

Cloud & Al for Space Exploration AWS / Wind River Space Day

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Rob Ruyak

Global Growth Sales/Business Development Aerospace & Satellite

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Global Space Market

- \$384B+ in Global Spend (2022)
- Between 2010 and 2015, venture capital investment was a combined ~\$3B in space companies; in 2017 alone, \$3B was invest in 122 firms
- Start-up space ventures attracted approximately \$8 billion in total financing in 2022, regardless of overall economic slow-down
- Current predictions estimate \$1T market by 2040
- Many international firms are establishing US-based entities to partner and capture investment



Note: Satellite manufacturing revenue includes total estimated manufacturing revenue for satellites launched in 2020.

Sources: Bryce internal estimates, Satellite Industry Association, European GNSS Agency, Organisation for Economic Co-operation and Development, government budget documents, and other published materials.

Government Spend on Space Programs



US Space Programs (Not Exhaustive)

- U.S. Space Force \$30B with 2024 proposal – 60%+ for R&D
- \$2.6B for launch, 5 launches for SDA
- Missile Tracking \$2.3B, up from \$1.2B
- LEO relay constellation \$2.1B
- NASA Artemis budget \$25.4B FY23, up \$1.3B in FY22
- SDA Proliferated Warfighter Space Architecture - \$4.78 FY24 request

AWS Global Infrastructure

Global network

Redundant 100GbE network and private capacity between all regions except China

Direct Connect

You can connect to every AWS Region from over 100 AWS Direct Connect PoPs worldwide (excluding China)





Space Market Segmentation



Aerospace & Aviation





Satellite Communications



Remote Sensing



Geospatial Analysis



Space Situational Awareness



Human Space Flight & Exploration



Space Solution Areas – Innovation Trends/Demands



Compute

Storage

Database

IoT

AI/ML

Example: Cloud-Enabled Mission Operations Centers

Satellite mission operations center reference architecture



https://docs.aws.amazon.com/whitepapers/latest/virtualize-satellite-operations-on-aws/architecture-options.html

Key Components

- Data processing
- Low latency
- Auto scaling
- Machine learning & analytics
- Storage

Example: Space Digital Engineering Workloads



Edge Processing/Storage to On-Premises to Cloud

Localized machine learning



Current Customer Profile/Maturity

There are numerous opportunities to help customers in this market as they are early in their cloud journey...



...and there are an initial set of questions that we lead with to build trust and focus

- Do you have ITAR/EAR data handling compliance challenges?
- Can processing data on orbit (including ML) benefit your mission?
- Is the monetization of space data part of your business model?
- Do you have the data to drive not only predictive maintenance, but also prescriptive maintenance?
- Are you able to change direction quickly, iterate, and lead the next generation of manufacturing for spacecraft?
- Is autonomy a requirement for executing/supporting your mission?

Generative AI Stack

APPLICATIONS THAT LEVERAGE LLMs AND OTHER FMs

TOOLS TO BUILD WITH LLMs AND OTHER FMs

INFRASTRUCTURE FOR FM TRAINING AND INFERENCE

 Image: GPUs
 Image: Trainium
 Image: Inferentia
 Image: SageMaker

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Aerospace & Satellite: Launch, Flight, & Exploration



Increase automated mission planning with optimal flight path generation



Accelerate operator training with natural language query against your document corpus

(

Add support during missions with enhanced scenario generation and evaluation



Opportunities to Lead

Commercial and public sector entities are seeking...

Skills / Resources

to fulfill their missions and increase time-to-market

- Domain Expertise
- Government Access
- Partners
- Training & Support
- Local/Regional Teams
- Talent / Diverse Workforce

Investment

to accelerate their cloud journey and focus on their core business

- New Feature Development
- Co-Investment Opportunities
- Customer Workshops
- RFP / RFQ Response Support
- Prototypes/Pilots
- University/Lab Tech Transfer

Amplification

to enter the market, test new business models, and grow business

- Joint PR/Marketing
- Channel Sales
- Marketplace Offerings
- Investor Connections
- Conference/Event Sponsorships
- Policy/Regulatory Leadership

AWS and our Partners have a unique opportunity to "connect the dots" across the ecosystem and be THE LEADER in accelerating the growth of the space economy, particularly in defense and national security missions



Thank you!

Rob Ruyak ruyar@amazon.com

LEARN MORE:

AWS for Aerospace and Satellite: aws.aws.awazon.com/public-sector/space AWS Public Sector blog: aws.awazon.com/public-sector/space AWS Public Sector blog: aws.awazon.com/public-sector/space

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AWS Ground Station tech specs and data delivery

X-Band

Receive

- Wideband Downlink
 - Up to 500MHz (LHCP & RHCP)
 - Demodulated data delivered to Elastic Cloud Compute (EC2) and Simple Storage Service (S3)

S-Band

- Transmit and receive
- Narrowband Uplink and Downlink
 - Up to 40 MHz (LHCP or RHCP)
 - **RF over IP** delivered to EC2 or S3
 - Software-defined radio at the EC2 instance
 - S3 stores PCAP files



Customers AWS Ground Station Architecture Bringing together the best of both worlds



S and X Band Data Downlink, S Band Uplink

Direct connection to AWS Data Centers

Storage and Compute in AWS Cloud

Cross-region Data Delivery

Produce near-real-time products



Cappella Space uses AWS to get near real-time Earth data from your personal device



"Running our ground infrastructure on AWS allows Capella and its customers to automate and scale operations across the globe in order to minimize latency and reactivity."

Payam Banazadeh CEO and Founder, Capella Space

<u>Cloud-Native</u>

Capella Space runs its entire IT infrastructure on AWS to automate and scale its operations.

<u>Simple</u>

AWS Ground Station makes it easy and economical for Capella to command and control its constellation using a fully managed, global antenna network.

<u>Fast</u>

Using AWS, Capella provides its customers with access to satellite data within minutes of its capture, far faster than traditional delivery services.

Orbital Reef is using AWS to enable a mixed use business park in space



"Amazon and AWS are ideal collaborators to support transportation, habitation, and communications. We're working with the world's best to reimagine logistics for a commercial mixed-use space business park."

Brent Sherwood Senior Vice President, Blue Origin

Next Generation

Orbital Reef, a commercially developed, owned, and operated space station, is currently in development to provide commercial, research, and tourism in LEO.

Visionary

AWS technology will be used to help streamline engineering design processes on Earth and to enable the flexible, secure, fully connected vision.

Integrated

AWS will support design, development, flight operations, data management, enterprise architecture, integrated networking, logistics, and communication.

Descartes Labs integrates petabytes from hundreds of datasets to generate planetary geospatial intelligence



"AWS' proven infrastructure and capabilities, along with a dedicated team that understands our unique challenges in the satellite and space industry, help us provide customers with actionable intelligence powered by geospatial data, backed by science, and available at planetary scale"

Richard Davis *CEO, Descartes Labs*

aws

Expansive

Descartes Labs uses HPC to power their geospatial insights, like analyzing crop health and other market data to produce commodity market forecasts.

Strategic

These forecasts are used by their customers to decide the best trading strategies, which can easily translate into millions in savings or profits.

Cost-Effective

They made #40 of the Top500 supercomputers, using the self-service model of AWS, for about \$5,000 instead of \$20-30 million in custom hardware.