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Development of a Telemetric Heat Stress Monitor

Final Abstract

CRADA No. LA94C10150

Hazardous-materials workers and firefighters wear clothing that protects them from external hazards, but the sealed environment of a protective suit makes its wearer susceptible to heat stress. Heat stress occurs when the body's natural cooling mechanisms fail: it causes loss of mental acuity and can lead to collapse and even death. A prototype of the Telemetric Heat Stress Monitor (THSM) was developed at LANL to warn workers, and personnel monitoring the workers, of incipient heat stress by detecting the workers' elevated temperatures and heart rates. This CRADA was used to transfer the information and technology from LANL to the industrial partner, the Mini-Mitter Company, and to assist in the further development of a commercial THSM product.

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Development of a Telemetric Heat Stress Monitor

Final Report

CRADA No. LA94C10150

A. Parties

The project is a relationship between Los Alamos National Laboratory (LANL) and the Mini-Mitter Company.

Los Alamos National Laboratory
P.O. Box 1663
Los Alamos, NM 87545

The Mini-Mitter Co., Inc.
PO Box 3386
56885 Enterprise Drive
Sunriver, OR 97707

B. Project Scope

Hazardous-materials workers and firefighters wear clothing that protects them from external hazards, but the sealed environment of a protective suit makes its wearer susceptible to heat stress. Heat stress occurs when the body's natural cooling mechanisms fail: it causes loss of mental acuity and can lead to collapse and even death. A prototype of the Telemetric Heat Stress Monitor (THSM) was developed at LANL to warn workers, and personnel monitoring the workers, of incipient heat stress by detecting the workers' elevated temperatures and heart rates. The purpose of this CRADA was to transfer the information and technology from LANL to the industrial partner, and to assist in the further development of a commercial THSM product.

At the end of the CRADA, the product was not entering production as originally planned, but most of the milestones were met. The delays occurred as a result of:

- LANL participating in and hosting an unexpectedly large number of time consuming meetings, demonstrations, and presentations.
- Mini-Mitter personnel changes and additions, and slippage in the schedule of a previous Mini-Mitter product.
- Unanticipated problems (subsequently resolved) in the THSM hardware design.

These problems were rectified and first deliveries of the product will occur within six months of CRADA close-out.

C. Technical

The THSM is the first extensive telemetric physiological monitor to be developed; previous monitors used wires between the sensors and the recording and display equipment. Developing a reliable, small, battery-powered, inexpensive telemetry system to share the RF spectrum with today's proliferating wireless devices was a significant technical accomplishment.

The optimum method for detecting the onset of heat stress is an unresolved issue. There are several possible algorithms (and sets of measurements), each of which can be integrated into the THSM.

Meetings were held to discuss the issue with DOE, DOD, LANL, Mini-Mitter, and others in attendance. A consensus was not reached, but several of the organizations will be using the first THSM commercial devices for monitoring personnel during testing aimed at resolving the question.

D. Partner Contributions

Mini-Mitter met the early milestones and, although some of the later milestones have not yet been completed, they invested more than their agreed CRADA contribution in their attempt to complete them on time.

Mini-Mitter led the system specification effort and then planned and completed the packaging for the THSM to contain the data acquisition, control, battery, and radio link electronics in a small enclosure. They designed and prototyped elements of the hardware and microcomputer software for the man-carried units and had a complete operational prototype system by the second quarter of 1996. They have completed most of the testing and preparation for production, prepared initial product literature, and are now completing the remainder of the software.

No subject inventions were created during the CRADA project.

E. Documents/Reference List

Quarterly reports for the CRADA were made to the Industrial Partnership Office. No other formal reports were published for the project.

Close communication was maintained with the funding agency, and a detailed written report was submitted to Dr. John Peeters and Dr. George Gebus (DOE-Germantown) on August 31, 1995. Numerous presentations and demonstrations were held at conferences and for civic and governmental organizations and DOE officials in Los Alamos.

F. Acknowledgment

Participant's signature on the final report indicates the following:

- 1) The Participant has reviewed the final report and concurs with the statements made therein;
- 2) The Participant agrees that any modifications or changes from the initial proposal were discussed and agreed to during the term of the project;
- 3) The Participant agrees that all reports either completed or in process are listed and all subject inventions and associated intellectual property protection measures attributable to the project have been disclosed or are included on a list attached to this report;
- 4) The Participant certifies that proprietary information has been returned or destroyed by LANL.

Denny Ebner

11/7/96
Date

Larry Berkbigler

10/31/96
Date