BY ORDER OF THE SECRETARY OF THE AIR FORCE	***AIR FORCE INSTRUCTION 21-104***
	1 JULY 1998
	Maintenance
	SELECTIVE MANAGEMENT OF SELECTED GAS TURBINE ENGINES

COMPLIANCE WITH THIS PUBLICATION IS MANDATORY

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This instruction implements AFPD 21-1, *Managing Aerospace Equipment Maintenance*. It directs the management of selected gas turbine engines identified in TO 00-25-254-1. It describes the propulsion management responsibilities required to manage Air Force engines. The Air Force specially manages selected gas turbine engines (hereafter referred to as "engines") as principal items, as defined by Department of Defense Instruction (DoDI) 4140.60, *DoD Materiel Management,* January 5, 1993. In the DoDI, certain items are so important that they require special centralized management, including inventory control, computation of requirements, distribution, and information. The justification includes safety and reliability considerations, impact on successful mission completion, limited available assets, and high acquisition and logistics support costs. The Air Force serially manages and controls engines through their lifetime. Another special characteristic of engines is the Air Force acquires most under the "Life-of-Type Buy" concept (see DoDI 4140.60), which means that procurement of engines after the acquisition program has ended is generally not economically feasible. Thus, only a finite quantity of engines are available to support the aircraft in which they are installed for their operational life.

SUMMARY OF REVISIONS

This document is substantially revised and must be completely reviewed.

This revision adds three annexes to **Attachment 2**; adds two attachments (Spare Engine Requirements Computations Acquisition Policy at **Attachment 3** and Reclamation and Disposal at **Attachment 4**); and incorporates some administrative changes for point clarification.

1. General Information. Managing selected engines requires direction and policy from HQ USAF to the major commands (MAJCOM), the Propulsion Product Group Manager (PPGM), and respective engine managers at base level. The Engine Advisory Group (EAG), Propulsion Management Committee (PMC), Propulsion Center of Excellence (COE), Maintenance Planning Group (MPG), Engine Review Organization (ERO), and Comprehensive Engine Management System (CEMS) Functional Review Board (FRB) help these organizations with management and policy decisions.

2. Responsibilities:

2.1. HQ USAF:

2.1.1. HQ USAF/ILM:

2.1.1.1. Provides engine management policy and directives for in service engines, excluding engines in procurement.

2.1.1.2. Provides management assistance and maintenance direction for engines in procurement.

2.1.1.3. Provides policy to develop logistics plans to implement approved mobility operational concepts and objectives.

2.1.1.4. Approves maintenance concepts and management policies to support engine requirements and stock levels.

2.1.1.5. Ensures Reliability Centered Maintenance (RCM) concepts are integrated into approved operational, support, and mobility maintenance policies.

2.1.2. HQ USAF/ILS:

2.1.2.1. Approves funding requirements for depot level repair of Air Force engines.

2.1.3. HQ USAF/ILXB:

2.1.3.1. Sends the latest version of the USAF Program Installations, Units, and Priorities (PD) file to MSG/SXW after completion of each President's Budget (PB).

2.1.3.2. Publishes the latest version of the PD Document following completion of each PB.

2.1.4. HQ USAF/XOOW:

2.1.4.1. Sends the most current version of the Requirements Daily Answer Tape (RDAT) to MSC/SMW after completion of the President's Budget each year. Format for War Mobilization Plan (WMP) 3&5 and D087P according to the memorandum of agreement (MOA) between HQ USAF/XOOW and MSG/SMW.

2.1.4.2. Sends hard copies of the RDAT to MAJCOM/LGMs, SA-ALC/LR/LP, OC-ALC/LP and ASC/LP after completion of the President's Budget each year. If updated RDAT is unavailable, notifies MAJCOMs, SA-ALC/LR/LP, OC-ALC/LP, and ASC/LP, which document to use for annual computations.

2.1.5. HQ USAF/XPPE:

2.1.5.1. Sends latest version of the *USAF Program Aerospace Vehicles and Flying Hours* (PA) file to MSG/SXW after completion of each President's Budget (PB). Format for K002 (PA) and D087Q according to the MOA between HQ USAF/XPPE and MSG/SXW.

2.1.5.2. Publishes the latest version of both the PA Documents, Volumes I and II, on the SIPRNET following the completion of each PB. Documents are located on the HQ USAF/XPP home page at HTTP//147.254.144.182/XPP.

2.1.6. SAF/ADP:

2.1.6.1. Provides policy and direction for development and procurement of engines for new aircraft programs.

2.1.6.2. Provides policy and direction for development of engine modifications and component improvements.

2.1.6.3. Monitors funding requirements for development and procurement of new engine models.

2.1.6.4. Monitors funding requirements for engine component improvements.

2.2. MAJCOMs:

2.2.1. Recommend improved logistic concepts, policies, and procedures for engines to HQ USAF/ILM.

2.2.2. Oversee Stock Record Account Number (SRAN) engine operations and appoint a command engine manager (EM).

2.2.3. Redistribute command owned engines (as required).

2.2.4. When designated, perform as "Lead Command" for specific engine Type, Model, Series (TMS) in accordance with **Attachment 2**, Annex 3.

2.2.5. Include engine plans in mobility planning directives, operating procedures, and logistics annexes and appendices.

2.2.6. Compute wartime engine removal rates in coordination with engine managers when wartime operating conditions (actual or anticipated) differ significantly from peacetime operating conditions.

2.2.7. Provide data requested by the PPGM to compute worldwide stock-level requirements.

2.2.8. Use Air Force planning documents to provide the PPGM with data to compute engine requirements.

2.2.9. Compute MAJCOM base stock-level requirements.

2.2.10. Forecast engine depot repair requirements prior to periodic negotiations.

2.2.11. With the PPGM, determine air-breathing drone engine unit-stock levels.

2.2.12. Obtain PPGM concurrence for specific engine transfers between the USAF and other services, security assistance programs (to include Foreign Military Sales programs), government agencies, and non-government organizations.

2.2.13. Make all required Program Objective Memorandum (POM) inputs for DPEM funds, Air Force Cost Analysis Improvement Group (AFCAIG) adjustments, and approved engine modifications.

2.2.14. Responsible for budgeting and allocating O&M funds used to purchase depot-level reparable items through MSD.

2.3. SRAN Engine Manager:

2.3.1. Execute engine management policy and procedures. Develops MOA with SRANs at prepositioned sites to manage engines. Also manages tenant spare engines according to AFI 25-201, *Support Agreements Requirements*.

2.3.2. Develop local engine management procedures to report and handle accountable engines and unaccountable items.

2.3.3. Track accountable engines in the SRAN sub-account according to T.O. 00-25-254-1.

2.3.4. Accountable for a shipped engine until the receiver acknowledges receipt in CEMS.

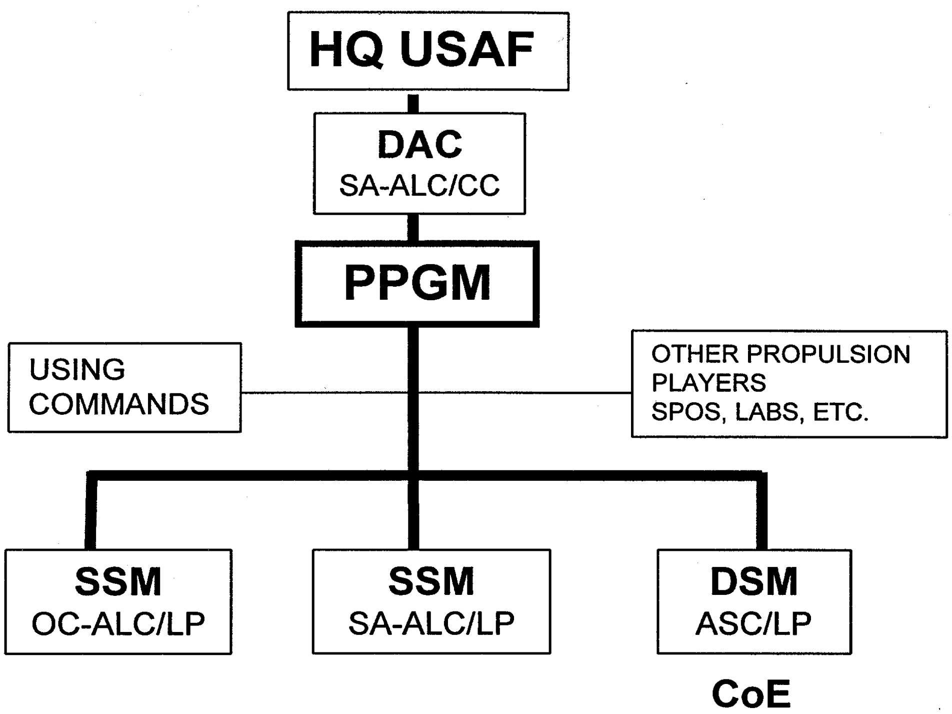
2.3.5. Prepares DD Form 1348-1A, **Issue Release/Receipt Document,** for all engine shipments and transfers.

2.3.6. Prepares DD Form 1149, **Requisition and Inventory Shipping Document**.

2.4. Propulsion PGM. As appropriate, the PPGM may delegate PGM responsibilities to subordinate organizations:

2.4.1. Act as single manager (POC) to users (or other external organizations) for propulsion activities/issues (see **Figure 1.**).

Figure 1. Propulsion Organization.



NOTE:

The Propulsion PGM is responsible and accountable for propulsion program execution and reports to the DAC for all matters affecting the Propulsion Product Group. These responsibilities include the oversight of acquisition programs, propulsion sustainment activities, the development of Propulsion Product Group long range goals and master plans, advocacy for propulsion program resources and data systems, advisor for resolution of propulsion related issues, and interface with other agencies.

2.4.2. Provide inputs for research and development of new engine technologies.

2.4.3. Represent USAF on joint service propulsion committees such as the Joint Propulsion Coordinating Committee (JPCC).

2.4.4. Support aircraft Systems Program Directors (SPDs) in determining Quick Engine Change (QEC) kit requirements.

2.4.5. Develop warranties in conjunction with the using commands and other government agencies according to AFMAN 64-110, *Weapon Systems Warranties*.

2.4.6. Manage engines throughout their life-cycle.

2.4.7. Manage engine inventories world wide and supports authorized engine stock levels for each SRAN by type, model, series, and modification (TMSM).

2.4.8. Engine configuration control manager.

2.4.9. Manage depot-level repair activities.

2.4.10. Develop engine factors.

2.4.11. Maintain an actuarial forecasting system that projects engine removal rates for the programming years based on age related engine removal histories derived from CEMS data and quantitative analysis techniques.

2.4.12. Manage CEMS and ETDS.

2.4.13. Act as accountable officer for the Air Force Centralized Engine Account, SRAN FJ2031.

2.4.14. Establish and publish relaxed or expedited retrograde transportation factors (as conditions permit).

2.4.15. Develop and distribute the procedures and models for computing stock level acquisition and distribution requirements.

2.4.16. Identify (to MAJCOMs) data necessary to accomplish stock-level computation.

2.4.17. With the MAJCOM EMs, determines air-breathing drone engine unit-stock levels.

2.4.18. Overall responsible for propulsion systems financial management.

2.4.19. Compute worldwide stock-level requirement, including depot and safety level stocks.

2.4.20. Develop engine repair and overhaul requirements.

2.4.21. Develop retention, reclamation, and disposal computations.

2.4.22. Dispose of out-of-production engines during aircraft or missile phase out cycle.

2.4.23. Chairs the Engine Advisory Group semi-annual meetings.

2.4.24. With HQ USAF, develops most cost-effective engine maintenance repair policies to ensure RCM tenets are appropriately applied across-the-board and optimum engine time-on-wing is achieved.

2.4.25. Maintains cognizance of all engine deficiency reports under T.O. 00-35D-54.

2.5. System Program Directors:

2.5.1. Responsible for POM inputs for initial spares, initial common support equipment, and interim contractor support.

2.5.2. Responsible for the resolution of all deficiency reports under T.O. 00-35D-54.

2.6. Planning Groups:

2.6.1. Engine Advisory Group (EAG). Established in accordance with DoD Instruction 5000.2-R, *Defense Acquisition Management Policies and Procedures.* Reviews and makes recommendations on funding requirements for the *Component Improvement Program (CIP)*. Membership includes PPGM (chairperson), Propulsion Management Directors at logistics, product and test centers, operating MAJCOM representatives, HQ AFMC, HQ USAF, and SAF Program Element Monitor (PEM).

2.6.2. Propulsion Management Committee (PMC). The PMC reviews overall trends in Air Force propulsion management, establishes propulsion concepts and principles, and addresses propulsion issues of common interest to Air Force EMs. Membership includes the Propulsion PGM (chairperson), all MAJCOM command EMs (including ANG), and representatives from the ALC/LP staffs.

2.6.3. Propulsion Center of Excellence (COE). Established by the PPGM. Membership is selective and includes highly skilled Air Force propulsion engineering personnel. The group is immediately managed out of ASC/LP. The COE conducts studies of the most complex Air Force engine issues and presents the findings to the PPGM.

2.6.4. Maintenance Planning Group (MPG). The PPGM establishes a MPG for each engine TMS to review and validate the maintenance plan developed according to DoD Instruction 5000.2-R and AFI 21-102, *Depot Maintenance Management*. Membership includes PPGM (chairperson), representatives from the subject engine ALC, appropriate product center, the depot engine repair facility, the operating MAJCOMs, and the engine manufacturer.

2.6.5. Engine Review Organization (ERO). The PPGM establishes an ERO for each TMS engine to review and validate whole engine factors. Membership includes the PPGM (chairperson), appropriate product and engine production centers, operating MAJCOMs (including ANG), and the engine manufacturers.

2.6.6. Propulsion Environmental Working Group (PEWG). The PEWG is chartered to serve as the Hazardous Material Management Subcommittee of the Joint Propulsion Coordinating Committee (JPCC). The mission of the PEWG is to establish a consortium of DoD and propulsion industry collaboration to identify and resolve common environmental issues. The PEWG promotes joint service and industry initiatives to introduce environmentally advantaged industrial materials and processes into the defense sector of the propulsion industrial base. The PEWG facilitates technical interchange of environmental information between developers, manufacturers, users, and logistics supporters of propulsion programs. The PEWG is chaired by the USAF

Propulsion DSO, ASC/LP. The PEWG implements pollution prevention requirements of SAF/AQ Policy Memorandum 94A-003.

WILLIAM P. HALLIN, Lt General, USAF
DCS/Installations and Logistics

Attachment 1

GLOSSARY OF REFERENCES AND SUPPORTING INFORMATION

References

DoDD 4000.19, *Interservice, Interdepartmental, and Interagency Support*

DoDI 5000.2-R, *Defense Acquisition Management Policies and Procedures*

AFPD 10-9, *Lead Operating Command Weapon Systems Management*

AFPD 21-1, *Managing Aerospace Equipment Maintenance*

AFI 21-102, *Depot Maintenance Management*

AFI 21-129, *Two Level Maintenance and Regional Repair of Air Force Weapon Systems and Equipment*

AFI 21-130, *Technical Analysis to Determine Criterion for 2 vs. 3 Level Repair*

AFI 21-132, *Air Force Engine Trending and Diagnostics Program*

AFI 21-133, *Air Force Policies on Engine Noise Suppressor and Test Cell Systems*

AFMAN 23-110CD, *USAF Supply Manual*

AFI 23-501, *Retention and Transfer Policy*

AFJMAN 24-204, *Preparing Hazardous Materials for Military Air Shipments*

AFI 25-201, *Support Agreements Requirements*

AFMAN 64-110, *Weapon System Warranties*

TO 00-20-5-1-X, *Instructions for Jet Engine Parts Tracking*

TO 00-25-254-1, *CEMS Engine Status, Configuration and TCTO Reporting Procedures*

TO 00-25-254-2, *Comprehensive Engine Management System Manual for DSD: D042*

TO 00-25-257, *Engine Trending and Diagnostics System (ETDS)*

TO 00-35D-54, *USAF Deficiency Reporting and Investigation System*

TO 00-85-20, *Engine Shipping Instructions*

TO 2-1-18, *Aircraft Engine Operating Limits and Factors*

TO 2J-1-18, *Preparation For Shipment and Storage of Gas Turbine Engines*

Abbreviations and Acronyms

ACI—Analytical Condition Inspection

AFI—Air Force Instruction

AFMAN—Air Force Manual

AFMC—Air Force Materiel Command

AFPD—Air Force Policy Directive

AFR—Air Force Regulation

AFRC—Air Force Reserve Command

ALC—Air Logistics Center

AMT—Accelerated Mission Test

ANG—Air National Guard

ARI—Actuarial Removal Information

ASC—Aeronautical Systems Center

BES—Budget Estimate Submission

BSL—Base Stock Level

CAMS—Core Automated Maintenance System

CEMS—Comprehensive Engine Management System

CII—Configured Item Identifier

CIP—Component Improvement Program

CLS—Contractor Logistics Support

COE—Center of Excellence

COMBS—Contractor Owned and Maintained Base Supply

DAC—Designated Acquisition Commander

DCS—Deputy Chief of Staff

DETS—Deployable Engine Tracking System

DLA—Defense Logistics Agency

DoD—Department of Defense

DoDI—Department of Defense Instruction

DPEM—Depot Purchased Equipment Maintenance

DRMO—Defense Reutilization and Marketing Office

DR—Deficiency Report

DSD—Data System Designator

DSM—Development Support Manager

EAG—Engine Advisory Group

ECMS—Engine Configuration Management System

ECP—Engineering Change Proposal

EEAG—Executive Engine Advisory Group

EFH—Engine Flying Hours

ELM—Engine Life Management

ELMP—Engine Life Management Plan

EM—Engine Manager

EMD—Engineering, and Manufacturing, Development

EMDP—Engine Model Derivative Program

EMP—Engine Maintenance Plan

ENMCS—Engine Non Mission Capable Supply

ENSIP—Engine Structural Integrity Program

EPM—Engine Program Management

ERRC—Engine Regional Repair Center

ERO—Engine Review Organization

ERS—Engine Requirement Scenario

ET&D—Engine Trending and Diagnostics

ETDS—Engine Trending and Diagnostics System

FMECA—Fracture Models, Effects, and Criticality Analysis

FMS—Foreign Military Sales

FOL—Forward Operating Location

FRB—Functional Review Board

FSC—Federal Stock Class

FSE—Field Service Evaluation

FSP—Forward Supply Point

ICP—Inventory Control Point

ICS—Interim Contractor Support

ILS—Integrated Logistics Support

ILSWG—Integrated Logistics Support Working Group

IOC—Initial Operating Capability

ISSL—Initial Spares Support List

JEIM—Jet Engine Intermediate Maintenance

JOAP—Joint Oil Analysis Program

JPCC—Joint Propulsion Coordinating Committee

LCC—Life Cycle Cost

LL—Lean Logistics

LMP—Life Management Plan

LSP—Logistics Support Plan

LTF—Lead The Fleet

MAJCOM—Major Command

MDS—Mission Design Series

MGM—Materiel Group Manager

MIL-STD—Military Standard

MPG—Maintenance Planning Group

MPWG—Maintenance Planning Working Group

MRB—Material Review Board

MSD—Maintenance Support Division

MTBF—Mean Time Between Failure

MTBM—Mean Time Between Maintenance

NDE—Non Destructive Evaluation

NDI—Non Destructive Inspection

NMCS—Non Mission Capable Supply

NSN—National Stock Number

OC-ALC—Oklahoma City Air Logistics Center

OCM—On Condition Maintenance

OEM—Original Equipment Manufacturer

O&M—Operations and Maintenance

PA—USAF Program Aerospace Vehicle
Flying Hours/Missiles

PACS—Propulsion Actuarial Client Server

PEM—Program Element Monitor

PEWG—Propulsion Environmental Working Group

PID—Prime Item Development

PGM—Product Group Manager

PMC—Propulsion Management Committee

POM—Program Objective Memorandum

PPGM—Propulsion Product Group Manager

PQDR—Product Quality Deficiency Report

PRS—Propulsion Requirements System

QEC—Quick Engine Change

RCM—Reliability Centered Maintenance

RDAT—Requirements Daily Answer Tape

RDD—Required Delivery Date

REALM—Requirements/Execution Availability Logistics Module

REMIS—Reliability and Maintainability Management Information System

RIPS—Remove, Inspect, Process to Ship

R&M—Reliability and Maintainability

RM&D—Reliability, Maintainability, and Durability

SA—Security Assistance

SA-ALC—San Antonio Air Logistics Center

SAF—Secretary of the Air Force

SAM—Sustainability Assessment Module

SER—Scheduled Engine Removal

SEMR—System Executive Management Report

SFC—Specific Fuel Consumption

SPD—System Program Director

SRAN—Stock Record Account Number

SSC—Standard Systems Center

SSM—System Support Manager

SVR—Shop Visit Rate

TCTO—Time Compliance Technical Order

TDR—Tear-Down Deficiency Report

TMS—Type, Model and Series

TMSM—Type, Model, Series and Modification

TO—USAF Technical Order

TPIPT—Technology Planning Integrated Product Team

2LM—Two Level Maintenance

UER—Unscheduled Engine Removal

UMMIPS—Uniform Materiel Movement and Issue Priority System

USAF—United States Air Force

WMP—War and Mobilization Plan

WRE—War Reserve/Readiness Engines

WSMIS—Weapon System Management Information System

SPO—System Program Office

SORTS—Status of Resources and Training

Terms

Accountable Officer—The designated individual required to ensure accurate property records are maintained.

Command Engine Manager—The focal point for engine management matters for the assigned command.

Comprehensive Engine Management System (CEMS)—provides WSMIS/SAM (D087C) with inventory data (both on hand and authorized), Family Group Codes, and Engine MS, to accomplish integrated unit level assessments for the Status of Resources and Training Systems (SORTS)

Current Factors—The current engine actuarial and pipeline factors developed from actual operational experience. (TO 2-1-18).

Development System Manager (DSM)—The lead individual at an AFMC product center when a single manager (SPD, PGM or MGM) located at another center delegates a specific development task to a product center. The DSM reports directly to the single manager.

Engine Model Derivative Program—The EMDP is an engineering development program that provides the latest in engine technology. EMDP supports the needs of the Propulsion Product Group Manager, System Program Directors and using commands. Customer needs are identified through direct interface and through involvement in the Technology Planning Integrated Product Teams (TPIPT predict the total number of engines required to support the weapon system through out its life cycle).

Engine Trending & Diagnostics—An analysis which provides engine health data to base level personnel and depots to aid in engine maintenance planning. ET&D evaluates engine health on-wing and identifies adverse trends in mechanical operation, performance, and material wear so proper corrective maintenance can be performed..

Factor—A value used in computing requirements and doing assessments. Factors are developed for peace (readiness), and for war (surge and sustained).

Forecasted Factors—Factors developed which predict what the official factors will be when the engine has reached stability. Engine stability on most development programs is achieved by 0.75 to 1.0 million engine hours of fleet operation or 5 to 7 years of operation. Forecast factors are used to predict the total number of engines required to support the weapons system throughout its life cycle.

JEIM Return Rates—The percentage of engines that will be repaired and returned to service by the JEIM (TO 2-1-18).

Life-of-Type Buy (Buyout)—Acquisition of enough total spares required to support the entire planned weapons system's life cycle prior to ceasing engine production.

Mission, Design, and Series (MDS)—Standard nomenclature for both aircraft and missiles.

Operating Unit—A term used in determining requirements. Defined as the lowest level tasked in planning documents for independent deployment or operational capability.

Peacetime Assets—Assets for day to day peacetime operations.

Product Group Manager (PGM)—The individual managing an AFMC Product Group who is ultimately responsible and accountable for decisions and resources in overall product group management. The PGM is the person who is charged with all cost, schedule, and performance aspects of a product group and related sustainment activities. Typically, the PGM's product is in direct support of one or more aircraft or non-aircraft systems SPDs.

Propulsion Requirements System (PRS)—(WSMIS/REALM/PRS (D078Q)) is the Air Force standard system for the computation of:

a. Whole engine stock levels for both acquisition and distribution.

b. Overhaul requirements.

c. Retention requirements.

PRS must provide WSMIS/SAM (D087C) with the computational data needed to assess whole engines and modules for SORTS.

Quick Engine Change (QEC) Kit—Externally mounted components needed to adapt and install the engine to the weapon system.

Reparable Engines—An engine requiring maintenance action before being a serviceable asset.

Requirements Computation Periods—

1. Peace--Computes spare assets needed for readiness capability.

2. War:

Surge--Computes spare engine assets needed to sustain the war effort until pipelines are filled and repair facilities are available.

Sustained--Spare engine assets needed to sustain the war effort for a long duration.

Retrograde—The time it takes an item to be returned from the unit to source of repair.

Scheduled Engine Removal—A planned engine removal due to required maintenance actions.

Scheduled Maintenance—Periodic prescribed inspection and/or servicing of equipment accomplished on a calendar, cycles, or hours of operation basis.

Serviceable Engine—An engine ready to be built-up or installed.

SRAN Engine Manager—Manages all engines possessed by the SRAN and is responsible for CEMS reporting.

Sustainability Assessment Module (SAM)—SAM predicts the combat capability of tactical, strategic, and airlift weapon systems for a given set of operations plans, logistics assets, and logistics performance factors. SAM provides insight into how well the on-hand-logistics resources (spares, engines, and consumables) support the wartime tasking. SAM also identifies potential logistics limitations (i.e., resources and processes) which need to be improved to increase the probability that required performance levels will be met.

System Support Manager (SSM)—The lead individual at an AFMC logistics center responsible for support when the single manager (SPD, PGM or MGM) is located at another center. The SSM reports directly to the single manager.

Type, Model, Series Modification (TMSM)—Standard nomenclature for engines according to MIL-STD-879.

Unscheduled Engine Removal—An unplanned engine removal due to failure or malfunction.

Unscheduled Maintenance—Unplanned maintenance actions required.

War Reserve/Readiness Engines (WRE)—The quantity of serviceable engines required to sustain an operational unit's war effort until pipelines are filled and repair facilities are available.

Attachment 2

ENGINE MANAGEMENT

A2.1. Selected Engines. Selected engines provide propulsion power to manned and unmanned aircraft. TO 00-25-254-1 lists the specific engine TMSMs that are managed according to this AFI. This AFI excludes the following engines:

A2.1.1. Reciprocating engines, engines that provide auxiliary aircraft power, and ground-based engines.

A2.1.2. Engines that are certified by the Federal Aviation Agency and maintained by contractor logistics support (e.g., installed on cargo and passenger aircraft that are essentially commercial models).

A2.1.3. Engines installed on classified aircraft.

NOTE:

These latter two categories of engines have their own equivalent management systems.

A2.2. Engine Asset Management. SRAN engine managers input CEMS data by serial numbers according to TO 00-25-254-1 for all accountable and non-accountable tracked items. SRAN and MAJCOM EMs use these data to evaluate the health of engines in individual accounts and to predict removals, repair, and spare engines. The PPGM, engineers, actuaries, and item managers use these data to help manage the engines, predict requirements (for acquisition, distribution, repair, and retention), maintain repair facilities, and manage spare parts to repair engines and components.

A2.3. Whole Engine Accountability. This AFI identifies accountability requirements for whole engines and selected critical engine parts. The Air Force uses the standard supply system to account for critical engine parts.

A2.3.1. Engine SRANs. The PPGM manages all engines identified in master SRAN FJ2031. SRAN EJXXXX or FJXXXX (as specified in TO 00-25-254-1) is a sub account to SRAN FJ2031 and provides accountability for engines. All activities possessing CEMS accountable engines require a SRAN. Air Force, AFRC, and ANG activities are FJXXXX SRANs. Contractors and interservice support activities are EJXXXX SRANs. Procedures for obtaining or deleting SRANs are in TO 00-25-254-1.

A2.4. Engine Life Management Plans:

A2.4.1. Each PPGM managed engine TMS, excluding AGM engines, will have an ELMP updated and on file. The ELMP is a living, dynamic, documented process to ensure optimum maintainability and supportability are achieved throughout the life cycle of the engine. ELMP provides a foundation for lifetime management and maturity of each engine system and implements reliability centered maintenance concepts.

A2.4.2. Each engine system is different and the individual ELMP will vary depending on life cycle progress. However, the ELMP template at annex 1 of this attachment further defines the ELMP process and provides a guide for developing life management plans.

A2.5. Whole Engine Requirements.

A2.5.1. Tools. The Air Force uses measurement techniques, modeling, and comparability analysis methods to develop whole engine flow times from the evaluation of major assembly repair requirements and probabilities. Otherwise, pipeline times use statistical analysis and adjustment techniques based on CEMS pipeline data.

A2.5.2. Engine Factors Policy. Forecasted and official factors are used to calculate spare engine requirements. The factors include whole engine removal rates, JEIM return rates, and pipeline times.

A2.5.2.1. Within each type factor, values are required for three time frames: peacetime, war surge, and war sustained. Factors are established from data analysis supported by documented assumptions and rationale. The sustained values may be the same as the peacetime values when data are not available. Maintain permanent documentation of supporting data, rationale, assumptions, and decisions as an appendix to the ERO meeting minutes. Decisions without supporting data must be fully explained in the documentation.

A2.5.2.2. Mathematical modeling and computer simulation are used to develop factors whenever practical.

A2.5.2.3. The factors are developed using the assumptions that engines have a zero wear out rate and that all unserviceable spare engines are capable of being repaired.

A2.5.2.4. Engine factor changes are approved for use in requirements calculations when coordination has been obtained among the operating commands and the engine SPD. Factor changes are published in TO 2-1-18.

A2.5.2.5. Review and update engine factors at least annually.

A2.5.2.6. Release engine factors on any manufacturer’s engine to another manufacturer when requested.

A2.5.2.7. Consider using the official factors for engine acquisition programs when there is significant military or commercial performance and reliability experience.

A2.5.2.8. Develop factors for the TMSM or combined TMSM at either world-wide or command level due to mission, operation, support differences, or requirements calculations methods.

A2.5.3. Forecast Factors. Forecasted factors (formerly called mature factors), determine spare engine acquisition requirements and are the basis for the engine life-of-type buy concept. They are estimated factors that will be achieved when the engine has stabilized through operational experience. Stability is normally reached either:

Between 0.75 to 1 million fleet engine flying hours.

Five to seven years after initial operational capability (IOC).

Earlier for commercial or military engine model derivative programs.

Forecasted factors represent the average requirement between the period from initial program stability to the end of economic life.

Develop forecast factors using all sources of information, including planned improvements. Use the latest data of comparable TMS engines, the manufacturer's data analysis and recommendations, and actual operational experience when available. Do not include data from early engine program performance or support irregularities to forecast factors for the life-of-type buyout.

Update until the time of buy-out. Afterwards, establish new factors when impacts are occurring in engine support due to significant engine program changes. Changes include revisions to operating scenarios, support concepts, reliability, and maintainability.

A2.5.3.1. ERO Factor Responsibilities.

A2.5.3.1.1. The ERO supports the AFMC engine SPD in developing forecasted factors.

A2.5.3.1.2. Start development of forecasted factors no later than the first ERO prior to the need for the first spare engine acquisition requirement calculation for a new TMS engine. Factors shall be reviewed at least annually until buy-out, or as required as the program stabilizes.

A2.5.3.1.3. Review and evaluate all pertinent facts, data sources, assumptions, and rationale impacting factor values. Reconcile disparities between data sources. Assess trade-offs among factors in terms of economics and risk to effective engine logistics support.

A2.5.4. Official Factors. Official (actual) engine factors are used in spare engine distribution, overhaul, retention, and reclamation requirements computations, and in capability assessments. Official factors are developed by the engine SPD from recent historical data. AFMC maintains an actuarial forecasting system that projects engine removal rates for the programming years based on age-related engine removal histories (CEMS data) and quantitative analysis techniques.

A2.6. Whole Engine Removal Rates. Engine removal rates are the number of engines removed per thousand flying hours. Engine managers use engine removal and JEIM return rates to determine spare engine requirements. Internal procedures to document estimated engine removal rates should include:

A2.6.1. Baseline assumptions and estimating relationships, which include individual component estimates in an engineering summary.

A2.6.1.1. Rationale for changes between contractor submittals.

A2.6.1.2. Rates appropriate to determine spare engine requirements, excluding engine removals projected solely to replace line replaceable units.

A2.6.1.3. Develop removal rates that include all reasons for removal that require a spare engine: unscheduled, scheduled, and non-usage removals at any maintenance level.

Incorporate into removal rates effects of maintenance policies that govern the removal of life limited components.

A2.6.2. Develop sustainability removal rates by making adjustments to the peacetime rate parameters. Some of the elements to consider are:

A2.6.2.1. Sortie duration and mission severity.

A2.6.2.2. Runway usage (improved or unimproved).

A2.6.2.3. Load weights.

A2.6.2.4. Operational environment.

A2.6.2.5. Frequency and types of landings and take-offs.

A2.6.3. Prepare removal rates based on mission profiles and weapon system utilization rates contained in the latest Air Force programming documents. Develop wartime engine removal rates when wartime operating conditions (actual or anticipated) differ significantly from peacetime operating conditions. A coordinated MAJCOM (operations and logistics planners) and ALC (engine managers) effort is required to develop the estimated wartime removal rates and ensure wartime operating conditions are appropriately considered.

A2.7. JEIM Return Rates. Develop return rates using a coordinated maintenance concept and other integrated logistics support (ILS) elements.

A2.8. Pipeline Times. Develop estimated times for the engine to flow through each segment of the pipeline. This is the average time to accomplish all necessary pipeline processes. Elements are frequency of occurrence, required manpower, facilities, tools, equipment, parts, technical data, and delays for maintenance and supply.

Use measurement techniques, modeling, and comparable analysis methods to develop whole engine flow times from the evaluation of major assembly repair requirements and probabilities, when practical. Otherwise, develop pipeline times using statistical analysis and adjustment techniques on CEMS pipeline data. Obtain the transportation times of the depot and centralized JEIM repair facilities retrograde and resupply cycles using the Uniform Materiel Movement and Issue Priority System (UMMIPS) transportation standards according to DoD Directive 4410.6. Include the effects of floating stock assets on the critical path flow times of subassemblies in repair.

A2.9. Engine Procurement Policy. Limit spare engine acquisition to the smallest number of engines essential to support the largest programmed requirement for each increment of the weapons system's production contract. During Demonstration and Validation phase, perform an analysis to determine the cost effectiveness of making a buyout decision for the TMSM engine. If the TMSM engine is a commercial or commercial derivative engine, conduct a life cycle cost analysis considering the benefits of a fixed inventory and the associated costs for support and modifications. Before engine production ends, procure the quantity necessary to support the weapon system's life cycle.

A2.9.1. Procedures for Documenting Engineering Estimated Spare Engine Removal Rates. The PPGM ensures internal procedures are developed to document annual engineering reviews and resulting estimates for the annual source selection of spare engines during acquisition. Internal procedures are established to document engineering data, factors, and assumptions to ensure effective reviews are conducted, continuity of efforts are maintained as personnel change, and communications are maintained between key offices. Internal procedures include, but are not limited to:

A2.9.1.1. Baseline engineering assumptions and estimating relationships (including individual component estimates) in an engineering summary.

A2.9.1.2. Rationale for changes between yearly estimates and between contractor submittals.

A2.9.1.3. Rates appropriate for use in determining spare engine requirements (excluding engine removals projected solely for replacing line replaceable units).

A2.9.2. Inventory Adjustments to Acquisition Requirements. A source of supply to offset acquisition requirements can be:

A2.9.2.1. Transferable retention engines in Air Force inventory, other DoD components, and other government agencies.

A2.9.2.2. Research, development, test, and evaluation engines, and excess or potential excess engines that can be economically modified to the new configuration. After modification, convert these engines to spares as soon as possible.

A2.9.2.3. Excess engines identified anytime during the life cycle may be used as donors for the planned recovery of assemblies and spare parts.

A2.9.3. Frequency. Forecast the next fiscal year's stock level by 15 April of each year. The deadline for acquisition programs for the Budget Estimate Submission (BES), Amended Budget Estimate Submission (ABES), and the POM cycle is 1 Aug of each year. Perform budget calculations for acquisition and distribution in time to support the budget process. Recalculate requirements whenever a significant event occurs.

A2.9.4. Engine Manufacturers Warranty Program. Consider warranties for each new TMS engine acquisition. Warranties must be easily understandable, enforceable, affordable, and not disrupt existing procedures for logistics support or data systems, nor require extensive new data systems to administer.

A2.10. Engine Repair and Overhaul Requirements. MAJCOMs forecast engine repair and overhaul requirements prior to periodic negotiations with engine depots. Procedures and models are established to forecast requirements to support the stock level policy, special projects, security assistance programs support, and consolidate worldwide engine repair and overhaul requirements.

A2.11. Retention, Reclamation, and Disposal. AFI 23-501, *Retention and Transfer Policy*, identifies requirements for retention of spare engines. DoD Directive 4000.19, *Interservice, Interdepartmental, and Interagency Support* (April 15, 1992), and joint regulations govern spare engine reclamation and disposal. Reclamations are excess to Air Force, other services, and FMS system support needs. The only exception is for engines on the save list of donated aircraft and missiles (see AFMAN 23-110CD, *USAF Supply Manual*. Also see **Attachment 4** of this AFI**.**

A2.12. Excess Engines. If there are excess engines in production, terminate or modify the contract to eliminate the excess. If the engines are out of production, dispose of the engines during the phasing out of the aircraft or missile. Reclamation engines and residue are transferred to the local Defense Reutilization and Marketing Office (DRMO) activity for disposal according to AFMAN 23-110CD. Also see **Attachment 4** of this AFI.

A2.13. Packaging, Handling, Storage and Transportation. Protect engines from corrosion, shock, and vibration damage during transportation, handling and storage according to TO 2J-1-18 and TO 00-85-20. Report damaged items due to improper packaging according to TO 2J-1-18, AFJMAN 24-204, *Preparing Hazardous Materials for Military Air Shipment*, and AFJI 23-215, *Report of Item and Packaging Discrepancies***.** TO 00-85-20 specifies shipping devices for the TMS engine.

A2.14. DD Form 1348-1A, Special Preparation Instructions for Engines. The SRAN EMs prepare

DD Form 1348-1A, **Issue Release/Receipt Document**, for all engine shipments and transfers. Retain this form until CEMS records are updated. Prepare a form for each shipment and transfer in accordance with T.O. 00-25-254-1.

A2.15. Comprehensive Engine Management System (CEMS) (DSD D042). CEMS provides a wide range of automated information system capabilities for engine management. TO 00-25-254-1 provides CEMS reporting requirements and procedures and TO 00-25-254-2 provides procedures on using data in CEMS. CEMS identifies owning SRAN, status, condition, and configuration information for all CEMS accountable engines by serial number and Configuration Item Identifier (CII). CEMS also incorporates the Engine Configuration Management System (ECMS). The ECMS capabilities of CEMS include the following:

A2.15.1. Configuration accounting and control by serial number and CII for CEMS accountable whole engines and CEMS non-accountable tracked items.

A2.15.2. Management of Time Compliance Technical Orders (TCTO) including serialized applicability and completion status.

A2.15.3. Tracks life limits and life expended for life limited parts also reference TO 00-20-5-1-X series.

A2.16. Engine Trending and Diagnostics (ET&D). CEMS IV is the Air Force standard system which processes, correlates, and plots engine performance, oil analysis, and maintenance data used to diagnose the health of an engine for engine maintenance shops. Use ET&D for all engines. Health monitoring and diagnostic systems for newly developed TMS engines will be compatible with ET&D according to TO 00-25-257. These personnel use ET&D:

A2.16.1. Base and depot-level engine maintenance shops to monitor trends in engine health, perform diagnostics, and monitor systems according to TO 00-25-257.

A2.16.2. Flight line personnel to collect raw engine data and transfer data to the base engine maintenance shop for analysis.

A2.16.3. Aircrew personnel to annotate appropriate flight data for later transfer to the base engine maintenance shop for analysis.

A2.16.4. Engine oil analysis personnel to send oil analysis program data to appropriate base engine maintenance shops for inclusion in ET&D analysis.

A2.16.5. Base engine maintenance shop ET&D personnel to send ET&D records to the depot with engines, controls, accessories, maintenance items subject to repair and modules returned to depot for overhaul.

A2.17. Deficiency Reporting. All reportable deficiencies on engines covered by this AFI shall be documented, reported, and resolved in accordance with T.O. 00-35D-54.

ANNEX 1--ENGINE LIFE MANAGEMENT PLANNING

Purpose. Assist engine program managers to develop Engine Life Management Plans (ELMPs). The ELMP is a living, dynamic, documented process which continuously assesses the field performance of engine components to ensure the best maintainability and supportability practices are used to achieve the optimum safety, performance, reliability, and life cycle cost capabilities of the engine TMS. Developing, implementing, and maintaining ELMP will help engine program managers execute comprehensive life management efforts throughout an engine's life cycle. Content of individual ELMPs will vary depending on life cycle maturity; however, PPGM managed engine TMS, except AGM engines, must have and maintain an ELMP.

Objective. Structure a process and program that assures each engine TMS attains its inherent safety, performance, reliability and life cycle cost capabilities and restore safety, performance, and reliability if deteriorated, while assuring supportability. The ELMP defines the approach to attaining structured and operationally verified growth to mature life limits of durability for fracture-critical engine components. ELMP gathered data will be used to assess and update life limits, maintenance and support plans, for CIP inputs and modification programs, and update factors for spare parts buy and repair computation programs lead time away from need dates.

A comprehensive engine life management program is a structured series of:

Plans (Engine Structural Integrity Program (ENSIP) master plan, safety plan, structural maintenance plan, etc.).

Life limits (durability and fracture-critical components, etc.).

Toll gates (life limit growth plans, etc.).

Programs (Field Service Evaluations (FSE), Lead the Fleet (LTF), Non Destructive Evaluation/ Non Destructive Inspection (NDE/NDI), CIP, maintenance program, etc.).

Events (Analytical Condition Inspections (ACI), Tear-down Deficiency Reports (TDR), Deficiency Reports (DR), etc.).

Required data to enable Engine Program Managers (EPMs) to obtain optimum engine safety, performance, reliability, supportability, and life cycle cost capabilities.

The key to managing engines throughout their life cycle is continuous life management planning with periodic updates based on changing planning factors, actual operational and maintenance experience, and other data specified in this document. ELMP is a tool for the engine program manager, developer, using command, supporter, and Original Equipment Manufacturer (OEM) to coordinate plans, programs, events, and data necessary for safe, reliable, and economic engine management.

The PPGM reviews initial ELMPs and ensures annual reviews and periodic updates are accomplished. Updated and approved ELMPs can drive requirements changes in affected using commands. MAJCOM coordinated and PPGM approved ELMPs are forwarded to HQ USAF/ILM for review.

Engine Life Management Planning. The technical basis for ELM programs is the Engine Structural Integrity Program (ENSIP), as defined in MIL-STD-1783. However, ELM programs extend beyond ENSIP to other areas such as life prediction, life assessment, maintenance, and field management. Periodic verification events and inspections provide the data needed to ensure engine components reach mature life limits while retaining required performance characteristics. In addition these events and inspections provide inputs into the Component Improvement Program (CIP) and modification programs for redesign and replacement of components that do not reach their expected mature life limits in actual field usage. They also feed data into spare parts and repair requirements and update factors to assure supportability.

Development of Engine Life Management Plans. ELMPs shall be developed and updated for each PPGM managed engine TMS, except AGM engines. Engine Program Managers (EPMs) are responsible for developing initial ELMPs for their weapon system and updating the plan throughout its life cycle. The ELMP template in this annex is a guide for developing individual life management plans and should be followed to the fullest extent possible. However, individual ELMPs can be tailored for unique requirements of a specific engine.

Engine program managers coordinate individual ELMPs with the Maintenance Planing Working Group (MPWG), the Maintenance Planning Group (MPG), and with the designated engine ALC/LP prior to submission to the PPGM. The PPGM reviews the plans for consistency, applicability, and mission impact before approving and forwarding to HQ USAF/ILM for review. The EPM notifies the using commands of operational impacts and resource requirements.

Operational Use and Updating Engine Life Management Planning.

ELMP reviews and updates are required annually. Document and list the annual reviews and updates in the change record in the plan. If necessary, ELMP updates can be completed out-of-cycle, when factors change, so that life management goals need to be recalculated. Communication among users and supports must be continuous and timely to maintain performance and reliability.

During initial engine deployment, safety, performance, reliability, durability, and usage data are collected to transition the planning from initial design life projections to actual field experience. The data is used to update the ELMP, engine maintenance and support plans, and spares requirements. ELMP generated data can also assist in updating forecasting factors for spare parts, repair, CIP, and modification programs. The data is also used by the Engine Program Manager and MPWG to establish maintenance plans and an engine build policy based on “best value” analyses to minimizes engine operating cost and optimize reliability and time on wing.

Engine Maintenance Planning.

Engine maintenance plan and logistics support plan inputs are components of a comprehensive ELMP. Major elements of maintenance and support plans are developed in the initial Engineering, Manufacturing and Development Program (EMD). Some of these components are Preliminary Engine Development/ Component Model Specification, Reliability Centered Maintenance (RCM) analysis, Failure Modes, Effects, and Criticality Analysis (FMECA), the initial fracture mechanics analyses conducted under the ENSIP, and the design verification through Accelerated Mission Testing (AMT).

An Integrated Logistics Support Working Group (ILSWG) reviews Initial Spare Engines, Initial Spares Support List (ISSL), and Provisioning, and War Readiness Spares requirements to ensure initial operational capability (IOC) and base activation support is available. Participants in the ILSWG process are logistics, engineering, and maintenance specialists from the ALC, using commands, and system contractor when appropriate. This experience base forms the nucleus for the MPWG.

Engine build policies are designed to ensure the highest safety standards, restore required performance and reliability, optimize time-on-wing, and minimize life cycle cost (LCC). Consider mission requirements and changes, time-on-wing goals, LCC impacts, using command needs and performance margin when developing build policies. Base policies on "best value" analysis with MPWG review. If variable build policies are implemented, consider variable pricing that recognizes the best value analyses.

Maintenance Planning Working Groups (MPWG) review and recommend changes to each ELMP, maintenance plan, and support plan. The MPWG performs a vital and integral function throughout the life cycle of an engine, providing input to the developer, supporter, and using commands to assure adequate support for peacetime and wartime missions/readiness requirements. The MPWG reviews ELMP impacts, and recommends adjustments to support and maintenance plans to optimize engine readiness. MPWG recommendations are reviewed by the Maintenance Planning Group (MPG). The MPWG meets twice annually and provides timely recommendations and feedback to the MPG.

Spares Requirements Processes. Spares requirements processes impact ELM. Data from life limits, inspection intervals, and engine build policies impact requirements determinations and requirements policies affect engine life management planning. Parts availability and repair requirements must be communicated back to the Engine Program Manager (EPM) for consideration in ELMP execution.

Communicating requirements and data between ELMP and spares requirements processes is essential. Consider the following data for transfer:

Inspection Data. Included in this category is data obtained from ACI, TDR, Material Review Boards (MRB), one time engineering workarounds, NDE/NDI programs, and overhaul experience. This data provides a valuable tool to predict unscheduled engine removals. Provide this data at the earliest opportunity after completion of inspection, ideally in time to affect the next scheduled computation cycle. Incremental reporting should be considered.

Build Policy. Build policy is documented in appropriate T.O.s and requirements shall be included in the statement of work or the statement of objectives for the depot and for repair contractors.

Time Change Removals. Time change (ENSIP life limits) removal data are captured primarily in the CEMS database for parts life tracking.

Configuration Changes. Configuration changes from CIP and modification programs are essential to resolving life management deficiencies and are an important part of the continuing engine life management process.

Interim Contractor Support and Warranty Parts Usage Data. Interim support contracts and warranty programs include provisions to provide usage data for spares requirements.

Component Improvement and Modification Programs.

CIP provides critical engineering support for active inventory engines. CIP is one element of ELMP which develops solutions to increase safety of flight, correct operationally identified deficiencies, improve reliability and maintainability, and reduce cost of ownership. The Engine Advisory Group (EAG) reviews CIP integrated task listings and allocations biannually.

Engine modifications are incorporated into production and fielded engines to correct service revealed deficiencies corrected through the CIP. Modifications restore or enhance engine performance, safety, reliability, maintainability, or reduce life cycle costs. Engine modifications frequently include configurations developed and qualified in the CIP program and require updates in ELMP.

ELMP Template Outline.

Section	Description
Title Page	Show the engine TMS name, then the name, office, DSN, and e-mail address for the Engine Program Manager, Lead Engineer, Item Manager, and Equipment Specialist. Show the date of the report.
Coordination Page	Each plan will be signed by the Program Manager, LPDivision Chief, LP Director, MAJCOM LGM, aircraft SPD, and the Propulsion PGM.
Table of Contents	After the table of contents, include a list of tables, list of abbreviations and terms, and a revision history.

Executive Summary	(Section 1.0) State the goals and objectives of the engine program and summarize progress toward meeting them. Discuss the management theme: Reliability Centered Maintenance. In a table, show the number of items involved in each of these programs: ACI, LTF, Mission Usage Survey, AMT, and TDR. Show another table with rows labeled TCTOs, studies/analysis, modifications, CIP tasks, and other programs. Label the columns safety, reliability, parts support, or operational performance and fill in the matrix showing where each initiative in the ELMP fits in. Summarize the forecasted budget.
Introduction	(Section 2.0) Discuss the long term goals and objectives of the Life Management Plan in detail without regard for resource constraints. Discuss separately the impact of personnel, equipment, and funding shortfalls.
Engine Description	(Section 2.1) Present a technically detailed description of the TMS.
Aircraft Description	(Section 2.2) Describe the airframe propelled by this engineand its unclassified performance envelope. Discuss all the common operational and training missions flown by the aircraft including the time and environmental factors involved with each.
Engine Mission Description	(Section 2.3) Analyze the aircraft missions in terms of their technical impact upon the engine (thermal cycles, LCF counts, throttle excursions, augmentor/thrust reverser usage, FOD). Define how LCF and thermal cycles are calculated. Describe how the mission has changed since the initial design was fielded, if applicable. If the TMS is based on a commercial application, explain the analysis performed to assure comparability.
Engine Life Management Concept	(Section 3.0) Summarize the philosophy and execution of theELMP in support of the objectives stated in the Introduction. This section is a condensed version of everything else that follows in the ELMP.
Safety of Flight	(Section 3.1) Summarize the discussion in the Flight Safety section.
Reliability Enhancement	(Section 3.2) Describe efforts to increase of sustain the current level of engine reliability, and the impact of constraints.

Maintenance Concept	(Section 3.3) Summarize the Build Policy section, the levels of maintenance used, the inspection program, and any impacts of engine modifications to-maintenance practices. State the impact of constraints.
Spare Parts Support	(Section 3.4) State the general status of the supply chain and sources. Summarize the Parts Usage Prediction section. Discuss maintaining the viability of sources of supply.
Scheduled Removals	(Section 3.5) Discuss the engine program's SER rate goal and status. Include a table of historical and projected engine counts and operating hours. Chart historical, current, and projected Mean Time Between Removal, both SER and UER, including the current goal and inherent time on wing (manufacturer's specification). Project the data forward at least four years. Explain any changes to the Scheduled MTBR trend.
Unscheduled Removals	(Section 3.6) Discuss the engine program's UER rate goal and status. Include the "Top 10 reasons for Unscheduled Removals" actuarial table. Reference any CIP tasks or modifications designed to improve the UER rate. State the impact of constraints.
Design Parameters	(Section 4.0) Describe how well the original design-qualification matches the mission descriptions in the Engine Mission Description section. Explain how the engine is qualified for new missions.
Design Life Limits	(Section 4.1) For a new ENSIP engine, describe the design assumptions of fracture and durability critical components. For a mature or commercial derivative engine, discuss its history.
Design Verification	(Section 4.2) Discuss the Accelerated Mission Test (AMT) program for this engine. Include the AMT-duty cycle chart for the missions described in the Engine Mission Description or, if not available, the initial qualification cycle.

Flight Safety	(Section 4.3) Include two charts depicting the Non-Recoverable In Flight Shutdown and Class-A mishap rates. Discuss the trends in these charts, the program goal, and theplan to reach the goal. Include a table showing open risk management items with the following data: Event or Part; Risk Mitigation (inspection, speed line, etc.); plan to eliminate (CIP, mod, etc.); incorporation date. Discuss the curren-tactive safety TCTOs and attach a complete list.
Operational Verification Plan	(Section 5.0) Describe the activities and tools used to ensure engineering assumptions match field usage. Include a table indicating whether the following items are used now, planned now, or not planned: mission usage survey, PACER, ACI, TDR/MRB, FSE, MPWG action items. Include a table of parts life limits with these data: Component; Life Parameter (TACs, EFH); Tracking Method; Data Archive; Initial Life, Current Life, Extension to Current Life Considered, and Inherent/Potential Life.
Initial Life Limits	(Section 5.1) State how the initial life limits were established, the assumptions made, and why any item is still on its initial limit.
Engine Monitoring	(Section 5.2) Describe the engine monitoring devices, both hardware and software, that collect and/or store data. Also describe the use of any non-destructive inspections and the role of Engine Trending and Diagnostics (ET&D).
Parts Life Tracking	(Section 5.3) Discuss the significant drivers (safety, durability, economic) to the life of key parts.
Life Limit Growth Plan	(Section 5.4) Explain the current, planned, and potential life limits for key parts and the plan to grow the current limit.
Inspections	(Section 5.5) Describe the kinds of inspections performed on the engine, the ownership costs associated with them, and the impact upon SER and UER rates. Include a table showing: Part/Assembly Inspected; Interval; What's being looked for; Man-hours to perform; and Resolution item and date. Summarize T.O. guidance for routine inspections. Also include a graph of the historical maintenance man-hour backlog, by year, and the future goal.

Parts Usage Prediction	(Section 5.6) Describe the mechanism by which ELMPinitiatives and engineering changes drive D041 and DLA input factors. Refer to the 1997 Parts Supportability Study (PSS) and 1997 Engine Independent Review Team (EIRT) findings and the program's specific responses to those findings and the program's specific responses to those findings. If response constrained, quantify the impact.
Maintenance Management	(Section 6.0) State the objectives of the maintenance program and how the levels of maintenance (2LM, 3LM) are controlled. Describe your reliability enhancement initiatives.
Maintenance Planning Working Group	(Section 6.1) Summarize the history of the program's MPWG and typical meeting topics. List the members, who has voting authority, and identify the chair.
Engine Build Policy	(Section 6.2) Restate the goals of your build policy from the Maintenance Concept section and quantify them. Describe in detail the RCM-based matrix of what's fixed and when. State the level, depth, and content of reconditioning or replacement at each visit to the depot, JEIM, and contractor. For modular engines, discuss efforts to build reliability into each module, then into the whole engine.
Depot Maintenance	(Section 6.3) State the plan to enhance production output and reduce overhead costs, including the goals for cost control, materiel control, and IPE availability. If these issues overlap with other engine programs, describe the interface with them.
Component Improvement and Modification Programs	(Section 7.0) Describe the general role and benefits of CIP and mods to this engine's program including a comment about the magnitude of the annual CIP effort (i.e. $/yr.).
Component Improvement Program	(Section 7.1) Describe your CIP process. Use deficienciesalready discussed as justification for tasks in action. Include a graph of the current and past several years of CIP funding to show the magnitude of your program by specific expenditurecategories (Reliability, Repair, Safety). Include a table summarizing the quantity and funded/unfunded dollaramounts of Safety, Reliability Enhancement, and Repair Procedure Development CIP tasks. Attach a complete task list.

Modification Program	(Section 7.2) Include a table of approved and proposed engine modifications including: modification description; funded amount; unfunded amount; and method (forced retrofit, attrition, etc.) and completion date. Attempt to quantitatively state the impact of unfunded mods upon reliability, cost of ownership, or another ELMP metric.
Reliability Enhancement	(Section 7.3) Provide the details of the reliability goals, hardware, and programs discussed in Reliability Enhancement and Maintenance Management, other than CIP tasks. Include "preferred spares" items. Includea table showing: Enhanced Item; Goal; Funded Amount; Unfunded Amount; Method and Completion Date. The "Goal" column could be any of reaching on-wingreliability goals, reducing the Reasons For Removal items, contributing to the composition of the engine build policy, etc. Attempt to quantitatively state the impact of unfundedreliability tasks upon safety, cost of ownership, or another ELMP metric.
Feedback	(Section 8.0)
D041	(Section 8.1) Specify and discuss the inputs to D041 spare parts forecasting mentioned earlier in the ELMP. State how those inputs are collected and how often are they translated into D041 factors. Discuss any special manual tweaking of those factors by the IMs. Evaluate how well the system issupporting your engine.
DLA	(Section 8.2) Present a similar discussion to D041, but focus on how well the DefenseLogistics Agency supports the engine.
Air Force Automated Tracking Systems	(Section 8.3) Give a detailed description of the program's interface to CEMS III, CEMS IV, ITADS, and other applicable Air Force-wide systems. Layout the jet-to-CEMS-to-actuarials data flow.
Local Databases	(Section 8.4) Describe tools used routinely for engine management which are not Air Force or DoD databases, such as an Excel spreadsheet on the EM's PC.
Contractor Support	(Section 8.5) Summarize the program's use of contractor support, identifying the parties involved and terms of the contracts. Detail exchanges of technical information.

User and SPD	(Section 8.6) Beyond the MPWG, describe other lines of communication between this engine program's management and the using MAJCOMs and aircraft System Program Director.
Associated Plans	(Section 9.0) *ENSIP Master Plan* (Section 9.1) Provide the document number for this TMS' ENSIP, or explain why this engine was not created to this specification. Explain unique features or exceptions to the ENSIP guidelines.
Logistics Support Plan	(Section 9.2) Applicable to Contractor Logistics Supported engines only. The LSS covers the spares acquisition concept, initial provisioning plan, support equipment, technicalmanuals, maintenance concept, engineering data, and training elements. Give the document number and discuss how well the current plan supports this ELMP.
Business Operating Plan	(Section 9.3) The Business Operating Plan provides the financial realities of what the engine management team and the customers have decided are achievable. Attach the plan and describe its evolution and status here.
Roadmap	(Section 9.4) A Roadmap study presents a long-range analysis of the propulsion needs of an aircraft and all engines will develop one. Summarizing the assumptions and findings of the most recent study.
Management and Budget Time Lines	(Section 10.0)
Master Time Line	(Section 10.1) Document program management planning in a table listing each project discussed in the ELMP. For each, put a code indicating implementation milestones and duration. The time line should include the prior and current year and a projection 13 years into the future. There's no limit to thenumber and types of codes in the table. Example project codesare: (ES) spares buys; (UP) configuration changes; (M1) major mod starts; (M2) major mod ends; (SP) spare parts buy; TO) tech data changes, and ACI.

Funding Requirements (Section 10.2) Document the consolidated fundin-grequirements by year as justified throughout the ELMP. Group specific tasks and list each by the ap-propriationcategory, such as 3010/BP11, 3010/BP16, 3080, 3400, 3600, MSD, and DPEM. Include a Prior Year and Current Year column showing ap-propriation level. Show projected allocation of funding for the budget year as "Year 1" then project requirements 13 years into the future.

Updating the LMP- Data elements which can change significantly between the EMD phase and the operational deployment environment that impact the need to update the LMP include but are not limited to the following:

Actual flying hours and cycle rate/engine flying hour (EFH)

Safety considerations

Basing and deployment locations

Mission mix and severity (thrust loading, flight envelope, etc.)

NDI requirements

Changing component retirement and/or inspection intervals due to updated analyses, testing and field experience

Repair development

Configuration changes

Economic consideration (lack of funds or fluid fund-ingprofiles)

Change in maintenance or support concept (2 level vs. 3 level, organic vs. contract, agile logistics)

Various sources of data exist which will provide information during the ELMP periodic review or to help assess whether an out-of-cycle update is required. These sources include, but are not limited to:

USAF Programming Documents (PA, PG, PD, etc.)

Mission usage surveys

Updated AMTs

Safety requirements

Field experience

Field Service Evaluation (FSE) reports

Lead the Fleet (LTF) programs

Analytical Condition Inspection (ACI) reports

Tear down Deficiency Reports (TDRs)

Deficiency Reports (DRs) - AF

Product Quality Deficiency Reports (PQDRs) - DoD

Comprehensive Engine Management System (CEMS/DO42) reports

Actuarial data (DO42)

Reliability and Maintainability Management Information System (REMIS)

GO50

Parts Condition Monitoring (NDE/I) inspections

Warranty returns or Interim Contractor Support (ICS) parts usage reports

Other indicators that a revisit to the ELMP is warranted include such items as:

New technology or analysis techniques

New NDE/NDI capabilities

Aircraft and engine modifications

New capabilities or ordinance

Maintenance and support concept changes

Updates to the ELMP impact numerous areas which have to be reviewed and revised to implement these changes. These include, but are not limited to:

Life Limits - definition of critical features, the actual limit itself, etc., may change which would. require technical order changes.

Inspections - inspection capability, frequency (intervals), and where accomplished may be affected.

AMT Update - the cyclic content, duration of test, hot time accumulated, altitude, etc., may require updates to keep the AMT a viable test which is representative of the latest mission usage

Usage Monitoring / Parts Life Tracking - new parameters to monitor, new criteria for existing parameters, etc.

Engine Trending & Diagnostics (ET&D) - new algorithms, new instrumentation/capability.

Build Policy - maintenance build policy at the organizational, intermediate and depot levels to restore safety, performance, reliability and life cycle cost capability.

ANNEX 2--ENGINE METRICS

Engine Technical Metrics:

Engine Line Replaceable Unit Removals

Description:	Number of engine line replaceable components removed at organizational and intermediate (O&I) level per 1000 engine flying hours (EFH)
Objective:	Monitor component reliability
Data source:	Comprehensive Engine Management System (CEMS)
Narrative:	The quantity of engine components removed from engines at O&I level (for all engine related How Mal Codes, excluding 800, 804, 875), where the component is a known Configured Item Identifier (CII) at IND level 3 IAW T.O. 00 25-254-1.

NOTE: This will include the F100 series High Pressure Turbine Module (CII DF10050).

Maintenance Man-hours

Description:	Total Maintenance Man-hours expended at base level per EFH. Includes total maintenance man hours and TCTO maintenance man-hours per EFH.
Objective:	Highlight engine impact on maintenance. Engine Reliability and Maintainability (R&M) indicator.
Data source:	REMIS (Maintenance Man-hours) and CEMS (TCTO maintenance man-hours)
Narrative:	Quantity of Maintenance Man Hours expended at base level per engine flying hour. Also, the quantity of maintenance man hours expended against all Time Compliance Technical Orders (TCTOs) for a given time period. This is not delineated by each TCTO, but rather indicates the cumulative man-hours performed against all TCTOs delineated by TMS. The data source for maintenance man hours is REMIS. The data source for TCTO maintenance man hours expended EFH is CEMS.

Shop Visit Rate (SVR)

Description:	Engines removed for scheduled and unscheduled maintenance per 1000 EFH. This will be displayed by scheduled, unscheduled, and total removals. When applicable, engine Primary Item Description (PID) goals will be displayed.
Scheduled Removal:	Engines removed for time/cycle limit
Unscheduled Removal:	Engines removed for malfunction or discrepancy
Objective:	Highlight engine reliability and maintainability
Data source:	CEMS
Narrative:	This metric demonstrates the total number of engines removed for scheduled maintenance per 1000 EFH, the total number of engines removed for unscheduled maintenance per 1000 EFH, and the total number of engines removed for both scheduled and unscheduled EFH

Mean Time Between Maintenance (MTBM)

Description:	Mean time between maintenance actions performed on an engine
Objective:	Engine reliability indicator
Data source:	CEMS
Narrative:	The average time between all maintenance events associated with the engine This includes corrective maintenance associated with inherent, induced, and no-defect malfunctions.

Engine SEMR Metrics. For both War Readiness Engines (WRE) and Base Stock Level (BSL) metrics, SA-ALC/LR will forward the annual required and negotiated (authorized) amounts for each engine TMS to affected Weapon System Program Directors (SPDs), MAJCOM Engine Managers and HQ USAF/ILMY. Engine SEMR metrics will be reported semi-annually unless otherwise specified.

Net Serviceable Spares Engines/War Readiness Engines (WRE)

Description:	War Readiness Engines (WRE) is the number of net serviceable engines required to support a unit's war tasking. These engines are to be available to support a weapon system from the start of the war until resupply (via base repair and/or depot resupply) is established.

Required WRE:	WRE determined by the completed Propulsion Requirements System process to support the Air Force war tasking.
Negotiated (Authorized) WRE:	Level established due to insufficient assets or other constraints to support required WRE. Available assets are allocated against the requirement, this quantity is negotiated with the MAJCOMs.
Net Serviceable:	Actual serviceable assets on hand, that are not obligated to aircraft, that are available to be measured against the required/authorized WRE.
Objectives:	To determine if there are sufficient spare engines to support the Air Forces wartime mission. To determine if the Air Logistics Centers and MAJCOM operating units are working effectively to meet negotiated supportability levels.
Data source:	CEMS, SA-ALC/LR (required WRE, negotiated WRE)
Narrative:	The quantity of Net Serviceable (Serviceable Assets) engines for a given time period, where Serviceable Assets = Net Serviceables + Serviceable Due-Ins, as reflected by the Propulsion Unit Automatic Resupply report, calculated from "Bases with Levels."
Serviceable engines =	Serviceable engine awaiting maintenance or parts + serviceable engines in-work + serviceable ready for install
Net serviceable engines =	Serviceable engines - obligated engines for installation
Serviceable engines for WRE =	Net serviceable engines + serviceable engines due in

Net On-Hand Engines/Base Stock Level (BSL)

Description:	The number of spare engines (serviceable and unserviceable) required at the base level to support the Air Force mission to an 80% ready rate for combat coded units and 70% ready rate for non-combat units. Note: WRE is a subset of BSL.
Objectives:	To determine if there are sufficient spare engines to support the Air Force peace and war time missions

Data Source:	CEMS, SA-ALC/LR (required BSL, negotiated BSL)
Narrative:	The quantity of on hand spare engines (serviceable and unserviceable) required to support the Air Force mission.
On Hand Spare Engines =	Net engines on hand + serviceable engines due in + reparable engines due in

Average On Hand = Total Qty Net O/H / # days reported + Total Qty Serv D/Is / # days in period + Total Qty Rep D/Is / # days in period

Engines Not Mission Capable Supply (ENMCS)

Description:	The average percentage of time engines are in work stoppage condition awaiting parts from the supply system.
ENMCS Goal:	The acceptable percent of time engines are in NMCS status and/or the acceptable number of engines in NMCS status (10% or 10 engines for all TMSs).
Objective:	To determine if parts flow is adequate to support the field in the current operating environment.
Data Source:	CEMS
Narrative:	The average percent of engines that were NMCS (non-mission capable for supply reasons) during a given time period as reflected by the NMCS Uninstalled Engine Status Report. This rate is NMCS Days divided by Asset Days. (NMCS Days: the quantity of days a serviceable or reparable engine is not mission capable for supply. Asset Days: the quantity of uninstalled days of serviceable and reparable NMCS engines as of the end of the reporting period.)

Average # Uninstalled Engines = Asset Days / # days in reporting period

Average # NMCS Engines = NMCS Days / # days in reporting period

ENMCS Percentage = NMCS Days / Asset Days

Engine Time-On-Wing/Installed Time

Description:	The amount of time from engine installation to removal for scheduled or unscheduled engine maintenance.
Objective:	To minimize scheduled and unscheduled engine removals.
Data Source:	CEMS
Narrative:	The Maintenance Planning Working Groups for each engine TMS will establish the standard for that TMS. Through engine modifications, improved build practices, and optimizing parts replacement during scheduled maintenance intervals, optimum engine Time-On-Wing/installed time can be achieved that provides the highest reliability with the best life cycle cost. The engine standard should improve until it approaches or exceeds the Original Equipment Manufacturers projected rate

$$\textbf{Engine Time-On-Wing} = \frac{\textbf{Engine Flying Hours}}{\textbf{Scheduled and Unscheduled Engine Removals}}$$

ANNEX 3--CONSTRAINED SPARE ENGINE ALLOCATION DISTRIBUTION MANAGEMENT

General:

Air Force lead command for aircraft weapon systems is designated in AFPD 10-9. Lead command or agency is designated when more than one Air Force MAJCOM (or agency) possesses the same type weapon system. The other MAJCOMs/agencies are designated as “user” commands. If only one Air Force MAJCOM/agency possesses the weapon system, that MAJCOM/agency is the designated lead command.

In concert with AFPD 10-9, a lead command will be specified for each engine TMS. Lead command for engine TMS operated by active and ARC will prioritize requirements, resources, and schedules within a total force concept.

To facilitate readiness, when computed spare engine requirements exceed total spare engine inventory, the designated lead command will convene an IPT to negotiate and coordinated equitable allocation.

The IPT will be comprised of one core member from each of the TMSM MAJCOMs/agencies and ALC. The ALC engine manager provides the TMSM lead command engine manager with detailed, rolled up computations (by MAJCOM and unit), available spares, and recommended allocation. Within 30 days of data receipt, the IPT should meet and negotiate allocations and addresses any open issues. The lead command MAJCOM/LG resolves any remaining issues and conflicts should they arise. Lead commands report progress/allocation negotiations, and action item status from constrained engine conferences at the semi-annual EAG conferences.

The following proposed Constrained Spare Engine Allocation Process is a basic framework for future IPT meetings (it is not all inclusive and may be modified for unique requirements and needs):

ALC:

Prior to IPT conference

Review ALC Propulsion Requirements System (PRS) computed rolled up levels

Allocate 100% against peacetime requirement

Determine negotiated/projected Depot returns

Adjust Depot pipeline requirement (if required)

Compute wartime percentage against remaining engines

Determine depot safety levels allocation

ALC Engine Manager submits computed levels in standard format and suggested allocation to lead command --include depot requirements (peace and war time) by unit

Following the IPT conference

Publish negotiated levels to MAJCOMs within 7 days of meeting

Lead Command:

Prior to IPT conference

Review ALC allocated BSL/WRE levels

Host allocation IPT conference

Prioritize requirements, resources, and schedules

Following the IPT conference

Report allocation progress/negotiations, and action items to EAG

MAJCOMs:

Prior to IPT conference

Provide/justify additives (if required)

Identify command specific requirements and issues

Participate in IPT proceedings

Following the IPT conference

Identify negotiated levels to units

Transfer engines as required in accordance with T.O. 2-1-18

Attachment 3

SPARE ENGINE REQUIREMENTS COMPUTATIONS ACQUISITION POLICY

A3.1. General Policy. Acquisition requirements computations for spare engines are based on flying hours, demand rates (i.e., removal), return rates, and pipeline factors. These computations will be accomplished for peacetime and wartime.

A3.2. Acquisition Requirements for Operating Units and the Depot.

A3.2.1. Requirement Factors. Mature peace, war surge, and war sustained removal rates and standard pipeline times will be used with peace and wartime flying hour program inputs to compute requirements for engines. However, when the use of mature removal rates will result in the premature purchase of spare engines excess to operational requirements, removal rates based on peacetime operational or actual requirements will be used. Also, the engine computations will consider the issue of requirements over time, i.e., the requirement may be estimated year by year based on expected factors until the system reaches maturity, when there is a need to do so. The need will be determined by analyzing the shop visit rate and pipeline time trends, as well as any projected program changes.

A3.2.2. Acquisition Requirements. The quantity of engines to buy will be limited to the least number of engines required to support the aircraft over its expected life. These computations will be predicted on the most demanding peace and wartime sustained operational and logistics support scenario. Acquisition requirements are also driven by transportation time, number of sites, deployment scenario, and the supply and maintenance policies and concepts of the aircraft system.

A3.3. Computations. The microcomputer-based Propulsion Requirement System (PRS) allows any organization in the Air Force to compute whole engine requirements. It allows any organization in the Air Force to compute these requirements based upon the information required for the computation process. Each MAJCOM develops their own PRS Engine Requirement Scenarios (ERS) for Peace and War, based upon data provided from official Air Force flying hour document along with published pipeline factors and Actuarial Removal (ARI) data.

A3.3.1. Standard Computation. Regardless of the method or model, the following identifies the minimum computations required for both acquisition and distribution:

A3.3.1.1. Peace and War (Surge and Sustain). Separate computations for each TMSM engine which include the peak requirement for both peace and war programs including mobilization programs.

A3.3.1.2. Support Period. Includes the fiscal year immediately following the procurement lead time of the engine based on the aircraft delivery schedule.

A3.3.1.3. Additional Flying Hour Requirements. Short duration peaks are special mission support, alert, rotation hours or special surge requirements for wartime sorties called for by Defense Guidance or found in the standard planning and programming documents. Short duration peaks in flying hour programs are treated separately and validated with the command EM.

A3.3.1.4. Safety Stock Levels. Safety stock protects against pipeline shortages due to the uncertainty in the forecasted demand, repair production processes and transportation pipeline performance. Compute safety stock levels for:

A3.3.1.4.1. The depot based on repair and retrograde pipelines. If a TMSM engine is supported by more than one depot repair facility, do it for each depot.

A3.3.1.4.2. Each unit with an independent deployment or operational capability for both base repair and depot resupply pipelines.

A3.3.1.4.3. Centralized JEIM repair facilities based on base repair, retrograde from the supported unit and depot resupply pipelines.

A3.3.1.4.4. Each Forward Operating Location (FOL) and Forward Supply Point (FSP) based on the serviceable resupply pipeline from the JEIM site.

A3.3.2. Acquisition Computations for Operating Units and Depot. The total acquisition requirement for spare engines is the sum of peace and war requirements across all operating units plus the depot repair cycle requirement. Determine this requirement by using:

A3.3.2.1. Forecasted factors.

A3.3.2.2. Peacetime and war flying hours.

A3.3.2.3. Review of mission tasking.

A3.3.2.4. Peace and war bed down locations.

A3.3.2.5. The propulsion system and aircraft maintenance concept.

A3.3.2.6. Repair and transportation pipeline times.

A3.3.2.7. Maintenance availability and schedule.

A3.3.2.8. Depot re-supply.

A3.3.2.9. Aircraft procurement and delivery schedules.

A3.3.3. Distribution Computations for Operating Units and Depot. The spare engine distribution requirements are the greater sum of peace or war requirements across all operating units plus the depot repair cycle requirement. Determine this requirement using:

A3.3.3.1. Current factors.

A3.3.3.2. Peace and war flying hours.

A3.3.3.3. Review of mission tasking.

A3.3.3.4. Peace and war bed down locations.

A3.3.3.5. The propulsion system and aircraft maintenance concept.

A3.3.3.6. Repair and transportation pipeline times.

A3.3.3.7. Maintenance availability.

A3.3.3.8. Scheduled depot re-supply.

A3.3.4. Mid-Cycle Changes to Base Stock Level Computations. Whenever changes occur that affect the base stock level previously accomplished, the designated lead command may re-accomplish the PRS computations with updated information with PPGM concurrence. The same procedures apply to this computation as for the normal computations. Results of the computations along with justification for the re-computation requirement will be sent to the applicable ALC for roll up with other commands data and, if asset levels allow, the ALC should approve the required changes in the base stock levels affected. Actual redistribution within the command or stock reduction requirements will be handled by the Command EM. If there is an overall increase in the stock level requirements for the command, the Command EM will renegotiate their overhaul/repair requirement with the ALC for the additional asset(s) as necessary.

A3.3.5. Stock-Level Computations. Acquisition and distribution requirements computations are based on:

A3.3.5.1. Flying hours and removal rates.

A3.3.5.2. Return rates.

A3.3.5.3. Pipeline factors.

A3.3.5.4. Maintenance scheduled events.

A3.3.5.5. Deployment capability.

The computations must consider the transition between peace and war (surge and sustained) and whether peace assets are available to repair or reuse. If peace assets are available at a base in the combat theater, the stock level is the higher of peace or war requirement. The War Readiness Engines (WRE) requirement is the quantity needed above the peace level. If peace assets are not available to a unit that deploys to a bare base and repair capability is not immediately available, the unit requires that number of assets necessary to provide a remove and replace maintenance action, i.e., peace plus war requirements. The WRE requirement is the difference between the peace level and the war level. Stock level requirements are maintained at the lowest level based on the current war planning document.

A3.3.6. Peacetime Acquisition Requirements for Operating Units and the Depot.

A3.3.6.1. **Assumptions.** When computing the quantity of engines to buy for peacetime operational and logistics support concepts, the following assumptions are valid:

A3.3.6.1.1. The flying hour program demands (i.e., removals), pipeline times, and return rates are all stationary or steady state.

A3.3.6.1.2. A demand will generate a repair for the maintenance activity either at the operating unit or the depot.

A3.3.6.1.3. There are no condemnations of engines. This means that all removed engines are repaired at either the operating unit or the depot.

A3.3.6.1.4. There is no waiting or batching of engines before starting repair actions.

A3.3.6.1.5. There are no unplanned shipments between two bases to eliminate temporary shortages.

A3.3.7. Wartime Acquisition Requirements for Operating Units and the Depot.

A3.3.7.1. Assumptions. When computing the quantity of engines for war surge operational and logistics support concepts, the following assumptions are valid:

A3.3.7.1.1. The flying hour program demands (i.e., removals), pipeline times, and return rates are dynamic, not stationary.

A3.3.7.1.2. The JEIM return rate is constant, may not be the same as the peacetime rate, and will vary based on whether the unit is deploying or staying in place.

A3.3.7.1.3. A demand will generate a repair only at locations with JEIM in place at the start of the war surge.

A3.3.7.1.4. There are no condemnations of engines.

A3.3.7.1.5. Maintenance at deployed locations with no JEIM consists of remove and replace actions only.

A3.3.7.1.6. Peacetime engines in the depot repair cycle at the start of the surge are considered to be repaired first at the surge repair rate. Peacetime engines in the base repair cycles at the start of the surge are considered to be repaired first at the surge repair for bases that remain on station. Peacetime engines in the base repair cycle for units that deploy may or may not be repaired before deployment.

A3.3.7.1.7. Delays in transportation may occur.

A3.3.7.1.8. There is no waiting or batching of engines before starting repair actions.

A3.3.7.1.9. There are no unplanned shipments between two bases to eliminate a temporary shortage.

A3.3.7.1.10. Scheduled and non-safety corrective removals are normally suspended during war surge until sustained war.

A3.3.8. War Sustained Acquisition Requirements for Operating Units and Depot:

A3.3.8.1. Assumptions. War sustained requirements are computed using the same assumptions as the wartime surge with the following exceptions:

A3.3.8.1.1. Delays in transportation may occur.

A3.3.8.1.2. There may be a backlog of engines awaiting repair from the surge period.

A3.4. Developing an Engine Requirements Scenario (ERS). When developing each ERS, the MAJCOM should ensure that it represents the current force structure, deployment requirements, preposition support provided, maintenance concepts and any adjustments to unit related data that is not reflected in the published documents. These changes must be specifically identified and justified when the data is provided to the applicable ALCs. MAJCOMs will prepare a separate PRS file for maintenance concept (i.e., 3-level maintenance, 2-level maintenance, etc). Each PRS file will contain a Peace ERS, and, if applicable, a War ERS. Once the MAJCOMs complete their computations for both Peace and War, they must print a copy of the PRS computation results summary detailed report and send this report along with the data source (floppy disk, etc.) containing the PRS file to the applicable engine ALC with a cover letter signed by the MAJCOM three-digit office. The applicable engine ALC will roll up the results of the MAJCOM PRS files for each specific TMSM engine to determine the worldwide total requirement for all users, including the depot. If the ALC finds an error in the computation factors used by the MAJCOM that affects the overall quantity computed by them, the ALC will notify the MAJCOM of the changes and, if agreed, will make the changes to the file and re-compute. The ALC will send a copy of the updated file to the MAJCOM for their review. The Propulsion PGM has ultimate authority of the entire process and will publish required time lines for accomplishing the computations.

A3.4.1. Identification of Prepositioned Engine Requirements in the ERS Data. If part of the operational environment for an engine is to have prepositioned engines located at other than flying activities for transient aircraft support, the ERS must include data applicable to these locations for PRS to compute the actual requirement for the locations(s). Enter the data the same as you would for an actual flying unit and base with the next higher level of repair being the base responsible for prepositioning the engine(s) at the location(s). In order to actually identify the requirement for these activities, determine/estimate what portion of the off-station removals normally occur, or would occur in a wartime environment, at the location(s). Then, deduct that portion of flying hours from the units supported and allocate these hours to reflect one (1) aircraft authorization to allow PRS to compute the correct engine requirements for the location(s). The base SRAN for the forward location(s) will be the same as the prepositioning base SRAN. The on-shore rate will be 1.00 for the forward location as well as the supported units. Do the same for the Peace and War ERS(s), as applicable (the War portion of flying hours may be larger than the Peace).

A3.5. Publication of Authorized Stock Levels. Once stock level computations have been rolled up by the ALC and distribution of available assets is determined and negotiated with the MAJCOM EMs, the ALC will send a formal message to each MAJCOM advising them of the approved levels. The MAJCOM EMs will prepare official notification to all their assigned bases advising each of their approved base stock level of engines and applicable WRE levels. These levels remain in effect until the next computation cycle, unless the designated lead command and SA-ALC/LR determine changes have occurred requiring a mid-cycle re-computation as described in paragraph **A3.3.3.**

A3.6. Allocation of Depot Facility Serviceable Engine Requirements. Under the spare engine computation process, the difference between the depot facility's war requirement and peace requirement is considered an additional war reserve serviceable spare engine requirement that the community, as a whole, needs to maintain. This quantity is required to support resupply actions during the initial war period while the repair facility ramps up to the expected wartime demand rate. Since the eventual users of these assets are the MAJCOMs flying the wartime missions, allocation of these assets to the MAJCOMs is necessary to provide uninterrupted support during the initial surge period of a war. The MAJCOM EMs and the ALC must negotiate distribution of these assets to the bases along with adjusting the base stock levels and WRE requirements accordingly. The decision process should take the following into consideration:

A3.6.1. Depot repair facility safety level requirement to meet peacetime demands.

A3.6.2. Quantities computed for each MAJCOM at the repair facility (during peace and war).

A3.6.3. Primary base(s) providing support to forward location(s) during war.

A3.6.4. Continuous MAJCOM asset visibility.

NOTE:

Once the quantities of serviceable engines and distribution locations are identified, the base stock levels for affected activities must be adjusted for the required changes.

A3.7. Distribution of Assets. If engine availability is unconstrained, engines are distributed to MAJCOMs in accordance with the PRS computations. If engine levels are constrained, follow constrained engine allocation and distribution procedures in **Attachment 2**, Annex 3.

A3.8. Segments To Be Computed. Engine managers compute each unit's operating stock to support the minimum unit and depot stock acquisition and distribution pipelines. Compute unit operating stock to fill:

A3.8.1. Order and ship time with build up time for depot resupply pipeline.

A3.8.2. Base repair cycle pipeline.

A3.8.3. Remove, Inspect and Process to Ship (RIPS) pipeline.

A3.8.4. Safety level.

A3.8.5. WRE.

A3.8.6. Special mission additives.

A3.8.7. Preposition and prestock.

A3.8.8. Multiple Quick Engine Change (QEC) configurations that are required to be built up to at least 80 percent to make ready for installation.

A3.8.9. Supply and maintenance pipeline for centralized JEIM repair facilities and supported unit.

A3.8.10. Compute depot repair cycle stock using:

A3.8.10.1. Repair cycle, including safety levels.

A3.8.10.2. Retrograde pipeline.

A3.9. War Delays and Transportation Pipeline Assumptions. See WMP, volume 1, annex E, *Supply Class 7X*.

A3.10. Unit-Level Requirements Modeling. The Propulsion Requirements System (PRS) computes safety stock levels at the lowest supply level. For those units that fly and fight in place, consider peacetime assets as available to be repaired as long as JEIM is available and the unit has a remove and replace capability. Stock this type of unit with the greater of their peace or war requirement. For those units that deploy, determine the disposition of the peacetime assets. If the assets are available on the first day of the war for the repair pipeline, stock the unit with the greater of their peace or war requirement. If the peacetime stocks are not available for the repair pipeline and subsequent production at some later date, stock the unit with peace plus war requirements. Compute preposition requirements for aircraft that fly in and out of numerous locations in theater and have only limited remove and replace capability if a failure occurs. The total number of spare engines required at a specific base, with more than one unit with the same Mission Designs Series (MDS) and TMSM combination is the sum of each unit's peace or war requirement.

A3.11. Condemnation. Assume that engines have a zero wear-out and condemnation rate and are repairable. This does not prevent condemning an engine when the repair cost equals or exceeds the current acquisition cost.

A3.12. Cannibalization. Do not consider cannibalization when determining engine requirements. Due to the frequency of changes in operational programs and support capabilities, it is not practical to assess the impact of potential cannibalization.

A3.13. Special Stock Levels. Engine managers generate special stock levels for:

A3.13.1. Engines with small inventories.

A3.13.2. Air breathing drone engines.

A3.13.3. Use the following percentages to establish stock levels when 10 or fewer new MDS aircraft are to be procured or remain in the inventory:

A3.13.3.1. Single engine aircraft, 50 percent.

A3.13.3.2. Twin engine aircraft, 40 percent.

A3.13.3.3. Aircraft with more than two engines, 30 percent.

A3.13.4. The owning MAJCOM and Propulsion PGM jointly determine the operating unit's stock level for air-breathing drone engines. These stock levels are based on the operational and maintenance concept and the number of drones authorized for each location.

A3.14. The Acquisition Process/Method of Computation. Spare engine requirements will be computed using the approved USAF model, the Propulsion Requirements System (PRS). PRS computations will be documented by the center performing the acquisition. The input data used in the computations will be based on the latest credible information available, based on input from HQ USAF, users, depots, acquisition organizations and HQ AFMC. Typically the primary input information will come from the following sources:

A3.14.1. Aircraft quantities being procured - ASC aircraft SPD, HQ USAF.

A3.14.2. Peacetime factors:

A3.14.2.1. Beddown (by Primary Aircraft Authorized, including extended peacetime deployments) - ASC aircraft SPD, using commands and HQ USAF.

A3.14.2.2. Flying hours per location - HQ USAF (PA document) or using commands.

A3.14.2.3. Actuarial factors - Either ASC engineering or engine prime contractor estimates.

A3.14.2.4. Pipeline times - Using commands, engine depot and HQ AFMC Maintenance concept - Using commands, engine depot, ASC SPD, HQ USAF, HQ AFMC.

A3.14.2.5. Special considerations (e.g., prepositioned requirements, additives for special projects), an appropriate, official source.

A3.14.3. Wartime Factors:

A3.14.3.1. Beddown by PAA - RDAT document and using commands.

A3.14.3.2. Flying hours per location - RDAT document or using commands.

A3.14.3.3. Actuarial factors - Either ASC engineering or engine prime contractor estimates.

A3.14.3.4. Pipeline times - Using commands, engine depot and HQ AFMC.

A3.14.3.5. Maintenance concept - Using commands, engine depot, ASC SPO, HQ USAF, HQ AFMC.

A3.14.3.6. Special considerations - an appropriate, official source.

A3.14.4. Safety Level Criterion. Acquisition requirements for operating units will be computed to the percentage of an aircraft fleet expected to be available for missions or sorties. A confidence level factor of 70% or 80% will be used to compute the safety level portion of the pipeline for steady-state comparison.

A3.14.5. Life of Type Requirement Analysis. Before the production line for an engine is closed down, an in-depth life of type engine requirement analysis will be accomplished. The purpose is to determine the buy-out quantity of engines required for the operational phase of the engines' life cycle.

A3.15. Requirement Changes. Over time many factors can change that can influence the spare engine computations. These changes can include such things as peacetime and wartime flying hour program changes, maintenance concept changes, the application of agile logistics factors, revision of earlier actuarial factor and pipeline estimates as experience is gained on the engine, policy changes, and other PRS input factor changes. When significant changes occur, computations should be done to determine the impact on spare engine requirements. If the engine is still in production, the procurement status should be reviewed with the goal of adjusting the procurement (up or down) if contractually possible and deemed appropriate. This should be a user and acquisition organization coordinated action.

A3.15.1. AFMC Responsibilities:

A3.15.1.1. Computes Air Force acquisition stock level requirements for spare engines.

A3.15.1.2. Provide the number, fiscal year availability, and estimated unit cost for update or modification of research, development, test, and evaluation engines that can be economically modified or remanufactured to the operational configuration. These assets will be considered to prevent budgeting and procurement of spare engines to support aircraft buys.

A3.15.2. General Procedure for Computing Acquisition Requirements.

A3.15.2.1. Acquisition Computations. Factors are required to accomplish acquisition computations. These factors should be reviewed and approved by an appropriate engine management group such as the ERO, MPG, etc., prior to the computation of acquisition or procurement quantities of spare engines.

A3.15.2.2. Method of computation for Acquisition Requirements.

A3.16. Front Loading Assets. The quantity of spare engines will be held to minimum levels during early production phase in anticipation of aircraft program changes that could produce lower spare engine requirements. However, special attention should be given to the potential impact that higher removal rates or interim contractor support requirements may have on operational mission requirements during the early stages of operational deployment of new engine acquisitions. The results of an assessment to determine the risk of not meeting mature goals, primarily reliability, are critical in determining if it is necessary to front load assets on the aircraft production schedule.

A3.17. QEC Kit Requirements. MAJCOMs will determine the quantity of QEC kits required. They are bought as life of type items and are regulated by the quantity of spare engines acquired to support engine base stocks. Acquisition of QEC kits are based on one kit per spare engine authorized at the base level. An increase in the spare engine level during the acquisition phase may cause the acquisition of additional QEC kits.

A3.18. Documentation Availability.

A3.18.1. PRS Reports. As a part of each budget cycle or major decision point, the computations will be available for review by the involved using commands, engine depot, and PPGM. The computations will reflect the source of the input data used in the computations. Since the computations are normally classified, they will be provided on request only.

A3.18.2. Summary. The requirements will normally be reflected in an unclassified summary. The summary will identify the engine, aircraft, peacetime requirement for an appropriate period (e.g., maturity, by year or by quarter), and wartime requirement for the same period. The summary will be used as an aid in making appropriate management decisions which impact readiness, such as the following:

A3.18.2.1. When to procure additional spare engines above the mature requirement to avoid peacetime holes in aircraft.

A3.18.2.2. When to procure additional spare engines above an actual peacetime requirement to support possible wartime needs.

A3.18.2.3. When to limit procurement of spare engines so additional funds can be used to support engine modification programs that should improve R&M performance.

A3.18.3. PRS Reports and document files should be retained for five years (the four previous years and the current calendar year).

Attachment 4

RECLAMATION AND DISPOSAL

A4.1. General Policy Guidance:

A4.1.1. Engines are sent to reclamation only when it has been determined requirements for whole engines do not exist within DOD, and a valid foreign military sales (FMS) system support buy-out offer has been accomplished.

A4.1.2. The PPGM will assume control of engine assets on aircraft held in storage codes XS or XT which transfer to XX or XV. Management control of the on-wing engines will transfer to SA-ALC/LR to coincide with the storage code change. The engines will then be added into the Engine Requirements Retention Computation model. The available engines can then be used to offset whole engine requirements, be put into reclamation projects, or be disposed of through Defense Reutilization and Marketing Office (DRMO).

A4.1.3. The Engine Inventory Management Specialist initiates reclamation action.

A4.1.3.1. Before procuring engine spare parts, a local ALC engine reclamation panel will review engine reclamation programs. This panel will review the total reclamation requirement by engine TMS and accomplish a complete cost benefit analysis, including determining when the reclamation will be accomplished by fiscal quarter for the operating and budget years. The engine management division chief will approve or disapprove the reclamation requirements. Reclamation items will be entered into the requirements system.

A4.1.3.2. The cost analysis will determine the most cost-effective location to perform the reclamation. Factors to consider are:

A4.1.3.2.1. Shipping cost for engines to be moved from the current storage location to the proposed facility.

A4.1.3.2.2. Cost of reclamation at each proposed location.

A4.1.3.2.3. Estimated reimbursable cost for each reclamation facility.

A4.1.3.3. Assessment of capability for use on the proposed reclamation project will include personnel, facilities and equipment resources available, requirements for additional peculiar or common tools and equipment, ability to accomplish condition inspections, and ability to meet need dates for reclaimed items. The applicable production management specialist is responsible for negotiating maintenance workloads in support of engine reclamation through normal Depot Maintenance Industrial Fund procedures. This authority will require HQ AFMC/LGI coordination.

A4.2. Reporting. Engines in reclamation will be reported in the CEMS DO42 database. Additionally, Engine Managers are required to provide a biannual reclamation projects report by TMS to SA-ALC/LR. Reports coincide with SEMR reporting and cost updates are due to AF/ILMY by 1 May and 1 November each year. The report should include as a minimum:

A4.2.1. Engine TMS.

A4.2.2. Number of engines changing storage code.

A4.2.3. Engine price.

A4.2.4. Cost of reclamation project.

A4.2.5. Estimated cost savings against parts requisition.

A4.3. General Disposal Procedures. All reclamation residue and engines for which no reclamation requirements exist will be transferred to the local DRMO activity for disposal (see AFM 67-1, volume VI).

Attachment 5

REPORT CONTROL SYMBOLS FOR CEMS DO42 PROPULSION UNIT STATUS PRODUCTS

Table A5.1. RCSs for CEMS D042.

LINE	A	B	C	D	E	F
	RCS	**Title**	**Freq./Media**	**As Of/ Due Date**	**Emerg Status**	**Description**
1	RCS: HAF-LGM(AR) 8215	*Comprehensive Engine Management Transactions*	AISG	AR	C1	Provides output products used in the worldwide management of propulsion units
2	RCS: HAF-LEY(D) 8218	*Propulsion Unit Automatic Resupply Report*	Daily DASD	Daily	C1	Provides allocation and distribution of engines.