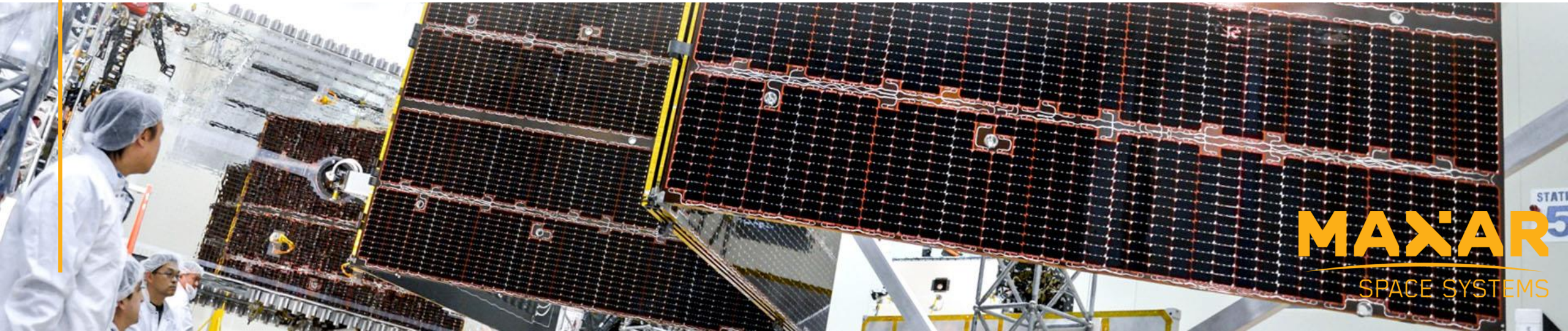# GSAW Working Group B: Leveraging New Space for Ground System Enterprise Evolution

End to End Missions Solutions

Jared Gill

A mission partner with proven heritage

Maxar Space Systems has been a trusted partner in commercial and government missions for more than 60 years. Our Space capabilities date back to the Apollo moon landing, and we continue to be at the forefront of innovation in space.

300+
Maxar-built spacecraft launched

>3,000
Combined years on orbit

100+
Maxar-built satellites on orbit

2.4+
Billion people rely on broadcasting services powered by Maxar-built satellites

Public – External Recipients

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Our space solutions support diverse missions

Commercial	Civil	National Security
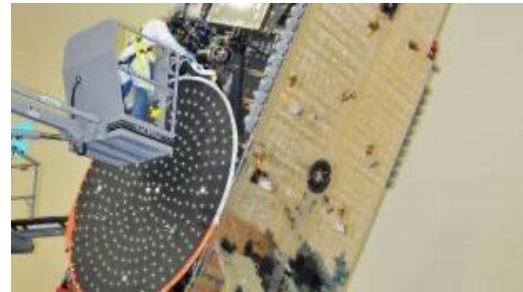
Direct broadcast

Two-way broadband

Exploration

Secure communications

Earth imaging

IoT

Robotics

Spacecraft

Entertainment

Internet access
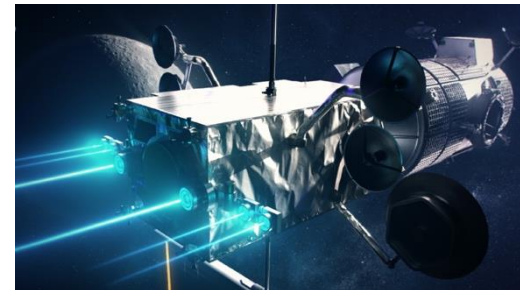
Propulsion

Smallsats

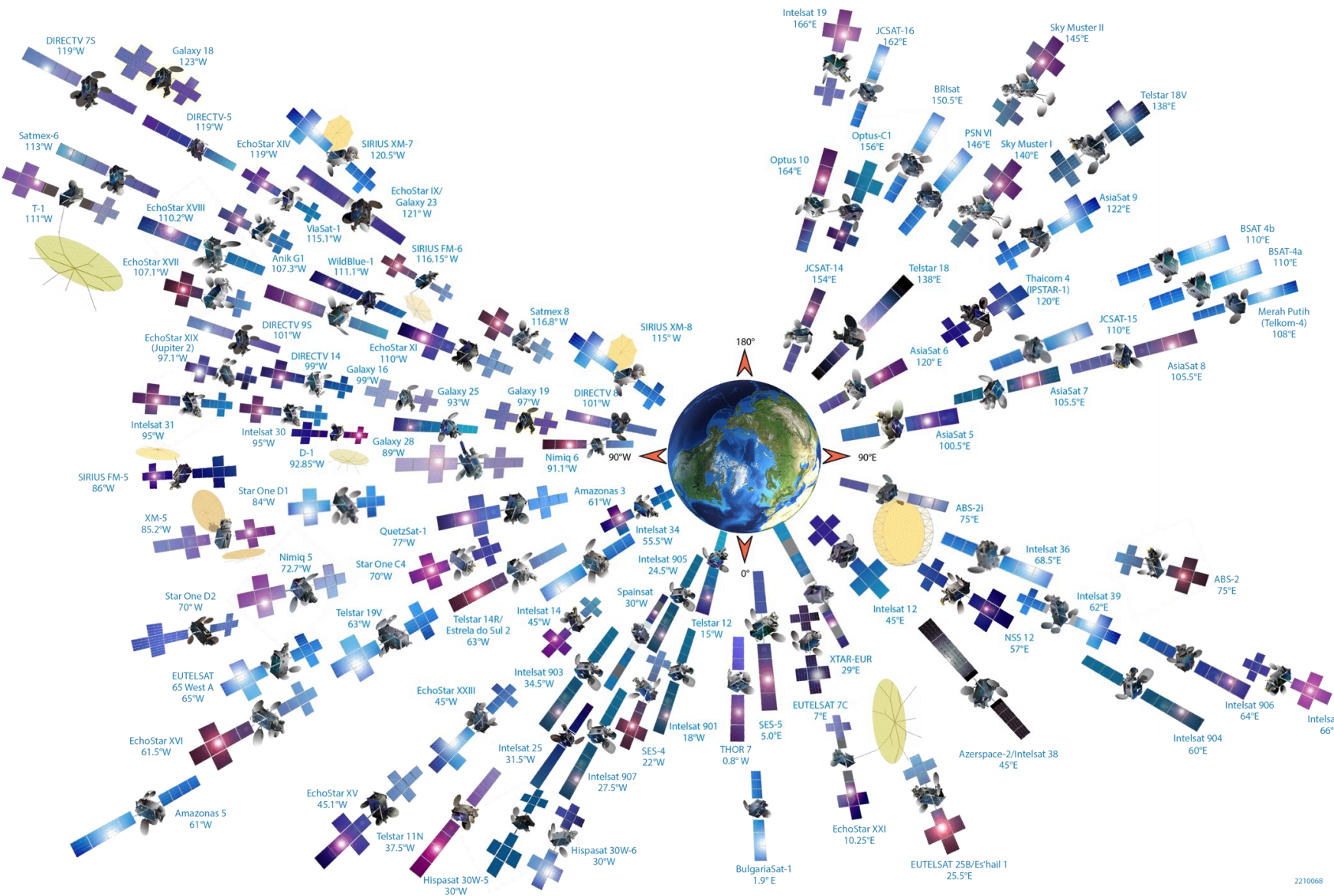Maxar Space Systems has 100+ satellites on orbit providing highly reliable service for our customers.

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Our next-generation imaging satellites enabled with the Maxar 500

WorldView Legion is a fleet of six high-performing satellites that dramatically expands our ability to revisit the most rapidly changing areas on Earth to better inform critical, time-sensitive decisions.

- Will enable up to 15 revisits per day
- Triples Maxar Space Systems' capacity to collect 30 cm class imagery
- Triples our overall capacity over high-demand areas
- Highest image quality and geometric accuracy available
- Simultaneous tasking, image and downlink with customer ground stations
- Compatible with global infrastructure and access programs for Maxar Space Systems' customers
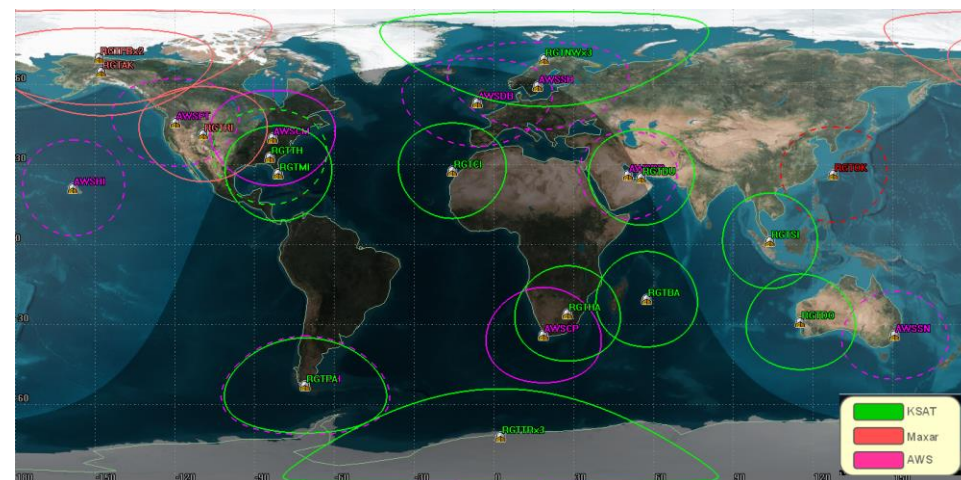
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Worldview Legion (WVL) Constellation supported by the Maxar 500 Platform

- WVL is a constellation of six high-performing satellites that dramatically expands our current ability to revisit the most rapidly changing areas on Earth
  - Multiple Launches (3) in 2024
  - Highest image quality and geometric accuracy available
  - Optimized for high agility and stable platform with high pointing accuracy
  - Simultaneous tasking, image and downlink with multiple ground stations
  - Compatible with global infrastructure and access programs for Maxar customers
  - Complete end-to-end system solution on commercial funding with own Mission Operations Center located in Longmont, CO

- Highly reliable 10 year mission life in LEO (SSO and inclined), full redundancy in all mission critical subsystems
- 2 to 4 SC per launch on Falcon 9
- Mission Data Link (MDL) allows 600 mbps real time downlink while imaging, for up to 60 TB/day

- Maxar Space Systems' current Remote Ground Terminal (RGT) network is comprised of 18-30 antennas
- Combination of Maxar-and vendor-owned and maintained
- Used for command uplink, in-contact state of health monitoring, and wideband downlink in S/X-band

WVL constellation is a complete end-to-end system solution
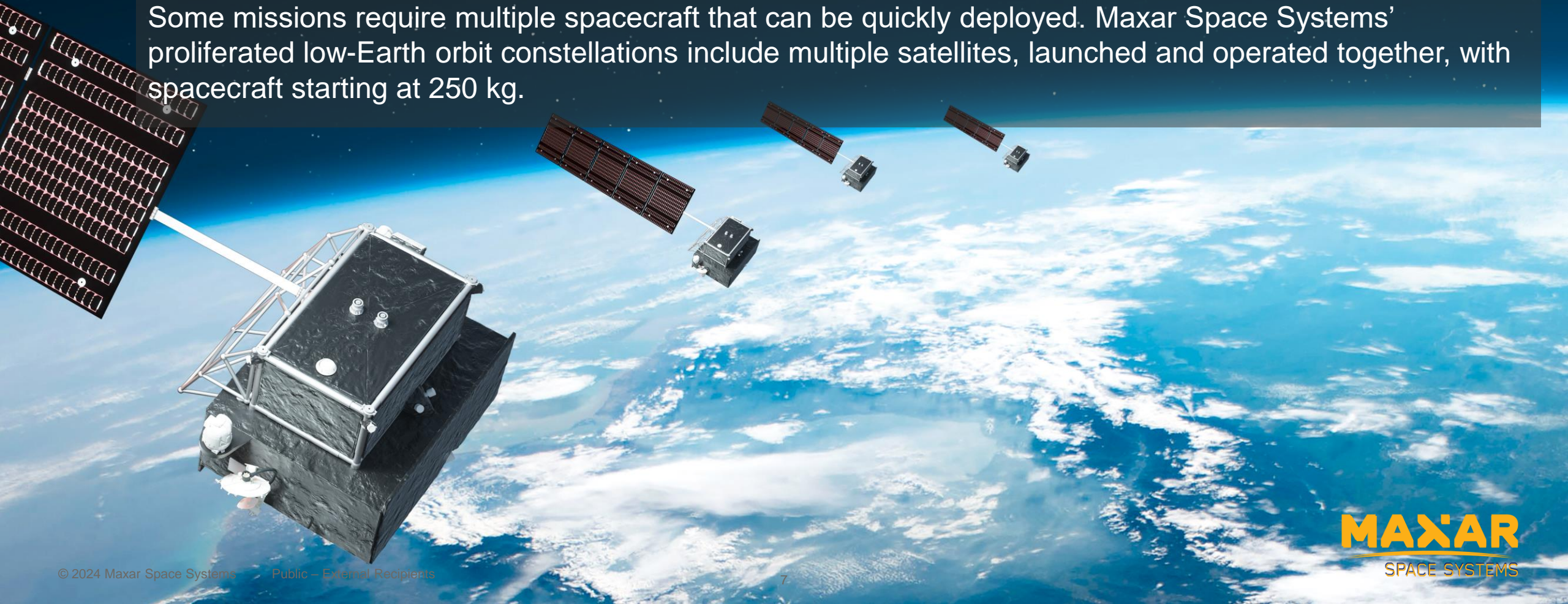
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Proliferated LEO Constellations supported by the Maxar 300

As access to space becomes more affordable and mission requirements change, many customers are shifting toward the use of large constellations to meet their needs.

Some missions require multiple spacecraft that can be quickly deployed. Maxar Space Systems' proliferated low-Earth orbit constellations include multiple satellites, launched and operated together, with spacecraft starting at 250 kg.

Maxar Space Systems Ground System and Mission Operations Capabilities

Cross-Domain Architecture for USG/Commercial

- Mission Operations Center provides complete constellation management for broad customer base
  - Performs consolidated operations across Maxar (legacy DigitalGlobe) constellation and global network of ground terminals for over 20 years
  - Integrates tasking/archive orders from USG, commercial, and allied government customers
- Supports expedited order – to – product delivery for customer
  - Utilizing our vast network of global ground terminals for expedited data downlink after image collection
  - Flexible and rapid data dissemination back to customer
- Enforces protection of mission critical and customer sensitive data
  - All data encrypted in transit between ground system and satellite
  - Command, telemetry, and imagery encrypted at rest
- Exposes APIs, data repositories, and web portals to facilitate easy integration with other systems
  - Can bent-pipe delivery of sensor data if this aligns with customer needs
- Highly scalable, available, and performant cloud-based architecture
  - Failover and disaster recovery support continuity of operations

Current Worldview Constellation

WorldView-1
WorldView-2
WorldView-3
GeoEye-1

- Full 24x7 crew performing Tier-1 and Tier-2 support
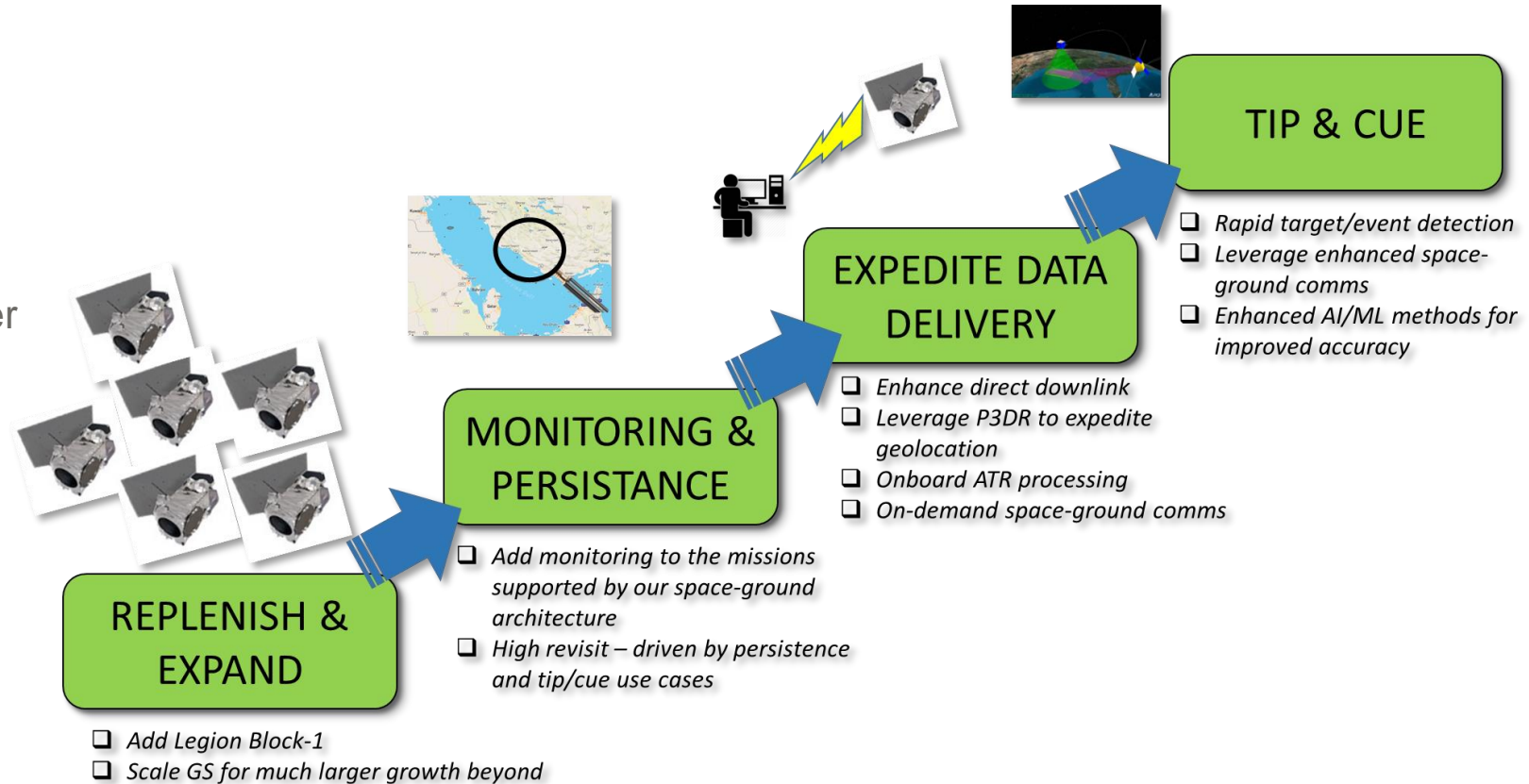
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Enable Key Capabilities
Scaffolding to Achieve Strategic Objectives

- ☐ Operationalizing key mission-enabling capabilities can be achieved via a progressive approach
  - ▪ Scale architecture for continued growth
  - ▪ Grow into constellation for higher revisit to support monitoring missions and higher revisit
  - ▪ Open pathways for mission data and actionable intelligence to be quickly disseminated to end user

- ☐ Tip-and-cue can be seen as the penultimate step in the progression of these capabilities
  - ▪ Multi-sensor collections with high revisit
  - ▪ Rapid execution of end-to-end workflow from tasking -> exploitation

REPLENISH & EXPAND
- ☐ *Add Legion Block-1*
- ☐ *Scale GS for much larger growth beyond*

MONITORING & PERSISTANCE
- ☐ *Add monitoring to the missions supported by our space-ground architecture*
- ☐ *High revisit – driven by persistence and tip/cue use cases*

EXPEDITE DATA DELIVERY
- ☐ *Enhance direct downlink*
- ☐ *Leverage P3DR to expedite geolocation*
- ☐ *Onboard ATR processing*
- ☐ *On-demand space-ground comms*

TIP & CUE
- ☐ *Rapid target/event detection*
- ☐ *Leverage enhanced space-ground comms*
- ☐ *Enhanced AI/ML methods for improved accuracy*

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Viable Ground System Product Offerings
Maxar Space Systems Built and Maintained Services

Command & Control	Contact Planning & Scheduling	Navigation / Orbit Maintenance	Collection Planning & Scheduling
• Realtime commanding • Command generation; spacecraft table management • Telemetry Archival, Monitoring, Trending, Analysis	• Generation of raw AOS/LOS and orbital events across constellation and ground terminals • Scheduling antenna use with commercial ground station providers	• Coarse and Precise Orbit Determination • Planning & execution of nominal orbit adjustments • Station keeping • Collision avoidance	• Low-latency predicted cloud cover data delivery • Constellation-aware, closed-loop scheduling

❑ Maxar Space Systems' architectural framework, build/ deploy/ test tenants, and overall software design allow for discrete ground system functionality to be provided as product offerings, i.e. "<x> As a Service"

❑ All services described here are Maxar Space Systems-built and maintained in-house; dependencies on COTS products and external services are minimized to the greatest extent the design allows
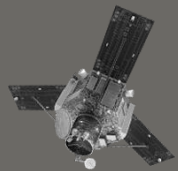
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Maxar Earth Observation Capabilities

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The Maxar satellite constellation

Maxar owns and operates the world's most sophisticated Earth imaging satellite constellation, providing the foundation for Maxar's capabilities in Earth Intelligence.
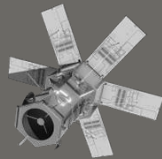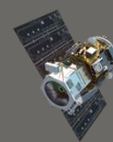
RETIRED / IMAGERY AVAILABLE IN ARCHIVE

ON-ORBIT / NEW AND ARCHIVE IMAGERY AVAILABLE

In production

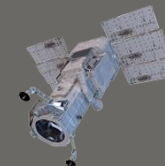**IKONOS**   **QuickBird**   **WorldView-4**   **WorldView-1**   **GeoEye-1**   **WorldView-2**   **WorldView-3**   **WorldView Legion**

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Earth Intelligence

Maxar capabilities in Earth Intelligence help customers map, detect and predict change across the globe. Fueled largely by Maxar's own constellation of high-resolution imaging satellites, we provide high-resolution satellite imagery and derived data layers, machine learning and rich domain knowledge so organizations can make decisions with confidence.

3.8M
Square kilometers of Earth imagery capacity each day

125+
Petabytes of data in our archive

20-year
Inventory of global change in high-resolution

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Geospatial foundation

Highest quality satellite imagery, basemaps and 3D data over any location on Earth

The highest-quality satellite imagery

OPTICAL IMAGERY

- Native 30 cm resolution and derived 15 cm HD imagery
- < 5 m CE90 positional accuracy
- Multispectral diversity

IMAGERY BASEMAPS

- Stunning, virtually seamless
- Accurate, consistent and actionable
- Local, regional and global scale

ANALYSIS-READY DATA

- Preprocessed time-series stacks of imagery
- Aligned and produced at a set standard
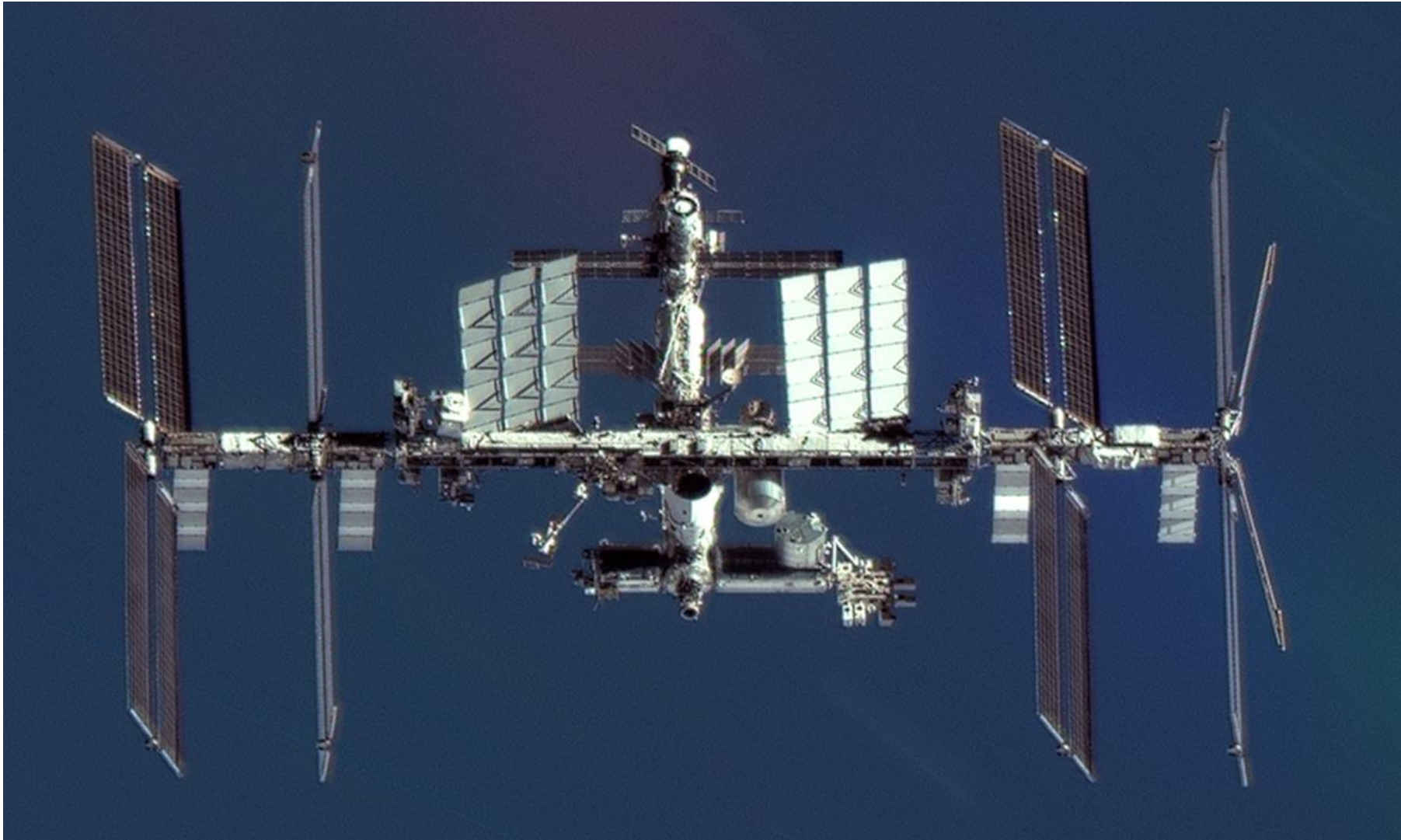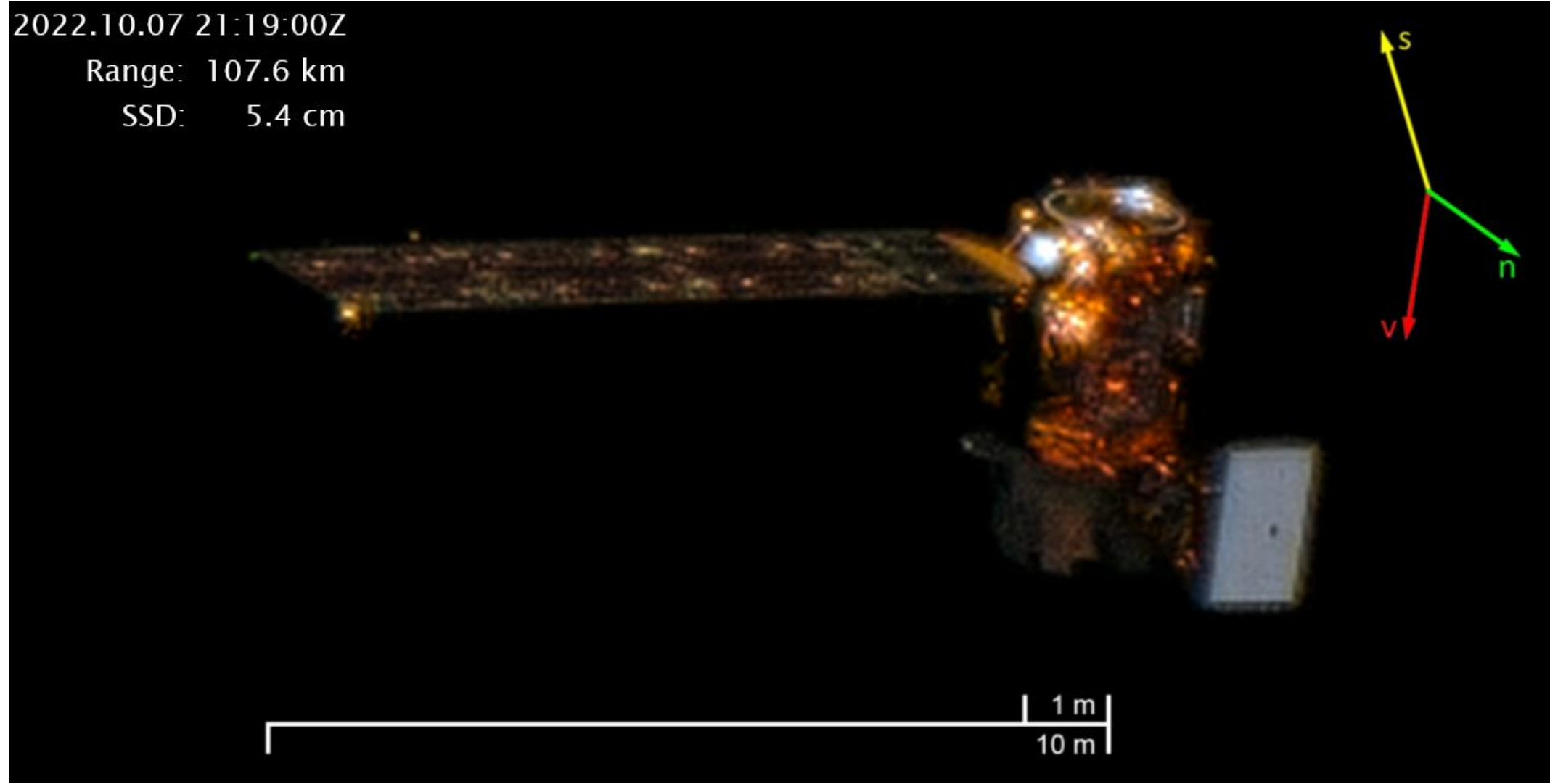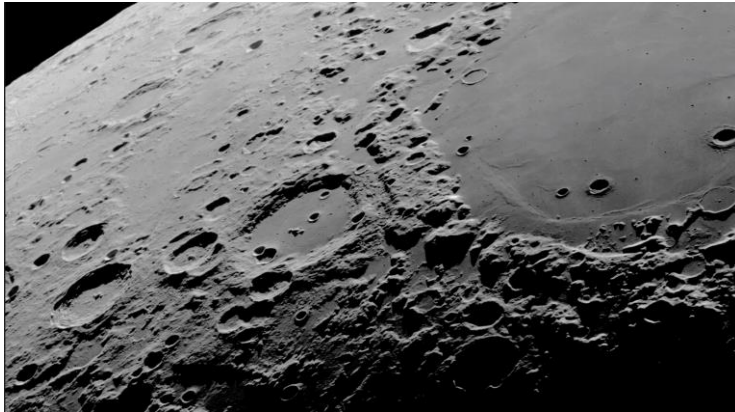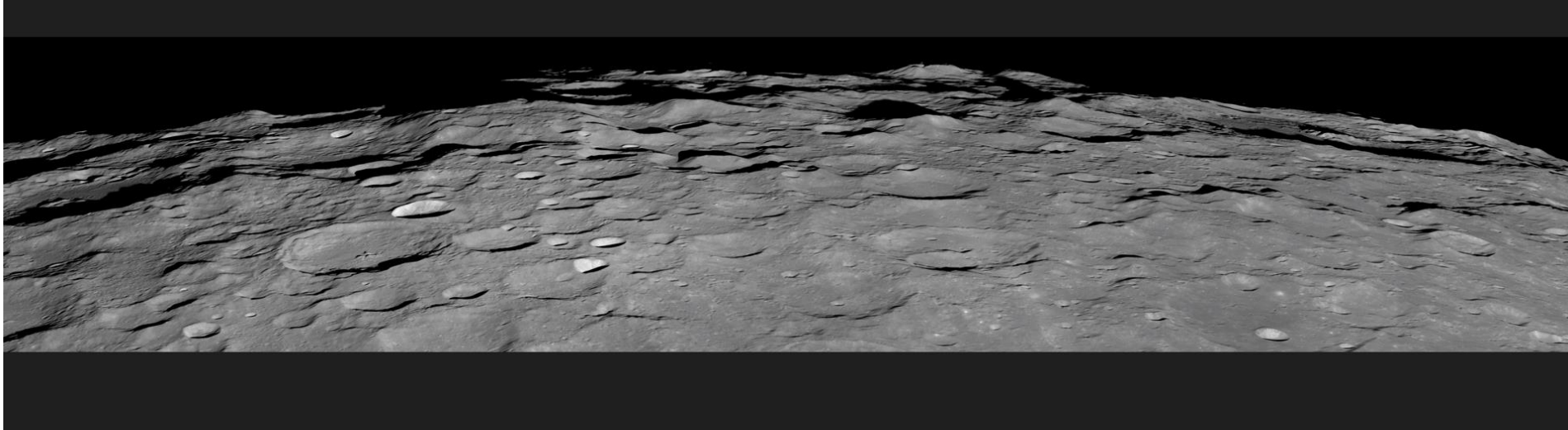- Subscription access to our 125+ petabyte archive

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