New Horizons sets up for New Year's flyby of Ultima Thule

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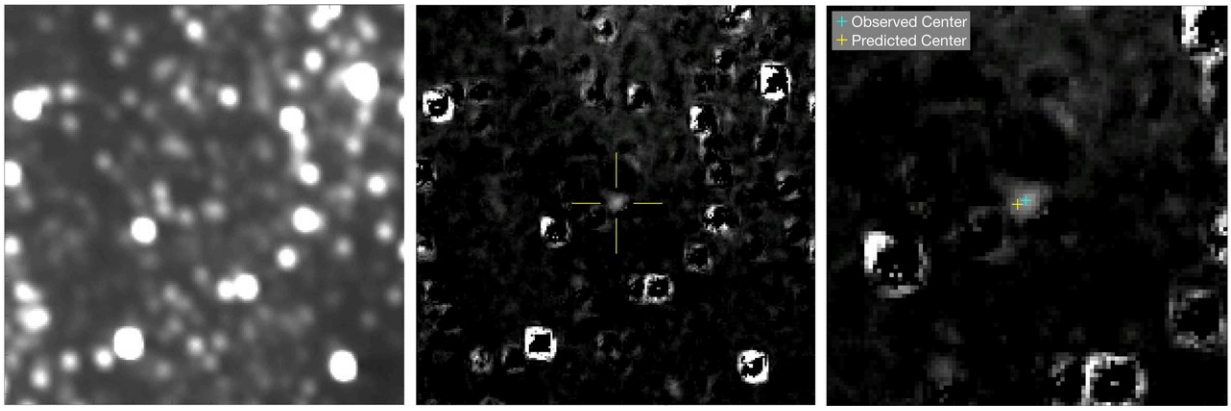

At left, a composite optical navigation image, produced by combining 20 images from the New Horizons Long Range Reconnaissance Imager (LORRI) acquired on Sept. 24. The center photo is a composite optical navigation image of Ultima Thule after subtracting the background star field; star field subtraction is an important component of optical navigation image processing since it isolates Ultima from nearby stars. At right is a magnified view of the star-subtracted image, showing the close proximity and relative agreement between the observed and predicted locations of Ultima. Credit: NASA/JHUAPL/SwRI/KinetX

NASA's New Horizons spacecraft carried out a short engine burn on Oct. 3 to home in on the location and timing of its New Year's flyby of the Kuiper Belt object nicknamed Ultima Thule.

Word from the spacecraft that it had successfully performed the

3½-minute maneuver reached mission operations at the Johns Hopkins Applied Physics Laboratory in Laurel, Maryland, at around 10:20 p.m. EDT. The maneuver slightly tweaked the spacecraft's trajectory and bumped its speed by 2.1 meters per second – just about 4.6 miles per hour – keeping it on track to fly past Ultima (officially named 2014 MU69) at 12:33 am EST on Jan. 1, 2019.

"Thanks to this maneuver, we're right down the middle of the pike and on time for the farthest exploration of worlds in history – more than a billion miles beyond Pluto," said mission Principal Investigator Alan Stern of the Southwest Research Institute. "It almost sounds like science fiction, but it's not. Go New Horizons!"

At 4.1 billion miles (6.6 billion kilometers) from Earth, Ultima Thule will be the most distant object ever visited by a spacecraft. New Horizons itself was about 3.95 billion miles (6.35 billion kilometers) from home when it carried out Wednesday's trajectory correction maneuver (TCM), the farthest course-correction ever performed.

This was the first Ultima targeting maneuver that used pictures taken by New Horizons itself to determine the spacecraft's position relative to the Kuiper Belt object. These "optical navigation" images – gathered by New Horizons' Long Range Reconnaissance Imager (LORRI) – provide direct information of Ultima's position relative to New Horizons, and help the team determine where the spacecraft is headed.

The New Horizons team designed the TCM by determining the current trajectories of the spacecraft and its target, and then calculating the maneuvering required to put the spacecraft at the desired "aim point" for the flyby – 2,200 miles (3,500 kilometers) from Ultima at closest approach.

"The recent navigation images have helped us confirm that Ultima is

within about 300 miles [500 kilometers] of its expected position, which is exceptionally good," said Fred Pelletier, New Horizons navigation team chief, of KinetX Aerospace, Inc. "We're excited for the flyby."

Confirming that Ultima is at its expected location is an important and somewhat unique aspect of this flyby. "Since we are flying very fast and close to the surface of Ultima, approximately four times closer than the Pluto flyby in July 2015, the timing of the flyby must be very accurate," said Derek Nelson, New Horizons optical navigation lead, also from KinetX. "The images help to determine the position and timing of the flyby, but we must also trust the prior estimate of Ultima's position and velocity to ensure a successful flyby. These first images give us confidence that Ultima is where we expected it to be, and the timing of the flyby will be accurate."

The spacecraft is just 69 million miles (112 million kilometers) from Ultima, closing in at 32,256 miles (51,911 kilometers) per hour. Pelletier said the team will eventually have to guide the spacecraft into an approximately 75 by 200-mile (120 by 320-kilometer) "box" and predict the flyby to within 140 seconds. "There is definitely more work to do," he said. "But we are taking pictures of the most distant world ever explored. How cool is that?"

Provided by NASA

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