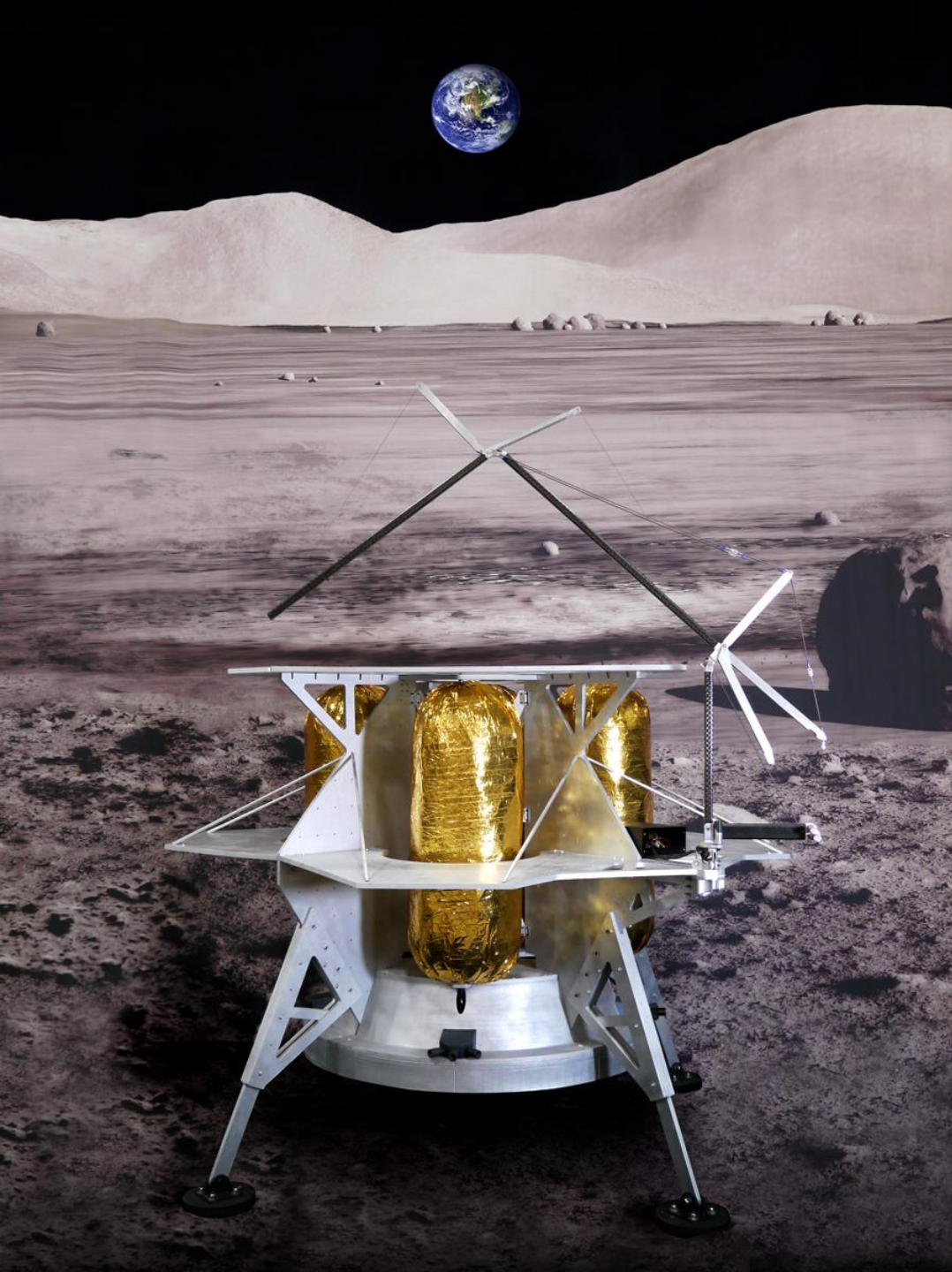




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Payload off-loading and handling on Planetary Surfaces

IOK M. WONG | NATIONAL INSTITUTE OF AEROSPACE
Advance In-Space Assembly Research and Development
March 16, 2021



2000kg @ 10+M

1000kg @ 8M

500kg @ 5M

35kg @ 2.25M

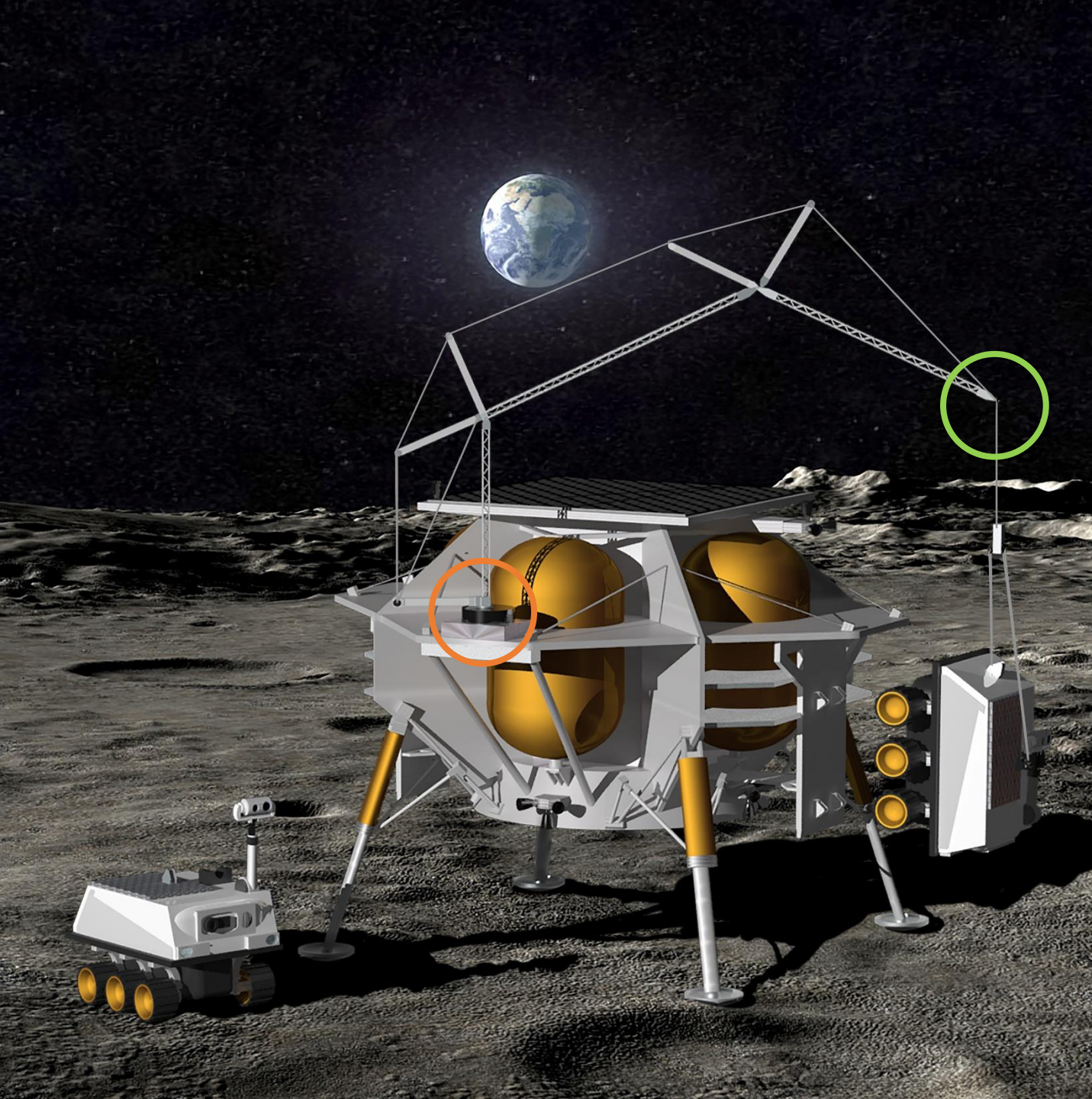
Mini - Class

Mid - Class

Full - Class

Heavy - Class





LSMS Leveling Base – Up to 15° incline leveling

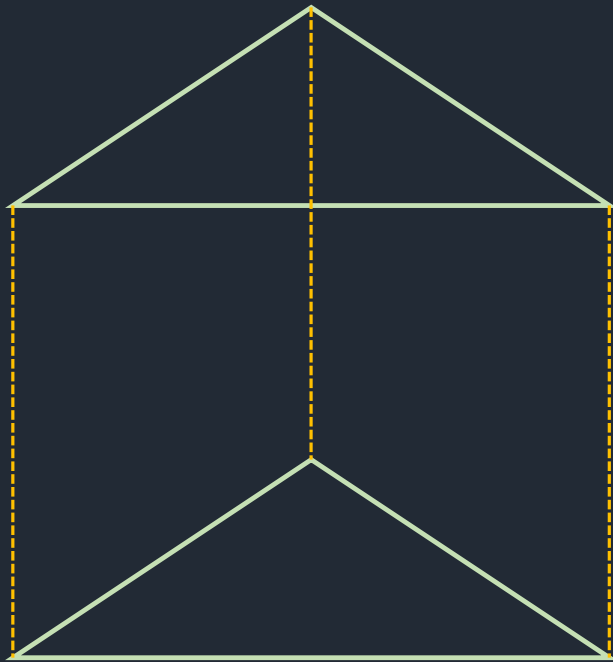
Payload Leveling Tool – At least 15° tilt control of payload



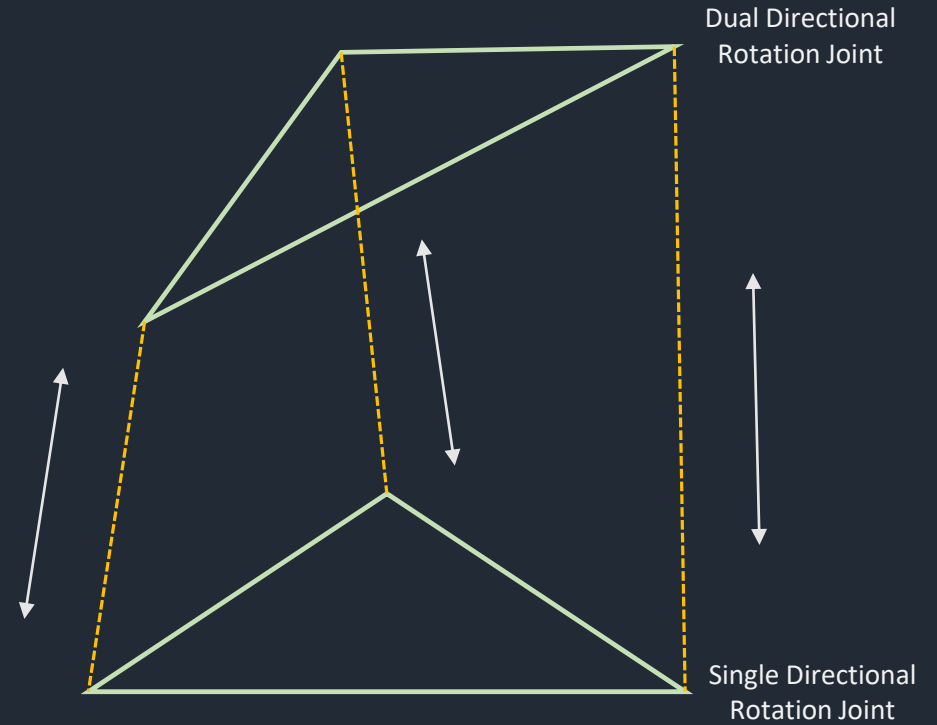
This is a manual 3-way leveler for a camera, we are making a fully automated robotic version, among other Leveling solutions that can be scaled up for a
larger crane.

Geometric Principle for 3-way leveling

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Home Position



Leveling Operation



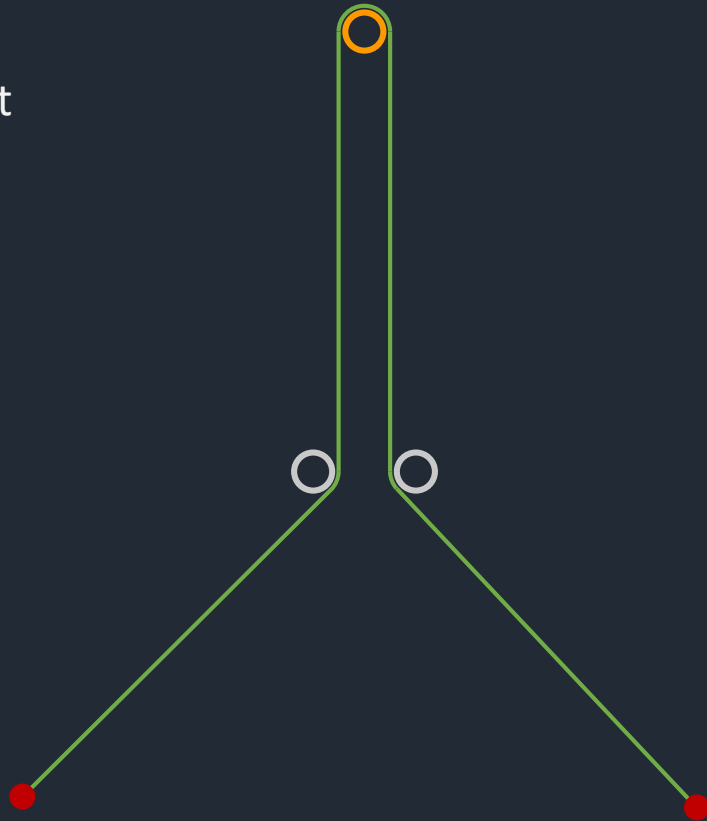
Basically we are trying to perform lifting and off-loading of cargo, without the folks in orange holding their Walkie Talkies!

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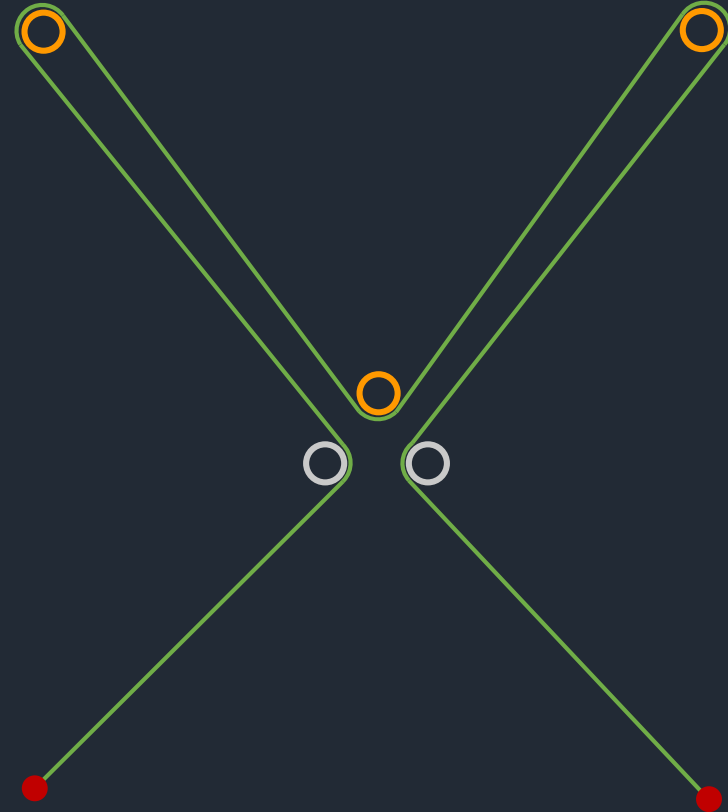


Lifting Anchor Point Diagram

- Fixed Point
- Cable
- Roller
- Capstan



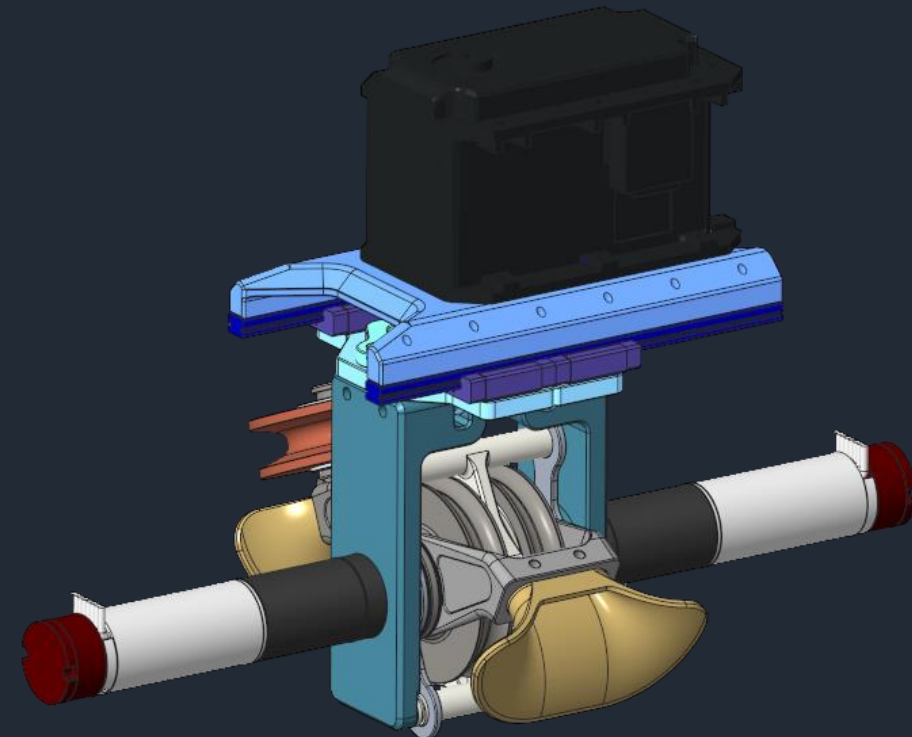
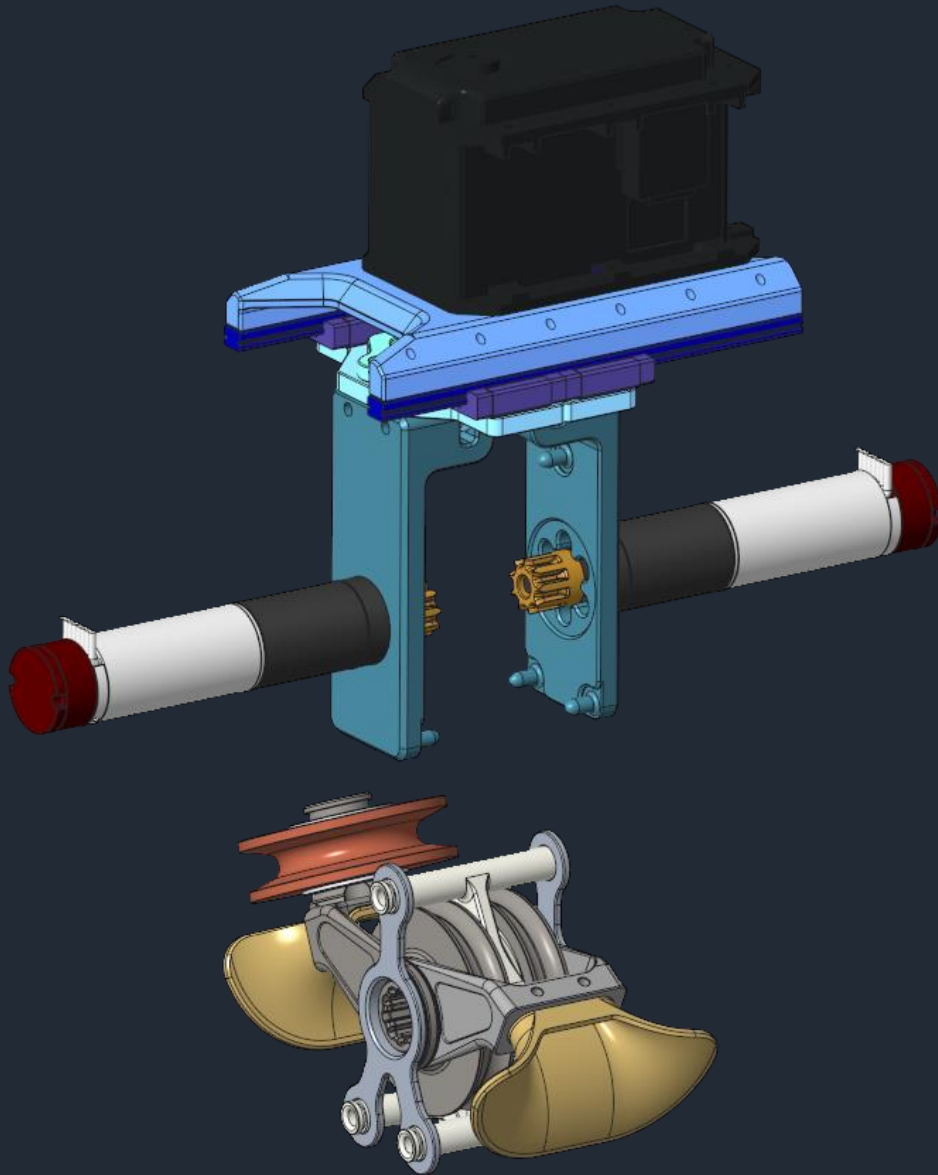
3 Point Lifting
Configuration



4 Point Lifting
Configuration

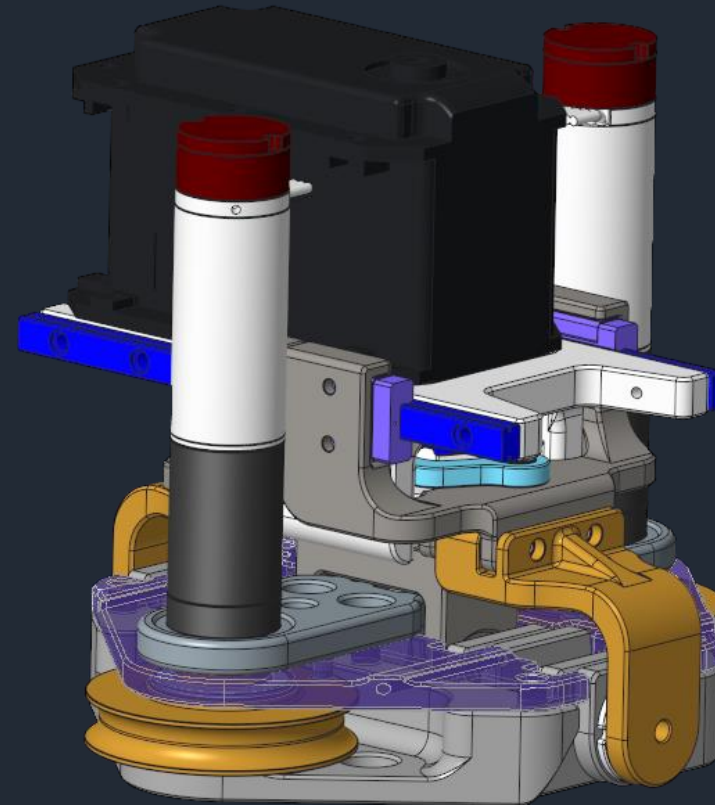
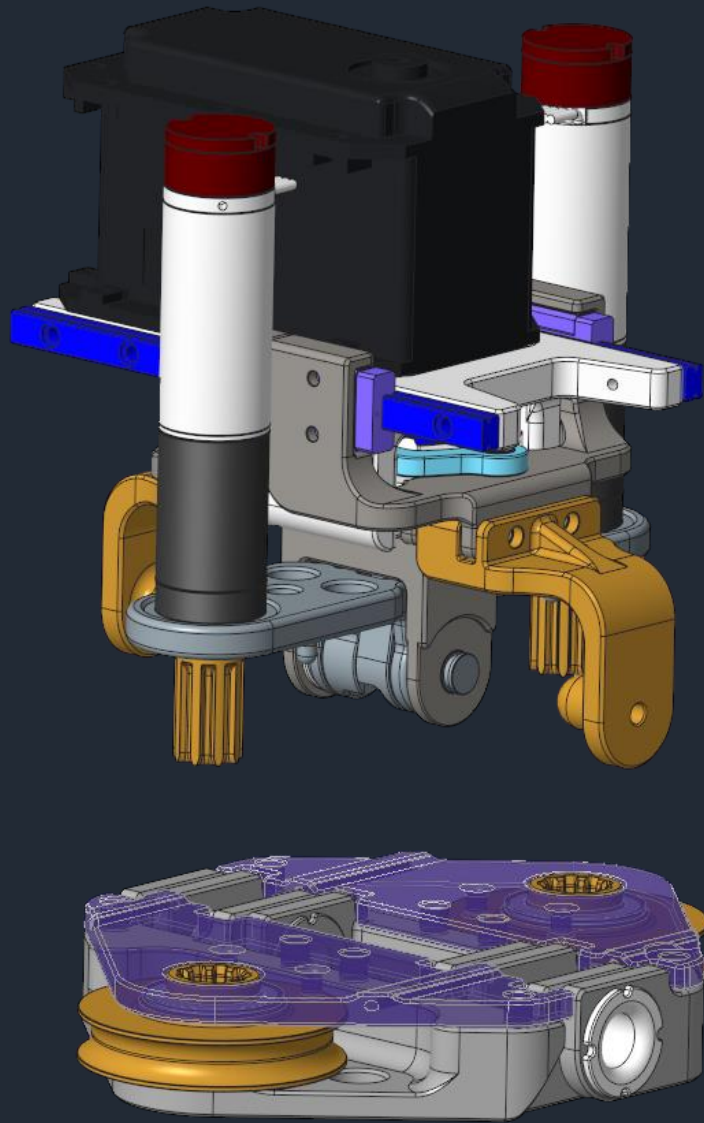


Payload leveling Tool – Scheme A

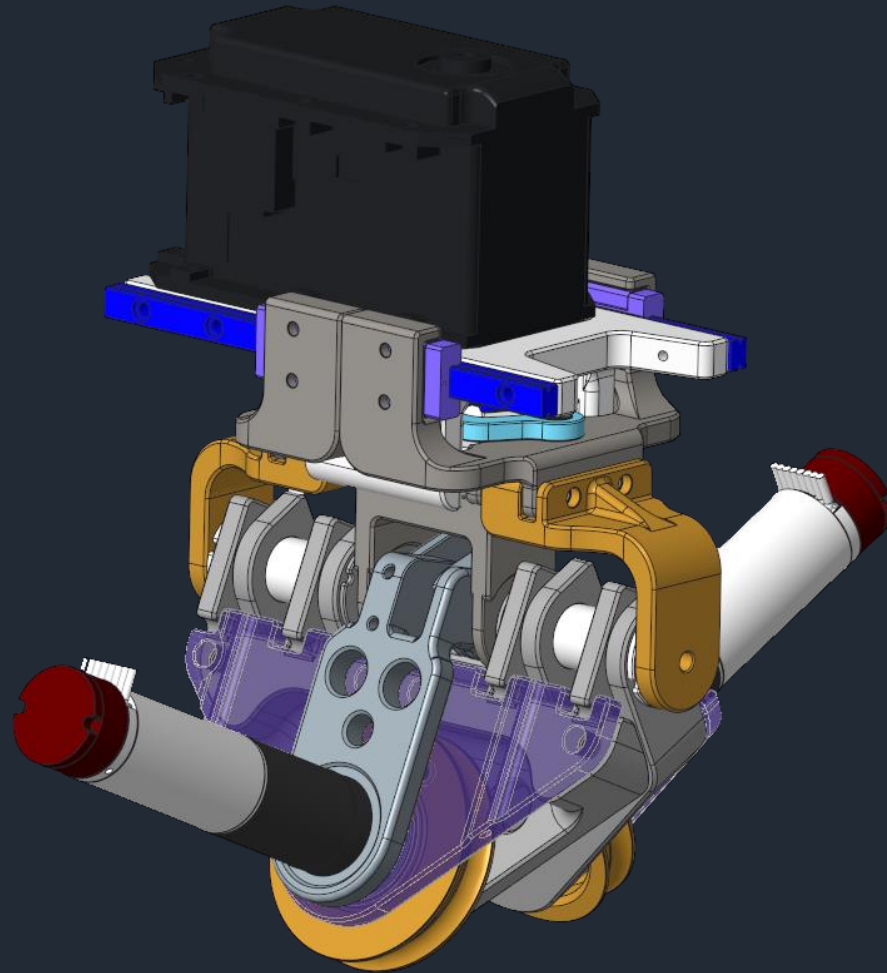




Payload leveling Tool – Scheme B



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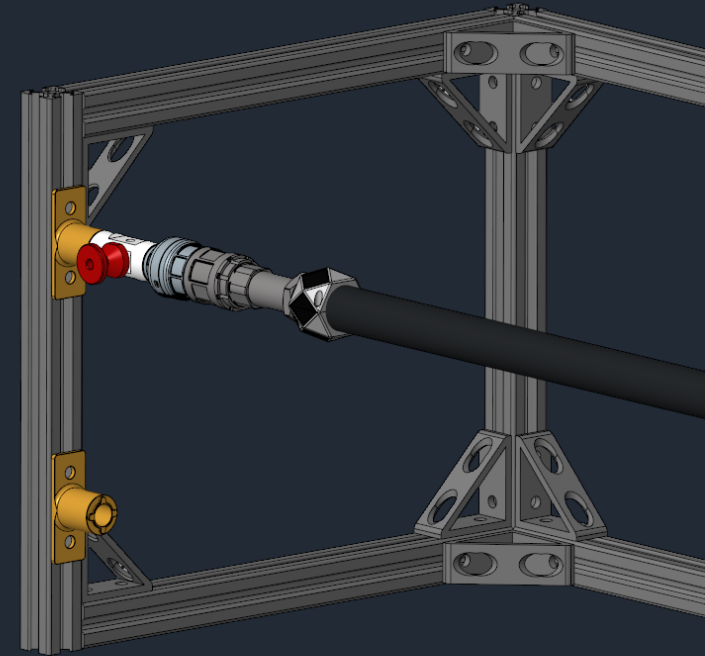
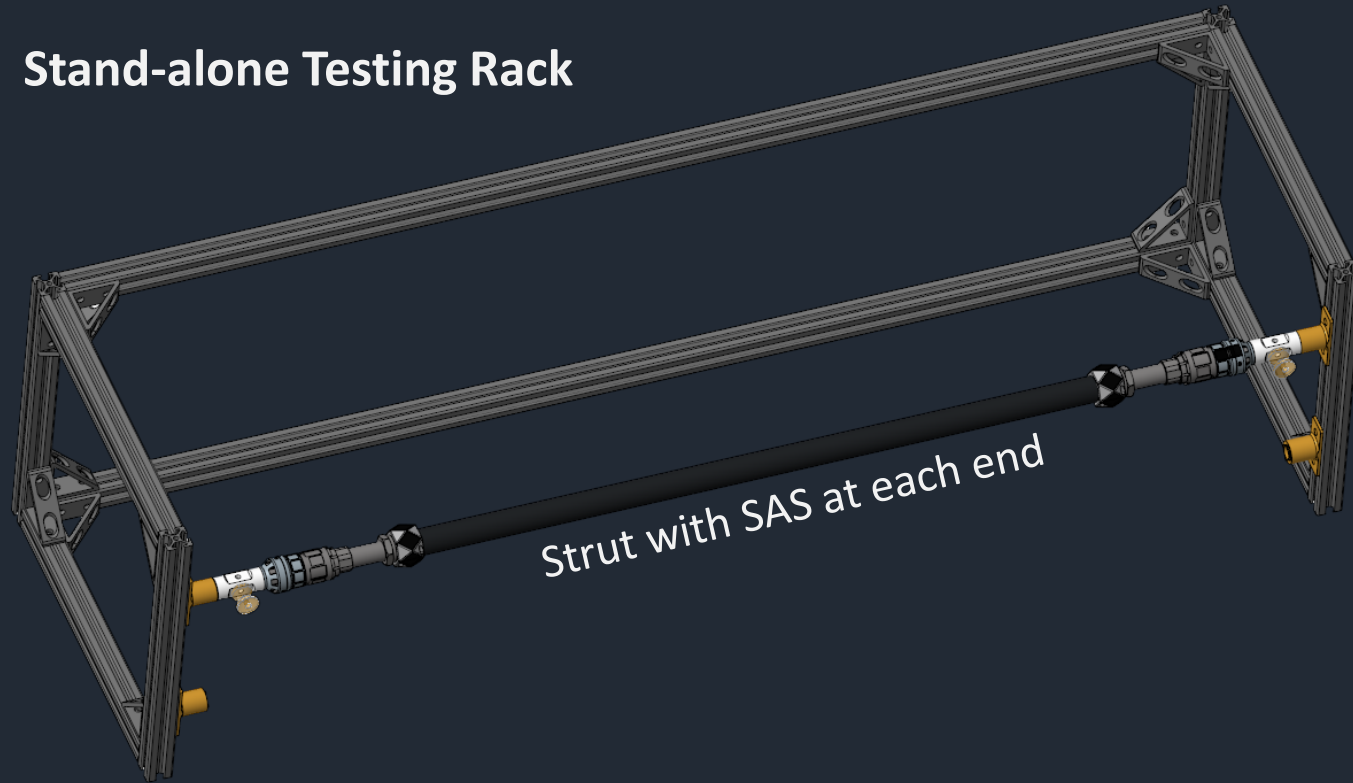


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Strut Attachment System (SAS) End-Effector

Stand-alone Testing Rack



Strut Attachment System (SAS) End-Effector

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1. End-Effector Body Frame
2. Strut Gripper Module
3. Node Gripper Module
4. Nut Runner Module
5. Linear Stage Modules
6. Node
7. HoneyBee Strut Attachment System

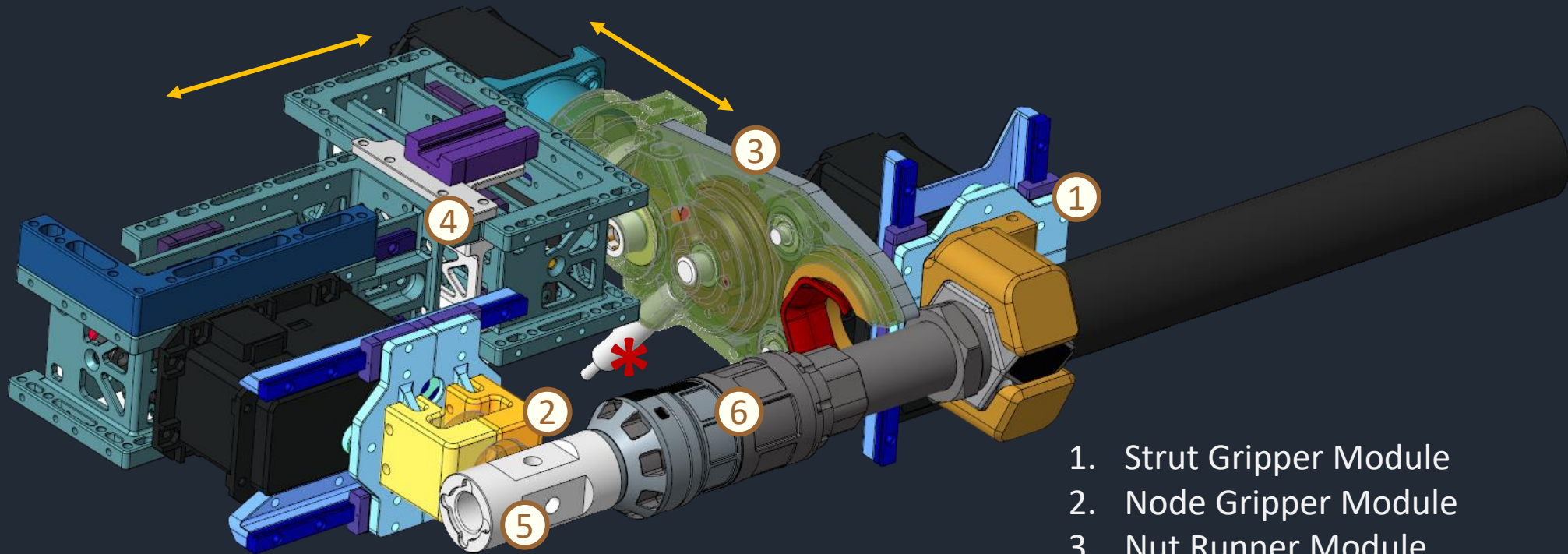


Requirements:

- Be able to grab and retrieve the SAS attached strut.
- Be able to grab the Nodes with SAS receptacles, and fix the end-effector to a relative position
- Be able to get to a position and drive the nut on the SAS to fully mate with the SAS receptacle

Strut Attachment System (SAS) End-Effector

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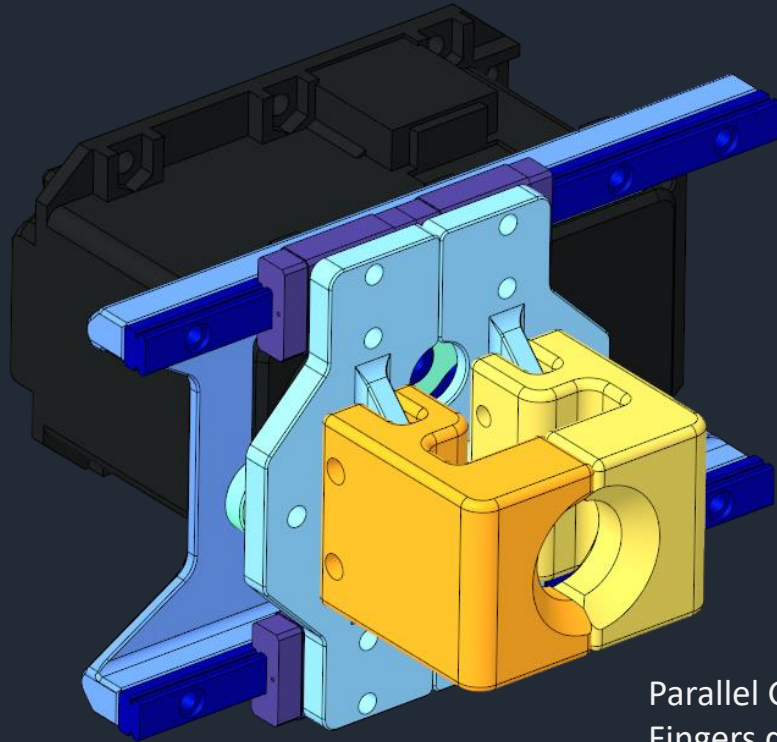
1. Strut Gripper Module
2. Node Gripper Module
3. Nut Runner Module

* Sensor that read the rotational position of the nut running gear *

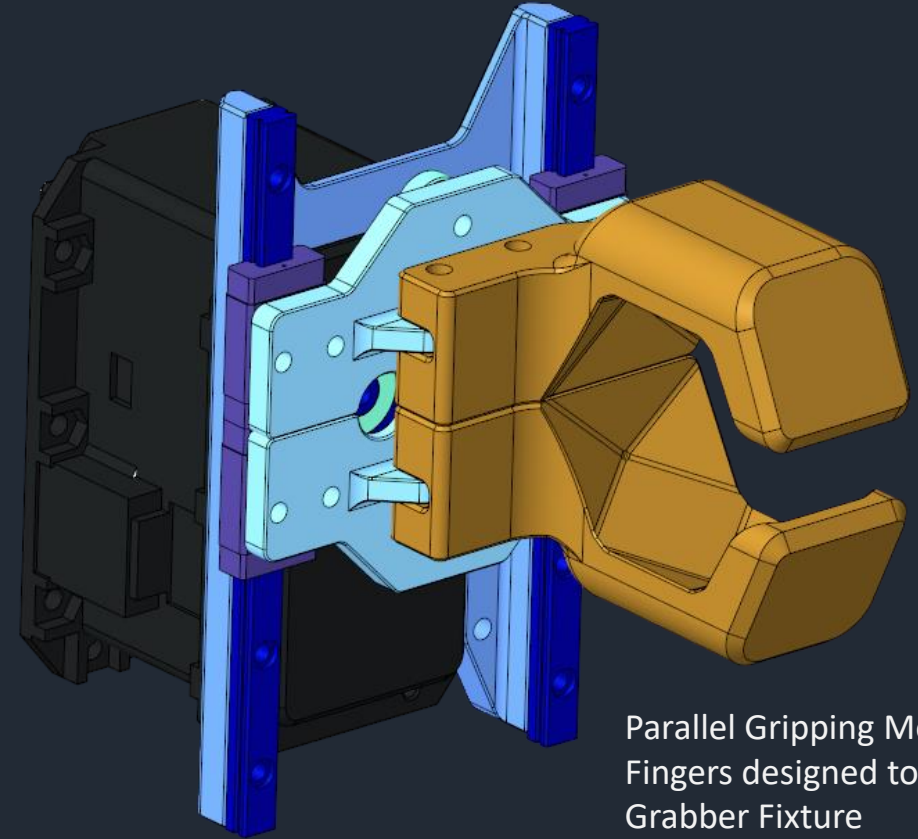
4. Linear Stage Modules
5. Node
6. HoneyBee Strut Attachment System

Strut Attachment System (SAS) End-Effector

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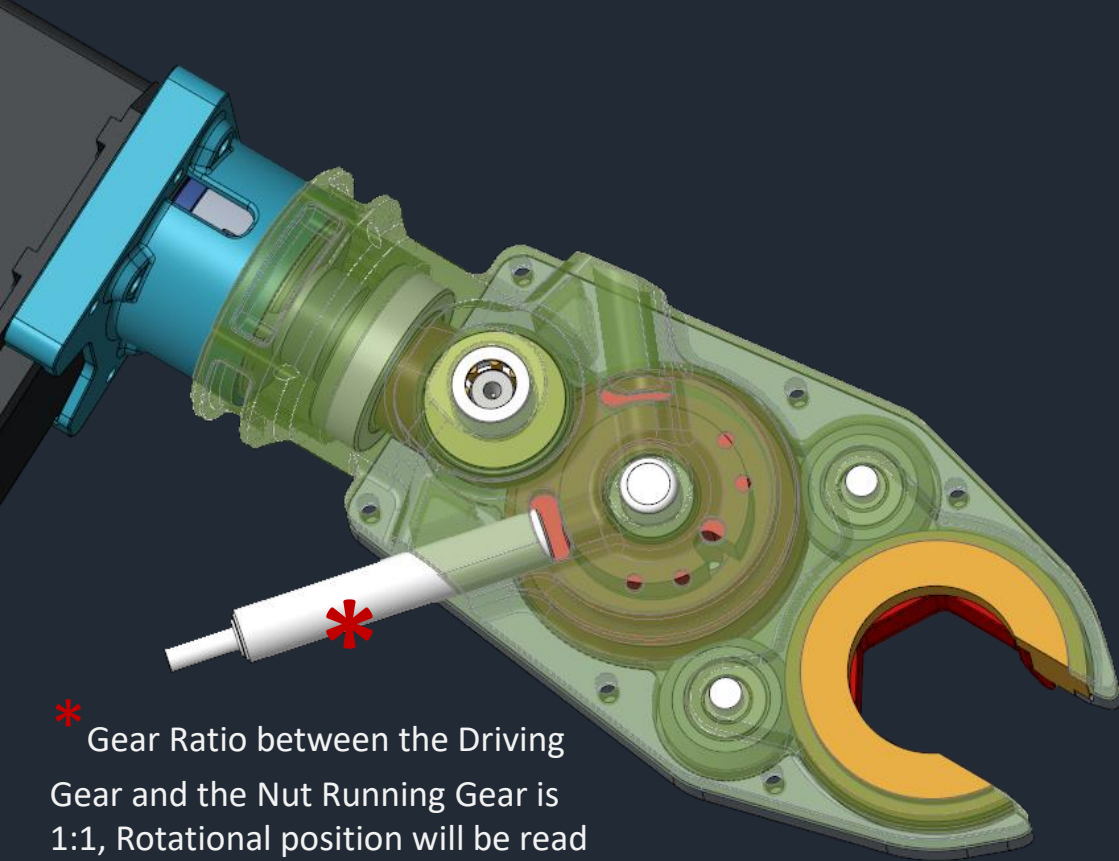
Parallel Gripping Module with
Fingers designed for the Node
Grabber Fixture



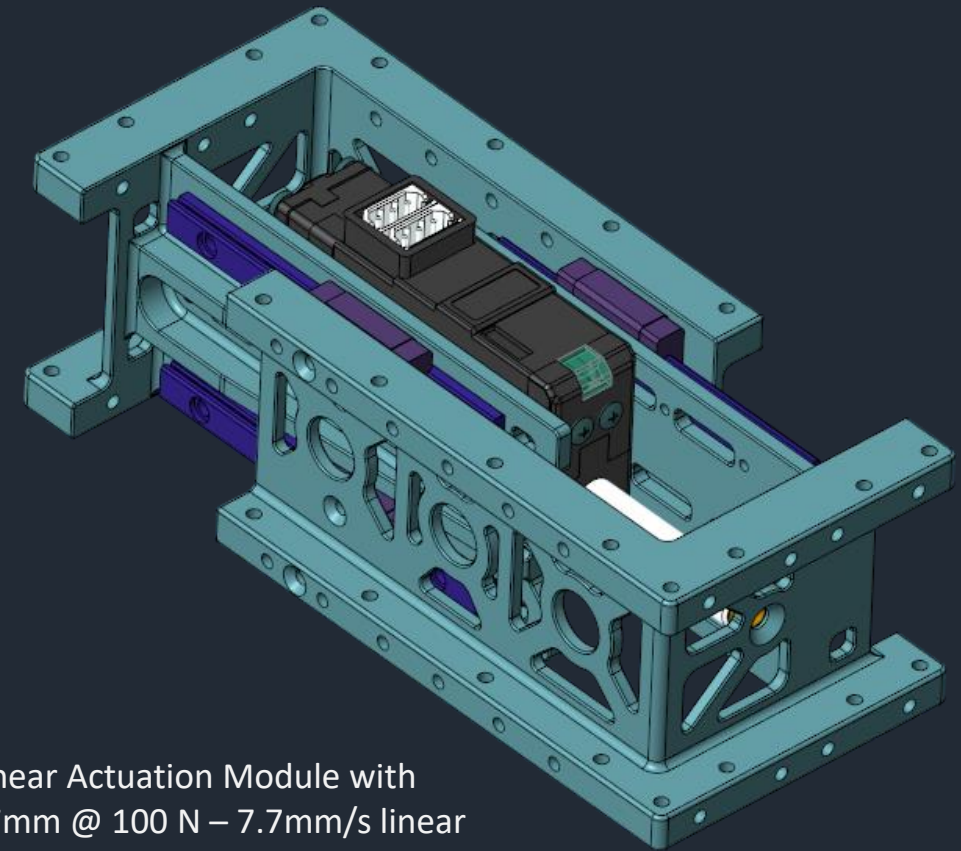
Parallel Gripping Module with
Fingers designed to grab the SAS
Grabber Fixture

Strut Attachment System (SAS) End-Effector

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* Gear Ratio between the Driving Gear and the Nut Running Gear is 1:1, Rotational position will be read from the Driving Gear



Linear Actuation Module with
27mm @ 100 N – 7.7mm/s linear
actuation

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Moving Forward

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