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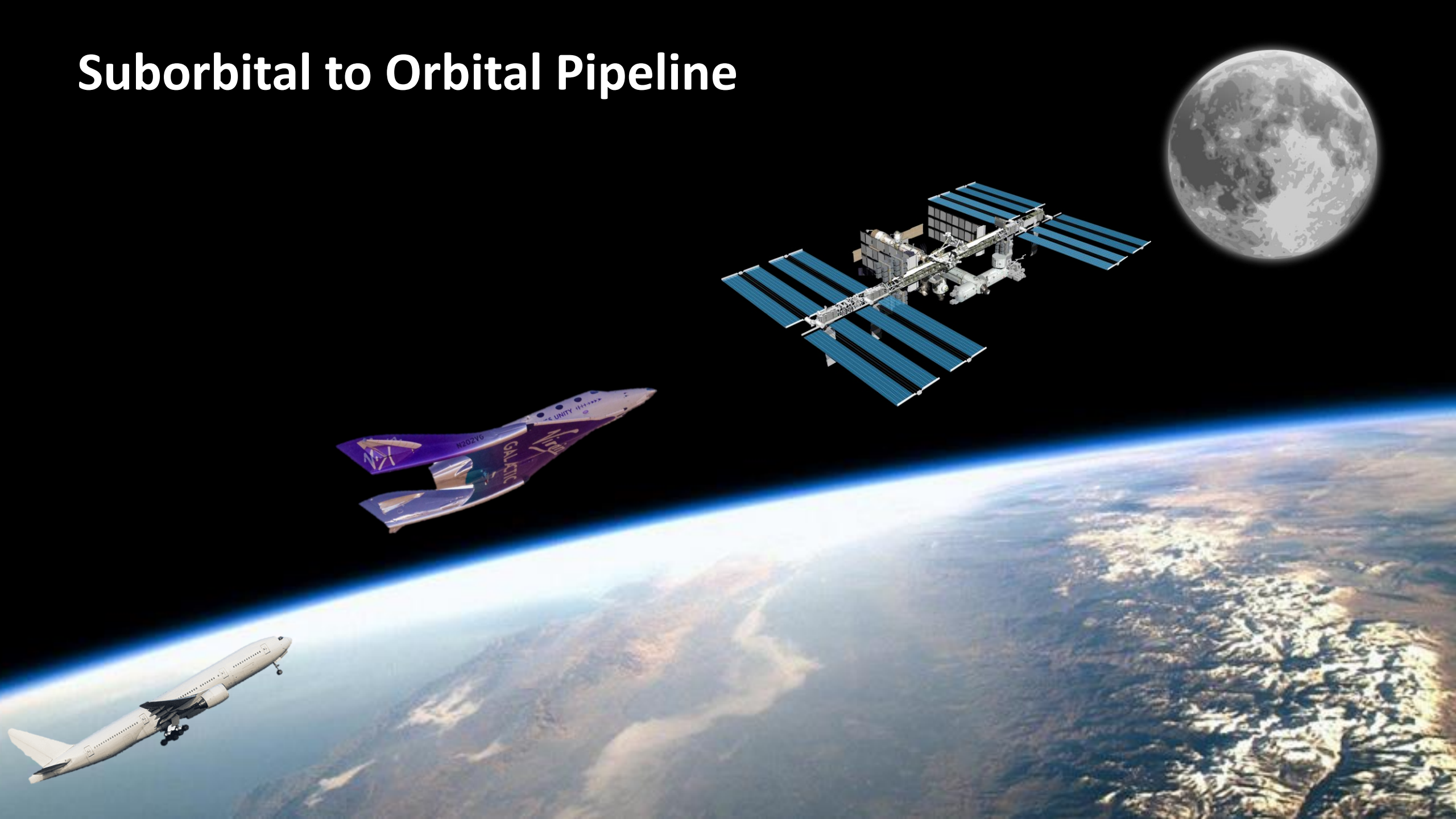
Creating a Resilient LEO Economy: The Suborbital to Orbital Pipeline

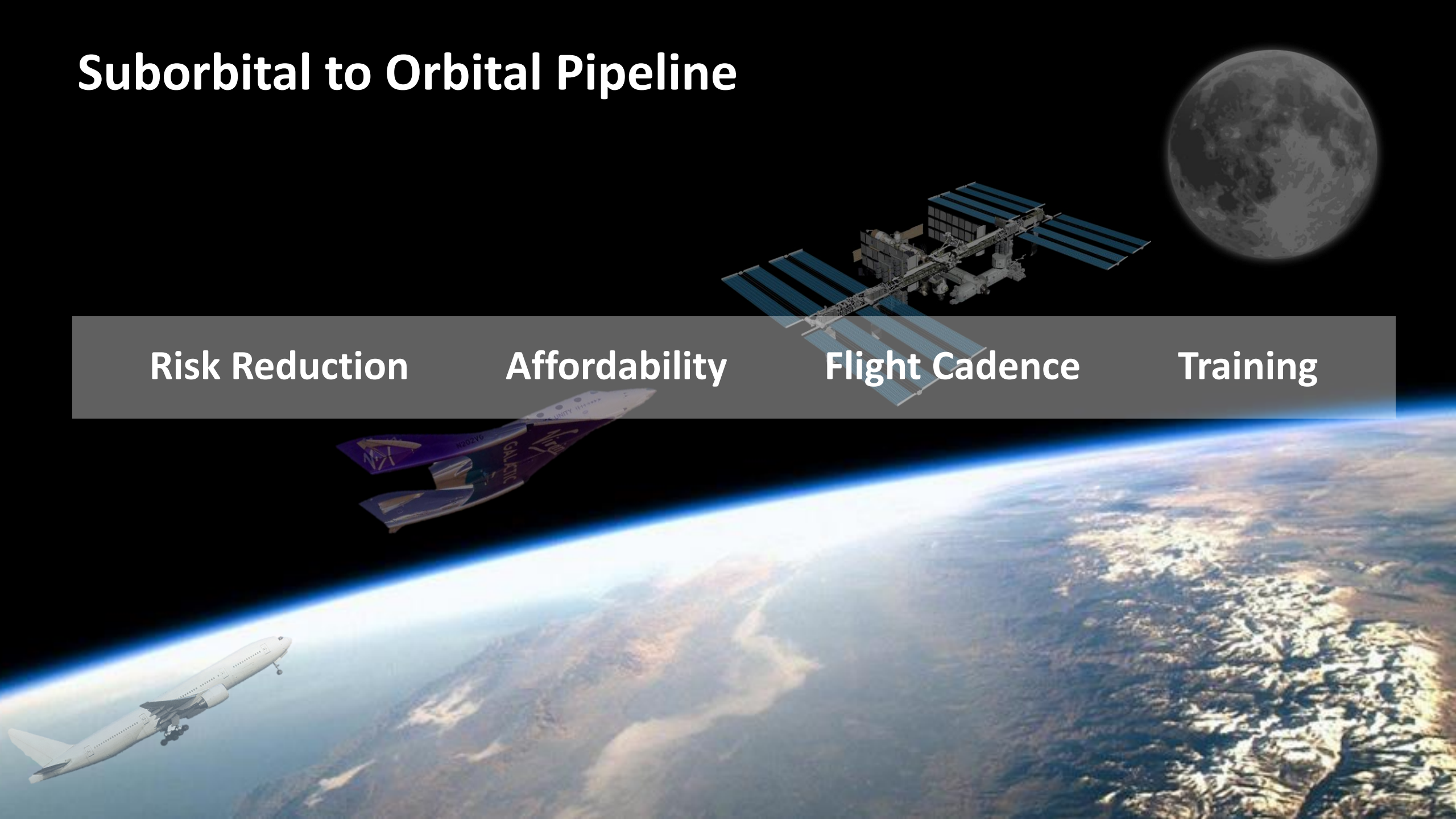
Kathleen Karika
Virgin Galactic

AIRBUS
Technical Session Sponsor

Suborbital to Orbital Pipeline

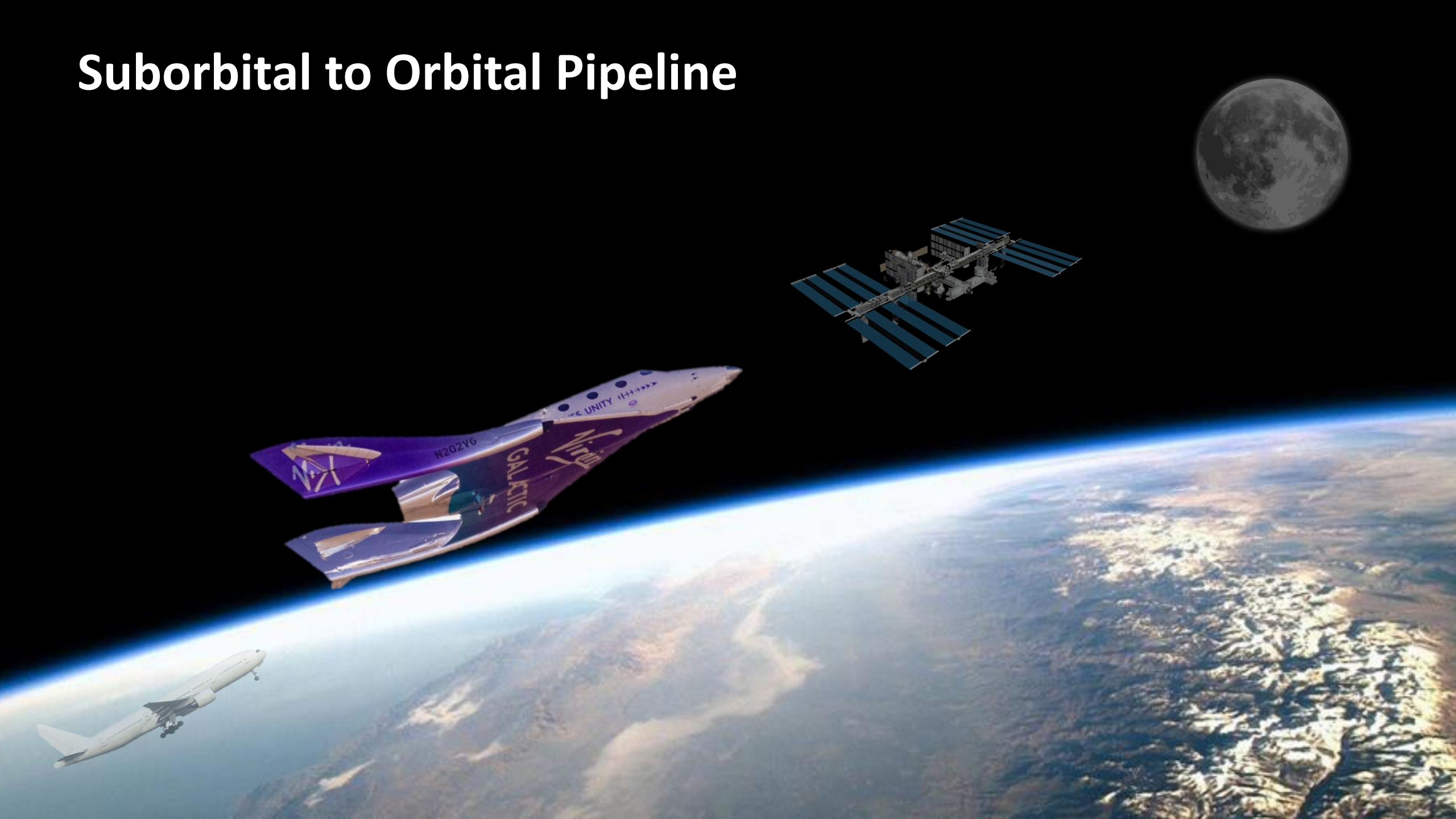


Suborbital to Orbital Pipeline



Risk Reduction | Affordability | Flight Cadence | Training

Suborbital to Orbital Pipeline



VG by the Numbers

1st
Fully Crewed Commercial Spaceflight

7
Research Missions Flown

Dozens
Of Payloads in Space

Spaceflight System

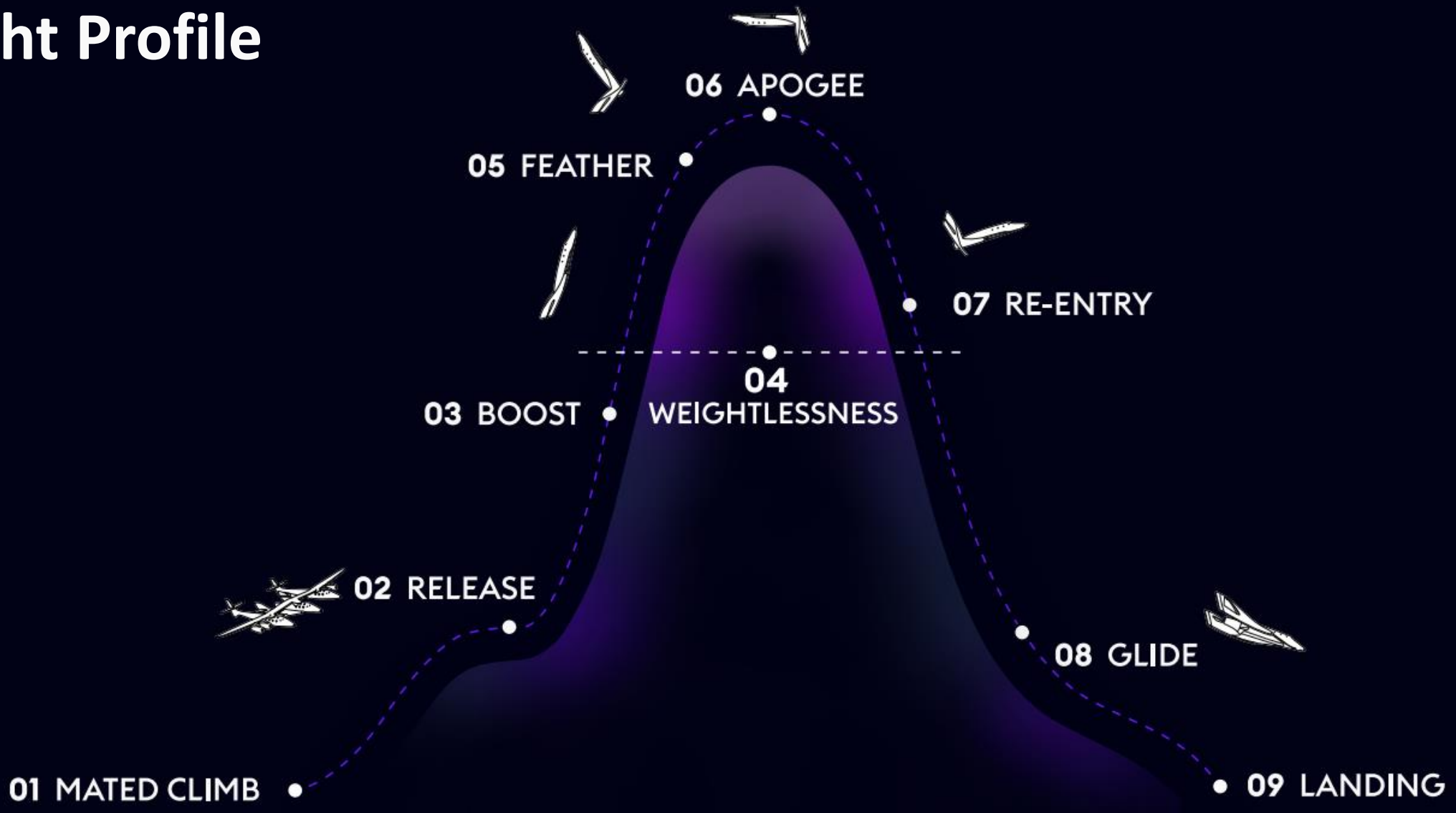
Mothership:

- High-altitude, high-performance jet aircraft
- Capable of heavy-lift missions
- “Carrier craft” for Spaceship

Spaceship:

- Suborbital spaceplane
- Designed to safely and routinely transport people and payloads to suborbital space and back
- Carries a crew of two pilots, up to six astronauts, or equivalent research experiments

Flight Profile



Virgin GALACTIC

Operations

- Training, preparation, and payload integration at Spaceport America
- Timely payload access with late load and early unload options
- Full-size cabin mockup for testing and training

Suborbital Space Lab Research Offerings

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Suborbital to Orbital – Astrosurgery

- **Principal Investigator:** Dr. George Pantalos, University of Louisville
- **Mission:** Refining mechanisms for rehydrating red blood cells in space environments
- **Application:** Transfusion therapy for astronauts on long-duration orbital and space exploration missions
- **Funding:** Flight Opportunities awards
- **Research Type:** Autonomous and potential future human-tended

Suborbital to Orbital – Training

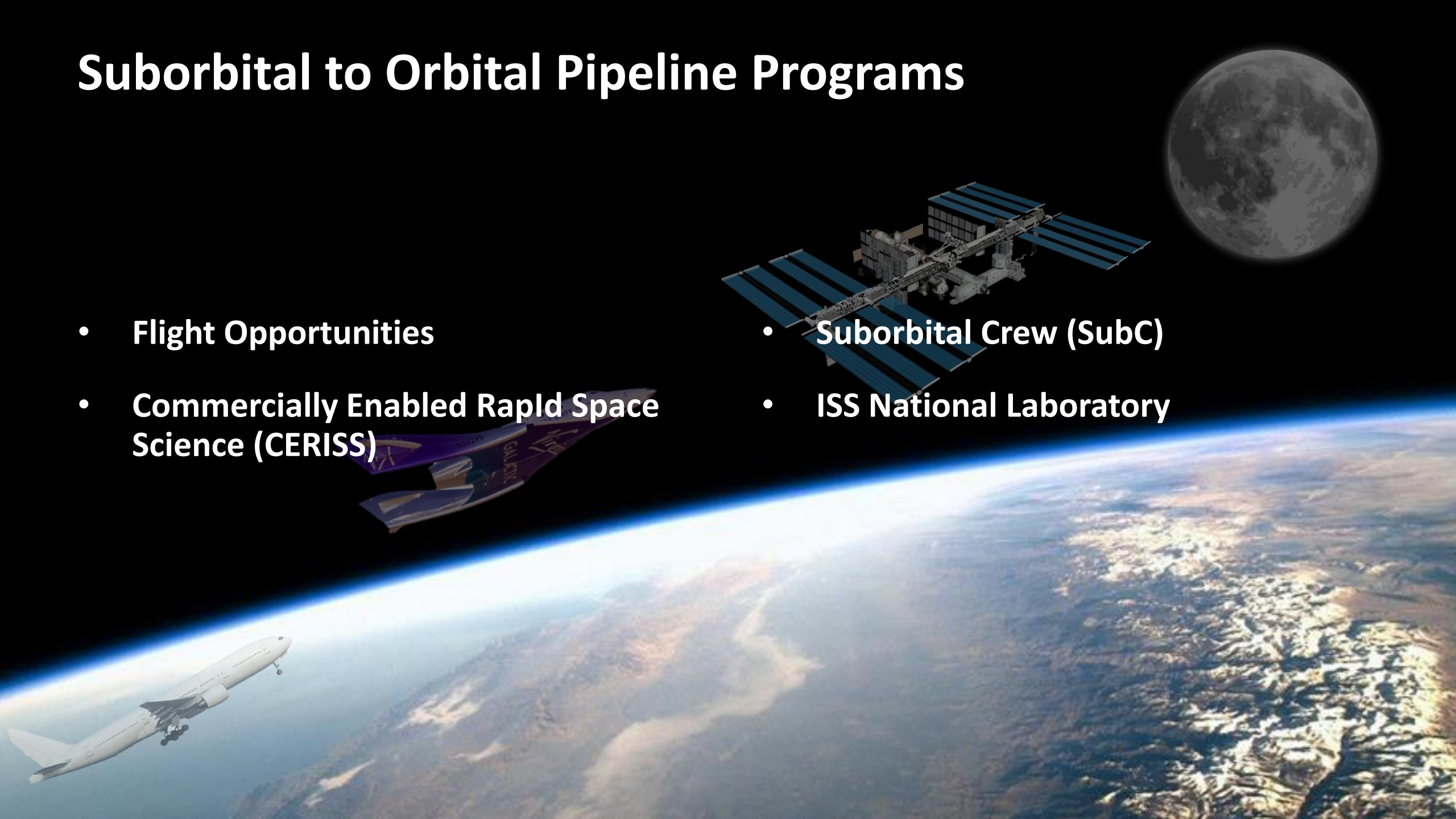
"This kind of training is an **entire mission compressed in a few minutes**, so you can experience all phases of the flight, from the takeoff to the boost, the coasting and then working in microgravity and re-entry…In a nutshell, it is a good environment to really **test all the things the astronauts are supposed to do once they get to the ISS**." – Col. Walter Villadei, ItAF

Orbital to Suborbital – Combustion

- **Principal Investigators:** CNR's Institute of Sciences and Technologies for Sustainable Energy and Mobility (STEMS)
- **Mission:** Combustion characteristics of renewable liquid biofuels and the behavior of complex fluids at high temperatures
- **Application:** Efficient technologies for eco-sustainable energy and propulsion systems
- **Flight History:** 2013 ISS Mission
- **Research Type:** Autonomous and human-tended

Suborbital to Orbital – Human Tending

Suborbital to Orbital Pipeline Programs



- Flight Opportunities
- Commercially Enabled RapId Space Science (CERISS)
- Suborbital Crew (SubC)
- ISS National Laboratory

Acknowledgements

Dr. George Pantalos, University of Louisville

NASA Flight Opportunities

Italian Air Force

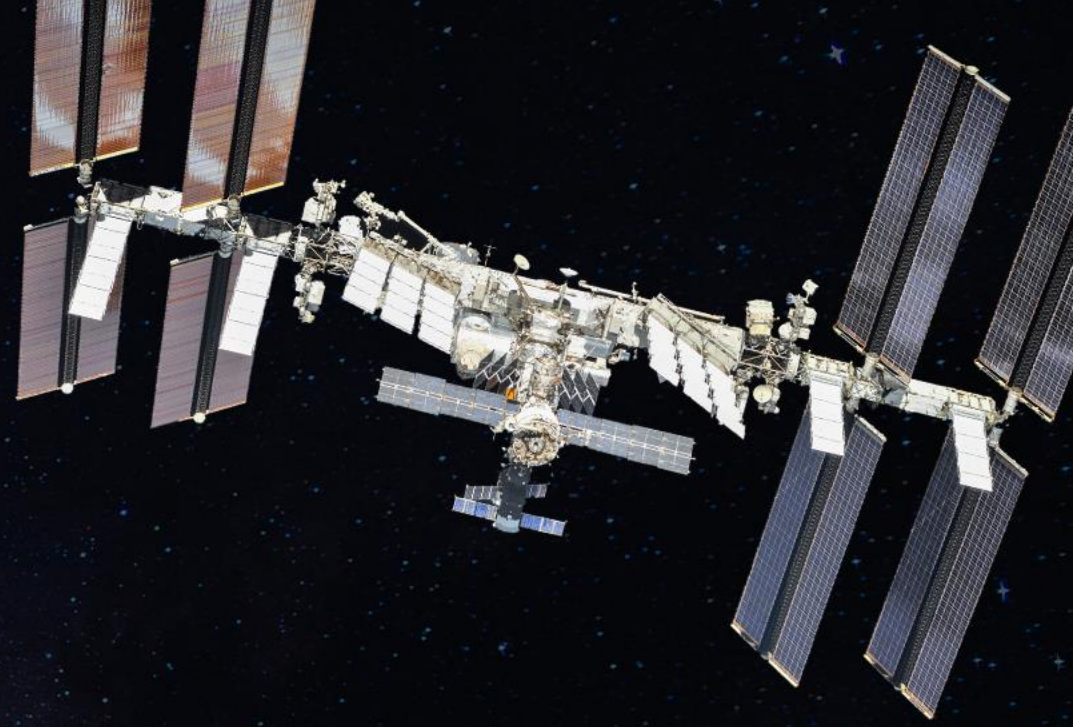
National Research Council of Italy

Axiom Space

International Institute for Aeronautical Sciences (IIAS)

Turkish Space Agency (TUA)

Massachusetts General Hospital (MGH)



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