

Spacecraft Autonomous Inventory Tracking



Name of Technology:

Autonomous inventory tracking and management for multiple element spacecraft

Participating NASA Centers:

SSC (Lead)

Technological Area:

T9.02 Integrated Life-Cycle Asset Mapping, Management, and Tracking

Vision for the Technology:

Long term space missions require an autonomous inventory tracking and management system to help crews locate assets in real time. NASA has implemented the RFID-Enabled Autonomous Logistics Management (REALM) initial system but requires real time location accuracy.

Challenges:

Currently on the International Space Station (ISS), locating logistics items is mostly manual bar code reading and heavy ground support for database updates. Locating an item on ISS can take on the order of days without localization automation. Technology improvements are needed to better pinpoint item location and software improvements are needed to autonomously process data and report directly to the crew. NASA has installed REALM-1 hardware in 3 of ISS's modules and generates raw RFID data to locate an item with ~ 1.5 meters in instrumented modules and 7.3 meters in un-instrumented modules. All data analysis is

completed on the ground and requires 4.8 hours due to limitations with the predictive algorithms. The location is reported to mission control, who then report location information to the crew. This entire process can take on the order of hours to days from the time the crew requests an item until it is located.

Existing ISS REALM mass is ~6.6kg/module. This will pose a safety risk for emergency scenarios and significant inefficiencies in crew performance due to time spent searching for logistics items. In addition, there is an increased risk an item may not be transferred between departing vehicle (lander, logistics module, etc).

NASA Seeks to Meet the Following Specs:

Success will be measured by demonstration of a scalable technology that exhibits:

- 1) ability to locate items to within 50 cm for basic location,
- 2) ability to locate items to within 10 cm for specific items,
- 3) ability to locate items (from request to in-hand) within 30 seconds without ground involvement,
- 4) REALM (RFID-Enabled Autonomous Logistics Management) mass <4.0 kg/outfitted module.

Overview of Student Project:

NASA seeks innovative technologies that autonomously tracks the location of inventory but also provides logistic management to help crews locate assets in real time. Utilizing RFID technology, improvements need to be made in the exact location of the item and providing that information in real time to the crew.

Innovative Areas Student Projects Can Address:

A. RFID location accuracy and/or

B. Processing RFID position data to provide real time asset location

Project Phases

- I. Analytical and experimental proof-of-concept of critical function and/or characteristics.
- II. Component and/or breadboard validation in a laboratory environment.

Research Funded by NASA on this Topic:

Proposal Number: 03-B3.08-8618

[ISS Inventory Tracking System](#)

Proposal Number: 171 Z5.01-8677

[Small Form Factor RFID Applicator](#)

Proposal Number: 12.05-5801

[Applications of an Automatic Inventory and Personnel Tracking System](#)

Proposal Number: 12.06-9200

[A Multiple-Read SAW Tag Inventory System Development](#)

References:

[T9.02 Integrated Life-Cycle Asset Mapping, Management, and Tracking](#)

[Z5.01 Payload Technologies for Assistive Free-Flyers](#)

[O3.01 Remotely Operated Mobile Sensing Technologies for inside ISS](#)

[O1.05 Transformational Communications Technology](#)

[REALM \(RFID-Enabled Autonomous Logistics Management\)](#)