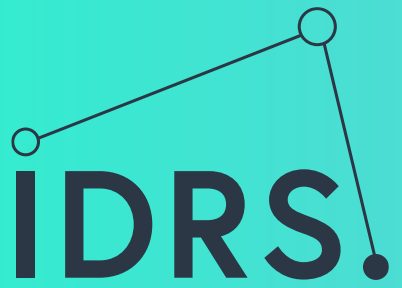


Data Relay Services for Delivering Always-On / On-Demand Connectivity to LEO Satellites

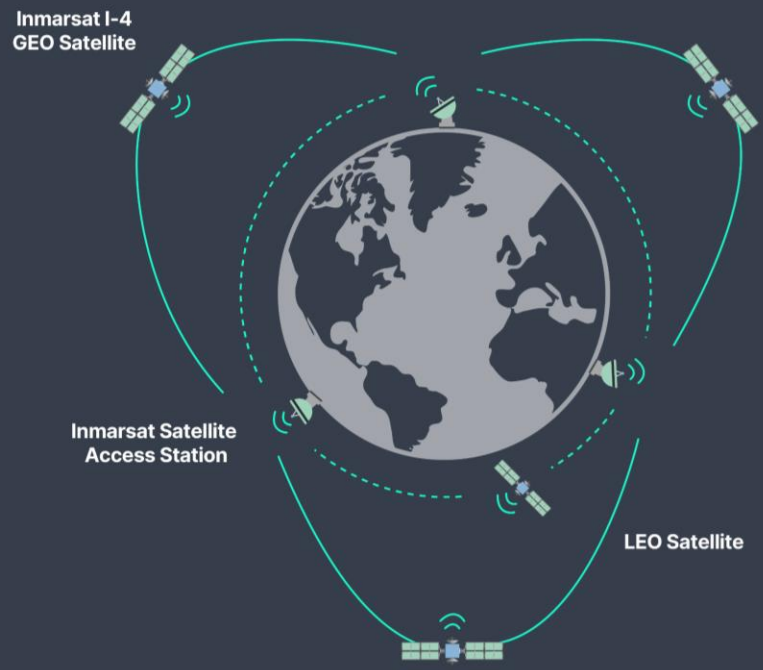
Powered by Inmarsat, Developed by Addvalue

Eyal Trachtman

ALWAYS CONNECTED

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

WITH IDRS



GLOBAL coverage
Builds on use of Inmarsat I-4 constellation at L-band, complemented by the I6-F1 and I6-F2 satellites

GLOBAL connectivity
Builds on mature, secure and highly reliable Inmarsat BGAN ground infrastructure

Communication with your LEO satellite is up to 99% of the orbit

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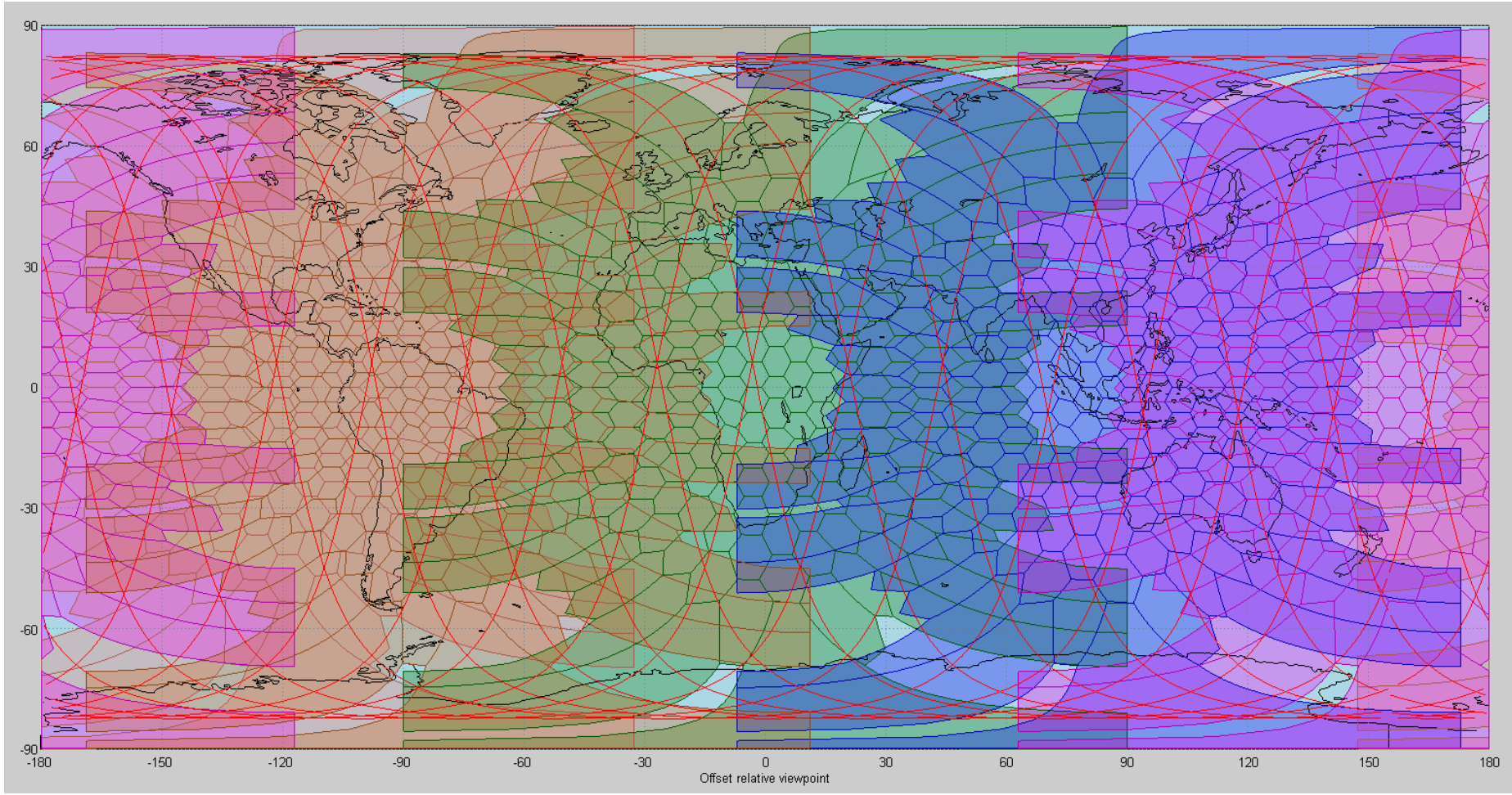
SERVICE COVERAGE

Inmarsat Constellation from 2023:

- I-4 constellation + 2x I-6
- LEO satellite at SSO, altitude 500 km (illustrated in red)



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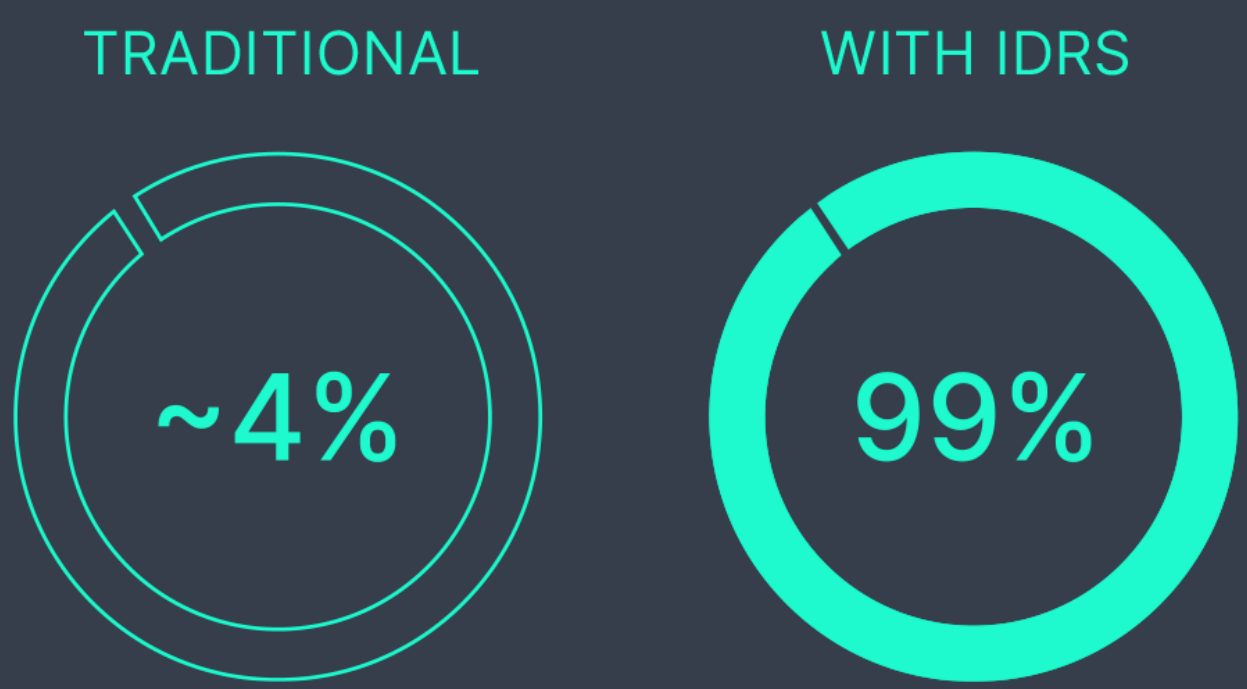
ALWAYS CONNECTED

Addvalue's IDRS solution is

THE WORLD'S FIRST
communications system relayed through a GEO satellite constellation system for commercial Low Earth Orbit ("LEO") satellite operators



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GLOBAL LEADER IN MOBILE SATELLITE COMMUNICATIONS

Addvalue has partnered with Inmarsat to deliver real-time connectivity to LEO satellite customers via IDRS

POWERED BY inmarsat

Fully-funded

Financially strong FTSE 250 status

Global

Seamless coverage and in-orbit redundancy

Reach

Global distribution network

Multi-band

L-,S-,Ka-, Mil-Ka band capabilities

Breadth

Unrivalled product and service range

99.9%

Reliability over our secure satellite and ground network

Security

Highly secure networks

Mobile

A network specifically built for mobility

Fleet Features

- Four in-orbit geostationary L-band satellites providing global communications coverage with proven resilience
- $2 Billion plus invested in I-4 constellation and BGAN ground network
- Only GEO L-Band operator providing global coverage – this is essential for on-demand communications with LEO satellites
- Committed to continued provision of L-band satellite service well into 2030's with the I-6 next generation of L/Ka-band satellites.

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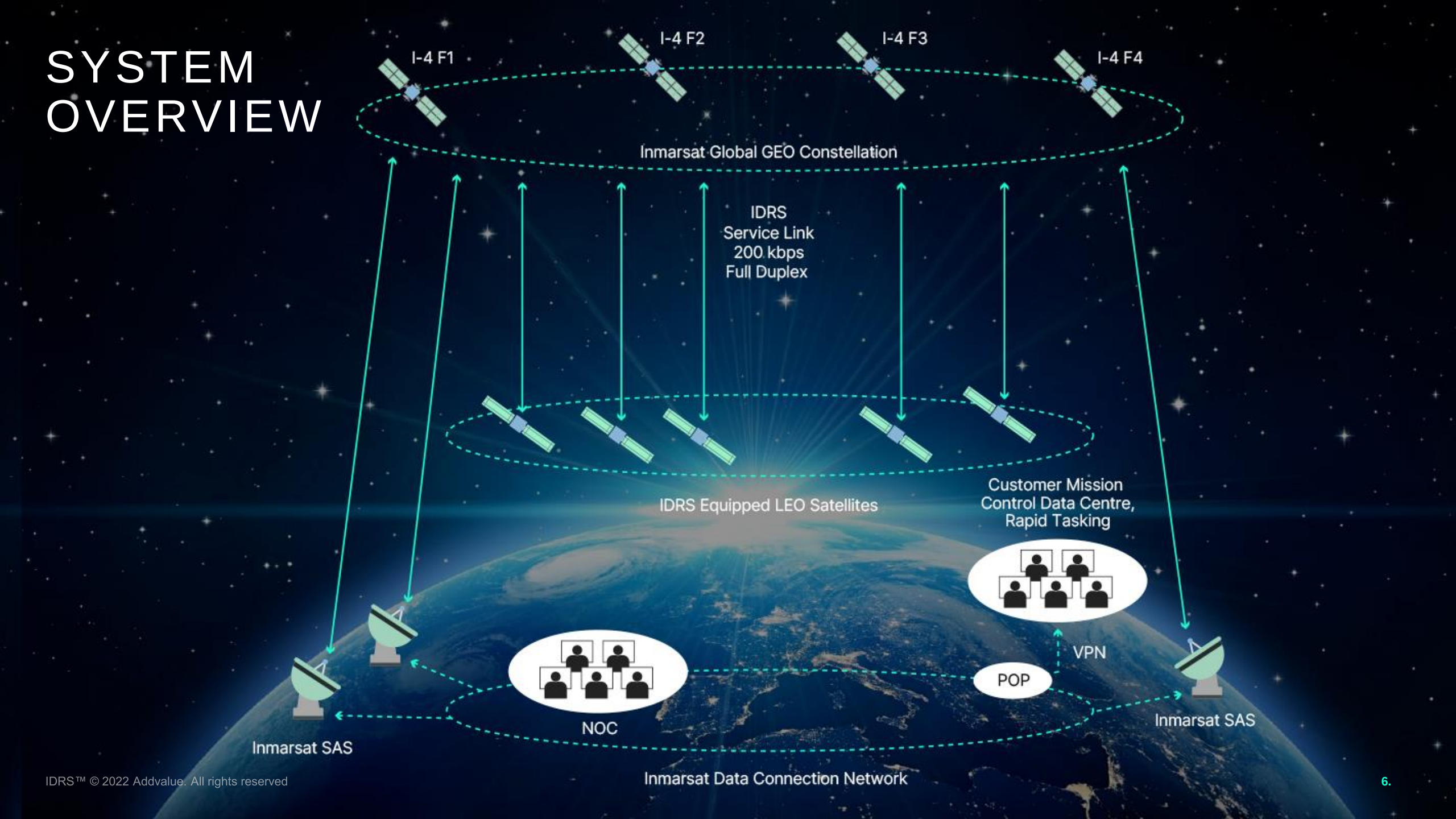
Proprietary & Confidential

SYSTEM OVERVIEW



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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 BGAN communications network**
  - Network availability better than 99.95% (dual gateway redundancy)
  - Link budget availability better than 99% (rate adapted air-interface keeps minimum link margin)
- **Coverage varies with LEO orbital altitude and inclination**

Heritage: Commercial Service Operation since August 2020

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IDRS APPLICATIONS & BENEFITS

Global, real-time and 24/7/365 data relay service to LEO satellites in support of TT&C, Tasking, Key-holing, 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 BGAN mobile to mobile connectivity)

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

- Supports missions that need satellite-originated connectivity on-demand and in real-time
- Satellite-originated “alerts” based on real-time response to time critical observed events
- Surveillance missions, Defence missions (responsive space)
- Real-time delivery of low volume, high value data: e.g., NB-IoT, weather “now-casting”, situational awareness data (AIS, VDES, ADS-B)
- Coordinated Tip & Cue missions among clusters of formation flying satellites

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Capella Space

IDRS

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 – currently 7 satellites in orbit.
- 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.

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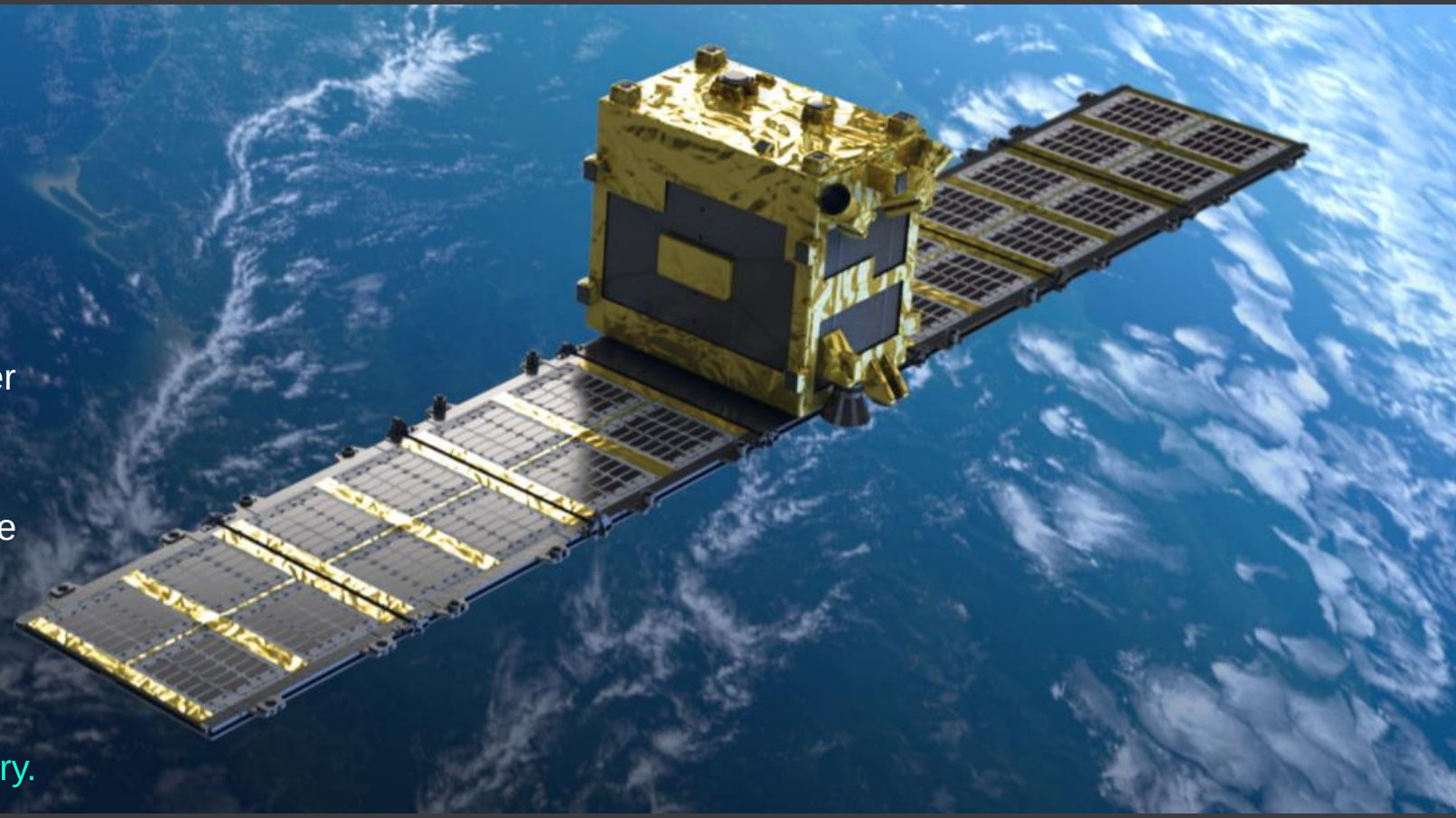
Synspective

IDRS

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.



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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

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HEDRON

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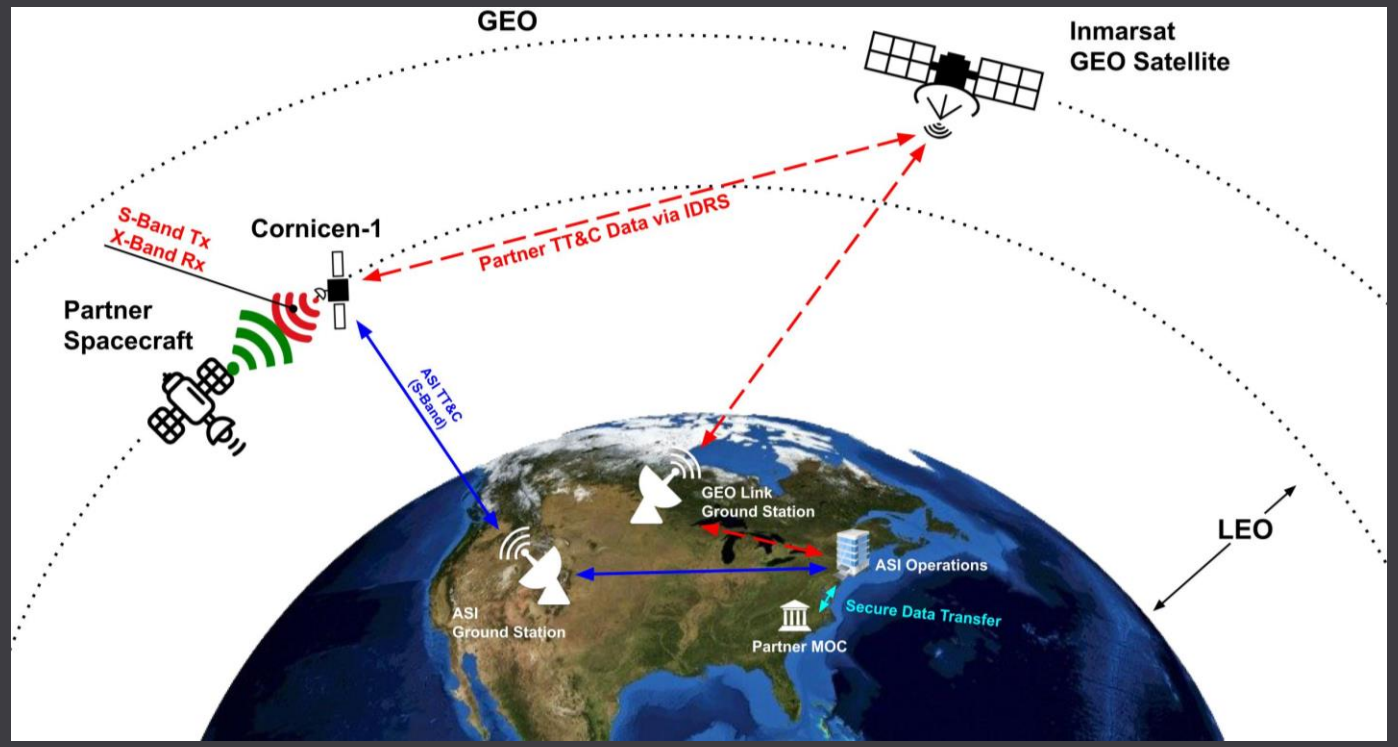
Customer's Perspective – **Hedron**



Mission & Use Case

- Building a Data relay network for remote sensing satellite Operators
- High Speed Hybrid Optical / RF Crosslinks and optimal data routing
- IDRS provides Always-On link to enable around the clock TT&C and tasking of critical EO satellites
- IDRS enables critical Hedron fast *pixel network* assets to be accessed when they are needed most

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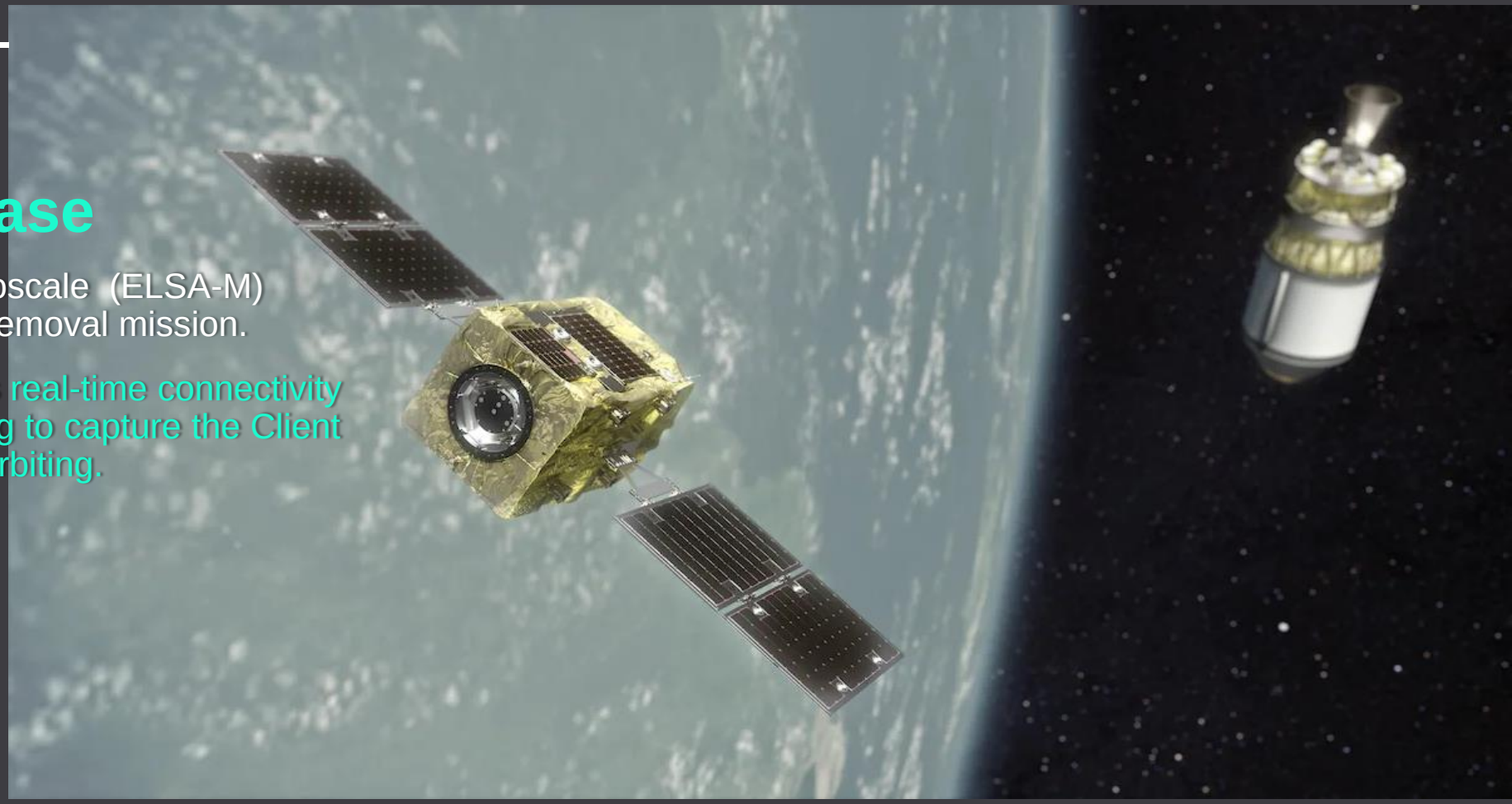
Customer's Perspective – Astroscale

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.



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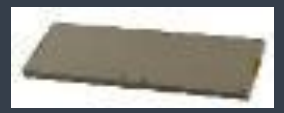
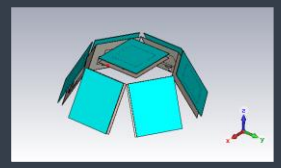
IDRS SPACE QUALIFIED TERMINAL OVERVIEW

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 mm³**	
Transceiver Weight	**< 1Kg**	
Antenna Design		
Antenna Weight	<150g	<2.8kg

i100 transceiver

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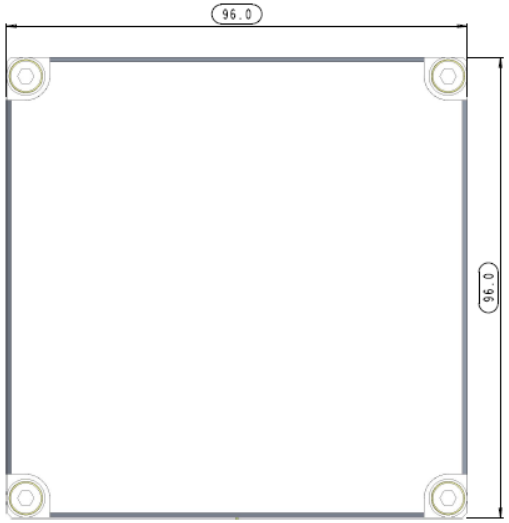
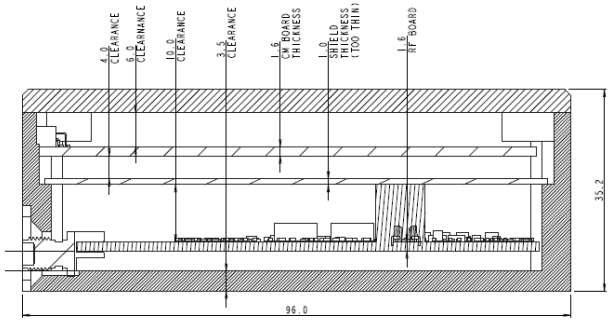
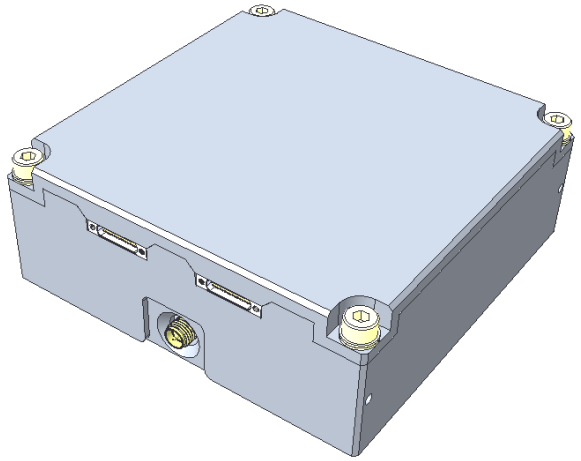
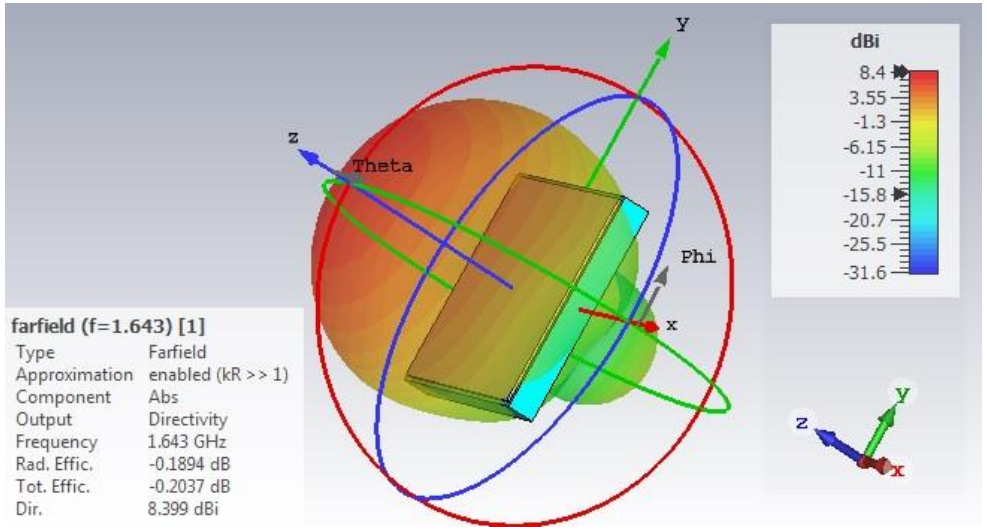
Next Generation IDRS Transceiver

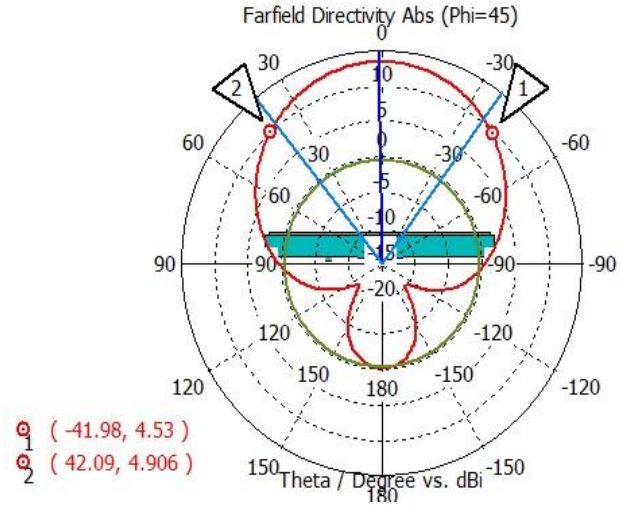
Compact form factor at less than 0.35U, 350g











Added Omni-Antenna option:

A patch Antenna with wide coverage to include low elevation <20deg

InCommand – A Future Contact-Based Data Relay Service

In Technology Validation Stage

- Based on dynamic “contact” allocation of L-band spot beam capacity over the Inmarsat I-4 and I-6 global constellation;
- Benefits from the Inmarsat global coverage at LEO orbital altitudes
- Static bench tests June 2022;
- In-orbit validation tests planned later in 2023;
- Service to be developed in collaboration between Inmarsat (ground infrastructure), IQ-Spacecom (terminal) and Addvalue (solution / service provision);

Service Characteristics

- Contact-based data relay service on-demand for LEO satellites
- Intended for occasional use (e.g., 3-4 contacts a day)
- Compact transceiver form-factor (0.3U, 350g)

Applications

- Scheduled (low-latency) tasking contact on-demand
- Scheduled (low-latency) data download contact on-demand

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THANK YOU

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CONNECT.
COMMAND.
CONTROL.