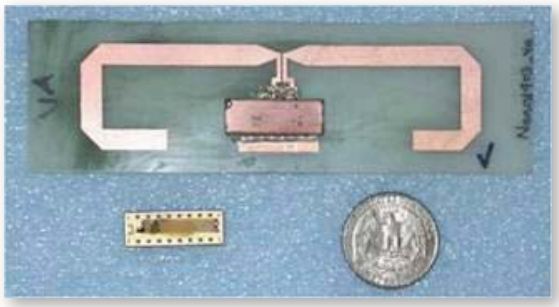
Wireless Multiplexed Surface Acoustic Wave Sensors Project

Center Innovation Fund: KSC CIF Program

Space Technology Mission Directorate (STMD)

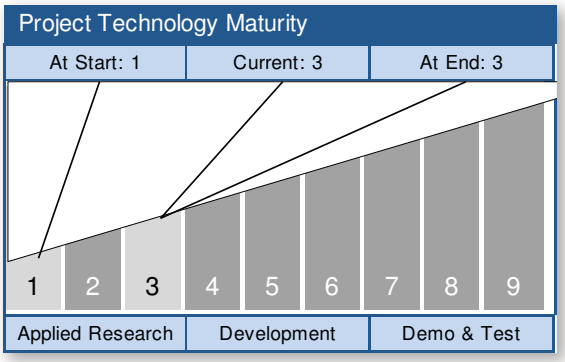
National Aeronautics and Space Administration



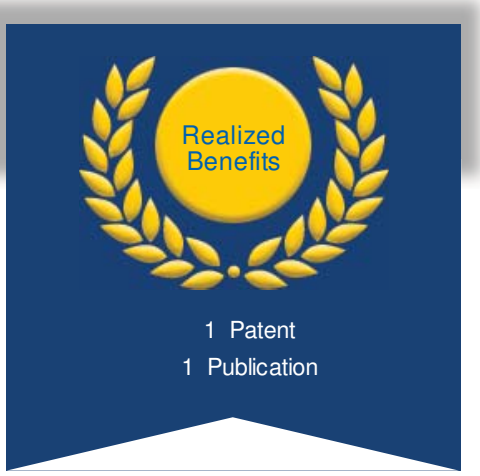
ABSTRACT

Wireless Surface Acoustic Wave (SAW) Sensor is a new technology for obtaining multiple, real-time measurements under extreme environmental conditions. This project plans to develop a wireless multiplexed sensor system that uses SAW sensors, with no batteries or semiconductors, that are passive and rugged, can operate down to cryogenic temperatures and up to hundreds of degrees C, and can be used to sense a wide variety of parameters over reasonable distances (meters).

Wireless Multiplexed Surface Acoustic Wave (SAW) Sensors



Technology Area: Robotics, Tele-Robotics & Autonomous Systems TA04 (Primary)
Ground & Launch Systems Processing TA13 (Secondary)

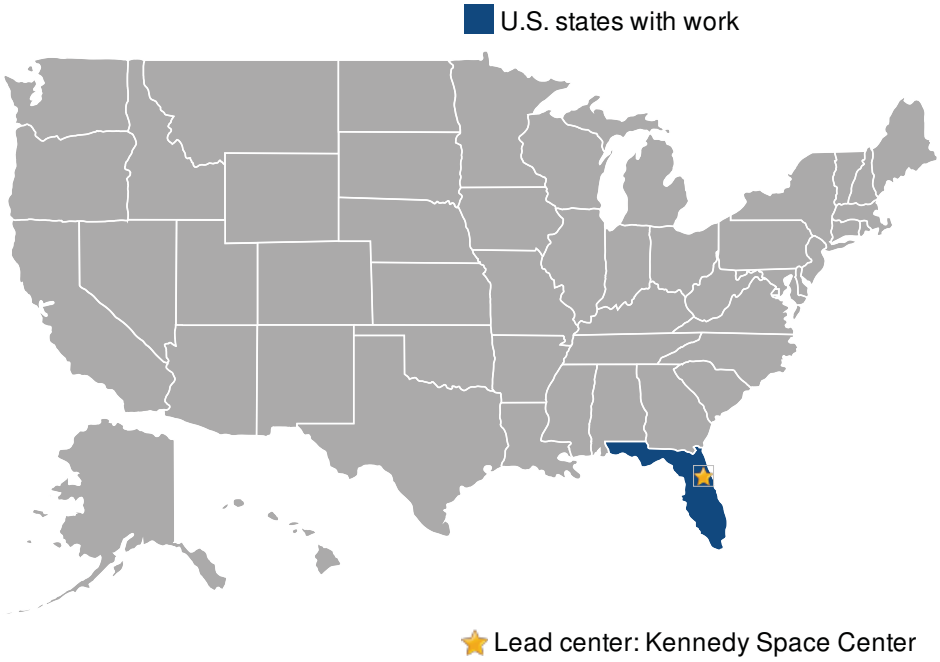


ANTICIPATED BENEFITS

To NASA funded missions:

By developing multiplexed wireless systems rugged, lightweight, versatile measurements can be made both on the ground and in future spacecraft. This can reduce wiring on spacecraft sensors while allowing spinning blades and bearings to be monitored, and providing passive monitoring at lunar and deep space temperature extremes. These sensors require no batteries and can be accessed wirelessly with RF pulses out to distances of several meters. They can operate under very harsh conditions (cryogenic temperatures, buried in concrete, high radiation background, etc.), yet are relatively ...

Read more on the last page.



Other Organizations Performing Work
QinetiQ North America/ESC

MANAGEMENT

Program Director: John Falker

Program Manager: Nancy Zeitlin

Project Manager: Emilio Valencia

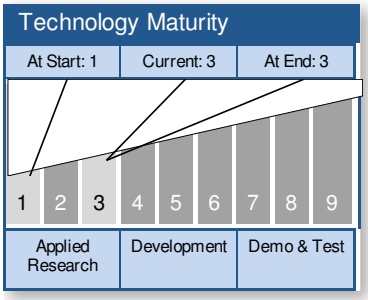
Principal Investigator: Robert Youngquist

DETAILED DESCRIPTION

This work continues the development of a novel wireless, passive, sensing system that uses surface acoustic wave (SAW) sensors. During this effort a new multiplexing concept, coherence multiplexing, was developed and an operational system was constructed and tested. A set of wireless hydrogen sensors was tested and found to work surprisingly well. In addition, magnetic field sensors, temperature sensors, and cryogenic liquid level sensors were demonstrated. Technical progress was made on sensor performance, types of sensors, but primarily on the new coherence multiplexing scheme. Algorithms were developed, new hardware configurations developed, and sensor enhancements achieved.

TECHNOLOGY DETAILS

Wireless Multiplexed Surface Acoustic Wave (SAW) Sensors



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This technology is categorized as a hardware system for other applications

- Technology Area
    - TA04 Robotics, Tele-Robotics & Autonomous Systems (Primary)
    - TA13 Ground & Launch Systems Processing (Secondary)
    - TA08 Science Instruments, Observatories & Sensor Systems (Additional)

CAPABILITIES PROVIDED

Surface Acoustic Wave sensors require no batteries, yet can measure many parameters over a wider temperature range than semiconductors. By developing multiplexed, wireless systems rugged, lightweight, versatile measurements can be made both on the ground and in future spacecraft. NASA generated a new concept to allow more surface acoustic wave sensors to be access with better signal to noise than existing approaches.

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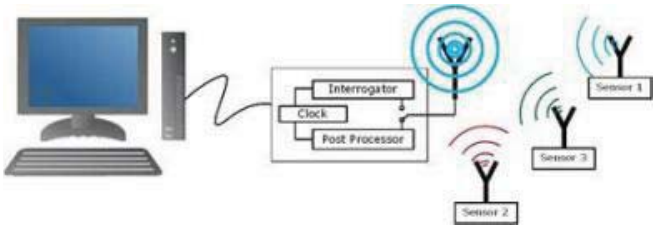
TECHNOLOGY DETAILS

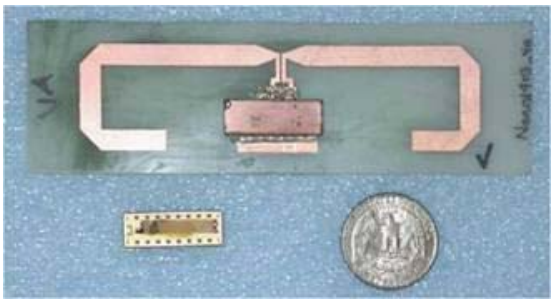
POTENTIAL APPLICATIONS (CONT'D)

phone.

IMAGE GALLERY



Passive, Wireless Sensor System Operates by Launching of RF Pulses to the Sensors



Wireless Multiplexed Surface Acoustic Wave (SAW) Sensors

ANTICIPATED BENEFITS

To NASA funded missions: (CONT'D)

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To the commercial space industry:

NASA also demonstrated a set of four wireless multiplexed SAW hydrogen sensors; this work led to the granting of a PhD to a graduate student at the University of Central Florida. The KSC Ground Systems Development Office (GSDO) as well as the Florida Space Institute (FSI) are providing funding to continue the development and testing of these hydrogen sensors. In addition, the NASA Rocket Propulsion Test Board is funding the demonstration of a set of wireless SAW liquid level sensors that can operate in cryogenic liquids.