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AIR FORCE INSTRUCTION 10-602

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Operations

DETERMINING MISSION CAPABILITY AND SUPPORTABILITY REQUIREMENTS

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This instruction implements Air Force Policy Directive (AFPD) 10-6, *Mission Needs and Operational Requirements,* and Department of Defense Instruction (DoDI) 5000.2, O*peration of Defense Acquisition Systems,* 23 October 2000 with Change 1, 4 January 2001. It provides procedures and parameters to define and maximize logistics mission capability and supportability throughout the system life cycle, especially emphasizing the acquisition of new systems and modification of fielded systems. Use this instruction with AFI 10-601, *Air Force Requirements Generation Process and Procedures*; AFI 21-118, *Improving Aerospace Equipment Reliability and Maintainability*; AFI 63-1201, *Assurance of Operational Safety, Suitability, & Effectiveness*; AFI 99-101, *Developmental Test and Evaluation*; and AFI 99-102, *Operational Test and Evaluation*.

Records Disposition. Ensure that all records created by this AFI are maintained and disposed of IAW AFMAN 37-139, "Records Disposition Schedule".

SUMMARY OF CHANGES

This revision incorporates Interim Change IC 2005-1. This change incorporates the sustainment planning and assessment elements as documented in DoDI 5000.2 and AFI 63-107. The text in AFI 63-107 paragraph 3.2.3 and sub paragraphs 3.2.3.1 – 3.2.3.10 are the "overarching" sustainment elements that must be addressed by program managers. The logistics support elements in AFI 10-602 paragraph **A2.5.** and subparagraphs **A2.5.1.-A2.5.10.** complement AFI 63-107. In some cases the AFI 10-602 elements have been combined into one sustainment element in AFI 63-107, while others such as Manpower, Personnel, and Training have been broken into separate sustainment elements. Paragraph **A2.5.** of the basic document is replaced by IC paragraph **A2.5.** Paragraph **A2.6.** and sub paragraphs **A2.6.1.** – **A2.6.10.** are added to identify the correlation between AFI 63-107 and AFI 10-602. A bar (|) indicates revision from the previous edition. The entire text of the IC is at the last attachment.

1. Purpose and Scope. This instruction provides terms, definitions, methods, and measures to determine reliability, availability, maintainability (RAM) and deployability; interoperability; and other parameters which contribute to increased mission capability and supportability. Building in RAM and deployability, in particular, can be a significant force effectiveness multiplier, resulting in increased combat capability with smaller, more responsive deployable systems requiring fewer spare parts, less specialized support equipment, and fewer people. The incorporation of RAM and deployability considerations during all phases of the system life cycle serves to maintain technological superiority and a high state of operational readiness in a resource-limited environment. The early stages of system acquisition provide the best opportunity to maximize potential mission capability and supportability. However, mission capability and supportability must be considered throughout the system life cycle. The identification and articulation of qualitative and quantitative mission capability and supportability requirements in concepts of operations (CONOPS), mission needs statements (MNS), and operational requirements documents (ORD) ensure users' needs are properly considered. AFPD 10-6 and AFI 10-601 contain in-depth flow charts and more detailed descriptions of the requirements process.

1.1. **Applicability.** This instruction provides definitions, measures, and methodologies for use by lead commands, major commands (MAJCOMs), single managers (SM), enterprise commanders (EC), and others to identify and continually refine mission capability and supportability requirements. Single manager is the generic title for the designated Air Force Materiel Command (AFMC) and Air Force Space Command (AFSPC) system program director or product group manager.

2. Air Force Operational Requirements Development Process. The Air Force develops operational requirements for acquisition of new systems and the modification of existing systems to correct deficiencies identified during the mission needs analysis of the Air Force modernization planning process (AFPD 90-11, *Planning System*). Mission capability and supportability requirements for new acquisitions and modification of existing weapons systems must be developed in concert with operational requirements (AFPD 10-6 and AFI 10-601). Requirements are linked through operational tasks to national security objectives using the Strategies-to-tasks (STT) process described in AFI 10-1401, *Modernization Planning Documentation* (Note: AFI 10-1401 is due to be replaced with AFI 90-1101). Development of requirements through the modernization planning process incorporates technology forecasts and correlates with overall Air Force planning efforts. Requirements development is an iterative, multi-command process and must consider compliance with international agreements and identify applicable design documents to ensure interoperability with allied systems and equipment. Lead commands have primary responsibility for developing system operational requirements, including mission capability and supportability requirements. Lead commands must coordinate with, and incorporate inputs from, the MAJCOMs and acquisition, support, and test organizations, among others.

2.1. **Developing Mission Capability and Supportability Requirements.** Lead commands will use the guidance in this AFI to initially develop and continually refine mission capability and supportability requirements. When practicable, these requirements will address recent initiatives to use commercial standards, Commercial Off The Shelf (COTS) equipment, common systems, open architecture avionics and support equipment, and reduction of mobility footprint. The systems engineering process is applied iterative throughout the system life cycle. The process translates stated problems into design requirements, providing an integrated system solution consisting of people, products, and processes with the capability to satisfy customer needs.

2.1.1. The Air Force requirements process is being refined. As mentioned in the summary, "effects-based" requirements are being implemented, therefore the logistics processes must be integrated into the new process. Initial Requirements Documents (IRD) are being developed as a precusor to the Operational Requirement Document and will include "effects'based" requirements. The IRD uses "spiral development" to evolve the requirements. Spiral development may require the logistician to insert boiler plate support and sustainment requirements in the initial IRD and update the requirements in later spirals as the system requirements are refined.

2.1.2. Developers of mission capability and supportability requirements, as appropriate to the particular system, will:

2.1.2.1. Select, tailor, and justify appropriate measures based on mission area assessments (MAA), mission needs analyses (MNA), mission area plans (MAP), and functional area plans (FAP).

2.1.2.2. Ensure compatibility with the Air Force and MAJCOM logistics strategic plans (LSP).

2.1.2.3. Incorporate appropriate support strategy as identified in DoD 5000.2R, Chapter 2.

2.1.2.4. Coordinate with the SM the development of a Product Support Management Plan as described in AFI 63-107, Integrated Product Support Planning and Assessment. The SM shall develop a Source Of Repair Assignment Process (SORAP) recommendation and brief the Acquisition Strategy Panel as soon as feasible. The PSMP and SORAP recommendation need to be in line with the Air Force depot strategy and the SORAP must be coordinated with the Center Commander.

2.1.2.5. Develop a depot maintenance decision based on "best value" criteria as outlined in AFI 21-102, Depot Maintenance Management, and AFI 63-107, Integrated Product Support Planning and Assessment. It will include a 10 U.S.C. 2464 "core analysis", a 10 U.S.C. 2466 (50/50) assessment and a review of organic and contract capabilities. Depot maintenance posturing decisions for both hardware and software are made utilizing the Source of Repair Assignment Process (SORAP) which is outlined in AFI 63-107. The goal is to provide best value to the warfighter and to ensure compliance with AF directives, Department of Defense guidance, specifically DoDD 4151.18, *Maintenance of Military Materiel* and DoD 5000.2-R, *Mandatory Procedures for Major Defense Acquisition Programs* and public law as noted above.

2.1.2.6. Investigate operational and support concepts for similar systems. Work with the SM to describe the desired support concept for the capability.

2.1.2.7. Use "lessons learned" databases and the Defense Acquisition Deskbook (DAD), or similar resources to avoid repeat design and support problems. Ensure serious support problems learned are included in the shortfall paragraph of the ORD.

2.1.2.8. Cite critical mission capability and supportability requirements in specific operational terms.

2.1.2.9. Identify contradictions and redundancies in different operational requirements documents.

2.1.2.10. Consider surge and combat support needs, such as Readiness Spares Package (RSP), at austere sites, en-route locations, and Forward Operating Locations (FOLs).

2.1.2.11. Tailor support requirements; Assess and prioritize tradeoffs.

2.1.2.12. Use the measures in **Attachment 3** through **Attachment 11** of this instruction.

2.2. **Responsibilities for Documenting Operational Requirements.** Lead commands and MAJCOMs must identify and communicate the importance of mission capability and supportability requirements and shortfalls. They must determine if a non-materiel solution, such as a change in tactics, doctrine, policy, or training can eliminate identified deficiencies. If a materiel solution (e.g., hardware, equipment, software etc.) is required, the mission need must be documented in a mission need statement (MNS) as required by AFI 10-601 Lead commands must identify RAM and deployability and other key performance parameters that satisfy the mission capability and supportability requirements of the MNS and operational requirements document (ORD). These parameters will be identified by the user in the ORD Requirements Correlation Matrix (RCM) and included in the acquisition program baseline (APB). In some cases a MNS and ORD may be developed specifically to correct RAM and deployability deficiencies that detract from mission capability and supportability. Support Equipment requirements should be compared to those capabilities listed in the Support Equipment Master Plan, Developed by WR-ALC/LE. Master Plan items to be reviewed are the current capabilities, technology insertion opportunities, and expected life cycle of the current equipment. When documenting requirements the commonality of components with other systems, common support equipment, open systems architecture, and downsizing equipment footprints will receive special consideration. Utilization of these concepts potentially could optimize the number of stocked items, spares requirements, proprietary designs, and airlift requirements.

2.2.1. **Documentation Process.** Lead commands will:

2.2.1.1. Document the methodologies and assumptions used to develop specific requirements.

2.2.1.2. Keep an information trail that traces the evolution of these requirements.

2.2.1.3. Provide the rationale for including specific RAM, deployability, and other parameters in requirements documents. This rationale will include the quantified impact of RM&D on operational tasks, assumptions about the operational mission scenario, mission profile, and failure definitions for operational testing and evaluation (OT&E). An optional method for documenting mission capable and supportability needs is the reliability, availability, maintainability, and supportability (RAMS) rationale process, developed and used by HQ Air Combat Command (ACC/DR). **Attachment 12** describes the RAMS rationale process.

2.2.2. **Using Analytical Techniques.** Lead commands use analytical and modeling techniques to help select and define mission capability and supportability requirements for complex, highly integrated weapon systems. Often, the interrelationships between mission capability and supportability and other performance requirements are not clear. In many cases hard, quantifiable data is not readily available and only rough qualitative relationships will exist. To ensure the link to this data, commands document use and operations by reporting maintenance data documentation IAW T.O. 00-20-2. Therefore, lead commands should use an appropriate weapon system model, where one exists, to establish, refine, and document the interrelationships and priorities among operational and mission capability and supportability requirements. These models should have the capability to use both qualitative and quantitative approaches to assist decision makers.

2.2.3. **Translating Requirements into Contract Terms.** The SMs, in conjunction with the enterprise capability planners, will translate lead command capability requirements into specific needs that the SM can put into quantifiable terms and articulate these throughout the design process. SMs will document the methodologies and rationale used. SMs must link the measures of effectiveness used in the Analysis of Alternatives (AoA), the Operational Requirements Document (ORD), and the measures stated in test and evaluation master plans (TEMPs). A Deficiency Reporting System IAW T.O. 00-35D-54 shall be established at the beginning of each acquisition program to support quantitative data analysis and measure the progress towards satisfying operational requirements in weapon systems.

2.3. **Funding Mission Capability and Supportability Requirements.** SMs will determine the costs associated with solutions to satisfy mission capability and life cycle supportability requirements. Adequate resources must be programmed to fully fund research and development (R&D), including support and sustainment planning (e.g. life-cycle cost, support equipment development, technical order (TO) development and all other supporting technical data, support software development, mission capability and supportability demonstrations, testing, etc.). SMs use "lesson learned" in AFTOC (Air Force Total Ownership Cost) database to ensure the system can be supportable with a minimum cost. Funding volatility must be controlled so as not to drive program costs and schedule delays. SMs also identify funding associated with the production and fielding of a supported system, including funding for training courses, trainer development, procurement, modification, and concurrency, as appropriate. This may include contractor logistics support (as described in AFI 63-111); interim contractor support; contractor field teams; initial and replenishment spares; initial and replenishment spares for Aircrew Training Devices (ATDs), Maintenance Training Devices (MTDs) and software integration labs (SILs), RSP spares requirements; Technical Data, ie., TOs, TCTOs, CPINs, Engineering Drawings, Wiring Diagrams, Digitization, software upgrades/revisions, etc., sustaining engineering; facility construction; storage and distribution; manpower; common, peculiar, and automated support equipment; training and training support; developmental test and evaluation (DT&E), operational test and evaluation (OT&E); and deactivation and disposal of materiel/systems, including hazardous materials. Modifications and changes are addressed in AFI 63-1101.

2.4. **Acquisition Logistics.** Acquisition Logistics includes those technical and management activities that ensure supportability implications are considered early in the requirements definition and throughout the acquisition process to minimize support costs and provide the user with the resources to sustain the system in the field. The logistician developing support requirements for a weapon system must be familiar with **Attachment 2** of this AFI. **Attachment 2** provides guidance for the development of support requirements, as stated in formal program documentation and addresses them in terms of program performance specifications as opposed to distinct logistics elements. Specifically, support requirements should relate to a system's operational effectiveness, operational suitability, and total ownership cost reduction.

2.5. **Use of Terms.** This Air Force Instruction provides terms, definitions, methods, and measures to determine reliability, availability, maintainability (RAM), deployability, interoperability, and other parameters which contribute to increased mission capability and supportability. General definitions of these terms are presented in **Attachment 1**. However, specific application of these terms depends on the type of system involved. For example, the use of mission capable rates for missile systems includes some factors not needed for aircraft systems. Furthermore, there are different terms to describe parameters for integrated logistics functions and system supportability measures. For example, software maturity is used to measure the progress of software development toward satisfying operational requirements in weapons systems. **Attachment 3**-**Attachment 11** provide standard definitions of the above terms and parameters for the following major systems and logistics functions: Aircraft Systems; Strategic or Tactical Ground-Launched Missiles; Air-Launched Missiles and Munitions; Trainers and Support Equipment; Subsystems, Line Replaceable Units and Modules; Software

Design; Space, Space Surveillance, and Missile Warning Systems; Automated Information Systems; and Ground Communications-Electronics.

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Attachment 1

GLOSSARY OF REFERENCES AND SUPPORTING INFORMATION

References

AFPD 10-6, *Mission Needs and Operational Requirements;* AFI 10-601*, Mission Needs and Operational Requirements Guidance and Procedures***.** These two documents establish procedures and assign responsibilities for identifying and processing operational needs and for initiating programs responsive to those needs. These documents also summarize the overall DoD system acquisition process and explain its relationship to the Air Force requirements process.

AFPD 10-9, *Lead Operating Command Weapon Systems Management;* AFI 10-901*, Lead Operating Command -- Communications and Information Systems Management.* The Air Force assigns responsibility for overall management of each system to a "lead command" to ensure that all requirements associated with every system receive comprehensive and equitable consideration. These two documents establish procedures and assign responsibilities for identifying and processing operational needs for communications and information systems. AFCA web site **https://www.afca.scott.af.mil/leadcommand/** lists lead commands and responsibilities associated with communications and information systems.

AFPD 21-1, *Managing Aerospace Equipment Maintenance;* AFI 21-101**,** *Aerospace Equipment Maintenance Management;* AFI 21-118**,** *Improving Aerospace Equipment Reliability and Maintainability.* These documents establish the basic system, policy and procedures for managing the Air Force aerospace equipment maintenance program.

AFPD 63-12, *Assurance of Operational Safety, Suitability, & Effectiveness*, establishes the Air Force requirement for assurance of operational safety, suitability, and effectiveness throughout a system's or end-item's operational life.

AFPD 90-11, *Planning System*, supersedes Air Force Policy Directive 10-14, dated 3 March 1995, titled *Modernization Plannin*g. Additionally, it incorporates new Performance Management guidance from the rescinded AFPD 90-5.

AFI 21-103, *Equipment Inventory, Status, and Utilization Reporting***.** This document prescribes the reporting system to account for aerospace equipment and analyze its availability and use.

AFI 33-103, *Requirements Development and Processing***.** This document outlines the processing, programming budgeting, and funding requirements for information systems. It details a process to streamline the development of and response to communications and information systems requirements. It also provides an oversight procedure to maintain the integrity of the process. The communications and information systems requirements process enables users to obtain new, nondevelopmental information technology (IT) capabilities with total program cost of less than or equal to $15 million, and to sustain existing IT systems.

AFI 33-104, *Base-Level Planning and Implementation***.** This document outlines the program management and acquisition processes for information systems. It outlines standardized management practices and tells how to manage planning and implementation of communications and information systems and the base-level infrastructure. This instruction provides guidance to activities requiring, implementing, and supporting communications and information systems and defines management responsibilities when program acquisition will cost less than $15 million.

AFI 36-2201, *Developing, Managing and Conducting Training*

AFI 36-2551, *Management of Air Force Training Systems.* This instruction provides direction for managing Training Systems. It outlines the requirements to develop, acquire, modify, test, validate and support Prime Mission Training Systems and Training Services throughout the total life-cycle of a system. It encompasses any system, which requires training for operators, maintainers, or support personnel.

AFI 63-107, *Integrated Product Support Planning and Assessment.* This document outlines the Product Support functions.

AFI 63-111, *Contract Support for Systems and Equipment.* This document provides policies and guidance on Contract Support throughout the life cycle of the system.

AFI 63-1101. *Modification Management.* It defines and describes the modification process and delegates Milestone Decision Authority (MDA) for modifications to the lowest appropriate level.

AFI 63-1201, *Assurance of Operational Safety, Suitability, & Effectiveness*, implements **AFPD 63-12**, *Assurance of Operational Safety, Suitability, & Effectiveness*. It defines a process for establishing and preserving the safety, suitability, and effectiveness of Air Force systems and end-items over their entire operational life. The process preserves technical integrity via prudent use of disciplined engineering practices, assurance of proper operation and maintenance, effective supply systems, and field utilization and maintenance trends feedback to system program offices.

AFI 91-102, *The U.S. Air Force Mishap Prevention Program.* System safety disciplines apply engineering and management principles, criteria, and techniques throughout the life cycle of a system within constraints of operational effectiveness, schedule, and cost. It establishes the use of MIL-STD-882 when modifying systems, end-items, facilities and equipment.

AFI 99-l01, *Developmental Test and Evaluation,* **AFI 99-102,** *Operational Test and Evaluation,* and **AFI 99-109**, *Test Resource Planning***.** These documents prescribe policy and assign responsibility for testing and evaluating Air Force systems during development, production, and deployment.

AFH 36-2235, Vol 1-11, *Information for Designers of Instructional Systems*

AFMAN 36-2234, *Instructional System Development*

AFPAM 36-221, *Guide for Management of Air Force Training Systems*

DoDD 5000.1, *The Defense Acquisition System,* **DoDI 5000.2,** *Operation of the Defense Acquisition System,* **DoD 5000.2R,** *Mandatory Procedures for Major Defense Acquisition Programs (MDAPS) and Major Automated Information System (MAIS) Acquisition Program.* These documents direct and describe the system acquisition process and provide procedures for accomplishing the process.

MIL-HDBK 29612-1A thru -5A, *MIL-PRF Performance Specification of Training Data Products*

MIL-HDBK-502, *Acquisition Logistics*

MIL-PRF-49506, *Performance Specification Logistics Management Information.* This specification describes information required by the government to perform acquisition logistics management functions. It replaces MIL-STD-1388B and implements a fundamental change in the way data requirements are levied on contract. The document provides the DoD a contractual method for acquiring support and support related data for initial provisioning, maintenance planning, cataloging, support equipment data, and item management.

MIL-STD-882D, *DoD Standard Practice for System Safety.* Addresses an approach in the management of environmental, safety, and health mishap risks encountered in the development, test, production, use, and disposal of DoD systems, subsystems, equipment, and facilities. The approach described herein conforms to the acquisition procedures in DOD Regulation 5000.2-R and provides a consistent means of evaluating identified mishap risks.

Abbreviations and Acronyms

A_o—Operational Availability

AoA—Analysis of Alternatives

AFMETCAL—Air Force Metrology and Calibration Program

ARC—Air Reserve Component

APB—Acquisition Program Baseline

BCS—Baseline Comparison System

BIT—Built-In Test

BIT/FD—Built-In-Test Fault Detection

CALS—Continuous Acquisition and Life-Cycle Support

CFI—Critical Faults Identified

CM—Corrective Maintenance

CM—Configuration Management

COMR—Communications Reliability

CND—Can Not Duplicate

CONOPS—Concept of Operations

CPIN—Computer Program Identification Number

D_o—Operational Dependability

DISN—Defense Information Switch Network

DRMP—Design Reference Mission Profile

DOC—Designated Operational Capability

DT&E—Developmental Test and Evaluation

ESRT—Essential System Repair Time

FA—False Alarm

FAP—Functional Area Plan

EC—Enterprise Commander

ECP—Engineering Change Proposal

FD—Fault Detection

FI—Fault Isolation

FMC—Fully Mission Capable

FSL—Full System List

ICBM—Intercontinental Ballistic Missile

ID—Integrated Diagnostics

IETM—Interactive Electronic Technical Manual

IFR—In-flight Reliability

ILS—Integrated Logistics Support

IMPACTS—Integrated Manpower, Personnel, and Comprehensive Training and Safety

IRSP—In-Place Readiness Spares

ISO—International Standards Organization

JCALS—Joint Computer-Aided Acquisition and Logistics Support

LR—Launch Reliability

LRM—Line Replaceable Module

LRU—Line Replaceable Unit

LSA—Logistics Support Analysis

MAJCO—MMajor Command

MAP—Mission Area Plan

MC—Mission Capable

MCMT—Mean Corrective Maintenance Time

MDT—Mean Downtime

MEFL—Mission Essential Functions List

MESL—Minimum-Essential Subsystem List

MLH/AH—Maintenance Labor Hours per Active Hour

MMH/FH—Maintenance Man-Hours per Flying Hour

MMH/LU—Maintenance Man-Hours per Life Unit

MMH/PH—Maintenance Man-Hours per Possessed Hours

MMT—Mean Maintenance Time

MMY/L—Maintenance Man Years per Launch

MNS—Mission Needs Statement

MP—Mission Profile

MP/U—Maintenance Personnel per Operational Unit

MR—Maintenance Ratio

MRS—Mobility Requirements Study

MRSP—Mobility Readiness Spares Package

MRT—Mean Repair Time

MTBCF—Mean Time Between Critical Failure

MTBDE—Mean Time Between Downing Event

MTBF—Mean Time Between Failures

MTBM—Mean Time Between Maintenance

MTBR—Mean Time Between Removal

MTD—Maintenance Training Device

MSMT—Mean Scheduled Maintenance Time

MTBUM—Mean Time Between Unscheduled Maintenance

MTBSM—Mean Time Between Scheduled Maintenance

MTTR—Mean Time To Repair

MTTRF—Mean Time To Restore Function

MTTRS—Mean Time To Restore System

NMC—Not Mission Capable

NMCB—Not Mission Capable Both

NMCM—Not Mission Capable Maintenance

NMCMU—Not Mission Capable Maintenance Unscheduled

NMCS—Not Mission Capable Supply

OMS—Operational Mission Summary

ORD—Operational Requirements Document

OT&E—Operational Test and Evaluation

PH—Possessed Hours

PM—Preventive Maintenance

PMC—Partially Mission Capable

PMEL—Precision Measurement Equipment Laboratory

PSMP—Product Support Management Plan

RAA—Required Asset Availability

RAM—Reliability, Availability, and Maintainability

RAMS—Reliability, Availability, Maintainability, and Supportability

RM&D—Reliability, Maintainability, and Deployability

RSP—Readiness Spares Package

R&D—Research and Development

R_m—Mission Reliability

RSR—Re-Entry System Reliability

RTOC—Reduction Total Ownership Costs

RTOK—Retest OK

SAR—Strategic Alert Reliability

SE—Support Equipment/System Engineering

SIL—Software Integration Lab

SLA—Service Level Agreement

SM—Single Manager

SORAP—Source of Repair Assignment Process

SPF—Single Point Failure

SRU—Shop Replaceable Unit

STT—Strategy-To-Task

TCTO—Time Compliance Technical Order

T&E—Test and Evaluation

TO—Technical Order

UTE—Utilization

UR—Utilization Rate (as used in formulas)

UTR—Uptime Ratio

WSR—Weapon System Reliability

WUC—Work Unit Code

Terms

Use this glossary as a general guide for terms. Consult other documents, such as MIL STD 721C and AFI 21-103, for reliability and maintainability terms and definitions, and their contextual variations.

Acquisition Logistics—Acquisition Logistics includes those technical and management activities that ensure supportability implications are considered early and throughout the acquisition process to minimize support costs and provide the user with the resources to sustain the system in the field.

Active Equipment —Equipment that is installed and in use unless it has an open job against it (does not include cold spares or off-line serviceable equipment).

Active Hours—Possessed hours equipment is reported in use.

Administrative and Logistics Delay Time—A period of downtime during which no maintenance takes place due to delays in administrative processing, parts delivery, assignment of maintenance personnel or equipment, and transportation.

Alert Reliability —The probability that a weapon or system, once uploaded on a host and accepted for alert, will remain free from critical failure until download or launch.

Availability —The degree (expressed in terms of 1.0 or 100 percent as the highest) to which one can expect an equipment or weapon system to work properly when it is required. The equation is uptime over uptime plus downtime, expressed as A_o. It is the quantitative link between readiness objectives and supportability.

Built-In Test—An internal automatic or semiautomatic feature in a system or subsystem designed to detect and identify faults by interrogating a system or monitoring system performance.

Built-In-Test Effectiveness—The measure of a system's ability, through automated or semi-automated diagnostic mechanisms, to detect and identify performance degradation or faults. Built-In-Test will quickly convey any mission critical information to the operator in an understandable format and display and/or store all significant fault and associated environmental data for operators or maintenance personnel to use.

Break Rate—The percentage of sorties flown during a specified period of time that return with one or more previously working mission-critical systems or subsystems inoperable, thus rendering the aircraft not mission capable or partially mission capable relative to the previous type mission.

Cannot Duplicate—A situation that results in a recorded malfunction maintenance personnel cannot confirm.

Code 3—An evaluation code used by operational and maintenance personnel which describes an aircraft returning from a mission with one or more inoperable systems or subsystems that personnel must repair before allowing it to perform "like type" missions. A "Code 3" discrepancy on a mission-essential system or subsystem is a failure that makes the aircraft NMC or PMC.

Combat Capability—The number of successfully executed consecutive events (sorties, miles, orbits, hours) that a weapon system can perform to accomplish the assigned mission under specified conditions.

Corrective Maintenance—All actions performed to restore an item to a specified condition after a problem occurs or the item fails. Corrective maintenance may include localizing a problem, isolating a problem, disassembling a system, interchanging components, reassembling a system, aligning parts, and checking a system out.

Critical Failure—Any degradation, indication of failure, actual failure, or combination of problems resulting in a loss of mission-essential function(s). **Note that a critical failure does not have to occur during a mission, it merely must or could cause mission impact.**"

Defect—A product anomaly that causes faults and errors.

Degradation—The decline in a system or subsystem's performance.

Dependability—The probability that a system can be used to perform a specified mission when desired. **Note that a system cannot be used to perform a specified mission when preventative maintenance (or other) downtime, with respect to that mission, is experienced**.

Deployability—The inherent ability of resources to be moved, used, sustained, and recovered with ease, speed, and flexibility to meet mission requirements.

Design Reference Mission Profile (DRMP)—The DRMP identifies tasks, events, timeliness and duration, operating conditions and environments of the system for each phase of a mission. The DRMP also defines the boundaries of the performance envelope and identifies appropriate system constraints.

Downing Event—The criteria of a downing event will generally include any occurrence resulting in a time during which the system cannot be used for a specified purpose.

Downtime—A time during which the system cannot be used for a specified purpose.

Enterprise Commander (EC)—A designated lead for enterprise integration with accountability and responsibility for activities that support common systems requirements, interoperability, crosscutting system solutions, and system-of-systems architectures within the respective enterprise (aeronautical, command and control, armament, or space) portfolio.

Failure—In hardware, a condition caused by operational, maintenance, physical or other environments, which results in the inability of the equipment to perform its required or expected functions.

False Alarm—A system-indicated malfunction that can not be validated because no request for corrective maintenance follows. A CND differs from a false alarm in that it signifies a malfunction that can not be confirmed.

Fault Isolation—The process of systematically tracing any identified system or subsystem or item malfunction to the defective item or component.

Fix Rate—The percentage of broke aircraft returned to flyable status in a certain amount of clock hours. For fighter aircraft, measurements are made at the 4 hour and 8 hour points; for all others, measurements are taken at the 12 hour point. A broke aircraft is an aircraft that lands with an overall status of Code 3 (a grounding condition in which the aircraft is unable to meet at least one of its wartime missions).

Fully Mission Capable (FMC)—The system is capable of doing all of its assigned missions.

Functional Area Plan (FAP)—The FAP outlines an investment strategy for a particular functional area that requires investments in systems or leveraging technologies which must be standardized across all MAJCOMs. FAPs are analogous to Mission Area Plans (MAPs) and are the primary product of the Air Force Modernization Planning process.

Gradual Degradation—The gradual decline in a systems performance that eliminates or delays an NMC condition through the use of redundancy, reallocation or other operational correction strategies.

Hazardous Materials—Those materials requiring special handling, storage, and disposal because they are harmful to either the environment, people, and/or animals.

IMPACTS (Integrated Manpower, Personnel and Comprehensive Training and Safety)—The Air Force program that implements Human Systems Integration (HSI), C5.2.3.5.9 of DOD 5000.2R *(Mandatory Procedures for Major Defense Acquisition Programs (MDAPS) and Major Automated Information System (MAIS) Acquisition Programs*). HSI major categories are: manpower, personnel, training, human factors engineering, safety, and health.

Inactive Equipment—Serviceable equipment not on line or in use; includes equipment in storage, tactical and C-E equipment not deployed, mock-ups, training equipment, and equipment not being used to perform the organization's primary mission(s).

Inactive Hours—Possessed hours of equipment that is reported not in use.

Integrated Diagnostics (ID)—A structured total-system approach for designing the most effective combination of automated, semi-automated, and manual diagnostic resources. Such an approach gives the required performance information to the appropriate personnel and provides support mechanisms that efficiently isolate all faults to the *specific* malfunctioning item(s). ID seeks to unambiguously detect and isolate 100 percent of the known or expected system faults. ID minimizes diagnostic effectiveness by integrating the following elements: inherent testability; on-board mission environmental monitoring; built-in test and automatic test equipment; portable maintenance aids; reusable test data; CALS compatibility; electronic TOs; and on-the-job-training for maintenance personnel.

Integrated Diagnostics Effectiveness—A measure of a system's ability, through automated, semi-automated, and manual diagnostic resources, to give the operator a timely and understandable indication of any change in a system or mission-essential weapon function, correlate and store all pertinent diagnostic data in a nonvolatile memory medium that operator and maintenance personnel can access on demand, expedite the unambiguous isolation of any system or weapon malfunction to the defective part or item, and reduce the number of unconfirmed fault indicators such as CNDs and false alarms.

Interoperability—The ability of systems, units, or forces to provide data, information, materiel, and services to and accept the same from other systems, units, or forces, and to use the data, information, materiel, and services so exchanged to enable them to operate effectively together.

Lead Command—The MAJCOM, DRU, or FOA designated as the Air Force user advocate.

Life Unit—The generic term for a standard time - or event - based unit of measure against which operational conditions are evaluated. Life units include flying hours, operating hours, possessed hours, sorties, rounds, mileage, other calendar or clock time, and other recurring events.

Logistics Reliability—The ability of a system to perform failure free, under specified operating conditions and time without demand on the support system. Typical measures include mean time between maintenance, demand or removals.

Logistics Requirements—These include operations, maintenance (including depot activities), training, and base operating support requirements. Logistics encompasses design interface; maintenance planning; support equipment; supply support; packaging, handling, storage, and transportation; technical data; facilities; personnel; training and training support; and computer resources support.

Logistics Support Elements—The term "Logistics Support Elements" as used in this document defines a group of elements previously identified as the Integrated Logistics Support (ILS) elements. The term Integrated Logistics Support has been deleted from DoD 5000.2-R and replaced by "Product Support". Because the elements are so critical to support and sustainment the users of this document requested the elements be retained.

Maintainability—Describes the ease with which an item to be retained in, or restored to, a specified condition when maintenance is performed by personnel having specified skills using prescribed procedures and resources at each prescribed level of maintenance and repair.

Maintenance Action—An element of a maintenance event. One or more tasks taken to restore a system or maintain it in working order.

Maintenance Event—One or more preventive or corrective maintenance actions, including troubleshooting due to any type of failure or malfunction, scheduled maintenance, or servicing.

Maintenance Event Time—The sum of unscheduled and scheduled maintenance action times spent on a specific maintenance event.

Maintenance Man-Hours per Life Unit—The maintenance hours required divided by the appropriate life unit.

Maintenance Turn Time—The time required to prepare a returning mission-capable aircraft for another sortie. This calculation takes into account servicing of fuel, oil, and oxygen; the "look" phase of through flight inspection; and launch preparation.

Manpower Spaces Per System—Total on and off equipment maintenance staffing requirements per system including number of spaces and skill levels.

Mean Downtime—The average elapsed time between losing MC status and restoring the system to at least partially mission capable status.

Mission Area Plan (MAP)—This plan outlines an investment strategy to support the programming, requirements, laboratory, and independent research and development processes for a specific mission area or necessary subset.

Mission Capable (MC)—An assessment of a system's ability to perform its assigned peacetime or wartime mission(s).

Minimum-Essential Subsystem List (MESL)—Lays the groundwork for reporting the status of aircraft capability. MESLs list the minimum essential systems and subsystems that must work for an aircraft to perform specifically assigned unit wartime, training, test or other missions. The MESL brings together the Full Systems List (FSL) and Basic Systems List (BSL).

Mission Reliability—The probability that the system is operable and capable of performing its required function for a stated mission duration or for a specified time into the mission.

Mobility—The characteristic of military forces to move from place to place while fulfilling their primary mission. Mobility requirements for a deploying unit are usually expressed as the number of C-17 load equivalents needed to move that unit. For a unit that does not deploy, but may disperse, the mobility requirements are expressed as the number and type of vehicles necessary to move the unit and support it at the dispersal site.

Not Mission Capable (NMC)—The system cannot do any assigned missions.

Not Mission Capable Both (NMCB)—Not Mission Capable Both Maintenance and Supply -- The system cannot do any assigned missions because of maintenance and supply. Aircraft cannot fly (restricted from use).

Not Mission Capable Maintenance (NMCM)—The system cannot do any assigned missions because of maintenance. Aircraft cannot fly (restricted from use).

Not Mission Capable Maintenance Unscheduled (NMCMU)—The system cannot perform its assigned mission due to unscheduled maintenance.

Not Mission Capable Supply (NMCS)—The system can not do any assigned missions because of supply. Aircraft cannot fly.

Not Mission Capable Unscheduled (NMCU)—The time the system is not mission capable because of unscheduled maintenance and associated delays. Total NMCU hours is the sum of hours not mission capable because of unscheduled maintenance plus hours not mission capable because of supply delays plus hours not mission capable for both reasons.

Operating Time—The time that the system or equipment is considered to be operable. ***Operating Time*** is the same as ***Uptime.***

Operational Availability—The probability a system will be ready for operational use when required (i.e., the availability of a weapon system in an operational environment).

Operational Dependability—The probability that a system is operable at any time within its operational environment given that the system is not down due to scheduled maintenance.

Operational Effectiveness—The overall degree of mission accomplishment of a system when used by representative personnel in the environment planned or expected for operational employment of the system considering organization, doctrine, tactics, survivability, vulnerability, and threat.

Operational Mission Failure—A failure, equivalent to a critical failure occurring in an operational environment, that precludes successful completion of a mission.

Operational Sustainability—A measure of the degree to which a system can continue to maintain the necessary level of support for a specified duration of operations beyond its initial deployment period.

Operational Suitability—The degree to which a system can be placed satisfactorily in field use with consideration given to availability, compatibility, transportability, interoperability, reliability, wartime usage rates, maintainability, safety, human factors, manpower supportability, logistics supportability, natural environmental effects and impacts, documentation, and training requirements."

Operational Transportability—A measure of the degree to which a system can be moved by specified transportation means (air, water, road, pipeline, or rail) using specified transportation assets (C-141, C-5, C-17, truck, etc.) to achieve specified mission deployment requirements (pallet load, setup time, weight, volume, etc.).

Partially Mission Capable (PMC)—The system is operating in an impaired condition. It can perform at least one, but not all of its assigned missions.

Partially Mission Capable Maintenance (PMCM)—The system is operating in an impaired condition due to uncompleted maintenance actions. It can perform at least one, but not all of its assigned missions.

Partially Mission Capable Maintenance Unscheduled (PMCMU)—The system is operating in an impaired condition due to uncompleted, unscheduled maintenance. It can perform at least one, but not all of its assigned missions.

Partial Mission Capable Supply (PMCS)—The system is operating in an impaired condition due to uncompleted supply actions. It can perform at least one, but not all of its assigned missions.

Possessed Hours—The total hours in a given calendar period where assigned equipment is under the operational control of the designated operating organization, expressed as possession stop date and time minus start date and time.

Preventive Maintenance—The care and servicing of systems by personnel to maintain equipment and facilities in satisfactory operating condition by systematically inspecting, cleaning, detecting, and correcting incipient failures either before they occur or before they develop into major defects.

Product Support Management Plan (PSMP)—This document serves as the consolidated life cycle weapon system/product group sustainment plan. It integrates the vision, strategy, and specific product support concepts and arrangements that will ensure the reliability, maintainability, and readiness necessary to meet the needs of the warfighter at best value. Although developed by the SM, it requires the early and consistent involvement of a wide range of stakeholders to ensure a broad Air Force perspective and facilitate coordination and approval of the final plan proposal.

RAMS Rationale Process—Reliability, Availability, Maintainability, and Supportability (RAMS) is a process that provides a structured development of readiness requirements. It ensures proper crosstalk between the user, system program office, and the test/evaluation organizations. The RAMS rationale process, developed by HQ ACC/DR, integrates RAMS parameters into the requirements development process, thus ensuring a linkage to operational utility. The RAMS rationale report is the "living" readiness requirements document, recording the analysis, rationales and tradeoffs made in the development of readiness requirements. The process can be tailored to meet the scheduling and programmatic needs of weapons systems managers.

Readiness—The ability of forces, units, weapon systems or equipment to deploy or employ without unacceptable delays and deliver the outputs they were designed to provide.

Reliability—The probability that a system will perform satisfactorily for a given time when used under specified operating conditions.

Reliability Growth—The improvement in a reliability parameter caused by successfully correcting design or manufacturing deficiencies.

Repair Time—The corrective maintenance time required to return a system or part to operational status (may be calculated as a mean or maximum repair time). Repair time takes into account set-up; access; troubleshooting; disassembly; repair, reassembly, and repair verification; system test; and backout procedures.

Restoral Time—The maximum time allowed for restoring the mission essential functions of a system or weapon to MC status. Also see MDT.

Retest OK or Bench Test Serviceable—A maintenance event involving a part or subsystem malfunction at the on-equipment maintenance level that personnel can't duplicate at the off-equipment maintenance level. As a result of this event, personnel may return the item to service without taking corrective action.

Scheduled Maintenance—Periodic inspection and servicing of equipment prescribed on a calendar, mileage, hours-of-operation. or other life unit basis.

Single Manager—The generic title for a designated AFMC or AFSPC system program director or product group manager. The individual who is ultimately responsible and accountable for decisions, resources, and overall program execution relative to a weapon system or product group. (Note: See AFI 63-107 for an expanded definition of SM)

Software Architecture—A top-level definition of a software design that is defined early in a system's life cycle. It is the result of system design activity to synthesize a software system that will support the system's functions; be in concert with a synthesized hardware system; be responsive to imposed developmental, environmental, and operational conditions; and be demonstratively supportive of a vision for growth and change. To be useful, the software architecture must first be articulated and include provisions for change; second, it must be controlled and maintained throughout the system's life cycle (Reference: Software Architecture Version 2.0, APPENDIX G).

Software Failure—The termination of the ability of a system to perform its required function as a result of a software fault.

Software Fault—A defect in the code that can be the cause of one or more failures.

Software Maintainability—A factor that depends on the inherent characteristics of software, as documented in manuals and source listings, to facilitate software modifications.

Software Maturity—A measure of the evolution of software to satisfy operational requirements. The primary indicators of software maturity are the number and severity of the required software changes.

Software Reliability—The probability that software will contribute to failure-free system performance for a specified time under specified conditions. The probability depends on information input into the system, system use, and the existence of software faults encountered during input.

Subsystem Break Rate—The percentage of operable subsystems per sortie that experience critical failures when a sortie demand is placed on the host system.

Subsystem Utilization Rate—The percentage of time per sortie that the subsystem will operate, including time in standby mode.

Support Structure Vulnerability—The amount of space necessary to decrease the vulnerability of support base-level operational maintenance activities subject to attack.

Sustainability—A system's ability to maintain the necessary level and duration of operations to achieve military objectives. Sustainability depends on ready forces, materiel, and consumables in enough quantities and working order to support military efforts.

System Independent Airlift Support—The amount and type of airlift required to support an independent squadron or unit for 30 days without additional support. Airlift support is usually expressed in numbers of 463L pallets or C-17 equivalents and consists of enroute support teams, initial tactical support elements, readiness spares packages, and support equipment.
EXCEPTION: Airlift support does not include support such as fuels, munitions, medical, etc.

System Safety—A key objective of DoD, to include mishap risk management consistent with mission requirements, in technology development by design for DoD subsystems, equipment, facilities, and their interfaces and operation. The DoD goal is zero mishaps.

Technical Data—Data that may include engineering drawings, lists, specifications, standards, process sheets, manuals and documentation, technical reports and orders, and catalog items.

Time Between Maintenance Events—The accrued operating hours or uptime between maintenance events.

Time Between Removals—The accrued operating hours or uptime between removals of a particular component or item or subsystem.

Time To Restore Function—The time required to restore a mission function interrupted by a critical failure (may be calculated using the mean or maximum time to restore a system).

Total Not Mission Capable Maintenance (TNMCM)—An aircraft that is unable to meet any of its wartime missions is considered to be Not Mission Capable (NMC). There are only three reasons for that: Not Mission Capable Maintenance (NMCM), Not Mission Capable Supply (NMCS), or Not Mission Capable Both (NMCB). An NMCB condition occurs when an aircraft is NMCM and NMCS at the same time. The Total Not Mission Capable Maintenance (TNMCM) rate is the amount of time aircraft are in NMCM plus NMCB status.

Total Not Mission Capable Supply (TNMCS)—An aircraft that is unable to meet any of its wartime missions is considered to be Not Mission Capable (NMC). There are only three reasons for that: Not Mission Capable Maintenance (NMCM), Not Mission Capable Supply (NMCS), or Not Mission Capable Both (NMCB). An NMCB condition occurs when an aircraft is NMCM and NMCS at the same time. The Total Not Mission Capable Supply (TNMCS) rate is the amount of time aircraft are in NMCS plus NMCB status.

Uptime—The time that the system or equipment is considered operable. ***Uptime*** is the same as ***Operating Time.***

Utilization Rate—The average number of sorties or hours flown per authorized or chargeable aircraft per month. Under this area, each unit is compared with their goal for the year, their monthly program goals versus their actual, and their cumulative rate so far this fiscal year. Fighter aircraft are measured with Sortie UTE Rates; all other aircraft are measured with Flying Hour UTE Rates.

Attachment 2

ACQUISITION LOGISTICS

A2.1. Acquisition Logistics. Acquisition Logistics includes those technical and management activities that ensure supportability implications are considered early in the requirements definition and throughout the acquisition process to minimize support costs and provide the user with the resources to sustain the system in the field. The DoD movement toward the use of commercial specifications, best practices, and performance specifications dictates that support requirements, as stated in formal program documentation, be addressed in terms of program performance specifications as opposed to distinct logistics elements. Specifically, support requirements should relate to a system's operational effectiveness, operational suitability, and total ownership cost as addressed in AFI 63-1201, *Assurance of Operational Safety, Suitability, & Effectiveness*, and DoD 5000.2R The MAJCOMS may require a Turnover Plan/Agreement for ACAT I, II, III acquisition programs to ensure Required Asset Availability (RAA) satisfies all logistics support requirements for the operational command to assume operations and maintenance responsibility. Turnover Plans/Agreements are authored by the system program office and approved by the lead command, but may be waived by the MAJCOM and the SM. The RAA is integral to logistics working groups.

A2.2. Product Support. Office of the Secretary of Defense, with Service concurrence, defined product support as: "The package of support functions necessary to maintain the readiness and operational capability of weapon systems, subsystems, and support systems". It encompasses all critical functions related to weapon system readiness, including materiel management, distribution, technical data management, software management, maintenance, training, cataloging, configuration management, engineering support, repair parts management, failure reporting and analyses, and reliability growth. The source of support may be organic or commercial, but its primary focus is to optimize customer support and achieve maximum weapon system availability at the lowest total ownership cost (TOC)" (Reference DoD report on Product Support July 1999, Section 912 (c) page 1-1).

A2.2.1. **Product Support Philosophy.** The Product Support philosophy integrates the process for development and ongoing review and maintenance of a product support strategy during the acquisition and sustainment phases of the weapon system life cycle. It is applicable to all Single Manager (SM) managed programs. (note: the term Single Manager (SM) applies to any individual charged with managing an Air Force program office, including both weapon systems managers and product group managers (PGMs)). The compelling need to achieve a life-cycle focus on weapon system sustainment cost dictates a seamless, integrated, continuing process to assess and improve product support strategies.

A2.2.2. **The Product Support Concept.** The Product Support Concept includes a requirement for the SM to create and maintain a Life Cycle Product Support Strategy for their system/product, including specific mission or capability. This strategy will be documented in a Product Support Management Plan (AFI 63-107 Attachment 2). The development of this strategy should be the result of a rigorous assessment process led by the SM and will ensure that the resulting strategy addresses, at a minimum:

A2.2.2.1. Existing or projected cost drivers and performance shortfalls

A2.2.2.2. Potential product support concepts to prevent, halt, or reduce cost increases and alleviate performance shortfalls

A2.2.2.3. Deliberate evaluation of proposed concepts and practices against legislative, regulatory, and other applicable decision criteria

A2.2.2.4. Include a Depot Maintenance Source Of Repair Assignment Process (SORAP) recommendation and a Depot Maintenance Interservice Source of Repair determination as outlined in AFI 21-133(I)

A2.2.2.5. Migration Plan by which the SM evaluates Aerospace Maintenance and Regeneration Center (AMARC) stored aircraft and articulates plans to optimize their use as outlined in AFI 63-107.

A2.2.2.6. Develop public-private partnering arrangements to accomplish product support as outlined in AFI 63-107.

A2.2.3. **Product Support Strategies.** Product Support Strategies will show a clear preference for inclusion of the following characteristics:

A2.2.3.1. Performance-based support arrangements/contracts, based on high-level metrics

A2.2.3.2. Preference for a single prime support integrator (organic or contractor)

A2.2.3.3. Exploit common mechanical and structural components across systems, common avionics, common support equipment, open systems architecture, and reduction of deployment foot prints

A2.2.3.4. Long term business relationships (Utilize multi-year, multi-NSN contracts)

A2.2.3.5. Preference for commercial standards (Recommend this be contemplated only when the government does not intend to buy, repair, or reprocure data.

A2.2.3.6. Partnering: Leveraging the best skills and capabilities for support, wherever they exist as outlined in AFI 63-107.

A2.2.3.7. Service Level Agreements (SLAs) as described in AFI 63-107 Attachment 6 are bilateral agreements between the customer (Single Managers) and their suppliers. Their purpose is to establish a framework of expectations between both parties regarding service levels as measured in terms of quantity, quality, and timeliness. SLA's apply only to organically supported functions.

A2.2.4. **Technology.** Encourage continuous technology refreshment through adopting performance specifications, commercial standards, non-developmental and commercial-off-the-shelf items wherever feasible, in both the initial acquisition design phase and all subsequent modification and reprocurement actions. Ensure top-level interface descriptions are delivered which describe the interfaces that will be used for any possible technology refreshment.

A2.3. Logistics Planning Responsibilities:

A2.3.1. Lead commands ensure that logistics elements as well as supportability and readiness concepts are addressed in the development of operational and logistical requirements and will:

A2.3.1.1. Address and accept trade-offs, as necessary, between a system's various supportability and operational requirements.

A2.3.1.2. Ensure logistics support requirements are tailored and refined throughout the system acquisition process to describe a viable support concept for the system.

A2.3.1.3. Ensure the qualitative and quantitative operational RAM and deployability thresholds and objectives are defined as precisely as possible.

A2.3.1.4. Ensure the RAM and deployability parameters are continually refined throughout the acquisition process as the overall system design matures. Use **Attachment 3**-**Attachment 11** for supportability measures when developing quantitative RAM and deployability requirements relevant to specific systems.

A2.3.2. SMs will ensure that logistics support includes inputs from lead commands, MAJCOMs, users, developers, and testers and that each of the logistics support elements are considered.

A2.3.3. The SM is the primary author of the PSMP, but development of the plan should include as direct participants those stakeholders identified in AFI 63-107, Attachment 2. All managers must ensure logistics planning is in concert with weapon system Operational Requirements Documents by reviewing the logistics support elements below and tailoring the PSMP to include those applicable to the acquisition program.

A2.4. Logistics Management. Logistics Management Information (LMI) is acquired to provide item sustainment data on a material system and information needed for planning, assessing program status, and program decisions. Use the Supportability Analysis Summaries below to obtain that data and information.

A2.4.1. **Logistics Management Information.** MIL-PRF-49506 Appendix A describes the Supportability Analysis Summaries. The requirement for the following reports shall be tailored to provide the information required by the requiring agency to conduct logistics planning and analysis, influence program decisions, assess design status, and verify contractor performance.

A2.4.1.1. **Maintenance Planning.**

A2.4.1.2. **Repair Analysis.**

A2.4.1.3. **Support and Test Equipment.**

A2.4.1.4. **Supply Support.**

A2.4.1.5. **Manpower, Personnel, and Training.**

A2.4.1.6. **Facilities.**

A2.4.1.7. **Packaging, Handling, Storage, and Transportation.**

A2.4.1.8. **Post Production Support.**

A2.5. Sustainment Planning Elements**.** The guidance in this paragraph replaces paragraph **A2.5.** of AFI 10-602 dated 13 September 2003. The ten Logistics Support Elements identified in this document under paragraphs **A2.5.1.** – **A2.5.10.** are replaced with: Manpower, Personnel, Maintenance, Supportability, Systems Engineering, Data Management, Supply, Transportation, Configuration Management, and Training. The logistics support elements are critical factors in the early phases of design development. In planning and executing product support, logisticians shall consider system key performance parameters identified in the Capability Development Document and Capability Production Document.

A2.5.1. **Design Interface:**

A2.5.1.1. Integrate the logistics-related readiness, combat capability, systems commonality, and supportability design parameters into system and equipment design. The factors listed below collectively affect the testing, operation, support, and costs of our weapons systems.

A2.5.1.1.1. Reliability, maintainability, and deployability

A2.5.1.1.2. Availability

A2.5.1.1.3. Sustainability

A2.5.1.1.4. Survivability

A2.5.1.1.5. Standardization and interoperability

A2.5.1.1.6. Integrated diagnostics effectiveness

A2.5.1.1.7. Fuel, utility and energy management

A2.5.1.1.8. Transportability

A2.5.1.1.9. Testability

A2.5.1.1.10. Accessability

A2.5.1.1.11. Dependability

A2.5.1.1.12. Spares support

A2.5.1.1.13. Transportability

A2.5.1.1.14. Mission effectiveness

A2.5.1.1.15. Durability

A2.5.1.1.16. Serviceability

A2.5.1.1.17. Software reprogrammability

A2.5.1.1.18. Software speed and efficiency

A2.5.1.1.19. Level of repair

A2.5.1.1.20. Calibration

A2.5.1.1.21. Industrial support base

A2.5.1.1.22. Revised tactics

A2.5.1.1.23. Support equipment

A2.5.1.1.24. Training

A2.5.1.1.25. Inspections

A2.5.1.1.26. Manpower

A2.5.1.1.27. Human factors

A2.5.1.1.28. System safety

A2.5.1.1.29. Corrosion

A2.5.1.1.30. Nondestructive inspection

A2.5.1.1.31. Physical obsolescence

A2.5.1.1.32. Changes in threat environment

A2.5.1.1.33. Hazardous material management

A2.5.1.1.34. Mobility

A2.5.2. **Maintenance Planning:**

A2.5.2.1. Address the requirements and constraints inherent in applicable on-equipment (organizational), off-equipment (intermediate), and depot maintenance for operational and supporting commands. Consider the entire life cycle of the system, including its requirements during peacetime, wartime and other contingency scenarios. Maintenance planning is documented in the Mission Need Statement, Concept of Operations, ORD and PSMP.

A2.5.2.2. Describe the operational maintenance environment for the total (scheduled and unscheduled) maintenance effort, including basing concept; expected weather and climate (consider all weather to accommodate mobility); and acceptable frequencies and repair times (including ease of maintenance, accessibility of components, and accurate fault isolation testing).

A2.5.2.3. Specify levels and organizations responsible for maintenance. Evaluate three levels of maintenance (organizational, intermediate, and depot) with a design, development, and contracting goal of two levels (organizational and depot) in all new acquisition programs. Specify ensuing/required logistics support for each specific level of maintenance.

A2.5.2.4. Specify an acceptable interservice, organic, or contractor mix. Ensure that planning includes contractor participation in fielded operations if contractor support is anticipated.

A2.5.2.5. List the generic type of maintenance tasks these organizations will perform. Include workload and time phasing for depot maintenance requirements.

A2.5.2.6. Assess the need for, or intention to perform, centralized repair at selected operating sites or at safe areas. Include requirements for battle damage repair.

A2.5.2.7. Address maintenance constraints posed by requirements for the physical make-up of the equipment, electronics, chemicals, nuclear hardness, survivability, safety, occupational health, and environment.

A2.5.2.8. Include requirements for demilitarization and redistribution.

A2.5.2.9. Address the requirements for spares, consumables, technical orders, support equipment, facilities, skill levels, training, and other pertinent logistics support areas.

A2.5.2.10. Where appropriate, consider compatibility with systems that transmit on-aircraft or system faults to base-level management information systems.

A2.5.2.11. Define requirement for maintenance data collection. Technical Order 00-20-2 provides a broad understanding of the objectives, scope, concept, and policy of Maintenance Data Documentation (MDD) and some intended uses of the data collected. Define what is to be collected (failure, availability, maintenance) and when it should be reported (IOC, turnover, etc.). Define how and where to report data. CAMS is the approved Air Force Base Level MDD system and REMIS is the approved Depot Level MDD system. Any unique MDD system, such as one using contractor format, must interface to either CAMS or REMIS; depending upon the level of data being collected.

A2.5.2.12. Consider using expert systems to help reduce data and filter fault data down to a manageable level.

A2.5.2.13. Include and use the Air Force Repair Enhancement Program IAW AFI 21-123.

A2.5.3. **Support Equipment (SE):**

A2.5.3.1. SE considerations include equipment for transportation, ground handling, munitions maintenance, metrology and calibration, test and diagnostics, aircraft battle damage repair, software support and reprogramming, and automatic test along with tools and computer programs.

A2.5.3.2. Consider IMPACTS (see paragraph **A2.5.8.5.**) when designing and modifying SE. Correlate the SE requirement with the maintenance concept and identify SE development constraints. Ensure that the SE is supportable and meets the timing and calibration requirements necessary to the systems.

A2.5.3.3. All support equipment acquisitions must be pre-coordinated with WR-ALC/LES and the lead MAJCOM. Standardize equipment or make it compatible with other systems or equipment. Consider a design that incorporates existing common support, non-developmental items, or commercial off-the-shelf equipment. For calibration support solutions and analysis of alternatives for calibration support, contact WR-ALC/Det 1, Air Force Metrology and Calibration Program, AFMETCAL Det 1/MLSR.

A2.5.3.4. Schedule, when possible, SE development in phases that correlate with the development of the prime mission equipment. SE should be kept to a minimum and the use of common SE is preferred rather than peculiar SE. System should be designed to utilize standard support equipment and common, embedded test, measurement, and diagnostics equipment to support organizational maintenance and depot support.

A2.5.3.5. Specify SE design limitations and requirements, such as RAM and deployability parameters; size, weight, and power; complexity, safety, and calibration; test tolerance consistency and self-test features; required manpower skills and levels; repair tools; climatic operational environment; and equipment performance, mobility, transportability, service life, and user Operational Test and Evaluation (OT&E).

A2.5.3.6. Determine warranty/repair contract/service agreement requirements for SE under development and SE undergoing modification, if appropriate.

A2.5.3.7. Relate SE use to built-in test and integrated diagnostics; i.e., how they will work together or alone.

A2.5.3.8. Consider integrated test and diagnostic software and download capabilities for both software and hardware.

A2.5.3.9. Consider acquiring deployable, integrated, multi-function SE rather than separate SE for each subsystem.

A2.5.3.10. Consider what equipment and software tools will be needed for software support, including support equipment that sends and receives software changes; when possible, use tools previously used for software development.

A2.5.3.11. Consider the impact of support equipment availability on the force structure of large active duty units; squadrons split due to mobilization; and smaller, geographically separated Air Reserve Component (ARC) units (each unit requires a full set of SE).

A2.5.3.12. Develop firm requirements and goals for reducing the impact of support equipment on deployment footprints, logistics support tails, and logistics system infrastructure vulnerabilities.

A2.5.3.13. The following factors that influence the quantities of Support Equipment (SE) required at field units to facilitate beddown and sustainment of weapon systems should be considered:

A2.5.3.13.1. Types and quantities of weapons to be supported at that location.

A2.5.3.13.2. Net Explosive Weight (NEW) storage capability versus new weapon receipt.

A2.5.3.13.3. Quantity of weapons to be transported per unit SE.

A2.5.3.13.4. Distances from weapon storage to build-up area, flight line and return.

A2.5.3.13.5. Operational concept, i.e., weapon build-up, pre-built weapons, two-stage or single-stage delivery concept, NEW capability, etc.

A2.5.3.13.6. Number of Combat Coded (CC) aircraft to support.

A2.5.3.13.7. Number of OPS squadrons/load crews to support and their deployment locations.

A2.5.3.13.8. Aircraft initial load/Take-Off/Quick-turn time requirements.

A2.5.3.13.9. Deployment/mobility requirements/locations.

A2.5.3.13.10. Deployment with SE or prepositioned SE available at deployment location.

A2.5.3.13.11. Additional SE required for returning aircraft/weapons download after deployment.

A2.5.3.13.12. SE Maintenance Concept developed by SPO with MAJCOM approval for both home station and deployed location(s).

A2.5.3.13.13. Environmental consideration affecting any of the above factors, i.e., snow, desert sand, rough terrain, day/night operations, etc.

A2.5.3.13.14. SE differences/capabilities affecting aircraft/weapon support.

A2.5.3.13.15. Spare parts/spare SE as computed by weapon system/SE SPO and MAJCOM.

A2.5.3.13.16. Calibration requirements affecting SE at home station and deployed location(s).

A2.5.3.13.17. Peculiar SE requirements that supplement/replace common SE.

A2.5.3.13.18. Funding availability for procurement of required SE.

A2.5.4. **Supply Support:**

A2.5.4.1. Specify the importance of the sparing concept to RAM and deployability requirements, taking into account peacetime and wartime operations and maintenance concepts; and primary operating stocks and readiness spares support concepts.

A2.5.4.2. MAJCOMs define wartime assignments based on RSPs and IRSPs in terms of deployability (deployment footprint and associated support tail), maintenance concepts, operations tempo, days of support without resupply, and peculiar mission requirements of each organization.

A2.5.4.3. Develop a provisioning strategy and plan that balances best value, production, reliability, the industrial base, procurement lead times, availability of vendor provided spares, and the adequacy of commercial data needed to identify replacement parts. Provisioning must be completed on all support equipment acquisitions. Consider these factors when planning for pre-operational spares support; government and contractor-furnished equipment programs; direct purchase, breakout and competition; data acquisition; initial and replenishment provisioning; and contractor support.

A2.5.4.4. Ensure adequate funding for provisioning technical documentation, spares acquisition integrated with production, reprocurement data that support competitive replenishment spares acquisition, and long-term spares support for non-developmental or commercial-off-the-shelf items.

A2.5.4.5. Consider energy requirements in system design, especially systems operated under austere conditions in deployed locations. Consider requirements for standby emergency power, liquid oxygen or nitrogen, hydraulic fluids, electricity, multi-fuel and synthetic fuel, and energy storage.

A2.5.5. **Packaging, Handling, Storage, and Transportation (PHS&T):**

A2.5.5.1. Specify PHS&T requirements to ensure that personnel package, transport, preserve, protect, and properly handle all systems, equipment, and support items.

A2.5.5.2. Consider geographical and environmental restrictions; electrostatic discharge-sensitive and hazardous materiel PHS&T requirements; and standard handling equipment and procedures.

A2.5.5.3. Specify development and procurement plans for systems, equipment, and munitions so that existing or programmed commercial or military transportation facilities can accommodate their gross weights and dimensions. Require a search of the Container Design Retrieval System for suitable existing containers before developing new ones.

A2.5.5.4. Minimize the deployment footprint, particularly for outsized airlift.

A2.5.5.5. For equipment approaching the dimensions of an international standards organization (ISO) container, specify design and building requirements so that individual or mated ISO containers can accommodate the equipment.

A2.5.5.6. Clarify mobility, deployability, and transportability requirements. For example, specify maximum allowable cubic dimensions per load or pallet and maximum number of loads or pallets to support the design reference mission profile. Calculate pallet dimensions to ensure that airlift is flexible and compatible with available logistics transportation within theaters of employment. Specify air/ground vehicle when known (e.g., will be deployed on C-17 aircraft). Ensure design requirements do not exceed capabilities of existing ground, air, rail, or ocean vessels.

A2.5.5.7. Specify the maximum time permitted to prepare for deployment and set up on arrival (consider both movement preparation and assembly time) at austere and improved sites, as applicable.

A2.5.5.8. State requirements for specialized (environmental), internodal, or tactical shelter containers and container handling equipment to support mobility operations. If mobility is required, specify the requirement and identify limitations. For example, state that personnel must be able to transport an item in fielded military design vehicles or airlift them in road mobile configuration.

A2.5.5.9. For missiles, munitions, and other items as appropriate, address shelf life; service life; quantity-distance criteria; and other storage, mobility, and transportation characteristics, such as how to reprogram missiles stored in containers or loaded on aircraft.

A2.5.5.10. Consider alternatives that could improve PHS&T efficiency, such as system or subsystem design modularity and standardization.

A2.5.5.11. Consider any special security handling implications to PHS&T.

A2.5.5.12. Consider marking and or labeling to assist with In-Transit Visibility (ITV).

A2.5.6. **Technical Data:**

A2.5.6.1. Lead commands will provide SM's requirements for fielding up-to-date, technically accurate, and user friendly technical data at the point of use.

A2.5.6.2. Describe unique requirements for developing, distributing, using and maintaining technical data IAW Technical Order 00-5-3.

A2.5.6.3. Require delivery of digital data to satisfy Joint Computer-Aided Acquisition and Logistics Systems (JCALS) initiatives and standards. The use of intelligent data and formats is highly desired.

A2.5.6.4. Automated technical orders are preferred. Consider interactive Electronic Technical Manuals, if benefits justify.

A2.5.6.5. Establish a process whereby the developer validates and the government verifies technical data is accurate and adequate to support, operate and maintain system and equipment in the required state of awareness.

A2.5.6.6. Evaluate existing commercial manuals or technical data from other services, and decide whether these give adequate information or if supplementing existing data will be acceptable.

A2.5.6.7. Consider backup methodologies for archiving technical data to protect it from destruction during disasters.

A2.5.7. **Facilities**

NOTE: Logistics considerations for facilities do not include Civil Engineering areas of responsibility. Logistics considers support requirements such as space for maintenance activities in support of the weapon system, space systems, and Communication-Electronic systems. It may also include storage for spare parts, controlled storage, training space for maintenance and operations, technical orders, operational storage library, mobility equipment, etc.

A2.5.7.1. Consider the full spectrum of Air Force facility engineering responsibilities, including environmental analysis, programming, design, and facility acquisition.

A2.5.7.2. Identify the facility constraints that may apply, including support facility requirements.

A2.5.7.3. Specify whether the system or equipment needs new facilities or must be designed to fit existing facilities. Give specific utility requirements.

A2.5.7.4. Identify the impact of the new facility on existing facilities including airfield pavements.

A2.5.7.5. Consider explosives hazards and site licensing requirements, as applicable.

A2.5.7.6. Consider physical security requirements for the new system.

A2.5.8. **Manpower and Personnel:**

A2.5.8.1. Specify both quantitative and qualitative manpower requirements.

A2.5.8.2. Establish personnel requirements based on operations and support tasks, their frequency, and the planned future force structure.

A2.5.8.3. Specify number of manpower authorizations; the desired mix of officers, enlisted personnel, civilian employees, Air Reserve technicians, and contractors; the Air Force specialty code structure; the desired distribution of skill levels; sources of specialists; and the facility's projected impact on the draw-down system.

A2.5.8.4. Manpower and personnel requirements encompass wartime scenarios, projected manpower budgets, system training plans, potential safety and health hazards, and the effect of planned work loads on operators and maintenance personnel (including software support personnel) in the operational environment.

A2.5.8.5. *Integrated Manpower, Personnel, and Comprehensive Training and Safety (IMPACTS) Program*, provides a framework to address and integrate all the human elements of manpower, personnel, training, safety, and health. Each IMPACTS element affects weapon system cost, schedule, design, and performance.

A2.5.9. **Training and Training Support:**

A2.5.9.1. Specify the training concept to include aircrew, operator, and maintenance training; its relationship to training for existing systems; and using mockups, simulators, and training aids.

A2.5.9.2. Emphasize the need to establish a multi-command Training Planning Team (TPT) to prepare a life-cycle training development plan or system training plan according to AFI 36-2201.

A2.5.9.3. Coordinate scheduling with MAJCOMs and Headquarters Air Education and Training Command (AETC) to ensure that using and maintenance personnel (including software support personnel) receive timely, appropriate training.

A2.5.9.4. Address training needs, including civilian (depot), active duty, and reserve personnel training; individual and crew training; new equipment training; and initial, formal, and on-the-job training.

A2.5.9.5. Develop a training program that:

A2.5.9.5.1. Integrates weapon system design, operational concepts, employment environments, and current maintenance concepts.

A2.5.9.5.2. Encompasses the full training spectrum, including on and off equipment maintenance at all applicable maintenance levels.

A2.5.9.5.3. Addresses training for personnel with site activation test team and initial cadre responsibilities.

A2.5.9.5.4. Supports organic course development, development test and evaluation, and initial operational test and evaluation team training requirements.

A2.5.9.6. Identify responsibilities of the Air Force and the contractor for developing and conducting each phase of training.

A2.5.9.7. Include required training equipment for inventory items, prime-mission equipment, support equipment and training devices.

A2.5.9.8. Address logistics support for training equipment and devices; projected equipment type, number, required location, and interim training support provisions; additional facility or manpower requirements necessary to support projected training and training devices; and IMPACTS application and warranty considerations when designing and modifying training equipment.

A2.5.9.9. Address the need for a System Training Plan as identified in AFI 36-2551.

A2.5.9.10. Emphasize the need for a Training System Requirements Analysis (TSRA) to determine total training requirements (training hardware, software, facilities, instructional media, etc) throughout the life cycle of the defense system, reference AFPAM 36-2211 and AFMAN 36-2235 Vol III.

A2.5.9.11. Identifies existing training, if applicable; identifies training needs and deficiencies, if applicable, for operator training: Documents a functional composition of the mission, identifies all functions and tasks required to accomplish the mission; compares existing operational and maintenance training with functional baseline, and identifies tasks requiring training.

A2.5.9.12. Identify existing, emerging, and state-of-the-art training systems; compare similar systems; identify optimal number and mix of training equipment.

A2.5.9.13. Identify sensory stimulus requirements of the learning objectives, identify instructional delivery system functional characteristics, document training system support considerations.

A2.5.9.14. Address funding of sustaining the training system for the life of the weapon system.

A2.5.9.15. Specify the training concept, to include operator and maintenance training; procedure, crew and mission training; its relationship to training for existing systems; and preferred media (i.e. mockups, simulators, training aids).

A2.5.10. **Computer Resources Support:**

A2.5.10.1. Consider system requirements and design constraints within the context of the support concepts. When justified by program size, establish Computer Resource Support Plan to describe development, acquisition, test, and support plans for computer resources.

A2.5.10.2. Describe specific requirements and constraints pertaining to computer programs and associated documentation, related software, source data, facilities, hardware, firmware, manpower, personnel, and other factors required to operate and support mission-critical computer systems.Make sure that the system can support and use the software in the operational environment when the system is delivered.

A2.5.10.3. Specify the level of MAJCOM involvement and control of mission software and data. Identify requirements for configuration management and software quality control for using and supporting commands.

A2.5.10.4. Consider using spare memory loader verifiers (MLV) memory storage media and blank or programmed firmware devices to accommodate multiple software configurations to meet mission requirements.

A2.5.10.5. When appropriate and cost effective, consider a one-time, lifetime buy of microcircuits if reasonably certain that the specific technology will become obsolete within a system's lifetime.

A2.5.10.6. Outline required interfaces. Include message formats for data sharing between systems, human-machine interfaces, and interaction among subsystems. Identify other systems that may need to adapt to new requirements. If feasible, consider identifying standardized interfaces across various weapon systems to enhance the operations and support efficiency.

A2.5.10.7. Specify interfaces to the Defense Information Switch Network (DISN) or other networks.

A2.5.10.8. Identify requirements for spare memory, spare throughput, computer memory growth, software partitioning, modular design, and software module size.

A2.5.10.9. Outline constraints such as operating environment, package limitations, standards (including higher order language, architecture, modularity, and MLV), required reliability, separation of mission data from the operating systems, and partitioning required to meet operational needs.

A2.5.10.10. Specify required reaction times for all support agencies. Tell them how long they have to respond after receiving change requirement notices and before receiving software or firmware changes by operational unit.

A2.5.10.11. Specify maximum time allowed between software updates, corollary test program set updates, and automatic test equipment updates.

A2.5.10.12. Specify requirements for reprogramming software. Specify when personnel need to upload software in all of an end item's reprogrammable components for peacetime and wartime configuration. (TCTOs should be considered one of the primary documents that provide implementation/incorporation start dates and rescission dates. CPINs should be included for configuration management purposes.

A2.5.10.13. Address requirements for computer system security, sensitive information protection, the integrity of critical processing, and support software such as compilers, simulators, emulators, and software development or support tools.

A2.5.10.14. The software support concept can affect significantly both mission capability and system operating and support costs. If you require changes to software:

A2.5.10.14.1. Consider how to implement them at the operational unit level and what manpower, training, equipment, and documentation you need to accomplish the task.

A2.5.10.14.2. Ensure that all reprogrammable assemblies in the end item have as many of the same design interfaces as possible for uploading new or changed software. When possible, ensure that all items share the same protocols, data buses, architecture, power levels, pin connections, connector types, and so on.

A2.5.10.14.3. Consider ways to distribute software changes.

A2.6. Element Cross Reference**.** This paragraph provides a cross reference of the ten Logistics Support Elements in AFI 10-602, 13 September 2003, paragraphs **A2.5.1.** through **A2.5.10.**, to the ten Sustainment Planning Elements in AFI 63-107, 10 November 2004, paragraphs 3.2.3.1 through 3.2.3.10.

A2.6.1. -- AFI 63-107 places **Design Interface** under "Systems Engineering"

A2.6.2. -- AFI 63-107 places **Maintenance Planning** under "Maintenance"

A2.6.3. -- AFI 63-107 places **Support Equipment** under "Maintenance"

A2.6.4. -- AFI 63-107 places **Supply Support** under "Supply"

A2.6.5. -- AFI 63-107 places **Packaging, Handling, Storage, and Transportation** under "Transportation"

A2.6.6. -- AFI 63-107 places **Technical Data** under "Data Management"

A2.6.7. -- AFI 63-107 places **Facilities** under "Maintenance"

A2.6.8. -- AFI 63-107 divides **Manpower and Personnel** into "Manpower" and "Personnel"

A2.6.9. -- AFI 63-107 defines **Training and Training Support** as "Training"

A2.6.10. -- AFI 63-107 places **Computer Resources Support** under "Supportability"

Attachment 3

AIRCRAFT SYSTEMS

A3.1. Use the following mission capability and supportability measures for aircraft systems.

A3.2. Availability and Sustainability Measures:

A3.2.1. **Mission Capable (MC) Rate.** Use the MC rate to measure how long, in percent of possessed time, a system can perform at least one of its assigned missions. Base the MC rate on the sum of the fully mission capable (FMC) and partially mission capable (PMC) rates, expressed as:

$$\text{MC Rate} = \frac{\text{FMC hours} + \text{PMC hours}}{\text{Possessed Hours}} \times 100$$

The overall MC requirement addresses different design missions, the expected percentages of equipment use, and the desired MC rate for each mission. FMC status indicates that an aircraft can perform all of its assigned missions. PMC status indicates that an aircraft can perform at least one, but not all of its assigned missions. A multi-mission aircraft may be PMC even if it is unable to accomplish its primary mission. Report FMC and PMC rates via the status reporting system in accordance with AFI 21-103. Be sure to consider system operating time when determining MC rate requirements in that the more a system operates in a given period of time, the more downtime for corrective and preventative maintenance is required. The MC rate is affected by, but does not accurately account for preventative maintenance efforts.

A3.2.2. **Utilization Rate (UR).** Express UR as flight hours or sorties per aircraft per relevant period of time, such as a day or month, as follows:

$$\text{Daily wartime sortie UR} = \frac{\text{Average number of sorties per day}}{\text{Average number of aircraft authorized}}$$

A3.2.3. **Essential System Repair Time per Flight Hour (ESRT/FH).** Use ESRT/FH to compare clock time needed to repair mission-essential equipment and operating time measured in flying hours. ESRT/FH addresses both corrective maintenance (CM) and preventive maintenance (PM) performed on mission-essential equipment. This measurement pertains only to full system list (FSL) equipment. Express this calculation as:

$$\text{ESRT/FH} = \frac{\text{Elapsed PM} + \text{Elapsed CM}}{\text{Flight Hours}}$$

A3.3. Mission Reliability Measures:

A3.3.1. **Weapon System Reliability (WSR).** Use WSR to measure the probability that a system will perform satisfactorily for a given mission time when used under specified operational conditions. Compute WSR by dividing the number of missions completed successfully by the number of missions attempted. Define “mission” in terms of start-finish criteria, factor in the effect of crew changes, and relate the success of the mission to the satisfactory performance of mission-essential items during the mission. Base WSR on a design reference mission profile to allow for translation of WSR into contractual requirements. Determine functional profiles for storage, build-up, preflight, takeoff, ingress, over-target, weapons delivery, egress, landing, and shutdown. Determine environmental profiles such as temperature, air density, humidity, vibration, shock, and corrosive agents. Determine mission critical systems for these profiles and establish a single peacetime and wartime WSR value for each given mission. **EXCEPTION:** If the peacetime mission length differs significantly from the wartime mission length, establish two values for WSR. When more than one type of mission is specified, state the percentage of time and the desired WSR for each mission. Express this calculation for WSR as:

$$WSR = \frac{\text{Successful Missions}}{\text{Total Missions}}$$

A3.3.2. **Break Rate (BR).** Use break rate to measure the percentage of sorties from which an aircraft returns with an inoperable mission-essential system that was previously operable. Break rate includes "Code 3" conditions, such as ground and air aborts. Calculate BR as:

$$\text{Break rate (\%)} = \frac{\text{Number of aircraft Code 3 breaks during measurement period}}{\text{Number of sorties flown during period}} \times 100$$

A3.3.3. **Combat Rate (CR).** Use the combat rate to measure the average number of consecutively scheduled missions flown before an aircraft experiences critical failures. Combat Rate reflects the philosophy that scheduling and completing a mission are more important than changing it mid-flight because of equipment failures. Express CR as:

$$\text{Combat Rate} = \frac{\text{Number of successful sorties flown}}{(\text{Number of Scheduled missions} - \text{Number of ground aborts} - \text{Number of air aborts})}$$

A3.3.4. **Mean Time Between Critical Failure (MTBCF).** Use MTBCF to measure the average time between failures of mission-essential system functions. Critical failures occur when mission essential systems become inoperable or operate outside their specified range of performance. MTBCF includes critical failures of all hardware and software that occur during mission and non-mission time. Express MTBCF as:

$$MTBCF = \frac{\text{Number of operating hours}}{\text{Number of critical failures}}$$

A3.4. Logistics Reliability Measures:

A3.4.1. **Mean Time Between Maintenance (MTBM).** Use MTBM to measure the average flying hours between scheduled and unscheduled maintenance events. Select an appropriate MTBM parameter based on MAJCOM requirements. Current and planned information systems permit tracking of standard MTBM parameters, such as inherent malfunctions, induced malfunctions, no-defect events, total corrective events, preventive maintenance, mean time between removal, and mean time between demand. Specify peacetime and wartime values for MTBF if equipment used during these periods differ. Express MTBM **for a selected type of maintenance event** as:

$$MTBM = \frac{\text{Flight Hours}}{\text{Number of Maintenance Events (of selected type)}}$$

A3.5. Maintainability Measures:

A3.5.1. **Mean Downtime (MDT).** Use MDT to measure the average elapsed time between losing MC status and restoring the system to at least PMC status. Downtime includes on-equipment (and in some instances off-equipment) repair labor time; non-labor time, such as cure time for composites; maintenance and supply response time; administrative delays; and time for other activities that result in NMC status, such as training and preventive maintenance. MDT requirements must take into account field conditions, such as technical order availability and adequacy; support equipment capability and availability, supply levels, and manning (including experience level and structure of duty shifts). MDT mainly addresses unscheduled maintenance, but it can also include scheduled maintenance, such as scheduled inspections. Develop a single peacetime and wartime value for MDT. **EXCEPTION***:* When you expect maintenance or support conditions in wartime to differ significantly from those in peacetime, describe those differences and describe separate values for MDT. Express MDT as:

$$\text{MDT} = \frac{\text{NMC Time}}{\text{Number of Downing Events}}$$

A3.5.2. **Fix Rate (FR).** Use FR to calculate the percentage of aircraft that return as Code 3 and must be returned to MC status within a specified amount of time (for example, 70 percent in 4 hours or 85 percent in 8 hours). The FR time requirement includes direct maintenance time and downtime associated with administrative and logistics delays. Express FR as:

$$\text{Fix Rate} = \frac{\text{Number of aircraft fixed within “X” hours}}{\text{Total number of broken aircraft}}$$

A3.5.3. **Mean Repair Time (MRT).** Use MRT to measure the average on-equipment and/or off-equipment corrective maintenance time in an operational environment. State MRT requirements for on-equipment at the system level and for off-equipment at the line replaceable unit (LRU) level. MRT starts when the technician arrives at the aircraft site for on-equipment maintenance or receives the LRU at the off-equipment repair location. MRT includes all necessary corrective maintenance actions such as preparation; LRU access; troubleshooting; removing and replacing parts; repairing, adjusting; checking functions; and curing. Do not include maintenance or supply delays in MRT calculations. Express MRT as:

$$\text{MRT (overall)} = \frac{\text{Total corrective maintenance time}}{\text{Total number of maintenance events}}$$

$$\text{MRT (on-equipment)} = \frac{\text{Total on-equipment corrective maintenance time}}{\text{Total number of on-equipment maintenance events}}$$

$$\text{MRT (off-equipment)} = \frac{\text{Total off-equipment corrective maintenance time}}{\text{Total number of off-equipment maintenance events}}$$

NOTE: Do not confuse MRT, an operational term, with the contractual term mean time to repair (MTTR). MTTR only includes time to perform those tasks for which the contractor has design responsibility. It is based on contractual requirements.

A3.6. Manpower Measures:

A3.6.1. **Maintenance Man-Hours per Life Unit (MMH/LU).** MAJCOMs base their maintenance man-hours per flying hour (MMH/FH) on their specific needs. Specify MMH/FH peacetime and wartime values, since equipment usage, maintenance needs, and support concepts may differ during these periods. Current and planned maintenance information systems permit tracking of the following:

A3.6.1.1. MMH/FH, support general work unit code (WUC 01-09)

A3.6.1.2. MMH/FH, corrective (WUC 11-99) for inherent malfunctions, induced malfunctions, no-defect actions, or total events

A3.6.1.3. MMH/FH, product improvement (time compliance technical order)

A3.6.1.4. MMH/FH, preventive maintenance (time change items)

A3.6.1.5. MMH/FH, all categories totaled

A3.6.2. **Maintenance Personnel per Operational Unit (MP/U).** Use MP/U to measure the total number of direct maintenance personnel needed for each specified operational unit to perform direct on-equipment and off-equipment maintenance. Develop manpower projections to support specified operating and maintenance concepts, taking into consideration basing, deployment, and operational scenarios. MP/U calculations include direct on-equipment and off-equipment maintenance personnel and specialties related to direct on-equipment and off-equipment support, such as structural repair (including sheet metal and composites) and nondestructive inspection. When analyzing manpower requirements, MAJCOMs should consider and use projected MC, PMC, MRT, and MTBM rates, coupled with aircraft battle damage repair analyses to determine overall manpower needs. MP/U calculations exclude maintenance staff agencies, logistics command section operations and support personnel, powered support equipment personnel, and munitions supply and missile maintenance personnel.

A3.7. Deployability Considerations. MAJCOMs must consider building in deployability when describing top-level mission capability and supportability requirements for aircraft systems. Address capability of the system to be deployed to the theater of operations within the constraints of the user-defined requirements.

A3.7.1. **Deployability Footprint.** Deployability footprint is defined by the manpower, materiel, equipment, and infrastructure required to support the design reference mission profile under peacetime, wartime, or other contingency operations. As a basis of measure use, for example, equivalent pallet positions.

A3.7.2. **Logistics Follow-on Support.** Logistics follow-on support specifies the manpower, materiel, and equipment required to sustain the design reference mission profile under peacetime, wartime, or other contingency operations. Logistics support requirements must account for manpower, materiel, and equipment directly or indirectly associated with the weapon system under consideration. Logistics requirements are included in Mission Need Statements (MNS), Concept of Operations (CONOPS), Operational Requirements Documents (ORDs), and Product Support Management Plans

Attachment 4

STRATEGIC OR TACTICAL GROUND-LAUNCHED MISSILES

A4.1. Use the following mission capability and supportability measures for strategic or tactical ground-launched missiles.

A4.2. Availability and Sustainability Measures:

A4.2.1. **Mission Capable (MC) Rate.** Use MC rate to calculate the percentage of possessed time that a weapon system can perform its assigned mission. MC rate is defined as the combination of the fully mission capable (FMC) and partially mission capable (PMC) rates. It can be obtained using the status reporting system defined in AFI 21-103. MC rate is equal to the number of alert hours divided by the number of possessed hours (PH). Express MC as:

$$\text{MC rate} = \frac{\text{Alert hours}}{\text{PH}} = \text{FMC rate} + \text{PMC rate}$$

NOTE: Since these systems offer little or no repeat mission capability, calculate a single MC requirement for both peacetime and wartime.

A4.3. Mission Reliability Measures:

A4.3.1. **Weapon System Reliability (WSR).** Use WSR to measure the probability that a given system in MC status will successfully complete its designated mission or function. Operational commands base WSR on their specific requirements. For intercontinental ballistic missile (ICBM) systems, WSR gives the probability that an ICBM, launched in reaction to a valid execution order, will deliver a warhead that will detonate as planned in the target area. Express WSR as:

$$\text{WSR} = \text{SAR} \times \text{LR} \times \text{COMR} \times \text{IFR} \times \text{RSR}$$

A4.3.1.1. Strategic alert reliability (SAR) represents the probability that a deployed missile can react to a valid launch order. It is based on the ratio of FMC missile hours to total missile hours available.

A4.3.1.2. Communications reliability (COMR) represents the probability that a combat crew in the deployed force will receive a transmitted launch order. It does not consider enemy action.

A4.3.1.3. Launch reliability (LR) represents the probability that an MC missile will launch as planned and that the ancillary equipment functions properly. It does not take into account enemy action.

A4.3.1.4. Inflight reliability (IFR) represents the probability that a launched missile will properly signal a re-entry vehicle and place it in the correct ballistic trajectory so that it impacts in the target area.

A4.3.1.5. Re-entry subsystem reliability (RSR) represents the probability that a properly positioned re-entry subsystem will successfully deploy a re-entry vehicle so that it detonates a warhead in the target area.

A4.3.2. **Mean Time Between Maintenance (MTBM).** Use MTBM to measure the average life units between maintenance events, as the using command defines them. Use PH as the time base for missiles. PHs may include time in which the system is not operating or is in a storage or dormant condition. Current and planned maintenance information systems permit tracking of several MTBM parameters including inherent malfunctions, induced malfunctions, no-defect events, total corrective events, preventive maintenance, and mean time between removal (MTBR). Specify the same peacetime and wartime value for MTBM and MTBR, if possible, using a standard term. Use an appropriate MTBM or MTBR parameter based on specific MAJCOM needs.

A4.4. Maintainability Measures:

A4.4.1. **Mean Downtime (MDT).** Use MDT to measure the average elapsed time between losing MC status and restoring the system to at least PMC status. Downtime continues until maintenance personnel return the system to at least PMC status. Downtime includes maintenance and supply response, administrative delays, actual on-equipment repair, and activities that result in not mission capable (NMC) status, such as training and preventive maintenance. When computing MDT, also consider TO availability and adequacy, support equipment capability and availability, supply levels, manning, experience levels, and shift structure. Specify a single peacetime and wartime MDT value. ***NOTE:*** Do not confuse MDT, which describes an operational environment, with mean time to repair (MTTR) which is used as a contractual term.

A4.4.2. **Mean Repair Time (MRT).** Use MRT to measure the average on-equipment and/or off-equipment corrective maintenance time in an operational environment. State MRT needs for on-equipment at the system level and off-equipment at the line replaceable unit (LRU) level. MRT starts when the technician arrives at the missile site for on-equipment maintenance or receives the LRU at the off-equipment repair location. The time includes all maintenance done to correct the malfunction, including preparing for tests, troubleshooting, removing and replacing parts, repairing, adjusting, and conducting functional checks. ***EXCEPTION:*** Do not include maintenance or supply delays in MRT calculations. ***NOTE:*** Do not confuse MRT, an operational term, with MTTR, which is used as a contractual term. Express MRT as:

$$\text{MRT (overall)} = \frac{\text{Total corrective maintenance time}}{\text{Total number of maintenance events}}$$

$$\text{MRT (on - equipment)} = \frac{\text{Total on- equipment corrective maintenance time}}{\text{Total number of on - equipment maintenance events}}$$

$$\text{MRT (off - equipment)} = \frac{\text{Total off- equipment corrective maintenance time}}{\text{Total number of off - equipment maintenance events}}$$

A4.5. Manpower Measures:

A4.5.1. **Maintenance Man-Hours per Life Unit (MMH/LU).** Use MMH/LU to measure the average man-hours per life unit needed to maintain a system. Base missile time on PHs, in most cases. Current and planned maintenance information systems permit tracking of the following:

A4.5.1.1. MMH/PH, support, general (WUC 01-09)

A4.5.1.2. MMH/PH, corrective (WUC 11-99) for inherent malfunctions, induced malfunctions, no-defect actions, or total events

A4.5.1.3. MMH/PH, product improvement (TCTO)

A4.5.1.4. MMH/PH, preventive maintenance (time change items)

A4.5.1.5. MMH/PH, total of the above categories establish a single required peacetime and wartime value. Use an appropriate MMH/LU based on specific MAJCOM needs. PH is commonly used, but other life units may be more appropriate for different systems.

A4.5.2. **Maintenance Personnel per Operational Unit (MP/U).** Use MP/U to calculate the number of maintenance personnel needed to support an operational unit under specified operating and maintenance concepts. Develop manpower projections to support operating and maintenance concepts.

EXCEPTION: Do not include depot-level personnel and other manpower excluded by AFI 38-201 when calculating MP/U. Specify peacetime and wartime levels of manning for Air Reserve Component (ARC) maintenance organizations. Peacetime MP/U reflects the number of full-time personnel needed to support daily peacetime flying operations. Wartime MP/U includes full-time and traditional reservists and is normally identical to the MB/U established by the gaining MAJCOM for a similar unit.

Attachment 5

AIR-LAUNCHED MISSILES AND MUNITIONS

A5.1. Use the following mission capability and supportability measures for air-launched missiles and munitions.

A5.2. Availability and Sustainability Measures:

A5.2.1. **Mission Capable (MC) Rate.** Use MC rate to measure the percentage of possessed time that a system can perform any of its assigned missions. Establish required MC values for specific missions at the wartime utilization or sortie rate. MC applies only to items inspected periodically, such as short-range attack missiles and air-to-air missiles. Calculate the MC rate as the sum of FMC and PMC rates:

$$\text{MC rate} = \text{FMC rate} + \text{PMC rate}$$

NOTE: Use MC rate only for systems that can be tracked according to AFI 21-103 or similar reporting systems.

A5.2.2. **Availability Measurement.** At wing level, use availability to calculate the percentage of possessed or authorized equipment that can perform intended functions. Use the term "availability" in place of MC rate for systems not tracked by a status-reporting system. For example, apply the term "availability" to the quantity of possessed equipment which is tracked only through an inventory-reporting system. Specify a single peacetime and wartime value of availability, with associated time and condition criteria.

A5.3. Mission and Logistics Reliability Measures:

A5.3.1. **Weapon System Reliability (WSR).** Use WSR to measure the probability that an available or MC weapon system will successfully complete its designed mission or function. When defining "mission," take into account storage, alert, captive-carry, launch, and flight of the item. Calculate the value of WSR by dividing the number of successfully completed missions by the number of attempted missions. Success of the mission should relate performance to design capability. For most munitions, there may only be one mission, and thus a need for only one WSR value. Peacetime missions for missiles may significantly differ from wartime missions. In such cases, develop a WSR value for each mission. If platform environments differ dramatically, either provide a WSR value for the harshest environment or develop WSR values for each environment or pylon.

A5.3.2. **Mean Time Between Maintenance (MTBM).** Use MTBM to calculate the average life units between maintenance events, as defined by the operational command. Apply MTBM to those items that operate or are active during times other than actual free flight. If reported, use captive-carry and ground operating hours as the time base for applicable items; otherwise, use PHs. PHs include time in which the system is not operating or is in a storage or dormant condition. Current and planned maintenance information systems permit tracking of several standard MTBM parameters, including inherent malfunctions, induced malfunctions, no-defect events, total corrective events, preventive maintenance, and mean time between removal (MTBR).

A5.4. Maintainability Measures:

A5.4.1. **Mean Downtime (MDT).** Use MDT to measure the average elapsed time between losing MC status and restoring the system to at least PMC status. Downtime includes maintenance and supply response, administrative delays, actual on-equipment repair activities that result in not mission capable (NMC) status, such as training and preventive maintenance. When calculating MDT, also consider TO availability and adequacy, support equipment capability and availability, supply levels, manning, experience levels, and shift structure. ***NOTE:*** MDT describes an operational environment; it is not the same as the contractual term, mean time to repair (MTTR).

A5.4.2. **Mean Repair Time (MRT).** Use MRT to measure the average on-equipment and/or off-equipment corrective maintenance time in an operational environment. State MRT requirements for on-equipment at the system level and off-equipment at the LRU level. MRT starts when the technician arrives at the system or equipment for on-equipment maintenance or receives the LRU at the off-equipment repair location. The time includes all actions taken to correct the malfunction, such as preparing tests, troubleshooting, removing and replacing parts, repairing, adjusting, and conducting functional checks. Express MRT as:

$$\text{MRT (overall)} = \frac{\text{Total corrective maintenance time}}{\text{Total number of maintenance events}}$$

$$\text{MRT (on - equipment)} = \frac{\text{Total on - equipment corrective maintenance time}}{\text{Total number of on - equipment maintenance events}}$$

$$\text{MRT (off-equipment)} = \frac{\text{Total off - equipment corrective maintenance time}}{\text{Total number of off - equipment maintenance events}}$$

EXCEPTION: Do not include maintenance or supply delays when calculating MRT.

NOTE: Do not confuse the operational term MRT with the contractual term MTTR.

A5.5. Manpower Measures:

A5.5.1. **Maintenance Man-Hours per Life Unit (MMH/LU).** Use MMH/LU to calculate the average man-hours per life unit needed to maintain a system. Use the MTBM life units as the time base for maintenance man-hours. Operational commands define MMH/LU according to their specific needs. Current and planned maintenance data collection and processing systems use PHs as the time base and permit tracking of several standard MMH/PH terms (see **A2.5.1.**). Establish a single required peacetime and wartime MMH/LU value. Use an appropriate MMH/LU measure based on specific MAJCOM needs. PH is commonly used, but other life units may be more appropriate in some cases.

A5.6. Deployability Considerations. MAJCOMs must consider building in deployability when describing top-level requirements for air-launched missiles and munitions. Address capability of the system to be deployed to the theater of operations within the constraints of the user-defined requirements.

A5.6.1. **Deployment Footprint.** See **A3.7.1.**

A5.6.2. **Logistics Follow-on Support.** See **A3.7.2.**

Attachment 6

TRAINERS AND SUPPORT EQUIPMENT

A6.1. This category includes the equipment needed to operate and maintain a weapon system, such as trainers and training equipment, all mobile and fixed equipment, and ground segment equipment for ground-launched missile systems.

A6.2. Availability and Sustainability Measures:

A6.2.1. **Mission Capable (MC) Rate.** Use MC rates to calculate the percentage of possessed time that equipment can perform any of its assigned missions. Calculate the value of MC by using the sum of fully mission capable (FMC) and partially mission capable (PMC) rates.

Express MC as:

$$\text{MC rate} = \text{FMC rate} + \text{PMC rate}$$

A6.2.2. **Uptime Ratio (UTR).** Use UTR to calculate the percentage of time that operational equipment can satisfy critical mission needs relative to the designated operational capability (DOC). Express all times in clock hours. UTR is similar to MC rate except that system status depends on current use of the system as well as the DOC. For example, a system with several DOC missions can be MC if at least one of those missions can be accomplished. However, if an immediate need exists for a mission capability that is "down" while other mission capabilities are "up", the overall system is considered to be "down." Express UTR as:

$$\text{UTR} = \frac{\text{Total operating hours} - \text{total downtime hours}}{\text{Total operating hours}}$$

A6.2.3. **Utilization Rate (UR).** Use UR to calculate the average life units used or missions attempted per system during a specified interval of calendar time. Establish required peacetime and wartime UR values. Express this term as a ratio of planned or actual operating hours to PHs for a given calendar period. For example:

$$\text{UR} = \frac{\text{Operating hours}}{\text{PH}}$$

A6.3. Reliability Measures:

A6.3.1. **Mean Time Between Critical Failure (MTBCF).** Use MTBCF to measure the average time between failures of mission essential system functions. For ground electronic systems, MTBCF equals the total equipment operating time in hours, divided by the number of mission essential system failures. MTBCF includes all critical hardware and software failures that occur during mission and non-mission time. Express MTBCF as:

$$\text{MTBCF} = \frac{\text{Number of operating hours}}{\text{Number of critical failures}}$$

A6.3.2. **Mean Time Between Maintenance (MTBM).** Use MTBM to calculate the average life units between maintenance events. Use the operating hours, if reported, as the time base for applicable items; otherwise, use PHs. Apply MTBM to items in active operation for long periods of time. Current and planned maintenance information systems permit tracking of several standard MTBM measures, including inherent malfunctions, induced malfunctions, no-defect events, total corrective events, preventive maintenance, and mean time between removal (MTBR). Use the appropriate MTBM or MTBR measure based on specific MAJCOM needs.

A6.4. Maintainability Measures:

A6.4.1. **Mean Downtime (MDT).** Use MDT to measure the average elapsed time between losing MC status and restoring the system to at least PMC status. Downtime includes maintenance and supply response, administrative delays, actual on-equipment repair, and activities that results in not mission capable (NMC) status, such as training or preventive maintenance. When computing MDT, also consider TO availability and adequacy, support equipment capability and availability, supply levels, manning, experience levels, and shift structure.

A6.4.2. **Mean Repair Time (MRT).** Use MRT to measure the average on-equipment and/or off-equipment corrective maintenance time in an operational environment. State MRT requirements for on-equipment at the system level and off-equipment at the assembly, subassembly, module, or circuit card assembly level. MRT starts when the technician arrives at the system or equipment for on-equipment maintenance or receives the assembly, subassembly, module, or circuit card assembly at the off-equipment repair location. The time includes all maintenance done to correct the malfunction, including test preparation, troubleshooting, removing and replacing parts, repairing, adjusting, and conducting functional checks. Express MRT as:

$$\text{MRT (overall)} = \frac{\text{Total corrective maintenance time}}{\text{Total number of maintenance events}}$$

$$\text{MRT (on-equipment)} = \frac{\text{Total corrective maintenance time}}{\text{Total number of maintenance events}}$$

$$\text{MRT (off-equipment)} = \frac{\text{Total corrective maintenance time}}{\text{Total number of maintenance events}}$$ ”

EXCEPTION*:* MRT does not include maintenance or supply delays.

NOTE: Do not confuse the operational term MRT with the contractual term MTTR.

A6.5. Manpower Measures:

A6.5.1. **Maintenance Man-Hours per Life Unit (MMH/LU).** Use MMH/LU to measure the average man-hours per life unit needed to maintain a system. Use an appropriate MMH/LU term based on specific MAJCOM needs. Use PHs as the time base for ground electronic systems. Current and planned maintenance information systems permit tracking of several standard MMH/PH terms (see **A3.5.1.**)

A6.5.2. **Maintenance Personnel per Operational Unit (MP/U).** Develop manpower projections to support operating and maintenance concepts.

EXCEPTION*:* When calculating MP/U, do not include depot level and other personnel that are excluded from maintenance planning factors by AFI 38-201.

A6.6. Deployability Considerations. MAJCOMs must consider building in deployability describing top-level requirements for trainers and support equipment systems. Address capability of the system to be deployed to the theater of operations within the constraints of the user-defined requirements.

A6.6.1. **Deployment footprint.** See **A3.7.1.**

A6.6.2. **Logistics Follow-on Support.** See **A3.7.2.**

Attachment 7

SUBSYSTEMS, LINE REPLACEABLE UNITS, AND MODULES

A7.1. Use the following mission capability and supportability measures for subsystems, line replaceable units, and modules.

A7.2. Availability and Sustainability Measures:

A7.2.1. **Operational Availability (A_o).** Use A_o to measure the percentage of time that a subsystem, line replaceable unit (LRU), or line replaceable module (LRM) can satisfactorily perform in an operational environment. A_o for subsystems, LRUs, and LRMS is similar to the MC rate for aircraft, communications, electronics, and some missile systems. Express A_o as:

$$A_o = \frac{MTBDE}{MTBDE + MDT}$$

Mean time between downing events (MTBDE) is the average time between events that bring the system down, including critical or non-critical failures, scheduled maintenance, and training. Mean downtime (MDT) is the average elapsed time to restore the subsystem, LRU, or LRM to full operational status, following a downing event. **NOTE:** A_0 does not express whether an item can operate over a specific period of time. This characteristic is covered in WSR.

A7.2.2. **Other Parameters.** For subsystems, LRUs, and LRMs, apply the definitions and discussion of the appropriate reliability and maintainability measures as described for the parent system in this instruction.

A7.3. Deployability. MAJCOMs must consider building in deployability when describing top- level requirements for aircraft subsystems, line replaceable units, and modules. Address capability of the system to be deployed to the theater of operations within the constraints of the user-defined requirements.

A7.3.1. **Deployability Footprint.** See **A3.7.1.**

A7.3.2. **Logistics Follow-on Support.** See **A3.7.2.**

Attachment 8

SOFTWARE DESIGN

A8.1. MAJCOMs must consider software design and supportability measures when describing top-level logistics requirements for weapon system and support system software.

A8.2. Software Maturity. Use software maturity to measure the progress of software development toward satisfying operational requirements. This progress is based on the number and severity of problems that require software changes. Software maturity measures the rate at which software problems are discovered and resolved. Software problems are those which require software changes to correct errors in system design and improve or modify a system's function. Use **Table A8.1.** to assign a severity level and associated weighting factor to each software problem. As you make software changes to correct the problems, sum the weighted problems that are originated and closed. Keep statistics and plot the results over time to provide indicators of overall software maturity. Indicators include trends of the accumulated weighted software unique failures versus time, the difference between the weighted software failures discovered versus the weighted software failures resolved, the average severity of the software failures versus time and the time necessary to implement software changes. Document software severity levels and weights in the AF Deficiency Reporting System IAW T.O. 00-35D-54 until the new software Deficiency Reporting process is developed.

Table A8.1. Software Severity Levels and Weights.

Priority/Severity Level	Impact	Description	Severity Weight (Points)
1	System Abort	A software or firmware problem that results in a system abort or loss.	30
2	System degraded No Work Around	A software or firmware problem that severely degrades the system and no alternative work around exists,	15
3	System Degraded Work Around	A software or firmware problem that severely degrades the system and an alternative work around exists (e.g., system rerouting through operator actions).	5
4	Software Problem	An indicated software or firmware problem that doesn't severely degrade the system or any essential system function.	2
5	Minor Fault	All other minor deficiencies or nonfunctional faults.	1

A8.2.1. Although the total number of weighted software problems discovered and resolved may be very large, the resulting difference between problems discovered and resolved must be kept to a minimum. This is especially true for mission-critical, safety-critical, and high-reliability systems. None of the indicators in and of themselves are direct measures of software maturity, but must be considered together. Begin measuring software maturity after the software is placed under formal configuration control. Continuous measurement helps to prevent software from entering the field with known problems that could abort or degrade the mission (see IEEE 12207). Assign severity points to program restarts or reboots—whether or not they are successful—based on the impact an unsuccessful restart or reboot had, or would have had, on the mission.

A8.2.2. **Growth Capacity.** Use growth capacity to calculate a computer system's capacity to handle added functions and system users. Growth capacity ensures that sufficient processing power and memory exists to make room for required changes after a system is delivered to the field. For example, growth capacity may be stated as a requirement for the delivered computer system to have a minimum of "X" percent of reserve computer memory in contiguous memory locations, a minimum of "Y" percent reserve timing for each computational cycle, an overall average of "Z" percent for all cycles, and the capability to expand by "A" percent.

A8.2.3. **Block Release Cycle.** Use block release cycle to calculate the anticipated frequency and number of software changes needed periodically. After a system is fielded, appropriate personnel normally develop and release new versions of software based on a block release cycle. Define this cycle using the interval of time during which personnel make software block changes and the number of changes in the block. For example, express block release cycle requirements as "block releases every 'X' months with an average of 'Y' changes per release."

A8.2.4. **Reliability.** Use reliability to calculate the probability that software will remain failure-free for a specified time under specified conditions. In a system context, software reliability is the probability that software will not cause failure of the system for a specified time under specified conditions. Sources of failure include system inputs and uses as well as existing software faults. Count software defects that cause the system to fail in the system-reliability allocation. In cases where this is not practical, specify software reliability separately. State the reliability requirement as:

$$\text{MTBCF} = \frac{\text{Cumulative central processing unit time}}{\text{Cumulative failures}}$$

A8.2.5. **Machine Independence.** Use machine independence to calculate software dependence on the machine's architecture. Machine-dependent software is tied to the inherent architecture of the computer processor. Machine-dependent software is generally more expensive to support over the software's life cycle than software that can run on several machines. A change in the processor forces a change in the machine-dependent code. Assess costs and risks associated with modifying machine-dependent code. The percentage of machine-dependent code varies with different systems under development. Communication systems, such as network control systems or operating systems, may contain significant amounts of machine-dependent code because their functions are closely tied to the hardware. State requirements for machine-dependent software as:

$$\text{Amount of machine independent code} = \text{“X” percent of total code}$$

Calculate machine independence for each module. If a module contains machine-dependent code, then the entire module qualifies as machine dependent. This encourages developers to use machine-dependent code in only a few small modules and helps to ensure that developers create software that personnel can easily and inexpensively modify. **EXCEPTION:** Do not assess machine dependence for assembly languages or special-purpose processors that use their own languages. Both of these cases require 100-percent machine- dependent software.

A8.2.6. **Software Maintainability.** Software maintainability is the ease in which changes to software source code and its associated documentation can be made. Software maintainability can be indirectly measured by evaluating the characteristics which impact future modifications. These characteristics include documentation (organization, description, and traceability); source code (modularity, description, consistency, simplicity, expandability testability, and traceability); and implementation (modularity, convention, simplicity, testability, and design). Use automated software evaluation tools to support the measurement of software maintainability.

A8.2.7. **Software Support.** MAJCOMs and SMs determine organizational and depot level support.

Attachment 9

SPACE, SPACE SURVEILLANCE, AND MISSILE WARNING SYSTEMS

A9.1. Use the following definitions, mission capability and supportability measures for space, space surveillance, and missile warning systems.

A9.2. Availability and Sustainability Measures. The majority of space systems are forward deployed and perform at the same level of operational intensity in peacetime as in time of conflict. These systems are normally employed in networks (systems of systems) and can usually be described as being composed of space, launch, control, and user segments. Operational availability, operational dependability, and mission reliability parameters should be specified for each segment as well as the overall system. The methodologies used to combine the segment-level parameters into system-level parameters should be stated. The segments are defined as:

A9.2.1. Space segment - the satellites, payloads, and platforms that are placed into orbit to provide operational forces with intelligence, communications, navigation mapping/geodesy, meteorological, or surveillance information.

A9.2.2. Launch segment - the two basic types of launch vehicles (expendable and reusable) and their associated launch processing facilities and range support.

A9.2.3. Control segment - the resources which perform the functions required to monitor and control the orbiting space vehicles of the space segment.

A9.2.4. User segment - the transmit and/or receive equipment to communicate with the payload or control segment, processing equipment, and communications equipment linking the processed payload information to the end user.

A9.3. MAJCOMs must consider the following measures in describing top-level mission capability and supportability requirements for space, space surveillance, and missile warning systems.

A9.3.1. **Operational Availability (A_o)** -- A_o is the probability that a system can be used for any specified purpose when desired. A_o includes both the inherent RAM and deployability parameters and logistics support effectiveness of the system that relates to the total time the system might be desired for use. A_o is defined as follows:

$$A_o = \frac{\text{Uptime}}{\text{Total time}}$$

which is equivalent to

$$A_o = \frac{\text{MTBDE}}{\text{MTBDE} + \text{MDT}}$$

where:

Mean time between downing events (MTBDE) is the average time between events that bring the system down (e.g., critical or non-critical failures, preventive maintenance, training, maintenance and supply response, administrative delays, and actual on-equipment repair). Operating hours are the time the system or equipment is considered to be operable. Besides the inherent repair and maintainability characteristics, field conditions such as tech-order availability and adequacy, support equipment capability and availability, supply levels, manning, experience level and shift structure also affect down times. MTBDE is usually defined as:

$$\text{MTBDE} = \frac{\text{Number of operating hours}}{\text{Number of downing events}}$$

Mean Down Time (MDT) is the average elapsed time, as a result of a downing event, required to restore a system to full operating status.

$$\text{MDT} = \frac{\text{Total Down Time}}{\text{Number of downing events}}$$

A9.3.2. **Operational Dependability (D_o)** -- D_o is the probability that a system can be used to perform a specified mission when desired. D_o includes both the inherent RAM and deployability parameters and logistics support effectiveness of the system that relates to all the time the system might be desired for mission use and for which critical failures could occur. D_o is defined as follows:

$$D_o = \frac{\text{MTBCF}}{\text{MTBCF} + \text{MTTRF}}$$

where:

Mean time between critical failures (MTBCF) is the average time between failure of mission-essential system functions. Critical failures do not have to occur during a mission. They merely must or could cause mission impact. MTBCF is defined as:

$$\text{MTBCF} = \frac{\text{Number of operating hours}}{\text{Number of critical failures}}$$

Mean time to restore functions (MTTRF) is the average elapsed time, as a result of a critical failure, required to restore a system to full operating status. MTTRF includes administrative and logistics delay times associated with restoring function following a critical failure.

$$\text{MTTRF} = \frac{\text{Total critical restore time}}{\text{Number of critical failures}}$$

A9.3.3. **Mission Reliability.** Mission reliability (denoted R_m) is the probability that the system is operable and capable of performing its required function for a stated mission duration or at a specified time into the mission. R_m is based on the effects of system reliability during mission time only. Rm does not take into account system maintainability. There are many missions and systems that do not allow restoration of specific functions during the mission. For systems whose times to failure exhibit an exponential probability density function (i.e., systems which exhibit constant failure rates), R_m is defined as:

$$R_m = e^{-(t/MTBCF)}$$

where "t" is the average mission time. If the system is used under significantly different mission lengths, the specific mission time should be used to determine the Rm for each mission.

A9.3.4. **Logistics Reliability.** Logistics reliability is a measure of the system's frequency of maintenance under defined operational and support concepts, using specific logistics resources. A measure of logistics reliability is mean time between maintenance (MTBM). It is the average time between all maintenance events, that is, both scheduled and unscheduled events. MTBM is most often defined as follows:

$$MTBM = \frac{\text{Number of operating hours}}{\text{Number of maintenance events}}$$

This is equivalent to:

$$MTBM = \frac{(MTBUM)(MTBSM)}{MTBUM + MTBSM}$$

where MTBUM is the mean time between unscheduled maintenance and MTBSM is the mean time between scheduled maintenance and are most often defined as:

$$MTBUM = \frac{\text{Number of operating hours}}{\text{Number of unscheduled maintenance events}}$$

$$MTBSM = \frac{\text{Number of operating hours}}{\text{Number of scheduled maintenance events}}$$

A9.3.5. **Mean Repair Time (MRT).** MRT is the average on-equipment and/or off-equipment corrective maintenance times. It includes all maintenance actions needed to correct a malfunction, including preparing for test, troubleshooting, removing and replacing parts, repairing, adjusting, reassembly, alignment and adjustment, and checkout. MRT does not include administrative and logistics delays. MRT is most often defined as:

$$MRT = \frac{\text{Number of corrective repair hours}}{\text{Number of corrective maintenance events}}$$

NOTE: MRT differs from the contractual term mean time to repair (MTTR) in that it measures maintenance activities that occur in the operational environment.

A9.3.6. **Launch Segment Specific Parameters:**

A9.3.6.1. **Maintenance Man Years Per Launch (MMY/L).** MMY/L is the total manpower-maintenance resource requirements associated per launch. MMY/L includes non-mission time (for example, launch pad preparation and build-up) and active mission time (for example, prelaunch, launch, and postlaunch operations).

A9.3.6.2. **Pad Turnaround Time.** This is the total time associated with the preparation and configuration of the pad after the launch of a similarly configured launch vehicle.

A9.3.7. **Contact Success Rate (CSR).** Contact Success Rate is the ratio of successful contacts with respect to total attempts. The Contact Success Rate metric is calculated only at the Network level since a complete end-to-end configuration is required for a successful satellite contact. The Network Utilization metric is also calculated only at the Network level as a measure of overall AFSCN antenna utilization.

See Guidelines for Reliability, Maintainability, and Availability (RMA) Metrics for the Air Force Satellite Control Network (AFSCN) Common User Element (CUE) Volume I, Revision 3.

$$CSR = \frac{\text{(Number of Successful Contacts)}}{\text{(Total Number of Contacts)}}$$

A9.3.8. **Space MICAP.** A space MICAP is an item, that when it fails, causes a System Reporting Designator (SRD) down. This is not restricted to Single Point of Failure items, but could be the loss of a final triple redundant part in a SRD.

A9.3.9. **Single Point of Failure (SPF).** A space SPF item is a single item type within a SRD, that when it fails, brings a SRD down.

A9.3.10. **Training Systems/Devices.** Space systems trainers are required to be supported/managed by the SM on an equal priority to the space system they serve. This includes configuration management and sustainment.

A9.3.11. **Modification and Change Management.** Hardware and software modifications and changes must be accomplished IAW AFI 63-1101 and NORAD Unified Instruction (NUI) 10-21.

Attachment 10

AUTOMATED INFORMATION SYSTEMS (AIS)

A10.1. Use the following mission capability and sustainability measures for automated information systems (AIS).

A10.2. Availability and Sustainability Measures:

A10.2.1. **Operational Dependability (D_o).** Use operational dependability to determine the percentage of the time the AIS is able to satisfy the need for critical management information. Mean time between critical failure (MTBCF) is based on user-provided guidance on information criticality and timing for D_o to be meaningful. Mean time to restore function (MTTRF) is the average time required after a critical failure has occurred.

$$D_o = \frac{(MTBCF)}{(MTBCF + MTTRF)} \times 100$$

A10.2.2. **Operational Availability (A_o).** Use operational availability to determine the percentage of time the system can be used to perform any assigned task, critical and non-critical. A_o is calculated using mean time between downing events (MTBDE) and mean downtime (MDT).

$$A_o = \frac{(MTBDE)}{(MTBDE + MDT)} \times 100$$

A10.3. Reliability Measures:

A10.3.1. **Mean Time Between Critical Failure (MTBCF).** Use MTBCF to measure the average time between failures of mission-essential system functions. For AIS, MTBCF equals the total equipment operating time in hours, divided by the number of mission-essential system failures. MTBCF includes all critical hardware and software failures that deny the user critical management information based on user-determined critical and timing requirements. Express MTBCF as:

$$MTBCF = \frac{\text{Number of operating hours}}{\text{Number of critical failures}} = \frac{\text{Active hours - NMCMU hours}}{\text{Number of NMCMU events}}$$

A10.3.2. **Mean Time Between Downing Events (MTBDE).** Use MTBDE to calculate the average life units between downing events, scheduled and unscheduled. Use operating hours, if reported, as the time base for applicable items; otherwise, use PHs.

A10.4. Maintainability Measures:

A10.4.1. **Mean Downtime (MDT).** Use MDT to measure the average elapsed time between losing full operating status and restoring the system to at least partial operating status. The downtime clock continues to run until maintenance personnel return the system to a user-acceptable level of system operability. When computing MDT also consider TO availability and adequacy, support equipment capability and availability, supply levels, manning, experience levels, and shift structure.

A10.4.2. **Mean Time to Restore Functions (MTTRF).** This pertains to the average total elapsed time, as the result of a critical failure, required to repair and restore a system to full operating status with respect to providing critical information to the user. Users quantify and qualify the degree of MTTRF acceptable to perform assigned tasks effectively. Quantifiable objective evaluation criteria (average in hours) represent user satisfaction with the MTTRF of the AIS to support the performance of assigned tasks effectively. Express MTTRF as:

$$\text{MTTRF} = \frac{\text{Total critical restore time}}{\text{Number of critical failures}}$$

A10.5. Manpower Measures:

A10.5.1. **Maintenance Man-Hours per Life Unit (MMH/LU).** Use MMH/LU to measure the average man-hours per life unit needed to maintain a system.

A10.6. Deployability Considerations. MAJCOMs must consider building in deployability when describing top-level requirements for automated information systems. Address capability of the system to be deployed to the theater of operations within the constraints of the user-defined requirements.

A10.6.1. **Deployment Footprint.** See **A3.7.1.**

A10.6.2. **Logistics Follow-on Support.** See **A3.7.2.**

Attachment 11

GROUND COMMUNICATIONS-ELECTRONICS (C-E)

A11.1. Use the following mission availability, capability, and supportability measures for ground communications-electronics (C-E). For Space Systems, ITWAA Systems and Cheyenne Mountain, NORAD Unified Instruction (NUI) 10-21 must be used in conjunction with this attachment.

A11.2. Availability and Sustainability Measures. MAJCOMs must consider availability and sustainability measures when describing top-level logistics requirements for ground communications-electronics systems. Use the equations in this attachment to develop these measures.

A11.3. Availability. Availability is the probability of a system being fully mission capable (FMC) or partially mission capable (PMC), at a random moment in time, or equivalently, the percent of the desired operating time a system is FMC or PMC. It is expressed using one of the following formulas.

A11.3.1. **Operational Availability (A_o).** Operational availability measures the probability that, at any point in time, the system is either operating or can operate satisfactorily when operated under specified conditions. It is the preferred method of defining availability in operational requirements documents (ORDs). It can be expressed as follows:

$$A_o = \frac{\text{Active hours - Downtime}}{\text{Active hours}} = \frac{\text{Active hours - NMC hours}}{\text{Active hours}} = \frac{\text{MTBCF}}{\text{MTBCF + MDT}}$$

Downtime and NMC hours account for situations when the system is not mission capable for any reason.

A11.3.2. **Operational Readiness (O_R).** The operational readiness of the system measures the probability that the system is operating satisfactorily at any point in time when measured under specified conditions where downtime for scheduled maintenance and training is excluded. It is often the preferred method for defining availability in the System Executive Management Report (SEMR). It is expressed as follows:

$$O_R = \frac{\text{Active hours - NMCU hours}}{\text{Active hours}}$$

Not mission capable unscheduled (NMCU) refers to those times when the system is not mission capable because of unscheduled maintenance and associated delays.

A11.3.3. **Utilization Rate (UR).** Utilization rate is the average use of a system during a specified period of calendar time. Mathematically, it is the ratio of active hours to possessed hours in a given calendar period.

$$UR = \frac{\text{Active hours}}{\text{Possessed hours}}$$

A11.4. Reliability. Reliability is the probability that a system and its parts will perform its mission without failure, degradation, or demand on the support system. Reliability is used to calculate the probability of mission success and to determine logistics needs.

A11.4.1. **Mean Time Between Critical Failure (MTBCF).** MTBCF is a measure of the average operating time between failures of mission-essential system functions. MTBCF equals the total system operating time divided by the number of mission downing events, including all disabling hardware and software failure events. MTBCF excludes scheduled maintenance, and it can be expressed as follows:

$$\text{MTBCF} = \frac{\text{Number of operating hours}}{\text{Number of critical failure}} \quad \text{or} \quad \frac{\text{Active hours - NMCMU hours}}{\text{Number of NMCMU events}}$$

MTBCF is the preferred method of defining reliability in the ORD.

A11.4.2. **Mean Time Between Failures (MTBF).** MTBF is a measure of the average operating time between any failure of the system, excluding scheduled maintenance. It can be expressed as follows:

$$\text{MTBF} = \frac{\text{Operating hours}}{\text{Number of failures}} \quad \text{or} \quad \frac{\text{Active hours - (PMCMU + NMCMU hours)}}{\text{Number of PMCMU + NMCMU events}}$$

A11.4.3. **Mean Time Between Maintenance (MTBM).** MTBM measures the average operating time between maintenance events, scheduled and unscheduled. It can be expressed as follows:

$$\text{MTBM} = \frac{\text{Operating hours}}{\text{Number of maintenance events}} \quad \text{or} \quad \frac{\text{Active hours - (PMCM + NMCM hours)}}{\text{Number of PMCM + NMCM events}}$$

A11.5. Maintainability. Maintainability is the ability of equipment to be maintained, and is typically expressed as the average time to complete a maintenance action.

A11.5.1. **Mean Downtime (MDT).** MDT is a measure of the average time between losing MC or PMC status and restoring the system to MC or PMC status. It includes, but is not limited to, active maintenance, maintenance and supply delays, administrative delays, scheduled maintenance, and all activities that result in NMC status, such as training and preventive maintenance. MDT can be expressed as follows:

$$\text{MDT} = \frac{\text{Downtime (in hours)}}{\text{Number of downing events}} = \frac{\text{NMC hours}}{\text{\# of NMC events}}$$

A11.5.2. **Mean Repair Time (MRT).** MRT measures the average corrective maintenance time in an operational environment. MRT starts when the technician arrives at the system or equipment for on-equipment maintenance or receives the assembly, subassembly, module, or circuit card assembly at the off-equipment repair location. MRT includes all maintenance done to correct the malfunction, including preparation, LRU access, troubleshooting, removing and replacing parts, repair, adjusting, and conducting functional checks. MRT does not include maintenance, supply, or other delays. It is expressed as follows:

$$\text{MRT} = \frac{\text{Corrective maintenance hours}}{\text{\# of corrective maintenance events}}$$

A11.6. Manpower. Manpower is an estimate or requirement for human resources to support operation and maintenance. Lead commands must consider manpower measures when describing top-level logistics requirements.

A11.6.1. **Maintenance Labor-Hours per Active Hour (MLH/AH).** The general formula for MLH/AH is obtained by dividing the total maintenance labor-hours by the active system hours accrued as shown by the following formula:

$$\text{MLH / AH} = \frac{\text{Maintenance Labor Hours}}{\text{Active Hours}}$$

A11.6.2. **Maintenance Personnel per Operational Unit.** This is the estimated manpower to support maintenance and operation. It does not include depot-level personnel and others that are excluded from maintenance planning by AFI 38-201, *Determining Manpower Requirements*.

A11.7. System Deployability. Lead commands must consider deployability in describing top-level logistics requirements for C-E systems. Deployability considers whether or not the system can be deployed to a theater of operations within the constraints of the user-defined requirements and logistics planning factors such as:

A11.7.1. Manpower (operations and maintenance)

A11.7.2. Maintenance concept

A11.7.3. Interoperability

A11.7.4. Electromagnetic compatibility

A11.7.5. The deployed environment (climate and terrain)

A11.7.6. Safety

A11.7.7. Support equipment (test equipment, mobile electric power generators, tools, environmental control units)

A11.7.8. Transportation and basing factors, such as the system's weight and cube, and the number and types of vehicles required to transport the system to the deployed destination

A11.7.9. System/equipment set-up and tear-down times

A11.7.10. Supply support

A11.7.11. Software support

A11.7.12. Depot-level support

A11.8. Deployment Footprint. The manpower, materiel and equipment required to support a deployment is often referred to as the deployment footprint. One common way to express the deployment footprint is the number of equivalent airlift pallet positions required to deploy a system. The number of personnel required to operate and maintain the deployed system must also be factored into the deployment footprint.

Attachment 12

RAMS RATIONALE PROCESS

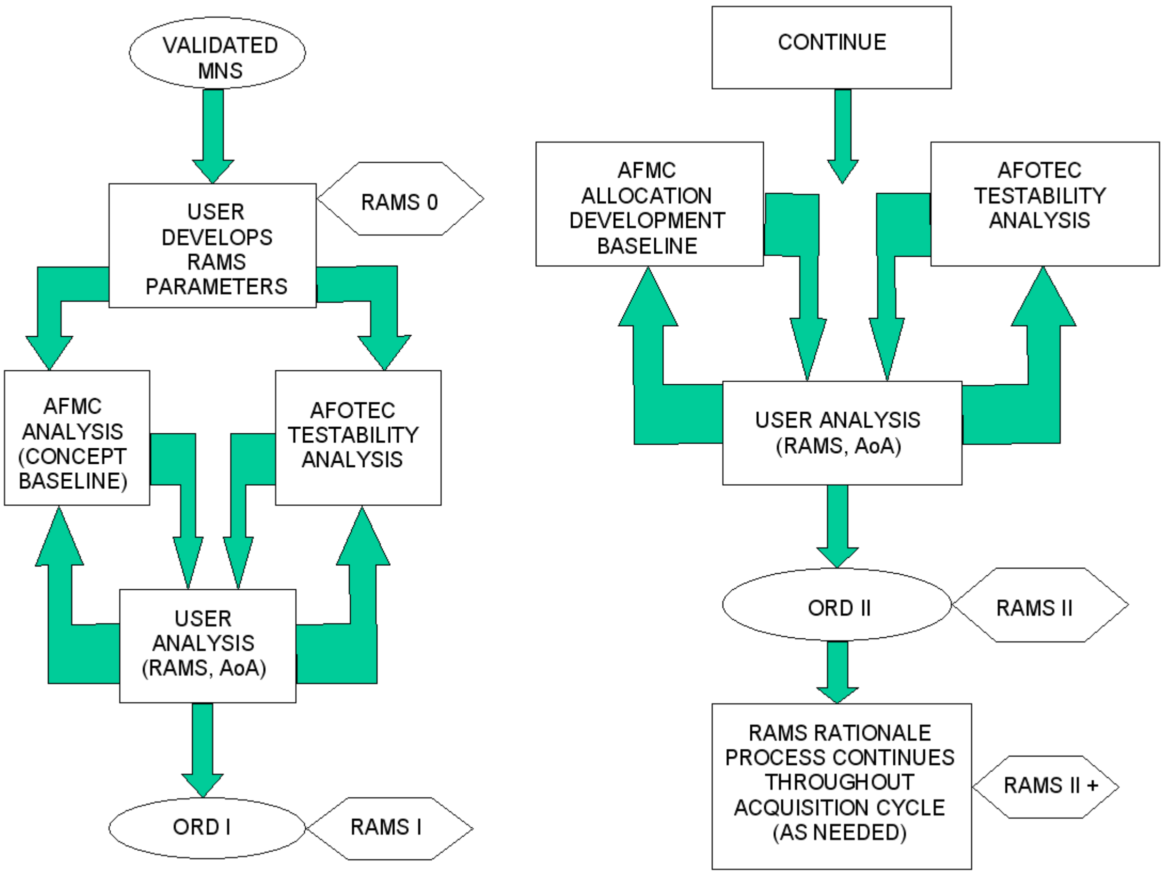
A12.1. OVERVIEW. The reliability, availability, maintainability, and **s**upportability (RAMS) rationale process was created to provide a structured development of RAMS requirements. It ensures proper crosstalk between the user, materiel developer, and the tester on critical RAMS issues. The RAMS rationale process integrates the RAMS parameters into the requirement development process, thus ensuring the linkage to operational utility. The RAMS rationale report documents the analysis, rationales and tradeoffs made in the joint development of the RAMS requirements by the using command, AFMC, and AFOTEC. RAMS rationale reports are coordinated at the three-letter level within the using command headquarters. AFMC and AFOTEC decide the appropriate level of coordination for their organizations. The RAMS rationale report is then approved by the using command headquarters Directorate of Requirements or equivalent.

A12.2. Purpose. The RAMS rationale process defines RAMS requirements and rationale, and quantifies operational RAMS concerns and benefits. The RAMS rationale report records assumptions used in the RAMS analysis, documents the analysis conducted for RAMS parameters, and documents the rationale for RAMS tradeoffs.

A12.3. Responsibility. Overall responsibility for establishing RAMS requirements rests with the using command. The using command manages the RAMS rationale process. The materiel developer (program office) recommends affordable, technically achievable RAMS parameters, that are within all other program constraints. An independent test/evaluation agency (not always AFOTEC) ensures that all RAMS requirements are measurable and can be directly tested or modeled.

A12.4. When Accomplished. The initial work to develop RAMS requirements begins with a validated mission need statement (MNS) which identifies goals, constraints and key parameters. The work to develop RAMS requirements continues and parallels the work to develop the operational requirements document (ORD). The using command develops a RAMS I report corresponding to the ORD I. The developer and tester add an analysis section and the user updates the analysis to include feedback from the developer and tester. The RAMS rationale process continues as the acquisition process progresses. The user updates the RAMS I report and produces a RAMS II report corresponding to the ORD II. The RAMS II report is the most comprehensive of all the RAMS reports and includes all final analyses. The user develops the failure definitions/scoring criteria (FD/SC) section and adds it the RAMS II report. The user, tester, and developer complete their analysis to finalize and update the RAMS requirements. Programmatic changes may occur during the acquisition cycle that impact RAMS requirements. As a result, the analyses in the RAMS report may need updating and a RAMS report is produced to reflect the impact on the RAMS requirements. The updated RAMS report will still be numbered according to the acquisition phase. **Figure A12.1.** provides an overview of the RAMS Rationale Report and the RAMS report updates.

Figure A12.1. RAMS Requirement Process.



A12.5. RAMS Rationale Report.

A12.5.1. **Contents.** The RAMS rationale reports consist of the following eight sections:

Table A12.1. RAMS Report.

SECTION	DESCRIPTION	OPR
1. Executive Overview	This executive summary is a brief one page summary of the RAMS goals and constraints, the material developer's and users' analysis, and the threshold RAMS requirements.	User
2. CONOPS, OMS, and MP	This section describes the planned deployment, employment, and operations of the weapon system.	User
3. FD/SC	This section documents the failure definitions and scoring criteria used to classify the cause and effect of failures during testing.	User
4. Material Developer Analysis	This section documents the material developer's feasibility analysis and allocation of users' RAMS requirements. It identifies the RAMS characteristics that are not only technically achievable, but have acceptable cost, schedule, and risk. Included is the documentation of the translation of operational requirements into specifications. The range of tailoring can run from a short assessment of the appropriateness and achieveability of the users' requirements to an extremely detailed RAMS analysis.	Materiel Developer
5. Tester Analysis	This section documents the testability analysis of the RAMS requirements.	Tester
6. User Analysis	This section documents the analysis used to develop the RAMS requirements and their operational utility. It is an interactive process with the developer's analysis to ensure proper balance between operational utility, cost, schedule, and risk considerations. It includes the RAM impacts analysis performed during the users' AoA.	User
7. RAMS Parameters	This section defines RAMS parameters and methods of calculation.	User
8. Points of Contact	Lists names, addresses and telephone numbers of all working group members.	User
ReportParagraphs Required		
RAMS 0	1 2 6 7 8	
RAMS I	1* 2* 3 4 5 6* 7* 8*	
RAMS II	1* 2* 3* 4* 5* 6* 7* 8*	

*Updated as needed

A12.5.2. **Executive Overview:**

A12.5.2.1. **Purpose.** The executive overview briefly communicates the results of the RAMS rationale process to decision makers. It briefly summarizes the RAMS goals and constraints, the materiel developer's, tester's, and users' analyses, and the RAMS requirements.

A12.5.2.2. **Responsibility.** The using command completes this section.

A12.5.2.3. **When accomplished.** This is the last section written for each report. It should be updated for each succeeding version (RAMS 0, I, II) of the report.

A12.5.2.4. **Contents.** The Executive Summary contains:

A12.5.2.4.1. Summary of users' RAMS goals and constraints (RAMS 0)

A12.5.2.4.2. Summary of materiel developer analysis

A12.5.2.4.3. Summary of tester analysis

A12.5.2.4.4. Summary of user analysis including a summary of the RAMS requirements when completed

A12.5.2.4.5. Coordination signatures

A12.5.3. **Concept of Operations, Operational Mission Summary, Mission Profile:**

A12.5.3.1. **Purpose.** The concept of operations (CONOPS), operational mission summary (OMS), and mission profile (MP), describe the planned deployment, employment, and operation of the weapon system.

A12.5.3.2. **Description/Contents:**

A12.5.3.2.1. **Concept of Operations (CONOPS).** States broad mission areas the system will be expected to perform in. It describes the using command's approach to the deployment, employment, and operation of a new or upgraded system or capability being advocated to meet identified tasks or missions. It need not be exclusive to a single system, command, or service, but can rely on other systems and organizations as required. Operational factors come from the core for Analysis of Alternatives (AoAs) and ORDs, and provide the basis for understanding how a system will be used, and associated system interoperability, commonality, or standardization issues.

A12.5.3.2.2. **Operational Mission Summary (OMS).** Describes the anticipated ways the equipment will be used in carrying out its operational role. The OMS covers all missions listed in the CONOPS. The OMS shows the relative frequency of the various missions or the percentage of systems involved in each mission.

A12.5.3.2.3. **Mission Profile (MP).** Provides a time-phased description of the operational events and environments a system experiences from the beginning to end of a specific mission. A design reference mission profile (DRMP) will be developed that identifies the tasks, events, timelines and duration, operating conditions, and environments of the system for each phase of a mission. The DRMP also defines the boundaries of the performance envelope and identifies appropriate system constraints.

A12.5.3.3. **Responsibility.** The using command develops the CONOPS, OMS, and MP.

A12.5.3.4. **When Accomplished.** The CONOPS, OMS, and MP are among the first items to be completed in the RAMS rationale process. They are used in developing RAMS requirements and are necessary to begin the materiel developer analysis.

A12.5.4. **Failure Definition/Scoring Criteria:**

A12.5.4.1. **Purpose.** The failure definition/scoring criteria (FD/SC) section documents the guidelines needed to classify the cause and effect of failures during testing. The result of this classification of failures will be used to evaluate the system RAMS characteristics.

A12.5.4.2. **Terms and Contents:**

A12.5.4.2.1. **Mission-Essential Functions List (MEFL).** The MEFL documents the minimum operational tasks that the weapon system must be capable of performing to accomplish its mission profiles. All intended mission profiles will have a MEFL.

A12.5.4.2.2. **Minimum Essential Subsystem List (MESL).** The MESL lists the minimum essential subsystems needed to perform the intended missions. All intended mission profiles will have a MESL. The MESL is used to judge the mission criticality of failures during testing.

A12.5.4.2.3. **Classification/Chargeability Guidelines.** The classification/chargeability guidelines describe the rules for coding failures and maintenance actions during testing. This section defines the critical failure classification guidelines for the system.

A12.5.4.3. **Responsibility.** The user develops FD/SC. Close coordination with the materiel developer and the tester will ensure proper development of this section.

A12.5.4.4. **When Accomplished.** Work on the MEFL starts after the initial RAMS 0 is completed. The Mission Essential Functions List is updated throughout the RAMS Rationale process. The MESL and the Classification/Chargeability Guidelines will be incorporated into the RAMS II report.

A12.5.5. **Material Developer Analysis:**

A12.5.5.1. **Purpose.** This section documents the materiel developer's feasibility analysis and allocation of the users' RAMS requirements. It identifies the RAMS characteristics as constrained by technology, cost, schedule and risk. This section includes documentation of the translation of operational requirements into technical contract specifications.

A12.5.5.2. **Terms:**

A12.5.5.2.1. **Baseline Comparison System (BCS).** The BCS is a system used to estimate the RAMS characteristics of a proposed system. The BCS may be an actual system, such as the proposed system's predecessor, or a hypothetical system of assemblies with similar technology and complexity to the proposed system.

A12.5.5.2.2. **Design Reference Mission Profile (DRMP).** The DRMP identifies the tasks, events, timelines and duration, operating conditions, and environments of the system for each phase of a mission. The DRMP also defines the boundaries of the performance envelope and identifies appropriate system constraints.

A12.5.5.3. **Responsibility.** The materiel developer performs this analysis. Dialogue with industry, as needed, identifies technological advancements with potential application to exploit in the proposed system design.

A12.5.5.4. **When accomplished.** Although data collection efforts can begin earlier, this analysis cannot begin until the user completes the CONOPS, OMS, and MP.

A12.5.5.5. **Contents.** The material developer tailors the analysis as appropriate for the particular program. The range of tailoring can run from a short assessment of the appropriateness and achievable user requirements to an extremely detailed RAMS analysis as described below:

A12.5.5.5.1. **Feasibility Analysis of User Requirements.** A BCS should be selected or synthesized. When there is no direct predecessor to serve as a BCS, a hypothetical BCS should be synthesized using similar building blocks from other systems. Compare the users' top-level RAMS requirements (threshold and objective) to the BCS and assess their technological feasibility. As the system design matures the top-level user requirements should be allocated to the appropriate lower level in this and all other analysis performed by the materiel developer.

A12.5.5.5.2. **State-of-the-Art Analysis.** This analysis identifies opportunities to improve the design of the new system in comparison with the BCS. Technological advancements should be identified that have the potential for exploitation in the proposed system design. The output of this analysis should be an assessment of the "upper boundary"' solution for the proposed system from a technological perspective.

A12.5.5.5.3. **Materiel Developer RAMS Allocation Analysis.** This is a technological and cost analysis of alternative solutions available to meet the operational needs of the user. The evolution of user requirements into a materiel developer proposal should yield RAMS characteristics that are not only technically achievable, but have acceptable cost, schedule, and risk. The materiel developer should document the allocation of the top level user requirements (mission reliability, operational availability, etc.) to the appropriate lower level (MTBCF, MTTR, MTBF, etc.) in all analyses. This section also includes the analysis of the allocation from system-level requirements to subsystem-level requirements.

A12.5.5.5.4. **Translation of Operational Requirements into Technical Specifications.** The materiel developer documents the methods and assumptions used to translate the users' operational requirements (e.g., mission reliability, operational availability, etc.) into technical contractual specifications.

A12.5.6. **Tester Analysis:**

A12.5.6.1. **Purpose.** The tester analysis section documents the testability analysis.

A12.5.6.2. **Responsibility.** The tester completes this section.

A12.5.6.3. **When accomplished.** Work on this section starts once the key parameters are identified. The analysis starts in Phase 0 of the acquisition cycle, after publication of the RAMS 0 report. During Phase I users and developers update the analysis. The updated analysis is then documented in the RAMS II report. Programmatic changes may impact RAMS requirements. As a result, the testability analysis done for the RAMS II report may need updating. If an update is required, a RAMS report is produced to reflect the impact on the requirements.

A12.5.6.4. **Contents.** The testability analysis determines if the parameters identified are testable. This section documents the test methods for each parameter.

A12.5.7. **User analysis:**

A12.5.7.1. **Purpose.** The user analysis section documents the analysis used in developing the RAMS requirements and their operational utility. It includes the RAMS impacts analysis performed during the users' AoA.

A12.5.7.2. **Responsibility.** The user completes this section.

A12.5.7.3. **When accomplished.** Work on this section starts once the MNS is validated. The analysis starts in Phase 0 of the acquisition cycle, where goals, constraints, and key parameters are identified. The user starts the initial RAMS analysis and documents this in the RAMS 0 report. The process to develop RAMS requirements continues through Milestone I with a more detailed analysis, which is documented in the RAMS I report. During Phase I the analysis is updated with the developer's input and other updated information. The updated analysis is then documented in the RAMS II report. Programmatic changes may impact RAMS requirements, resulting in the need to update the analyses for the RAMS II report. If required an updated RAMS III report is produced to reflect the impact on the RAMS requirements.

A12.5.7.4. **Contents:**

A12.5.7.4.1. **Key Parameters Analysis.** This analysis defines key RAMS parameters such that if the thresholds are not met, the milestone decision authority would require a reevaluation of alternative concepts or design approaches. The rationale and assumptions made in defining the system performance objectives and minimum acceptable requirements are documented in this section. The key parameters are developed in Phase 0 and serve as the basis for all other analyses. They become progressively more detailed at successive milestone decision points, in both number and specificity.

A12.5.7.4.2. **Operational Effectiveness Analysis.** This analysis derives the RAMS requirements that can be tied to operational capability. It includes analysis of mission reliability, operational availability, and deployability.

A12.5.7.4.3. **Cost of Ownership.** This analysis determines RAMS requirements related to cost of ownership. It includes analysis of support manpower and Operation & Support (O&S) Costs.

A12.5.7.4.4. **Strategy-To-Task (STT) Analysis.** To insure operational utility, all RAMS requirements will include a STT analysis. This insures proper linkage between RAMS requirements and operational characteristics.

A12.5.8. **RAMS parameters:**

A12.5.8.1. **Purpose.** The RAMS parameters section documents RAMS requirements and their definitions. It identifies thresholds, objectives, and key parameters and their methods of calculation.

A12.5.8.2. **Terms.** RAMS Parameters characterize the weapon system in five areas:

A12.5.8.2.1. **Mission Reliability.** The parameters in this area describe the probability that a system will successfully complete a specified mission, given that the system was initially capable of doing so.

A12.5.8.2.2. **Operational Availability.** The parameters in this area describe the probability that a system can perform at least one of its intended missions.

A12.5.8.2.3. **Support Manpower** . The parameters in this area describe the support manpower resources required to maintain the system.

A12.5.8.2.4. **Operational and Support Cost.** The parameters in this area describe the cost associated with operating and supporting the system.

A12.5.8.2.5. **Deployability.** The parameters in this area describe the ability to deploy the system, including personnel, spares, supplies, and support equipment, in a wartime environment.

A12.5.8.3. **Responsibility.** The user develops the RAMS parameters in close coordination with the materiel developer and the tester.

A12.5.8.4. **When accomplished.** Work on the RAMS Parameters section can start once the MNS is validated. The parameters are further developed during the acquisition cycle, and incorporated into the RAMS report.

A12.5.8.5. **Contents.** The RAMS parameters section consists of a table of the RAMS threshold and objective values.

A12.5.9. **Points of Contact:**

A12.5.9.1. **Purpose.** The points of contact section identifies key individuals and organizations involved with the RAMS rationale process for the particular system being studied. It will serve as an audit trail to show all contributors to the RAMS rationale report and facilitate communication to clarify details used therein.

A12.5.9.2. **Responsibility.** The using command completes this section.

A12.5.9.3. **When accomplished.** This paragraph should be written with the RAMS 0 report and updated in future reports.

A12.5.9.4. **Contents.** This paragraph contains two parts: RAMS rationale process working group members and other key points of contact. The following information should be provided for both parts: organization, office symbol, name, phone number (commercial, DSN, and fax), and E-mail address.

Attachment 13

IC 03-1 TO AFI 10-602, DETERMINING MISSION CAPABILITY AND SUPPORTABILITY REQUIREMENTS

1 AUGUST 2003

SUMMARY OF REVISIONS

This revision incorporates Interim Change IC 2003-1. Eagle Look report PN 01-508 identified a deficiency in determining the quantity of support equipment required to ensure effective munitions operations throughout the Air Force. HQ AF/XORW has provided a list of factors that should be considered to determine quantities of required support equipment at field units to facilitate beddown and sustainment of weapon systems. These factors are added to AFI 10-602 after paragraph **A2.5.3.12.** A bar (|) indicates revision from the previous edition.

A2.5.3.13. The following factors that influence the quantities of Support Equipment (SE) required at field units to facilitate beddown and sustainment of weapon systems should be considered:

A2.5.3.13.1. Types and quantities of weapons to be supported at that location.

A2.5.3.13.2. Net Explosive Weight (NEW) storage capability versus new weapon receipt.

A2.5.3.13.3. Quantity of weapons to be transported per unit SE.

A2.5.3.13.4. Distances from weapon storage to build-up area, flight line and return.

A2.5.3.13.5. Operational concept, i.e., weapon build-up, pre-built weapons, two-stage or single-stage delivery concept, NEW capability, etc.

A2.5.3.13.6. Number of Combat Coded (CC) aircraft to support.

A2.5.3.13.7. Number of OPS squadrons/load crews to support and their deployment locations.

A2.5.3.13.8. Aircraft initial load/Take-Off/Quick-turn time requirements.

A2.5.3.13.9. Deployment/mobility requirements/locations.

A2.5.3.13.10. Deployment with SE or prepositioned SE available at deployment location.

A2.5.3.13.11. Additional SE required for returning aircraft/weapons download after deployment.

A2.5.3.13.12. SE Maintenance Concept developed by SPO with MAJCOM approval for both home station and deployed location(s).

A2.5.3.13.13. Environmental consideration affecting any of the above factors, i.e., snow, desert sand, rough terrain, day/night operations, etc.

A2.5.3.13.14. SE differences/capabilities affecting aircraft/weapon support.

A2.5.3.13.15. Spare parts/spare SE as computed by weapon system/SE SPO and MAJCOM.

A2.5.3.13.16. Calibration requirements affecting SE at home station and deployed location(s).

A2.5.3.13.17. Peculiar SE requirements that supplement/replace common SE.

A2.5.3.13.18. Funding availability for procurement of required SE.

Attachment 14

IC 2005-1 TO AFI 10-602, DETERMINING MISSION CAPABILITY AND SUPPORTABILITY REQUIREMENTS

18 MARCH 2005

SUMMARY OF REVISIONS

This revision incorporates Interim Change IC 2005-1. This change incorporates the sustainment planning and assessment elements as documented in DoDI 5000.2 and AFI 63-107. The text in AFI 63-107 paragraph 3.2.3 and sub paragraphs 3.2.3.1 – 3.2.3.10 are the "overarching" sustainment elements that must be addressed by program managers. The logistics support elements in AFI 10-602 paragraph **A2.5.** and subparagraphs **A2.5.1.-A2.5.10.** complement AFI 63-107. In some cases the AFI 10-602 elements have been combined into one sustainment element in AFI 63-107, while others such as Manpower, Personnel, and Training have been broken into separate sustainment elements. Paragraph **A2.5.** of the basic document is replaced by IC paragraph **A2.5.** Paragraph **A2.6.** and sub paragraphs **A2.6.1.** – **A2.6.10.** are added to identify the correlation between AFI 63-107 and AFI 10-602. A bar (|) indicates revision from the previous edition. The entire text of the IC is at the last attachment.

A2.5. Sustainment Planning Elements**.** The guidance in this paragraph replaces paragraph **A2.5.** of AFI 10-602 dated 13 September 2003. The ten Logistics Support Elements identified in this document under paragraphs **A2.5.1.** – **A2.5.10.** are replaced with: Manpower, Personnel, Maintenance, Supportability, Systems Engineering, Data Management, Supply, Transportation, Configuration Management, and Training. The logistics support elements are critical factors in the early phases of design development. In planning and executing product support, logisticians shall consider system key performance parameters identified in the Capability Development Document and Capability Production Document.

A2.6. Element Cross Reference**.** This paragraph provides a cross reference of the ten Logistics Support Elements in AFI 10-602, 13 September 2003, paragraphs **A2.5.1.** through **A2.5.10.**, to the ten Sustainment Planning Elements in AFI 63-107, 10 November 2004, paragraphs 3.2.3.1 through 3.2.3.10.

A2.6.1. -- AFI 63-107 places **Design Interface** under "Systems Engineering"

A2.6.2. -- AFI 63-107 places **Maintenance Planning** under "Maintenance"

A2.6.3. -- AFI 63-107 places **Support Equipment** under "Maintenance"

A2.6.4. -- AFI 63-107 places **Supply Support** under "Supply"

A2.6.5. -- AFI 63-107 places **Packaging, Handling, Storage, and Transportation** under "Transportation"

A2.6.6. -- AFI 63-107 places **Technical Data** under "Data Management"

A2.6.7. -- AFI 63-107 places **Facilities** under "Maintenance"

A2.6.8. -- AFI 63-107 divides **Manpower and Personnel** into "Manpower" and "Personnel"

A2.6.9. -- AFI 63-107 defines **Training and Training Support** as "Training"

A2.6.10. -- AFI 63-107 places **Computer Resources Support** under "Supportability"