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Drawing Capital

Space: Opportunities in the Final Frontier

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Presented by:

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About

Drawing Capital is an innovation-focused private investment firm headquartered in Silicon Valley, CA.

Drawing Capital aims to capture the expansion of a technology-forward world by investing in leaders that we believe carry undervalued growth. Our expertise in finance and data science enables us to participate in investment opportunities in public markets not captured by passive investing.

“The revenue generated by the global space industry may increase to more than \$1 Trillion by 2040.”

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Historical Context



Market Breakdown



Governance & Regulation



Why Now?



Sizing the Market



Sample Companies

Historical Context

- Important historical events
- Recent developments
- Outlining the opportunity ahead



Important Historical Events

1957

- 1st artificial satellite, Sputnik I, launched by Soviet Union.

1961

- Apr 12 - Yuri Gagarin (Soviet Union) completes the first manned space flight, orbiting Earth in 108 minutes.
- May 5 - U.S. launches first American astronaut, Alan Shepard Jr., into space, on a 15-minute, 22-second suborbital flight.

1962

- John Glenn becomes first American to orbit Earth, completing three orbits.

1969

- A big step for humanity: Neil Armstrong and Buzz Aldrin land on the moon and spend nearly a day there, with 2.5 hours outside of the capsule.

1981

- Shuttle Columbia becomes first winged spaceship to orbit Earth and return to airport landing.

1999

- Discovery becomes first shuttle to dock with international space station, a multinational, permanent, orbiting research laboratory.

2000

- An American and Russian crew begins living aboard the international space station.

Since 2010, and especially since 2013 or 2014, "it has been an enormous change — a sea change, almost... It's mind-boggling."

- Eric Stallmer, President, Commercial Spaceflight Federation

Recent Developments - Overview



Early-innings of satellite internet

Starlink (SpaceX), Project Kuiper, and Kepler Communications



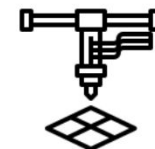
Declining space transportation costs

Cost to reach low Earth orbit (LEO) has declined by at least a factor of 20. NASA's previous space shuttle had a cost of ~\$1.5 billion to launch 27,500 kg to LEO. ²



Increasing launch frequency

Relativity Space, SpaceX, Planet Labs, Swarm Technologies



Manufacturing & 3D Printing

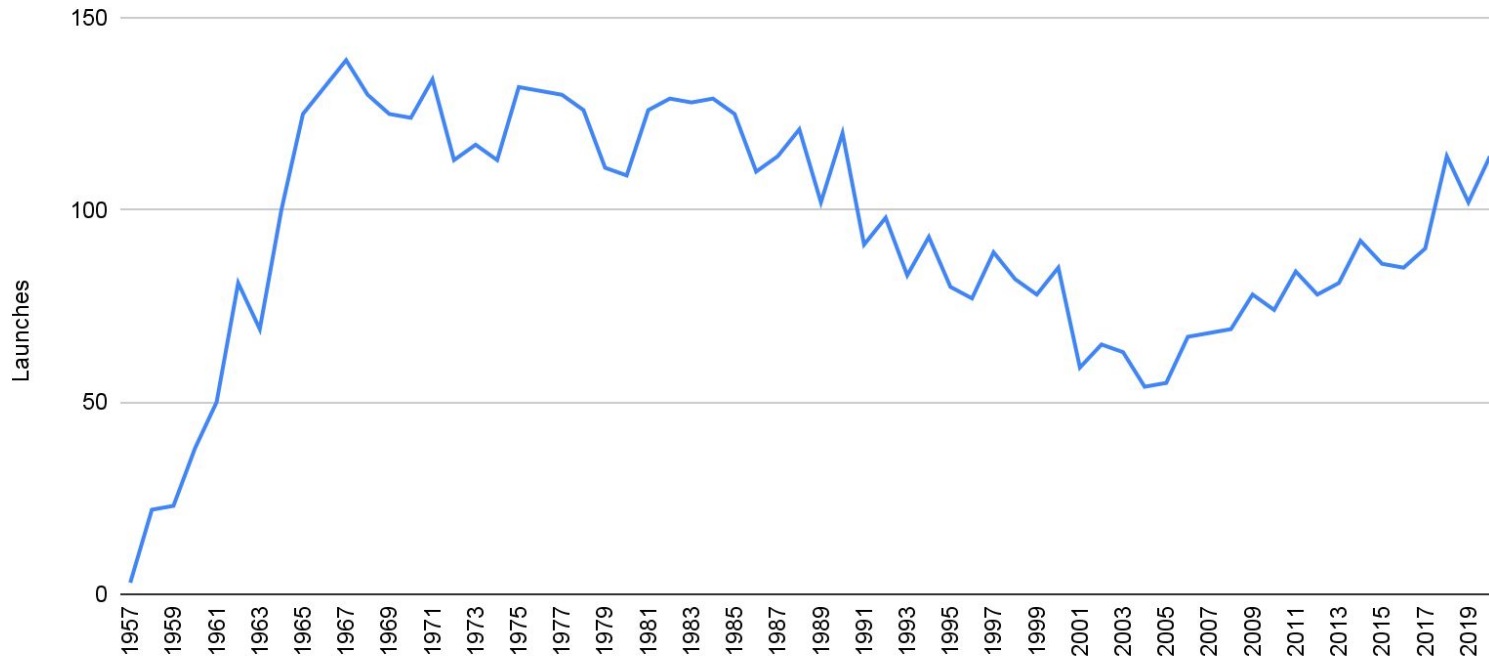
Varda Industries, Relativity Space

¹<https://www.spacex.com/about/capabilities>

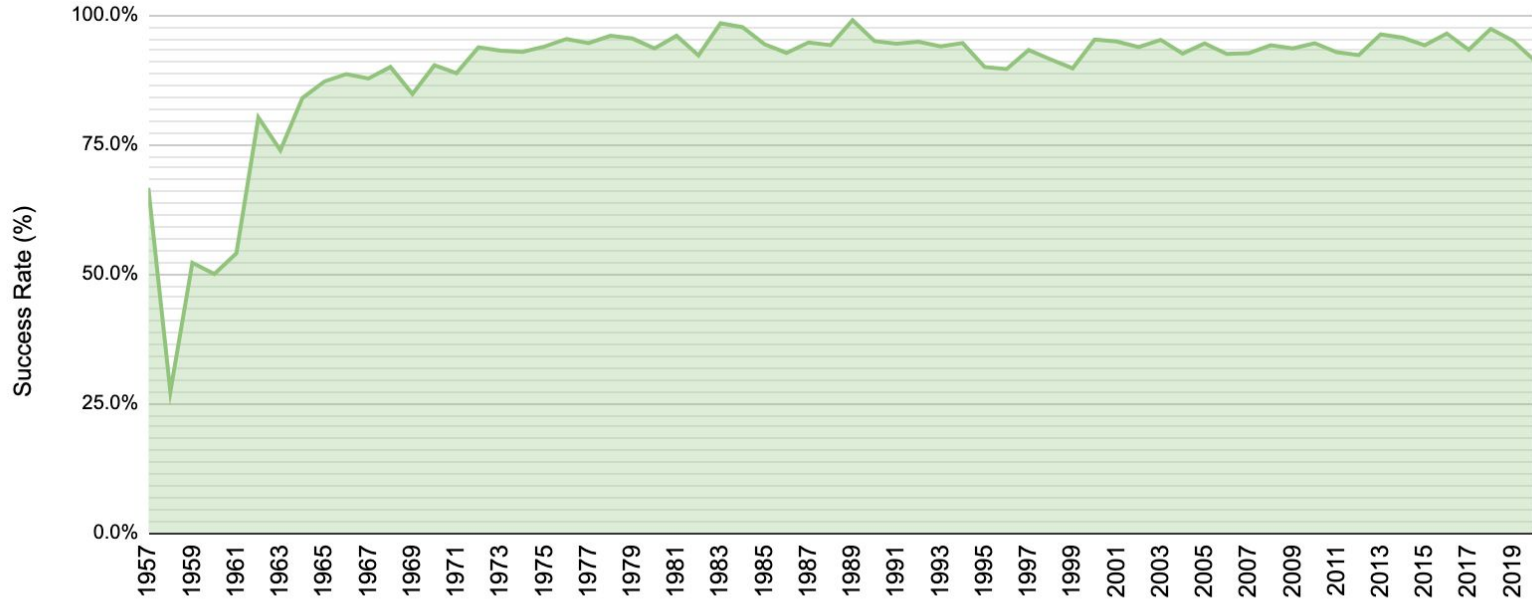
² https://ttu-ir.tdl.org/bitstream/handle/2346/74082/ICES_2018_81.pdf?sequence=1&isAllowed=y



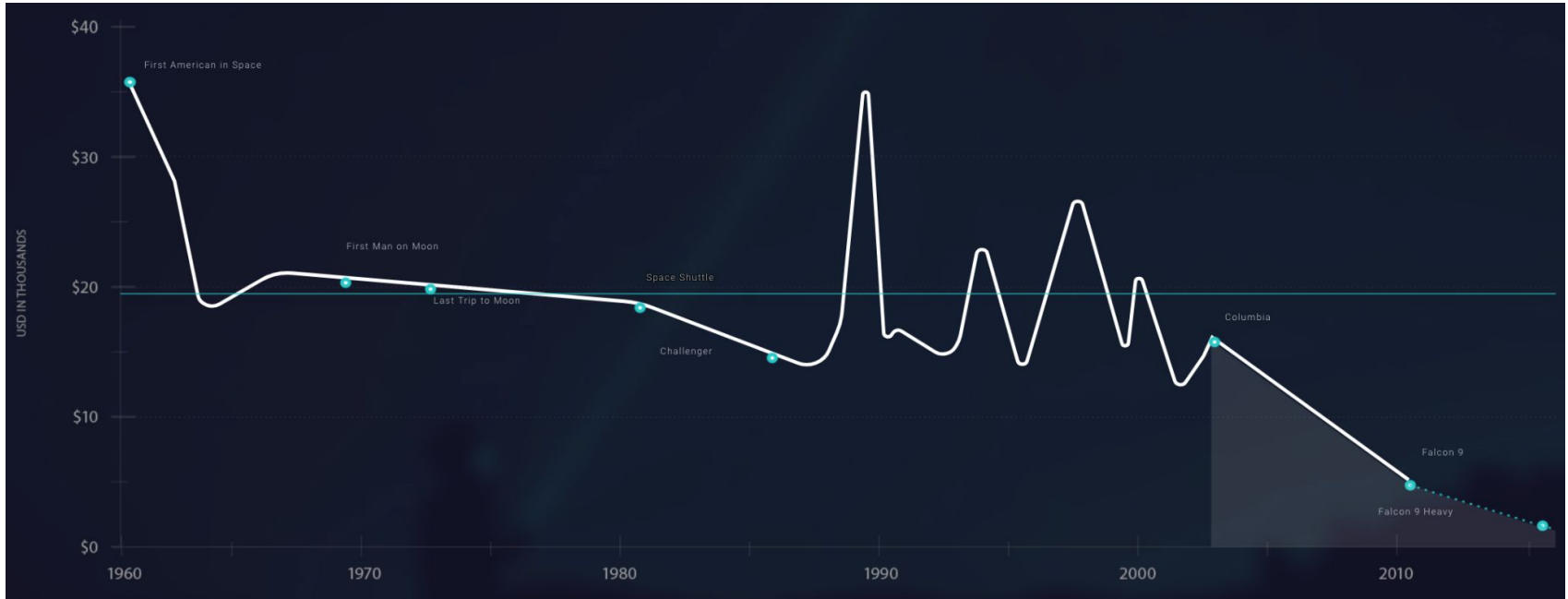
Worldwide Orbital Launches By Year



Worldwide Orbital Launch Success Rates (%)



Cost to Launch 1kg of Mass into Orbit



Recent Developments - Battle of the Billionaires

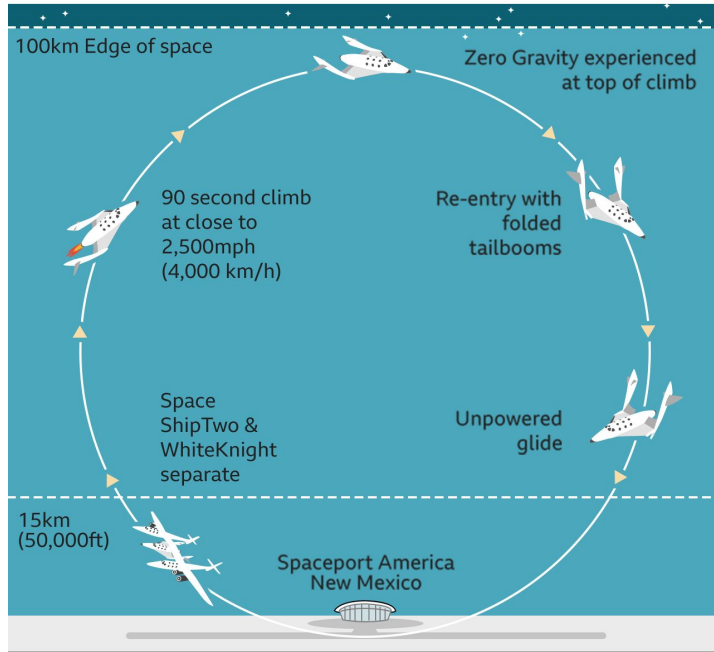


Recent Developments - Battle of the Billionaires

| | Virgin Galactic | SpaceX | Blue Origin |
|---------------------|--|--|---|
| Founded | 2004 | 2002 | 2000 |
| Goal | Make space available for all (tourism) | 1 million people on Mars by 2050 (exploration) | Build a “road” to space (process/ infrastructure) |
| Vehicle(s) | WhiteKnightTwo, SpaceShipTwo | Falcon 9, Falcon Heavy, Dragon, Starship | New Shepard, New Glenn |
| Cost Per Ticket | \$250,000 | \$55 million | \$28 million (auction) |
| Successful Trips | 20 | 152 | 15 |
| Tangential Business | Virgin Orbit (spin-off) | Starlink | Project Kuiper |

Recent Developments - Virgin Galactic

Unity rocket plane flight plan



Sir Richard Branson first announced his intent to make a space plane in 2004.

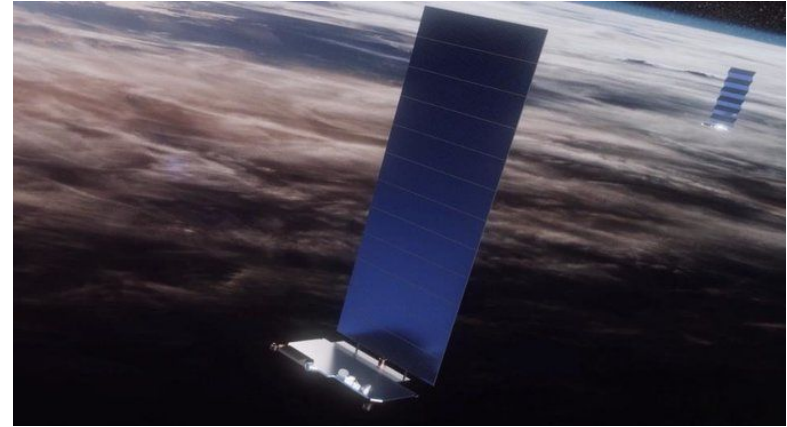
He has maintained a sharp focus on providing wide-spread space travel.

Displayed founder-led initiative by taking first flight on July 11, 2021.

Recent Developments - SpaceX



The Dragon spacecraft completed its 22nd Commercial Resupply Services mission to and from the International Space Station for NASA.



Starlink has deployed about 1,800 satellites and expects to have global coverage by September this year.

Recent Developments - Blue Origin



Bidding for July 20th flight to space with Jeff Bezos and his brother, Mark, goes for \$28 million.

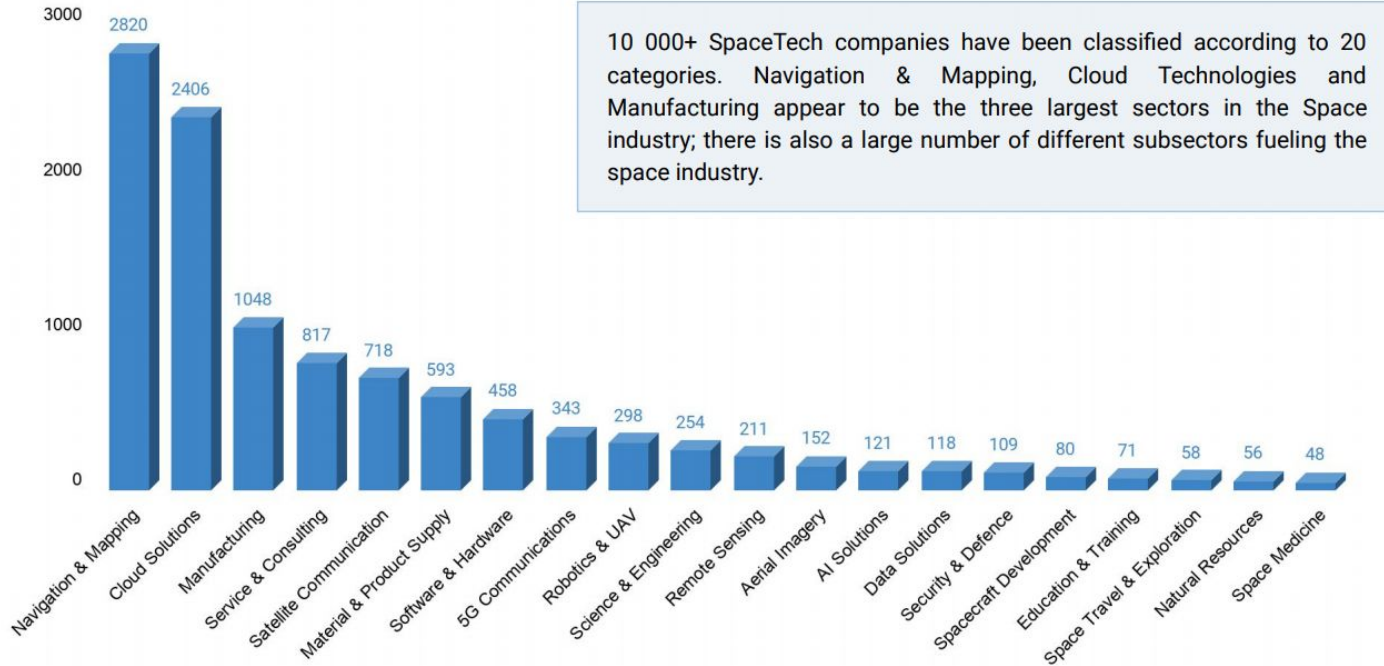
Project Kuiper takes on Facebook's satellite team.

Satellite launches for Kuiper have not started, but FCC agreement requires that half of the planned 3,236 launches take place by 2026.

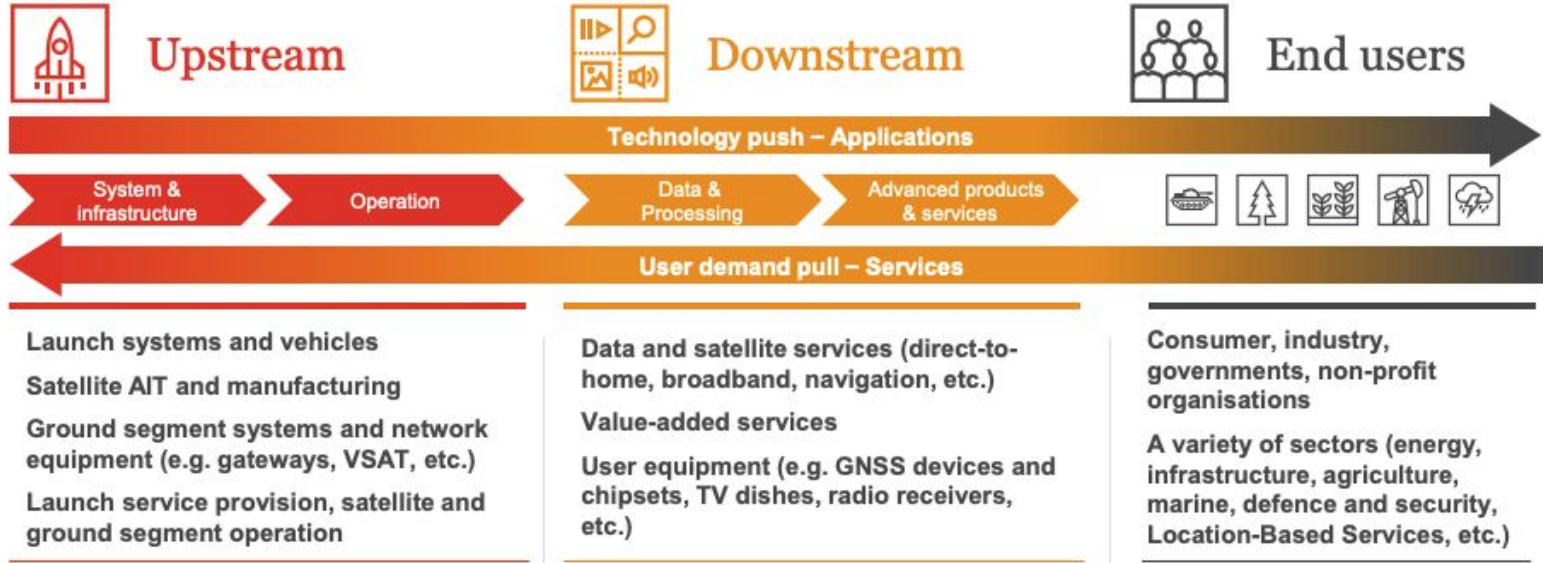
Market Breakdown

- Overview of industry layout
- Key market segments
 - Access, Exploration, and Launch technology
 - Satellite communications
- Catalysts for key segments

Number of Companies in Different Categories



Overview



Key Segments Today



Earth Observation



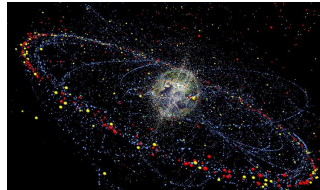
Satellite Communication
(Satcom)



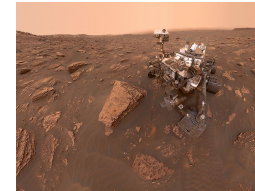
Navigation



Access to Space



Space Situational
Awareness



Space Exploration

Launch Technology: Access & Exploration



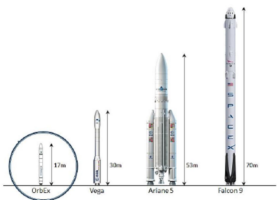
Catalysts for Launch Technology



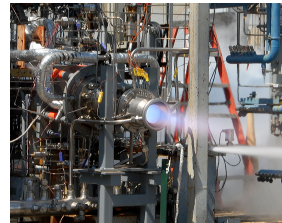
Cost reduction through the development of modular and reusable launchers.



Disruption of captive institutional market with larger private players.



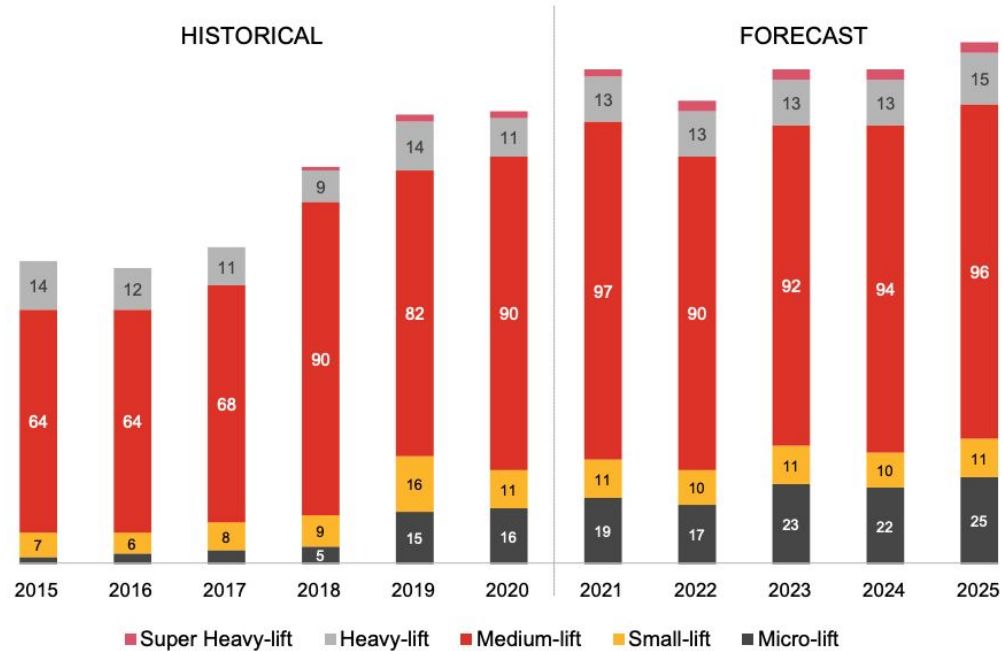
Development of micro-launcher systems for new entrants.



Development of engines using LOX/ methane propellant.

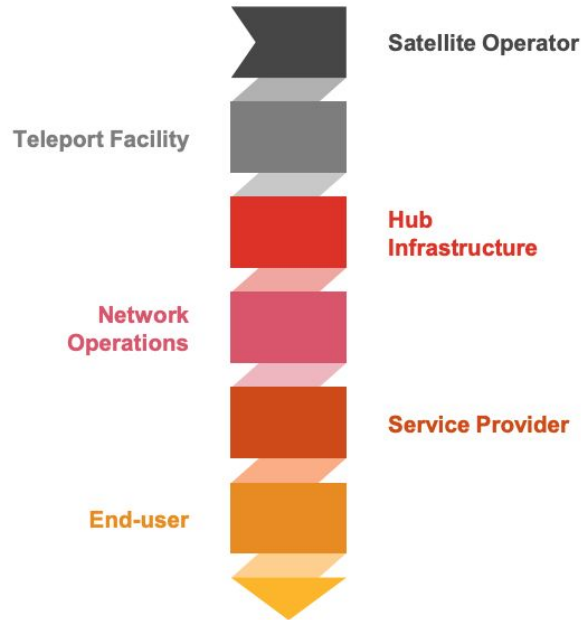
Launch Technology: Access & Exploration

Historical and forecasted evolution in space launches per launcher class (2015-2025)



Satcom is the biggest satellite services market.

Satellite Communication Value Chain



- Estimated global market of \$153 billion.
- 21% estimated CAGR.
- Compared to surface-based infrastructure, Satcom provides superior availability, coverage, confidentiality, and resilience.
- Beneficiaries range from leisure industry to governmental activities.



Low Earth Orbit (LEO) satellite constellations are expected to drive momentum within this market by supplying 85% of the capacity by 2024.

Catalysts for Satcom

1

Demand-pull from mobility markets and 5G enablers.

3

Low latency and high throughput connectivity demand across the globe, especially in rural areas.

2

Safety and reliability for offshore and merchant vessels; land mobility (i.e. emergency vehicles).

4

Increased frequency and capacity of launch vehicles can increase deployment of LEO constellations.

Governance & Regulation

- Domestic and international law
- Evolution of space agencies
- Space-asset insurance

Space regulations must comply with international law that directly impact domestic regulation.

INTERNATIONAL

International conventions, including:

- International liability for damages;
- Registration of launched objects;
- Agreement governing activities of the moon and other bodies.

UNOOSA Guidelines

- Space debris mitigation guidelines



DOMESTIC

Compliance with international law

- Space debris mitigation
- Environmental protection
- Liability to third-party and space insurance
- Safety of humans and property

Operation of space objects

- Sounding rockets & suborbital launches
- Orbital launches
- Launch permit
- Satellite operations

Space agencies are required to assume new roles in response to an evolving space environment.

Increasing reach into **downstream activities and value chains**.



Leads to a concept of a broader **space economy**.



With an increasing number of overlapping industries and potential users, there is a growing need to **re-align governance to match future needs of a new economy**.

Space insurance: growth of in-orbit activities increases the need for Space Traffic Management (STM) and insurance processes.

| Types of Insurance | | |
|--|---|---|
| Property Insurance Insures the value of space assets (rockets, satellites, etc.) | Third Party Liability (TPL) Insures against damages dealt to third parties. | Umbrella Policies One entity buys a fixed amount of coverage and distributes amongst assets based on internal analysis. |
| Current | | Future |

IV

Why Now?

- Growing demand for real-time spatial awareness of everything on Earth will drive demand for satellites and space infrastructure
- Governments are incentivized to invest in space infrastructure to compete against others doing so
- The more satellites launched, the more infrastructure needed to manage this traffic which enables more satellites; similar to how more cars and roads influence each other's growth.

Copernicus Program - Free Satellite Data for EU

In July 2020, the ESA (European Space Agency) awarded EUR 2.5B to the European space industry for development of 6 HPCMs (High Priority Candidate Missions).



Atmosphere

Analyze atmospheric composition



Marine

Track marine pollution



Land

Monitor deforestation rates



Climate

Monitor melting of polar ice caps



Security

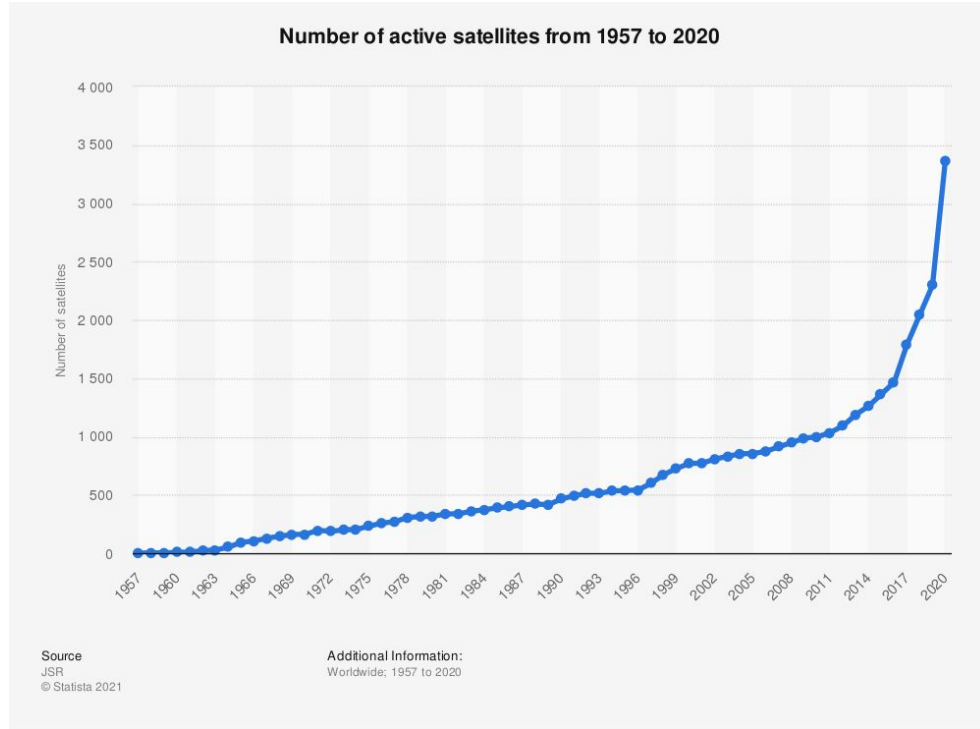
Assess risk at EU borders



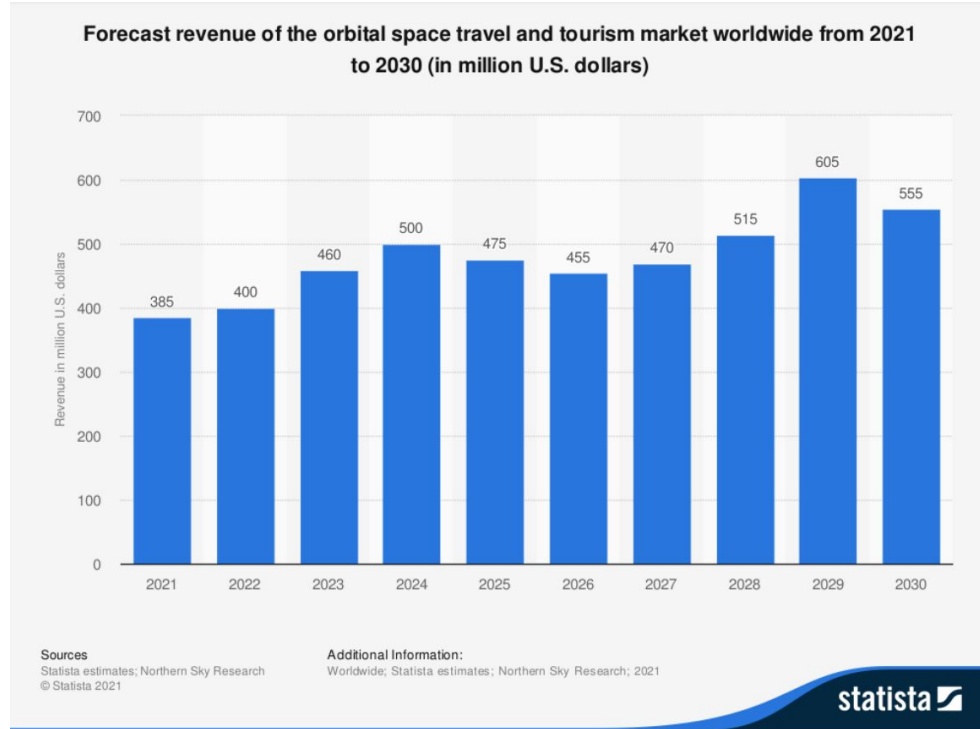
Emergency

Trace outbreaks of disease

Number of Active Satellites Has Grown Exponentially



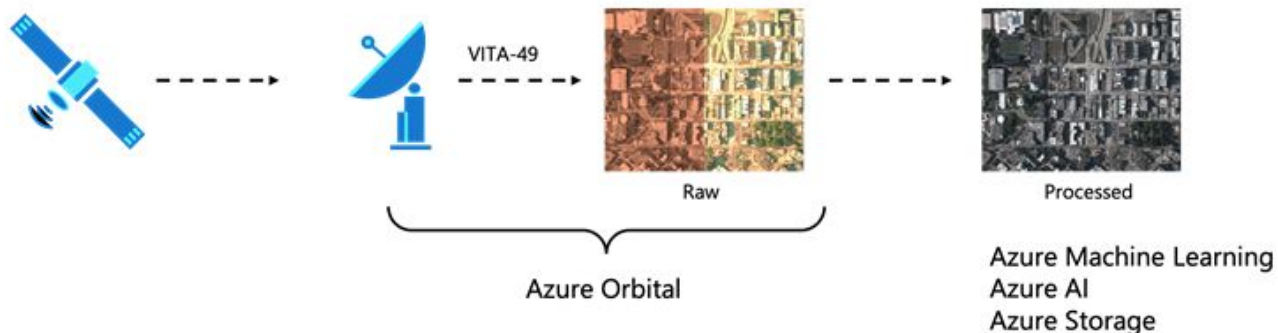
Space Tourism Market Expected to Grow 44% by 2030



Ground Station as a Service (GSaaS)

- Problem: Satellites need to send data to ground stations, but they move so fast that there's only a 10-20 minute window to relay data.
- Solution: Create a network of ground stations that satellites use on demand i.e. GSaaS.
- Microsoft and Amazon already compete for GSaaS by utilizing their data centers.

Microsoft offers GSaaS and AI/ML, a superior combined product over its incumbents.



Growing Demand for Navigation and Mapping

- Unidentified Flying Objects present a security threat
- Optimizing delivery, freight, and vehicle routes can have vast cost/resource savings
- Managing air and space traffic will become increasingly important
- Monitoring Earth's forests and polar ice caps is important to tackle climate change

Navigation + Mapping Use Cases



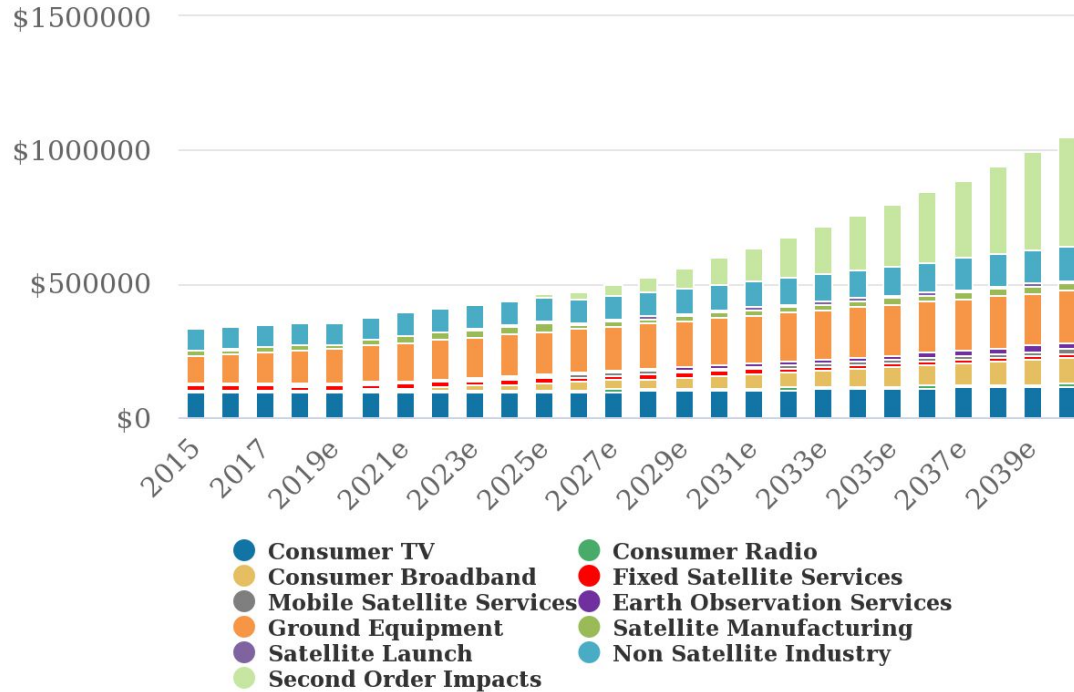
V

Sizing The Market

- Lack of space-tech assessment makes estimating difficult
- Space-tech is growing because derivative markets are growing
- The United States leads in number of satellites currently in orbit and space-tech budgets

The Global Space Economy

(USD, millions, estimated)



Lack of Taxonomy and Boundaries Makes TAM Hard to Estimate

- Different estimates include or exclude certain sub-categories.
- Boundaries between space and non-space activities are blurred
- Current lack of assessment on how space-tech benefits other industries

Sources

Market estimate



USD 371 Bn
(2020)

Includes military, research, space services, infrastructure, satellite manufacturing



USD 423.8 Bn
(2020)

Includes space infrastructure and government budgets



USD 366 Bn
(2019)

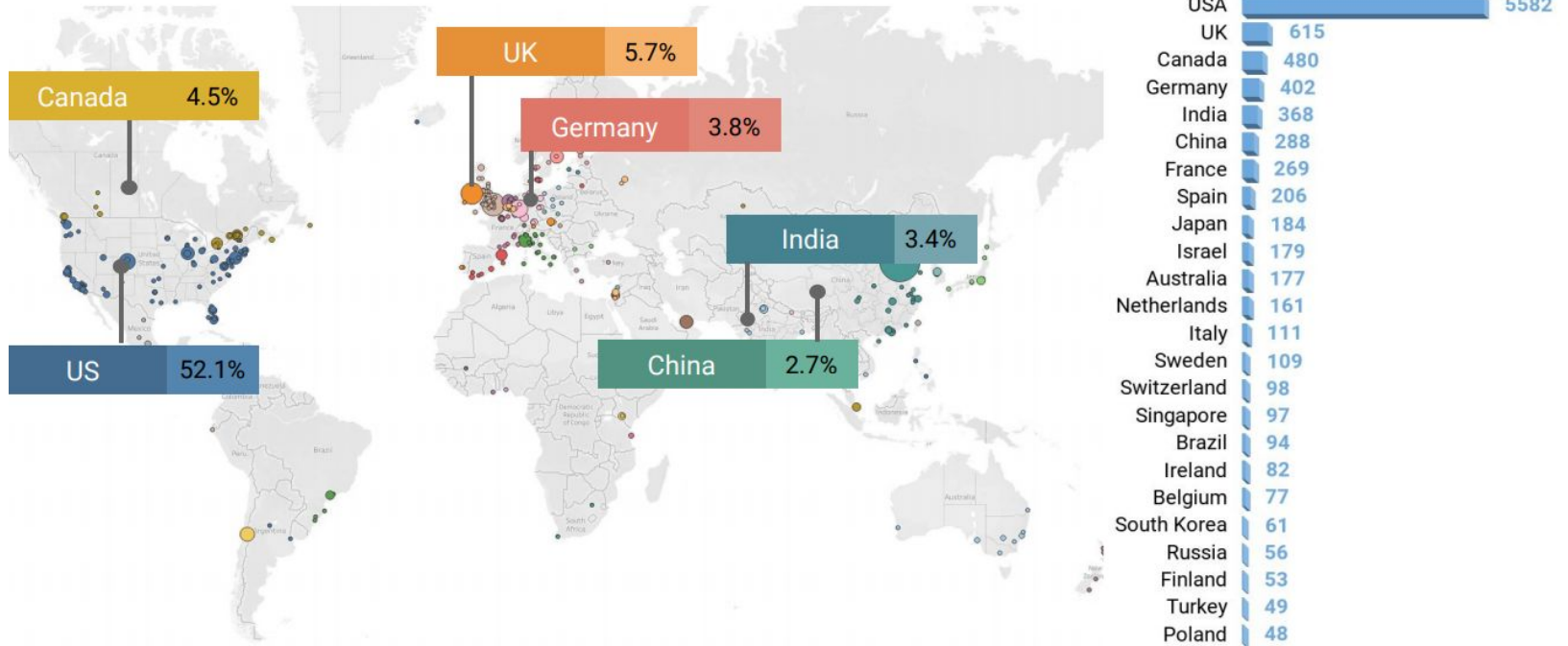
Includes telecom, remote sensing, security, government budgets



USD 298 Bn
(2019)

Includes only satellite operations and manufacturing

Number of Space-tech Companies by Country

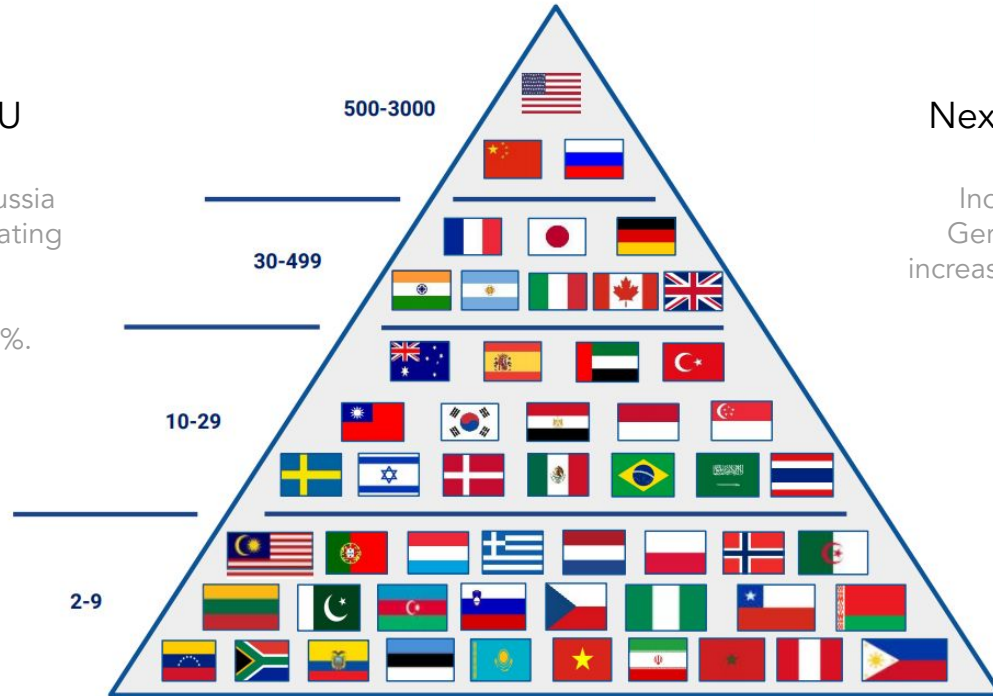


Number of Satellites Launched by Country

Leaders - US, CN, RU

United States, China, and Russia show large interest in dominating orbital real estate.

Combined, they own > 75%.
US owns > 50%.



Next Up - IN, UK, DE, etc

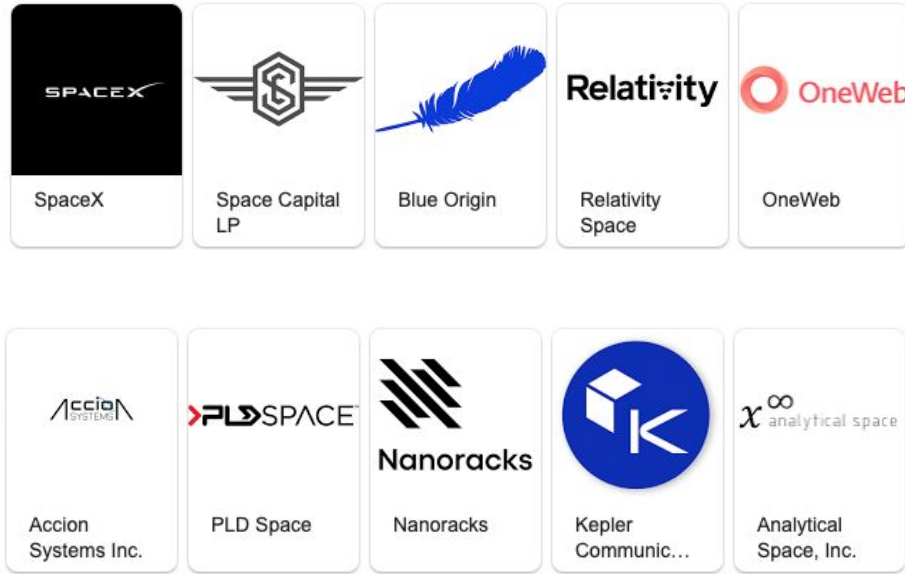
India, United Kingdom, and Germany among others show increasing competition in the space race.

VI

Sample Companies

- A sample list of industry-leading businesses and exciting startups within the space economy.
- There are numerous ETFs and SPACs providing opportunity to invest in the space-tech.

Examples of Startups & Private Companies in the Space Industry



Any stock, options or futures symbols, companies or investment products displayed are for illustrative purposes only and are not intended to portray recommendations. Source: Google

Top 20 Public Companies Involvement in Space by Market Cap

| | | | | | |
|----|-----------------------------------|-----------|----|-----------------------------------|----------|
| 1 | Eli Lilly and Company | \$176.2 B | 11 | Atlas Copco AB | \$70.6 B |
| 2 | Danaher Corporation | \$153.4 B | 12 | Safran SA | \$62.1 B |
| 3 | Honeywell International Inc. | \$150.8 B | 13 | Viacom CBS Inc. | \$54.8 B |
| 4 | The Boeing Company | \$149.4 B | 14 | Northrop Grumman Corporation | \$52.5 B |
| 5 | Amgen Inc. | \$141.2 B | 15 | General Dynamics Corporation | \$51.6 B |
| 6 | Raytheon Technologies Corporation | \$118.6 B | 16 | TE Connectivity Ltd. | \$43.6 B |
| 7 | General Electric Company | \$116.2 B | 17 | Parker Hannifin Corporation | \$40.6 B |
| 8 | Lockheed Martin Corporation | \$98 B | 18 | Microchip Technology Incorporated | \$38.2 B |
| 9 | Deutsche Telekom AG | \$94.5 B | 19 | TransDigm Group Incorporated | \$32.6 B |
| 10 | Airbus SE | \$94.3 B | 20 | Virgin Galactic | \$4.56 B |

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Source: SpaceTech Analytics



Sample ETFs in the Space Economy

ARKX

ARK Space
Exploration
ETF

ITA

iShares US
Aerospace &
Defense ETF

UFO

Procure
Space ETF

ROKT

SPDR® S&P
Kensho Final
Frontiers ETF



Sample SPACs in the Space Economy

VACQ

Vector Acquisition
Corp
→ RocketLab

SRAC

Stable Road
Acquisition Corp
→ Momentus

SPFR

Jaws Spitfire
Acquisition Corp
→ Velo3D

SFTW

Osprey Technology
Acquisition Corp
→ BlackSky

Summary

- 1 Space-tech is what makes derivative markets like delivery, ride-sharing, flights, earth observation, telecom, etc possible
- 2 The “Fourth Industrial Revolution” is fueling development in space-tech as more information about Earth helps manage logistics across various industries
- 3 Government interest in the space economy is a vital piece to a country’s participation in space-tech
- 4 Declining costs in launching and manufacturing satellites is driving further adoption of space-tech industries even in developing countries
- 5 Space is still a largely unexplored frontier that has abundant opportunities for our civilization

Resources



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