

Capabilities

ThermAvant Technologies is expanding to a 33,000 sqft facility in late 2018 to strengthen administrative, engineering, fluid processing, laboratory and production capabilities

Software, analytical and testing resources:

- SolidWorks, MasterCam, AutoDesk, ANSYS, LabView, BenchView, and more
- Seven liquid-cooled thermal test vehicles
- Three vacuum test stations
- One 1,200 CFM thermal/flow test stand
- Two 180-degree variable-g test beds
- Dozens of microchip, circuit card thermal simulators to mimic customers' devices

Production and quality control resources

- Six high-speed CNC machining centers
- Three vacuum/controlled atm. furnaces
- Two turbo-molecular pumped vacuum bakeout ovens
- TIG, MIG and laser welding stations
- Two ultrasonic cleaning stations
- Four fluid charging stations
- Thermoelectric characterization station
- Digital height gauges, 3D optical scanner, stereo microscope, and calibrated calipers, weight gauges, micrometers, and profilometers

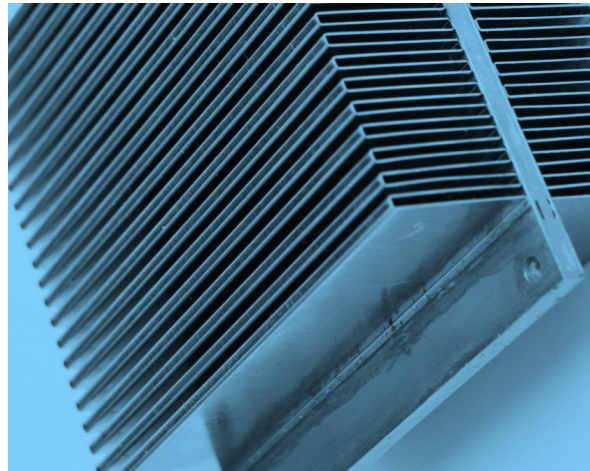


Learn More About Us

Our team of scientists, engineers and technicians have decades of experience in the design and manufacture of single- and two-phase heat transfer solutions. Read up on our team at www.thermavant.com/team/

And we aim meet or exceed customer requirements by continuously improving our engineering, production and quality management systems. Our credentials include:

- ITAR Registrant Code M37261
- AS9100D Certified
- ISO 9001:2015 Certified



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ThermAvant Technologies is the leading AS9100D designer and manufacturer of **oscillating heat pipe**, micro-channel and two-phase **thermal-mechanical solutions** for aerospace, defense and **advanced technology applications**

Company Overview

ThermAvant Technologies designs, develops and manufactures **high efficiency** thermal-mechanical solutions for aero-defense and advanced technology applications seeking **both higher power density and lower SWaP-\$** (Size, Weight, and Power plus Cost)

Customers engage ThermAvant for:

- Radar and opto-**electronics cooling**
- **Spacecraft** thermal control
- 3U and 6U **conduction cooled PCBs**
- **Li-ion battery** safety and packaging
- Industrial **heat exchangers**
- **GaN power amplifier** thermal mgt.
- Heat-driven, **ejector refrigeration**
- **Thermoelectric** generators/coolers
- Thermal **engineering and analysis**

Markets/Customers

- Government agencies (NSF, Army, Navy, Air Force, NASA, MDA, and more)
- Defense contractors
- Commercial energy and technology firms
- Non-profit and research institutions

Contract Vehicles

- Government contracts, subcontracts including nearly two-dozen SBIRs
- Firm fixed price or cost-plus-fixed fee with DCMA approved rates
- Commercial purchase orders and development agreements

Oscillating Heat Pipes

Our flagship solution is the **Oscillating Heat Pipe (OHP)**, a passive, two-phase heat transfer technology. We build OHPs into conventional materials to raise **thermal conductivities (k_{eff}) by up to 100x**. OHPs are pressure-driven and do not have internal wick structures. **OHP advantages** include:

- $k_{\text{effective}} > 75,000 \text{ W/mK}$ in lengths $> 1 \text{ m}$
- Heat flux limits $> 1,700 \text{ W/cm}^2$
- Fluids for < -150 to $> +600 \text{ }^\circ\text{C}$ operation
- **Complex 3D shapes** and 3D fluid paths
- Zero to **weak gravity dependence**
- **Tailorable** material/structural properties (e.g., Mo (CTE of 5ppm/K) to Al6061-T6)

"this technology solution could be headed for every major DoD space system, where it will replace the current, state-of-the-art technology"

- Dr. G. Spanjers, Chief Scientist AFRL/RV
Air Force Magazine January 2015

ASETS-II launch for long-duration on-orbit OHP testing



Cut away of an OHP heat spreader aboard ASETS-II

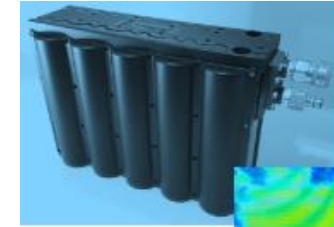
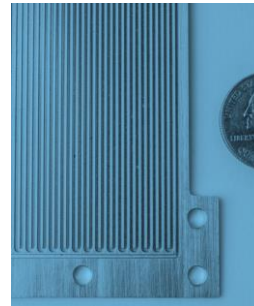
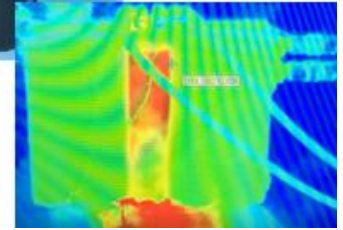


Photo of Navy Li-ion battery package for improved power density and safety



Infrared photo of "runaway" cell in package without propagation

Custom Cold Plates

When customers have access to **actively pumped systems** and need tightly controlled temperatures of **mission critical devices**, we design, manufacture, test and deliver customized **micro-channel** cold plates. Applications include liquid-cooled batteries, avionics and shipboard power electronics, and pumped **two-phase heat sinks**

Common Questions

- What are lead times for hardware?
 - First articles in 8-16 weeks
 - **Production runs in 4-10 weeks**
- What is the price of an OHP?
 - From **\$10 to >\$1,000 \$/unit** based on volume and complexity
- How much power can an OHP handle?
 - Heat fluxes < 1 to $> 1,700 \text{ W/cm}^2$
 - Heat loads $< 1\text{-W}$ to **$> 8 \text{ kW per OHP}$**
- What is the maturity level of OHPs?
 - **TRL of 8-9** ($> 28,000$ hrs on-orbit)
- How do you **predict OHP performance**?
 - Published **Limits Model** and proprietary database of results