Cooling Boot: Reinventing the Boot for Personal Thermal Comfort

**CHALLENGE:** Save energy by cooling (or heating) individuals, not buildings

- Provide Individual comfort
- Cool with a wearable device
- Save energy, improve productivity

**SOLUTION:** Cooling Footwear for Wearable Thermal Comfort

SRI, with the University of California, Los Angeles (UCLA) and Stanford University, is developing footwear designed to keep the wearer comfortable by augmenting the human body’s natural thermal regulation system. SRI’s system uses a combination of low-cost pumps, fans and thermally conductive materials to manage heat transfer from the soles of the feet. The quiet, comfortable system builds on experimentally validated techniques developed by Stanford University that leverage heat flow through glabrous tissue (such as the soles of the feet). The technology can also be used to provide heating. Future enhancements may include personal performance tracking, integration with smart buildings, and enhanced performance through the incorporation of advanced technologies—such as highly-efficient solid-state heat pumps based on electrocaloric polymers, enhanced airflow based on biologically-inspired fans, and materials that are thermally conductive yet low-cost and flexible.

**HOW COOLING BOOT WORKS**

SRI’s system uses low-cost pumps, fans, and thermally conductive materials to move heat from the skin to the air. Critical thermal resistances include the skin and heat sink to the air. Maximizing the area of skin contact minimizes the effective skin resistance. Enough heat can be removed to maintain comfort ambient temperatures of 79ºF or above.
WEARABLE THERMAL COMFORT

WORKING WITH THE BODY

Vascular structures in the glabrous tissue found in the soles of the feet, palms of the hand, and parts of the head act as the body’s radiator to eliminate excess heat. SRI’s system augments the body’s natural cooling system by augmenting heat flow through the glabrous tissue.

Stanford University experimentally validated that thermal regulation at the foot expands the temperature range in which an individual feels comfortable.

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