



## **COMMERCIALIZATION ASSISTANCE PROGRAM**

### **Microclimate Cooling System (Personal Cooling for Warfighters)**

#### **RINI Technologies**

##### **Business Opportunity:**

Presently, there is no man-mounted cooling unit that can effectively mitigate heat stress without impairing mobility. RINI Technologies' (RINI) Microclimate Cooling System (MCCS) addresses this estimated \$50M (2009) personal cooling market growing to \$160M (2014). The market is currently served exclusively by vehicle mounted personal cooling system.

RINI is primarily focused on the U.S. Military market where hot environments hinder soldiers, decreasing cognitive skills and increasing fatigue. A secondary focus is on the first responder market, including fire fighters, police and HAZMAT workers.

RINI is looking for its first military customer (production orders) and the subcomponent manufacturing partners needed to successfully fill and manage these orders. In addition, RINI is willing to entertain licensing opportunities for additional applications and markets.

##### **Company Background:**

RINI is a privately held, for-profit S corporation. Headquartered in a 12,000 square foot facility in Oviedo, Florida, Dr. Dan Rini founded the company in 2000, and it currently staffs 16 full-time and 5 contract employees. The company has a nine year history of winning competitive research contracts (over 35 awards) from government customers including the Army Natick Soldier Center, AFRL, ONR, and DARPA.

The Company's laboratory is equipped with several fully automated data acquisition systems, high voltage power supplies, chillers, thermal test chambers, life and reliability test stations for systems and components, and other equipment needed to conduct research and development in the thermal management field. The on-site machine shop facility houses several CNC milling machines, lathes, grinders, and manual equipment enabling precision machining capabilities. This fully capable on-site facility allows for rapid fabrication of custom prototype parts and the flexibility to make rapid design changes facilitating parametric design tests to be conducted.

**Industry Problem:**

There is currently no man mounted cooling unit that can effectively mitigate heat stress in soldiers and as a result the military must work within the physical and health limitations of these heat stress conditions. The ambient temperature in today's war zones can often reach 120°F; and when soldiers are required to wear body armor or chem./bio gear it is very difficult to effectively execute many of their missions. There are vehicle mounted personal cooling systems that have recently been deployed in select U.S. Military air and vehicle platforms. In these cases the soldier must be tethered to the vehicle to receive cooling; however, the cooling effect has been demonstrated to have considerable tactical and operational benefits. The Army therefore has a good understanding of what level of cooling is needed, and the limits on the size and weight a system must meet to be feasibly carried by a warfighter. The Army has developed a specification for the man mounted cooling system that the RINI system is meeting.

**Technology:**

The MCCS is a miniature refrigeration system that circulates chilled water through a "tube suit" garment located under the protective suit (uniform, body armor, etc.). Every component within the system was custom designed by RINI in order to meet the size, weight and efficiency requirements. Examples being: a custom developed small positive displacement rotary compressor; and an evaporator, water pump and condenser assembly designed to meet the heat transfer requirements while tightly integrated together.

**Advantages and Differentiating Features:**

This system is non-tethered, man mounted, orientation independent and removes body heat trapped by protective garments. It provides 120 watts of cooling in a 1.5 liter package that weighs 4 lbs. The unit consumes 50 watts of DC power allowing 4 hours of continuous operation from a 2.6 lbs battery.

**Stage of Development:**

The development of the system is almost complete. Between June 2009 and June 2010, RINI is funded via an Army contract to bring the system to TRL 7 with full qualification and operational environment testing. In the same time period a manufacturing program will develop a production plan and build low rate "production ready" runs. Transition to a Program of Record is also anticipated over the next year with the first LRIP production order in 2011.

**Competing Technologies:**

All existing personal cooling solutions fall into 3 categories:

- *Phase transition technology (melting)* – Melting can absorb a great deal of heat, however 4 lbs of ice melts in 45 minutes when used for personal cooling.
- *Compressed air* – Cooling vests filled with cool air are effective removing heat. However, available compressors to supply airflow are too large to be man mounted.
- *Vehicle integrated cooling* – The vehicle carries the weight of the system and supplies power so that cooling can be provided for a long time. This is the current military approach.

A 2005 study commissioned by the Department of Homeland Security and executed by the U.S. Army concluded that there is no perfect solution for portable personal cooling on the market. Of the 260 identified products, 36 have cooling capabilities that can perform better than the bare minimums of 45 minutes and 50 watts. Only six products were found that can operate for two hours with a capacity of 100 watts of cooling. Of these six products, only three can

operate without tethers to external equipment. Two of these three are based on wearable ice chests requiring replacement. The third product, from Aspen Systems, is 50% greater in size compared to RINI's MCCS and is not orientation independent; meaning that the system must be upright in order to operate.

**Benefits:**

In situations where the temperature is high or protective garments are necessary, the MCCS provides both a physiological and cognitive benefit by removing body heat trapped by protective garments. The system allows for mobility while cooling, enabling increased missions times and physical stamina. This system gives combatant commander extended capabilities when planning missions and improved soldier performance since heat stress is less of a factor.

**Intellectual Property:**

RINI Technologies is implementing an IP strategy to secure patents that cover the configuration and cooling method of the overall system, the subcomponents within the system and any key elements that give the system an advantage. At present RINI Technologies holds two issued U.S. patents and have five pending patents. The company also has three patents for laser and electronics cooling, with three other related patents pending in the U.S.