In 1988, NASA began working with private industry to develop thermally adaptive phase-change materials that could be applied to astronauts' suits and gloves for better protection against the bitter cold and scorching heat encountered in space.

**PARTNERSHIP**

Triangle Research and Development Corporation, of Research Triangle Park, North Carolina, participated in a Phase I Small Business Innovation Research (SBIR) contract with Johnson Space Center to assist in the creation of phase-change materials for NASA. Prior to this contract, the company demonstrated the value of manufacturing textile fabrics and fibers containing impregnated, microencapsulated phase-change materials for the U.S. Air Force. This work, also carried out under a Phase I SBIR contract, explored the necessity of such materials to protect pilots from temperature extremes.

**PRODUCT OUTCOME**

Three years after the completion of the NASA contract, a Boulder, Colorado-based firm acquired from Triangle Research and Development Corporation the exclusive patent rights for incorporating phase-change technology in commercial fibers and fabrics. Ed Payne and Bernard Perry, the founders of Gateway Technologies, saw the potential for using phase-change technology to enhance the comfort levels for individuals with active outdoor lifestyles. In 1997, Gateway Technologies changed its name to Outlast Technologies, Inc., and subsequently introduced the world to the first line of commercial gloves and footwear incorporating Outlast® Smart Fabric Technology™.

Beginning with the very first set of Outlast gloves, each Outlast product contains a lining that continuously interacts with the unique microclimate of the human body and the environment to moderate temperature from being too hot or too cold to being just right. Traditional clothing systems trap heat in during high activity. The human body naturally sweats to cool the skin, reducing the ability of clothing to keep the body dry and comfortable. Outlast technology, conversely, will keep individuals comfortable by absorbing body heat when too much is created, thereby diminishing the amount of moisture in their clothing. The clothing essentially stays drier and maintains its effectiveness. A “comfort zone” can also be sustained in cold-weather environments, as Outlast garments will release stored heat back to the body when it begins to chill or shiver.

Within the Outlast products there are millions of microcapsules called Thermocules® that recycle stored energy by absorbing and releasing excess body heat to balance temperature. To insure durability against the rigors of everyday wear and tear, phase-change materials are placed into these Thermocules, which are very much like miniature ping pong balls, but much smaller at 1/2 to 1/20th the diameter of a human hair. Not only are Thermocules small but their shells are very stable, since they are made to be inert and not melt. Once the phase-change materials are microencapsulated into Thermocules, they can be blended into compounds suited for fabric, fiber, and foam coatings.

From head to toe, Outlast Technologies is covering the everyday consumer with pure comfort. Boots, socks, underwear, shirts, pants, jackets, gloves, and hats have been made “smart” with the addition of Outlast Thermocules. Even bedding has successfully adopted the temperature-controlling technology. The company’s Adaptive Comfort® Bedding has been the answer to a restless night’s sleep for...
The list of products does not stop here. Outlast Technologies has entered strategic partnerships with over 200 premium-brand leaders in North America, Europe, and Asia, such as: Adidas, Bugatti, Burton, Kenneth Cole, Lands' End, Nordstrom, Rainforest, The North Face, Timberland, and Weatherproof. Expanding beyond consumer apparel, Outlast material has been considered by General Motors as the material of choice for leather bucket seats in the conceptual design of future Hummer H2 sports utility models.

Meanwhile, hundreds of miles above the Earth, Outlast apparel is making space exploration more comfortable for astronauts. NASA will continue to test new Outlast gloves and footwear in order to make those living and working in space feel “more at home.”