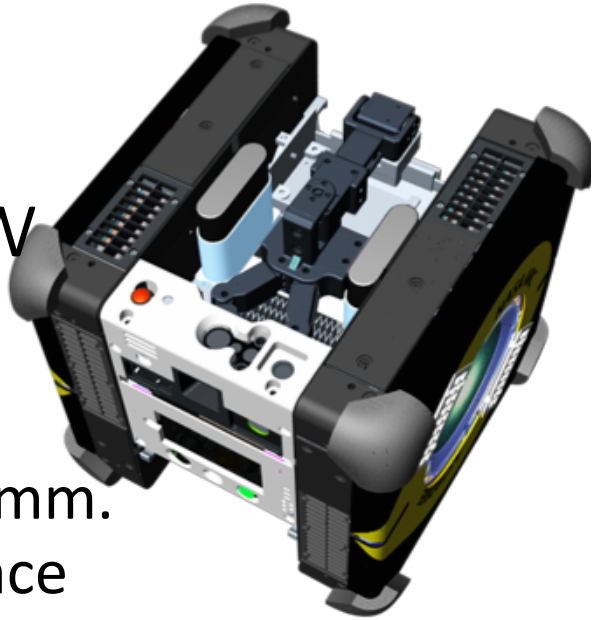
Astrobee Guest Science

ISS R+D Conference 07/16/2016

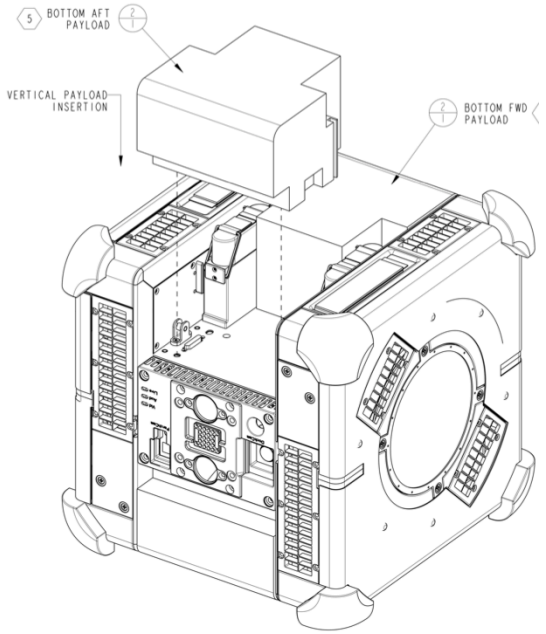
Astrobee Overview



- A total of 3 units on board ISS
- Docking station for recharge and wired comm.
- Built in perching arm using payload interface
- 6 total cameras for various purposes, including one cellphone class HD camera.
- Main purposes:
  - Host guest science payload (GSP payloads)
  - Serve as mobile camera for ISS situational awareness
  - Serve as mobile sensor platform
- First GSP Payloads
  - REALM RFID reader
  - Zero Robotics High School and Middle School competitions

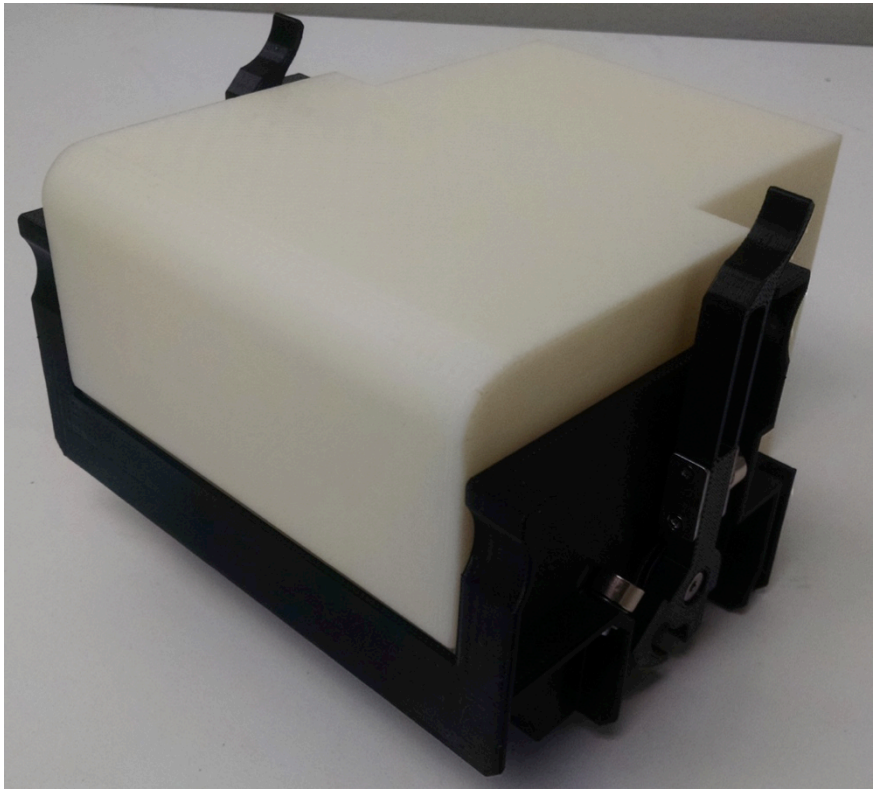
Interface - Mechanical

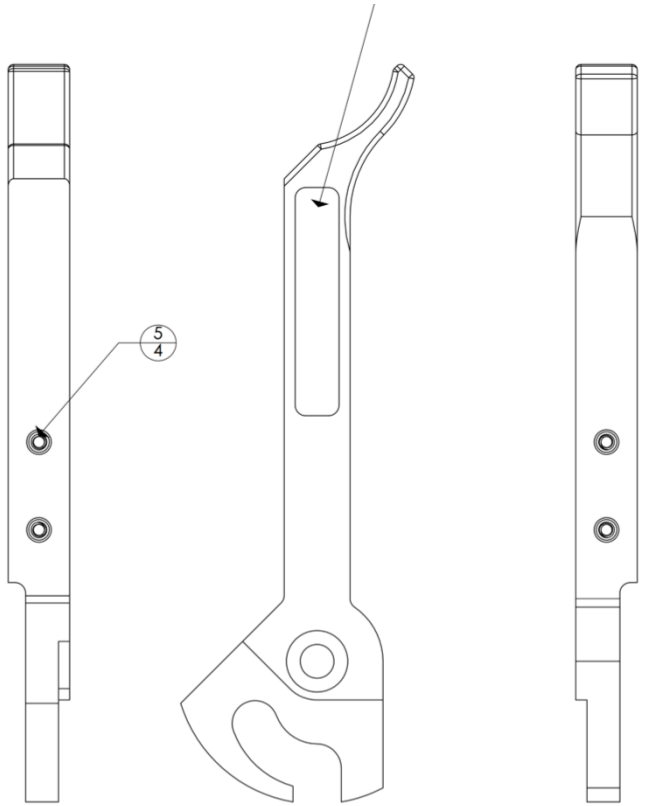
- ~12 x 15 x 10 cm bays
- Keep outs provided via CAD model
- Payloads may extend beyond the exterior of robot
- Payloads within payload volume use built-in bumpers for impact protection
- Alignment pins and rails for easy alignment



Interface – Quick Attatchment

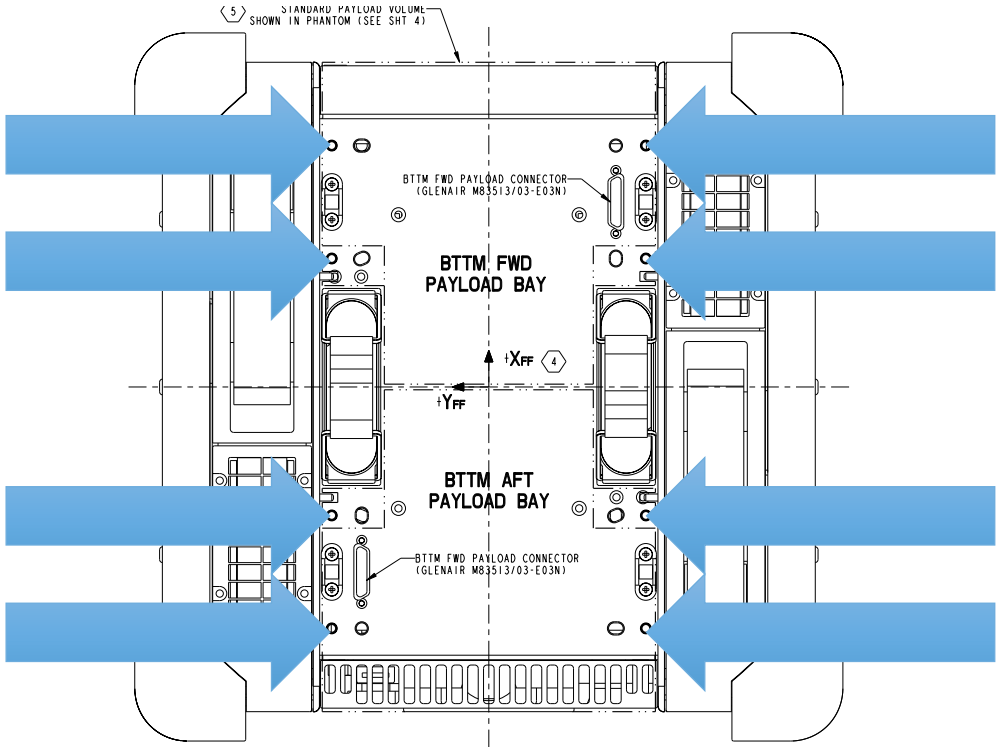
- No-tool quick-release levers attachment system





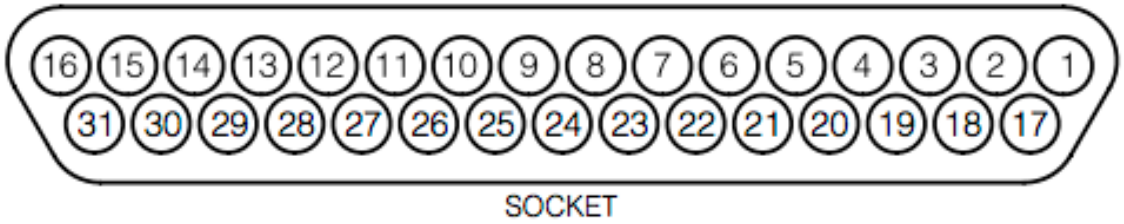
Interface – Rigid Attatchment

- Four #8-32 bolt pattern for each GSP payload bay



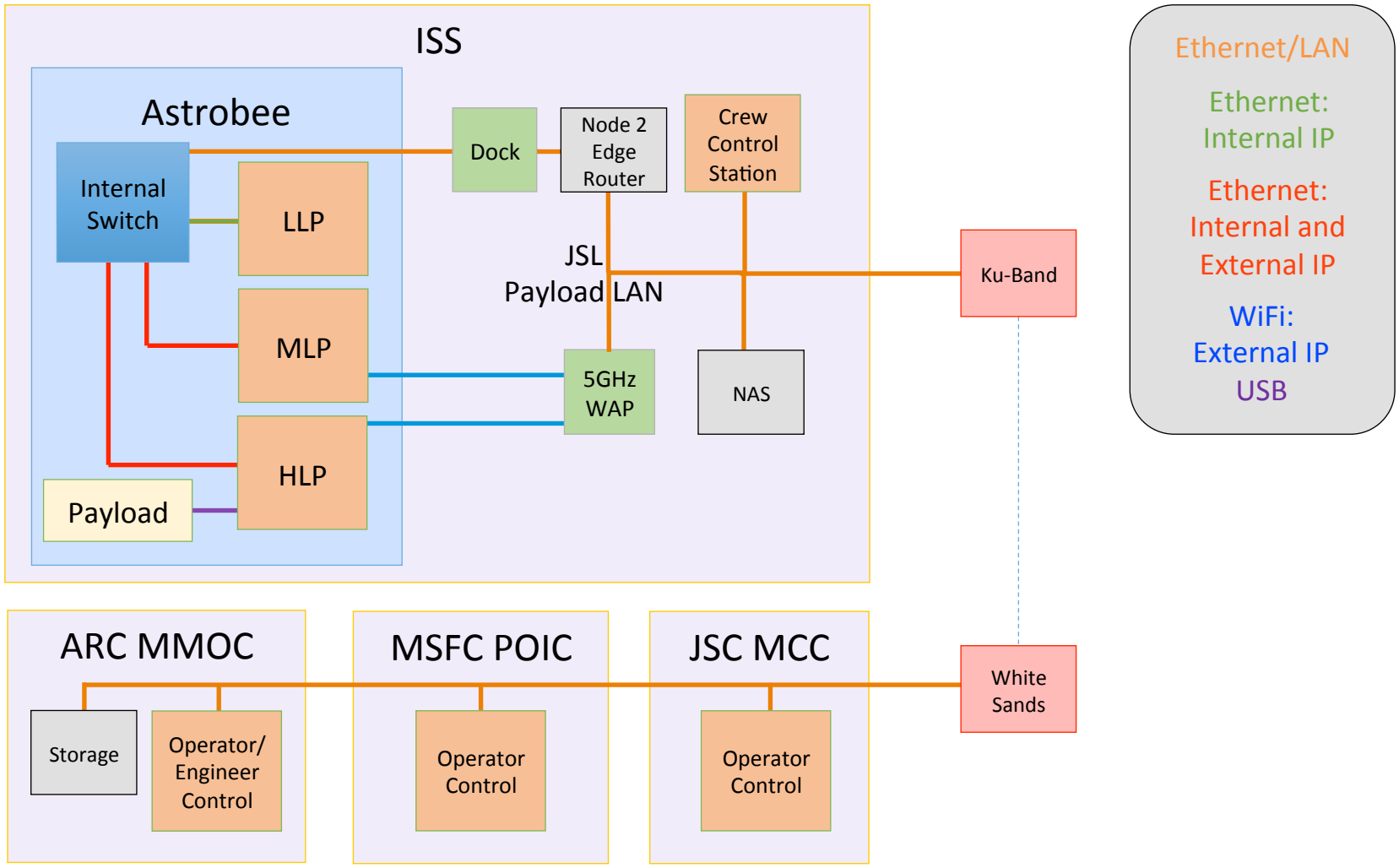
Interface - Electrical

- Payload side M83513/04/E03C
- 4 sets of USB pins
- Unregulated Battery Volatage

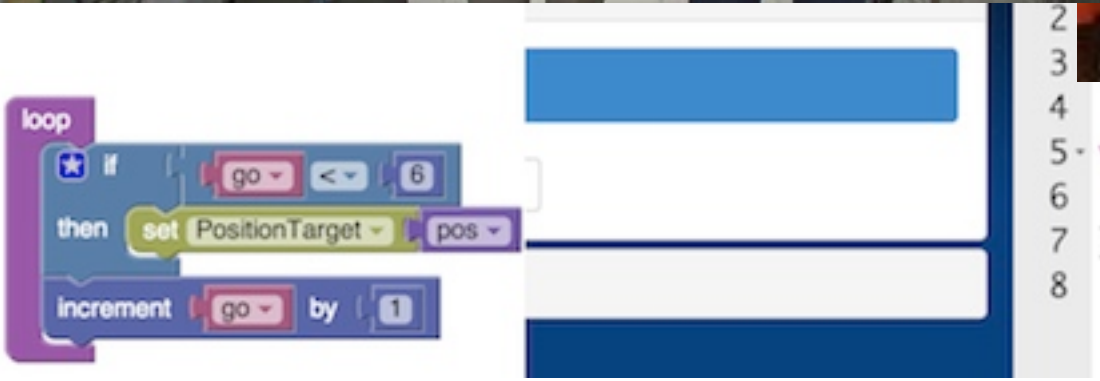


R1 (A)	R2 (B)	Description
1		GND
	17	GND
2		PWR
	18	PWR
3		MLP_USB GND
	19	MLP_USB PWR
4		MLP_USB D+
	20	MLP_USB D-
5		Reserved
	21	Reserved
6		Reserved
	22	Reserved
7		Reserved
	23	Reserved
8		Reserved
	24	Reserved
9		Reserved
	25	Reserved
10		HLP_USB GND
	26	HLP_USB PWR
11		HLP_USB D+
	27	HLP_USB D-
12		MLP_USB GND
	28	MLP_USB PWR
13		MLP_USB D+
	29	MLP_USB D-
14		MLP_USB GND
	30	MLP_USB PWR
15		MLP_USB D+
	31	MLP_USB D-
16		

Interface - Communications



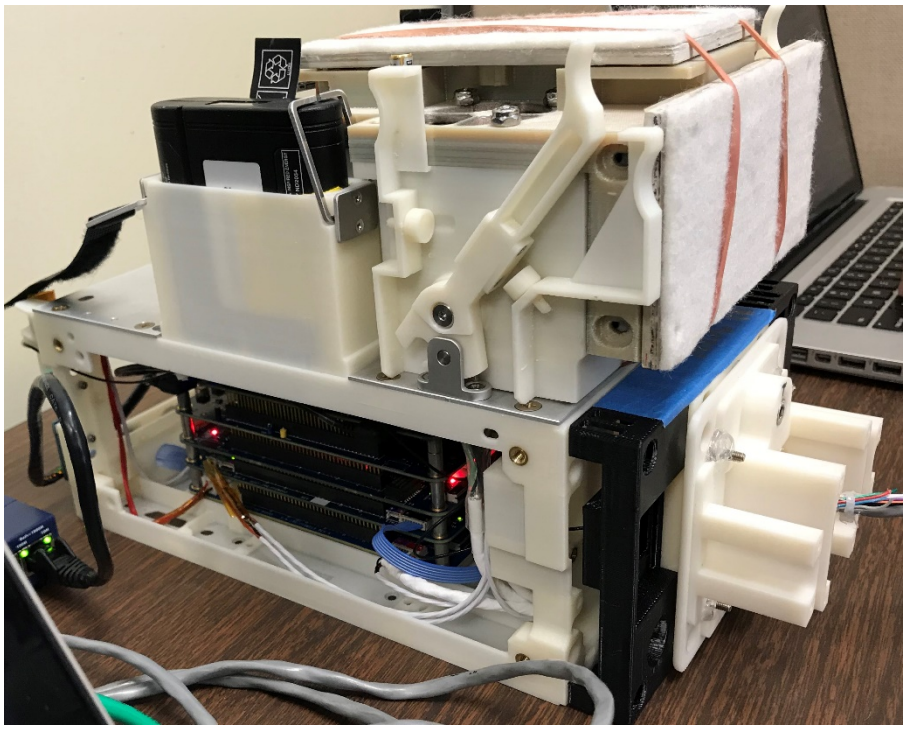
Payloads – Zero Robotics



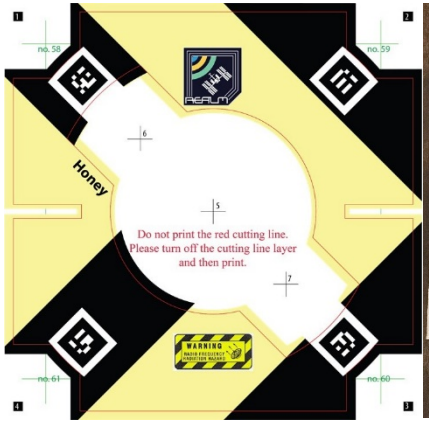

```
2
3
4
5  void loop() {
6
7  }
8
```

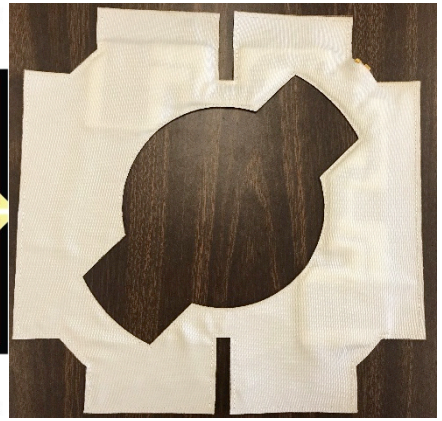
Payloads – REALM 2

- RFID tag reader
- 1 payload bay
- Antennas in Skins



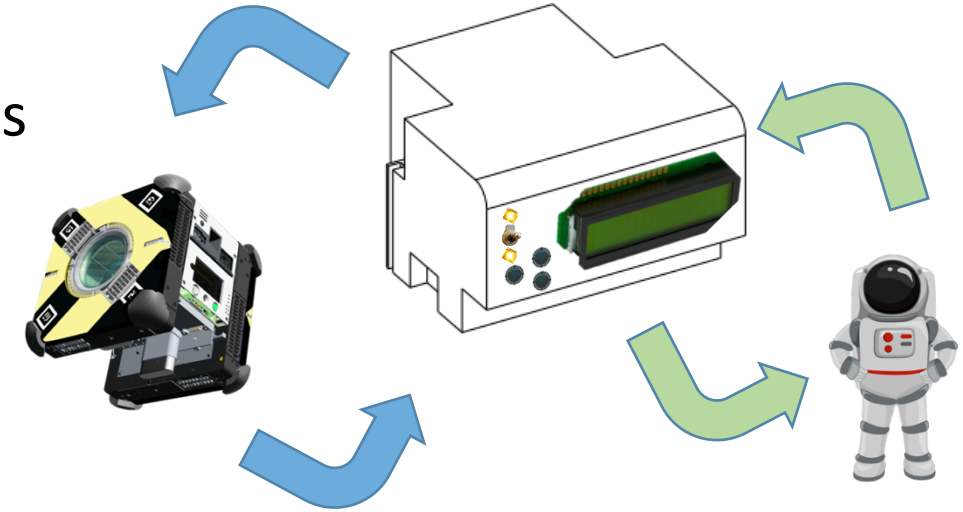
REALM-2 prototype integrated with Astrobee flat sat – March 2018





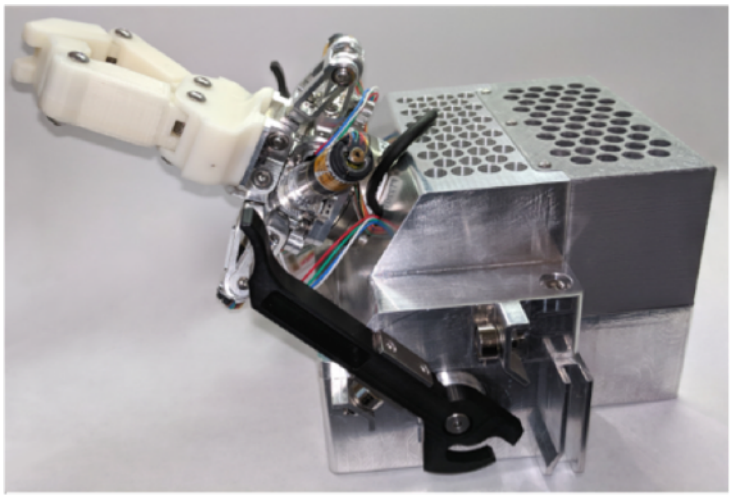
Payloads – Payload Tester

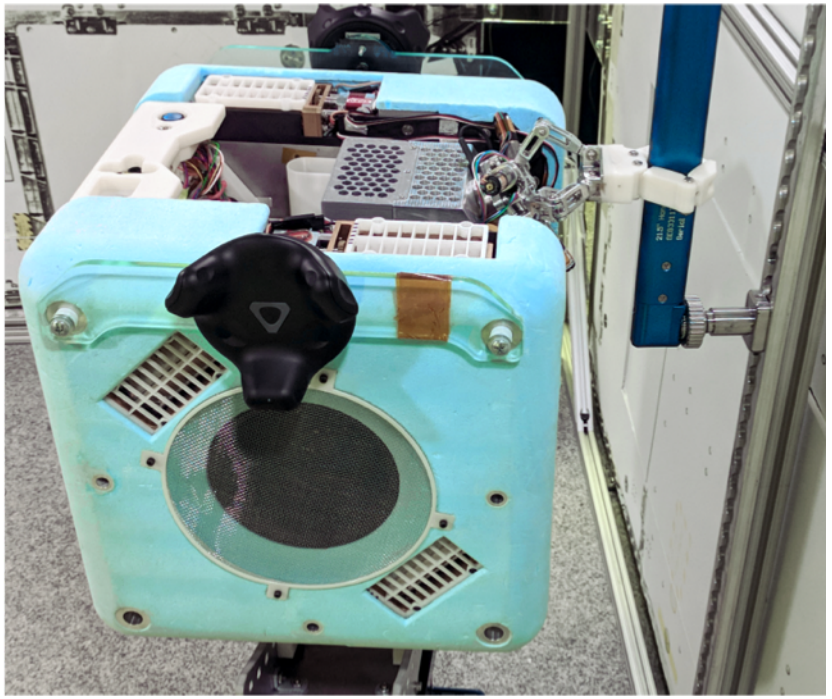
- Facilitates diagnostics of Astrobee's internal USB ports
- Tests safe electrical current operational limits
- 1U design to fit within Astrobee's payload bays
- Includes both hardware and software development:
  - Structure, electronics, supports, interfaces
  - Port tester's human and Astrobee interfacing programs and HLP Guest Science APK
- Connection with Astrobee through HLP Guest Science APK



Payloads – CobraBee

- CobraBee demonstrated 3-DOF gimbal payload
  - SBIR Phase I (2017)



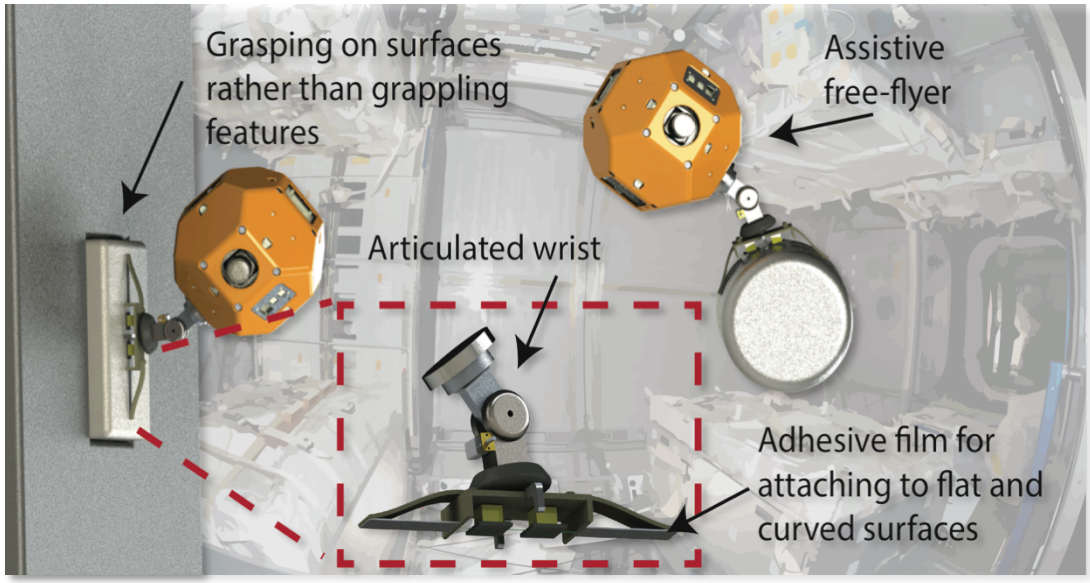


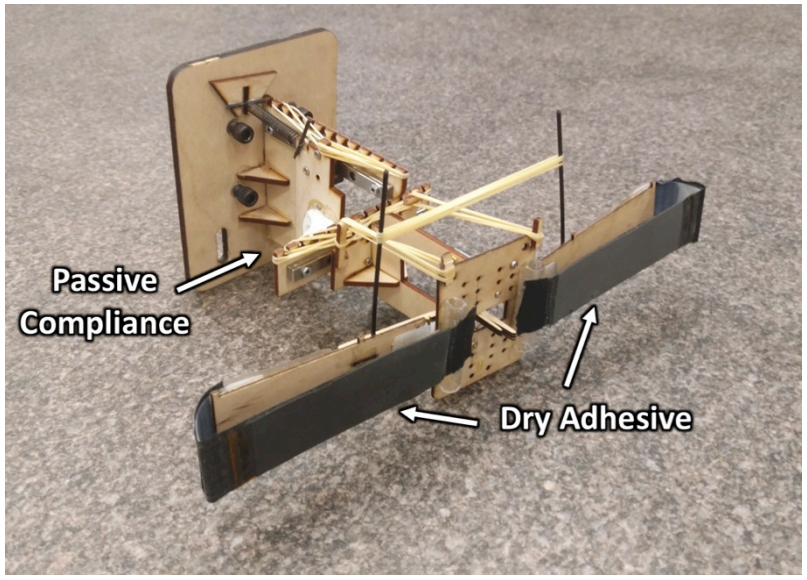
Payloads – Gecko Gripper

Objective 1: Design, analyze, and test mechanisms for grasping and manipulation that employ controllable adhesion

Objective 2: Devise control and planning algorithms that allow free-flyers to grasp and manipulate payloads with adhesion-based appendages

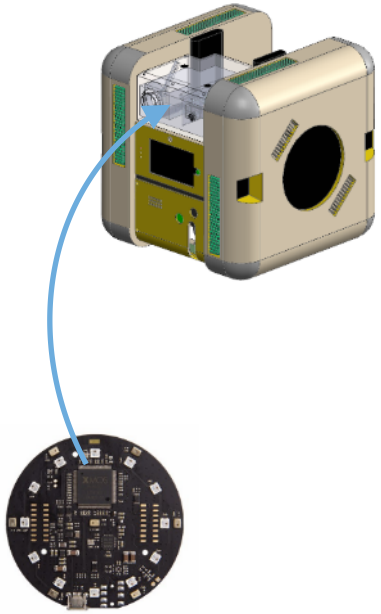
Objective 3: Validate the technology on a state-of-the-art test bed at Stanford and on the Astrobee platforms

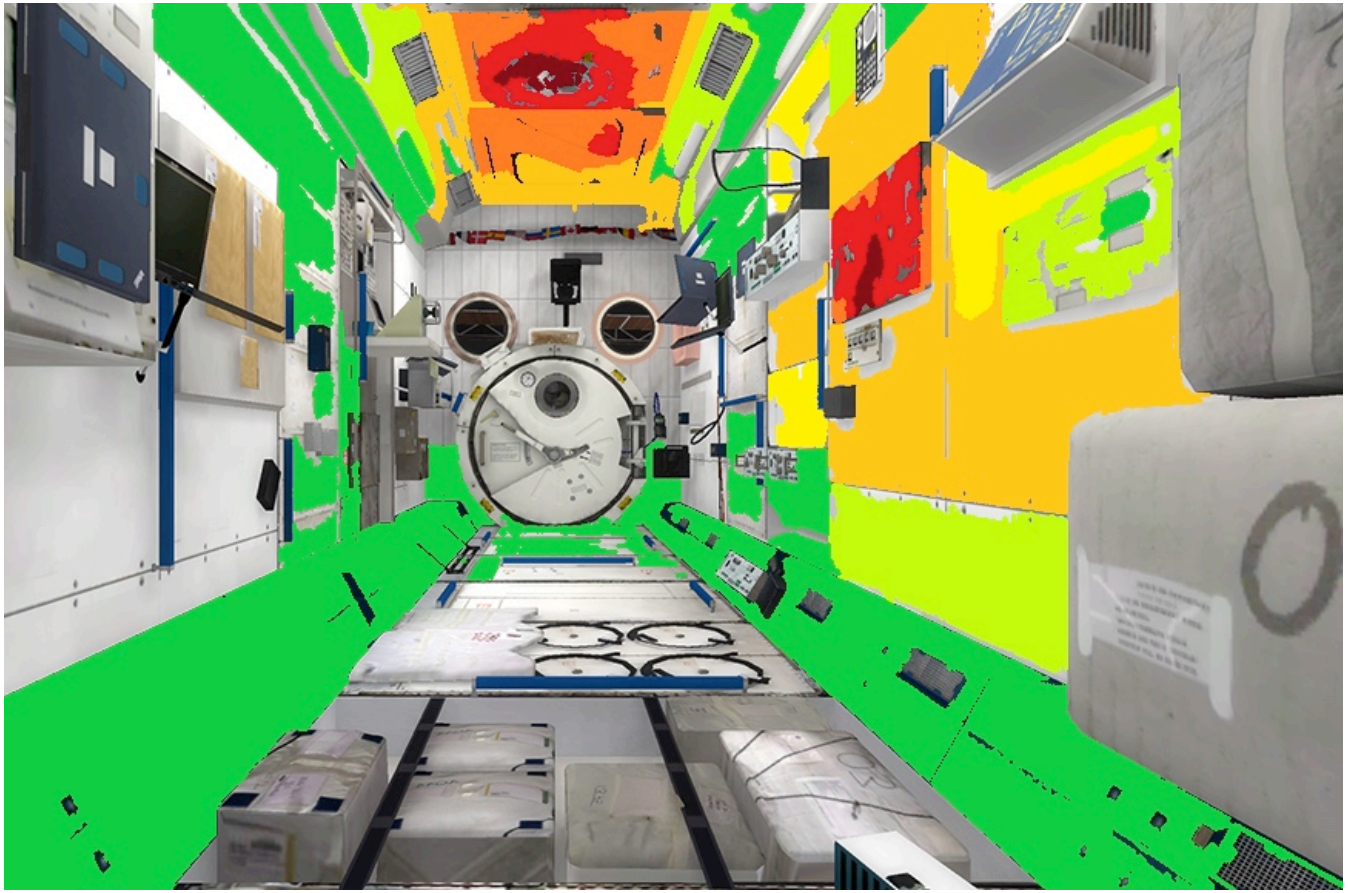




Payloads – Deep Audio Analytics

Spatiotemporal Mapping of ISS Acoustic Environment





Payloads – Astrobatics

Demonstrating spacecraft robotic hopping