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
Capabilities

- 4MW of Electrical Power
- Flight Loads Laboratory
- Water Cooling System
- Test Chamber
- Nitrogen Purge & Gas Cooling System
- Data Acquisition Systems
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
Status

HTV2

G-III/C-20A

Heat Flux Mapping

SBLT

SOFIA

Pulsed Thermography

Hot Structures Instrumentation

Ruddervators

X-37 C/SIC RSTA

Pulsed Thermography

High-temperature Modal Survey

Hot Structures Testing

Flaperons
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

Aircraft at the Dryden Flight Research Center and the Dryden Aircraft Operations Facility