



DEPARTMENT OF THE AIR FORCE
HEADQUARTERS AERONAUTICAL SYSTEMS CENTER (AFMC)
WRIGHT-PATTERSON AIR FORCE BASE OHIO

BULLETIN
AWB-007
5 May 2011

United States Air Force (USAF) Airworthiness Bulletin (AWB)-007

Subject: Determining Reportability of Modifications

Attachments: (1) Glossary of References and Supporting Information
(2) Examples of Airworthiness Related Modifications
(3) Modification Risk Assessment Procedure
(4) Director of Engineering (DOE) Annual Determination Report

- 1. Purpose:** This Bulletin provides detailed instructions to Chief Engineers (CE) and Directors of Engineering (DOE) for making airworthiness modification reportability determinations. This bulletin supersedes and provides further clarification for the determination process outlined in Attachment 3 of Air Force Instruction (AFI) 62-601.
- 2. Office of Primary Responsibility (OPR):** USAF Airworthiness Office (ASC/EN). Comments, suggestions, or questions on this bulletin should be emailed to the USAF Airworthiness Office Mailbox (ASC.ESI.Mailbox@wpafb.af.mil).
- 3. Policy:** AFI 62-601 mandates an airworthiness assessment for all aircraft system design changes (i.e., change to type design), operational usage changes, flight envelope changes, and service life extensions. The assessment results in a determination of the modification's impact to airworthiness, and the required level of documentation, independent review, and airworthiness approval. The level of independent technical review required is directly proportional to the level of risk to loss of aircraft, diminished safe operation of the aircraft and/or the airspace, and/or injury to personnel. For higher risk modifications (e.g., significant impact on airworthiness), airworthiness oversight and certification approval comes from an independent Technical Airworthiness Authority (TAA), or from a Delegated Technical Authority (DTA) for lower risk modifications.
- 4. Airworthiness Assessment Methodology:** The first step is to determine whether the modification will affect airworthiness at all. For those modifications that do impact the airworthiness, the second step is to classify the modification as either reportable or nonreportable. When making airworthiness assessments, the Chief Engineer/DTA (CE/DTA) should consider the current modification's interaction with all approved ongoing and planned modification efforts.
 - a. Airworthiness Impact Assessment:** This step can be viewed as an audit of the aircraft equipment and functions to determine if the modification will change them in a way that could impact airworthiness. The airworthiness technical criteria in MIL-HDBK-516B

Distribution Statement A. Approved for public release; distribution is unlimited.

Expanded can be used as a checklist to ensure that all aspects of air system design have been considered. Clearly, if a Critical Safety Item (CSI) is involved, airworthiness must be assessed. Similarly, Table A3.2 of AFI 62-601 and Attachment 2 of this Airworthiness Bulletin give examples of changes that would typically be classified as airworthiness related. The CE/DTA may also use the following noninclusive question set to assist in determining airworthiness impact. A positive response to any of these questions is a strong indication that the modification impacts airworthiness.

- (1) Does the approved certification basis (i.e., applicable criterion, standards and methods of compliance) need to be updated?
- (2) Is reaccomplishment of verification activities required to show compliance to the certification basis?
- (3) Have any existing safety hazards been impacted or have new safety hazards been identified?
- (4) Are any safety-/flight-critical items, logic and/or functions impacted?
- (5) Is formal flight test required?
- (6) Does the operational usage change?
- (7) Does the flight envelope change?
- (8) Does the service life change?

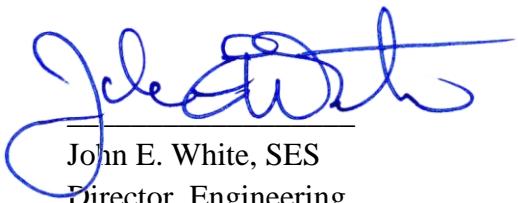
It is important to understand that this is not a simple checklist activity. There is no “cookbook” solution that could be used by a novice to determine whether a modification will affect airworthiness. Will a planned structural change affect structural integrity? Is the software change “significant”? A small modification might have a subtle but critical impact on airworthiness while a large change might have none at all. The task requires a knowledgeable, experienced CE/DTA and a thorough analysis. A further complication is that planning for airworthiness certification occurs in the conceptual phase of a modification when detailed technical data may not be available, particularly for complex modifications. A seasoned CE/DTA can recognize when it is necessary to consult with a technical expert to get insight into a vital issue. Checklists are helpful as a guide but the success of airworthiness certification ultimately hinges on the sound professional engineering judgment and experience of the CE/DTA.

b. Reportability Determination: This step requires the CE/DTA to conduct a risk assessment, then make and document a reportability recommendation to the Director of Engineering/DTA (DOE/DTA) for approval.

- (1) **CE/DTA Recommendation:** The CE/DTA conducts a risk assessment of the potential safety hazard risks per Attachment 3 of this Bulletin. The CE/DTA compiles supporting analysis and rationale, and makes a reportability recommendation to the DOE/DTA for approval. If the risk exceeds the established threshold value, the CE/DTA will recommend that the modification be classified as reportable; otherwise it is nonreportable.

(2) **DOE/DTA Determination:** The DOE/DTA reviews the supporting analysis and rationale and makes the final reportability classification. If the CE/DTA or DOE/DTA determine there are special circumstances that might make an otherwise reportable modification nonreportable (or vice versa), the TAA may be contacted for guidance. The DOE/DTA may contact the TAA for an official ruling of the modification in question by submitting a request through the [ASC/ENSI Mailbox](#). The DOE/DTA documents all reportability determinations as described in paragraph 5 and notifies the CE/DTA.

5. Documentation: DTAs act on behalf of the TAA and therefore must be able to support their determinations. The TAA reserves the right to conduct organizational airworthiness audits. Paragraph 1.3.6.2 of AFI 62-601 requires DOE/DTAs to provide an annual summary report to the TAA of all determinations. A template (see Figure 2) is included in Attachment 4 of this bulletin which shows the required format for the DOE/DTA annual summary report.

A handwritten signature in blue ink, appearing to read "John E. White".

John E. White, SES
Director, Engineering
Aeronautical Systems Center
USAF Technical Airworthiness Authority

Attachment 1

GLOSSARY OF REFERENCES AND SUPPORTING INFORMATION

References

AFI 62-601, *USAF Airworthiness*
AFMCI 62-202, *AFMC Core Criteria for Critical Engineering Positions*
MIL-HDBK-516B, *Expanded ASC/EN Airworthiness Certification Criteria, Expanded Version*
MIL-STD-882, *Standard Practice for System Safety*

Abbreviations and Acronyms

BFDGW – Basic Flight Design Gross Weight
CE — Chief Engineer
CNS/ATM – Communications, Navigation and Surveillance Systems for Air Traffic Management
CSI – Critical Safety Item
DOE— Director of Engineering
DTA—Delegated Technical Authority
D3 – Electromagnetic Environmental Effects
ECP – Engineering Change Proposal
EFVS – Enhanced Flight Vision Systems
EME – Electromagnetic Environment
EMI – Electromagnetic Interference
GVT – Ground Vibration Test
HAZMAT – Hazardous Material
HIRF – High Intensity Radiated Fields
HMI – Hazardous Misleading Information
HUD – Head-Up Displays
IA – Information Assurance
MAC – Mean Aerodynamic Chord
MDS – Mission Design Series
MTC – Military Type Certificate
MTOGW – Max TakeOff Gross Weight
OML – Outer Mold Line
OPR – Office of Primary Responsibility
PO – Program Office
SLEP – Service Life Extension Program
SoF – Safety of Flight
SSOR – Strength Summary and Operating Restrictions
SVS – Synthetic Vision Systems
TA—Technical Airworthiness Authority

Terms

Chief Engineer (CE) - Senior engineer/technical authority for a weapon system or equivalent product; has Operational Safety, Suitability, and Effectiveness (OSS&E) responsibility, as defined in AFMCI 62-202.

Chief Engineer/Delegated Technical Authority (CE/DTA) - Chief Engineer who has been accredited and delegated by the TAA or DOE/DTA to exercise airworthiness authorities as directed by AFI 62-601.

Critical Safety Item (CSI) - A part, an assembly, installation equipment, launch equipment, recovery equipment, or support equipment for an aircraft or aviation weapon system if the part, assembly, or equipment contains a characteristic for which any failure, malfunction, or absence could cause a catastrophic or critical failure resulting in the loss of or serious damage to the aircraft or weapon system, an unacceptable risk of personal injury or loss of life, or an uncommanded engine shutdown that jeopardizes safety. Damage is considered serious or substantial when it would be sufficient to cause a “Class A” accident or a mishap of severity category I. The determining factor in CSIs is the consequence of failure, not the probability that the failure or consequence would occur. Items formerly identified as “flight safety part,” “flight critical part,” “flight-safety-critical aircraft part,” or “safety-of-flight item” are considered a CSI.

Director of Engineering (DOE) - Senior engineer/technical authority responsible for multiple chief or lead engineering positions; ensure programs under their purview address OSS&E; ensures Chief and Lead Engineers assigned to systems/end items within their organization execute responsibilities appropriately; fulfills Chief Engineer responsibilities for systems/end items without an assigned Chief Engineer, as defined in AFMCI 62-202.

Director of Engineering/Delegated Technical Authority (DOE/DTA) - Director of Engineering who has been accredited and delegated by the TAA to exercise airworthiness authorities as directed by AFI 62-601.

Modification - A change to an aircraft system form, fit, function, software logic or interface of an in-service USAF hardware or software configuration item.

Nonreportable Modification – Any permanent or temporary configuration change or alteration to an item, change in capability, or change in mission usage that does not have a potentially significant impact on airworthiness. Requires CE/DTA airworthiness approval as delegated by the TAA supported by engineering data.

Reportable Modification – Any permanent or temporary configuration change or alteration to an item, change in capability, change to the service life, or change in mission usage that has a potentially significant impact on airworthiness.

Reportability Determination - A decision by a DOE/DTA that assigns airworthiness certification approval authority for an aircraft system modification. Reportable modifications require TAA approval; nonreportable modifications are approved by a DOE/DTA.

Technical Airworthiness Authority (TAA)—The AF official authorized to define airworthiness standards, approve the certification basis, issue findings of compliance, and issue Military Type Certificates (MTC) and other flight releases.

Type Design— Description of the physical configuration of similar aircraft systems which, from an airworthiness perspective, are functionally equivalent.

Attachment 2

EXAMPLES OF AIRWORTHINESS RELATED MODIFICATIONS

The following noninclusive list contains a number of examples of the types of modifications which could be classified as airworthiness related.

- **Loads:**
 - Change to the external aerodynamics of the aircraft.
 - A significant change to flight and/or ground loads.
 - Any modification that requires ground loads testing.
- **Dynamics:**
 - Any modification that changes the stiffness of a major aircraft component (wing, horizontal stabilizer, vertical tail, etc.).
 - Any modification that requires a ground vibration test (GVT) and/or a flight flutter test.
 - Any modification that will change the vibration and/or acoustic loading.
 - Any modification that will change dynamic loads.
- **Strength:**
 - Any modification that changes the primary structure internal load paths.
 - Any modification that requires full-scale or large-scale component static testing.
 - Any modification that requires a material allowables development program.
 - Any modification anticipated that affects the strength summary and operating restrictions report (SSOR) and/or the flight manual.
- **Durability and Damage Tolerance:**
 - A change of Certificate Service Life Limit.
 - Any modification that changes the primary structure internal load paths.
 - Any modification that requires a material characterization development program.
 - Any modification that is anticipated to reduce the fail-safe capability.
 - Any modification anticipated to require full-scale or large-scale component durability and/or damage tolerance testing.
- **Mass Properties:**
 - Any modification anticipated to increase the basic flight design gross weight (BFDGW) or max take-off gross weight (MTOGW) by 5%.
 - A shift of the aircraft's center of gravity by more than 1% of the Mean Aerodynamic Chord (MAC).

- **Propulsion:**
 - New centerline engine.
 - Service Life Extension Program (SLEP) modification.
 - Change in engine model designation.
 - Propulsion control system architecture change.
 - New material insertion in CSI applications (unproven in any application).
 - Any change that measurably affects the engine's fit, function, or compatibility with existing aircraft installations.
 - A change in the material or design of highly stressed parts, either rotating, reciprocating, or nonrotating, which is likely to adversely affect the airworthiness of such parts in some fashion.
- **Avionics:**
 - Changes to diagnostic interfaces and processing, or shares resources with flight- and safety-critical diagnostics.
 - Changes to air data system that would impact accuracy of air data parameters.
 - Changes that impact reliability, range (e.g., link margin and antenna coverage), interoperability, and interpretation (display) of SOF datalink subsystems.
 - Changes to navigation data sensors or other navigation system components that affect information necessary for safe operation of the aircraft, or system redundancy and negatively impacting aircraft performance in the event of sensor or component failure or degradation.
 - Changes that implement new communications, navigation and surveillance systems for air traffic management (CNS/ATM) capability or that alters an existing CNS/ATM capability functional design, to include changes to navigation database implementation.
 - Changes to surveillance and collision avoidance type systems (ground and mid-air), to include station keeping/formation flight.
 - Changes to avionics architecture, data buses, and networks that impact flight-critical or safety-critical systems.
 - Changes to the displays, annunciation or critical information presented to the aircrew which may affect situational awareness, aircraft control, weapons launch, etc.
 - Changes to Avionics systems due to deviating from environmental performance envelope or operating limitations.
 - Changes to Head-up displays (HUD), enhanced flight vision systems (EFVS), or Synthetic Vision Systems (SVS) used for primary navigation.
 - Changes to Countermeasure systems.

- **Electromagnetic Environmental Effects (E3):**
 - Addition of any new or relocation of installed electrical/electronic equipment, including electrical harnesses which would change exposure to the electromagnetic environments (EME).
 - Changes to aircraft audio or radio frequency operation characteristics including antenna gains, antenna patterns, transmission power levels which would cause any increase output levels or expand/shift frequency spectrum.
 - Changes to aircraft structure that could affect any designed conduction current paths, electrical bonding features or aircraft electromagnetic shielding characteristics.
 - Changes to electronic equipment at the connector interface or internally that could impact electromagnetic profile or performance. Any changes that affect the equipment enclosure shielding, designed bonding features, filters, circuit design, internal oscillator frequency changes, new layout of circuit boards/traces/components, or chassis and enclosures.
 - Changes to aircraft harness shielding that affect metallic coverage, terminations, shielding material properties or change in length exceeding $\pm 10\%$ of original lengths.
 - Changes in software that affect operating frequency characteristics of equipment.
 - Changes to the aircraft power system, including power sources, distribution, conversion, storage and grounding scheme.
 - Changing wire shielding or components that may affect high intensity radiated fields (HIRF), electromagnetic interference (EMI), or lightning compliance.
- **Safety:**
 - Any modification in response to a safety mishap.
 - Changes that rectify, negatively impact, or introduce a single-point failure into the system.
 - Changes to nuclear certified systems that affect the four key DoD Nuclear Weapon System Safety design standards for hardware and software.
 - Changes involving extensive use of new/alternate/substituted/incompatible materials (e.g., HAZMATs/nano-materials) in safety-critical systems, sub-systems or structure.
 - Changes or modifications which negatively impact the existing fail-safe design of a safety-critical system or subsystem.
 - Changes to support equipment or ground control stations that are made due to Class A or B mishap recommendations.
 - Changes that negatively impact the power sources, controls and critical components of redundant subsystems.
 - Changes which have the potential to introduce/create Hazardous Misleading Information (HMI) to/for the aircrew or ground station operators.

- Changes to software/hardware for safety-critical/flight-critical systems or subsystems.
- **Computer Resources:**
 - New or modified safety-/flight-critical system, hardware, software or function; or one that impacts a safety-critical physical, functional or logical interface.
 - Changes that impact the aircraft's Information Assurance (IA) security posture that could impact safety-critical software and associated systems.
 - Change to processes, procedures, and external interfaces/systems (mission planning, logistics, etc.) that could impact the safety-/flight-critical systems.
- **Maintenance:**
 - Changes affecting maintenance of flight-critical components.
- **Armament Integration:**
 - Changes to laser systems impacting control and radiation.
 - Adding new weapon and/or suspension and release equipment to aircraft.
 - Modification to existing weapon and/or suspension and release equipment which changes outer mold line (OML), mass properties or ballistics.
 - Modifications to interface which affect separation and/or guidance of weapon.

Attachment 3

MODIFICATION RISK ASSESSMENT PROCEDURE

Introduction: This procedure is a deeper look at the hazards that could result from a modification and relies on the engineering judgment of the CE/DTA to properly analyze the potential safety risks and estimate their impact. It borrows some of the structure and language from the mishap risk assessment guidance in MIL-STD-882, but its purpose is different. MIL-STD-882 mishap risk assessment applies to all phases of a system life cycle; it prioritizes risks for the purpose of risk mitigation actions. In contrast, reportability determination applies only to aircraft modifications and usage changes, establishing a single threshold to set the oversight level required for airworthiness certification.

PROBABILITY	SEVERITY			
	Negligible	Marginal	Critical	Catastrophic
Could result in injury or illness not resulting in a lost work day, or minimal environmental damage not violating law or regulation.	Could result in injury or occupational illness resulting in one or more lost work day(s), or mitigable environmental damage without violation of law or regulation where restoration activities can be accomplished.	Could result in permanent partial disability, or injuries or occupational illness that may result in hospitalization of at least three personnel, or reversible environmental damage causing violation of law or regulation.	Could result in death, permanent total disability, or irreversible severe environmental damage that violates law or regulation.	
Frequent: Continuously experienced; likely to occur often in the life of an item, with a probability of occurrence greater than 10^{-1} in that life.				
Probable: Will occur frequently; will occur several times in the life of an item, with a probability of occurrence less than 10^1 but greater than 10^2 in that life.				
Occasional: Will occur several times; likely to occur some time in the life of an item, with a probability of occurrence less than 10^2 but greater than 10^3 in that life.				
Remote: Unlikely, but can reasonably be expected to occur; unlikely but possible to occur in the life of an item, with a probability of occurrence less than 10^3 but greater than 10^6 in that life.				
Improbable: Unlikely to occur, but possible; so unlikely it can be assumed occurrence may not be experienced, with a probability of occurrence less than 10^6 in the life of the item.				



Reportable Modification



Non Reportable Modification



Non Reportable but Requires Additional Review from TAA

Figure 1 - Modification Risk Matrix

- a. The CE/DTA examines the modification including all design and mission usage changes and identifies potential risk hazards. The CE/DTA estimates the unmitigated consequences (i.e., severity) of potential hazards and the probability (i.e., frequency) of occurrence of each. Note that development and qualification activities are expected to mitigate all risks to an acceptable level, but at the outset of the modification, mitigation has not yet occurred; for this purpose, it is necessary to evaluate the unmitigated risk.
- b. If any aspect of the modification has a combination of hazard severity and probability of occurrence that falls in the yellow portion of Figure 1, the modification is classified as reportable. Otherwise, the risk hazard is classified as nonreportable. For risk hazards that fall on the line between reportable and nonreportable (the lower right three blocks marked with a hash), the DOE/DTA should seek an additional review from the TAA.

NOTE 1: Modification Risk Matrix: Figure 1 is derived from MIL-STD-882 and illustrates how modification risk is classified. The horizontal axis defines five hazard categories in terms of the severity of their occurrence. The vertical axis addresses the expected probability of their occurrence. Each block in the matrix is colored yellow or green to indicate if the modification results in a reportable or nonreportable determination.

NOTE 2: System Level Risk Determination: Figure 1 should be applied to the entire aircraft system block upgrade. An aircraft system undergoing modification is comprised of many subsystems, items and parts which may contain numerous safety hazards, each of which has its own combination of expected frequency and consequence. The system level risk determination is at least equal to the greatest individual risk. If there is a chance of interaction between the different hazards, the system level risk may be more than the greatest individual risk. This determination of reportability requires the CE/DTA and DOE/DTA to consider the unique complexity and criticality of each modification and exercise seasoned technical judgment in tailoring their analysis.

Attachment 4

**DIRECTOR OF ENGINEERING (DOE) ANNUAL DETERMINATION
SUMMARY REPORT**

MODIFICATION REPORTABILITY DETERMINATION RECORD						
ORGANIZATION: Organization name/symbol DIRECTOR OF ENGINEERING: DOE/DTA name						
Determination Date	Program Name/ MDS	Chief Engineer	Modificaton/ECP Name	ECP or Mod Tracking Number	Determination Justification File Location (P.O)	Reportable, Non Reportable, or No Impact
Date	System MDS	CE/DTA name	Name	Number	File location	
Date	System MDS	CE/DTA name	Name	Number	File location	
Date	System MDS	CE/DTA name	Name	Number	File location	
Date	System MDA	CE/DTA name	Name	Number	File location	

Figure 2 –Template