carriers. Because safety is not common sense, the WSESRB provides independent oversight to ensure maximum compliance with system explosives safety requirements. The WSESRB responsibilities, authorities, and operation procedures are issued by NAVSEAINST 8020.6D and apply to all Navy systems. The WSESRB authority chain is as follows:

DoDI5000.2 Para E7.7

- PM shall identify, evaluate and manage safety and health hazards.
- Explains the process for accepting risk

SECNAVINST 5000.2C

- CNO may establish system safety advisory boards.

SECNAVINST 5100.10H

- Directs Chief of Naval Operations (CNO)/Commandant of the Marine Corps (CMC) to establish safety programs.

OPNAVINST 8020.14 / Marine Corps Order (MCO) P8020.11

- Explosives Safety Policy
- Tasks COMNAVSEASYSCOM to establish WSESRB

NAVSEAINST 8020.6D

- Defines WSESRB process and procedures

NAVAIR Weapon Certification Process

The range of issues of concern related to explosives include: Hazard Classification, Insensitive Munitions, Final (Type) Qualification of Energetics, Lithium Battery Certification, and Human Systems Integration. The WSESRB reviews system designs, provides concurrence or non-concurrence with system design, recommends design changes, concurs or non-concurs with PM risk assessments. Each program has a WSESRB POC who is to facilitate interactions between the program and the WSESRB. The WSESRB POC follows the procedures detailed in NAVSEAINST 8020.6D to request a review of a system by the board. A board representative informs the POC when the board can review the system.

A program representative and the WSESRB POC attend a meeting of the WSESRB to brief the system. The board confers and issues its findings. If the board finds that there is residual risk it may not concur with the design and recommend design changes. Residual risk may be accepted by the program; but any residual risk assessments must be concurred with by the WSESRB and accepted at the appropriate level: High Risk = Assistant Secretary of the Navy (ASN) Research Development and Acquisition (RDA), Serious Risk = PEO, Moderate/Low Risk = PM. Usually multiple reviews are required.

Weapon Waivers/Interim Approval Request

The recommendations of the WSESRB can be waived by having the associated residual risk accepted at the appropriate level. The assessment of residual risk must be concurred with by the WSESRB. The appropriate level for accepting residual risk is as follows: High Risk = ASN (RDA), Serious Risk = PEO, Moderate/Low Risk = PM. There are no interim approvals.

<u>System Safety Certification</u>

Statutory/Regulatory System Safety Requirement

Imposed under statutory requirement, the system safety standard practice MIL-STD-882 ascertains DoD's methodology for identifying and assessing Environmental, Safety, and Occupational Health (ESOH) hazards as well as mitigating ESOH risks confronted during integration, testing, fielding, operation, and disposal of defense systems if applied. The approach shall be compliant with DoDI 5000.02.

NAVAIR System Safety Certification Process

With commitment to ensure safety of defense systems, public property, and organizational resources from accidental destruction, damage, or environmental impacts and to protect private and public personnel from accidental loss, injury, or occupational illness, a system safety approval is essential in managing and minimizing ESOH risks related to DoD systems. The System Safety Risk Assessment (SSRA) process should be applied appropriately based on the ESOH disciplines to identify hazards and mitigate associated risks throughout the SE process for any defense system, including integrating and fielding even tested modular payloads with new or existing technology development.

The system safety risk assessment process consists of, but not limited to, establishing an ESOH hazard analysis, operator's and maintainer's manuals with appropriate cautions and warnings, system safety engineering plan, hazardous materials management plan (HMMP), Programmatic Environmental, Safety, and Health Evaluation (PESCHE), system-of-system integration and interoperability hazard analysis, Failure Mode Effects and Criticality Analysis (FMECA) or other reliability data, and any fault tree analysis. It will also include, if applicable, Hazards of Electromagnetic Radiation to Personnel (HERP) and Hazards of Electromagnetic Radiation to Fuel (HERF) calculations, NOSSA approval of lithium batteries and Material Safety Data Sheet (MSDS), and all other system safety related documents. In order to obtain an approval for system safety, a System Safety Risk Assessment (SSRA) should be processed and approved by PMA within one (1) to 26 weeks, with a cost ranging from $3k to $50k, depending on the complexity of the system.

System Safety Waivers/Interim Approval Request

No interim approval and waivers are authorized for system safety certification. According to MIL-STD-882, "ESOH hazards shall be identified and assessed, and ESOH risks shall be mitigated and accepted in accordance with DoD policy." {{36 United States Department of Defense 2000}}.

<u>Range Safety Certification</u>

Statutory/Regulatory Range Safety Requirement

According to NAVAIR Instruction 3700.3 paragraph 4a, "DoDD 3200.11 establishes the policy for operations and administration of DoD test and evaluation (T&E) facilities designated as Major Range and Test Facility Bases (MRTFB) and designates the Range Commander as responsible for safety on each MRTFB range." {{77 United States Navy 2007}}. Paragraph 4b of the same instruction states the requirement that "the NAVAIR Range Department, consisting of three (3) MRTFB range sites, requires a unified approach for range safety" {{77 United States Navy 2007}}. For purposes of consistency and the effectiveness of range safety programs at each site, all sites shall implement common policies. Any deviation from policies will be limited to those necessitated by site-unique missions, capabilities or constraints." Further details on range safety are found in Naval Air Warfare Aircraft Division (NAWCAD) Instruction 3710.1A.

NAVAIR Range Safety Certification Process

Range Safety is concerned with many of the same issues as the System Safety community, but specifically in the context of operating the system in and T&E range environment. The test range environment has different system stressors and additional concerns that may not be present in the operational environment. These special requirements must be addressed to ensure safety of defense systems, public property, and organizational resources from accidental destruction, damage, or environmental impacts and to protect private and public personnel from accidental loss, injury, or occupational illness on or around a test range. Range Safety approval builds on the work done to obtain System Safety and IFC approvals. The NAVAIR range safety office (AIR-5.2.3) is responsible for the review and approval of range safety-related portions of test plans, determining project support requirements are in concert with established command policy, and providing day-to-day policy interpretation. Range Safety Officers (RSO) are tasked with ensuring that no unnecessary risk is accepted by the range.

In order to aid in obtaining approval of a test plan from the RSO, it is crucial that it includes containment of all hazards, avoids single point failures, and categorizes all risks that the equipment may present to the range and its personnel along with its mitigating steps. Risks should be identified as early as possible during the process of writing the test plan. Standard operating procedures for handling such risks must be written and established. Training must be given to personnel who are operating the equipment on such risks, with any go/no-go criteria established prior to operation.

The range safety risk assessment process consists of, but is not limited to, reviewing the hazardous materials management plan (HMMP); Programmatic Environmental, Safety, and Health Evaluation (PESCHE); system-of-system integration and interoperability hazard analysis; Electromagnetic Environmental Effects Integration Analysis Report (E3IAR) and associated verification reports; Hazards of Electromagnetic Radiation to Personnel (HERP) and Hazards of Electromagnetic Radiation to Fuel (HERF) calculations; Hazards of Electromagnetic Radiation to Ordnance (HERO) (on the system as well on other systems exposed to the system); the findings of the WSESRB; NOSSA approval of lithium batteries and Material Safety Data Sheet (MSDS); and all other system safety related documents. Additional information that may be required includes, but is not limited to, hazard pattern analyses, system design descriptions, system operation descriptions, and test plans. Exact requirements will be based on the system design and operation descriptions, test plan, and discussions between the RSO, test engineers and PMA. Once the required information needs is submitted, a determination will usually be made within four (4) weeks, with cost dependent on the complexity of the system.

Range Safety Waivers/Interim Approval Request

There are no formal range safety waivers. Similar to System Safety, hazards shall be identified and assessed, and ESOH risks mitigated and accepted in accordance with DoD policy. All risks to the range or people on or around the range must be approved by the RSO, who is the cognizant point of contact if any questions arise about any particular situations in regards to range issues related to risks.

Electromagnetic Environmental Effects (E3) Certification

Statutory/Regulatory E3 Requirement

Electromagnetic radiation permeates the environments of the modern battlefield and the modern test range. In order to ensure the safe and correct operation of military electronic systems, the DoD directs the services to address E3 concerns in DoDD 3222.3. The Navy implements that directive through SECNAVINST 2400.0, SECNAVINST 5000.2, OPNAVINST 2400.20, and NAVAIRINST 2400.1. The procedures and standards to be used to comply with these regulations are MIL-STD-464, MIL-STD-461, MIL-HDBK-235, and NAVAIR 16–1–529.

E3 is concerned with the negative or unintended effects of the electromagnetic environment on both the system of interest and the systems with which it interacts. All electrical systems produce electromagnetic signals that can travel via both radiation and conduction, and potentially cause unintended unsafe malfunctions of the system of interest or other external systems. Because of this, system designs must adequately protect the system from the environment and protect external systems from its emissions. Both analysis and test are used to determine if the system has adequate protections to ensure safe operation in its intended environments. Up to thirteen analyses and certifications may be required that “encompasses the electromagnetic effects addressed by the disciplines of electromagnetic compatibility (EMC), electromagnetic interference (EMI), electromagnetic vulnerability (EMV), electromagnetic pulse (EMP), electronic protection (EP), electrostatic discharge (ESD), and hazards of electromagnetic radiation to personnel (HERP), ordnance (HERO), and volatile materials (HERF). E3 includes the electromagnetic effects generated by all electromagnetic environment (EME) contributors including radio frequency (RF) systems, ultra-wideband devices, high-power microwave

(HPM) systems, lightning, precipitation static, etc.” {{42 United States Air Force 2010}}.

NAVAIR E3 Certification Process

The first step is the E3 Integration & Analysis Report (E3IAR), which details the tailoring of the requirements in MIL-STD-464C & MIL-STD-461F for the system of interest by providing a rationale to conduct testing or not for each requirement. Additionally, a Radiation Hazard (RADHAZ) analysis may be required. Depending on the findings from the E3IAR and RADHAZ analysis, the below compliance certifications may be required:

- EMC
- EMI
- EMP
- EMV
- ESD
- HERF
- HERO
- HERP
- Bonding & Grounding
- Lighting
- Precipitation Static (P-Static)

“Within NAVAIR, Electromagnetic Environmental Effects/Spectrum Supportability (E3/SS) approval and enforcement is the responsibility of the Electromagnetic Environmental Effects Division, (AIR-4.1.13).” (NAVAIRINST 2400.1 2009, p.3)

E3 Waivers/Interim Approval Request

Waivers may be granted for most of the E3 certifications by the CNO, except for HERO testing, which can be waived by NOSSA through the WSESRB. Interim certifications do not apply, but systems that do not fully comply with certifications regarding radiated emissions may be subjected to minimum standoff distances from other systems, fuel, or people.

SECURITY COMPONENTS

The following certifications, as shown in Figure 38, satisfy the Security system requirements:

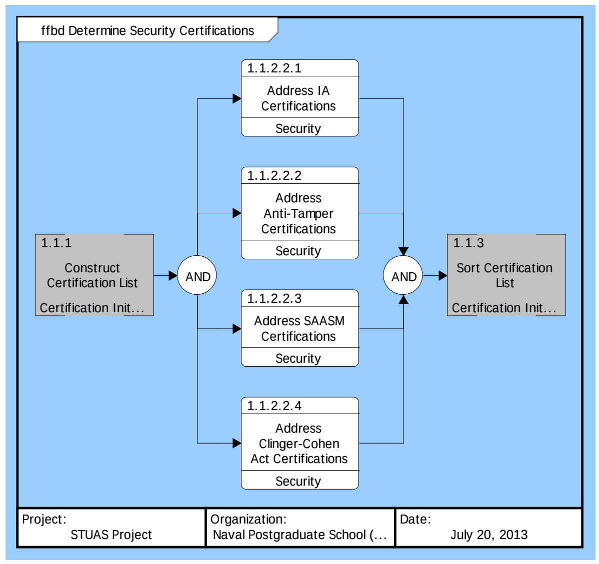

Figure 38: Security Certifications

Information Assurance (IA) Certification

Statutory/Regulatory IA Requirement

Information Assurance (IA) provides a secure, interoperable, net-centric Information Management (IM)/Information Technology (IT) environment across the Department of Navy (DoN) Enterprise. All DoN information and Information Systems (ISs) are serious to maintaining our naval control and national security. To ensure adequate protection for our information assets, DoD Information Assurance Certification and Accreditation (C&A) Process (DIACAP) evaluates the defense-in-depth layering of

IA principle and control to people, processes, and technology by following the DoDI 8500.01E, DoDI 8500.2, and DoDI 8510.01 guidelines.

NAVAIR Information Assurance (IA) Certification Process

The SME from AIR 7.2.6 submits a DoD IA Certification (DIACAP) package to the Operational Designated Accrediting Authority (ODAA) for an Authorization to Operate (ATO). Although collection of the required data and performance of the vulnerability scans can be completed in 30 to 60 days, review of the DIACAP package by the ODAA can take up to 52 weeks.

IA Waivers/Interim Approval Request

No waivers are authorized for IA certification. An Interim Authority to Test (IATT) may be issued by the Designated Accrediting Authority (DAA) (NAVAIR Chief Information Officer - CIO) or an Interim Authority to Operate (IATO) may be issued for use of the system for a limited time while identified security weaknesses are addressed.

Anti-Tamper (AT) Certification

Statutory/Regulatory AT Requirement

Anti-Tamper (AT) involves activities to prevent and/or delay exploitation of critical technologies in U.S. weapon systems. These activities involve the entire life-cycle of systems acquisition, including research, design, development, implementation, and testing of AT measures. To prevent unapproved technology transfer, alteration of system competency, or countermeasure development, program protection may require anti-tamper capabilities, which are a derivative of the security engineering process. The AT process is addressed under DoDI 5000.2, DoDI 5200.39, and AT Guideline Version 2 (the guideline is mapping of DoD Information Assurance Certification and Accreditation Process DIACAP to IA Controls) to complete and obtain an AT certification.

NAVAIR AT Certification Process

The SME from AIR 4.1.14 submits the AT plan and the Critical Program Information (CPI) Identification and Critical Analysis assessment to the Anti-Tamper Executive Agent (ATEA). The AT certification shall be conducted in accordance with ATEA. The duration and cost to obtain AT certification is dependent on Development Test (DT).

AT Waivers/Interim Approval Request

No waivers are authorized for AT certification; but interim approvals may be issued by the ATEA for a limited time while the approval package is pending.

<u>Selective Availability Anti-Spoofing Module (SAASM) GPS Certification</u>

Statutory/Regulatory SAASM GPS Requirement

DoD GPS Security Policy issued in 2006 mandates all newly fielded DoD GPS systems deploy SAASM-compliant Precise Positioning System (PPS) devices due to the need for improving GPS security. Receivers without SAASM have a higher risk of dropping GPS signal due to spoofing or jamming, which would result in the loss of precise location and increase the time required to synchronize over communications systems. SAASM utilizes anti-spoofing and anti-jamming measures through encryption and keys to protect authorized receivers from operating with false satellite signals generated intentionally or unintentionally by allies or enemy. Although government regulations require all the latest DoD GPS systems to incorporate SAASM GPS receiver cards to increase security of crypto keys and counteract spoofing, many federal agencies and military groups still employ non-SAASM GPS receivers that put them in a higher security risk. Since standard GPS service can be rejected at any time via tactical combats, such as spoofing and jamming, it will be a challenge for non-SAASM GPS receivers to correct the situation quickly.

NAVAIR SAASM GPS Certification Process

All requests for NAVAIR SAASM GPS Certification are processed and approved by the GPS Directorate (GPSD), including Security Approval for SAASM Host Application Equipment (HAE) and SAASM Design Requirements for HAE.

SAASM GPS Waivers/Interim Approval Request

Integrating non-SAASM GPS requires a waiver, which can be authorized by Assistant Secretary of Defense. However, no waiver is obtained for Security Approval for SAASM HAE and SAASM Design Requirements for HAE (SAASM Functionalities, including Extended Functions).

<u>Clinger-Cohen Act (CCA)</u>

Statutory/Regulatory CCA Requirement

Clinger-Cohen Act (CCA) has reformed and improved the way the Navy acquires and manages Information Technology (IT) resources. An approved Acquisition Information Assurance (IA) Strategy is mandatory for systems that are or have IT when determined to be Mission Critical and Mission Essential. The CIO will be responsible for developing, maintaining, and facilitating the implementation of a sound and integrated IT architecture under USC Title 40 Subtitle III and Office of Management and Budget (OMB) Circular A-11 Appendix J {{53 United States Department of Defense 2008}}, {{35 United States Navy 2011}}.

NAVAIR CCA Certification Process

The SME from AIR 7.2.6 (CCA Center of Excellence (COE)) provides an executive summary, in addition to the statutory and regulatory documentation, to the NAVAIR CIO. The CCA Compliance Table must be populated with the Milestone Decision Authority (MDA) specified program governing documentation and an Acquisition IA Strategy. There is no test related to CCA. CCA certification for Acquisition Category (ACAT) III and below can be achieved in 32 days, with the cost as low as $6K. ACAT I & II would take an additional three (3) months due to review by the second echelon, for a cost of $51K.

CCA Waivers/Interim Approval Request

No waivers or interim approvals are authorized for CCA certifications.

INTEROPERABILITY COMPONENTS

The following certifications, as shown in Figure 39, satisfy the Interoperability system requirements:

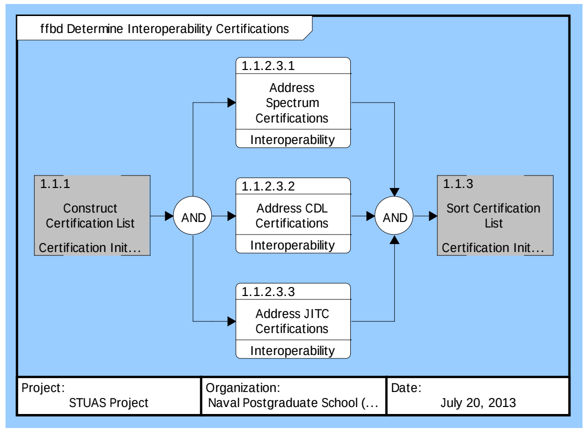

Figure 39: Interoperability Certifications

<u>Interoperability Certification</u>

Statutory/Regulatory Interoperability Requirement

Joint interoperability supports the U.S. Navy's and DoD's mission to have net-centric systems that ensure clear communication among all military systems, thus enhancing the warfighter's capabilities. In an excerpt from DoDI 5000.2, Enclosure 6, Paragraph 2-C-8:

"All DoD Major Defense Acquisition Programs (MDAPs), programs on the OSD T&E Oversight list, post-acquisition (legacy) systems, and all programs and systems that must interoperate, are subject to interoperability evaluations throughout their life cycles to validate their ability to support mission accomplishment. For IT systems (including Network Security Services (NSS)) with interoperability requirements, the Joint Interoperability Test Command (JITC), regardless of ACAT, shall provide system interoperability test certification memorandums to the Deputy Under Secretary of Defense (Acquisition and Technology) (Deputy Undersecretary of Defense (DUSD)(Acquisition and Technology (A&T)), the Assistant Secretary of Defense (ASD)(NII)/Department of Defense Chief Information Officer (DoD CIO), and the Director, Joint Staff J-6, throughout the system life-cycle." {{56 United States Department of Defense 2008}}

NAVAIR Interoperability Certification Process

The JITC representative for the PMA is responsible for identifying the required certification level for a given stage in the development and fielding of the payload. With all the necessary architecture views, a limited interoperability certification can be obtained in two (2) to three (3) months, with full certification in an additional three (3) months.

Interoperability Waivers/Interim Approval Request

No waivers are authorized for interoperability certification. A limited interoperability certification may be obtained for purposes of testing and training, but full certification is required for an Initial Operational Capability (IOC) decision.

Spectrum Certification

Statutory/Regulatory Spectrum Requirement

Assigning electromagnetic radio frequencies for a variety of defense systems such as satellites, radio, or radars on the ever-diminishing electromagnetic spectrum is a critical process. With the rapidly-changing nature of current tactics, more complex defense systems rely on the spectrum to acquire information superiority and guide advanced weapons, especially unmanned systems. To be compliant, DoD has established policies and guidance to obtain spectrum certification imposed through a statutory requirement, Title 47 U.S. Code §305, §901–904. To ensure that communication equipment operating within an intended environment meet standard rules, guidelines, regulations, and limitations, National Telecommunications and Information Administration (NTIA) has established the Spectrum Certification Process.

NAVAIR Spectrum Certification Process

Spectrum certification requests shall be submitted by the SME from AIR 4.1.M.1 to the NTIA in the Equipment Location-Certification Information Database (EL-CID) format. The process should take about nine (9) to 208 weeks, with the cost ranging from $2k to $48k, depending on certification and complexity of the systems.

Spectrum Waivers/Interim Approval Request

No waivers are authorized for spectrum certifications. However, interim approvals may be granted with submission to the Spectrum Planning Subcommittee (SPS) or the local NTIA Authority for limited duration.

Common Data Link (CDL)

Statutory/Regulatory CDL Requirement

H.R.1815 National Defense Authorization Act for Fiscal Year 2006 mandates all datalinks used by UAS shall be CDL compliant. The Act is further clarified by ASD Memo Dec 30 2005 Subject DoD CDL Policy, which amplifies the importance of CDL for UAS video Datalinks, and exempted UAS under 30 Lbs.

CDL is a family of government-developed and -owned communication waveforms. Under the new Bandwidth Efficient – CDL (BE-CDL) waveforms and Standard CDL Rev H waveforms, users have a selection of frequency bands in which they may operate, including S-Band, C-Band, Ku-Band, and X-Band. The CDL family also utilizes a common and interoperable encryption schema that includes both Suite A and Suite B. The purpose of the CDL family is to reduce development and interoperations cost of proprietary radio systems and increase user interoperability by using a common communication schema.

NAVAIR CDL Certification Process

For the certification package it is submitted by SME from AIR 4.5 to the CDL executive agency. It is presented to the CDL executive agency the Systems Engineering Technical Review (SETR) milestone review.

NAVAIR CDL Waivers/Interim Approval Request

Interim CDL waivers can be obtained, if certain requirements are met and a long-term plan to obtain CDL is developed, funded, and exercised. A CDL waiver will take 26 to 104 weeks, if the waiver process is begun with all of the required justification substantiated upfront. To successfully obtain a CDL Waiver, it must be demonstrated that utilizing CDL would prevent the system from completing its mission. The Waiver must be routed to the Assistant Secretary of the Navy for Research, Development, and Acquisition (ASN RDA), Assistant Secretary of Defense for Networks and Information Integration (ASD NII), the Office of the Secretary of Defense (OSD), and the DoD CIO.

To begin this waiver process, a program should meet with their branch's CDL Executive Office to determine feasibility and identify the correct stakeholders.

COMPATIBILITY COMPONENTS

The following certifications, as shown in Figure 40, satisfy the Compatibility system requirements:

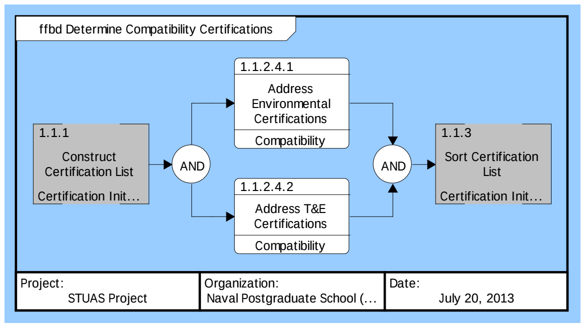

Figure 40: Compatibility Certifications

Environmental Certification

Statutory/Regulatory Environmental Requirement

Materials are the building blocks of an aircraft and react based upon the environment. They need to operate within different environments; they need to provide a degree of protection from the environment to survive each mission profile and the physical asset needs to have degree of durability. This relates directly to reliability, availability, maintainability, longevity and cost. This requirement is outlined in SECNAVINST 5000.2E and specifically states in section 6.1.5 that each ACAT I program shall document its corrosion prevention and control. While any program other than an ACAT I does not need a corrosion prevention and control plan, it is advised to aid in meeting regulatory requirements for example the Hexavalent Chromium DFARS 2252.223–7008 that requires the control or elimination of the use of hexavalent chromium from weapons platforms. Hexavalent Chromium is primarily found in the coatings and materials that make up the platform, of which the performance and use are found in the corrosion prevention and control plan. The corrosion prevention and control plan (CPC) also outlines the specific testing that will be performed as found in MIL-STD-810. Thus, based upon the materials of construction and the environment that the air vehicle will see, specific tests are chosen to prove the performance and effect on the life cycle of the aircraft.

Typically the Contractor shall develop and implement a Corrosion Control Plan (CCP) for the system using the DoD Corrosion Prevention and Control Planning Guidebook Spiral No. 3 of Sep 2007 (Ref Section 3.2.11) as a guide to ensure corrosion, wear, and erosion resistance is considered in the Contractors design of the system. The Contractor shall develop, utilize, and maintain a CPC Plan and shall establish, participate in, and support a Corrosion Prevention and Control (CPC) Advisory Team jointly with the Government to track the progress of CPC engineering efforts.

NAVAIR Environmental Certification Process

To meet the air vehicle (AV) and air worthiness requirements the materials and processes of protection requirements apply to both structural and non-structural materials and applications used for the AV. The AV environmentally-degraded properties shall account for exposure to any natural and induced environment reflecting authorized usage, storage, and maintenance throughout the service life of the AV. The AV environmentally degraded properties shall account for representative production processing, manufacturing variability, final assembly interfaces, life cycle exposure, and the supplier base. Specific tests from MIL-STD-810 and others are selected

The AV and its component parts shall be finished In-Accordance-With (IAW) MIL-STD-7179 the environmental certification process for each air vehicle platform is outline in the specific Corrosion Control Plan (CCP). The CCP details the tailoring of the requirements of MIL-STD-810 to the system of interest by providing a rationale to conduct testing to meet the operational environment and materials compatibility. Depending on the value of the payload, mission requirements, and funding environmental performance tests below may be required to comply with the certification:

- Humidity (48hrs)
- Salt Atmosphere (48hrs)
- Dust Test
- Rain Test
- High Temperature Operational & Non-Operational
- Internal Operational Temperature
- Low Temperature Operational & Non-Operational
- Temperature Change
- Shock per MIL-STD -810G Methods for flight, launch, recovery, & transportation, equipment/payload per MIL-S-901D
- Vibration per MIL-STD-810G Methods for flight, launch, recovery & transportation, equipment/payload per MIL-STD-167–1A

Within NAVAIR, Environmental approval and enforcement is the responsibility of the Materials Engineering Division, (AIR-4. 3.4) and the PMA-263 Systems Engineer. Payloads are generally certified for shock and vibration via a certification provided by the Contractor, if the testing is performed at all. Since the programs are not ACAT I, they are not required to have a CCP and test for environmental durability thus this requirement is advisory for durability risks.

Environmental Waivers/Interim Approval Request

The environmental performance testing certification is part of the Flight Clearance documentation and the requirement can be waived. The agreement to waive these requirements for payloads is coordinated by the cognizant Corrosion Engineer and Senior Materials Engineer from AIR 4.3.4 Materials Engineering Division and PMA-263 Systems Engineer with the PMA-263 management.

<u>Test & Evaluation (T&E)</u>

Statutory/Regulatory T&E Requirement

The test program will be managed by the AIR 5.0 T&E representative at the PMA. A Test Project Worksheet will be submitted to the T&E representative requesting testing of the desired platform, with the required objectives and timeframe. If necessary, the T&E representative will coordinate with the external test agency for OT&E and submit reports for approval to the Director of OT&E. The level of complexity of the required test(s) will determine the cost and duration.

NAVAIR T&E Certification Process

T&E is invaluable to the development and fielding of new capabilities to the warfighter. It is utilized to determine the technical maturity level of the system, identify deficiencies that need to be corrected, and provide technical risks to assist the decision-makers. Developmental test and evaluation (DT&E) focuses on system requirements and the system level risk, while operational test and evaluation (OT&E) is concerned with the capability the system delivers to the soldier, the operational risks, and how the system performs in its intended environment (paraphrased from the DAG5000.02 enclosure 6). This is imposed through a statutory requirement, Department of Defense Directive (DoDD) 5000.1, The Defense Acquisition System.

T&E Waivers/Interim Approval Request

OT&E is required for all major defense acquisition programs, as defined in Title 10 USC 2340 – Major Defense Acquisition Program and thus, cannot be waived.

Combined DT&E and OT&E is authorized when schedule and cost savings can be justified. This integrated test program must allow for separate evaluations from the developmental and operational communities.

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APPENDIX I. PAYLOAD INTEGRATION SCHEDULE

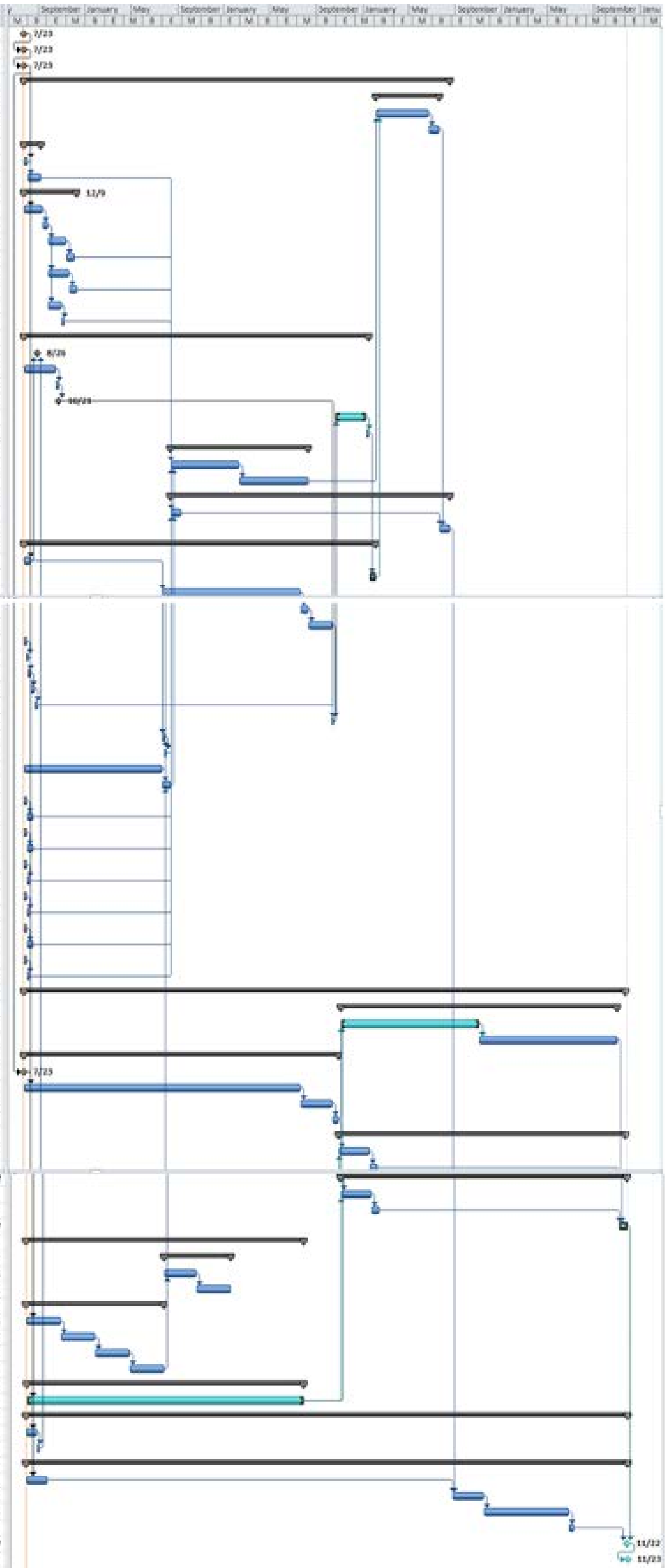
Payload Integration Checklist for PMA-263 in MS Project® Worse Case Longest Schedule

Schedule for All Certifications in Checklist using RAIN Model Data for All Certifications

(Start 7/23/13 end 11/22/17 approximately 4 years 4 months corresponds)

The Payload Integration Schedule is a product of the RAIN Team Research and is a deliverable item to PMA-265 for future integration projects.

	Task Mode	Task Name	Duration	Start	Finish
1		Start	0 wks	Tue 7/23/13	Tue 7/23/13
2		Develop & Build	0 wks	Tue 7/23/13	Tue 7/23/13
3		PMA	0 wks	Tue 7/23/13	Tue 7/23/13
4		**Safety Components**	**160.3 wks**	**Tue 7/23/13**	**Wed 8/17/16**
5		**Airworthiness IFC**	**24 wks**	**Wed 2/3/16**	**Wed 7/20/16**
6		IFC Lead Time	20 wks	Wed 2/3/16	Wed 6/22/16
7		IFC	4 wks	Wed 6/22/16	Wed 7/20/16
8		**Battery**	**6.6 wks**	**Tue 7/23/13**	**Thu 9/5/13**
9		Approval Lead Time	8 days	Tue 7/23/13	Thu 8/1/13
10		Approval Checklist	25 days	Fri 8/2/13	Thu 9/5/13
11		**LASER (LSRB)**	**20 wks**	**Tue 7/23/13**	**Mon 12/9/13**
12		LSRB Lead Time	7 wks	Tue 7/23/13	Mon 9/9/13
13		LSRB	2 wks	Tue 9/10/13	Mon 9/23/13
14		LASHAZ Eval Lead Time	7 wks	Tue 9/24/13	Mon 11/11/13
15		LASHAZ Eval	3 wks	Tue 11/12/13	Mon 12/2/13
16		LASER Design Checklist Lead Time	8 wks	Tue 9/24/13	Mon 11/18/13
17		LASER Design Checklist	3 wks	Tue 11/19/13	Mon 12/9/13
18		FDA MIL-Exempt Letter Lead Time	5 wks	Tue 9/24/13	Mon 10/28/13
19		FDA MIL-Exempt Letter	1 wk	Tue 10/29/13	Mon 11/4/13
20		**WSESRB**	**129.8 wks**	**Tue 7/23/13**	**Fri 1/15/16**
21		Collect Inputs	0 wks	Mon 8/26/13	Mon 8/26/13
22		WSESRB Lead Time	12 wks	Tue 7/23/13	Mon 10/14/13
23		WSESRB	1 wk	Tue 10/15/13	Mon 10/21/13
24		Collect WSESRB Results	0 wks	Mon 10/21/13	Mon 10/21/13
25		WSESRB Output Lead Time	12 wks	Mon 10/19/15	Fri 1/8/16
26		WSESRB Output	1 wk	Mon 1/11/16	Fri 1/15/16
27		**System Safety**	**52 wks**	**Tue 8/12/14**	**Mon 8/10/15**
28		System Safety Lead Time	26 wks	Tue 8/12/14	Mon 2/9/15
29		System Safety	26 wks	Tue 2/10/15	Mon 8/10/15
30		**Range Safety**	**105.3 wks**	**Tue 8/12/14**	**Wed 8/17/16**
31		Range Safety Lead Time	4 wks	Tue 8/12/14	Mon 9/8/14
32		Range Safety	4 wks	Wed 7/20/16	Wed 8/17/16
33		**E3**	**132.3 wks**	**Tue 7/23/13**	**Wed 2/3/16**
34		E3IAR	2.5 wks	Tue 7/23/13	Thu 8/8/13
35		E3IAR Update	2.5 wks	Mon 1/18/16	Wed 2/3/16
36		HERO Testing Lead Time	52 wks	Tue 7/22/14	Mon 7/20/15
37		HERO Testing	3 wks	Tue 7/21/15	Mon 8/10/15
38		HERO Test Report	9 wks	Tue 8/11/15	Mon 10/12/15
39		RADHAZ Analysis Lead Time	1 wk	Tue 7/23/13	Mon 7/29/13
40		RADHAZ Analysis	0.5 wks	Tue 7/30/13	Thu 8/1/13
41		HERF	1.24 wks	Thu 8/1/13	Fri 8/9/13
42		HERP	1.24 wks	Fri 8/9/13	Mon 8/19/13
43		HERO	1.24 wks	Mon 8/19/13	Wed 8/28/13
44		Collect HERO Results	0.2 wks	Tue 10/13/15	Tue 10/13/15
45		EMC Lead Time	1 wk	Tue 7/22/14	Mon 7/28/14
46		EMC (Intra-Sys EMC)	0.25 wks	Tue 7/29/14	Wed 7/30/14
47		EMV Lead time	52 wks	Tue 7/23/13	Mon 7/21/14
48		EMV (Inter-Sys EMC)	3 wks	Tue 7/22/14	Mon 8/11/14
49		EMI Lead Time	1 wk	Tue 7/23/13	Mon 7/29/13
50		EMI	2.48 wks	Tue 7/30/13	Thu 8/15/13
51		EMP Lead Time	1 wk	Tue 7/23/13	Mon 7/29/13
52		EMP	2.48 wks	Tue 7/30/13	Thu 8/15/13
53		ESD Lead Time	1 wk	Tue 7/23/13	Mon 7/29/13
54		ESD	1.24 wks	Tue 7/30/13	Wed 8/7/13
55		Bonding & Grounding Lead Time	1 wk	Tue 7/23/13	Mon 7/29/13
56		Bonding & Grounding	1.24 wks	Tue 7/30/13	Wed 8/7/13
57		Lightning Lead Time	1 wk	Tue 7/23/13	Mon 7/29/13
58		Lightning	2.48 wks	Tue 7/30/13	Thu 8/15/13
59		P-Static Lead Time	1 wk	Tue 7/23/13	Mon 7/29/13
60		P-Static	1.24 wks	Tue 7/30/13	Wed 8/7/13
61		**Security Components**	**226.3 wks**	**Tue 7/23/13**	**Wed 11/22/17**
62		**Information Assurance**	**104 wks**	**Tue 11/3/15**	**Tue 10/31/17**
63		IA Lead Time	52 wks	Tue 11/3/15	Tue 11/1/16
64		IA (Interim)	52 wks	Tue 11/1/16	Tue 10/31/17
65		**SAASM**	**118.5 wks**	**Tue 7/23/13**	**Thu 10/29/15**
66		SAASM Leadtime	0 wks	Tue 7/23/13	Tue 7/23/13
67		SAASM HAE	104 wks	Tue 7/23/13	Mon 7/20/15
68		SAASM Design Reqs for HAE Lead Time	12 wks	Tue 7/21/15	Mon 10/12/15
69		SAASM Design Reqs for HAE	2.5 wks	Tue 10/13/15	Thu 10/29/15
70		**Clinger-Cohen Act**	**107.8 wks**	**Thu 10/29/15**	**Wed 11/22/17**
71		CCA Lead Time	11.4 wks	Thu 10/29/15	Mon 1/18/16
72		CCA	3 wks	Mon 1/18/16	Mon 2/8/16
70		**Clinger-Cohen Act**	**107.8 wks**	**Thu 10/29/15**	**Wed 11/22/17**
71		CCA Lead Time	11.4 wks	Thu 10/29/15	Mon 1/18/16
72		CCA	3 wks	Mon 1/18/16	Mon 2/8/16
73		IA & CCA Finish Together	3.2 wks	Tue 10/31/17	Wed 11/22/17
74		**Interoperability**	**104.6 wks**	**Tue 7/23/13**	**Thu 7/23/15**
75		**Joint Interoperability (JITC)**	**25 wks**	**Tue 7/22/14**	**Mon 1/12/15**
76		JITC Lead Time	12 wks	Tue 7/22/14	Mon 10/13/14
77		JITC	13 wks	Tue 10/14/14	Mon 1/12/15
78		**Spectrum**	**52 wks**	**Tue 7/23/13**	**Mon 7/21/14**
79		Equip Spectrum Cert Lead Time	13 wks	Tue 7/23/13	Mon 10/21/13
80		Interim Equip Spectrum Cert	13 wks	Tue 10/22/13	Mon 1/20/14
81		Freq Assignments Lead Time	13 wks	Tue 1/21/14	Mon 4/21/14
82		Freq Assignments	13 wks	Tue 4/22/14	Mon 7/21/14
83		**Common Data Link (CDL)**	**104 wks**	**Fri 7/26/13**	**Thu 7/23/15**
84		CDL	104 wks	Fri 7/26/13	Thu 7/23/15
85		**Compatibility Components**	**226.5 wks**	**Tue 7/23/13**	**Thu 11/23/17**
86		Environmental Quality Lead Time	4 wks	Tue 7/23/13	Mon 8/19/13
87		Environmental Quality	1 wk	Tue 8/20/13	Mon 8/26/13
88		**Test & Evaluation**	**226.5 wks**	**Tue 7/23/13**	**Thu 11/23/17**
89		DT Lead Time	8 wks	Tue 7/23/13	Mon 9/16/13
90		DT	12 wks	Wed 8/17/16	Wed 11/9/16
91		OT Lead Time	32 wks	Wed 11/9/16	Wed 6/21/17
92		OT	2 wks	Wed 6/21/17	Wed 7/5/17
93		Wait until all Certs are done	0 wks	Wed 11/22/17	Wed 11/22/17
94		End	0 wks	Thu 11/23/17	Thu 11/23/17



APPENDIX J. RAIN IPR MEETING NOTES

RAIN IPR #1:

21 March 2013

Attendees:

Ronnie Lyliston	Wayne Parsons	Dr. Rama Gehris
Bonnie Young	Angel Perez	Chris Ironhill
Fred Lancaster	Diana Ly	Bryan Otis
Luis Conde-Santos		Nam Tran

Notes:

Questions and Information (FYI's) from Brigitte T. Kwinn

The U.S. Army has tactical UAVs, have you looked at what the Army does?

- We did check with the Army (PM UAS). They don't have a documented process, either.

What other SE processes did you consider? Why did you select the V model instead of another model?

- V model was selected because it's the process of choice throughout NAVAIR and would be readily-accepted by our Sponsors. We did consider other models including the DAU waterfall model and the one from SE3100 but we like the 'Vee' model better because of the explicit and linear verification connection between the definition and decomposition products and the integration and decomposition products that the 'Vee' model affords.

You have identified system inputs and outputs; did you consider establishing input or output requirements? Why?

- We did consider establishing input and output requirements, and we plan on doing that. The requirements are dependent on research that we have not finished yet.

Have you identified any other functions for the system?

- We have not agreed on the system functional hierarchy yet.

17 top level system requirements is a pretty large number, typically there are about 10 that deal with the system inputs, system outputs, system functions, system interfaces and the "ilities."

- Actually, we only have four top-level system requirements: Interoperability, Safety, Security, and Suitability/Environmental Compatibility.

The 17 are the Component-level requirements that were derived from the System-level requirements.

- There are only two stakeholder level requirements, or four System level requirements (see slide 28). What is listed in the requirements research matrix are the component level and configuration item level requirements.

FYI 2: You can do the requirements tracing and management in CORE also, it will capture the same info you have in your matrix on page 33

- We are using CORE®. The matrix is just for tracking research based on the requirements.

Second Reply from Bridgette Quinn

Make sure you emphasize that the Army doesn't have a process either, this makes what you are doing that much more important.

Your process has to fit your system and system life cycle that is why there are so many processes. The V is a system development process not a process for system process creation. That doesn't mean you can't use it but you must have evidence why it fits what you are doing.

Your 4 top system level requirements are the "ilities"? You don't have any capability/function requirements? What must the system do not what must the system be?

You don't have to answer this second round of questions.
End of notes.

RAIN IPR #2:

06 June 2013

Attendees:

Benjamin Teich	Wayne Parsons	Vincent Tolbert
Dr. Paul Montgomery	Dr. Rama Gehris	Prof. Bonnie Young
Fred Lancaster	Angel Perez	Bryan Otis
Chris Ironhill	Diana Ly	Nam Tran
	Luis Conde-Santos	

Notes:

Wayne Parsons;

Clinger Cohen Act, statutory requirement, some clarification since it applies to automated data equipment, does it apply?

- It(data) drives a lot of security issues.

The DRM he thought it was out of scope specifically T&E.

- T&E is an external interface. T&E is conducted by T&E facilities and organizations where PMA-263 is a customer

Dr. Gehris:

Is there any one system that is really worse case? Obtaining all certifications for example?

- SME's take weeks to review on the WESRB Board only meet at certain times and creates a backlog and the longest pole is security.

Dr. Montgomery:

Trying to craft a process of what is called RAIN, do you have a model of what is the current process?

- Ad hoc process does not exist.

No process where schedule & risk trade use case certification process vectors to trade risk and schedule, only data in-house/ad hoc. So some use case ma take 36 months but now there is structure.

Problem statement is not “what we are doing,” hearing no way to assess what we are doing against a variety of scenarios.

- Process instead of method.
- Slide 103 is sorted by work time, but both wait time and cycle time is there as well.

Top title has to do with rapid integration of stuff, appears just trading off certification of stuff?

Sounds like interoperability analysis.

- All things needed to get to the warfighter get to be interoperable.

What do you envision the product and what do you think it is?

Sounds 3-dimensional, still don’t see the light at the end of the tunnel.

- NAVAIR has a bunch of procedures but there isn’t a process in place for all of the procedures. This process organizes and maps out the requirements via architecture using CORE and then simulates the process of procedures in iGraphx. (Dr. Gehris – the project is the process, Bonnie- not a method but a process) bringing a process to procedures – this will be brought out up front in the report.

End of \notes

APPENDIX K. PROGRAM MANAGEMENT PLAN (PMP)

NAVAL POSTGRADUATE SCHOOL

Capstone Project Management Plan

Small Tactical Unmanned Aircraft System (STUAS) Rapid Integration and Fielding Process

Luis Conde-Santos

Christopher Ironhill

Frederick Lancaster

Diana Ly

Bryan Otis

Angel Perez

Nam Tran

3/08/2013

(Draft) DISTRIBUTION STATEMENT A
Approved For Public Release

Page **1** of **34**

APPROVAL SHEET FOR PROJECT MANAGEMENT PLAN

Team Approval

3/13/2013

X Bryan R Otis
Bryan Otis

X
Angel Perez

X
Frederick Lancaster

X
Christopher Ironhill

X
Luis Conde

X
Diana Ly

X
Nam Tran

Advisors Approval

X GEHRIS.RAMA.D.1231705720
Digitally signed by GEHRIS.RAMA.D.1231705720
DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=USN, cn=GEHRIS.RAMA.D.1231705720
Date: 2013.03.19 10:17:22 -04'00'
Dr. Rama Gehris

X YOUNG.BONNIE.W.1259743032
Digitally signed by YOUNG.BONNIE.W.1259743032
DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=USN, cn=YOUNG.BONNIE.W.1259743032
Date: 2013.03.19 19:26:22 -04'00'
Professor Bonnie Young

MSSE Dept Approval

X WHITCOMB.CLIFFORD.ALAN.1010636481
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Date: 2013.03.27 17:36:49 -07'00'
Dr. Cliff Whitecomb
SE Dept Chair

X PAULO.EUGENE.PACELLI.1171407431
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Date: 2013.03.20 13:04:15 -07'00'
Dr. Gene Paulo
MSSE Acad. Assoc.

RECORD OF CHANGES

*A - ADDED M - MODIFIED D – DELETED

VERSION NUMBER	DATE	NUMBER OF FIGURE, TABLE OR PARAGRAPH	**A* M D**	TITLE OR BRIEF DESCRIPTION	CHANGE REQUEST NUMBER
Rev A	2/18/13	Draft Changes	M	Reply to Advisor Comments Resolution	1
Rev B	3/7/13	Draft Changes	M	Reply to Advisor Comments Resolution	1

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1 Introduction

1.1 Project Background

The Department of the Navy (DoN) maintains a relatively small inventory of Small Tactical Unmanned Aircraft Systems (STUAS). These systems are designed to be highly modular and support multiple configurations, allowing for user selection of payloads based on unique mission needs. This modularity reduces the necessity for multiple unique Unmanned Aircraft Systems (UAS) platforms and their associated life cycle costs, while still providing mission flexibility. Technology developers have been successful in designing new payloads which integrate into the UAS platform and meet mission requirements. This provides a technology that is at a suitable Technology Readiness Level (TRL), meets all technical requirements of a particular UAS Interface Control Document (ICD), and size, weight, and power (SWAP) requirements, but does not address the DoN System-level requirements for integration and fielding.

It is the responsibility of the systems integrator to ensure that the platform, with its new payload, meets all regulatory and statutory requirements for deployment to the fleet. This is done by obtaining the necessary technical certifications (e.g., laser, Li battery, airworthiness approvals) imposed by regulatory requirements on the systems. An example of a statutory requirements placed on UAS, which must be addressed for successful integration, is H.R1815 National Defense Authorization Act for Fiscal Year 2006 (HR Bill, 2005), which states all data links used by an UAS must use the government developed Tactical Common Data Link (TCDL). This particular example has caused challenges in the past because some payloads are developed with their own Command and Control (C2) data links, so they do not have to integrate with the existing UAS data links, reducing the complexity of integration. Unfortunately if the payload is not developed to the TCDL requirement, this piece of the payload has to be re-engineered to complete systems-level integration.

The transition process between integration of the payload into the target platform and its ultimate integration into the encompassing DoN System is not well-defined. Each DoN System level requirement is handled by a different organization within the government, where the knowledge of that particular process and its associated requirements is self-contained. To date, little effort has been made to take a systems-level approach to bridge those lines of communication between organizations and collect all that information into one readily-accessible repository.

This elongates the timeline and creates new technical challenges between the integration of a payload and the fielding of a new UAS capability. With the current undefined process once a payload is delivered for integration into the system it takes approximately 24 to 36 months, depending on complexity of the effort, to thoroughly satisfy all the applicable statutory and regulatory requirements before the system can be inducted into the DoN inventory. This timeframe is unacceptable in supporting the rapidly-evolving environment to which our warfighters are exposed. For the sake of expediency the integration timeline is often shortened by waiving or inadvertently overlooking the systems-level requirements without an understanding of technical risk in these decisions, resulting in a rapidly-fielded system that may be technically insufficient to meet mission needs and could pose substantial risks to the warfighters in the future. To address these technical challenges and reduce the integration timeline, systems engineers must capture trade-offs that provide leadership with option to balance cost, schedule, and performance risk to the program.

1.2 Project Management Plan Purpose

The purpose of this Project Management Plan (PMP) is to outline the approach the RApid INtegration (RAIN) Team will take to address current short-comings in integration and fielding new capabilities on STUASs.

1.3 Problem Statement

The Department of the Navy (DON) does not have a documented process that maintains sufficient Systems Engineering (SE) discipline to rapidly integrate and field new mission configurations for their inventory of modular STUAS to the fleet to support aggressive schedules and urgent user needs in a timeframe of six to 18 months instead of the typical 24 to 36 months while minimizing technical risk to mission success. The requirements for whether or not to perform each certification (sub process) in the current process are not well understood and are often addressed in a reactive fashion, sometimes when identified as the entry criteria for a different certification or approval

1.4 Problem Scope

The scope of this project will be limited to new capabilities that can be integrated into modular STUAS in the existing PMA 263 inventory. The candidate payloads will be limited to those that meet the technical requirements of the platform's ICD and will not require re-design of the UAS or modification of the current airframe.

1.5 Project Goals

The goal of this project is to create and document a comprehensive process for the integration of new capabilities of modular UAS into the DoN System, then conduct a SE trade study, similar to an Analysis of Alternatives (AoA), to address the UAS systems integration challenges outlined in section 1.1. The trade study's goal will be to find the best way to rapidly integrate and field new configurations, meet technical requirements, balance technical risk, and produce options for a rigorous SE process that can be tailored to meet program needs.

1.6 Project Deliverables

The goal of this project is to conduct a trade study of a comprehensive SE plan to address payload integration of DoN requirements onto PMA-263 STUAS platforms. To complete this study a documented process to facilitate integration and fielding of new capabilities must be developed. The documented process will be used for modeling and simulation of the systems integration process. The final trade study will allow a tailoring of systems-level integration requirements to support the rapid integration and fielding of UAS capabilities into the DoN System. The following deliverables will be produced to support this analysis, and contained within the final report.

1.7.1 Project Management Plan

The Project Management Plan (PMP) will contain the approach and process the Team will use to address the problem statement and conduct the trade study.

1.7.2 Project Schedule

The project schedule will address the timing and execution of the PMP; it will include a Microsoft Project schedule that addresses delivery dates and detailed work flow.

1.7.3 Systems Engineering Plan

The Systems Engineering Plan (SEP) will provide the details of the project execution and the templates used to conduct the trade study. The plan will include, but is not limited to, the following subject areas:

- Body (Note: this is not an all inclusive list)
    - SE Approach
    - Risk Management
    - Specialty Areas (Note: this is not an all inclusive list)
        - Security
        - Information Assurance
        - Spectrum Management
        - Anti Tamper
        - Software
    - Test Planning
    - Requirements Management
    - Project Architecture

The SEP will also include the following items as tools to conduct the trade study.

1.7.3.1 Integration Checklist

The Integration Checklist will provide a detailed list of all system-level SE work that needs to be addressed to properly integrate a new capability. Each item in the list will address its purpose and deliverables. The goal of this list is to capture the systems-level requirements for payload integration that will drive the trade-off analysis.

It will also provide a technology developer the information needed to scope and execute comprehensive integration of their payload to support timely fielding. This checklist will flow into the cost and schedule templates and provide the typical cost and time needed to perform each item based on interactions, internal and external, to PMA 263.

1.7.3.2 Schedule Template

The schedule template will be used to determine schedule impacts while conducting the trade-off analysis. It will be based on the systems level requirements derived for the integration check list.

It could be also a starting point for future work that could provide the technology developer a scheduling tool to assist in the development of each effort's required work and execution plan, based on the applicable integration items from the checklist.

1.7.4 Trade-off Analysis Results

The trade-off Analysis results will be a summary of the conclusions derived from incorporating and analyzing the variables captured with-in this project's scope.

2 Project Organization and Participants

2.1 Project Organization

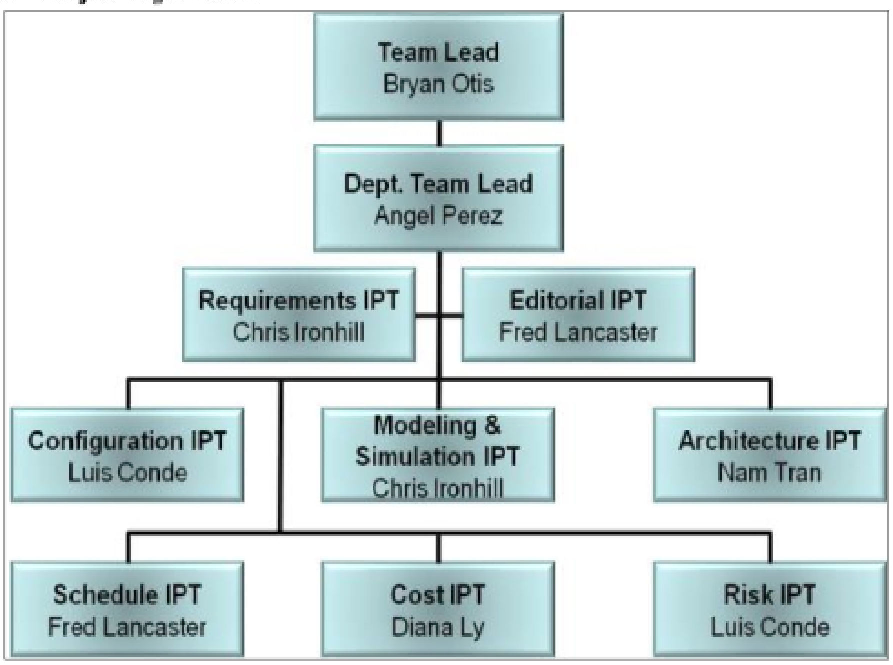


Figure 1. Team Organization

2.1.1 Project Lead

The Project Lead for this project will be Mr. Bryan Otis. He will provide overall management and leadership for the RAIN Team. The Lead will organize and run all Team meetings and represent the Team as the interface to Project Advisors, Stakeholders, and Sponsors. He will be responsible for ensuring the Team maintains schedule and provides deliverables on time. The lead will also manage Team assignments, actions, and any issues that arise over the project. He will provide project directions and ensure the Team functions smoothly, addressing any inter-Team challenges.

2.1.2 Deputy Project Lead

The Deputy Project Lead for this project will be Ms. Angel Perez. She will support the project lead as they provide overall management and leadership for the RAIN Team. The Deputy will assist with organizing and running all Team meetings and represent the Team as the interface to Project Advisors, Stakeholders, and Sponsors. She will be responsible for ensuring the Team maintains schedule and provides deliverables on time when the project lead is unavailable. The Deputy will also assist with the management of Team assignments, actions, and any issues that arise over the project. She will work with the project lead to determine project directions and ensure the Team functions smoothly, addressing any inter-Team challenges.

2.1.3 Modeling & Simulation Lead

The Modeling & Simulation (M&S) Lead for this project is Mr. Christopher (Chris) Ironhill. He will be responsible for the division and management of M&S products assigned by Team leadership, among the M&S working group. For the RAIN project, the M&S Lead will be responsible for providing models of the current, the "to-be", and the transitional states of the system and processes involved in integrating a payload onto a STUAS. Additionally, he will conduct verification and validation (V&V) that the models adequately represent reality to ensure that they will produce reliable data.

2.1.4 Architecture Lead

The Architecture Lead for this project is Mr. Nam Tran. He will be responsible for the basic structure development of the rapid payload integration and fielding of STUAS, defining the essential schema through Department of Defense Architecture Framework (DoDAF) artifacts.

2.1.5 Editorial Lead

The Editorial Lead for this project is Mr. Fred Lancaster. He will oversee the written products by collecting and editing Team members' written inputs project briefs and compiling and tracking references using RefWorks®. When editing the team's writing inputs he will conduct a technical writing review to ensure consistency, document flow, formatting, references, and the final product's writing quality. He will work with Team leadership to assign report sections and set up reviews of each Team member's work.

2.1.6 Risk Manager

The Risk Manager for this project is Mr. Luis Conde. He will be responsible for identifying and analyzing project and product risks and their subsequent tracking and managing. For the RAIN project, the Risk Manager will develop the Risk Management Plan template and process, which will be delivered in the SEP. The Risk Manager will be responsible for communicating with all Stakeholders and Team members about the risks, performing the risk analysis, and approving the risk mitigation plan. It is his responsibility to ensure that all risks have been adequately mitigated or that plans are in place prior to proceeding past the respective milestone reviews.

2.1.7 Requirements Manager

The Requirements Manager for this project is Mr. Chris Ironhill. He will be responsible for "the identification, derivation, allocation, and control in a consistent, traceable, correlatable, verifiable manner of all the system functions, attributes, interfaces, and verification methods" that the RAIN "system must meet including customer, derived (internal), and specialty engineering needs." [[(Buede, 1999)194].

2.1.8 Configuration Manager

The Configuration Manager for this project is Mr. Luis Conde. He will be responsible for the configuration management of Team deliverables and will work closely with the Lead Editor.

2.1.9 Cost Estimator

The Cost Estimator for this project is Ms. Diana Ly. She will be responsible for developing the model to conduct cost estimation of rapid payload integration and fielding. She will identify cost estimates of system/functional requirements by developing models based on collected data within scope of this project.

2.1.10 Scheduler

The Scheduler for this project is Mr. Fred Lancaster. He will be responsible for managing the schedule of the RAIN Team's project. He will work with Team leadership to outline project timelines and product delivery dates. Mr. Lancaster will also be responsible for leading the Team in developing the scheduling model to support the necessary events and timelines of conducting tailorable payload integration on to a STUAS.

2.2 Communications

Team members will coordinate individual Integrated Project Team (IPT) events and work via email and the Sakai website to post work products and project deliverables. The Team will utilize Elluminate Live during non-working hours and Defense Connect Online (DCO) with a dedicated phone bridge during working hours, as shown in Table 1 and Table 2.

Table 1. Meeting Resources

Resources	Link
Elluminate Live	Individuals Saki site
Defense Connect Online	https://connect.dco.dod.mil/r35782610
Dedicated Phone Bridge	1-866-214-2635 Meeting Number: *2949314*

Table 2. Battle Rhythm

Meeting Type	Time and Location	Duration & Purpose
Core Project Team and Advisor Meetings	Thursday 1700-2000 EST, Elluminate	1 to 3 Hours – Advising meeting, work review, and Strategy meeting
Team Meeting	Friday 1500 – 1600 EST, DCO and Phone Bridge	1 Hour – weekend assignments and strategy meeting
Working Groups	Sunday Flexible times, Elluminate	1 to 2 hours – working groups time
Team Meeting	Monday 1500 – 1600 EST, DCO and Phone Bridge	1 Hour – work review, weekly assignments, and strategy meetings

2.3 Capstone Advisors

There are two advisors for this project:

- Dr. Rama Gehris

Dr. Gehris has a PhD in SE and has taught at Naval Postgraduate School (NPS) since 2011. She has also served as an advisor on four Capstone projects.

- Professor Bonnie Young

Professor Young has a MS in SE and is working on her PhD. She has taught at NPS since 2011 and served as an advisor on five capstone projects.

2.4 Stakeholders

The project stakeholders are identified below and shown in Figure 2. Each project stakeholder interfaces with each other and the RAIN team to help guide and scope the project, subject to RAIN advisors concurrence. The Stakeholders can be broken down in to three main groups, as listed below, and are further decomposed in Figure 2. While main stakeholders exist, when categorized into three groups each group's interests are the same. The RAIN team's primary interest is in completing a Capstone project that both shows the students' mastery of Systems Engineering, while producing a useful product to other stakeholders. PMA-263's primary interest is to implement a rapid system integration process, while maintaining systems engineering rigor. The External stakeholders' primary interest is in rapidly fielding new technology, while reducing risk to technical challenges.

- RAIN Team
    - Students
    - Project Advisors

- PMA 263:
    - Chief Engineer
    - Weapon Systems Integration IPT Lead
        - Configuration Manager
- External Stakeholders:
    - APEO (U&W) Engineering
    - Warfighters
    - Requirements Officers
    - Technology developer

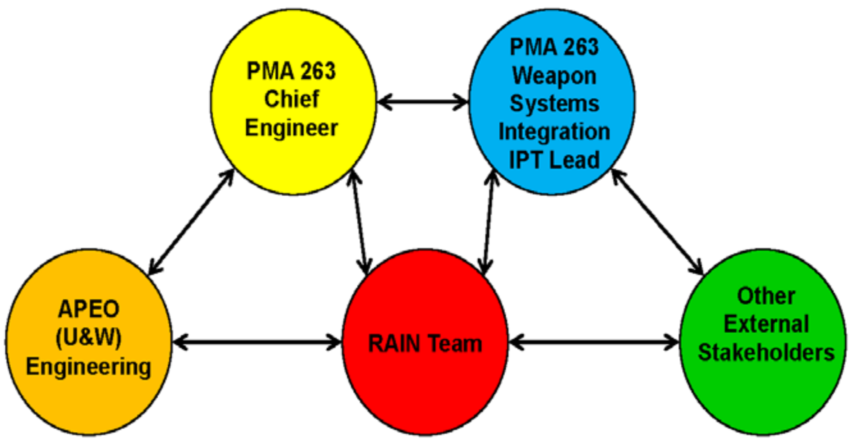


Figure 2. Project Stakeholders

External stakeholders, identified in the list below, all hold interest in the results of this project's trade study analysis. Each stakeholder interacts with the RAIN team and each other, conceptualized in a cloud formation below in Figure 3. PMA-263 is interested in the risks with different implementation options of the systems engineering process to complete capabilities integration. Individual platform IPT leads will be interested in what options they have when implementing an integration effort, and how their decisions will affect a systems engineer's ability to maintain rigor while executing a program plan. The Requirements officers and end users stake in this project revolve around delivering the end product. The technology developer's interest is the ability to rapidly integrate and deliver their products, while maintaining systems engineering rigor to reduce risk of future technical challenges.

- PMA 263
- Platform IPT Lead
- Requirements Officers

- Platform Integrators
- Technology developers
- Warfighters/End Users

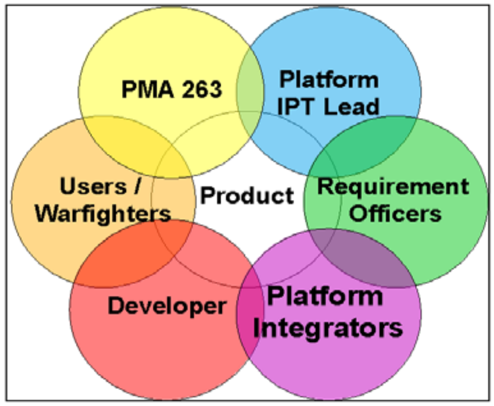


Figure 3. External Stakeholders

2.5 Subject Matter Experts (SME)

Subject matter expertise for this project will be provided by the following:

- PMA 263 Advance Development IPT Lead
- PEO(U&W) Chief Airworthiness Engineer (Unmanned & Weapons)
- PMA 263 Air-Ship Integration Lead
- PMA 263 E3 Technical Authority Expert (TAE)
- PMA 263 Product Support Manager
- Spectrum Management Support
- Laser Safety Review Board (LSRB) Chair
- Weapon Systems Explosive Safety Review Board (WSESRB),
- PMA 263 Program Protection Lead
- PMA 263 System Safety TAE
- Naval Ordinance Safety and Security Activity (NOSSA)
- Joint Interoperability Test Command (JITC)
- PMA-263 Training TAE
- PMA 263 Test and Evaluation (T&E) IPT Lead

3 Systems Engineering Approach

3.1 Systems Engineering Process

The Team will utilize the Forsberg and Mooz "Vee" Development Model, shown in Figure 4, as the basis of our SE approach, to execute the CAPSTONE project, due to its common utilization throughout NAVAIR.[(FHA, 2013)] This model begins with the identification of

Stakeholders' needs in the top left, with the design of the product continuing down the left side of the "Vee". The right side of the "Vee" involves the actual development and verification of the product, resulting in a final product that is validated by the user at the top right.

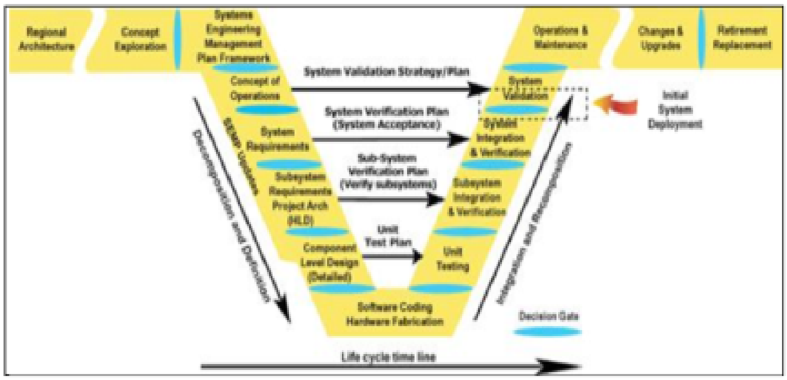


Figure 4. Forsberg & Moor "Vee" Development Model for SE Approach

The team tailored this model as applicable for the development of a process rather than a tangible system, as shown in Figure 5 since no hardware will be designed nor developed for this project. This process will produce the project deliverables outlined in Section 6.

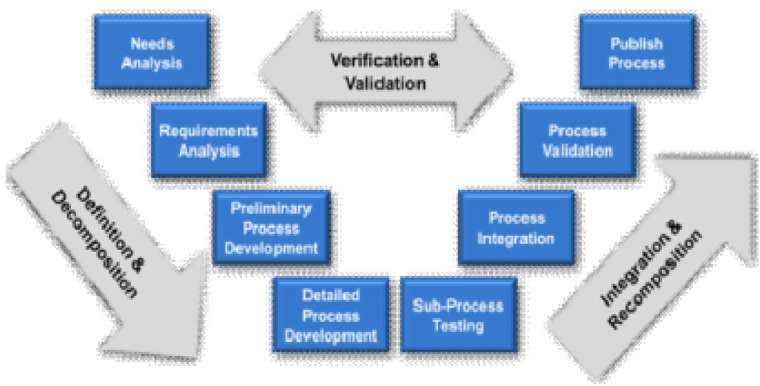


Figure 5. Tailored Process

Similar to the base "Vee" SE approach, an initial analysis of the Stakeholders' needs will be conducted. This will result in the formulation of top-level requirements. An analysis of those requirements will then form the foundation of the preliminary payload integration process, which will lead to the detailed process development. This will conclude the Definition and Decomposition phase of the "Vee" approach.

Integration and Re-composition will begin with the establishment of a model to simulate execution of the developed process. Using this model, the RAIN Team will examine several options that will reduce implementation time, to address urgent user needs, of the process while minimizing risk to the user. The high, medium, and low cost estimates will be captured and used as another factor in the analysis. Further investigation will enable the development of a more detailed, comprehensive process. Upon the identification of viable alternatives, they will be demonstrated to the Stakeholders and published in the final report for the project.

3.1.1 Stakeholder & Needs Analysis

The purpose of a Needs Analysis is to develop a comprehensive description of the nature of the problem. This begins with determining what the Stakeholders want and formulating the initial problem statement. The desired needs are then organized and prioritized based on the Stakeholders' stated level of importance.

The Stakeholders were be interviewed to ascertain the problems and frustrations they have encountered when attempting to field a new payload into existing platforms. This provided a better understanding as to what issues are causing delays in the fielding process, resulting in the initial problem statement. The needs obtained from the interviews were then analyzed to further refine the problem statement and provide focus for the project.

These dialogues will determine what requirements are most important to the Stakeholders and will define what aspects of the process are inflexible. This will be used to develop the initial Measures of Effectiveness (MOE) and systems boundaries, assumptions and constraints. They will also identify where the schedule can be reduced, depending on the Stakeholders' willingness to accept risk in terms of type (cost, schedule, technical) and level (low, medium, high). These negotiable areas will form the space to conduct a trade-off analysis for an optimal process allowing the Stakeholders to rapidly field a new payload.

3.1.2 Requirements Analysis

Requirements will be gathered from the Stakeholders, internal and external, of the payload integration process. Assumptions and constraints will be captured and identified as such. Once gathered, the requirements will be analyzed for conflicts and feasibility. Requirements conflicts will be brought to the Stakeholders for clarification. Documented statutory and regulatory requirements will be assumed to override other requirements. If statutory and regulatory requirements conflict with end user needs, waivers, when feasible, will be considered as part of the project's trade-off analysis.

Requirements analysis will follow an iterative process that addresses identification of the need, analysis of feasibility, definition of system operational requirements. [(Blanchard & Fabrycky, 2006)p.35]. To track the performance of this project, measures of effectiveness to govern the trade-off analysis will be defined in terms of technical performance measures (TPM). One example of a potential project TPM may be theoretical time to field a new capability.

Figure 6 (After (Blanchard & Fabrycky, 2006),p.58), shows the tailored approach for this project.

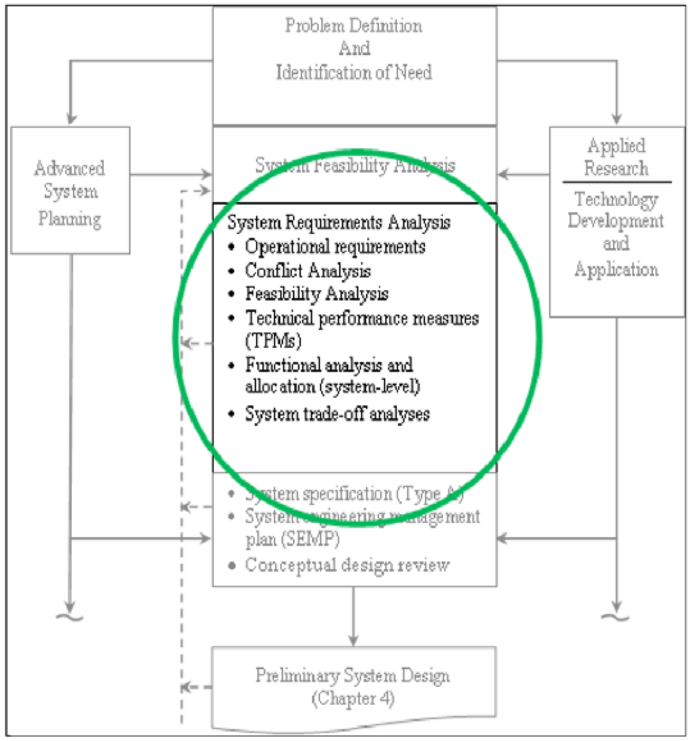


Figure 6. Major Steps in the Systems Requirements Definition Process (After Blanchard and Fabrycky 2006, p.58)

The basic and derived requirements from this analysis will be tracked through the use of tiered requirements traceability matrices. It may not be feasible to address all of the requirements during the Capstone effort, and some requirements may, by necessity, need to be left for later updates. Any unaddressed requirements will be tracked as such in the matrices.

3.1.3 Functional Analysis

The purpose of the Functional Analysis is to identify "what" needs to be done to satisfy the stated requirements. The top-level requirements provided by the Stakeholders will be translated into top-level functions. These functions will form the key components of the integration plan being developed. Analysis of these functions shall be performed to ensure that the derived requirements are allocated to the appropriate functions and satisfactorily met.

3.1.4 Architectural Analysis

The purpose of Architectural Analysis is to define the integration process approach. The Architectural Analysis will follow an "as-is" / "to-be" approach. The current architecture will be captured first, and from which the "to-be" architecture will be further defined. The current architecture representation will be based on a decomposition of the functions, and then project deliverables (certifications and re-certifications demands), involved in the current system employed to integrate a payload onto a STUAS. The "to-be" functional architecture will be constructed based on the decomposition of the critical functions needed in the system, as derived from the problem statement, problem scope, and Stakeholder input. The physical architecture of the process for integration of capabilities onto a system will be the allocation of the critical functions to the project deliverables (documents, forms, databases, or templates) needed to achieve PMA-263's rapid integration and fielding schedule requirements.

The system architecture will provide the RAIN Team's view of how to implement rapid integration and fielding of a new capability into the inventory of modular STUAS. In order to ensure the smoothest possible process and for requirements traceability, all technical requirements will be documented using Vitech CORE®.

3.1.5 Modeling and Simulation Process

"All models are bad, but some are useful" [(George E.P. Box, 1987)p.424]. Because of the complicated interactions between the sub-processes involved in integrating a payload onto a STUAS and approving the use of the new system, M&S will be used to represent the integration process. It will be used as a tool to assist in understanding the current process and various proposed processes. Simulation will be used to verify the model of the current process and to project the performance of the desired and planned process implementations. The desired process is the one that addresses all potentially required certifications or accreditations in the manner that minimizes process duration without resorting to waivers. To facilitate this analysis, flow diagrams will be used to optimize the integration, certification, and testing process. Intermediate state process implementations will be explored to understand the relationship between schedule compression, cost, and risk expansion associated with different combinations of waivers and certifications. The outputs of these simulations will be used to identify the efficient frontier of risk vs. duration associated with the use of waivers, and rank the various options.

The model will be built of simplifications of the current sub-processes used for integrating a payload into a STUAS. The requirements for whether or not to perform each certification (sub process) in the current process are not well understood and are often addressed in a reactive fashion, sometimes when identified as the entry criteria for a different certification or approval. The often reactive start of each certification causes statistical special cause variation in the duration of the current Ad Hoc process (delays), so the duration distributions are believed to be non-normal. Duration distributions for each sub-process will be modeled as triangular (Raymond, 1999) and will be based on SME predictions for best case, most likely, worst case, and where available historical data. Simulation with the model of the current process will be used to verify that the model and its component parts are appropriately accurate by comparing the simulation output to expert opinion or if available historical data on past payload integrations' mean duration and duration variation. In the cases where the distributions are not normal measures of central tendency and variation other than the mean and standard deviation would have to be used to compare expert opinion or historical data to the simulation results at the system and task (certification) levels. Following Dam's recommendation [(Dam, 2006) p.14], the resultant understanding of the current process will be used to formulate the ultimately desired "to-be" process, balancing schedule, cost, and systems engineering proficiency, before any intermediate concepts are considered.

The desired "to-be" process will be modeled using the building blocks that were verified in the model of the current process. The desired state is assumed to be meeting all certification requirements in the shortest possible time without resorting to waivers. The least desired state is assumed to be waiving all certification requirements. Combinations of waivers and certifications are assumed to be intermediate states with schedules, costs, and performance risks scaled between the assumed extremes. Simulation will then be run to predict its performance. Because it is often impractical to implement the desired process, due to expense or schedule or policy impediments, intermediate processes will be explored, modeled, and simulated. The results will be used to pick processes, based on risk and integration constraints, to implement that are better than the current one, but may not have all the features of the desired "to-be" state.

Simplified representations of the sub-processes will be done in iGrafx® and Microsoft Excel®, as deemed appropriate. Simulations of the process and sub-processes will be run in iGrafx or Risk Simulator®. The applications Minitab® or Microsoft Excel® will be used to quickly provide the needed descriptive and inferential statistics on the various process designs. Deliverables will include static views of the models and statistical analyses of the results of model simulations run in iGrafx and Risk Simulator, as needed, to aid in communication or provide decision-quality data about expected performance a process design.

3.1.6 Cost Estimation Process

This section is to estimate the cost of integrating and fielding process of modular payloads into a STUAS and will involve collecting and analyzing data based on scope definition of the project. Quantitative models, techniques, and/or tools will be applied to predict Non-Recurring Engineering cost (low/med/high) for the whole process of integration and fielding and identify all variables necessary for trade-off analysis between risk, cost, and schedule. The process will be separated into three main parts to ensure the accuracy and completeness of the whole estimating practice. This is shown in Figure 7 below and highlighted as follows.

Part 1 of the RAIN Cost Estimation process is called Project Definition. During this part, the estimator clarifies the reason for the estimation and begins to understand the project that will be estimated. As the estimate is being conducted, all necessary cost elements will be identified based on the inputs of the stakeholders, including all the possible items of cost contained in the cost model. Each element will be defined so that all costs are essentially covered, with no duplications within the structure. These elements help form the foundation for the estimate and may be revisited whenever new information is obtained as the estimator continues throughout the process.

Part 2 of the RAIN cost estimating process mainly focuses on selecting and administering the cost methodology, which will guide the development of the estimate based on all identified cost-related assumptions and/or constraints. As methodologies are selected and data is gathered, cost estimating templates will be developed and even the cost model may be constructed and refined as appropriate.

Part 3 of the RAIN cost estimating process is called Estimate, it includes the actual conduct, analysis, presentation, and maintenance of the cost estimate. All of these tasks are important in their own right and together, they become critical for a defensible and complete estimate.

Figure 7: Cost Estimation Process

4 Risk Management Process

The RAIN Team will have a risk manager who is responsible for tracking all the risks associated with this project, both technical and to the Capstone Completion. With regard to Capstone completion, the manager ensures each risk has a mitigation plan, and the mitigation plans are being followed. He will work with the team leads closely on the Capstone Completion risks and gather team inputs to feed into the technical risks.

4.1 Risk Identification

It is the responsibility of every team member to stay vigilant for any risks that may surface within any of these areas, requirements, technical baseline, management, schedule, and external factors to keep this Capstone Project on schedule and to meet its objectives.

The following is a list of the risks that have been identified for the RAIN Team Capstone Project:

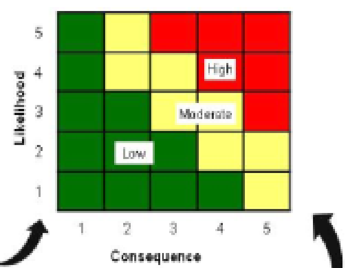
A. Loss of team member(s)
B. Federal budget sequestration
C. Stakeholders see no value
D. Lack of expertise among members
E. Lack of concurrence from a Key Group
F. Project cannot meet schedule

G. Imbalance of effort
H. Team member gets sick
I. Accessibility of tools

4.2 Risk Analysis

The same basic process will apply to both technical risks and risks to completing this Capstone Project. Each risk will be evaluated independently for its effect on the applicable areas. The evaluation will look at the likelihood and the consequence of each risk and assign it a level based on the criteria shown in the following tables within Figure 8. After the risk has been assigned a level for each of the two areas (performance and schedule), a risk will be categorized as High, Medium, or Low based on the matrix at the top right corner of Figure 8 for each.

What is the source (likelihood) the risk will happen?		
Level	Likelihood	Probability of Occurrence
1	Not Likely	~10% ...will effectively avoid or mitigate this risk based on standard practices
2	Low Likelihood	~30% ...have usually mitigated this type of risk with minimal oversight in similar cases
3	Likely	~50% ...may mitigate this risk, but workarounds will be required
4	High Likely	~70% ...can not mitigate this risk, new approach and/or workaround will be required
5	Near Certainty	~90% ...can not mitigate this risk, no known processes or workarounds are available



Given the risk is realized, what would be the magnitude of the impact?		
Level	Performance	Schedule
1	Minimal or no consequence to performance	Minimal or no impact
2	Minor reduction in performance or supportability can be tolerated with little or no impact on program; same approach retained	Additional activities required, able to meet key dates. **Slip <1 week**
3	Moderate reduction in performance or supportability with limited impact on program objectives; workarounds available	Minor schedule slip, no impact to key milestones **Slip <3 weeks**
4	Significant degradation in performance or major shortfall in supportability; may jeopardize program success; workarounds may not be available or may have negative consequences.	Program critical path affected, all schedule float associated with key milestone exhausted. **Slip <5 weeks**
5	Severe degradation in performance; cannot meet KPP or key technical/supportability threshold; will jeopardize program success; no workarounds available	Cannot meet key program milestones **Slip >5 weeks**

Figure 8. Risk Matrix for Payload Integration Process

When evaluating risks, it was determined that by working far in advance of the Capstone's due dates, we can allow for additional time to make corrections if need be. For this reason, we are putting more emphasis on schedule than on performance. In determining a cumulative Consequence Factor (CF) for each risk, a weight of 60% and 40% respectively was given to the Schedule Impact Factor (SIF) and Performance Impact Factor (PIF) respectively as shown in Equation 1.

$$CF = 0.6\, SIF + 0.4\, PIF \quad (1)$$

The final value of the consequence was then rounded to its nearest integer.

4.3 Risk Mitigation

For each risk identified in Section 4.1, a mitigation strategy has been identified for each to reduce the overall risk to the project. As a result there is no high risk items left for completion of the project. All moderate risks will need to be monitored to ensure that the planned mitigation strategies are executed if need be and adjust the mitigation strategies for each accordingly.

4.4 Risk Tracking

After identifying a mitigation strategy for each of the high and moderate risks, the final risks level was obtained. Figure 9 shows each of the risks for the RAIN Project on a risk matrix. Table 3 further shows in detail each of the risks with their individual values for SIF and PIF, as well as a detail description of the risk and a mitigation strategy in the "Narrative" column. This figure and table will be tracked throughout the duration of the project to ensure consistent risk implementation should any of these risks or any other similar to these occur.

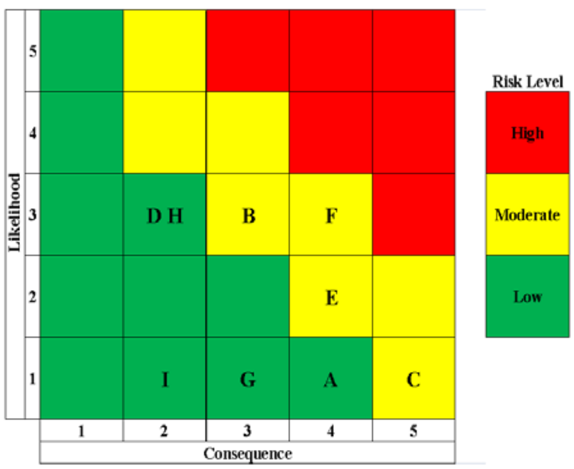


Figure 9 - Risk Matrix for RAIN Project

Table 3: List of Risks

Risk ID	Risk Title	Likelihood	Consequence			Narrative	Risk Level
			Overall	Schedule	Performance		
A	Loss of Team Member(s)	1	4	3	5	Losing one or more members, while not likely, will increase the workload on the remaining members and potentially over-stress the remaining team members. It might also require de-scoping one or more areas to accommodate workload. If the people who prepare this plan leave, the other members may lack some of the knowledge of a particular problem. Communication can reduce some of this burden.	Low
B	Federal Budget Sequestration	3	3	3	3	Professors/Stakeholders/SMEs may not be available for consultation to push our project forward. There doesn't seem to be a resolution coming any time soon, so the team can continue performing but without stakeholder's feedback. As a result, we could have lots of corrections to make later in the project which could've been taken care of earlier. Sequestration may also limit the ability for our team to meet on base facilities and use of communication tools.	Moderate
C	Stakeholders See No Value	1	5	5	5	If the stakeholders feel this project adds no value and lose interest, it could require the team to re-scope the project. While unlikely, this would also put us significantly behind. The consequence gets aggravated if it happens later in the project.	Moderate
D	Lack of Expertise Among Members	3	2	2	2	Not enough team members have adequate experience in this type of field to obtain worthwhile information. Also, some of the effort relies on in depth knowledge of STUAS and access to said information above what team members now have. Lack of knowledge can be easily addressed by doing additional research or relying on our resources in PMA-263.	Low
E	Lack of Concurrence from a Key Group	2	4	3	5	If a particular groups feels that the project is not meeting their needs or expectations, it can potentially delay the project until their concerns are addressed. While this would be disastrous to no get concurrence from a key group of stakeholders, keeping everyone informed of things reduces the possibility of having anything that would set back the project significantly.	Moderate
F	Project Cannot Meet Schedule	3	4	5	3	If for any reason, including but not limited to the ones stated in this document, the project cannot maintain schedule, it would seriously degrade the performance of the team and delay the completion of the overall project. While it may vary in consequence, worse case scenario would require de-scoping in order to be able to meet delivery date of Capstone project.	Moderate
G	Imbalance of Effort	1	3	3	4	If one team member does not pull his weight, it will bring down the entire team's performance. This is being addressed by having backup roles in each section of the project.	Low
H	Team Member Gets Sick	3	2	2	3	If a team member gets sick for a period of time it would cause additional stress on other members which are listed as backups for their role, or his delivery may be delayed. Working ahead of schedule allows for extra slack time.	Low
I	Accessibility of Tools	1	2	2	3	If one of the tools a group member is using to work their particular sections (i.e. CORE, ExtendSim, Internet access, etc.) is temporarily cut off, the team may delay its delivery.	Low

5 Configuration/Change Management Process

The deliverables created by the RAIN Team will be in the form of documents, presentations, architectures, models, and analyses. The CM Lead will maintain a copy of all deliverables and revisions in a chronological master archive. The RAIN Team will revise each of the deliverables as necessary prior to final submittal. The RAIN Team internal edits will be tracked using a system of Numeric_Date_Time revisions (e.g., PMP Rev 1_Feb1_1600, PMP Rev 2_Feb2_1100, significant change PMP Rev 3_Feb 3_1300, and on out) by the Lead Editor.

Once a deliverable is ready for submittal it will be published with an alphabetical ending (e.g. PMP Rev A, PMP Rev B, etc). If a deliverable comes back to the Team for revision, it will pick up the document at the last internal numeric designation and noted.

6 IPR's and Deliverables/Schedule

The RAIN Team Deliverables are outlined in Table 5 below and the detailed schedule is shown in Appendix C.

6.1 IPRs and Deliverables

Table 5 below lists each major IPR and milestone associated with the RAIN Team project for the SI0810 Capstone Class.PMA-263 advisors and the RAIN Team must agree that the required deliverable(s) are completed satisfactorily before an IPR or Final Report is considered complete.

Table 5. IPR and Deliverables Schedule

Milestone	Description	Deliverable
Presentation	Weekly Group Status to Advisors	PowerPoint Presentation
Report/Update	Assessment of Team Members/Individual Assesments	Report Sheet
Project Plan Outline	Project Plan Outline/Rough Draft of PMP. Problem Definition Refinement	PowerPoint Presentation
Draft PMP	Draft of PMP to Advisors for Review	Draft Project Management Plan
PMP	PMP approval-reviewed by AA, for SE Dept Chair Approval	Project Management Plan
IPR #1 Brief	Interim Project Review - Problem /Background/Project Management Plan	PowerPoint Presentation
IPR#2 Brief	Interim Project Review-Project Status	PowerPoint Presentation
Draft Final Report	Draft Final Report for Advisor Review	Draft Final Report (Electronic)
Final Report	Final Report for submittal to Thesis Processing Committee	Final Report (Electronic)
Final Brief	Brief of Project to Advisors & Stakeholders during working hours @ Pax River to PMA-263	Powerpoint Presentation

6.2 Schedule

The schedule for the RAIN Team will be constructed and managed using Microsoft Project®. The schedule includes the major milestones as outlined in Figure 10. The detailed schedules for the RAIN Team is provided in Appendix C. Project efforts will be aligned to the schedule in regards to resource planning and provide a visual metric for Team time management. The Microsoft Project® schedule will provide the detailed plan of action and milestones for project execution.

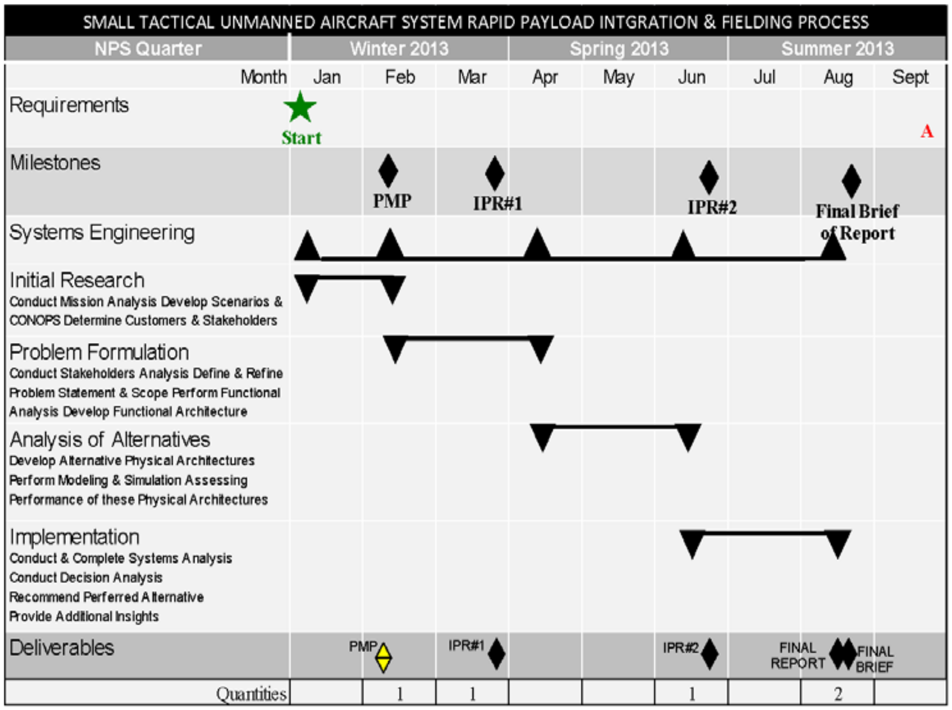


Figure 10: Schedule Overview of Major Milestones

Appendix A Team Bios

Luis A. Conde:

Mr. Luis Conde graduated from Virginia Tech in 2009 with a degree in Mechanical Engineering. With his background in thermo-fluid research and propulsion, he was hired by NAVAIR to work in the Propulsion and Power Department, where he has worked for the past four years. He started out by supporting the turbine design group for the first year, working on the F404 and T56 engines. After that he moved on to become a project engineer for the F/A-18 and EA-18G Auxiliary Power Systems, where he has worked at ever since. He is responsible for the design and integration of the various components, the safety and mitigation planning, and the lead on any improvement projects of the same. Luis is currently attending the Naval Post-graduate School pursuing a master's degree in Systems Engineering.

Christopher Ironhill:

Mr. Ironhill has 18 years of process design experience in both private sector manufacturing and defense test and evaluation support infrastructure. He worked as a manufacturing engineer who designed new processes; designed and built tooling and fixtures; designed, fabricated, and programmed automated assembly equipment. His work supported the building of automotive alternators and starters as well as medical equipment lead wires and cable assemblies. For six years, he worked as a telecommunications systems engineer designing and implementing fiber optic and microwave links used to transport data and control signals between range instrumentation equipment, operations control, and data processing on the NAWCWD test and evaluation ranges. During his time in Range Communications, he implemented process improvements for the Ranges Department at Point Mugu. He is a graduate of the Naval Leadership Development Program (NLDP) where he received both leadership training and Lean Six Sigma Black Belt certification. Additionally, he has earned American Society of Quality certification as a Department of the Navy Lean Six Sigma Black Belt. He also has DAWIA level III certification in SE and Test & Evaluation. Currently he is assigned to the NAVAIR Airborne Instrumentation Systems Division (AISD) as a Project Manager where he leads the development, design, qualification, and manufacturing of telemeters used on AIM-9X and HARM test missiles. He has a Bachelor of Science from the University of California at Santa Barbara in Mechanical Engineering and is completing his Master of Science in SE from the US Naval Postgraduate School.

Frederick A. Lancaster:

Mr. Lancaster has over 20 years of corrosion control and metal finishing experience with department of defense products ranging from ammunition, ships, land systems and vehicles to aircraft. His work has encompassed industrial production, research and development, equipment design and field implementation of corrosion control-related products for aircraft and other DOD systems. He is currently assigned to the NAVAIR Corrosion and Wear Branch of the Materials Engineering Division Headquarters NAVAIR Patuxent River, MD as Lead Corrosion Engineer where he develops and leads science and technology projects related to the mitigation of material degradation on Naval Aviation assets. He is also the head Corrosion Acquisition Engineer on the CH53K Heavy Lift Helicopter program for PMA-261. He has a BS degree in Physics from Frostburg State University and is completing his Masters in SE from the US Naval Postgraduate School.

Diane T. Ly:

For almost 7 years of being employed at NAVAIR, Mrs. Ly has been continuously working as an assembly language developer at SWDTT (Software Development Task Team). She constantly provides support AN/AYK-14 Mission Computer software development by providing complete life-cycle support for the F/A-18 mission computer operational flight programs in the areas of Joint Helmet Mounted Cueing System (JHMCS), Expanded Multi-Source Integration (EMSI), Gross Weight and Software Configuration, Complimentary Navigation Message (CNM), Maintenance Status Panel (MSP) Code, Up Front Control Display (UFCD), and some other software related SORs. Mostly, she performs software engineering tasks covering the entire software life-cycle from requirements analysis, design, and coding to unit and system integration testing. Besides, she also includes assisting in the engineering efforts to analyze fleet anomaly reports, determine solutions to the stated problems, and design and implement corrections to the specific OFP. Regarding educational background, she graduates from a BS Degree in Computer Science at Cal Poly Pomona University and is currently working on her Masters in Engineering Systems from the US Naval Postgraduate School.

Bryan R. Otis:

Mr. Bryan Otis attended college at Old Dominion University, and received a BS in Mechanical Engineering, with a concentration in Aerospace Engineering. He did his internships as in electrical engineering and applied physics' research, before he joined NAVAIR as a Sensors and Imagery Engineer. Currently he works as the NAVAIR 4.5.1.4 Avionics Systems Project Engineer assigned to the Navy/Marine Corps Small Tactical Unmanned Air Systems (STUAS) Program office, PMA-263. Primary responsibilities include providing avionics SE oversight, and working as a Team lead to Subject Matter Experts (SMEs). Responsible for all Avionics across multiple UAS platform including RQ-21A (STUAS), Scan Eagle/Curser, Aerosonde 4.7 G, RQ-7 (Shadow), RQ-11B (Raven), T-Hawk, Wasp III, Wasp IV, Puma. Other duties include special projects in support of long term UAS improvement projects, and urgent needs in support of past and present combat operations in Operation Iraqi Freedom (OIF), the Global War on Terror (GWT), and Operation Enduring Freedom (OEF).

Angel M. Perez:

Ms. Angel Perez received her undergraduate degree in Materials Engineering from the University of California – Los Angeles, as well as a commission into the United States Navy as a Nuclear Power Officer. Following her stint as an active duty Naval Officer, she taught Reactor Theory at Pearl Harbor Naval Shipyard to engineers conducting repairs/modifications on US Navy submarines. She transitioned to a SE career with Defense Contract Management Agency (DCMA) at Raytheon – Tucson on the Enhanced Sea Sparrow Missile (ESSM) program, followed by the Standard Missile Six (SM-6) program with Naval Surface Warfare Center (NSWC)-Port Hueneme Division. Upon relocating to the East Coast, she became a Systems Engineer for AgustaWestlandBell, performing Requirements Management for the Presidential Helicopter Program. She returned to federal government service as the Deputy Class Desk for the Unmanned Combat Air Systems - Demonstration (UCAS-D). She is currently the Class Desk/Systems Engineer for PMA-263 Group 1 UAS at NAS Patuxent River, MD providing technical expertise for small UAS' that weigh less than 55 lbs.

Nam T. Tran:

Mr. Tran has been working with NAVAIR 4.1.4 Software Engineering Branch at China Lake for over 4-1/2 years crossing multiple programs. He has experiences with database design using PL/SQL programming interface with java application for web design at Intelligent Division. He is also knowledgeable with MIL-STD-1553 data bus and telemetry communication for real time flight test and post data analysis supporting RAAF Supper Hornet, TACTAIR EW, EW community, and FMS programs. On top of that, he is also an expert of using C++ to develop Graphical User Interface (GUI) for MIL-STD-1553 Server, decoder, and data analysis test tools. While working with Software Engineering group at China Lake, he has applied Personal Software Process (PSP) and Team Software Process (TSP) to complete the projects. Beside software engineering related fields, he also has more than 2 year experience with Structural Analysis of heavy facility structure as well as Road and Bridge Design in Transportation. He completed few big projects involving in Civil Engineering such as FWY 15 Interstate widening, 95% drainage design of FWY 215 State of California, and bridge alignment at Junction FWY 215 and FWY 60. Educationally, he has a Bachelor of Science Degree from Cal Poly Pomona in Civil Engineering and is in progress of achieving his Master of Science Degree in SE from the US Naval Postgraduate School.

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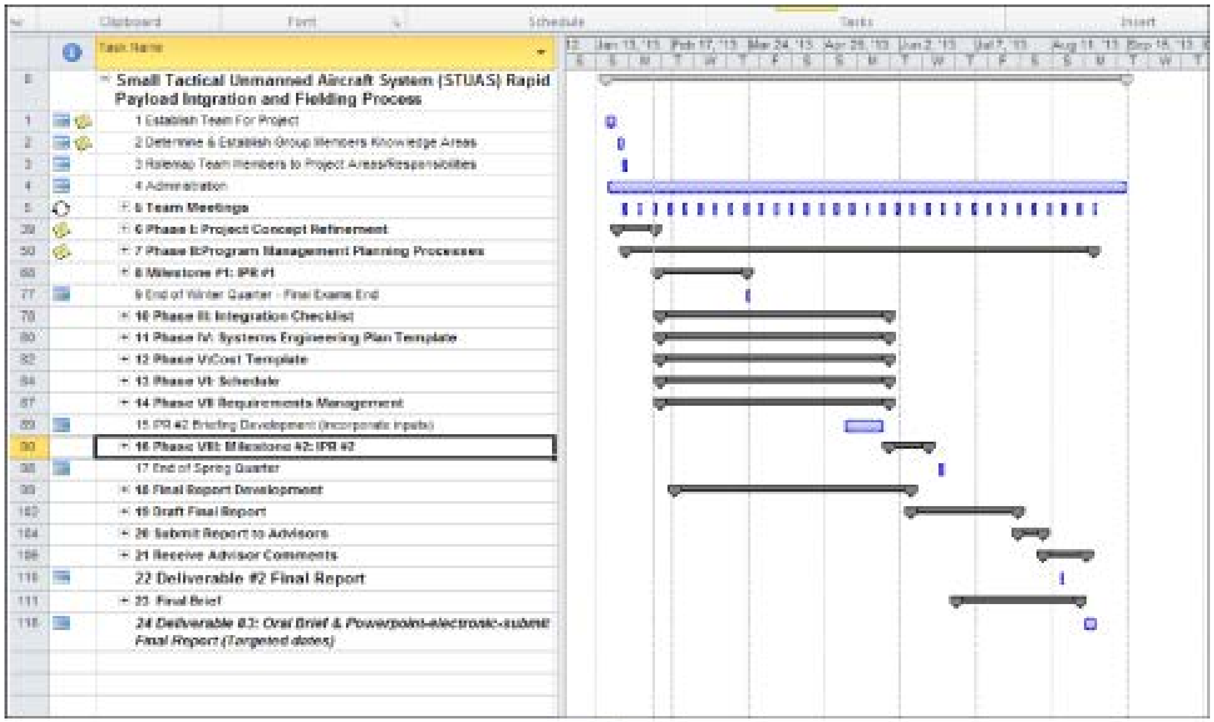
Appendix B Management and Working Groups

IPT	Leadership	M&S	Arch.	Edit	Risk	Schedule	Reqt	Cost	CM
Bryan Otis	Lead						Member		
Angel Perez	Deputy					Member			Member
Christopher Ironhill		Lead					Lead		
Fred Lancaster				Lead		Lead			Member
Luis Conde				Member	Lead				Lead
Diana Ly					Member			Lead	
Nam Tran		Member	Lead					Member	

Appendix C Project Schedule



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Appendix E Abbreviations and Acronyms

APEO	Assistant Program Executive Office
B&F	Blanchard & Fabrecky
CF	Consequence Factor
CM	Configuration Management
CMP	Configuration Management Plan
DCO	Defense Connect Online
DCMA	Defense Contract Management Agency
DoD	Department of Defense
DoDAF	Department of Defense Architectural Framework
DoN	Department of the Navy
ESSM	Enhanced Sea Sparrow Missile
GWT	Global War on Terror
IEEE	Institute of Electronics and Electrical Engineers
ICD	Interface Control Document
IPR	Interim Program (or Project) Review
IPT	Integrated Product Team
LSRB	Laser Safety Review Board
M&S	Modeling & Simulation
MIL-STD	Military Standard
NAVAIR	Naval Air Systems Command
NAS	Naval Air Station
NOSSA	Naval Ordnance Safety & Security Activity
NSWC	Naval Surface Warfare Center
OEF	Operation Enduring Freedom
OSD	Office of the Secretary of Defense
PEO	Program Executive Office
PIF	Performance Impact Factor
PM	Project Manager
PMA	Program Manager, Air
PMP	Project Management Plan
RAIN	RApid INtegration
RMP	Risk Management Plan
SE	Systems Engineering
SEP	Systems Engineering Plan
SIF	Schedule Impact Factor
SM	Standard Missile
SME	Subject Matter Expert
STUAS	Small Tactical Unmanned Arial System
SWAP	Size, Weight, and, Power
T&E	Test and Evaluation
TAE	Technical Authority Expert
TPM	Technical Performance Measures
TRL	Technology Readiness Level
UAS	Unmanned Aircraft System

UCAS-D	Unmanned Combat Air Systems-Demonstration
USN	United States Navy
U&W	Unmanned & Weapons
V&V	Verification & Validation
WSESRB	Weapons Systems Explosive Safety Review Board

APPENDIX L. SELECTED PLATFORM STUAS BACKGROUND

RQ-21A (Integrator)

Figure 41: RQ-21 (Rector 2012)

The RQ-21A provides persistent maritime and land-based tactical Reconnaissance, Surveillance, and Target Acquisition (RSTA) data collection and dissemination capabilities to the warfighters. For the United States Marine Corps (USMC), the RQ-21 seen in Figure 41 will provide the Marine Expeditionary Force (MEF) and subordinate commands (divisions and regiments) a dedicated Intelligence, Surveillance, and Reconnaissance (ISR) system capable of delivering intelligence products directly to the tactical commander in real time. For the United States Navy (USN), the RQ-21 will provide persistent RSTA support for tactical maneuver decisions and unit-level force defense/force protection for Navy ships, Marine Corps land forces, Navy Expeditionary Combat Command (NECC) forces and Navy Special Warfare (NSW) units. It is envisioned that the United States Air Force (USAF) will employ the Integrator to provide persistent RSTA in support of security forces, integrated base defense and convoy protection requirements, and meteorological survey and data analysis by weather personnel(Rector 2012).

RQ-7B (Shadow)

Figure 42: RQ-7B (Shadow) (From 263 UAS Portfolio Brief, 2012)

The RQ-7B UAS shown in Figure 42 provides a dedicated RSTA, Intelligence, Battle Damage Assessment (BDA) and Force Protection capability to USMC units. The RQ-7B shares the same system baseline configuration as the Army's STUAS POR, commonly referred to as the Shadow UAS.

RQ-7B UAS consists of four (4) air vehicles (each configured with an electro-optic (EO)/infrared (IR) sensor payload with laser designator (LD) capability), launcher, ground control station, attrition engine, and support equipment including: power generation, communications equipment, automated recovery equipment, remote video terminals, vehicle mounted shelters, and High Mobility Multipurpose Wheeled Vehicles (HMMWV). Each system is equipped with one Maintenance Section Multifunctional Vehicle and is supported by a Mobile Maintenance Facility (Rector 2012).

ScanEagle

Figure 43: ScanEagle (Rector 2012)

The ScanEagle family of systems, including the ScanEagle shown in Figure 43, Night Eagle, and CRUISER UAS, provides ISR capabilities through an ISR Services Contract. This Contract is an interim solution to Naval Commanders' maritime and littoral ISR capability gaps and pending RQ-21A Integrator Initial Operational Capability (IOC). ScanEagle currently provides Overseas Contingency Operations (OCO) surge assets with an organic, tactical level ISR asset to support full spectrum operations (Rector 2012).

Aerosonde 4.7 G

Figure 44: Aerosonde 4.7 G (Rector 2012)

The Aerosonde 4.7 G shown in Figure 44 provides ISR capabilities through an ISR Services Contract. This Contract supports USMC units in support of Operation Enduring Freedom (OEF) and the Global War on Terror (GWOT) stationed in Afghanistan. It is an interim solution to ISR capability gaps and pending RQ-21A Integrator IOC.

Arcturus

Figure 45: Arcturus (Rector 2012)

The Arcturus UAS shown in Figure 45 was designed to provide an ISR capability through an ISR Services Contract. This contract supports military units in support of OEF and GWOT. It is an interim solution to ISR capability gaps and pending RQ-21A Integrator IOC.

RQ-12A (Wasp IV)

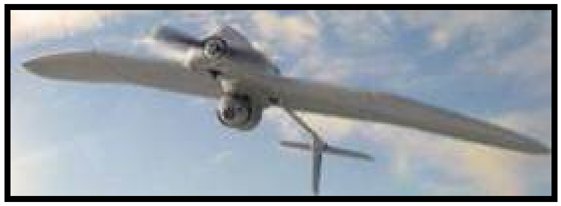

Figure 46: WASP IV (Rector 2012)

The USMC Wasp Micro Unmanned Aerial Vehicle (MUAV) in Figure 46 provides near real-time area reconnaissance required by the platoon and rifle squad. The system greatly reduces the ISR request-to-response timeframe, and eliminates delays or denials for coverage from higher headquarters due to an imbalance of UAS assets to requests. The system provides the small unit with still images and live video out to line-of-sight (LOS) ranges of 5 km. Wasp provides an operational capability in the following areas: remote reconnaissance and surveillance, force protection, convoy security, target acquisition, and battle damage assessment (Rector 2012).

RQ-20A (PUMA)

Figure 47: RQ-20 (Puma) (Rector 2012)

Figure 47 PUMA delivers flexibility, endurance and a payload capability unmatched by other systems in its vehicle class. With a wingspan of 9.2 feet, this lightweight, all-environment, hand-launched UAS provides aerial observation at LOS ranges up to 20 kilometers. The system is deployed with the USMC and USN Special Forces. The systems provide Route Clearance Platoons (RCP) and Combat Logistics

Patrols (CLP) the required ISR asset that allows them to scan an area prior to moving through it in order to detect Improvised Explosive Devices (IEDs), IED materials and IED emplacement teams and after clearing it to monitor for re-seeding.

RQ-11B (Raven)

Figure 48: RQ-11B (Raven) (Rector 2012)

Raven in Figure 48 is a small, reusable, back-packable UAS used for “over-the-hill” reconnaissance at the company/detachment level. It is hand-launched and flies under manual operator control or via a pre-programmed route. It uses onboard sensors and communications equipment to gather and transmit live airborne video imagery, compass headings, and location information back to the ground control station and remove video terminals out to a LOS range of 10 km. The Raven enables operators to navigate, search for targets, recognize terrain, and record all information for analysis.

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