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IS DIGGING A HOLE
ON MARS

AIR & SPACE

MARCH 2021

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Earth's orbit. However, before 2020 SO was captured by this planet's gravity, it was orbiting around the sun in a near circle and in an orbital plane that almost matched Earth's. Adding to the mystery, the trajectory of 2020 SO was changing slightly in response to getting pushed by the solar wind, suggesting it was likely hollow.

Suspecting that they had discovered an old rocket booster, CNEOS director Paul Chodas calculated the object's orbit backward in time and found that 2020 SO's approach in late 1966 would have been close enough that it might have originated from Earth—coinciding with the launch of the Surveyor 2 spacecraft aboard an Atlas-Centaur rocket. A thruster malfunction had caused the spacecraft to crash into the moon on September 23,

← An Atlas-Centaur rocket lifts Surveyor 2 to the moon on September 20, 1966. Nearly 60 years later, the rocket's upper booster, similar to the one pictured below in 1965, swung close to Earth after a lengthy orbit around the sun.



A Prodigal Booster Returns

Found in a search for asteroids, an old pal checks in on its way around the sun.

Astronomers have confirmed that a small object temporarily captured by Earth's orbit is the Centaur upper-stage rocket booster that helped lift NASA's ill-fated Surveyor 2 spacecraft toward the moon in 1966.

The object, designated 2020 SO, was initially detected by the Panoramic Survey Telescope And Rapid Response System, which monitors near-Earth objects such as asteroids that might pose a threat to Earth. Upon closer examination, scientists at the Center for Near-Earth Object Studies (CNEOS) realized that this was no ordinary asteroid. Typically, the orbit of an asteroid is more elongated and tilted relative to

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while the spent Centaur upper-stage rocket sailed into space.

Final confirmation of the identity of 2020 SO came from a team led by Vishnu Reddy, an associate professor and planetary scientist at the Lunar and Planetary Laboratory at the University of Arizona. “My job description is pretty simple—if something is going to hit the Earth, I tell what it is made of...before it hits us of course!” says Reddy, who performed follow-up observations using NASA’s Infrared Telescope Facility. He and his team compared the spectrum data from 2020 SO with that of 301 stainless steel, the material used to construct Centaur rocket boosters in the 1960s.

While the match was good, it wasn’t perfect, so they investigated further. “A colleague in the Air Force alerted us to look at other similar rocket bodies in Earth orbit,” says Reddy. “My grad student was able to initially get visible wavelength spectra of two of the Centaur rocket bodies from the 1970s using our small 24-inch telescope at the university.” The spectra matched with 2020 SO, confirming its identity as a fellow Centaur booster.

2020 SO made its closest approach to Earth on December 1, 2020, and will remain within Earth’s sphere of gravitational dominance until it escapes back into a new orbit around the sun in March 2021.

But even after we say farewell to the Centaur rocket booster, this might only be the beginning of encounters with historic space artifacts. Says Reddy: “The number of objects we put in space each year is only going up, so we are bound to run into objects like 2020 SO in the future as humanity spreads its wings across the inner solar system.” Who says you can’t go home again?



DEPARTURES

Chuck Yeager, 1923–2020

CHARLES ELWOOD YEAGER, THE FIRST PILOT TO FLY PAST MACH 1, WAS THE COOLEST OF TEST PILOTS.

Chuck Yeager, who died in December at age 97, was a U.S. Air Force junior test pilot when he was chosen for the mission to attempt to break the sound barrier. The chief of the Air Force flight test division who chose him wasn’t sure the program would succeed. Albert Boyd had been advised that the severity of the shock waves could break the airplane apart. He needed someone fearless, confident, and skilled. That described all 125 candidates in the division, but Boyd later wrote of Yeager, “none of them could quite match his skill in a cockpit or his coolness under pressure.”

Yeager climbed down a ladder in the bomb bay of the B-29 carrier aircraft to reach the Bell X-1 cockpit—to him, the worst part of the flight. In his autobiography, he wrote of those moments in the slipstream: “That bitch of a wind took your breath away and chilled you to the bone.” The flight through Mach 1 turned out to be less remarkable. His logbook records it on October 14, 1947, with the comment, “ok.”

↑ Chuck Yeager and the Bell X-1 in 1948, when the Air Force acknowledged that the previous year, the two had broken the sound barrier.

Today, the orange X-1 is displayed at the National Air and Space Museum.

Most people know that Yeager was a World War II ace and that he went on after his famous mission to head the new U.S. Air Force Aerospace Research Pilot school, an astronaut training operation, where he nearly met his end in an NF-104 Starfighter. What is often forgotten is that Yeager also served in Vietnam, where he commanded the 405th Tactical Fighter Wing, which included two squadrons flying B-57s. Imagine serving under the most famous pilot in the world.

In his later years, Yeager often showed up at aviation events, where he growled at autograph seekers but never tired of talking about airplanes. Pilots would lean in to hear from possibly the most talented one of them who ever flew.

■ LINDA SHINER