

de Crespigny on single-pilot operations

Navigating autonomously

Is there such a thing as too safe?

# AEROSPACE

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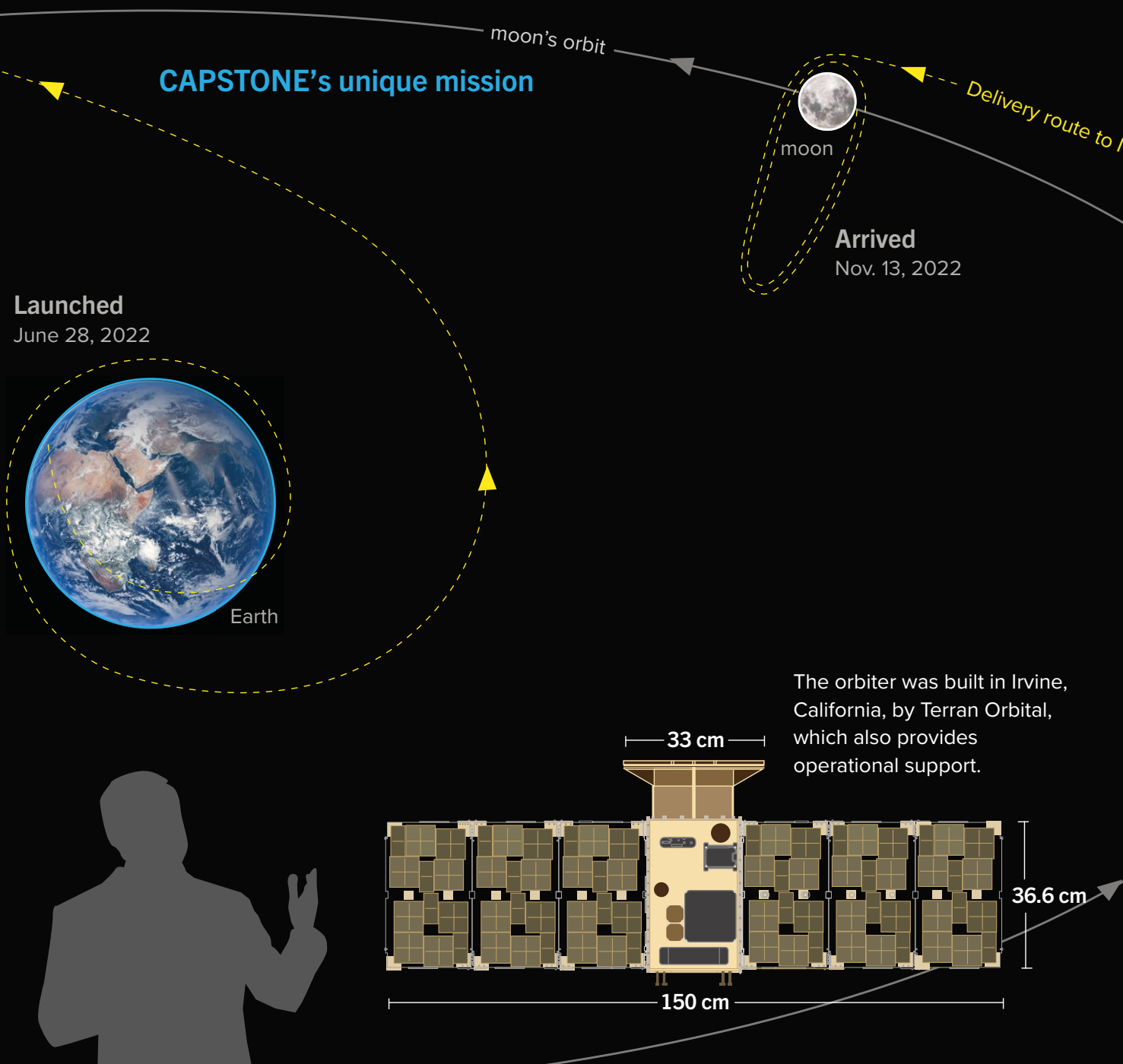


# Tailor-made

**The U.S. and other nations lack enough air tankers to fight wildfires on a hotter, drier planet. Is it time for another clean-sheet design, just as the 1990s gave us the CL-415s? It's an idea that's percolating. PAGE 26**

# Focus of Gateway experiment shifts to navigation tech

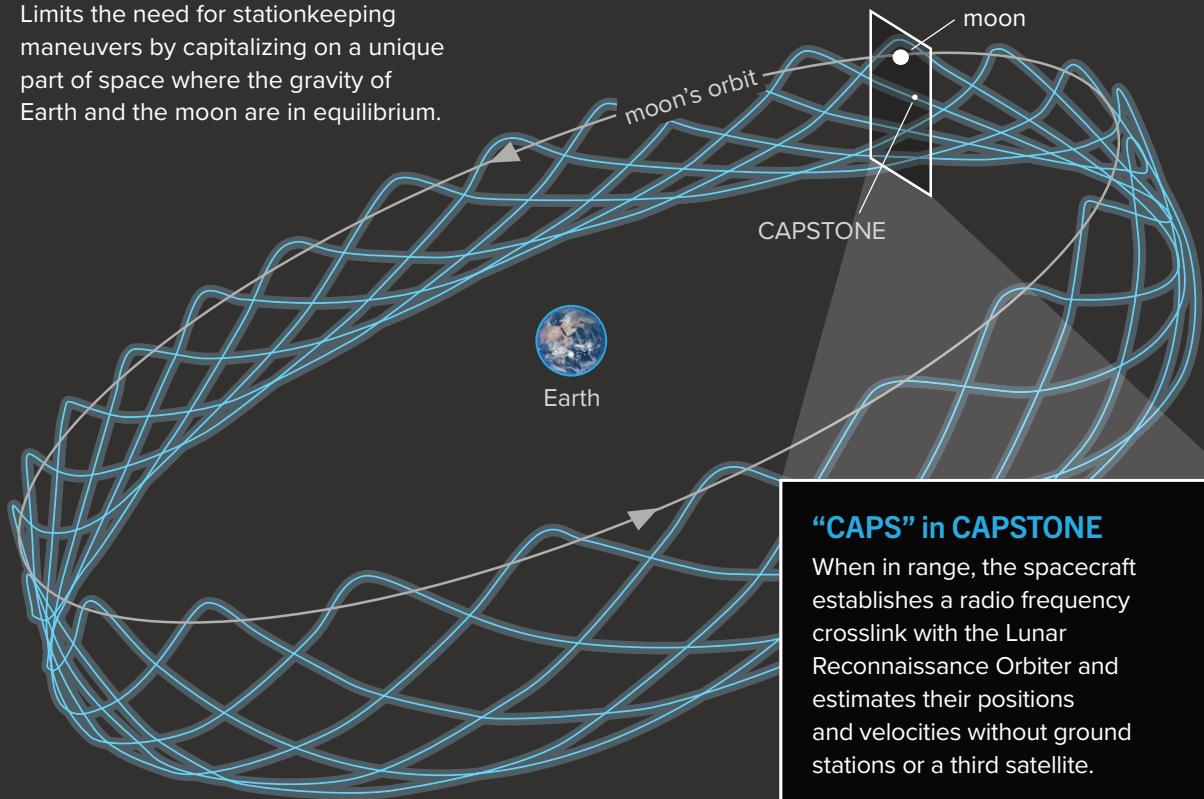
The NASA-funded CAPSTONE satellite in May began a yearlong enhanced mission to test a technique for determining its position without the aid of antennas on Earth, while also continuing to provide lessons about operating in the unusual orbit planned for NASA's Lunar Gateway space station. CAPSTONE establishes crosslinks with NASA's Lunar Reconnaissance Orbiter and deduces position and velocity (estimated states) for itself and LRO relative to Earth. The test partly inspired the name of the satellite and mission: Cislunar Autonomous Positioning System Technology Operations and Navigation Experiment. Accuracy will be judged by comparing the test states to those derived conventionally. Advanced Space of Colorado is in charge of the experiment.



### 3 benefits for future spacecraft in Near-Rectilinear Halo Orbit (NRHO)

#### ■ Stability

Limits the need for stationkeeping maneuvers by capitalizing on a unique part of space where the gravity of Earth and the moon are in equilibrium.



#### ■ Geometry

Provides almost continual line-of-sight to Earth and extended view of the moon's south polar region, an area of particular scientific interest. Also makes it easier to avoid eclipses and occultations.

#### ■ Easy access

Offers frequent opportunities to reach the lunar surface or come back up. Equilibrium makes it easy to head off to other destinations, such as Mars.

#### “CAPS” in CAPSTONE

When in range, the spacecraft establishes a radio frequency crosslink with the Lunar Reconnaissance Orbiter and estimates their positions and velocities without ground stations or a third satellite.

