SOFEMA
AVIATION SERVICES

FAA – EASA – TCAA - Aircraft Repair Assessment & Facilitation

Sofema Aviation Services (SAS) www.sassofia.com offers insight into the process of assessing and managing aircraft repairs, considering damage tolerance principles to ensure continued structural integrity.

- Repairs are of particular concern for older aircraft, where they may induce or obscure metal fatigue, corrosion, or other structural damage.
- Regular inspections and maintenance are crucial to ensure long-term safety.

Introduction

Repairs particularly on older airplanes present specific challenges. The potential for metal fatigue, corrosion, or damage developing within the repair or surrounding structures necessitates rigorous damage-tolerance evaluations.

- The main objective of repair assessment is to maintain structural integrity, with inspections forming a key part of ongoing safety protocols.
- Unlike new structures, repairs are more complex to predict, as they are customized for each situation.

Repair Assessment

As aircraft age, the number of repairs increases, as does the complexity of evaluating their long-term effects. Key factors in repair assessment include:

- Increased number and aging of repairs.
- The possibility of unforeseen repair interaction or autogenous failure.
- Continued operational safety depends on well-designed maintenance programs, including inspections based on damage-tolerance principles.
- Over time, repair evaluation becomes more critical as part of the maintenance program.

Damage Tolerance Methodology

Damage-tolerance methodology has evolved over the years, and many older repairs were not designed to modern standards.

Pre-1978 aircraft designs were not subject to current damage-tolerance requirements, which means repair characteristics may vary and sometimes require additional inspections under modern standards.

Aircraft Repair Considerations

When a repair extends beyond Structural Repair Manual (SRM) guidelines or involves primary structural elements, airworthiness approval is required. Below are the processes followed by different authorities:

FAA and EASA Repair Design Data Approval Process

- **FAA**: The FAA approves major repairs under:
    - FAA Order 8110.4 (Type Certification),
    - FAA Order 8110.37 (Designated Engineering Representative Guidance Handbook),
    - FAA Order 8100.15 (Organization Designation Authorization Procedures),
    - FAA Order 8300.16 (Major Repair and Alteration Data Approval).
    - Minor repairs are accepted under 14 CFR Part 43.
- **EASA**: EASA approves repairs under Part 21 Subpart M. The process involves the airworthiness of type design, with design approval issued for all repair design data.

Boeing and Airbus Repair Processes

- **Boeing**: FAA Form 8100-9 approves Boeing repairs, either for regular repairs or repairs affecting Airworthiness Directives. This process is under Boeing's Organization Designation Authorization (ODA).
- **Airbus**: Airbus uses a Repair Design Approval Sheet (RAS) under EASA Part 21 Subpart M (21A.431). The RAS addresses structural damage across ATA chapters and system interfaces. Airbus' system repair process is called Technical Adaptation (TA).

Notes in the use of FAA 8100-9 instead of FAA Form 337

Boeing issues FAA Form 8100-9 for certain repairs instead of Form 337 due to the Organization Designation Authorization (ODA) system, which allows Boeing, as a delegated organization, to directly approve repairs. Here's a breakdown of the key reasons for this distinction:

Organization Designation Authorization (ODA)

- **Boeing holds an ODA** issued by the FAA, which grants the company the authority to approve certain types of repairs, alterations, and modifications on its own products (e.g., Boeing aircraft).
- Under the ODA system, authorized organizations like Boeing can approve repair design data without direct involvement from the FAA, so long as the repairs fall within the scope of the organization's approval.

FAA Form 8100-9 for Repairs

- **FAA Form 8100-9** is used when an **ODA holder** (like Boeing) certifies and approves a repair as compliant with airworthiness standards.
- It is a form that certifies major repairs or alterations conducted by the ODA holder, particularly when the repair affects the aircraft's airworthiness or involves flight-critical structures or systems.
- Boeing uses Form 8100-9 because, under the ODA system, it can approve and sign off on its own repairs rather than requiring FAA Form 337, which is used when the repair approval comes from an external certified mechanic or repair station.

Difference Between FAA Form 8100-9 and FAA Form 337

- **Form 337** is used for major repairs and alterations that are typically done by maintenance personnel or repair stations who are not part of an ODA. It serves as a means for these personnel to document and submit the repair to the FAA for approval or acceptance.
- **Form 8100-9**, on the other hand, is used by **ODA organizations** like Boeing to **approve their own design data** and certify that repairs meet all applicable airworthiness standards. Since Boeing, under the ODA, has the authority to approve repairs directly, they issue **Form 8100-9** instead of submitting a **Form 337** to the FAA for approval.

Direct Delegation of Approval Authority

- **FAA Form 337** is generally used for repairs performed by entities that need external validation by the FAA, such as individual mechanics, repair stations, or smaller entities without ODA status.
- In contrast, **Boeing**, through its ODA, has been delegated the responsibility of ensuring compliance with FAA regulations for its products. Thus, instead of relying on an external certification process (like Form 337), Boeing directly certifies its repairs using **Form 8100-9**.

Specific Use for Major Repairs and Alterations

- **Form 8100-9** is used for major repairs that involve substantial modifications or repairs, especially when it comes to **primary structural elements** or repairs that affect **Airworthiness Directives (ADs)** or other safety-critical components.
- Boeing can issue **Form 8100-9** under its ODA to certify that the repair is compliant with all relevant airworthiness regulations without needing to go through the FAA approval process required for **Form 337**.

Scope of Repairs

- **Form 337** is typically used for repairs and alterations that do not require organizational approval or for those that are carried out on a smaller scale by repair stations or individuals.
- **Form 8100-9**, by contrast, is used when an ODA organization like Boeing handles repairs for larger, more complex aircraft that require design data approvals, particularly for unique or one-off repair situations that are not covered by standard procedures (such as those outlined in a Structural Repair Manual (SRM)).

Differences Between FAA, EASA, and TCCA (Canada)

While the FAA and EASA follow similar principles, there are differences in processes when compared to Transport Canada Civil Aviation Authority (TCAA):

- **FAA**: Utilizes Organization Designation Authorization (ODA) to delegate repair approvals to organizations (like Boeing).
- **EASA**: Uses a Design Organization Approval (DOA) to delegate authority but requires a RAS for structural repairs.
- **TCCA**: The Canadian system shares many principles with FAA and EASA but has distinct requirements under **CAR 521**, including the requirement for **TCCA-approved repair data**. Repairs must comply with the **Canadian Aviation Regulations (CARs)**, and major repairs require the submission of a **Repair Design Approval (RDA)**, akin to EASA's RAS.

Key Differences Between FAA, EASA, and TCAA

1. **Delegation of Authority**: FAA delegates repair approval through ODA, while EASA uses DOA. TCAA also delegates but maintains specific requirements via CAR 521 for design approvals.
2. **Documentation**: FAA and EASA use different forms (FAA Form 8100-9 vs. Airbus' RAS) for repair approvals. TCCA uses its own RDA process for major repairs.
3. **Regulatory Differences**: TCCA has specific regulations tailored to Canadian aviation requirements, while the FAA and EASA follow a more globalized structure.

TCAA-Specific Considerations

- In Canada, repairs outside the SRM or involving primary structures require specific **TCAA-approved repair data**.
- Like the FAA and EASA, TCCA places strong emphasis on **damage tolerance assessments** and regular inspections.

- Additional TCCA guidance ensures that repairs adhere to **Canadian airworthiness standards**, particularly for structural integrity and ongoing maintenance protocols.

EASA Blend Out Repair Requirements

EASA emphasizes that dimensions of material removed during blend-out repairs must be recorded. This is crucial to assess future damage tolerance and ensure that repairs remain within the allowable limits.

FAA Form 337 in the Context of Other Aviation Authorities

- **EASA**: In Europe, EASA does not have an exact equivalent to FAA Form 337. Instead, repair and alteration approvals are typically handled through the **Part 21 Design Organization Approval (DOA)** system. EASA uses forms such as the **EASA Form 1** for component repairs and **Repair Design Approval Sheet (RAS)** for structural repairs. The processes are documented, and EASA oversees major repairs and alterations through approved maintenance organizations and engineers.
- **TCAA (Canada)**: Transport Canada Civil Aviation (TCCA) has its own process for documenting major repairs and alterations, known as **Form 24-0045**, which functions similarly to FAA Form 337. The process requires submission of details related to major repairs or alterations, and TCCA ensures compliance with Canadian Aviation Regulations (CARs). The major repair or alteration must be supported by **TCCA-approved repair data**, and the form must be included in the aircraft's maintenance records.

Key Differences Between FAA, EASA, and TCAA

- **FAA**: Uses Form 337 for documenting major repairs and alterations, which must be submitted to the FAA and retained in the aircraft’s maintenance records.
- **EASA**: Relies on DOA-approved procedures and other forms (e.g., EASA Form 1, RAS) for repair and alteration documentation.
- **TCAA**: Uses a similar form (Form 24-0045) to record major repairs and alterations, which must be submitted to Transport Canada and added to the aircraft’s records.

Importance of FAA Form 337

1. **Traceability**: The form serves as a permanent record of significant maintenance events, which is critical for the future sale of the aircraft or during inspections.
2. **Safety**: Documenting major repairs and alterations ensures that an aircraft remains airworthy and that any changes made to its structure, engine, or systems comply with federal safety standards.

3. **Regulatory Oversight**: By requiring submission of Form 337, the FAA ensures it has oversight of all major repairs and alterations, providing an additional layer of safety in the maintenance process.
4. **Compliance and Accountability**: The form holds the certifying individuals accountable for their work, ensuring that repairs and alterations meet the necessary standards and are legally documented.

When importing an aircraft from the U.S. into an EU jurisdiction, the acceptance of repairs and alterations documented on FAA Form 337 involves several steps to ensure compliance with European Union Aviation Safety Agency (EASA) regulations.

EASA does not automatically accept all work performed under FAA approval without review. Therefore, the acceptance of FAA Form 337 is subject to a validation process to ensure that the aircraft complies with EASA airworthiness requirements under Part 21 of the EASA Regulations.

Evaluate the Type of Repair or Alteration

Not all repairs and alterations performed in the U.S. are automatically recognized by EASA. Before beginning the importation process, it is crucial to:

- **Identify if the repair or alteration documented on FAA Form 337 is major** according to **EASA standards**.
- Determine if the repair or alteration has been performed in accordance with **approved design data**. The data used must either have been:
    - **FAA-approved and accepted by EASA** under **Bilateral Aviation Safety Agreements (BASA)** between the FAA and EASA, or
    - **Revalidated** by EASA, particularly if the design data is proprietary or specific to a U.S.-registered aircraft and not directly recognized by EASA.

Verify Bilateral Aviation Safety Agreement (BASA) Provisions

The **FAA-EASA Bilateral Aviation Safety Agreement** facilitates the mutual recognition of certain airworthiness approvals, but with limitations. Some major repairs and alterations may not be automatically accepted by EASA. The **Technical Implementation Procedures (TIP)** of the BASA specify the scope of mutual acceptance for repairs.

- **Standard Repairs**: If the repair or alteration falls within the scope of the BASA's Technical Implementation Procedures, it may be accepted by EASA without further approval.
- **Non-standard Repairs**: If the repair does not fall under the BASA agreement, additional steps such as validation or re-approval by EASA may be required.

Obtain EASA Validation for Non-standard Repairs

If the FAA Form 337 documents repairs or alterations that are not automatically accepted by EASA, the following steps may be required:

- **Submit the repair data** to EASA for validation.
- **EASA Design Organizations** or an **EASA-approved Continuing Airworthiness Management Organization (CAMO)** may need to evaluate the repair or alteration. This often involves reviewing the **approved design data** referenced in FAA Form 337 to ensure it meets EASA's airworthiness requirements.
- If necessary, the organization may need to submit the repair data to EASA for **formal approval** or **re-approval** under **EASA Part 21, Subpart M** (repairs).

Review Documentation and Supporting Data

Alongside FAA Form 337, supporting documentation, such as engineering reports, drawings, and manuals referenced during the repair or alteration, must be reviewed:

- Ensure that all repair documentation, including FAA-approved data (e.g., Designated Engineering Representative (DER) approvals), is complete and accessible.
- EASA may require a **Repair Design Approval Sheet (RAS)** or equivalent documentation if the repair affects the structural integrity or involves significant alterations.

Check if a Supplemental Type Certificate (STC) is Involved

If the alteration on FAA Form 337 involves a **Supplemental Type Certificate (STC)**, verify if the STC is recognized by EASA:

- **FAA STCs** used in alterations may need **EASA validation** if not already accepted under the BASA. EASA has a validation process for STCs, and this must be completed before the aircraft can be registered in the EU.
- In cases where the STC is not validated or accepted by EASA, additional steps, such as submitting the alteration for **EASA design approval**, will be necessary.

Submit the Documentation to the EASA Competent Authority

Once all repairs and alterations have been reviewed and validated:

- The CAMO or the individual importing the aircraft must submit the required documentation, including the **FAA Form 337**, supporting data, and any validation or approval paperwork, to the relevant **EASA competent authority** (usually the local National Aviation Authority).

- The competent authority will evaluate the submissions to determine if the aircraft can be issued an **EASA Certificate of Airworthiness (CoA)**.

Physical Inspection of the Aircraft

As part of the importation process, (Airworthiness Review Certificate – ARC) the aircraft will typically undergo a physical inspection by the EASA competent authority or a CAMO. During this inspection:

- All repairs and alterations documented on FAA Form 337 will be checked to ensure they were completed in compliance with the approved design data.
- The inspection ensures that the aircraft conforms to EASA standards and that no non-compliant modifications or repairs exist.

Next Steps

Sofema Aviation Services (SAS) www.sassofia.com and Sofema Online (SOL) www.sofemaonline provides regulatory training related to Bilateral relationships between EASA – FAA – TCAA and UK CAA please see the websites or email team@sassofia.com