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Logistics

PROPULSION LIFE CYCLE MANAGEMENT FOR AERIAL VEHICLES

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This Air Force Manual (AFMAN) implements Air Force Policy Directive (AFPD) 63-1/20-1, *Integrated Life Cycle Management*. It describes propulsion management responsibilities and provides the processes required to manage United States Air Force (AF) engines for aerial vehicles. This publication applies to all uniformed members of the Regular Air Force, the Air Force Reserve, the Air National Guard, the Civil Air Patrol, when conducting missions as the official Air Force Auxiliary, all AF civilian employees, and those with a contractual obligation to abide by the terms of AF issuances. This publication does not apply to the United States Space Force. The authorities to waive wing/unit level requirements in this publication are identified with a Tier ("**T-0, T-1, T-2, T-3**") number following the compliance statement. See DAFI 33-360, *Publications and Forms Management*, for a description of the authorities associated with the Tier numbers. Submit requests for waivers through the chain of command to the appropriate Tier waiver approval authority, or alternately, to the requestor's commander for non-tiered compliance items. Ensure all records generated as a result of processes prescribed in this publication adhere to Air Force Instruction 33-322, *Records Management and Information Governance Program*, and are disposed in accordance with the Air Force Records Disposition Schedule, which is located in the Air Force Records Information Management System. Compliance with the attachments in the publication is mandatory. Refer recommended changes and questions about this publication to AFLCMC/LP using the AF Form 847, *Recommendation for Change of Publication* and submit through the functional chain of command. To ensure standardization, any organization supplementing this publication must send the implementing publication to AFLCMC/LP for review and coordination before publishing. The use of the name or mark of any specific manufacturer, commercial product, commodity, or service in this publication does not imply endorsement by the Department of the Air Force.

SUMMARY OF CHANGES

This document has been substantially revised and updated, and should be read in its entirety. Major changes encompass applicable information from rescinded AFI 20-115, and include identification and clarification of roles, responsibilities, requirements and processes governing management of propulsion systems. This rewrite also addresses exemptions from propulsion management requirements, Condition Based Maintenance Plus (CBM+), Engine Health Indicator/Metrics, Engine Life Cycle Management Plans (ELMPs), and Maintenance Planning Working Group (MPWG) Charters.

Chapter 1

OVERVIEW

1.1. General. Propulsion management as used in this publication refers to the management of assets that are air breathing, primary power systems for manned and unmanned aerial vehicles. This publication identifies minimum standardized processes required for management of propulsion assets.

1.2. Scope. Requirements herein apply to all AF propulsion items, including those which are military unique engines managed as Contractor Logistics Support (CLS) programs, except as noted below.

1.2.1. On a case-by-case basis, the AF Director of Propulsion (DoP) may grant an exemption from all or some of the requirements of this AFMAN for commercial gas turbine engines in service on AF commercial derivative aircraft, certified by Federal Aviation Administration (FAA), and maintained by CLS to the manufacturer's specifications. **NOTE:** The AF Life Cycle Management Center, Director of Propulsion (AFLCMC/LP) is the designated DoP (see **paragraph 3.1.2**).

1.2.1.1. Exemption requests need to:

1.2.1.1.1. Be submitted on applicable Program Executive Officer (PEO)/organizational letterhead and addressed to the DoP;

1.2.1.1.2. List impacted engine for which exemption is being requested;

1.2.1.1.3. Describe the issues and why the exemption is needed;

1.2.1.1.4. List the engine fleet size (current and future);

1.2.1.1.5. Identify engine ownership (AF owned or leased from);

1.2.1.1.6. Be approved and signed by the PEO/commander; and

1.2.1.1.7. Be submitted to the DoP's workflow email address at **AFLCMC.LP.Workflow@us.af.mil**

1.2.1.2. When the DoP grants an exemption, the DoP and Program Manager (PM) will retain the approved exemption as part of the program and engine documentation, and the PM will document the exemption in the Life Cycle Sustainment Plan.

1.2.2. Requirements in this publication do not apply to:

1.2.2.1. Reciprocating or turbine engines that provide ground-based auxiliary/generator power.

1.2.2.2. Unique engine configurations installed on classified/experimental aerial vehicles.

1.2.3. Legacy engines not compliant with this publication will be identified to the DoP by the PM of the System on which the engine is used.

Chapter 2

RESPONSIBILITIES

2.1. Assistant Secretary of the Air Force for Acquisition, Technology, and Logistics (SAF/AQ). Ensures Program Executive Officers (PEOs)/PMs incorporate relevant propulsion product support elements into program documentation.

2.2. Deputy Chief of Staff for Operations (AF/A3).

2.2.1. Coordinates with and/or obtains inputs from PMs and the DoP in the development of life cycle propulsion management capability requirements and the associated courses of action.

2.2.2. Creates and makes available each year to Air Force Materiel Command (AFMC) the most current version of the Requirements Daily Answer Tape for the Weapon System Management Information System (WSMIS) with the Program Objective Memorandum (POM) and after the President signs the budget.

2.2.3. Creates and makes available each year to DoP the most current version of the peacetime/home-station programmed force structure worksheet. **NOTE:** Documents include engine configuration codes assignment applicable to a specific aircraft Mission Design Series (MDS) and/or Type, Model, Series

2.3. Deputy Chief of Staff for Logistics, Engineering and Force Protection (AF/A4).

2.3.1. Develops policy and issues enterprise implementation direction/guidance for propulsion management.

2.3.2. Ensures Condition Based Maintenance Plus (CBM+), which includes Propulsion Center of Excellence (PCoE) BP-99-04C *Reliability Centered Maintenance* (RCM) and PCoE BP-02-13 *Engine Trending and Diagnostics/Prognostics* (ET&D/P), requirements are integrated into supply chain/sustainment direction and guidance.

2.4. Deputy Chief of Staff for Strategic Plans and Programs (AF/A8). Publishes the latest version Force Structure Worksheet, on the Secure Internet Protocol Network, following the submission to the President's Budget.

2.5. AF Chief of Safety (AF/SE). Provides independent assessments on overall propulsion safety (hazards and associated risks).

2.6. Major Commands (MAJCOM)s, Air Force Reserve Command (AFRC) and National Guard Bureau (NGB).

2.6.1. Support AFMC in developing or revising propulsion management implementation and execution procedures/processes and/or guidance.

2.6.2. Designate a Command Engine Manager (CEM) to oversee Stock Record Account Number (SRAN) reporting and a Command Office of Primary Responsibility (OPR) for CBM+.

2.6.3. Ensure propulsion management is addressed in mobility planning and operating procedures.

2.6.4. Review and coordinate all computation inputs into the Propulsion Requirements System (PRS) database.

2.6.5. Provide support to AFMC with the individual MAJCOM distribution computations, within sufficient time for the next fiscal year engine level requirements.

2.6.6. Forecast, validate, and prioritize engine repair/overhaul requirements.

2.6.7. Input programming documents/Centralized Asset Management requirements for Depot Purchased Equipment Maintenance funds, AF Cost Analysis Improvement Group (CAIG) adjustments, and CBM+ support. **NOTE:** AFRC and NGB manage the programmed engine funding and execution of requirement for their units.

2.6.8. Support approved enterprise engine management and/or repair improvement initiatives.

2.6.9. Collaborate with PMs and the DoP in developing and implementing new or revised propulsion training requirements. Define engine specific training requirements by instructional system development analysis according to DAFI 36-2670; *Total Force Development*. **NOTE:** Air Force Handbook 36-2235V1; *Information for Designers of Instructional Systems-ISD Executive Summary for Commanders and Managers,* contains additional information.

2.6.10. Ensure engines within their MAJCOM are recognized, identified and documented in the Comprehensive Engine Management System (CEMS), including engine (organic and contractor maintained) status.

2.6.11. Work with PMs; DoP; and Engine Type, Model, Series (TMS) Managers as part of the risk assessment and mitigation process; e.g., to define and execute action plans and support POM activities.

2.7. Lead MAJCOMs.

2.7.1. Support PMs, DoP, and AFMC activities in:

2.7.1.1. Developing engine life-cycle management planning.

2.7.1.2. Developing and computing engine peacetime/home-station and enduring operations removal rates.

2.7.1.3. Acquiring engines; including engine technical data and/or data rights for life cycle sustainment, technical orders development, and ensuring technical data completeness and accuracy throughout the life cycle. In accordance with TO 00-5-1, *AF Technical Order System*, TO 00-5-3, *AF Technical Order Life Cycle Management*, and AFI63-101/20-101, *Integrated Life Cycle Management*.

2.7.1.4. Determining worldwide engine stock-level requirements.

2.7.1.4.1. Providing allocation of engines if engine availability is computed as constrained in PRS.

2.7.1.4.2. Developing an engine redistribution plan and schedule transfers in accordance with TO 2-1-18, *Aircraft Engine Operating Limits and Factors*.

2.7.1.5. Determining engine overhaul requirements based on applicable factors; e.g. flying hours or calendar time criteria.

2.7.1.6. Executing the Component Improvement Program (CIP) Task prioritization process.

2.7.1.7. Establishing engine health measurement goals for each engine TMS.

2.7.1.8. Advocating for 3600 funding for the CIP.

2.7.2. Prioritize and advocate for 3010 modification budget to achieve engine life-cycle management planning goals.

2.7.3. Ensure capability and sustainment modification requirements are documented, reviewed, and processed for approval and funding.

2.8. Commander Air Force Materiel Command (AFMC/CC). **I** n addition to what is applicable under **Paragraph 2.6**.

2.8.1. Fosters new and/or improved capabilities, energy efficiencies, reliability, availability, maintainability, safety, and reduction of Total Ownership Cost for propulsion systems.

2.8.2. Provides direction to AFMC activities to ensure:

2.8.2.1. Implementation of propulsion assets' life cycle management.

2.8.2.2. Integrated standardized processes.

2.8.2.3. Positive inventory control, accountability, and reporting of AF propulsion assets.

2.8.3. Accomplishes Research, Development, Test and Evaluation (RDT&E) for technologies (including evaluating cost effectiveness) associated with propulsion assets, performance, and sustainment.

2.8.4. Provides propulsion technical support to PEOs/PMs for:

2.8.4.1. Development of CBM+ concepts, functions, IT architecture and software tools.

2.8.4.2. Airworthiness certification compliance, safety risk assessments, technical risk assessments, and Propulsion Systems Integrity Program compliance.

2.8.5. Manages engine depot-level repair activities.

2.8.6. Operates and manages the FJ2031 centralized record for CEMS reporting.

2.8.7. Develops, integrates and maintains the CEMS or equivalent (D042) Data System Designator.

2.9. Director of Propulsion (DoP).

2.9.1. The DoP will:

2.9.1.1. Coordinate with appropriate agencies to bring all USAF engines into compliance with this publication or determine a feasible/beneficial Course of Action with the PM;

2.9.1.2. Approve or deny an exemption request to comply with all or portions of this publication.

2.9.2. Principal representative for AF propulsion to the Department of Defense (DoD), joint services, and industry forums.

2.9.3. Reports program execution for the propulsion enterprise as required through the cognizant PEO in accordance with AFI 63-101/20-101, *Integrated Life Cycle Management.*

2.9.4. Coordinates with appropriate agencies to bring all USAF engines into compliance or determine the extent of compliance that is feasible/beneficial and coordinates with the PM the course of action for executing the determination.

2.9.5. Approves or denies an exemption request to comply with all or portions of this publication.

2.9.6. Provides overarching standardized procedures, guidance and processes for life cycle management of AF propulsion assets.

2.9.6.1. Develops and recommends to Headquarters Air Force new or revised propulsion management official publications.

2.9.6.2. Be the AF OPR for official publications of AF propulsion management procedures and processes. (Refer to DAFI 33-360, *Publications and Forms Management*, for definition of "official publications" and responsibilities of a publication OPR).

2.9.7. Provides technical support and recommendations to MAJCOMs, PMs, or functional/activities on matters affecting engine readiness, affordability, safety, effectiveness, suitability or other propulsion associated issues.

2.9.8. Documents assignment and/or identification of Engine TMS managers, SRAN managers, Propulsion Safety managers (leads), CIP managers, and PRS functional managers for general and/or specific engines.

2.9.9. Manages:

2.9.9.1. TO 00-25-254-1, *Comprehensive Engine Management System Engine Configuration, Status and TCTO Reporting Procedures*;

2.9.9.2. TO 00-25-257, *Technical Manual -- Engine Health Management Plus General Information User Manual* for selected organic managed engine programs. **NOTE:** Not all organic managed engine programs require a dedicated Engine Health Management Plus manual. The TMS MPWG may determine alternate means for implementation of CBM+ capabilities in accordance with the specific maintenance concept for a particular program. Contractor or CLS supported engine programs will state CBM+ requirements in their respective contracts and/or MAJCOM Instructions.

2.9.9.3. TO 00-85-20, *Engine Shipping Instructions*;

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

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

2.9.10. Develops and maintains an AF enterprise Propulsion Strategic Plan. At a minimum, the Propulsion Strategic Plan will address: technology development; energy efficiency; Environment, Safety, and Occupational Health (ESOH); reliability improvements; readiness; surge requirements; and reduction of Total Ownership Cost across the propulsion community.

2.9.11. Monitors and initiates action with appropriate authority to ensure technical data/TOs required for propulsion support are available in accordance with TO 00-5-1 and TO 00-5-3.

2.9.12. Monitors fleet wide engine health metrics/trends and creates timely executable corrective action plans to address negative indicators impacting any of the following: safety, availability, maintainability, reliability, or Total Ownership Cost.

2.9.13. Ensures that CEMS data records are established and maintained for all engines.

2.9.14. Manages and computes engine spares using the Propulsion Requirements System (PRS).

2.9.14.1. Establishes Memorandum of Agreement s, as needed, with AF/A3, AF/8 and AFLCMC/HIS for the War and Mobilization Plan, ENDURING OPERATIONS, and Force Structure Worksheet and WSMIS/PRS (D087Q) formats; to include procedures for allocating aircraft flying hours and engine configuration codes assignment applicable to specific aircraft MDS and/or Type, Model, Series, Modifications. Establish memorandum of agreements with lad MAJCOMs, AFRC and NGB.

2.9.14.2. Provides guidance for computation factors within PRS for all engine acquisition and distribution computations.

2.9.14.3. Provides oversight and is the Whole Engine Repair Requirements process owner. Computes the engine repair and overhaul requirements. Coordinates computations with MAJCOMs/AFRC/NGB/PMs. Ensures requirements are based on appropriate criteria for applicable engine; which may be flying hours, accumulated cycles, sorties, or calendar time between inspection/overhaul.

2.9.15. Establishes, guides and manages the Engine Lead the Fleet/Analytical Condition Inspection (LtF/ACI) Program

2.9.16. Supports and participates in identifying propulsion capability requirements and accomplishing analysis of alternatives for a materiel development decision.

2.9.17. Works with other research and development organizations (e.g., Air Force Research Laboratory) to assess existing and/or potential technologies for insertion into propulsion assets.

2.9.18. Monitors propulsion associated actions for ESOH requirements and take action through appropriate authority for enforcement.

2.9.19. Develops, approves, and releases the annual propulsion safety message.

2.9.20. Monitors and assesses Cost Per Engine Flying Hour (CPEFH) and Cost Affordability. Initiates and/or advocates actions to reduce such costs.

2.9.21. Manages CEMS and CBM+ activity (includes RCM and ET&D/P program requirements).

2.9.22. Supports requirements for operations and maintenance funding of engines through the Centralized Asset Management process.

2.9.23. Establishes Memorandum of Agreement s, as needed, with aircraft PMs to monitor Quick Engine Change (QEC) kit requirements and collaborate with the PM throughout the life cycle to ensure supportability and prevent obsolescence. Supports PMs in determining QEC kit requirements.

2.9.24. Oversees mission usage life analysis updates and implementation.

2.9.25. Maintains oversight of:

2.9.25.1. Propulsion sustainment activities and advises PMs and/or sustainment activity managers of noted issues.

2.9.25.2. Retention, reclamation, and disposal computations and resulting actions.

2.9.26. Coordinates with and directs PMs on propulsion issues, activities, requirements computations, funding, and planning relevant to the PM's system.

2.9.27. Ensures the life-cycle engine management documentation is established and maintained in either the Life Cycle Sustainment Plan or Engine Life Cycle Management Plan (ELMP) unless the DoP has granted an exemption.

2.9.28. Functions as the engine Product Support Integrator (PSI).

2.9.29. Develops propulsion long range goals and master plans.

2.9.30. Serves as the Chairperson for the Engine Advisory Board (EAB) and the Propulsion Technology Office Steering Committee, and AF principal on the Joint Propulsion Coordinating Committee.

2.9.31. Collaborates with Air Force Research Laboratory and other research and development organizations to assess existing and/or potential technologies for insertion into propulsion assets.

2.9.32. Develops warranties as required in conjunction with the Contracting Officer, Lead MAJCOMs, and other government agencies according to guidance provided in the Department of Defense Warranty Guide, Federal Acquisition Regulation 46.7 (Warranties), and Defense Federal Acquisition Regulation Supplement, Subpart 246.7, Warranties.

2.9.33. Manages engine inventories worldwide and supports authorized engine stock levels for each SRAN by TMS.

2.9.34. Maintains configuration control per AFI 63-101/20-101 and performs periodic review and comparison of life-limit data in CEMS against the published TO life-limits. **NOTE:** Review will be accomplished a minimum of every six months.

2.9.35. Develops and oversees engine repair and overhaul requirements and activities; coordinates with PMs and Lead MAJCOMs for each TMS.

2.9.36. Maintains a Propulsion Actuarial Forecasting Model to project engine removal rates for the programming years based on age related engine removal histories derived from CEMS data, proactive adjustment and quantitative analysis techniques.

2.9.37. Is accountable for the Air Force Centralized Engine Account, SRAN FJ2031.

2.9.38. Works with CEMs to compute worldwide stock-level requirement.

2.9.39. For propulsion system program office managed engines, develops engine repair and overhaul requirements and coordinates with PMs and Lead MAJCOMs.

2.9.40. Develops retention, reclamation, and disposal computations.

2.9.41. Disposes of out-of-production engines during aircraft or missile phase-out cycle.

2.9.42. Maintains cognizance of all engine and engine-related deficiency reports under TO 00-35D-54, *USAF Deficiency Reporting and Investigation System.*

2.9.43. Charters maintenance planning and engine review activities for each engine TMS.

2.9.44. Establishes reliability goals in coordination with Lead MAJCOM.

2.9.45. Assists with development of CBM+ analysis tools.

2.9.46. Monitors and supports appropriate authority to ensure compliance with propulsion system safety requirement.

2.9.47. Conducts propulsion enterprise review of depot maintenance support strategies through strategic workload optimization. **NOTE:** Review will be accomplished biennially on off-POM years; out-of-cycle reviews may be accomplished upon major programmatic changes (e.g., force structure change, 20% change in projected contract cost).

2.10. Program Executive Officer (PEO).

2.10.1. Accepts mishap risks that the TMS Managers, DoP, or PMs are not authorized to accept.

2.10.2. Ensures programs in their portfolio have implemented a system safety effort using the methodology in Military Standard (MIL-STD)-882, *DoD Standard Practice for System Safety*.

2.11. Program Manager (PM).

2.11.1. Reports to DoP for all acquisition and sustainment program planning and execution including **(T-3)**:

2.11.1.1. Product support planning and execution.

2.11.1.2. Budget, cost, schedule and performance requirements development.

2.11.1.3. Acquisition strategy development and Milestone Decision Authority designation.

2.11.1.4. Engine selection, breakout assessment, and decisions.

2.11.1.5. Foreign Military Sales (FMS) planning and execution.

2.11.1.6. Engine production planning, delivery, and repair network status implemented to support FMS and Total Force operations.

2.11.1.7. Contractor Performance Assessment Reporting.

2.11.2. Leads Integrated Product Teams (IPTs) and Working Groups as needed to combine the expertise necessary to execute the propulsion vision.

2.11.3. Reports propulsion system program status to the DoP and weapon system PEOs as required. **(T-3).**

2.11.4. The Engine Component Improvement Program Manager plans, programs, and executes the CIP requirements approved by the DoP, including **(T-3)**:

2.11.4.1. Develops and defends the POM input for Directorate approval.

2.11.4.2. Collaborates on the allocation of CIP funds across the TMS contracts to support the approved requirements and to meet execution goals, to include funds assigned by Fair Share calculations (see **Chapter 5**).

2.11.4.3. Leverages the expertise of the DoP as PSI, sustaining engineering, product support, field support, and technology sectors to monitor, test, and bring CIP tasks to conclusion as efficiently as possible.

2.11.5. Reports propulsion system requirements, issues, and activities (e.g., quantity of QEC kits, support equipment and aircraft modifications, overhaul requirements, system safety/risk metrics, hazards) to the DoP as required. **(T-3).**

2.11.6. Establishes performance based agreement with the DoP for system propulsion support. **(T-3).**

2.11.7. Verifies and defends the DoP's propulsion projected requirements, budget estimates, and sustainment planning associated with the PM's system; e.g., whole engines, sub-assemblies, parts, overhaul (including flying hours or calendar days criteria), technical data, performance/reliability criteria. **(T-3).**

2.11.8. Ensures engine life cycle management planning and safety is incorporated into the associated system life cycle planning and safety program. **(T-3).**

2.11.9. Establishes and maintains a system safety effort using the methodology in latest approved MIL-STD-882E. **(T-3).**

2.12. Engine TMS, SRAN, Propulsion Safety, and PRS Managers.

2.12.1. Engine TMS Manager.

2.12.1.1. Inputs, through procurement accounts, for the funding of initial spares, common support equipment, interim contractor support, and engine modifications. **(T-3).**

2.12.1.2. Develops, maintains, and executes the ELMP for their engine TMS, in accordance with the PM's direction. **(T-3).**

2.12.1.3. Provides POM inputs for initial spares, initial common support equipment, interim contractor support, and engine modifications funded through procurement accounts. **(T-3).**

2.12.1.4. Supports the DoP in conducting mission usage surveys. **(T-3).**

2.12.1.5. Notifies the DoP of force structure and mission changes. **(T-3).**

2.12.1.6. Coordinates the ELMP with the responsible MAJCOMs, Product Support Manager (PSM) and PM and provides to the DoP for approval. **(T-3).**

2.12.1.7. Uses ELMP/Engine Health Indicators (EHI) to manage engines throughout their life cycle. **(T-3).**

2.12.1.8. Collaborates with the Lead MAJCOM, to publish EHI goals in their respective ELMP and track variance. **(T-3).**

2.12.1.9. Ensures only approved funded engine overhaul requirements are provided to contract repair facilities for planning and execution. **(T-3).**

2.12.1.10. Executes the direction of the DoP in propulsion related planning and activities.

2.12.2. SRAN Engine Manager (SEM).

2.12.2.1. Executes engine management in accordance with TO 00-25-254-1. **(T-2).**

2.12.2.2. Prepares and retains DD Form 1348-1A, *Issue Release/Receipt Document*, or DD Form 1149, *Requisition and Invoice Shipping Document*, for each engine shipment and transfer in accordance with TO 00-25-254-1. **(T-2).**

2.12.2.3. Executes engine management responsibilities in accordance with AFI 23-101, *Materiel Management Policy*; and TO 00-25-254-1. **(T-2).**

2.12.2.4. Prepares a DD Form 1348-1A, *Issue Release/Receipt Document*, or DD Form 1149, *Requisition and Inventory Shipping Document*, for each engine shipment and transfer in accordance with TO 00-25-254-1. Retains signed copy for a minimum of 2 years in accordance with Records Disposition Schedule.

2.12.2.5. Reports all life-limited/serially tracked components (including propellers) identified in TO 00-25-254-1 Configured Item Identifier tables. **(T-2).**

2.13. Propulsion Director of Engineering (DoE).

2.13.1. Serves as the Organizational Site Functional for propulsion engineers and scientists, providing competency management and training for technical staff. **(T-3).**

2.13.2. Establishes and provides technical process guidance and recommendation to PEOs, PMs, DoP, and Chief Engineers on matters affecting engine airworthiness. (T-3).

2.13.3. Co-chairs the USAF Propulsion Safety and Technical Reviews and supports the Joint Propulsion Coordinating Committee and the Propulsion Executive Independent Review Team.

2.13.4. Oversees the Propulsion Center of Excellence (PCoE). **(T-3).**

2.14. Propulsion Chief Engineer (CE).

2.14.1. Serves as the Cognizant Engineering Authority for assigned propulsion programs. **(T-3).**

2.14.2. Establishes and provides technical guidance and recommendation to CEs, DoP, DoE, and Systems Lead Engineers on matters affecting engine safety, suitability and/or effectiveness. (**T-3**).

2.14.3. Co-chairs the Configuration Control Boards and Hazard Review Boards for assigned programs. **(T-3).**

2.15. Advisory and Working/Support Groups. MAJCOMs and PMs support DoP propulsion advisory, planning, and working groups/activities. **(T-3).** Participants listed below include the DoP plus representation from other activities/organizations:

2.15.1. EAB: A representative forum of Lead MAJCOMs to discuss AF and FMS propulsion initiatives, challenges, revisions, and requirements. This includes reviewing and endorsing budget year CIP project prioritization and investment plans. This board also reviews each TMS ELMP and status as required. The EAB members (may be delegated but must be O6/GS15 or above) include: Lead MAJCOM/A4s, the Propulsion Sustainment Division Chief, the Propulsion Sustainment Chief Engineer, the Propulsion Acquisition Division Chief, and the Propulsion Acquisition Chief Engineer.

2.15.2. Maintenance Planning Working Group (MPWG): The MPWG reviews and validates the maintenance plan developed according with AFI 63-101/20-101, including the use of CBM+ (RCM/ET&D/P) principles.

2.15.2.1. The MPWG meets at least annually and will be collaboratively co-led between TMS logistics and technical (including equipment specialist and engineering) IPT leaders. Issues that cannot be resolved between the IPT logistics and technical leaders will be elevated to the LPS Division Chief (PM/SML) for resolution.

2.15.2.2. MPWG membership (voting and advisory) (see **Table 2.1**), includes voting and advisory membership. Each office listed represents one vote, with the exception of the program office getting two votes (program management and logistics [one vote], engineering and technical equipment specialist [one vote]). Each applicable MAJCOM has a separate vote. The MPWG Chair may grant advisory participation (Other Org's – e.g. aircraft OEM) when appropriate. In the event of a tie vote, the Lead MAJCOM has the deciding vote.

Table 2.1. MPWG Membership (voting and advisory).

Member	Engine TMS PO	Applicable MAJCOM	Program Office	Source of Repair Activitiies	AF Sustainment Center	DLA Supply	Engine OEM	Other Orgs
Voting	X	X						
Advisory			X	X	X	X	X	X

2.15.2.3. Each TMS engine program manager will establish a MPWG charter and ensure key areas of awareness are discussed at least annually. See **Attachment 4** for MPWG charter requirements and key areas of awareness.

2.15.2.4. The TMS MPWG may determine alternate means for implementation of CBM+ capabilities in accordance with the specific maintenance concept for its particular program. Contractor or CLS supported engine programs will state CBM+ requirements in their respective contracts and/or MAJCOM Instructions. (**T-3**).

2.15.2.5. The MPWG Chair will publish MPWG meeting minutes and action items.

2.15.3. Engine Review Organization (ERO): The ERO collects, develops, reviews and validates whole engine forecasted factors for use in spare engine acquisition and distribution computations for engines to be or still in production. Membership includes Lead Engineer, engine Program Office (including program manager, logistician, engineer, and technical equipment specialist), MAJCOMs (including AFR/ANG), and engine manufacturer.

2.15.4. Propulsion Center of Excellence (PCoE): The PCoE is managed by the Propulsion DoE. The PCoE conducts studies of the most complex AF engine issues and maintains propulsion best practices for the DoP. Membership includes highly skilled propulsion engineering and test personnel.

2.15.5. Propulsion Technology Office Steering Committee: A consortium of Propulsion, Air Force Research Laboratory and Air Force Sustainment Center senior leaders, who facilitate the migration of maturing technologies and maintenance capabilities into the propulsion enterprise. The group works collaboratively to address technology insertion, component improvement and maintenance processes, environmental issues and to enhance overall weapon system performance, reliability and affordability. Primary goals are to lower propulsion total ownership costs and to develop repeatable standardized repair processes by implementing state of the art technologies within the Air Logistics Complex. (**T-3**).

2.15.6. Propulsion Support Equipment Working Group: A forum under the chairmanship of the Support Equipment Product Group Manager for dialogue between propulsion support equipment stakeholders at all levels to exchange ideas, share technology information, and review sustainment planning for the benefit of the AF Product Support Enterprise to improve engine readiness rates, reduce total ownership cost, and minimize the logistics footprint. (**T-3**).

Chapter 3

MANAGEMENT OF PROPULSION ASSETS

3.1. Program Integrated Life Cycle Management (ILCM).

3.1.1. Accountability for ILCM of Programs acquired in accordance with AFI 63-101/20-101, is unchanged. The PM accountability and the Product Support Manager (PSM) responsibilities are contained in AFI 63-101/20-101, which take precedence concerning a conflict that may be within this publication regarding accountability of the PM or PSM. Therefore, in regard to the relationship between the PM, PSM and the DoP, the DoP is a Propulsion Product Support Integrator (PSI). **NOTE:** The terms PM and PSI throughout this publication refers to individuals as defined in AFI 63-101/20-101.

3.1.2. AFMC/CC has designated DoP responsibilities to the AF Life Cycle Management Center Propulsion Management Directorate (AFLCMC/LP). The DoP will be the single focal point for propulsion life-cycle management procedures and processes, and the AFMC point of entry for support to PMs and MAJCOMs.

3.1.3. The requirements in this publication will be included in all acquisition and sustainment planning phases. AFLCMC/LP acquisition personnel are to be included in engine acquisition planning, and AFLCMC/LP sustainment personnel are to be included in the engine sustainment planning.

3.2. Comprehensive Engine Management System (CEMS). CEMS, Data System Designator - D042 or equivalent, the accountable property system of record, is used to provide automated information system capabilities for engine management. TO 00-25-254-1 provides CEMS reporting requirements and procedures. CEMS identifies owning SRAN, status, condition, and configuration information for all CEMS accountable engines by serial number and Configuration Item Identifier. CEMS capabilities include the following:

3.2.1. Engine status reporting, engine inventory management, allocation and distribution, pipeline analysis, configuration management, TCTO management, CBM+ data can be extracted, as well as actuarial experience.

3.2.2. Tracking of engine life limits and life expended for life limited parts. For additional guidance, refer to TO 00-20-1, *Aerospace Equipment Maintenance Inspection, Documentation, Policies, and Procedures*.

3.2.3. Financial feeder system to Defense Finance and Accounting Service for the Chief Financial Officer.

3.3. Engine Asset Management. CEMS data will be:

3.3.1. Managed by serial number in accordance with TO 00-25-254-1 for all AF propulsion life-limited serially tracked items;

3.3.2. Used to evaluate the health of engines in individual SRAN accounts;

3.3.3. Used to predict engine performance condition, removals, repairs and spare engine requirements.

3.4. Whole Engine Accountability. AFMC will manage all engines identified in Master SRAN FJ2031. SRAN EJXXXX and FJXXXX, as specified in TO 00-25-254-1, are sub-accounts to SRAN FJ2031 and provide accountability for engines. Activities possessing CEMS accountable engines require a SRAN. AF, AFRC, and ANG activities are FJXXXX SRANs. Contractors and inter-service support activities are EJXXXX SRANs. Procedures for obtaining or deleting SRANs are in TO 00-25-254-1. The DoD Activity Address Code is the authoritative source for all official asset repair locations.

3.5. Engine Life Cycle Management Plan (ELMP).

3.5.1. Each TMS currently active in the AF inventory has an ELMP. The ELMP may be embedded within the Life Cycle Sustainment Plan provided it contains all required ELMP elements and is provided to the DoP. Engine life cycle management planning and documentation in an ELMP begins as early as practicable in the acquisition process.

3.5.2. The ELMP is a dynamic living strategy, ensuring the Operational Safety, Suitability, and Effectiveness (OSS&E) goals are established, in coordination with operating MAJCOMs, and achieved throughout the life cycle of the engine. See **Chapter 7** for detailed ELMP requirements.

3.5.3. The DoP will ensure development of ELMPs, certify content completeness and accuracy, and provide to applicable PMs for incorporation into program documentation.

3.6. Propulsion Requirements System (PRS). The PRS is used to compute all whole engine stock levels including contingency operations, special projects, and security assistance programs. **NOTE:** PRS results are also utilized for computing repair, overhaul, and retention requirements.

3.6.1. The annual computations are computed in accordance with processes, procedures, and formats/forms published in **Chapter 6** below.

3.6.2. Whole engine computations will establish acquisition and distribution of spare engine levels.

3.6.2.1. The acquisition computation establishes the procurement quantity of whole spare engines the AF needs to acquire in support of the respective weapons system life cycle.

3.6.2.2. The distribution computation establishes the quantity and locations where the AF will place its spare engines.

3.6.2.3. Additional computations are also accomplished for repair, overhaul, and retention requirements.

3.6.3. The PRS results are used for computing engine overhaul and repair requirements.

3.6.3.1. Engine overhaul requirements will be accomplished at least annually, beginning with the aircraft flying hours, engine cycle time, and/or time since last maintenance/overhaul (refer to specific engine technical data), to determine the number of whole engines requiring maintenance for the current year and for the Five Year Defense Plan (FYDP).

3.6.3.2. Engine Intermediate Maintenance repair computations will be accomplished at least annually. The Engine Intermediate Maintenance Computation Process includes the repair computation for the current and next six years. **NOTE:** Computations will be used by repair activities/managers to determine recommendations for manpower, facilities, and spare levels required to support Engine Intermediate Maintenance.

3.7. Repair Network Management. Refer to DAFI 20-117, *Repair Network Management* for Enterprise Repair Network Integration (RNI), issuance that codifies the AF RNI structure, governance, terminology, requirements, and responsibilities.

3.8. Strategic Workload Optimization. Refer to Propulsion Directorate Process Guide for Strategic Workload Optimization and Prioritization. Provides a strategic enterprise approach to product support for propulsion depot repair requirements which allows AFLCMC/LP to consolidate data and rationale for a viable, auditable workload review in order to effectively manage an appropriate maintenance posture. **https://usaf.dps.mil/sites/22041/LPZ/LPZL/Strategic%20Workload%20Optimization/Forms/AllItems.aspx?viewpath=%2Fsites%2F22041%2FLPZ%2FLPZL%2FStrategic%20Workload%20Optimization%2FForms%2FAllItems.aspx**

3.9. Retention, Reclamation, and Disposal. Retention of spare engines, reclamation of engines, and disposal of engine residue will be in accordance with DoDM 4160.21, Volume 3, *Defense Materiel Disposition Manual: Reutilization, Transfer, and Sale of Property*, and AFI 23-101. The DoP will coordinate requirements for reclamation of engines and provide necessary unique additional reclamation guidance that is applicable solely to engines. **NOTE:** Supply chain management personnel are responsible for identifying economically reclaimable parts, in accordance with above references, from excess engines **(T-0)**.

3.10. Packaging, Handling, Storage and Transportation.

3.10.1. Engines will be protected from corrosion, shock, vibration damage during transportation, handling and storage in accordance with TO 2J-1-18, *Preparation for Shipment and Storage of Gas Turbine Engines* and TO 00-85-20, *Engine Shipping Instructions*. Items damaged due to improper packaging will be reported in accordance with TO 2J-1-18, AFMAN 24-604, *Preparing Hazardous Materials for Military Air Shipments*, and Defense Logistics Manual 4000.25, *Defense Logistics Management Standards (DLMS), Vol 3*. TO 00-85-20 specifies shipping devices for the TMS engine.

3.10.2. Transportation of engines will be accomplished in accordance with AFI 24-602V2, *Cargo Movement.*

3.10.3. For each engine shipment and transfer the SEMs prepares a DD Form 1348-1A, or DD Form 1149. Retain, and update to specify the disposition of the engine in accordance with TO 00-25-254-1.

3.10.4. Engines will be protected during off-wing maintenance to mitigate damage from exposure to adverse environmental and/or corrosion causing conditions in accordance with the engine TO and/or Operating Instruction.

3.11. Condition Based Maintenance Plus (CBM+). CBM+ will be used with the application and integration of appropriate processes, technologies, and knowledge-based capabilities to achieve the target availability, reliability, and operation and support costs of propulsion systems and components across their life cycle. At its core, CBM+ is maintenance performed based on evidence of need, integrating RCM, Engine Trending & Diagnostics/Prognostics (ET&D/P) analysis with those enabling Digital Engineering Strategy processes, technologies, and capabilities that enhance the readiness and maintenance effectiveness of propulsion systems and components. CBM+ uses a systems engineering approach to collect data, enable analysis, and support the decision-making processes for system acquisition, modernization, sustainment, and operations. Reference DoDI 4151.22, *Condition-Based Maintenance Plus for Materiel Maintenance* and AFI 63-101/20-101, *Integrated Life Cycle Management* and *DoD Digital Engineering Strategy*, June 2018 (**https://ac.cto.mil/wp-content/uploads/2019/06/2018-Digital-Engineering-Strategy_Approved_PrintVersion.pdf**).

3.11.1. Engine Trending and Diagnostics/Prognostics (ET&D/P). ET&D/P is an engineering analysis process to reduce engine flight safety risk, improve reliability, and reduce TOC. AFMC will ensure accurate limits for each engine type are developed and procedures established where applicable to achieve ET&D/P objectives of **(T-2)**:

3.11.1.1. Eliminating catastrophic engine failures.

3.11.1.2. Preventing or limiting engine damage by prediction and/or early detection of adverse trends towards known failure modes and/or performance degradation/failures.

3.11.1.3. Minimizing the ET&D/P deployment footprint by standardizing ET&D hardware, software, test instrumentation, techniques and procedures, and consolidating base level tasks.

3.11.1.4. Maximizing on-board automated data collection and analysis.

3.11.1.5. Minimizing the level of repairs.

3.11.1.6. Improving life measurement of critical components to reduce TOC and improve reliability.

3.11.1.7. Increasing mean time between engine removals.

3.11.2. Reliability Centered Maintenance (RCM). RCM is used to determine what failure management strategies should be applied to ensure a system achieves the desired levels of safety, reliability, environmental soundness, and operational readiness in the most cost-effective manner. Reference DoD 4151.22-M, *Reliability Centered Maintenance (RCM)*, for the three RCM metrics of Business, Program Management, and Technical.

3.12. Deficiency Reporting (DR). All reportable deficiencies on engines covered by this Instruction will be documented, reported, and resolved in accordance with TO 00-35D-54, *USAF Deficiency Reporting and Investigation System*.

3.13. Engine Component Improvement Program (CIP). The Engine CIP is to improve safety, reliability and availability of engines. **Chapter 5** contains detailed CIP requirements. The overall funding sources will be matched against the engine CIP requirements to:

3.13.1. Provide for sustaining engineering support for developing solutions to engine problems; i.e., increase safety of flight; correct operationally identified deficiencies; improve reliability, maintainability and durability; and reduce TOC.

3.13.2. Support ground and flight testing of existing and newly fielded engines.

3.13.3. Establish a prioritized list of projects or tasks each calendar year as agreed to by the Lead MAJCOMs. **NOTE:** Integrity programs are functionally under Systems Engineering codified within SAF/AQ issuances.

3.14. Propulsion Airworthiness Certification. Refer to Air Force Policy Directive 62-6, *USAF Airworthiness*, AFI 62-601, *USAF Airworthiness*, and AWB-330A, *Propulsion System Type Certification* for policy and implementation direction to obtain and maintain Propulsion Airworthiness Certification.

3.15. Engine Lead the Fleet (LtF)/Analytical Condition Inspection (ACI). Engine LtF (e.g., "Pacer" and "Compass Vector") and ACI activities will determine the actual distress modes of an engine and its subsystems in the field. **Chapter 8** contains additional details on LtF/ACI.

3.15.1. TMS engineers monitor engines, modules, Line Replaceable Units (LRUs), and Shop Replaceable Units (SRUs) in field operations to identify and assess all the potential distress modes encountered by an engine during operational use. Once distress modes are identified and assessed, PMs will adjust maintenance planning, in collaboration with AFMC, to ensure the fleet continues to operate safely.

3.15.2. PMs and MAJCOMs will support/collaborate with AFMC propulsion technical and management activities as requested. **(T-3).**

3.15.3. The objective of LtF Engines (accelerated engine usage activity to accrue flying hours ahead of the fleet) is to assist in defining corrective actions prior to the maturity of the fleet. LtF Engines will provide:

3.15.3.1. Early intelligence on engines/modules/LRU/SRUs integrity, reliability, and maintainability before the majority of the fleet is impacted.

3.15.3.2. Engineering and procurement lead time data for orderly updates and modification of the engine, and the engine's controls and accessories.

3.15.4. LtF engines/modules/LRU/SRUs may be used to test flight worthy new durability hardware that has been qualified by AF engineering.

3.15.5. The objective of ACI is to reveal defects that may not otherwise be detected through normal TO and maintenance inspection. ACI will also provide opportunity to evaluate changes to TOs and possible life extensions.

3.15.6. See **Chapter 8** for detailed LtF/ACI requirements.

3.16. Propulsion System Safety. Propulsion safety management is in accordance with Air Force Policy Directive 91-2, *Safety Programs*, and AFI 91-202, *The US Air Force Mishap Prevention Program*.

3.16.1. Processes or additional guidance to ensure AF propulsion systems safety will be complementary to the processes utilized by Systems as documented in AFI 63-101/20-101, AFI 91-202 and in the latest approved MIL-STD-882E, *DoD Standard Practice for System Safety*.

3.16.2. MAJCOM/CCs, AF Chief of Safety (AF/SE), AF Director of Logistics (AF/A4L) and applicable PMs will be sent an annual propulsion safety message by the DoP that:

3.16.2.1. Summarizes the propulsion risks on all engines within the AFMC portfolio that exceed the propulsion safety thresholds. (See **Table 4.2**)

3.16.2.2. Describes the risk's causes, risk level, action being taken, funding issues and slips to the plan of action.

3.16.3. See **Chapter 4** for detailed Propulsion System Safety processes.

3.17. Base Stock Level (BSL) and War Readiness Engines (WRE). BSL is the number of spare engines (serviceable and unserviceable) required at the bases to support the AF mission (both peace and war) to an 80% ready rate. WRE is a subset of BSL, which is the number of net serviceable engines available to support the AF's war tasking. WRE are to be available to support a weapon system from the start of the war until re-supply (via base, intermediate and /or depot repair) is established. **NOTE:** For information on War Reserve Materiel, refer to AFI 25-101, *War Reserve Materiel (WRM)*.

Chapter 4

PROPULSION SAFETY

4.1. Overview. The DoP and the Air Vehicle PM collaborate to implement a planned, integrated, and comprehensive propulsion safety effort that complies with the requirements in AFI 63-101/20-101 and AFI 91-202. **Paragraph 4.2** describes the use of the system safety methodology in MIL-STD-882E as tailored by propulsion-specific guidance, criteria, and procedures. **Paragraph 4.3** describes the additional safety management tasks executed by the DoP. Propulsion safety efforts contribute to the overall OSS&E of USAF and international air vehicle systems.

4.2. Propulsion-specific System Safety Implementation Requirements. This section defines relationships between the two communities (propulsion systems and the aircraft systems) in executing the system safety methodology for propulsion systems, implementing the requirements in AFI 63-101/20-101, and AFI 91-202 for program offices to use the system safety methodology in MIL-STD-882E to integrate safety, occupational health, and environmental risk management into the systems engineering process. This section does not summarize or repeat all of the system safety requirements from the aforementioned referenced documents. The DoP has provided supplemental procedures and criteria included in this publication to tailor that methodology for propulsion systems. The additional use of engine-specific quantitative probability criteria, i.e. Non-Recoverable In-flight engine Shutdown (NRIFSD) and Engine Related Loss of Aircraft (ERLOA) (correlating to uncontained failures, fires, or total loss of thrust), provide a basis for more detailed risk assessment and comparison.

4.2.1. DoP ensures the Chief Engineer:

4.2.1.1. Defines, documents, and adopts safety risk management matrices and/or tables.

4.2.1.2. Reports annually the propulsion safety risk management situational status and guidance to their respective Centers, Complexes, the appropriate PMs, International partners, Headquarters AFMC safety office, and lead-MAJCOM safety offices.

4.2.1.3. Notifies the DoP and respective Air Vehicle PMs of all safety hazards and risks in accordance with MIL-STD-882E.

4.2.1.4. Identifies "Propulsion Safety Threshold" risks or hazards per Propulsion Best Practice PCOE BP-99-06E, *Aircraft Gas Turbine Engine Flight Safety Risk Management Process*. Establishes, in coordination with PMs, an appropriate understanding of propulsion specific risks. In accordance with the MIL-STD-882E methodology, use the propulsion hazard severity category assignments in **Table 4.1** and the NRIFSD rate as the hazard probability level assignment to define the risk. Propulsion hazards will be managed per **Table 4.2**.

Table 4.1. Propulsion Hazard Severity Category Assignment.

A Hazard That Can Result In	Must be Assigned These Severity Categories, as a Minimum
Engine Related Loss of Aircraft (ERLOA) OR Uncontained Fire	Catastrophic
Non-Recoverable In-Flight Shut-Down (NRIFSD) on a single/twin-engine air vehicle	Catastrophic
NRIFSD of one engine on a three-or-more-engine air vehicle	Critical
Uncontained Failures	Critical
Anything other than NRIFSD or ERLOA that does not meet the MIL-STD-882E definitions of Critical or Catastrophic *	Less than Critical *
* NOTE: There may be non-NRIFSD or non-ERLOA mishaps/events that could be assessed as critical or catastrophic.	

Table 4.2. Propulsion Safety Threshold Risk Levels for Non-Recoverable In-Flight Shut-Down and Engine Related Loss of Aircraft (ERLOA).

Single/Twin Engine	3 or More Engines	Action Required by Propulsion Enterprise
<0.01 NRIFSD/100K EFH	<0.05 NRISFD/100K EFH	Review
0.01-0.05 NRISFD/100K EFH	0.05-0.1 NRISFD/100K EFH	Monitor
>0.05 NRISFD/100K EFH	>0.1 NRISFD/100K EFH	Corrective Action Required
>0.5 ERLOA mishaps over the remaining life of the engine TMS in USAF inventory	>0.5 ERLOA mishaps over the remaining life of the engine TMS in USAF inventory	Corrective Action Required

4.2.1.5. Accomplishes risk mitigation verification throughout the interim and corrective action implementation.

4.2.1.6. Revise/updates propulsion hazard risk assessments in accordance with **Paragraph 4.2.8**.

4.2.2. DoP ensures Propulsion Safety Managers (TMS Lead Engineers):

4.2.2.1. Establish and maintain an appropriate propulsion system safety program (project) according to DoP established processes and MIL-STD-882E.

4.2.2.2. Integrate system safety efforts with other engineering and program milestones.

4.2.2.3. Identify and assess safety hazards and risks throughout the engine program life and report safety risks that require acceptance in accordance with AFI 63-101/20-101.

4.2.2.4. Provide propulsion system safety assessments for design and program reviews.

4.2.2.5. Conduct special tests to verify proper system performance and ensure that safety managers resolve or control all hazards.

4.2.2.6. Track identified hazards and their solutions, when feasible or applicable.

4.2.2.7. Document management decisions for acceptance of mishap risks.

4.2.2.8. When required by the DoP, develop quantitative propulsion system safety criteria and operating limits in concert with the system program office or operational command.

4.2.2.9. Support System Safety Groups/System Safety Working Groups for aircraft that use engines which are managed in accordance with this publication.

4.2.2.10. Support implementation of propulsion system safety within the propulsion system development, modification, and sustainment.

4.2.2.11. Maintain engine hazard risk acceptance documentation.

4.2.2.12. Identify and assess safety hazards and risks throughout the worldwide (USAF and international) operational fleet as required by AFMAN 16-101, *International Affairs and Security Assistance Management*.

4.2.3. Air vehicle program office(s) integrates the MIL-STD-882E system safety methodology into the air vehicle program's systems engineering process in accordance with AFI 63-101/20-101. The PM's lead systems engineer will work with the Engine TMS manager and the Propulsion Safety Manager to evaluate and respond to hazard identifications and risk assessment notifications. This process involves integration of the propulsion-specific safety risks into the overall program's system safety process. As a critical part of this system safety process, the PM obtains formal risk acceptance in accordance with AFI 63-101/20-101.

4.2.4. Propulsion system safety risk assessment types:

4.2.4.1. Baseline risk assessment must be developed following a new propulsion hazard or safety risk surfacing, depending on the seriousness of the new hazard or risk as described in this publication. **NOTE**: Baseline risk is the MIL-STD-882E "initial risk" that is retained in the PM and DoP hazard tracking system.

4.2.4.2. Interim risk assessment will be developed depending on the seriousness of the new hazard or risk as described in this publication. The interim risk will represent the reduction, if any, of the baseline risk due to inspections, life limits, flight restrictions or other maintenance. If interim actions are not feasible, the interim risk equals the baseline risk. **NOTE**: Interim risk usually results from the "non-hardware" fixes possible to reduce risk exposure.

4.2.4.3. If any corrective action plans are dependent upon receipt of funding, final risk will be calculated once funding is obtained and a fleet implementation plan for the corrective action is developed.. **NOTE**: This risk is the MIL-STD-882E "target risk" that is retained in the PM and DoP hazard tracking system, which reflects the risk level that will be attained pending funding and implementation of corrective actions.

4.2.5. At a minimum, risk assessments contain the following:

4.2.5.1. Background: Description of events, photos, drawings or diagrams, and investigation results of sufficient detail to describe the history and impact of the new events.

4.2.5.2. Failure Mode and Effects: Hazardous condition description and an explanation of the cause of the condition and the effects.

4.2.5.3. References: Prior applicable risk assessments and related source documents.

4.2.5.4. Assumptions: Suspect population, usage rates, ERLOA/NRIFSD ratio, metal containment factor if applicable, life analysis assumptions if applicable, or future fleet flying hour estimation.

4.2.5.5. Risk Quantification: Future events and rates estimation, explanation of statistical techniques utilized, (i.e. Weibull analysis, Monte Carlo simulations, probability estimation, if applicable life limited parts Low Cycle Fatigue life, deterministic/probabilistic fracture mechanics life, or Low Cycle Fatigue initiation plus propagation statistical distribution).

4.2.5.6. Conclusions/Recommendations: Summary of risk in terms of NRIFSD rate and predicted ERLOA recommended interim field actions with supporting rationale and impact to risk, long term corrective action concepts, and impact to risk.

4.2.6. In parallel to the propulsion safety risk determination, notification of new propulsion system hazards and risks to the respective PMs will be accomplished using a systematic and phased approach as outlined in **Table 4.3** This will result in an increased level of understanding of the hazard, risk, root cause, corrective action plan, and risk mitigation effectiveness as the new hazard investigation process progresses. The lead MAJCOM and the Air Force Safety Center will be notified concurrently of the risk. **NOTE**: If the new hazard is associated with an active Safety Investigation Board, the Convening Authority provides notification in accordance with DAFI 91-204, *Safety Investigations and Reports*. The following describes the notification timelines and the phased reporting timeline and content to the PMs required for any newly discovered or on-going propulsion risks or hazards.

4.2.6.1. The timelines in **Table 4.3** begin at the "time of discovery". The Hazard Severity Classification is defined in Mil-STD-882E. Notification of the hazard discovery must be accomplished via e-mail memorandum. Depending on risk, the formal risk acceptance may be obtained for the baseline, interim, or final risk.

Table 4.3. DoP Risk Assessment Timeline.

Hazard Severity Classification	Preliminary Qualitative	Baseline	Interim	Final
Catastrophic / Critical	Within 30 days of hazard discovery	Within 90 days of hazard discovery and upon Baseline Rates determination	Upon determination of Interim risk Rates	Upon root cause determination and final fleet implementation plan
Less Than Critical	N/A	Within 150 days of hazard discovery and upon Baseline Rates determination	Upon determination of Interim risk Rates	Upon root cause determination and final fleet implementation plan

4.2.6.2. Preliminary Qualitative Assessment. For catastrophic/critical risks, a preliminary qualitative risk assessment is submitted to the risk acceptance authority to provide a preliminary notification of risk and contains the initial “best understanding” of the new failure mode, the qualitative Risk Assessment Code defined in MIL-STD 882 (e.g., 1E), the preliminary timeline for root cause investigation, rationale for identification of this hazard being potentially a catastrophic/critical hazard, and if necessary, a recommendation on limitation of operations. This notification is not intended for risk assessment. This notification will provide an estimated timeline for submission of the quantitative baseline risk assessment.

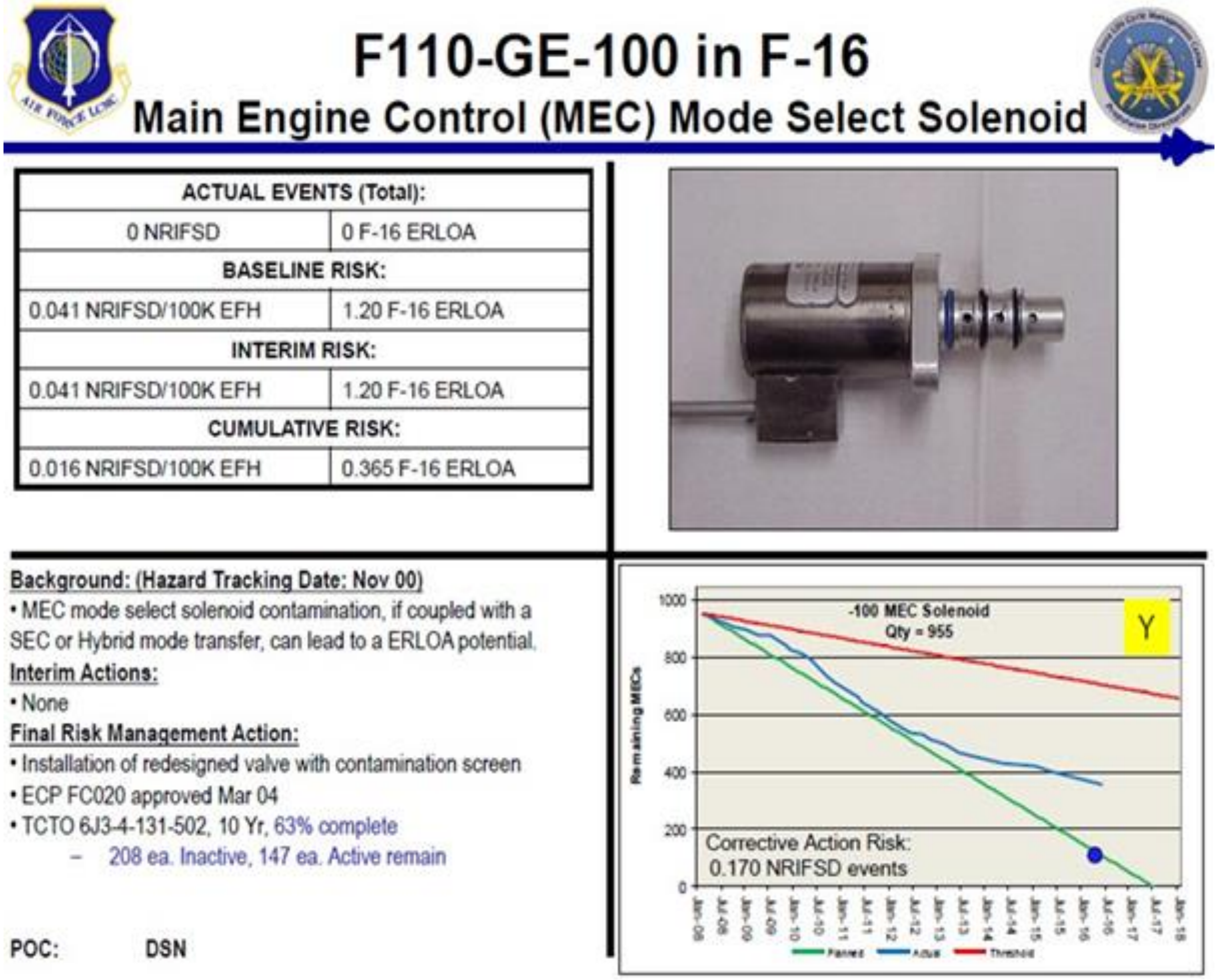
4.2.6.3. Baseline Risk Assessment. This assessment provides the baseline quantitative risk, and if previously developed, updates the qualitative assessment. The risk assessment will include the baseline NRIFSD rate and Engine-Related Loss of Aircraft (ERLOA) events for an unmitigated risk. Mitigation is required for risks exceeding the propulsion safety thresholds in **Table 4.2** This notification will provide an estimated timeline for submission of the interim risk assessment unless the interim risk rates are included with the baseline notification.

4.2.6.4. Interim Risk Assessment. After interim risk reduction actions are identified, the interim assessment is completed. The interim risk represents the reduction, if any, of the baseline risk due to inspections, life limits, flight restrictions or other maintenance. This assessment will include the calculated interim NRIFSD rate/ERLOA events. If interim actions are not feasible, the interim risk equals the baseline risk. This notification will provide an estimated timeline for submission of the final risk assessment unless the final risk rates are included in the interim notification.

4.2.6.5. Final Risk Assessment. The final (aka target) risk is calculated once a final fleet implementation plan for the corrective action is developed. The final (aka target) risk is from the beginning of the final corrective action incorporation through the end of the projected fleet life. As with all risk mitigation measures, the goal is to bring the risk below threshold, but on rare occasions the risk remains above PST even with final correction action. By comparison, the cumulative risk updates the interim risk and is the average risk over the total exposure period that accounts for the baseline period, interim actions, if any, and final corrective actions.

4.2.7. Propulsion hazards and mitigation actions will be tracked using the format shown in **Figure 4.1**.

Figure 4.1. Format for Tracking Propulsion Hazards and Mitigation Actions.



4.2.8. Program Execution Chain Risk Acceptance

4.2.8.1. DoDI 5000.88 requires formal risk acceptance by the appropriate authority in the program execution chain prior to exposing people, equipment, or the environment to a known hazard. The PM is required to document that the risks have been accepted by the following acceptance authorities: the Component Acquisition Executive for high risks, PEO-level for serious risks, and the Program Manager for medium and low risks. The following paragraphs describe the AF process for complying with the DoDI 5000.88 requirement for hazards identified by the propulsion enterprise.

4.2.8.2. For air vehicle systems in development, the PM must work closely with the DoP community to respond to the DoP hazard notifications described above. This process involves the PM integrating DoP-identified risks with program office's system safety risk management effort and working with the DoP community to evaluate and implement appropriate design changes or mitigations. During development, there is no requirement for formal risk acceptance on a specific timeline until an activity is planned that involves the exposure of people, equipment, or the environment to the hazard.

4.2.8.3. For air vehicle systems in sustainment, the DoDI 5000.88 risk acceptance requirement creates the necessity for rapid decision-making on whether to suspend system operations (i.e. "grounding" a system) or obtain appropriate risk acceptance to allow operations to continue. **Table 4.4** defines the AF risk acceptance timelines for fielded systems.

Table 4.4. PM Risk Acceptance Timeline, for Fielded Systems Only, following receipt of DoP Risk Assessments.

Hazard Severity Classification	Baseline	Interim	Final
High	120 days	120 days	120 days
Serious	90 days	90 days	90 days
Medium or Low	30 days	30 days	30 days

4.2.8.4. In response to receipt of the DoP risk assessment, if the PM determines the air vehicle risk to be high, the PM will notify the risk acceptance authority. For the purpose of complying with this guidance, this notification constitutes initial risk acceptance and will be in effect for up to 120 days to allow time to complete the formal risk acceptance.

4.2.8.5. In response to receipt of the DoP risk assessment, if the PM determines the air vehicle risk to be serious, the PM will notify the risk acceptance authority. For the purpose of complying with this guidance, this notification constitutes initial risk acceptance and will be in effect for up to 90 days to allow time to complete the formal risk acceptance.

4.2.8.6. In response to receipt of the DoP risk assessment, if the PM determines the air vehicle risk to be medium/low, the PM will provide formal risk acceptance within 30 days.

4.2.9. Propulsion hazard risk assessment revision (updates) and notification will be accomplished if interim or corrective action plan risks change due to delayed implementation, reduced interim or corrective action effectiveness, increased unpredicted failures or for other issues that, in the judgment of the Engine TMS manager, warrant notification. A PM update notification is not required unless the revised propulsion hazard risk increases.

4.3. Propulsion Safety Management Program.

4.3.1. DoP sends an annual message to affected PMs, International Engine Management Program (IEMP) Chief, MAJCOM/A4s; Air Force Chief of Safety (AF/SE); and USAF Directorate of Logistics (AF/A4L). This message summarizes the propulsion risks on all engines, actions being taken, and any programmatic issues affecting the plan of action for engines managed by the USAF which exceed the Propulsion Safety Thresholds in **Table 4.2**.

4.3.2. DoP ensures the Chief Engineer:

4.3.2.1. Reports annually the propulsion safety risk management situational status and guidance to their respective Centers, Complexes, the appropriate PMs, IEMP Chief, HQ AFMC safety office, and lead- MAJCOM safety offices.

4.3.2.2. Develops a budget process that supports mishap investigations and corrections of deficiencies in line with guidance found in DAFI 91-204, *Safety Investigations and Reports*.

4.3.3. DoP ensures propulsion safety managers (leads):

4.3.3.1. Provide data for the annual safety message and hazard notifications. At a minimum this will include identification of hazards, risk levels, actions being taken to eliminate or mitigate hazards, funding issues, and any slips to risk mitigation plans.

4.3.3.2. Assigned to system safety positions (e.g., DoP propulsion safety lead and TMS engine safety leads) complete an approved system safety course within 90 days of assignment (or first available course thereafter). **NOTE**: DoP documents rationale for assigned individuals who have not completed training within 120 days of assignment.

4.3.3.3. Incorporate propulsion and aircraft safety requirements and design criteria into all program documents and ensure compatibility with other program requirements such as reliability, maintainability, and human factors.

4.3.3.4. Support engineering in the assurance of system and/or end-item's operational safety, suitability, and effectiveness.

4.3.3.5. Assess annually, commercial safety experience (applicable if managing a commercial derivative engine).

4.3.4. PMs respond to the annual DoP safety message by acknowledging receipt.

Chapter 5

COMPONENT IMPROVEMENT PROGRAM (CIP)

5.1. General. The DoP is responsible for overall management and the execution processes of CIP. Engine CIP provides the only source of critical sustaining engineering support for in-service Air Force engines to maintain flight safety (highest priority), correct service related deficiencies, improve system Operational Readiness and Reliability & Maintainability, reduce engine Life Cycle Cost, and sustain propulsion systems throughout their service life not under Warranty, Contractor Logistics Support (CLS) or "power by the hour" type maintenance. Additionally, CIP supports testing and maturation of newly fielded engines. CIP develops solutions to in-service engine problems for the AF, other U.S. military services and international participants. The objective of CIP is to correct design; manufacturing; and/or the maintenance procedures of parts, components, and support equipment that limit worldwide engine safety, reliability, durability, and operational capability that cannot be corrected under warranty or other contract provisions. CIP establishes an agreed upon prioritized list of projects and tasks each calendar year, and funds the tasks above the "cut line" using AF Research, Development, Test, and Evaluation (RDT&E), other military services and international partners and Foreign Military Sales (FMS) participant funds.

5.2. Execution Management Roles.

5.2.1. The DoP is responsible to:

5.2.1.1. Ensure assignment and documented identification of CIP program managers and TMS engineering managers for applicable engine TMSs.

5.2.1.2. Provide CIP program managers and TMS engineering managers guidance and processes.

5.2.1.3. Coordinate the CIP POM submissions for RDT&E funding including preparation of the R-2 document and New Start notification.

5.2.1.4. Implement changes and modifications that have demonstrated the appropriate Technology Readiness Level (TRL) and Manufacturing Readiness Levels.

5.2.1.5. Program, budget and execute post-CIP requirements on behalf of MAJCOM customers, Services and FMS participants.

5.2.1.6. Direct the work of CIP TMS engineering managers with assistance from the Lead Development Test Organization, to ensure engine changes and modifications are adequately tested before approval for production and implementation.

5.2.1.7. Monitor and report execution status to PEOs.

5.2.1.8. Prepare annual CIP project and task lists in coordination with MAJCOMs, OEMs, Services, international partners, FMS participants and other applicable stakeholders.

5.2.2. Engine TMS managers plan and budget for incorporation of completed CIP tasks into aircraft.

5.2.3. The Technical Airworthiness Authority approves aircraft airworthiness type design certification documents in accordance with AFI 62-601, *USAF Airworthiness*, and MIL-HDBK-516C, *Airworthiness Certification Criteria.*

5.2.4. Lead Development Test Organization:

5.2.4.1. Serves as the Development Test and Evaluation agent in support of the systems engineering test and evaluation process, system integration and test, and transition to and certification of readiness for dedicated Operational Test and Evaluation in accordance with AFI 99-103, *Capabilities-Based Test and Evaluation.*

5.2.4.2. Coordinates the development test strategy for each CIP project or task that requires engine-level testing.

5.2.5. Lead MAJCOM/Services:

5.2.5.1. Communicate operational goals and requirements for specific engine TMS CIP and assist the DoP and Propulsion DoE in establishing requirement priorities.

5.2.5.2. Coordinate on CBM+ requirements and advocate for program funding and CIP support.

5.2.5.3. Provide appropriate representatives to the Engine CIP Working Group (ECWG).

5.2.6. AFLCMC Financial Management Functional:

5.2.6.1. Manages financial activities during program execution.

5.2.6.2. Monitors obligations and expenditures against the Office of the Secretary of Defense (OSD) goals and provides monthly status charts to Program Manager.

5.2.7. International CIP Participation: International participants can only join the USAF CIP program through membership in the IEMP. International partners with the F-35 Joint Program Office follow established separate guidance for CIP participation. International participants benefit through cost sharing as well as improvements to the engine TMSs in their fleet. Maintaining common configuration with CIP engines maximizes the benefits for all members. Common configuration benefits both the USAF and the international partners or participants by reducing operational cost, reducing safety risks and allowing our allies to fly and fight together with the USAF at greater efficiency. Each Engine TMS owner participates in cost pools of the tasks benefiting each TMS, and there is no 'task' related selective participation. CIP-derived improvements in components, procedures, technical data and repairs are not to be shared with non-IEMP members, and engine manufacturers are not permitted to release CIP information to non-IEMP countries. **NOTE**: See **Attachment 3** for guidance to compute the Engine CIP Fair Share Rate.

5.2.7.1. Member countries are invited to yearly CIP User's Conferences and planning meetings.

5.2.7.2. Participating countries receive proposed Engineering Change Proposals (ECPs) through the IEMP or Joint Configuration Change Boards for review/coordination. **NOTE:** Countries will receive copies of approved ECPs and develop/follow their own implementation plan. Foreign militaries may appoint Foreign Liaison Officers to perform as a single Point of Contact (POC) for CIP efforts.

5.2.7.3. Countries may submit task proposals through IEMP country managers for inclusion in CIP. The CIP TMS engineering manager determine if the task is considered fleet common or unique. Tasks determined to be fleet common will be added to the ECWG and racked and stacked to determine priorities with other tasks. Tasks determined to be FMS unique will not be considered for the annual ECWG prioritization. **NOTE:** OEMs submit proposals for EAB approved FMS unique tasks like all other tasks on the approved list. Costs of an FMS unique task will be borne by the benefiting FMS country or countries. In case of a dispute in determination of FMS uniqueness of a task, the DoP will make the final decision.

5.2.7.4. After a country's initial membership in the CIP is established, continuous membership is required to maintain CIP benefits. If a country experiences a lapse in service, the CIP TMS engineering manager ensures equitable costs are facilitated for all members by applying a reinstatement cost.

5.2.7.5. International partner's participation in an engine enhancement program for non-CIP engines will be a unique cooperative process between the engine contractor, DoD components, and international partners.

5.3. CIP Processes. The four inherent CIP processes are requirements generation, requirements approval, program execution, and product transition.

5.3.1. Prior to the ECWG, the CIP TMS engineering manager will complete the requirements generation process depicted in **Figure 5.1** using **Attachment 2** "Engine CIP Scorecard Process Guidance". **NOTE**: The F135 Propulsion Advisory Board will follow Joint Program Office established processes to determine requirements generation. This process relies on developing and selecting strategic options based primarily on safety and reliability and maintainability needs.

5.3.2. Cost Effectiveness Analysis (CEA). A determination that the Life Cycle Cost and Return-on-Investment of a CIP task is required to ensure affordability for the TMS. With current standard history files, and ground rules and assumptions, a CIP task Return-on-Investment and delta improvement can be estimated. CEA information does not apply to safety issues in most cases. CEAs are required in each OEM contract. The CEA model is managed by the CEA Joint Propulsion Coordinating Committee Steering Committee. Engine TMS managers will update CEA ground rules and standard history files annually and provide inputs to the CIP program manager for transmission to the OEMs ensuring accurate Life Cycle Costs and Return-on-Investment s are provided in applicable proposed efforts.

5.3.3. Engine Health Indicators (EHI) Goals. Top-level engine health must be managed by the EHI defined in **Chapter 10**. The TMS engine-specific plan for setting and achieving these goals will be documented in the ELMP. Achievement of these goals is the primary objective of the requirements generation process. Specific customer-set goals must be defined for safety, availability, reliability, maintainability, and affordability. **NOTE:** Issue dependent metrics may also be used.

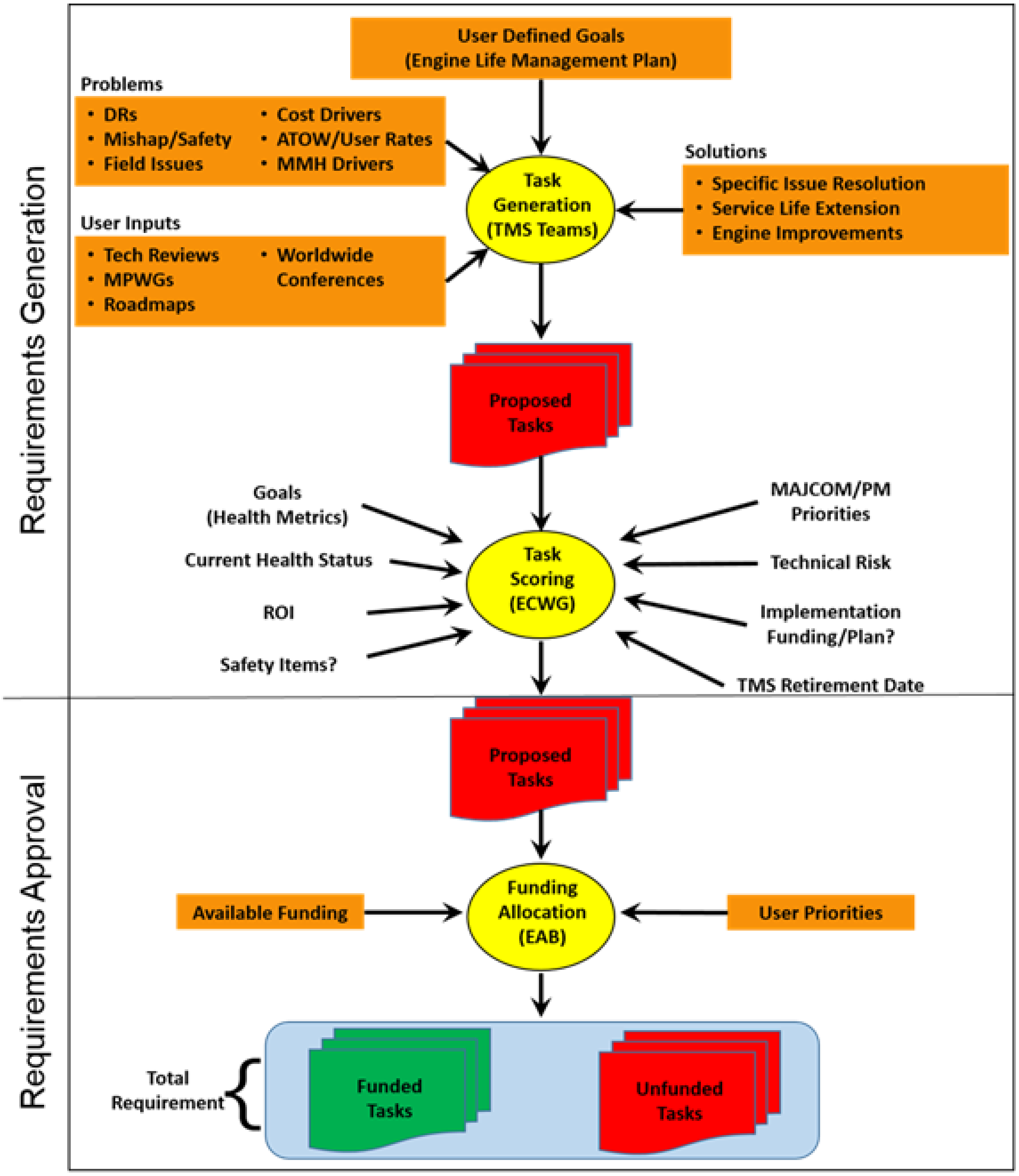
5.3.4. Customer Requirements Forums. In addition to the top-down view provided by the EHI goals, a bottom-up approach must also be used to identify specific engine deficiencies and customer requirements. These inputs will be collected via USAF, Services, international partner and FMS participant customer requirements solicitations and/or forums; e.g., MPWG and World-Wide User's Conferences. Additionally, top driver information must be collected from Deficiency Reports (DRs) and other usage statistics; e.g., Average Time on Wing (ATOW), Mean Time Between Removal (MTBR), Unscheduled Engine Removal (UER), Maintenance Man Hours (MMH).

5.3.5. Planning Forums. Considering engine health metric goals and the specific engine issues, the CIP TMS engineering manager generates a list of proposed solutions to resolve specific known issues and propose systemic improvements for long-term achievement of these goals (e.g., Service Life Extension Programs). These issues and solutions will be consolidated into specific engineering tasks for which the cost, schedule, and expected improvement in the engine health metric can be identified. The Propulsion CE will ensure:

5.3.5.1. Presentation of tasks to appropriate forums such as Propulsion Safety and Technical Reviews.

5.3.5.2. Development of plans to implement the CIP tasks and coordination with stakeholders (e.g., DoP, engine TMS managers, TMS engineering managers, CIP program managers, Lead MAJCOMs).

Figure 5.1. CIP Requirements Generation Process.



Note: IEMP member unique tasks are developed and funded outside the USAF scoring process depicted above.

5.3.6. CIP Requirements Approval Process: The CIP requirements approval process will utilize the ECWG, EAB and F135 PAB forums to integrate the user, technical, acquisition, and sustainment communities. **NOTE**: The PAB will follow Joint Program Office established processes to determine requirements approval.

5.3.6.1. The ECWG is chaired by the Fighter Engine Branch Chief. The ECWG data call and collection is done by the Fighter Engine Branch. Co-Chair participation includes the Chief Engineers for all impacted TMS engines, as well as Auxiliary and Secondary Power Unit and PCOE POCs. Participation includes, but is not limited to engine CIP program managers, TMS managers, TMS engineering, MAJCOMs, and IEMP PMs. The ECWG official recording is completed annually to provide future year requirements and prioritization (6 year plans) for the TMS-specific engine needs outlined in each TMS ELMP. The requirement list is consolidated and maintained by the Propulsion Acquisition CIP Branch.

5.3.6.1.1. ECWG/EAB agenda, required presentations, timing need, and scorecard guidance (**Attachment 2** to this AFMAN) will be provided by the Fighter Engine Branch. Informed decisions are required.

5.3.6.1.2. The resulting presentations and scoring are due as provided in the agenda notification (normally 30 days in advance of the ECWG date provided) or requirements may not be considered until the following year in order to avoid conflicts in Fair Share or User needs.

5.3.6.2. The EAB is a decision-making forum chaired annually by the DoP. Using the Engine TMS-specific requirements generated by the ECWG, the Propulsion DoE:

5.3.6.2.1. Ensures the needs for all the engines in the CIP portfolio are collected into a single combined requirement.

5.3.6.2.2. In the year prior to program execution, ranks the entire combined task list without FMS unique tasks and establishes a cut line determined upon projected funding by applying a scoring process that is focused on the achievement of the AF defined engine health metrics.

5.3.6.2.3. Technically validates data/outputs from the ECWG and prior to the EAB (initial approval) and provides to the DoP for final approval.

5.3.6.2.4. Executes funded requirements and retains unfunded requirement information resulting from DoP annual approval process.

5.3.7. CIP Execution Process: The CIP task list must be coordinated with the DoP. CIP TMS engineering and engine TMS managers will accomplish technical evaluations and Cost Effective Analyses of proposals prior to start of contract negotiations. The TMS engineering, CIP and TMS program managers will also review applicable CEAs for each proposal and resolve discrepancies through the technical evaluation process prior to start of contract negotiations.

5.3.7.1. CIP TMS engineering managers, with Propulsion DoE oversight, work with the CIP program managers, engine TMS managers and OEMs in planning and execution of engineering work and substantiation and validation of improvements. Engine TMS managers will oversee the logistic implementation plan of each Engineering Project Description and provide inputs to the CIP program manager.

5.3.7.2. CIP changes must be submitted to the Fighter Engine Branch Chief for consideration and decision action guidance. Safety related changes must be submitted immediately; all others as established by the Fighter Engine Branch Chief.

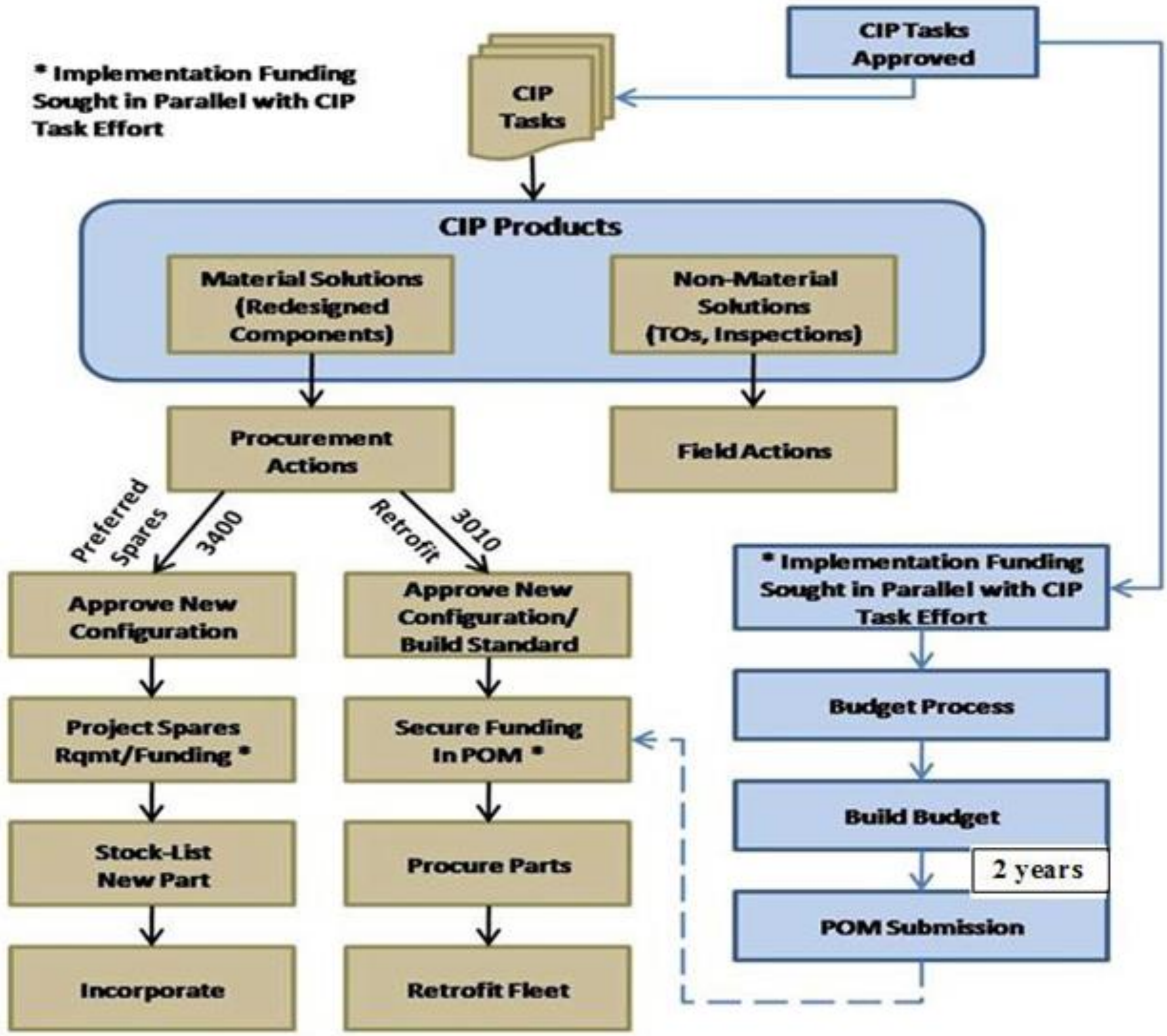
5.3.7.3. When the validation and substantiation of a task is complete and accepted by the CIP TMS engineering manager, all engineer development work ends, and the OEM will submit an Engineering Change Proposal (ECP).

5.3.7.4. OEM support in production incorporation must be included in the CIP contract. The CIP TMS engineering manager works closely with the OEM during production incorporation and, once the ECP has been delivered, the TMS engineering manager provides final approval to the CIP TMS program manager. The CIP TMS program manager will officially notify the OEM of ECP deliverable approval through the contracting officer and the Engineering Project Description will be considered closed at the end of the period of performance.

5.3.8. CIP Product Transition Process. The final step in the successful CIP process is to transition the developed and validated products to the customer. The process is outlined in **Figure 5.2** For hardware re-designs, the CIP TMS engineering manager ensures integration of activities. **NOTE**: To facilitate this critical coordinated effort, the PCoE BP-06-24B, *Propulsion Systems Modification Management Process*, is utilized.

5.3.8.1. As reflected in **Figure 5.2**, the modification management process utilizes the results of the CIP tasks combined with other means, to identify engine modification candidates requiring funds. Modification requirements will be incorporated into the ELMP.

Figure 5.2. CIP Product Transition Process.



5.3.8.2. DoP ensures coordination with the Lead MAJCOMs and key stakeholders in the propulsion community.

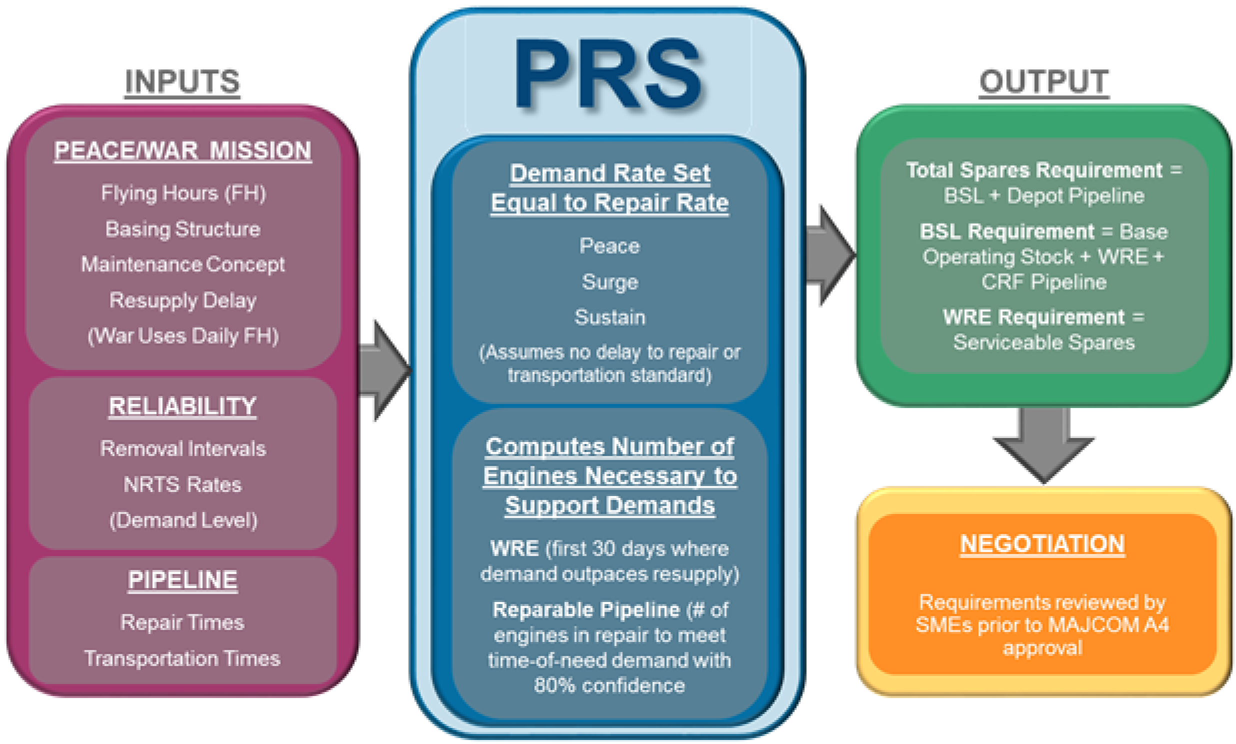
5.3.8.3. The Lead MAJCOM plans and supports incorporation of expected CIP products by way of attrition/retrofit.

Chapter 6

WHOLE ENGINE SPARE REQUIREMENTS COMPUTATION

6.1. Propulsion Requirements System (PRS). Whole spare engine requirements computations establish acquisition and distribution of spare engine levels. The acquisition computation establishes the quantity of whole spare engines the AF needs to buy for the System until retirement. The distribution computation establishes the quantity and locations where the AF will place its spare engines based on current planning policy and engine reliability. Engine reliability is established through removal intervals and Not Reparable This Station (NRTS) rates. In addition, other computations are accomplished for repair and retention requirements. The AF standard system used for the computation of whole spare engine requirements is WSMIS/PRS (D087Q), also known as PRS. An overview of PRS is provided in **Figure 6.1**.

Figure 6.1. PRS Overview.



6.1.1. Documentation. DoP ensures adequate supporting documentation is maintained for the whole spare engine requirements computations to establish an effective system of management controls. This includes documentation to support assumptions made, verify the accuracy of data used, validate the currency/applicability of data, identify data (factor) changes and trends, and re-create the requirements computation if required. Sources used and pertinent assumptions made during the computation of whole spare engine requirements will also be documented. Engine TMS manager retains with the computation results supporting documentation for the time periods specified in **Table 6.1**.

Table 6.1. Engine Documentation Retention Matrix.

If Document is from…	Retain for	After…
Acquisition Computation	2 years	The data is replaced in the computation.
Distribution/Retention Computation	2 years	The data is replaced in the computation.
Buyout Acquisition Computation	10 Years	The day the buyout computation is approved.

6.2. PRS Management.

6.2.1. The WSMIS Program Manager is under the responsibility of AFMC/CC, which is assigned to Logistics Readiness Branch (AFLCMC/HIS) Weapon System Management Information System (WSMIS) program office. The WSMIS Program Manager is responsible for ensuring the input data is loaded into the WSMIS/PRS (D087Q) database and works with the PRS Functional Managers and AFLCMC/LPA's PRS Subject Matter Expert to prepare for and support the computations process with the MAJCOM CEMs and Engine TMS actuaries.

6.2.2. DoP will:

6.2.2.1. Initiate and monitor the Engine Spare Requirements Computation process.

6.2.2.2. Ensure the accuracy of the computation.

6.2.2.3. Manage the schedule for the spare whole engine distribution computation.

6.2.2.4. Ensure compliance with computation.

6.2.2.5. Oversee the proper documentation of whole engine computation model software, PRS logic, and processes.

6.2.3. MAJCOM CEMs will:

6.2.3.1. Review and coordinate all computation inputs and accomplish the individual MAJCOM distribution computations.

6.2.3.2. Review data prior to running the PRS model, resolve errors, validate information, and provide unique command inputs during the allocation process.

6.2.3.3. Collaborate across commands on constrained engine programs.

6.2.3.4. Interact with the PRS functional manager, the Engine TMS actuary, the Engine TMS manager, and other MAJCOM CEMs to develop (peacetime and enduring operations) spare engine requirements.

6.2.4. The PRS functional manager will accomplish spare whole engine stock level acquisition computations and roll-up spare whole engine stock level distribution computations for the TMS. 6.2.4.1. The Engine TMS actuary will forecast actuarial removal intervals for use in the whole engine stock level distribution and overhaul computations.

6.2.5. DoP will charter activities to ensure coordination and integration with all stakeholders:

6.2.5.1. The ERO (Engine Review Organization) will:

6.2.5.1.1. Collect, develop, and coordinate factors used in the spare engine requirements acquisition/distribution computations for engines still in production.

6.2.5.1.2. Ensure factors used in spare engine acquisition and distribution computations are current and complete.

6.2.5.1.3. Document briefings presented, decisions reached, action items, and status of actions.

6.2.5.1.4. Develop factors to reflect the transition from peace to surge to sustained war. The DoP will determine the need to develop mature or actual factors, or both. The peace, surge, and sustained war factors established under the ERO responsibility are: Shop Visit Rate (SVR); Not Reparable This Station; and Pipeline Times, as provided by the MPWG, to include Base Repair In-work Times and Depot Repair In-work Times.

6.2.5.1.4.1. Transportation standards will be obtained from TO 2-1-18, *Aircraft Engine Operating Limits and Factors* guidance, and utilized as a factor for spare engine requirements.

6.2.5.1.4.2. Within each type factor, values are used for three time frames: peacetime/home-station, 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/home-station values when data are not available. Supporting data, rationale, assumptions, and decisions are documented. Explanations are included in the documentation for decisions without supporting data.

6.2.5.1.4.3. Mathematical modeling and computer simulation are used to develop factors or document why they are not used.

6.2.5.1.4.4. 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.

6.2.5.1.4.5. Engine factor changes are approved for use in requirements calculations when coordination has been obtained from the Lead MAJCOM and the PM.

6.2.5.1.4.6. Factors are re-validated at least annually and updated as necessary.

6.2.5.1.4.7. Concurrence from the OEM is obtained and documented prior to release of OEM engine factors to another manufacturer.

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

6.2.5.1.4.9. Factors for the TMS or combined TMS are developed at either worldwide or command level depending on mission, operation, support differences, or requirements calculations methods.

6.2.5.1.4.10. Estimated repair pipeline times for the engine are developed to flow through each segment of the pipeline per TO 2-1-18. **NOTE**: This is the average time to accomplish all necessary pipeline processes. Elements are frequency of occurrence, required manpower, facilities, tools, equipment, parts and technical data. Standard pipeline times for mature engine TMS, as documented in TO 2-1-18, serve as a goal for each maintenance, transportation and supply activity to achieve and will not consider delays for induction to maintenance and supply.

6.2.5.1.5. Spare engine computations representing maturity use standard pipeline times and a mature SVR. The mature SVR considers the impact of both Unscheduled Engine Removals (UERs) and Scheduled Engine Removals (SERs) over time.

6.2.5.1.5.1. The mature estimate will reflect the point in the engine's life cycle when only small changes are expected to occur in the slope of the UER rate curve per flying hour.

6.2.5.1.5.2. SER is evaluated to determine if there is a stable slope, or if "peaks and valleys" exist. If a stable SER exists, that value is used in the computation. Where "peaks and valleys" are expected to exist, the Engine TMS manager will make a recommended buy decision after considering the impact at points such as the peak SER value, the minimum SER value and selected mid-range values between the peak and minimum. **NOTE:** Groups such as the EAB, Senior Steering Groups, MPWG may also be utilized to develop factors and used to compute spare engines.

6.2.5.2. Aerospace Engine Life (AEL) Committee:

6.2.5.2.1. Validates, at least annually, changes to factors used in development of Actuarial Removal Interval tables for the distribution computation or when necessary to correct accuracy of forecasting Actuarial Removal Interval (ARI) Tables. AFLCMC/LP OI 20-012, *Aerospace Engine Life Committee for Engines*, and provides direction on the AEL process and outlines roles and responsibilities of the Aerospace Engine Life Committee members.

6.2.5.2.2. Recommends changes to factors (provided by Engine TMS actuaries from engine history) based on changes in engine reliability, employment of weapon system, and maintenance philosophies that affect the ARI table development. Timing ensures incorporation of approved factor changes in the development of ARI tables for use in the next PRS and repair computation cycle.

6.2.5.2.3. Example of factors to be reviewed are: AF/A3T projected peace and enduring operations flying hours, changes in force structure, scheduled/unscheduled/non-usage engine removal rates, operating limits, level of repair, base/depot screens, Not Reparable This Station percent, and engine flying hour to Type Limit Code ratios. Development of factors will exclude quick turn removals.

6.2.5.2.4. The Engine TMS manager, prior to the AEL convening, forwards necessary data to MAJCOM CEMs for review of proposed factor changes for development of ARI tables.

6.2.5.2.4.1. The data includes rationale for the changes and projected impacts of the changes in the removal forecasts.

6.2.5.2.4.2. The CEMs review and assess the impacts of the proposed changes and provide any alternative or additional factor change recommendations to the Engine TMS manager and actuary for inclusion in the review process.

6.2.5.2.4.3. The Engine TMS actuary presents supporting data and rationale for their proposal to the *Aerospace Engine Life Committee*.

6.2.5.2.4.4. If consensus of affected MAJCOMs is not achieved, the DoP defers to the Lead MAJCOM for the factor changes resolution.

6.2.5.2.4.5. The Engine TMS manager maintains documentation of rationale/justification for approved factor changes.

6.2.5.2.4.6. Engine TMS manager reviews forecast accuracy metrics for engine removals and ARIs quarterly.

6.3. Engine Acquisition Stock Level Computation.

6.3.1. Spare whole engine acquisition requirements are computed using PRS. The PM obtains and reviews PRS initial acquisition computations prior to establishing an engine spares requirement for a new system. For CLS engines, the Lead MAJCOM and PM may use PRS to validate the contractor spare engine requirements estimates.

6.3.1.1. Spare engine acquisitions are limited to the smallest number of engines essential to support the largest programmed requirement for each increment of the weapon system's production contract.

6.3.1.2. During Engineering & Manufacturing Development phase, the PM and Lead MAJCOM, in coordination with the DoP, performs an analysis to determine the cost effectiveness of making a buyout decision for the TMS engine. If the TMS engine is a commercial or commercial derivative engine, a life cycle cost analysis is conducted that considers the benefits of a fixed inventory and the associated costs for support and modifications.

6.3.2. There are four types of acquisition computations.

6.3.2.1. Initial: The initial whole spare engine acquisition computation is the first computation performed for a new TMS. The Engine TMS manager will determine when sufficient data are available to perform the baseline (initial) PRS computation.

6.3.2.2. Annual: A computation is performed annually after the initial computation to address any changes (program data, pipelines, maintenance concept, and actuarial data) that have occurred. The results are published in the ELMP.

6.3.2.3. Buyout: The Engine TMS manager performs a buyout computation to determine the final procurement quantity of spare whole engines for the TMS prior to the end of the engine production run. Buyout computations are completed lead-time away from the closure of the engine production line.

6.3.2.4. Others: Changes to force structure, weapon system procurement schedules, mission, or overall program changes will drive additional computations during the acquisition cycle.

6.3.3. Acquisition Computation Process Description: This process is followed for any type of acquisition computation (see **Figure 6.2**).

6.3.3.1. Initiate Computation: The Engine TMS manager, in coordination with the PM and Lead MAJCOM, will accomplish the whole spare engine acquisition computation and will initiate a review of the PRS model input factors to determine if an updated computation is required. If required, the Engine TMS manager initiates the action necessary to produce the updated computation. War planning scenario used for computation must be consistent with current distribution war scenario data. The CEM will provide any unique command requirements such as additives, Forward Operating Locations (FOLs), etc. Documentation of all additives explain how the additive quantity was determined and why the requirement could not be expressed through the conventional methodology (i.e., PRS). The MAJCOM CEM and the Engine TMS manager keep all documentation as long as the additive is required.

6.3.3.2. Peace Flying Hours: The peacetime program will be extracted from the latest *USAF Program, Aerospace Vehicles, and Flying Hours* (PA) document by the Engine TMS manager. The force structure bed-down reflected in the PA document will be updated to reflect the latest approved bed-down changes. If the PA document does not contain the needed peacetime information, the CEMs obtain and provide the peacetime information (flying hours and basing structure) to be used in the computation. Any force structure bed-down changes not contained in the latest PA will have documentation and justification for inclusion in the computation.

6.3.3.3. War Flying Hours: The enduring operations program will be extracted from the latest war computation data provided by AF/A3O. Enduring operations hours related to the squadrons will be revised to maintain consistency with any changes identified in the peacetime program information. If the enduring operations program data is not ascertainable or provided, previous enduring operations information may be used. MAJCOMs CEMs may provide updated force structure to be used in the computation. Any force structure bed-down changes not contained in the latest enduring operations data will have documentation and justification for inclusion in the computation.

6.3.3.4. Actual Removal Intervals: The ARIs are developed by the ERO as previously detailed in **Paragraph 6.2.5.1**.

6.3.3.5. Repair Pipeline Times: The field level and depot repair pipeline times are developed by the ERO in accordance with **paragraph 6.2.5.1.4.10**.

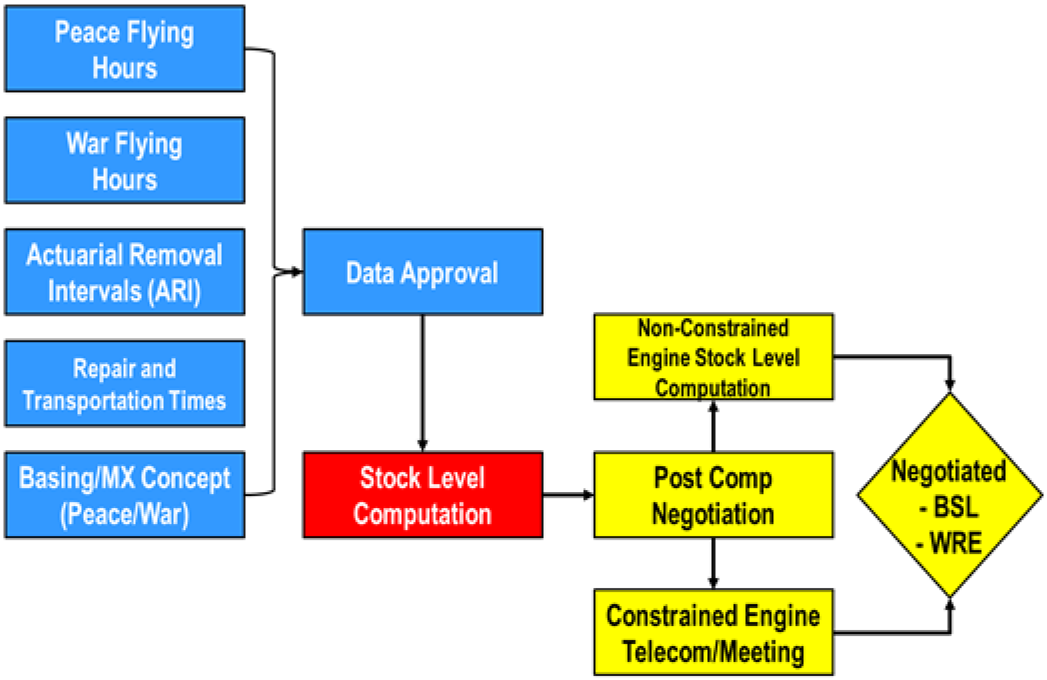
6.3.3.6. Transportation Pipeline Times: The transportation pipeline times are the standards published by the Uniform Material Movement and Issue Priority System. Refer to DoDM 4140.01, Volume 8, *DoD Supply Chain Materiel Management Procedures: Materiel Data Management and Exchange*, for guidance.

6.3.3.7. Maintenance Concept: The MPWG will provide the maintenance concept (both peace and war), including Not Reparable This Station rate, to be used in the computation, once approved by the ERO.

6.3.3.8. Concurrence of Computation Input Factors: Prior to accomplishing the computation, the Engine TMS manager documents the Engineering, PM, Lead MAJCOM/A4, and DoP concurrence of the input factors.

6.3.3.9. Engine Acquisition Stock Level Computation: The Engine TMS manager loads the information into PRS and runs the model **(Figure 6.2.).**

Figure 6.2. Acquisition Computation Flow Chart.



6.3.4. Coordination and Approval of Results: The Engine TMS manager accomplishes coordination with applicable stakeholders and submits to applicable PMs for endorsement and to the DoP for approval.

6.3.5. Implementation Plan: The Engine TMS manager develops a computation implementation plan that is coordinated with Lead MAJCOM and PMs and approved by the DoP.

6.3.6. Buyout Support Period: Before the closure of the engine production line, the Engine TMS manager performs a buyout computation that determines the number of spare engines required to support the applicable MDS during its planned life. The buyout computation will document whether the computation reflects maturity [Maturity = fleet age > 500,000 Engine Flying Hours (EFHs)] or another support period.

6.3.6.1. During engine production, the Engine TMS manager determines the actual number of spare engines required to support an MDS. The Engine TMS manager initiates a computation that will reflect the actual number of spare engines required to support an MDS over a period of time. **NOTE**: Period being next two to three years, with the requirement being computed quarter-by-quarter.

6.3.6.2. The computation reflects maturity when fleet age is greater than 500,000 EFHs.

6.3.6.3. When required to perform a buyout computation for an immature engine (Immature = fleet age<500,000 EFH), the first step is to identify the time period when the MDS will be fully supported from a spare engine perspective. Unless separately identified by either Air Force Deputy Chief of Staff for Plans and Operations (AF/XO) or the Lead MAJCOM, the period to be fully supported begins with the delivery of the last MDS with the TMS being computed. Actuarial factors and pipeline times representing the supported period are developed for use in the buyout computation. Computation results are used by the Engine TMS manager in recommending a spare engine procurement quantity. **NOTE**: Depending on the estimated period of immaturity in years, evaluating requirement at various points may also be required.

6.3.7. Small Fleet (ten or fewer aircraft): Before a TMS reaches maturity and near term supportability problems are expected by the System or Propulsion managers, the Engine TMS manager initiates a small fleet computation. The actual number of spare engines required use the projected "actual" SVR and pipeline times.

6.3.8. Special Stock Levels: Engine TMS managers generate special stock levels for small engine inventories and air breathing drone engines.

6.3.8.1. The following percentages are used to establish stock levels when ten or fewer new MDS aircraft are to be procured or remain in the inventory:

6.3.8.1.1. For single engine aircraft, 50 percent.

6.3.8.1.2. For twin-engine aircraft, 40 percent.

6.3.8.1.3. For aircraft with more than two engines, 30 percent.

6.3.8.2. The owning MAJCOM and Engine TMS manager jointly determine the operating unit's stock level for air breathing drone engines based on the operational concept, maintenance concept, and programmed flying hours.

6.3.9. Whole Engine Requirements Considerations for QEC Kit Acquisition: The PM, with Engine TMS manager input, must determine the quantity of QEC kits to be bought. They will be bought as life-of-type items and are regulated by the quantity of spare engines.

6.3.9.1. QEC Configurations: If there is more than one engine configuration:

6.3.9.1.1. Requirement for each configuration is determined by computing the proportions of each configuration installed on each aircraft.

6.3.9.1.2. The total raw computational requirement is multiplied by the portion of each configuration (do not round off the requirement).

6.3.9.1.3. Each new requirement to the ready rate table is used to determine requirements for each configuration.

6.3.9.1.4. All configuration requirements are added together to determine total requirement.

6.4. Distribution Stock Level Computation. The purpose of the distribution computation is to determine spare whole engine operational requirements and distribution for using MAJCOMs and Engine TMS managers.

6.4.1. Spare whole engine distribution stock level requirements are computed using PRS.

6.4.2. Distribution Stock Level Computation Process Descrdfion: The computation will be conducted at least annually (one of several events in the whole engine requirements process, see **Figure 6.3**). The computation, which requires a classified processing capability, includes participation from MAJCOM CEMs, Engine TMS manager and actuary, PRS functional managers, AFLCMC/LPA's PRS Subject Matter Expert and WSMIS representatives.

6.4.2.1. Peacetime and Enduring operations Flying Hours: The peacetime program is extracted from the latest PA document. The enduring operations program is extracted from the latest war computation data provided by AF/A3T.

6.4.2.1.1. The WSMIS Program Manager is responsible for ensuring the WSMIS/PRS (D087Q) data is downloaded electronically and formatted for input into the PRS database.

6.4.2.1.2. If the PA (peacetime) document does not contain the needed information, the MAJCOM CEMs obtain and provide the information (flying hours and basing structure) to be used in the computation. If the enduring operations program data is not ascertainable or provided, previous enduring operations information may be used.

6.4.2.1.3. Any force structure bed-down changes not contained in the latest PA document and/or wartime program data will have adequate documentation and justification for inclusion in the computation.

6.4.2.1.4. Notification will be sent to all participants for endorsement prior to the computation.

6.4.2.2. Actuarial Removal Interval (ARI): An ARI is developed for engine scheduled and unscheduled removals for all maintenance levels for both peace and war by the Engine TMS actuaries through mathematical models, simulations, statistical trends, and historical analysis.

6.4.2.2.1. The Engine TMS managers will:

6.4.2.2.1.1. Maintain documentation of supporting data, rationale, assumptions, and decisions as an appendix to the published ARI tables.

6.4.2.2.1.2. Screen engine removals to exclude engines removed to facilitate other maintenance.

6.4.2.2.1.3. Consider time remaining on life-limited components.

6.4.2.2.2. The Engine TMS actuary furnishes ARI data for PRS computation at least 14 duty days prior to PRS conference.

6.4.2.3. Repair Pipeline Times: Repair pipeline standards in TO 2-1-18 is used for the PRS computation. The TMS MPWG will review pipeline times at least annually and recommend changes to the standards contained in TO 2-1-18 when required.

6.4.2.4. Transportation Pipeline Times: TO 2-1-18 is used for transportation pipeline times.

6.4.2.5. Basing/Maintenance Concept: The computation uses the basing structure contained within the PA/wartime program document. **NOTE**: Addition of bases required to account for spare engines pre-positioned at en route locations to support transiting strategic airlift aircraft may also be included as FOL. Units that have multiple configurations of engines that cannot be interchanged due to engineering or safety of flight considerations may also be considered.

6.4.2.6. Coordination of Computation Input Factors: All input factors will be coordinated with the MAJCOM CEMs and Engine TMS managers prior to accomplishing the computation

6.4.2.7. Distribution Stock Level Computation: After the peacetime, wartime and ARI information is loaded into PRS and reviewed, the MAJCOM CEM runs the computation for their individual command. The Engine TMS manager rolls-up computation across all MAJCOMs for each TMS.

6.4.2.8. Post Computation Actions: The Engine TMS manager determines spare engine availability versus requirement immediately following the computation.

6.4.2.8.1. Non-Constrained Allocations: If engine availability is non-constrained, engines are negotiated with using commands in accordance with the PRS computations or MAJCOM/A4 approved additives. MAJCOMs provide written justification for additives.

6.4.2.8.2. Constrained Allocations: A constrained engine is when the computed spare engine requirements exceed the total available spare engine inventory. If engine availability is constrained, the Lead MAJCOM coordinates an equitable allocation with using MAJCOMs and Engine TMS manager. The Lead MAJCOM/A4 certifies the allocations. Prior to the Lead MAJCOM coordination, the following will be accomplished:

6.4.2.8.2.1. Engine TMS manager provides suggested allocation to Lead MAJCOM/A4 after accomplishing the following:

6.4.2.8.2.1.1. Allocate 100% peacetime requirement (BSL and Repair Cycle Requirement). Determine negotiated/projected Depot returns.

6.4.2.8.2.1.2. Adjust Depot pipeline requirement, if required.

6.4.2.8.2.1.3. Compute wartime percentage against remaining engines.

6.4.2.8.2.2. Lead MAJCOM:

6.4.2.8.2.2.1. Allocates 100% peacetime requirement for all locations.

6.4.2.8.2.2.2. Coordinates equitable allocation of WRE.

6.4.2.8.2.2.3. Resolves using MAJCOMs' issues.

6.4.2.8.2.3. Using MAJCOMs: Identify command specific requirements and issues. **NOTE**: Provide justification for additives, if applicable.

6.4.2.8.3. DoP will:

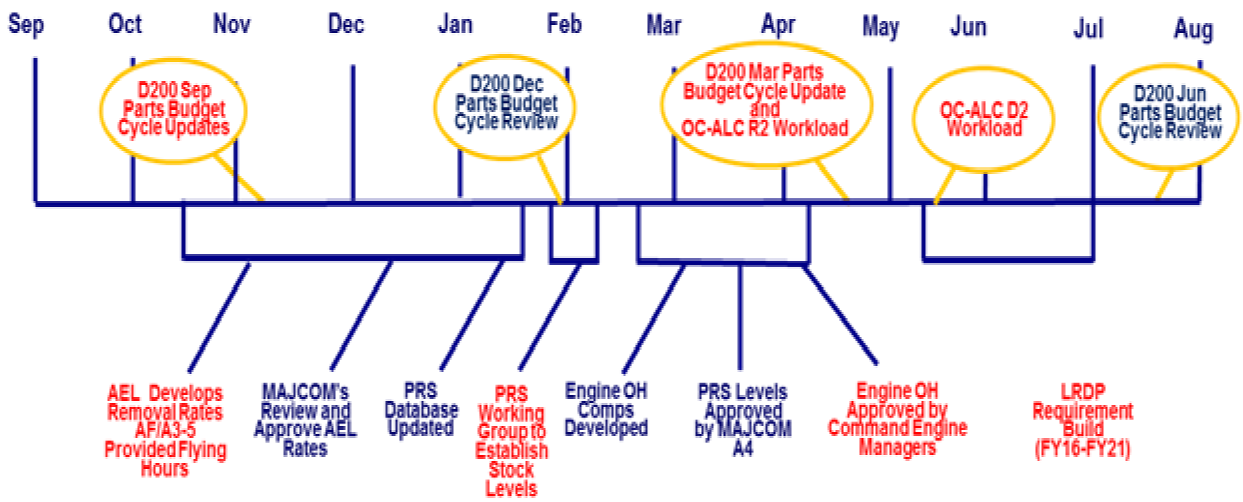
6.4.2.8.3.1. Endorse the Lead MAJCOM certified allocations.

6.4.2.8.3.2. Resolve distribution stock level discrepancies with the Lead MAJCOM/A4 based on the computation and allocation process. Notify each MAJCOM/A4 of their authorized BSL and WRE.

6.4.2.8.4. MAJCOM CEM notify applicable bases of their approved base stock level engines and applicable WRE engine levels, with information copy to respective Engine TMS manager. **NOTE**: These levels remain in effect until the next computation cycle, unless changes have occurred requiring a mid-cycle re-computation, or as a result of negotiations between the MAJCOM CEM and the Engine TMS manager.

6.4.2.8.5. Redistribution of Engines: If required, the Lead MAJCOM CEM is responsible for developing a redistribution plan to include the TMS, the losing MAJCOM, the gaining MAJCOM, and the schedule for transfer. All engine transfers will be in accordance with TO 2-1-18. The plan will be provided by message to all users no later than 30 September prior to the beginning of the Fiscal Year (FY).

Figure 6.3. Whole Engine Requirements.



6.4.3. Consolidation Computation Process. Engine configurations with a high reliability of on wing time may require a consolidation computation process in addition to the PRS distribution stock level computation process. This process may be required when peace requirements offset war requirements to an unacceptable WRE level. Use of a consolidation computation is a Lead MAJCOM option.

6.4.3.1. The consolidation computation process use the raw requirements computed by PRS to determine peace and war requirements for units within a regional/Main Operating Base (MOB) support structure and will:

6.4.3.1.1. Identify the bases/units that will be supported by a regional/MOB location.

6.4.3.1.2. Consolidate the peace requirement for the individual units/bases under the regional/ MOB location.

6.4.3.1.3. Combines the war requirements of those units that deploy to the same location as one requirement for that deployed location.

6.4.3.1.4. Total and assign to the regional/ MOB location.

6.4.3.2. The following is an example of the Consolidation Computation process for the F108-100 engine which uses regional centers for resupply support of bases within their geographical region. **Table 6.2** (PRS Consolidation Worksheet).

6.4.3.2.1. Enter PEACE raw requirement for each unit in the “Base Raw Peace Rqmt” column.

6.4.3.2.2. Total all units PEACE raw requirements within each geographical area in the "Total Regional Raw Peace Rqmt" column on the Regional Center line.

6.4.3.2.3. Apply conversion factor from **Table 6.3** (Confidence Level Table) by locating the range that the sum of the raw requirements equal and select the whole engine requirement for the appropriate confidence level and enter in the “Regional Peace Engine Rqmt” column for each Regional Center.

6.4.3.2.4. Continue process until all peace requirements are determined.

6.4.3.2.5. Total the “Regional Peace Engine Rqmt” column at the bottom as the “Total Base Peace Rqmt”. Enter the “Depot Peace Rqmt from the PRS Comp” directly below the base level total.

6.4.3.3. Consolidation Computation Process for war **Table 6.2** (PRS Consolidation Worksheet).

6.4.3.3.1. Determine 30-day average peak war raw requirement for each until along with war deployed location and enter the raw requirement in the “Unit Raw War Peak Rqmt” column.

6.4.3.3.2. For units from the same Continental United States geographic area that deploy to the same war location, total war raw requirements for the location and enter in “Total Raw War Rqmt by Location” column.

6.4.3.3.3. Determine war engine requirement from **Table 6.3** (Confidence Level Table) by locating the range that the sum of the raw requirements equal and select the whole engine requirement for the appropriate confidence level, and enter this number in “War Engine Rqmt” column for each deployed location.

6.4.3.3.4. Continue this process for each geographic area and war location.

6.4.3.3.5. Total “War Engine Rqmt” column at the bottom as the “Total War Base Lvl Rqmt”. Enter the “Depot War Rqmt from the PRS Comp” directly below the base level total.

Table 6.2. PRS Consolidation Worksheet.

FYxx	F108-100 PRS Consolidation						FYxx			Consolidated Rqmt	
CMD	Base/Unit	CONUS Area	Base Raw Peace Rqmt	Total Regional Raw Peace Rqmt	Regional Peace Engine Rqmt	W-Base	Unit Raw War-Peak Rqmt	Total Raw War Rqmt by Location	War Engine Rqmt	Regional BSL	Regional WRE
ANG	Lincoln	Central	0.01891			1	0.32700				
AMC	McConnell CENTRAL REGIONAL CENTER	Central	0.20674	0.31607	1					6	5
AMC	McConnell	Central				1	0.41830	0.74530	1	(WRE+Peace)	
AMC	McConnell	Central				2	1.37217	2.22863	3		
ANG	Sioux City 174	Central	0.01891			2	0.33693				
AMC	Grand Forks 905	Central	0.04313			2	0.51963				
ANG	Forbes 117	Central	0.02838			3	0.51963	0.51953	1		
AMC	FOL Al Udeida	McConnell	0.00008	0.00008	1		PEACE ONLY			1	0
AMC	FOL AOR	McConnell	0.00008	0.00008	1		PEACE ONLY			1	0
AMC	FOL Manis	McConnell	0.00008	0.00008	1		PEACE ONLY			1	0
AFR	Andrews 756	North East	0.02586			5	0.34839	0.34839	1		
ANG	Pease 133	North East	0.01891			1	0.36062	0.70443	1		
ANG	Selfridge 63 - 171	North East	0.01891			1	0.34381				
AFR	Grissom 72 NE REGIONAL CENTER	North East	0.04645	0.30434	1	2	0.35679	1.17734	2	13	12
ANG	McGuire 108/141	North East				2	0.16847			(WRE+Peace)	
ANG	General Mitchell 126	North East	0.02128			2	0.37933				
ANG	Pittsburgh 146	North East	0.02082			2	0.27275				
ANG	Scott 126	North East	0.01891				PEACE ONLY				
ANG	McGuire 108/141	North East	0.01891			3	0.17534	0.74682	1		
ANG	Pittsburgh 147	North East				3	0.17534				
ANG	Rickenbacker 145	North East	0.02128			3	0.39614				
ANG	Rickenbacker 166	North East	0.02128			6	0.04469	0.04469	1		
ANG	Rickenbacker 166	North East				12	0.10429	0.10429	1		
ANG	Rickenbacker 166	North East				13	0.10429	0.10429	1		
AFR	Grissom 74	North East	0.02486			8	0.21927	0.21927	1		
ANG	Bangor 101	North East	0.02609			9	0.20858	0.20858	1		
ANG	Bangor 101	North East				10	0.05081	0.05081	1		
ANG	Pittsburgh 147	North East	0.02078			11	0.17534	0.17534	1		
ANG	Birmingham 106	South East	0.01891			14	0.21927	0.21927	1		
ANG	Key Field 153	South East	0.01891			2	0.33693	0.33693	1		
AMC	MacDill 91	South East	0.07472			6	0.71397	0.71397	1		
ANG	McGhee Tyson 134	South East	0.02128			9	0.23532	0.23532	1	(WRE+Peace)	
AFR	Seymour Johnson 916/77 SE REGIONAL CENTER	South East	0.02789	0.16171	1	15	0.41715	0.41715	1	6	5
AMC	Fairchild NW REGIONAL CENTER	North West	0.12675	0.12675	1					4	3
AMC	Fairchild	North West				2	1.29233	1.29233	2	(WRE+Peace)	
AMC	Fairchild	North West				3	0.35068	0.35068	1		
AFR	March 452/336 SW REGIONAL CENTER	South West	0.03480	0.07262	1	12	0.31019	0.31019	1	4	3
ANG	Phoenix 197	South West	0.01891			2	0.31477	0.31477	1	(WRE+Peace)	
ANG	Salt Lake City 191	South West	0.01891			16	0.21927	0.21927	1		
AETC	Altus 55	NA	0.07666	0.07666	1		PEACE ONLY			1	0
AFR	Tinker 507/465	NA	0.00358	0.00358	1	4	0.02216	0.02216	1	2	1
						5	0.25900	0.25900	1		
ANG	Eielson 168	NA	0.02941	0.02941	1	5	0.34839	0.34839	1	1	0
ANG	Hickam 203	NA	0.02941	0.02941	1	6	0.35641	0.35641	1	1	0
PAF	Kadena 909	NA	0.10728	0.10728	1	1	0.74491	0.74491	1	1	0
MTC	Edwards 412	NA	0.01249	0.01249	1		PEACE ONLY			1	0
AFE	Mildenhall 351	NA	0.09805	0.09805	1	7	0.66240	0.66240	1	1	0
		Total Base Peace Rqmt			15		TOTAL War Base Lvl Rqmt		34	44	29
		Depot Peace Rqmt from PRS Comp			8		Depot War Rrqmt from PRS Comp		42	42	0
					23				76	86	29

Processing for PRS:

These units are OCONUS units or units that are not regionalized due to mission or location.

FOLs are computed in PEACE but require serviceable assets to support contengency operations.

Table 6.3. Confidence Level Table.

80% Pipeline	Level	70% Pipeline		80% Pipeline	Level	70% Pipeline
0.0 – 0.824	1	0.0 – 1.097		44.914 – 45.854	51	47.028 – 47.990
0.825 – 1.535	2	1.098 – 1.913		45.855 – 46.796	52	47.991 – 48.954
1.536 – 2.296	3	1.914 – 2.763		46.797 – 47.738	53	48.955 – 49.918
2.297 – 3.089	4	2.764 – 3.633		47.739 – 48.681	54	49.919 – 50.883
3.090 – 3.903	5	3.634 – 4.517		48.682 – 49.624	55	50.884 – 51.847
3.904 – 4.733	6	4.518 – 5.410		49.625 – 50.568	56	51.848 – 52.812
4.734 – 5.576	7	5.411 – 6.312		50.569 – 51.512	57	52.813 – 53.778
5.577 – 6.428	8	6.313 – 7.219		51.513 – 52.457	58	53.779 – 54.743
6.429 – 7.289	9	7.220 – 8.132		52.458 – 53.403	59	54.744 – 55.709
7.290 – 8.157	10	8.133 – 9.050		53.404 – 54.348	60	55.710 – 56.675
8.158 – 9.030	11	9.051 – 9.971		54.349 – 55.294	61	56.676 – 57.642
9.031 – 9.910	12	9.972 – 10.896		55.295 – 56.241	62	57.643 – 58.608
9.911 – 10.793	13	10.897 – 11.823		56.242 – 57.188	63	58.609 – 59.575
10.794 – 11.682	14	11.824 – 12.753		57.189 – 58.136	64	59.576 – 60.543
11.683 – 12.573	15	12.754 – 13.686		58.137 – 59.083	65	60.544 – 61.510
12.574 – 13.469	16	13.687 – 14.620		59.084 – 60.032	66	61.511 – 62.478
13.470 – 14.367	17	14.621 – 15.557		60.033 – 60.980	67	62.479 – 63.446
14.368 – 15.268	18	15.558 – 16.495		60.981 – 61.919	68	63.447 – 64.414
15.269 – 16.172	19	16.496 – 17.435		61.920 – 62.879	69	64.415 – 65.383
16.173 – 17.078	20	17.436 – 18.377		62.880 – 63.829	70	65.384 – 66.352
17.079 – 17.987	21	18.378 – 19.320		63.830 – 64.779	71	66.353 – 67.320
17.988 – 18.897	22	19.321 – 20.264		64.780 – 65.729	72	67.321 – 68.289
18.898 – 19.810	23	20.265 – 21.210		65.730 – 66.680	73	68.290 – 69.258
19.811 – 20.724	24	21.211 – 22.156		66.681 – 67.631	74	69.259 – 70.228
20.725 – 21.640	25	22.157 – 23.104		67.632 – 68.582	75	70.229 – 71.198
21.641 – 22.558	26	23.105 – 24.053		68.583 – 69.534	76	71.199 – 72.168
22.559 – 23.477	27	24.054 – 25.002		69.535 – 70.486	77	72.169 – 73.138
23.478 – 24.398	28	25.003 – 25.953		70.487 – 71.438	78	73.139 – 74.108
24.399 – 25.320	29	25.954 – 26.904		71.439 – 72.391	79	74.109 – 75.078
25.321 – 26.243	30	26.905 – 27.856		72.392 – 73.344	80	75.079 – 76.049
26.244 – 27.168	31	27.857 – 28.809		73.345 – 74.297	81	76.050 – 77.020
27.169 – 28.094	32	28.810 – 29.763		74.298 – 75.251	82	77.021 – 77.991
28.095 – 29.020	33	29.764 – 30.717		75.252 – 76.205	83	77.992 – 78.962
29.021 – 29.948	34	30.718 – 31.673		76.206 – 77.159	84	78.963 – 79.933
29.949 – 30.877	35	31.674 – 32.628		77.160 – 78.113	85	79.934 – 80.906
30.878 – 31.807	36	32.629 – 33.585		78.114 – 79.068	86	80.907 – 81.878
31.808 – 32.738	37	33.586 – 34.542		79.069 – 80.023	87	81.879 – 82.850
32.739 – 33.670	38	34.543 – 35.499		80.024 – 80.978	88	82.851 – 83.822
33.671 – 34.603	39	35.500 – 36.457		80.979 – 81.933	89	83.823 – 84.794
34.604 – 35.537	40	36.458 – 37.416		81.934 – 82.890	90	84.795 – 85.766
35.538 – 36.471	41	37.417 – 38.375		82.891 – 83.846	91	85.767 – 86.739
36.472 – 37.406	42	38.376 – 39.335		83.847 – 84.802	92	86.740 – 87.711
37.407 – 38.342	43	39.336 – 40.295		84.803 – 85.758	93	87.712 – 88.684
38.343 – 39.279	44	40.296 – 41.255		85.759 – 86.715	94	88.685 – 89.657
39.280 – 40.216	45	41.256 – 42.216		86.716 – 87.672	95	89.658 – 90.630
40.217 – 41.154	46	42.217 – 43.178		87.673 – 88.629	96	90.631 – 91.603
41.155 – 42.093	47	43.179 – 44.139		88.630 – 89.586	97	91.604 – 92.577
42.094 – 43.032	48	44.140 – 45.102		89.587 – 90.544	98	92.578 – 93.550
43.033 – 43.972	49	45.103 – 46.064		90.545 – 91.501	99	93.551 – 94.524
43.973 – 44.913	50	46.065 – 47.027		91.502 – 92.459	100	94.525 – 95.497

6.4.3.4. Consolidated Requirement will be determined as follows:

6.4.3.4.1. Total the war requirements in the "War Engine Rqmt" column for all deployed locations and units within each geographic area and enter in "Regional WRE" column on the line of the Regional Center.

6.4.3.4.2. For the “Regional BSL” column, add the total peace requirement from “Regional Peace Engine Rqmt” column to the WRE identified in the “Regional WRE” column and enter on the Regional Center line. (This gives the Regional Center an engine for resupplying units in Peace time.)

6.4.3.4.3. Total the “Regional BSL” and the “Regional WRE” columns for base level requirements at the bottom. Enter the Depot requirements from the PRS computations immediately below the base level total. The sum of these two numbers is the total Consolidation Requirement.

6.5. Target Serviceable Requirement (TSR). TSR is a portion of the computed peacetime requirement that is necessary to be serviceable in support of special demands and where periodic spikes in removal outpace forecasted production. TSR is not an additive requirement and will not increase total requirements of computed/allocated inventory above spare engines possessed.

6.5.1. TSR is established at MAJCOM discretion. Computation of TSR will be accomplished by analyzing PRS model results using 80% confidence factor as a baseline and varying ready rates up to 99%. The delta between 80% and the higher confidence factor becomes the TSR.

6.5.2. Validation and Approval of TSR: Documentation of all TSRs explain how the TSR quantity was determined. The requesting MAJCOM/A4 provides justification to the DoP with copy to the Engine TMS manager. The MAJCOM CEM and Engine TMS manager keep all documentation as long as the TSR is required and for two years after TSR is removed.

6.6. Additive Requirements. An Additive is a requirement not computed through normal computational methodology and manually added to the PRS requirement. If PRS can compute the requirement with validated rates and factors, then an additive is not appropriate. Additive requirements for retaining assets otherwise considered for disposal or termination are not appropriate. Additives are not authorized for constrained engines and are only valid for the current PRS comp cycle.

6.6.1. Additive requirement examples:

6.6.1.1. Training: Assets required to provide spare engine(s) used by Air Education and Training Command field training teams or detachments that do not have war flying hours in PRS.

6.6.1.2. Special Projects/Unit Segmentation: Assets required to provide spare engine(s) in support of undefined tasks as directed by AF or MAJCOMs.

6.6.1.3. Small fleet multi engine aircraft:

6.6.1.3.1. Foreign Object Damage (FOD)/Bird-strike history combined with a normal failure could exceed computed BSL.

6.6.1.3.2. Real-world peace obligation to support multiple long-term commitments where no spare engines are computed.

6.6.2. Documentation of Additive Requirements: Documentation of all additives explain how the additive quantity was determined and why the requirement could not be expressed through the PRS methodology. The requesting MAJCOM A4M or designee will forward the justification letter to the DoP with copy to the Engine TMS manager. The MAJCOM CEM and Engine TMS manager keep all documentation as long as the additive is required and for two years after additive is removed.

6.7. Overhaul Computation. The Overhaul Computation process includes a whole engine repair computation and negotiations of repair quantities to determine the number of whole engines requiring maintenance, depot and/or field, for the current and FYDP.

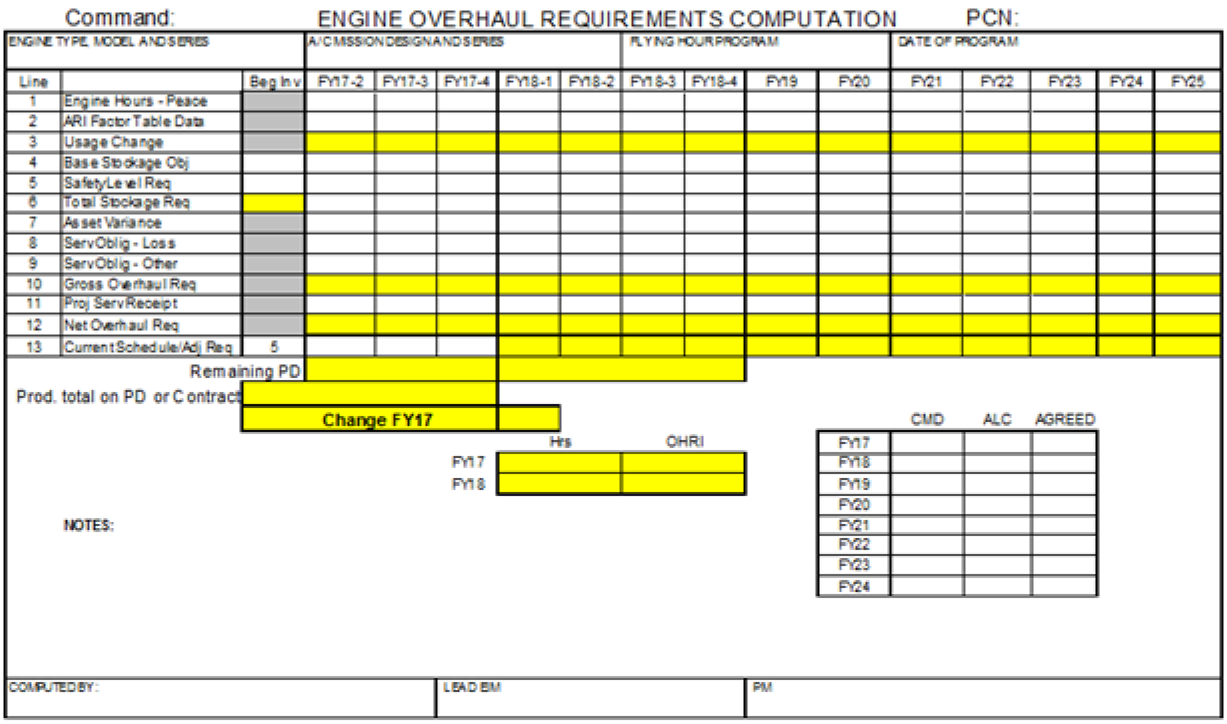
6.7.1. DoP accomplish whole engine repair computations annually in sufficient time to be used for the annual Repair Negotiations with MAJCOM CEMs.

6.7.1.1. MAJCOM CEMs and Engine TMS managers will negotiate a production requirement for each TMS based on computed numbers and coordinate results with the applicable PMs. Once the negotiated repair levels are set, the operating commands, PMs, and/or the Centralized Asset Management office, will commit to funding the negotiated number of engine inductions during a particular time, and the repair activities will agree to repairing and returning, as serviceable, an agreed to number of whole engines.

6.7.1.2. MAJCOM CEMs notify the Engine TMS managers when projected flying hours used for computation of the repair requirements change outside the published flying hour document. The Engine TMS manager determines if the repair requirements' re-computation is necessary. If the flying hour change will impact repair requirement, the Engine TMS manager will re-accomplish computation and negotiate/collaborate repair requirement increases/decreases with funds holder, Lead MAJCOM and PM.

6.7.2. Repair Computation Process. The repair computation will use the Engine Overhaul Requirements Computation Worksheet, **Figure 6.4**.

Figure 6.4. Computation of Engine Repair Requirements (Output Quantity) Worksheet.



Command: ENGINE OVERHAUL REQUIREMENTS COMPUTATION PCN:

ENGINE TYPE, MODEL AND SERIES	A/C MISSION DESIGN AND SERIES	FLYING HOUR PROGRAM	DATE OF PROGRAM

Line		Beg Inv	FY17-2	FY17-3	FY17-4	FY18-1	FY18-2	FY18-3	FY18-4	FY19	FY20	FY21	FY22	FY23	FY24	FY25
1	Engine Hours - Peace															
2	ARI Factor Table Data															
3	Usage Change															
4	Base Stockage Obj															
5	Safety Level Req															
6	Total Stockage Req															
7	Asset Variance															
8	Serv Oblig - Loss															
9	Serv Oblig - Other															
10	Gross Overhaul Req															
11	Proj Serv Receipt															
12	Net Overhaul Req															
13	Current Schedule/Adj Req	5														

Remaining PD

Prod. total on PD or Contract

Change FY17

	Hrs	OHRI
FY17		
FY18		

NOTES:

	CMD	ALC	AGREED
FY17			
FY18			
FY19			
FY20			
FY21			
FY22			
FY23			
FY24			

COMPUTED BY:	LEAD EM	PM

6.7.2.1. Computation of Whole Engine Repair Requirements.

6.7.2.1.1. Engine Hours – Peace (Line 1). The whole engine repair requirements computation begins with the flying hours for the engine and MAJCOM being projected. These flying hours represent the peacetime flying hours projected for the engine and are based on the PA data received from Air Staff.

6.7.2.1.2. ARI Factor (Line 2). For the purposes of calculating the whole engine repair requirement, only the Overhaul Removal Interval/With Maximum Time (OHRI/WMT) is used. The OHRI/WMT reflects the average number of flying hours between engine overhauls and/or 2-level maintenance repairs, which both occur at a depot or contractor facility.

6.7.2.1.3. Usage Change (Line 3). The result of this calculation (Line 1 divided by Line 2) represents the usage changes for overhaul and/or 2-level maintenance action for the engine for the computed period.

6.7.2.1.4. Base Stockage Objective (Line 4). The BSL objective represents the number of engines a MAJCOM is required to have available or "in stock" at their installations. BSL can be either computed by the PRS or negotiated by the Engine TMS manager and MAJCOM.

6.7.2.1.5. Safety Level Requirement (Line 5). The safety level represents the number of engines a MAJCOM is required to maintain over and above their BSL to support the unevenness of generations. These are usually maintained at the depot/repair facility. Propulsion Division approval is required.

6.7.2.1.6. Line 6. Total Stockage Requirement. In addition to the whole engines required to support the projected flying hour program, a certain number is needed to maintain a certain stock level for the applicable MAJCOM. This total stockage level is comprised of a BSL objective and the depot safety level requirement (if approved).

6.7.2.1.7. Beginning Inventory (Line 6, 1st Column). The beginning inventory represents the adjusted MAJCOM spare asset position at the end of the period prior to the time frame being computed.

6.7.2.1.8. Asset Variance (Line 7). The total stockage requirement is compared to the assets on hand or projected to be on hand at the beginning of the period (end of the previous quarter). The delta between the requirement and the beginning inventory represents the additional engines that must be repaired to maintain the stock level. If more engines are in the inventory at the beginning of a computation period than are required to meet the stock level of the MAJCOM, these assets can be used to offset either the flying hour requirement or other obligations. This calculation will normally only result in a delta during the first quarter of the computation or of a fiscal year since a new BSL is only established once a year.

6.7.2.1.9. Serviceable Obligation–Loss and Serviceable Obligation– Other (Lines 8 and 9). Engines may also be obligated for other uses which will increase the overhaul requirement. Service Obligation–Loss refers to those serviceable assets that have been obligated to another use such as a training requirement or a Foreign Military Sales (FMS) customer. Service Obligation–Other represents those serviceable assets that have been obligated to another service within the DoD, payback to another MAJCOM, Programmed Depot Maintenance, etc.

6.7.2.1.10. Gross Overhaul Requirements (Line 10). The Gross Overhaul Requirement is calculated using the sum of the following:

6.7.2.1.10.1. Engines needed to support the forecasted flying hour program (Line 3).

6.7.2.1.10.2. Assets needed to cover the difference between BSL plus safety requirements and inventory on hand at beginning of the period being computed (Line 7).

6.7.2.1.10.3. The engines obligated by the MAJCOM for another use (Lines 8 and 9).

6.7.2.1.11. Projected Serviceable Receipts (Line 11). Prior to the calculation of the final (net) overhaul output requirement, the Gross Overhaul Requirement is offset by any serviceable assets the MAJCOM or engine TMS manager expects to receive from any source (e.g., new production, return of low time assets from Aerospace Maintenance and Regeneration Group), Quality Deficiency Returns where the user was not charged an overhaul cost, aircraft undergoing modification or re-engine, transfers from other services, etc.).

6.7.2.1.12. Net Overhaul Requirements (Line 12). The net overhaul requirement is Gross Overhaul Requirement (Line 10) offset by Projected Serviceable Receipts (Line 11). This requirement represents the number of engines that must be available as output from depot level repair facility to satisfy all of the MAJCOMs requirements for that engine during the period.

6.7.2.1.13. Current Schedule/Adjusted Requirements (Line 13). This requirement considers any adjustment between current scheduled production and repair requirement. In the first quarter, enter current project directive (or contract) negotiated output quantity. Compare this quantity with the figure on line 12. If current schedule is greater than line 12, subtract the overage from the next quarter entry on line 12 and enter result. Continue until the overage is absorbed. If the current schedule is less than the figure on line 12, the shortage will be added to next quarter line 12 requirement. After initial adjustment has been accomplished, lines 12 and 13 will be equal. These quantities become the Adjusted Requirement. This number serves as the basis for the negotiation process and is eventually converted to the number of engines that must be input into the repair pipeline. The input requirement is what is ultimately converted to a dollar requirement for publication into the Depot Purchased Equipment Maintenance Brochure via Centralized Access for Data Exchange.

6.7.3. Approval: The Engine TMS manager coordinates the repair computation with the MAJCOM CEM and PM for approval by the DoP or designee.

6.7.4. Increases to Computed Requirement: A negotiated increase is a requirement not computed through normal computational methodology and manually added to the computed repair requirement. Increased repair requirement documentation will be prepared by the requesting organization. Documentation explains how the additional repair requirement was determined and why the requirement could not be determined via repair computation process. The requesting MAJCOM CEM and Engine TMS manager keep all documentation as long as the increased repair is required and for two years after increase is removed.

6.7.5. The Engine TMS manager converts Overhaul Output requirements to Input and Funding requirements.

6.7.6. Repair requirement increases subsequent to the repair meeting are documented and retained as described under **Paragraph 6.1.1** above.

6.7.7. Approval of Repair Increases: Whole engine repair requirement increases during year of execution above the POM will follow Centralized Asset Management guidance.

6.8. Retention Computation. The purpose of the retention computation is to identify engine retention requirements, inventory long supply and potential excess quantities for planning appropriate management action. The Engine TMS manager performs the retention computation at least annually following the PRS computation cycle, or as needed to cover special program needs.

6.8.1. Approval Process: The DoP or designee, which may be delegated no more than two levels, is the final approval authority for excess decisions.

6.8.1.1. If the DoP disapproves proposal, no further action is required. If the DoP approves excess quantities, the Engine TMS manager coordinates with other DoD agencies to ensure a valid requirement does not exist for the TMS.

6.9. Whole Engine Reclamation and Disposal.

6.9.1. Engines are sent to reclamation only after being determined requirements for these engines do not exist within DoD.

6.9.2. Engine TMS manager:

6.9.2.1. Be responsible for engine assets on aircraft held in storage codes XS or XT upon change of the storage code to XX or XV. **NOTE**: For additional data refer to AF Handbook (AFH) 23-123V1, *Materiel Management Reference Information*, and Air Force Joint Manual 23-210, *Joint Service Manual (JSM) for Storage and Materials Handling.*

6.9.2.2. Add engines into the Engine Requirements Retention Computation as required.

6.9.2.3. Coordinate with the PMs to determine if Aerospace Maintenance and Regeneration Group -stored engines are needed in support of aircraft missions or have the potential for reuse. **NOTE**: The PM is accountable for the ILCM of a system until that system is disposed.

6.9.2.4. Work with PMs, Air Force Sustainment Center POCs and Lead MAJCOM CEMs to dispose of engines, through the Defense Logistics Agency Disposition Services [previously, Defense Reutilization and Marketing Service (DRMS)], which are no longer needed to support the AF mission, or can be reclaimed or used to support FMS.

6.9.2.5. Evaluate the need for inactive engines identified on the annual Aerospace Maintenance and Regeneration Group engine listing in conjunction with the annual Distribution Stock Level Computation and notify PMs and Aerospace Maintenance and Regeneration Group of disposal requirements based on this evaluation.

6.9.2.6. Report reclaimed engines as losses in CEMS D042 database in accordance with TO 00-25-254-1.

6.9.2.7. Transfer all residual engines/engine items that do not have reclamation instructions to the local Defense Logistics Agency Disposition Services activity for disposal in accordance with AFI 23-101. **NOTE:** Residue resulting from engine reclamation that might be potential hazardous waste will be processed in accordance with AFMAN 32-7002, *Environmental Compliance and Pollution Prevention*.

Chapter 7

ENGINE LIFE CYCLE MANAGEMENT PLAN (ELMP)

7.1. General.

7.1.1. The ELMP, in coordination with using MAJCOMs and PM, is a living, dynamic strategy to ensure engine OSS&E goals are established and Integrated Product Support objectives establish affordable rates throughout the engine life cycle.

7.1.1.1. For new acquisition programs, engine life cycle management planning and documentation via an ELMP begins during the system Materiel Solution Analysis Phase.

7.1.2. The ELMP details:

7.1.2.1. How objectives of Integrated Product Support Elements (as defined in the DoD Product Support Manager Guidebook (**www.dau.edu/tools/t/Product-Support-Manager-(PSM)-Guidebook**), as applicable to the engine TMS, will be achieved.

7.1.2.2. How to assure OSS&E is consistent with guidance of AFMCI 63-1201, *Implementing Operational Safety Suitability and Effectiveness (OSS&E) and Life Cycle Systems Engineering (LCSE)*, while also minimizing engine operating cost. This includes describing the actions and quantifying the resources required to achieve and maintain OSS&E and affordability goals, and identifying the impact of resource constraints.

7.1.3. DoP, with PM concurrence, may exempt the ELMP requirement for commercial derivative engines in-service on AF commercial derivative aircraft, certified by the Federal Aviation Administration, and maintained by Contractor Logistics Support (CLS) to the manufacturer specifications. Exemptions may also be granted for those engines managed by lead Service other than the AF. Requests for Exemption will be in accordance with **Paragraph 1.2.1**.

7.2. Responsibilities.

7.2.1. The DoP ensures:

7.2.1.1. Approved ELMPs are published and provided to PMs, IEMP Chief and using MAJCOM/A4s.

7.2.1.2. ELMPs are annually revalidated and updated, as necessary. Full coordination with PM and MAJCOM/A4 is required at a minimum every three years or when significant changes occur to the approved strategies. Engine metric exhibits are updated annually without requiring full coordination.

7.2.2. Engine TMS managers are the focal points for developing, maintaining and executing an ELMP for their engine TMS to:

7.2.2.1. Develop requirements to achieve health metric goals and incorporate into the ELMP.

7.2.2.2. Obtain Lead MAJCOM, PM and CIP/sustainment stakeholders' coordination and issues resolution on the ELMP.

7.2.2.3. Work with Lead MAJCOM and PM to ensure budgetary documents [e.g. Program Objective Memorandum, Budget Estimate Submission, Modification Proposal (AF Form 1067), and Modernization Improvement Program Sheets] are updated and submitted to reflect funding required for implementing the ELMP.

7.2.2.4. Report to the DoP on execution of approved/funded ELMP activities and initiatives.

7.2.2.5. Develop ELMP adjustments to achieve goals and reflect funding commitments.

7.2.2.6. Monitor the engine sustainment activities to achieve optimized effectiveness and minimize life cycle cost while achieving readiness objectives.

7.2.2.7. Provide a fully coordinated copy of the ELMP to the DoP, as required in **paragraph 7.4**, via email to the AFLCMC/LP Workflow (**AFLCMC.LP.Workflow@us.af.mil**).

7.3. ELMP Content.

7.3.1. The ELMP includes how to:

7.3.1.1. Track and report OSS&E using the engine fleet health indicators/metrics described in **Chapter 10**.

7.3.1.2. Assess future performance expectations based upon the ELMP and resource commitments.

7.3.1.3. Report on lower level metrics which impact overall OSS&E performance. These lower level metrics are listed in **Chapter 10** and are used to isolate the root cause(s) of OSS&E deficiencies and address how each is to be corrected.

7.3.1.4. Track and report costs and forecast future costs based on resource decisions and commitments.

7.3.1.5. Achieve and maintain engine affordability.

7.3.2. Strategies and activities that are addressed:

7.3.2.1. Performance Based Logistics contracts.

7.3.2.2. Propulsion System Integrity Program consistent with MIL-STD-3024, *Propulsion System Integrity Program (PSIP).*

7.3.2.3. Operational Usage and Verification. Periodic verification events (mission usage surveys, LtF/ACI engine teardowns, Accelerated Mission Tests, inspections, etc.) will provide data needed to ensure engine components reach mature life limits, while retaining required performance characteristics and provide inputs into the CIP, maintenance program, spares requirements, modification programs, and Science & Technology programs. Data gathered from these programs is used to establish program priorities and develop execution and out year budget requirements.

7.3.2.4. Condition Based Maintenance Plus (CBM+) (how it will be achieved).

7.3.2.4.1. Operational readiness through affordable, integrated, off-board and embedded diagnostics and prognostics.

7.3.2.4.2. ET&D/P and RCM to enable the commander to make fleet-wide decisions based on weapon system capability to meet real-time operational needs; including impacts and requirements from both efforts on engine life.

7.3.2.5. LtF/ACI Program (If applicable, when and how it will be accomplished).

7.3.3. The most current ELMP Template providing a format for all content to be addressed in the TMS-specific ELMP or the corresponding aircraft Life Cycle Sustainment Plan can be found on the ELMP SharePoint Site at **https://cs2.eis.af.mil/sites/13234/ELMP/SitePages/Home.aspx?RootFolder=%2Fsites%2F13234%2FELMP%2FShared%20Documents%2FELMP%20Policy%20and%20Templates&FolderCTID=0x0120005084CFBAAAA4E74580EE09A05C2FF74C&View=%7B19483179%2DCEA5%2D40AD%2D94FC%2D34A0F98F091E%7D&InitialTabId=Ribbon%2ERead&VisibilityContext=WSSTabPersistence**.

7.4. ELMP Updates.

7.4.1. Review the ELMP annually and, at a minimum, update the Appendices.

7.4.2. Recurring dialog between the using MAJCOMs, PM, Science and Technology community, and TMS Stakeholders, in order to proactively analyze factors, may impact engine OSS&E and life management (such as: system modification, system mission change, logistics support concept changes, system service life extensions, parts obsolescence/diminishing manufacturing sources and material shortages, and emerging technologies.) Update the entire ELMP when any of these program changes occur.

7.5. ELMP Coordination.

7.5.1. Obtain full ELMP coordination every three years by the respective Branch and Division Chiefs (where engine program management resides), Lead MAJCOM director of engine maintenance, and aircraft System Program Manager or Product Support Manager.

7.5.2. Obtain limited ELMP coordination (engine program management Branch Chief) when only the Appendices are required to be updated (except every third year when full coordination is required). Document Branch Chief coordination for Appendices updates on the ELMP Revision Page.

7.5.3. Obtain full ELMP coordination (identified in **Paragraph 7.5.1**) any year there is a significant change in the approved strategies.

Chapter 8

ENGINE LEAD THE FLEET/ANALYTICAL CONDITION INSPECTION (LTF/ACI) PROGRAM

8.1. Purpose and Objectives.

8.1.1. The DoP institutes an LtF/ACI Program to determine actual distress modes of an engine and its subsystems to provide better understanding of distress modes by monitoring engines/modules/Line Replaceable Units (LRUs)/Shop Replaceable Units (SRUs) during operational use. Once these distress modes are identified, better maintenance planning will be achieved to allow the fleet to continue to operate safely.

8.1.2. LtF/ACI Program Objectives:

8.1.2.1. Accelerate usage of LtF/ACI engines/modules/LRUs/SRUs ahead of the remaining fleet to identify potential premature engine component failures, enable early analysis of trends/failure modes/rates, and assist in defining the required corrective actions prior to fleet maturity.

8.1.2.2. Accurately update scheduled maintenance requirements and safely extend TO hardware inspection limits.

8.1.2.3. Rapidly advance engine/module/accessory maximum life limits, so that they are consistent with the capability of the hardware.

8.1.2.4. Enable early analysis of trending data to improve planning and forecasting in procuring initial and follow-on spares.

8.1.2.5. Identify hardware service life deficiencies and the areas that require redesign/rework before extensive production commitments are made and/or limited funds exhausted on obsolete hardware.

8.1.2.6. Develop CIP tasks to address design deficiencies and CIP repair tasks to address wear out modes and allow for rework and re-use of hardware.

8.1.2.7. Identify hardware life impacts on system life cycle costs.

8.1.2.8. Detect any unique durability problems that might force special scheduled inspections.

8.1.2.9. Evaluate the engine controls and accessories to include engine monitoring systems.

8.1.2.10. Provide lead-time for solving maintenance issues, developing maintenance plans, and resource provisioning.

8.2. Active and Passive LtF/ACI Engine/Module Groups. The DoP will establish Groups and be the authority to explain definition maturity and use of whole engines or modules. Below EFH definitions and use of whole engines or modules will be used if the DoP has not otherwise established for the LtF/ACI.

8.2.1. Active Groups:

8.2.1.1. Immature fleets (<500,000 EFH) use full engines.

8.2.1.2. Mature fleets (>500,000 EFH) use modules.

8.3. Passive Group. The Passive Group will be comprised of engines/modules that have greater than average number of cycles but are not members of the Active Engine/Module Group.

8.4. Process.

8.4.1. ACIs will be accomplished to reveal defects that may not otherwise be detected through normal TO and programmed depot maintenance inspections.

8.4.2. ACIs will be used to substantiate a life limit extension.

8.4.2.1. Generate safety analysis based on inspection results in conjunction with historical failure data, failure mode and analysis.

8.4.2.2. Quantifies the potential risk of a life limit increase.

8.4.3. LtF/ACI engines/modules will have roughly the same cycles per EFH, hot time per EFH, mission/operations time, and augmentor usage per EFH as compared to the rest of the fleet.

8.4.4. There are two basic types of ACIs:

8.4.4.1. Field Level.

8.4.4.1.1. Performed at engine field maintenance facility by depot and/or Original Equipment Manufacturer (OEM) engineering.

8.4.4.1.2. Performed to examine one area of the engine (e.g., hot section).

8.4.4.1.3. Performed to identify issues with a subset of engines without the downtime associated with a depot level ACI.

8.4.4.2. Depot Level.

8.4.4.2.1. Performed at the depot or OEM overhaul facility by depot and/or OEM engineering.

8.4.4.2.2. Complete inspection of all parts of the engine for an extensive engineering review.

8.4.5. ACIs are performed in two primary steps.

8.4.5.1. Dirty layout – engine disassembled into modules and laid out for engineering evaluation.

8.4.5.2. Clean layout – engine disassembled to the piece part level and cleaned.

8.5. LtF/ACI Program Management.

8.5.1. DoP will:

8.5.1.1. Assist MAJCOMs in identifying and distributing LtF/ACI engines evenly among operational squadrons to ensure full range of missions and environments are encountered by the LtF/ACI fleet.

8.5.1.2. Determine and establish predetermined intervals for ACI engines/modules.

8.5.1.3. Ensure funds are available for ACI requirements, and that ACI requirements are addressed in appropriate contractual documents.

8.5.1.4. Provide the logistics community with the results of the ACI to allow provisioning within lead-time for supportability.

8.5.1.5. Establish Memorandum of Agreements with using MAJCOM/A4s describing LtF/ACI Program management and responsibilities.

8.5.1.6. Ensure Engine TMS managers collaborate/consult with such activities as MAJCOM/A4s, OEMs, sustainment/engineering activities, Air Force Research Laboratory for support, advice, and participation in developing LtF/ACI Program plans and implementation for each engine type.

8.5.1.6.1. Ensure LtF/ACI assets are processed and positive inventory control is applied to serial numbered controlled items.

8.5.1.6.2. Report monthly, by the seventh duty day of each month, status of the LtF/ACI engine/modules/LRUs/SRUs to the MAJCOM/A4 and DoP.

8.5.1.6.2.1. Provide engines/modules/LRUs/SRUs serial number, average EFH/Total Accumulated Cycles (TACs) accumulated for the wing, EFH/TAC's accumulated (month & total), maintenance performed, and a brief explanation why the engines did not meet the desired flying goal.

8.5.1.6.3. Request supply Project Codes for LtF/ACI part requisitions. **NOTE**: Refer to AF Handbook 23-123V1, *Materiel Management Reference Information*, for additional information.

8.5.1.6.4. Coordinate parts requisitions for backordered parts with the individual unit monitor. The requisition number, part number, national stock number, and quantity of each item required will be handled through the item managers for expedited shipment to the requesting unit.

8.5.1.6.5. Coordinate with participating field units to schedule TCTO compliance at the earliest opportunity.

8.5.2. MAJCOMs will:

8.5.2.1. Participate and resource support for the LtF/ACI Program.

8.5.2.2. Designate units that will be required to participate in the LtF/ACI Program.

8.5.2.3. Ensure LtF/ACI Program monitoring systems and direction are established at the appropriate Numbered AF units and participating field units.

8.5.2.3.1. Establish scheduling, maintenance, records keeping functions, parts requisition procedures, and reporting procedures for LtF/ACI engines/modules/LRUs/SRUs.

8.5.2.3.2. Designate LtF/ACI Program monitors at organizational and intermediate levels.

8.5.2.4. Give LtF/ACI engines/modules/LRUs/SRUs priority attention and ensure all maintenance actions documented.

8.5.2.5. Ensure LtF/ACI engines/modules/LRUs/SRUs are dedicated to the flying schedule to the maximum extent possible.

8.5.2.6. Ensure participating Maintenance Groups strive to accelerate LtF/ACI engines at twice the normal flying rate until the engine/modules/accessories are, at a minimum, two years ahead of the top 10% (high time) fleet engines. **NOTE**: Calculate “twice the normal flying rate” by doubling the average monthly total operating time for the squadron’s passive engines. For unique fleets with high utilization rates; a reasonable goal can be set between the normal flying rate and twice the rate.

8.5.2.7. Maintain LtF/ACI engine status and provide to the Engine TMS manager or other stakeholders as may be established.

8.5.2.8. Ensure LtF/ACI engines removed from an aircraft down for maintenance more than ten duty days are reinstalled into an aircraft active in the flying schedule.

8.5.2.9. Ensure the Engine TMS manager is notified immediately when accessories or major components are removed for maintenance.

8.5.2.10. Obtain Engine TMS manager approval prior to the removal of any major component from an LtF/ACI engine for cannibalization to another engine or a waiver of the LtF/ACI engine’s maintenance for continued service.

8.5.2.11. Use engine specific LtF/ACI Project Code when requisitioning and shipping assets.

8.5.2.12. Clearly mark all LtF/ACI Program assets being returned to the depot or to the contractor with the reason for removal and a description of the defects.

8.5.2.13. Requisition LtF/ACI components through normal supply channels and inform the Engine TMS manager part number, national stock number, quantity, and requisition number.

8.5.2.14. Not replace LtF/ACI engine parts and/or components with earlier released versions without documented prior approval of the Engine TMS manager.

8.5.2.15. Provide assistance (manpower, facilities, and expendables) in performing mini-ACIs. **NOTE**: Mini-ACI permits a quick turnaround on engines that do not require a complete teardown.

8.5.2.15.1. Requested ACI support will be within capabilities of each field maintenance unit.

8.5.2.15.2. The Engine TMS manager provides a list of expected fall out parts and requisition accordingly when a mini-ACI is to be performed at the intermediate level.

Chapter 9

CONDITION BASED MAINTENANCE PLUS (CBM+)

9.1. General. CBM+ processes support DoDI 4151.22, *Condition Based Maintenance Plus (CBM+) for Materiel Maintenance*, and AFI 63-101/20-101, *Integrated Life Cycle Management*. Additional information/guidance, is also in the Condition Based Maintenance Plus DoD Guidebook; TO 00-25-257, for selected organic managed engine programs; DAFI 21-101, *Aircraft and Equipment Maintenance Management.*

9.1.1. CBM+ is the application of RCM and ET&D/P concepts to aircraft engines and will be implemented into all new acquisition propulsion systems and current/fielded propulsion systems where technically feasible and beneficial. The enterprise goal of CBM+ is to tie together ET&D/P and RCM to enable a predictive maintenance end state capability. However, implementation of CBM+ will vary depending on the TMS support concept (organic vs. contractor), MAJCOM requirements, and data availability.

9.1.2. Engine Trending & Diagnostics/Prognostics (ET&D/P). ET&D/P integrates hardware, software, maintenance, diagnostic and prognostic processes on board and off board to quantify and monitor/manage engine condition utilizing Engineering Digital Strategy processes. ET&D/P activities help maintainers determine if maintenance must be performed before the next flight and/or the next scheduled engine removal based on engine operating data. All preventative maintenance recommendations will be provided by the cognizant engineering authority (may be delegated to a contractor per contract requirements). The primary goal is to:

9.1.2.1. Prevent or limit damage to propulsion systems by prediction or early detection of performance degradation and/or failures.

9.1.2.2. Minimize the deployment footprint by standardizing and consolidating ET&D hardware, software, test instrumentation, techniques/procedures, and base level tasks.

9.1.3. ET&D/P Data Sources and Utilization. ET&D/P utilizes data from a variety of sources including: on-board aircraft and engine data sensors and collection devices, intermediate and depot test cell data collection devices, organizational, intermediate and depot maintenance records/data systems, Non-Destructive Inspection (NDI) and oil analysis data. ET&D/P analyses will be used to: predict, detect and conduct pre-emptive analysis of adverse trends; forecast time and material requirements to optimize supportability and maintenance man-hours; develop engine trend algorithms and provide support to field users by diagnosing engine performance problems; determine engine operational parameters in support of mishap/problem investigations; and reduce life cycle costs and optimize reliability through improved measurement of life used on critical components.

9.1.4. Reliability Centered Maintenance (RCM). RCM is an analytical process to determine the appropriate failure management strategies, including preventive maintenance requirements and other actions that are warranted to ensure safe operations while balancing readiness and costs. Through utilizing the RCM process, maintainers learn to optimize Expected Time on Wing (ETOW) through disciplined analysis and structured processes to identify cost effective and technically sound maintenance practices. These practices affect field and depot maintenance, supply, training, engineering, operator procedures, technical data, and other areas to ensure the most effective maintenance practices are used.

9.1.4.1. RCM Data Sources and Utilization. RCM utilizes data from a variety of sources; e.g., including: maintenance records/data systems, primary failure and root cause records/data systems, cost data systems. RCM analyses is used to: reduce shop flow days, improve reliability by phasing out time-based removals and increasing ATOW or MTBR, and reduce life cycle costs.

9.2. New Acquisitions. CBM+ is included in the selection of maintenance concepts, technologies and processes for all new aircraft engines based on readiness, requirements, life cycle cost goals and RCM-based functional analysis. CBM+ tenets include: designing engines that require minimum/need-driven maintenance, appropriate use of embedded diagnostics and prognostics, improved maintenance analytical and production technologies, automated maintenance information generation, trend based reliability and process improvements, integrated information systems response based on equipment maintenance condition, and smaller maintenance and logistics support footprints.

9.2.1. The PM, Lead MAJCOM/A4, Air Force Research Laboratory, and DoP are the principles to facilitate the implementation of CBM+ into new acquisition and legacy propulsion systems. They collaborate to coordinate decisions/activities that impact CBM+ direction, processes and implementation with key stakeholders, develop implementation/sustainment plans for CBM+ tools (systems and software) utilizing a net-centric environment when feasible, and identify technological opportunities related to CBM+.

9.2.1.1. DoP will:

9.2.1.1.1. Ensure CBM+ is implemented for applicable propulsion systems.

9.2.1.1.2. Serve as champion for acquisition of CBM+ tools.

9.2.1.1.3. Identify appropriate personnel to manage and implement CBM+ programs for applicable engine TMSs.

9.2.1.1.4. Ensure personnel are trained and have adequate resources/processes to implement CBM+ for applicable engine TMSs.

9.2.1.1.5. Identify appropriate personnel to participate in CBM+ conferences, meetings, and committees when required to identify and discuss operational issues and policies. Build an annual CBM+ roadmap which incorporates ET&D/P and RCM, resolve operational issues and develop processes and procedures.

9.2.1.1.6. Identify appropriate CBM+ processes, technologies and knowledge based capabilities, endorse Air Force Research Laboratory CBM+ related projects as needed and ensure new CBM+ related capabilities approved for implementation have a transition plan and the transition plan considers agile governance and change management processes. Ensure CBM+ capabilities support a net-centric environment and support the DoD digital engineering initiative.

9.2.1.1.7. Ensure ELMPs and acquisition performance specifications identify CBM+ requirements.

9.2.1.1.8. Include CBM+ guidance in engine specific TOs.

9.2.1.1.9. Support MAJCOMs for CBM+ course development and training.

9.2.1.1.10. Serve as the PSI in order to program, budget and execute CBM+ requirements on behalf of PMs/MAJCOMs.

9.2.1.1.11. Coordinate development and test activities with the Support Equipment Product Group Manager for CBM+ software that impacts support equipment.

9.2.1.1.12. Coordinate with the Air Force Safety Center to ensure ET&D/P analysis is integrated into mishap analysis and corresponding recommendations are assessed and incorporated into appropriate policy and guidance.

9.2.1.2. Air Force Research Laboratory will:

9.2.1.2.1. Identify appropriate personnel to accomplish RDT&E for technologies, management of RDT&E contract projects, identify appropriate personnel to participate in CBM+ conferences, meetings, and committees to identify and discuss RDT&E technologies, issues and policy.

9.2.1.2.2. Serve as focal point for Science and Technology initiatives in support for CBM+ technologies.

9.2.1.2.3. Communicate status of emerging CBM+ technologies to PMs and DoP. Support the transition of technologies from Air Force Research Laboratory to programs and support transition planning.

9.2.1.2.4. Ensure CBM+ IT technology is designed to operate/support the DoD net-centric environment when feasible.

9.2.1.3. Support Equipment Product Group Manager will:

9.2.1.3.1. Coordinate development and test activities with the DoP and PM for support equipment that impacts CBM+ software.

9.2.1.3.2. Support System unique development of support equipment TOs and updates. Provide TO updates for common support equipment.

9.2.1.3.3. Ensure support equipment that generates data needed for CBM+ business processes can be formatted, collected and transferred to the required DoD Maintenance Information System.

9.2.1.4. PMs will coordinate with the DoP and Support Equipment Product Group Manager on aircraft modifications that impact CBM+ data sources (such as data recorders) and associated support equipment by providing necessary interface control documentation.

9.2.1.5. MAJCOMs will:

9.2.1.5.1. Identify operational goals and requirements for specific engine TMS CBM+ and assist the Engine TMS manager establishing requirement priorities.

9.2.1.5.2. Provide CBM+ requirements to the PM, ensure documented in the ELMP and performance specification, and advocate for CBM+ support funding.

9.2.1.5.2.1. Ensure CBM+ requirements that require an IT solution support DoD net-centric goals and objectives, when feasible, provide rationale when an IT solution must provide local CBM+ capabilities outside the DoD net-centric environment.

9.2.1.5.3. Provide support for identification and resolution of CBM+ issues.

9.2.1.5.4. Ensure units have qualified CBM+ personnel and execute CBM+ programs and activities in accordance with applicable TO 00-25-257 series TOs for selected organic managed engine programs, contracts and/or MAJCOM Instructions for contract or CLS managed programs, or other methods as deemed appropriated by the MPWG.

9.2.1.5.5. Identify specific CBM+ training requirements to Air Education and Training Command for course development and ensure appropriate personnel are trained.

9.2.1.5.6. Ensure operations and maintenance (includes flight line, NDI, and test cell) personnel capture appropriate raw engine data and flight data when automated data collection methods are inoperable and transfer to CBM+ activity for analysis.

9.2.1.5.7. Ensure that each unit provides timely and accurate inputs to system of record.

9.2.1.6. Air Education and Training Command in addition to above will:

9.2.1.6.1. Coordinate on training requirements submitted by MAJCOMs and establish supportability for training.

9.2.1.6.2. Develop and update CBM+ course material as required in accordance with MAJCOM identified training requirements.

9.2.1.6.3. Provide CBM+ training for MAJCOM personnel in accordance with the identified training requirements.

Chapter 10

ENGINE HEALTH INDICATORS (EHI)

10.1. General Information. The DoP and Engine TMS managers develop and utilize EHI to drive a desired behavior with standardized engine metrics that provide leadership an overview of readiness and sustainment issues. The metrics and indicators are organized by the capability or attribute that they measure.

10.1.1. Each Metric/Indicator will be divided into four sections: Metric Objective, Metric Description, Metric Methodology, and Metric Interpretation.

10.1.2. Those metrics that have established goals will display stoplight indicators on the same page as the graph and support data. The goals will be generated for each engine TMS. The stoplight indicators cover the current reporting period; however, stoplight indicators for future periods are subjective assessments and require management decision. **NOTE**: Unless goals are specifically identified in this AFMAN, metrics that provide a historical trend will not be assigned a goal and relevant stoplight indicators.

10.1.3. The Engine TMS managers will obtain and report EHI to the DoP.

Table 10.1. Engine Health Indicators.

Capability / Attribute	**Top Level Metric** **Supporting/Lower Level Metric**
Safety	Engine System Safety (ESS)
	Non-Recoverable In-flight Shutdown (NRIFSD)
	Engine-Related Loss of Aircraft (ERLOA)
Availability	Net Serviceable (WRE - War Readiness Engines)
	Base Stock Level (BSL)
	Engines Non-Mission Capable Supply (ENMCS)
Reliability	Mean Time Between Removal (MTBR)/Average Time On Wing (ATOW)
	Shop Visit Rate (SVR) per 1000 EFH
	SER rate per 1000 EFH
	UER rate per 1000 EFH
Maintainability	Maintenance Man Hours per Engine Flying Hour (MMH/EFH)
	O-Level: Maintenance Man Hours (OMMH/EFH)
	I-Level: Maintenance Man Hours (IMMH/EFH)
	TCTO: Maintenance Man Hours (TCTO MMH/EFH)
Affordability	Engine Operating Cost
	Cost Per Engine Flying Hour (CPEFH)
	Cost Reduction

10.2. Safety.

10.2.1. Engine System Safety (ESS): The goal of the ESS metric is to maximize flight safety.

10.2.1.1. Metric Objective: The ESS metric will be a composite over-arching measurement of safety risk for a given TMS. All the safety issues on each TMS will be tracked and an overall system risk related to the individual risk of each identified safety issue established.

10.2.1.2. Metric Description: The issues identified by this metric ensure those that are identified by the Engine Risk Management Process, which is detailed in the PCoE, BP 99-06E, *Aircraft Gas Turbine Engine Flight Safety Risk Management Process*.

10.2.1.2.1. A safety issue will be identified from a number of sources, to include, Deficiency Reports (DRs), IFSD, NRIFSD, ERLOA, test and evaluation, research and development, field, overhaul, and mishaps. Identified safety issues will be assessed for relative risk.

10.2.1.2.2. Assessed risk will be mitigated through several methods, to include material changes, process changes and maintenance/inspection practices. Each risk mitigation action will be tracked via the ESS metric.

10.2.1.3. Metric Interpretation: The ESS will present the number of known safety issues, grouped according to their risk color code defined by PCoE BP 99-06E.

10.2.1.3.1. Each individual safety issue will be assigned a stoplight indicator of Red, Yellow, or Green according to its assessed risk level and its related risk mitigation actions. TMSs that have one or more red issues are scored an engine safety status of red. TMSs that have zero red issues but one or more yellow issues are scored an engine safety status of yellow. TMSs that have zero red issues and zero yellow issues are scored an engine safety status of green.

10.2.2. NRIFSD: The goal of this metric is to minimize the NRIFSD rate.

10.2.2.1. Metric Objective: This safety indicator provides quarterly trending of NRIFSD rate for a given TMS. Refer to PCoE BP 99-06E for actions to be taken when exceeding established Propulsion Safety Threshold on this indicator.

10.2.2.2. Metric Description: Any engine shutdown in-flight, either due to an engine malfunction or by the aircrew following flight manual procedures whereby: the engine is unable to restart, or further investigation determines that a restart attempt would not have been successful, or further investigation determines that continued operation would have caused the engine to fail, or the aircraft cannot maintain level flight at a safe altitude as determined by the situation.

10.2.2.3. Metric Methodology: NRIFSD rate is calculated as the number of NRIFSD in the fleet within a time interval divided by the EFHs within the same interval, multiplied by 100,000. This metric will show the six quarter rolling average and a cumulative value for each quarter of the fiscal year. Number of NRIFSD is defined as the NRIFSD rate within a time interval multiplied by the EFHs within the same interval divided by 100,000.

10.2.3. ERLOA: The goal for this metric is to minimize the ERLOA rate.

10.2.3.1. Metric Objective: This safety indicator provides quarterly trending of ERLOA for a given TMS. Refer to PCoE BP 99-06E for actions to be taken when exceeding established Propulsion Safety Threshold on this indicator.

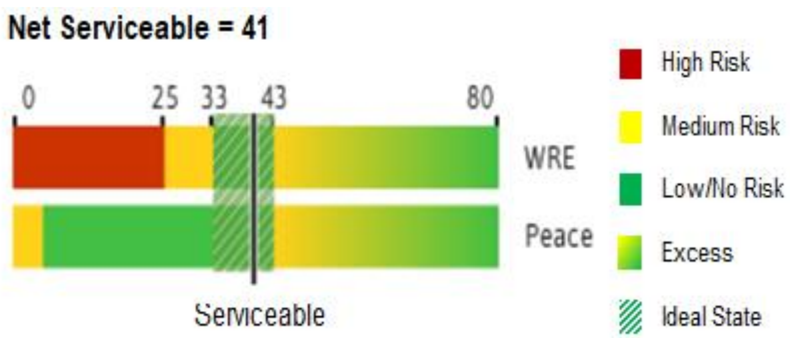
10.2.3.2. Metric Description: An engine related mishap resulting in destruction of an aircraft.

10.2.3.3. Metric Methodology: ERLOA will be calculated as the number of engine related loss of aircraft over the program life of the weapon system. ERLOA will show the six quarter rolling average and cumulative value per quarter for each fiscal year. Mishap data is obtained from the Air Force Safety Automated System database maintained by the USAF Safety office.

10.3. Availability.

10.3.1. Net Serviceable Metric: This metric is used as a tool for managing serviceable engines to an ideal level. The standards for this metric are established within the PRS model to portray the current net serviceable quantity of engines for peace and wartime in a risk format.

Figure 10.1. Net Serviceability Metric.



10.3.1.1. Metric Description: This metric graphically portrays the risk to peace and war posture based on the current net serviceable engine quantity.

10.3.1.1.1. TSR: The number of serviceable engines required to support peacetime operations.

10.3.1.1.2. WRE: The number of serviceable engines required to support the Air Force war tasking. These engines are required to support a weapon system from the start of the war until re-supply is established.

10.3.1.2. Metric Methodology:

10.3.1.2.1. Net Serviceable: The number of total serviceable engines minus installed and obligations. Data for computing the metric can be found in the Propulsion Automatic Re-supply Report in CEMS. Serviceable due-ins will be in serviceable built-up status. Obligations to depot possessed aircraft that exceed the base level Backup Aircraft Inventory are also included.

10.3.1.2.1.1. Net Serviceable (Weekly Snapshot) = Total Net Serviceable – raw (Whole engine requirement) + Total Serviceable Due-in.

10.3.1.2.1.2. Net Serviceable (Monthly Average) = Sum of Weekly Snapshots ÷ Number of Weeks in Month.

10.3.1.2.1.3. Net Serviceable (Quarterly Average) = Sum of Monthly Averages ÷ 3.

10.3.1.3. Metric Interpretation: Peace and war stock levels used in the metric are computed by PRS. An 80% confidence factor will be used in the PRS computation to account for "peaks and valleys" associated with spare engine demands.

10.3.1.3.1. Peace Levels:

10.3.1.3.1.1. Red = High risk due to net serviceable level at or below zero (mitigation rules allow utilizing engines temporarily from Programmed Depot Maintenance facility in some instances).

10.3.1.3.1.2. Yellow = Medium risk due to net serviceable level between zero and the PRS established peacetime resupply quantity (of engines being produced at time of need for during peace operations, calculated by PRS).

10.3.1.3.1.3. Green = Low/no risk due to net serviceable level between peacetime resupply quantity and 125% of negotiated WRE that supports peace operations.

10.3.1.3.1.4. Yellow/Green = Excess due to net serviceable level greater than 125% of negotiated WRE.

10.3.1.3.2. WRE Levels:

10.3.1.3.2.1. Red = High risk as net serviceable level is below the 70% PRS computed confidence level. (Not to be confused with 70% of negotiated WRE).

10.3.1.3.2.2. Yellow = Medium risk as net serviceable level is equal to or greater than the PRS computed confidence of 70% and less than the MAJCOM negotiated level.

10.3.1.3.2.3. Green = Low/no risk as net serviceable level is equal to or greater than the MAJCOM negotiated level.

10.3.1.3.2.4. Upper and Lower Control Limits = 100% to 125% of negotiated WRE.

10.3.1.4. For reporting purposes, the following WRE/TSR color ratings are used:

10.3.1.4.1. Yellow/Green = WRE/TSR is greater than 125% of the MAJCOM negotiated level.

10.3.1.4.2. Green = WRE/TSR is between 100% and 125% of the MAJCOM negotiated level.

10.3.1.4.3. Yellow = WRE/TSR is greater than or equal to the PRS computed confidence level of 70% and less than the MAJCOM negotiated level.

10.3.1.4.4. Red = WRE/TSR is less than the PRS 70% confidence level.

10.3.2. BSL: This metric determines if there are sufficient spare engines to support the peace and war mission to an 80% ready rate for combat and non-combat coded units.

10.3.2.1. Metric Description:

10.3.2.1.1. Engine BSL is the number of spare engines (serviceable and unserviceable) required at bases to support peace and war requirement to an 80% ready rate. **NOTE**: WRE is a subset of BSL.

10.3.2.1.2. Computed BSL: BSL is computed by PRS to support the peace and war requirement to an 80% ready rate.

10.3.2.1.3. Negotiated BSL: BSL can be negotiated in place of the computed requirement (constrained or non-constrained). This quantity will be determined by the Lead MAJCOM/A4 in coordination with the using MAJCOMs.

10.3.2.1.4. On Hand: Actual number of spare engines available at the bases, including in- transit engines (repairable and serviceable); excludes base level obligations.

10.3.2.2. Metric Methodology:

10.3.2.2.1. Data from the Propulsion Automatic Re-supply Report in CEMS will be used for the BSL Computations.

10.3.2.2.2. Metric Computations: On Hand BSL (Weekly Snapshot) equals the Total Qty on Hand + Total Qty Serviceable Due-in + Total Qty Repairable Due-in. Serviceable due-ins will be in serviceable built-up status. Obligations to base possessed aircraft are excluded in the net serviceable computation.

10.3.2.2.3. On Hand BSL (Monthly Average) = Sum of Weekly Snapshots ÷ Number of Weeks in Month.

10.3.2.2.4. On Hand BSL (Quarterly Average) = Sum of Monthly Averages ÷ 3.

10.3.2.3. Metric Interpretation:

10.3.2.3.1. Green = On hand assets greater than or equal to 90% of the Computed BSL.

10.3.2.3.2. Yellow = On hand assets are less than 90% of the Computed BSL and greater than or equal to 90% of the negotiated BSL.

10.3.2.3.3. Red = On hand is less than 90% negotiated BSL.

10.3.2.4. Occasionally the negotiated BSL may be set above the computed level. Color Ratings in this event are:

10.3.2.4.1. Green = At or above 90% of the negotiated level.

10.3.2.4.2. Yellow= Below 90% of the negotiated level but at or above 90% of the computed level.

10.3.2.4.3. Red = Below 90% of the computed level.

10.3.3. ENMCS: This metric determines if the flow of parts is adequate to support the field requirements.

10.3.3.1. ENMCS applies only to uninstalled engines undergoing repair or build-up where work stoppage resulted because spare parts were not available and supply requisitions have been submitted. An engine is not be considered ENMCS when in work and a work stoppage occurs for lack of manpower, tools, work space, or parts that are in repair cycle processing due-in from maintenance.

10.3.3.2. Metric Description:

10.3.3.2.1. Average quantity and/or percent of uninstalled engines in work stoppage awaiting parts from the supply system over a given time period.

10.3.3.2.2. Acceptable quantity and/or percent of the uninstalled engines in NMCS status.

10.3.3.2.2.1. For non-trainer aircraft engines, criteria will be less than 10% ENMCS and/or 10 engines.

10.3.3.2.2.2. For trainer aircraft engines, criteria will be less than 20% ENMCS and/or 20 engines.

10.3.3.2.3. ENMCS%: The average percent of the uninstalled ENMCS engines during a given time period.

10.3.3.2.4. # ENMCS Engines: The average quantity of ENMCS engines during the time period.

10.3.3.3. Metric Methodology:

10.3.3.3.1. Data Collection: ENMCS engine status will be reported in accordance with TO 00-25-254-1.

10.3.3.3.2. ENMCS% = NMCS Days ÷ Asset Days.

10.3.3.3.2.1. ENMCS Days: Total number of days of serviceable and reparable engines ENMCS within the reporting period.

10.3.3.3.2.2. Asset Days: Total number of days serviceable and reparable engines were uninstalled within the reporting period.

10.3.3.3.3. CEMS compute and display the monthly NMCS percent on the end of month report.

10.3.3.3.4. #ENMCS Engines (Monthly average) = NMCS Days ÷ # of days in reporting period.

10.3.3.3.5. #ENMCS Engines (Quarterly Average) = Sum of monthly ENMCS engines ÷ 3.

10.3.3.4. Metric Interpretation:

10.3.3.4.1. Green = Less than 10% ENMCS.

10.3.3.4.2. Red =10% or more ENMCS.

10.4. Reliability.

10.4.1. ATOW and MTBR: ATOW and MTBR are similar metrics that provide a macro-level indication of whole-engine and engine component reliability.

10.4.1.1. Metric Description: Time on wing is the fundamental indicator of an engine's reliability. An effective maintenance plan based upon principles of RCM will increase the time on wing of an engine to the hardware's inherent capability. MAJCOMs, Depots, and field units will use ATOW or MTBR as the primary metric to measure RCM effectiveness and overall engine reliability health.

10.4.1.1.1. Total and inherent ATOW or MTBR will be reported by the Engine TMS manager. Both measures will exclude all serviceable built up removals and quick turn removals. The inherent ATOW or MTBR will also exclude removals for Foreign Object Damage (FOD), fuel/oil contamination (non-engine related), and other maintenance faults exclusive of the design. See list of Non-Inherent removals to exclude (**Figure 10.2**).

10.4.1.2. Metric Methodology:

10.4.1.2.1. Engine programs can use either MTBR or ATOW to measure reliability. MTBR is used to measure whole-engine or engine component reliability and ATOW is used to measure whole-engine reliability. The goals for MTBR and ATOW are the same. Reliability reports will be titled to reflect the method selected.

10.4.1.2.2. MTBR is defined as: MTBR = EFHfleet ÷ # removals, where engine flying hours for the fleet (EFHfleet) and number of engine/engine component removals were captured over some period of time, typically each quarter year. This is calculated manually as CEMS and Propulsion Actuarial Client/Server do not automatically report this number.

10.4.1.2.3. ATOW is calculated as: ATOW = ∑ EFH removed engine ÷ # removals, where ∑ EFH removed engine is the sum of flying hours since the last removal on only the engines removed in a given quarter. This is calculated manually as CEMS and Propulsion Actuarial Client/Server do not automatically report this number.

10.4.1.2.4. Quarterly data from Propulsion Actuarial Client/Server is used for EFH and number of removals.

10.4.1.2.5. MTBR is calculated quarterly by the Engine TMS actuary, using a four quarter rolling average to smooth any seasonal variation, and posted on the Actuarial SharePoint site (**https://usaf.dps.mil/teams/21162/act/Shared%20Documents/Forms/AllItems.aspx?viewpath=%2Fteams%2F21162%2Fact%2FShared%20Documents%2FForms%2FAllItems%2Easpx**).

10.4.1.2.5.1. MTBR or ATOW will be undefined if no engines are removed in a quarter.

10.4.1.2.6. For each TMS, Total and Inherent reliability value is reported for each quarter. If the ATOW methodology is used to represent reliability for an engine TMS, then the Total and Inherent reliability values are represented as total ATOW and inherent ATOW. If the MTBR methodology is used to represent reliability for an engine program, then the Total and Inherent reliability values are represented as total MTBR and inherent MTBR.

10.4.1.2.7. Total and Inherent reliability values are calculated the same way when using ATOW or MTBR. Total and Inherent reliability values differ based upon what removals are counted.

10.4.1.2.8. Total reliability will be calculated using all removals reported in CEMS except Transaction Condition Code LB = Serviceable Depot Removal and Transaction Condition Code LQ = Quick Turn Removal.

10.4.1.2.9. Inherent reliability is calculated by excluding all non-inherent (or induced) removals. Non-inherent removals are either those with Transaction Condition Codes LB and LQ or with the HOW MAL Codes (HMCs) shown in **Figure 10.2** below.

10.4.1.2.10. Engine TMS managers will optimize Inherent reliability. SEMs will be trained in the procedures for reporting accurate data.

10.4.1.2.11. TCTO compliance may be scheduled or unscheduled maintenance usually to correct or mitigate design problems and therefore will be chargeable to the engine Inherent reliability. All TCTO removals are included in Inherent reliability, unless transaction condition codes LB or LQ apply.

10.4.1.2.12. An "unserviceable removal" will be an action that drives the engine into I-level maintenance.

10.4.1.2.13. The Lead MAJCOM/A4 is responsible for resolving inaccurate reporting of engine removals.

Figure 10.2. Non-Inherent HOW MAL Codes.

045	Battery replaced	476	Solid FOD (metal, stone)	812	No defect - associated equip
086	Improper handling/shipping	477	Semi-solid FOD (ice)	867	TO 2-1-18 Transfer time limit
116	Cut	478	Semisolid FOD (rags, plastic)	868	Failed external component
127	Adjustment/align ment improp	479	Damage from simulated combat	870	Research, test, diagnostic
157	Thrust reverser failure	480	Damage by accident/incident	872	PDM
167	Tension or torque incorrect	481	Exposure to fire extinguisher	874	Storage damage / deterioration
174	QEC discrepancy	482	Excessive G-force inspection	875	Cannibalization
198	Contaminated fuel	483	Dummy engine transaction	876	Non-T.O. directed removal
210	Servicing with wrong fuel or oil	602	Damage by associated equip	877	T.O. identified components
	Contaminated by foreign mat'l	731	Battle damage	890	Lightening strike
300	Foreign object (no damage)	750	Missing	911	TCTO compliance error
301	FOD or sabotage	796	No defect - TCTO not applicable	943	Data error
303	Semisolid FOD (bird)	797	No defect - TCTO already done	988	Loss of vacuum
410	Lack of / improper lubrication	799	No defect	298	Domestic Object – No Damage
425	Pitted, nicked, chipped, scored	800	No defect - FOM	138	Fan Blade Damage

10.4.1.3. Metric Interpretation:

10.4.1.3.1. Inherent Design Reliability (IDR) provides a baseline for establishing a TMSs reliability goal in collaboration with the Lead MAJCOM.

10.4.1.3.2. The IDR for immature fleets (<500,000EFH)/populations is determined by using the engine's first run interval, where the first run interval is the anticipated average EFH on all engines when first removed for maintenance, including UERs. Deviations are authorized for the use of a higher number when major upgrades are incorporated or a lower number when thrust is increased.

10.4.1.3.3. The IDR for mature fleets (>500,000EFH)/populations determination, (if historical data is not sufficient or applicable to determine the first run interval, inherent reliability) will be assumed to be such that 10% of the engines are currently on wing longer than the inherent reliability. This will be done using a recent time-on- wing histogram and locating the 90th percentile.

10.4.1.3.4. Engine TMS managers submit their IDR with justification and a graph of the ATOW or MTBR metric looking back three years through the CE to the DoP for approval.

10.4.1.3.5. Engine TMS managers submit to the DoP a graph of Total ATOW or MTBR and Inherent ATOW or MTBR, with a color rating based on the inherent ATOW or MTBR relative to the goal established in collaboration and agreement with the Lead MAJCOM.

Table 10.2. ATOW or MTBR Color Rating.

Green = Inherent ATOW or MTBR is greater than goal approved by Lead MAJCOM Yellow = Inherent ATOW or MTBR is less than 100% of goal and greater than 75% of goal Red = Inherent ATOW or MTBR is less than 75% of goal

10.4.1.3.5.1. The IDR is calculated using "hours since base maintenance" for the past three years as reported in the CEMS G341Q Data, Aircraft Engine Removal and Loss Report, excluding non-inherent (or induced) removals. **NOTE**: The IDR analysis generates a histogram of this data locating the 90 percentile, which is consistent with assuming that 10% of the engines are currently on wing longer than the inherent reliability.

10.4.1.3.5.2. The Engine TMS manager initially establishes a baseline MTBR goal at 67% of IDR. In coordination with MAJCOMs the MTBR goal will be updated based on relevant information from sources such as removal trends, top removal drivers, forthcoming CIP incorporations, Propulsion System Integrity Program enhancements, RCM decisions, build policies and CBM+ enhancements to adjust MTBR goals up or down accordingly.

10.4.2. SVR (Shop Visit Rate): The SVR is another indicator used to measure a TMS's reliability. This indicator tracks the number of engines removed from aircraft and subsequently sent to an intermediate maintenance shop or a depot for repair.

10.4.2.1. Metric Methodology: The number of engines removed from aircraft for all reasons (SER + UER + TCTO ER) and subsequently sent to an intermediate maintenance shop or a depot for repair within a time interval divided by the EFH within the same interval, multiplied by 1000. Excludes quick turn (LQ) and serviceable (LB) engine removals.

10.4.2.2. Metric Interpretation: The total SVR is considered inverse of the total ATOW or total MTBR; therefore, the goals for total SVR will be the inverse of those goals listed for the total ATOW or total MTBR.

10.4.3. SERs: The SER (Scheduled Engine Removal) rate is a trend metric; therefore, this indicator will be presented to show the historical trend of SER.

10.4.3.1. Metric Description: SERs are the removals as scheduled by the applicable TO. Scheduled removals for TCTO compliance are not included.

10.4.3.2. Metric Methodology: The number of engines removed from aircraft and subsequently sent to an intermediate maintenance shop or a depot for repair as scheduled by the applicable TO within a time interval divided by the EFH within the same interval, multiplied by 1000. Excludes quick turn (LQ) and serviceable (LB) engine removals.

10.4.4. UERs: The UER (Unscheduled Engine Removal) rate is a trend metric, therefore this indicator will be presented to show the historical trend of UER.

10.4.4.1. Metric Description: UERs are removals caused by an inherent engine malfunction(s). Engine removals resulting from TCTO inspections performed with engine uninstalled are classified as UER. **NOTE**: Inherent engine removal HMC's include unscheduled, scheduled and non-usage. There are also unscheduled non-inherent removal codes. Actuaries currently include only unscheduled removals in this metric.

10.4.4.2. Metric Methodology: The number of engines removed from aircraft and subsequently sent to an intermediate maintenance shop or a depot for repair divided by the EFH within the same interval, multiplied by 1000. Excludes quick turn (LQ) and serviceable (LB) engine removals.

10.5. Maintainability.

10.5.1. Maintenance Man-Hours Per Engine Flying Hour (MMH/EFH):

10.5.1.1. Metric Objective: Be a macro level metric to measure maintainability of a TMS.

10.5.1.2. Metric Description: This metric measures man-hours required for fault isolation and checkout, engine removal and replacement, engine buildup and teardown, module component and part repair or adjustment, component removal and replacement, installed maintenance and all scheduled inspections, service and maintenance include TCTO accomplishments.

10.5.1.3. Metric Methodology: Total MMH/EFH rate as reported in the Logistics, Installations, and Mission Support – Enterprise View (LIMS-EV) system.

10.5.1.4. Metric Interpretation: In coordination with MAJCOM/A4s and engine TMS managers, the MMH/EFH is recommended by each engine's TMS manager at their respective MPWG and established in collaboration and agreement with the Lead MAJCOM.

Table 10.3. MMH/EFH Goals.

Engine TMS Manager and Lead MAJCOM determine the MMH/EFH goal. Green = MMH/EFH is at or below the established goal. Yellow = MMH/EFH is between 100% and 115% of the established goal. Red = MMH/EFH exceeds 115% of the established goal.

10.5.2. Organizational Maintenance Man Hours per Engine Flying Hour (OMMH/EFH):

10.5.2.1. Metric Objective: This indicator measures the operational maintainability of a TMS by quarterly showing the trend of OMMH/EFH and is only reported when the MMH/EFH metric is yellow or red.

10.5.2.2. Metric Description: This metric measures man-hours required for activities chargeable to engines that take place at the organizational level of maintenance.

10.5.2.3. Metric Methodology: Organizational MMH/EFH rate is reported in the LIMS-EV system.

10.5.2.4. Metric Interpretation: In coordination with MAJCOM/A4s and PM, the Engine TMS manager determines the OMMH/EFH goal.

10.5.3. Intermediate Maintenance Man Hours per Engine Flying Hour (IMMH/EFH):

10.5.3.1. Metric Objective: This indicator is aimed at measuring maintainability of a TMS at the intermediate level by quarterly showing the historical trend of IMMH/EFH and is only reported when the MMH/EFH metric is yellow or red.

10.5.3.2. Metric Description: This indicator measures man-hours required for those activities chargeable to engines that take place at the intermediate level of maintenance.

10.5.3.3. Metric Methodology: The IMMH/EFH rate will be as reported in the LIMS-EV system.

10.5.3.4. Metric Interpretation: In coordination with MAJCOM/A4s and PM, the Engine TMS manager determines the IMMH/EFH goal.

10.5.4. TCTO Maintenance Man Hours per Engine Flying Hour (TCTO MMH/EFH):

10.5.4.1. Metric Objective: This indicator is aimed at measuring the TCTO related maintenance activities of a TMS by quarterly showing the historical trend of TCTO MMH/EFH.

10.5.4.2. Metric Description: This metric measures man-hours required for those activities chargeable to engines that take place as a result of TCTOs.

10.5.4.3. Metric Methodology: TCTO MMH/EFH rate will be as reported in the LIMS-EV system.

10.5.4.4. Metric Interpretation: In coordination with MAJCOM/A4s and PM, the Engine TMS manager determines the TCTO MMH/EFH goal.

10.6. Affordability.

10.6.1. Engine Operating Cost.

10.6.1.1. Metric Objective:

10.6.1.1.1. Monitor engine TMS operating cost contribution to overall weapon system cost.

10.6.1.1.2. Determine if supply support, the air logistics complexes and MAJCOM operating units are working effectively to control and reduce operating and support costs.

10.6.1.2. Metric Description: Engine Operating Cost provides total operating cost to operate an engine type. Engine Operating Cost is calculated by the Engine TMS manager using standard OSD Operations & Support cost elements and the following formula: Depot Level Reparable (DLRs) + General Support Division (GSD) + Depot Maintenance (non-DLRs) + O & I Level Maintenance. Flying hours are shown but not a part of calculation.

10.6.1.3. Metric Methodology:

10.6.1.3.1. Information required for calculation will be obtained from Air Force Total Ownership Cost (AFTOC) database and/or contract reports for those engine TMS supported by contractor logistics support (CLS).

10.6.1.3.2. AFTOC elements used include Level 2 and 3 Cost Analysis Improvement Group (CAIG) elements (**https://aftoc.hill.af.mil**): Depot Level Reparable (Flying DLR) – CAIG element 2.3.1, Consumables (GSD) – CAIG element 2.2.1, Depot Maintenance (not DLRs) – CAIG element 4.1.3.1, Organizational Maintenance – CAIG element 1.2.1, and Intermediate Level Maintenance – CAIG element 1.2.2.

10.6.1.3.3. Engine Flying Hours will be as reported in CEMS and available on the Actuary SharePoint site (**https://usaf.dps.mil/teams/21162/act/Shared%20Documents/Forms/AllItems.aspx?viewpath=%2Fteams%2F21162%2Fact%2FShared%20Documents%2FForms%2FAllItems%2Easpx**).

10.6.1.3.4. Accuracy of AFTOC data for the Depot Maintenance (CAIG Element 4.0) is verified by comparing to actual historical data. Each fiscal year whole engine input schedule and sales price are checked. If the resulting amount is within +/- 5% of the AFTOC amount, no further action is required. If the variance exceeds +/- 5%, then the actual historical data will be used. **NOTE**: Notify AFTOC and the MAJCOM of the discrepancy and request a review by AFTOC to determine the source of the discrepancy.

10.6.1.4. Metric Interpretation: Engine TMS manager will evaluate cost increase/decrease and use as a product support integration tool between various product support providers and the MAJCOMs.

10.6.2. CPEFH.

10.6.2.1. Metric Objective:

10.6.2.1.1. Monitor engine operating cost to determine whether supply support, the air logistics complexes and MAJCOM operating units are working effectively to control and reduce operating and support costs.

10.6.2.2. Metric Description: CPEFH is a flying hour metric for an engine type. CPEFH is calculated by the Engine TMS manager by dividing the Engine Operating Costs by the engine flying hours using the following formula: Depot Level Reparable (DLRs) + General Support Division (GSD) + Depot Maintenance (non-DLRs) + O & I Level Maintenance (detailed information on these AFTOC elements is provided in **Paragraph 10.6.1.3.2** above) ÷ (aircraft flying hours x installed engines).

10.6.2.3. Metric Methodology:

10.6.2.3.1. Information required for calculation will be obtained from Air Force Total Ownership Cost (AFTOC) database and/or contract reports for those engine TMS supported by contractor logistics support (CLS).

10.6.2.3.2. Engine Flying Hours will be as reported in CEMS and available on the Actuarial SharePoint site **https://usaf.dps.mil/teams/21162/act/Shared%20Documents/Forms/AllItems.aspx?viewpath=%2Fteams%2F21162%2Fact%2FShared%20Documents%2FForms%2FAllItems%2Easpx**.

10.6.3. Cost Reduction:

10.6.3.1. Metric Objective:

10.6.3.1.1. Track development, implementation, and benefit of efforts to drive down overall propulsion costs.

10.6.3.2. Metric Description: Cost reduction is a metric for an engine TMS or program that is measured by comparing cost versus benefit of engine affordability initiatives.

10.6.3.3. Metric Methodology:

10.6.3.3.1. Information required for calculation will be obtained from a variety of sources; e.g., CEMS and AFTOC database. Engine TMS or program managers will input and track cost reduction initiatives by projected versus actual cost and benefit.

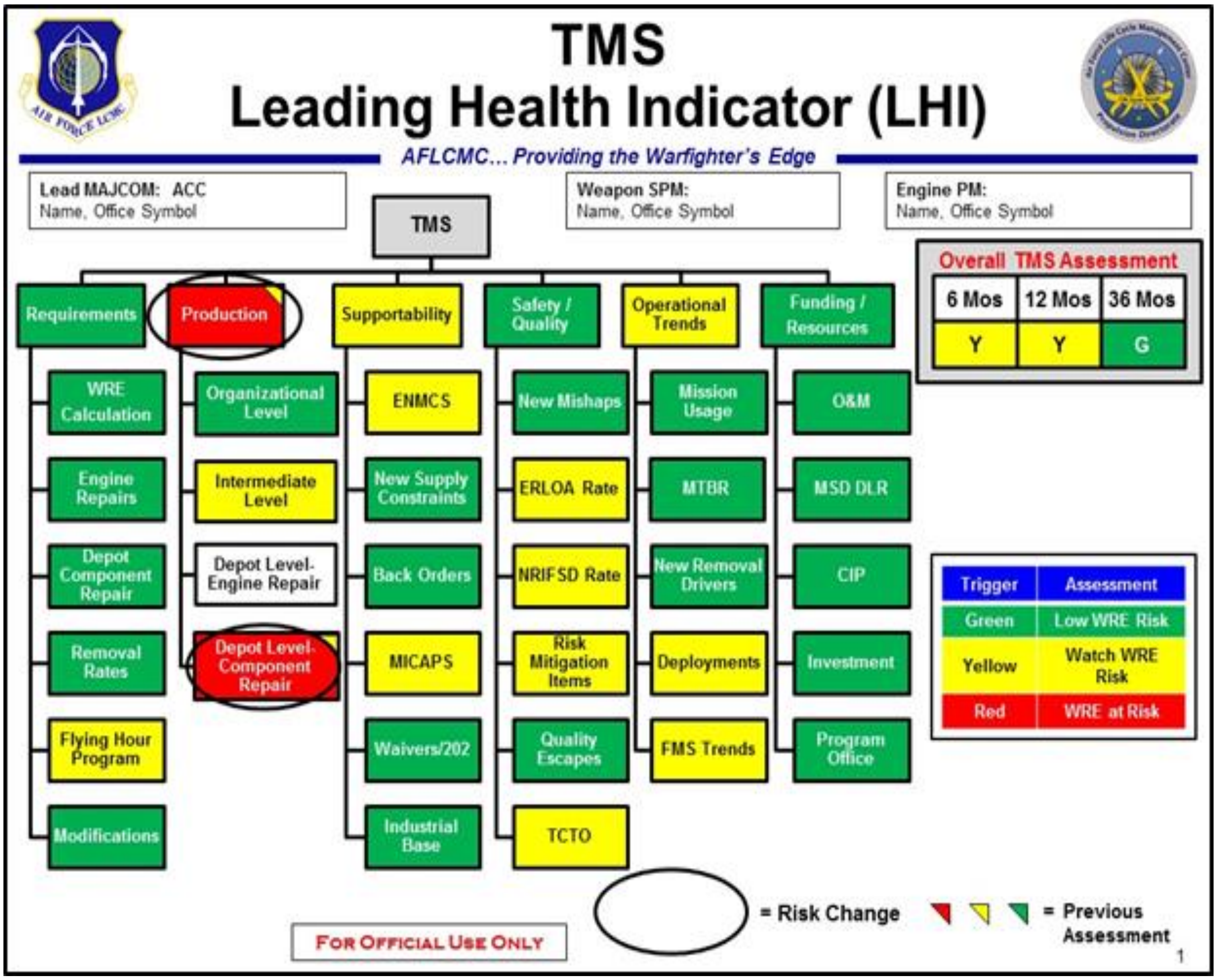
10.6.3.4. Metric Interpretation: Engine TMS or program manager implement cost reduction initiatives to drive down engine contribution to overall life cycle costs.

Chapter 11

ENGINE LEADING HEALTH INDICATORS

11.1. General. This chapter directs the Leading Health Indicator process for propulsion systems health reporting and the criteria for evaluating these indicators. Applicability of this quarterly process is to assess future WRE/TSR outlook. The objective is to drive a desired program behavior with standardized risk identification and provide leadership a comprehensive overview of readiness and sustainment issues. The indicators will be organized by the capability or attribute that they are intended to measure. There are six elements that trigger changes in WRE/TSR outlook: Requirements, Production, Supportability, Safety/Quality, Operational Trends, and Funding/Resources. **(See Figure 11.1)**

Figure 11.1. Leading Health Indicator Overview.



11.1.1. The Lead Engine TMS manager is accountable to the DoP for status and information collected from stakeholders.

11.1.2. Engine TMS managers will complete a Leading Health Indicator assessment quarterly within the FY and update with current data as applicable.

11.1.2.1. Engine TMS managers will coordinate with Lead MAJCOM, AFLCMC, Defense Logistics Agency, Air Force Sustainment Center, other MAJCOMs as required, source of supply, OEMs, and Source of Repair when performing Leading Health Indicator assessments and accessing program status. Final authority of program status rests with the Lead Engine TMS manager based on information collected from stakeholders.

11.1.2.2. Each element will be assigned a red, yellow green rating based on 6, 12, and 36 months impact to WRE/TSR. The Lead Engine TMS manager assigns the rating based on overarching risk to fleet health using the complete assessment as a tool.

11.1.2.2.1. Rate each assessment sub-element to assist in determining the overall element rating.

11.1.2.2.2. Rate elements/sub-elements red if risk goes uncorrected, it will negatively impact WRE/TSR or require extreme measures to mitigate the risk.

11.1.2.2.3. Rate elements/sub-elements yellow if watch item for risk to WRE/TSR; yellow sub-elements are not currently a risk to WRE/TSR but need to be investigated.

11.1.2.2.4. Rate elements/sub-elements green if low risk to WRE/TSR and no issues are projected within lead-time (e.g., future POM to cover issue).

11.1.3. The overall Engine TMS engine rating is based on the Lead Engine TMS manager's cumulative subjective assessment and presented to the DoP. The DoP is accountable for the resolution action plan.

11.1.3.1. There is no set rule for how many reds, yellows or greens make an overall element red, yellow or green; the Lead Engine TMS manager determines based on impacts to WRE/TSR.

11.1.3.2. If the rating is red, the sub-element of: (W) –Watch, (I) – Investigating, (A) – Action must be identified.

11.1.3.3. Briefing charts:

11.1.3.3.1. Change to rated Leading Health Indicator elements will be indicated by an oval circle/previous quarter color rating on the Leading Health Indicator Overview briefing chart.

11.1.3.3.2. Red rated elements/sub-elements requiring action will have backup slide(s) that clearly identify the risk, impact, and mitigation plan.

11.1.3.3.3. Yellow rated elements/sub-elements do not require a back-up slide but is up to discretion of PM.

DARLENE J. COSTELLO
Acting Assistant Secretary of the Air Force
(Acquisition, Technology & Logistics)

Attachment 1

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None

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DD Form 1149, *Requisition and Invoice/Shipping Document*

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Abbreviations and Acronyms

ACI—Analytical Condition Inspection

AEL—Aerospace Engine Life

AF—Air Force (United States)

AFH—Air Force Handbook

AFI—Air Force Instruction

AFJMAN—Air Force Joint Manual

AFLCMC—Air Force Life Cycle Management Center

AFMAN—Air Force Manual

AFMC—Air Force Materiel Command

AFPD—Air Force Policy Directive

AFRC—Air Force Reserve Command

AFTOC—Air Force Total Ownership Cost

ATOW—Average Time on Wing

BSL—Base Stock Level

CAIG—Cost Analysis Improvement Group

CBM+—Condition Based Maintenance Plus

CE—Chief Engineer

CEA—Cost Effective Analysis

CEM—Command Engine Manager

CEMS—Comprehensive Engine Management System

CIP—Component Improvement Program

CLS—Contractor Logistics Support

CPEFH—Cost Per Engine Flying Hour

DAFI—Department of Air Force

DLR—Depot-Level Repairable

DoE—Director of Engineering

DoD—Department of Defense

DoDI—Department of Defense Instruction

DoP—Director of Propulsion

DR—Deficiency Report

EAB—Engine Advisory Board

ECP—Engineering Change Proposal

ECWG—Engine CIP Working Group

EFH—Engine Flying Hours

EHI—Engine Health Indicators

ELMP—Engine Life Cycle Management Plan

ENMCS—Engine Non Mission Capable Supply

ERLOA—Engine Related Loss of Aircraft

ERO—Engine Review Organization

ESOH—Environment, Safety, and Occupational Health

ESS—Engine System Safety

ET&D/P—Engine Trending and Diagnostics/Prognostics

ETOW—Expected Time on Wing

FAA—Federal Aviation Administration

FCCOM—, Facilities Capital Cost of Money

FLO—Foreign Liaison Officer

FMS—Foreign Military Sales

FOD—Foreign Object Damage

FOL—Forward Operating Location

FY—Fiscal Year

FYDP—Five Year Defense Plan

GSD—General Supply Division

HMC—How Malfunctioned Code

HQ—Headquarters

IDR—Inherent Design Reliability

IEMP—International Engine Management Program

IFSD—In-flight Shutdown

ILCM—Integrated Life Cycle Management

IMMH—Intermediate Maintenance Man Hours

IPT—Integrated Product Team

JEIM—Jet Engine Intermediate Maintenance

LIMS-EV—Logistics, Installations, and Mission Support – Enterprise View

LRU—Line Replaceable Unit

LtF—Lead the Fleet

MAJCOM—Major Command

MDS—Mission Design Series

MIL-STD—Military Standard

MMH—Maintenance Man Hours

MOB—Main Operating Base

MPWG—Maintenance Planning Working Group

MTBR—Mean Time Between Removals

NDI—Non-Destructive Inspection

NGB—National Guard Bureau

NMCS—Non Mission Capable Supply

NRIFSD—Non-Recoverable In-Flight Shut Down

OEM—Original Equipment Manufacturer

OHRI—Overhaul Removal Interval

OMMH—Organizational Maintenance Man Hours

OPR—Office of Primary Responsibility

OSD—Office of the Secretary of Defense

OSS&E—Operational Safety, Suitability and Effectiveness

PCoE—Propulsion Center of Excellence

PEO—Program Executive Officer

PM—Program Manager

POC—Point of Contact

POM—Program Objective Memorandum

PRS—Propulsion Requirements System

PSI—Product Support Integrator

PSM—Product Support Manager

QEC—Quick Engine Change

RCM—Reliability Centered Maintenance

RDT&E—Research, Development, Test and Evaluation

RNI—Repair Network Integration

SAM—Sustainability Assessment Module

SEM—SRAN Engine Manager

SER—Scheduled Engine Removal

SRAN—Stock Record Account Number

SRRB—System Requirement Review Board

SRU—Shop Replaceable Unit

SVR—Shop Visit Rate

TACs—Total Accumulated Cycles

TCTO—Time Compliance Technical Order

TMS—Type, Model, Series

TO—Technical Order

TOC—Total Operating Cost

TRL—Technology Readiness Level

TSR—Target Serviceable Requirement

UER—Unscheduled Engine Removal

USAF—United States Air Force

WMT—With Maximum Time

WRE—War Readiness Engines

WSMIS—Weapon System Management Information System

Terms

Acquisition Stock Level Computation Process—The acquisition stock level computation process determines the number of whole spare engines required to be procured in support of each MDS/TMS.

Accountable Asset—Any asset monitored in the EJ-FJ account from initialization into the AF inventory until the serial number is removed from the system.

Actuarial Removal Interval—The number of flying hours per scheduled and unscheduled removals for any maintenance level per 1000 flying hours. ARIs are inputs into the overhaul and retention computations.

Aerospace Engine Life (AEL) Committee—Group whose purpose is to validate/review changes to factors used in developing ARI tables. Factors affecting the assessment are: engine reliability, weapon system employment and maintenance philosophies.

Average Time on Wing (ATOW)—This metric will be reported in the ELMP, the annual ELMP review and elsewhere. ATOW is the fundamental indicator of an engine's reliability. The formula for ATOW is: ATOW = Sum EFH removed engines ÷ # removals.

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

Comprehensive Engine Management System (CEMS)—The USAF "System of Record" for all aspects of Propulsion Management and is the tool used to support the Propulsion enterprise mission from cradle to grave.

Condition Based Maintenance Plus (CBM+)—CBM+ is the application and integration of appropriate processes, technologies, and knowledge-based capabilities to improve the reliability and maintenance (Mx) effectiveness of DoD systems and components. At its core, CBM+ is maintenance performed based on evidence of need provided by Reliability Centered Maintenance (RCM) analysis and other enabling processes and technologies. CBM+ uses a systems engineering approach to collect data, enable analysis, and support the decision-making processes for system acquisition, sustainment, and operations. CBM+ supports the larger DoD improvement efforts of the Under Secretary of Defense for Acquisition, Technology, and Logistics (USD (AT&L)), with the goal of delivering cost-effective joint logistics performance by maximizing weapon system and equipment availability through a more effective logistics process.

Cost Per Engine Flying Hour (CPEFH)—A flying hour metric for an engine TMS. The values for calculating CPEFH are derived using Engine Operating Costs, obtained using a subset of the cost categories obtained from the Engine Cost Analysis Improvement Group (CAIG) product of the AF Total Ownership Cost database, divided by engine flying hours. The formula is: Depot Level Reparable (DLRs) + General Support Division (GSD) + Depot Maintenance (non-DLRs) + O & I Level Maintenance ÷ (aircraft flying hours x installed engines).

Constrained Engines—When computed spare engine requirements exceed total available spare engine inventory.

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

Distribution Stock Level Computation—The computation that determines the whole spare engine requirements for using MAJCOMs and depots.

Director of Propulsion (DoP)—Develops/deploys policy, guidance, processes and coordinates propulsion activities for organizations with execution responsibilities for Air Force aircraft and missile propulsion system acquisitions, sustainment, test, and R&D activities. The DoP is the Director of the Air Force Life Cycle Management Center, Propulsion Directorate (AFLCMC/LP).

Engine Operating Cost—The monitoring of engine TMS operating cost contribution to overall weapon system cost. The values for calculating the Engine Operating Cost are derived using a subset of the cost categories obtained from the Engine Cost Analysis Improvement Group (CAIG) product of the AF Total Ownership Cost database. The formula is: Depot Level Reparables (DLRs) + General Support Division (GSD) + Depot Maintenance (non-DLRs) + O & I Level Maintenance.

Engine Trending and Diagnostics/Prognostics—The monitoring by propulsion and Nondestructive Inspection (NDI) technicians to predict engine condition, performance, and structural integrity.

Expected Time on Wing (ETOW)—ETOW is the projected average time on wing expected to result from application of a specific maintenance work-scope to a specific engine. ETOW is calculated from the statistical distribution of times on wing predicted for a specific engine build. ETOW is a forward looking indicator, as opposed to ATOW which is a historical indicator.

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

Fair Share—A way to calculate CIP contribution amounts using calculations that determine a partners fair share by finding the TMS per engine cost and multiplying that by the partner's engine inventory.

Forecasted Factors—Factors developed which predict what the official factors will be when the engine has reached stability. Forecast factors are used to predict the total number of engines required to support the weapons system throughout its life cycle.

Jet Engine Intermediate Maintenance (JEIM)—Intermediate level maintenance facility.

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

Life Cycle Sustainment Plan (LCSP)—The primary program management reference governing operations and support planning and execution from Milestone A to final disposal.

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.

Mission Essential Item—An item or repair part whose absence renders the supported system or end item inoperable.

Non—accountable Item—Assemblies and/or parts tracked by CEMS for reasons of life limitations or logistical criticality.

Non—Constrained Engines—When total spare engine inventory meets or exceeds computed spare engine requirements.

Non—Usage Removal—An engine removal which is management directed for required maintenance action.

Not Repairable This Station—Percent of engine repairs not accomplished at an operating units' repair location.

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.

Process Owner—An individual with the authority and responsibility for overseeing the development and execution of a process.

Program Manager (PM)—Designated individual with responsibility for and authority to accomplish program objectives for development, production, and sustainment to meet the user's operational needs. The PM is accountable for credible cost, schedule, and performance.

Propulsion Requirements System (PRS)—WSMIS/PRS (D087Q) is the Air Force standard system for the computation of whole engine stock levels for both acquisition and distribution, overhaul requirements, and retention requirements.

Propulsion Safety Threshold—A risk management term used to refer to the DoP defined Risk Thresholds for Non-Recoverable In-flight engine Shutdown and Engine Related Loss of Aircraft (ERLOA). It is used to determine if/when corrective action is necessary to reduce risk to an acceptable level.

Propulsion System—Any air breathing AF propulsion item to include gas turbine engines, reciprocating engines, fuel cells driven propulsive fan/distributed fan, battery driven propulsive fan/distributed fan systems for manned and unmanned aerial vehicles as well as missiles.

Quick Engine Change Kit—Externally mounted components/structures needed to adapt and install the engine to the weapon system.

Quick Turn Engine Removal—An unserviceable engine removal that does not require the engine to be inducted into a repair shop and thus does not drive the use of a spare engine.

Requirements Computation Periods—:

a. Peace: Computes spare assets needed for peace readiness capability
b. War Surge: Computes spare engine assets needed to sustain the war effort until pipelines are filled and repair capabilities are available.
c. War Sustained: Spare engine assets needed to sustain the war effort for a long duration

Reliability Centered Maintenance (RCM)—An analytical process to determine the appropriate failure management strategies, including preventive maintenance requirements and other actions needed to ensure safe operations while balancing readiness and costs.

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

Scheduled Engine Removal (SER)—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.

Stakeholder—Individual or activity whose mission is impacted.

SRAN Engine Manager (SEM)—Manager of engines under an assigned 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 enduring operations 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.

Target Serviceable Requirement (TSR)—TSR is the portion of the computed peacetime requirement that is necessary to be serviceable in support of special requirements.

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

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

Unscheduled Maintenance—Unplanned maintenance actions required.

War Readiness Engine (WRE) Levels—The quantity of net serviceable engines required to support the Air Force war tasking and to sustain operational units' war efforts until pipelines are filled and repair capabilities are available. These engines are to be available to support a weapon system from the start of the war until re-supply (via base, intermediate and/or depot repair) is established.

Attachment 2

ENGINE CIP SCORECARD PROCESS GUIDANCE

A2.1. Consistent with the USAF Engine Health Indicator (EHI) guidance of Chapter 8. This scorecard will serve as a tool for the DoP Propulsion Division Chiefs, and Lead MAJCOMs to reach funding decisions regarding candidate projects and tasks. The scorecard is not the sole determinant, but rather one tool to help guide this decision process.

A2.2. All propulsion systems are monitored for the health of their programs using. Operationally relevant health metrics of Safety, Availability, Reliability, Maintainability and Affordability compared to customer identified goals. The CIP is utilized to address shortfalls and develop strategy plans which are documented in the individual ELMP. Candidate CIP tasks can be identified from a variety of means including:

A2.2.1. Operationally identified deficiencies surfaced through mishap and deficiency reports.

A2.2.2. Maintenance data trends.

A2.2.3. Test and evaluation programs including accelerated mission tests, lead the fleet programs and analytical inspections.

A2.2.4. Depot maintenance and repair improvements.

A2.2.5. Top material cost drivers as identified by the AFTOC system. AFTOC is the authoritative source across the Air Force for financial, acquisition, and logistics information.

A2.3. Process Guidance: The scoring process is composed of two parts as shown in **Figure A2.1**.

A2.3.1. The CIP TMS Engineering Manager will generate a candidate project/task list which will be scored by the engineering manager using the objective criteria listed below in **Paragraph A2.3.8.2.2**.

A2.3.2. The subjective prioritization of the candidate projects/tasks will be conducted by three functional groups independently. These consist of a TMS Team score, a MAJCOM score and scores from the Chief Engineers.

A2.3.3. Each functional group subjectively scores the candidate tasks, ranking each task on the task list from 0-5 (5 being the highest and 0 the lowest). To provide for maximum discrimination, each group is asked to place an equal number of tasks within each rank (0 to 5).

A2.3.3.1. The TMS team will complete their subjective scoring first, then the scorecard with the TMS Team results will be forwarded to the appropriate MAJCOM lead for their scoring input.

A2.3.3.2. Once the MAJCOMs have completed and returned their scorings, the Chief Engineers will review the scoring to date and provide their scoring input.

A2.3.3.3. The TMS Program Manager is responsible for the timely distribution and collection of the scorecards to ensure all data is available for subsequent consideration in preparation for the ECWG.

A2.3.4. This section provides specific guidance on the categorizing and scoring of projects and tasks. The scoring criteria is presented in **Table A2.1** and a scoring sample is provided in **Table**

A2.3.5. At the completion of the engineering objective scoring and the functional scorings, as well as the non-scored project tasks, the CIP Branch Chief will compile all the scores and rankings and then present the results to the Director of Engineering (DOE) for review prior to proceeding to the EAB.

A2.3.5.1. As much as possible, combine non-separable items into one project/task (e.g. include all costs of a given test into one scored project – test costs at Government facility, fuel, contractor support, etc).

A2.3.5.2. Do not lump separable items into one all-encompassing project/task (e.g., do not put multiple tests into one large test task). As a general rule, if parts of a project or task would warrant different scores, they should be scored as separate projects or tasks.

A2.3.6. Non-scored projects/tasks:

A2.3.6.1. The following types of efforts constitute general program support and are not scored. These tasks will be identified on the task scorecard as "PM" (Program Management) type tasks. This is not to be confused with risk reduction efforts, which are program content (see guidance below). The use of these categories and dollar amounts will be absolutely the bare minimum required. See **Chapter 8** for summary definitions.

A2.3.6.1.1. "PM": (a) Award Fee (if applicable), (b) General Product Support (not linked to a scored task), (c) MILSTRIP, (d) Minor common support (e.g., test equipment and data management. Consult the scoring summary table (**Table A2.1**) for specific score values/criteria for each metric.

A2.3.6.2. The following types of risk reduction activities will not be scored. These tasks will be identified on task scorecard as "RR" (Risk Reduction) type tasks:

A2.3.6.2.1. "RR": (a) LtF/ACI, (b) Accelerated Mission Test (w/o task validation – See **A2.3.8.2.1**. below for Accelerated Mission Test w/task validation), (c) Mission analysis, (d) Parts life analysis.

A2.3.7. The TMS risk reduction efforts/plans will be presented at the ECWG meetings and then consolidated for the entire propulsion community for presentation/approval at the ELMP review. Approved elements will be shown above the cut line at the EAB; non-approved elements will be shown below the cut line. Depending upon available funding and other issues, items may be moved above/below the cut line at the EAB.

A2.3.8. Scored projects and tasks:

A2.3.8.1. Each distinct effort (project or task) will be scored relative to the TMS health status it is targeted to improve. Use the health metric that most justifies doing the project or task to arrive at the score for these criteria. If more than one targeted metric is currently rated "Yellow" or "Red," use the metric resulting in the highest score justifying the proposed project or task. DoP health metrics are defined in **Chapter 8**.

A2.3.8.2. Tasks that are common across multiple TMSs are to be rated against the worst case health metric status for all the TMSs affected.

A2.3.8.2.1. Validation tests (including Accelerated Mission Test s used for validation) are scored the same way the projects(s)/task(s) being validated are scored - use the highest applicable project or task score.

A2.3.8.2.2. Specific scorecard criteria are described below:

A2.3.8.2.2.1. Category 1, Current Health Measure Status. Using the health measure that was targeted to be improved by implementing the project or task, assign the applicable score. Color rating of health metric is assigned according to criteria defined in **Chapter 5**. Specific goals are documented in the ELMP for each engine program.

A2.3.8.2.2.2. Category 2, Projected Health Measure Status. Using the projected status of the health measure that was targeted to be improved by the task, assign the applicable score. The projected health measure status should look five years into the future based on current funded implementation efforts. Do not include any benefits from the proposed new task list. Benefits from the proposed new CIP tasks will be accounted for on the applicable “TMS CIP Requirements Summary” slide. In specific instances where five years is an insufficient timeframe, a longer range projection can be recommended – annotate any instances where the five-year projection is not used. Color rating criteria is to be in accordance with requirements defined in **Chapter 8**. Specific goals are documented in the ELMP for each engine program.

A2.3.8.2.2.3. Category 3, Safety Risk Item. If the CIP task has been initiated to address a red safety risk item, the task will earn points. An item is a red safety risk item if corrective action is required per **Table 10.1**.

A2.3.8.2.2.4. Category 4, Carry-Over/New Task. If the CIP task was initiated and funded in prior year(s) it is classified as a carry-over. If the task is new, it is considered a new start.

A2.3.8.2.2.5. Category 5, Technical Risk. If the proposed corrective action being proposed has been designed and approved for use on other USAF systems, the technical risk is less. The Technology Readiness Level (TRL) definitions are used to assign ratings per **Table A2.3**.

A2.3.8.2.2.6. Category 6, Benefits/Improvements. Each CIP task should be based on the customer’s request to improve one of the health metrics; however, since a task can affect more than one metric (e.g., Safety and WRE), this category allows tasks to earn points for their benefits to each metric. Tasks can score points for improvements to any of the metrics (a maximum of 5 points total). Consult the Scoring Summary Table for specific score values/criteria for each metric.

A2.3.8.2.2.7. Category 7, Implementation Plan Resources. Points for this category will be based upon the status of implementation resources. Approved means that the required resources to implement the output product of the CIP task have been approved by the Lead MAJCOM in System Requirement Review Board (for 3400) or the future MAJCOM POM (for 3010). Projected means that the implementation plan has been developed by the MPWG and included in the ELMP (3400), or is being submitted in the POM (3010). However, a projected status will not be shown indefinitely. Once a task has met the System Requirement Review Board and/or been through the POM process, if implementation funding has not been approved, it can no longer be considered as projected and will receive no points in this category. Upon subsequent re-submittal and approval, it would then be considered approved.

A2.3.8.2.2.8. Category 8, TMS Life Remaining. Each CIP task will earn points based on the TMS length of life remaining. For engine models with multiple series of engines, use the series with the most years remaining to score all tasks, unless the task is applicable to only one series that has fewer years of life remaining.

A2.3.8.2.2.9. Category 9. Multi-Engine Benefits. If more than one engine TMS benefits from a CIP task, it can earn 2 to 5 extra points depending on the number of engine TMS's it benefits.

Table A2.1. Scoring Summary.

CATEGORY / METRIC	1 Current Health	2 Projected Health	3 Safety Risk	4 Carry-Over/ New Task	5 Technical Risk	6 Benefits/ Improvements	7 Implementation Plan Resources	8 TMS Life Remaining	9 Multi Engine Benefits
Safety	R=5 Y=2 G=0	R=5 Y=2 G=0	Risk Item=6	Carry-Over=3 New Task=0	TR9=3 TR8=2 TR7=1 TR<7=0	Risk Level R=5 Y=3 G=0	Approved=5 Projected=3 None=0	Years ≥15=4 ≥5=2 <5=0	1 Engine=0 2 Engine=2 3 Engine=3 >3 Engine=5
WRE	R=5 Y/G=0 G=0	R=5 Y/G=0 G=0	0			% Improvement (of Goal) ≥5%=5 ≥4%=4 ≥3%=3 ≥1%=2 ≥0.5%=1 <0.5%=0			
ATOW (or MTBR)	R=5 Y=2 G=0	R=5 Y=2 G=0				% Improvement (of Goal) ≥5%=5 ≥4%=4 ≥3%=3 ≥1%=2 ≥0.5%=1 <0.5%=0			
MMH/EFH						% Improvement (of Goal) ≥2.5%=5 ≥2.0%=4 ≥1.5%=3 ≥0.5%=2 ≥0.2%=1 <0.2%=0			
ETOC						% Improvement (of Goal) ≥1.0%=5 ≥0.8=4 ≥0.6%=3 ≥0.2%=2 ≥0.1%=1 <0.1%=0			
Operability	Critical Mission Impact=5 Mission Impact=2 No Impact=0	Critical Mission Impact=5 Mission Impact=2 No Impact=0				Restores Operability/ Meets Mission Need 100%=5 80%=4 60%=3 20%=2 10%=1 <10%=0			

Table A2.2. Scoring Summary Sample.

Category	**Status**	**Score**
Current Health Measure Status	Red (< 450)	5
Projected Health Measure Status	Yellow (>450, <500)	2
Safety Risk Item	Non-Safety	0
Carry-Over / New Task	New Task	0
Technical Risk	TRL = 8	2
Benefits/ Improvements	Improvement=20 hours = 4% of Goal ATOW Improvement >4% = 4 points MMH Improvement ≥1.5% = 3 points Total “Benefits Improvements” score is 7 points. Max allowed is 5.	5
Implementation Plan Resources	Projected (has been through MPWG)	3
TMS Life Remaining	>15 years	4
Multi-Engine Benefits	Benefits two engine TMS	2
Total Score		**21**

Scoring Summary Sample data:

Target Health measure: ATOW Current health metric value = 420 hours

Projected health metric value = 480 hours ATOW Thresholds:

Green > 500 hours Red < 450 hours New Task

TRL Level = 8

Health metric improvement = 20 hours

Implementation plan resources = Projected for 3400 incorporation

TMS remaining life = 22 years

Provides benefits to two engine TMS

Table A2.3. Technology Readiness Levels (TRL).

TRL	**Description**
9 = Actual system proven through successful mission operations.	Actual application of the technology in its final form and under mission conditions, such as those encountered in operational test and evaluation. Examples include using the system under operational mission conditions.
8 = Actual system completed and qualified through test and demonstration.	Technology has been proven to work in its final form and under expected conditions. In almost all cases, this TRL represents the end of true system development. Examples include developmental test and evaluation of the system in its intended weapon system to determine if it meets design specifications.
7 = System prototype demonstration in an operational environment.	Prototype near, or at, planned operational system. Represents a major step up from TRL 6, requiring demonstration of an actual system prototype in an operational environment such as an aircraft, vehicle, or space. Examples include testing the prototype in a test bed aircraft.
< TRL 7	Any level below TRL 7 which includes technology concept, analytical and experimental critical function and/or characteristic proof of concept, component and/or breadboard, or system/subsystem model or prototype demonstration validation in relevant environment

Figure A2.1. Sample Scorecard.

2012 Pre-Decisional Competition Sensitive => For Official Use Only <= Do not disseminate outside government		Update/Sort Tasks			Scoring																Cutoff Score	
					Rank Scorings					Category Scoring Summary												
Engine	Number or ID	Title	Effort Type	Management Override	Total Score	MAJCOM Priority	Single Mgr Priority	TMS Team Priority	Objective Score	TMS	Metric (Tasks Only)	1. Current Health	2. Projected Health	3. Safety Risk Item	4. Carry-over/ New Task	5. Technical Risk	6. Benefits/ Improvements	7. Impl. Plan Resources	8. TMS Life Remaining	9. Multiple Engine Benefit	2012 Req	Sub-task Costs
F100	998C	Award Fee	PM							F100 Common	N/A										$3,736.00	
F100	003C	Program Management	PM							F100 Common	N/A										$858.00	
F100	008C	Deliverable Data	PM							F100 Common	N/A										$1,162.00	
F100	012Z	F100-PW-229 Engine Integration	PM							F100-229	N/A										$906.00	
F100	012S	F100-PW-100/200/220 Engine Integration	PM							F100-220/220E	N/A										$912.00	
F100	020C	CIP Task Benefits Analysis	PM							F100 Common	N/A										$547.00	
F100	041C	CIP Roadmap / Proposal Activity	PM							F100 Common	N/A										$822.00	
F100	087C	Test Integration	PM							F100 Common	N/A										$400.00	
F100	571C	F100 Engine Life Mgmt Plan (ELMP)	PM							F100 Common	N/A										$480.00	
F100	717C	Logistics Integration	PM							F100 Common	N/A										$110.00	
F100	900C	Program Control	PM							F100 Common	N/A										$298.00	
F100	757C	Engine Model Substantiation & Validation	RR							F100 Common	N/A										$500.00	
F100	762S	F100-PW-220 Lifing and DAR Report	RR							F100-220/220E	N/A										$200.00	
F100	762Z	F100-PW-229 Lifing and DAR Report	RR							F100-229	N/A										$100.00	
F100	764C	PW-220 Mission Analysis Duty Cycle	RR							F100 Common	N/A										$315.00	
F100	791S	Life Verification Plan	RR							F100-220/220E	N/A										$1,020.00	
F100	967C	MFC Component Lifing	RR							F100 Common	N/A										$300.00	
F100	986C	MFC Bypass valve Task	Design		36.5	2	5	2	33	F100 Common	Safety	5	2	6	3	3	5	5	4		$75.00	
F100	970C	Group VI DEEC Power Supply Margin Improvements	Design		33	5	5	0	28	F100 Common	Safety	5	2	6	3	3	0	5	4		$60.00	
F100	542Z	Improved Durability 2nd BOAS - Phase 2	Design		32	3	5	1	28	F100-229	Safety	5	0	6	3	3	2	5	4		$27.00	
F100	098Z	PW-229 Engine P721296 - 6000 TAC RAMAMT	Test		32	3	5	2	28	F100-229	Safety	5	0	6	3	3	2	5	4		$246.00	
F100	325Z	3rd Rotor Attachment / 3rd Stator Improv.	Design		31	5	5	1	28	F100-229	Safety	5	0	6	3	3	0	5	4		$64.00	
F100	205Z	Exit Guide Vane Bolt	Design		30	3	5	1	28	F100-229	Safety	5	0	6	3	3	0	5	4		$46.00	
F100	090Z	FX178 Engine - Altitude Development	Test		27.5	3	0	0	28	F100-229	Safety	5	0	6	3	3	0	5	4		$810.00	
F100	647Z	External Flap Attachment Durability Improvement	Design		27	2	0	0	28	F100-229	Safety	5	0	6	3	3	0	5	4		$30.00	
F100	187Z	Improved #5 Bearing Damper Seals	Design		25.5	3	4	3	22	F100-229	ATDW	5	0	0	3	3	2	5	4		$15.00	
F100	781C	FOD / DOD Management Plan	Design		24	4	4	4	20	F100 Common	WRE	5	0	0	3	3	0	5	4		$1,763.00	
F100	959C	Controls Casting Life Extension	Design		24	5	3	2	20	F100 Common	ETDC	0	0	0	3	3	5	5	4		$300.00	
F100	848S	Improved Seg IV Spray Manifold	Design		24	5	5	5	19	F100-220/220E	ATDW	2	0	0	3	3	2	5	4		$202.00	
F100	957C	Proactive Electronic Component Obs Mgmt	Design		24					F100 Common	WRE				3						$120.00	
F100	081S	FX231 Engine - Robust RAMAMT	Test		23.5	4	3	4	20	F100-220/220E	ETDC	0	0	0	3	3	5	5	4		$11,880.00	
F100	089C	BOM Hardware	Test							F100 Common	ETDC											$1,700.00
F100	108Z	Robust 3rd Blade Lock Ring	Design		23.5	4	3	3	20	F100-229	ATDW	5	0	0	3	3	0	5	4		$25.00	
F100	980C	MOPT System Reliability Trade Study and Improvements	Design		23.5	5	2	3	20	F100 Common	WRE	5	0	0	3	3	0	5	4		$350.00	
F100	030C	Repair Procedures	Design		23	3	3	4	20	F100 Common	ETDC	0	0	0	3	3	5	5	4		$1,400.00	
F100	962Z	Improved Wear T3 Sensor	Design		22.5	2	1	1	21	F100-229	ATDW	5	0	0	0	3	4	5	4		$160.00	
F100	317S	Combustion Chamber Stiffener Improvement	Design		22.5	5	4	4	18	F100-220/220E	ATDW	2	0	0	0	3	4	5	4		$275.00	
F100	780S	Field Eval of Advanced Life Management System	Design		21	5	5	5	18	F100-220/220E	ATDW	2	0	0	3	2	0	5	4		$436.00	
F100	424Z	Improved Durability 4th Vane	Design		20.5	4	3	4	17	F100-229	ETDC	0	0	0	3	3	2	5	4		$27.00	
F100	252Z	6th Stage Vanes & ID Shroud Durability	Design		20.5	4	5	5	18	F100-229	ETDC	0	0	0	3	3	1	5	4		$105.00	
F100	080S	P2104 Engine - Altitude Development	Test		20	0	0	0	20	F100-220/220E	ETDC	0	0	0	3	3	5	5	4		$110.00	
F100	224Z	7-12th Stator Wear Reduction	Design		20	2	2	2	18	F100-229	ETDC	0	0	0	3	3	3	5	4		$175.00	
F100	006S	Externals Routing & Clamping Enhancement	Design		20	5	5	5	15	F100-220/220E	ETDC	0	0	0	3	3	0	5	4		$75.00	
F100	808C	No. 4 Front Heatshield Durability Improvement	Design		19.5	2	1	1	18	F100 Common	ETDC	0	0	0	3	3	3	5	4		$17.00	
F100	XXXS	Improved Life LPT 3rd Disk	Design		19.5	2	5	5	18	F100-220/220E	ETDC	0	0	0	0	3	4	5	4		$230.00	
F100	787C	ERLE Inspection Development	Design		19.5	4	5	5	15	F100 Common	ETDC	0	0	0	3	3	0	5	4		$1,740.00	
F100	914Z	HPC Case Durability	Design		19	3	5	5	15	F100-229	ETDC	0	0	0	3	3	0	5	4		$180.00	
F100	794C	WinCE/98 Software Improvements with 1553 interface	Design		19	5	5	5	14	F100 Common	Operability	2	0	0	0	3	0	5	4		$650.00	
F100	248Z	Robust RCVV Durability Improvements	Design		18.5	1	2	2	17	F100-229	ETDC	0	0	0	3	3	2	5	4		$25.00	

Attachment 3

ENGINE CIP FAIR SHARE RATE COMPUTATION GUIDANCE

A3.1. Purpose. The Engine CIP is a sustainment engineering effort intended to address the long-term needs of the propulsion systems, through engine safety, reliability and maintainability enhancement tasks supported through yearly contracts with the engine Original Equipment Manufacturers (OEM). The CIP is a multi-faceted program that combines efforts of the Life Cycle Management Center, Type, Model, Series (TMS) Engineering Function, Major Commands (MAJCOMs) and in many cases the US Navy and International partners and customers who operate US made weapon systems. Based on the fact that the CIP is a cross service program with international participation, the roles/responsibilities along with critical processes must be defined and documented for consistence and equitable implementation based on benefits (**See Figure A3.2** Process Flow Chart).

A3.2. Roles and Responsibilities.

A3.2.1. DoP: Provides the guidance on the Fair Share Rate computation process.

A3.2.2. AF CIP Program Manager: implements the Fair Share Rate computation guidance. Responsibilities include:

A3.2.2.1. Every October, solicit the active engine inventory as of 1 January each year from Engine Sustainment Operations Office, International Engine Management Program (IEMP) office, and the Navy.

A3.2.2.2. Determine the final Fair Share rate using the contracted task amounts and active engine inventory as of 1 January of the execution year. Issue the final Fair Share letter to the IEMP office for funding.

A3.2.3. Engine Inventory Manager: Maintains USAF engine inventory data, both active and inactive and provides the data to AF CIP Program Manager upon request. Source of data is CEMS.

A3.2.4. IEMP: Is an AF program, chartered to support the follow-on technical and logistical needs of participating international users through the Foreign Military Sales (FMS) process. This support includes the management of international participation in the CIP program, as governed by AFMAN 16-101. Responsibilities include, but are not limited to:

A3.2.4.1. The yearly collection and documentation of international engine inventories, both active and inactive. The IEMP will solicit participating members in October to obtain the international partner inventory, as of 1 January each calendar year. These inventories will be provided to the AF CIP Program Manager.

A3.2.4.2. The IEMP will maintain line management authority over participating members Letter of Offer and Acceptance (LOA) lines for CIP participation. After contract award, the AF CIP Program Manager will issue the final Fair Share letter to IEMP. IEMP will provide funding through the AF Form 616, *Fund Cite Authorization*, process within 45 days of receipt of the Fair Share letter, or by 2 January, whichever comes later.

A3.2.4.3. The IEMP will participate in CIP task development and the TMS Team ranking process. Each year the IEMP will solicit international users for potential CIP tasks. During the annual CIP TMS engineering meetings, the IEMP will attend along with International partners and participate along with the AF TMS engineer in evaluating and determining CIP task benefits.

A3.3. Rules of Inventory Participation. Since the CIP is a cost share program, with funding requirements being determined based on users engine inventory count as of 1 January each calendar year, it is important to understand that engines can and are maintained in various states. Dependent upon which state and engine is classified determines if that engine would be considered for CIP Fair Share funding. Rules for determining an engine status are listed below:

A3.3.1. Active Engine Inventory. Active engines are those identified as being active for service within a user's fleet. Only engines in an active status receive CIP benefits through the incorporation of Engineering Changes developed under the CIP program. Inventory of active engines as of 1 January will be used to compute the Fair Share rate for that year.

A3.3.2. Inactive Engine Inventory. Inactive engines are those engines that are not expected to receive EC implementation for a variety of reasons, and will not be included in yearly inventory counts used to determine the CIP Fair Share rates. Examples of inactive engines include:

A3.3.2.1. Destroyed engines/modules.

A3.3.2.2. Static engine/module displays.

A3.3.2.3. Engines/modules in non-recoverable storage.

A3.3.2.4. Engines/modules designated for long-term parts cannibalization.

A3.3.2.5. USAF engines stored at Aerospace Maintenance and Regeneration Group.

A3.3.2.6. International engines stored in an Aerospace Maintenance and Regeneration Group -like condition (Refer to AFMAN 16-101 for additional guidance.

A3.3.3. Transfer of engines from active to inactive inventory and vice versa. Based on mission requirements, engines can be moved from active inventory to inactive inventory during the year. However, active inventory at the beginning of each calendar year will be used in Fair Share computation. Fair shares will not be recomputed during the year for movement of engines between active and inactive inventories or any other reasons, such as changes in task costs during execution year.

A3.4. Computation of Fair Share Rate. The Fair Share rate of a TMS provides a common cost basis for computing the CIP contribution amount of each participating member commensurate with its engine inventory for that TMS. Examples of cost pool, TMS Fair Share Rates and Fair Share Rate Computations can be found in **Figure A3.1**.

A3.4.1. Cost Pool. The methodology used in computing Fair Share rates follows the accounting principles used in job costing. CIP tasks are grouped in cost pools depending on TMS or group of TMSs they provide benefits to. The total cost of a cost pool is equally allocated to the worldwide inventory of TMS or TMSs benefiting from that cost pool. Cost per engine in a pool = (Cost of all tasks in the pool) ÷ (Total number of engines of all TMSs in the pool).

A3.4.2. TMS Fair Share Rate. The Fair Share rate of a TMS will be the sum of per engine cost of all cost pools in which the TMS is included. If a TMS benefits from say three cost pools, its Fair Share rate will be the sum of per engine allocation from those three cost pools. TMS Fair Share Rate = Sum of per engine cost allocations of all cost pools in which the TMS is included.

A3.4.3. Country Contribution Amount for a TMS. TMS Contribution Amount = (TMS Fair Share Rate) x (Country's TMS Active Engine Inventory) as of 1 January of CIP calendar year.

A3.4.4. Fair Share Rate Spreadsheet Setup. The Fair Share spreadsheets are set up by calendar year and by technical order (TO). For the first year that new tasks are approved and put on contract, those tasks will be put in a new spreadsheet. The dollar values will be for the current calendar year only. If a task is carried over into a new calendar year, either as a carryover or an extension, a new spreadsheet will be created. For instance, if a CY20 task continues into CY21, that task will be put into a CY21 TO20 spreadsheet with only CY21 dollar values included in the new spreadsheet. This will continue for the life of the task--a new spreadsheet for each year the task is on contract. The new CY21 tasks will be put into a separate spreadsheet.

A3.4.5. Fair Share Rate Estimates. Throughout the year, there will be new updated estimates for Fair Share rates. The initial estimate will be completed once all tasks are approved after EAB. The rates will then be recalculated once all tasks are put on contract. This usually happens in the fall of each calendar year. Contract values for Profit Bearing Cost, Facilities Capital Cost of Money (FCCOM), and Fee are loaded into the spreadsheet, and a new per engine value is calculated. After the end of the calendar year, each engine manufacturer will submit actual costs for each task. Those values are put into the spreadsheet and added to FCCOM and Fee. These values will create a calendar year Total Price.

A3.4.6. Final Fair Share Rate Calculation. The final Fare Share rate for the calendar year spreadsheets will be calculated once the Total Price has been determined. Each task Total Price will be divided by the sum of the Total Price for all tasks on that spreadsheet. This will calculate a Percent of Final Cost. The sum of all Obligations from the "FMS Contributions" tab (**Figure A3.3**) will be multiplied by the Percent of Final Cost for each task. This will determine a proportionate Obligation amount for each task. This value will be the amount that is distributed to the Cost Pools and used for the final per engine cost. This calculation will be completed for each Fair Share spreadsheet for that TMS for each year.

Figure A3.1. Sample TMS CIP Fair Share Computation.

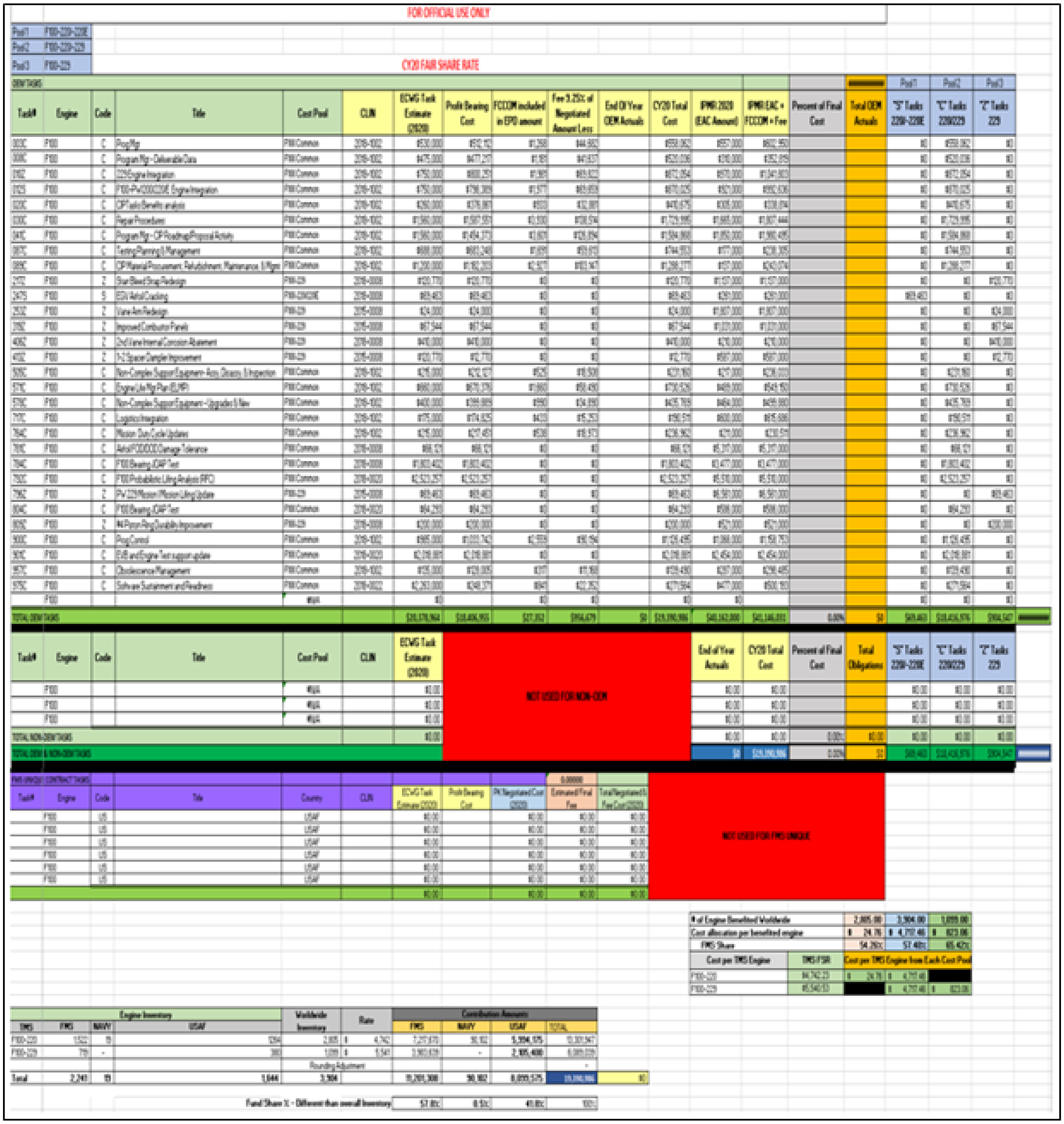


Figure A3.2. Process Flow Chart.

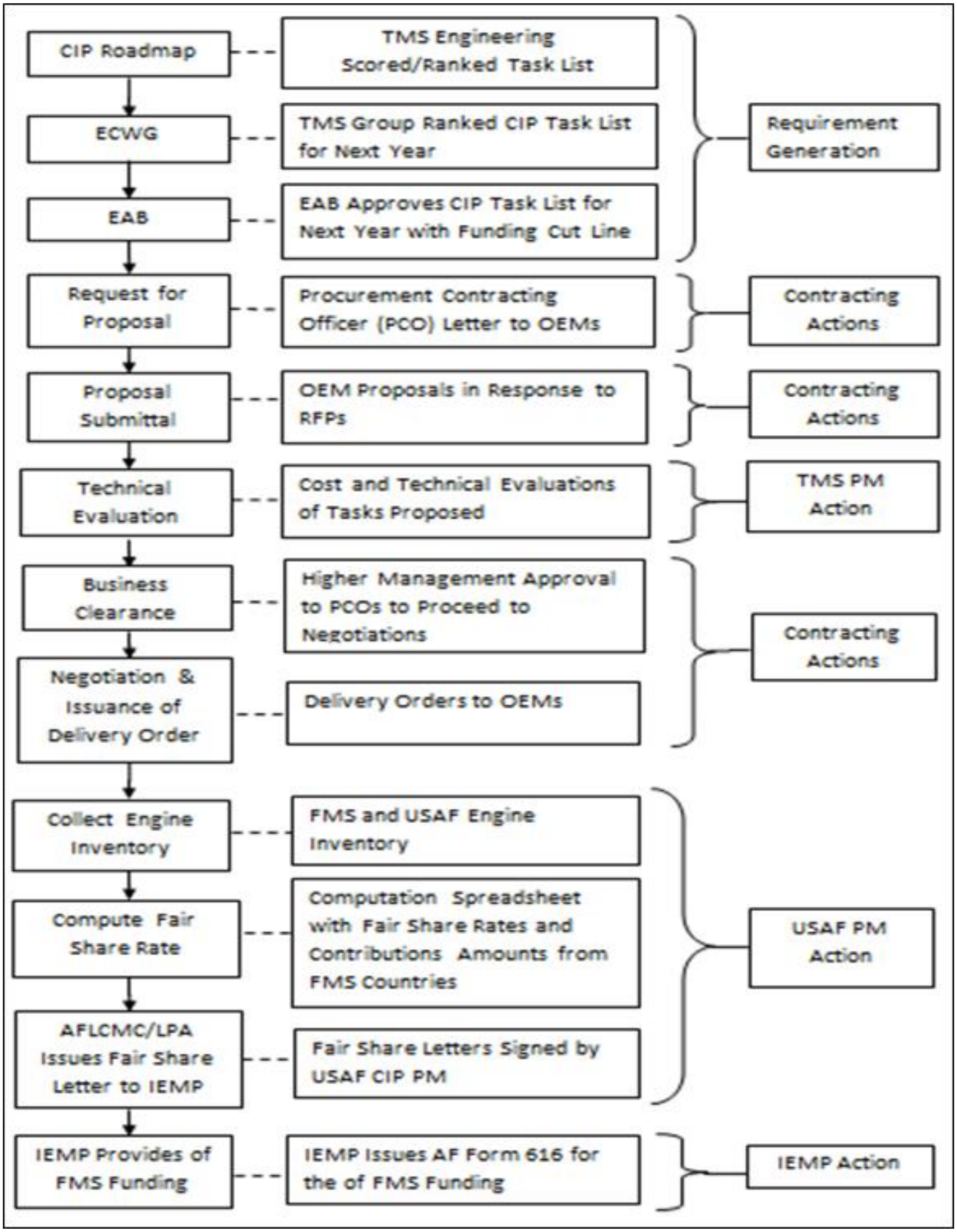
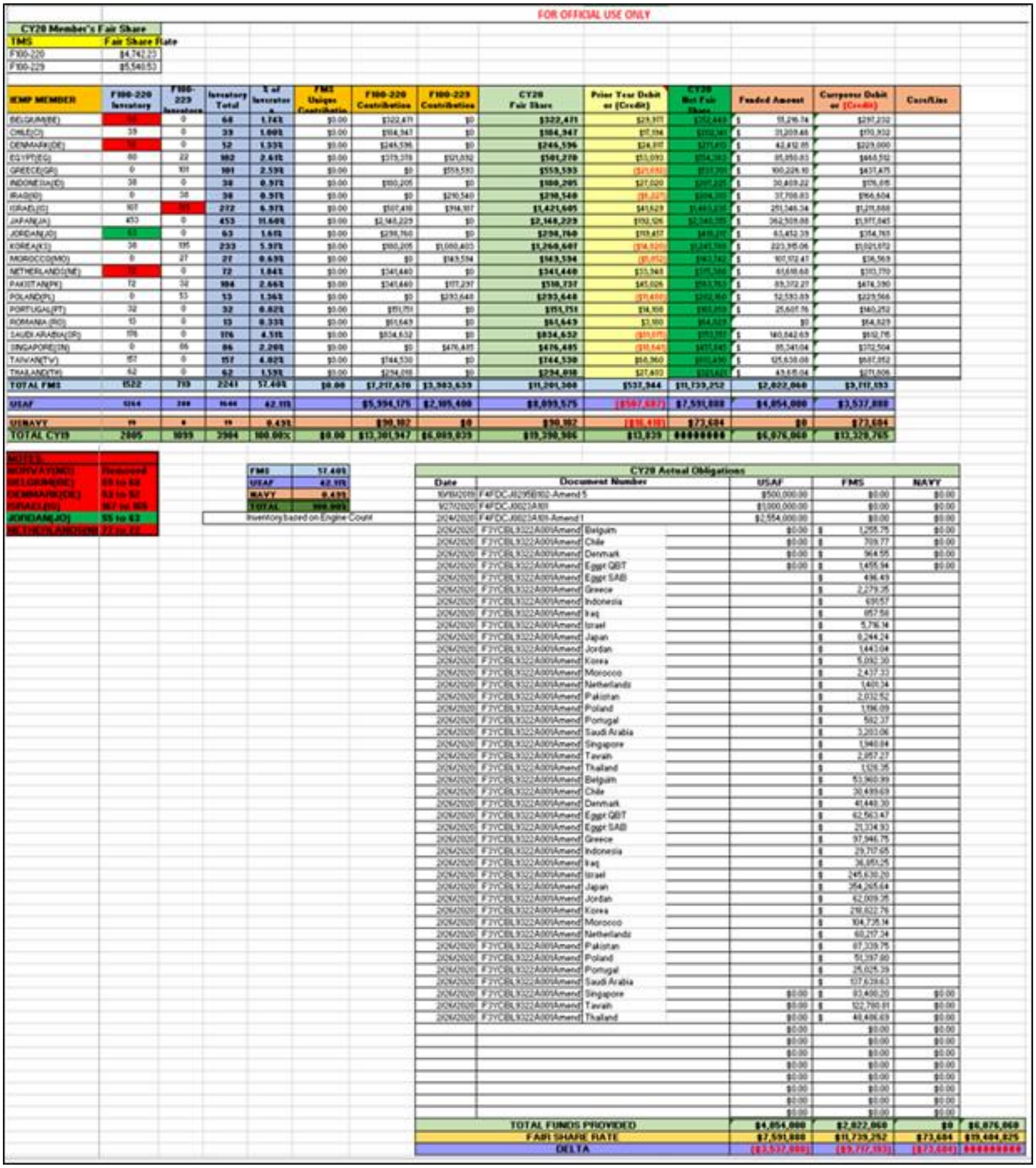


Figure A3.3. Sample FMS Contributions Tab.



Attachment 4

MAINTENANCE PLANNING WORKING GROUP (MPWG) CHARTER REQUIREMENTS

Figure A4.1. Maintenance Planning Working Group (MPWG) Charter Requirements.

A MPWG charter contains several standard paragraphs and may be tailored as needed.

CHARTER STATEMENT

A Maintenance Planning Working Group (MPWG) for each U.S. Air Force (USAF) engine program will be structured to formulate and ensure implementation of a logistically supportable maintenance plan for the life cycle of the engine program and develop a road map of actions necessary to accomplish the plan and to achieve program goals. The MPWG will task appropriate individuals, groups or agencies to provide the needed elements of information.

MEMBERSHIP

The MPWG is designed to be small and agile in order to efficiently work issues and brainstorm approaches and solutions. To that end, the MPWG will be collaboratively co-led between TMS logistics and technical (including equipment specialist and engineering) IPT leaders. Issues that cannot be resolved between the IPT logistics and technical leaders will be elevated to the LPS Division Chief (PM/SML) for resolution. MPWG membership (voting and advisory) includes representatives of the Engine Type, Model, Series (TMS) Program Office (voting – program management and logistics [one vote], engineering and technical equipment specialist [one vote]), applicable Major Commands (MAJCOMs) (voting – each MAJCOM has a separate vote), Weapon System Program Office (voting), Source of Repair activities (advisory), engine Original Equipment Manufacturer (OEM) (advisory), and Air Force Sustainment Center (advisory) and Defense Logistics Agency (advisory) supply chains. The MPWG Chair may grant advisory participation from the aircraft OEM and other organizations or services when appropriate. In the event of a tie vote, the Lead MAJCOM has the deciding vote.

MEETINGS

MPWG should meet as needed, but at least annually. Date/location is determined by the MPWG Chair.

RESPONSIBILITIES

MPWG acts as a governing body to ensure all organizations involved with the engine maintenance are aware of actions that may affect them and can properly react to changes in the maintenance concept and support environment. MPWG must consider anything that could impact how the engine is or will be maintained. Key areas of awareness requiring at least an annual review are:

Safety (semiannually)
Pacer Plan Status and Projection (semiannually)
Emerging Issues (semiannually)
Customer Feedback (semiannually)
Life Limited Parts and Limit Changes (annually or sooner if new limit changes)
Time Compliance Technical Orders (TCTOs) (implementation status) (semiannually/as required)
Engine Life Cycle Management Plan (ELMP) Roadmap (semiannually)
Metrics: Engine Health Indicators (In accordance with AF Manual 20-116, Ch. 10) (MPWG to approve metric goals) and OEM (quarterly)
In-Process Inspection Review (annually or sooner if inspection process is changing)
Mission Profile Change (annually)
Work Inspection Review (annually or sooner if inspection process is changing)
Modification Planning (semiannually/as required)
Hot Topics (semiannually/as required)
Scheduled Maintenance Plans (annually or sooner if plans are changing/as required)
Condition Based Maintenance Plus (annually or sooner if changing/as required)
Parts Availability (semiannually/as required)
Aircraft Tech Data Review (annually or sooner if changes/as required)
Component Improvement Plan: New Engineering Project Description buy in by MAJCOMs and Engineering Change Proposal implementation planning (semiannually)
Funding Changes (semiannually/as required)
Engine Draw Down Planning (semiannually, if applicable)
Action Item Reviews (semiannually/as required)
The MPWG must monitor these items and take positive actions to minimize the impact they have on maintenance or to change the maintenance plan as required. The MPWG Chair will task appropriate individuals, groups or agencies to provide the needed elements.

MEASURE

To ensure effective maintenance planning, the following activities must be performed in MPWG Meetings: The MPWG Chair will also solicit proposed additional topics from the MPWG Membership prior to establishing the Agenda. The Agenda must include a review of topics at least semiannually or annually (as listed above), and topical discussions must identify specific actions, decisions and milestones (documented in presentation form). Documented decisions must be forwarded for concurrence by senior leaders including: Propulsion Group, Lead MAJCOM, and Weapon System Program Office (if applicable) before implementation.

For accountability and historical tracking, the MPWG Chair will publish MPWG Meeting Minutes and Action Items and then ensure Action Items are timely completed.

[The Director of Propulsion's Propulsion Integration Office will provide a sample MPWG Charter upon request to AFLCMC.LPZ.Workflow@us.af.mil.