Issues Associated with Modification and Repair of Primary Aircraft Composite Structures

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Where Would Someone Start

- Two Possible Scenarios
  - Knowledgeable DER – (Few)
  - Others (Many)

Knowledgeable – DER Plan

- Material Properties
- Inspection Techniques – Before and After
- Design Issues
- Analysis Methodologies
- Effects of Defects Before and After
- Process Specification for Bonding, Drilling, etc.
- Experience of the Installation Mechanics

Material Properties

- Equivalence (70 K $)
- Complete Basic Material Properties (CMH-17 Data Set) (150 K $)
- Building Block Approach for Each Modification Or Repair (50-150 K $)

Inspection Techniques – Before and After

- Need to first assess the existing structural integrity,
  - C-Scan
  - A-Scan
- Second to ensure quality of the repair or modification
  - C-Scan
  - A-Scan

Design Issues

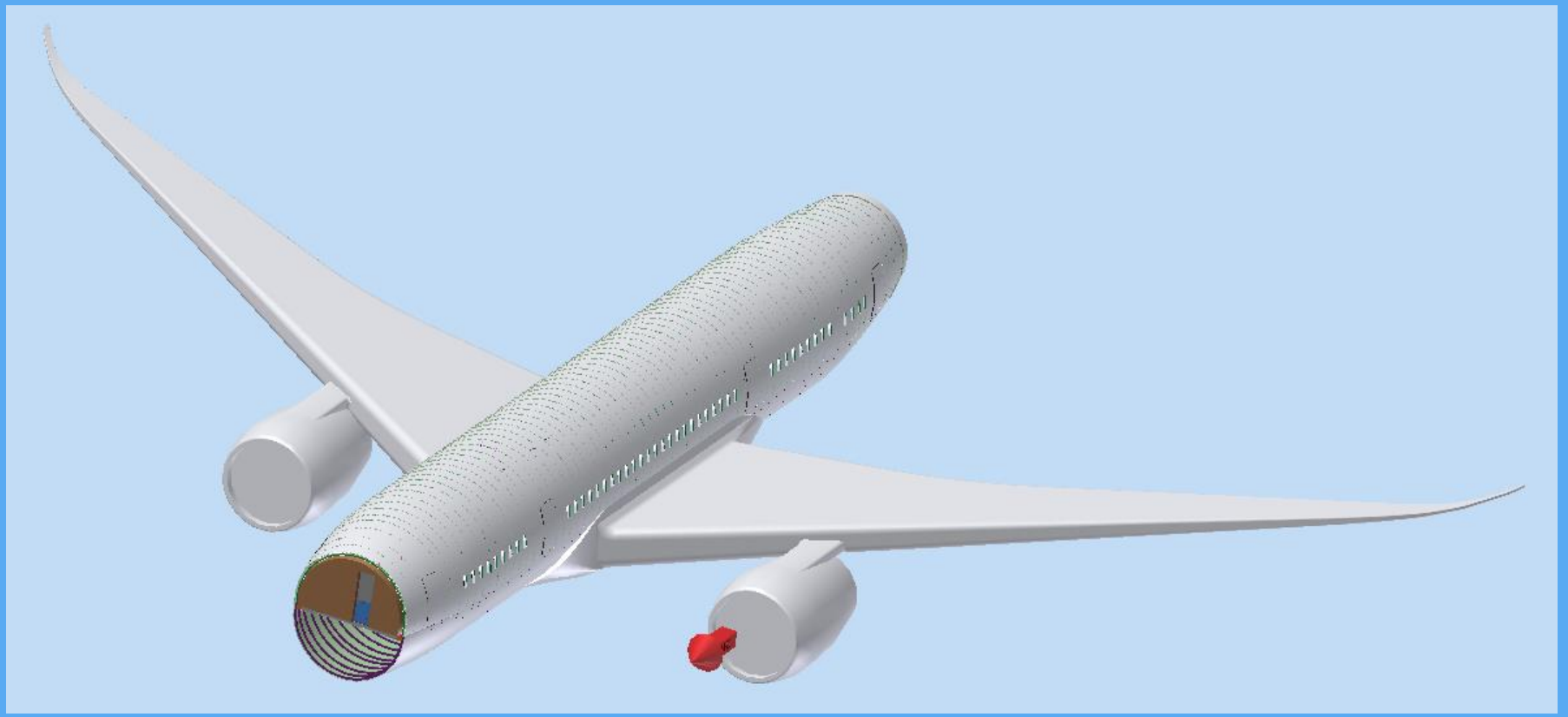
- Location Selection
  - Minimize complexity as much as possible
- Less is more – Minimize effect on existing Load Path
- Clearly present work plan for correct installation (Utilize SRM Methods and procedures as much as possible)
- Replace Lightning protection
- ETC

Analysis Topics

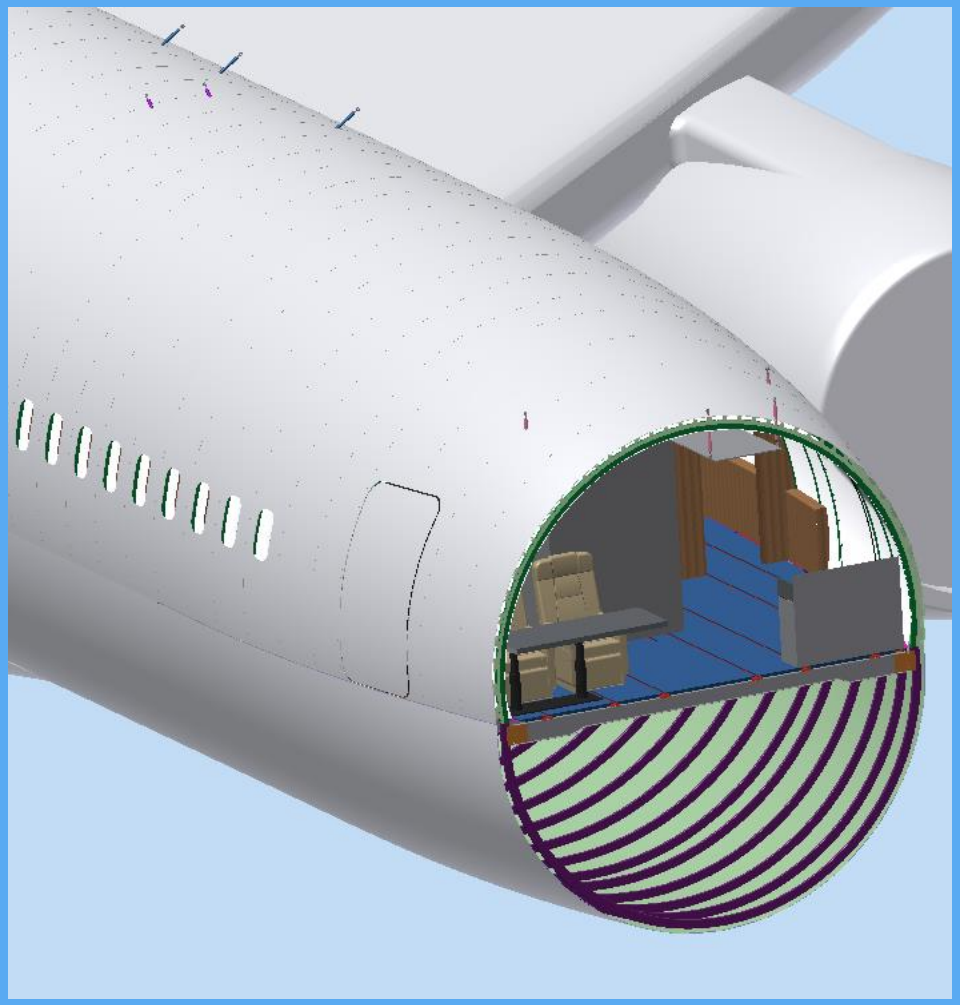
- Bolted Design
  - Bolt Load Distribution Methods
  - FEM for Existing Structure Load Distribution
- Bonding Design
  - Bonded Load Distribution Methods
  - FEM for Existing Structure Load Distribution

Note: FEM of Existing Structure Defined by Survey

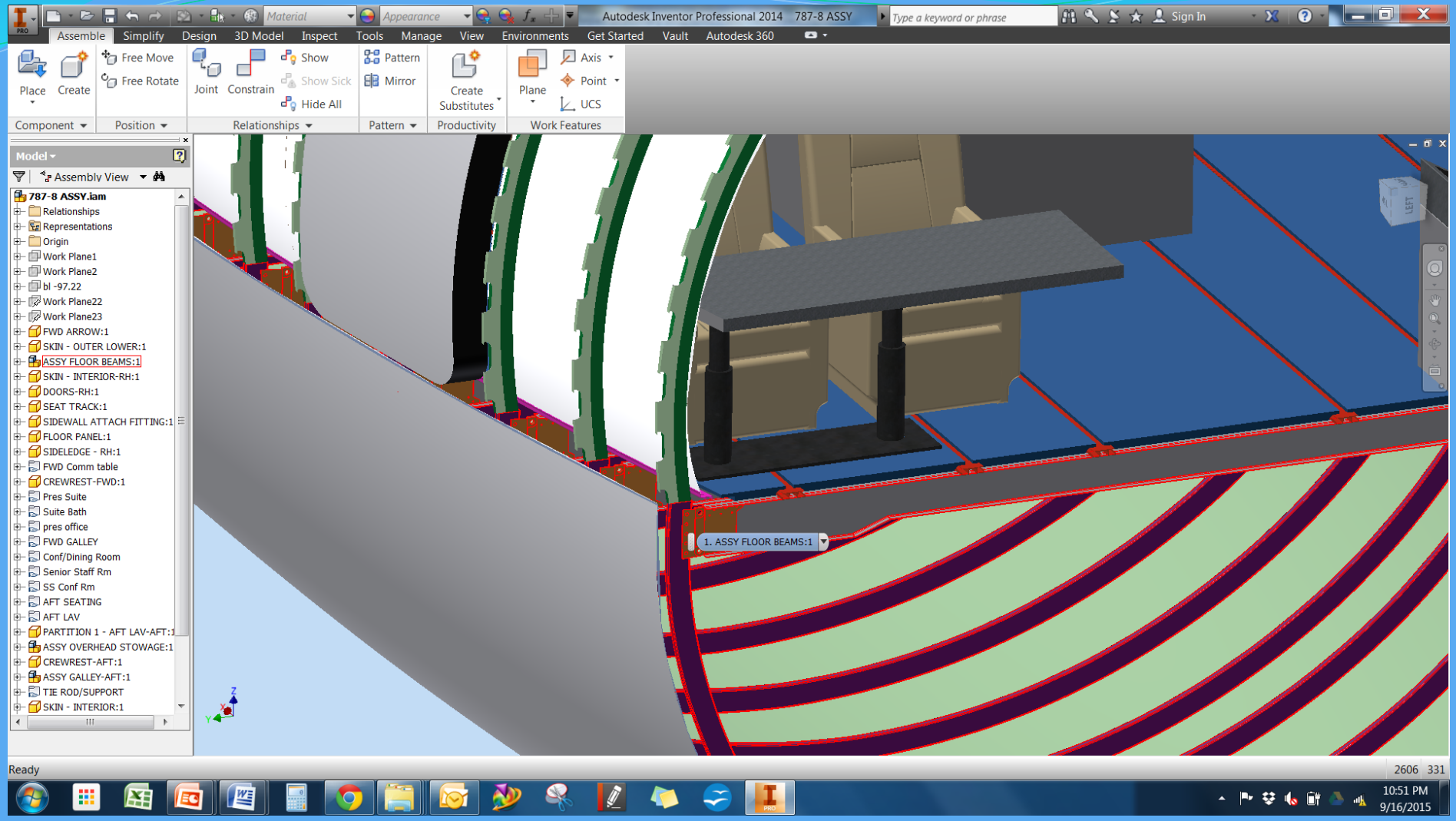
Analysis Topics (Cont.)



Analysis Topics (Cont.)



COMPOSITE TRANSPORT WORKSHOP ON DAMAGE TOLERANCE AND MAINTENANCE



Effects of Defects Before and After

- Effects on properties of delamination, porosity, and other manufacturing defects
- Effects on properties of damage (Impact, Heat Damage etc)

Process Specification for Bonding, Drilling, Sanding etc.

Approval of the process specification necessary to perform the installation of the repair or modification

What happened if this isn't an STC Project => All process specification information must be on drawing

Limited Knowledgeable – DER Plan

- Assumptions
  - Metal Process – Installation of a metal doubler
  - Bolt Attachment - Analysis all bolts have equal load
  - What is lighting protection
  - Damage Tolerance – Crack Growth in the metallic doubler

How Do We Regulate These Issues?

- Experience of the Engineering
  - How to ensure that the engineering is completed correctly with sufficient information – must investigate Composite DER Authorization similar to Damage Tolerance
- Experience of the Installation Mechanics
  - How to ensure that the installation is handled correctly (License Mechanics – Composite Specialists)

Conclusion

REPAIRS AND MODIFICATION OF PRIMARY AIRCRAFT STRUCTURES WILL BE PERFORMED WITHOUT OEM ASSISTANCE!!!