DEPARTMENT OF THE AIR FORCE
HEADQUARTERS AIR FORCE LIFE CYCLE MANAGEMENT CENTER
WRIGHT-PATTERSON AIR FORCE BASE OHIO

BULLETIN
AWB–330
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United States Air Force (USAF) Airworthiness Bulletin (AWB)-330

Subject: Propulsion System Type Certification

Attachments: (1) Glossary of References and Supporting Information
(2) Type, Model, Series (TMS) Type Certification Process Diagrams
(3) Propulsion System Reportability Criteria
(4) Air System Impact Criteria for Propulsion System Modifications

1. **Purpose:** Establish type certification of TMS propulsion systems used in USAF air systems, and define the process for issuing propulsion design approvals (DAs) and assessing integrated air system AW.

2. **Office of Primary Responsibility:** The USAF Airworthiness Office, AFLCMC/EZSA (USAF.Airworthiness.Office@us.af.mil).

3. **Applicability:** This bulletin applies to military developed and military unique propulsion systems that do not have their type design controlled by Federal Aviation Administration (FAA) or other civil airworthiness type certification processes. It does not apply to civil developed propulsion systems installed on Commercial Derivative Aircraft.

4. **Definitions:**

4.1 Initial Flight Release (IFR) – The milestone at which the propulsion system is released for limited flight operations.

4.2 Initial Service Release (ISR) – The initial propulsion design validation milestone which precedes approval for low rate production.

4.3 Derivative Propulsion System – A new propulsion system design substantially based on an existing, validated design to be applied to a new aircraft platform or to achieve improvements in performance or service life. Derivative engines will be identified by a change in series designation. Typical examples are: a new low spool on a two spool engine and/or a growth version of a previous design.

4.4 Propulsion Design Approval – A document which affirms that the appropriate tenets of the airworthiness process are met and that the propulsion system was assessed against the required airworthiness standards and any residual risk to aircrew, ground crew, passengers, or to third parties has been accepted by the appropriate authority.

4.5 Propulsion Modification – An engineering change made to existing propulsion system design for the purposes of improving performance, safety, affordability, or a change of operating environment or mission usage. Modifications will not result in a change to TMS designation.

4.6 Propulsion System – Assets that are air breathing, primary motive power systems for manned and unmanned aerial vehicles. Propulsion systems include the engine and any ancillary equipment required for producing thrust that are managed as a mission support item.

5. Background:

5.1 Historically, the AW assessment of the propulsion system happened concurrently with the air system. However, propulsion system design and development typically occurs years before aircraft system design and development, relying on ground testing to establish propulsion system integrity before entering into development flight test. In addition, propulsion system engineering changes are validated and incorporated at the first opportunity and not typically as block upgrades. Delaying an AW assessment of the propulsion system until an AW assessment of the integrated air system hampers the possibility of incorporating cost effective propulsion design or validation adjustments to comply with AW criteria.

5.2 This bulletin establishes a propulsion system TMS type certification process (see Attachment 2) to independently assess AW of a propulsion system during its design validation and permit timely incorporation of changes. It also prescribes required interactions between TMS and air system Mission Design Series (MDS) programs.

6. Propulsion System Type Certification Process: The propulsion system type certification process shall follow the tenets of the standard air system airworthiness process, including compliance with applicable AW Bulletins and presentation to the AW Board for disposition of reportable AW products. The following process shall be used to obtain propulsion DAs and interface with host air systems:

6.1 **Propulsion Delegated Technical Authority (DTA).** A propulsion Director of Engineering (DOE)/DTA, hereafter referred to as the TMS DOE/DTA, approves reportability determinations and AW products for non-reportable TMS modifications. A propulsion Chief Engineer (CE)/DTA, hereafter referred to as the TMS CE/DTA, approves TMS AW impact and air system impact assessments, and recommends modification reportability. The TMS CE/DTA is responsible for obtaining Technical Airworthiness Authority (TAA) approval of propulsion system AW products for reportable modifications and TMS DOE/DTA approval of propulsion system AW products for non-reportable modifications.

6.2 **Propulsion AW Plan.**

a. **New Propulsion Systems.** The TMS CE shall document the TMS AW Plan for the propulsion design and its integration into the air system(s) and coordinate with the host MDS CE(s).

b. **Propulsion System Modifications.** The TMS CE shall complete the Propulsion Airworthiness Determination Form (P-ADF) (see Attachment 1), which may include the AW Plan.

(1) The TMS CE/DTA shall determine if the modification impacts the AW of the uninstalled propulsion system. If there is no impact, no further AW work is required.

(2) The TMS CE/DTA shall assess reportability (see Attachment 3) and make a recommendation to the TMS DOE/DTA for approval.

(3) The TMS CE/DTA shall assess whether the modification impacts the air system(s) in which the propulsion system is installed (see Attachment 4). The TMS CE/DTA may request MDS CE/DTA assistance in determining air system impact. The TMS CE shall obtain coordination from all impacted MDS CE/DTAs, and from those with no current Interface Control Document (ICD) or equivalent. When no air systems are impacted, no further MDS CE/DTA involvement is required.

6.3 **Propulsion Certification Basis (CB).**

a. The TMS CE shall construct a TMS CB based on MIL-HDBK-516 for the uninstalled propulsion system which identifies applicable propulsion specific criteria from Sections 4, 7, 14, 15, and 16.

b. The TMS CE should coordinate with AW Board members at the earliest opportunity to facilitate incorporation of cost effective design or validation adjustments to comply with AW criteria and to ensure the program acquires sufficient substantiating artifacts through the engine ground test development and design verification process.

c. For derivative propulsion systems, the TMS CB shall define applicable criteria for unique engine components and their impact on the baseline, or for a change of operating environment or mission usage that substantially changes an existing certification basis or AW approval. Tailoring of the standards and methods of compliance is expected in order to avoid duplication of effort to meet criteria previously met by the baseline components and not impacted by the new components.

d. The TMS CB shall be initially approved by propulsion Milestone B. The propulsion design may be refined and validated throughout the development process, but the TMS CB should be finalized by the Critical Design Review.

e. The TMS CE shall provide the approved TMS CB to all impacted MDS CEs for incorporation into the MDS CB.

6.4 **Propulsion Compliance Report (CR).**

a. The TMS CE shall construct a TMS CR documenting artifacts and compliance findings against the approved TMS CB. AW compliance artifacts will leverage documentation identified in the Propulsion System Integrity Program (PSIP) Master Plan developed in accordance with MIL-STD-3024, *Propulsion System Integrity Program (PSIP)*. The TMS CR shall identify non-compliant criteria and recommended risk level.

b. For derivative propulsion systems, the TMS CR shall only address integration of new components into the propulsion system design or changes in operating environment or mission usage that substantially change an existing certification basis or AW approval.

c. The TMS CE shall notify affected MDS CEs of any identified hazard(s) and shall support MDS risk assessment.

6.5 **Risk Acceptance.** Propulsion system AW risks must be assessed, documented, and accepted IAW AWB-150, *Airworthiness (AW) Risk Assessment and Acceptance*, which directs assessment at the air system level and acceptance by the appropriate air system Risk Acceptance Authority. The MDS CE shall provide propulsion system risk acceptance to the TMS CE. NOTE: Risk acceptance for propulsion systems may occur early in the air system design cycle.

6.6 **Propulsion DAs.** After acceptance of all identified risks, the TAA, or TMS DTA if delegated IAW 6.1, may issue propulsion DAs.

a. Propulsion DAs are either Propulsion Military Flight Releases (P-MFRs) or Propulsion Military Type Certificates (P-MTCs) (see Attachment 1).

(1) Propulsion DAs shall be named and numbered IAW the guidelines in AWB-1009, *Airworthiness Flight Authorizations – Military Type Certificate (MTC)/Military Flight Release (MFR),* replacing the 'MDS' with the 'TMS' designation. It is incumbent upon the TMS CE/DTA to ensure each release is appropriately issued and recorded for tracking.

(2) Propulsion DAs shall identify propulsion system limitations and restrictions that must be observed for safe flight operations. Unless addressed in the ICD, the propulsion design approval will identify applicable terms, conditions, and assumptions regarding propulsion system installation or compliance findings.

b. The TMS DOE/DTA shall issue or obtain a P-MFR prior to propulsion system use for flight test, typically at the propulsion IFR milestone.

c. The TMS DOE/DTA shall issue or obtain a P-MTC prior to propulsion system use during fielded operations, typically at the propulsion ISR milestone.

d. The TMS CE shall provide propulsion DAs to all host MDS CEs.

7. **Air System AW Approval:** MDS CE/DTAs of air systems with new propulsion designs and those impacted by propulsion modifications shall assess integrated air system AW IAW the standard AW process with the following changes:

   7.1 The MDS CE shall initiate the AW process by completing an MDS AW Plan or an ADF considering the new or modified propulsion system design.

   7.2 The MDS CB shall include criteria to address installation and integration considerations, and shall not identify criteria solely applicable in the TMS CB. The MDS CB shall reference the TMS CB in the system description.

   7.3 The MDS CR shall document artifacts, compliance findings, and risks for integration considerations, and shall not identify criteria solely fulfilled by the TMS CR. The MDS CR shall reference the TMS CR and propulsion DA in the system description.

   7.4 Propulsion integration risks must be assessed, documented, and accepted prior to issuance of an MDS AW approval. It is not necessary to re-accept risks assessed, documented, and accepted IAW 6.5.

   7.5 The MDS AW approval shall include appropriate restrictions/limitations considering those noted on the propulsion DA.

8. **Other Considerations:**

   8.1 **TMS Document Control.** TMS DTAs shall institute a tracking system to facilitate configuration management and integration of TMS AW products into MDS AW products.

   8.2 **Updates to Propulsion AW Approvals.** Updates shall be IAW AWB-1009.

   8.3 **MDS-TMS Interface Control:** Maintaining configuration control of the propulsion system and air system functional and physical interfaces is essential to ensuring conformance to the configurations associated with the propulsion DAs and MDS AW Approvals. The MDS/TMS program offices shall establish ICDs during air system development. MDS and TMS PMs must maintain ICDs throughout the system life cycle as described in MIL-STD-3024. For legacy systems that do not have current ICDs, other program documentation (for example: specifications, drawings, and T.O.s) should be consulted to assess interface impacts to AW.

   8.4 **Process Audit:** Audits of TMS DTAs will be performed IAW AWB-1007, *Airworthiness Audit Process*.

8.5 **Legacy Propulsion System Type Certification:** Propulsion systems currently in use must be issued a parent propulsion DA by the TAA prior to issuance of propulsion DAs for modifications. To obtain a parent propulsion DA, TMS CE/DTAs shall send the following to the TMS DOE/DTA:

a. TMS type design definition.
b. List of known TMS risks, assessed IAW Propulsion Center of Excellence Best Practice 99-06, *Aircraft Gas Turbine Engine Flight Safety Risk Management Process*.
c. Proof of risk acceptance.
d. Draft P-MTC identifying configuration, Service Life Limits, and requisite approved operational and maintenance tech data (Flight Manuals/Maintenance TOs/Time compliance Technical Orders (TCTOs), etc.).

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Attachment 1

GLOSSARY OF REFERENCES AND SUPPORTING INFORMATION

References

AWB-150, *Airworthiness (AW) Risk Assessment and Acceptance*, 13 Sep 17
AWB-1007, *Airworthiness Audit Process*, 28 Sep 12
AWB-1009, *Airworthiness Flight Authorizations – Military Type Certificate (MTC)/Military Flight Release (MFR)*, 25 Mar 16
MIL-HDBK-516C, *Airworthiness Certification Criteria,* 12 Dec 14
MIL-STD-3024, *Propulsion System Integrity Program (PSIP),* Incorporating Change 1, 13 Jul 15
P-ADF, P-MFR, and P-MTC, available on the AW Sharepoint site:
https://cs.eis.afmc.af.mil/sites/AeroEngDisciplines/Systems/Airworthiness/default.aspx
Propulsion Center of Excellence (PCOE) Best Practice BB 99-06E, *Aircraft Gas Turbine Engine Flight Safety Risk Management Process*, 1 Mar 16

Abbreviations and Acronyms

ADF – Airworthiness Determination Form
AFI – Air Force Instruction
AW – Airworthiness
AWB – Airworthiness Bulletin
CB – Certification Basis
CE – Chief Engineer
CR – Compliance Report
DA – Design Approval
DOE – Director of Engineering
DTA – Delegated Technical Authority
ICD – Interface Control Document
IFR – Initial Flight Release
ISR – Initial Service Release
FAA – Federal Aviation Administration
MDS – Mission Design Series
P-ADF – Propulsion Airworthiness Determination Form
P-MFR – Propulsion Military Flight Release
P-MTC – Propulsion Military Type Certificate
PSIP – Propulsion System Integrity Program
TAA – Technical Airworthiness Authority
TCTO – Time compliance Technical Order
TMS – Type, Model, Series
TO – Technical Order
USAF – United States Air Force

Attachment 2

TMS TYPE CERTIFICATION PROCESS DIAGRAMS

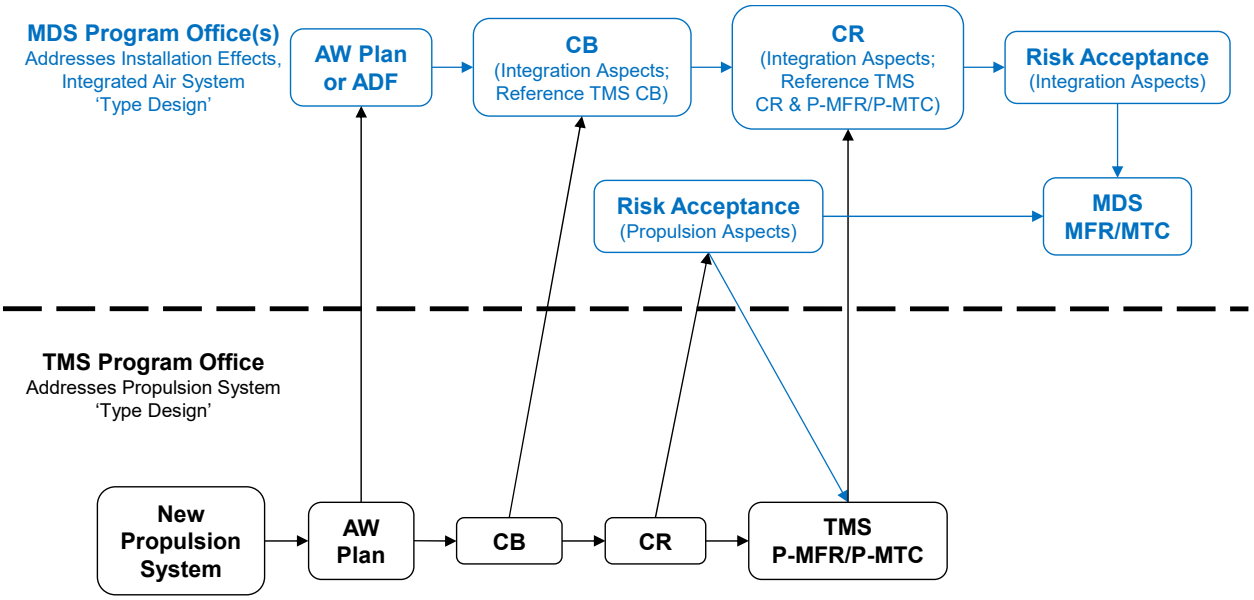

Figure 1. New Propulsion System Type Certification Process

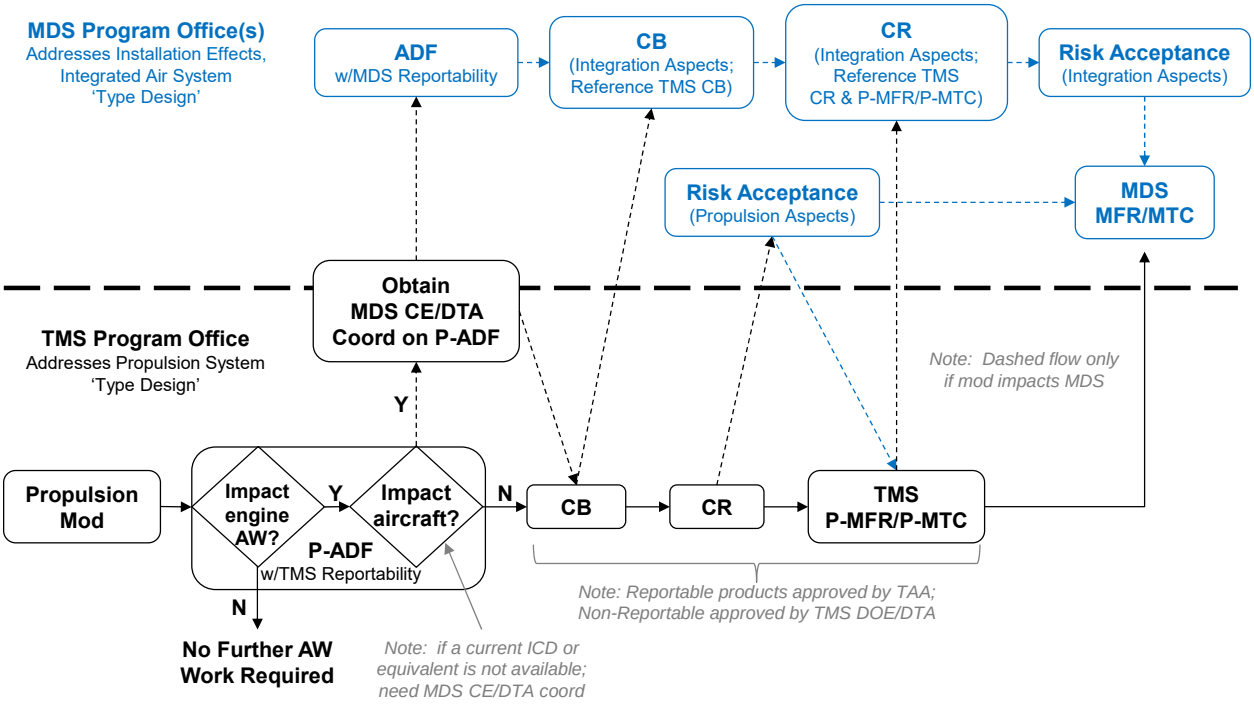

Figure 2. Propulsion System Modification Type Certification Process

Attachment 3

PROPULSION SYSTEM REPORTABILITY CRITERIA

TMS DTAs should use Table 1 and the categories in this attachment to assess propulsion system reportability. The frequency and severity categories used in this attachment are derived from propulsion specific criteria in AFI 20-115 and AFMAN 20-116.

Table 1. Propulsion System Modification Reportability Matrix

HAZARD CATEGORIZATION		SEVERITY*			
		CATASTROPHIC (1)	CRITICAL (2)	MARGINAL (3)	NEGLIGIBLE (4)
FREQUENCY	FREQUENT (A) ≥ 0.5/100K EFH	1	3	7	13
	PROBABLE (B) 0.1-0.49/100K EFH	2	5	9	16
	OCCASIONAL (C) 0.05-0.09/100K EFH	4	6	11	18
	REMOTE (D) 0.01-0.049/100K EFH	8	10	14	19
	IMPROBABLE (E) < 0.01/100K EFH	12	15	17	20

Reportable = AWHI 1-9 in Table 1

Non-Reportable = AWHI 10-20 in Table 1

* **Severity** is the worst credible consequence of a hazard in terms of degree of injury, property damage or effect on mission defined below:

Catastrophic (1): ERLOA / Uncontained Fire / NRIFSD on single- or twin-engine air vehicle / monetary loss ≥ $10M

Critical (2): Uncontained Failure / NRIFSD of one engine on a three-or-more-engine air vehicle / $1M ≤ monetary loss < $10M

Marginal (3): $100K ≤ monetary loss < $1M

Negligible (4): monetary loss < $100K

EFH: Engine Flying Hours

ERLOA: Engine Related Loss of Aircraft

NRIFSD: Non-Recoverable In-Flight Shut-Down - 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. (AFI 91-204, *Safety Investigations and Reports*)

Attachment 4

AIR SYSTEM IMPACT CRITERIA FOR PROPULSION SYSTEM MODIFICATIONS

The TMS CE/DTA should use the following criteria to assess whether a propulsion system modification impacts the air system(s) in which the propulsion system is installed. An air system is impacted if the propulsion system modification:

1. Is driven by a safety issue.
2. Increases safety risk.
3. Affects the ICD.
4. Affects air system operation.
5. Changes propulsion TMS designation.
6. Uses new material in an unproven application.
7. Requires flight test to show compliance.
8. Is determined to be Reportable in the P-ADF.

The TMS CE/DTA should utilize the system's ICD and consider the current modification's interaction with all physical and functional interfaces as well as approved ongoing and planned modification efforts.