Johnson Space Center Engineering Directorate

L-8: RFID technology and sensor interrogators to develop low cost sensor suites

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Public Release Notice

This document has been reviewed for technical accuracy, business/management sensitivity, and export control compliance. It is suitable for public release without restrictions per NF1676 #37712.
We are sharpening our focus on Human Space Flight (HSF) Exploration Beyond Low Earth Orbit.

We want to ensure that HSF technologies are ready to take Humans to Mars in the 2030s.

- Various Roadmaps define the needed technologies
- We are attempting to define our activities and dependencies

Our Goal: Get within 8 years of launching humans to Mars (L-8) by 2025
- Develop and mature the technologies and systems needed
- Develop and mature the personnel needed

This is one of a number of specific partnership opportunities that you might be interested in to discuss during SpaceCom 2016.
EA Domain Implementation Plan Overview

- Life Support
- Active Thermal Control
- EVA
- Habitation Systems

- Human System Interfaces
- Wireless & Communication Systems
- Command & Data Handling
- Radiation & EEE Parts

- Lightweight Habitable Spacecraft
- Entry, Descent, & Landing
- Autonomous Rendezvous & Docking
- Vehicle Environments

- Entry, Descent, & Landing
- Autonomous Rendezvous & Docking
- Deep Space GN&C

- Reliable Pyrotechnics
- Integrated Propulsion, Power, & ISRU
- Energy Storage & Distribution
- Breakthrough Power & Propulsion

- Crew Exercise
- Simulation
- Autonomy
- Software
- Robotics
Avionics Systems Opportunity

- Wireless & Communication Systems
- Command & Data Handling
- Human System Interfaces
- Radiation & EEE Parts

RFID technology and sensor interrogators to develop low cost sensor suites

The Problem

- wireless sensors can save significant vehicle mass, allow adding more instrumentation at later dates
- practical wireless sensing limited by short battery lifetimes
- current “active” protocols (WiFi, Bluetooth) not well suited to long-term vehicle sensing

- JSC/EV is developing a “zero-wire” sensing concept based on RFID
- RFID sensors are “passive”
  - no battery needed for communication
- path-to-flight hardware has been built/demonstrated (thermal sensors)
- partners sought for flight opportunities, further application development, demonstration (aerospace/otherwise)
RFID allows tags to report unique IDs to an interrogator...
RFID for Sensing

...but it can also be used to send sensor data:
RFID Sensor Architecture

• communication power provided by interrogator, “for free” from sensor’s perspective

• data acquisition (DAQ) power can come from several sources:
  • stored power (e.g., batteries)
  • harvested power (e.g., RFID, solar, thermal,...)
Internal Radio-frequency Instrumentation System (IRIS)

- developed for Orion heat shield monitoring
- passive thermocouple (TC) sensors:
  - 5.17 year standby time (CR2032 batt.)
  - 203.4 days streaming 10 Hz TC data
  - scaling to 50 sensors/interrogator demonstrated
    - 100-200 should be achievable
  - 0.04 lbs./sensor
    - inc. textile antenna
  - 1.25 in. x 1.25 in. form factor
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If you’re interested in one of these, or you have other ideas, let us know at:

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