The Robotic External Leak Locator and the On-Orbit Baseline and Validation Test

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Outline

• RELL Hardware Overview
• Concept of Operations
• On-Orbit Baseline and Validation Test
• Future Work
Design Overview

• RELL was designed to locate ammonia leaks in the External Active Thermal Control System (EATCS).

• RELL has 2 primary instruments for leak locating:
  – Residual Gas Analyzer (RGA)
  – Total Pressure Gauge (TPG)

• Standard robotic interfaces
Design Overview

Target assembly

OTCM microfixture

OTCM umbilical connector
Concept of Operations

• Flight Controllers detect loss of Ammonia from one of the thermal control loops.
  – Leak will be isolated to the extent possible by closing commandable valves.

• RELL is prepped and installed onto the Japanese Experiment Module (JEM) Airlock Slide Table

• JEM Airlock is closed, pumped down, and Slide Table is deployed to the JEM Payload Porch area, where RELL is picked up by Special Purpose Dexterous Manipulator (SPDM)/Space Station Remote Manipulator System (SSRMS)

• A scan is executed in area of interest and data is interpreted real-time

• When SPDM/SSRMS brings RELL into an area where the local pressure due to the ammonia leak is higher than the background pressure around ISS, the Ion Gauge should detect the localized pressure change and the RGA should detect a corresponding increase in ammonia

• Operations complete and RELL is returned to the vehicle via the JEM Airlock.
On-Orbit and Baseline and Validation Test
Test Objectives

- Characterize natural ISS environment
- Understand diurnal effects
- Understand truss induced environment
- Characterize reflectance off truss
- Understand impacts of AO
- Understand radiator induced environment

"Reflected" Atomic Oxygen

High Velocity Atomic Oxygen (Ram)
Test Results

• The hardware worked as expected!
• All planned test objectives successfully completed.
• Detailed data analysis is in progress.
• First look:
  – Pressure difference between ram and wake
  – Pressure difference between day and night
  – ISS venting events can be seen and measured
• This hardware has a future on ISS to support leak location.
Next Steps

• Complete detailed data analysis.
• Organize data for future investigations.
• Write test report.
• Make improvements from lessons learned from the test.
• Train hardware operators.
Questions and Discussion