AEROSPACE COATINGS
INTERNATIONAL
A WENCOR GROUP Company

DER Repairs

Federal Aviation Administration Designated Engineering Representative Approved Repairs

By

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Discussion Topics

- Regulatory Basis
- RS-DER
- Major versus Minor repair
- Customer Approval
- Example

Established by U.S. Law

- Code of Federal Regulation (CFR) – United States Law
- 14 CFR Part 183 - REPRESENTATIVES OF THE ADMINISTRATOR
- **[**This part describes the requirements for designating **private persons** to act as **representatives** of the **Administrator** in examining, inspecting, and testing persons and aircraft for the purpose of issuing airman, operating, and aircraft certificates. In addition, this part states the privileges of those representatives and prescribes rules for the exercising of those privileges, as follows:
  (a) An individual may be designated as a representative of the Administrator under subparts B or **C** of this part.
  (b) An organization may be designated as a representative of the Administrator by obtaining an Organization Designation Authorization under subpart D of this part.**]**
- Web Site: Regulatory and Guidance Library
  - http://rgl.faa.gov/

Types of Designated Engineering Representatives (DER)

- CFR 183, Subpart C--Kinds of Designations:
- Sec. 183.29 Designated Engineering Representatives; Amendment 183-9, Eff. 10/25/89

Designated Engineering Representatives	
Structural	Power Plant
Systems and Equipment	Radio
Engine	Propeller
Flight Analyst	Flight Test Pilot
Acoustical	

FAA Order 8100.8

- FAA Order 8100.8D Designee Management Handbook
  - Effective Date 10/28/2011

- Established Delegates:
  - Selection
  - Appointment
  - Orientation
  - Training
  - Oversight
  - Renewal
  - Tracking
  - Termination

- "under the cognizance of the **Aircraft Certification Service** and **Flight Standards Service**"

FAA Order 8110.37

- FAA Order 8110.37E; Designated Engineering Representative (DER) Handbook
  - Effective Date 3/30/2011
- Chapter 1-5: General Information; DER Authority and Limitations; DER Administration; Certification Activities of a DER; DER Guidance Material

- Appendix B. Delegated Functions and Authorized Areas
- Chart A, DER Structural
- Chart B, DER Powerplant Installations
- Chart C1, DER Systems and Equipment
- Chart C2, DER Systems and Equipment (Electrical Equipment)
- Chart D, DER Radio
- Chart E, DER Engines
- Chart F, DER Propellers
- Chart G, DER Flight Analyst
- Chart H, DER Flight Test Pilot
- Chart I, DER Acoustical

- Charts have **authorized areas** (**hardware**) and **delegated functions** (**analysis**)

DER and RS DER Duties

- Designated Engineering Representative
  - Compliance finding of FAA Regulations
    - FAA Form 8110-3 signed by DER
      - Repair Instructions
      - Substantiating Data
      - Not multiple use

- Repair Specification DER
  - FAA Requirement (Order 8110.37 revised 3/30/2011)
  - Only if multiple use repair
  - Focused on WHO is doing the repair
  - Cover Letter Approving Quality System signed by RS DER

Cover Letter for RS DER

- Quality System Addresses:
  - What the repair accomplishes:
  - When is the repair applicable:
  - How the repair will be accomplished:
  - How the repair will be substantiated:
  - How the repair will be inspected:
  - How the repair will be maintained:
  - How the repair specification will be kept up-to-date:

Cover Letter for RS DER continued

Yes	No	**Acceptable Repair Specification Checklist**
☐	☐	Results in a consistent, repeatable end state that can be evaluated to show compliance to the applicable airworthiness standards.
☐	☐	Provides the technical data for use in approving the aircraft or product for return to service
☐	☐	Is a procedure not listed in the current manufacturer's maintenance manual, ICA, or FAA-approved portions of service documents?
☐	☐	Is intended to be used repeatedly
☐	☐	Requires FAA data Approval.
☐	☐	Is authorized for use by the FAA for a specific maintenance entity. This includes maintenance facilities holding a 14 CFR part 145 certificate, and operators having a maintenance program authorized by operations specifications (OpSpecs) under 14 CFR part 121 or 135.

Major Repair Process (Aerospace Coatings International, ACI)

- Repair Development
  - Determine best repair process
    - Experience – similar or new
    - Part assessment (parent material, environment, damage)
    - Capability – in house or subcontract
  - Document repair instructions
    - Engineering Repair Instructions (ERI)
  - Safety Assessment
    - Engineering Substantiation Report (ESR)
    - Applicable Regulations

Major Repair Process (ACI)

- Engineering Repair Instructions:
  - Chrome Plate Example
    - Pre-Grind; ACI Standard Procedures
    - Etch Inspect; AMS 2649
    - Bake; AMS 2759/11 (pre grind stress relief)
    - NDT; ASTM-E-1444 (Magnetic Particle Inspection)
    - Chrome Plate; AMS 2460
    - Bake; AMS 2759/9 (Hydrogen Embrittlement Relief)
    - Finish-Grind; ACI Standard Procedures
    - NDT; ASTM-E-1444 (Magnetic Particle Inspection)
    - Final Inspection; ACI Standard Procedures(verify Dimensions)

Major Repair Process (ACI)

- System Safety Analysis
  - Minor and Major (next slide)
  - Failure effect analysis (part, NHA, System, Aircraft)
  - 3D Modeling
  - Stress Analysis
    - Finite Element Analysis
    - Hand Calculations
  - Margin of Safety Determination
    - Peak von Mises stresses compared to tensile yield strength
    - Shear Strength Analysis (ultimate strength to actual load)
    - Hoop Stress Analysis
      - Yield Strength compared to proof pressure
      - Ultimate Strength compared to burst pressure

Major or Minor Repair?

MAJOR AND MINOR DETERMINATIONS SHEET

(REF. 14 CFR 1.1, 14 CFR 43 Appendix A, 14 CFR 145, FAA Advisory Circular (AC) 120-77, & FAA Advisory Circular (AC) 145-9)

Section 1	**YES**	**NO**	**Comments**
Is the repair performed using accepted practice or elementary operations?	☒	☐	All Aerospace Coatings International (ACI) repairs are performed in accordance with current Aerospace Material Specifications.

If the answer to the question in Section 1 is "NO" then the repair is classified as "MAJOR". Otherwise continue on to Section 2.

Section 2	**YES**	**NO**	**Comments**
If improperly done, would repair appreciably affect airworthiness?	☐	☒	Failure of the part would be similar if not identical to the same failure of a non repaired part which the OEM had to address during certification.
Does the damage or its repair infringe upon the subject of an FAA Airworthiness Directive (AD)?	☐	☒	Search of the FAA (faa.gov) AD database yielded no results for the part or its higher assemblies.

Does the repair affect the following?	**YES**	**NO**	**Comments**
Weight	☐	☒	The parent material removed will be replaced with a material of similar density and if an increase or decrease is to occur it would be considered negligible with respect to the overall weight of the aircraft.
Balance	☐	☒	The parent material removed will be replaced with a material of similar density therefore it is considered to have no affect on the overall balance of the aircraft.
Structural Strength	☐	☒	A Substantiation Report showing the subject part is structurally acceptable at the listed pre-grind limits was performed. (See Page 1 for Report No.)
Performance	☐	☒	Since the overall weight and balance of the aircraft is not considered affected, the overall performance of the aircraft is considered not to be affected.
Power Plant Operation	☐	☒	Since the overall weight and balance of the aircraft is not considered affected, the power plant operation of the aircraft is considered not to be affected.
Flight Characteristics	☐	☒	Since the overall weight and balance of the aircraft is not considered affected, the flight characteristics of the aircraft is considered not to be affected.
Other Airworthiness Qualities	☐	☒	Repair to the subject part is considered not to affect any other Airworthiness Qualities.
Principal Structural Element	☐	☒	The subject part is considered not to be a principal structural element nor does it affect any other principal element.

If <u>any</u> question in Section 2 is answered "YES" the repair is classified as "MAJOR". Otherwise the repair is classified as "MINOR".

	MAJOR	**MINOR**	**Reviewed by:**	**Date:**
Repair Classification	☐	☒	Colin Bennett	02/17/2012

This repair is for a non-critical part. Therefore the repair is EASA approved by ED Decision No. 2007/001/C dated 9 March 2007.

Data Needed to Develop Repair

- ICA (Component Maintenance Manual)
  - Finish dimensions
  - Material (what is it made out of)
  - Leading Particulars (MNOP, Temperature etc.)
  - Function
  - IPL / IPC
  - Repair Section
- Part Sample
  - Evaluate for repair
  - XRF Material Analysis (non - destructive)

Customer Approval Data Request

- Typical Requirements (check your CAA)
  - Minor repair
    - CMM – no approval required, accepted data
    - Not in CMM - varies by customer
  - Major repair
    - FAA Form 8110-3
    - Engineering Substantiation Report (ESR)
    - Engineering Repair Instructions (ERI)
    - RS DER Cover Letter (multi-use)
    - The above can also vary by customer

    - ACI requires Non Disclosure Agreement to provide ESR and ERI

Customer Approval Question?

- Operator - CFR Part 121
- Repair Station - CFR Part 145
- Disagree on Minor finding – who is right

- Repair Station required to adhere to Operators FAA Approved Process

- Annotate on major/minor check sheet
- Annotate on FAA From 8110-3

Customer Approval (EASA)

The Agreement between the United States of America and the
European Union on Cooperation in the Regulation of Civil Aviation Safety and its Annexes
And
The Bilateral Oversight Board (BOB)
amendments to the Agreement
BOB Decision 001 amending Annex 1 dated 30 June 2011
BOB Decision 002 amending Annex 2 dated 30 June 2012
BOB Decision 003 amending Annex 2 dated 21 August 2012

Customer Approval (EASA)

TECHNICAL IMPLEMENTATION PROCEDURES
FOR
AIRWORTHINESS AND ENVIRONMENTAL CERTIFICATION
BETWEEN THE
FEDERAL AVIATION ADMINISTRATION
OF THE
UNITED STATES OF AMERICA
AND THE
EUROPEAN AVIATION SAFETY AGENCY
OF THE
EUROPEAN Union
Revision 2
October 22, 2012

Customer Approval (EASA) Major Repair

3.3.2.2 EASA Acceptance of FAA Repair Design Data.

(a) Non-Critical Components.

(1) EASA shall accept data used in support of major repairs regardless of the State of Design of the product, part or appliance, if:

(ii) the FAA repair design data approval is substantiated via an FAA letter, FAA Form 8110-3, FAA Form 8100-9, FAA Form 337 or a signed cover page of a repair specification.

Customer Approval (EASA) Minor Repair

3.3.2.2 EASA Acceptance of FAA Repair Design Data.

(a) Non-Critical Components.

(2) EASA shall also accept data used in support of minor repairs when:

(iv) for minor repairs from other than a U.S. TC/STC or TSOA holder, the determination that data are acceptable (under 14 CFR Part 43) has been made by a <u>U.S. maintenance organization under FAA's authorized system</u>

Customer Approval

- Check your states Civil Aviation Authority
- Bilateral Agreement with the United States FAA
  - Typically allows acceptance of DER approved repairs
  - 33 countries have agreement with the U.S.
- Web Site:
  - http://www.faa.gov/aircraft/air_cert/international/bilateral_agreements/baa_basa_listing/

Why Choose ACI Engineering ?

- Experience
  - Over 1,700 repairs available (1,433 with DER Approval)
  - Safety – Never had an in flight service difficulty
  - Quality
    - ISO Certificated
    - FAA 145 Repair Station Approval
    - EASA Approval
    - CAAC Approval
    - FAA Part 21 (PMA) Approval – pending
  - DER Services (15 + years experience)
    - Systems and Equipment Mechanical
    - Powerplant / Engine
    - Repair Specification (RS-DER), requirement in CY2011

What's Are Good Parts To Repair?

- Outer Diameters

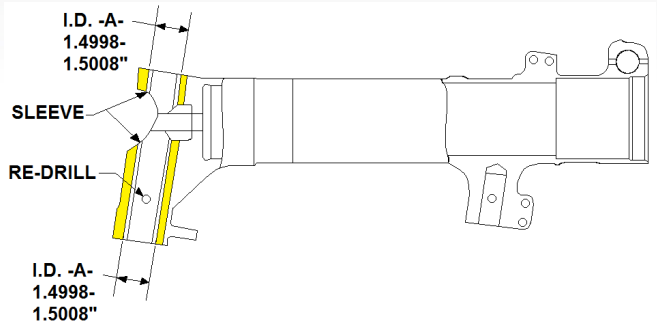


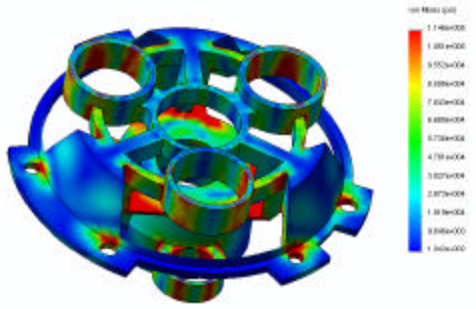
- Inner Diameters / Sleeve

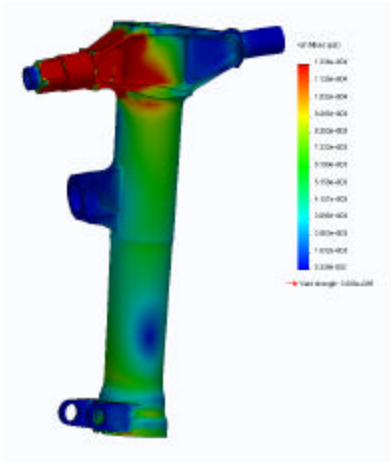


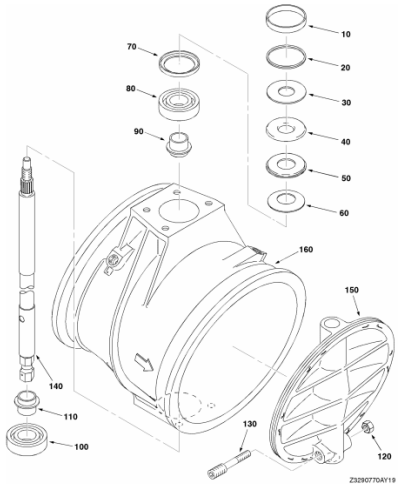
What Are Good Systems to Target?

- Pneumatic
- Hydraulic
- Landing Gear
  - Size limitation
- Flight Controls
- Door Mechanisms
- Engine
- Powerplant









Conclusion DER Repairs

- Based in U.S. Law, highly structured process
- EASA and US formalized acceptance
- Bilateral Agreement 33 Countries
- Accepted by CAA in most countries
- OEMs are removing repair instructions in the Instructions for Continued Airworthiness (CMM / AAM)
- Typically cheaper to repair than replace
- Typically lead time is less to repair than replace
- ACI Advantage
  - Engineered Repairs
  - One stop shop
  - Tailored to meet customer needs

Comparison of DER Repair to PMA

	DER	PMA (Test and Comp)
Part Number	Same as OEM	Different than OEM
FAA Approval	ACO Designee (DER)	ACO and MIDO (AEG)
Reverse Engineering	Use available data or basic analysis of subject part	Material and Dimensional requiring (5) OEM samples
Substantiation	Effect of repair on continued operation	Validate design and manufacture
Customer Approval	Less structured	More structured
Part Characteristics	Restored to OEM criteria (used)	Equal or better than OEM (new)
Airworthiness Release	FAA Form 8130-3 (repair / overhaul) or C of C	FAA Form 8130-3 (new)
Price	Based on repair (lower)	Percent of OEM (higher)