

Composite Bonding Workshop



Manufacturing Implementation & Experience

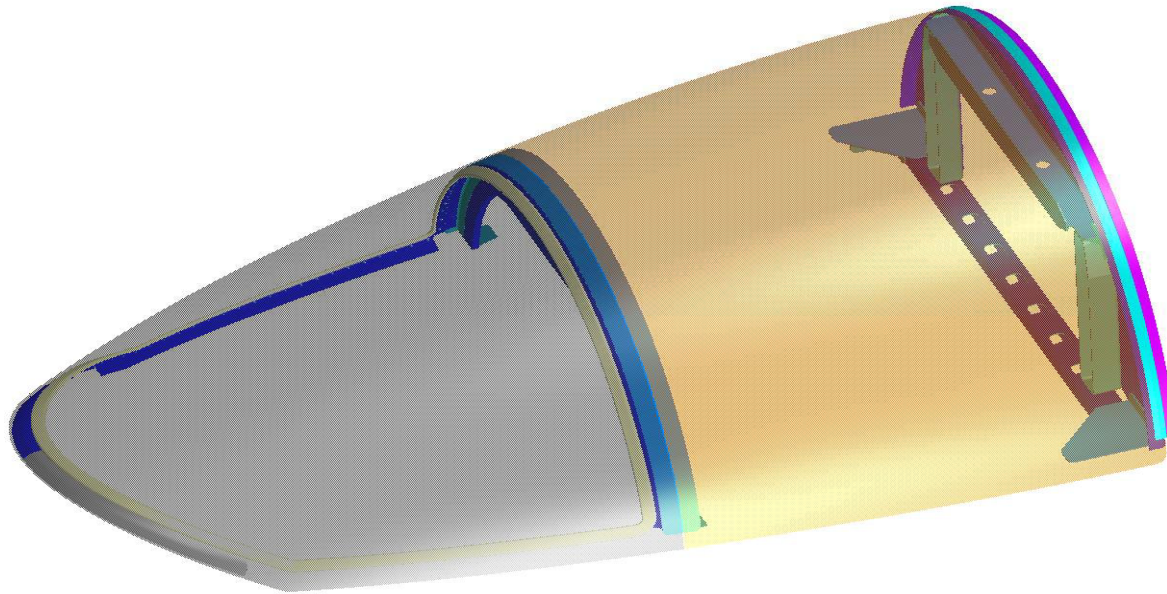
Steve Forness

6/18/04

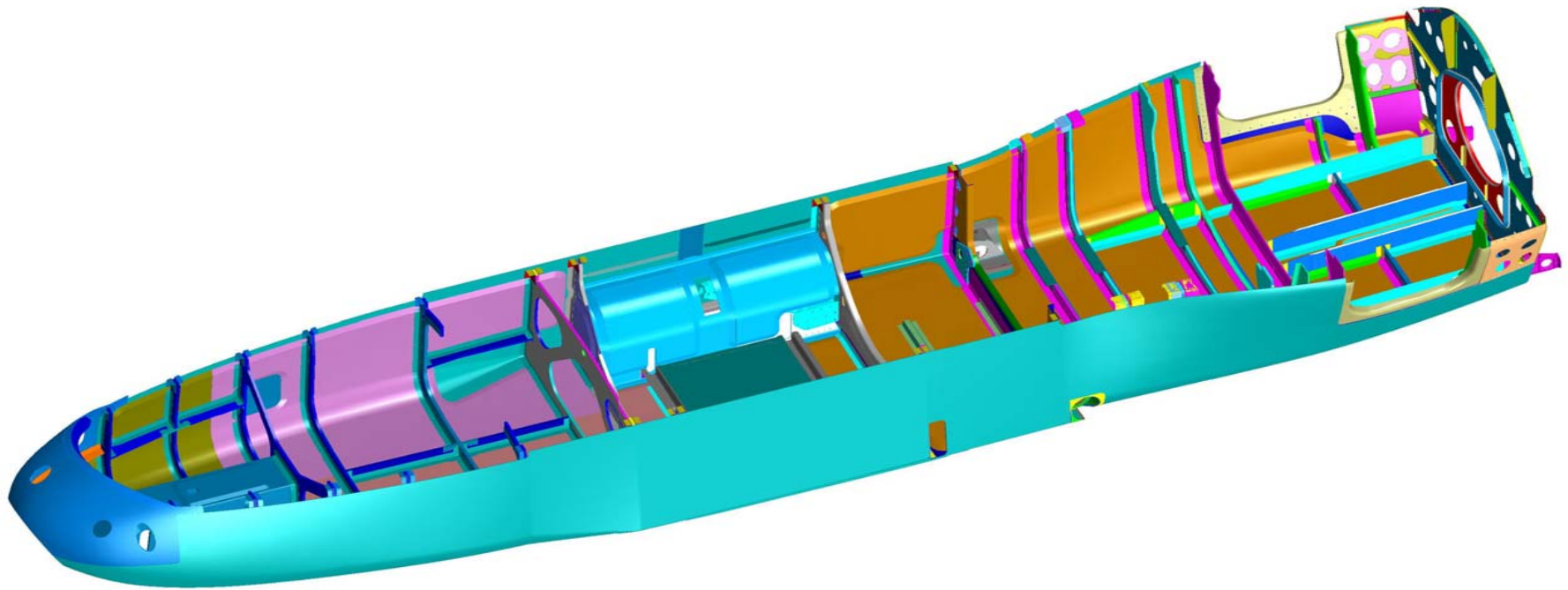
Complexities of Large Integrally Bonded Structures

- Material Types
 - Honeycombs of Various Types
 - Monolithic Layups
- Bonding Material Types
 - Paste Bonds
 - Film Adhesives
- Different Cure Processes
 - Autoclave Cure
 - Oven Cure
 - R/T Sets
- Different Joint Types
 - Single / Double Shear
 - Out – of - Plane
- Hybrid Structures
 - Metal and Composites
- NDT NIGHTMARE
 - C-Scans, A-Scans
 - X-Rays

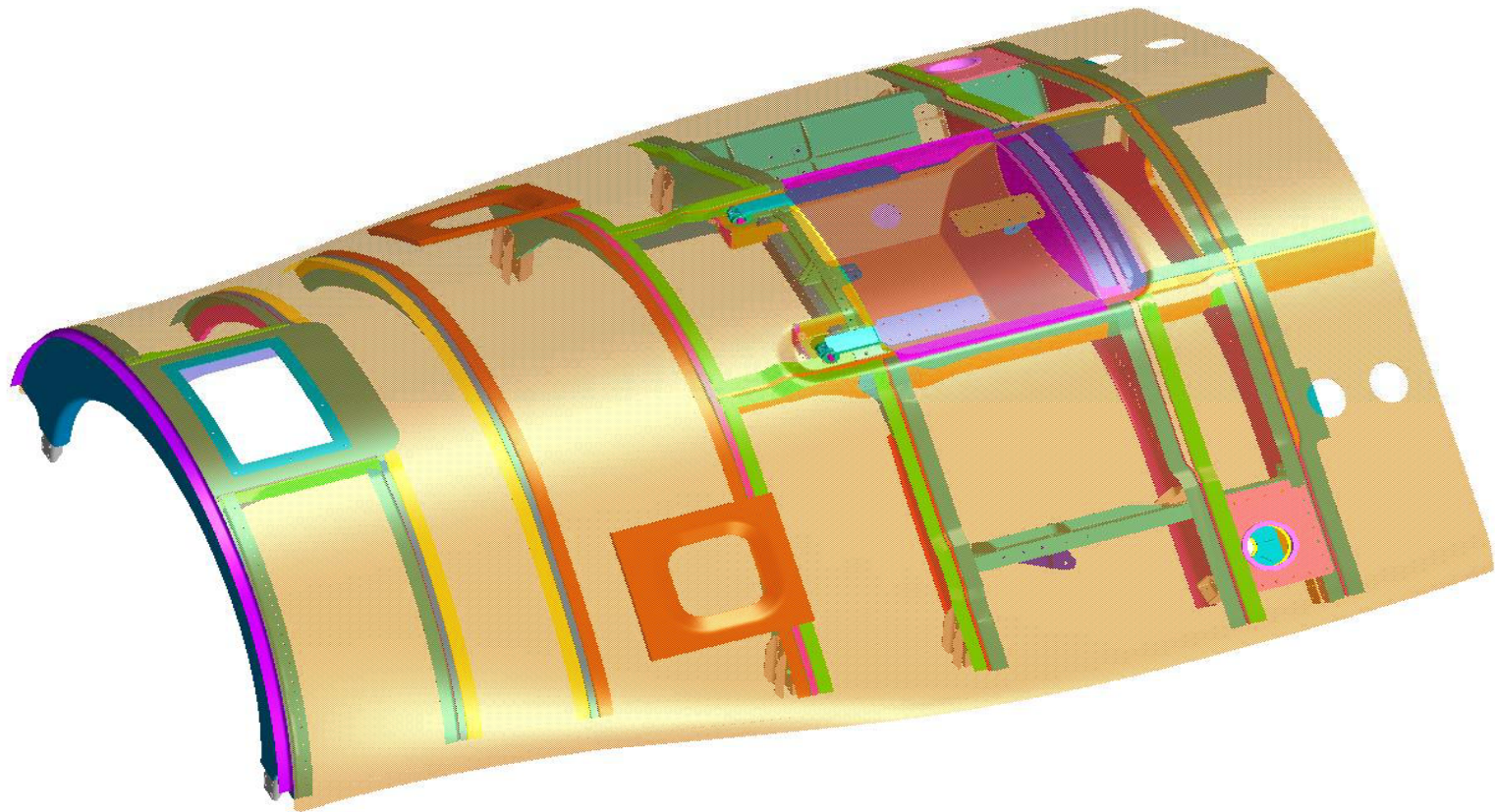
X-37 Composite Details



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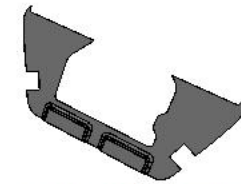
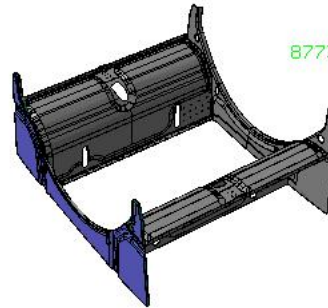
X-37 Composite Details



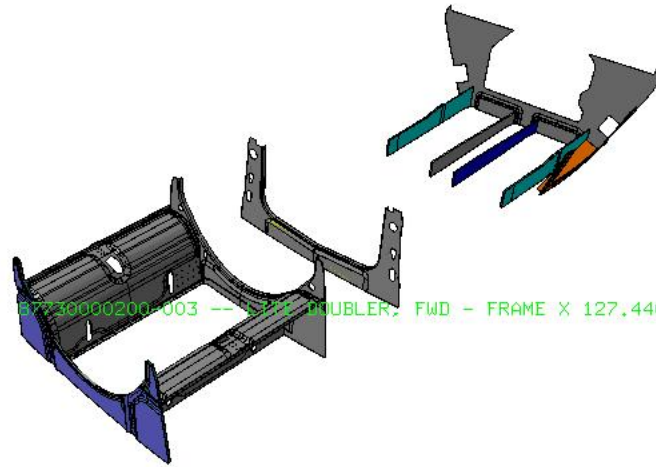
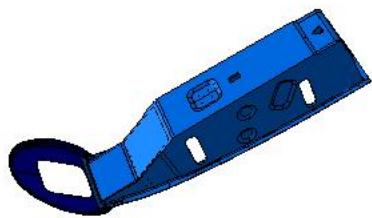


Bonded Assembly

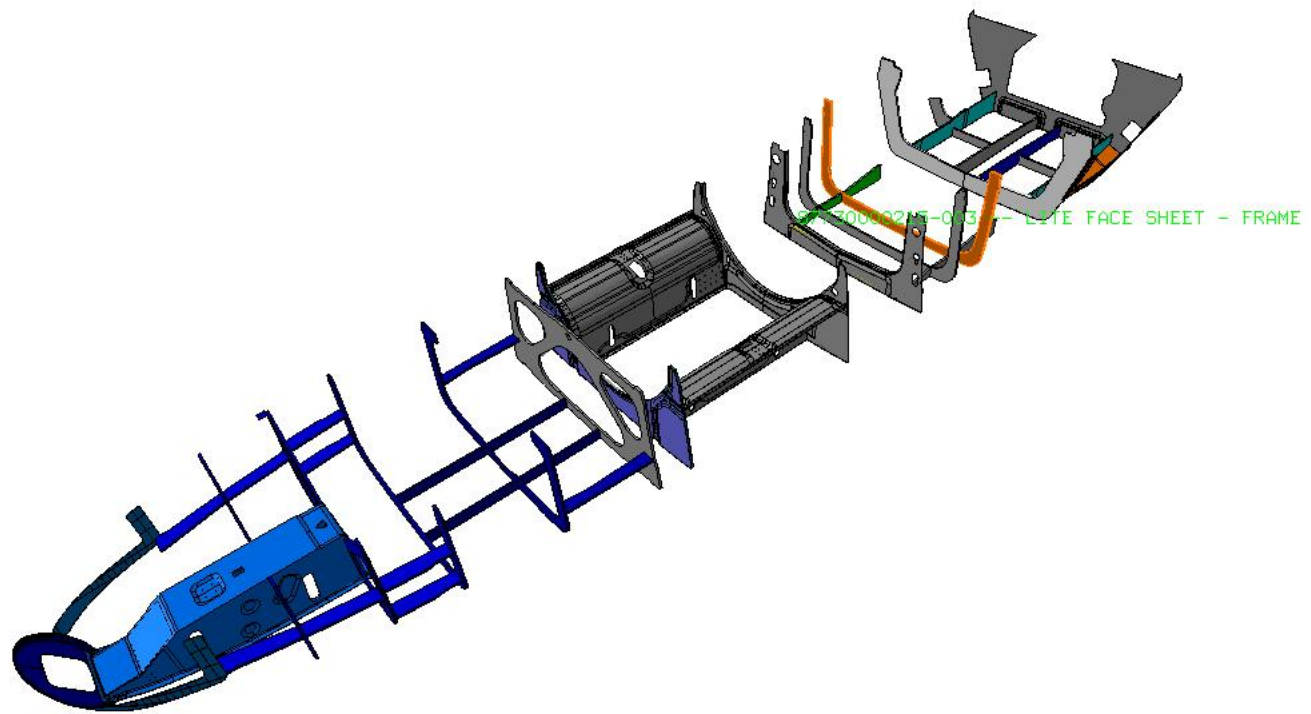
Bonded Assembly Sequence

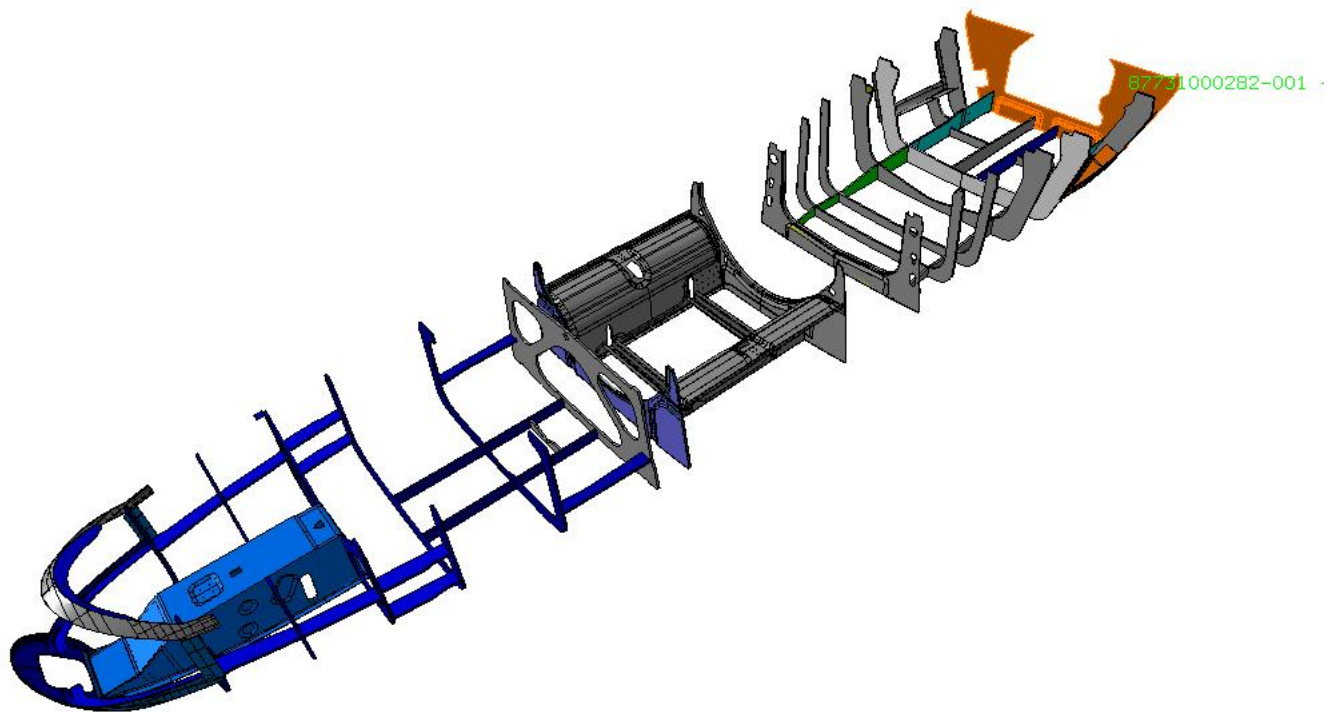


87730000216-001 -- LITE CORE - FRAME X=2:

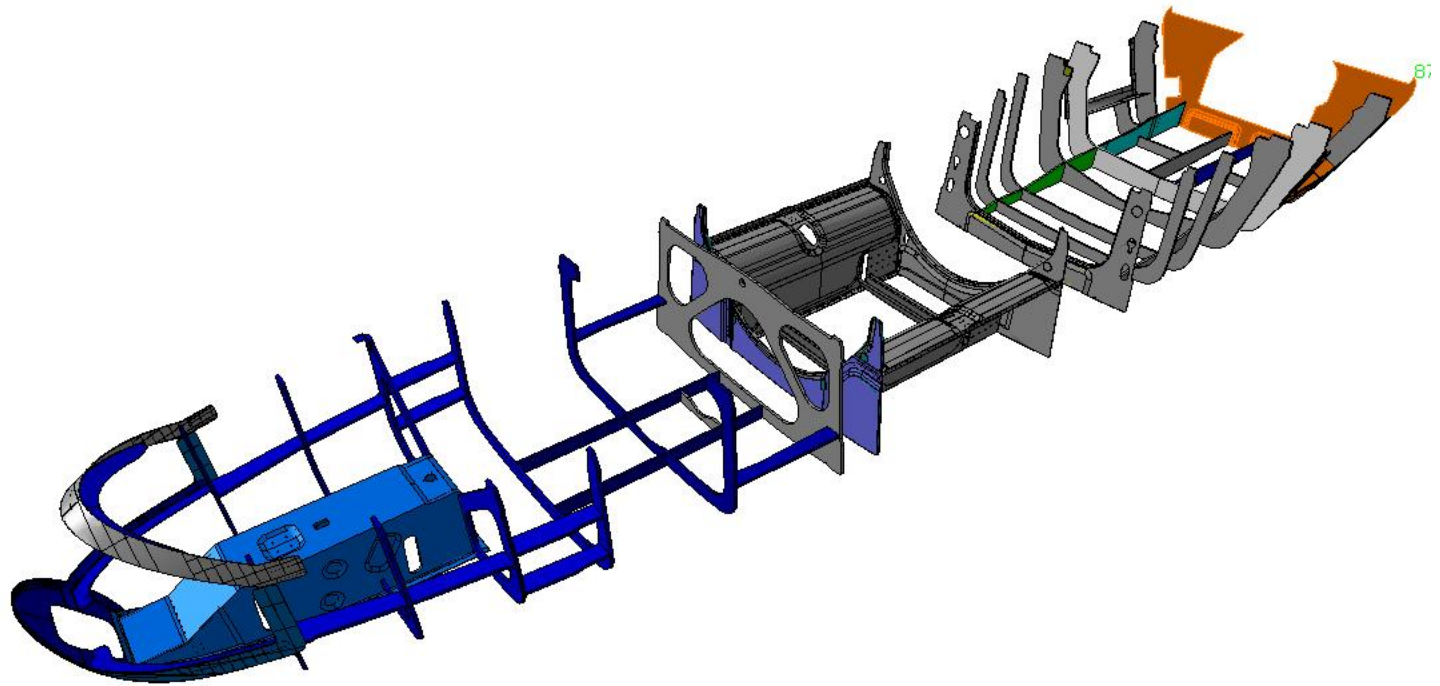


8723000200-003 -- 1 1/2" DOUBLER, FWD - FRAME X 127,440

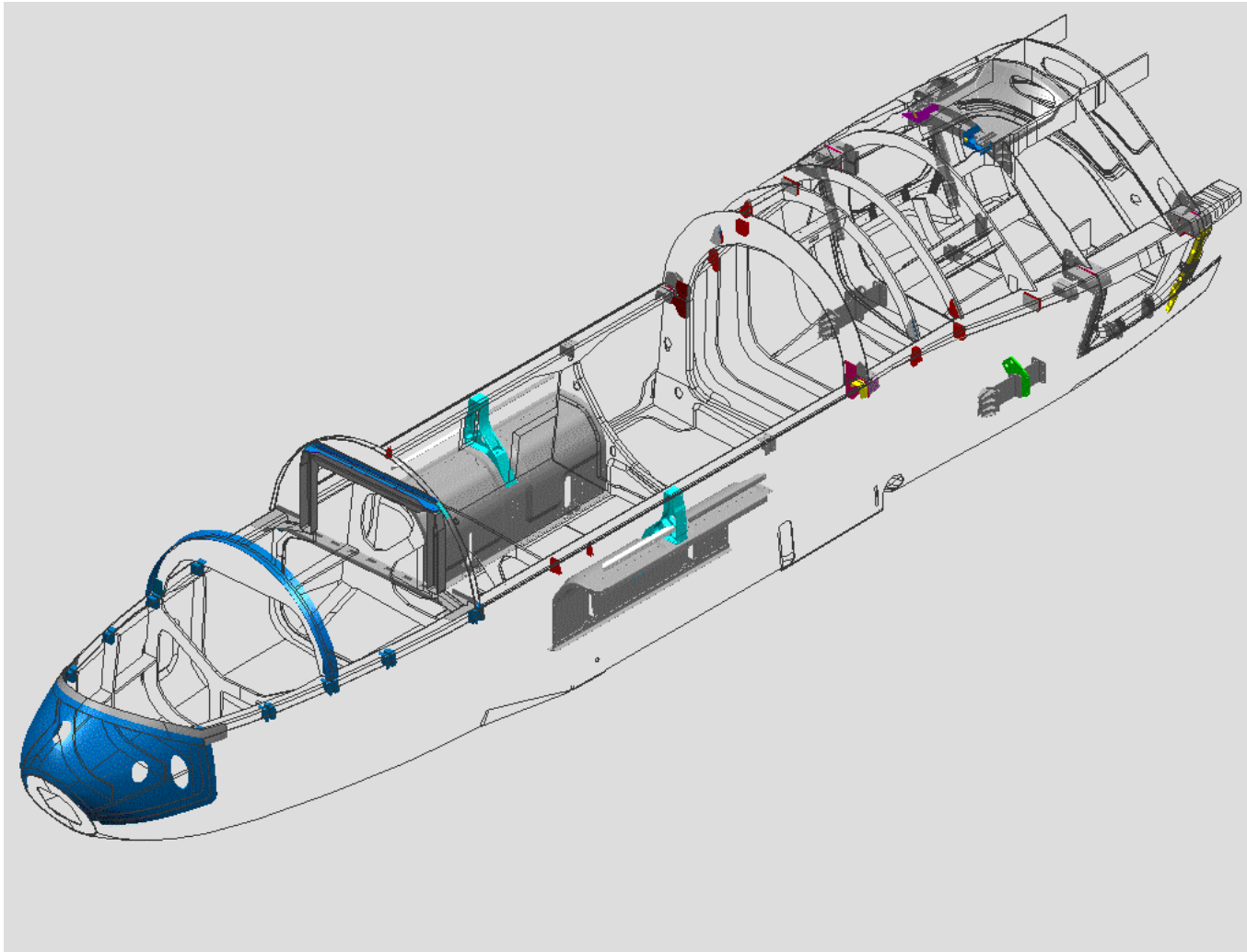


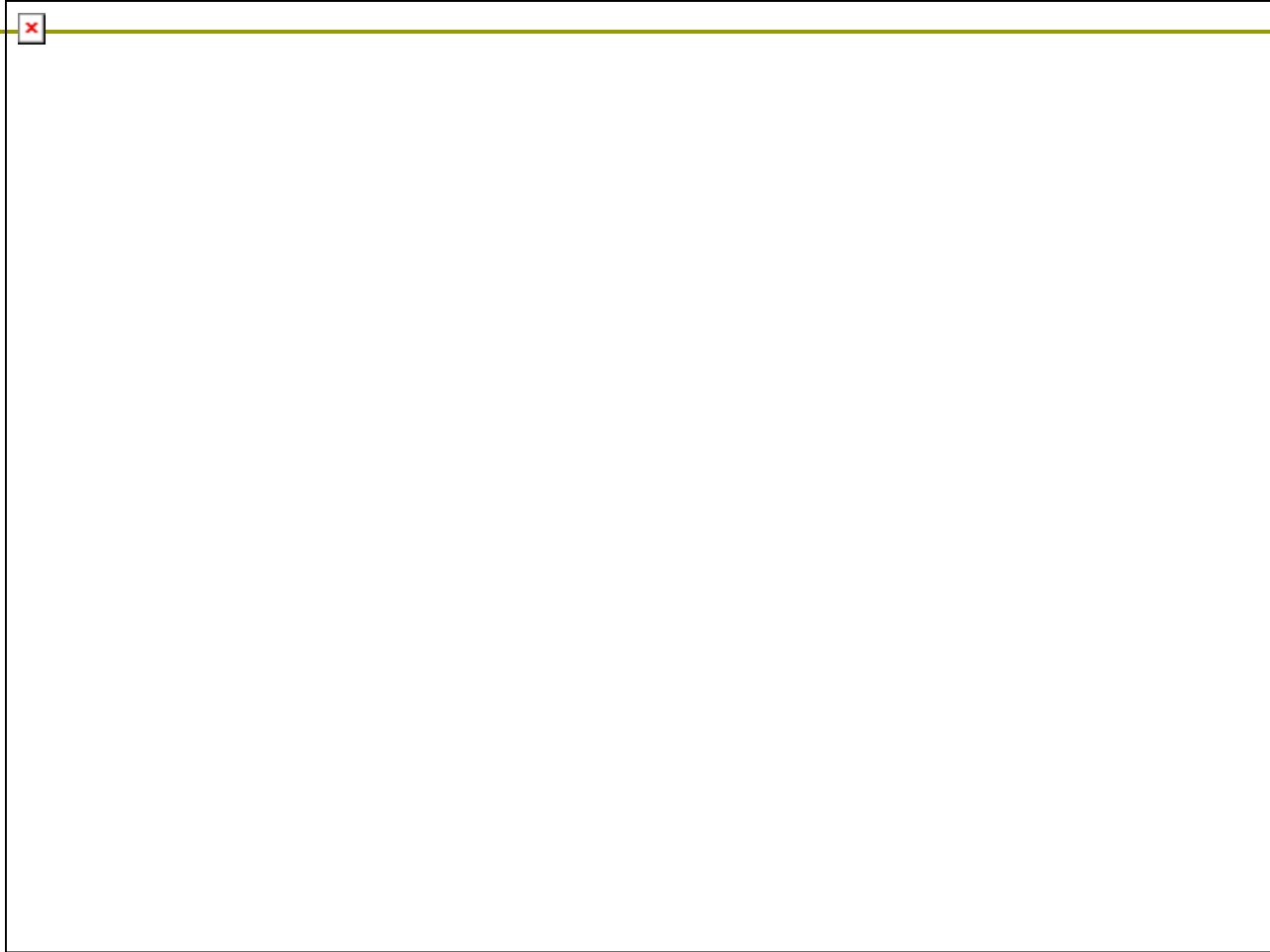


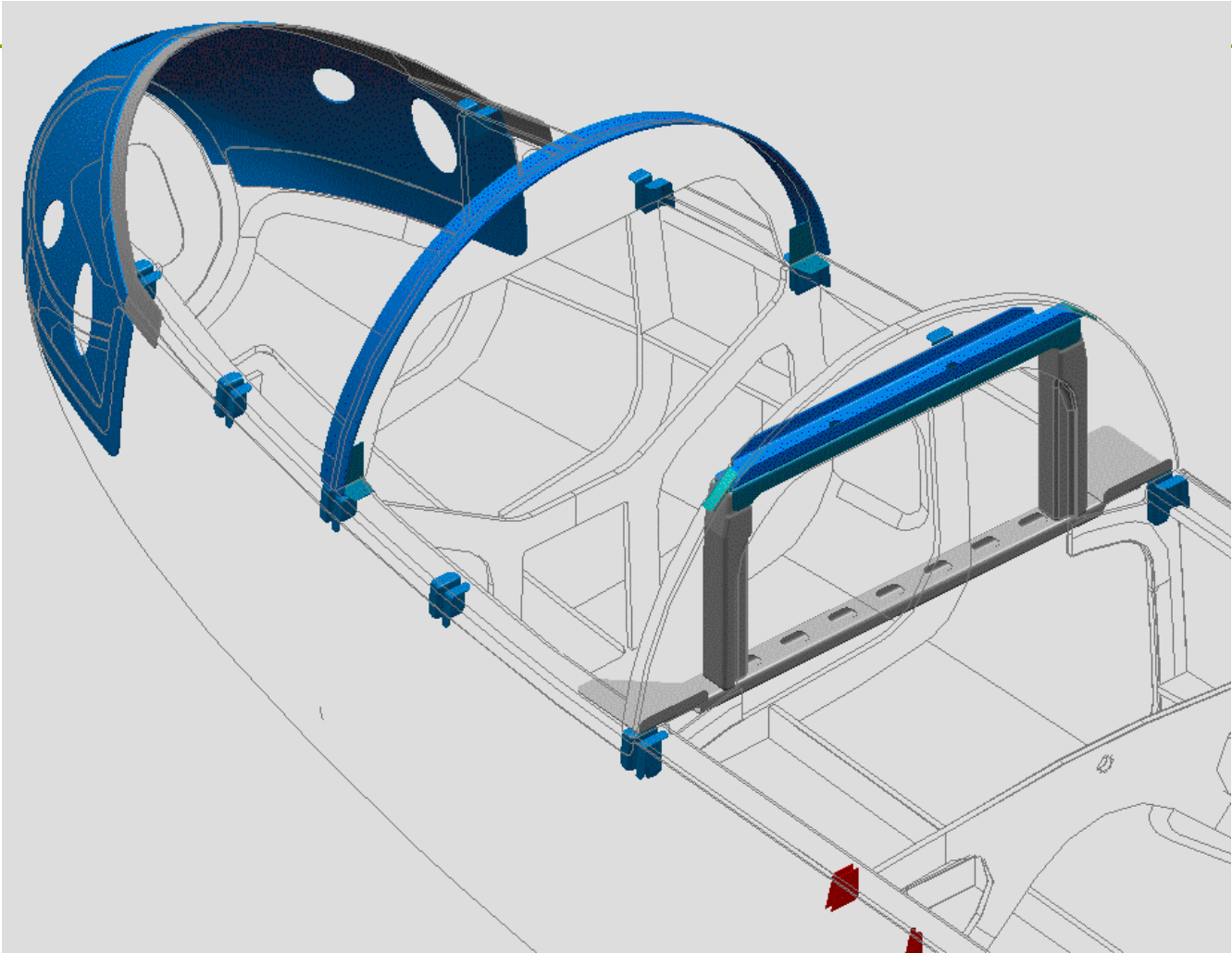
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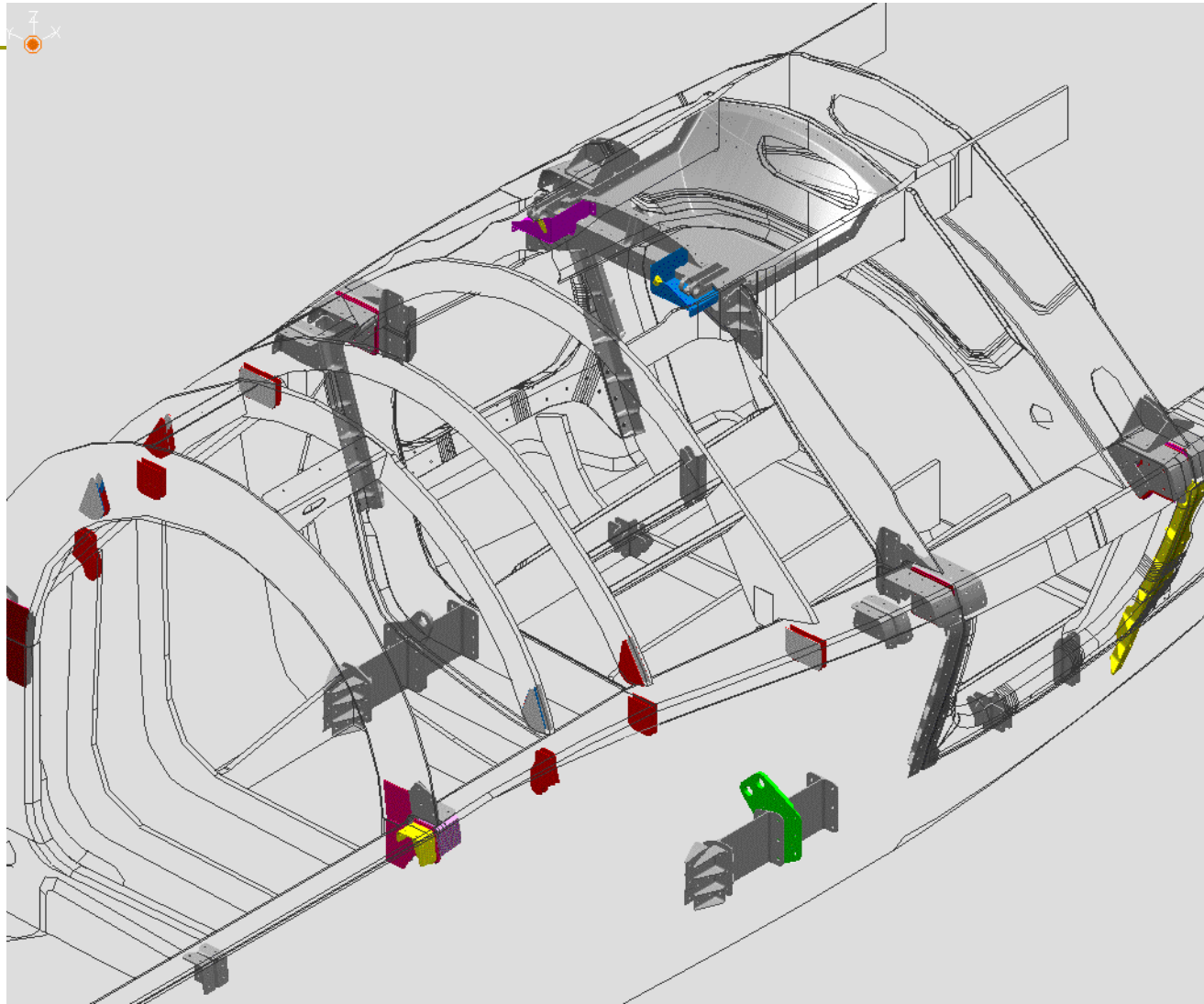


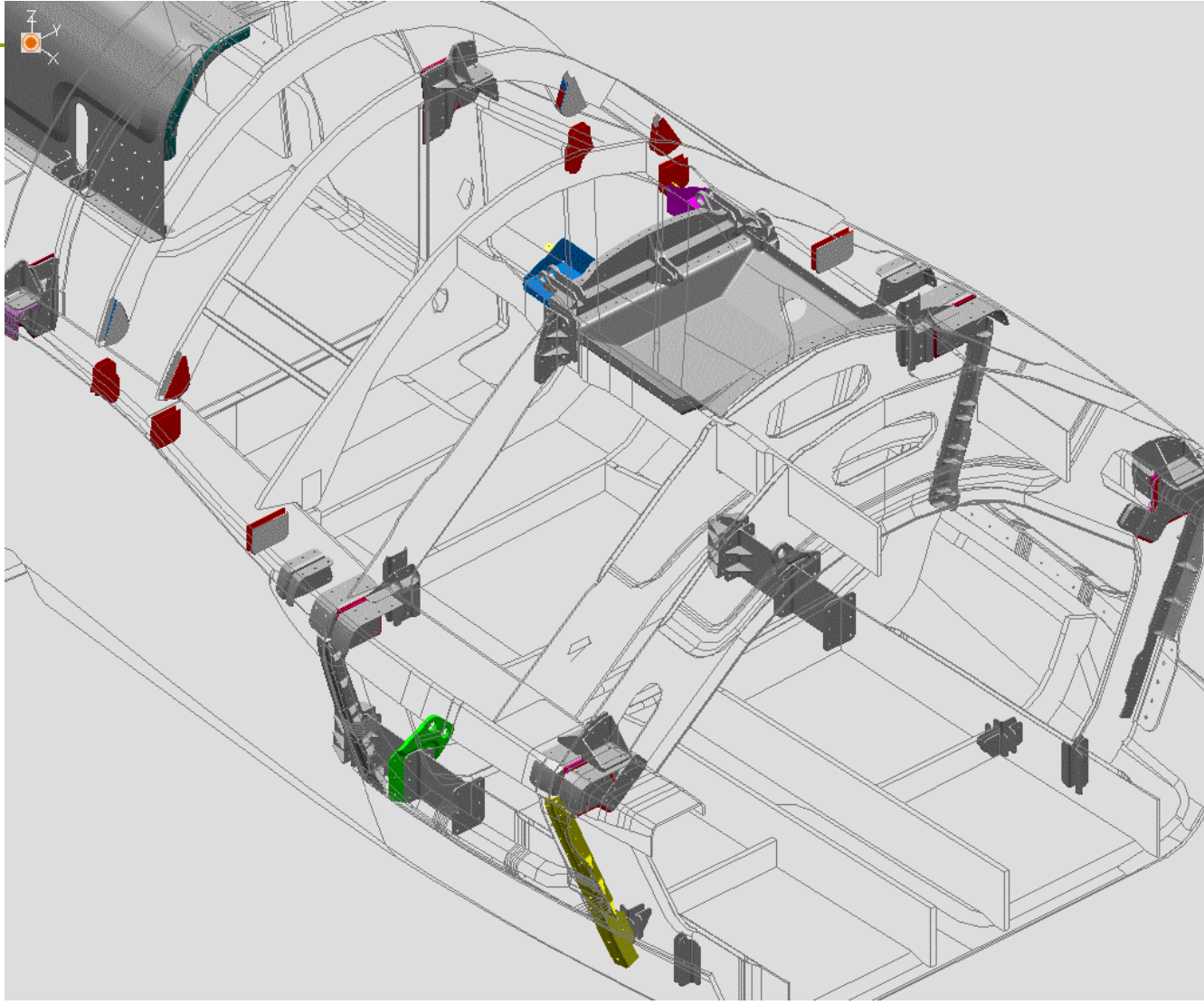
Mechanical Assembly



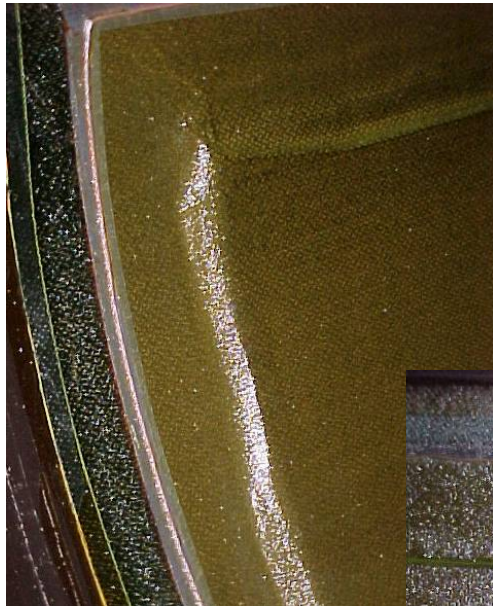




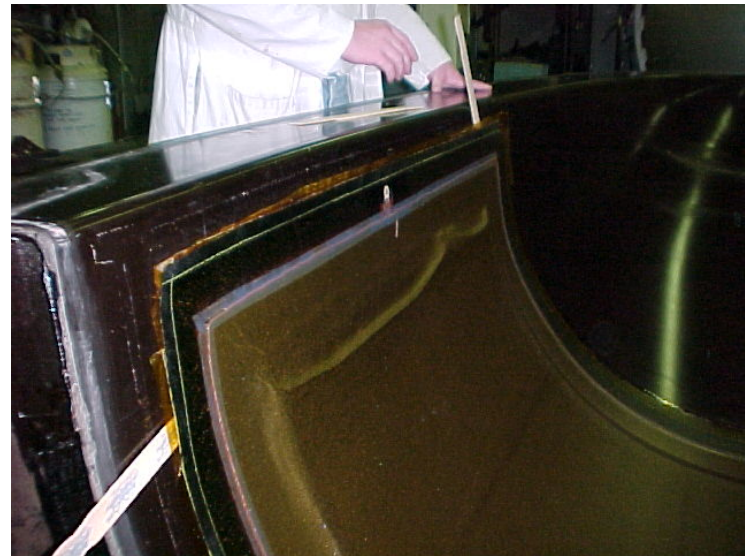




Core Collapse Problem with 3.5 pcf Honeycomb



Tank Skin



Conclusion:

3.5 Core not Compatible
with cocure process



Complex Shape Problems Longerons and Shear Clips

Complex Shape Problems Longerons and Shear Clips

Longeron



EXCELLENT RESULTS

Part had only a .2
deviation (Potato Chip
Twist) End to End

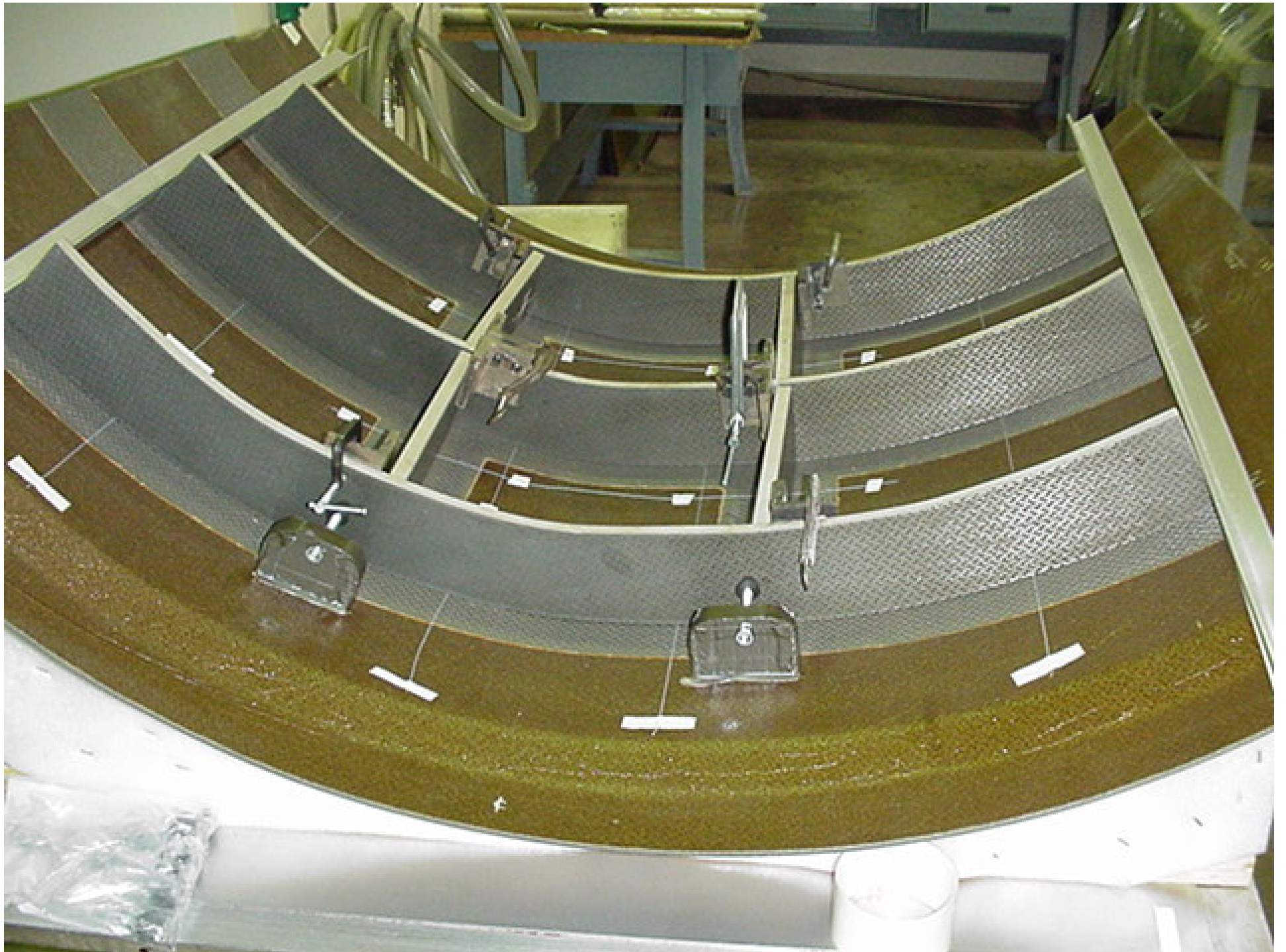
Complex Shape Problems Longerons and Shear Clips



Several Different Bagging
Methods being
Investigated

Paste Bond of Frames
Completed

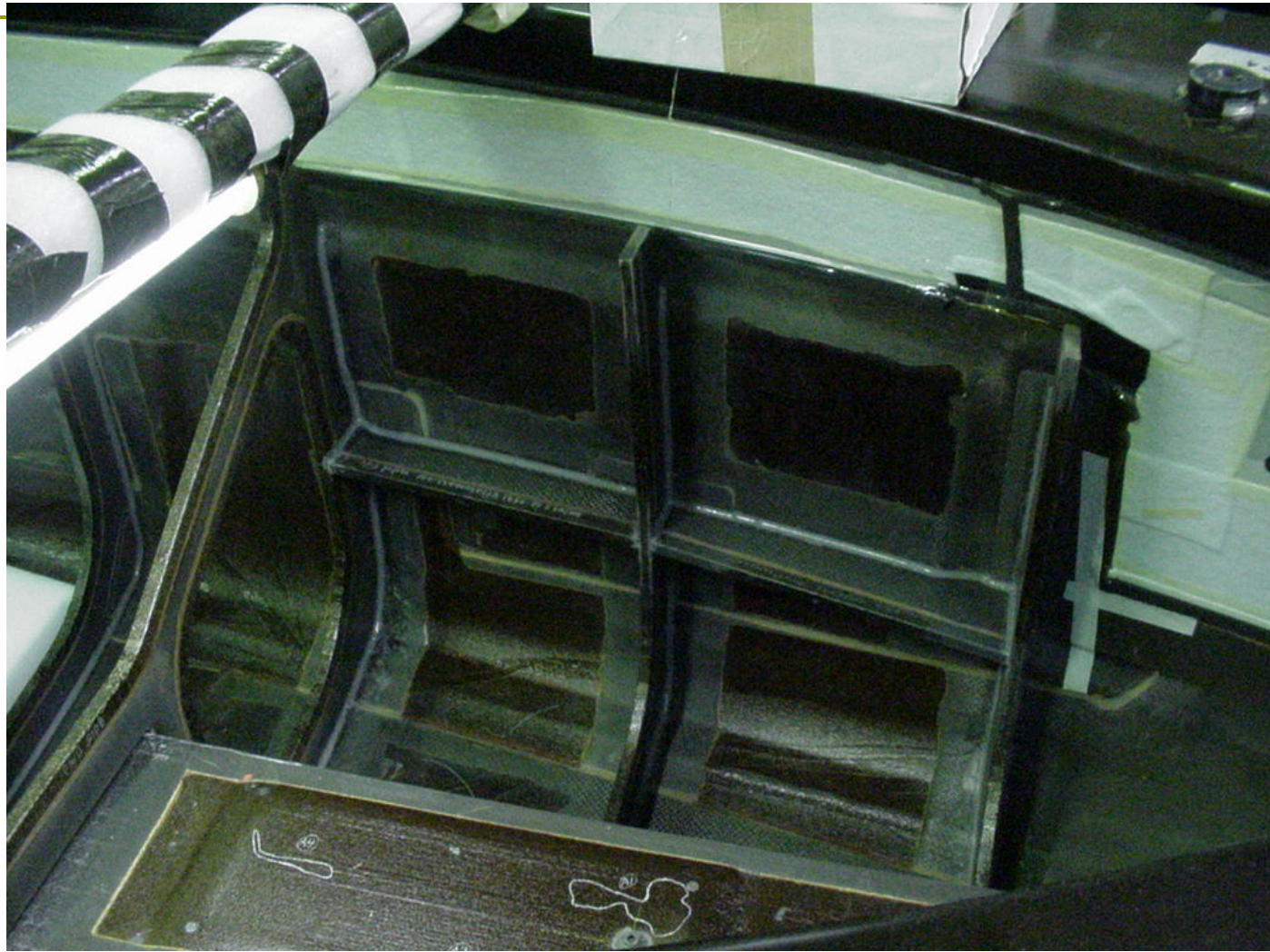












Conclusions

- ❑ Bonded Structures will Challenge All Aspects of Manufacture, Inspection, Analysis
- ❑ Certification will become much more a Joint Alliance Between All Areas

Planning and Execution of a Robust Design both Manufacturing and Engineering are
ESSENTIAL TO SUCCESS!