ADVANCED COOLING TECHNOLOGIES

INDUSTRY EXPERTISE

SPACE

Thermal Systems.
Structural Excellence.

YOUR PARTNER IN MISSION SUCCESS

With extensive flight heritage, high-reliability manufacturing, and the ability to deliver complete thermal solutions, ACT is uniquely positioned to support next-generation spacecraft, planetary systems, and launch infrastructure. From critical ground support to surviving the lunar night, we've delivered reliable performance for some of the world's highest-profile programs.

We bring together the people, facilities, and experience required to ensure your mission performs as designed—from the factory floor to orbit and beyond.

HOW WE DO IT

Research

Innovating technologies for next-generation missions in-orbit, lunar and deep space exploration

- Extreme temperature thermal management (cryogenic; high-temperature)
- Radiation shielding
- Variable emissivity
- 3D printing
- Plasma technologies

Product Development

Tailoring specific technologies to meet mission requirements

- Technology tailored for your mission
- Performance-mass-cost trades
- Design for manufacturability
- Leveraging years of unique mission successes

Qualification

Ensuring space readiness through efficient and effective test regimens

- Materials, subsystems, and processes
- Thermal performance and TVAC
- Similarity and leveraging prior life tests and flight heritage

Production

Repeatable, scalable infrastructure to meet growing industry demands

- Cellular manufacturing
- AS9100 quality control
- In-house welding and radiography
- Proven manufacturing at scale

ON-ORBIT THERMAL CONTROL SYSTEMS

Lancaster, PA

- Passive and active thermal control systems
- Advanced technology development
- Design, qualification, flight hardware manufacturing
- World's highest-capacity CCHP production facility

GROUND SUPPORT SYSTEMS

York, PA

- Large-scale, rugged cooling systems
- Harsh environment expertise
- Skilled engineering and production
- Up to 1MW cooling systems

COMPOSITES

Anaheim, CA

- Structural engineering
- High-quality, precision manufacturing
- Honeycomb radiator panels
- Solar substrates, backing structures

PAYLOAD/AVIONICS ELECTRONICS
- ↳ Space Copper-Water Heat Pipes
- ↳ Pulsating Heat Pipes

HEAT TRANSPORT
- ↳ Constant Conductance Heat Pipes
- ↳ Loop Heat Pipes

HEAT REJECTION
- ↳ Composites/Iso-Grids
- ↳ CCHP Honeycomb Panels
- ↳ Deployable Structures

SYSTEM-LEVEL THERMAL SOLUTIONS

Our team excels at delivering system-level space and ground support solutions by combining deep expertise in thermal management, structural design, and mission assurance. From design and analysis to prototyping, manufacturing, qualification, and lifecycle support, ACT integrates passive and active cooling systems to meet harsh-environment requirements. Our end-to-end approach and breadth of technology options ensure a one-stop shop for scalable, reliable, and optimized performance. ACT is your trusted partner for all aspects of design and mission-critical thermal systems.

LIQUID COOLING
- ↳ Vacuum Brazing
- ↳ Cold Plates

ELECTRONICS HEAT SPREADING
- ↳ HiK™ Plates
- ↳ Pulsating Heat Pipes
- ↳ Liquid-Cooled Chassis

LIQUID SYSTEMS
- ↳ Chillers
- ↳ CDUs
- ↳ Pumped Two-Phase

AIR COOLING
- ↳ ECUs
- ↳ Enclosure Coolers

BOARD-LEVEL THERMAL SOLUTIONS

Managing Heat at the Source

Electronic components continue to increase in power density, making board-level thermal control fundamental to spacecraft reliability. Especially in space vehicles requiring on-orbit processing, high heat flux and overall waste heat can lead to significant hot spots and potential failures at the component level. ACT has solutions!

Technologies

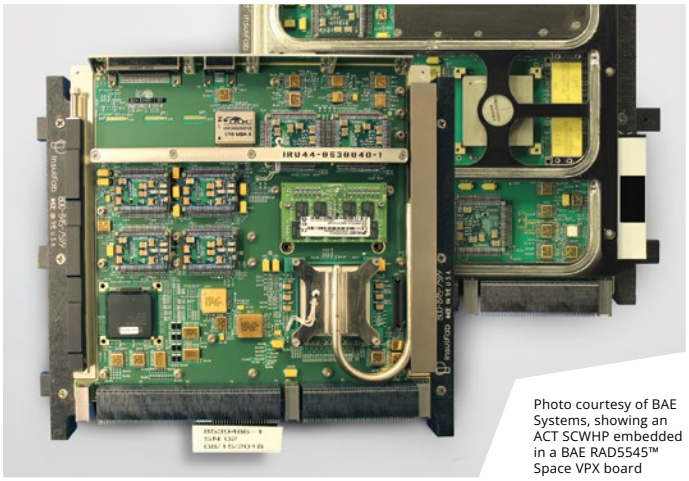


Photo courtesy of BAE Systems, showing an ACT SCWHP embedded in a BAE RAD5545™ Space VPX board

Pulsating Heat Pipes (PHP)

BOARD-LEVEL AND CHASSIS-LEVEL SPREADING

For cases with extreme temperature shifts or multiple thousands of freeze-thaw cycles, PHPs offer high performance heat spreading with lower freeze-point fluids.

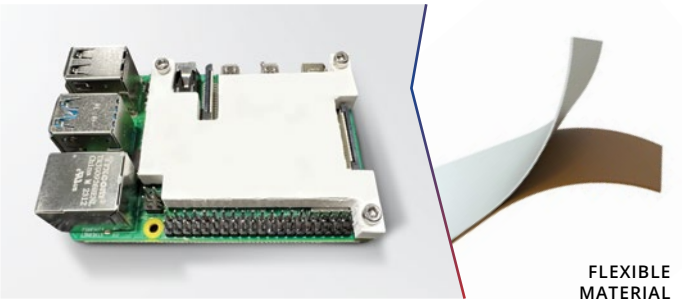
High Heat Flux and G-Load Performance	
Various Fluids/Operating Temperatures	Ammonia, propylene, acetone, refrigerants, and more
Low Profile	Down to 2 mm thickness
Tight Bend Radius	Sharp 90° turns

Space Copper-Water Heat Pipes (SCWHP)

BOARD-LEVEL AND CHASSIS-LEVEL SPREADING

A staple in terrestrial systems for decades, ACT has revolutionized the technology for space flight. Advanced manufacturing techniques and precision processing allow these heat pipes to withstand hundreds of freeze-thaw cycles, making it one of the highest-performing and most reliable solutions.

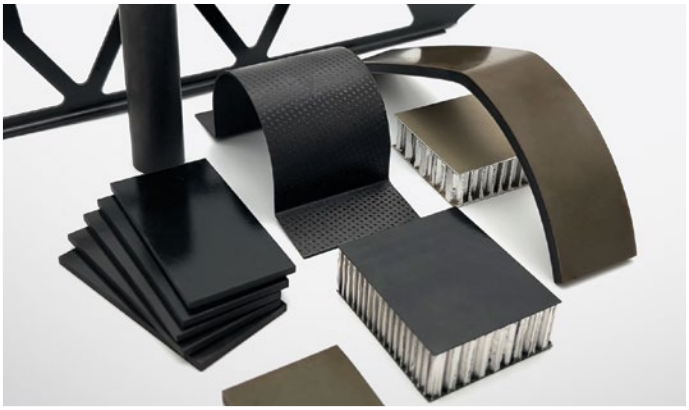
High Heat Flux Capability	Up to 50 W/cm^2
Low Temperature Gradient	2–5°C ΔT with typical heat loads
Wicking Capability	Up to 10" (25.4 cm) against gravity
Geometry/Routing	3x OD bend radius



Radiation Shielding

ACT's dual-layer composite-based radiation shield offers a lightweight, conformal solution to protect electronics from harsh space environments. Tested for high radiation tolerance, it is ideal for small satellites and missions requiring compact, high-performance protection for COTS electronics.

Radiation Tolerance	Up to 600 krad Total Ionizing Dose (TID)
Thermal Cycling	Qualified for 450+ thermal cycles
Standards Compliance	Meets NASA craftsmanship and ASTM E595 outgassing standards
Mass/Volume Savings	Up to 70% mass reduction and 50% volume reduction vs. aluminum



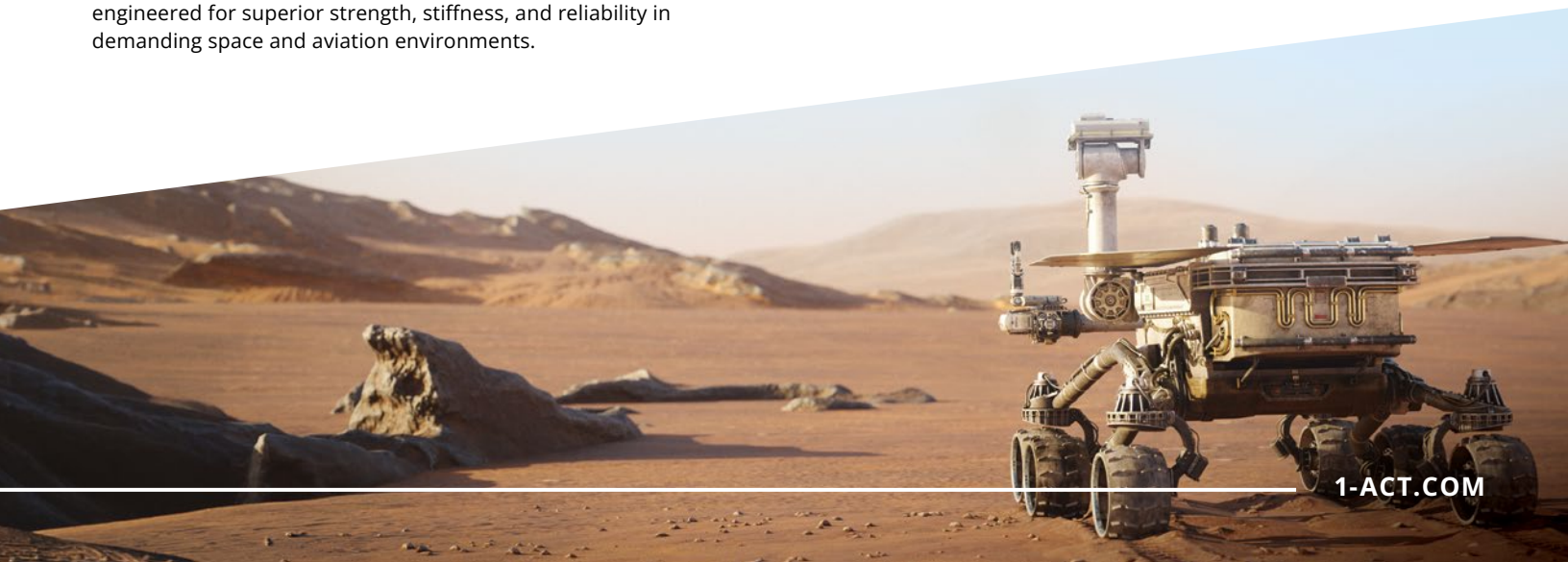
Enhanced Conduction Structures

Lightweight, high-performance aerospace composites—booms, support structures, payload and bus structures and backings—engineered for superior strength, stiffness, and reliability in demanding space and aviation environments.

ICE-Lok® Wedge Locks

Getting heat from board to chassis is often a bottleneck. ACT's patented ICE-Lok® was designed to mitigate the thermal resistance at this critical interface.

Thermal Resistance	0.08–0.15°C/W (33%+ reduction in thermal resistance from equivalent size COTS wedge locks)
Dimensions	VITA compliant for 0.375" (9.5 mm) and 0.25" (6.4 mm) cross-sections; custom sizes available
Base Material	Aluminum
Finish	Nickel-plated, anodized, chem film; others available upon request
Required Torque	Similar to conventional wedgelocks



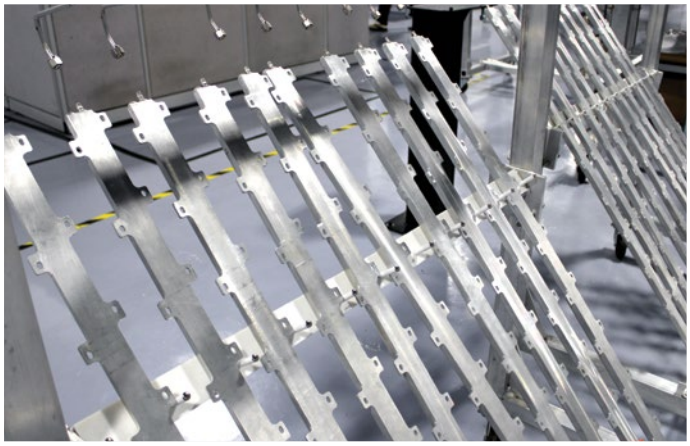
PASSIVE THERMAL CONTROL SOLUTIONS

Reliable, Zero-Power Solutions for Harsh Space Environments

Passive solutions offer unmatched reliability with no moving parts—critical for long-duration spacecraft.

- Increased system reliability
- No power consumption
- Mass-efficient thermal management
- Ideal for satellites, landers, deep-space probes, and scientific instruments

Technologies



Constant Conductance Heat Pipes (CCHP)

One of the most cost- and performance-effective solutions in the industry.

- Flight-proven in hundreds of missions
- Over 100 million hours of demonstrated on-orbit performance
- ACT has the world's highest manufacturing capacity

Length	Up to 20' (6.1 m)
Diameter	0.25" to 1.0" (0.64 cm to 2.5 cm)
Cross-Section	Dozens of qualified designs

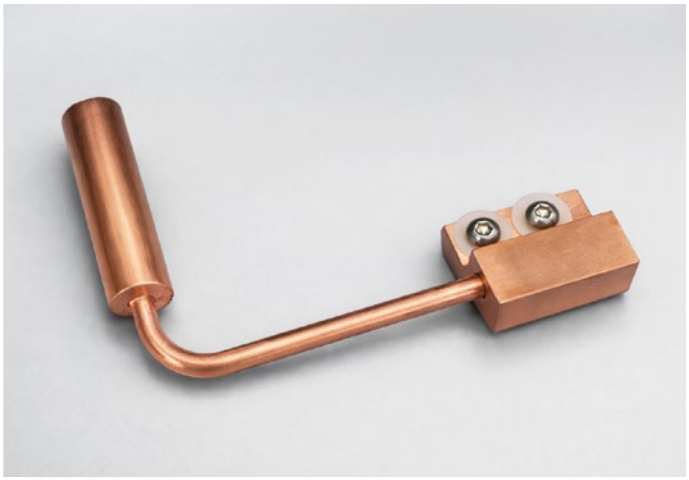
Contact us for our CCHP catalog!

LANCASTER, PA

World's Highest-Capacity CCHP Production Facility

Our vertically integrated production approach enables consistent quality, rapid throughput, and scalability for today's growing satellite constellations. With advanced in-house inspection and testing, ACT delivers reliable thermal solutions at production rates unmatched in the industry.

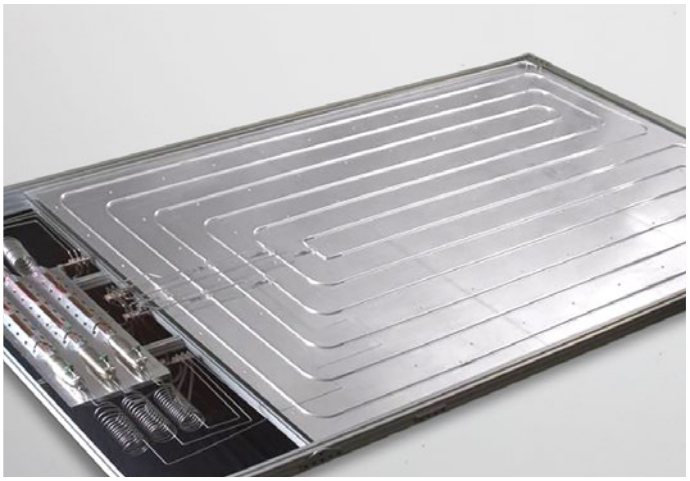
- In-house radiography capabilities for nondestructive inspection and quality assurance
- Proven ability to support large satellite constellation programs
- Space-flight heritage with high reliability and repeatability



Variable Conductance Heat Pipes (VCHP)

Used in systems that need to regulate temperature at the electronics, greatly reducing the survival heater requirement.

VARIANTS	USE CASE(S)
Cold Reservoir	Prevents overcooling in cold environments
Hot Reservoir	Increases heat rejection at high loads
Thermo-Modulating	Passive temperature control across operating ranges



Loop Heat Pipes (LHP)

ACT's loop heat pipes enable large-capacity, long-distance passive heat transport.

- ↳ Flexible links
- ↳ Can include passive thermal control
- ↳ ACT has advanced technology with use of 3D printing to enable faster lead times and reduced manufacturing complexity and cost

Honeycomb Radiator Panels

Lightweight, structurally efficient radiator panels with embedded CCHPs for maximum heat rejection.

Phase Change Material (PCM) Heat Sinks

Stable, repeatable thermal storage for eclipse conditions, peak loads, or survivability periods. Melt temperature can be tailored for mission requirements.

Emerging Technology

Innovation doesn't happen by accident—it's engineered. Our team brings multidisciplinary R&D and proven thermal expertise together to drive advanced space concepts into validated, mission-ready solutions.

- ↳ Heat pipes for fission surface power and energy conversion systems
- ↳ Deployable radiator panels
- ↳ 3D-printed loop heat pipes
- ↳ Cryogenic heat pipes
- ↳ Thermal control valves and thermal switches
- ↳ In-situ resource utilization; waste heat recovery and utilization
- ↳ Vapor venting technologies (e.g., Venus probes, comet sample return)
- ↳ Thermal technologies for icy moons (e.g., lunar, Europa)

3D-printed loop heat pipe with deployable radiator

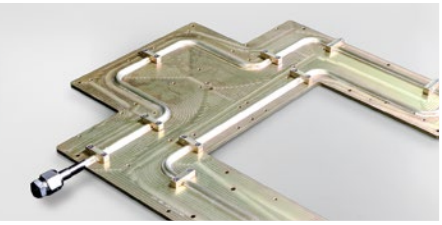
ACTIVE THERMAL CONTROL SOLUTIONS

High-Capacity, Precision-Controlled Cooling for Demanding Systems

When passive architectures are not enough, ACT delivers engineered active solutions for high heat loads or tightly controlled thermal environments.

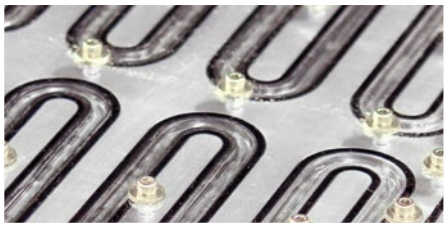
- Supports high-power payloads
- Enables precise temperature stability
- Integrates with complex spacecraft architectures
- Rugged design for space and ground environments

Technologies



Pumped Liquid Cooling Loops

Custom cold plate loops and pumped fluid systems for spacecraft, instruments, and laser payloads. Systems can be embedded into honeycomb panels as needed.



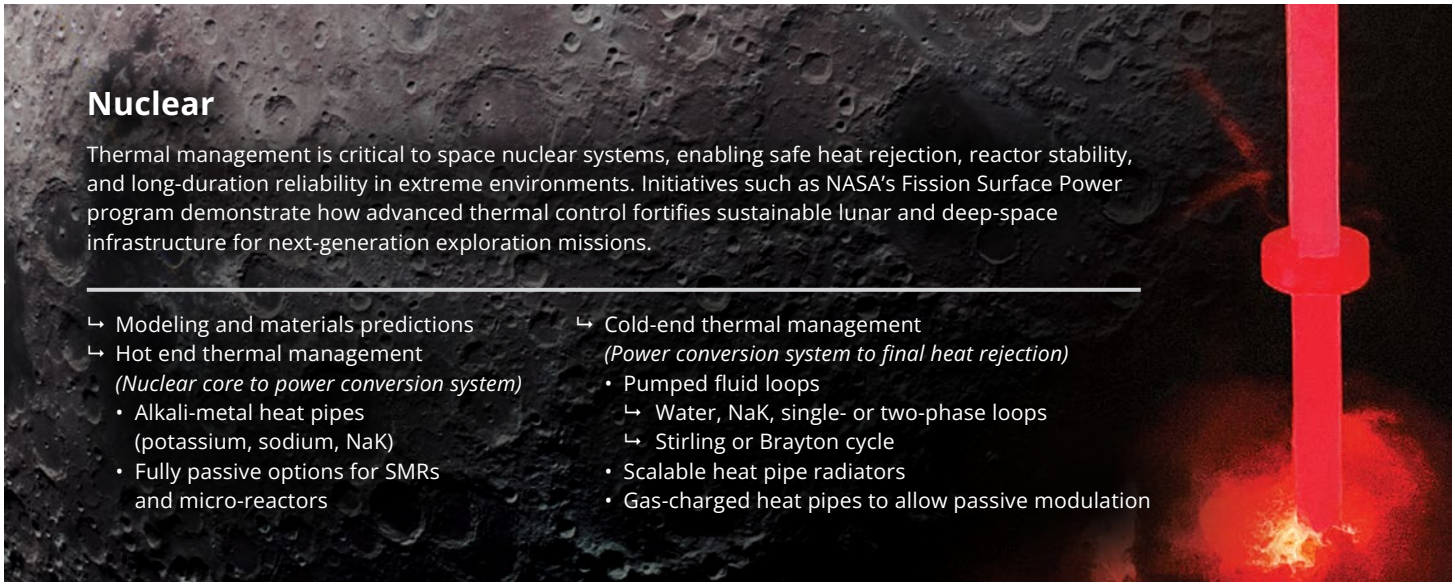
Pumped Two-Phase Systems

High-efficiency transport for large distances or high-temperature stability requirements.

Accumulators

Vital components in spacecraft liquid cooling loops, providing volume compensation and pressure control to ensure stable operation under varying thermal and environmental conditions.

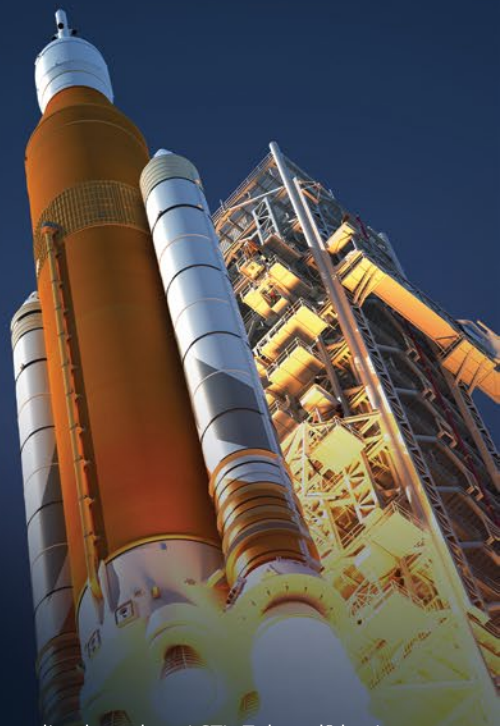
Working Fluid	Numerous fluids available including ammonia, propylene, and refrigerants	**Routing**	Allows complex routing between heat loads and heat sink
Use Case	Multi-kilowatt+ sized spacecraft	**Orientation**	Eliminates ground orientation testing limitations
Heat Isolation	Allows mechanical isolation of heat loads		



Nuclear

Thermal management is critical to space nuclear systems, enabling safe heat rejection, reactor stability, and long-duration reliability in extreme environments. Initiatives such as NASA's Fission Surface Power program demonstrate how advanced thermal control fortifies sustainable lunar and deep-space infrastructure for next-generation exploration missions.

- ↳ Modeling and materials predictions
- ↳ Hot end thermal management
  (Nuclear core to power conversion system)
  - Alkali-metal heat pipes (potassium, sodium, NaK)
  - Fully passive options for SMRs and micro-reactors
- ↳ Cold-end thermal management
  (Power conversion system to final heat rejection)
  - Pumped fluid loops
    - ↳ Water, NaK, single- or two-phase loops
    - ↳ Stirling or Brayton cycle
  - Scalable heat pipe radiators
  - Gas-charged heat pipes to allow passive modulation



CASE STUDY

ROLL-OUT PURGE UNIT FOR NASA'S SPACE LAUNCH SYSTEM

Supporting Artemis Program Ground Operations

In 2024, ACT was awarded a $6M contract by NASA Kennedy Space Center to design, manufacture, and test two Roll-Out Purge Units (RPUs) for the Space Launch System (SLS) Block 1B Mobile Launcher 2.

Mission of the RPU

The RPU provides conditioned purge air to the Service Module (SM) and Launch Abort System (LAS) during roll-out and roll-back between the Vehicle Assembly Building (VAB) and Launch Pad 39B.

Key Features

- Rugged vapor-compression cooling based on ACT's Tekgard® heritage
- Designed for high reliability in outdoor and marine environments
- Mobility-friendly architecture for ML-2 ground operations
- Replaces aging Mini Portable Purge Units (MPPUs)

The ACT Process

PRODUCT DEVELOPMENT

Working closely with NASA, ACT generated a detailed requirements verification matrix consisting of over 2000 'shall' statements and meticulously closed each requirement with objective evidence compiled into an acceptance data package. The product development process deployed by ACT routinely strikes the right balance of performance optimization, design for manufacturability, and mission assurance.

PROGRAM MANAGEMENT

ACT program management coordinated an integrated project team consisting of thermal, structural, electrical and quality experts along with highly skilled subcontractors for unique subsystems. The resulting design met program performance specifications, was executed on schedule, and satisfied all the mission assurance requirements of a launch environment.

QUALIFICATION

We developed a robust factory acceptance test plan including component, sub-system, and system level test procedures. In-house testing assets, such as thermal chambers, pressure testing rigs, and electrical panel shakedown equipment, can be utilized in advance of final assembly, ensuring schedule adherence and reduced iteration at final assembly.

PRODUCTION

ACT built two full-scale RPUs, leveraging highly qualified approved suppliers, a talented group of engineering and technician resources, and a team of quality and mission assurance engineers across multiple facilities in Pennsylvania for final assembly.

Impact

The RPU enhances ground-support readiness for NASA's Artemis missions, supporting safe transport and atmospheric conditioning of critical upper-stage hardware. This system exemplifies ACT's breadth—from spacecraft thermal control to launch-vehicle ground-support cooling technologies.

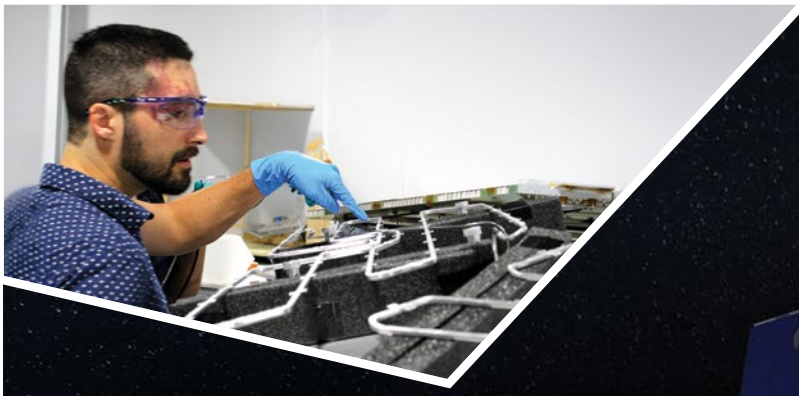


Image Credit: NASA

CASE STUDY

VIPER

Designed to Survive the Lunar Night

A key element of NASA's Artemis mission, ACT delivered a near-turnkey thermal management system for the VIPER lunar rover. The system was purpose-built to survive extreme thermal conditions during both lunar day operations and cold lunar night survival, supporting long-duration science missions in the Moon's polar regions.

Mission

The VIPER rover operates in the Moon's extreme polar environment to search for ice and support long-duration science. ACT's passive thermal management system enables reliable operation through repeated lunar day-night cycles by rejecting heat when needed and conserving it during cold survival periods.

Key Features

- Passive thermal "turn-down ratio" for day-to-night operation
- Aluminum–ammonia CCHPs
- Loop heat pipes (LHPs) with thermal control valves (TCVs)
- Aluminum honeycomb radiator panels
- Honeycomb heat spreader panels with embedded CCHPs

The ACT Process

RESEARCH	ACT's VIPER thermal system originated from a NASA SBIR focused on lunar night survival. Drawing on prior experience, we evaluated multiple thermal control technologies and proposed a solution supported by feasibility analyses, leading to selection for an Engineering Demonstration Unit (EDU).
PRODUCT DEVELOPMENT	During the EDU phase, we partnered with NASA to design and test multiple thermal control technologies within a mock rover "warmbox." Thermal vacuum testing validated performance and led to the selection of LHPs with TCVs as the primary flight solution.
QUALIFICATION	The ACT team supported flight system design while conducting parallel qualification testing to meet NASA's schedule. Testing included mechanical, thermal cycling, and performance validation, followed by successful system-level testing after integration.
PRODUCTION	We leveraged our EDU heritage to produce flight hardware efficiently. Components were built and tested in parallel to aerospace standards. Even late-stage design changes were successfully incorporated, demonstrating ACT's flexibility under evolving mission requirements.

Impact

The VIPER thermal management system enables sustained lunar surface operations and cold survival for NASA's Artemis mission. This program highlights ACT's ability to deliver flight-qualified, passive thermal solutions that perform reliably in the most extreme extraterrestrial environments.

THE THERMAL MANAGEMENT EXPERTS

Advanced Cooling Technologies, Inc. (ACT) is a leader in the design, analysis, and manufacture of high-performance thermal solutions for spacecraft, launch vehicles, scientific payloads, and critical ground support systems. With decades of experience across government, commercial, and international programs, we bring deep engineering expertise and proven flight heritage to every mission.

Our multidisciplinary teams combine thermal engineering, mechanical design, materials science, structural design and analysis, manufacturing, and qualification testing to deliver fully engineered solutions that meet the most demanding performance, mass, and reliability requirements.

Our facilities are ISO 9001 and AS9100 certified and ITAR and EAR compliant.

Proven Heritage.
Engineering Expertise. Mission Success.

Complete Support

From early-stage R&D and concept studies through thermal and structural design, analysis, qualification hardware, and full-scale production, we support every phase of the mission—transforming complex engineering challenges into elegant, reliable solutions.

Flight-Proven Hardware

Heritage matters. Our thermal technologies have supported hundreds of space missions, delivering rock-solid performance with a deep TRL legacy and millions of hours on orbit.

State-of-the-Art Manufacturing

Our manufacturing teams are constantly expanding capabilities, ensuring you have access to the latest and highest-performing technologies.

Custom Solutions for Unique Missions

No two missions are alike. We take the time to understand your requirements and engineer solutions tailored precisely to your needs—because your mission deserves hardware that fits exactly right, not “close enough.”

Let’s build your next space mission.

ADVANCED COOLING TECHNOLOGIES

Innovating thermal solutions for the next generation of spaceflight.

TALK TO AN EXPERT

Scan the QR code or visit
1-act.com/contact

THERMAL SOLUTIONS ENGINEERED FOR SPACE— DESIGNED TO SCALE, BUILT TO PERFORM.

“

I would not hesitate to recommend the ACT team to anyone. Easy to work with, and they strive to fully understand and meet project needs.

BLUEHALO

“

Professional attitude, cutting-edge thermal system design capabilities, and accommodated many of the schedule and budget challenges on this particular program.

VIASAT

“

Excellent performance and great flexibility!

NASA GODDARD

ADVANCED COOLING TECHNOLOGIES

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