

Spacecraft On-Orbit Advanced Refueling System (SOARS) *for* Astrobee Working Group

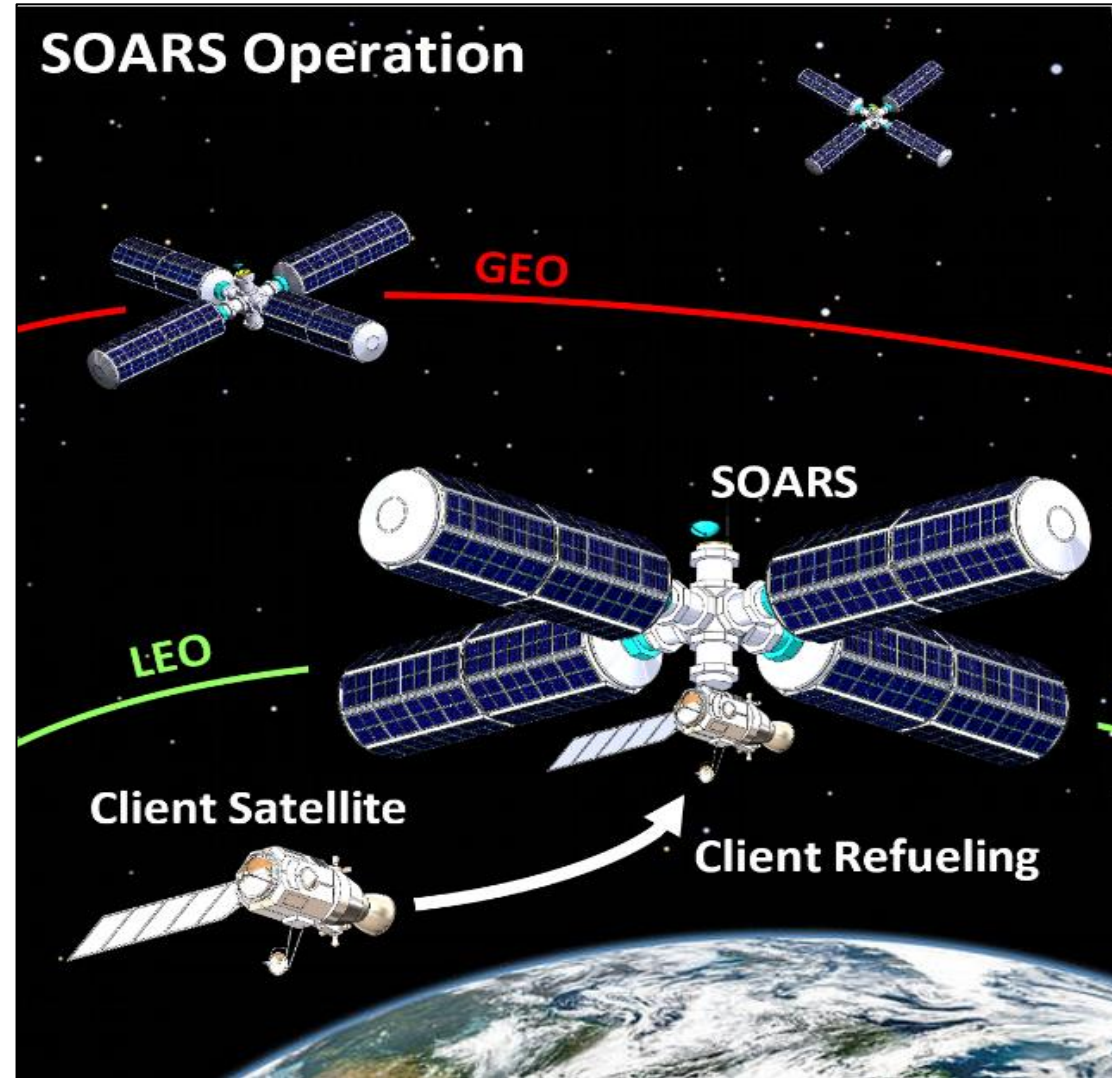
Zero-G Horizons Technologies, LLC
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PoP: September 30, 2020 – September 29, 2022

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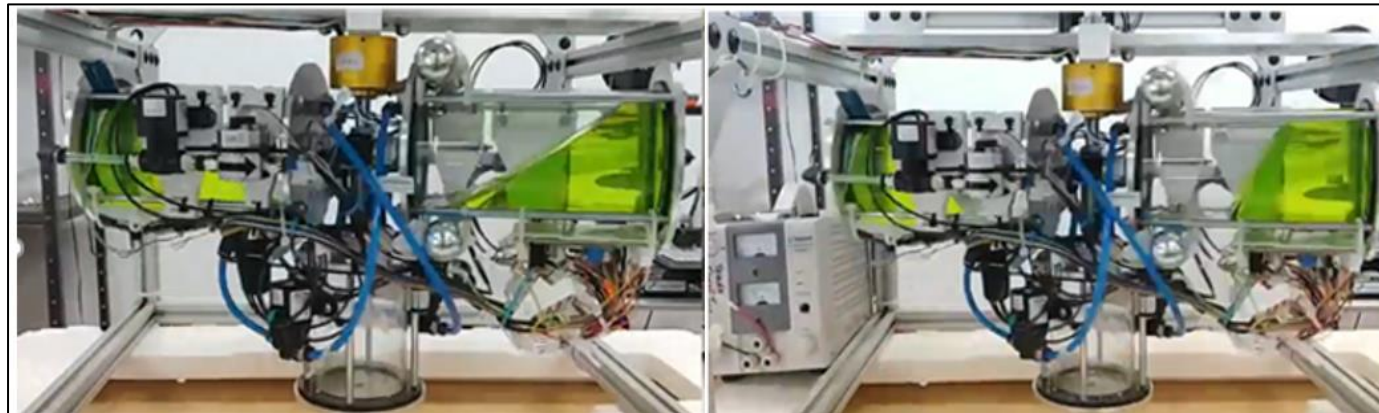
SOARS Concept of Operations



Phase I Accomplishments

Reached **TRL 4** (Laboratory Demonstration)

- Designed & Built a Partially-Automated Ground-based Test Rig
- Computationally Modeled Fluid Slosh, Settling, and Transfer
- Estimated Dynamics & Stability of Test Rig in Microgravity
- Conducted Preliminary Cryostat Testing

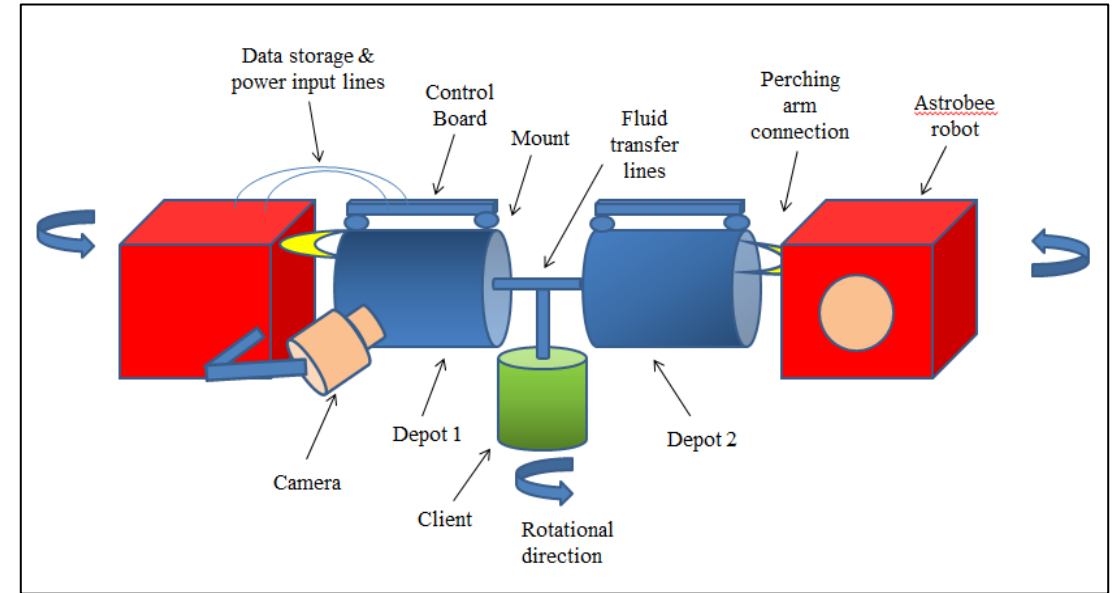


1-G Test Rig

Phase II Overview

Mature SOARS from TRL 4-to-7

- **SOARS Control Laws**
 - Develop, Validate, and Evaluate
- **SOARS Non-Cryogenic Capabilities**
 - Develop, Validate, and Evaluate
- **SOARS Cryogenic Capabilities**
 - Simulate and Design Phase II-E Test Rig
- **Experimental Flights Tests**
 - Blue Origin Suborbital Test
 - ISS-Astrobee On-Orbit Test
- **SOARS Prototype Design**
 - Design, Simulate, and Document



ISS Astrobee-Mounted Testing

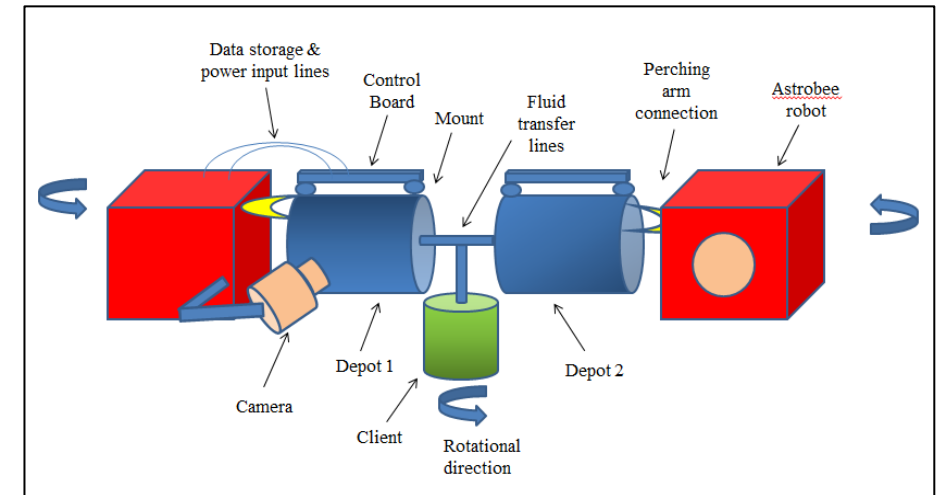
Astrobee Test & Demonstration Goals

Astrobee Testing

- **Validate Fluid Dynamics**
 - Settling time
 - Fluid-gas separation dynamics
 - Pressure-rotation effects on transfer
- **Validate Dynamics Models**
 - System dynamics and stability
 - Resilience against perturbations
- **Evaluate Control Laws**
 - Astrobee control effort
 - Custom control actuators

Demonstration Milestones

- Liquid-gas separation
- Liquid transfer characteristics
- System rotational stability
- Control laws



ISS Astrobee-Mounted Testing

Q & A



Discussion

