

Commercial Space and the New Entrepreneurs: A US Point of View

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NEW SPACE

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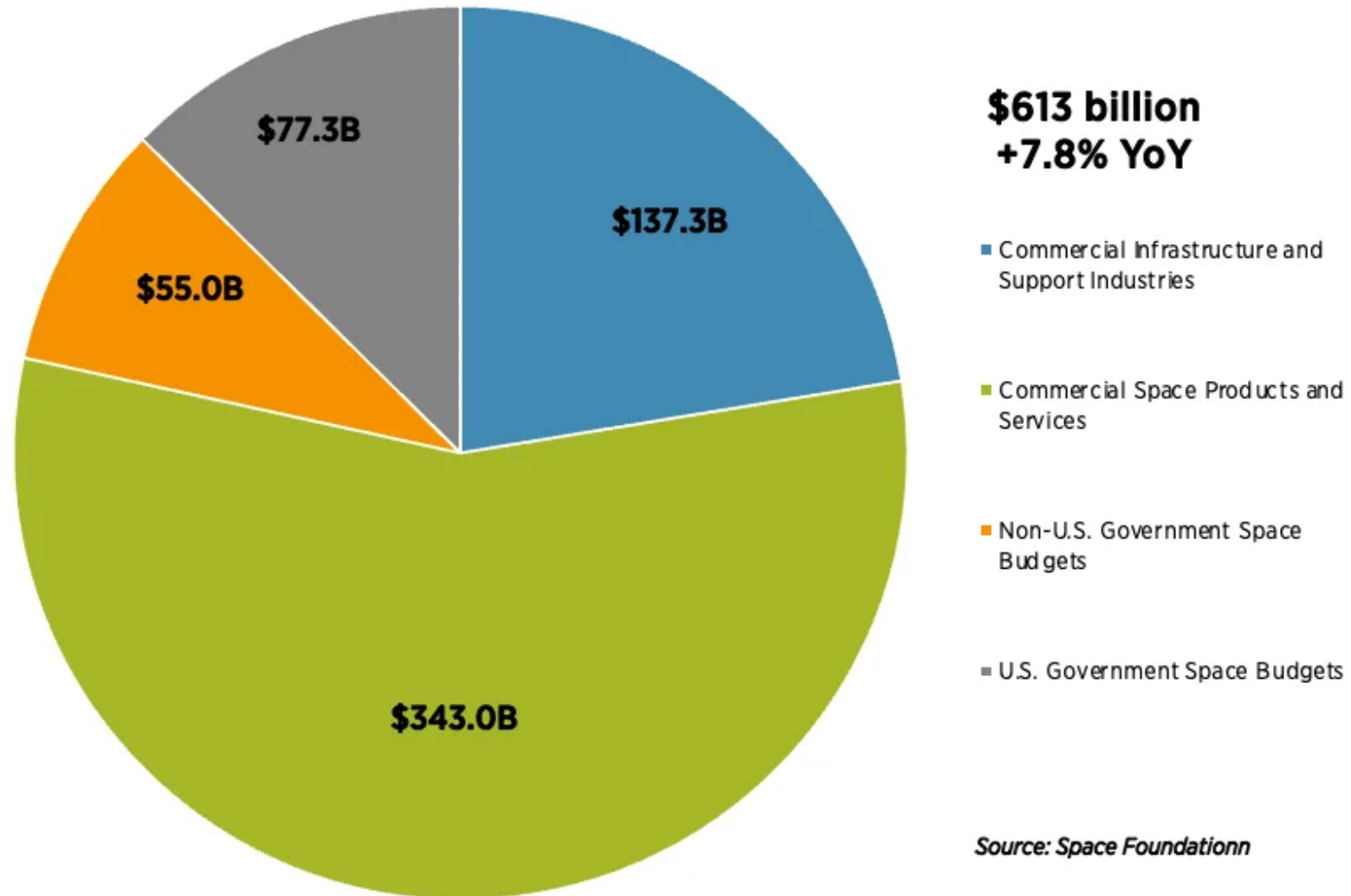


The Official Journal of



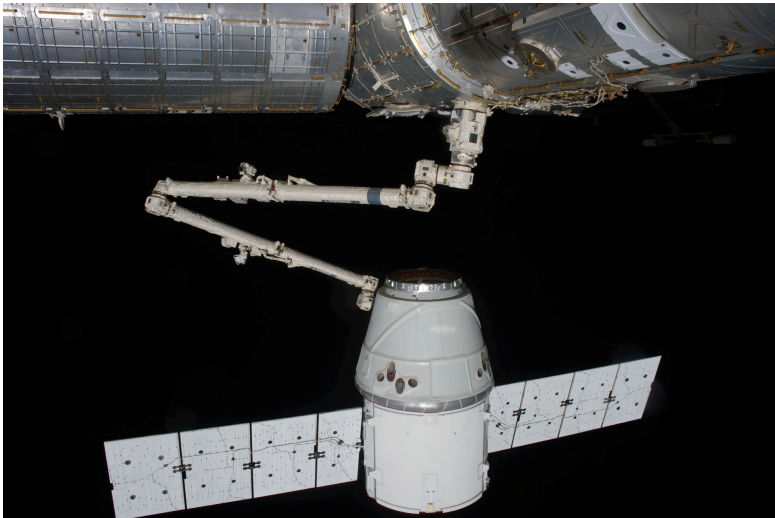
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Global Space Economy, 2024



- New Space is often taken to mean “commercial space”.
 - By the US National Space policy, the term “commercial” refers to space goods, services, or activities provided by private sector enterprises that bear a reasonable portion of the investment risk and responsibility for the activity, operate in accordance with typical market-based incentives for controlling cost and optimizing return on investment, and have the legal capacity to offer these goods or services to existing or potential nongovernmental customers.”
 - In other words, if your only customer is the US government it’s not commercial. If the government pays the whole cost (including overruns and a guaranteed fee or profit), it’s not commercial
- The single largest example of commercial space is the geostationary space communications industry and supporting areas (>\$200B/year)
- All commercial space launches are approved (a launch license) by the Federal Aviation Administration Office of Commercial Space Transportation
- Commercial Spaceports are given operating permits by the same office

SpaceX Dragon berths
with ISS
34 successful flights



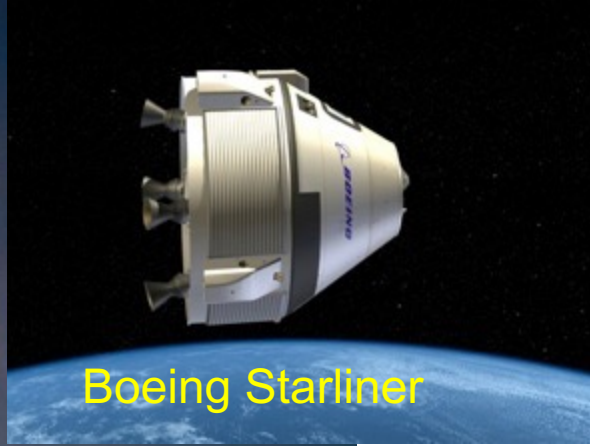
Orbital
Sciences/Northrup
Grumman
Cygnus and ISS
24 successful flights



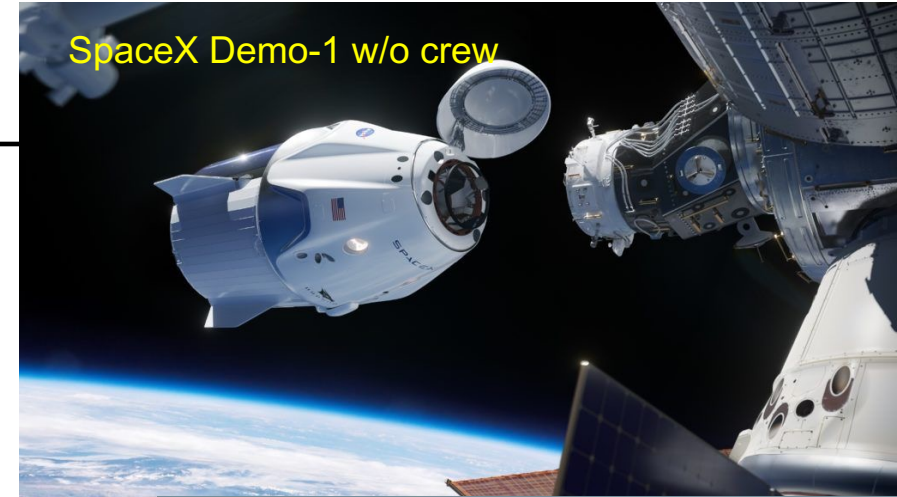
Sierra Space
Dreamchaser
selected for Cargo:
no flights yet



*Initial \$3.5B, Phase II up to
\$14B, Space Act, Fixed Price
and IDIQ



Boeing Starliner



SpaceX Demo-1 w/o crew

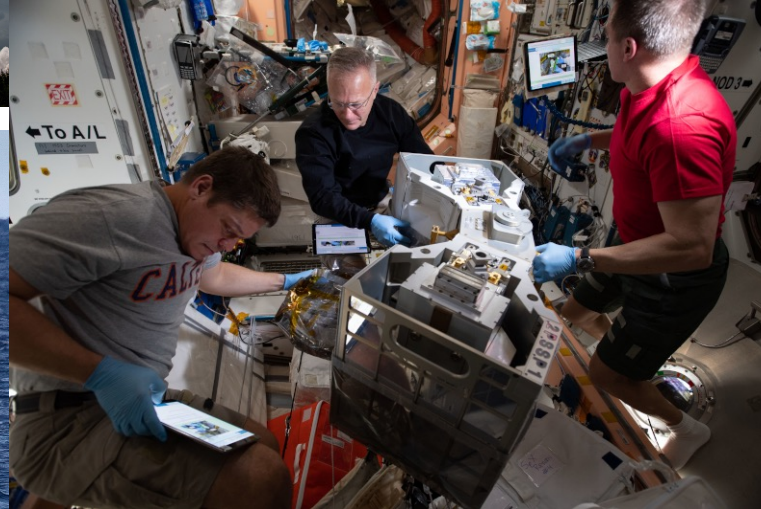


Commercial Crew initial selection:
Boeing (\$4.2B), SpaceX (\$2.6B)
SpaceX Demo-1 in 2019

SpaceX Demo-2* in May 2020



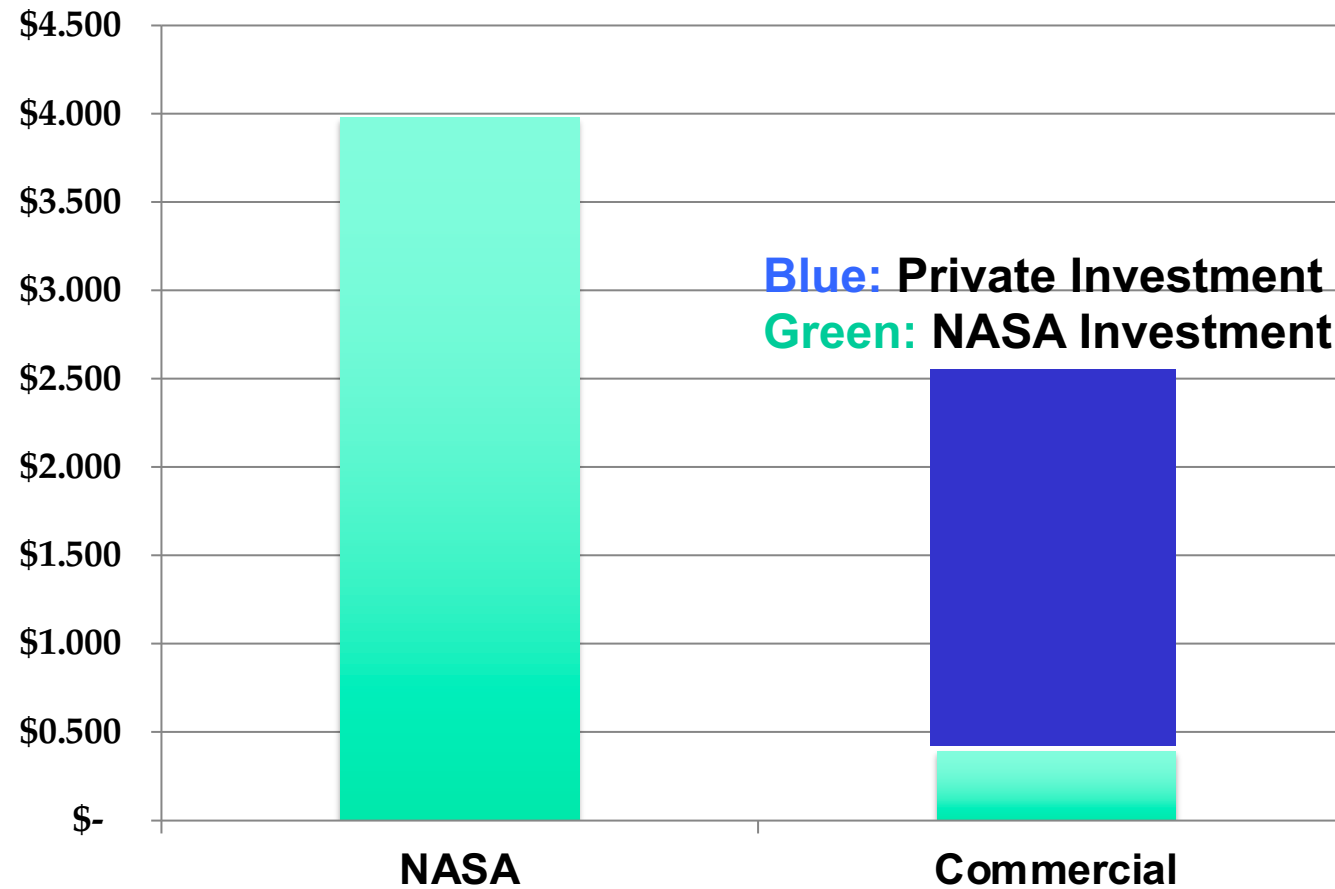
Bob and Doug go to the
Space Station – and
return safely after 2
months – in August 2020



*As of August 2026, there have been 15 successful
Commercial Crew missions by SpaceX

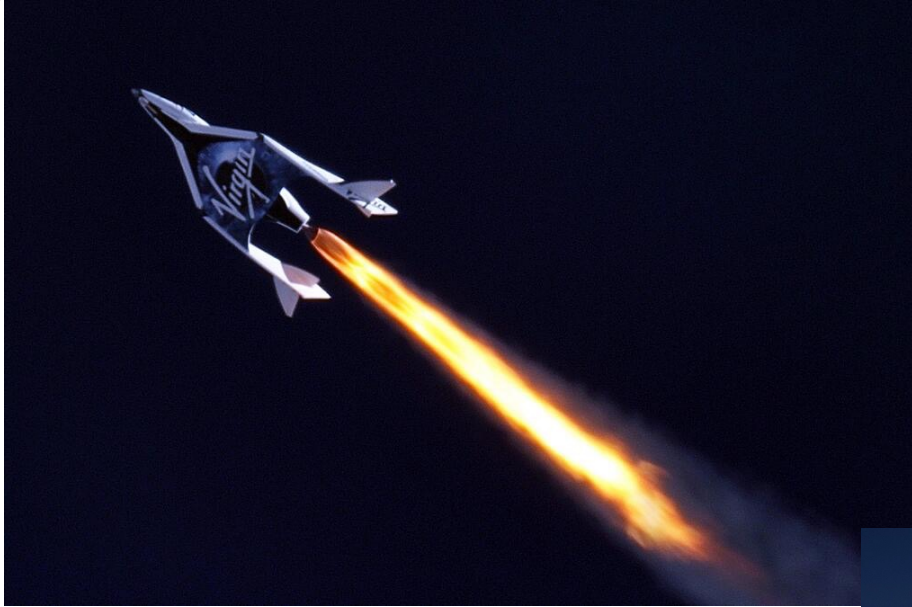
*Boeing has yet to have a fully successful launch
and return under Commercial Crew

Falcon 9 Comparison of Traditional NASA Development Cost vs Commercial



Public documents
plus G. Shotwell
comments

Suborbital Tourism – originally promising now suspended



Virgin Galactic: 7
commercial missions
carrying 61 passengers.
Suspended operations in
2024

Blue Origin: New Shepard
has 38 flights: 13 with
passengers – 98 people:
Operations suspended 2026



Digital Globe:
Worldview
Spacecraft:



High-resolution (30
cm) imaging sold to
Industry and US
Gov't

Skybox –
then Terra Bella;
purchased by Planet



Silicon Valley Startup:
~1 meter imaging with
high repeat rate.

Planet Labs – now Planet
very small spacecraft



Silicon Valley
Startup: ~3 meter
imaging with high
repeat rate.

Planet now has ~200 operating
spacecraft with resolution from
30 cm to 3 meters

- SpaceX is leading with ~11,000 Starlink satellites in Low Earth orbit
 - Google, along with Fidelity, have invested \$1 billion in Space Exploration Technologies (SpaceX).
- Virgin, Qualcomm have invested in OneWeb
 - Richard Branson's Virgin Group and Qualcomm have invested in a venture that is flying 654 satellites that can provide high-speed, global Internet access



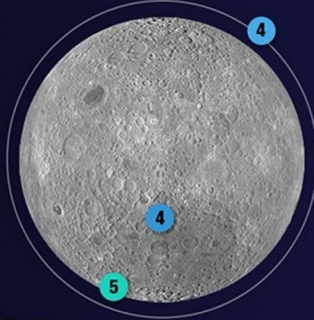
1,055 Starlink Satellites

Commercial Lunar Payload Services | Landing Sites



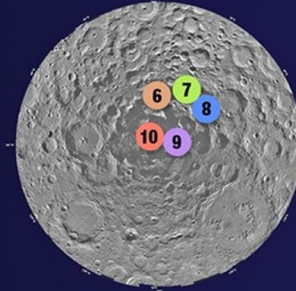
NEAR SIDE

- 1 **ASTROBOTIC PEREGRINE MISSION-1**
Landing Site: Did not land on the Moon
Lander Name: Peregrine
CLPS Contract Award: TO 2-AB
- 2 **INTUITIVE MACHINES IM-3**
Landing Site: Reiner Gamma
Lander Name: NOVA-C
CLPS Contract Award: TO CP-11
- 3 **FIREFLY BLUE GHOST MISSION 1**
Landing Site: Mare Crisium
Lander Name: Blue Ghost
CLPS Contract Award: TO 19D



FAR SIDE

- 4 **FIREFLY BLUE GHOST MISSION 2**
Landing Site: Lunar Far side and Orbit
Lander Name: Blue Ghost
CLPS Contract Award: TO CS-3 and CS-4
- 5 **TEAM DRAPER**
Landing Site: Schrodinger Basin
Lander Name: ispace-U.S. APEX 1.0 Lunar Lander
CLPS Contract Award: TO CP-12



SOUTH POLE

- 6 **INTUITIVE MACHINES IM-1**
Landing Site: Malapert A
Lander Name: NOVA-C
CLPS Contract Award: TO 2-IM
Status: Completed
- 7 **ASTROBOTIC GRIFFIN MISSION-1**
Landing Site: Mons Mouton
Lander Name: Griffin
CLPS Contract Award: TO 20A
- 8 **INTUITIVE MACHINES IM-4**
Landing Site: Mons Mouton
Lander Name: NOVA-C
CLPS Contract Award: CP-22
- 9 **BLUE ORIGIN BLUE MOON / MK1 PATHFINDER**
Landing Site: South Polar Region
Lander Name: Blue Moon
Mark 1 Lander
CLPS Contract Award: CP-22
- 10 **INTUITIVE MACHINES IM-2**
Landing Site: South Polar Region
Lander Name: NOVA-C
CLPS Contract Award: TO PRIME-1

Four NASA Commercial Lunar Payload Services (CLPS) missions have flown to space; one company went bankrupt: one successful landing, one partial success, and two failures

Peregrine Mission One (TO2-AB):

Launched by Astrobotic Technology on January 8, 2024; did not reach the Moon (failure).

IM-1 / Odysseus (TO2-IM): Launched by Intuitive Machines on February 15, 2024; tipped over, limiting operations (partial failure/success).

Blue Ghost Mission 1 (TO19D):

Launched by Firefly Aerospace on January 15, 2025; first fully successful lunar surface landing in Mare Crisium (success).

IM-2 (CLPS-3): Launched by Intuitive Machines on February 27, 2025, to Mons Mouton, but tipped over (failure).

- **Interlune:** Seattle-based space resource startup co-founded by former Blue Origin executives and Apollo astronaut Harrison Schmitt, which has secured high-profile supply contracts and payload agreements with NASA and private tech firms.
- **Lunar Helium-3 Mining, LLC (LH3M):** An Arizona-based venture focused on harvesting lunar helium-3 for commercial fusion and quantum markets.
- **Black Moon Energy:** A Houston-based firm targeting initial reconnaissance rovers to map and extract gas from lunar regolith.
- **Magna Petra:** A prospective lunar resource developer simulating solar wind deposits and planning surface-plume collection methods
- **Astrotech Corporation:** A company that has stated its intention to extract lunar helium-3 utilizing mass spectrometer technologies and heavy-lift rocketry.



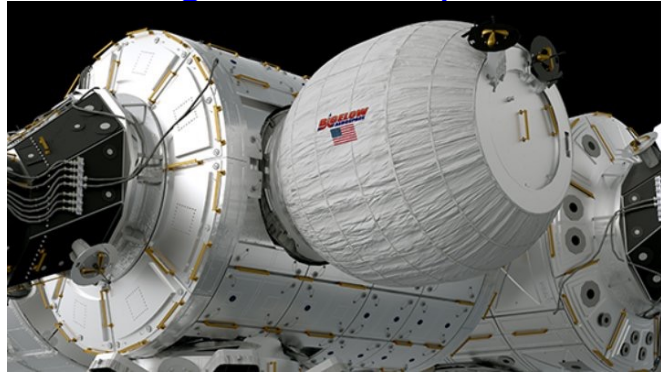
Interlune

Physics concept is sound, but not yet demonstrated

Living in Space: Replacing the ISS – A Serious Need



Proof of Principle:
Bigelow Aerospace



Real estate mogul developed an
“Expandable” habitat (BEAM) in
2016 still attached to ISS.

Axiom Station (Axiom Space): Building commercial modules that initially attach to the ISS. These segments will later disconnect to form a standalone, free-flying commercial station.

Haven-1 (Vast Space): A compact, single-module standalone station targeting an early launch on a SpaceX Falcon 9 to act as a human-centric pathfinder and microgravity lab

Orbital Reef (Blue Origin & Sierra Space): A large-scale mixed-use business park concept in orbit designed for research, industrial manufacturing, and space tourism.

Starlab (Starlab Space / Voyager Space & Airbus): A collaborative large-volume habitat and laboratory platform utilizing advanced inflatable or metal structures tailored for commercial research



Starlab



Axiom Station



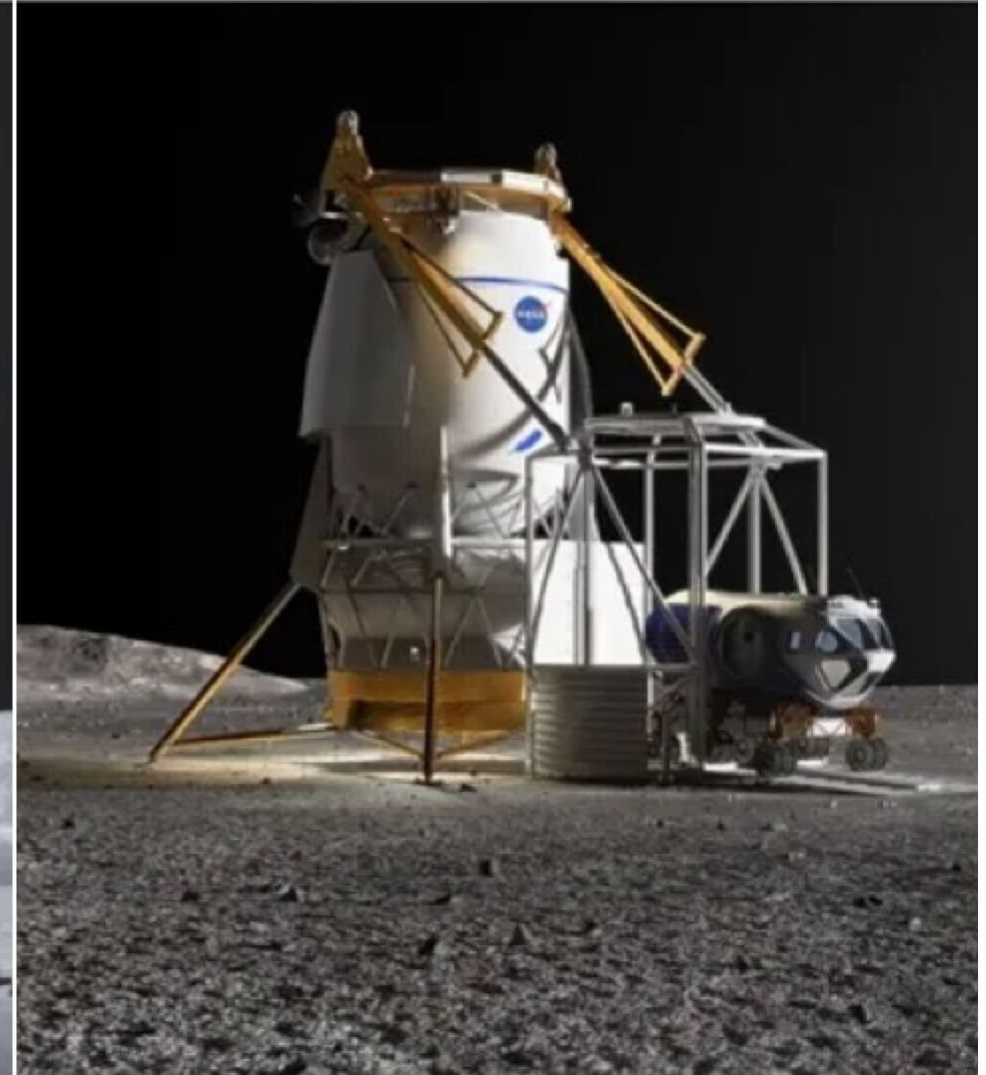
Haven-1



- SpaceX's 13th Starship test flight on July 24, 2026, was a success.
- The upper stage deployed 20 Starlink V3 satellites in space, completed a Raptor engine restart test, and survived atmospheric reentry

NASA elected to select commercial vendors for the Lunar Human Landing System

Currently both SpaceX and Blue Origin are on budget but well behind on schedule



Next major milestone: On orbit refueling challenges



- Both SpaceX Starship and Blue Origin's Blue Moon require on-orbit refueling
- SpaceX will require complex, unprecedented docking and the transfer of large amounts of cryogenic propellant (liquid methane and oxygen) in microgravity.
 - 4 – 10 docking and transfer operations are needed
- Blue Moon Mark 2 (Human Lander) requires refueling to carry 20 metric tons to the lunar surface. It will be refueled by a Cislunar Transporter, which is launched separately.
 - The process requires multiple tanker launches (at least four) of hydrogen and oxygen propellants to supply the lander in orbit.

It cannot be overemphasized that such on orbit cryogenic transfers have never been accomplished before

- Data Centers use vast amounts of power and generate huge amounts of waste heat
- The concept is to use the energy from the sun to power the computer processors and dump the heat into the cold of space
- Processed data would be sent to the ground stations
- 3 axis-stabilized spacecraft
 - Have one side toward sun receiving energy using large photovoltaic solar arrays that directly capture unfiltered solar radiation in space
 - One side radiating heat toward space
- Challenges:
 - Huge area solar array (football field)
 - Extremely large radiators (only heat removal possible.)
 - Packing/folding problem to get arrays into launch vehicle
 - Failure rates of reaction wheels that stabilize 3-axis S/C



Conceptual design

Summary: Major engineering challenges, unclear whether positive ROI business case is possible

KNOWN SPACE UNICORNS

Sorted in approximate order companies reached a \$1 billion valuation. Data compiled as of June 3.

This list will be updated at SpaceNews.com.



COMPANY	ACHIEVED UNICORN	SOURCE FOR UNICORN STATUS
Kepler Communications	2026	SpaceNews sources
Cowboy Space	2026	Company
Skyroot Aerospace	2026	Company
True Anomaly	2026	Company
Starcloud	2026	Company
Vast	2026	SpaceNews sources
Aalyria	2026	Company
Tomorrow io	2026	SpaceNews sources
Gilmour Space Technologies	2026	Company
Apex	2025	Company
Varda Space	2025	SpaceNews sources
Impulse Space	2025	SpaceNews sources
Isar Aerospace	2025	Company
K2 Space	2025	Company
Loft Orbital	2025	SpaceNews sources
Galactic Energy Aerospace Technology	2025	Reports
i-Space	2025	Reports
MinoSpace	2025	Company
Stoke Space	2025	SpaceNews sources
Shanghai Spacecom Satellite Technology	2024	Reports
Landspace	2023	Reports
Space Pioneer	2023	Reports
Iceye	2022	Company
Sierra Space	2021	Company
Astranis	2021	SpaceNews sources
Axiom Space	2021	SpaceNews sources
Relativity Space	2020	SpaceNews sources*
Mapbox	2020	SpaceNews sources
Changguang Satellite Technology	2020	Reports
SpaceX	2012	SpaceNews sources

*Relativity Space's valuation soared to \$4.2 billion after a 2021 funding round, a source told SpaceNews at the time, but a strategic pivot and majority sale to former Google CEO Eric Schmidt have since blurred the picture.

How Space Entrepreneurship has expanded

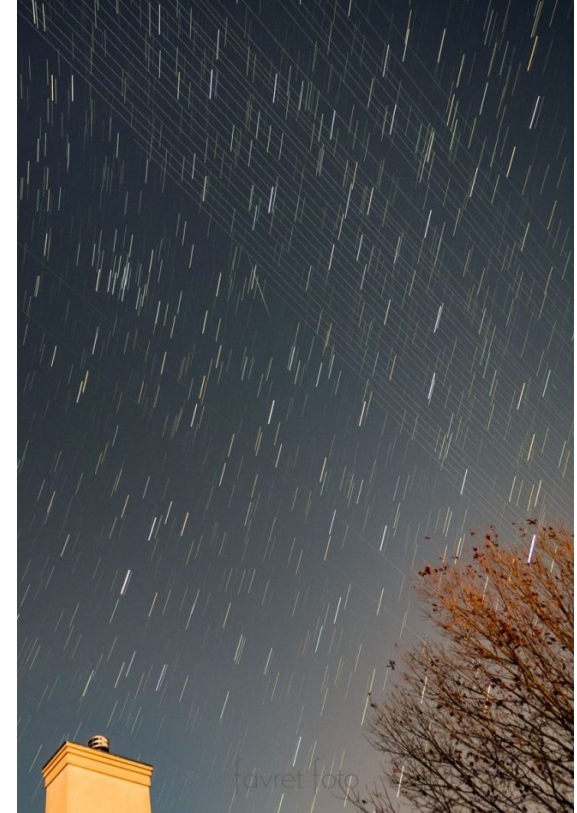


Unicorns are privately held startups valued at over \$1 billion.

When I gave a similar talk in 2019, there was only SpaceX

Now there are ~ 30 unicorns

- Just as Low Earth Orbit (LEO) has become an economic enterprise zone, the cis-lunar and Moon may as well.
- Mars is much further in the future
- Many ideas are being pursued. Some like LEO comsats will be driven by production line and launch cost. Some like He-3 depend on leading edge physics and technology
- Suborbital tourism still has a market if the recurring cost can be managed and VG propulsion technology resolved
- Much as happened in LEO, NASA is attempting via the commercial Human Landing System to give entrepreneurs a path forward – but the refueling cost and complexity must be addressed
- Starship and New Glenn vehicles (which just suffered a catastrophic explosion) must prove that they have an operation cadence which is acceptable



Whatever happens, it is now clear that a space economy beyond Geostationary Comsats is well underway