NAVAL POSTGRADUATE SCHOOL

SPACECRAFT ROBOTICS LABORATORY

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Astrobee Quarterly Meeting

"ASTROBATIC MANEUVERING" OF ASTROBEE

Dr. Marcello Romano, Professor and Lab Director
Dr. Josep Virgili-Llop, NRC Postdoctoral Fellow

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To Demonstrate baseline Astrobatic Maneuvers with Astrobee exploiting ARC perching arm.

- As early as possible once Astrobee reaches the station, in compliance with all of the applicable constraints.
- Software-only, no additional hardware required.
- Two basic maneuvers envisioned:
  - Astrobatic Maneuver 1: Push and Stabilize
  - Astrobatic Maneuver 2: Hopping

PI - Prof. Marcello Romano

SRL-Astrobee team members:

LT Katrina Alsup, USN, MS Student
- Guidance and control.

LT Justin Komma, USN, MS Student
- Evolved perching arm design.

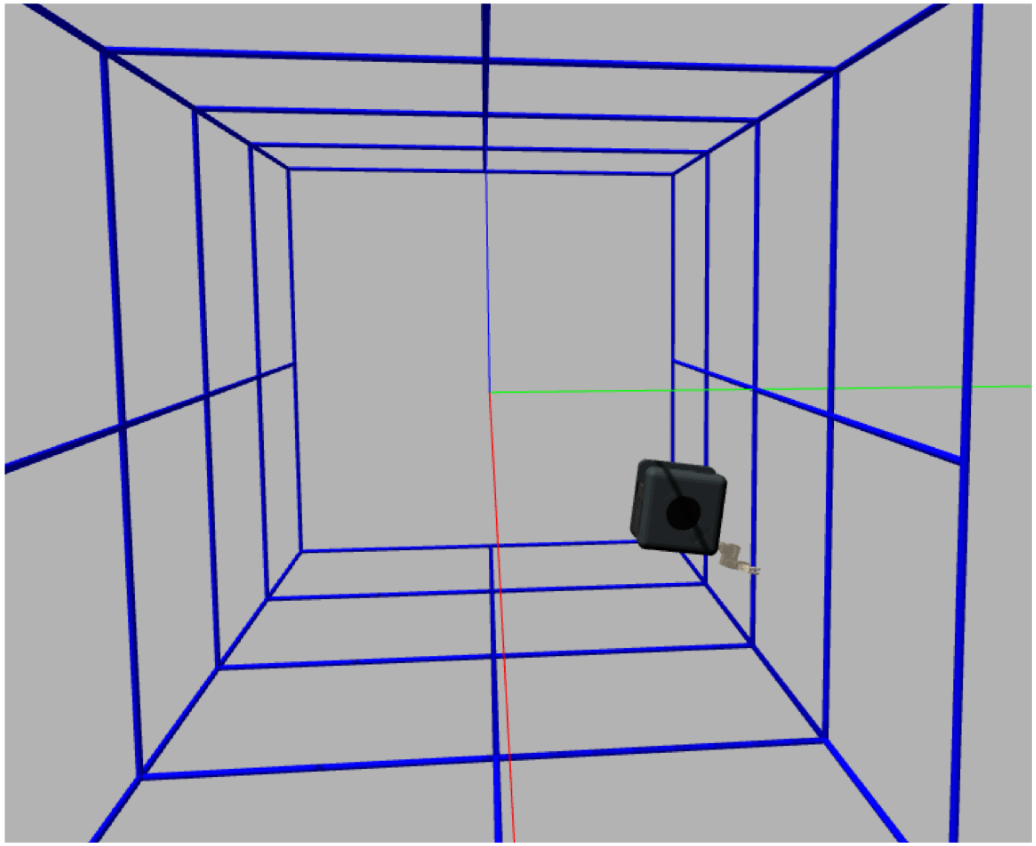
Dr. Josep Virgili, Postdoc
- ROS/Gazebo sim. environment.
- Flight SW.

Past SRL-Astrobee team members:

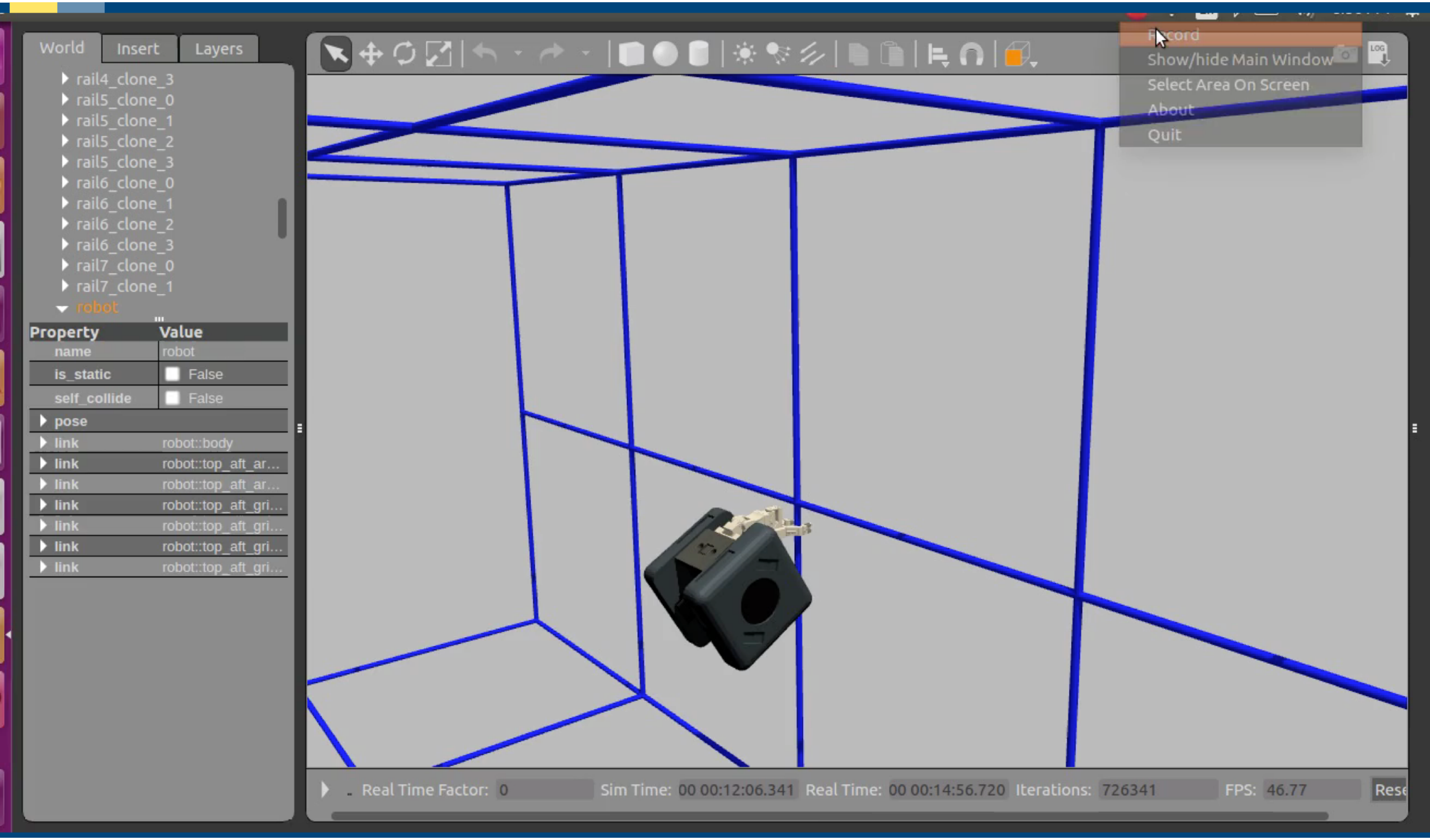
LT Andrew Bradstreet, USN, MS Student
- Proof of concept.

Sim. Environment (training area)

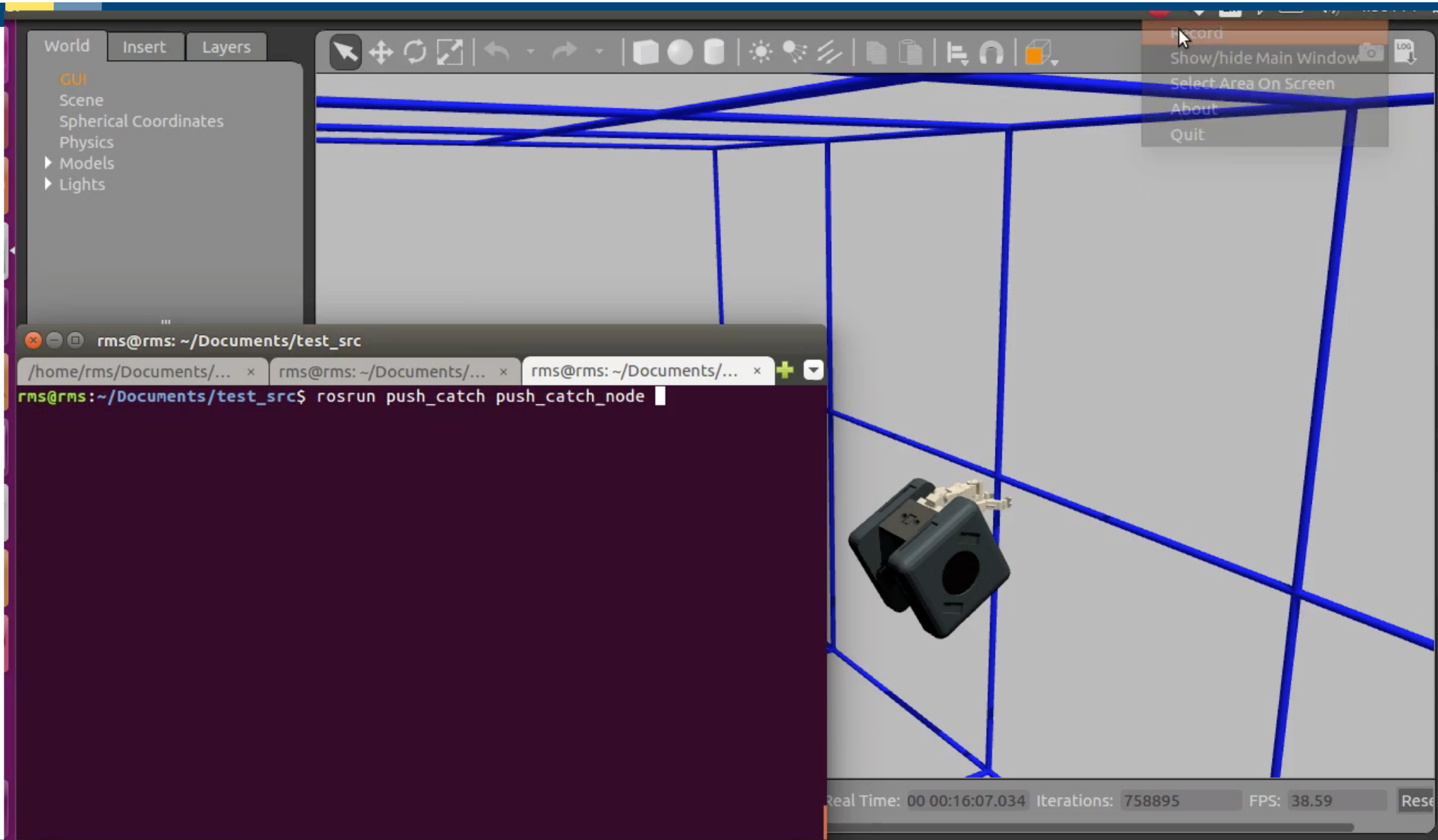
- Based on v0.2 of the GitHub public release.
- Simplified environemnt to facilitate maneuver development.
- Plugin for idealized handrail grasping.



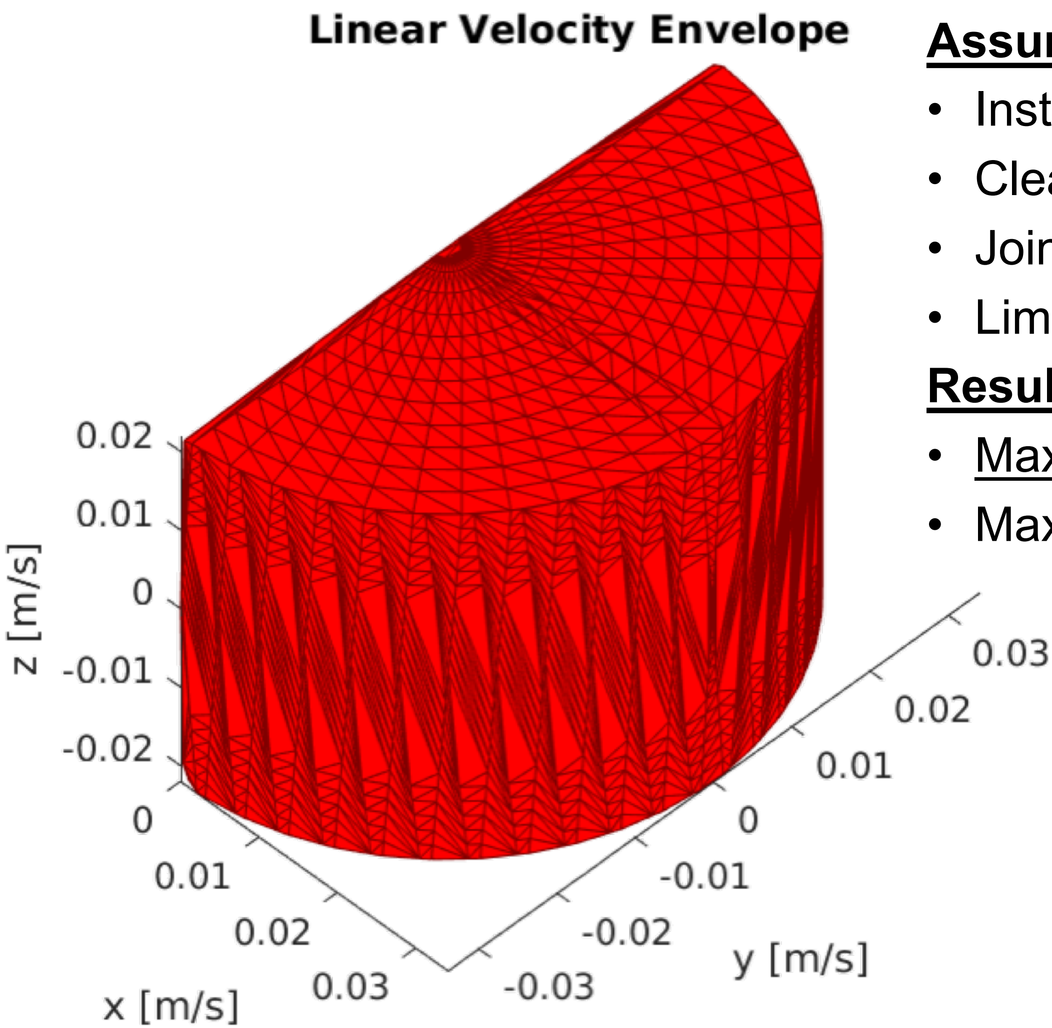
Astrobatic Maneuver 1: Push and Stabilize



Astrobatic Maneuver 2: Hopping



Astrobee's Body Linear Velocity Envelope

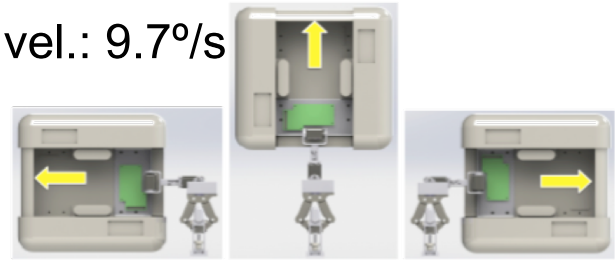


Assumptions:

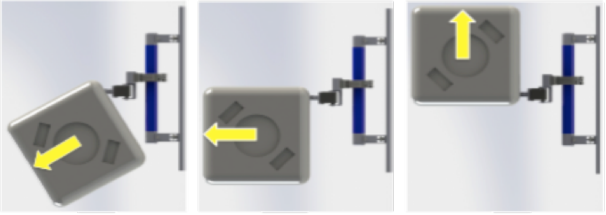
- Instantaneous acceleration.
- Clean rail separation is always possible.
- Joint velocity control is available.
- Limits as defined in In Won (2017)

Results

- Max linear vel.: 4 cm/s
- Max. angular vel.: 9.7°/s

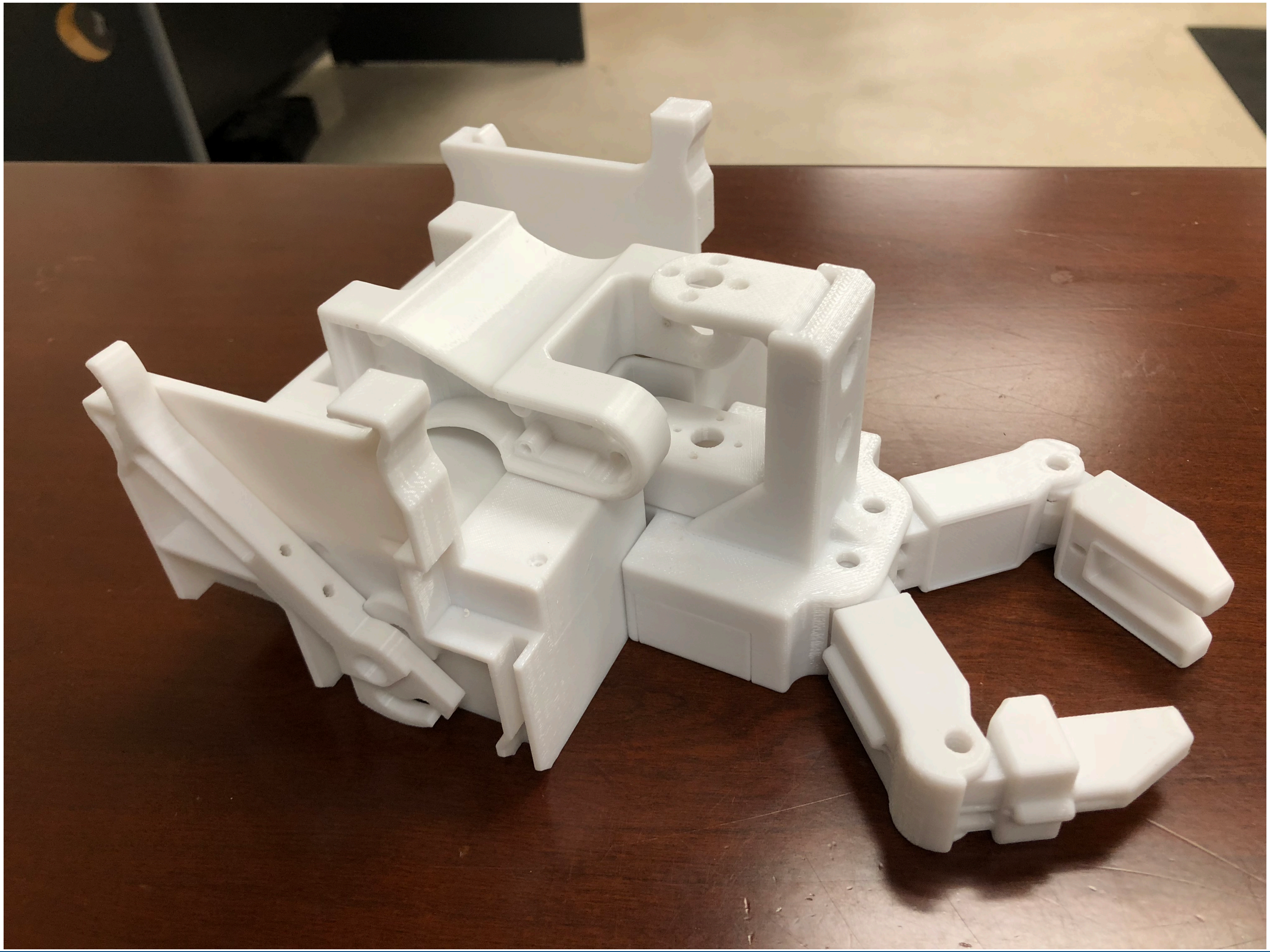


(a) Pan range of -90.0° to 90.0°



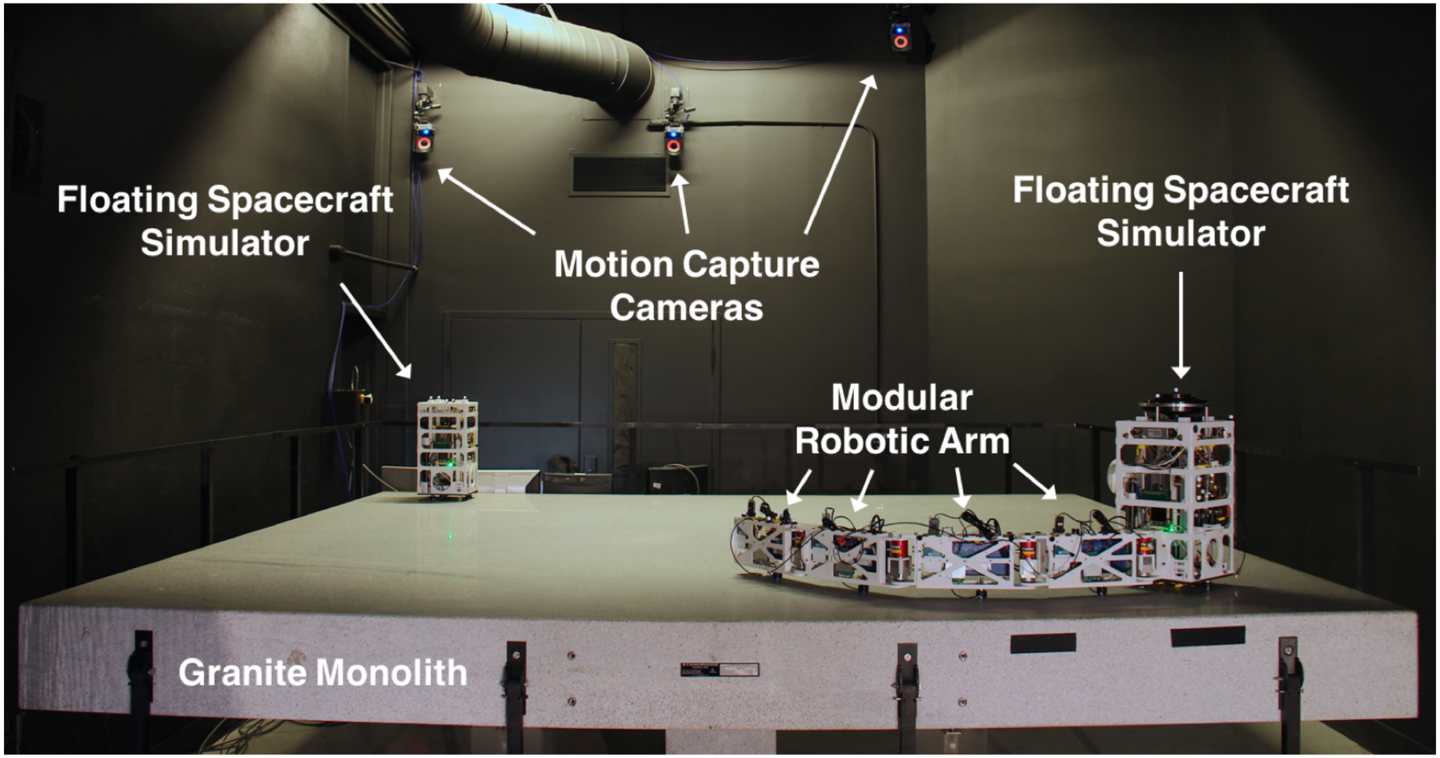
(b) Tilt range of -30.0° to 90.0°

Perching Arm Replica



The NPS POSEIDYN Test Bed (2004-2017)

Elements: 1) granite table, 2) autonomous floating S/C simulators, 3) metrology system.



Goals: testing of dynamic models GN&C algorithms for research and graduate students education

[Ref: Zappulla, Virgili-Llop, Zagaris, Park, Romano, POSEIDYN Air-Bearing Test Bed for Experimental Evaluation of Autonomous Spacecraft Proximity Maneuvers. Journal of Spacecraft and Rockets, 2017]

Questions?

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