2015 FAA IA Recurrent Seminar

Use of FAA Designated Engineering Representatives (DERs) for Major Repairs and Alterations under 14 CFR Part 43

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Purpose

- *The purpose of this presentation is to communicate how FAA DERs can be used as a practical resource for A&P/IAs to increase the safety and flexibility of aircraft maintenance operations*
- This is a collaborative presentation and we would like to thank our friends and colleagues that have contributed – we welcome all feedback that might help us improve this information for future use:

Authors: Kyle Taylor BSAE, DER, Structures and Powerplant
kyle@airforms.biz (907) 892-4353
Daniel Garrett, BSME, DER, Structures
daniel@airforms.biz (907)-892-4352

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- Disclaimer: any opinions or considerations in this presentation are those of the authors', and do not represent any official FAA position - every project is different - consult with your local FAA representative where interpretation might be required

References

The following references were used to support this presentation, and are all publically available:

- Website rgl.faa.gov – FAA regulatory and guidance library – an excellent website, and clearinghouse for all FAA regulatory information
- FAA Order 8110.37E – DER Handbook
- FAA Order 8300.16 – Major repair and alteration data approval, with Job Aid
- FAA Order 8110.54 – Instructions for continued airworthiness responsibilities , requirements, and contents
- 14 CFR Parts 21, 43, 65, and 183
- AC 43-18 – Fabrication of aircraft parts by maintenance personnel
- AC43-13-1B – Acceptable Methods, Techniques, and Practices - Aircraft Alterations
- AC43-210 – Standardized procedures for requesting field approvals of data, major alterations, and repairs [Author: outlines how a DER can support a field approval]
- AC120-77 Maintenance and alteration data

Acronyms

It wouldn't be a proper FAA presentation, after all, without lots of good acronyms to keep track of, in no particular order:

- DER – Designated Engineering Representative
- FAA – Federal Aviation Administration
- CFR – Code of Federal Regulations – previously called the "FARs"
- AC – Advisory Circular
- AFM – Aircraft Flight Manual
- ICA – Instructions for Continued Airworthiness
- ASI – Airworthiness Safety Inspector (of the FAA)
- A&P/IA – Airframe and Powerplant Mechanic with Inspection Authorization
- MRA – Major Repairs and Alterations, specifically using DER approved data
- ACO – Aircraft Certification Office
- FSDO – Flight Standards District Office
- CFA – Coordinated Field Approval
- FA – Field Approval
- STC – Supplemental Type Certificate
- TC – Type Certificate
- FSIMS – Flight Service Information Management System, FAA Order 8900.1
- TCDS – Type Certificate Data Sheet
- ELOS – Equivalent Level of Safety

What is a DER?

- A DER – Designated Engineering Representative – is an individual appointed by the FAA's certification branch who has exhibited integrity, experience and expertise in a particular engineering discipline(s) related to aviation, and who is authorized to approve certain types of engineering data. on the FAA's behalf
- DERs are authorized under 14 CFR Part 183 (along with AMEs, DPEs, DARs, etc…)
- With respect to major repairs/alterations (MRA) a DER is authorized to approve certain types of engineering data
- DERs are NOT authorized to approve an installation, or return an aircraft to service – DERs only approve data in support of those activities
- What does it mean to "approve the data" – the DER signs a statement of compliance, FAA Form 8110-3

What is a DER?

- *DERs are authorized by Category and Discipline*
- Each discipline corresponds, generally, to particular portions of an aircraft's airworthiness requirements
- Within each discipline are specific function codes that define even more specific authority
- A DER may also have a special authorizations MRA is one of them
- If you need a DER to support a major repair/alteration program, that DER *must* have special repair and alteration data approval authorization – not all DERs have this authorization
- How do I find the DER(s) I need? Online FAA DER directory
- What are some of the general limitations on DER authority – see Order 8110.37E, Appendix A.

DER Function Codes

Appendix B. Delegated Functions and Authorized Areas

Figure 1. Chart A, DER Structural

Functions and areas that *can* be authorized are defined by *white squares*. Each DER's authority may be different, and is identified in their letter of appointment.

	AUTHORIZED AREAS	Structural-General (1)	Structural-Wing Group	Structural-Fuselage Group	Structural-Empennage Group	Structural-Landing Gear	Structural-Flight Controls	Structural-Rotor	Loading Control Documents	Metallic Materials (2)	Nonmetallic Materials (3)	Interior Arrangements	Interior Materials	Fire Protection	Evacuation Systems	Door Systems	Special (Specify)
	DELEGATED FUNCTIONS	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	STATIC ANALYSIS																
2	DYNAMIC ANALYSIS		■	■	■		■		■	■	■	■	■		■	■	
3	FATIGUE ANALYSIS								■	■	■		■		■	■	
4	DESIGN AND CONSTRUCTION								■	■	■						
5	FLUTTER/GROUND VIBRATION		■	■	■	■	■		■	■	■	■	■		■	■	
6	SAFETY ANALYSIS		■	■	■			■	■	■	■	■	■				
7	FLOTATION & DITCHING ANALYSIS		■	■	■	■	■	■	■	■	■	■	■	■	■	■	
8	STRUCTURAL LOADING LIMITATIONS	■	■	■	■	■	■	■		■	■	■	■	■	■	■	
9	SERVICE DOCUMENTS								■	■	■						
10	MATERIAL & PROCESS SPEC.	■	■	■	■	■	■	■	■			■	■		■	■	
11	FLAMMABILITY	■	■	■	■	■	■	■	■	■	■	■			■	■	
12	DAMAGE TOLERANCE EVALUATIONS		■	■	■	■	■		■	■	■	■	■	■	■	■	

Note (1): Includes all airframe components: wing, fuselage, empennage, landing gear, flight controls, engine mounts, and special components. Does not apply to rotors.

Notes (2) and (3): Select Specialty by Note number and sub-letter from lists below. General applies to all processes listed.

(2) Metallic Materials/Processes
- A - Materials & Processes - General
- B - Non-Destructive Inspection/Testing
- C - Metallurgy
- D - Metal Joining Processes
- E - Structural Adhesives
- F - Mechanical Fasteners
- G - Surface Treatment/Coatings
- H - Bearings

(3) Nonmetallic Materials/Processes
- A - Material & Processes - General
- B - Transparent (Glazed) Material
- C - Polymeric Materials
- D - Structural Adhesives
- E - Mechanical Fasteners
- F - Composites
- G - Non-Destructive Inspection/Testing
- H - Surface Treatment & Coatings
- I - Structural Joining Methods

	AUTHORIZED AREAS	Structural-General (1)	Structural-Wing Group	Structural-Fuselage Group	Structural-Empennage Group	Structural-Landing Gear	Structural-Flight Controls
	DELEGATED FUNCTIONS	A	B	C	D	E	F
1	STATIC ANALYSIS						
2	DYNAMIC ANALYSIS		■	■	■		■
3	FATIGUE ANALYSIS						■
4	DESIGN AND CONSTRUCTION						
5	FLUTTER/GROUND VIBRATION		■	■	■	■	■

When maintaining a certified aircraft, what is a major alteration or repair?

- Easy… any repair or alteration that is not minor ☺
- Major repairs/alterations are NOT major changes in type design per 14 CFR Section 21.93 – major changes in type design generally require an STC
- 14 CFR Part 43 Appendix A provides a definition of what constitutes a major alteration or repair to an airframe, engine, propeller, or appliance

When maintaining a certified aircraft, what is a major alteration or repair?

- *A repair is the restoration of a damaged product or article accomplished in such a manner and using material of such quality that its restored condition will be at least equal to its original or properly altered condition (with regard to aerodynamic function, structural strength, resistance to vibration and deterioration, and other qualities affecting airworthiness).*
- *An alteration is the modification of an aircraft from one sound state to another sound state; the aircraft meets the applicable airworthiness standards both before and after the modification.*

When maintaining a certified aircraft, what is a major alteration or repair?

- A major repair or alteration using DER approved data (only) is NOT a field approval, from AC43-210 (italics added)

  "…When sufficient DER data has been obtained, the approval process applicable to the alteration is complete; the product can then be inspected for conformity and approved for return to service. *The person performing the alteration, rather than the DER, is then responsible for conforming and approving the installation. DER data is not a field approval, but is approved data that, like other approved data, can be used in the performance of major alterations or repairs without further approval if the data addresses the entire alteration or repair.* In this case, you do not need to request a field approval from the FAA. FAA Order 8110.45 provides guidance on this subject…"

How is a Field Approval different than an MRA with DER approved data?

- DER MRA – you have all the approved data you need; FA – you do not
- From AC43-210

"FAA Order 8110.37 addresses field approvals by reinforcing that DERs are not authorized to perform them… When sufficient DER data has been obtained, the approval process applicable to the alteration is complete; the product can then be inspected for conformity and approved for return to service. The person performing the alteration, rather than the DER, is then responsible for conforming and approving the installation. ***DER data is not a field approval, but is approved data that, like other approved data, can be used in the performance of major alterations or repairs without further approval if the data addresses the entire alteration or repair. In this case, you do not need to request a field approval from the FAA***."

What is “approved data?”

- AC 43-210 and 20-177 have a comprehensive list of what constitutes approved data
- Many, many types: TCDS, STC, ADs, AMOCs, SRMs, 337s, PMA, TSOA, ODA (or DAS), SFAR 36 (now RS ODA), manufacturers’ service documents, service bulletins, AC43-13 (as appropriate) … and DER approved data
- An important distinction: “approved data” vs. “acceptable methods and techniques”

What are some of the IA's responsibilities w/r/t MRA with DER approved data?

- As usual, the IA is "on the hook," as with any return to service
- The IA is responsible for determining what airworthiness data is required – a DER can often assist in this process
- AC120-77, para. 12(c) outlines how to evaluate the airworthiness requirements for a proposed major alteration/repair
- For a MRA with DER approved data: The inspector must have (1) all the necessary approved data (2) an appropriate authorization such as an A&P/IA, and (3) the tools, systems, knowledge and experience to ensure fabrication as accomplished in a manner compliant with 14 CFR Section 43.13(a)(b)

What are some of the IA's responsibilities w/r/t MRA with DER approved data?

- The IA is NOT responsible for (1) approving the content of analyses or reports and (2) approving drawings or specifications
- The IA decides if he/she has enough approved data to address all of the necessary portions of airworthiness compliance
- The IA is responsible for determining if the repair or alteration is within the limits of that which may be performed with DER approved data

What are some of the IA's responsibilities w/r/t MRA with DER approved data?

- If the IA determines that he/she does not have enough data to address compliance with all of the airworthiness requirements, then they may approach their FSDO/ASI with a request for a field approval supported with DER approved data, or for a CFA if needed
- A DER is required (Order 8110.37E) to tell the A&P/IA if they think any additional areas of compliance may be required beyond those listed on the approval form

What are some limits of using DER approved data to support MRA

- DER authority is strictly prescribed by the FAA – certain major repairs/alterations may include compliance elements outside those delegated to DERs
- DER authority applies only to aircraft/rotorcraft with an FAA Type Certificate – DER authority does not apply to any LSA or experimental amateur built aircraft.
- DER authority can apply to foreign (non US) registered aircraft with limitations (US state of design) – we also have a bilateral with Canada for DER approved repair data

What are some limits of using DER approved data to support MRA

- If your MRA involves any of the following elements, it may require a special delegation for the DER, or will require a FA or CFA:

AFMS or ICAW changes, Airworthiness Limitation changes, ground or flight test plans, compliance inspections, modifications to critical or life limited parts, special conditions, ELOS findings, or ADs

- Special conditions and ELOSs are located on TCDS
- ICA and AFM will have any limitations
- Compliance inspection(s) are sometimes completed for interior installations/modifications – used where the FAA says that compliance can not be determined by data inspection alone

Component fabrication for MRA without a Production Approval

- 14 CFR Part 21 defines the overarching certification procedures for products, articles, and parts
- 14 CFR Section 21.8 is for Approval of articles, and 21.9 is for Replacement and modification articles
- In essence, MRA articles/parts are *designed, certified, fabricated and consumed in the process of maintenance* under 21.9(a)(5) – for an individual, or 21.9(a)(6) for a certificate holder (CRS, for example)
- The *installation approval for MRA parts is via Part 43*
- MRA parts/articles are <u>not</u> approved under 21.8, i.e. TC, STC, PMA, TSO and <u>may not</u> be shipped for sale

Component fabrication for MRA without a Production Approval

- The preamble of 21.9(a)(6) clarified the FAA's position

"This exception [21.9(a)(6)]… allows for the production of articles without benefit of a production approval when articles are fabricated by an appropriately rated certificate holder with a quality system and consumed in the repair or alteration of a product or article in accordance with part 43. *Maintenance providers who do not have a quality system may continue to fabricate owner-produced articles* for installation on type-certificated aircraft…"

What can a DER do to support your major repair or alteration?

- Help you understand what portions of the Airworthiness Requirements might be applicable to a particular MRA
- Support your communications with the FSDO or ACO
- Bring to bear their knowledge and expertise to help you decide the course of your MRA
- Generate drawings and specifications that define the repair or alteration.

What can a DER do to support your major repair or alteration?

- Generate analyses and report documents containing the “guts” of the engineering compliance data – for example, structural analysis, electrical systems analysis, powerplant analysis, etc…)
- Approve certain types of engineering data (descriptive or analytical)
- Approve inspection intervals for fatigue critical structure, when specifically authorized
- Approve Repair Specifications (RS-DER) for a CRS

What can a DER do to support your major repair or alteration?

- Approve flammability test plans and reports
- Support you remotely or at the aircraft with design and certification experience

How do I practically use a DER for MRA data approval?

The following projects steps are generally in order:

- *Check* DER MRA *limitations*
- *Use the job aid* in FAA Order 8300.16

How do I practically use a DER for MRA data approval?

3. Items designated "Engineering" by the letters "**ENG**" may be eligible for approval by means other than a STC, but require FAA approved data. This data may be obtained from a Designated Engineering Representative (DER), Organization Designation Authorization (ODA) approved engineering data or through ACO coordinated field approval.

B	**Structural Strength**	
1	Changing primary structures (structures that carry flight, ground, or pressure loads as defined in the current edition of AC 23-13, Fatigue, Fail-Safe, and Damage Tolerance Evaluation of Metallic Structure for Normal, Utility, Acrobatic, and Commuter Category Airplanes).	ENG
2	Changes to significant structure to accommodate appliances installed on the exterior of the aircraft (i.e., Forward Looking Infrared (FLIR) equipment or system, cameras, firefighting, agricultural dispensing equipment, etc.) (See the current edition of AC 23-17, Systems and Equipment Guide for Certification of Part 23 Airplanes and Airships, for guidance for the substantiation of modifications involving installation of external equipment.)	ENG
3	Substituting airframe primary structural materials (i.e alloy substitutions).	ENG
4	Substituting an engine or propeller (such as replacing a reciprocating engine with a turbine engine).	STC

Ref: FAA Order 8300.16, Part 23 chart

How do I practically use a DER for MRA data approval?

- *Document*: description of article on which MRA is installed, description of proposed MRA, functional information, operating environment, interaction other aircraft systems
- *Review* existing approved data for adequacy
- If additional approved data is required, *outline Airworthiness Requirements* that apply (structures, electrical, powerplant…)
- Amendment levels of applicable requirements are very important
- *Identify* each technical area of *expertise* corresponding to airworthiness requirements and *locate DER(s)* – provide with your documentation and reference info

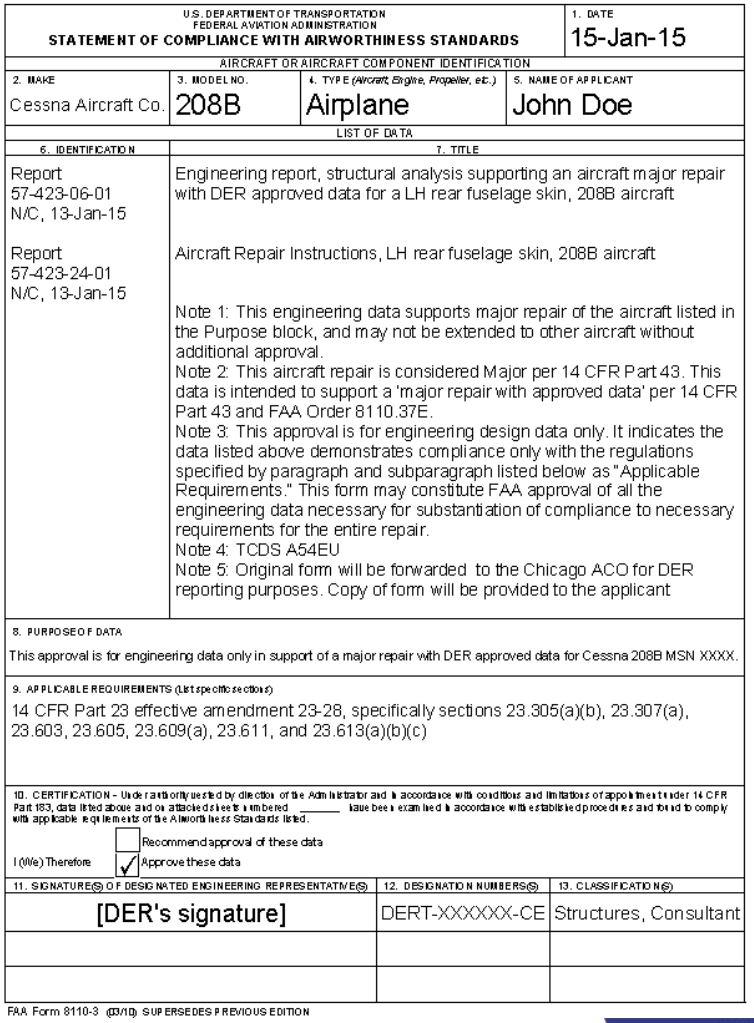
How do I practically use a DER for a repair or alteration data approval?

- *Formulate plan* with your DER
- If required, discuss with ASI or FSDO rep
- Work with DERs to *generate and approve* all *engineering and design data*
- *Execute and inspect MRA* on air(rotor)craft in accordance with approved data, including part fabrication and marking
- *Return aircraft to service* in repaired/altered condition via Form 337

How do I mark a part(s) that have been fabricated and consumed?

- FSIMS Order 8900.1, Vol. 4, Ch. 14, Sec. 13
- Marking approved under Part 43 – not Part 45
- Mark with name and/or trademark, new part number, and original part number (if obscured in the process of the MRA)
- Parts too small to mark – include info in logbook entry
- MRA that applies to TSOd article – add marking to show TSOd article has been changed/repaired
- Markings should be permanent, indelible, legible

What's included on FAA Form 8110-3?



U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

STATEMENT OF COMPLIANCE WITH AIRWORTHINESS STANDARDS

1. DATE: 15-Jan-15

AIRCRAFT OR AIRCRAFT COMPONENT IDENTIFICATION

2. MAKE	3. MODEL NO.	4. TYPE (Aircraft, Engine, Propeller, etc.)	5. NAME OF APPLICANT
Cessna Aircraft Co.	208B	Airplane	John Doe

LIST OF DATA

6. IDENTIFICATION	7. TITLE
Report 57-423-06-01 N/C, 13-Jan-15	Engineering report, structural analysis supporting an aircraft major repair with DER approved data for a LH rear fuselage skin, 208B aircraft
Report 57-423-24-01 N/C, 13-Jan-15	Aircraft Repair Instructions, LH rear fuselage skin, 208B aircraft
	Note 1: This engineering data supports major repair of the aircraft listed in the Purpose block, and may not be extended to other aircraft without additional approval. Note 2: This aircraft repair is considered Major per 14 CFR Part 43. This data is intended to support a 'major repair with approved data' per 14 CFR Part 43 and FAA Order 8110.37E. Note 3: This approval is for engineering design data only. It indicates the data listed above demonstrates compliance only with the regulations specified by paragraph and subparagraph listed below as "Applicable Requirements." This form may constitute FAA approval of all the engineering data necessary for substantiation of compliance to necessary requirements for the entire repair. Note 4: TCDS A54EU Note 5: Original form will be forwarded to the Chicago ACO for DER reporting purposes. Copy of form will be provided to the applicant

8. PURPOSE OF DATA

This approval is for engineering data only in support of a major repair with DER approved data for Cessna 208B MSN XXXX.

9. APPLICABLE REQUIREMENTS (List specific sections)

14 CFR Part 23 effective amendment 23-28, specifically sections 23.305(a)(b), 23.307(a), 23.603, 23.605, 23.609(a), 23.611, and 23.613(a)(b)(c)

10. CERTIFICATION - Under authority vested by direction of the Administrator and in accordance with conditions and limitations of appointment under 14 CFR Part 183, data listed above and on attached sheets numbered _____ have been examined in accordance with established procedures and found to comply with applicable requirements of the Airworthiness Standards listed.

I (We) Therefore
- ☐ Recommend approval of these data
- ☑ Approve these data

11. SIGNATURE(S) OF DESIGNATED ENGINEERING REPRESENTATIVE(S)	12. DESIGNATION NUMBER(S)	13. CLASSIFICATION(S)
[DER's signature]	DERT-XXXXXX-CE	Structures, Consultant

FAA Form 8110-3 (03/10) SUPERSEDES PREVIOUS EDITION

Date, make, type and applicant

Engineering and descriptive data

Notes will differ from form to form, but Note 3 should always be included for MRA

Purpose of data, typical for MRA

Applicable Airworthiness Requirements for this specific approval

Approved or recommended approved

Signature, DER number, classification

How do I fill out FAA Form 337 when using DER approved data for a MRA?

- See 14 CFR Part 43 Appendix B, and AC 43.9-1, Instructions for Completion of FAA Form 337
- 337 for MRA with DER approved data similar to one for installing an STC
- For MRA, block 8 should include (1) a list of the approved data that were used with date/rev, (2) list of airworthiness requirements with amendment levels, and (3) date of form 8110-3(s) approving the data

How do I fill out FAA Form 337 when using DER approved data for a MRA?

- 337 distribution generally: one copy to owner, one copy to OK City – sometimes a copy will go with the aircraft (fuel tanks)
- DER sends original 8110-3 to DER advisor, copy to applicant
- DER must provide IA with approved copy of descriptive data (drawings, instructions, specifications…)

How do I fill out FAA Form 337 when using DER approved data for a MRA?

- Engineering data (stress analysis, reports, or other data) may be proprietary – only the approval of data is required, not the data itself
- Drawings/specs *need not* be attached to the 337 – if they are, they need to be listed on block 8 as attachments

Structural examples where a DER has been used to support MRA or RS approval

- Repairs like the OEM, with a small difference
- Hardware replacement on TSOd wheel assy
- Skin repairs – seen often, usually from external damage or corrosion
- Bulkhead repairs – often due to corrosion
- Pressure vessel cutout or pass-thru
- Antenna installation
- Computer rack installation
- Antique aircraft alterations for non-existent replacement parts, such as a landing gear attachment pin
- Seat installation, modification and harness installations
- Non-structural fairing repairs for expensive fairings
- Repair Station repair specifications for multiple repairs at a CRS
- Support for MRA on former military aircraft

END

Thank you!!!

Questions??