

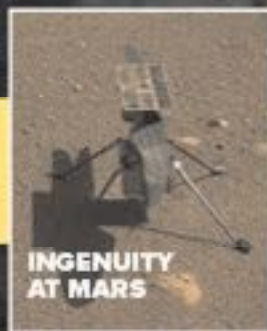
AEROSPACE

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2021 Year in review



247 kilometers on one charge
and dozens of other breakthroughs



INGENUITY
AT MARS



BILLIONAIRES
IN SPACE

A year of space tourism flights, planetary exploration and limited air travel

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The **Society and Aerospace Technology Outreach Committee** promotes the transfer and use of aerospace technology for the benefit of society.

This year marked a notable era for space tourism and new planetary exploration.

In February, three nations arrived at the Martian atmosphere. The Chinese orbiter and rover **Tianwen-1 and Zhurong** arrived at Mars, making China the only nation other than the United States to land and operate a spacecraft on the red planet. With a mission objective of acquiring a complete picture of the Martian atmosphere, **United Arab Emirates' Hope orbiter** also initiated its studies. One of the space exploration highlights that engaged the public and drove trending media worldwide was **NASA's Perseverance rover**, whose mission is to search for past life and collect samples for eventual return to Earth. Then in April, NASA's 1.8-kilogram **Ingenuity Mars Helicopter** demonstrated the first powered flight on another planet, after hitching a ride on Perseverance and 118 years after the Wright brothers' historic flight on Earth. This technological feat was not only extraordinary because of the bold technology demonstration goal but equally marked a flight environment within a thin atmosphere, less than 1% as dense as Earth's.

Civil aviation continued to suffer the effects of the covid-19 pandemic. In a summary released in November, the **International Civil Aviation Organization** projected that **airlines would offer 61% fewer seats for international passenger flights** this year compared to 2019, resulting in an approximate \$250 billion loss in gross operating revenue. A similar compar-

ison for domestic passenger traffic revealed an overall reduction of 24% of seats, resulting in an approximate \$72 billion loss. ICAO estimated there will be 1,300 million fewer international passengers this year compared to 2019 and about 860 million fewer domestic passengers.

Contrary to the unprecedented decline of world passenger traffic, commercial spaceflights began operating for the first time. In July, **Virgin Galactic's Unity 22** reached apogee at 86 kilometers with two pilots and four passengers, including Richard Branson, the founder of the Virgin Group. Nine days later, **Blue Origin's NS-16** carried four space passengers, including founder Jeff Bezos, to 107 km above sea level in an approximately 10-minute flight. In September, **SpaceX's Crew Dragon Resilience** spacecraft carried four private citizens, including Shift4Payments CEO Jared Isaacman, to an altitude of 590 km. After three days orbiting the Earth, the spacecraft splashed down in the Atlantic Ocean. Isaacman contracted SpaceX for the Inspiration4 mission, which benefited St. Jude Children's Research Hospital in Tennessee. ★



► NASA's Perseverance rover generated this selfie on Mars in September over a rock nicknamed Rochette. The rover's robotic arm drilled two holes in the rock to extract core samples.

NASA