

Lightweight, Wearable, Metal Rubber™ Sensor

For autonomous health monitoring

NanoSonic, Inc., has developed comfortable garments with multiple integrated sensors designed to monitor astronaut health throughout long-duration space missions. The combined high electrical conductivity, low mechanical modulus, and environmental robustness of the sensors make them an effective, lightweight, and comfortable alternative to conventional use of metal wiring and cabling.

During Phase I of this project, NanoSonic demonstrated the feasibility of using its patented Metal Rubber sheet and fabric materials as sensor elements and highly flexible electrodes integrated into prototype instrumented garments. In feasibility tests, heart rate and electrocardiogram (EKG) data taken with the sensors were essentially identical to those obtained with standard biomedical instrumentation.

In Phase II, NanoSonic improved the sensor materials and integration methods by working with a large-volume U.S. textile manufacturer, the sensor and electronics design group of a major aerospace company, and a biomedical sensor and device laboratory of the U.S. Food and Drug Administration. Specific and notable accomplishments include:

- Designing, fabricating, and evaluating the performance of sensor jerseys
- Developing data acquisition electronics needed to interface with standard storage and communication modules
- Investigating requirements for scaled-up manufacturing

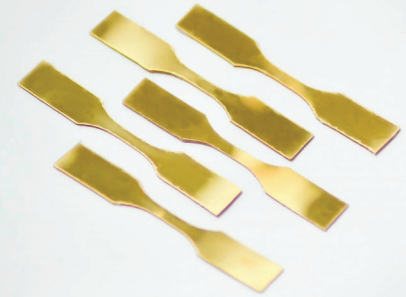
Applications

NASA

- ▶ Astronaut health monitoring
- ▶ Spacecraft instrumentation wiring
- ▶ Large-area radio frequency (RF) antennas, space-based radar, and photovoltaic arrays
- ▶ Ultralow-weight RF and electromagnetic interference shielding and ground planes for spacecraft and aircraft
- ▶ Highly flexible, conductive fairings and electrical interconnects in next-generation morphing air vehicles that change shape to optimize flight conditions
- ▶ Conformal “sensor skins” for unobtrusive measurement of aircraft skin friction and pressure

Commercial

- ▶ Physiological sensor garments for:
 - Emergency first responders
 - Athletes
 - Patients receiving home and institutional health care
 - Security personnel
- ▶ Electrical interconnects in flexible electronic displays
- ▶ Deployable photovoltaic fabrics for electrical power generation
- ▶ Low-weight RF shielding and ground planes for cell phones and other electronic instrumentation
- ▶ Low-weight, conformal RF phased-array antennas
- ▶ Air- and water-flow sensors for aircraft and ship systems
- ▶ Electrical interconnects in next-generation prostheses



NanoSonic, Inc. photo

Phase II Objectives

- ▶ Develop and demonstrate a low-weight, noninvasive, reliable, and comfortable autonomous health monitoring system for use by astronauts
- ▶ Develop an integrated smart sensor garment that can be worn comfortably to continuously monitor physiological status
- ▶ Use the patented Metal Rubber sheet and fabric as both electrical and mechanical sensor elements and flexible, low-weight electrical sensor interconnect materials

Benefits

- ▶ Monitors astronaut health through long-duration space missions
- ▶ Provides a lightweight and comfortable alternative to conventional monitoring systems composed of metal wiring and cables
- ▶ Offers high electrical conductivity and low mechanical modulus

Firm Contact

NanoSonic, Inc.
Andrea Hill
ahill@nanosonic.com
1485 South Main Street
Blacksburg, VA 24060-0618
Phone: 540-953-1785

Proposal Number: 06-2 X14.02-9306