



Astrobee: Air Sampling Device and Zero Robotics Game

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Air Sampling Device Background

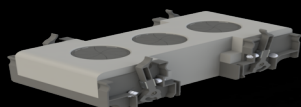
The Microbial Tracking Series (MT) focuses on characterizing the ISS atmosphere via microbial sampling. The current *Air Sampling Device (ASD)* has been used for over a decade and doesn't collect sufficient biomass. The Astrobee ASD will be designed to assist crew members with the sampling procedure, with the goal of improving upon the past procedure.

ASD Objectives

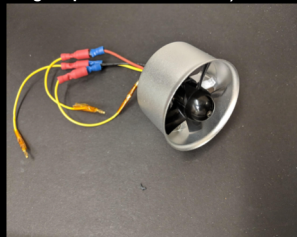
1. Develop a prototype Astrobee payload to facilitate air sampling.
 - a. Capable of moving 50 L/min of air through 3 selectable gel filters.
2. Create a ground unit for concept demonstration and further engineering development.

Results: ASD Hardware

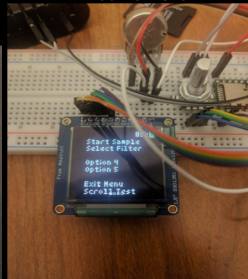
ASD CAD Mockup (on top face, irises serve as valves for air flow and shield 3 gel filters).



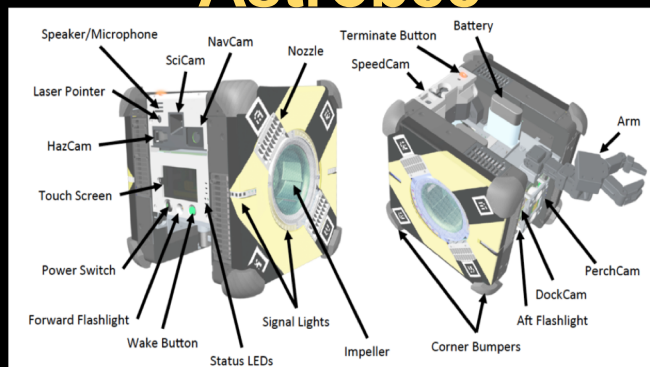
Electric Ducted Fan (used to achieve better air flow and create higher pressure differential).



Arduino Menu

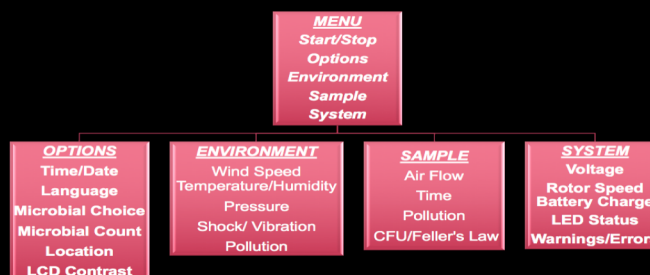


Astrobee



Astrobee is a free-flying, 1'x1'x1' cuboid robot that is planned to be onboard the International Space Station (ISS) by February 2019. Astrobee will be the successor of the current ISS free-flyer, SPHERES. Free-flying robots possess a range of potential. They can facilitate work for astronauts aboard the ISS by performing rudimentary tasks and housekeeping (e.g., record-keeping, sensor analysis, etc.) efficiently. Free-flyers also act as innovative testbeds for guest scientists to perform zero-gravity control theory research.

Next Steps: ASD Software



Zero Robotics Background

In recent years, SPHERES has hosted annual *Zero Robotics (ZR)* programming competitions in collaboration with MIT, challenging middle and high school students to write code to win an annual game. The ZR program will need to transition from SPHERES to Astrobee soon, beginning with a novel game.

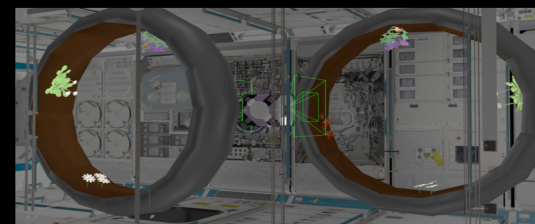
ZR Game Objectives

1. Implement a custom pipeline for students to participate in ZR competitions using Astrobee, and that would ultimately surpass former SPHERES games.
2. Create a novel ZR-API so students can easily and directly interact with the Astrobee through their own code.
3. Enable students to utilize the Astrobee simulation in a straightforward and simple fashion, i.e. from a cloud-based IDE.
4. Design a playable game that is educational to students about space concepts and themes, relevant to the ISS and Astrobee's general capabilities, and is both challenging and fun.

Results: ZR Game

Astrobotany

- 2 GRAVITATIONAL STATIONARY RINGS
- 4 PLANT TYPES
- FLASHLIGHT COLLECTS/RELEASES POLLEN
- GOAL: CROSS-BREED TO ATTAIN MAXIMUM SCORE



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