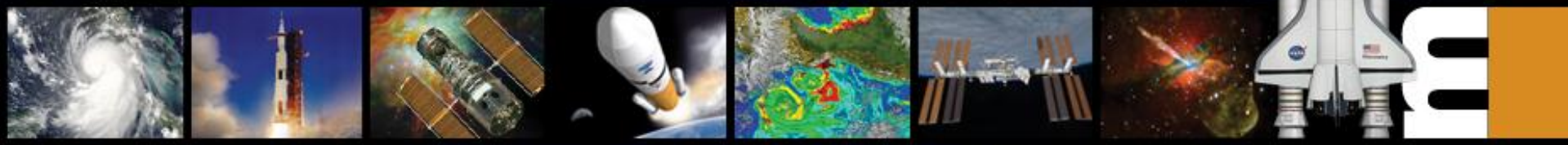
Super Light Weight Tank

Space Shuttle Knowledge Sharing Forum



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Super Light Weight Tank

Background

- NASA committed to a new higher inclination orbit for International Space Station (ISS)
- Required 15,000 lbs weight savings from Shuttle
- External Tank Project ask to provide 50% of the required savings (7500 lbs)
- ATP received February, 1994 to proceed with:
  - New Material-Aluminum Lithium
  - New Design for LH2 Tank-Orthogrid

Super Light Weight Tank

Lessons Learned from Material Substitution

- Lost the Recipe for Increased Ingot Size
  - Initial Properties Developed on Sub Scale Ingots
  - Material Properties Lost when Scaled Up

- Aluminum Lithium Weld Reparability
  - Initial Welding of Aluminum Lithium Certified
  - Significant Failures When Attempting Weld Repairs

Be Sensitive to All Parameters when Substituting Materials

Super Light Weight Tank

Lessons Learned from SLWT Testing

- Developed full scale Aluminum Lithium Test Article (ALTA)
  - All Orthogrid Configurations tested in full size ALTA
  - Tested ALTA to Failure
  - Demonstrated 218% Design Margin vs 140% Required

- Added Protoflight Testing for LH2 Tank
  - Each Flight LH2 Tank Subjected to 115% Limit Load Test
  - Test Demonstrated Structural Stability Margins of New Design
  - Demonstrated Processes and Workmanship Standards for New Material

Test Like You Fly

Super Light Weight Tank

Summary

- 7500 Lbs Weight Savings Accomplished
- First SLWT flew June 2, 1998
  - 52 Months from ATP to Flight on STS 91
  - 6 Months Ahead of ISS Need Date

- Completed Development Budget Under Cost
  - $132 Million Development Budget
  - $20 Million Returned to Shuttle Program

Back Up

Super Light Weight Tank Key Lessons Learned

- Embrace Independent Reviews
- Expect Vendor Changes/Certifications
- Verify Vendors Understand Flight Environments
- Develop Strong Relationships with Primes and Subcontractors
- Schedule as only Funding Variable Leads to Disaster
- Long Term Adequate Funding Essential