This Air Force Manual (AFMAN) provides the processes required to manage United States Air Force (AF) engines for aerial vehicles in accordance with (IAW) Air Force Instruction (AFI) 20-115, Propulsion Management for Aerial Vehicles, and these procedures are enforceable in accordance with (IAW) AFI 33-360, Publications and Forms Management. For Repair Network requirements, refer to AFI 20-117, Repair Network Integration, and AFMAN 20-118, Repair Network Integration Management. This publication applies to all military and civilian AF personnel including major commands (MAJCOMs), direct reporting units and field operating agencies, and to other individuals or organizations as outlined by binding agreement or obligation with the Department of the Air Force. This publication applies to the AF Reserve Command (AFRC) and Air National Guard (ANG), except as noted in the publication. Wing level mandates are not included in this publication and therefore tiering, IAW AFI 33-360, does not apply. Ensure all records created as a result of processes prescribed in this publication are maintained IAW AFMAN 33-363, Management of Records, and are disposed of IAW the Air Force Records Disposition Schedule (RDS) in the Air Force Records Information Management System (AFRIMS).

Refer recommended changes and questions about this publication to AFLCMC/LP using the AF Form 847, Recommendation for Change of Publication; route AF Form 847s from the field through 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.
SUMMARY OF CHANGES

This document has been revised and needs to be completely reviewed. Major changes include updates and clarification to the roles, responsibilities, requirements and processes governing the Component Improvement Program, Whole Engine Spare Requirements Computation, Engine Life Cycle Management Plans, Engine Health Management, and Engine Health Indicator/Metrics.

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Chapter 1

OVERVIEW

1.1. General. AFMAN 20-116 will be used in conjunction with AFI 20-115, Propulsion Management for Aerial Vehicles, which takes precedence over the AFMAN. 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. Commercial gas turbine engines, in service on AF commercial derivative aircraft and certified by Federal Aviation Administration (FAA) and maintained by CLS to the manufacturer specifications may, on a case-by-case basis, be granted an exemption from all or some of the requirements in this manual. Such exemptions must be approved by appropriate Programmatic Authority IAW Department of Defense Instruction (DoDI) 5000.02, Operation of the Defense Acquisition System, and AFI 63-101/20-101, Integrated Life Cycle Management.

1.2.2. The Program Manager (PM) coordinates with the AF Director of Propulsion (DoP) and gains approval from applicable stakeholders on such deviations, and provides the DoP documentation copies of approved deviation. DoP provides a copy of approved exemption to the AFMAN OPR. PM and DoP retains the exemption as part of the Program and Engine documentation. Note: The AF Life Cycle Management Center, Director of Propulsion (AFLCMC/LP) is the designated DoP.

1.2.3. Requirements in this publication do not apply to:

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

1.2.3.2. Unique engine configurations installed on classified/experimental aerial vehicles and ground testing.

1.3. Responsibilities.

1.3.1. PMs will:

1.3.1.1. Engage the DoP in propulsion related planning and activities including:

1.3.1.2. Product support planning and execution.

1.3.1.3. Requirements development.

1.3.1.4. Acquisition strategy development.

1.3.1.5. Engine selection, breakout assessment and decisions.

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

1.3.1.7. Integrated product teams (IPTs), working groups (WGs), and draft plan reviews.
1.3.2. The DoP will:

1.3.2.1. Provide overarching processes, guidance and coordination in the management of AF propulsion assets.

1.3.2.2. Function as the engine Product Support Integrator (PSI).

1.3.2.3. Develop propulsion long range goals and master plans.

1.3.2.4. As a PSI, oversee the Component Improvement Program (CIP) execution as allocated by the PM(s).
   1.3.2.4.1. Analyze propulsion issues and provide input from a functional enterprise perspective.
   1.3.2.4.2. Collaborate on the allocation of CIP funds and provide input to the CIP Program Objective Memorandum (POM) build process.

1.3.2.5. Serve as the Chairperson for the Engine Advisory Board (EAB), and AF principal on the Joint Propulsion Coordinating Committee (JPCC).

1.3.2.6. Collaborate with Air Force Research Laboratory (AFRL) and other Research and Development organizations to assess existing and/or potential technologies for insertion into propulsion assets.

1.3.2.7. Report program execution for the propulsion enterprise as required through the cognizant Program Executive Officer (PEO) IAW AFI 63-101/20-101, Integrated Life Cycle Management.

1.3.2.8. Support PMs in determining Quick Engine Change (QEC) kit requirements.

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

1.3.2.10. Manage engine inventories worldwide and support authorized engine stock levels for each Stock Record Account Number (SRAN) by Type, Model, and Series (TMS).

1.3.2.11. Maintain configuration control per AFI 63-101/20-101 and perform periodic review and comparison of life-limit data in the Comprehensive Engine Management System (CEMS) against the published Technical Order (T.O.) life-limits. Note: Review will be accomplished a minimum of every six months.

1.3.2.12. For propulsion system program office managed engines, provide oversight of propulsion repair and overhaul activities.

1.3.2.13. Develop engine factors for each engine TMS.

1.3.2.14. Maintain 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 and quantitative analysis techniques.
1.3.2.15. Manage CEMS and Engine Health Management (EHM) (includes Reliability Centered Maintenance (RCM) and Engine Trending and Diagnostics (ET&D) program requirements).

1.3.2.16. Be accountable for the Air Force Centralized Engine Account, SRAN FJ2031.

1.3.2.17. Work with Command Engine Managers (CEM) to compute worldwide stock-level requirement.

1.3.2.18. For propulsion system program office managed engines, develop engine repair and overhaul requirements and coordinate with PMs and Lead MAJCOMs.

1.3.2.19. Develop retention, reclamation, and disposal computations.

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

1.3.2.21. Maintain cognizance of all engine and engine related deficiency reports under T.O. 00-35D-54, USAF Deficiency Reporting, Investigation, and Resolution.

1.3.2.22. Charter maintenance planning and engine review activities for each engine TMS.

1.3.2.23. Establish reliability goals in coordination with Lead MAJCOM.

1.3.2.24. Assist with development of EHM analysis tools.

1.3.2.25. Monitor and support appropriate authority to ensure compliance with propulsion system safety requirement.

1.3.2.26. Manage the Engine Lead The Fleet/Analytical Condition Inspection (LtF/ACI) Program.

1.3.2.27. Compute engine spares using the Propulsion Requirements System (PRS).

1.3.2.28. Document assignment and/or identification of Engine TMS managers, SRAN managers, Propulsion Safety managers (leads), CIP managers, and PRS functional managers.

1.3.2.29. Review and provide change/update recommendations for engine related Data Item Descriptions (DID).

1.3.2.30. Conduct 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).

1.3.3. Engine TMS managers will:

1.3.3.1. Provide POM inputs for initial spares, initial common support equipment, interim contractor support, and engine modifications funded through procurement accounts.

1.3.3.2. Be the primary focal point for developing, maintaining and executing an Engine Life Management Plan (ELMP) for their engine TMS.

1.3.3.3. Support the DoP in conducting mission usage surveys.

1.3.3.4. Notify the DoP of force structure and mission changes.
1.3.3.5. Coordinate the ELMP with the responsible MAJCOMs and PM and provide to the DoP for approval.

1.3.3.6. Use ELMPs/Engine Health Indicators (EHI) to manage engines throughout their life cycle.

1.3.3.7. Collaborate with the Lead MAJCOMs, to publish Engine Health Indicator (EHI) goals in their respective ELMPs and track variance.

1.3.3.8. Ensure only approved funded engine overhaul requirements are provided to contract repair facilities for planning and execution.

1.3.3.9. Assist the DoP in Propulsion related planning and activities.

1.3.4. SRAN Engine Managers (SEMs) will:


1.3.4.2. Prepare a DD Form 1348-1A, Issue Release/Receipt Document, or DD Form 1149, Requisition and Inventory Shipping Document, for each engine shipment and transfer IAW T.O. 00-25-254-1. Retain signed copy for a minimum of 2 years IAW Records Disposition Schedule.

1.3.4.3. Report all life-limited/serially tracked components (including propellers) identified in T.O. 00-25-254-1 configured item identifier (CII) tables.

1.3.5. Propulsion Safety Managers will:

1.3.5.1. Work with the PMs and Lead System Engineers (LSE) to establish and maintain an appropriate propulsion system safety program IAW DoDI 5000.02, AFI 63-101/20-101, and AFI 91-202. Utilize the system safety methodology in Military Standard (MIL-STD)-882E, Department of Defense Standard Practice for System Safety, as supplemented by the additional procedures and criteria included in this publication.

1.3.5.2. Provide propulsion system safety assessments to the PM, International Engine Management Program (IEMP) Chief and LSE for design and program reviews.

1.3.5.3. Develop and conduct special tests to verify proper system performance and verify hazard mitigations.

1.3.5.4. Utilize life cycle tracking procedures for all identified hazards, their elimination or mitigation, and risk acceptance status.

1.3.5.5. Work with PM and MAJCOMs in developing quantitative propulsion system safety criteria and operating limits.

1.3.5.6. Support system safety groups or the appropriate program office IPTs for systems using AF engines that are managed IAW this publication and AFI 20-115.

1.3.5.7. Monitor system health to identify hazards throughout the life cycle of a propulsion system, including but not limited to operational experience, mission changes, environmental effects, mishaps, deficiency reports, or proposed system modifications.
1.3.5.8. Annually assess commercial safety experience (applicable if managing a commercial derivative engine).

1.3.5.9. Establish direct lines of communication between engine managers and their related air vehicle program offices for the timely exchange of information on identified hazards and assessed mishap risks.

1.3.5.10. Provide status of issues to the DoP to ensure continuity of effort and appropriate resource direction to safety issues.

1.3.5.11. Ensure that engine managers and air vehicle program offices manage the hazards associated with decommissioning or disposing of a propulsion system IAW AFI 63-101/20-101.

1.3.6. CIP managers manage the CIP IAW DoDI 5000.02 and AFI 63-101/20-101.

1.3.7. PRS functional managers provide guidance for engine acquisition and distribution computations.

1.3.8. Propulsion Director of Engineering (DoE) will:

1.3.8.1. Serve as the senior technical authority for propulsion assets within the AF.

1.3.8.2. Establish and provide technical guidance and recommendation to PEOs, PMs, DoP, and Systems Lead Engineers on matters affecting engine safety, suitability and/or effectiveness.

1.3.8.3. Co-chair the USAF Propulsion Safety and Technical Reviews, chair the Propulsion Engineering Councils, and support the JPCC and the Propulsion Executive Independent Review Team.

1.3.8.4. Oversee the Propulsion Center of Excellence (PCoE).

1.3.9. Advisory and Working/Support Groups. MAJCOMs and PMs support DoP propulsion advisory, planning, and working groups/activities. Participants listed in below text include the DoP plus minimal representation from other activities/organizations:

1.3.9.1. EAB: A representative forum of Lead MAJCOMs and Aircraft PEOs 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, Aircraft PEO, the Propulsion Sustainment Division Chief, the Propulsion Sustainment Chief Engineer, the Propulsion Acquisition Division Chief, and the Propulsion Acquisition Chief Engineer.

1.3.9.2. EHM Working Group: A team to facilitate development, implementation, and sustainment of EHM objectives, policies, training, and practices. Membership includes representatives of PMs, MAJCOMs, and AFRL.

1.3.9.3. Maintenance Planning Working Group (MPWG): The MPWG reviews and validates the maintenance plan developed according to DoDI 5000.02 and AF 63-101/20-101, and inclusion of EHM (RCM/ET&D) principles. Membership includes
representatives of the PMs, Engine TMS Managers, Source of Repair (SOR) activities, MAJCOMs, and engine manufacturer.

1.3.9.4. 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 still in production. Membership includes Propulsion DoE, Engine TMS managers, MAJCOMs (including the ANG), and engine manufacturer.

1.3.9.5. 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.

1.3.9.6. Propulsion Technology Office Steering Committee (PTOSC): A consortium of Propulsion, AFRL and AFSC 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.

1.3.9.7. Propulsion Support Equipment Working Group (PSEWG): A forum under the chairmanship of the Support Equipment Product Group Manager (PGM) 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.
Chapter 2

PROPULSION SAFETY

2.1. 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 DoDI 5000.02, AFI 63-101/20-101 and AFI 91-202. Section 2.2 describes the use of the system safety methodology in MIL-STD-882E as tailored by propulsion-specific guidance, criteria, and procedures. Section 2.3 describes the additional safety management tasks executed by the DoP. Propulsion safety efforts contribute to the overall operational safety, suitability, and effectiveness of USAF and international air vehicle systems.

2.2. 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 DoDI 5000.02, 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 shutdown and engine related loss of aircraft (correlating to uncontained failures, fires, or total loss of thrust), provides a basis for more detailed risk assessment and comparison.

2.2.1. DoP ensures Engine TMS managers:

2.2.1.1. Define, document, and adopt safety risk management matrices and/or tables.

2.2.1.2. Report annually the propulsion safety risk management situational status and guidance to their respective Centers, the appropriate PMs, International partners, Headquarters Air Force Material Command (AFMC) safety office, and lead-MAJCOM safety offices.

2.2.1.3. Notify the DoP and respective Air Vehicle PMs of all safety hazards and risks IAW the timelines and critical hazard classifications as specified in Table 2.4.

2.2.1.4. Identify “Propulsion Safety Threshold (PST)” risks or hazards per Table 2.1, Table 2.2 and Table 2.3. Establish, in coordination with PMs, an appropriate understanding of propulsion specific risks. IAW the MIL-STD-882E methodology, use the propulsion-hazard severity category assignments (Table 2.1.) and hazard probability level assignments (Table 2.2) to define the propulsion safety threshold (PST) risk levels (Table 2.3). Note: The PST risks or hazard statuses are evaluated at points in time consistent with baseline, interim, and final notification criteria as specified in Table 2.4.

2.2.1.5. Accomplish risk mitigation verification throughout the interim and corrective action implementation.

2.2.1.6. Revise/update propulsion hazard risk assessments IAW para. 2.2.12.
Table 2.1. Propulsion Hazard Severity Category Assignment.

<table>
<thead>
<tr>
<th>A Hazard That Can Result In . . .</th>
<th>. . . Must be Assigned These Severity Categories, as a Minimum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engine Related Loss of Aircraft (ERLOA) OR Uncontained Fire</td>
<td>Catastrophic</td>
</tr>
<tr>
<td>Non-Recoverable In-Flight Shut-Down (NRIFSD) on a single/twin-engine air vehicle</td>
<td>Catastrophic</td>
</tr>
<tr>
<td>NRIFSD of one engine on a three-or-more-engine air vehicle</td>
<td>Critical</td>
</tr>
<tr>
<td>Uncontained Failures</td>
<td>Critical</td>
</tr>
<tr>
<td>Anything other than NRIFSD or ERLOA that does not meet the MIL-STD-882E definitions of Critical or Catastrophic</td>
<td>Less than Critical *</td>
</tr>
</tbody>
</table>

* Note: There may be non-NRIFSD or non-ERLOA mishaps/events that could be assessed as critical or catastrophic.

Table 2.2. Propulsion Hazard Probability Level Assignment.

<table>
<thead>
<tr>
<th>Rates in These Ranges . . .</th>
<th>. . . Must be Assigned These Probability Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;0.01/100K Engine Flying Hours (EFH)</td>
<td>Improbable</td>
</tr>
<tr>
<td>0.01/100K EFH or greater, but less than 0.05/100K EFH</td>
<td>Remote</td>
</tr>
<tr>
<td>0.05/100K EFH or greater, but less than 0.1/100K EFH</td>
<td>Occasional</td>
</tr>
<tr>
<td>0.1/100K EFH or greater, but less than 0.5/100K EFH</td>
<td>Probable</td>
</tr>
<tr>
<td>≥0.5/100K EFH</td>
<td>Frequent</td>
</tr>
<tr>
<td>≥0.5 over the remaining life of the engine TMS in USAF inventory</td>
<td>Probable</td>
</tr>
</tbody>
</table>

Table 2.3. Propulsion Safety Threshold (PST) Risk Levels for Non-Recoverable In-Flight Shut-Down (NRIFSD) and Engine Related Loss of Aircraft (ERLOA).

<table>
<thead>
<tr>
<th>Single/Twin Engine</th>
<th>3 or More Engines</th>
<th>Action Required by Propulsion Enterprise</th>
<th>Risk Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;0.01 NRIFSD/100K EFH</td>
<td>&lt;0.05 NRISFD/100K EFH</td>
<td>Review</td>
<td>Medium</td>
</tr>
<tr>
<td>0.01-0.05 NRISFD/100K EFH</td>
<td>0.05-0.1 NRISFD/100K EFH</td>
<td>Monitor</td>
<td>Serious</td>
</tr>
<tr>
<td>&gt;0.05 NRISFD/100K EFH</td>
<td>&gt;0.1 NRISFD/100K EFH</td>
<td>Corrective Action Required</td>
<td>High</td>
</tr>
<tr>
<td>&gt;0.5 ERLOA mishaps over the remaining life of the engine TMS in USAF inventory</td>
<td>&gt;0.5 ERLOA mishaps over the remaining life of the engine TMS in USAF inventory</td>
<td>Corrective Action Required</td>
<td>High</td>
</tr>
</tbody>
</table>
2.2.2. DoP ensures propulsion safety managers (leads):

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

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

2.2.2.3. Identify and assess safety hazards and risks throughout the engine program life and report safety risks that require acceptance IAW DoDI 5000.02.

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

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

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

2.2.2.7. Document management decisions for acceptance of mishap risks.

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

2.2.2.9. Support System Safety Groups/System Safety Working Groups for aircraft that use engines which are managed IAW this publication and AFI 20-115.

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

2.2.2.11. Provide a copy of any engine hazard risk acceptance documentation to the specific Engine TMS manager.

2.2.2.12. Identify and assess safety hazards and risks throughout the worldwide (USAF and international) operational fleet as required by AFMAN 16-101.

2.2.3. Air vehicle program office(s) integrates the MIL-STD-882E system safety methodology into the air vehicle program’s systems engineering process IAW DoDI 5000.02. The PM’s lead systems engineer (LSE) 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 obtain formal risk acceptance IAW DoDI 5000.02.

2.2.4. Propulsion system safety risk assessment types (for use with Table 2.4 for DoP Risk Assessment Timelines):

2.2.4.1. 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.

2.2.4.2. 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
2.2.4.3. 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. Final risk is the average risk over the baseline exposure period (typically the remaining weapon systems life) that accounts for the baseline period, interim actions, if any, and final corrective actions. **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.

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

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

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

2.2.5.3. **References:** Prior applicable risk assessments and related source documents.

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

2.2.5.5. **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 (LCF) life, deterministic/probabilistic fracture mechanics life, or LCF initiation plus propagation statistical distribution.

2.2.5.6. **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.

2.2.6. In parallel to the propulsion safety risk determination, notification of new propulsion system hazards and risks to the respective PMs to be accomplished using a systematic and phased approach IAW **Table 2.4.** 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 following describes the notification timelines and the phased reporting content to the PMs required for any newly discovered or on-going propulsion risks or hazards.

2.2.6.1. The existing Deficiency Reporting System, as defined by T.O. 00-35D-54, establishes the notification timeline for deficiencies. This same timeline will be utilized as the basis for reporting new hazards and risks as a function of hazard severity categories based on MIL-STD-882E terminology. **Note:** With the understanding that propulsion system failure modes can potentially involve extensive investigation and engine testing to determine root cause, deviations from the below indicated “final” notification timeline can be made if mutually agreed to between the Engine TMS managers, the PMs, and the risk acceptance authority. **Note:** If the new hazard is
associated with an active Safety Investigation Board, the Convening Authority provides notification IAW AFI 91-204, *Safety Investigations and Reports*. The timelines described in Table 2.4 does not apply until notification and authorization to share the mishap information has been provided to the Engine TMS manager.

2.2.6.2. The timelines in Table 2.4 begin at the “time of discovery of the new hazard.” If events make the definition of a “time of hazard discovery” unclear, then the “time of hazard discovery” must be defined by the Engine TMS manager in coordination with the using MAJCOM and the PM. Notification of the hazard discovery must be accomplished via an e-mail memorandum from the Engine TMS manager and transmitted IAW the instructions in paragraphs 2.2.7., 2.2.8., and 2.2.9.

Table 2.4. DoP Risk Assessment Timeline and Content.

<table>
<thead>
<tr>
<th>Hazard Severity Classification</th>
<th>Baseline</th>
<th>Interim</th>
<th>Final</th>
</tr>
</thead>
<tbody>
<tr>
<td>Severity Of Issue – Potential For:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Catastrophic</td>
<td>1</td>
<td>15</td>
<td>60</td>
</tr>
<tr>
<td>Critical</td>
<td>10</td>
<td>30</td>
<td>120</td>
</tr>
<tr>
<td>Less Than Critical</td>
<td>30</td>
<td>60</td>
<td>180</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Risk Assessment Content</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Level of Fidelity</td>
<td>Qualitative</td>
<td>Quantitative “Initial Detailed” # Of Engines Involved</td>
<td>Fully Developed</td>
</tr>
<tr>
<td>Root Cause Status</td>
<td>Preliminary Timeline</td>
<td>Investigation Findings/Plans</td>
<td>Root Cause Determined</td>
</tr>
<tr>
<td>Risk Mitigation Fidelity</td>
<td>Guidance on Fly/No Fly &amp; Initial Risk Mitigation If Any</td>
<td>Interim Action Implementation/Development</td>
<td>Full Corrective Action Plan</td>
</tr>
</tbody>
</table>

*Note:* For the purpose of this table the “Qualitative Level of Fidelity” implies a subjective educated assessment by aircraft/propulsion experts and risk analysis experts based on the limited level of information available at the time of hazard discovery. The term “Quantitative Level Of Fidelity” refers to an analytical analysis (usually statistical) based on numerical data of the number of aircraft or engine parts involved, their operating hours and any other pertinent numerical facts combined with defined assumptions needed to complete the analysis (e.g. assume a 60% inspection effectiveness based on past experience of similar inspections).

2.2.7. Catastrophic hazard notification timeline: *Note:* A propulsion hazard has a catastrophic severity if it meets the catastrophic definition in Table 2.1 or in MIL-STD-882E.
2.2.7.1. Catastrophic hazard “baseline” notification must be provided within 24 hours of new hazard discovery to the PM, IEMP Chief, Air Force Safety Center Office (AFSEC/SEFE), and Lead MAJCOM Logistics Functional Authority (A4). The “baseline” notification provides the initial “best understanding” notification of the new failure mode, a qualitative assessment of risk, the preliminary timeline for root cause investigation, rationale for identification of this hazard as being potentially a catastrophic hazard, and recommendation on limitation of operations or continued operations while the investigation is underway.

2.2.7.2. Catastrophic hazard “interim” notification must be provided within 15 days of new hazard discovery to the PM, IEMP Chief, AFSEC/SEFE, and Lead MAJCOM Logistics Functional Authority (A4). The intent of the “interim” notification is to provide an updated assessment of the hazard including an initial detailed risk assessment, number of engines involved, root cause investigation findings/plans, and risk mitigation implementation/development.

2.2.7.3. Final catastrophic hazard notification must be provided within 60 days of new hazard discovery to the PM, IEMP Chief, AFSEC/SEFE, and Lead MAJCOM Logistics Functional Authority (A4). The intent of the “final” notification is to provide the root cause determination, fully developed risk assessment IAW paragraph 2.2.5., fully developed corrective action plan, and the Safety Quad Chart (Figure 2.1).

2.2.8. Critical hazard notification timeline: **Note:** A hazard has a critical severity if it meets the critical definition in Table 2.1 or in MIL-STD-882E.

2.2.8.1. Critical Hazard “Baseline” Notification must be provided within 10 days of new hazard discovery to the PM, IEMP Chief, AFSEC/SEFE, and Lead MAJCOM Logistics Functional Authority (A4). The intent of the “baseline” notification is to provide the initial “current understanding” notification of the new failure mode/hazard, a qualitative assessment of risk and the preliminary timeline for root cause investigation. Rationale for identification of this hazard as being potentially a critical hazard must be provided.

2.2.8.2. Critical Hazard “Interim” Notification must be provided within 30 days of new hazard discovery to the PM, IEMP Chief, AFSEC/SEFE, and Lead MAJCOM Logistics Functional Authority (A4). The intent of the “interim” notification is to provide an updated assessment of the hazard including an initial detailed risk assessment, number of engines involved, root cause investigation findings/plans and risk mitigation implementation/development.

2.2.8.3. “Final” Critical Hazard Notification must be provided within 120 days of new hazard discovery to the PM, IEMP Chief, AFSEC/SEFE, and Lead MAJCOM Logistics Functional Authority (A4). The intent of the “final” notification is to provide the root cause determination, fully developed risk assessment IAW paragraph 2.2.5., fully developed corrective action plan and the Safety Quad Chart (Figure 2.1).

2.2.9. Less than critical hazards classification and notification timeline: **Note:** A hazard has a less than critical severity if it meets the “marginal” or “negligible” definitions in MIL-STD-882E.
2.2.9.1. Less than critical hazard baseline notification must be provided, within 30 days of new hazard discovery to the PM, IEMP Chief, Air Force Safety Center Office, Lead MAJCOM/Logistics Functional Area Authority (A4 or three-letter), and HQ AFMC Safety. This notification must be accomplished via an e-mail memorandum signed by the DoP and may be delegated one level below. The preliminary notification provides the initial “current understanding” notification of the new failure mode/hazard, a qualitative assessment of risk, the preliminary timeline for root cause investigation, and rationale for identification of this hazard as being potentially a less than critical hazard.

2.2.9.2. Less than critical hazard interim notification must be provided to the PM and IEMP Chief within 60 days of new hazard discovery. The intent of the interim notification is to provide an updated assessment of the hazard including an initial detailed risk assessment, number of engines involved, root cause investigation findings/plans and risk mitigation implementation/development.

2.2.9.3. Final less than critical hazard notification must be provided to the PM and IEMP Chief within 180 days of new hazard discovery. The intent of the final notification is to provide the root cause determination, fully developed risk assessment IAW paragraph 2.2.5., fully developed corrective action plan, and the Safety Quad Chart (Figure 2.1).

Figure 2.1. Sample Safety Quad Chart.
2.2.10. Program Execution Chain Risk Acceptance

2.2.10.1. DoDI 5000.02, Enclosure 3, 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 user representative must, as defined in MIL-STD-882E, be part of this process throughout the life cycle and will provide formal concurrence prior to all serious- and high-risk acceptance decisions.” The following paragraphs describe the AF process for complying with the DoDI 5000.02 requirement for hazards identified by the propulsion enterprise.

2.2.10.2. 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.

2.2.10.3. For air vehicle systems in sustainment, the DoDI 5000.02 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 2.5 defines the AF risk acceptance timelines that constitute full compliance with the DoDI 5000.02 risk acceptance requirement for fielded systems.

<table>
<thead>
<tr>
<th>Air Vehicle Risk Level</th>
<th>Baseline</th>
<th>Interim</th>
<th>Final</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>1</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>Serious</td>
<td>1</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>Medium or Low</td>
<td>1</td>
<td>N/A</td>
<td>10</td>
</tr>
</tbody>
</table>

2.2.10.4. For High risk hazards, the Component Acquisition Executive (CAE) (SAF/AQ) is the risk acceptance authority IAW MIL-STD-882E.

2.2.10.4.1. In response to the baseline DoP hazard notification, if the PM determines the air vehicle risk to be high, the PM will notify the risk acceptance authority, IEMP Chief and user representative within 24 hours with a recommendation to temporarily accept the risk or suspend system operations. For the purposes of complying with DoDI 5000.02, this baseline notification constitutes the initial risk acceptance and...
will be in effect for no more than 20 days (until the interim notification). Within 24 hours of the baseline notification, both the risk acceptance authority and the user representative must concur with the PM’s risk acceptance recommendation or direct the suspension of system operations.

2.2.10.4.2. In response to the interim DoP hazard notification, if the PM determines the air vehicle risk to be High, the PM will notify the risk acceptance authority, IEMP Chief and user representative within five days with a recommendation to temporarily continue to accept the risk or to suspend system operations. For the purposes of complying with DoDI 5000.02, this interim notification constitutes an extension of the temporary risk acceptance that will be in effect until the final notification. Within 24 hours of the interim notification, both the risk acceptance authority and the user representative must concur with the PM’s risk acceptance recommendation or direct the suspension of system operations.

2.2.10.4.3. In response to the final DoP hazard notification, if the PM determines the air vehicle risk to be High, the PM will submit within ten days a recommendation to the risk acceptance authority, IEMP Chief and the user representative to formally accept the risk for the timeframe required to implement, validate, and verify the recommended mitigations or to suspend operation of the system. For high risks, the risk acceptance package must also be coordinated with the AF Chief of Safety.

2.2.10.5. For Serious risk hazards, the PEO is the risk acceptance authority.

2.2.10.5.1. In response to the baseline DoP hazard notification, if the PM determines the air vehicle risk to be Serious, the PM will notify the risk acceptance authority, IEMP Chief and user representative within 24 hours with a recommendation to temporarily accept the risk or suspend system operations. For the purposes of complying with DoDI 5000.02, this baseline notification constitutes the initial risk acceptance and will be in effect for no more than 35 days (until the interim notification). Within 24 hours of the baseline notification, both the risk acceptance authority and the user representative must concur with the PM’s risk acceptance recommendation or direct the suspension of system operations.

2.2.10.5.2. In response to the interim DoP hazard notification, if the PM determines the air vehicle risk to be Serious, the PM will notify the risk acceptance authority, IEMP Chief and user representative within five days with a recommendation to temporarily continue to accept the risk or suspend system operations. For the purposes of complying with DoDI 5000.02, this interim notification constitutes an extension of the temporary risk acceptance that will be in effect until the final notification. Within 24 hours of the interim notification, both the risk acceptance authority and the user representative must concur with the PM’s risk acceptance recommendation or direct the suspension of system operations.

2.2.10.5.3. In response to the final DoP hazard notification, if the PM determines the air vehicle risk to be Serious, the PM will submit within ten days a recommendation to formally accept the risk for the timeframe required to implement, validate, and verify the recommended mitigations or to suspend operation of the system.
2.2.10.6. For Medium and Low risk hazards, the air vehicle program office is the risk acceptance authority.

2.2.10.6.1. In response to the baseline DoP hazard notification, if the PM determines the air vehicle risk to be Medium or Low, the PM will notify the IEMP Chief user representative within 24 hours with a recommendation to temporarily accept the risk or suspend system operations. For the purposes of complying with DoDI 5000.02, this baseline notification constitutes the initial risk acceptance and will be in effect until the final notification (there is no interim risk acceptance for less than critical hazards). Within 24 hours of the baseline notification, the user representative must concur with the PM’s risk acceptance recommendation or direct the suspension of system operations.

2.2.10.6.2. In response to the interim DoP hazard notification, if the PM determines the air vehicle risk to be Medium or Low, the PM will work closely with the DoP community to evaluate proposed mitigations in support of the final DoP notification.

2.2.10.6.3. In response to the final DoP hazard notification, if the PM determines the air vehicle risk to be Medium or Low, the PM will submit within ten days a recommendation to the user representative to concur with acceptance of the risk for the timeframe required to implement, validate, and verify the recommended mitigations or to suspend operation of the system.

2.2.11. Lead Command response to propulsion hazard or risk notification:

2.2.11.1. The AF lead command for a system is the designated “user representative” as required in DoDI 5000.02 for concurrence prior to a risk acceptance decision by the designated risk acceptance authority.

2.2.11.2. Any baseline or interim hazard or risk notification must be responded to within 24 hours of receipt. The intent of the response will be to satisfy the DoDI 5000.02 requirement for user representative concurrence on risk acceptance, and the lead command must concur with the hazard classification and coordinate and establish a mutual understanding if aircraft grounding or operational limitations are being considered.

2.2.11.3. Formal risk acceptance packages from the PM will be evaluated and concurred with or rejected prior to PM submittal to the risk acceptance authority. The intent of this concurrence review will be to accept the existing plans for risk mitigation or elimination in the specified time period.

2.2.12. 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 plan 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.
2.3. Propulsion Safety Management Program.

2.3.1. DoP sends an annual message to affected PMs, IEMP Chief, MAJCOM/A4s; Air Force Chief of Safety (AF/SE); and HQ 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 (PSTs) in Table 2.3.

2.3.2. DoP ensures Engine TMS managers:

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

2.3.2.2. Develop a budget process that supports mishap investigations and corrections of deficiencies based on similar experience.

2.3.3. DoP ensures propulsion safety managers (leads):

2.3.3.1. 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.

2.3.3.2. 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.

2.3.3.3. 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.

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

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

2.3.4. PMs respond to the annual DoP safety message by acknowledging receipt.
Chapter 3

COMPONENT IMPROVEMENT PROGRAM (CIP)

3.1. General. The DoP is responsible for overall management and the execution processes of CIP. CIP overarching guidance is provided by DoDI 5000.02 Operation of the Defense Acquisition System, and AFI 63-101/20-101. 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 (OR) and Reliability & Maintainability (R&M), reduce engine Life Cycle Cost (LCC), 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.

3.2. Execution Management Roles.

3.2.1. The DoP is responsible to:

3.2.1.1. Ensure assignment and documented identification of CIP Program managers and TMS engineering managers for applicable engine TMSs.

3.2.1.2. Provide CIP PMs and TMS engineering managers guidance and processes.

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

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

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

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

3.2.1.7. Monitor and report execution status to PEOs.

3.2.1.8. Prepare annual CIP project and task lists in coordination with MAJCOMs, Original Equipment Manufacturers (OEMs), Services, international partners, FMS participants and other applicable stakeholders.

3.2.2. TMS engineering managers plan and budget for incorporation of completed CIP tasks into aircraft.
3.2.3. The Technical Airworthiness Authority (TAA) approves aircraft airworthiness type design certification documents IAW AFI 62-601, USAF Airworthiness, and MILHDBK516C, Airworthiness Certification Criteria.

3.2.4. Lead Development Test Organization (LDTO):

3.2.4.1. Serve 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 IAW AFI 99-103, Capabilities-Based Test and Evaluation.

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

3.2.5. Lead MAJC/OM/Services:

3.2.5.1. Communicate operational goals and requirements for specific engine TMS CIP and assist the DoP and Propulsion Director of Engineering (DoE) in establishing requirement priorities.

3.2.5.2. Coordinate on EHM requirements and advocate for program funding and CIP support.

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

3.2.6. AFLCMC Financial Management Functional:

3.2.6.1. Manage financial activities during program execution.

3.2.6.2. Monitor obligations and expenditures against the Office of the Secretary of Defense (OSD) goals and provide monthly status charts to Program Manager.

3.2.7. International CIP Participation: International participants can only join the USAF CIP program through membership in the International Engine Management Program (IEMP). International partners with the F-35 Joint Program Office (JPO) 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 4 for guidance to compute the Engine CIP Fair Share Rate.

3.2.7.1. Member countries are invited to yearly CIP User’s Conferences and planning meetings.
3.2.7.2. Participating countries receive proposed Engineering Change Proposals (ECPs) through the IEMP or Joint Configuration Change Boards (JCCB) 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 (FLOs) to perform as a single Point of Contact (POC) for CIP efforts.

3.2.7.3. 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.

3.2.7.4. 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.

3.2.7.5. 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.

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

3.3.1. CIP Requirements Generation: Requirements originate from CIP partners, the USAF, other Services, IEMP countries and OEMs. The requirements are generated from field mishap reports, service and material deficiency reports, CIP Users’ Conferences, and maintenance data. In addition, CIP proactively uses experience from the test and evaluation community, the Life Cycle Management and Sustainment Centers, engine laboratories, and OEM commercial experience to generate requirements.

3.3.1.1. Prior to the ECWG, the CIP TMS engineering manager will complete the requirements generation process depicted in **Figure 3.1** using Attachment 3 Engine CIP Scorecard Process Guide. **NOTE:** The F135 Propulsion Advisory Board (PAB) will follow JPO established processes to determine requirements generation. Note: This process relies on developing and selecting strategic options based primarily on safety and reliability and maintainability needs.

3.3.1.2. Engine Health Indicators (EHI) Goals. Top-level engine health must be managed by the EHI defined in **Chapter 5**. 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.
3.3.1.3. 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).

3.3.1.4. 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 DoE will ensure:

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

3.3.1.4.2. Development of plans to implement the CIP tasks and coordination with stakeholders (e.g., DoP, TMS engineering managers, CIP PMs, Lead MAJCOMs).
3.3.2. 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 JPO established processes to determine requirements approval.
3.3.2.1. The ECWG includes participation from TMS engineering managers, CIP PMs, the IEMP Chief and Lead MAJCOMs. The ECWG will annually provide future year requirements and prioritization for the TMS-specific engine needs to the TMS engineer managers and CIP PMs.

3.3.2.2. 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:

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

3.3.2.2.2. In the year prior to program execution, rank the entire combined task list without FMS unique tasks and establish 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.

3.3.2.2.3. Technically validate data/outputs from the ECWG and prior to the EAB (initial approval) and provide to the DoP for final approval.

3.3.2.2.4. Execute funded requirements and retain unfunded requirement information resulting from DoP annual approval process.

3.3.3. CIP Execution Process: The CIP task list must be coordinated with the DoP. CIP TMS engineering and program managers will accomplish technical evaluations of proposals prior to start of contract negotiations.

3.3.3.1. CIP TMS engineering managers, with Propulsion DoE oversight, work with the CIP PMs and OEMs in planning and execution of engineering work and substantiation and validation of improvements. Engine TMS engineering managers will oversee the logistic implementation plan of each EPD and provide inputs to the CIP Program Manager.

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

3.3.3.3. 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). Based on the nature of changes, the CIP TMS engineering manager classifies the ECP into one of three categories: Class I, Special Series Class II, and Class II.

3.3.3.3.1. A Class I ECP covers changes in form, fit, and function of a component and is approved by the System Configuration Control Board.

3.3.3.3.2. A Special Series Class II ECP covers improvements that do not involve changes in form, fit, or function; e.g., changes/corrections in engineering drawings. The Propulsion DoE is the authority to approve Special Series Class II ECPs.

3.3.3.4. 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 production incorporation is complete, officially notify the CIP PM who will ensure closure of the CIP task.
3.3.4. 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 3.2. For hardware re-designs, the CIP TMS engineering manager ensures integration of activities. For CIP products that must be fielded quickly (e.g., safety) or are classified as a modification (form-fit-function replacements) will be fielded via retrofit using procurement funds. These items will be identified IAW the POM process to receive funding. **Note:** To facilitate this critical coordinated effort, the PCoE BP-06-24B, *Propulsion Systems Modification Management Process*, is utilized. Despite the return-on-investment (ROI) benefits of many CIP tasks, procurement budget limitations cause CIP products to be fielded using a “preferred spare” attrition method utilizing Operations and Maintenance (O&M) funding. This simplifies the transition process, but typically triples the time necessary to complete fielding.

3.3.4.1. As reflected in **Figure 3.2**, 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.
3.3.4.2. DoP ensures coordination with the lead MAJCOMs and key stakeholders in the propulsion community.

3.3.4.3. The lead MAJCOM plans and support incorporation of expected CIP products by way of attrition/retrofit.
Chapter 4

WHOLE ENGINE SPARE REQUIREMENTS COMPUTATION

4.1. 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. 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 D087Q, also known as PRS. An overview of PRS is provided in Figure 4.1.

Figure 4.1. PRS Overview.

4.1.1. 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 4.1.
Table 4.1. Engine Documentation Retention Matrix.

<table>
<thead>
<tr>
<th>If Document is from…</th>
<th>Retain for</th>
<th>After…</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acquisition Computation</td>
<td>2 years</td>
<td>The data is replaced in the computation.</td>
</tr>
<tr>
<td>Distribution/Retention Computation</td>
<td>2 years</td>
<td>The data is replaced in the computation.</td>
</tr>
<tr>
<td>Buyout Acquisition Computation</td>
<td>10 Years</td>
<td>The day the buyout computation is approved.</td>
</tr>
</tbody>
</table>

4.2. PRS Management.

4.2.1. The AF PRS (D087Q) manager is under the responsibility of AFMC/CC, which is assigned to AFLCMC Logistics Systems Division (AFLCMC/HIA) Weapon System Management Information System (WSMIS) program office. The D087Q manager loads appropriate input data into the PRS database and send notification to MAJCOM Command Engine Managers (CEMs), Engine TMS actuaries, and the PRS functional managers.

4.2.2. DoP will:

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

4.2.2.2. Ensure the accuracy of the computation

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

4.2.2.4. Ensure compliance with computation

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

4.2.3. MAJCOM CEMs will:

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

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

4.2.3.3. Collaborate across commands on constrained engine programs

4.2.3.4. Interact with the PRS functional manager, the Engine TMS actuarial, the TMS manager, and other MAJCOM CEMs to develop (peacetime and wartime) spare engine requirements.

4.2.4. The Engine TMS manager accomplish spare whole engine stock level acquisition computations and roll-up spare whole engine stock level distribution computations for the TMS. The Engine TMS Actuary forecast actuarial removal intervals for use in the whole engine stock level distribution and overhaul computations.

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

4.2.5.1. The ERO (Engine Review Organization):
4.2.5.1.1. Collect, develop, and coordinate factors used in the spare engine requirements acquisition/distribution computations for engines still in production.

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

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

4.2.5.1.4. 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 that are established under the ERO responsibility are: Shop Visit Rate (SVR); Not Reparable This Station (NRTS); and Pipeline Times, as provided by the MPWG, to include Base Repair In-work Times and Depot Repair In-work Times.

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

    4.2.5.1.4.2. Within each type factor, values are used for three time frames: peacetime, war surge, and war sustained. Factors are established from data analysis supported by documented assumptions and rationale. The sustained values may be the same as the peacetime values when data are not available. Supporting data, rationale, assumptions, and decisions are documented. Explanations are included in the documentation for decisions without supporting data.

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

    4.2.5.1.4.4. 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.

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

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

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

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

    4.2.5.1.4.9. 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.
4.2.5.1.4.10. Estimated repair pipeline times for the engine are developed to flow through each segment of the pipeline per T.O. 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 T.O. 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.

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

4.2.5.1.5.1. 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.

4.2.5.1.5.2. 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.

4.2.5.2. Aerospace Engine Life (AEL) Committee:

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

4.2.5.2.2. Recommends changes to factors (provided by 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.

4.2.5.2.3. Example of factors to be reviewed are: AF/A3O projected peace and Overseas Contingency Operations (OCO) flying hours, scheduled/unscheduled engine removal rates, non-usage removal rates, changes in operating limits and component life expectancy, base and depot screens, Jet Engine Intermediate Maintenance (JEIM) return rates/NRTS, changes in force structures and utilization rates, application percentages, hour to cycle ratios, and periodic inspection requirements. Development of factors will exclude quick turn removals.

4.2.5.2.4. 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.
4.2.5.2.4.1. The data includes rationale for the changes and projected impacts of the changes in the removal forecasts.

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

4.2.5.2.4.3. The Engine TMS actuaries present supporting data and rationale for their proposal to the AEL.

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

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

4.2.5.2.4.6. Engine TMS manager review forecast accuracy metrics for engine removals and ARIs quarterly.

4.3. Acquisition Stock Level Computation.

4.3.1. 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.

4.3.1.1. Spare engine acquisition 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.

4.3.1.2. During Engineering & Manufacturing Development (EMD) 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.

4.3.2. There are four types of acquisition computations.

4.3.2.1. Initial: The initial 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.

4.3.2.2. 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 Engine Life Management Plan (ELMP).

4.3.2.3. 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.
4.3.2.4. Others: Changes to force structure, weapon system procurement schedules, mission, or overall program changes will drive additional computations during the acquisition cycle.

4.3.3. Acquisition Computation Process Description: This process is followed for any type of acquisition computation (see Figure 4.2).

4.3.3.1. 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.

4.3.3.2. Peace Flying Hours: The peacetime program will be extracted from the latest 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.

4.3.3.3. War Flying Hours: The wartime program will be extracted from the latest war computation data provided by AF/A3O. Wartime hours related to the squadrons will be revised to maintain consistency with any changes identified in the peacetime program information. If the wartime program data is not ascertainable or provided, previous wartime 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 wartime data will have documentation and justification for inclusion in the computation.

4.3.3.4. Actuarial Removal Intervals: The ARIs are developed by the ERO as previously detailed in Paragraph 4.2.5.1.

4.3.3.5. Repair Pipeline Times: The field level and depot repair pipeline times are developed by the ERO in accordance with Paragraph 4.2.5.1.4.10.

4.3.3.6. Transportation Pipeline Times: The transportation pipeline times are the standards published by the Uniform Material Movement and Issue Priority System (UMMIPS). Refer to DoD 4140.1, Volume 8, DoD Supply Chain Materiel Management Procedures: Materiel Data Management and Exchange, for guidance.

4.3.3.7. Maintenance Concept: The MPWG will provide the maintenance concept (both peace and war), including NRTS rate, to be used in the computation, once approved by the ERO.
4.3.3.8. 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.

4.3.3.9. Acquisition Stock Level Computation: The Engine TMS manager loads the information into PRS and runs the model.

**Figure 4.2. Acquisition Computation Flow Chart.**

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

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

4.3.6. 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.

4.3.6.1. 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.

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

4.3.6.3. When required to perform a buyout computation for an immature engine (Immature = fleet age<500,000EFH), 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 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.

4.3.7. 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.

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

4.3.8.1. 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:

4.3.8.1.1. For single engine aircraft, 50 percent.
4.3.8.1.2. For twin-engine aircraft, 40 percent.
4.3.8.1.3. For aircraft with more than two engines, 30 percent.

4.3.8.2. 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.

4.3.9. 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.

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

4.3.9.1.1. Requirement for each configuration is determined by computing the proportions of each configuration installed on each aircraft.
4.3.9.1.2. The total raw computational requirement is multiplied by the portion of each configuration (do not round off the requirement).
4.3.9.1.3. Each new requirement to the ready rate table are used to determine requirements for each configuration.
4.3.9.1.4. All configuration requirements are added together to determine total requirement.

4.4. 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.

4.4.1. Spare whole engine distribution stock level requirements are computed using PRS.
4.4.2. Distribution Stock Level Computation Process Description: The computation will be conducted at least annually (one of several events in the whole engine requirements process,
see Figure 4.3). The computation, which requires a classified processing capability, includes participation from MAJCOM CEMs, Engine TMS manager and actuary, PRS functional managers, and D087Q and WSMIS representatives.

4.4.2.1. Peacetime and Wartime Flying Hours: The peacetime program is extracted from the latest USAF Program, Aerospace Vehicles, and Flying Hours (PA) document. The wartime program is extracted from the latest war computation data provided by AF/A3O.

4.4.2.1.1. The data is downloaded electronically by the D087Q manager and formatted for input into the PRS database.

4.4.2.1.2. 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 wartime program data is not ascertainable or provided, previous wartime information may be used.

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

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

4.4.2.2. 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.

4.4.2.2.1. The Engine TMS manager will:

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

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

4.4.2.2.1.3. Consider time remaining on life-limited components.

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

4.4.2.3. Repair Pipeline Times: Repair pipeline standards in T.O. 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 T.O. 2-1-18 when required.

4.4.2.4. Transportation Pipeline Times: T.O. 2-1-18 is used for transportation pipeline times.

4.4.2.5. 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.
4.4.2.6. Coordination of Computation Input Factors: All input factors will be coordinated with the MAJCOM CEMs and Engine TMS managers prior to accomplishing the computation.

4.4.2.7. Distribution Stock Level Computation: The D087Q manager loads the information into PRS. The MAJCOM CEM runs the computation for their individual command. The Engine TMS manager rolls-up computation across all MAJCOMs for each TMS.

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

4.4.2.8.1. 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.

4.4.2.8.2. 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 command coordinates an equitable allocation with using MAJCOMs and Engine TMS manager. The lead command MAJCOM/A4 certifies the allocations. Prior to the Lead MAJCOM coordination, the following will be accomplished:

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

4.4.2.8.2.1.1. Allocate 100% peacetime requirement (Base Stock Level (BSL) and Repair Cycle Requirement). Determine negotiated/projected Depot returns.

4.4.2.8.2.1.2. Adjust Depot pipeline requirement, if required.

4.4.2.8.2.1.3. Compute wartime percentage against remaining engines.

4.4.2.8.2.2. Lead MAJCOM:

4.4.2.8.2.2.1. Allocate 100% peacetime requirement for all locations.

4.4.2.8.2.2.2. Coordinate equitable allocation of War Readiness Engines (WRE).

4.4.2.8.2.2.3. Resolve using MAJCOMs’ issues.

4.4.2.8.2.3. Using MAJCOMs: Identify command specific requirements and issues. Note: Provide justification for additives, if applicable.

4.4.2.8.3. DoP will:

4.4.2.8.3.1. Endorse the Lead MAJCOM certified allocations.

4.4.2.8.3.2. Resolve distribution stock level discrepancies with the Lead MAJCOM/A4 based on the computation and allocation process.

4.4.2.8.3.2.1. Notify each MAJCOM/A4 of their authorized Base Stock Level and War Readiness Engines.
4.4.2.8.4. 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.

4.4.2.8.5. 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 T.O. 2-1-18. The plan will be provided by message to all users no later than 30 September prior to the beginning of the FY.

**Figure 4.3. Whole Engine Requirements.**

4.4.3. 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.

4.4.3.1. 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:

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

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

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

4.4.3.1.4. Total and assign to the regional/MOB location.
4.4.3.2. 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 4.2 PRS Consolidation Worksheet).

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

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

4.4.3.2.3. Apply conversion factor from Table 4.3. (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.

4.4.3.2.4. Continue process until all peace requirements are determined.

4.4.3.2.5. 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.

4.4.3.3. Consolidation Computation Process for war Table 4.2. (PRS Consolidation Worksheet).

4.4.3.3.1. 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.

4.4.3.3.2. 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.

4.4.3.3.3. Determine war engine requirement from Table 4.3 (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.

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

4.4.3.3.5. 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 4.2. PRS Consolidation Worksheet

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<th>CMD</th>
<th>Base/Unit</th>
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<th>PRS Consolidation Worksheet</th>
<th>Total Regional Raw Peace Rptgmt</th>
<th>Regional Peace Engine Rptgmt</th>
<th>W-Base</th>
<th>Unit Raw War Eng Rptgmt</th>
<th>Total Raw War Eng Rptgmt by Location</th>
<th>Consolidated Rptgmt</th>
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**Processing for PRS:**
These units are CORSUS units or units that are not regionalized due to mission or location.
FOLs are computed in PEACE but require serviceable assets to support contingency operations.
4.4.3.4. Consolidated Requirement will be determined as follows:

4.4.3.4.1. 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.
4.4.3.4.2. 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.)

4.4.3.4.3. 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.

4.5. **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. TSRs are not authorized for constrained engines.

4.5.1. 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.

4.5.2. 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.

4.6. **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.

4.6.1. Additive requirement examples:

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

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

4.6.1.3. Small fleet multi engine aircraft:

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

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

4.6.2. 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.

4.7. 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.

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

4.7.1.1. 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 (CAM) 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.

4.7.1.2. 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 determine 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.

4.7.2. Repair Computation Process. The repair computation will use the Engine Overhaul Requirements Computation Worksheet, Figure 4.4.
4.7.2.1. Computation of Whole Engine Repair Requirements.

4.7.2.1.1. 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 to include projected over-fly hours received from the MAJCOMs.

4.7.2.1.2. 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 (2LM) repairs, which both occur at a depot or contractor facility.

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

4.7.2.1.4. 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.

4.7.2.1.5. 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 uneveness of generations. These are usually maintained at the depot/repair facility. Propulsion Division approval is required.
4.7.2.1.6. **(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).

4.7.2.1.7. 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.

4.7.2.1.8. 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.

4.7.2.1.9. 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 (PDM), etc.

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

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

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

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

4.7.2.1.11. 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 (AMARG), Quality Deficiency Returns where the user was not charged an overhaul cost, aircraft undergoing modification or re-engine, transfers from other services, etc.).

4.7.2.1.12. 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.

4.7.2.1.13. 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 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 (DPEM) Brochure via Centralized Access for Data Exchange.

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

4.7.4. 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.

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

4.7.6. Repair requirement increases subsequent to the repair meeting are documented and retained as described under paragraph 4.8.4 above.

4.7.7. Approval of Repair Increases: Whole engine repair requirement increases during year of execution above the programme objective memorandum will follow CAM guidance.

4.8. 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.

4.8.1. Approval Process: The DoP or designee, which may be delegated no more than two levels, is the final approval authority for excess decisions. 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.
4.9. Whole Engine Reclamation and Disposal.

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

4.9.2. Engine TMS manager:

4.9.2.1. 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 Air Force Pamphlet (AFPAM) 23-118, *Logistics Codes Desk Reference*, and AFJMAN 23-210, *Joint Service Manual (JSM) for Storage and Materials Handling*.

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

4.9.2.3. Coordinate with the PMs to determine if AMARG-stored engines are needed in support of aircraft missions or have the potential for reuse. **Note:** The PM is accountable for the integrated life cycle management of a system until that system is disposed.

4.9.2.4. Work with PMs and Lead MAJCOM CEMs to dispose of engines, through the DLA Disposition Services (DLADS) [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.

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


4.9.2.7. Transfer all residual engines/engine items that do not have reclamation instructions to the local DLADS activity for disposal IAW AFI 23-101, *Air Force Materiel Management* **Note:** Residue resulting from engine reclamation that might be potential hazardous waste will be processed IAW AFI 32-7042, *Waste Management*. 
Chapter 5

ENGINE LIFE MANAGEMENT PLAN (ELMP)

5.1. General.

5.1.1. The ELMP, in coordination with using MAJCOMs and PM, is a living, dynamic strategy to ensure engine Operational Safety Suitability and Effectiveness (OSS&E) goals are established and Integrated Product Support (IPS) objectives are achieved throughout the life cycle at an affordable cost (Refer to DoDI 5000.02 series, AFI 63-101/20-101, and AFPAM 63-128 for additional details on IPS).

5.1.1.1. Planning begins during the system Materiel Solution Analysis Phase.

5.1.2. The ELMP details:

5.1.2.1. How objectives of IPS Element, as applicable to the engine TMS, will be achieved.

5.1.2.2. 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.

5.1.3. 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.

5.2. Responsibilities.

5.2.1. The DoP ensures:

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

5.2.1.2. 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.

5.2.2. Engine TMS managers are the POC for developing, maintaining and executing an ELMP for their engine TMS to:

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

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

5.2.2.3. 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.

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

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

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

5.3. ELMP Content.

5.3.1. The ELMP includes how to:

5.3.1.1. Track and report OSS&E using the engine fleet health indicators/metrics described in Chapter 8.

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

5.3.1.3. Report on lower level metrics which impact overall OSS&E performance. These lower level metrics are listed in Chapter 8 and are used to isolate the root cause(s) of OSS&E deficiencies and address how each is to be corrected.

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

5.3.1.5. Achieve and maintain engine affordability.

5.3.2. Strategies and activities that are addressed:

5.3.2.1. Performance Based Logistics (PBL).

5.3.2.2. Propulsion System Integrity Program (PSIP) consistent with MIL-STD 3024 Rev. CHG-1, Propulsion System Integrity Program.

5.3.2.3. Operational Usage and Verification. Periodic verification events (mission usage surveys, LtF/ACI engine teardowns, Accelerated Mission Tests (AMT), etc.) and inspections 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 (S&T) programs. Data gathered from these programs is used to establish program priorities and develop execution and out year budget requirements.

5.3.2.4. Engine Health Management (EHM) (how it will be achieved):

5.3.2.4.1. Operational readiness through affordable, integrated, embedded diagnostics and prognostics.

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

5.3.2.4.3. Identify enterprise IT tools within a net-centric environment to provide holistic view of propulsion system condition when available.
5.3.2.5. LtF/ACI Program (If applicable, when and how it will be accomplished):

5.4. ELMP Updates. The ELMP is updated when: new goals are set and changes occur throughout the year. Fact-of-life changes, such as updates to schedule and funding adjustments, do not require a re-coordination of the ELMP unless they drive a significant change in the approved strategies. However, there will be recurring dialog between the using MAJCOMs, PM, S&T community, and TMS Stakeholders in order to proactively analyze factors that 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. At a minimum, ELMP re-coordination occurs at least every three years even if there are no significant changes to the approved strategies. Updating metrics and program status information in the Appendices does not require re-coordination in the off years.
Chapter 6

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

6.1. Purpose and Objectives.

6.1.1. 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.

6.1.2. LTF/ACI Program Objectives:

6.1.2.1. 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.

6.1.2.2. Accurately update scheduled maintenance requirements and safely extend T.O. hardware inspection limits.

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

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

6.1.2.5. Identify hardware service life deficiencies and the areas that require re-design/re-work before extensive production commitments are made and/or limited funds exhausted on obsolete hardware.

6.1.2.6. 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.

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

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

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

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

6.2. 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.

6.2.1. Active Groups:

6.2.1.1. Immature fleets (<500,000 EFH) use full engines.
6.2.1.2. Mature fleets (>500,000 EFH) use modules.

6.3. **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.

6.4. **Process.**

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

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

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

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

6.4.3. 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.

6.4.4. There are two basic types of ACIs:

6.4.4.1. Field Level

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

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

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

6.4.4.2. Depot Level

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

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

6.4.5. ACIs are performed in two primary steps.

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

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

6.5. **LtF/ACI Program Management.**

6.5.1. DoP will:

6.5.1.1. 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.

6.5.1.2. Determine and establish predetermined intervals for ACI engines/modules.
6.5.1.3. Ensure funds are available for ACI requirements, and that ACI requirements are addressed in appropriate contractual documents.

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

6.5.1.5. Establish Memorandum of Agreements (MOAs) with using MAJCOM/A4s describing LtF/ACI Program management and responsibilities.

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

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

6.5.1.6.2. 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.

6.5.1.6.2.1. 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.

6.5.1.6.3. Request supply Project Codes for LtF/ACI part requisitions. Note: Refer to AF Handbook (AFH) 23-123V1, Materiel Management Reference Information, for additional information.

6.5.1.6.4. 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.

6.5.1.6.5. Coordinate with participating field units to schedule Time Compliance Technical Order (TCTO) compliance at the earliest opportunity.

6.5.2. MAJCOMs will:

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

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

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

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

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

6.5.2.4. Give LtF/ACI engines/modules/LRUs/SRUs priority attention and ensure all maintenance actions documented.
6.5.2.5. Ensure LtF/ACI engines/modules/LRUs/SRUs are dedicated to the flying schedule to the maximum extent possible.

6.5.2.6. 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 2x the rate.

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

6.5.2.8. 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.

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

6.5.2.10. 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.

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

6.5.2.12. 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.

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

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

6.5.2.15. 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.

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

6.5.2.15.2. 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 7

ENGINE HEALTH MANAGEMENT (EHM)


7.1.1. EHM is the application of CBM+ 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 EHM is to tie together ET&D and RCM to enable a predictive maintenance end state capability. However, implementation of EHM will vary depending on the TMS support concept, MAJCOM requirements, and data availability.

7.1.2. **Engine Trending & Diagnostics (ET&D).** ET&D integrates hardware, software, maintenance, diagnostic and prognostic processes to quantify and monitor/manage engine health. A variety of software applications on ground-based computers are the primary analysis tools to diagnose and monitor engine health. ET&D 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. The primary goal is to:

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

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

7.1.3. **ET&D Data Sources and Utilization.** ET&D utilizes data from a variety of sources including: on-board aircraft and engine data collection devices, test cell data collection devices, maintenance records/data systems, Non-Destructive Inspection (NDI) and oil analysis data. ET&D 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.

7.1.4. **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.
7.1.4.1. **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.

7.2. **New Acquisitions.** EHM 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. EHM 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.

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

7.2.1.1. DoP will:

7.2.1.1.1. Ensure EHM is implemented for applicable propulsion systems.

7.2.1.1.2. Serve as champion for acquisition of EHM tools.

7.2.1.1.3. Identify appropriate personnel to manage and implement EHM programs for applicable engine TMSs.

7.2.1.1.4. Ensure personnel are trained and have adequate resources/processes to implement EHM for applicable engine TMSs.

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

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

7.2.1.1.7. Ensure ELMPs and acquisition performance specifications identify EHM requirements.

7.2.1.1.8. Include EHM guidance in engine specific TOs.

7.2.1.1.9. Support MAJCOMs and AETC for EHM course development and training.
7.2.1.1.10. Serve as the PSI in order to program, budget and execute EHM requirements on behalf of PMs/MAJCOMs.

7.2.1.1.11. Coordinate development and test activities with the Support Equipment PGM for EHM software that impacts support equipment.

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

7.2.1.2. AFRL will:

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

7.2.1.2.2. Serve as focal point for S&T initiatives in support for EHM technologies.

7.2.1.2.3. Communicate status of emerging EHM technologies to PMs and DoP. Support the transition of technologies from AFRL to programs and support transition planning.

7.2.1.2.4. Ensure EHM IT technology is designed to operate/support the DoD net-centric environment when feasible.

7.2.1.3. Support Equipment PGM will:

7.2.1.3.1. Coordinate development and test activities with the DoP and PM for support equipment that impacts EHM software.

7.2.1.3.2. Support System unique development of support equipment TOs and updates. Provide T.O. updates for common support equipment.

7.2.1.3.3. Ensure support equipment that generates data needed for EHM business processes can be formatted, collected and transferred to the required DoD Maintenance Information System (MIS).

7.2.1.4. PMs will coordinate with the DoP and Support Equipment PGM on aircraft modifications that impact EHM data sources (such as data recorders) and associated support equipment by providing necessary interface control documentation.

7.2.1.5. MAJCOMs will:

7.2.1.5.1. Identify operational goals and requirements for specific engine TMS EHM and assist the Engine TMS manager establishing requirement priorities.

7.2.1.5.2. Provide EHM requirements to the PM, ensure documented in the ELMP and performance specification, and advocate for EHM support funding.

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

7.2.1.5.3. Provide support for identification and resolution of EHM issues.
7.2.1.5.4. Ensure units have qualified EHM personnel and execute EHM programs and activities IAW applicable 00-25-257 series TOs.

7.2.1.5.5. Identify specific EHM training requirements to AETC for course development and ensure appropriate personnel are trained.

7.2.1.5.6. 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 EHM activity for analysis.

7.2.1.5.7. Ensure that each unit provides timely and accurate inputs to EHM data systems.

7.2.1.6. AETC in addition to above will:

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

7.2.1.6.2. Develop and update EHM course material as required in accordance with MAJCOM identified training requirements.

7.2.1.6.3. Provide EHM training for MAJCOM personnel in accordance with the identified training requirements.
Chapter 8

ENGINE HEALTH INDICATORS (EHI)

8.1. 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.

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

8.1.2. 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 Type, Model, Series (TMS). The stoplight indicators cover the current reporting period; however, stoplight indicators for future periods are subjective assessments and require management decision. Note: Metrics that provide a historical trend will not be assigned a goal and relevant stoplight indicators.

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

Table 8.1. Engine Health Indicators.

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

8.2. Safety.

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

8.2.1.1. 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.
8.2.1.2. 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.

8.2.1.2.1. 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.

8.2.1.2.2. 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.

8.2.1.3. 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.

8.2.1.3.1. 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.

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

8.2.2.1. 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 PST on this indicator.

8.2.2.2. 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.

8.2.2.3. 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.

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

8.2.3.1. 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 PST on this indicator.

8.2.3.2. Metric Description: An engine related mishap resulting in destruction of an aircraft.
8.2.3.3. Metric Methodology: ERLOA will be calculated as the number of engine related loss of aircraft in the fleet life per 100,000 engine flying hours. 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 (AFSAS) database maintained by the USAF Safety office.

8.3. Availability.

8.3.1. 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 8.1. Net Serviceability Metric.

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

8.3.1.1.1. Peace: The number of serviceable engines required to support peacetime operations.

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

8.3.1.2. Metric Methodology:

8.3.1.2.1. 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 base possessed aircraft are excluded in the net serviceable computation. Obligations to depot possessed aircraft that exceed the base level Primary Aircraft Inventory are also excluded.

8.3.1.2.1.1. Net Serviceable (Weekly Snapshot) = Total Net Serviceable – RAW + Total Serviceable Due-in.

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

8.3.1.2.1.3. Net Serviceable (Quarterly Average) = Sum of Monthly Averages ÷ 3.
8.3.1.3. 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.

8.3.1.3.1. Peace Levels:

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

8.3.1.3.1.2. 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).

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

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

8.3.1.3.2. WRE Levels:

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

8.3.1.3.2.2. 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.

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

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

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

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

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

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

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

8.3.2. 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.

8.3.2.1. Metric Description:

8.3.2.1.1. 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.
8.3.2.1.2. Computed BSL: BSL is computed by PRS to support the peace and war requirement to an 80% ready rate.

8.3.2.1.3. 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.

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

8.3.2.2. Metric Methodology:

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

8.3.2.2.2. Metric Computations: On Hand BSL (Weekly Snapshot) equals the Total Qty NET 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.

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

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

8.3.2.3. Metric Interpretation:

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

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

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

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

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

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

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

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

8.3.3.1. 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.

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

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

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

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

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

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

8.3.3.3. Metric Methodology:

8.3.3.3.1. Data Collection: The NMCS Uninstalled Engine Status Report in CEMS data will be used for determining ENMCS%. Refer to T.O. 00-25-254-2, Comprehensive Engine Management System Manual for DSD: D042 to navigate to the NMCS Uninstalled Engine Status Report.

8.3.3.3.2. ENMCS% = NMCS Days ÷ Asset Days

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

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

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

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

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

8.3.3.4. Metric Interpretation:

8.3.3.4.1. Green = Less than 10% ENMCS.

8.3.3.4.2. Red =10% or more ENMCS.

8.4. Reliability.

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

8.4.1.1. 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.

8.4.1.1. 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 8.2).

8.4.1.2. Metric Methodology:

8.4.1.2.1. 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.

8.4.1.2.2. 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.

8.4.1.2.3. 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 (PACS) do not automatically report this number.

8.4.1.2.4. Quarterly data from CEMS is used for EFH and number of removals. EFHs are found on CEMS product G232, Aircraft Engine Experience Analysis Report. Removals will be obtained from CEMS product G341, Aircraft Engine Removal and Loss Report.

8.4.1.2.5. ATOW or MTBR is calculated quarterly by the Engine TMS actuary, using a four quarter rolling average to smooth any seasonal variation, and posted on the Actuary SharePoint site (https://cs2.eis.af.mil/sites/21162/act/shared%20documents/forms/allitems.aspx).

8.4.1.2.5.1. MTBR or ATOW will be undefined if no engines are removed in a quarter; therefore, such quarters are ignored in the four quarter rolling average calculation.

8.4.1.2.6. 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.

8.4.1.2.7. 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.
8.4.1.2.8. 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.

8.4.1.2.9. 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 8.2 below.

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

8.4.1.2.11. 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.

8.4.1.2.12. An “unserviceable removal” will be an action that drives the engine into I-level maintenance.

8.4.1.2.13. The Lead MAJCOM/A4 is responsible for resolving inaccurate reporting of engine removals.
### Figure 8.2. Non-Inherent HOW MAL Codes.

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Code</th>
<th>Description</th>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>045</td>
<td>Battery replaced</td>
<td>476</td>
<td>Solid FOD (metal, stone)</td>
<td>812</td>
<td>No defect - associated equip</td>
</tr>
<tr>
<td>086</td>
<td>Improper handling/shipping cut</td>
<td>477</td>
<td>Semi-solid FOD (ice)</td>
<td>867</td>
<td>TO 2-1-18 Transfer time limit</td>
</tr>
<tr>
<td>116</td>
<td>Adjustment/alignment improp</td>
<td>478</td>
<td>Semisolid FOD (rags, plastic)</td>
<td>868</td>
<td>Failed external component</td>
</tr>
<tr>
<td></td>
<td></td>
<td>479</td>
<td>Damage from simulated combat</td>
<td>870</td>
<td>Research, test, diagnostic</td>
</tr>
<tr>
<td>157</td>
<td>Thrust reverser failure</td>
<td>480</td>
<td>Damage by accident/incident</td>
<td>872</td>
<td>PDM</td>
</tr>
<tr>
<td>167</td>
<td>Tension or torque incorrect</td>
<td>481</td>
<td>Exposure to fire extinguisher</td>
<td>874</td>
<td>Storage damage / deterioration</td>
</tr>
<tr>
<td>174</td>
<td>QEC discrepancy</td>
<td>482</td>
<td>Excessive G-force inspection</td>
<td>875</td>
<td>Cannibalization</td>
</tr>
<tr>
<td>198</td>
<td>Contaminated fuel</td>
<td>483</td>
<td>Dummy engine transaction</td>
<td>876</td>
<td>Non-T.O. directed removal</td>
</tr>
<tr>
<td>210</td>
<td>Servicing with wrong fuel or oil</td>
<td>502</td>
<td>Damage by engine component</td>
<td>877</td>
<td>T.O. identified components</td>
</tr>
<tr>
<td></td>
<td>Contaminated by foreign mat'1</td>
<td>731</td>
<td>Battle damage</td>
<td>890</td>
<td>Lightening strike</td>
</tr>
<tr>
<td>300</td>
<td>Foreign object (no damage)</td>
<td>750</td>
<td>Missing</td>
<td>911</td>
<td>TCTO compliance error</td>
</tr>
<tr>
<td>301</td>
<td>FOD or sabotage</td>
<td>796</td>
<td>No defect - TCTO not applicable</td>
<td>943</td>
<td>Data error</td>
</tr>
<tr>
<td>303</td>
<td>Semisolid FOD (bird)</td>
<td>797</td>
<td>No defect - TCTO already done</td>
<td>988</td>
<td>Loss of vacuum</td>
</tr>
<tr>
<td>410</td>
<td>Lack of / improper lubrication</td>
<td>799</td>
<td>No defect</td>
<td>298</td>
<td>Domestic Object – No Damage</td>
</tr>
<tr>
<td>425</td>
<td>Pitted, nicked, chipped, scored</td>
<td>800</td>
<td>No defect - FOM</td>
<td>138</td>
<td>Fan Blade Damage</td>
</tr>
</tbody>
</table>

### 8.4.1.3. Metric Interpretation:

8.4.1.3.1. IDR provides a baseline for establishing a TMSs reliability goal in collaboration with the Lead MAJCOM.

8.4.1.3.2. 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.

8.4.1.3.3. 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.
8.4.1.3.4. Engine TMS managers submit their IDR with justification and a graph of the ATOW or MTBR metric looking back three years through the Propulsion Director of Engineering (DoE) to the DoP for approval.

8.4.1.3.5. 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 8.2. ATOW or MTBR Color Rating.

<table>
<thead>
<tr>
<th>Color</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green</td>
<td>Inherent ATOW or MTBR &gt; Goal Established by Lead MAJCOM</td>
</tr>
<tr>
<td>Yellow</td>
<td>Inherent ATOW or MTBR is less than 100% of goal and greater than 75% of goal</td>
</tr>
<tr>
<td>Red</td>
<td>Inherent ATOW or MTBR is less than 75% of goal</td>
</tr>
</tbody>
</table>

8.4.1.3.5.1. 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 workbook located on the AFLCMC Actuarial EIM (SharePoint) web site will generate 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.

8.4.1.3.5.2. 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 PSIP enhancements, RCM decisions, build policies and EHM enhancements to adjust MTBR goals up or down accordingly.

8.4.2. 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.

8.4.2.1. 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.

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

8.4.3. SERs: The SER (Scheduled Engine Removal) rate is a trend metric; therefore, this indicator will be presented to show the historical trend of SER.
8.4.3.1. Metric Description: SERs are the removals as scheduled by the applicable T.O. Scheduled removals for TCTO compliance are not included.

8.4.3.2. 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 T.O. within a time interval divided by the EFH within the same interval, multiplied by 1000. Excludes quick turn (LQ) and serviceable (LB) engine removals.

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

8.4.4.1. 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.

8.4.4.2. 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.

8.5. Maintainability.

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

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

8.5.1.2. 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.

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

8.5.1.4. Metric Interpretation: In coordination with MAJCOM/A4s and engine TMS manager, the MMH/EFH goal is recommended by each engine TMS manager at their respective Maintenance Planning Working Group.
Table 8.3. MMH/EFH Goals.

**Engine TMS Manager 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.

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

8.5.2.1. Metric Objective: This indicator measures the operational maintainability of a TMS by quarterly showing the trend of OMMH/EFH.

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

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

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

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

8.5.3.1. 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.

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

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

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

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

8.5.4.1. 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.

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

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

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

8.6.1. CPEFH.

8.6.1.1. Metric Objective:

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

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

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

8.6.1.3. Metric Methodology:

8.6.1.3.1. 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).

8.6.1.3.2. 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.

8.6.1.3.3. Engine Flying Hours will be as reported in CEMS and available on the Actuary SharePoint site (https://cs2.eis.af.mil/sites/21162/act/shared%20documents/forms/allitems.aspx) for each Engine Management Group.

8.6.1.3.4. 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.

8.6.1.4. 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.

8.6.2. Cost Reduction:

8.6.2.1. Metric Objective:

8.6.2.1.1. Track development, implementation, and benefit of efforts to drive down overall propulsion costs.
8.6.2.2. 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.

8.6.2.3. Metric Methodology:

8.6.2.3.1. 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.

8.6.2.4. Metric Interpretation: Engine TMS or program manager implement cost reduction initiatives to drive down engine contribution to overall life cycle costs.
Chapter 9

ENGINE LEADING HEALTH INDICATORS (LHIS)

9.1. General. This chapter directs the LHI process for propulsion systems health reporting and the criteria for evaluating these indicators. Applicability of this quarterly process is to assess future WRE 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 outlook: Requirements, Production, Supportability, Safety/Quality, Operational Trends, and Funding/Resources. (See Figure 9.1.)

Figure 9.1. LHI Overview.

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

9.1.2. Engine TMS managers will complete an LHI assessment quarterly within the FY and update with current data as applicable.

9.1.2.1. Engine TMS managers will coordinate with Lead Command, AFLCMC, DLA, AFSC, other MAJCOMs as required, source of supply, OEMs, and SOR when performing LHI assessments and accessing program status. Final authority of program status rests with the Lead Engine TMS manager based on information collected from stakeholders.
9.1.2.2. Each element will be assigned a red, yellow, green rating based on 6, 12, and 36 months impact to WRE. The Lead Engine TMS manager assigns the rating based on overarching risk to fleet health using the complete assessment as a tool:

9.1.2.2.1. Rate each assessment sub-element to assist in determining the overall element rating. In the Response column, provide justification for the suggested rating. Ensure justification references the sub-element and can stand alone as a bullet as back-up.

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

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

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

9.1.3. 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.

9.1.3.1. 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.

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

9.1.3.3. Briefing charts:

9.1.3.3.1. Change to rated LHI elements will be indicated by an oval circle/previous quarter color rating on the LHI Overview briefing chart.

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

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

DARLENE J. COSTELLO
Principal Deputy, Assistant Secretary of the Air Force
(Acquisition & Logistics)
Attachment 1

GLOSSARY OF REFERENCES AND SUPPORTING INFORMATION

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T.O. 00-25-254-1, *CEMS Engine Configuration, Status and TCTO Reporting Procedures*, 1 November 2015
T.O. 00-35D-54, *USAF Deficiency Reporting and Investigation System*, 1 September 2015
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*Adopted Forms*

AF Form 616, *Fund Cite Authorization*
AF Form 847, *Recommendation for Change of Publication*
AF Form 1067, *Modification Proposal*
DD Form 1149, *Requisition and Inventory Shipping Document*
DD Form 1348-1A, *Issue Release/Receipt Document*

*Abbreviations and Acronyms*

2LM—Two Level Maintenance
ACAT—Acquisition Category
ACI—Analytical Condition Inspection
AEL—Aerospace Engine Life
AETC—Air Education Training Command
AFMAN—Air Force Instruction
AFLCMC—Air Force Life Cycle Management Center
AFMAN—Air Force Manual
AFMC—Air Force Materiel Command
AFPAM—Air Force Pamphlet
AFPD—Air Force Policy Directive
AFRC—Air Force Reserve Command
AFRL—Air Force Research Laboratory
AFSAS—Air Force Safety Automated System
AFSEC—Air Force Safety Center
AFTOC—Air Force Total Ownership Cost
AMARG—Aerospace Maintenance and Regeneration Group
AMT—Accelerated Mission Test
ANG—Air National Guard
ARI—Actuarial Removal interval
ATOW—Average Time on Wing
BSL—Base Stock Level
CAE—Component Acquisition Executive
CAIG—Cost Analysis Improvement Group
CAM—Centralized Asset Management
CBM+—Condition Based Maintenance Plus
CEM—Command Engine Manager
CEMS—Comprehensive Engine Management System
CIP—Component Improvement Program
CLS—Contractor Logistics Support
CPEFH—Cost Per Engine Flying Hour
CRF—Centralized Repair Facility
CSAG-S—Consolidated Sustainment Activity Group-Supply
DLADS—Defense Logistics Agency Disposition Services
DLR—Depot Level Reparables
DMAG—Depot Maintenance Activity Group
DoD—Department of Defense
DoDI—Department of Defense Instruction
DoP—Director of Propulsion
DPEM—Depot Purchased Equipment Maintenance
DR—Deficiency Report
EAB—Engine Advisory Board
ECP—Engineering Change Proposal
ECWG—Engine CIP Working Group
EFH—Engine Flying Hours
EHI—Engine Health Indicators
EHM—Engine Health Management
EHMS—Engine Health Management System
ELMP—Engine Life 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—Engine Trending and Diagnostic
ETOW—Expected Time on Wing
FAA—Federal Aviation Administration
FLO—Foreign Liaison Officer
FMS—Foreign Military Sales
FOD—Foreign Object Damage
FOL—Forward Operating Location
FYDP—Five Year Defense Plan
GSD—General Supply Division
HMC—HOW MAL Codes
HQ—Headquarters
IAW—In Accordance With
IDR—Inherent Design Reliability
IEMP—International Engine Management Program
IFSD—In-flight Shutdown
IMMH—Intermediate Maintenance Man Hours
IPS—Integrated Product Support
JEIM—Jet Engine Intermediate Maintenance
JPCC—Joint Propulsion Coordinating Committee
LCF—Low Cycle Fatigue
LHI—Leading Health Indicator
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
MOA—Memorandum of Agreement
MOB—Main Operating Base
MPWG—Maintenance Planning Working Group
MTBR—Mean Time between Removals
NDI—Non-Destructive Inspection
NMCS—Non Mission Capable Supply
NRIFSD—Non Recoverable In-Flight Shut Down
NRTS—Not Reparable This Station
OCO—Overseas Contingency Operations
OEM—Original Equipment Manufacturer
OHRI—Overhaul Removal Interval
O&M—Operations and Maintenance
OMMH—Organizational Maintenance Man Hours
OPR—Office of Primary Responsibility
OSS&E—Operational Safety, Suitability and Effectiveness
PA—USAF Program Aerospace Vehicle Flying Hours
PACS—Propulsion Actuarial Client Server
PBL—Performance Based Logistics
PCoE—Propulsion Center of Excellence
TMS—Type, Model and Series  
TO—Technical Order  
TRL—Technology Readiness Levels  
TSR—Target Serviceable Requirement  
UER—Unscheduled Engine Removal  
UMMIPS—Uniform Material Movement and Issue Priority System  
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.

Actuarial Removal Interval (ARI)—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.

Cost per Engine Flying Hour (CPEFH)—A flying hour metric for an engine TMS. The values for calculating CPEFH are a subset of the cost categories obtained from the Engine Cost Analysis Improvement Group (CAIG) product of the AF total ownership cost database. CPEFH will include all Federal Stock Classes specific to engine expenses, e.g., 28 and 29, made by flying units in Element of Expense/Investment Category Code (EEIC) 64402 (flying hour spares) and consumption data (Consolidated Sustainment Activity Group-Supply (CSAG-S), EEIC 644 & GSD, EEIC 609) for parts needed to repair engines. The formula is: (CSAG-S plus GSD) ÷ (aircraft flying hours × 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. (T.O. 2-1-18).

Distribution Stock Level Computation—The computation that determines the whole spare engine requirements for using MAJCOMs.

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 Health Management (EHM)—EHM is a program integrating hardware, software, maintenance, processes and people to diagnose, quantify and monitor engine health. Engine Health Management is performed at the unit, base, MAJCOM, life cycle management and depot levels.

Engine Health Management System (EHMS)—The EHMS is a suite of tools used to perform/execute Engine Health Management. EHM Systems are comprised of various hardware and software components, including but not limited to, on-board aircraft and engine data collection devices and test cell data collection devices. Additional data sources may include, but are not limited to, maintenance and oil analysis data available from other data systems. EHM Systems use a variety of software applications on ground-based computers to process data and diagnose and monitor engine health.

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).

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 (T.O. 2-1-18).

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

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

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 (NRTS)—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.

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

Propulsion Safety Threshold (PST)—A risk management term used to refer to the DoP defined Risk Thresholds for Non-Recoverable In-flight engine Shutdown (NRIFSD) 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 (QEC) 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

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 wartime tasking. SAM also identifies potential logistics limitations (i.e., resources and processes) which need to be improved to increase the probability that required performance levels will be met.

**Target Serviceable Requirement (TSR)**—TSR is the portion of the computed peacetime requirement that is necessary to be serviceable in support of special requirements.

**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, Engine Health Indicators/Indicators Metrics, 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.

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) AMT (w/o task validation – See A3.3.7. below for AMT 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, Engine Health Indicators.

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 AMTs 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, Engine Health Indicators. 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 IAW requirements defined in Chapter 8, Engine Health Indicators. 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 8.1, Chapter 8 Engine Health Indicators.

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 (SRRB) (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 SRRB 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.

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety</td>
<td>R=6 Y=2 G=0</td>
<td>R=5 Y=2 G=0</td>
<td>Risk Item=3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WRE</td>
<td>R=5 Y/G=0 G=0</td>
<td>R=5 Y/G=0 G=0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ATOW (or MTBR)</td>
<td>R=6 Y=2 G=0</td>
<td>R=5 Y=2 G=0</td>
<td>0</td>
<td>Carry-Over=3 New Task=0</td>
<td>TR=9</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MMHEF</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>ETOC</td>
<td>Critical Mission Impact=5</td>
<td>Critical Mission Impact=3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operability</td>
<td>Critical Mission Impact=3</td>
<td>Critical Mission Impact=2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table A2.2. Scoring Summary Sample.

<table>
<thead>
<tr>
<th>Category</th>
<th>Status</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current Health Measure Status</td>
<td>Red (&lt; 450)</td>
<td>5</td>
</tr>
<tr>
<td>Projected Health Measure Status</td>
<td>Yellow (&gt;450, &lt;500)</td>
<td>2</td>
</tr>
<tr>
<td>Safety Risk Item</td>
<td>Non-Safety</td>
<td>0</td>
</tr>
<tr>
<td>Carry-Over / New Task</td>
<td>New Task</td>
<td>0</td>
</tr>
<tr>
<td>Technical Risk</td>
<td>TRL = 8</td>
<td></td>
</tr>
<tr>
<td>Benefits/ Improvements</td>
<td>Improvement=20 hours = 4% of Goal</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ATOW Improvement &gt;4% = 4 points</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MMH Improvement ≥1.5% = 3 points</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total “Benefits Improvements” score is 7 points. Max allowed is 5.</td>
<td>5</td>
</tr>
<tr>
<td>Implementation Plan Resources</td>
<td>Projected (has been through MPWG)</td>
<td>3</td>
</tr>
<tr>
<td>TMS Life Remaining</td>
<td>&gt;15 years</td>
<td>4</td>
</tr>
<tr>
<td>Multi-Engine Benefits</td>
<td>Benefits two engine TMS</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total Score</strong></td>
<td></td>
<td>21</td>
</tr>
</tbody>
</table>

**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).

<table>
<thead>
<tr>
<th>TRL</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>9 = Actual</td>
<td>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.</td>
</tr>
<tr>
<td>system</td>
<td>proven through successful mission operations.</td>
</tr>
<tr>
<td>8 = Actual</td>
<td>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.</td>
</tr>
<tr>
<td>system</td>
<td>completed and qualified through test and demonstration.</td>
</tr>
<tr>
<td>7 = System</td>
<td>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.</td>
</tr>
<tr>
<td>prototype</td>
<td>demonstration in an operational environment.</td>
</tr>
<tr>
<td>&lt; TRL 7</td>
<td>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</td>
</tr>
</tbody>
</table>
Figure A2.1. Sample Scorecard.
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.

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, International Affairs and Security Assistance Management. 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 (ECs) 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 AMARG.
A3.3.2.6. International engines stored in an AMARG-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.

A3.3.4. Equivalent Engine. When a new series is created off of a TMS for some minor configuration changes, the new series, for CIP funding purposes, may be considered as a percentage (say 85%) equivalent to the original TMS (determined by TMS engineering in coordination with IEMP). The percentage equivalency is used to compute an equivalent inventory for the new series, which is used to determine the CIP contribution amount. For example: F110-132 series is 75% equivalent to F110-129 TMS and has an active inventory of 84. F110-132 will participate in the fair share as F110-129 with F110-129 equivalent inventory of 63 (84 x 0.75) engines.
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.
Figure A3.1. Sample TMS CIP Fair Share Computation.

Example of CIP Fair Share Computation

<table>
<thead>
<tr>
<th>Task#</th>
<th>Task Title</th>
<th>Approved FY Amount [S$]</th>
<th>Benefiting TMSs</th>
<th>Cost Pools</th>
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<tbody>
<tr>
<td>C0111004</td>
<td>Program Management</td>
<td>7,000</td>
<td>F110/111/119 Common</td>
<td>7,000</td>
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<td>F110/111/119 Common</td>
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<td>Engine Model (NP13) Development</td>
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<td>F110/111 Common</td>
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<tr>
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<tr>
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<td>F110/111/119 Common</td>
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<tr>
<td>F1100</td>
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<td>F110/111/119 Common</td>
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<tr>
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<td>F110 Common</td>
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<td>Lufthansa Engine Test</td>
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<td>F110 Common</td>
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Total Cost: 12,390

Cost per engine: 4,130

TMS Inventory

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<td>F101</td>
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<td>F113</td>
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</table>

Total Contribution: 13,300
Figure A3.2. Process Flow Chart.