OASIS

Orbital Autonomous Spacecraft Interception System

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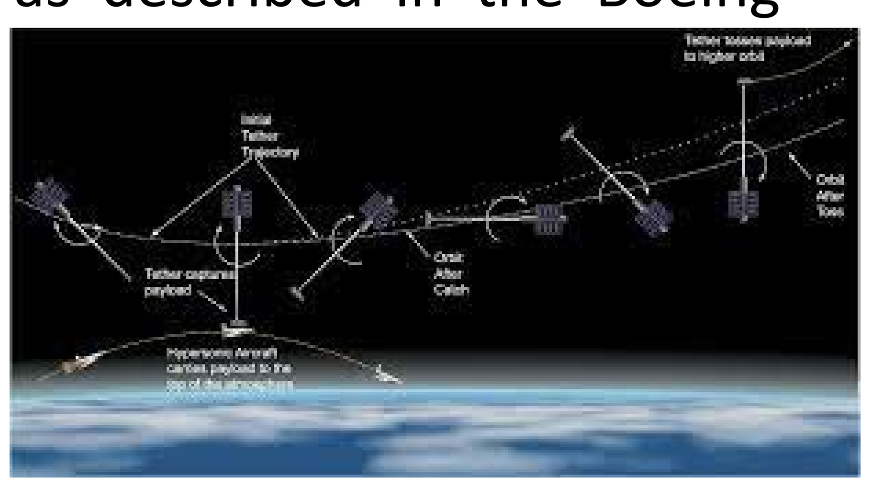
NORTHROP GRUMMAN ENGINEERING & SCIENCE STUDENT DESIGN SHOWCASE FLORIDA TECH

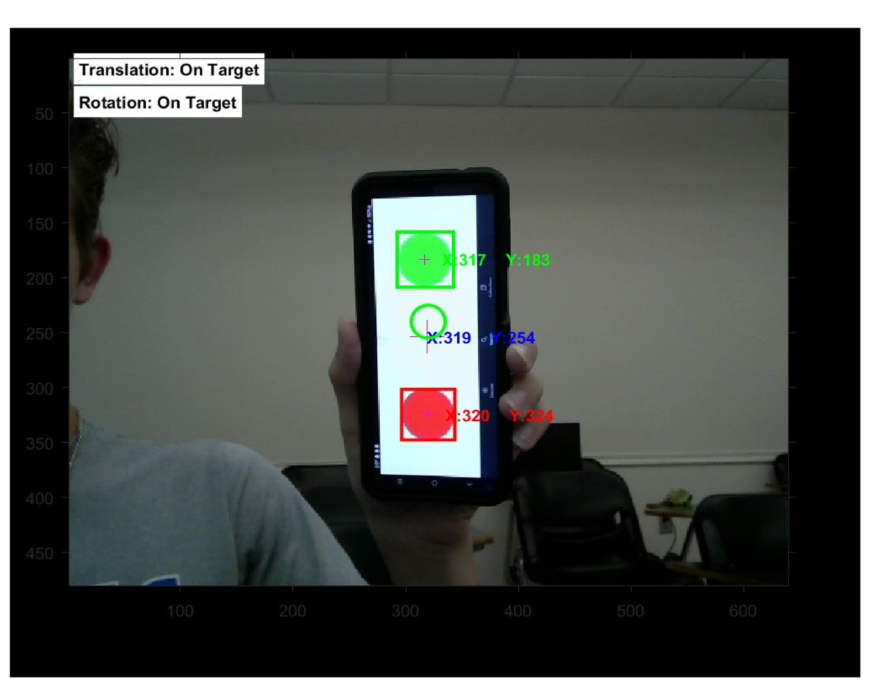
MISSION STATEMENT

- **Momentum Exchange Tethers are an alternative launch system that would cut the cost to deliver a payload into orbit by significantly reducing fuel requirements.**
- A retrieval mechanism is required to ensure a secure connection between the tether and the payload in a limited time window.
- OASIS shall fill this role as a fast-capture docking method designed for the momentum exchange tether specifications as described in the Boeing – *Hypersonic Airplane Space Tether Orbital Launch* (HASTOL) report.



GUIDANCE, NAVIGATION, & CONTROL

- For the docking process, a camera on the payload will track the movement and position of the Iris, while LiDAR sensors will track the distance between the OASIS and payload.



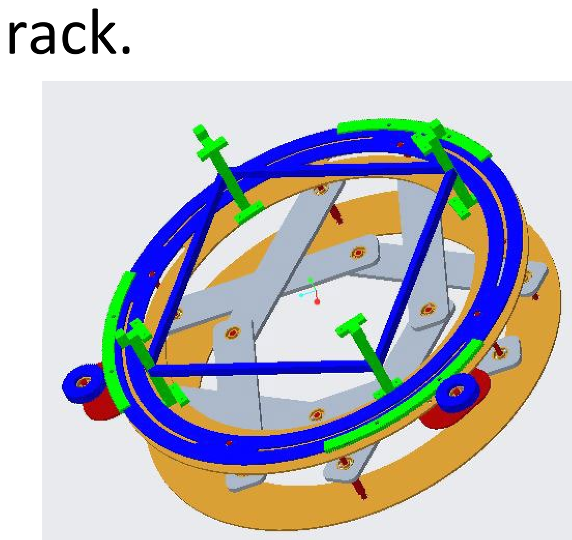
- An LED configuration will be on the bottom of the Iris, for a color detection algorithm, that will find the centroid of the LEDs and provide guidance to move along a 2-D plane.
- To initiate capture, the LiDAR depth sensors must read the desired "docking" value for a given time. The Iris will then close around the payload probe, followed by the hard capture around the top of the probe for a secure capture.

IRIS

- The docking system consists of a soft capture (Iris) and hard capture (collet) that will capture the payload probe.
- As the probe approaches and enters, the Iris will close to center the payload probe with the collet.
- The collet will close around the probe, providing a hard capture point between the payload probe and the OASIS.
- To disengage and release the payload probe, the Iris and collet will loosen separately.
- The Iris consists of four two-point bending arm bars, that will close in unison when the payload probe has entered the Iris.

Prototype

- The previous iteration of OASIS depicted an Iris that had 3 two-point bending arm bars that could only close and had to be manually opened.
- Scaled-down prototypes for the 2022-2023 Iris tested out moving in both directions by a motor rotating on a gear rack.
- Multiple wood-cut prototypes were fabricated with slightly varying designs to determine what would be best suited for OASIS.



- A three- and two-point bending arm would be tested in the prototypes to conclude that the two-point bending arm would be best.

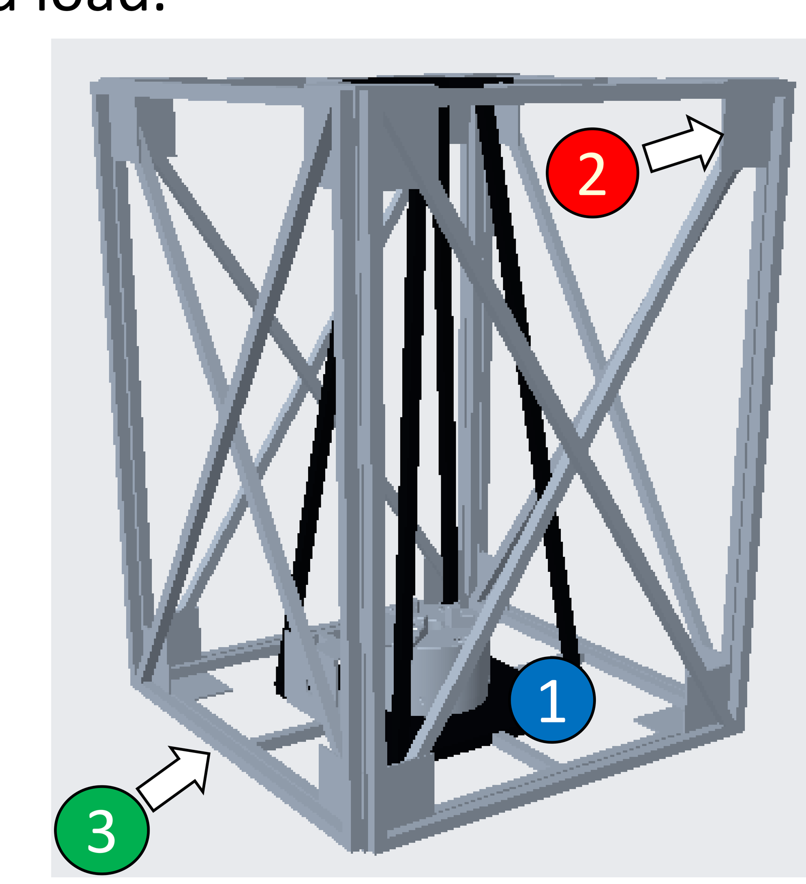
PROBE STAND

- The probe stand is designed to test the ability of the camera to align the payload with the Iris for capture.
- This is done by moving a probe on an XY belt, the position will be determined by the camera and will tell the probe to move relative to the position of the Iris.
- Once in the correct position, the camera will give the OK for the probe to continue in the Z direction for soft capture in the Iris and then hard capture in the collet.

STRUCTURES & SHIELDING

1) The inner pyramid shown in black was designed as the primary structure with a factor of safety of 2.0 for its design yield load.

2) The Aluminum 6061-T6 roll cage serves as the secondary structure. Here is where the shielding frame and Iris are mounted on the outside, and the hardware on the inside.



3) The shielding consists of four frames each with a panel of acrylic attached on the outside. These panels are easily interchangeable in case of damage.