

INTER-SATELLITE DATA RELAY SERVICE

WORLD'S FIRST ON-DEMAND REAL-TIME
CONNECTION FOR ANY LEO SATELLITE

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Version 5



THE CHALLENGE OF MANAGING LEO CONSTELLATIONS

Addvalue IDRS offers the solution

- LEO applications utilize large constellations
- Time delay between connectivity intervals is an operational issue, especially for time sensitive tasking and responding to satellite anomalies
- Traditional scheduled high latency T&C communications is not suitable for efficient management of multi-satellite constellations.
- Real-time operational support of these constellations overwhelm current ground control station capacity
- Real-time on demand communications is essential and the space tested Addvalue Inter-Satellite Data Relay Service (IDRS) provides the solution

Real-time connectivity is a new paradigm for commercial LEO satellite missions

OPTIONS FOR REAL-TIME CONNECTIVITY WITH LEO SATELLITES

Current options are not suitable for most applications:

- NASA TDRSS - Not suitable for smaller satellites nor available for commercial and non-US Gov't missions
- EDRS - Not suitable for smaller satellites due to power/mass requirements

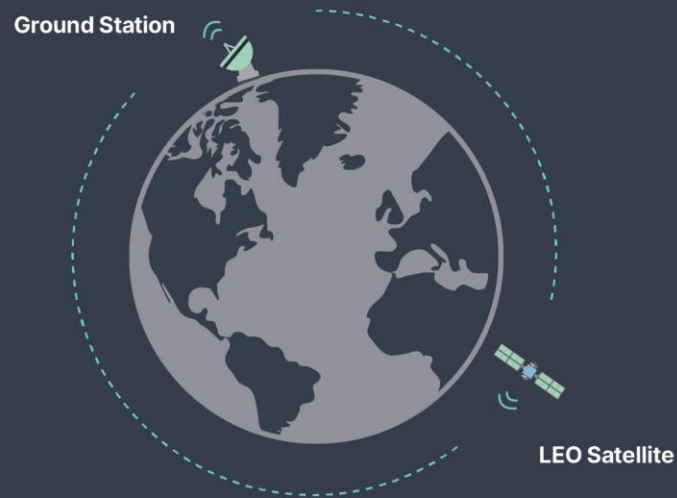
IDRS is often the best solution:

- Addvalue's IDRS is currently the only option for real-time on-demand connectivity
- No other entity has:
 - Space-proven LEO equipment
 - Access to in-orbit GEO space segment for data relay
 - Suitable secure terrestrial communications infrastructure in place
 - Established a record of high-quality service

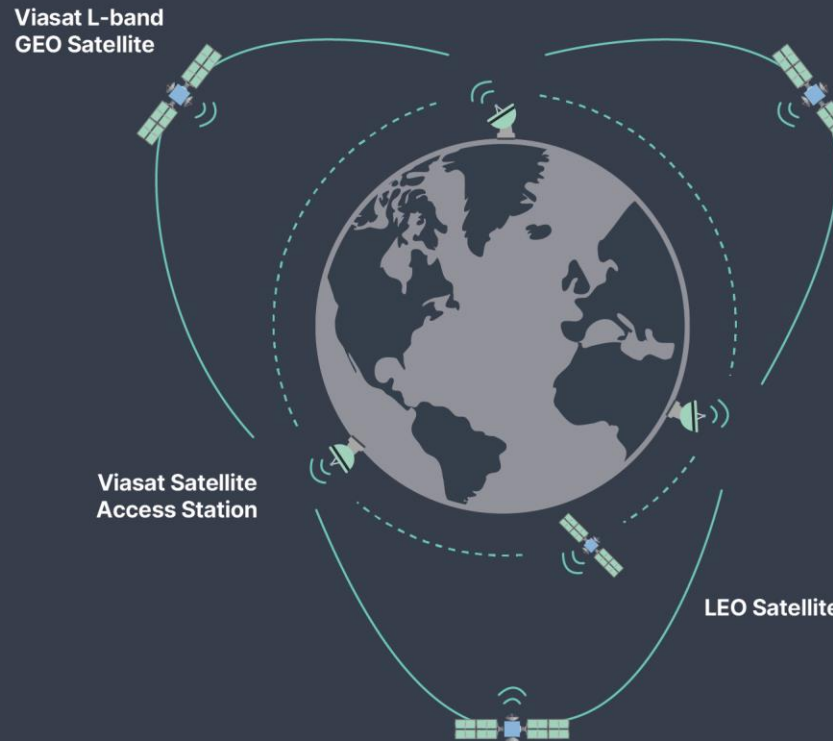
IDRS is ready - space tested and in service NOW

ALWAYS CONNECTED

LEO spacecraft operations have suffered from a limited window of connectivity with their ground infrastructure.



WITH IDRS

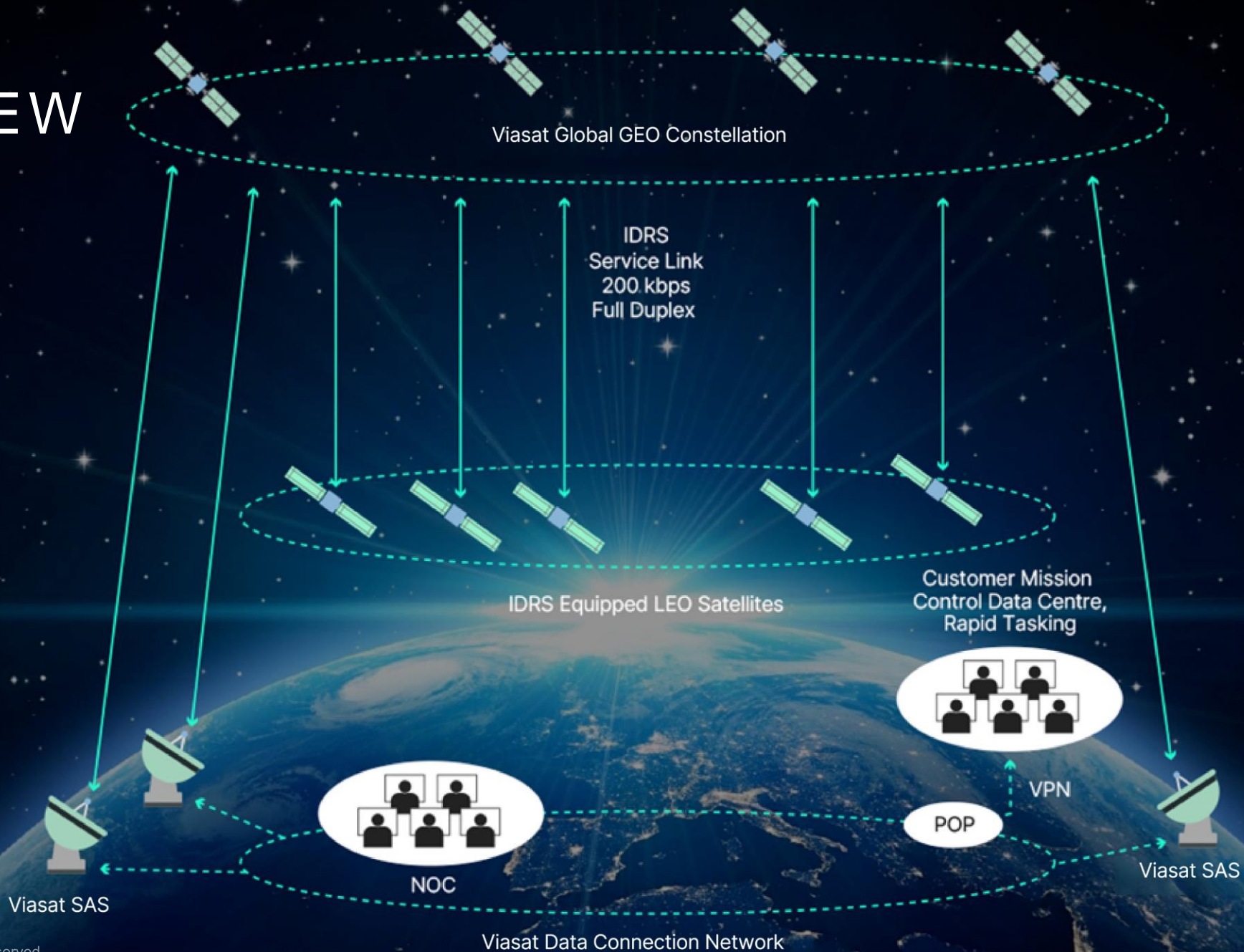


GLOBAL coverage
Builds on Viasat L-band constellation

GLOBAL connectivity
Builds on Viasat ground infrastructure

Communicate with your LEO satellites up to 99% of the orbit

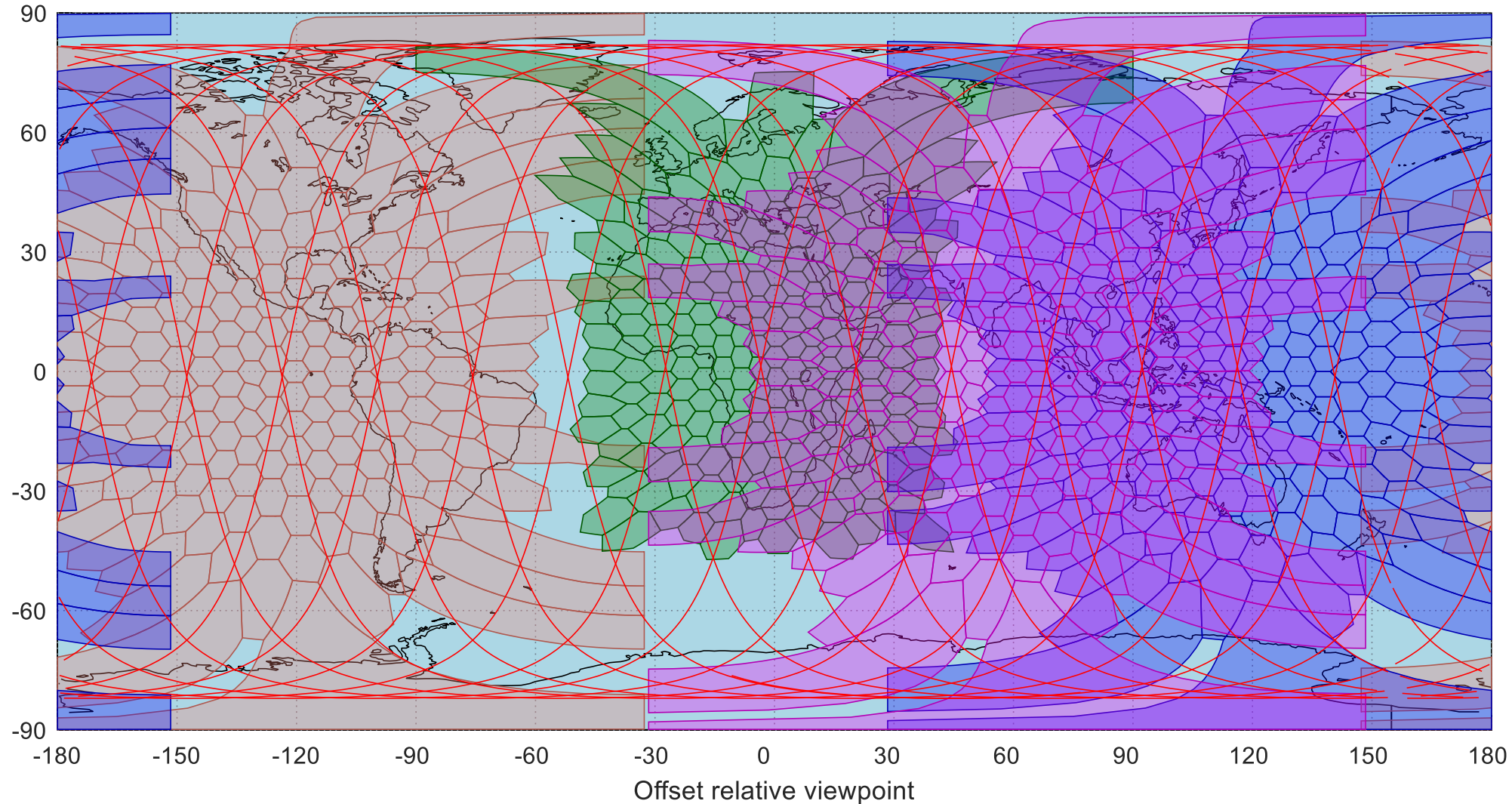
SYSTEM OVERVIEW



SERVICE COVERAGE

Provided by the Viasat GEO constellation:

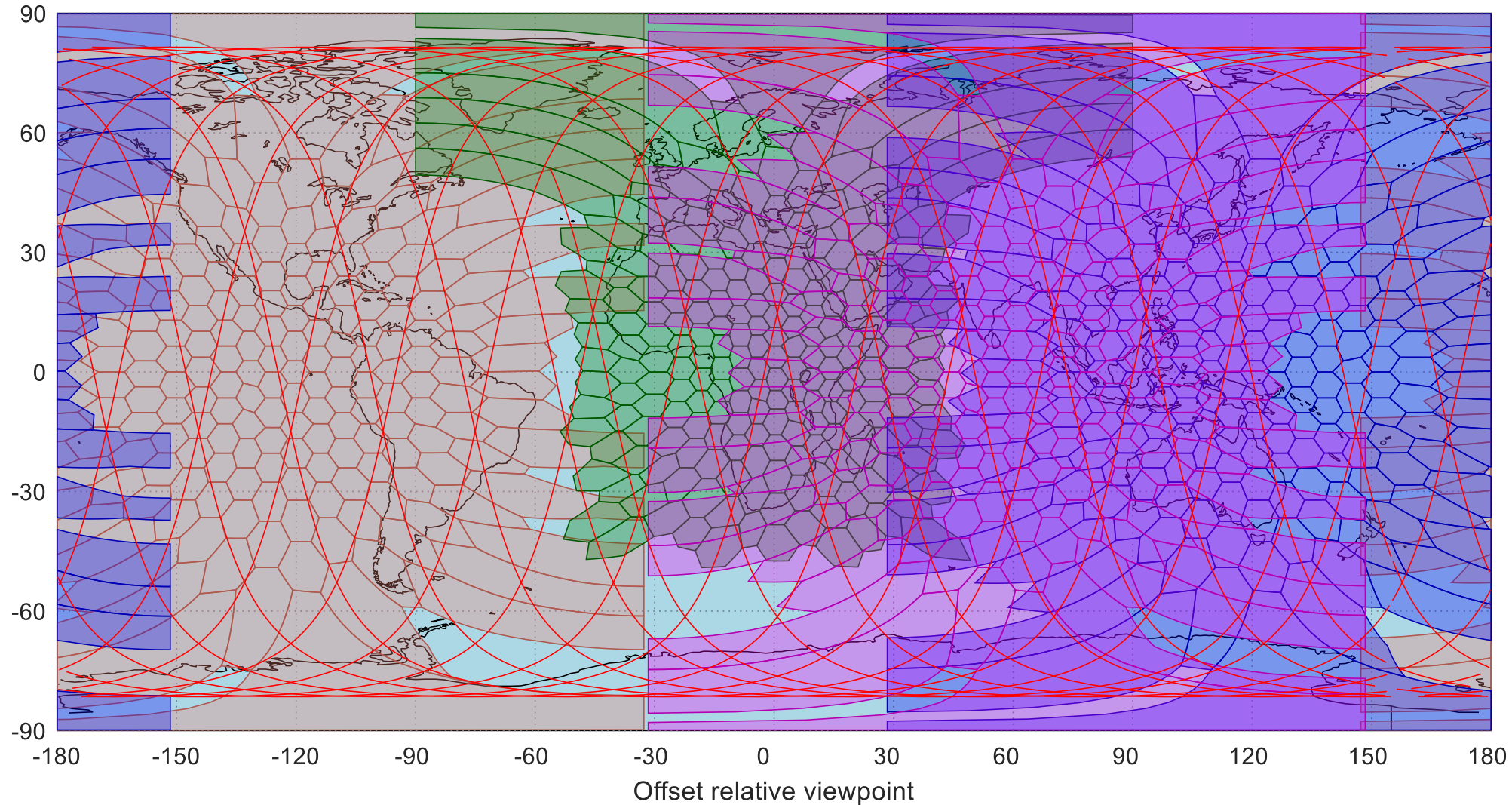
- GEO Orbital Slots:
 - I4-F3:
AMER@98W,
 - Alphasat:
EMEA@25E,
 - I6-F1:
IOE@83.5W,
 - I4-F2:
APAC@143.5E,
- **Orbital altitude 550 km (LEO)**
- SSO illustrated



SERVICE COVERAGE

Provided by the Viasat GEO constellation:

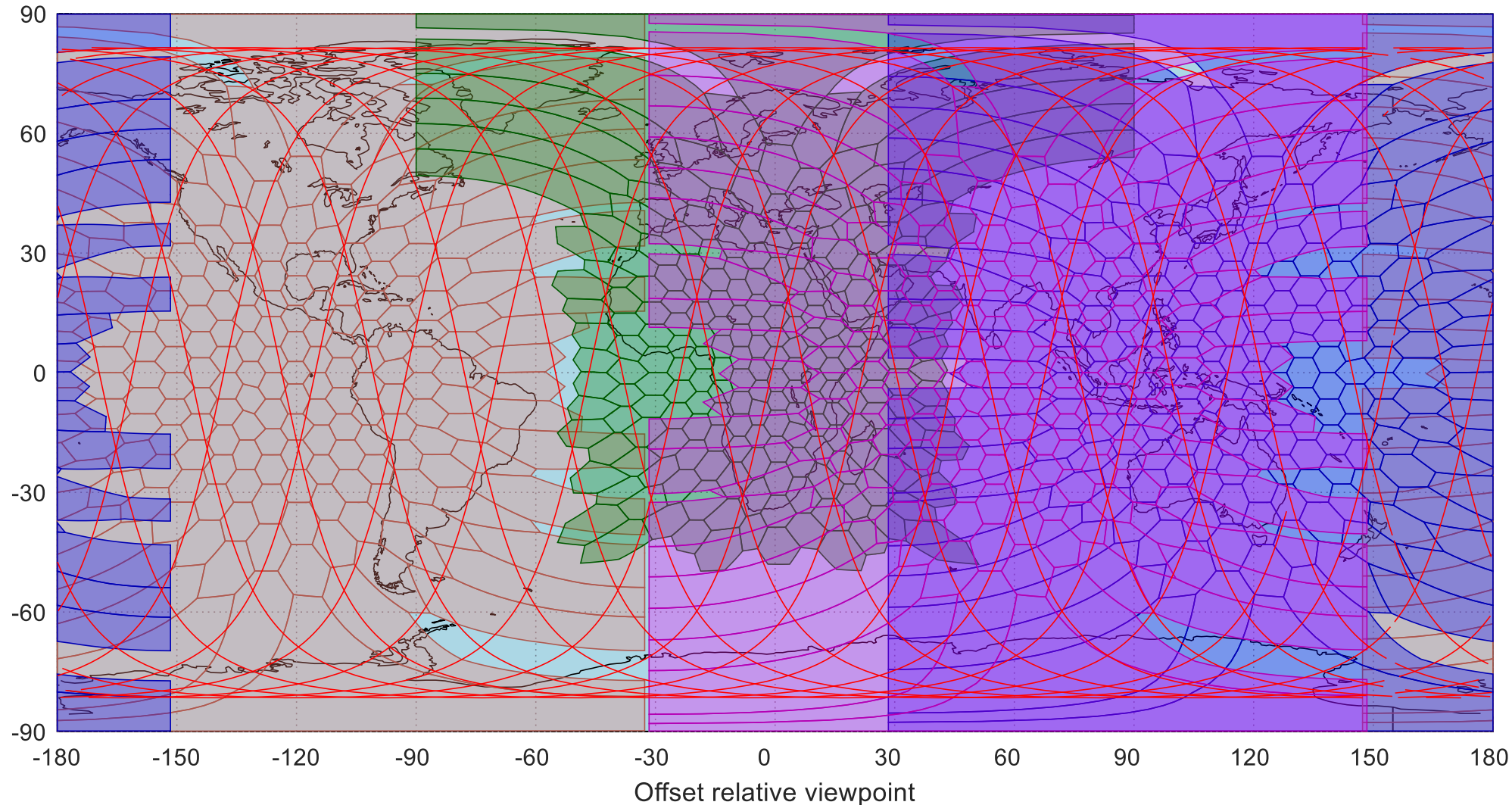
- GEO Orbital Slots:
 - I4-F3:
AMER@98W,
 - Alphasat:
EMEA@25E,
 - I6-F1:
IOE@83.5W,
 - I4-F2:
APAC@143.5E,
- **Orbital altitude 400 km (LEO)**
- SSO illustrated



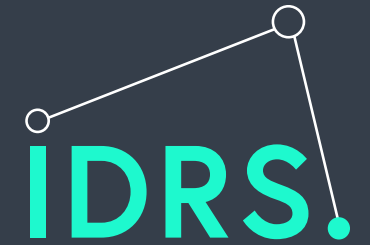
SERVICE COVERAGE

Provided by the Viasat GEO constellation:

- GEO Orbital Slots:
 - I4-F3:
AMER@98W,
 - Alphasat:
EMEA@25E,
 - I6-F1:
IOE@83.5W,
 - I4-F2:
APAC@143.5E,
- **Orbital altitude 350 km (VLEO)**
- SSO illustrated



IDRS Connection Characteristics



- **Always On**
 - Continuous connectivity with the LEO satellite
 - No charge for connectivity – customers subscribe to a Data Plan for transferring data between the LEO satellite and ground
- **IP session continuity during rapid spot beam handovers**
 - Spot-beam handover frequency every 2-3 minutes
 - No IP session interruption during spot beam handovers
 - Short interruption for ~20 sec during handovers between GEO satellites.
- **Latency: 0.5 – 1.5 seconds end to end**
- **Secure end-to-end links compatible with user defined encryption**
- **High availability / reliability provided by the Viasat L-band network**
 - Network availability better than 99.95% (dual gateway redundancy)
 - Link budget availability better than 99% (rate adapted air-interface keeps minimum link margin)

Continuous Communications with LEO satellites

IDRS infrastructure is in place, operational and fully space-tested

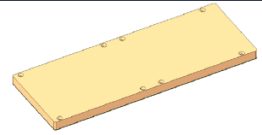
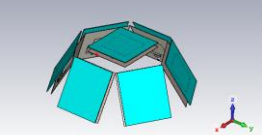
- **Secure “always-on” real-time 24/7 data communications links to LEO satellites**
- **Network maturity** – Leverages off the in-orbit, proven and highly reliable plus secure Viasat L-band satellite constellation with its global ground network.
- **A Viasat managed service** – IDRS is certified and space qualified for interworking with the Viasat global BGAN network
- **Space Heritage**
 - Utilizes a space-borne equipment suite that has been validated since 2015, and in commercial service operation since 2020
 - Currently 22 operational satellites with IDRS onboard; over 50 additional IDRS terminals in the hands of clients, in preparation for launch.
- Specifically designed to support the operation of multi-satellite LEO constellations
- Is globally available now to commercial, scientific and government LEO satellites
- Has an economically sound and affordable total cost of ownership

Addvalue has been delivering space-qualified IDRS equipment since 2020

Continuous Communications With LEO Satellites – In More Details

- **Mobile IP router:** Each IDRS terminal functions as an IP router with its own static and private IP address
- **Support of IP LAN onboard the satellite:** The IDRS terminal can interface to an IP LAN onboard the satellite and support independent IP sessions between the ground and the computers, edge processors and sensors onboard the satellite.
- **Full Duplex IP:** Can exchange IP data in both uplink and downlink simultaneously and independently.
- **Always-on connectivity:** Once switched on, the IDRS terminal registers to the Viasat BGAN network and stays always connected while within the footprint of the Viasat L-band GEO satellite.
- **Subscription based data service:** The IDRS customer doesn't pay per contact – IDRS offers a monthly subscription, just like a mobile phone monthly data plan.
- **Constellation Data Plan:** Giving operators the flexibility to share the monthly data between the satellites in the constellation, just like a “family plan” in the mobile phone world.
- **No more reservations, no more scheduling:** At any given time, the operator can send data to the satellite using the IP protocol. Independently, at any given time the satellite computers, edge processors and sensors can send data to the ground using the IP protocol.
- **Full versatility of Mobile IP networking in space:** The IDRS terminal can connect to any IP address on the ground or in space, depending on the application.
 - Supporting both connectivity with the ground, and ISL with other satellites – all via the Viasat BGAN network (no need for line-of-sight).

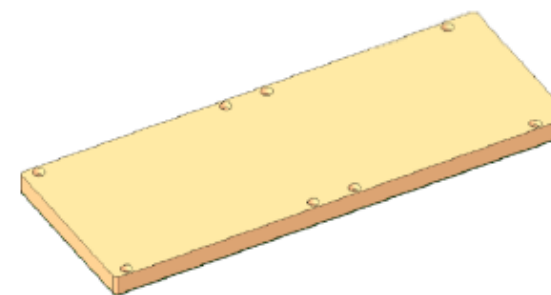
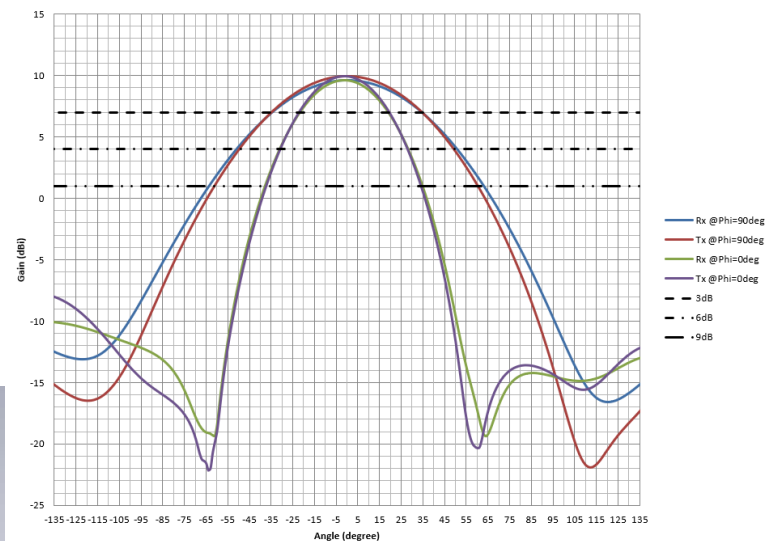
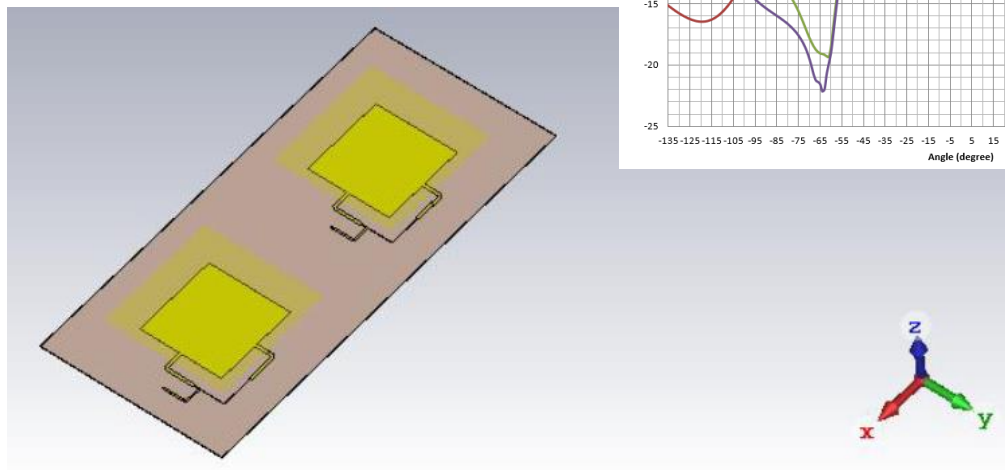
IDRS SPACE QUALIFIED TERMINAL OVERVIEW

Antenna Type	Directional	Hemispherical
Antenna Dimensions	Patch Ant. 200mm x 100mm	7 Segment Antenna. 150mm x 270mm Mounted on anti-nadir face or side panels
Transceiver type	i100 (1U)	
Transceiver Dimensions	125 x 96 x 70 mm ³	
Transceiver Weight	< 1Kg	
Antenna Design		
Antenna Weight	<150g	<2.8kg

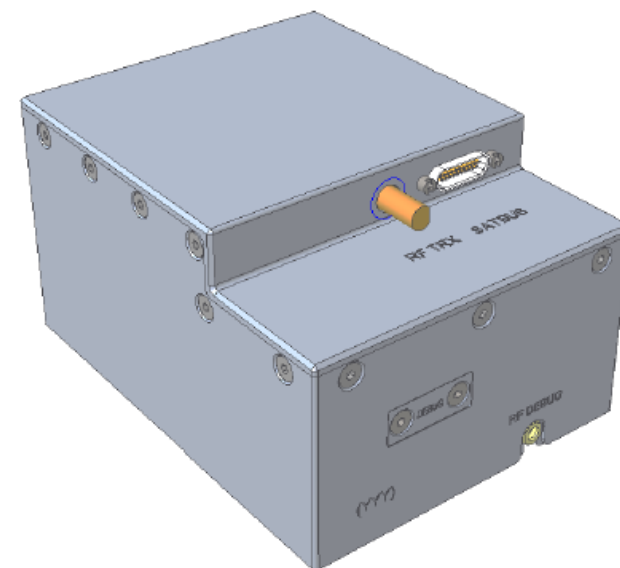


i100 transceiver

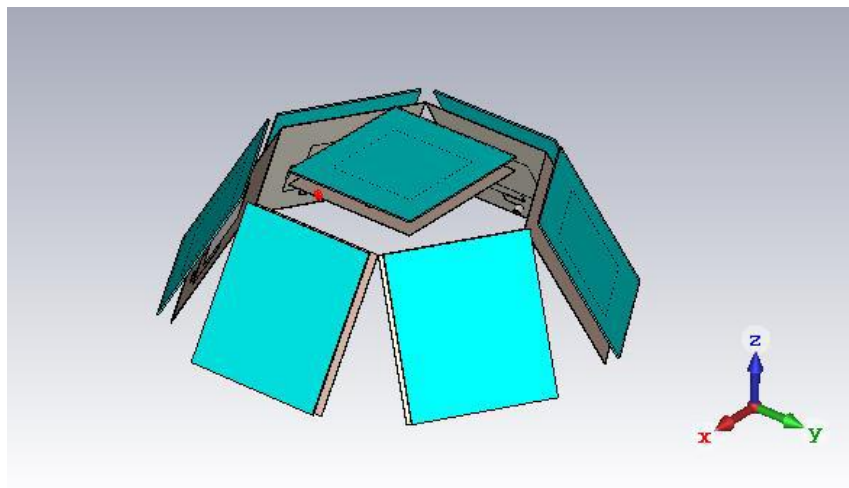
DIRECTIONAL ANTENNA SOLUTION



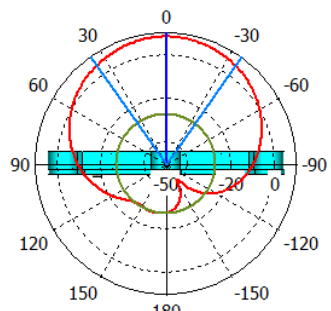
(Top Isometric View)



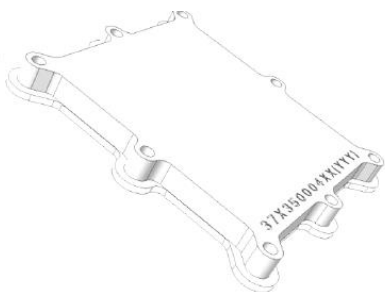
HEMISPHERICAL ANTENNA SOLUTION



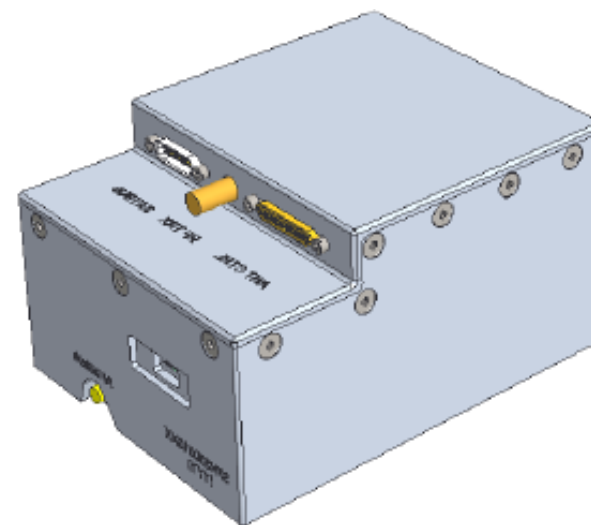
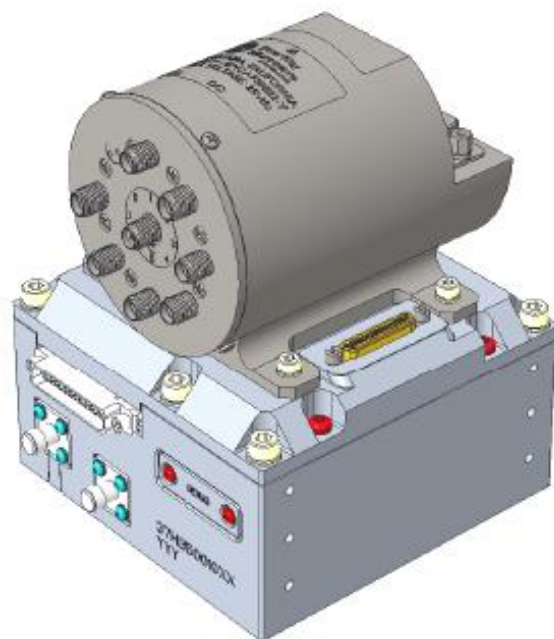
Farfield Realized Gain Right Polarisation (Phi=0)



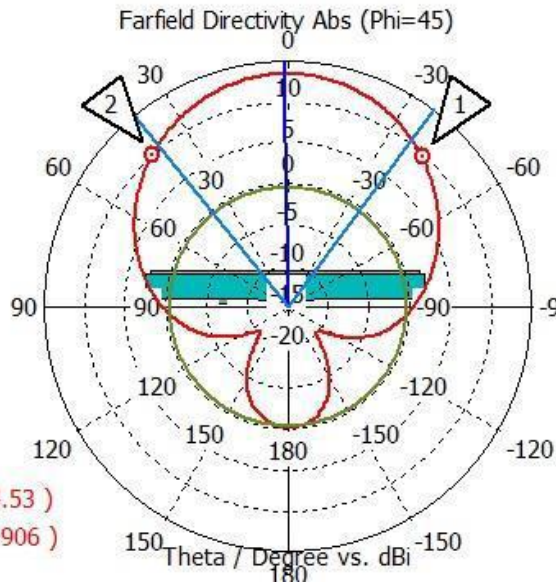
Theta / Degree vs. dBi



Main lobe magnitude = 8.11 dBi
Main lobe direction = 0.0 deg.
Angular width (3 dB) = 70.5 deg.
Side lobe level = -35.2 dB

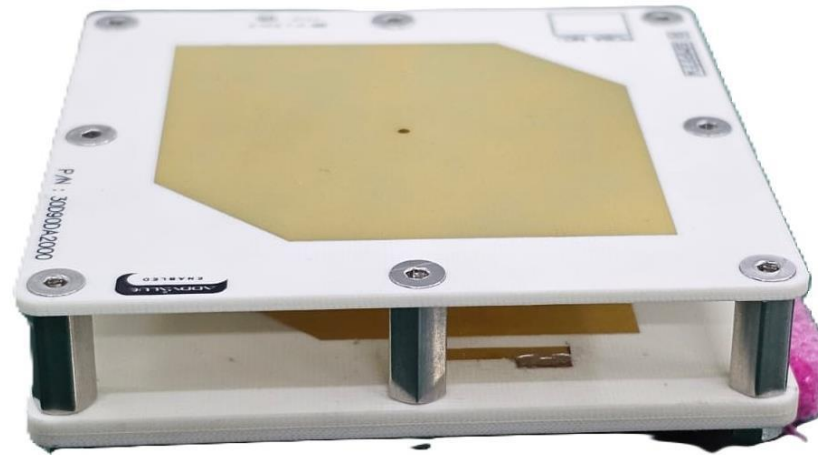


IDRS-G2 Omni Solution



Omni operation:

- 5° to 90° elevation



Omni antenna:

- Volume: 1.68 x 8.0 x 8.0 cm
- Mass: 100 g

Transceiver:

- SDR based
- Volume: 3.52 x 9.6 x 9.6 cm
- Mass: < 600 g
- High dynamic range rate adaptation
- Integrated power saving mode



IDRS APPLICATIONS & BENEFITS

Global, real-time and 24/7/365 data relay service to LEO satellites in support of TT&C, Tasking and Mission Data downlinking

Real-time Constellation Management

- “Always-On” connectivity
- Real-time TT&C and management of anomalies to extend LEO satellite life

Real-time Tasking

- Updating of LEO tasking plan in real time
- Shortens time between image order and delivery
- Surveillance, EO missions

LEO asset management on the move

- Real-time, on-demand management of LEO assets directly from maritime, land, and aeronautical vehicles (native IP-based mobile to mobile connectivity)

Real-time delivery of mission data and “alert” messages to ground

- Satellite-originated “alerts” based on real-time response to time critical observed events using edge processing
- Real-time delivery of low volume, high value data: e.g., NB-IoT, weather “now-casting”, situational awareness data (AIS, VDES, ADS-B), “thumb-nail” image delivery in surveillance applications
- Coordinated Tip & Cue missions among clusters of formation flying satellites
- Responsive space



Customer's Perspective – Capella Space

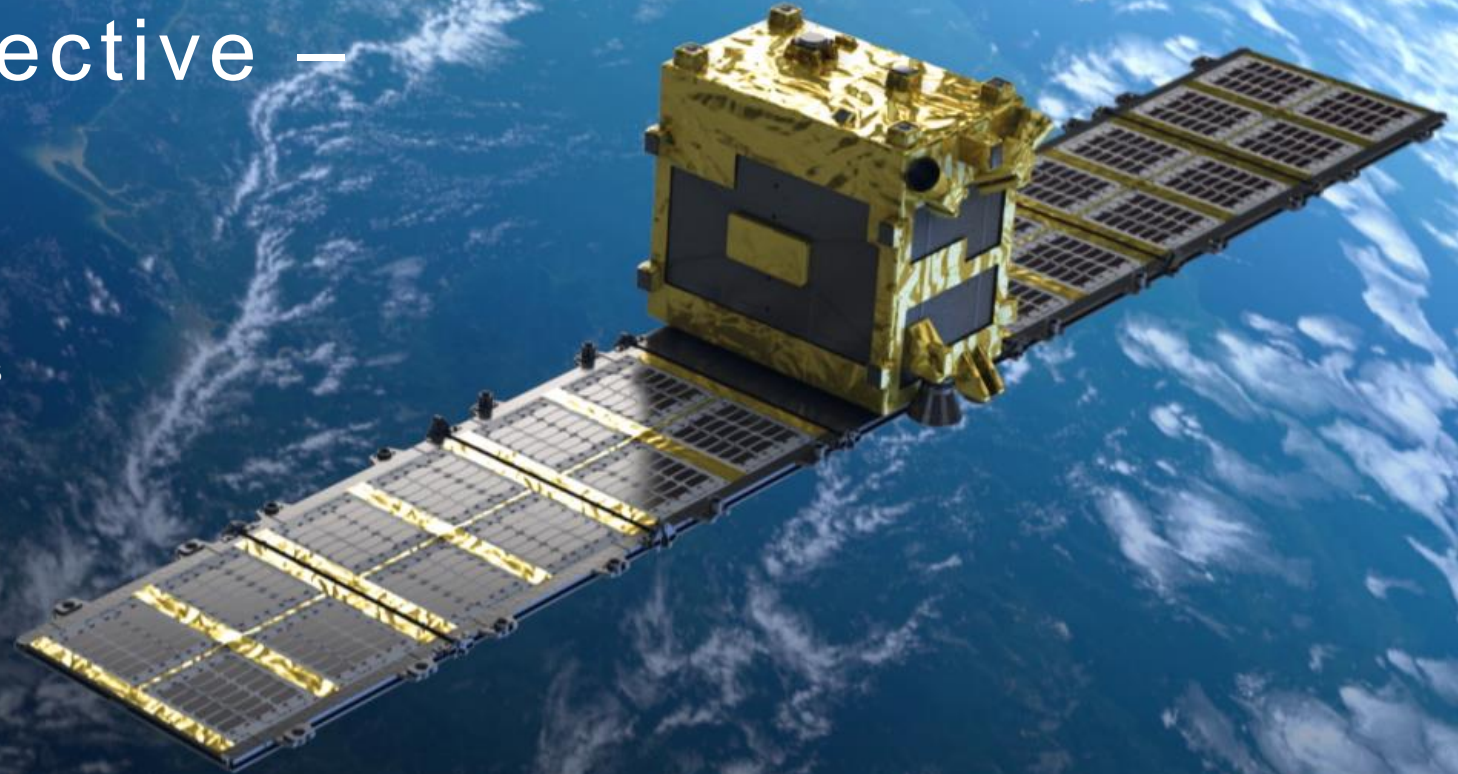
Mission & Use Case

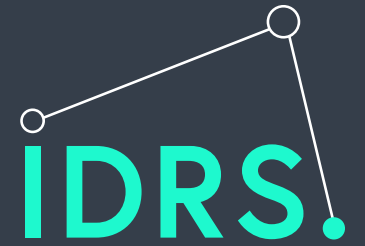
- A Commercial SAR Constellation offering < 50 cm image resolution.
- Capella satellites have been equipped with IDRS since the first launch in 2020 – 12 operational satellites launched so far.
- Working with Capella provided IDRS with significant operational expertise and space heritage.
- “Always On” constellation management – TT&C, Anomaly detection and response.
- Real-Time Constellation tasking by IDRS enables rapid IMAGE collection and delivery.

Customer's Perspective – Synspective

Mission & Use Case

- SAR Satellites provide 24-hour all weather earth observation and generate data analytics and solutions focusing on disaster risk management and disaster resilience.
- IDRS™ enhances and optimizes the operational efficiency of the Synspective constellation – minimizing system response times to enhance crisis management.
- “Always On” constellation management – TT&C comms, anomaly identification and response.
- Real-Time Constellation tasking by IDRS enables rapid IMAGE collection and delivery.

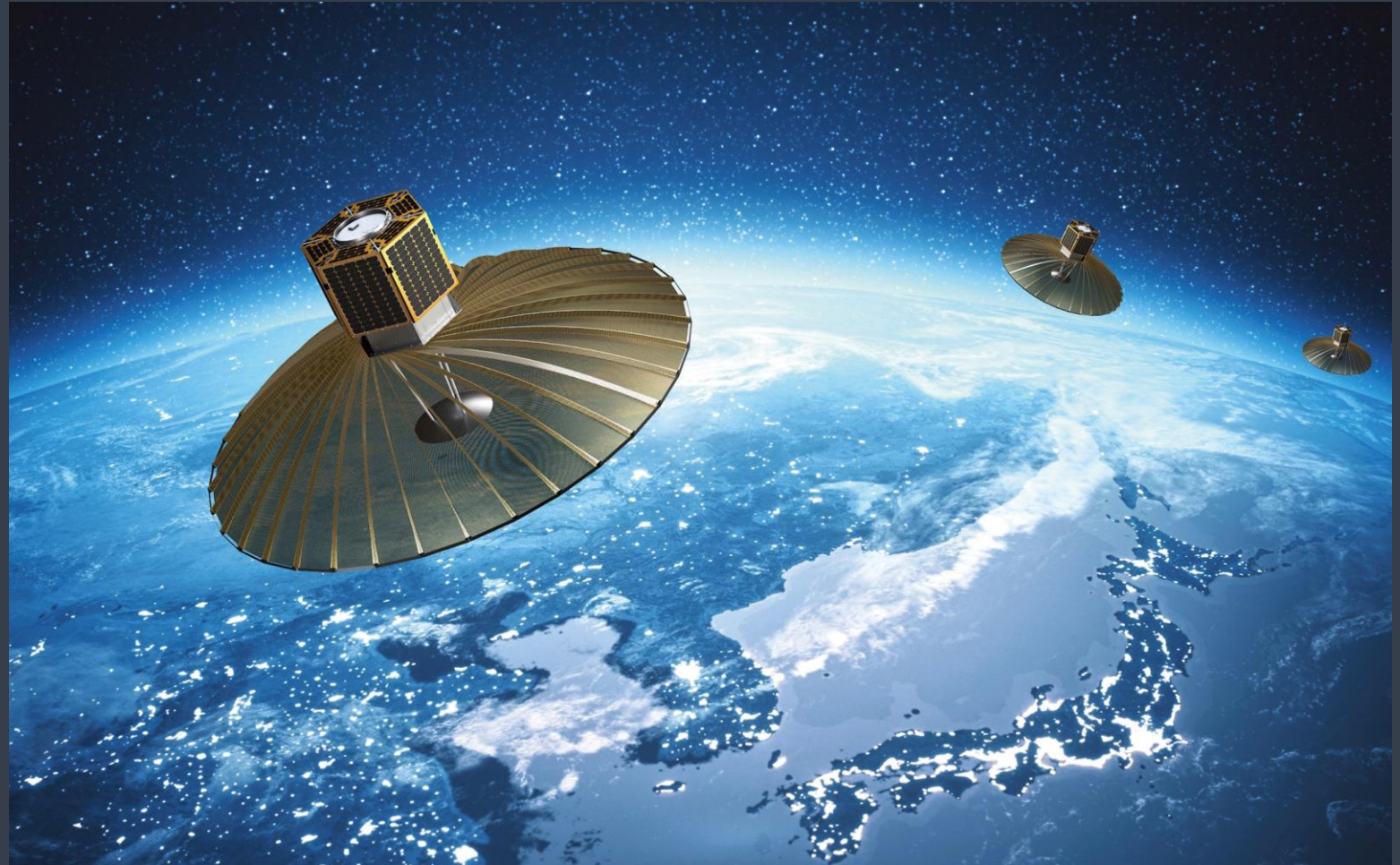




Customer's Perspective – iQPS

Mission & Use Case

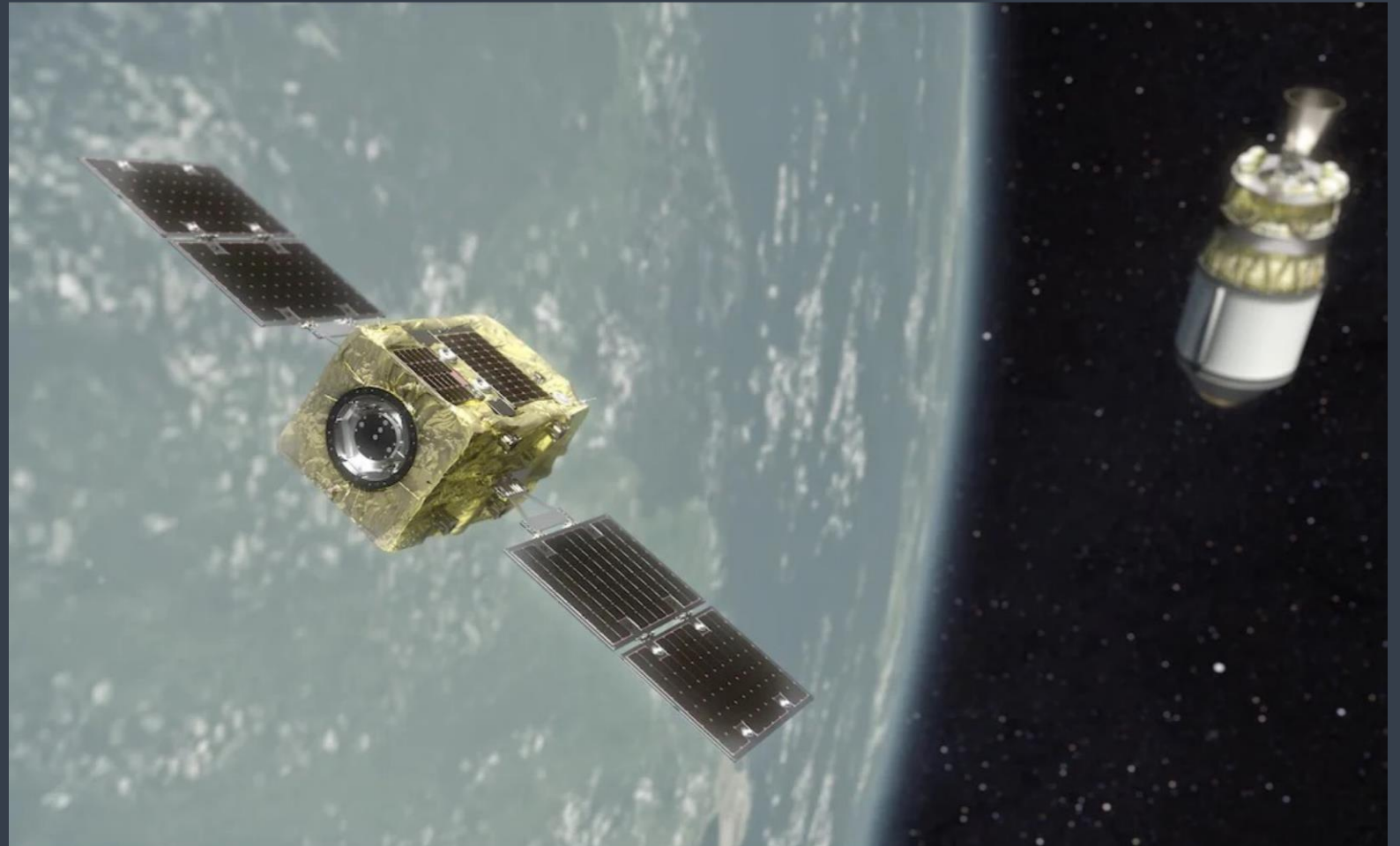
- SAR images with the world's best-in-class resolution and image quality
- First iQPS satellite with IDRS since 2023
- Aims to establish a 36-QPS-SAR satellite constellation that will enable observation almost anywhere in the world at an average 10-minute interval
- “Always On” constellation management – TT&C comms, anomaly identification and response.
- Real-Time Constellation tasking by IDRS enables rapid IMAGE collection and delivery.



Customer's Perspective – **Astroscale**

Mission & Use Case

- End-of-Life Services by Astroscale (ELSA-M) debris satellite capture and removal mission.
- IDRS will provide continuous real-time connectivity during proximity manoeuvring to capture the Client satellite and ready it for de-orbiting.



Customer's Perspective – Loft Orbital

Mission & Use Case

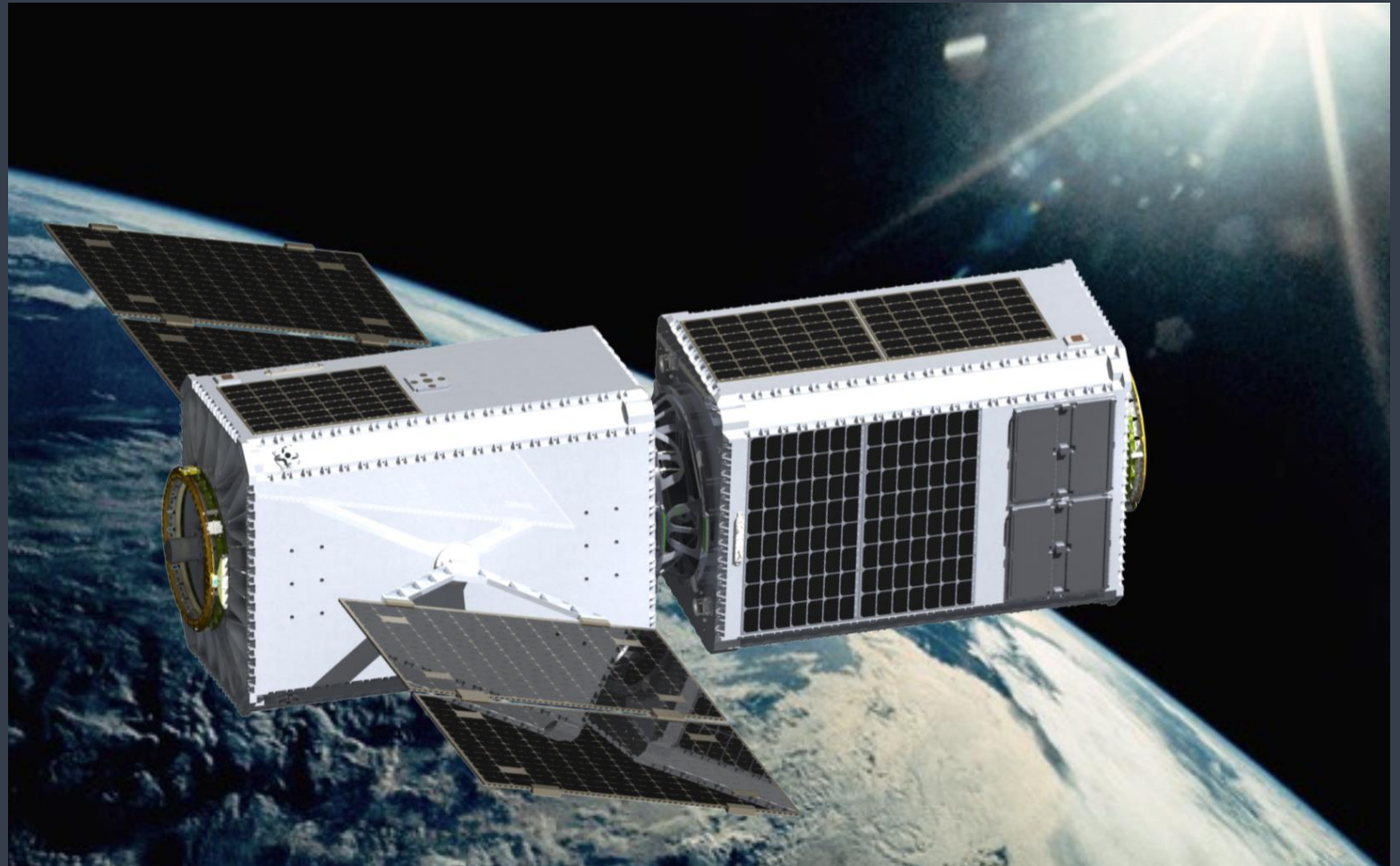
- Loft Orbital offers a ground-breaking 'Space Infrastructure As a Service'
- Partnered with Addvalue to offer Always-On end-user access to connectivity through IDRS
- IDRS provides Loft Orbital's customers with constant connectivity to their missions, allowing them to benefit from real-time tasking, increased responsiveness, highly secure data collection and a wider range of tactical and real-time use cases

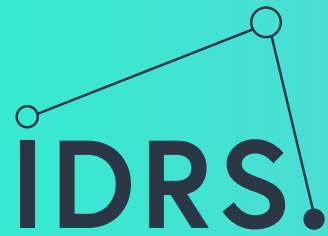


Customer's Perspective – Atomos Space

Missions & Use Case

- Deploy a fleet of Orbital Transfer Vehicles (OTVs) that will serve the growing space economy by delivering satellite operator assets precisely to their needed slot in orbit.
- By equipping orbital transfer vehicles with IDRS 'Always On' command and control connectivity, Atomos will be able to safely perform its mission-critical precision rendezvous and proximity operations.
- real-time constellation management, and for mission-critical precision rendezvous and proximity operations.
- The need for Atomos to remain in close contact with its orbital transfer vehicles during the critical phase when docking with customers, makes Addvalue's IDRS™ data relay technology the perfect fit





THANK YOU

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POWERED BY



DEVELOPED BY



CONNECT.
COMMAND.
CONTROL.