December 2019

Travel beyond 2020
Space travel

Key themes

- **Private companies are providing the impetus to make space travel more accessible.**
- **Blue Origin and Virgin Galactic may offer the first suborbital trips as early as 2020.**
- **Plans are underway for travel to the Moon and spaceflight beyond.**
- **The first fare-paying spaceflights may be just around the corner.**
- **Space travel promises to significantly cut existing journey times and open new frontiers.**

NASA's Space Shuttle completed its last mission in 2011, but the appetite for space travel hasn't disappeared. The race for space has continued among private enterprise. Passengers could be traveling into space as soon as 2020.

Private companies have taken a clear interest in space travel in recent years. From US$176 billion in 2006, the value of the global space marketplace reached more than $345 billion in 2018.[1] Investors have taken note and are backing the industry. Between 2000 and 2014, space startups received a total of $1.1 billion in venture capital investment—roughly $73 million per year. In 2015 alone, investment exceeded $1.8 billion. In 2016, more than 100 investors contributed $2.8 billion to 43 space-related startup companies. By 2017, this had risen nearly 40% to 120 investors contributing $3.9 billion to commercial space companies.

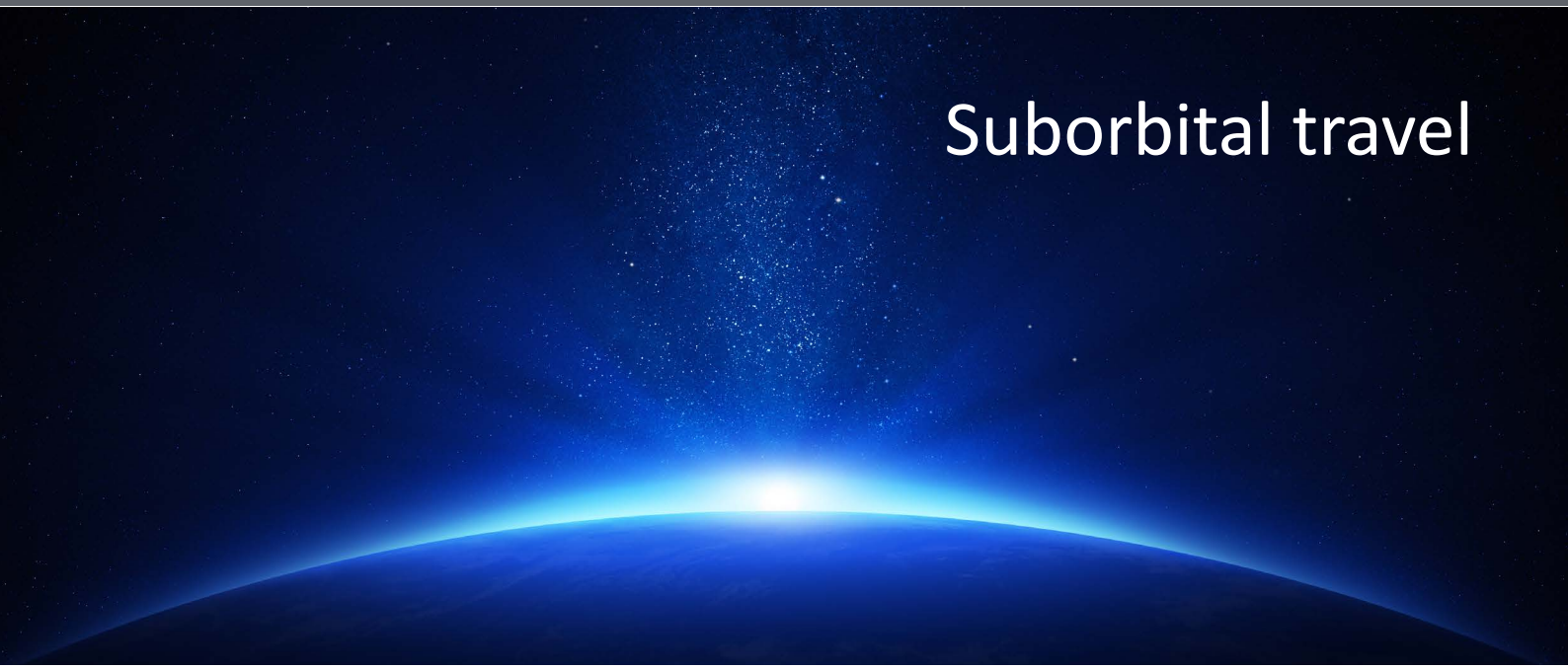
[1] NASA, *Feb. 27, 2019*

BCD travel

Space travel

Private sector engagement with space is part of a NASA plan. By initiating the Commercial Orbital Transportation Services (COTS) public-private partnership program in 2006, NASA actively encouraged private companies to get directly involved in space travel. SpaceX and Orbital (now Northrop Grumman Innovation Systems) were two of the first commercial space transportation enterprises to emerge. Today, both are actively involved in providing launch services for ISS (International Space Station) resupply missions.

Costs have plummeted: Using SpaceX's Falcon Heavy rocket, it costs under $700 for each pound of weight to reach low-earth orbit (LEO). Falling costs make the space marketplace more accessible and will bring the days of space tourism much closer. Initially, travelers will have the chance to make suborbital space trips before venturing in future years into orbital space, the Moon and beyond.



Suborbital travel

Suborbital or low-earth orbit (LEO) travel will one day transform long-haul travel.[2] Including take-off and landing, a trip from New York to Tokyo would take 90 minutes instead of 14 hours. LEO travel could also cut the journey time from New York to Sydney by 90%.

Three companies are going head to head to launch the first suborbital flights for fare paying passengers: Virgin Galactic, Blue Origin and SpaceX. This should be good news for travelers, as competition may drive down what is sure to be an exorbitant fare. Valerie Stimac, editor of the blog *Space Tourism Guide*, believes prices will come down to $50,000 within 15-20 years.[3] Competition and technological advances may bring prices down even faster.

SpaceX

Founded in 2002 by technologist billionaire Elon Musk to revolutionize space technology enabling people to live on other planets, SpaceX designs, manufactures and launches advanced rockets and spacecraft.[4] It seems to be concentrating more on reusable launch systems for NASA and on vehicles capable of space and interplanetary flight.

(Photo by Taylor McKnight/Shutterstock.com)

[2] Phocuswire, *Apr. 4, 2013*
[3] Skift, *June 25, 2019*
[4] SpaceX

Blue Origin

Founded in 2001 by Amazon's Jeff Bezos, Blue Origin is developing rocket-powered vertical takeoff and vertical landing (VTVL) vehicles for traveling to suborbital and orbital space. Initially concentrating on suborbital spaceflight, it's been testing the New Shepard spacecraft since 2015. It consists of a reusable rocket and a six-seat capsule. The capsule returns under a parachute while the rocket makes a propulsive vertical landing. New Shepard should make its first manned flight in 2020.[5] Expect tickets to be initially expensive: "in the hundreds of thousands of dollars for people to go, initially," according to Blue Origin CEO Bob Smith.

Blue Origin has already started work on the next phase, developing the New Glenn orbital launch vehicle.

In May 2019, Bezos unveiled Blue Origin's vision for space and plans for a Moon lander known as "Blue Moon." Scheduled to launch in 2024, it would initially operate as a robotic space cargo carrier, delivering the infrastructure needed for a Moon base. It could one day also carry passengers to the Moon.

Virgin Galactic

Virgin Galactic aims to carry its first paying customers into space on SpaceShip Two class spaceplane VSS Unity as early as June 2020.[6] The craft first reached suborbital space in December 2018. The piloted vehicle has already successfully carried people into suborbital space.

Virgin Galactic has ambitious plans to offer space flights every 32 hours by 2023. It will start with 16 flights a year in 2020, rising to 270 by 2023, when all five vessels are operational. This will give it the capability to carry 1,565 people per year from New Mexico's Spaceport America.

Seats aboard VSS Unity currently cost $250,000, and around 700 people have already paid their deposits. Passengers can expect a rocket-powered launch and several minutes of weightlessness. Seats aren't available through a global distribution system (GDS) or online booking tool. Bookings must be made directly with Virgin Galactic. Travelers must seek legal advice before signing contracts or making payments.

(Photo by Steve Mann/Shutterstock.com)

[5] Space.com, *Oct. 4, 2019*
[6] Business Insider, *Sep. 10, 2019*

In September 2018, Japanese billionaire Yusaku Maezawa signed up with SpaceX to become the first tourist to fly around the Moon in 2023, marking an important step in the journey towards passenger space travel.

Progress is being made possible by privately owned companies, such as SpaceX and Blue Origin, which have been working with NASA for their mutual benefit—the agency provides them with an important early customer; NASA leaves them to develop the technology to make spaceflight happen. SpaceX's Falcon 9 has now become the mainstay for resupplying the International Space Station (ISS). NASA's interest in commercial solutions means many startups are keen to participate.

SpaceX is developing the Crew Dragon for NASA.[7] It's a capsule for carrying cargo and crew into space on top of a Falcon 9 rocket. Although it has already operated unmanned to the ISS, manned-flights are currently two to three years behind schedule but may happen in 2020. Undeterred by these delays, Space X is already planning Starship, an even bigger vessel capable of carrying larger crews (up to 100 people) into deep space, helping to fulfill Musk's dream of a permanent settlement on Mars. The technology and principles it establishes could have a wider application for general space travel.

Boeing has taken a more conventional approach, developing the Starliner primarily to transport crew to the ISS and to private space stations, such as the Bigelow Aerospace Commercial Space Station.

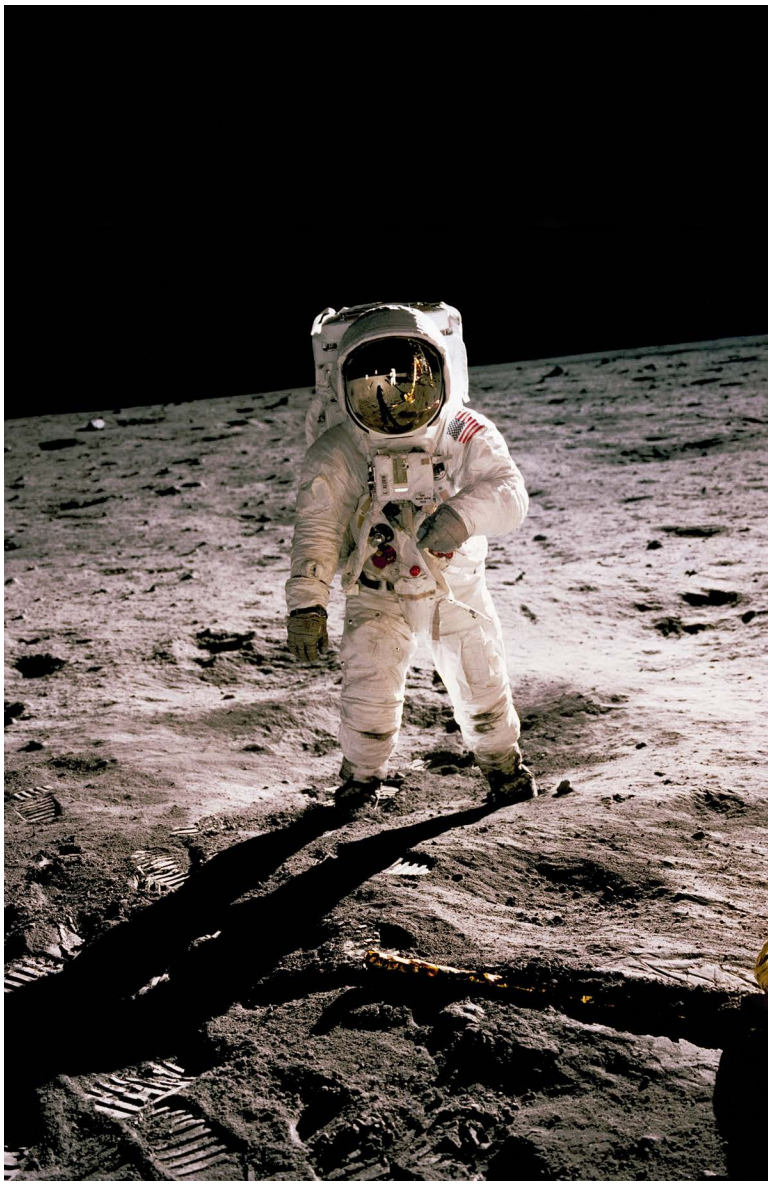
Astrobotic may conduct the first commercial transports to the Moon as early as 2021.[8] Sponsored by DHL, it is offering to land payloads on the lunar surface for $1.2 million per kilogram. NASA's lunar payload program is designed to put equipment on the Moon ahead of the next human mission. While robots will be the first business travelers to the Moon, it won't be long before humans follow.

[7] Space.com, *Oct. 7, 2019*
[8] Financial Times, *July 19, 2019*

Astrobotic may be beaten to the Moon by the aptly named Moon Express. Its first mission, Lunar Scout, is planned for July 2020.

Relying on a private space industry, rather than government-funded agencies like NASA, may be the best way to create a sustainable lunar economy. Private companies take a longer-term view and aren't as vulnerable as governments to sudden changes in priorities. The can create a marketplace, eventually turning the Moon into an industrial base and launchpad for travel to the rest of the solar system. For the time being, NASA is turning its attention from near-Earth exploration to the Moon, and this promises to provide a catalyst for the commercial space industry. Fear of politically-driven project cancellations may give private companies the extra impetus to rapidly deliver progress.

A return to the Moon offers great promise for the commercial sector and genuine prospects for business travel. If there is enough frozen water at the Moon's poles, the oxygen and hydrogen it contains could be used for rocket fuel. This would transform the Moon into a refueling station for trips to Mars and beyond.



Resources companies would also be keen to exploit the Moon, mining precious metals left by asteroid strikes. The rush to claim these resources may create a new space race, bringing forward the reality of lunar business travel.

As NASA's interest in the Moon grows, private companies are keen to take their share of the action. Blue Origin has been developing a Moon lander for three years. It may be best-placed to meet the U.S. government's target to return to the Moon in 2024. Recognizing the size of the commercial opportunity, Musk has switched his attention from Mars back to the Moon.

Backed by private sector investment, the transformation of the Moon into a business travel destination seems inevitable. "It's a place to live and work off-world," said Laura Forczyk, space consultant at Astralytical.[9]

[9] Financial Times, *July 19, 2019*

Living in space

While companies like Blue Origin, SpaceX and Virgin Galactic have shown they can actually get tourists into space, they'll still need somewhere to stay when they get there.

In 2010, Orbital Technologies and Rocket and Space Corporation Energia announced plans for a commercial space station, aimed at paying individuals as well as scientists.[10] It would basically be the first space hotel. Hotel-style stays would typically be between three and 14 days, depending on the availability of space travel to/from the space hotel.

Orion Span Inc. hopes to launch Aurora Station, the first luxury hotel in space, as early as the end of 2021, welcoming its first guests the following year.[11] Average daily rates might be outside the budget of most travelers: A 12-day stay would cost $9.5 million; that's a little under $800,000 per night. Occupancy would be limited to four guests plus two crew. Orion's timeline may prove somewhat ambitious, particularly since it hadn't lined up a launch provider in 2018.

Orion Span Inc. is among a number of companies that see the falling cost of space travel opening up a new market for accommodation.

- Bigelow Aerospace LLC – has implemented a five-year installation of an activity module on the ISS
- Axiom Space LLC – plans to launch habitation modules for the ISS
- World View Enterprises Inc. – developing a fleet of high-altitude platforms—stratolites—carried by balloons to the edge of space

[10] Phocuswire, *Sep. 20, 2010*
[11] Skift, *Apr. 6, 2018*

The European Space Agency (ESA) is working on accommodation for visitors to the Moon's hostile environment.[12] It's already planning to build a lunar village, with tourists included among its guests. Space travel has its challenges: the heart shrinks in space; tear ducts stop functioning; it's impossible to burp; and muscles waste away. So, ensuring traveler wellbeing while they travel in space will be critical.

Do you have questions or comments regarding this report? Please email Mike Eggleton to share your thoughts.

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[12] DW, *July 2019*