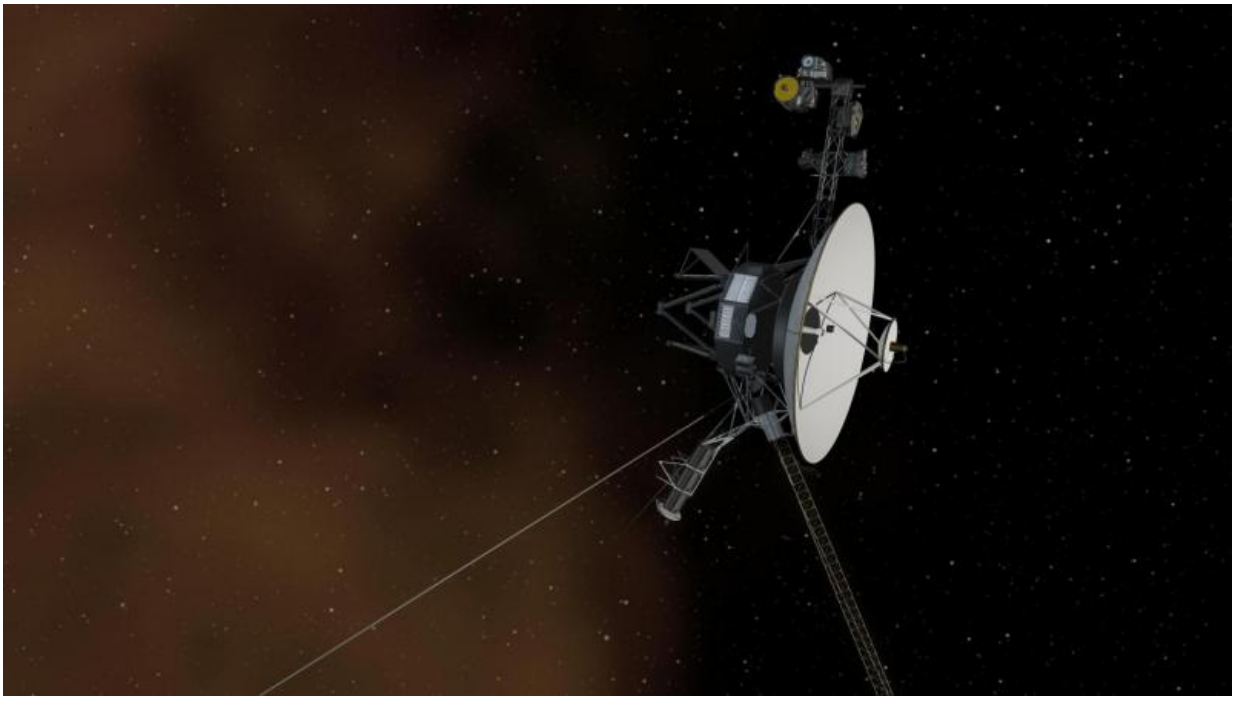
A day in the life of NASA's Voyagers

September 19 2017, by Lina Tran



Credit: NASA

At more than 10 billion miles away from Earth, there is no day and night. Time and space are fathomless and our Sun is a distant point of starlight—a faint reminder of the home NASA's twin Voyagers, humanity's farthest and longest-lived spacecraft, left behind 40 years ago. Voyager 1, which launched on Sept. 5, 1977, and Voyager 2, launched on Aug. 20, 1977, continue to return data that shape our view and understanding of our place in the universe.

We often think of space as empty, but even the vacuum of space is filled with the remnants of stellar explosions from millions of years ago and dominated by invisible magnetic forces. Such magnetic forces carve out unique space environments throughout the galaxy, each one like a neighborhood with its own distinct feel. Voyager has helped scientists define the boundaries of our own stellar neighborhood—which scientists call the heliosphere—by returning observations about the conditions where the Sun's influence wanes and interstellar space begins.

"Voyager is seeking out our place in the galaxy: How does the solar system interact with the rest of the galaxy and how does that affect us?" said Eric Christian, a space scientist at NASA's Goddard Space Flight Center in Greenbelt, Maryland. "If anything embodies the spirit of discovery, it's Voyager." Christian served as Voyager program scientist for NASA Headquarters between 2002 and 2008, and continues to do scientific work with the mission. These questions are key to understanding our own star and enabling human space exploration, but they could also shed light on the workings and potential habitability of other star systems.

The heliosphere is generated by the Sun's constant outward flow of magnetic solar material, called the solar wind. This high-speed wind fills the solar system and forms a vast bubble, more than 20 billion miles across, where the space inside is different from space outside. Within the heliosphere, space is influenced by the dynamic properties of the Sun carried in the solar wind—including magnetic fields, energetic particles and ionized gases called plasma. The Sun and entire heliosphere move through interstellar space, and this relative motion shapes the heliosphere.

Exploring our interstellar backyard

Traveling at speeds of more than 35,000 mph, the Voyagers travel about

900,000 miles farther from Earth each day, a distance equal to roughly 36 times Earth's circumference. Five years ago, in August 2012, Voyager 1 crossed the edge of the heliosphere, called the heliopause, venturing for the first time into the space between stars, where no spacecraft had gone before.

The mission has informed researchers that inside the heliosphere, Earth and the rest of the solar system are shielded from cosmic radiation and wisps of hot hydrogen and helium gases composing what's known as the Local Fluff—a series of massive clouds, each one several light-years wide, of interstellar medium through which the heliosphere is currently traveling. No longer cocooned by the heliosphere, Voyager 1 is currently exploring our interstellar backyard, measuring one of these clouds and searching the Fluff for clues to our origins, and those of nascent solar systems.

"We're not in a typical part of the galaxy, if there is a typical part of the galaxy," Christian said. "We're in a bubble where multiple supernovas blew up, and it's amazing to be traveling through that. It would almost make you feel insignificant, if there wasn't also plenty of things to learn here."

Studying the nature of space itself

The probes' planetary instruments were turned off after they passed the outer planets, but a suite of instruments carries out their interstellar mission. Voyager 1 currently has four working instruments that measure the magnetic fields, charged energetic particles (two instruments are responsible for this) and low-frequency radio waves of its surroundings. Voyager 2 also has these four, and additionally a working plasma sensor, which directly measures the solar wind.

Day in and day out, both Voyagers constantly beam data back to Earth.

This feed of data is only received, however, when NASA's Deep Space Network locks onto the spacecraft. The project goal is to acquire at least 16 hours of real-time data per spacecraft each day, but the actual amount of time varies depending on the network's resources.

Voyager 1, now almost 13 billion miles from Earth, travels through interstellar space north out of the plane of the planets, while Voyager 2, almost 11 billion miles away, travels south and is expected to enter interstellar space in the next few years. The different locations of the two Voyagers allow scientists to compare two regions of space where the heliosphere interacts with the surrounding interstellar medium. Once Voyager 2 crosses into the interstellar medium, they will also be able to sample this space from two different locations simultaneously.

The final frontier

Throughout their 40 years in space, the pioneering Voyagers have redefined what scientists consider the final frontier. "Decades ago, the joke among scientists was that the estimation of the edge of the heliosphere was moving out at the same rate that Voyager was," Christian said.

Their scientific legacy is unparalleled, and the mission still enables fascinating discoveries. More recently, Voyager 1 hinted that the magnetic field of the local interstellar medium is wrapped around the heliosphere. Data from the probes also suggested an entirely new picture of the heliosphere—one that is much more compact and rounded than previously thought.

Communications with the spacecraft will be maintained until the Voyagers' nuclear power sources can no longer supply enough electricity to operate the satellites. Engineers expect each spacecraft to continue operating at least one science instrument until around 2025.

However, even after the spacecraft go silent, thanks to remarkable engineering, they'll otherwise be in good condition. Barring catastrophic collisions, the Voyagers are expected to continue to prosper on their lonely, boundless journeys, cruising at their present speed and completing an orbit around the center of the Milky Way every 225 million years.

More information: For more information about the Voyager spacecraft, visit www.nasa.gov/voyager or voyager.jpl.nasa.gov

Provided by NASA

Citation: A day in the life of NASA's Voyagers (2017, September 19) retrieved 18 April 2024 from https://phys.org/news/2017-09-day-life-nasa-voyagers.html

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.