



# cleansat

BB12

Promoting Fragmentation by use of Demisable Joints  
Belstead Research; Fluid Gravity; R.Tech

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DEFENCE & SPACE



ThalesAlenia  
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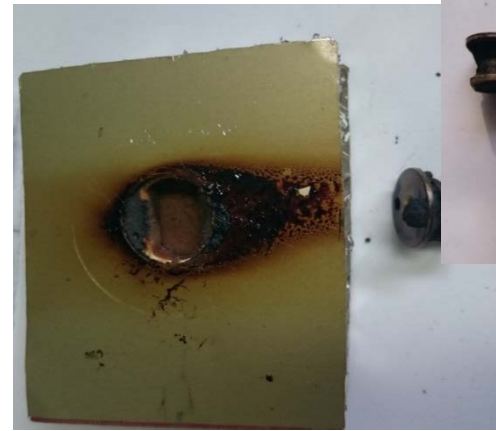
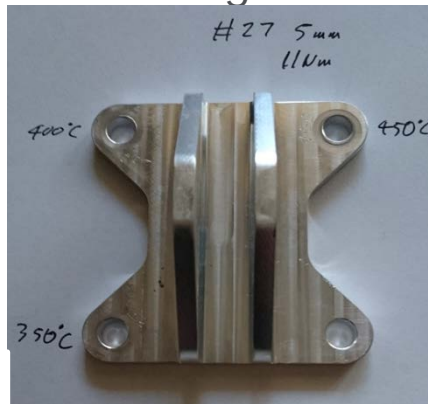


# Promotion of Joint Demise

- Understanding of Spacecraft Fragmentation is weak
  - Perform set of tests to identify phenomenology
- Initial Selection of Key Joints/Fastenings
  - Facesheet Adhesives in Sandwich Materials
  - Epoxy Inserts in Sandwich Materials
  - Bolt/Brackets with CTE Difference
- Basic Phenomenological Tests
  - Heat Samples Under Load
  - Determine Hot Strength
  - Understand Important Drivers for Joint Failure
    - Temperature; Heat Soak; Force
  - Understand Likely Failure Regimes
  - Inform Design
- Should be Generally Applicable with Minimal System Impact

# Phenomenological Testing

- Facesheet Peel
  - Low forces/temperatures
- Facesheet Shear
  - Higher (but still low) force
- Insert Pull
  - Heat soak important
  - Epoxy needs to react
  - Significantly easier pull from CFRP!
- Bolt/Bracket Loosening
  - Thermal stress damage evident



- Improved Understanding of Failure Processes
  - Panels peel/shear with failed epoxy at low temperatures
  - Panel failure expected at panel level; not holes from melt
  - CFRP much more resistant to heating
  - Inserts relatively resistant
    - Fail from epoxy heat soak, not instantaneous insert temperature
  - Easier pull from CFRP sandwich (epoxy/CTE? TBD)
  - Bolts loosened from thermal stresses; brackets/threads damaged
  - Temperatures of interest are well below aluminium melt temperature
- Improved Understanding of Likely Fragmentation
  - Low forces at high altitude; some separation force is required
  - Initial failures around 250C for inserts; 350C for bolts
  - Dynamic loads expected to result in relatively rapid failure of joints at lower altitudes; well before melt temperatures
  - Intact joints not expected at lower altitudes



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