**Project Introduction**

Life Support Services provides personal protective equipment services to the Space Shuttle, Delta and Atlas launch vehicles and their payloads, and other tenant organizations at Kennedy Space Center (KSC) and Cape Canaveral Air Force Station (CCAFS). The life support function includes operation and maintenance of 50 different types of life support equipment totaling over 10,000 individual items consisting primarily of protective clothing and respirators and associated support equipment. Responsibilities include replacement, procurement, fabrication, maintenance, management and issuance of these items to Spaceport customers at hundreds of locations across the Spaceport and Shuttle contingency landing sites around the world.

The Biomedical Engineering and Research Laboratory is working with the NASA Life Support group and BCS Life Support to improve the safety of the environmental control units (ECUs) used in the self-contained atmospheric-protective ensemble (SCAPE) suits at Kennedy Space Center (KSC). ECUs are liquid-air-based backpacks that allow operators to work in hazardous environments for up to 2 hours. Though ECUs have been used at KSC with great success for over 30 years, some ECU deficiencies have required mitigation.

Because the breathing commodity is liquid, the liquid pickup in the dewar can come out of the fluid if the dewar is near the end of its service life and if the operator lies on his side. This can prevent air from flowing in the SCAPE suit. Furthermore, the ECUs have no liquid level sensors to indicate to the operator that the unit is running low on air. BCS Life Support has invented a novel liquid pickup system that will allow the ECU to operate safely in the horizontal position. The system has a liquid level sensor that will warn the operator when the commodity is at 25%. The overall objective for this project was to evaluate two candidate alternatives for the existing Propellant Handler’s Ensemble (PHE) escape ventilator.

**Anticipated Benefits**

Benefits from this technology provided NASA improved hazardous operations ground processing. Reducing the weight of the PHEs provides its users better mobility without the need to carry excess weight. The new ventilator design reduces physical stress on users while improving safety when performing transfers from one location to another in propellant handlers ensemble suits.
Primary U.S. Work Locations and Key Partners

<table>
<thead>
<tr>
<th>Organizations Performing Work</th>
<th>Role</th>
<th>Type</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>✨Kennedy Space Center (KSC)</td>
<td>Lead Organization</td>
<td>NASA Center</td>
<td>Kennedy Space Center, FL</td>
</tr>
<tr>
<td>InoMedic Health Applications, Inc.</td>
<td>Supporting Organization</td>
<td>Industry</td>
<td></td>
</tr>
</tbody>
</table>

Organizational Responsibility

**Responsible Mission Directorate:**
Human Exploration and Operations Mission Directorate (HEOMD)

**Lead Center / Facility:**
Kennedy Space Center (KSC)

**Responsible Program:**
Exploration Ground Systems

Project Management

**Program Managers:**
Michael Bolger
Thomas Whitmeyer

**Project Manager:**
Nancy P Zeitlin

**Principal Investigator:**
David R Bush

Technology Maturity (TRL)

- Start: 6
- Current: 9
- Estimated End: 9

For more information and an accessible alternative, please visit: https://techport.nasa.gov/view/10494
Exploration Ground Systems

Propellant Handler's Ensemble, aka Self-Contained Atmospheric Protective Ensemble (SCAPE), Ventilator Improvement Study (PHE)

Completed Technology Project (2012 - 2012)

Technology Areas

Primary:

- TX13 Ground, Test, and Surface Systems
  - TX13.1 Infrastructure Optimization
  - TX13.1.6 Test, Operations, and Systems Safety

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