NASA Center Status

Dryden Flight Research Center (DFRC)

Thermal Capabilities & Status

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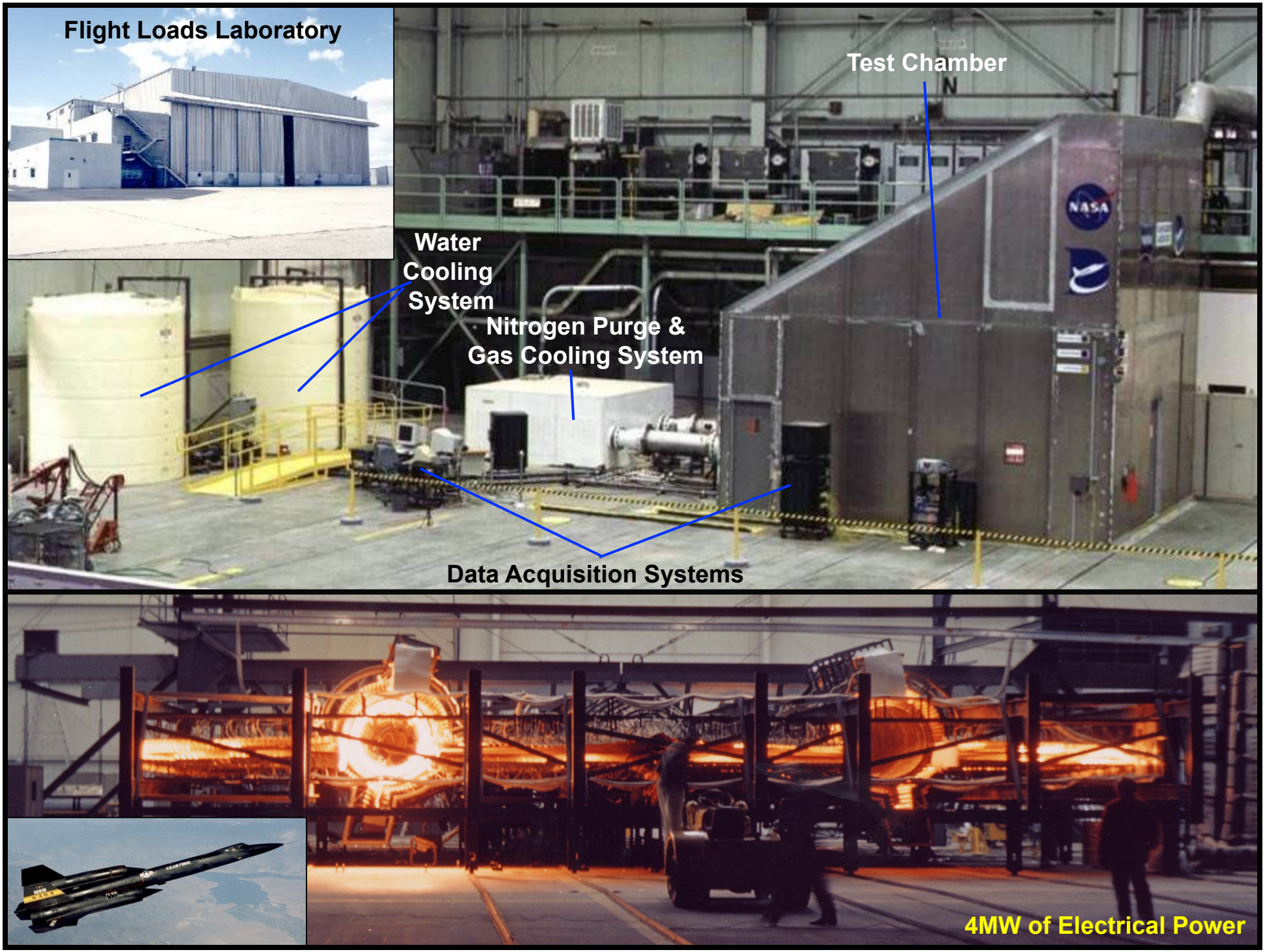
Thermal & Fluids Analysis Workshop
TFAWS 2010
August 15-20, 2010
Houston, TX

Capabilities

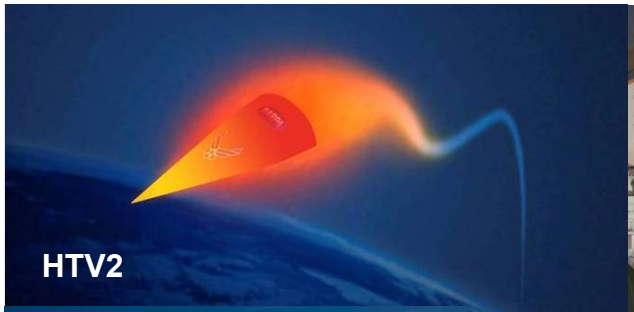
- Analysis capabilities
  - MSC family (Patran, PThermal, Nastran, Marc)
  - Thermal Desktop
  - TPATH (aeroheating)
  - In house code development for aerothermal, ablation, shape change
- Facility capabilities
  - Flight Test
    - Testbed Aircraft: F-15D (Mach 2+, PW-229 engines), F-15B, F-18s, GIII, 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
Test Chamber
Water
Cooling
System
Nitrogen Purge &
Gas Cooling System
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

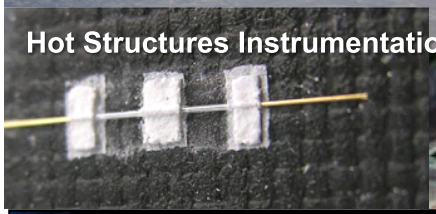
Status


HTV2

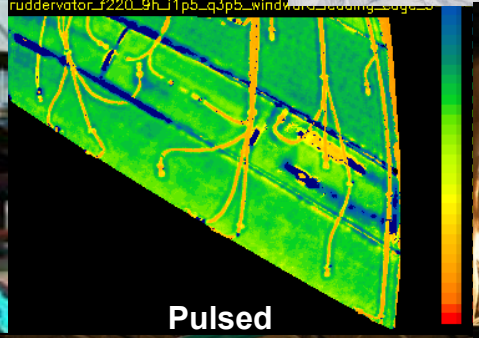

SBLT

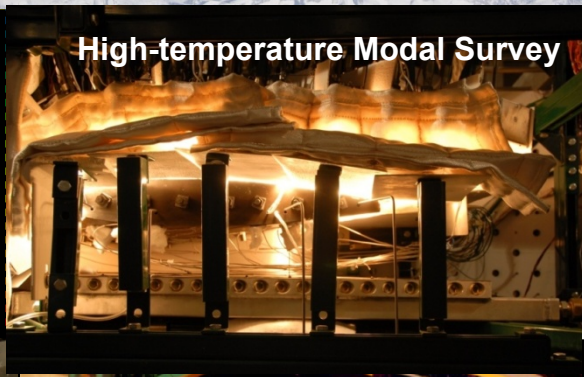

SOFIA
NASA
DLR

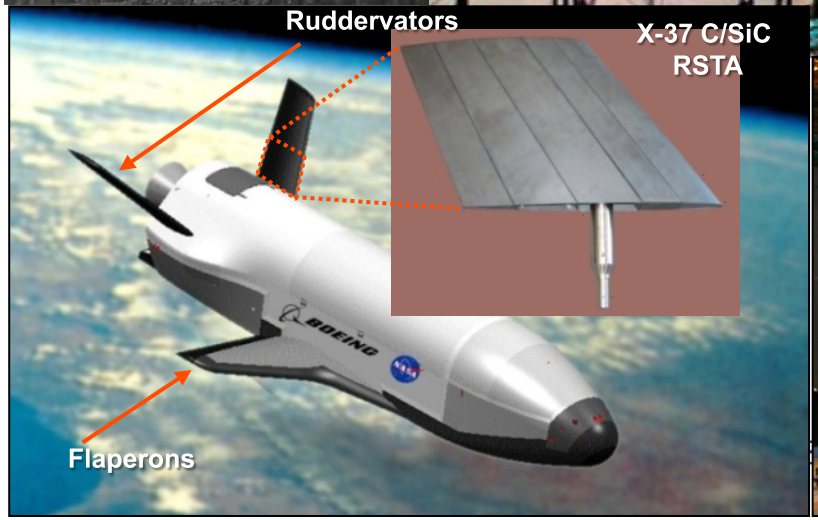

G-III/C-20A

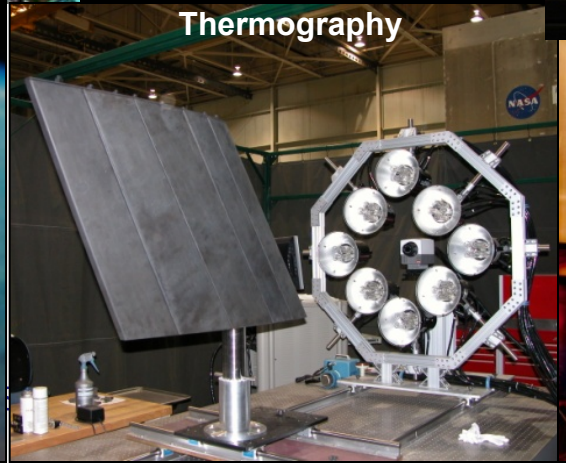

Hot Structures Instrumentation


Heat Flux Mapping


Pulsed
Thermography


High-temperature Modal Survey


Ruddervators
X-37 C/SiC
RSTA
Flaperons
BOEING




Hot Structures Testing

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