



GAS STATIONS IN SPACE™

Orbit Fab - Astrobeer

June 2023

STRATEGIC INVESTORS:

LOCKHEED MARTIN



NORTHROP
GRUMMAN

Munich Re Ventures

Marubeni
Ventures





Company Overview



OUR MISSION

To Build the In-Space
Propellant Supply Chain

OUR VISION

A Bustling In-Space
Economy Supporting
Permanent Jobs in Space



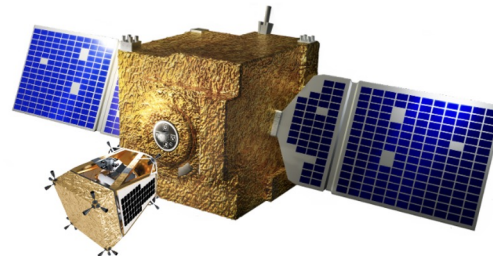
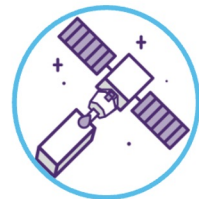
Company Highlights

Founded in 2018 to build the in-space propellant supply chain

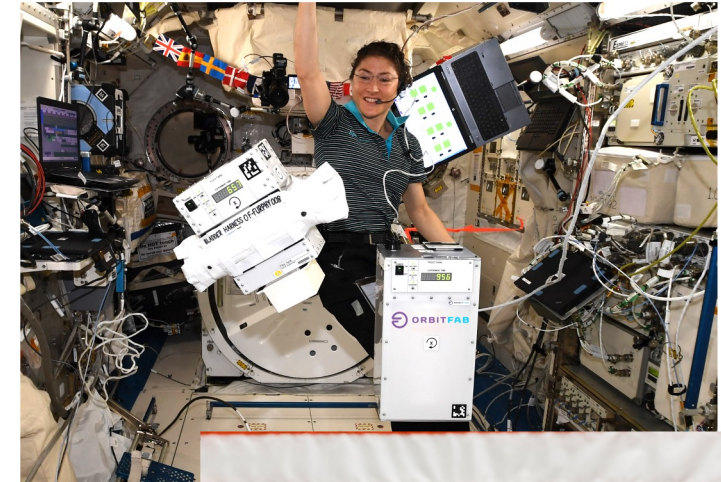
- Headquartered in Lafayette, CO, USA; UK office opened 2022
- 60+ employees & growing globally
- Received investment from Lockheed Martin & Northrop Grumman
- Two successful space flight missions
- First private commercial company to resupply the ISS with water
- RAFTI baselined on 4 DoD & 100+ commercial satellites
- First commercial in-space fuel sale deal signed with Astroscale in early 2022
- First DoD GEO refueling mission under contract for 2025



Sell RAFTI Service Valves



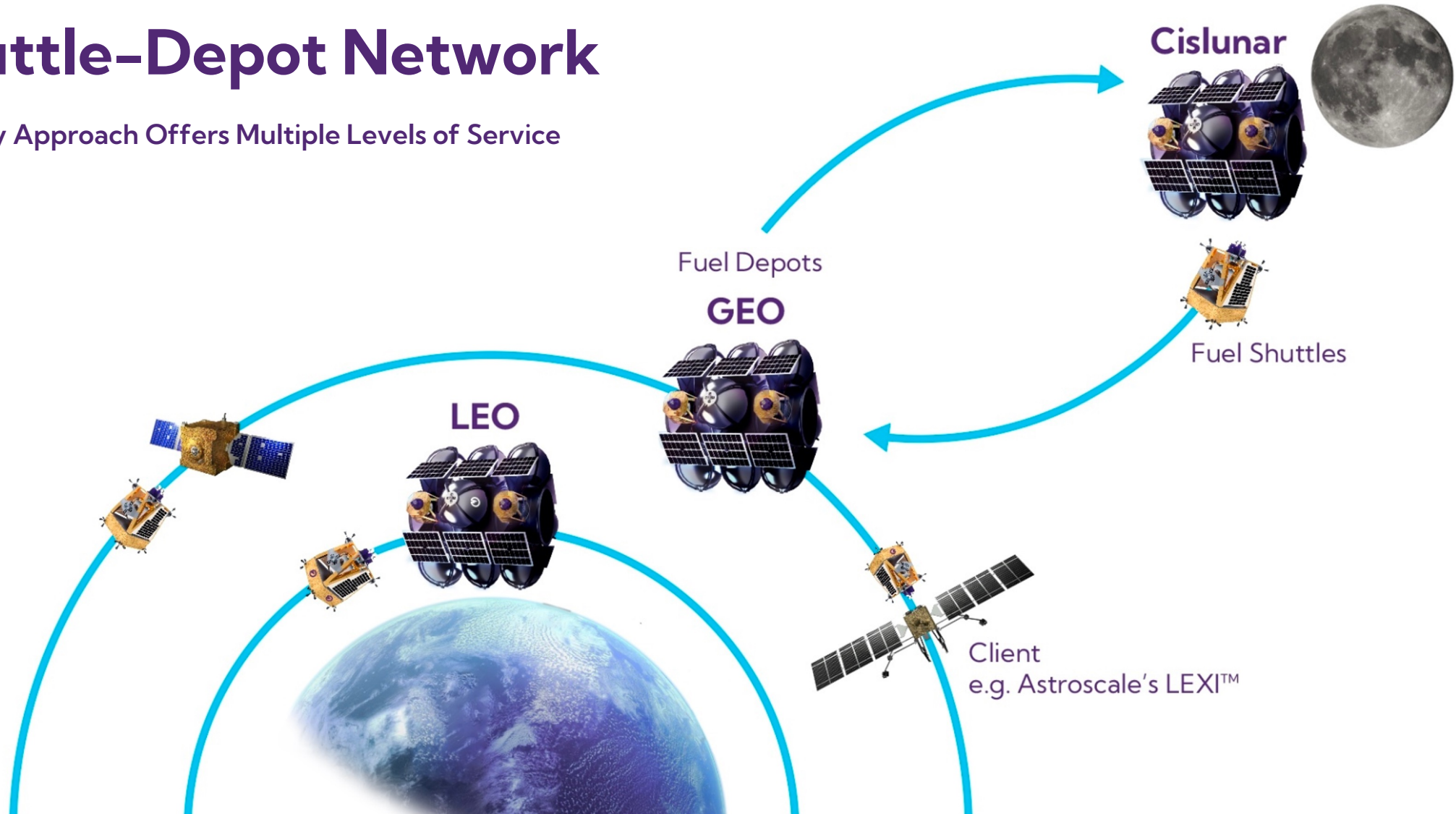
Sell Fuel In Space

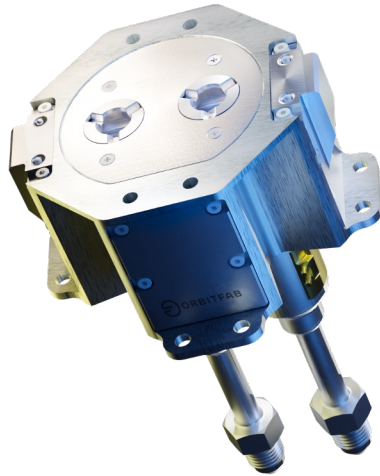
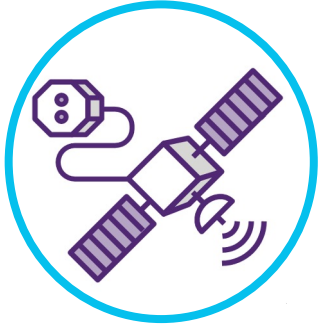


*Top: ISS water resupply mission, Furphy (2019)
Bottom: First commercial fuel depot, Tenzing (2021)
Left: Orbit Fab's refueling products and services*

Shuttle-Depot Network

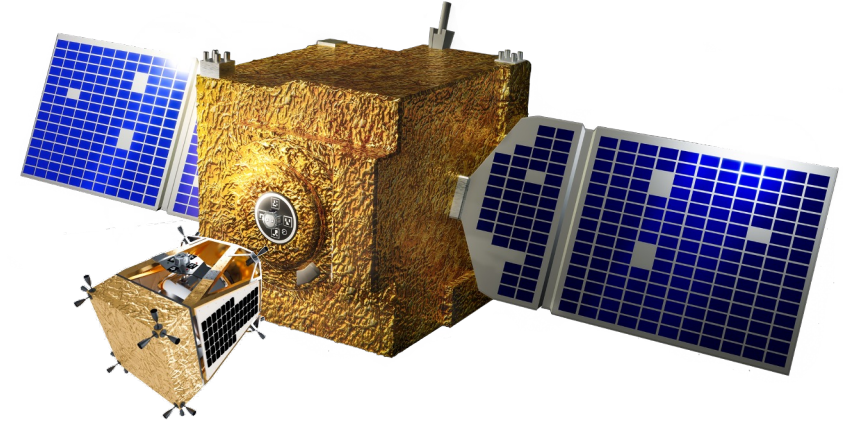
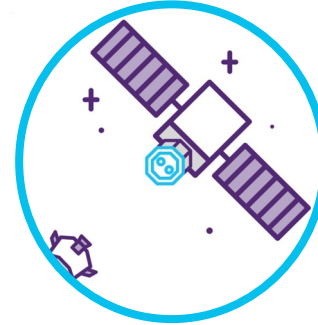
Delivery Approach Offers Multiple Levels of Service





Sell **RAFTI** Service Valves

- Manufacture and Sell RAFTI
- Offer RAFTI Open License
- Certify Propulsion Partners
- Certify Spacecraft Bus Partners
- Certify Hardware Manufacturers



Sell **Fuel** In Space

- Develop and Operate In-Space Infrastructure
- Develop and Operate Logistics and Ground Ops
- Offer Depots and Fuel Shuttles to select customers

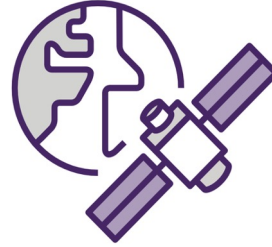


Why Refuel?



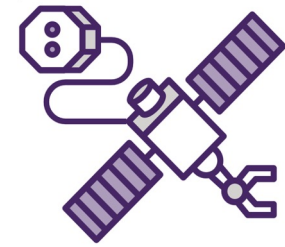
Increase Revenue Potential

- Extend spacecraft lifetime
- Trade fuel mass for payload mass
- Decrease launch cost
- Enable faster asset deployment
- Realize direct cost savings



Enhance Spacecraft Mobility

- Reposition assets
- Negate mission life reduction caused by collision avoidance maneuvers
- Enable on-demand retasking
- Correct orbital insertion inaccuracies



Enable New Operations & Business Models

- Perform secondary missions
- Offer unique capability to clients
- Enable access to novel maneuvers, orbits, spacecraft designs, and constellation architectures

We can help you understand how refueling benefits your business with our in-house refueling mission planning service, UMPIRE.

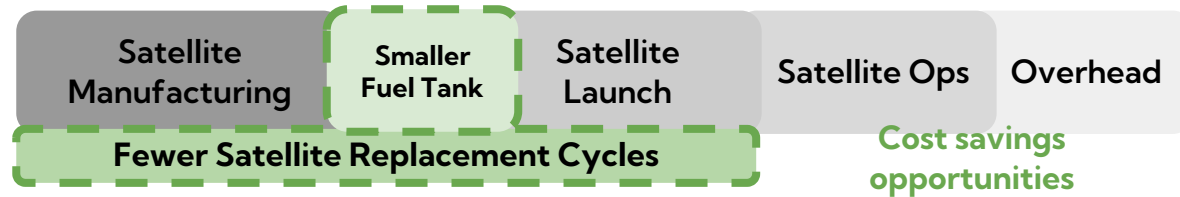


Cost Benefits from Refueling

Cost Structure without Refueling



Cost Structure with Refueling

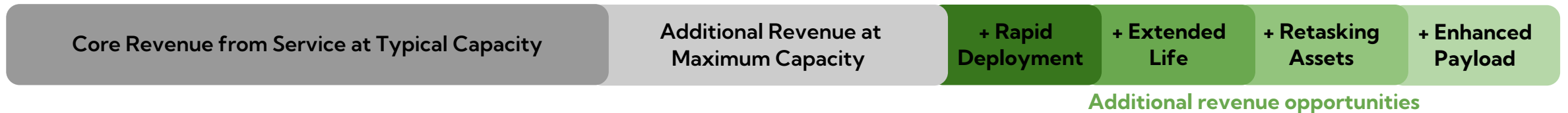


Revenue Benefits from Refueling

Revenue Structure without Refueling



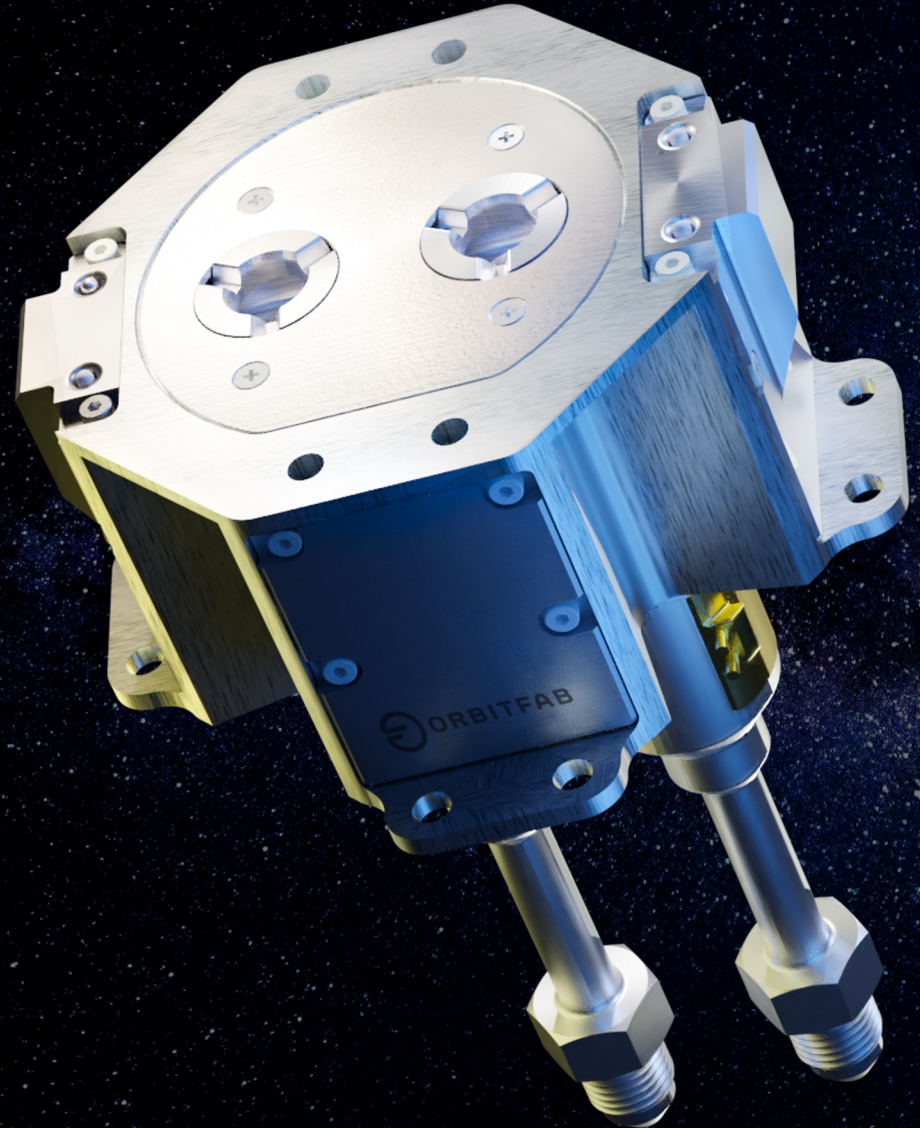
Revenue Structure with Refueling



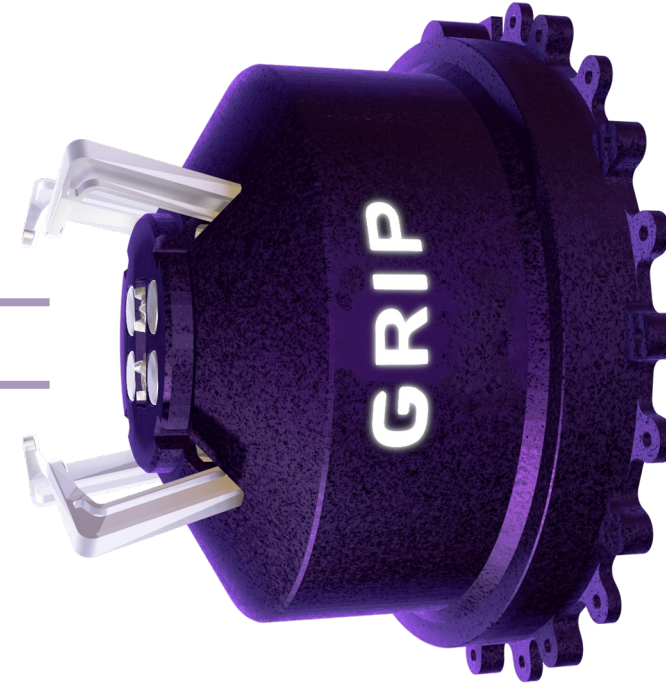
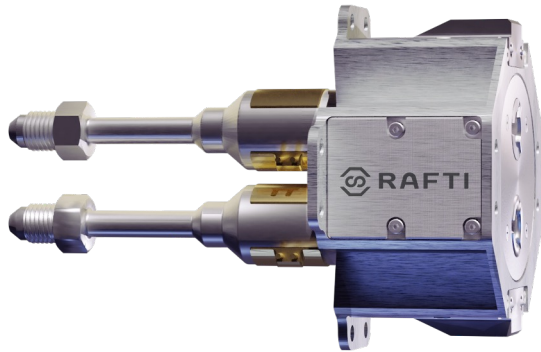


RAFTI

Rapidly Attachable Fluid
Transfer Interface



Refueling Interfaces



RAFTI

- Rapidly Attachable Fluid Transfer Interface
- Passive RAFTI Valve Cores
- Passive Grapple Fixture
- Used on Clients, Depots & Fuel Shuttles
- TRL 7 (TRL 9 in 2023/2024)

GRIP

- Grappling & Resupply Interface for Products
- Active RAFTI Valve Cores
- Active Grappling Mechanism
- Used on Fuel Shuttles (& Depots)
- TRL 5 (TRL 9 in 2023/2024)

Rapidly Attachable Fluid Transfer Interface (RAFTI™)

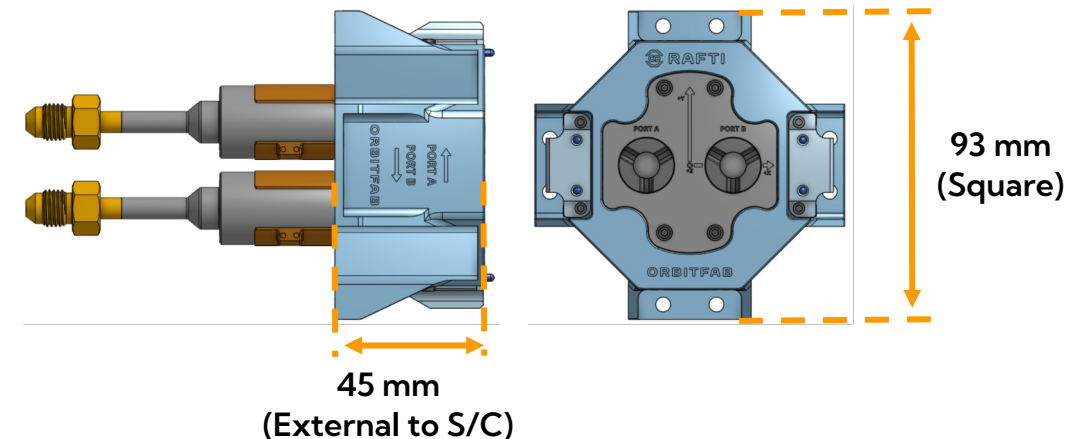
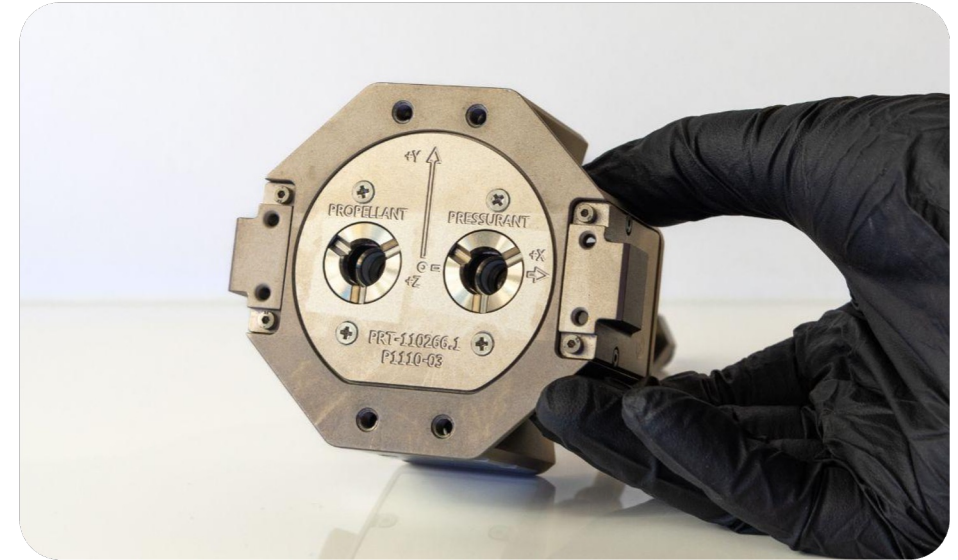
RAFTI is an open license TRL 7 refueling and docking interface that replaces a Fill and Drain Valve to enable on-orbit and ground fueling.

Size & Weight:

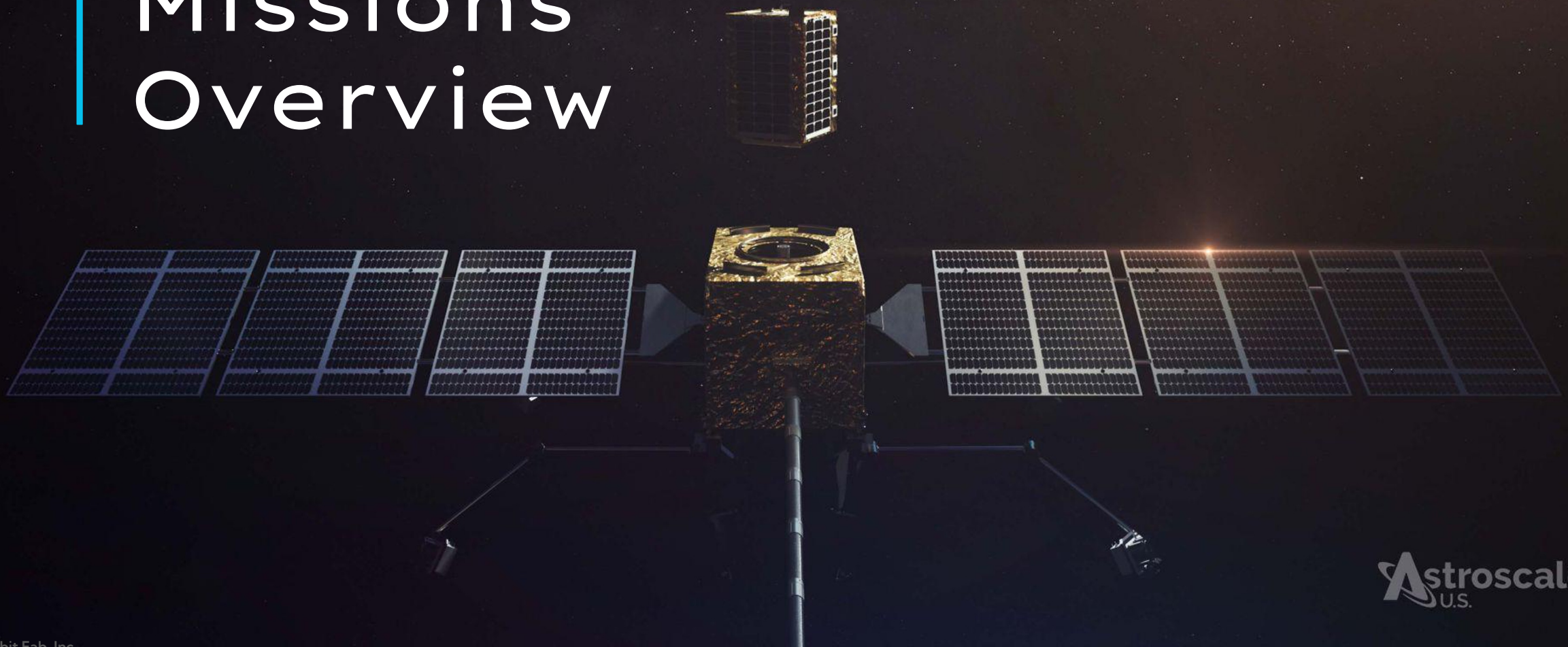
- Size: 93mm x 45mm (external to spacecraft)
- Mass: ~500g

Features:

- Dual fluid ports with high and low pressure variants
- Common geometry for all fluids, with material changes as needed for compatibility (N₂H₄, Xenon, ASCENT, HTP, H₂O, Krypton, N₂O-C₃H₆, etc.)
- Three inhibits to overboard leakage
- Energized seals for fluid and radiation compatibility
- Passively actuated covers to mitigate radiation exposure
- Grasp features to allow direct-docking and capture capability
- Can integrate with third party docking interfaces for a larger docking capture box (e.g. ASPIN & PRM)
- Designed to scale to 10-ton spacecraft



Missions Overview

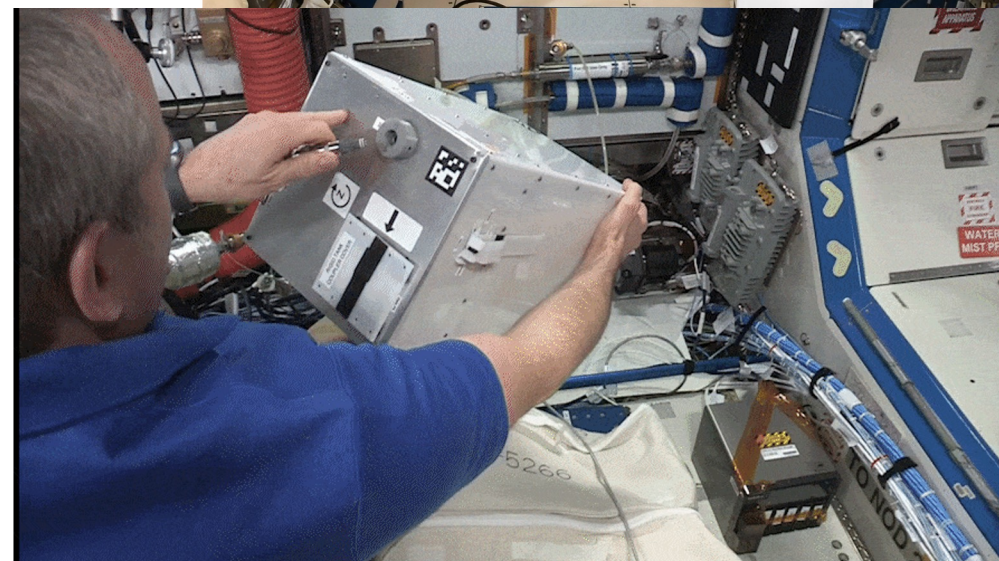
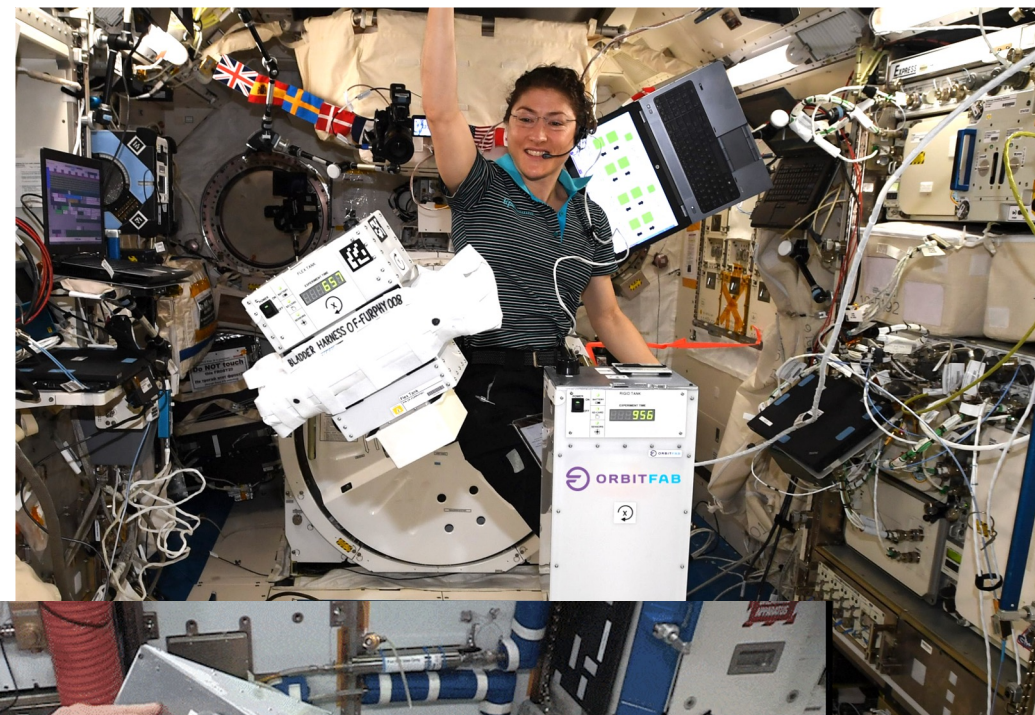


Furphy - Mission Overview

**First Private Company to
Resupply Water to the ISS**

Mission Details

- Launched and tested on ISS in 2018 and 2019
- 4.5 month program from ATP to launch
- 2 tanker test beds testing fluid transfer in orbit: 1 rigid and 1 flexible
- First private company to supply water to the ISS

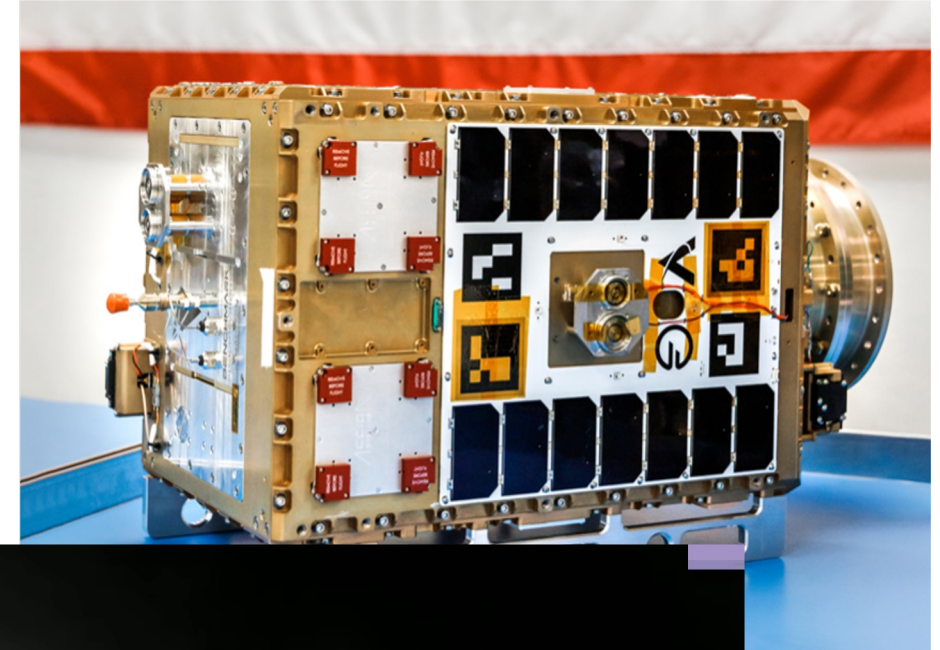


Tanker-001 Tenzing - Mission Overview ORBITFAB Gas Stations in Space™

Demonstrated Ground Operations, Depot Deployment, and Fuel Storage On Orbit

Mission Details

- Launched and deployed Q3 2021
- Operating at 550 km SSO
- 35 kg spacecraft carrying HTP
- Cameras to support RPO risk reduction
- Tank, valves, pressure transducers, RAFTI Block 1 all developed/assembled in house
- 9 months from ATP to launch

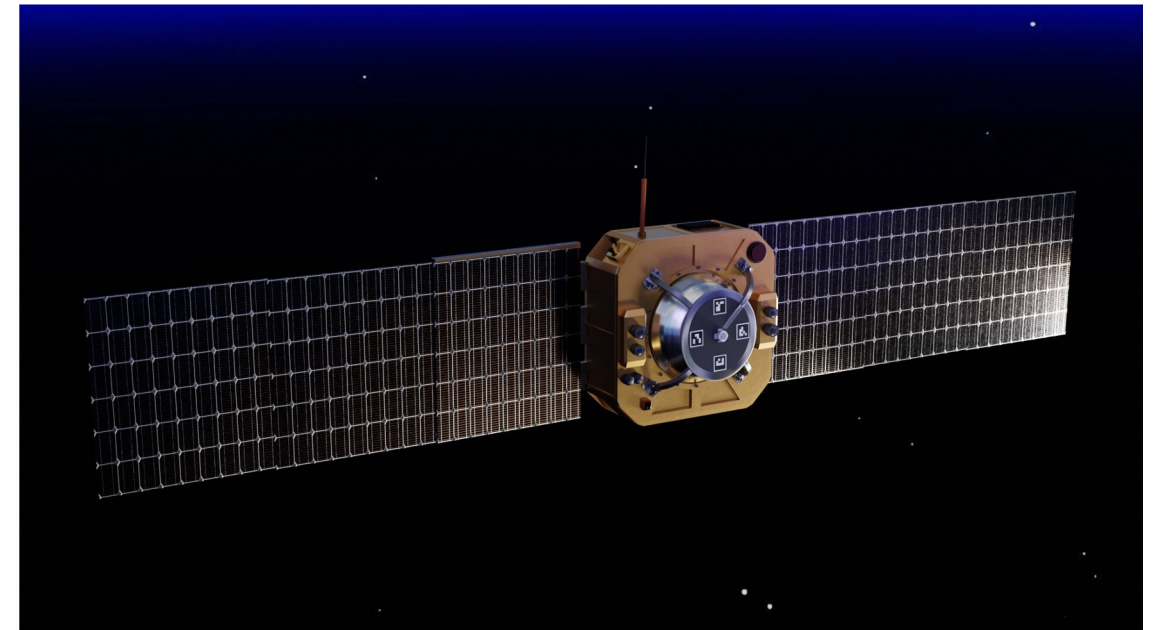
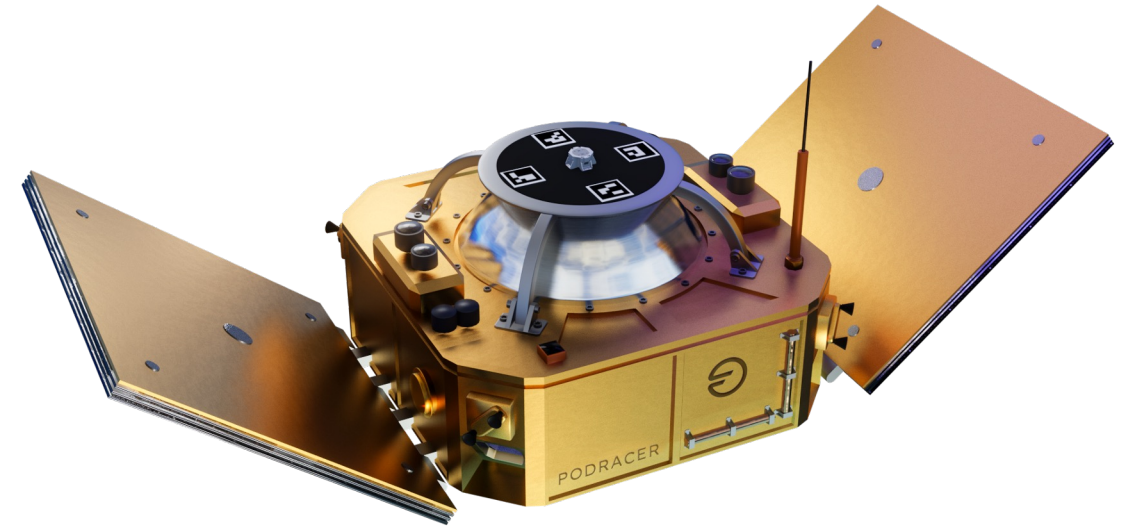


Podracer - Program Overview

Demonstrate Rendezvous and Proximity Operations (within meters)

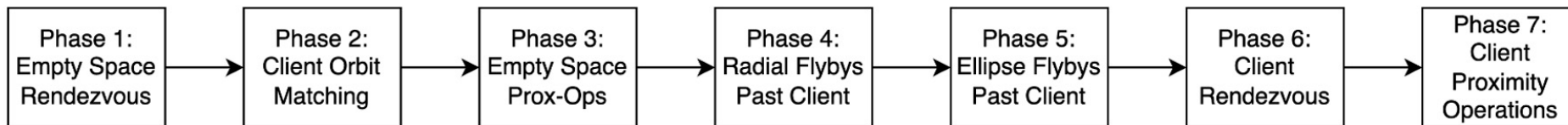
Program Goal: To test on-orbit RPO with a RAFTI-enabled partner in ~same LTAN

- Orbit Fab's Podracer-1 spacecraft is equipped with SPARK (RPOD suite) and 6-DoF hydrazine prop system w/ RAFTI
- Launch: Transporter 10 or 11 (2024)
- Partner spacecraft to be equipped with RAFTI and fiducials (low SWaP)
- Joint spacecraft ConOps could occur post-primary mission objective completion
- Marketing outcome: 2 companies working together to pioneer RPO (and bustling in-space economy)



Furphy (ISS) → Tenzing Depot → Podracer → Astrobees → docking depot...

Podracer conops:



Flows into potential Astrobee mission:

- First in-space docking and grappling between RAFTI and GRIP
- Observe propellant slosh behavior while docked
- Determine grasp envelope in practice
- Determine repeatability of grappling

Astrobees enable all of the above behaviors to be observed and characterized in a controlled microgravity environment, where human input is an option. This allows Orbit Fab to continue lowering technical risk to refueling operations building on Podracer.

Astrobees enable a demonstration of the building blocks of on orbit refueling.

These building blocks can be shown to customers and investors, and increase confidence in Orbit Fab's technical ability to accomplish a successful docking and refueling.

This results in sooner availability of fuel on orbit, lowering operating costs and increasing sustainability of in-space economy.

