SPHERES/Astrobee ISS Free-Flyer Facility

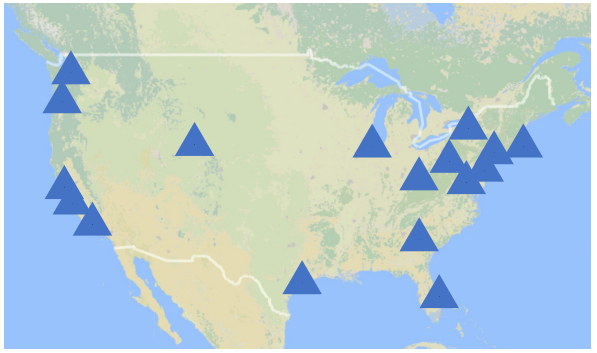
Guest Science Program (GSP)

- *What's available from the Astrobee Facility?*
  - Astrobee Robotics Software Simulation
  - Ground Hardware: Qty 3 & ”Flat-Sats”
  - Labs: Granite & MGTF
  - Documentation and Training
  - Proposal Support
  - ISS Payload Partner
- *How can I use Astrobee and what does it take?*
  - **Guest Scientist Guide** & Mechanical Payload ICD
  - New Hardware or ”just” Software?
  - Ground Demonstration or ISS Operation?
- *We want to hear from you!*
  - Approximate Scheduling
- *Information found on website*

https://www.nasa.gov/astrobee

Guest Scientists

- Replacing SPHERES, it is anticipated that Astrobee will carry on as the **most highly utilized payload** on the ISS
- 40+ projects have expressed interest in using Astrobee
  - *Topics range from 0g fuel tank slosh to propellantless flight via acrobatic arm motion*
- 7 Projects actively working towards ISS payloads
  - *MIT/Zero Robotics*
  - *Naval Postgraduate School*
  - *Astrobotic/Bosch*
  - *Stanford*
  - *REALM*
  - *JAXA joint activity*
  - *[Redacted]*

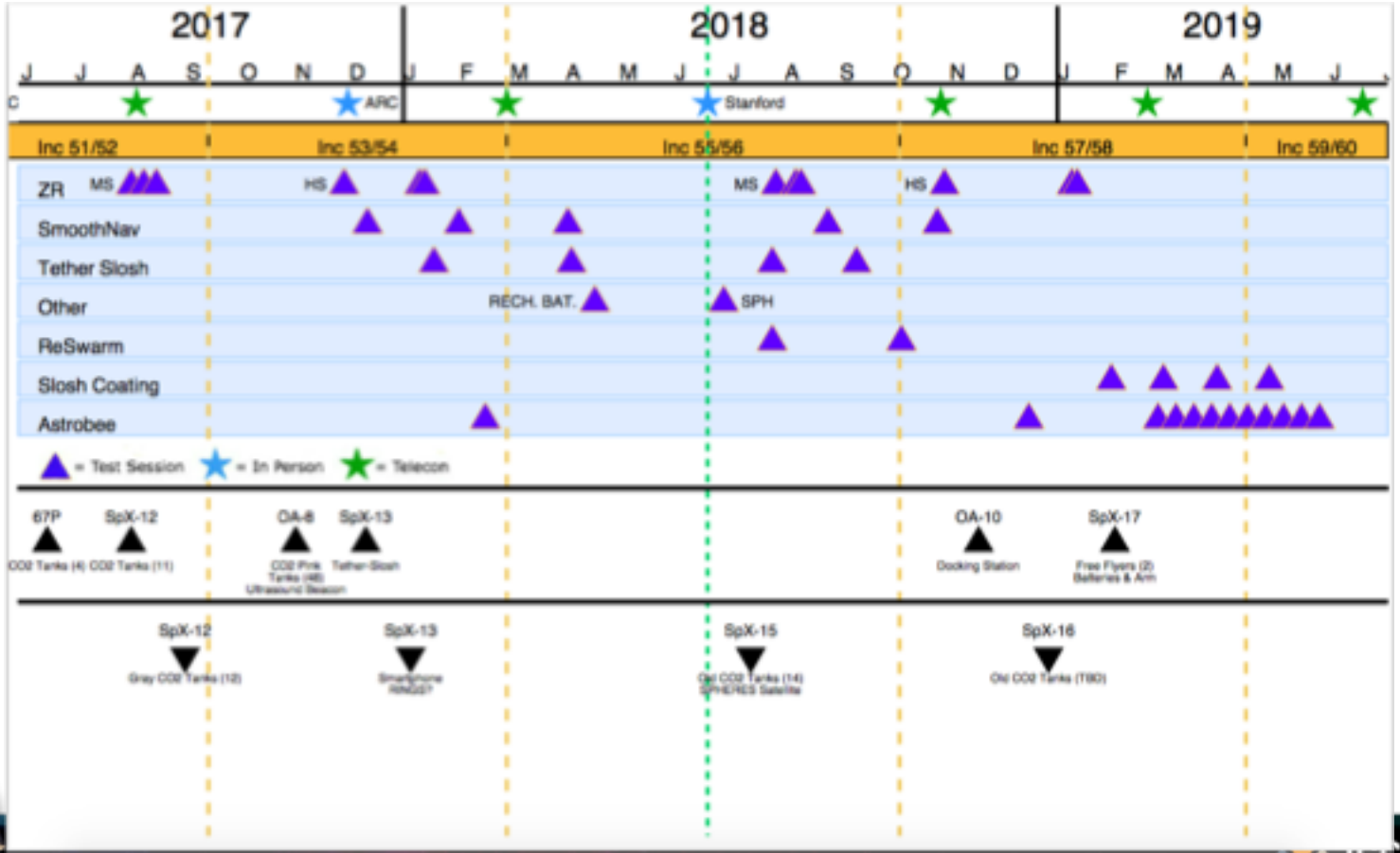


Astrobee guest scientist institutions in the US

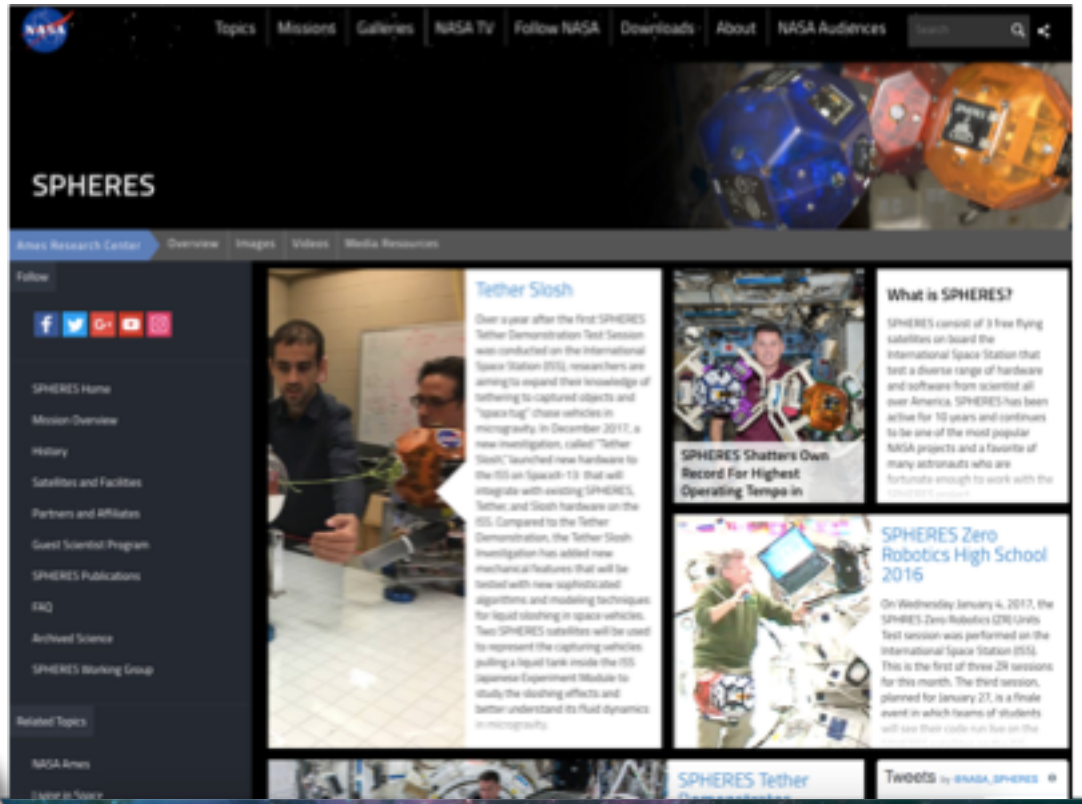
❑ Ground Studies

- FIT/RINGS
- Tethers Unlimited
- NMSU

SPHERES Calendar



SPHERES/Astrobee on Social Media



Twitter

https://twitter.com/NASA_SPHERES

Website

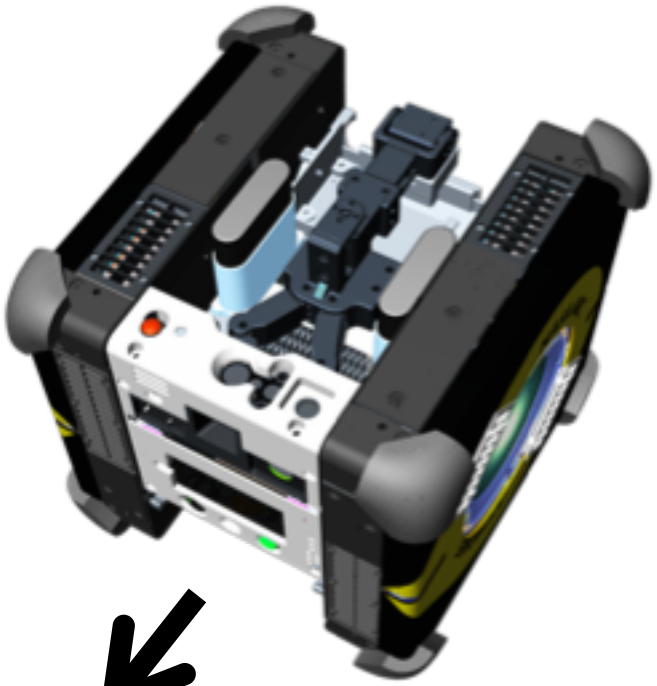
http://www.nasa.gov/spheres

http://www.nasa.gov/astrobee

Astrobee Overview

- Three free flyers on ISS starting spring 2018
- Docking station for recharge and wired communication
- 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*
- **Guest Scientist opportunities as early as fall 2018**

Current Robot Design

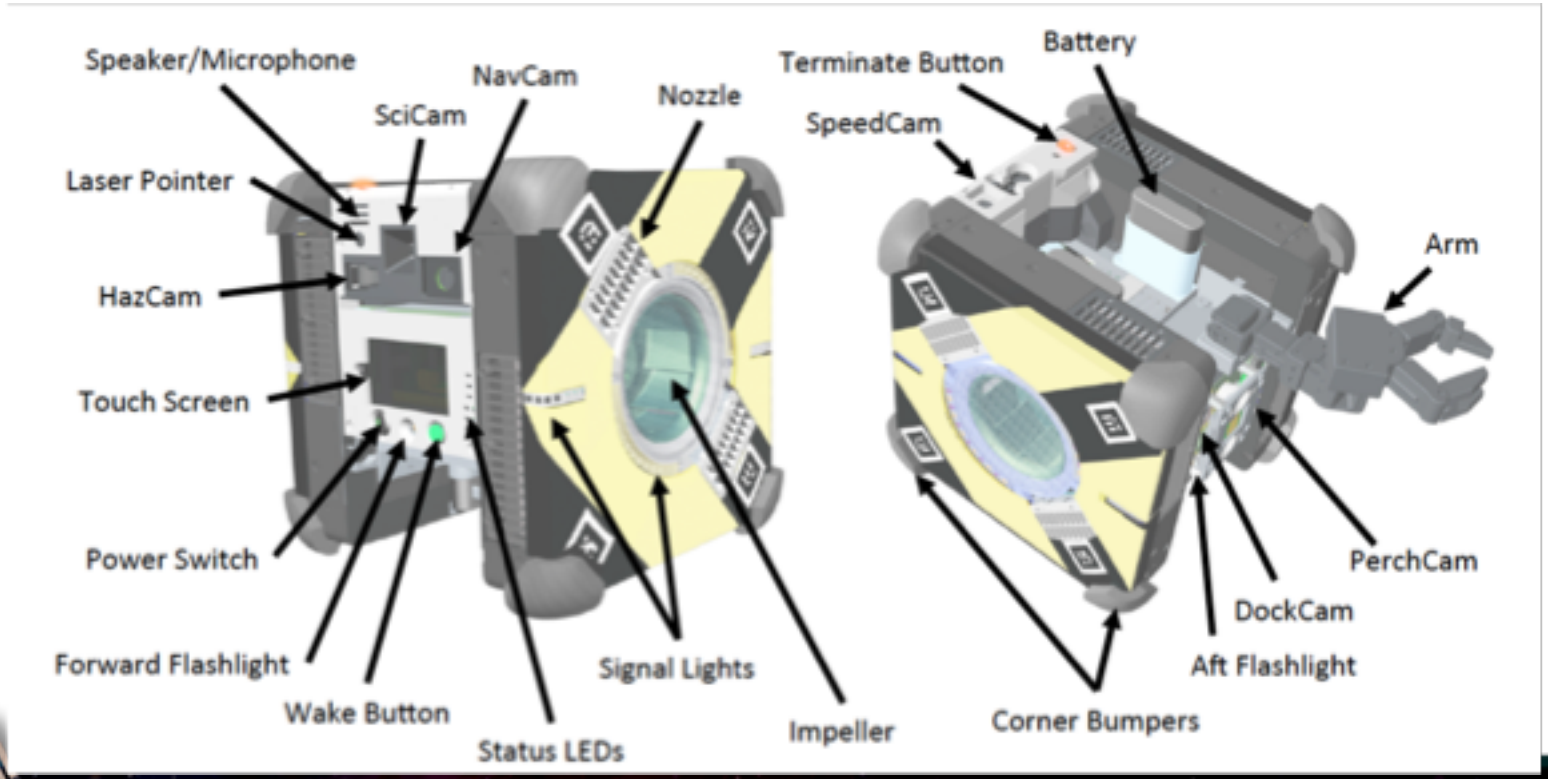


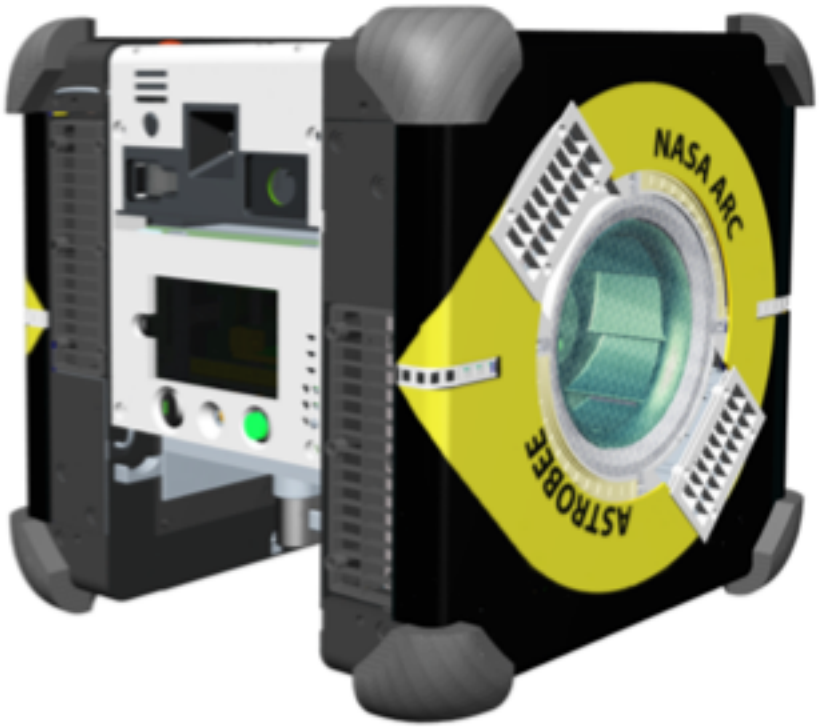
FORWARD

12.5 x 12.5 x 12.5 inches

10 kg mass target

Astrobee


Speaker/Microphone
SciCam
NavCam
Nozzle
Laser Pointer
HazCam
Touch Screen
Power Switch
Forward Flashlight
Wake Button
Status LEDs
Signal Lights
Impeller
Terminate Button
Battery
SpeedCam
Arm
PerchCam
DockCam
Aft Flashlight
Corner Bumpers



Guest Scientist Program

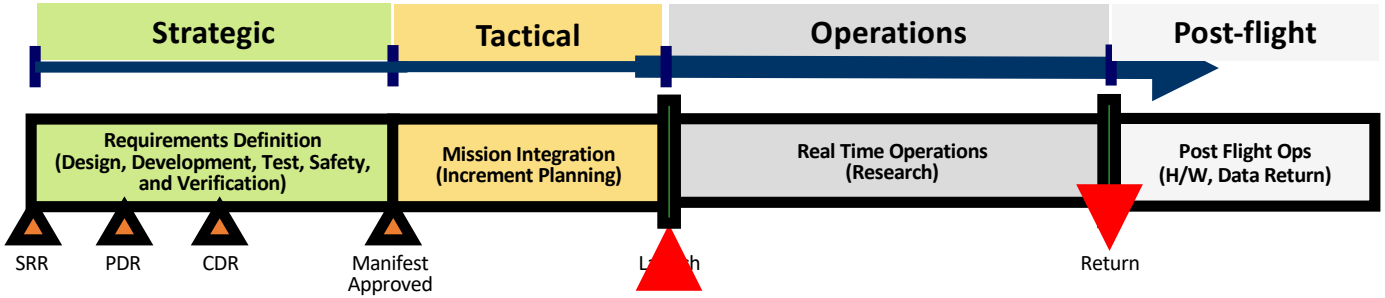
- There are several avenues which can lead to integrating science on the SPHERE Facility:
  - NASA ISS Technology Demonstration Office
  - CASIS (Center for the Advancement of Science In Space)
  - Defense(DOD)/DARPA

- The SPHERES program (and Astrobee) welcomes scientist from around the world.
- Contacting a party above in addition to reading about the GSP in the pdfs on the SPHERES homepage can assist you in getting started. The GSP Interface Documents are updated as needed so keep checking back.

  https://www.nasa.gov/spheres/guest-scientist-program
- Also available for download below is the SPHERES Simulator. It's hosted by the ISS SPHERES project on Source Forge.

NOTE: These processes (this and the following slide) are also being developed for Astrobee. Continue to follow the Astrobee homepage (see last slide).

SPHERES Guest Scientist Program



PIMs provide integration leadership during all phases of the payload's life cycle

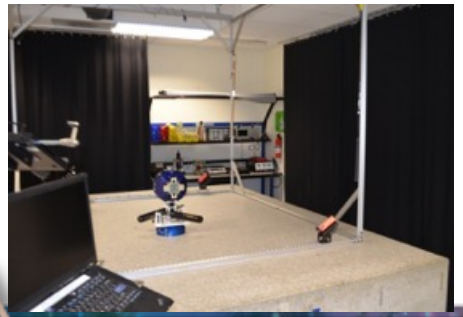
- Strategic – facilitate definition of ISS integration requirements, products, and schedule development to ensure that an ISS compatible payload is built; support manifest process (payload data collection and feasibility assessments)
- Tactical – represent PD interests to Increment and Flight-specific teams to ensure that integration and operations requirements are addressed; coordinate verification submittals and payload Certificate of Flight Readiness (CoFR)
- Operations – coordinate payload resupply or return requirements; coordinate verification submittals and payload CoFR during payload lifetime on-orbit

Astrobee Facility Labs

Flight Lab

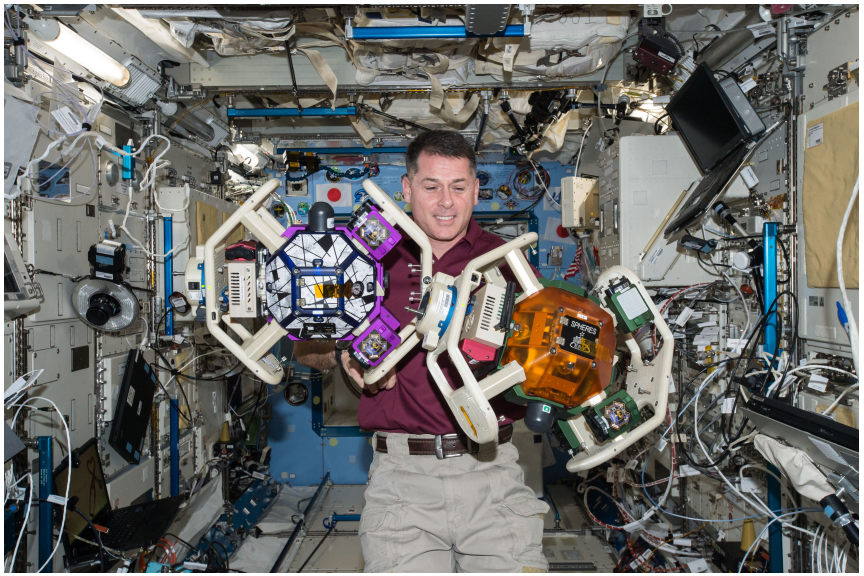
International Space Station

Engineering Evaluation Lab (EEL)



Questions?

Social Media



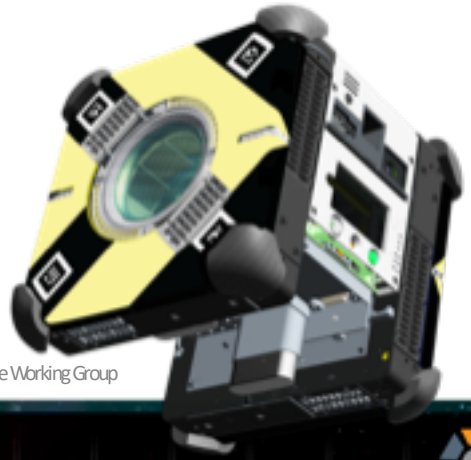
www.nasa.gov/spheres

twitter.com/NASA_SPHERES

www.nasa.gov/astrobee

Astrobee Equipment

- 3 free flyers, dock, spare ORUs on orbit
  - Honey (yellow)
  - Bumble (blue)
  - Queen (green)
- 3 free flyers, 2 docks (1 a flight spare), spares on ground
  - Melissa (pink)
  - B♯ (purple)
  - Killer (orange)



Astrobee Status

- Astrobee hardware delivery has slipped
  - *Addressing an electrical issue in the prop module*
  - *Dock to launch on Orbital-ATK 10 (November 17, 2018)*
  - *Honey and Bumble to launch on Space-X 17 (February 1, 2019)*
  - *Queen to launch on Orbital-ATK 11 (April 17, 2019)*
- Nearly done with Cert Unit integration
  - *All but prop module and final assembly of free flyer*
- Flight Unit integration has begun
  - *Completed hazcam and perchcam assemblies, and bumper assemblies and balanced impellers for 2 free flyers*
  - *Now concentrating on docking station integration*
- Available to Guest Scientists:
  - *Beta release of Flight Software/Simulator*
  - *Mechanical Payload ICD drawings*
  - *Initial draft of the Guest Science Guide*