

FABRICATION AND TESTING OF LARGE-SCALE JOINING ELEMENTS

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OBJECTIVE

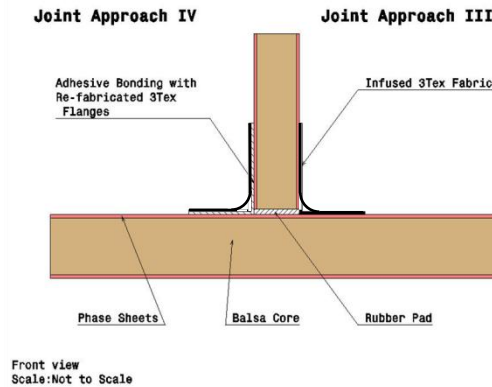
OBJECTIVE

- ◆ Investigate the performance of large-scale composite joints using 3D woven materials
- ◆ Evaluate various joints concept based on Mechanical Performance

APPROACH

- ◆ Concept for the joint in T-configuration
- ◆ Fabricate the joints using 2 variants
 - ◇ Flange concept
 - ◇ Triangular balsa core concept
- ◆ 3Tex materials/2D fabric materials used
- ◆ The full-scale joint tested in tensile loading and the failure modes investigated

CONCEPT FOR THE FLANGE



FABRICATION OF THE JOINTS

◆ Fabrication of Face sheets

- ◇ 48" by 24" bulkheads fabricated using quasi-isotropic layup of 1/8" thick of the T700 carbon fabric.

◆ Fabrication of Flange Concept

- ◇ Joint A : 3/16" thick 2-D fabric ([0/45]3S)
- ◇ Joint B : 3/16" thick 3TEX (92oz e-Glass/carbon),
- ◇ Joint C : 3/32" thin 3TEX,
- ◇ Joint D : fabricated using the split 3-D perform

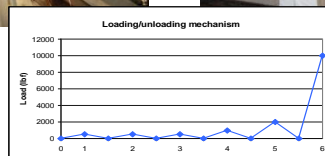
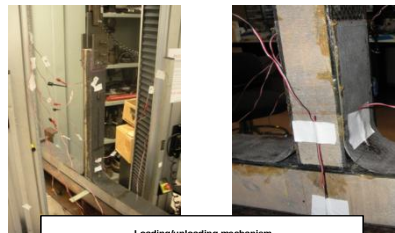
bonded with plexus adhesive (AO420)

TEST FIXTURE AND TESTING

- ◆ Instron 4484 testing machine with a load cell of 30,000lbf.
- ◆ The two ends of the horizontal part was supported by 3/4" diameter bolts and the load applied perpendicular to the hull with a crosshead speed of 0.05in/min.
- ◆ 5 strain gages to observe the strain.
- ◆ LVDT (Linear Variable Differential Transformer) observe the displacement at the center of the base panel.

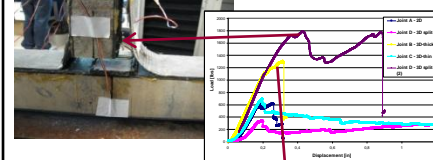
TEST FIXTURE AND TESTING

◆ Loading mechanism :

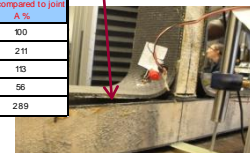


RESULTS

Results of flange concept



	Ultimate load (lbf)	Load compared to joint A %
Joint A - 2D	518	100
Joint B - 3D-thick	1303	211
Joint C - 3D-thin	697	113
Joint D - 3D split	345	56
Joint D - 3D split (2)	1785	289



CONCLUSION

- ◆ The flange concept using 3TEX material showed promise as the maximum load capacity was about 1800lbf for the 3.5 inch wide specimen
- ◆ The split 3D flange increased in the ultimate load capacity by more than 25%

ACKNOWLEDGEMENTS

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