Northrop Grumman combines engineering expertise in thermal and structural design and hardware fabrication to provide advanced thermal control systems. Northrop Grumman is the world’s largest manufacturer of aerospace heat pipes and thermal systems with an annual production rate of 4,000 heat pipes.

Northrop Grumman has been manufacturing heat pipes for the aerospace industry for over 30 years with extensive proven flight heritage.

**Facts At A Glance**
- Over 65,000 heat pipes delivered
- 100% mission success
- Over 50 standard qualified extrusion profiles as well as over 100 custom profiles
- Operation temperature ranges from cryogenic to 50°C
- High Heat Transport capability of 100's of watts across several meters

**Types of Heat Pipes offered:**
- Rigid Aluminum Axially Grooved Constant Conductance
- Variable conductance for temperature control
- Diode Heat Pipe for heat transfer in one direction only
**Operation**
Heat pipes are two-phase heat transfer devices circulating a working fluid, such as ammonia, that evaporates and condenses to transport waste heat. The heat pipes provide an energy efficient means to transport hundreds of watts of heat across several meters.

**Heritage**
- Over 65,000 heat pipes have been delivered for flight applications with no known flight failures for many different programs
- Programs range from commercial programs for all telecommunication satellite primes, NASA, Department of Defense, European, Japanese, and Government Special Programs

Our heat pipe experience, combined with our extensive structural experience and systems design and analysis, provides for complete thermal control systems integrated with the spacecraft structure.

**Application**
Heat pipes move heat from one area to the other with no moving parts for heat transport, isothermalization, radiator heat dissipation and rejection, and/or payload thermal management. For example, heat pipes can be embedded within a honeycomb panel and bonded to the interior side of the facesheets to provide radiator isothermalization and heat rejection. Heat Transport applications exist using external (non-embedded) heat pipes such as surface-mounting heat pipes with flanges attached to heat pipe panels to transfer heat from internal equipment panels to external radiator panels.

Northrop Grumman manufactures equipment and radiator panels at the same facility as our heat pipes at our Integrated Thermal Systems facility. Radiator panels can be aluminum honeycomb structures with aluminum facesheets or machined aluminum plates. Heat pipe panels often have hundreds of inserts and serve as equipment shelves transferring heat from electronics base plates.

**More Information**
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