

SBIR 06.2 PHASE I - AWARD DETAILS	
ORGANIZATION	PEO GCS
TOPIC NUMBER	A06-193
CONTRACT NUMBER	
YEAR OF AWARD	
AWARD START DATE	
AWARD COMPLETION DATE	
PROPOSAL NUMBER	A062-193-3318
TITLE	Shock and Vibration Tolerant Capillary Two-Phase Loops
PROJECT MANAGER	Chanwoo Park (717) 295-6073 chanwoo.park@1-ACT.com
COMPANY	Advanced Cooling Technologies, Inc. 1046 New Holland Avenue Lancaster PA 17601-5688 Minority Owned: No Veteran Owned: No Number of Employees: 19
KEYWORDS	Capillary two-phase loop, Shock and vibration tolerant, Graded wick, Check valve, Military vehicle cooling, Loop heat pipe, Capillary pumped loop
ABSTRACT	Advanced Cooling Technologies, Inc. (ACT), supported by Hamilton Sundstrand, proposes to develop a shock and vibration tolerant Capillary Two-Phase Loop for military vehicle applications. The proposed capillary two-phase loop differs from the traditional loop heat pipes and capillary pumped loops in the evaporator design, which provides inherent tolerance to shock and vibration. Two additional features are added to further improve the shock and vibration tolerance: (1) graded wicks are used in the evaporator to mitigate the shock and vibration impact on the liquid-vapor interface (meniscus); and (2) check valves are used in the liquid transport line to mitigate the macro-scale liquid churning motion. The Phase I project will verify the basic concept of combining graded wick evaporator with liquid check valves to achieve improved shock and vibration tolerance. A proof-of-concept capillary two-phase loop using water as the working fluid will be designed, fabricated and tested at Mil-Spec shock and vibration conditions for Army vehicles. The Phase II project will design, fabricate and test full scale capillary two-phase loops under startup and transient heat loading as well as Mil-Spec shock and vibration conditions. The follow on Phase III project will integrate the technology in actual vehicles and conduct qualification tests in simulated operational environments.
BENEFITS	A vibration/shock-tolerant capillary two-phase loop technology has broad applicability in military and commercial markets: • Civilian land vehicles (power electronics, optoelectronics, electrical converters, drives and motors, fuel cell reformers and stacks). Current standard technology is pumped liquid cooling. • Military aerial vehicles (electronics onboard high altitude UAV, power electronics onboard All Electric Fighter Jets, directed energy weapons). Current standard technology is pumped fuel cooling. • Commercial server farms or data

	<p>centers. Current standard technologies are air-cooling and conditioning. • Commercial telecommunication equipment enclosures (indoor and outdoor). Current standard technologies are air-cooling and conditioning. These markets/applications are synergistic in that technical development in one aid all, and commercial progress in one will increase the production base and reduce unit costs for all. This Army SBIR program will provide an opportunity to demonstrate the technology in representative aerospace environments that are far more severe than most commercial systems.</p>
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