Dryden Flight Research Center (DFRC)
Thermal Capabilities & Status

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Capabilities

• Analysis capabilities
  – MSC family (Patran, PThermal, Nastran, Marc)
  – Thermal Desktop
  – TPATH (aeroheating)
  – In house code development for aerothermal, ablation, shape change

• Facility capabilities
  – Flight Test
    • Testbed Aircraft: F-15D (Mach 2+, PW-229 engines), F-15B, F-18s, GIII, Ikhana
    • Flight qualified instrumentation (thermocouples, strain gauges, fiber optic TC & SG, IR)
  – Ground Test – Flight Loads Laboratory (FLL)
    • Large-scale thermal/structural testing of aircraft or components with custom-contoured banks of quartz (2500°F) or graphite (>3000°F) heaters
      – Large & Small Nitrogen Chambers – Thermal/structural testing in an inert atmosphere
      – Several smaller ovens – Various atmospheres, instrumentation, coupons, small test articles
      – Blackbody furnace – Optical pyrometer calibration, heat flux sensor development
    • High-temperature instrumentation validation and integration technology
      – Conventional and optical strain technology to 1800°F, thermocouple integration technology to 2800°F, heat flux sensor development & validation
    • Test chambers for altitude pressure/temperature testing aircraft equipment
    • Nondestructive evaluation capabilities
      – Pulsed thermography & acoustic emission

• Staffing
  – Research Aerostructures Branch (DFRC-RS), Thermostructural Group: 10 FTE, 3.5 WYE
Flight Loads Laboratory

- Water Cooling System
- Nitrogen Purge & Gas Cooling System
- Test Chamber
- Data Acquisition Systems

4MW of Electrical Power
Status

• Current projects/programs supported
  – ARMD HYP
    • SITPS (Structurally Integrated Thermal Protection System)
  – ARMD SUP
    • SBLT (Supersonic Boundary Layer Transition)
  – ARMD SUB
    • GIII Wing Glove Experiment (laminar flow)
  – SMD
    • SOFIA (Stratospheric Observatory for Infrared Astronomy)
  – Reimbursable
    • HTV2 (Hypersonic Technology Vehicle 2)
    • Testing several advanced TPS concepts
  – Research
    • High-temperature Modal Survey
    • Heat Flux Mapping
    • High-temperature sensor validation & integration
Issues and Outlook

• **Capabilities issues**
  – Flight Loads Laboratory (FLL) power controller cabinets getting upgraded to 264 thermal control channels, 65kW process chiller system, other minor upgrades

• **Outlook**
  – DFRC is in good health and is in a good position to support the administrator’s direction of basic research, proving or disproving low TRL concepts ("TRL bumping") through ground & flight test with analysis support