# AEDC High Temperature Materials Characterization and Evaluation

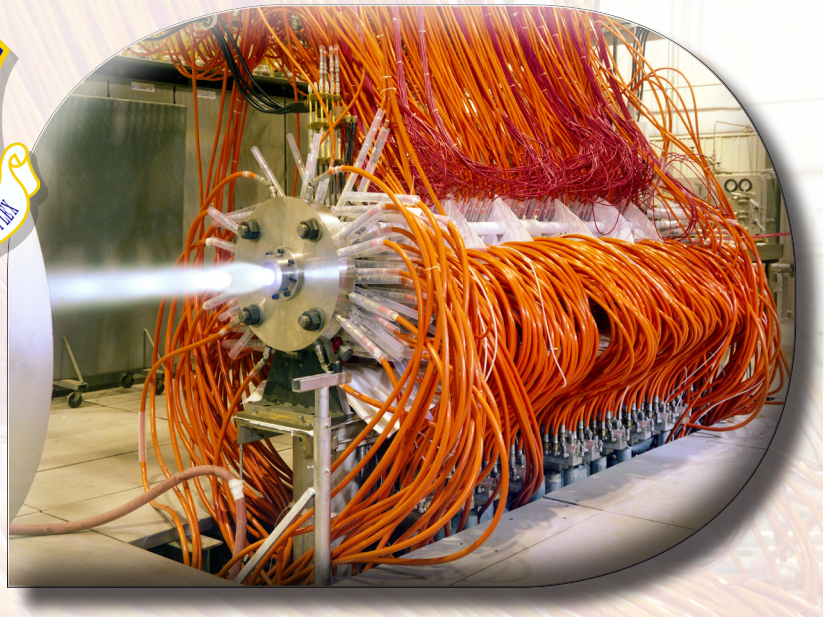
The Arnold Engineering Development Complex (AEDC) has the capability to test and evaluate (T&E) materials used for thermal protection systems (TPS).

This is accomplished by using high enthalpy arc-heated facilities to provide test conditions that simulate the aeroheating from Mach 8 to 20 hypersonic flight.

Aerothermal ground test simulations over a wide range of velocities and pressure altitudes are conducted by AEDC's experienced high temperature test team. Using the arc heaters, the team is able to expose materials and components for long periods of time necessary to validate thermostructural performance and survivability.

The team and its unique facilities support materials and structures development for the Department of Defense, and commercial aerospace industry. They have assisted the development of ballistic and hypersonic missiles, re-entry vehicles, high-speed transports, space transportation & space access vehicles, and ordnance & munitions systems.

H1 Arc Heater: This test unit incorporates a selectable number of cooled, electrically-isolated, stacked segments to optimize heater efficiency, total enthalpy, and flow uniformity. Normal operating conditions produce high stagnation enthalpies and heater chamber pressures up to 120 atmospheres. A programmable rotary model injection system positions up to seven test TPS samples sequentially into the freejet for preset dwell times.

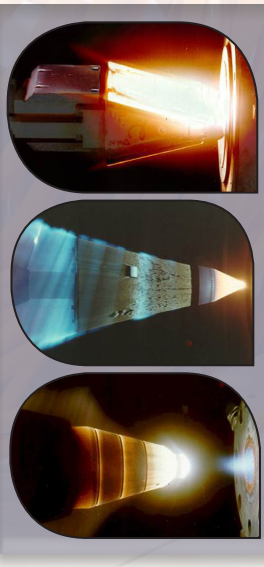


H2 Arc Heater: This test unit similarly generates high-enthalpy flow at pressures up to 120 atmospheres. H2 uses a non-segmented Huels arc heater and a hypersonic nozzle to expand flow into an evacuated test cell. Flight conditions between Mach 3.4 and 8.3 are possible.

H3 Arc Heater: This test unit has sufficient size and performance for testing full- and large-scale missile and reentry samples and structures. H3 is a 12 module, 50 percent geometric scale-up of H1 and operates at over twice the available power level and mass flow, with pressures up to 150 atmospheres.

Future T&E Capability: AEDC is replacing the Huels heater in H2 with a segmented heater and upgrading its exhaust diffuser. This will enable the test team to reach test conditions required for Conventional Prompt Global Strike (CPGS) by 2017.

In summary, the AEDC High Temperature Materials Characterization and Evaluation is unique in capability and is supporting T&E needs for current and future hypersonic programs.



## Arc Test Environment Options:

- ✓ Nosetip material steady-state ablation
- ✓ Nosetip boundary-layer transition (BLT) with variable Reynolds number
- ✓ 2D material wedge samples exposed to pressure and heat transfer rate combinations
- ✓ Environmental ablation/erosion tests using graphite dust accelerated to high velocity
- ✓ Effectiveness of actively-cooled electromagnetic apertures or transpiration cooled nosetips
- ✓ Hot antenna window material transmission