



U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
National Policy

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SUBJ: Major Repair and Alteration Data Approval

This order provides guidance on the responsibilities and requirements for the approval of technical data associated with major repairs or alterations. Types and sources of technical data are discussed. Considerations that must be addressed in the development of technical data to substantiate major repairs or alterations are also addressed. This order does not provide guidance for making decisions on major or minor changes in type design.

A handwritten signature in black ink, appearing to read "Ali Bahrami".

Ali Bahrami
Associate Administrator for Aviation Safety

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Chapter 1. General Information

- 1. Purpose of This Order.** This order provides guidance applicable to the data approval process for major repairs and alterations, including field approvals. The source basis for this order is Title 14 of the Code of Federal Regulations (14 CFR) part 43.
- 2. Audience.** The audience for this order is responsible Flight Standards offices, aviation safety inspectors (ASI), Aircraft Certification Offices (ACO), Aviation Safety Engineers (ASE), designees (Designated Engineering Representatives (DER), Organization Designation Authorizations (ODA), and Designated Airworthiness Representatives (DAR)), and others engaged in the approval process for major repairs, major alterations, and the data associated with each. For the purpose of this order, the use of the term “ASI” includes DARs authorized to approve data in support of major repairs or alterations when performing work in accordance with Federal Aviation Administration (FAA) Order 8000.95, Designee Management Policy.
- 3. Where You Can Find This Order.** You can find this order on the MyFAA employee website at https://employees.faa.gov/tools_resources/orders_notices. Inspectors can access this order through the Flight Standards Information Management System (FSIMS) at <http://fsims.avs.faa.gov>. Air carriers (operators) can find this order on the FAA’s website at <http://fsims.faa.gov>. This order is available to the public at http://www.faa.gov/regulations_policies/orders_notices.
- 4. What This Order Cancels.** FAA Order 8300.16 CHG 1, Major Repair and Alteration Data Approval, dated December 7, 2015, is canceled.
- 5. Scope.**
 - a. Process.** This order defines the process for the approval of technical data for major repairs and major alterations. This order does not provide guidance for making decisions on major or minor changes in type design.
 - b. Definitions.** The use of the terms “major” and “minor” are sometimes inappropriately applied or misunderstood. A major change in type design can be approved only by an ACO or an ODA holder with Supplemental Type Certificate (STC) or type certificate (TC) authorization. A major alteration requires the use of FAA-approved technical data. Minor alterations only require data that is acceptable to the FAA. During an evaluation, an anticipated major alteration may be subsequently classified as a major change in type design, and thus would require application for an amended TC or STC.
 - c. Job Aid.** In order to assist the applicant, the Major Repair and Alteration Data Approval Job Aid associated with this order may be used. The job aid lists those alterations that fall within the authority of this order and those that the FAA has determined must be processed as major changes in type design. The job aid includes description of a reclassification request process applicants may use if they believe a specific change does not warrant the STC process.
- 6. Major Repair and Alteration Data Approval Job Aid.** A job aid associated with this order provides current Aviation Safety (AVS) organization policy for approval methods for specific major repairs and alterations. You may access it from FSIMS—Publications—Other—Job Aids

or via the Aircraft Maintenance Division's (AFS-300) web page at https://www.faa.gov/about/office_org/headquarters_offices/avs/offices/afx/afs/afs300/.

7. Directive Feedback Information. Direct questions or comments to AFS-300 at 202-267-1675. For your convenience, FAA Form 1320-19, Directive Feedback Information, is the last page of this order. Note any deficiencies found, clarifications needed, or suggested improvements regarding the contents of this order on FAA Form 1320-19.

Chapter 2. Field Approval Eligibility

1. Eligibility.

a. Review. ASIs must review the data packages submitted for approval in order to ensure that a field approval is necessary and appropriate. ASIs who deny field approval requests to applicants for alterations or repairs that do not need or qualify for field approvals must explain to the applicant the reason for the denial and, if requested, provide the reason(s) in writing or electronically.

b. Consideration. When determining the basic eligibility of a proposed major repair or major alteration for field approval, the ASI must consider whether the repair or alteration is major or minor. Refer to 14 CFR part 1, § 1.1 and part 43 appendix A.

c. Minor Alterations or Repairs. Minor alterations or repairs do not require FAA-approved data and therefore typically do not receive field approval.

d. Repairs and Alterations. Repairs and alterations that have all the necessary FAA-approved data also do not require field approval.

e. Major Changes. Data supporting major changes in type design are not eligible for approval using the field approval process. Refer to the Major Repair and Alteration Data Approval Job Aid to determine if a reclassification of the change might be justified.

f. Maintenance Program. Data associated with major repairs and alterations to Title 14 CFR part 121-operated aircraft are typically not eligible for approval using the field approval process since owners/operators are required by part 121, § 121.367 to follow their own maintenance program, which includes repairs and alterations. See Chapter 3, Field Approval Process and Data Approval, paragraph 6a, for details.

g. Approved Technical Data. Major alterations and major repairs that have all the necessary DER- or ODA-approved technical data should not require further approval.

h. Field Approval. The field approval process is not authorized for data associated with installation of auxiliary fuel tanks or any other fuel system alterations to which § 121.1117, 14 CFR part 125, § 125.509, and 14 CFR part 129, § 129.117 apply. In addition, data approval using the field approval process is not to be performed for installation of auxiliary fuel tanks or any other fuel system alterations to which 14 CFR part 91, § 91.1507 and §§ 121.1113, 125.507, and 129.113 apply.

i. Limitations. When determining the basic eligibility of a proposed major repair or major alteration for data approval using the field approval process, the ASI must consider limitations that are imposed at aircraft certification and noted on the Type Certificate Data Sheet (TCDS), or that may be the result of issues related to those systems or equipment that have been discovered during the service life of the aircraft and the limitations are mandated by the FAA (e.g., an Airworthiness Directive (AD)).

Chapter 3. Field Approval Process and Data Approval

1. General Information.

a. Data Approval Authority. One of the means used by the FAA to approve technical data that is used to accomplish a major repair or major alteration is through an authorized ASI or other delegated authority. Technical data, when so approved, becomes data approved by the FAA, but it does not constitute a “type design change approval.”

Note: A No Technical Objection (NTO) letter or statement that a particular maintenance or alteration action is “DER approvable” does not constitute FAA approval. However, such a statement when supported along with other technical information may provide the basis for a field inspector or delegate approval. When evaluating the compliance of data representing a particular maintenance or alteration action or continue-in-service condition, the data must include substantiated data to support the approval.

b. Field Approval. Field approvals are a method by which the FAA approves technical data used to accomplish a major repair or a major alteration on a single aircraft. A field approval is a one-time approval limited in application to the product or appliance to which it applies. The overall repair and alteration process is illustrated in Figure 3-1, Repair and Alteration Data Approval Process Overview. Paragraphs 2 through 5 below provide further details on the process contained in Figure 3-1. An authorized FAA ASI or appropriately rated DAR signs block 3 of FAA Form 337, Major Repair and Alteration (Airframe, Powerplant, Propeller, or Appliance), in order to approve the data referenced on the form (refer to Order 8000.95). An ASI may approve the data package only or approve the technical data by physical inspection. See paragraph 5 for details. Appropriately rated designees are limited to data approval only.

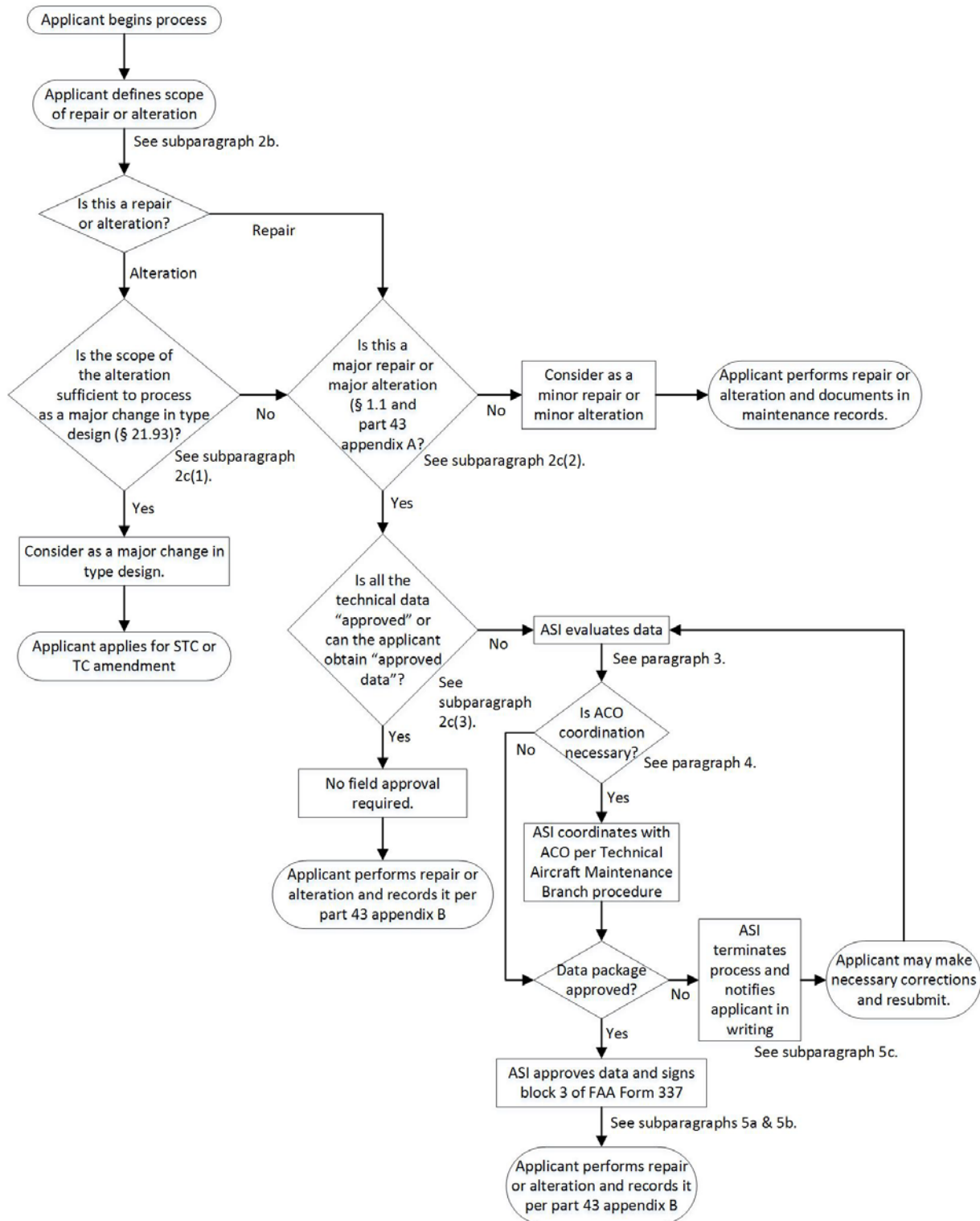
Note: The information and process steps are provided in Figure 3-1 in a specific order to give a logical representation of progression through the major repair or alteration process. This is not meant to imply that one step must follow another in the order presented. Indeed, several actions may take place concurrently or in a different order. Within the limitations described in this order, the field approval process may be one method of data approval associated with this process.

Note: The paragraph numbers next to the blocks in Figure 3-1 correspond to associated paragraph numbers in this order, which provide information in more detail.

Note: An ASI (or an appropriately rated DAR) approves data on FAA Form 337 for a major repair or alteration to a specific aircraft, powerplant, propeller, or appliance. Prior to September 2002, the FAA permitted approval of data on a single FAA Form 337 for use on multiple aircraft. This practice is no longer permitted. However, past multiple approvals can still be used on identical aircraft by the original modifier.

c. Coordination. A field approval may or may not require engineering assistance or coordination with an ACO.

Figure 3-1. Repair and Alteration Data Approval Process Overview



d. Alternative to Field Approval. An alternative to a field approval is approval of all the data by a DER or an ODA. In some cases, multiple DERs may be required when the repair or alteration deals with several disciplines, such as systems and structures. A DER or ODA that is

approving data for a major repair or major alteration must follow paragraphs 2 and 3 of this chapter, as well as Chapters 4 through 8, in making their approvals.

2. Initial Review.

a. Overview. This paragraph presents an overview of the actions an applicant may take when preparing the data package to support a major repair or alteration and the involvement of an ASI when field approval of data is requested.

b. Define the Scope. The applicant may use Advisory Circular (AC) 43-210, Standardized Procedures for Obtaining Approval of Data Used in the Performance of Major Repairs and Major Alterations, or another method acceptable to the FAA, to define the scope of the repair or alteration and develop the associated data.

c. Review and Confirm. The ASI or appropriately authorized designee will review the applicant's package and confirm that the repair or alteration qualifies as a major repair or alteration. The ASI or designee will:

(1) Refer to the Major Repair and Alteration Data Approval Job Aid to confirm that the project is within the scope of a field approval. If it is determined that the alteration requires an STC, inform the applicant to apply for an STC or amended TC (if the applicant is the design approval holder (DAH)).

(2) Confirm that the applicant, in accordance with § 1.1 and part 43 appendix A, properly determined that the repair or alteration is major. Minor alterations and repairs do not need approved data and therefore do not require approval.

(3) When examining the data for the repair or alteration field approval, determine if all of the data for the project has been approved. If all the required data is approved, then a field approval is not required. If all of the required technical data is not approved, then additional approvals (i.e., DER-approved data) or a field approval are necessary. The compliance checklist in AC 43-210 may be used.

d. Explanation of Denial. ASIs or designees who deny data approval requests for alterations or repairs that do not need or qualify for approval must explain to the applicant the reason for the denial and, if requested, provide the reason(s) in hardcopy or electronic form.

3. Data Evaluation.

a. Considerations. This paragraph addresses several general factors that must be considered when evaluating a data package for major repairs and alterations. The following is a summary of considerations:

- (1) Determine the certification basis of product repaired/altered.
- (2) Does the data meet the applicable airworthiness requirements?
- (3) Does the installation meet the requirements of the applicable rules?

(4) Are there any model-specific issues that would affect accomplishment of the proposed major repair or alteration (e.g., an AD or a limitation contained in the TCDS that requires ACO consultation for alteration of specific systems)?

(5) Do the installation instructions provide adequate detail to complete the installation on the aircraft?

(6) Is the intended function described and appropriate for the aircraft? If based on previously approved data, is the intended function the same as was approved by the original data?

(7) Are the current or proposed instructions for continued airworthiness (ICA) or maintenance instructions adequate for the proposed repair or alteration? (See Chapter 5, Maintenance Information and Instructions for Continued Airworthiness.)

(8) Is the equipment being installed required under 14 CFR parts 23, 25, 26, 27, 29, 31, 121, and/or 135?

(9) Is the equipment approved per 14 CFR part 21, § 21.8?

Note: Any installed equipment must still meet the airworthiness requirements of the product on which it is installed.

(10) Has adequate substantiating data been provided?

(11) Is an Aircraft Flight Manual Supplement (AFMS)/Rotorcraft Flight Manual Supplement (RFMS) required? If so, is it provided? (See Chapter 6, Airplane and Rotorcraft Flight Manual Supplements.)

(12) Will a flight evaluation be performed? Has it been addressed in the documentation? (See Chapter 7, Flight Evaluation and Flight Test.)

(13) Have applicable, specific considerations been addressed? (See Chapter 8, Technical Considerations.)

(14) Does the installation or repair affect any special conditions or equivalent level of safety (ELOS) findings? Are those conditions and findings addressed within the supporting data?

Note: This list is not all-inclusive.

b. Aircraft Airworthiness. The applicant must have conducted an evaluation in order to ensure that a proposed repair or alteration will not impact the airworthiness of the aircraft. The applicant will provide verification that the aircraft has been inspected and any aircraft records have been reviewed in order to ensure compatibility of this repair or alteration with previously approved changes to the aircraft.

c. Effect. The technical data that a major repair or alteration may require must be determined based on the specifics of each application. Installation of equipment or a system that does not have a primary function in flight operation, and whose failure would have no adverse effect on the ability of the flightcrew to properly perform their duties and does not involve complex interface, still requires sufficient data to show compliance with the certification basis and all applicable requirements. In contrast, an alteration that, if it failed, would have more serious consequences would require more extensive substantiation and supporting technical data.

d. Compliance with Airworthiness Standards. The repair or alteration data must show compliance with the pertinent certification basis for the aircraft in question. This will include the basic airworthiness standards and, in addition, any special conditions or ELOS findings that may be applicable, including previously accomplished STCs or major alterations.

e. Operational and Equipment Requirements. An alteration's effect on required equipment and the aircraft's operational capability must be considered in the evaluation of the data package. It is important to ensure that an alteration does not inadvertently reduce the operational capability of the aircraft.

4. ACO Coordination Determination.

a. Considerations. This paragraph presents an overview of necessary considerations to determine if engineering assistance is required.

(1) Review the applicant's data package and consult the Major Repair and Alteration Data Approval Job Aid for the approval path to be followed.

(2) The job aid describes methods of approval for typical major alterations. The job aid is not all-inclusive. The ASI must evaluate each project on a case-by-case basis.

(3) Items not listed in the job aid must be independently evaluated.

b. Necessary Data. If the repair or alteration requires additional engineering-approved data, but does not necessitate ACO involvement, the ASI identifies the data necessary to complete the substantiation of the repair or alteration. The ASI will direct the applicant to use AC 21-47, Submittal of Data to an ACO, a DER, or an ODA for a Major Repair or a Major Alteration, for guidance. The applicant must obtain the approved data on FAA Form 8100-9, Statement of Compliance with Airworthiness Standards, or FAA Form 8110-3, Statement of Compliance with Airworthiness Standards, as necessary.

c. ACO-Coordinated Field Approval.

(1) A coordinated field approval is one in which an ASI requests FAA engineering to provide an evaluation of the proposed repair or alteration and accompanying technical data. The ASI requests a concurrence or nonconcurrence for approval of the technical data.

(2) A coordinated field approval is initiated when it is determined that a proposed repair or alteration (project) may, because of its scope and complexity, be beyond the expertise of an ASI to approve data. The ASI "coordinates" the field approval with an ACO. Alterations

requiring an AFMS/RFMS may have to be coordinated with the ACO unless ASIs have been specifically authorized to sign the document(s).

(3) An ASI requests ACO engineering assistance following the responsible Flight Standards office's or Technical Aircraft Maintenance Branch's procedure. The ASI should submit a copy of the entire package and identify the elements of the project that require ACO participation. A designee must coordinate with their appropriate FAA managing advisor for the procedures to communicate with other lines of business.

(4) If the ACO determines that the intended alteration introduces a major change to the type design requiring application for an STC, the ASI must officially notify the applicant that the field approval request is no longer appropriate and direct the applicant to contact the ACO directly.

(5) If the repair or alteration requires additional engineering-approved data, the ACO will identify the needed information to the ASI who will then coordinate with the applicant to obtain that data.

(6) If ACO coordination is necessary, the written ACO concurrence (e.g., memo or email) becomes an attachment to FAA Form 337.

5. Data Package Approved/Denied for Field Approval.

a. Approval for Data Package Only. If the repair or alteration data substantiates that the repaired or altered product will comply with the applicable airworthiness regulations, record data approval by entering the appropriate statement and signing block 3 of FAA Form 337; then return both copies to the applicant. When recording FAA approval in block 3, the following statement from AC 43.9-1, Instructions for Completion of FAA Form 337, should be used:

“The data identified herein complies with the applicable airworthiness requirements and is approved for the above described aircraft, subject to conformity inspection by a person authorized in section 43.7.”

b. Approval of Technical Data by Physical Inspection. ASIs may schedule a physical inspection with the applicant in order to verify workmanship and conformance to the data submitted. If the repair or alteration complies with regulations, record the repair or alteration approval by entering the appropriate statement and signing block 3 of FAA Form 337; then, return copies to the applicant. When recording FAA approval in block 3, the following statement from AC 43.9-1 should be used:

“Approval by Physical Inspection, Demonstration, Testing, etc.—One Aircraft:
The alteration or repair identified herein complies with the applicable airworthiness requirements and is approved for the above described aircraft, subject to conformity inspection by a person authorized in section 43.7.”

Note: An ASI (or an appropriately rated DAR) approves data on FAA Form 337 for a major repair or alteration to a specific aircraft, powerplant, propeller, or appliance. Prior to September 2002, the FAA permitted approval of data on

a single FAA Form 337 for use on multiple aircraft. This practice is no longer permitted. However, multiple approvals can still be used on identical aircraft by the original modifier.

c. Denial of Proposed Repair or Alteration Approval. If the applicant is unwilling or unable to comply with the requirements to obtain the requested field approval, terminate the process by notification in writing to the applicant. This notification must include the reason for denial. The applicant may be given the opportunity to make necessary corrections within a reasonable amount of time from receipt of notification.

6. Variations to the Field Approval Process.

a. Airplanes TC'd Under Part 23 or Part 25—Operated Under Part 121.

(1) Field Approval Eligibility. These aircraft, although not specifically prohibited from having data approved by field approvals, are not generally eligible, since owners/operators are required by § 121.367 to follow their own maintenance program, which includes repairs and alterations. Field approval of data may be performed on these aircraft for extenuating circumstances, and each request must be evaluated on a case-by-case basis. If an ASI from a responsible Flight Standards office believes that a field approval request is appropriate, the responsible Flight Standards office will obtain concurrence from the appropriate Air Carrier Safety Assurance Office prior to performing the approval. Designated Airworthiness Representatives-Maintenance (DAR-T) are prohibited from performing these types of approvals.

(2) Field Approval Database. The cognizant Air Carrier Safety Assurance Office will maintain a database of field approvals accomplished on aircraft operated under part 121 for which it either concurred or nonconcurred. This database will contain:

- (a) A unique control number for each instance;
- (b) The date of concurrence or nonconcurrence;
- (c) The name of the ASI assigned to field approve the data;
- (d) The responsible Flight Standards office's routing symbol;
- (e) An indication of concurrence or nonconcurrence;
- (f) The air carrier identifier;
- (g) The make and model (M/M) of the aircraft; and
- (h) A brief description of the requested approval.

b. Commercial Derivative Aircraft (Military). TC'd aircraft operated by or for the U.S. military require special consideration when approving data by field approvals due to the complexity of the aircraft and systems. Coordinate any request for field approval of data through the FAA Military Certification Office (MCO). The MCO must provide a concurrence that the

proposed data is compatible with previously installed systems or design criteria. In general, the MCO discourages the use of field approval of data on military aircraft.

c. Incomplete or Incremental Installations.

(1) Conditions and Limitations. If the applicant intends that the aircraft operate for an unspecified period of time (per § 91.213) or without complete equipment or system functionality, then installations of such equipment or components are considered incomplete or incremental. Installation of equipment or components, such as racks, wiring, circuit breakers, hard-points, etc., may be accomplished and may be eligible for field approval of data if it is determined that the installation is a major alteration to an aircraft. Such aircraft having been altered may receive approval for return to service only if the following have been accomplished:

(a) All applicable technical data was FAA-approved prior to performance of the installation;

(b) The determination that the incomplete or incremental installation does not adversely affect safe operation of the aircraft;

(c) The equipment or components as installed remain deactivated and appropriate placards have been affixed to prohibit use of such equipment or components;

(d) Aircraft Weight and Balance (W&B) data reflects the incomplete installation; and

(e) The aircraft maintenance records and FAA Form 337 for the work that was actually accomplished is complete and signed.

Note: In order to maintain a current airworthiness certificate, the approval for return to service must be accomplished by a person authorized in part 43, § 43.7.

(2) Conformity Inspection. The applicant must conduct a conformity inspection on the completed alteration and submit an FAA Form 337 with complete installation description in block 8. FAA approval of the incremental installation data may provide for use of installed equipment if the FAA can determine that such equipment can be used safely (e.g., may require placards, AFMS/RFMS, or crew training).

d. Transport Canada. Transport Canada Civil Aviation (TCCA) or TCCA designee-approved repair data is considered FAA-approved for use on aircraft registered in the United States, or on engines, propellers, or articles used on U.S.-registered aircraft. Refer to FAA Order 8110.53, Reciprocal Acceptance of Repair Design Data Approvals Between FAA and TCCA, for more information.

e. Reversal of STC or Major Alteration. Occasionally, a request to remove an installed STC or major alteration may be made. When the alteration was originally accomplished, an FAA Form 337 and accompanying data was submitted to record the configuration change. Similarly, the restoration must be recorded via FAA Form 337, including consideration of any accompanying documentation used in the original alteration. If the original FAA Form 337 data included restoration instructions, then a new FAA Form 337 would not be required. In some

cases, the original FAA Form 337 may have been submitted only to record approval of an AFMS/RFMS. The removal of the supplement must be recorded via FAA Form 337 and may require ACO or ASI approval.

Note: For removal of a major alteration, whether installed by the manufacturer in production or post-production by an STC, removal of the alteration requires an FAA Form 337 unless the removal instructions are provided with the STC or as part of the production.

f. Major Repairs and Alterations for Engines and Propellers. Major repairs and alterations can also be performed on engines and propellers. The repair or alteration is documented on FAA Form 337, but it is not recorded until the engine or propeller is installed on an aircraft. Refer to AC 43.9-1.

Chapter 4. Data

1. Introduction. This chapter provides guidance related to the sources, use, and approval of data used to substantiate an aircraft major repair or major alteration.

2. Types of Technical Data. In the context of this order, technical data means the drawings, specifications, and other material that provide the description and substantiation of an aircraft repair or alteration. There are several ways in which data may be labeled and described.

a. Descriptive Data. Descriptive data describes the design of the repair or alteration. Descriptive data should include reference to installation methods, materials, fabrication processes, dimensions, and tolerances. It may also include intended function and how the alteration is appropriate to the aircraft.

b. Substantiating Data. Substantiating data shows that the design complies with the applicable regulations and that all appropriate technical considerations have been addressed.

c. Acceptable Data. Acceptable data means data acceptable to the FAA. The terms “acceptable to the Administrator” and “acceptable to the FAA” appear numerous times in the maintenance regulations. They refer to any item addressed in the regulation (e.g., data; methods, techniques, and practices; manual contents; tools; materials; equipment, etc.) that must meet regulatory standards. If the regulation requires only that an item must be “acceptable to,” it does not necessarily follow that the FAA requires the item to have specific FAA review and acceptance before it may be used. A person making a determination of whether an item is “acceptable to” the agency must ensure the item addresses specific applicable section(s) of the regulations.

d. Approved Data. Approved data means data approved by the FAA. The term “approved” is based on § 1.1, which states, “Approved, unless used with reference to another person, means approved by the FAA or any person to whom the FAA has delegated its authority in the matter concerned, or approved under the provisions of a bilateral agreement between the United States and a foreign country or jurisdiction.” For the FAA ASI, “approved” or “approved by” means the item (e.g., data; methods, techniques, and practices; manual contents; tools; materials; equipment, etc.) is required to be and has been reviewed and formally approved by the FAA (or appropriate Civil Aviation Authority (CAA)). Approvals are granted only by letter, by a stamp of approval, by the issuance of operations specifications (OpSpecs), or by other official means. All data used to substantiate a major repair or alteration, regardless of the source, must be approved before being used.

e. Previously Approved. This term refers to data that was approved for a specific purpose, such as an STC or major alteration on an aircraft, powerplant, propeller, or appliance. All previously approved data has to be applicable to the requested major repair or alteration. All differences, deviations, inclusions, and exclusions between the original use of the data and the current one must be considered before the data can be approved for use. Figure 4-1, Possible Resources for Approved Data Relevant to Major Repairs or Major Alterations, identifies possible

sources of previously approved data that may be relevant to a major repair or major alteration. Figure 4-1 is not all-inclusive.

(1) Previously approved data on FAA Form 337 for a single product identified in block 1 may be used to substantiate a similar repair or alteration on a different product or article, but it must be evaluated for each new application to determine if, and how much of, the data can be directly approved. Reference to the previous FAA Form 337 itself does not constitute substantiation; the actual data must be available if requested.

(2) Previously approved data may also refer to data that has been approved for use on multiple products or articles. In this case, further review or approval of that data would not be necessary for the products or articles identified in the approval.

(a) An example of this would be data approved by a DER on FAA Form 8110-3 that is applicable to more than one specific serial number aircraft.

(b) Another example would be technical data contained in a repair specification (RS). RS provide an alternative to major repair technical data. Approval as an RS is required for multiple-use major repairs that do not come from the DAH and do not specifically identify serial numbers of all the products or parts currently in need of repair to which the RS applies. Refer to FAA Order 8110.37, Designated Engineering Representative (DER) Handbook, and FAA Order 8300.13, Repair Assessment Program, for more details on RS.

f. Multiple Use Data. An ASI (or an appropriately rated DAR) approves data on FAA Form 337 for a major repair or alteration to a specific aircraft, powerplant, propeller, or appliance. Prior to September 2002, the FAA permitted approval of data on a single FAA Form 337 for use on multiple aircraft. This practice is no longer permitted. However, existing multiple approvals can still be used on identical aircraft by the original modifier.

Figure 4-1. Possible Resources for Approved Data Relevant to Major Repairs or Major Alterations

TCDS. Refer to FAA Order 8620.2, Applicability and Enforcement of Manufacturer's Data, for guidance.
<p>Repair data from AC 43.13-1, Acceptable Methods, Techniques, and Practices—Aircraft Inspection and Repair, may also be used as approved data, and the AC chapter, page, and paragraph listed in block 8 of FAA Form 337 when the user has determined that it is:</p> <ul style="list-style-type: none"> • Appropriate to the product that receives repairs; • Directly applicable to the repair being made; and • Not contrary to the airframe, engine, propeller, or appliance manufacturer's repair data or instructions.
<p>Alteration data from AC 43.13-2, Acceptable Methods, Techniques, and Practices—Aircraft Alterations, may be used as approved data for major alterations when the AC chapter, page, and paragraph are listed in block 8 of FAA Form 337 when the user has determined that it is:</p> <ul style="list-style-type: none"> • Appropriate to the product being altered; • Directly applicable to the alteration being made; and • Not contrary to the airframe, engine, propeller, product, or appliance manufacturer's data.
ADs.
Appliance manufacturer's manuals or instructions, unless specifically not approved by the FAA, may be used as approved data for major repairs.
Data describing an article used in an alteration which is FAA-approved under a Parts Manufacturer Approval (PMA).
Data developed during the FAA authorization of an article for production under a Technical Standard Order (TSO) when applicable to the repair or alteration intended.
Data in the form of an appliance type approval issued by the Minister of Transport Canada for those parts or appliances for which there is no current TSO available. The installation manual provided with the appliance includes the environmental performance qualification statement.
DER-approved data, including repair specifications, within the limitations listed on the DER's authorization (see chapter 9, paragraph 5).
ODA-approved data, within the limitations of the ODA holder's procedures manual (see chapter 9, paragraph 6).
FAA-approved portions of Structural Repair Manuals (SRM).
FAA-approved Service Bulletins (SB) and Service Letters (SL) or similar documents as documented in AC 20-77, Use of Manufacturers' Maintenance Manuals.
Foreign bulletins, for use on U.S.-certificated foreign-designed aircraft, when approved by the foreign authority within the provisions of a bilateral agreement with the United States or as listed in the TCDS notes.
<p>Original aircraft manufacturer's service and repair data in accordance with current regulations, for major repairs on nonpressurized elements of aircraft that are 12,500 pounds or less maximum certificated takeoff weight provided the person intending to perform such repair determines that:</p> <ul style="list-style-type: none"> • Data is appropriate for the specific M/M aircraft being repaired; • Data is applicable to the specific M/M aircraft being repaired; and • The repair does not deviate from the manufacturer's methods, techniques, and practices.

Figure 4-1. Possible Resources for Approved Data Relevant to Major Repairs or Major Alterations (Continued)

United States Department of Commerce (DOC) Form ACA-337, Major Repair and Alteration, dated prior to October 1, 1955, provided the data is appropriate, directly applicable, and not contrary to regulatory requirements.
STC data, including that for approved model list (AML) STCs, may be used, if applicable, to substantiate a major alteration on a different aircraft.
FAA Form 337, used by the original alterer for approval of multiple identical aircraft.
<p>Note: Maintenance manuals issued by DAHs, Production Approval Holders (PAH), and certain supplier manuals (i.e., those for which the supplier is the actual designer and producer of an article that is approved under 14 CFR part 21) were developed using part 21 approved technical data. This technical data remains FAA-approved provided the design change requirements of part 21 are followed. Therefore, it does not require reapproval when a major repair or major alteration is performed in accordance with these maintenance manuals.</p>

(3) Previously approved data may not be directly applicable to repair or alteration of certain products or appliances. For example, such data may identify a location to which an appliance or component part cannot be located due to a mounting conflict or configuration differences. Relocation may be considered a deviation from the previously approved data. In these instances, the ASI must consider the deviation and, if appropriate, may consult with the cognizant ACO responsible for issuance of the TC or STC. Consideration for field approval may occur provided that the applicant can show that the alteration meets the certificated characteristics with regard to aerodynamic function, structural strength, resistance to vibration, and deterioration, and that other qualities affecting airworthiness are not adversely affected. Minor deviations from previously approved data do not require reapproval. The aircraft records must identify and include such deviations.

(4) Data that was approved for alteration of a particular product type (e.g., part 25 aircraft) may be used to provide substantiation for a similar alteration on a different product type (e.g., part 23 aircraft). Typically, data that meets a more stringent airworthiness standard when applied to an alteration requiring a less stringent airworthiness standard is normally acceptable. The same is not true for the application of a less stringent airworthiness standard to an alteration requiring a more stringent airworthiness standard—while not specifically prohibited, it is not recommended. For example:

(a) STC for a part 23, Single-Engine Land (SEL) aircraft to another aircraft of the same M/M. In this situation, there is a strong probability that the data developed for the first aircraft is directly applicable to the second.

(b) STC for a part 23, SEL aircraft to a part 23 aircraft of a different M/M. In this situation, the two aircraft would have to be compared for equivalency, and depending on that determination, the data may be directly or partially applicable.

(c) STC for a part 23, SEL aircraft to a part 25 aircraft. In this situation, since there are two different airworthiness standards involved, an extensive evaluation must be performed in order to ensure that the data for the first aircraft meets the requirements for the second.

(5) Use of STC data to substantiate a major repair or major alteration requires extra considerations. Exercise caution when approving STC data for alteration of an aircraft of a different type design. STCs are issued for major changes in type design of a specific product design. Incorporation of that alteration on a different design will likely introduce a major type design change to that product. This would require application for an STC or addition of that model to an approved model list (AML) STC. If an STC is being installed directly, further approval may not be required. If the STC data is being used to do something similar to “part” of the STC, then the existence of the STC may be adequate substantiation, but the applicant also needs descriptive data. Per § 91.403(d), if the applicant is not the STC holder, the applicant must have written permission from the STC holder to alter an aircraft based on the STC.

(6) Care should be taken regarding the use of any previously approved data used in a different application. Even in situations where the reuse of data appears appropriate, there are many things to consider before approving the data for the new application, including:

(a) Differences in certification basis. The data may have been originally approved under a certification basis different than the one for the new application of the data. Different amendments of regulations (either newer or older) or new regulations may be applicable to the new application.

(b) ADs. The repair or alteration may affect systems or structures that are the subject of an AD. There may be ADs that are applicable to the new application that were not applicable to the original application. In these situations, an alternative method of compliance (AMOC) may be appropriate.

(c) Special conditions. The original approval may have included special conditions that affect the proposed alteration.

(d) ELOS findings. The original approval may have been based on an ELOS finding.

Note: The ASI must be especially attentive to the existence of any special conditions or ELOS findings that apply to the aircraft and their impact on the proposed alteration.

(e) Exemptions. The original approval of the data may have been based on an exemption to regulations. If so, the applicable rule must be complied with or a request for an exemption must be submitted.

(f) Any adverse interaction with other changes to the product must be addressed.

(g) Any added function.

(h) Any differences in selected or programmed functions.

Chapter 5. Maintenance Information and Instructions for Continued Airworthiness

1. Repair or Alteration Data Package.

a. Continued Airworthiness. The FAA has determined that the major repair or major alteration data package must address how the major repair or alteration affects continued airworthiness. If the major repair or alteration does not affect continued airworthiness, then the applicant must state such. If the major repair or alteration affects the ICA, then the applicant must develop maintenance information which addresses those changes. If the major repair or alteration affects the Airworthiness Limitation Section (ALS) of the ICA, then that maintenance information that affects the ALS must be approved by the FAA (e.g., by the ACO or ODA).

b. Maintenance Information. The purpose of maintenance information is to provide adequate instructions to maintain the altered product in an Airworthy condition.

c. Maintenance Information Checklist. The maintenance information checklist (see Figure 5-1, Major Repair or Major Alteration Maintenance Information Checklist) is a guide for the applicant who develops maintenance information in accordance with methods, techniques, and practices acceptable to the FAA.

d. Advantages of Maintenance Information Checklist. The maintenance information provides the aircraft owner or operator with the following advantages when it is included in block 8 of FAA Form 337:

(1) The major alteration and reference to the maintenance information are contained in one document;

(2) The maintenance information becomes a permanent aircraft record, as required by § 91.417(a)(2)(vi); and

(3) The owner or operator can contact the FAA registry for a replacement FAA Form 337 if the maintenance information is lost or destroyed. The owner or operator may also forward a previously completed FAA Form 337 and the associated maintenance information if it is not currently in the registry.

e. Future Inspections. The additional reference to the presence of maintenance information as part of the major alteration in the aircraft's maintenance entry will ensure that maintenance personnel appropriately address maintenance of the major repair or alteration during future inspections.

2. Data Approval of Major Alterations Under the Civil Air Regulations (CARs). For field approval of major alteration data to aircraft, engines, and propellers certificated under the CARs, the maintenance information must meet the original certification basis. In cases where the major alteration adds new items which the CARs requirements did not address, the major alteration must meet the applicable 14 CFR requirements. The checklist in Figure 5-1 provides acceptable guidance for these types of installations that require additional maintenance, or inspections not covered by the Original Equipment Manufacturer's (OEM) instructions.

Figure 5-1. Major Repair or Major Alteration Maintenance Information Checklist

A/C Make _____	Model _____	S/N _____	Reg. #N _____
Revision: _____	Date: _____	System: _____	
Item	Subject		
1.	Introduction: This section briefly describes the aircraft, engine, propeller, or component that has been altered. Include any other information on the content, scope, purpose, arrangement, applicability, definitions, abbreviations, precautions, units of measurement, referenced publications, and distribution of the maintenance information, as applicable.		
2.	Description: Describe the major alteration and its functions, including an explanation of its interface with other systems, if any.		
3.	Control, operation information, or special procedures, if any.		
4.	Servicing information: Such as types of fluids used, servicing points, and location of access panels, as appropriate.		
5.	Maintenance instructions: Such as recommended inspection/maintenance periods in which each of the major alteration components are inspected, cleaned, lubricated, adjusted, and tested, including applicable wear tolerances and work recommended at each scheduled maintenance period. This section can refer to the manufacturer's instructions for the equipment installed where appropriate (e.g., functional checks, repairs, and inspections). It should also include any special notes, cautions, or warnings, as applicable.		
6.	Troubleshooting information: Information describing probable malfunctions, how to recognize those malfunctions, and the remedial actions to be taken.		
7.	Removal and replacement information: This section describes the order and method of removing and replacing products, parts, and any necessary precautions. This section should also describe or refer to manufacturer's instructions to make required tests, trim checks, alignment, calibrations, center of gravity (CG) changes, lifting, or shoring, etc., if any.		
8.	Diagrams: Of access plates and information, if needed, to gain access for inspection.		
9.	Special inspection requirements: Such as x-ray, ultrasonic testing, or magnetic particle inspection, if required.		
10.	Application of protective treatments: To the affected area after inspection and/or maintenance, if any.		
11.	Data: Relative to structural fasteners such as type, torque, and installation requirements, if any.		
12.	List of special tools: Special tools that are required, if any.		
13.	For commuter category aircraft: The following additional information must be furnished, as applicable: A. Electrical loads. B. Methods of balancing flight controls. C. Identification of primary and secondary structures. D. Special repair methods applicable to the aircraft.		

**Figure 5-1. Major Repair or Major Alteration Maintenance Information Checklist
(Continued)**

14.	Recommended overhaul periods: Are required to be noted on the maintenance information when an overhaul period has been set by the manufacturer of a component or equipment. If there is no overhaul period, the maintenance information for item 14 should state, “No additional overhaul time limitations.”
15.	ALS: Include any approved airworthiness limitations (AL) identified by the manufacturer or FAA Certificate Management Aircraft Certification Office (CMACO) (e.g., an STC incorporated in a larger field-approved major alteration may have an AL). The FAA inspector will not establish, alter, or cancel ALS without coordinating with the appropriate FAA CMACO. If there are no changes to the ALS, the maintenance information for item 15 should state, “No additional airworthiness limitations” or “Not applicable.”
16.	Maintenance information is required to be acceptable to the FAA. As such, changes should be documented by submitting the revised maintenance information along with the original FAA Form 337 to the Aircraft Registration Branch in Oklahoma City. An entry in the aircraft records should indicate the current revision.

3. Maintenance Instruction Requirements. The maintenance instruction requirements for a major alteration are very similar to those for an STC except that an applicant for an STC must produce ICA. Changes that affect the ALS must be approved by the cognizant ACO or a qualified ODA. Changes that affect the certificated life limit of a part are major changes to type design and must not be field-approved. The vast majority of major alterations approved by the field approval process are simplistic in design and execution. Therefore, the applicant’s maintenance information may not need as much detail as it would for a complicated STC. If the manufacturers’ instructions are not available, the applicant may use FAA publications such as AC 43.13-1, Acceptable Methods, Techniques, and Practices – Aircraft Inspection and Repair; AC 43.13-2, Acceptable Methods, Techniques, and Practices – Aircraft Alterations; part 43 appendix D, or other applicable aviation standards that aid in developing the maintenance instructions.

4. Changes to Maintenance Information After Approval. If owners or operators wish to formally incorporate maintenance information developed for existing major alterations, they may do so using the revision process in checklist item number 16 in Figure 5-1.

5. Maintenance Information Procedures.

a. Description of Maintenance Information. Each major alteration that requires additional maintenance or inspections not covered by acceptable OEM’s instructions must have maintenance information prepared in accordance with methods, techniques, and practices acceptable to the FAA. The description of the maintenance information prepared will be documented on FAA Form 337. The ASI, DAR, DER, or ODA will advise the applicant that the entry for the major alteration in the aircraft’s maintenance records required by § 43.9 must also include a reference to the maintenance information and be identified by the approval date of the FAA Form 337 on which the instructions are documented. The form will be kept in the aircraft’s permanent records, in accordance with § 91.417(a)(2)(vi).

b. Supporting Data. If the applicant employs a DER or ODA to provide approved technical data to support a major repair or major alteration, then the applicant is responsible for ensuring that the DER or ODA is authorized to approve such technical data, as applicable to the repair or alteration. If the data, as approved, addresses the entire repair or alteration, and all of the requirements of parts 21 and 43 are met, there is no requirement for any further approval by the ASI. If the repair or alteration data is approved solely by the DER, ODA, or DAR, but necessitates maintenance instructions, the maintenance instructions should be prepared by the applicant and recorded in block 8 of FAA Form 337.

6. Develop the Maintenance Information.

a. Approval Request. The applicant is to develop the maintenance information and present it in conjunction with the approval request. The maintenance instructions provide the aircraft owner or operator with the advantages contained in subparagraph 1d. Additional guidance is provided in AC 43-210.

b. Guidance. The applicant should use Figure 5-1 as a guide that will help ensure that all the applicable requirements are met.

c. Continued Airworthiness. The maintenance information must include specific instructions that describe how to maintain the affected area in order to ensure continued airworthiness. For example, the maintenance information might include a new requirement for a special inspection to be accomplished during each 100-hour or annual inspection. Such maintenance information must also include installed appliances that may impact maintainability of the product or require periodic maintenance to ensure their continued performance. When appropriate, the maintenance information should also include specific instructions for determining excessive wear or deterioration, troubleshooting information, installation and removal procedures, and functional checks. Servicing requirements, such as recommended fluid change intervals or lubrication schedules, should also be included.

Note: For DER- or ODA-approved data, the applicant is responsible for preparing maintenance information acceptable to the FAA, and when done in accordance with Figure 5-1, is considered acceptable to the FAA.

d. Maintenance Information Approval. In the instances that a repair or alteration must meet part 26 requirements for support of the continued airworthiness of and safety improvements for transport category airplanes, only the ACO may approve the maintenance information developed. (See chapter 8, paragraph 12 for additional information on part 26.) The maintenance information must contain:

- (1) Inspection tasks and task intervals;
- (2) Instructions and procedures to accomplish the tasks, which are contained in the Aircraft Maintenance Manual (AMM); and
- (3) Protection and caution instructions and information, which are contained in the standard wiring practice manual (SWPM).

Chapter 6. Airplane and Rotorcraft Flight Manual Supplements

1. General Information. This chapter provides guidance for approval of AFMs required for major repairs or alterations that affect the existing Airplane Flight Manual (AFM) or Rotorcraft Flight Manual (RFM). While manual supplement approval may be accomplished in conjunction with alteration data approval, it is a separate process.

2. AFMs/RFMs. Aircraft operating procedures and performance limitations are provided in one of the following forms:

- AFM (including either AFM or RFM);
- Markings or placards; or
- Combinations of the above.

3. Manual Supplements. Repairs or alterations that result in a change to limitations, procedures, performance, or loading information from the current AFM/RFM or placards require that revised or supplemental information is provided by one of the following methods:

a. Supplemental Information. If the aircraft has an AFM or RFM, the supplemental information must be provided in an AFMS, RFMS, or Supplemental Aircraft Flight Manual (SAFM). For the purposes of this guidance, AFMS/RFMS include SAFMs, as well. An SAFM is used to complement a pilot's operating handbook (POH), which may not have specific FAA approval. The procedures for creating and approving an SAFM are the same as those for an AFMS/RFMS.

b. Presenting Supplemental Information. The supplemental information may be presented as modified or additional markings and placards in aircraft that were TC'd before AFMs/RFMs were required.

c. Data from a Previous Approval. Major alterations based on data from a previous approval must include an AFMS/RFMS if the previous approval provided for one. The supplement must contain the same pertinent details as the supplement approved under the original alteration and be consistent with the format of that supplement and basic AFM/RFM.

4. Supplement Approval.

a. Methods of Approval. Approval of the supplement (including placards) is accomplished through one of the following methods:

(1) Alterations that cause a change to the operating limits of the aircraft, aircraft engine, or propeller require coordination with the appropriate ACO for at least the approval of the supplement or placard that stipulates limitations of the aircraft.

(2) Qualified ASIs with field approval authorization may be specifically authorized by Flight Standards policy or delegated by an ACO to review and approve certain AFMS/RFMS. This is for alterations that are based on data from a prior TC or STC approval and where the AFMS/RFMS is based on the one that was approved as part of the TC or STC. A list of those alterations is maintained as part of the Major Repair and Alteration Data Approval Job Aid.

Note: In general, the ASI or ACO need approve only the changes to performance, operational conditions, or limitations and any abnormal or emergency procedures.

Note: The ASI must be familiar with the airworthiness requirements for flight manuals appropriate to the product when approving the AFMS/RFMS.

Note: The AFMS/RFMS should also contain a “General” or “Systems Description” section that may be approved (or not) at the discretion of the ASI. However, if a change in the General or Systems Description sections of the FAA-approved AFM/RFM affects certain elements (e.g., the instrument layout or configuration by description or illustration), the ASI must refer the AFMS/RFMS to the ACO for approval.

(3) An authorized DER or ODA may approve an AFMS/RFMS or placards within their authority.

b. Repairs or Alterations Not Resulting in a Change. Repairs or alterations that do not result in a change to limitations, procedures, performance, or loading information may not require a supplement, or the supplemental information may consist of system operating instructions only.

c. Explanation of Operating Procedures. Alterations frequently include an AFMS/RFMS to explain the operating procedures for a newly installed piece of equipment or system, or the equipment manufacturer’s operating manual containing detailed instructions may be incorporated by reference into the AFMS/RFMS.

d. Operating Instructions. Manufacturers’ operating instructions for systems or equipment, such as those for navigation systems, that are included or referenced in the AFMS/RFMS do not require specific approval; however, the AFMS/RFMS itself must be approved, and the approval can be accomplished by a qualified ASI.

Note: Inclusion of a reference to an operating manual in an AFMS/RFMS, and requiring its carriage on board during flight, ensures that the information is available to the pilot.

e. Operational Limitations. In some cases, operational limitations are not affected by an alteration. Additionally, no requirements may exist for the equipment or system to be installed. Therefore, an AFMS/RFMS may not be necessary.

f. Placard Approval. A qualified ASI with field approval authorization may review the language and approve an appropriately affixed placard (refer to part 23, § 23.2610; part 25, § 25.1541; part 27, § 27.1541; or part 29, § 29.1541) that specifically characterizes operating limitations or information such as that stipulating the use of certain equipment and systems. For examples of such placards—“Not For IFR” or “VFR Only”—refer to Kinds of Operations in § 23.2610, § 25.1525, § 27.1525, or § 29.1525.

g. Conditions to Consider an Alteration Minor. If all of the following conditions are met, an AFMS/RFMS is not required. For certain systems such as Global Navigation Satellite System (GNSS) for visual flight rules (VFR) use only, the alteration may be considered minor and FAA Form 337 is not required:

- (1) Does not restrict, displace, or limit the use of required equipment;
- (2) All new limitations can be addressed via placards;
- (3) The aircraft performance is not negatively affected;
- (4) Does not require a placard per TC or STC;
- (5) VFR use only; and
- (6) Is nonrequired equipment (refer to AC 20-138, Airworthiness Approval of Positioning and Navigation Systems).

h. VFR Operations. For equipment limited to VFR, a readable placard must be installed in clear view of the pilot stating that the equipment is only to be used for VFR operations, unless the equipment automatically displays this message on startup and pilot action is required to clear the message. An AFMS/RFMS is not required since the placard or display contains the equipment limitation.

5. ACO Approval Process.

a. Data Package Submittal. In those cases where the ACO must approve the AFMS/RFMS, the ASI submits the alteration data package, including proposed AFMS/RFMS. A designee must coordinate with their appropriate FAA managing advisor for the procedures to communicate with other lines of business.

b. Verification. When submitting the AFMS/RFMS to the ACO for approval, the ASI responsible for the field approval or coordinated field approval of data must verify the applicant has conducted an analysis of the system and equipment operational conditions, limitations, abnormal and emergency procedures, and whether performance sections or paragraphs are compatible with instructions in the AFMS/RFMS.

c. Review. During ACO review, the AFMS/RFMS may be routed to the appropriate ACO flight test personnel for review.

d. Documentation. At the conclusion of review and approval of the AFMS/RFMS or limitations placard (by the ACO or ASI, as appropriate), the applicant is responsible for ensuring that the AFMS/RFMS is recorded in block 8 of FAA Form 337 by reference to the approval date and document name and number. Such entry must indicate that the AFMS/RFMS is inserted or affixed to the AFM/RFM or POH.

Note: The AFMS/RFMS approved by the ACO does not require additional approval when all other data covering the entire alteration is approved.

e. Subsequent Review and Approval. The ASI should advise the applicant that, if a manufacturer of installed equipment upgrades the equipment (e.g., changes the operating system software or associated hardware), it may invalidate the FAA-approved AFMS/RFMS and may require subsequent review and approval of a revised AFMS/RFMS.

6. Format and Content.

a. Updated Information. The AFMS/RFMS or placards must contain any new or changed limitations, emergency or abnormal operating procedures, normal operating procedures, performance, and system operating instructions. The supplement must be consistent with the format of the basic AFM/RFM and applicable to the specific installation configuration for the installed equipment and systems. ASI approvals of AFMS/RFMS should not contain conditional operation descriptions and need to be explicit for the configuration of the targeted aircraft. AC 23-8, Flight Test Guide for Certification of Part 23 Airplanes, and AC 25.1581-1, Airplane Flight Manual, provide guidance on what is recommended in an AFMS/RFMS for aircraft.

b. Requirements. Whether being approved directly by the ASI or designee, or coordinated with the ACO, the detail contained in the proposed AFMS/RFMS must conform to the requirements described below.

c. Necessary Information. The AFMS/RFMS should include:

- (1) The aircraft manufacturer's name;
- (2) Model number;
- (3) Serial number; and
- (4) Registration number. The approved AFMS/RFMS is applicable only to the specific serial number aircraft.

d. Additional Information. The following must also be included, as applicable:

- (1) Abnormal or emergency procedures;
- (2) Normal operating procedures;
- (3) Aircraft performance; and
- (4) Aircraft W&B and loading information.

e. Placement of Placards. Placards must be installed in clear view of the pilot and, as applicable, in proximity to the affected equipment. Refer to § 23.2610, § 25.1541, § 27.1541, or § 29.1541.

7. Online Job Aid. The Major Repair and Alteration Data Approval Job Aid identifies those alterations for which a qualified ASI is authorized to approve the AFMS/RFMS. The job aid also provides expanded guidance related to manual supplements for specific alterations.

Chapter 7. Flight Evaluation and Flight Test

1. Introduction. This chapter provides guidance for flight evaluation and flight test requirements related to field approvals.

2. Flight Evaluation.

a. Operational Evaluation. A flight evaluation, also referred to as a flight check, is an operational evaluation of an aircraft or system after maintenance or alteration to ensure proper function.

b. Purpose of Operational Evaluation. Any major repair or alteration that may substantially affect the aircraft's operation may require the applicant to conduct an operational flight evaluation, in accordance with § 91.407(a) and (b). The purpose of this flight is to ensure that the repair or alteration that was accomplished with all of the FAA-approved data functionally works correctly. The purpose of the operational flight is not to gain additional data that is needed to show compliance with the regulations. A flight evaluation can be conducted by an appropriately rated pilot with at least a Private Pilot Certificate. Following successful completion, the results are recorded in the aircraft records. The specific criteria evaluated must be part of the record entry. For some coordinated field approvals, the ACO may want to conduct these flight evaluations.

3. Flight Test.

a. Gathering Substantiating Data. A flight test is performed to develop and gather substantiating data for an airworthiness approval on an aircraft or system that has been altered. Flight testing is generally performed during an article's first approval by TC, amended TC, or STC.

b. Coordinating a Flight Test. An alteration that requires a flight test to show compliance with the regulations in accordance with requirements of § 21.191(b) must be coordinated with the appropriate ACO. In order to gather additional flight test data for the purposes of showing compliance, an Experimental, Show Compliance Airworthiness Certificate is needed. In some cases, an alteration that requires a flight test to show compliance with the applicable regulations may be a major change to type design, and therefore ineligible for using the field approval process. The ASI should contact the ACO for further guidance on the requirements for approval of the proposed modification.

Chapter 8. Technical Considerations

1. Introduction.

a. Technical Considerations. This chapter provides a series of discussions of the technical considerations that a data package for a proposed major repair or alteration should address. As new technology or new applications of existing technology occur, related concerns may become apparent and should be addressed by the applicant. In particular, the introduction of new or novel technology will generally warrant coordination with an ACO to ensure that a thorough evaluation of the data is accomplished.

b. Additional Guidance. This chapter is intended to be generic and is not all-inclusive. The Major Repair and Alteration Data Approval Job Aid provides additional guidance for specific alterations.

c. Addressing Technical Considerations. Not all considerations will be applicable to a particular repair or alteration. The ASI is encouraged to develop their own aids, such as checklists, to ensure that they address the appropriate technical considerations for each data package.

2. Powerplant.

a. Unpermitted Engine Installations. Field approvals of turbine or turboprop engine installations on piston engine-powered aircraft are not permitted. Engine changes that alter an aircraft from a reciprocating engine to a turbine engine require the use of either an amended TC or an STC.

b. Powerplant Major Repairs and Alterations. Refer to part 43 appendix A(a)(2) for a description of powerplant major alterations and part 43 appendix A(b)(2) for a description of powerplant major repairs.

3. Propeller. Only an appropriately rated repair station may accomplish major repairs or major alterations. Title 14 CFR part 65, § 65.81 specifically excludes certificated Airframe and Powerplant (A&P) mechanics from performing major repairs or major alterations on aircraft propellers. However, 14 CFR part 145, § 145.201 provides that an appropriately rated repair station may perform such major repairs or major alterations provided the work is done in accordance with technical data approved by the FAA.

4. Rotorcraft.

a. Evaluation of Potential Alterations. Rotorcraft, due to specifics of regulations, their design, and their operational environment, require considerations in the evaluation of potential alterations that are not common to other categories of aircraft.

b. Strict Alterations. Even a VFR-only helicopter cannot be altered as freely as a fixed-wing aircraft.

c. Considerations Unique to Rotorcraft. Below is a list of rotorcraft-unique considerations that must be addressed, as appropriate, in addition to those common to all aircraft:

(1) Handling qualities. Rotorcraft are not aerodynamically stable like fixed-wing aircraft; they induce a higher pilot workload.

(2) Temperature. The greenhouse effect on the temperature requirements for equipment, due to the amount of large glass windows typically found in rotorcraft.

(3) Vibration spectrum is more severe compared to fixed-wing. Consequences include, but are not limited to, fatigue life and strength capability. Life limits on principal structural elements which are affected by alteration or repair must be determined based on flight test load data as appropriate to the alteration or repair.

(4) System separation is more challenging due to the smaller size compared to most fixed-wing aircraft.

(5) The High Intensity Radiated Fields (HIRF) environment is more severe since rotorcraft operate in closer proximity to HIRF sources.

(6) Fewer options for antenna or line replaceable unit (LRU) placement. This results in more challenges in reduction or elimination of electromagnetic interference (EMI) with required systems, such as full-authority digital electronic control (FADEC) or navigation systems.

(7) Instrument panels are smaller.

(8) Rotorcraft capabilities expose it to environments and operations that generally increase risk.

(9) Rotorcraft VFR visibility requirements.

(10) The certification regulations for rotorcraft (i.e., parts 27 and 29, CAR 6, and CAR 7) have significant certification and regulation differences than the corresponding regulations for other aircraft. AC 27-1, Certification of Normal Category Rotorcraft, and AC 29-2, Certification of Transport Category Rotorcraft, contain guidance on how to address those differences.

(11) Different regulations apply to alterations requiring instrument flight rules (IFR) certification versus those that require only VFR certification. Appendix B for parts 27 and 29 drives the requirements for IFR certification for systems and equipment, as well as for handling qualities.

(12) Components or parts may be considered or deemed “critical” by the manufacturer or TC holder under part 27, § 27.602 or part 29, § 29.602. Alterations to critical parts must consider the quality requirements determined by the TC holder.

5. System Failure Modes and Effects.

a. Perform an Analysis. During development of the data package to support a major alteration, the applicant will perform an analysis to determine the failure effects of systems or equipment being installed or modified. There are several methods and types of analysis, and the choice will depend on the complexity and criticality of the particular system or equipment. For detailed information about analysis methods, the applicant is referred to AC 23.1309-1, System Safety Analysis and Assessment for Part 23 Airplanes; AC 25.1309-1, System Design and Analysis; AC 27-1; AC 29-2; and SAE Aerospace Recommended Practice (ARP) 4761, Guidelines and Methods for Conducting the Safety Assessment Process on Civil Airborne Systems and Equipment.

b. Analysis as Part of a Data Package. In many cases, the analysis may have been accomplished as part of a data package for an STC or other approval that is being used as the basis for an alteration. In these cases, it is not necessary that it be done again, provided it is appropriate to the alteration in question. The analysis must still be provided as part of the data submitted for field approval. It cannot be assumed that an analysis was done, or what was included in the analysis, when done as part of an STC or other approval. The goal is to ensure operational safety and aircraft airworthiness.

c. Documenting the Analysis. The applicant can choose the manner in which the analysis is documented.

d. Confirmation. The ASI must confirm that the applicant has addressed the failure modes and effects of the proposed alteration.

6. Structure.

a. Effects of Alteration of Structure. The applicant must consider the structural requirements that may be affected by the repair or alteration as well as the W&B computations. Depending on the repair or alteration, the structural requirements may include, but are not limited to, those pertaining to loads, materials, fasteners, flutter, fatigue, damage tolerance, and environmental considerations as defined in the certification basis.

b. Guidance for Alteration of Structure. Further guidance for alteration of structure is found in AC 43.13-1 and AC 43.13-2. AC 25.571-1, Damage Tolerance and Fatigue Evaluation of Structure, provides fatigue and damage tolerance guidance for part 25 aircraft. AC 120-93, Damage Tolerance Inspections for Repairs and Alterations, provides guidance to comply with the requirements of the Aging Aircraft Safety Act. AC 29-2 and AC 27-1, including AC 27 Miscellaneous Guidance (MG) 11, Fatigue Evaluation of Rotorcraft Structure, provide unique fatigue tolerance guidance for rotorcraft.

7. Systems.

a. Addressing Applicable Considerations. Major repairs or major alterations to aircraft systems must address applicable considerations provided in this chapter. The certification basis of the particular aircraft provides the requirements of the specific system. The Major Repair and Alteration Data Approval Job Aid contains additional guidance for systems.

b. Compatibility of Systems.

(1) When interfacing a new system into an aircraft, the compatibility of the new and existing aircraft systems must be evaluated and substantiated. Often, manufacturers will provide interface connection information concerning other manufacturers' products designed to similar standards. However, unless specifically identified, these interfaces may not actually have been tested to determine that they are indeed compatible. If the interface being proposed has not been previously approved, the assumption should be that compatibility has not been demonstrated. An appropriate evaluation is the best approach to ensure that adequate analysis, testing, and verification of interface has been shown, and that the system performs its intended function and is safe.

(2) Previous installations may also be a source of information concerning compatibility. Be careful that any differences are identified and considered. A specific test plan might be included in the alteration data to provide showing of compatibility.

(3) Anytime you have questions regarding compatibility, consider coordinating with the appropriate ACO. This could be the ACO that issued a referenced or previous STC, or the ACO that issued the design and production authorization for a major component.

(4) Remember that compatibility could be dependent on operating system or software revision. Many manufacturers introduce additional functions as their product line evolves and is updated. When compatibility is not ensured, the effect of the alteration or installation on other avionics systems is unpredictable.

c. Configuration Requirements.

(1) The post-alteration system is configured following the installation instructions. Configuration could consist of a specific wire termination at the radio rack connector, or be done via software using a flight deck multifunction display (MFD) to access configuration or settings menus.

(2) Some form of configuration record should be created that can be referenced for maintenance or future alteration. Information such as software and modification level of avionics hardware should be included in addition to the individual configuration items.

(3) Future updates may warrant reapproval, as functionality and hardware changes could have a negative impact on compatibility of the system under question and could result in interference to other required systems.

8. Avionics General.**a. Data Bus Standards, Protocols, and Format.**

(1) Integration of different components requires compatibility of communications.

(2) There are several data bus standards applied to aircraft systems. ARINC 429 is one of the more common standards, but several others, like RS-232 and more recently Ethernet-based aviation data buses, are used.

(3) Data bus standards provide a basis for determining compatibility, but fall short of ensuring compatibility. Some standards may establish more commonality of elements than other standards. Data bus standards may (or may not) provide a basis for the protocol or format employed to transfer data between components or systems. The design standards for a specific system generally employ industry standards, yet ultimately the equipment manufacturers establish the criteria for their system, so the actual method of employment of the standard may vary. The ability of equipment to interface with other equipment on the same aircraft depends on a manufacturer's decision to employ an industry convention. This is why it is especially important to conduct a rigorous analysis of data availability and compatibility when integration decisions are made between equipment of different manufacturers.

b. Design-Specific Elements. Even when communications are possible, it is necessary to ensure appropriateness and adequacy of information. For example, Global Positioning System (GPS) information provided by a GPS sensor without wide area augmentation system (WAAS) augmentation does not qualify with the same accuracy as information provided by a WAAS-augmented sensor. Design characteristics of one system may impose additional requirements. These requirements may not be readily apparent. How the configuration of the equipment is set up will dictate how the equipment will function.

c. Effects on Other Avionics Systems and Undesirable Effects.

(1) When compatibility is not ensured, the effect of the alteration or installation on other avionics systems is unpredictable.

(2) Some obvious effects that can occur when the avionics systems are truly incompatible are smoke and flames. Some less obvious effects include functional issues, such as system interruption or transfer of failure modes.

(3) Erroneous or missing information must be flagged so it is known to the user.

(4) If additional data will be provided for transmission, the duty cycles of the transmitters should be considered.

(5) Display characteristics and Flight Technical Error (FTE).

(a) FTE relates to a pilot's or autopilot's ability to follow the defined path or track, including any display error. Adding weather or other imagery to a display may affect the current settings of the display's brightness and update response time, impacting latency of display. Additionally, adding more imagery to the display may cause the owner/operator to misinterpret the information displayed.

(b) For example, consider a display providing steering information during an approach that has had terrain imagery added. It is possible that the aircraft could be off course

and the display may not show it immediately because the display was refreshing pictures of all the added images.

(6) Failure transfer.

(a) The impact of a failure of one component or system on another integrated system must be minimized. An example would be a recorder added to an audio system to help a pilot remember his clearance. The recorder must be designed so that its failure could not prevent the audio system from working.

(b) Error protection should be robust enough to alert a user prior to the display of erroneous information. Protection against, or lack of failure transfer, should be substantiated in the data.

(7) Isolation.

(a) Isolation of separate avionics systems prevents transfer of failure modes and avoids installing dependencies that were not previously present.

(b) The applicant may perform a safety assessment of each system and the combined functionality to determine if it is capable of meeting safety requirements.

d. Integration of Systems. Considerations of other factors, such as adding equipment and functionality to aircraft, are referred to as integration concerns. Integration includes connectivity, communication, and other factors necessary to ensure compatibility. As systems and applications are integrated into the aircraft, a safety assessment may need to be conducted in order to identify and substantiate the areas affected by the introduction. This is achieved by conducting an analysis on the interaction of the system and application with other functions on the aircraft. If the system and applications interface with other systems on the aircraft, such as a flight management system (FMS), flight guidance system (FGS), navigation display, or radar display, then the safety assessment should consider potential failure conditions of the other functions.

e. Isolation of Systems.

(1) Systems should be designed to prevent undesirable results on other systems or functions when operating normally. Additionally, any failures of a newly integrated system should not adversely affect other installed systems.

(2) Where redundancy requirements exist, systems must be isolated.

9. Circuit Protection. In most cases, some form of circuit protection will be necessary. A proposed alteration should address the need for such protection. Refer to AC 43.13-1, Chapter 11, Section 5, Electric Wire Rating, and/or ASTM F2639-15, Standard Practice for Design, Alteration, and Certification of Aircraft Electrical Wiring Systems, for additional guidance.

10. Commercial Off-the-Shelf (COTS) and Other Articles Not Produced Under § 21.9.

a. COTS Articles. COTS refers to articles that have been developed for sale to the general public. For the purposes of this order, both COTS and articles not produced under § 21.9 are addressed in the same manner. Installation of such articles can be approved but requires an evaluation based on their intended functions and failure modes and effects. In addition, such articles installed for “situational awareness” or as a supplemental system may be acceptable provided they do not interfere with or displace required equipment, or otherwise interfere with the safe operation and airworthiness of the aircraft.

b. Installation of COTS Articles. Section 21.9 was not intended to restrict an owner or operator or their repair and maintenance facility or person from installing “commercially available” articles on their products.

c. Determining the Suitability of an Alteration. A commercially available article (part) does not have to be approved in order for an alteration including that article to be accomplished in accordance with part 43. The installer must determine the suitability of the alteration as follows:

(1) For major alterations, the installation of an article must be performed with approved technical data.

(2) For minor alterations, the installation of an article must be performed with acceptable data.

(3) The approved or acceptable data must show that an article meets the airworthiness requirements and is suitable for its intended purpose.

d. Evaluating an Alteration. The ASI should use the same criteria for evaluating an alteration that includes the installation of an article not requiring FAA approval as that of any other alteration, since the provided data should show that the article is Airworthy. If the ASI has any doubt about the airworthiness of the article, he or she should request assistance from the ACO. The approved or acceptable data for the alteration does not mean the installed article is approved under § 21.9, nor does it mean the article is approved by the installation technical data approval.

e. Return to Service. Maintenance information for the COTS equipment in the form of repair instructions or test specifications will facilitate maintenance and approval for return to service of the original COTS item.

f. Limitations of COTS Articles. The installer and owner/operator should be aware of these limitations associated with installation and maintenance of COTS equipment.

11. Commercial Parts. A commercial part is defined as an article (part, component, or possibly an appliance depending on the appliance, but not a material or process) that was originally approved through an FAA design approval and is listed on an FAA-approved commercial parts list included in the DAH’s ICA. FAA Order 8110.118, Commercial Parts, and AC 21-45,

Commercial Parts, provide guidance on repair and replacement, including use of alternatives, of commercial parts.

12. Enhanced Airworthiness Program for Airplane Systems (EAPAS).

a. Critical Configuration Congruence. Part 26 consists of the EAPAS-related rules applicable to certain part 25 aircraft, and introduces maintenance program requirements for parts 121 and 129 operators. The requirements consist of mandatory repetitive maintenance and inspection tasks at specific frequencies, as well as critical design configuration control limitation (CDCCL) items, which are specific instructions designed to ensure that whenever maintenance actions, repairs, or design changes occur, the critical configuration is not compromised.

b. Considering the Requirements. The applicant must consider these requirements if developing a major repair or major alteration for affected aircraft.

13. Lightning, HIRF, and Electromagnetic Compatibility (EMC).

a. Assessing Changes to Aircraft Protection. Aircraft or system repairs or alterations should be assessed for the impact that any changes will have on the HIRF and lightning protection. Shielding and bonding are two of the basic methods of providing that protection for the aircraft. Some systems or equipment may require specific features to provide HIRF and lightning protection. Repairs and alterations must not compromise existing protection features and may require new or additional protection features for the affected systems or equipment.

b. Compatibility of Systems. Newly installed or altered systems or equipment must be compatible with the function of other systems or equipment. The extent of a post-alteration EMC test will depend on the specific system involved. Several generic checklists are available, or a customized checklist may be developed by the applicant. When evaluating a data package for approval, ensure that HIRF, lightning protection, and EMC have been addressed as necessary, including revisions to instructions for continued airworthiness (ICA).

c. Lightning Protection and EMC. AC 20-136, Aircraft Electrical and Electronic System Lightning Protection; AC 20-158, The Certification of Aircraft Electrical and Electronic Systems for Operation in the High-Intensity Radiated Fields (HIRF) Environment; and AC 33.4-3, Instructions for Continued Airworthiness: Aircraft Engine High Intensity Radiated Fields (HIRF) and Lightning Protection Features, address HIRF and lightning protection. AC 20-177, Design and Installation Guidance for an Airborne System for Non-Required Telecommunication Service in Non-Aeronautical Frequency Bands, addresses EMC for nonrequired equipment.

d. Additional Resources. Other sources, both FAA and industry, address the subject.

e. Documenting Compliance. HIRF, lightning, and EMC compliance should be documented and included in the field approval data package for evaluation, when applicable to the installation or modification.

14. Electrical Load Analysis (ELA).

a. Purpose of an ELA. The purpose of an ELA is to determine that the demand on the aircraft's electrical system does not result in the undesirable situation that, during operations in the most adverse circumstances, the electrical system would be inadequate in meeting those system demands or where the emergency reserves are insufficient to meet the requirements during an emergency.

b. Explanation of an ELA. An ELA is a complete and accurate analysis of available aircraft power and all electrical loads under the most adverse operating conditions during taxi, takeoff and climb, slow cruise, normal cruise, and landing operations. Special considerations must be given to the emergency electrical demands due to the safety impact an inaccurate analysis could have. An aircraft electrical emergency architecture is designed to provide only essential systems to support safe flight and landing in a reasonable time for a worst-case emergency.

c. Determining System Capacity. Anyone performing an alteration that may have an effect on an aircraft's electrical power system must determine that the system has the capacity to accommodate that change and does not negatively impact electrical power availability for previously installed, required systems.

d. Importance of an ELA. An ELA needs to be performed to establish the baseline electrical capacity of the aircraft. The form this analysis takes will depend on the type, age, and complexity of the aircraft. From this baseline, it can be determined whether the modification is viable and remains compliant with the applicable standards.

e. Limitations of the Original ELA. The aircraft manufacturer's original ELA applies only to the original delivered configuration.

f. Information on Creating or Revising an ELA. ASTM F2490-05 (2013), Standard Guide for Aircraft Electrical Load and Power Source Capacity Analysis, and MIL-E-7016F, Electric Load and Power Source Capacity, Aircraft, Analysis of, provide detailed information on the creation or revision of an ELA. AC 43.13-1 does not contain ELA procedures; however, use of AC 43.13-1, paragraph 11-36, Electrical Load Determination, as a reference is appropriate for the purpose of an electrical load determination.

g. Ensuring That an ELA Has Been Accomplished. When evaluating a data package for an approval, ensure that an ELA has been accomplished and is referenced on FAA Form 337.

15. Software Considerations. The role of the ASI for a software change or installation to avionics hardware or systems is limited. The ASI's primary function with regard to software should be determining if the article to be installed on an aircraft has the appropriate approval and that the software has been developed to at least the software level required by the safety assessment for the installation. For example, if the applicant proposes to install an MFD, the software development level must be commensurate with the MFD's safety assessment determination. This verification of regulatory requirements is usually coordinated with the appropriate ACO or DER.

16. Human Factors (HF).

a. Considering HF. Alterations to aircraft systems, especially those relating to avionics systems and equipment, may impact human performance and decision making. Because of this, HF issues should be considered when installing new or altered equipment, or changing components. Effective HF design will help owners/operators understand their environment; provide accessible information that is clear, relevant, and timely; and support decision making. In the design and operation of aircraft systems, failure to consider relevant HF issues may lead to problems ranging from inefficiencies to unsafe conditions.

b. Ensuring Desired Outcomes. When evaluating or ensuring proper substantiation of the data, ensure that the interaction between the altered or new equipment and the human owner/operator leads to the desired outcome.

c. Potential HF. Some of the HF issues you might encounter and will need to consider when evaluating the outcomes associated with a change to aircraft systems include:

- (1) Arrangement and location,
- (2) Visibility,
- (3) Readability,
- (4) Usability,
- (5) Pilot workload, and
- (6) Symbology.

Note: For example, one of the more obvious HF affecting installations would be the installation of an electronic display. AC 23.1311-1, Installation of Electronic Display in Part 23 Airplanes, provides guidance on these installations.

d. Avoiding Human Errors. Consider the interaction between the altered or new piece of equipment and existing equipment or systems to ensure that this interaction does not result in human errors. HF issues should be considered when evaluating data required for proper substantiation of an alteration.

Note: The FAA Human Factors website provides a cross-reference to HF-related airworthiness standards, along with links to other guidance and policy on HF, at https://www.faa.gov/aircraft/air_cert/design_approvals/human_factors/.

Chapter 9. Roles and Responsibilities

1. General Information. This chapter details the roles and responsibilities of the various FAA personnel, designees, and the applicant with respect to major repairs and major alterations.

2. Applicant. Although the guidance in this order is directed to FAA personnel and relevant designees, it is appropriate to include items that the applicant is expected to have accomplished prior to submitting a proposed repair or alteration for field approval. The ASI, in order to determine the proposed data's eligibility for field approval, must consider these decisions made by the applicant.

3. ASI.

a. Qualifications. The ASI must be authorized, experienced, or trained in the methods, techniques, and materials involved in the major repair or major alteration.

b. Seeking Assistance. If the ASI is not thoroughly familiar with all aspects of the repair or alteration, or has any doubt about the expected airworthiness, an airworthiness determination must not be given. The ASI will seek assistance to the extent necessary to ensure that the decision is technically supported before approval or denial is given.

c. Functions Performed by an ASI. The ASI has a larger role when approving the repair or alteration data. The two functions that the ASI performs are administrative and technical.

(1) The administrative role begins at first contact with the applicant regarding a planned or proposed project. It is at this point that the path for approval can be determined. As outlined in Figure 3-1, the ASI must understand the proposed repair or alteration. Discussion with the applicant about the requirements that must be met will help to avoid confusion and subsequent conflicting expectations on the part of either the ASI or the applicant.

(2) The primary technical task the ASI must perform is the evaluation of the data package provided by the applicant. The package should consist of both descriptive and substantiating data.

(a) The descriptive data will fully describe the repair or alteration, including all interfaces, functions, and other aspects.

(b) The substantiating data will identify the certification basis for the aircraft and equipment and how the repair or alteration will comply with the applicable standards and other airworthiness or operational requirements. A complete package will include all necessary documentation (e.g., maintenance information, AFMS/RFMS, etc.).

d. Ensuring Safe Operation. The ASI must determine if, when approving data, the affected product or appliance will result in safe operation and conform to regulatory requirements.

e. Reviewing a Data Package. When the ASI reviews the data package, the ASI must:

(1) Verify that the information supplied is complete and appropriate. The applicant may specify the certification rule used as a basis for the approval (refer to § 21.101).

(2) Review and evaluate the following before the applicant starts the actual work, and identify any flight test or evaluations that may be required, as applicable:

(a) A formal request submitted on either FAA Form 337 or on other administrative forms used by a manufacturer or owner/operator that are acceptable to the FAA, such as engineering orders.

(b) The proposed AFMS/RFMS or SAFM.

(c) FAA Form 8110-3 or FAA Form 8100-9, if applicable.

(d) The description of the proposed repair or alteration, in order to ensure that it correctly and accurately describes the repair or alteration.

(e) Methods, sketches, drawings, stress analyses, photographs, ELAs, etc., in order to ensure that the applicant has considered all applicable design standards and has analyses to substantiate the findings in this regard. The ASI must consider at least the following:

1. The certification basis, including special conditions (fail-safe, damage tolerance, etc.).
2. The structural requirements applicable to the repair or alteration.
3. Any hazards, and the associated crashworthiness requirements, that may affect the aircraft or its occupants.
4. W&B computations.
5. Operating limitations.
6. Any other factors affecting safety or airworthiness.
7. All ground and flight tests and operational checks. Ensure that they meet applicable certification requirements to substantiate the repair or alteration.

(f) Maintenance information, as required (see Figure 5-1).

(g) Compliance checklist, as outlined in AC 43-210.

f. When an ASI Requests Appropriate ACO Assistance.

(1) The ASI can transmit a request for FAA engineering assistance by one of several means, including use of a record of communications, an email request to the FAA ACO manager through the responsible Flight Standards office manager or designated person, or with

coordination of the Technical Aircraft Maintenance Branch for the specific technical area or specialty on the matter of interest. The ASI must identify what elements require ACO participation based on the applicant's intended repair or alteration. A designee must coordinate with their appropriate FAA managing advisor for the procedures to communicate with other lines of business.

Note: Typically, ACOs have working agreements with the responsible Flight Standards offices with which they work. The ASI should follow office procedures in accordance with national policy for requesting field approval assistance.

(2) If the ACO discovers that the intended alteration is significant enough to warrant application for an STC, then instruct the person intending to perform the work to contact the ACO.

(3) An alteration that requires a flight test to show compliance with the regulations in accordance with requirements of § 21.191(b) must be coordinated with the appropriate engineering office or flight test DER, as authorized. See Chapter 7 for more details.

4. Responsible Flight Standards Offices.

a. Authorization to Perform Field Approvals. Authorization to perform field approvals is granted by the inspector's responsible Flight Standards office manager after verification that the inspector has satisfied all prerequisites. A signed statement of authorization will be placed in the ASI's file or in the office manual (the authorization will state that the ASI has authorization to perform field approvals and may also include limitations to this authority).

b. Avoiding a Stoppage in the Field Approval Process. The responsible Flight Standards office manager must ensure that an ASI's lack of experience or qualifications does not necessarily stop the approval process. The ASI's lack of qualifications does not mean that the office must deny a field approval and tell the applicant that an STC is needed. The ASI can seek assistance from another ASI or office, as appropriate.

5. DER.

a. Employing a DER. A properly authorized DER may be employed by an applicant to provide approved technical data to support a major repair or alteration.

(1) If the DER is employed by the applicant prior to involving the FAA and the applicant has determined that the DER has provided all the approved data necessary for the repair or alteration, then no field approval is required.

(2) If the applicant does not employ a DER to provide approved data until after a field approval is determined, the approval is considered an engineering-assisted major alteration unless the DER provides all the approved data.

b. DER Authorizations. DER authorizations and limitations, including Repair Specification Designated Engineering Representatives (RS-DER), and general guidance on approving data for major repairs and major alterations are referenced in Order 8110.37.

c. List of DERs. A list of current DERs and their appointed functions and authorizations is available on the FAA Designees and Delegations website at http://www.faa.gov/other_visit/aviation_industry/designees_delegations/find_designees.

6. ODA.

a. Employing an ODA. An ODA holder may be employed by an applicant to provide approved technical data to support a major repair or major alteration. If an ODA is employed by the applicant prior to involving the FAA, and the applicant has determined that the ODA has provided all the approved data necessary for the repair or alteration, then no field approval is required.

b. ODA Authorizations. A TC or STC ODA holder with specific authority for major repairs or major alterations may approve data within its authority and limitations. The data approved by an ODA holder may not be adequate to cover every aspect of the repair or alteration.

c. Approval of All Aspects of Repair or Alteration Data. A major repair, alteration, and airworthiness (MRA) ODA unit must be able to approve all of the data required to complete a repair or alteration. However, the ODA unit may use data approvals provided by the product manufacturer's designee or ODA unit as part of its approved data package. The ODA unit may not approve data if the alteration or repair requires other approval(s) in areas in which the ODA holder is not authorized.

d. Guidance on Approving Repair or Alteration Data. For ODA authorizations and limitations, and general guidance on approving data for major repairs and major alterations, refer to FAA Order 8100.15, Organization Designation Authorization Procedures.

e. List of ODAs. A list of authorized ODA holders is available on the FAA Designees and Delegations website at http://www.faa.gov/other_visit/aviation_industry/designees_delegations/find_designees.

7. ACO.

a. ACO Authorizations. In regard to field approvals, the ACO can provide several levels of involvement. ACO engineers may act in a consultant capacity to an ASI evaluating an application for field approval or have a more formal role in coordinated field approvals. This is described in more detail in Chapter 3.

b. Obtaining ACO Assistance. Responsible Flight Standards office ASIs must contact the ACO in their geographic region, or Certificate Management Aircraft Certification Office (CMACO) if applicable, in order to obtain ACO assistance.

8. DAR.

a. Employing a DAR. Order 8000.95 establishes policy and procedures for the selection, appointment, orientation, training, oversight, renewal, and termination of a Designated Airworthiness Representative-Maintenance (DAR-T) authorized to issue data approvals in

support of a major repair or major alteration, and establishes function codes for those DARs issuing data approvals.

b. List of DARs. A list of authorized DARs is available on the FAA Designees and Delegations website at http://www.faa.gov/other_visit/aviation_industry/designees_delegations/find_designees.

Chapter 10. Recording and Reporting

1. Disposition of FAA Form 337 (Other Than Additional Fuel Tank Installations).

a. Submitting FAA Form 337. There is no requirement for an ASI to review a completed FAA Form 337. The person completing FAA Form 337 must do so in duplicate, giving one copy to the owner or operator and sending one copy to the Federal Aviation Administration, Aircraft Registration Branch, P.O. Box 25504, Oklahoma City, OK 73125, within 48 hours. Any FAA Form 337 that is incorrectly sent to the responsible Flight Standards office for processing may be forwarded to the Aircraft Registration Branch; however, the submitter may be counseled on the correct procedure. The Aircraft Registration Branch receives electronic versions of FAA Form 337 (e337) automatically through an interactive web-based system.

b. Processing FAA Form 337 Electronically. Persons authorized to perform field approvals have been issued digital signatures and given access to the eForm system in order to process the e337. It is their responsibility to maintain their digital signature and update their system account profiles as necessary. The eForm website was designed with tutorials, PowerPoint slides, Help Desk assistance, and other information for using the system. Additional email notification provides an alert of a pending action requirement. ASIs and DARs are encouraged to visit the eForms website at <https://eformservice.faa.gov/eForms.aspx> and become familiar with the various tools for use of the e337.

c. Eligibility to Access FAA Form 337 Electronically. Persons requesting access to e337 are required to visit their responsible Flight Standards office for application and certificate validation. Personnel authorized to perform the certificate validation and complete the application process function are established by office policy. Obtain more information on e337 at <https://eformservice.faa.gov/eForms.aspx>.

d. Avoiding Noncompliance. ASIs are encouraged to inform the users of FAA Form 337 of their responsibility to provide complete and accurate data in order to avoid noncompliance. It is the applicant's responsibility to remove proprietary information prior to submitting FAA Form 337 to the Aircraft Registration Branch.

e. Document Size Requirement. Additionally, ASIs and the users of FAA Form 337 must be aware of the aircraft registration document size requirement. Attachments larger than the standard 8.5" x 11" cannot be processed and will be returned. Larger-sized documents may be reduced to 8.5" x 11" and submitted.

f. Accommodating the Implementation of the Electronic FAA Form 337. The current FAA Form 337 incorporates revised regulatory text verbiage and minor reformatting to accommodate implementation of the e337. The changes are identified in AC 43.9-1 and can be used for both paper and electronic submittals.

Note: Military aircraft without a U.S. registration, foreign-registered aircraft, and component parts not installed on an aircraft cannot have FAA Form 337 submitted to the Aircraft Registration Branch because they cannot be identified by aircraft make, model, serial number, and U.S. registration number.

2. Disposition of FAA Form 337 for Extended-Range Fuel Tank Installations.

a. Submitting FAA Form 337. In addition to the requirements of paragraph 1 above, for extended-range fuel tank installation in the passenger or cargo compartments, the person completing FAA Form 337 must, within 48 hours, complete the form in triplicate, giving one copy to the owner or operator, placing one copy onboard the aircraft, and sending one copy to the Federal Aviation Administration, Aircraft Registration Branch, P.O. Box 25724, Oklahoma City, OK 73125. The Aircraft Registration Branch receives e337 automatically through an interactive web-based system.

b. Availability of Records. Although disposition of the completed form is the responsibility of the applicant, ASIs must be aware of the owner's or operator's requirements to make these records available for inspection by the FAA, authorized representatives of the National Transportation Safety Board (NTSB), or upon request of any Law Enforcement Officer (LEO).

Note: This is only for installations to which §§ 91.1507, 121.1113, 121.1117, 125.507, 125.509, 129.113, and 129.117 do not apply.

Appendix A. Definitions

- 1. Acceptable Data.** Data that you can reasonably expect the Federal Aviation Administration (FAA) to find acceptable for the purpose it was created.
- 2. Alter.** To change or modify.
- 3. Appliance.** Refer to Title 14 of the Code of Federal Regulations (14 CFR) part 1, § 1.1.
- 4. Approval for Return to Service.** The approval given by an appropriately rated person that enables an aircraft to be returned to service.
- 5. Approved Technical Data.** The data that describes and substantiates a major repair or alteration and that has been approved by the FAA or an authorized representative for a specific application.
- 6. Field Approval.** One of the means used by the FAA, through an authorized aviation safety inspector (ASI) or other delegated authority, to approve technical data used to accomplish a major repair or major alteration.
- 7. Coordinated Field Approval.** A procedure initiated by an ASI when he or she determines that a proposed repair or alteration (project) may exceed the scope and complexity of a field approval or be beyond the knowledge and expertise of an ASI to approve.
- 8. Major/Minor Repairs/Alterations.** Refer to 14 CFR part 1 and part 43 appendix A.
- 9. Major/Minor Type Design Changes.** Refer to 14 CFR part 21, §§ 21.93, 21.95, 21.97, and 21.113.
- 10. Meet Minimum Technical Standard Order (TSO) Established Standards.** Means that the equipment need not have TSO approval, but that it meets requirements set by the TSO.
- 11. Methods, Techniques, and Practices.** The step-by-step, “how-to” instructions for accomplishing maintenance, preventive maintenance, and alterations.
- 12. Product.** Aircraft, aircraft engine, or propeller, as defined in part 21.
- 13. Return to Service.** The action of making an aircraft operational, after an appropriately rated person grants approval.
- 14. Substantiating Data.** Technical data used to show that an article complies with the applicable airworthiness standards. Compliance may be shown by tests, analysis, experience, and/or computations appropriate to the maintenance, alteration, or continue-in-service condition of the article being evaluated. Substantiating data shown to comply with the applicable airworthiness standards is acceptable to the Administrator because it establishes that the article meets the regulatory requirements and would be returned to its original or properly altered condition by use of this data.

15. Technical Data. Drawings and specifications, including a list of drawings and specifications, needed to define the configuration and design features of a particular article, repair, or alteration. Typically, this includes information on materials, dimensions, and processes necessary to define structural strength, any required airworthiness limitations (AL), and any data necessary to determine the airworthiness, noise characteristics, fuel venting, and exhaust emissions (as applicable) of the altered or repaired aircraft. Technical data also includes test data and engineering analyses and other engineering information, such as engineering handbooks or approved military or industry specifications. It may also include operational and service experience, maintenance and alteration experience, reliability data, and other documented factual information that can be shown to be directly applicable to the airworthiness of the article.

Appendix B. Related Publications and References

1. References (current editions).

a. Regulations:

- Title 14 of the Code of Federal Regulations (14 CFR) Parts 1, 21, 23, 25, 27, 29, 31, 33, 34, 35, 36, 39, 43, 91, and 121.
- Applicable Special Federal Aviation Regulations (SFAR).

b. FAA Orders:

- Order 4040.26, Aircraft Certification Service Flight Test Risk Management Program.
- Order 8000.95, Designee Management Policy.
- Order 8100.8, Designee Management Handbook.
- Order 8100.15, Organization Designation Authorization Procedures.
- Order 8110.37, Designated Engineering Representative (DER) Handbook.
- Order 8110.54, Instructions for Continued Airworthiness Responsibilities, Requirements, and Contents.
- Order 8110.118, Commercial Parts.
- Order 8130.2, Airworthiness Certification of Aircraft.
- Order 8900.1, Flight Standards Information Management System (FSIMS).

c. Advisory Circulars (AC):

- AC 20-77, Use of Manufacturers' Maintenance Manuals.
- AC 20-138, Airworthiness Approval of Positioning and Navigation Systems.
- AC 20-177, Design and Installation Guidance for an Airborne System for Non-Required Telecommunication Service in Non-Aeronautical Frequency Bands.
- AC 21-40, Guide for Obtaining a Supplemental Type Certificate.
- AC 21-45, Commercial Parts.
- AC 21-47, Submittal of Data to an ACO, a DER, or an ODA for a Major Repair or a Major Alteration.
- AC 23-8, Flight Test Guide for Certification of Part 23 Airplanes.
- AC 23-17, Systems and Equipment Guide for Certification of Part 23 Airplanes and Airships.
- AC 23-21, Airworthiness Compliance Checklists Used to Substantiate Major Alterations for Small Airplanes.
- AC 23.1309-1, System Safety Analysis and Assessment for Part 23 Airplanes.
- AC 25-15, Approval of Flight Management Systems in Transport Category Airplanes.
- AC 25.1309-1, System Design and Analysis.
- AC 25.1581-1, Airplane Flight Manual.
- AC 27-1, Certification of Normal Category Rotorcraft.
- AC 29-2, Certification of Transport Category Rotorcraft.
- AC 33.4-1, Instructions for Continued Airworthiness.

- AC 33.4-3, Instructions for Continued Airworthiness, Aircraft Engine High Intensity Radiated Fields (HIRF) and Lightning Protection Features.
- AC 43-9, Maintenance Records.
- AC 43-210, Standardized Procedures for Obtaining Approval of Data Used in the Performance of Major Repairs and Major Alterations.
- AC 43.9-1, Instructions for Completion of FAA Form 337.
- AC 43.13-1, Acceptable Methods, Techniques, and Practices—Aircraft Inspection and Repair.
- AC 43.13-2, Acceptable Methods, Techniques, and Practices—Aircraft Alterations.
- AC 60-6, Airplane Flight Manuals (AFM), Approved Manual Materials, Markings, and Placards—Airplanes.
- AC 120-77, Maintenance and Alteration Data.
- AC 120-93, Damage Tolerance Inspections for Repairs and Alterations.

d. Documents:

- Aeronautics Bulletin 7-A, Air Commerce Regulations.
- Aeronautics Bulletin 7-F, Airworthiness Requirements for Aircraft Components and Accessories.
- Aeronautics Bulletin 7-G, Airworthiness Requirements for Engines and Propellers.
- Aeronautics Bulletin 7-H, Air Commerce Regulations Governing Alterations and Repairs to Licensed Aircraft.
- Type Certificate Data Sheets (TCDS) applicable to the product.
- Safety Assurance System (SAS) Element Performance Data Collection Tool (EP DCT) 4.3.4 (AW) Major Repairs and Alterations.

e. Forms:

- FAA Form 337, Major Repair and Alteration (Airframe, Powerplant, Propeller, or Appliance).
- FAA Form 8100-9, Statement of Compliance with Airworthiness Standards.
- FAA Form 8110-3, Statement of Compliance with Airworthiness Standards.
- FAA Form 8110-12, Application for Type Certificate, Production Certificate, or Supplemental Type Certificate.

f. Job Aids. Major Repair and Alteration Data Approval Job Aid.

2. Commercial and Military Standards. All referenced commercial and military standards are available on their corresponding websites:

- ASSIST Quick Search: <http://quicksearch.dla.mil>.
- ARINC Store: <http://aviation-ia.com/cf/store/>.
- ASTM International: <https://www.astm.org>.
- RTCA Standards: https://my.rtca.org/nc__store.
- SAE Aerospace Standards: <http://standards.sae.org/aerospace>.
- Institute of Electrical and Electronics Engineers (IEEE) Standards: <http://www.techstreet.com/ieee>.

Appendix C. Acronyms

14 CFR	Title 14 of the Code of Federal Regulations
A&P	Airframe and Powerplant
AC	Advisory Circular
ACO	Aircraft Certification Office
AD	Airworthiness Directive
AFM	Airplane Flight Manual
AFMS	Airplane Flight Manual Supplement
AFS-300	Aircraft Maintenance Division
AL	Airworthiness Limitation
ALS	Airworthiness Limitations Section
AML	Approved Model List
AMM	Aircraft Maintenance Manual
AMOC	Alternative Method of Compliance
ARP	Aerospace Recommended Practice
ASE	Aviation Safety Engineer
ASI	Aviation Safety Inspector
AVS	Aviation Safety
CAA	Civil Aviation Authority
CARs	Civil Air Regulations
CDCCL	Critical Design Configuration Control Limitation
CG	Center of Gravity
CMACO	Certificate Management Aircraft Certification Office
COTS	Commercial Off-the-Shelf
DAH	Design Approval Holder

DAR	Designated Airworthiness Representative
DAR-T	Designated Airworthiness Representative-Maintenance
DER	Designated Engineering Representative
DOC	Department of Commerce
e337	Electronic Version of FAA Form 337
EAPAS	Enhanced Airworthiness Program for Airplane Systems
ELA	Electrical Load Analysis
ELOS	Equivalent Level of Safety
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
FAA	Federal Aviation Administration
FADEC	Full-Authority Digital Electronic Control
FGS	Flight Guidance System
FMS	Flight Management System
FSIMS	Flight Standards Information Management System
FTE	Flight Technical Error
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
HF	Human Factors
HIRF	High Intensity Radiated Fields
ICA	Instructions for Continued Airworthiness
IEEE	Institute of Electrical and Electronics Engineers
IFR	Instrument Flight Rules
LRU	Line Replaceable Unit
M/M	Make and Model

MCO	Military Certification Office
MFD	Multifunction Display
MRA	Major Repair, Alteration, and Airworthiness
NTSB	National Transportation Safety Board
ODA	Organization Designation Authorization
OEM	Original Equipment Manufacturer
OpSpecs	Operations Specifications
PAH	Production Approval Holder
PMA	Parts Manufacturer Approval
POH	Pilot's Operating Handbook
RFM	Rotorcraft Flight Manual
RFMS	Rotorcraft Flight Manual Supplement
RS	Repair Specification
RS-DER	Repair Specification Designated Engineering Representative
SAFM	Supplemental Aircraft Flight Manual
SAS	Safety Assurance System
SB	Service Bulletin
SEL	Single-Engine Land
SFAR	Special Federal Aviation Regulations
SL	Service Letter
SRM	Structural Repair Manual
STC	Supplemental Type Certificate
SWPM	Standard Writing Practice Manual
TC	Type Certificate
TC'd	Type Certificated

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Appendix C

TCCA	Transport Canada Civil Aviation
TCDS	Type Certificate Data Sheet
TSO	Technical Standard Order
VFR	Visual Flight Rules
W&B	Weight and Balance
WAAS	Wide Area Augmentation System



U.S. Department
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**Federal Aviation
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FAA Form 1320-19, Directive Feedback Information

Please submit any written comments or recommendations for improving this directive, or suggest new items or subjects to be added to it. Also, if you find an error, please tell us about it.

Subject: FAA Order 8300.16A, Major Repair and Alteration Data Approval

To: Flight Standards Directive Management Officer, AFB-140 Directives Mailbox
(9-AWA-AFB-140-Directives@faa.gov)

(Please check all appropriate line items)

An error (procedural or typographical) has been noted in paragraph _____ on page _____.

Recommend paragraph _____ on page _____ be changed as follows:
(attach separate sheet if necessary)

In a future change to this directive, please include coverage on the following subject
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