

# Part-21 Implementation Workshop

## Acceptance of demonstration by similarity

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**Your safety is our mission.**

## Certification data for a Major Change or STC

- 21.A.113 (b) (application for a STC) , *“specify whether the certification data has been or will be prepared **completely by the applicant** or on the basis of an **arrangement with the owner of the type-certification data**”*
- 21.A.115 (approval) : *“A STC shall only be issued when... it has been demonstrated that the change to a type-certificate and areas affected by the change **comply with the type-certification basis** and the environmental protection requirements, as established by the Agency in accordance with point 21.A.10 “*

For any installation,

- What is the expected extent of certification data?
- When can an applicant prepare the justification without an arrangement with the TC holder (use of assumptions and reverse engineering)?

# Continued Airworthiness

→ **21.A.3B (c)** (ADs) *“When an airworthiness directive has to be issued by the agency to correct the unsafe condition referred to in point (b), or to require the performance of an inspection, the holder of the type-certificate, restricted type-certificate, supplemental type-certificate, major repair design approval, ETSO authorisation or any other relevant approval deemed to have been issued under this Regulation, shall: 1. **propose the appropriate corrective action** or required inspections, or both, and submit details of these proposals to the Agency for approval;”*

→ The availability of a logical, structured evaluation will assist in this process. It may be impractical to follow the disposition of occurrences associated to a design by another approval holder

**21.A.5 (a)** Record-keeping. Organisations that hold a STC shall maintain the relevant design information/data. According to GM1.A.5, this includes the drawings and test reports, and the compliance demonstration data

# Examples of acceptability of similarity/reverse engineering 1/4



- Chicago Paper for antenna installation:
  - A conservative stress is estimated assuming that the baseline aircraft has MS=0 at ultimate load, and a recognized spectrum.
  - Acceptable within its applicability

$$\sigma_{IG,max} = (F_{tu}/1.5 - \Delta PR/2t)/n_z$$

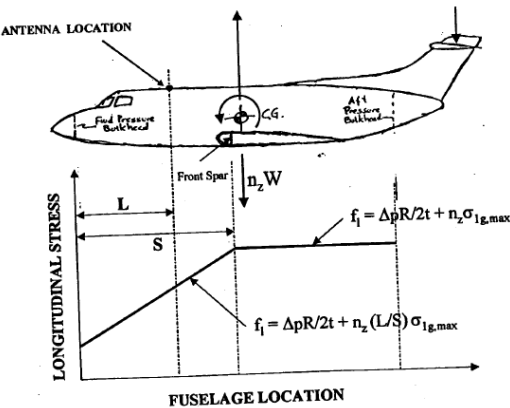


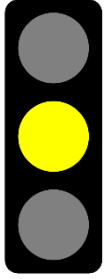
Figure 2 Assumed Longitudinal Stress Distribution



- Usage of the TCDS for justification of evacuation:
  - Each TC holder will give the MPSC for a given emergency exits configuration.
  - LOPA has to remain similar to the one used for initial certification.

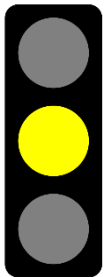
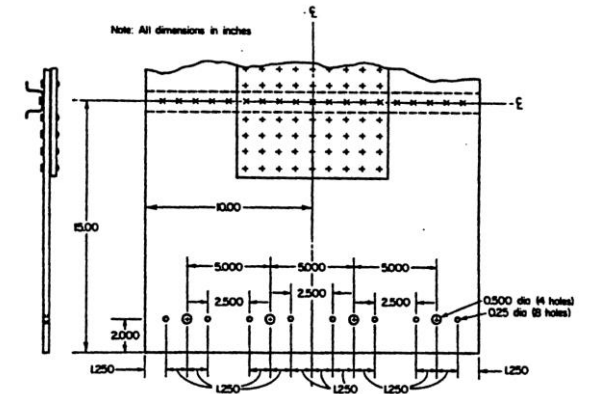
MPSC	Cabin configuration	Modification	Minimum CC
195	C*-III-III-C*	156723, 158708 or 158819	4
180	C-III-III-C		4
165	C*-III-C*	164024	4
150	C-III-III-C	150364	3
145	C-III-C	150016 or 35177	3

# Examples of acceptability of similarity/reverse engineering 2/4



## → Inspiration from Type Certificate Holder: **SRM repair** designs

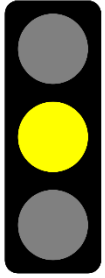
- It is good practice to maintain the design principles of the TCH (fastener rows, hole distances, etc...)
- SRM repair solutions can't be exported outside of its conditions (location, geometry, etc) without further justification
- It is still the responsibility of the applicant to show compliance with the static strength and F&DT requirements
- Consider existing life limits, inspections, applicable ADs
- Ensure accessibility to inspections, corrosion protection



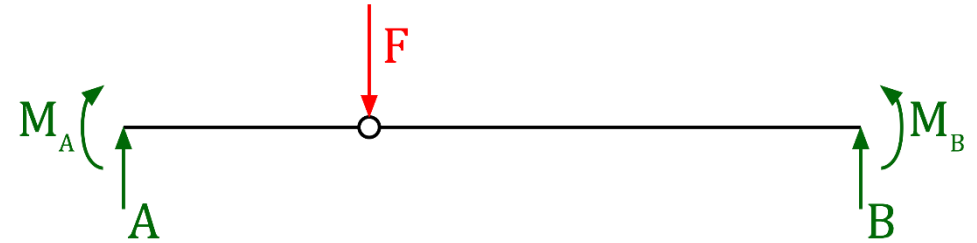
## → Usage of IPC to justify the installation of parts/monuments

- IPC is a maintenance document for a given MSN.
- It indicates parts interchangeabilities as a maintenance task.
- It cannot be considered as approved airworthiness data.

# Examples of acceptability of similarity/reverse engineering 3/4



- Installation of cabin items of mass to the floor (static substantiation)
  - If there is a specification from the TCH, it has to be considered
  - For existing structures and load paths, instead of an absolute analysis/test, a body loads balance analysis may be provided showing that forces and stresses are smaller.
  - All new structures have to be justified
  - **FAQ** <https://www.easa.europa.eu/faq/105007>

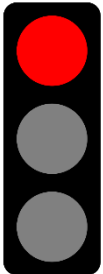


# Examples of acceptability of similarity/reverse engineering 4/4



- Usage of EASA Form 1 for compliance to airworthiness requirements
  - The EASA FORM 1 only shows that the part has been manufactured in accordance with approved data.
  - Only shows that the part has been certified by another DOA.
  - Design data must be owned.

1. DIRECTION GENERALE DE L'AVIATION CIVILE FRANCE		2. AUTHORISED RELEASE CERTIFICATE Certificat Libération Autorisée EASA FORM 1 Formulaire 1 de l'EASA				3. Form Tracking Number N° de repère du Formulaire									
4. Organisation Name and Address Nom et Adresse de l'Organisation :		Head Office: DERICHEBOURG Air Maintenance Station :				5. Work Order / Contrat / Invoice Bon de commande / Contrat / Facture									
6. Item / Item		7. Description / Description		8. Part No. / N° de pièce		9. Qty / Qté									
10. Serial No. / N° série		11. Status / Work / Etat / Travaux													
12. Remarks Remarques															
13a. Certifies that the items identified above were manufactured in conformity to: Certifie que les éléments identifiés ci-dessus ont été fabriqués conformément aux : <input type="checkbox"/> approved design data and are in a condition for safe operation données de conception approuvées et sont en état de fonctionner en toute sécurité <input type="checkbox"/> non-approved design data specified in block 12 données de conception non approuvées spécifiées dans le case 12								14a. <input type="checkbox"/> Part 145.A.50 Release to Service Approbation pour remise en service Selon Partie 145.A.50 Certifies that unless otherwise specified in block 12, the work identified in block 11 and described in block 12, was accomplished in accordance with Part 145 and in respect to that work the items are considered ready for release to service. Certifie que, sauf indication contraire spécifiée en case 12, les travaux identifiés en case 11 et décrits en case 12 ont été réalisés conformément à la partie 145 et qu'en ce qui concerne ces travaux, les pièces sont considérées prêtes à la remise en service.							
13b. Authorised Signature Signature autorisée		13c. Approval/Autorisation Number Numéro d'agrément d'autorisation		14b. Authorised Signature Signature autorisée		14c. Certificate/Approval Ref. No. N° du Certificat/Agrément									
13d. Name / Nom		13e. Date (dd mm yyyy) / Date (jj mm aaaa)		14d. Name / Nom		14e. Date (dd mm yyyy) / Date (jj mm aaaa)									
<small>USER/INSTALLER RESPONSIBILITIES / Responsabilités de l'utilisateur/installateur This certificate does not automatically constitute authority to install the items. Ce document ne constitue pas forcément l'autorisation d'installer (l'act) des items. When the user/installer performs work in accordance with regulations of an airworthiness authority different than the airworthiness authority specified in block 1 it is essential that the user/installer ensures that higher airworthiness authority approval exists from the airworthiness authority specified in block 1. Quand l'utilisateur/installateur travaille selon les réglementations d'une autorité de navigabilité différente de l'autorité de navigabilité mentionnée dans le case 1, il est essentiel que l'utilisateur/installateur s'assure que son activité de navigabilité est approuvée par l'autorité de navigabilité mentionnée dans le case 1. Statements in blocks 13a and 14a do not constitute installation certification. In all cases aircraft maintenance records must contain an installation certification issued in accordance with the national regulations by the user/installer before the aircraft may be flown. Les indications portées en cases 13a et 14a ne constituent pas une certification de montage. Dans tous les cas le dossier d'entretien de l'aéronef doit contenir une certification d'installation délivrée conformément aux règlements nationaux par l'utilisateur/installateur avant que l'aéronef puisse voler.</small>															



- Replication of an approved design without demonstration
  - It's installed on the same model of aircraft in the operator's fleet
  - It's approved by the TC holder (seats, monuments...)
- = It's certainly certifiable. Who owns the original compliance data?
  - Structural justification
  - Flammability justification
  - ...



# Conclusions 1/5

→ Demonstration by similarity should:

- Be compliant with 21.A.113 and 21.A.115
- The applicant should have access to the necessary data, or a DO-DO agreement with the owners
- Be organized with sufficient detail, and should in general be quantitative.
- Compensate unknown characteristics or uncertainty with conservative assumptions.
- Not depend on the EASA LOI
- Be able to support future Continued Airworthiness activity.

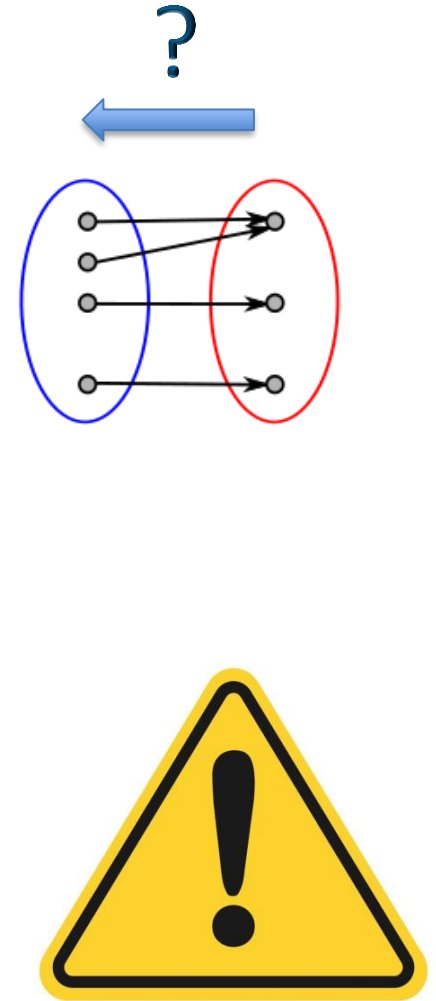




## Conclusions 2/5

### → Caution points about reverse engineering/similarity:

- Reverse engineering is a process in which products are deconstructed to extract design information, however, the solution may not be fully determined, and assumptions may be wrong.
- The output of reverse engineering may be absolute parameters like stresses/spectra (e.g. Chicago Paper), or relative values between two designs (e.g. unit external stress comparisons). However relative values generally don't provide sufficient data for the initial demonstration or continued airworthiness, as explained in the previous slide.
- AMC to 25.307 addresses the means of compliance required, based on previous test and analysis evidence, depending on the similarity with a new structure. According to 25.307, access to the reference certification data is necessary for demonstration by similarity.
- Approved design can't be exported to other configurations, usage, different locations, geometries, without justification.



## Conclusions 3/5

### → Caution points about reverse engineering/similarity:

- Interactions with the AFM, AMM and SRM conditions/limitations should be considered. Access for inspections and corrosion protection should be ensured
- It's difficult to exhaustively determine all the initial certification conditions. E.g. the structure may have to sustain system failure cases.
- The baseline and the comparison criteria should be reviewed carefully
- Chains of demonstrations by similarity will lose reliability. Conservative assumptions need to compensate for this uncertainty
- Airworthiness Directives issued after the certification of the original design should be considered



## Conclusions 4/5

- Interactions need to be evaluated when similarity and reverse engineering are proposed:
  - A change of stiffness can modify the load distribution to adjacent areas, or change the aerolastic behaviour
  - Flutter, particularly in case of: mass concentrations on flexible parts. Change of mass on control surfaces.
  - Sudden decompression: Introduction of new compartments, change of opening and vent sizes
  - Crashworthiness: Changes potentially affecting energy absorption mechanisms. Potential to injure occupants or obstruct egress paths.
  - Interaction with systems, e.g. hydromechanical or powerplant. Failure probability or severity could rely on sufficient structural strength
  - ...



## Conclusions 5/5

- The principle of safety certification is gaining a comprehensive understanding of the behavior of the design and its failure modes



# Coffee with the experts

Kindly invited to meet EASA Experts in Foyer (Grand hall)

→ 16:00 – 17:00

Please return badges at reception when leaving for **Recycling**



**EASA**  
European Aviation Safety Agency

**Thank you!**

**Your safety is our mission.**

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