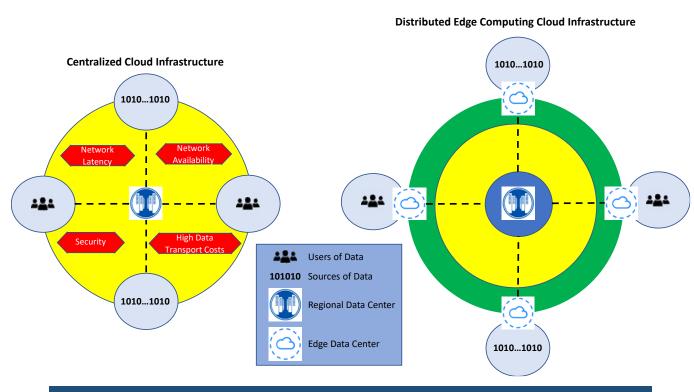


# Edge Computing and Space

LEOcloud 21

- Gartner: By 2022 about 75% of all data will need analysis and action at the edge
- Emerging commercial space market opportunity is greater than \$1T
  - Satcom, Applications, Infrastructure
- By 2028, Edge Computing is expected to be an \$800B market opportunity
  - Driven by demand for cloud edge computing services as close as possible to the sources and users of data
- Key demand drivers for edge computing are AI and analytics which drive research, and commercial and mission-critical success



"Ranging from business models looking to commercialize crew and cargo missions to near-earth orbits, to emerging Earth Observation-based Data Analytics opportunities the "\_\_\_ As-A-Service" business models have arrived for within the Space and Satellite Markets."

Source: NSR- The Global Space Economy, March 2021





- End users across market segments are driving the demand for space-sourced data
- The benefits of microgravity is driving the demand for data-driven R&D in space
  - Today: ISS National Research Lab
  - Future: Commercial Space Stations
- To realize the benefits of space-sourced data users require facilities, communications, cloud infrastructure and services
  - Infrastructure and services in space will evolve to resemble today's terrestrial infrastructure
- A commercial ecosystem of infrastructure and services will be essential for advancing the commercialization of space for R&D, commercial services and government use

### **End Users**

- Government
- Defense
- Public Sector
- Finance
- Pharma
- Energy Grid
- Oil and Gas
- Maritime
- Film Production
- Space Situational Awareness
  - Orbital Debris
  - Space Traffic Management
  - Space Weather

J.P. Morgan has tested the world's first bank-led tokenized value transfer in space...

https://www.jpmorgan.com/insights/technology/blockchain-in-space

New Film Studio Will Be Built in Space by 2024

https://variety.com/2022/film/news/film-studio-space-1235157521/







#### **On-Orbit Manufacturing**

- For use On-Orbit
- For use On-Ground

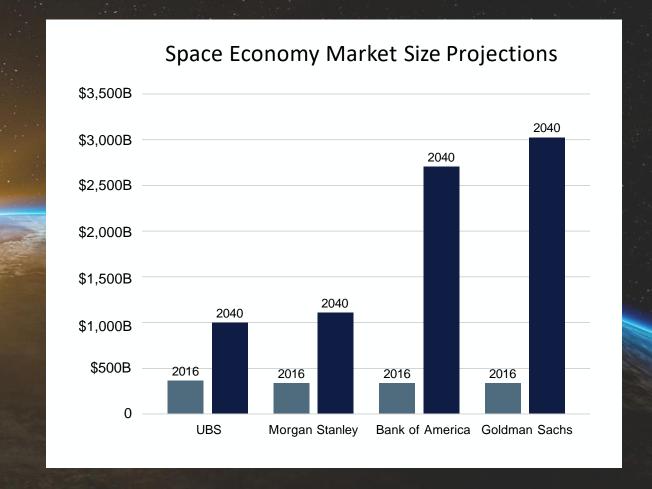
#### **On-Orbit Research**

- Applied Research
- Medical Research
- Fundamental Research
- Edge Computing, Data Storage and Blockchain

Entertainment from/in Space

Satellite Deployment and Servicing

Communications







Users	International Space Station	Commercial Space Stations	
International Partner Utilization	Through ISS Intergovernmental Agreement (IGA) and bilateral agreements	Bilateral government to government agreements and arrangements directly with industry	
NASA Technology Demonstration	Long-duration microgravity testing of exploration systems (ECLSS, Crew Health Systems, Food Production, etc.)	Accommodation for ongoing subset of testing, possible incorporation into CLD designs	
NASA Human Research	HRP risk reduction plans - multiple subjects for varied durations	Ongoing research with NASA crew and possibly private astronauts, exploration analogs	
NASA Science	Biological, Physical, Earth, Planetary decadal-driven science	Purchase accommodation for ongoing decadal-driven science; transfer hardware or purchase commercial facility services	
Other Government Agency Research	Through ISSNL or NASA collaboration (NIH, NSF, DoD, others)	Through LEO National Lab	
In-Space Product Manufacturing	NASA in-space production + ISSNL	Development through LEO National Lab; commercial production business to business	
Commercial Tourism, Marketing	ISS PAMs, Commercial Use Policy, reimbursement of resources	Business to business	





100				
		2012	2021	2030 Goals
	Projects	0	334	835
	Payloads	0	538	>1,250
	NASA + External Funding	\$15M	\$394M	\$985M
	Start-Up Capital Raised (Post Flight, Cumulative)	0	> \$1.1B	\$3B

159
ACADEMIC, NONPROFIT, & NON-NASA
GOVERNMENT AGENCY PROJECTS
Emory, MIT, MJFF, ORNL, et al

175 INDUSTRY PROJECTS AstraZeneca, Delta Faucet, Goodyear, Merck, Novartis, et al



We are the Infrastructure as a Service (IaaS) provider at the Space Edge and in Space to enable public cloud services as close as possible to the sources and users of data

- LEOcloud's space laaS will enable public cloud service providers to offer their customers a hybrid cloud service in space
- LEOcloud IaaS will provide the cloud computing resources for operations and researchers in space, that will enable frictionless collaboration with their colleagues and cloud services on Earth
  - Enable public cloud regions in space
- Provide integrated end-to-end service management
- Provide services on LEOcloud's satellite constellation, on commercial space stations and in the lunar region

## **LEO**cloud

#### **Space Edge**

Co-location of cloud services at satellite
 Ground Stations

## **Space Edge LEO**

 Constellation of satellite-hosted cloud services data centers in LEO

#### **Commercial Space Stations**

 Space Edge cloud services hosted on commercial space stations

## **Lunar Region**

 Space Edge cloud services in Lunar orbit and on the Moon

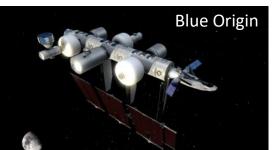
# LEOcloud Space Edge Services - Commercial Space Stations







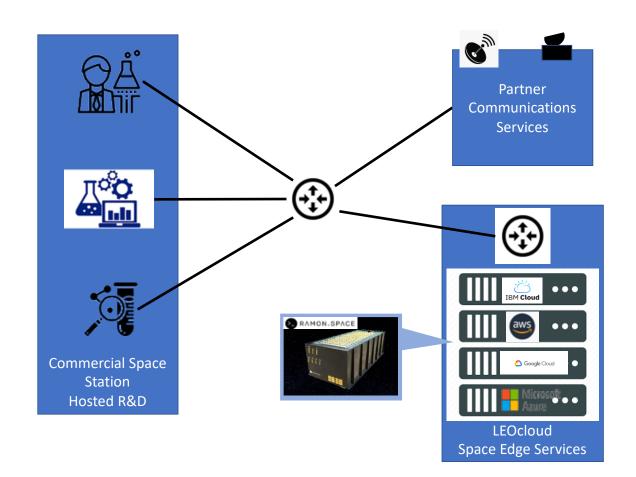








- Researchers on CSS will require support of their cloud service provider so their terrestrial virtual private clouds can be extended to the CSS
  - Seamless collaboration with their colleagues on Earth



## Big Picture ...





A commercial ecosystem of infrastructure and services will be essential for advancing the commercialization of space for R&D, commercial services and government use

