

APEX ANCHOR - A MULTI  
MISSION DEVELOPMENTAL  
PROGRAM

*Khushi Shah, Intern*



# CONTENT



---

Apex Anchor 03

---

Apex Region 04

---

Developmental Phases 05

---

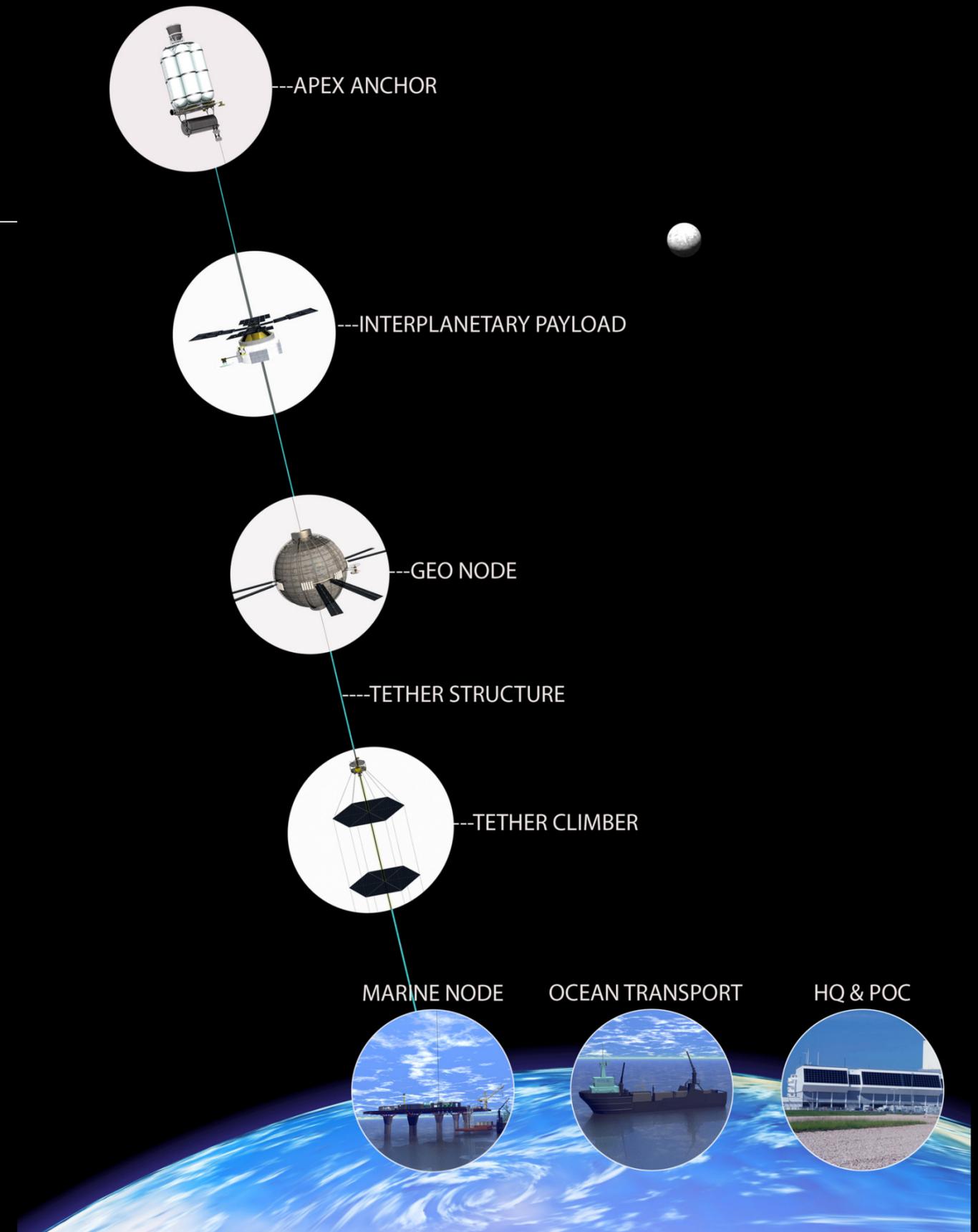
Hubs in Robotics Phase 10

---



# APEX ANCHORS

- Provides counterweight stability for space elevator as a large end mass
- Original deployment satellite moved to the top at 100,000 km as it extends all of its tether
- Provides outward force with tensile pull along tether leading to inherent space elevator stability
- Equipped with facilities to manage tether dynamics, telecommunication, attitude control, space debris & more
- Operates as a Space Transportation concept taking 'Just in Time Delivery' into effect
- Situated at a high energy location



# WHAT IS THE APEX REGION?

---

- The region around Apex Anchor defined by the amount of motion expected at full extension of the tether
  - During normal operations, this region is the volume swept out by the end of tether
- 

## **Assumptions**

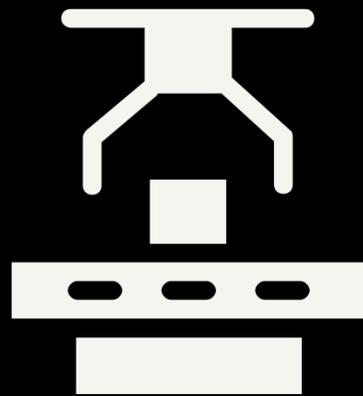
- Full volume in hard vacuum
- Rare transits of space rocks or human spacecraft during assembly phase
- Significant amount of fuel required for thrust to keep objects within region without attachment to Apex Anchor



# PHASES OF DEVELOPMENT

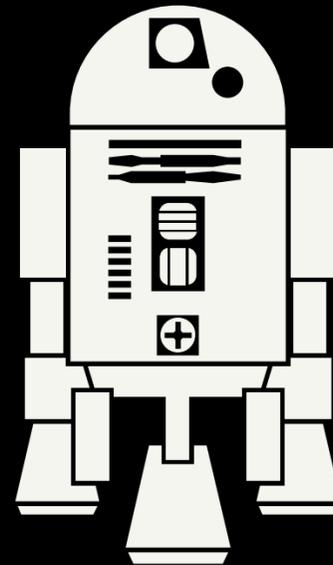
---

Assembly



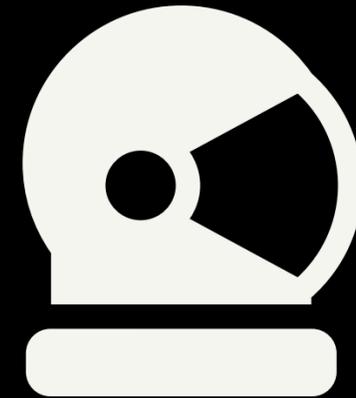
Phase I

Robotics



Phase II

Humans



Phase III



# — PHASE I ASSEMBLY

- The deployment and continued stability of the tether are the primary function of the Apex Anchor
- Four Stages of Assembly:
  1. Initial Deployment of Satellite in Low Earth Orbit
  2. Apex Anchor Buildup to Match Tether Mass Buildup
  3. Initial Operations Capability to stabilize the entire tether
  4. Customer Support towards Full Operations Capability



# — PHASE II - ROBOTICS

- For the beginning of this phase we assume that Apex Anchor is fully capable of providing stability to the tethers
- Supports the development and deployment of technologies for exploration, planetary science and space situational awareness
- Equipped with facilities to manage tether dynamics, telecommunication, attitude control, debris detection, space based solar power, lab experiments
- To deal with the logistics and management of these activities, six hubs have been conceptualized



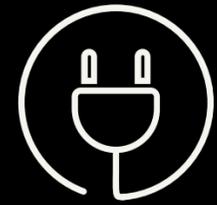
- 
- 
- 
- 

# HUBS ROBOTICS PHASE



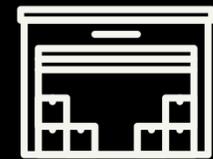
**Operations Hub**

---



**Storage Hub**

---



**Service Hub**



- 
- 
- 
- 

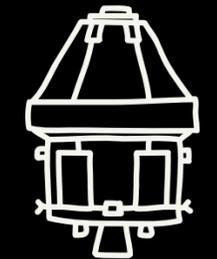
# HUBS ROBOTICS PHASE



**Refuel Hub**



**Interplanetary Spacecraft Hub**



**Planetary Defense Hub**



# — UNDERSTANDING THE HUBS

---

## Operations Hub

- Communications for elevator transport and network across the various hubs
- Space solar power and distribution across the Apex Anchor
- Autonomous systems monitoring the traffic on the Anchor

## Storage Hub

- Acts as a docking area for spacecrafts & satellites
- Storage space for missions

## Service Hub

- Maintenance units containing In-orbit servicing modules that can be launched out of Apex Anchor
- Autonomous System assisting servicing & maintenance activities
- Emergency protocol wing



# — UNDERSTANDING THE HUBS

---

## Refuel/ Innovation Hub

- Refueling stations for spacecrafts
- Construction of space systems and payloads

## Interplanetary Spacecraft Hub

- Provide support for Parking Orbits
- Acquire resources from Moons/ Asteroids
- Docking & Landing area for spacecrafts

## Planetary Defense Hub

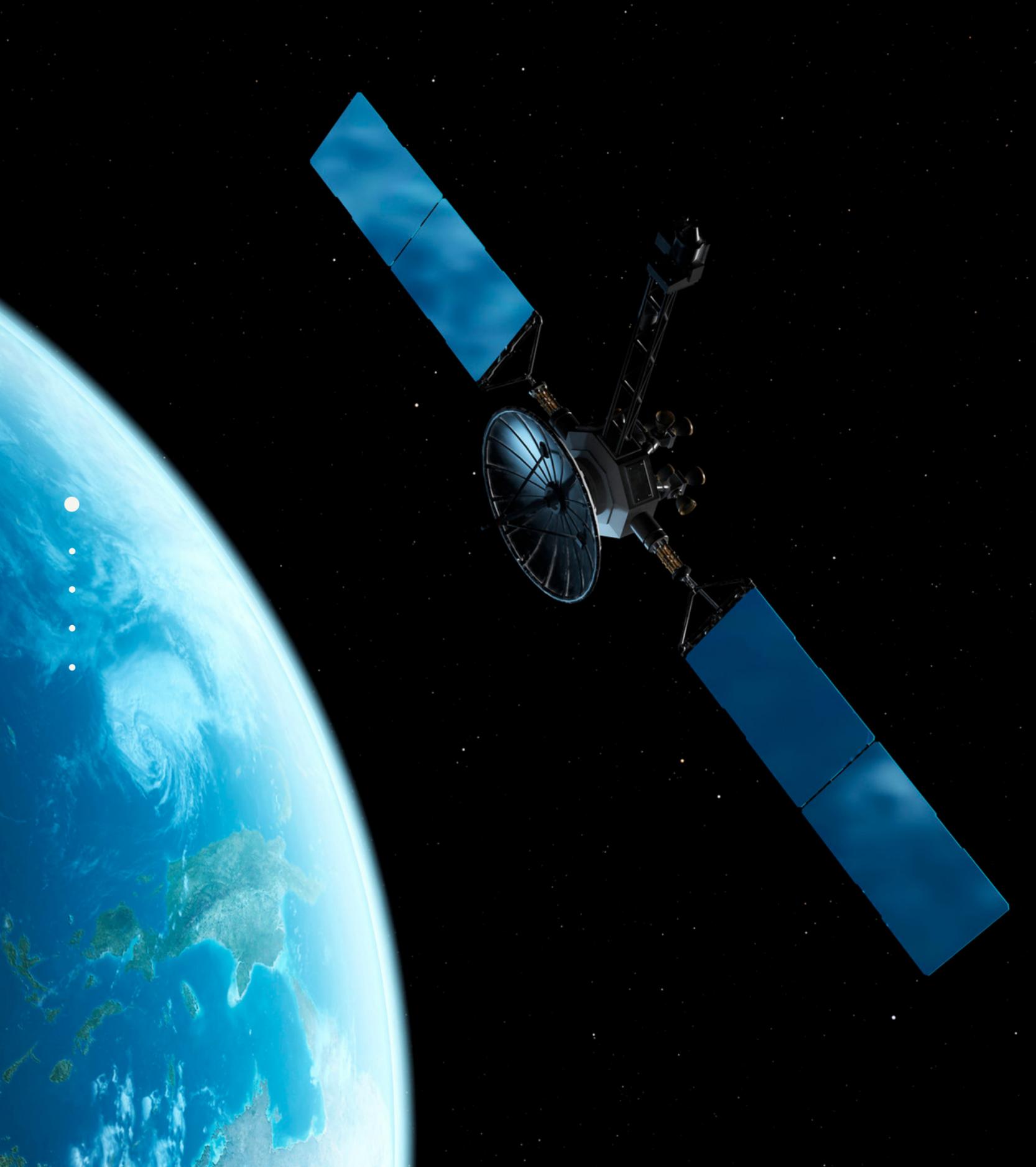
- Assist with removal of defunct satellites
- Data sensors & systems for Space Situational Awareness



# — PHASE III - HUMANS

- For the beginning of this phase we assume that Apex Anchor has a well established network of robotic systems, communications and emergency protocols
- This phase will support commercial activities such as establishment of a lab for conducting experiments & research with the involvement of humans onboard
- Development of Environment Control & Life Support systems, HVAC systems etc for potential rescue missions for humans residing on other bodies





# — THANK YOU

---

Khushi Shah,

Mechanical Engineer & Designer

Intern at ISEC





ANY QUESTIONS?

