



Structures Bulletin

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Subject: Structural Certification Plans for Changes with the Potential to Impact Aircraft Structural Integrity

References:

1. MIL-STD-1530, "Aircraft Structural Integrity Program (ASIP)"
2. AFD 62-6, "USAF Airworthiness"
3. AWB-1015, "Airworthiness Process for Deploying New or Substitute Materials, Processes, and Product Forms"
4. EZ-SB-13-001, "Material, Product Form, and Process Substitution Guidelines for Metallic Components"
5. AWB-003A, "Tailored Airworthiness Certification Criteria/Modification Airworthiness Certification Criteria (TACC/MACC) Document Approval Process"
6. ENFS-SB-05-002, "Joint USAF/USN Aircraft Strength Flight Release Methodology"

Purpose:

MIL-STD-1530 (Ref. 1) establishes the requirement for structural certification updates during the aircraft force management execution phase. The purpose of this Structures Bulletin (SB) is to establish a process for executing this requirement after initial Airworthiness Certification is obtained from the Technical Airworthiness Authority in accordance with AFD 62-6 (Ref. 2).

Discussion:

AWB-1015 (Ref. 3) establishes the Airworthiness process for aircraft material and process substitutions with the potential to impact aircraft structural integrity. AWB-1015 states to use EZ-SB-13-001 (Ref. 4) during the evaluation of these design and process changes and characterizes the technical and programmatic risk for each change. All of these aircraft design and process changes should be supported by a structural certification plan (SCP). In addition, other changes with the potential to impact aircraft structural integrity as described above should be supported by an SCP.

The SCP should be used for both reportable and non-reportable modifications and be completed prior to and be the basis for aircraft structural criteria, standards, and methods of compliance of MACCs (Ref. 5). For design and process changes evaluated by Reference 3, an SCP should be established by each program office sponsoring the changes for consideration by the Change Evaluation Team (CET) required by Reference 3 to develop the optimum plan that integrates all of the certification requirements.

If a modification program, aircraft component replacement (e.g., wing, horizontal stabilizer) or other effort integrates two or more changes, a single SCP can be developed to address all changes.

Scope:

This SB applies to changes with the potential to impact aircraft structural integrity as described below.

1. Aircraft design changes with the potential to impact aircraft structural integrity include but are not limited to: parts consolidation (i.e., unitized construction), addition of new parts, material substitution to include composite part fiber and/or resin, product form substitution, composite part layup, composite part fabrication, fastener substitution, addition of holes or cutouts, addition of conformal fuel tanks, addition of or relocation of antennas/radomes, introduction of new cavities, new joining method (e.g., bonded structure), engine replacement with higher performance, and mass changes to include local impacts such as equipment installations and ballast.
2. Process changes applied to aircraft with the potential to impact aircraft structural integrity include but are not limited to: metal cutting, metal removal, hole drilling, fastener installation, fastener removal, paint removal, plating and coating, etching, chem-milling, machining, heat treating, composite material cure cycle, and engineered residual stresses such as interference fit fasteners, cold expanded holes and laser shock peening.
3. Other changes with the potential to impact aircraft structural integrity include but are not limited to: new or expanded operational capabilities such as new mission types or new mission profiles, and/or new operational environments.

This SB does not apply to “minor” changes that are consistent with aircraft sustainment practices that are already approved. “Minor” changes include but are not limited to:

Repairs based on materials and processes already approved for program use, fastener substitutions already approved for program use, local repairs or modifications designed to improve durability and/or damage tolerance life, cold expansion of holes in similar locations to those already approved, and part or component replacement with same design.

Requirement:

An SCP for each change that has the potential to impact aircraft structural integrity, as described in the scope section, shall be established and approved prior to the decision to implement the change. Each SCP shall address the following as a minimum:

1. Overview

- 1.1. Description of change.
- 1.2. Classification of structure affected by change (e.g., Fracture Critical Traceable, Fracture Critical Non-Traceable, Durability Critical, Normal Controls).
- 1.3. Change effectivity (e.g., aircraft serial number range).
- 1.4. Applicable requirements (e.g., contractual specifications).

2. Scope of Change

- 2.1. Change to mission usage or component usage (e.g., flight control surfaces)?
- 2.2. Change to Outer Mold Line (OML), aerodynamics, or external loads?
- 2.3. Change to internal or external stores?
- 2.4. Change to vibration or acoustic loading?
- 2.5. Change to load paths, stiffness, or load distribution?
- 2.6. Change to weight, weight distribution, or center of gravity?
- 2.7. Change incorporates new material, product form, or process?
- 2.8. Change requires material allowables/characterization development testing?
- 2.9. Change expected to require subcomponent, component, or full-scale ground testing (e.g., static, durability, ground vibration test) to validate analysis?
- 2.10. Change expected to require flight testing (e.g., loads, flutter) to validate analysis?
- 2.11. Change expected to impact strength capability?
- 2.12. Change expected to impact certified service life?
- 2.13. Change expected to impact maintenance requirements?
- 2.14. Change expected to impact repairability, accessibility, inspectability, or interchangeability?

Note: This section is intended to be an overview of the change scope. For questions with a response of “No,” no further information is necessary in this section. For questions with a response of “Yes,” a brief description shall follow the response in this section with additional details provided in the appropriate sections below.

3. Loads

- 3.1. Loads Structural Design Criteria (SDC). This section shall identify any new, or changes to existing, loads criteria from the most current aircraft TACC/MACC such as: maximum vertical load factor, maximum takeoff weight, sink speed at landing, gust loads, thermal loads, and crash loads.
- 3.2. Loads analysis. This section shall describe the loads and/or repeated loads analysis plan along with rationale to support any assumptions.
- 3.3. Loads testing. This section shall describe the testing necessary to develop the loads analysis (e.g., wind tunnel testing, ground vibration testing) and/or to validate the loads analysis (e.g., flight loads flight testing, buffet flight testing, ground loads flight testing, landing gear shimmy testing). If flight and/or ground

loads flight testing is needed, this section shall describe the plan for the strength envelope release based on the methodology described in Ref 6.

4. Dynamics

- 4.1. Dynamics SDC. This section shall identify any new, or changes to existing, dynamics criteria from the most current aircraft TACC/MACC such as: minimum flutter margin, free-play, phase and gain margins for control system feedback loop, uncertainty factor applied to aeroacoustic sound pressure levels, and environmental criteria.
- 4.2. Dynamics analysis. This section shall describe the dynamics analysis plan (e.g., full-span flutter, whirl flutter, panel flutter, aeroservoelastic, divergence and buzz, vibration, sonic fatigue).
- 4.3. Dynamics testing. This section shall describe the testing necessary to develop the dynamics analysis (e.g., wind tunnel testing) and/or to validate the dynamics analysis (e.g. ground vibration testing, control surface rigidity and free-play tests, flutter flight testing, acoustic fatigue testing).

5. Strength

- 5.1. Strength SDC. This section shall identify any new, or changes to existing, strength criteria from the most current aircraft TACC/MACC such as: minimum margins-of-safety, factors (e.g., fitting, casting), allowables basis, no detrimental deformation at X% design limit load (DLL), no initial buckling below Y% DLL, and no permanent buckling below Z% DLL.
- 5.2. Material allowables. This section shall describe the data source or the plans to generate the material allowables to be used in the static strength analysis. If material property testing is planned, the statistical methods and criteria for establishing each property shall be described.
- 5.3. Critical loading conditions. This section shall describe the critical loading conditions.
- 5.4. New design details. This section shall describe any design details that require detailed Finite Element Model (FEM) analysis or require testing to develop an empirical analysis method.
- 5.5. Analysis. This section shall describe the strength analysis plan.
- 5.6. Testing. This section shall describe the strength testing plan (e.g., strength, full-scale static testing, functional proof testing, pressure proof testing, strength proof testing, bird strike testing)

6. Durability and Damage Tolerance (DADT)

- 6.1. DADT SDC. This section shall identify any new, or changes to existing, DADT criteria from the most current aircraft TACC/MACC such as: minimum factor on durability and/or damage tolerance life, damage tolerance design concept, and initial and/or in-service damage size assumptions.
- 6.2. Material properties. This section shall describe the data source or the test plans to generate the material properties to be used in the DADT Analysis (DADTA) and/or for corrosion assessments. If material property testing is planned, the statistical methods and criteria for establishing each property shall be described.

- 6.3. DADT control. This section shall describe any new or changes to existing DADT controls associated with the proposed change such as fracture toughness of each heat lot, updates to material procurement specifications, changes to manufacturing process specifications, etc.
- 6.4. Corrosion Prevention and Control (CP&C). This section shall describe any new, or changes to existing, CP&C requirements associated with the proposed change.
- 6.5. NDI requirements. This section shall describe any new, or changes to existing, NDI requirements for production and/or sustainment.
- 6.6. Primary repeated loads source(s) (e.g., wing root bending).
- 6.7. New design details. This section shall describe any changes in splice design, fastener types, interference fit levels, and any changes to manufacturing build and assembly that have the potential to impact fastener and joint performance. It also shall describe if the design change includes part consolidation, sustained loading in S-T direction.
- 6.8. Analysis. This section shall describe the DADT analysis plan including spectrum development.
- 6.9. Testing. This section shall describe the DADT testing plan (e.g., DADT building block testing, full-scale durability testing, impact damage tolerance testing, corrosion testing).

7. Mass Properties

- 7.1. Mass properties SDC. This section shall identify any new, or changes to existing, mass properties criteria from the most current aircraft TACC/MACC.
- 7.2. Analysis. This section shall describe the mass properties analysis plan.
- 7.3. Testing. This section shall describe the mass properties testing plan (e.g., part weighing, fuel system calibration, aircraft weighing).

8. Force Management

- 8.1. Force Structural Maintenance Plan (FSMP). This section shall describe if an update to the FSMP is anticipated to be required.
- 8.2. Loads/Environment Spectra Survey (L/ESS). This section shall describe if a change to the L/ESS system is anticipated to be required.
- 8.3. Individual Aircraft Tracking (IAT). This section shall describe if a change to the IAT system is anticipated to be required.
- 8.4. Service life limit. This section shall describe if a change to the service life limit included in the airworthiness documents is anticipated to be required.
- 8.5. Economic service life. This section shall describe if an update to the economic service life analysis is anticipated to be required.
- 8.6. Structural risk analysis. This section shall describe if a change to the structural risk analysis is anticipated to be required.
- 8.7. Analytical Condition Inspection (ACI). This section shall describe if any changes to the ACI structural tasks are anticipated to be required.
- 8.8. Aircraft structure teardown inspection. This section shall describe an aircraft structure teardown inspection and evaluation is anticipated to be required.

The ASIP Master Plan shall be updated with information for each change implemented to include the SCP and a summary of the analysis and test results.

Prepared and Approved by:



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