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Solar System Missions: New Horizons

Pluto and Beyond

Aira Astralis

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Conclusion

This free sample contains the Introduction and Chapter 1. The complete book contains the full contents above.

Introduction

New Horizons is an interplanetary space probe launched as a part of NASA's New Frontiers program. Launched in 2006, it became the first spacecraft to perform a flyby study and capture high-resolution photographs of Pluto and its moons during its encounter. It was engineered by the Johns Hopkins University Applied Physics Laboratory (APL) and the Southwest Research Institute (SwRI), with a team led by Alan Stern. New Horizons is the fifth human-made object boosted past the Sun's escape speed, bound to leave the Solar System behind.

On January 19, 2006, New Horizons was launched from Cape Canaveral Space Force Station by an Atlas V rocket directly into an Earth-and-solar escape trajectory with a speed of about 16.26 kilometres each second, or 58,500 km/h (36,400 mph), measured against the Sun. It was the fastest (average speed with respect to Earth) human-made object ever launched from Earth. It is not the fastest speed recorded for a spacecraft, which, as of 2026, is that of the Parker Solar Probe.

After a brief encounter with asteroid 132524 APL, New Horizons proceeded to Jupiter, making its closest approach on February 28, 2007, at a distance of 2.3 million kilometers (1.4 million miles). The Jupiter flyby provided a gravity assist that increased New Horizons' speed; the flyby also enabled a general test of New Horizons' scientific capabilities, returning data about the planet's atmosphere, moons, and magnetosphere. Most of the post-Jupiter voyage was spent in hibernation mode to preserve onboard systems, except for brief annual checkouts.

On December 6, 2014, New Horizons was brought back online for the Pluto encounter, and instrument check-out began. On January 15, 2015, the spacecraft began its approach phase to Pluto. On July 14, 2015, at 11:49 UTC, it flew 12,500 km (7,800 mi) above the surface of Pluto, which at the time was 34 AU from the Sun, making it the first spacecraft to explore the dwarf planet.

Some of the questions the mission attempts to answer are: What is Pluto's atmosphere made of and how does it behave? What does its surface look like? Are there large geological structures?

The chapters that follow trace the full arc of the mission: the long campaign to get a Pluto expedition funded and built, the engineering of a spacecraft meant to survive a decade in the dark, the Jupiter rehearsal, the historic Pluto encounter and the science it returned, the improbable flight past Arrokoth, and the mission's future as it sails outward among the small worlds of the Kuiper Belt.

Even the rocket was an event. The Atlas V flying the mission was assembled in its most powerful five-solid-booster configuration with a beefed-up Centaur stage, the only combination capable of the job, and the January 19, 2006 liftoff from Cape Canaveral sent the probe out faster than anything had ever left Earth. Spectators along Florida's coast watched a streak that was, for a few seconds, brighter than anything human hands had ever thrown at the sky, and the departing spacecraft reached the orbit of the Moon before the night was out.

What follows is the story of that campaign in full: the politics and engineering that created the mission, the instruments it carried, the worlds it revealed, and the small, fast spacecraft that, after so many false starts across two decades, finally made the exploration of Pluto a fact rather than a hope.

Chapter 1: The Discovery of New Horizons

In August 2018, NASA cited Alice's readings from New Horizons as the strongest confirmation yet of the "hydrogen wall" at the Solar System's edge, a structure the two Voyager probes first saw hints of in 1992. New Horizons is traveling through the Kuiper belt; it is 64.21 AU (9.61 billion km; 5.97 billion mi) from Earth and 64.45 AU, roughly 9.64 billion kilometres, from the Sun as of April 2026.

NASA has announced its plan to extend operations for New Horizons until the spacecraft exits the Kuiper belt, which is expected to occur in either 2028 or 2029. The White House's proposed budget for FY2026 would have cut funding for New Horizons, but the continued funding of the mission was heavily debated in the United States Congress and a final budget of 24.44 billion USD guaranteed the mission continuation.

In August 1992, JPL scientist Robert Staehle called Pluto discoverer Clyde Tombaugh, requesting permission to visit his planet.

Stamatios "Tom" Krimigis, head of the Applied Physics Laboratory's space division, one of many entrants in the New Frontiers Program competition, formed the New Horizons team with Alan Stern in December 2000. Appointed as the project's principal investigator, Stern was described by Krimigis as "the personification of the Pluto mission".

New Horizons was based largely on Stern's work since Pluto 350 and involved most of the team from Pluto Kuiper Express. The New Horizons proposal was one of five that were officially submitted to NASA.

It was later selected as one of two finalists to be subject to a three-month concept study in June 2001. The other finalist, POSSE (Pluto and Outer Solar System Explorer), was a separate but similar Pluto mission concept by the

University of Colorado Boulder, led by principal investigator Larry W. Esposito, and supported by the JPL, Lockheed Martin and the University of California.

However, the APL, in addition to being supported by Pluto Kuiper Express developers at the Goddard Space Flight Center and Stanford University were at an advantage; they had recently developed NEAR Shoemaker for NASA, which had successfully entered orbit around 433 Eros earlier that year, and would later land on the asteroid to scientific and engineering fanfare. In November 2001, New Horizons was officially selected for funding as part of the New Frontiers program.

However, the new NASA Administrator appointed by the Bush administration,

Sean O'Keefe, was not supportive of New Horizons and effectively canceled it by not including it in NASA's budget for 2003. NASA's Associate Administrator for the Science Mission Directorate, Ed Weiler, prompted Stern to lobby for the funding of New Horizons in hopes of the mission appearing in the Planetary Science Decadal Survey, a prioritized "wish list", compiled by the United States National Research Council, that reflects the opinions of the scientific community.

After an intense campaign to gain support for New Horizons, the Planetary Science Decadal Survey of 2003-2013 was published in the summer of 2002. New Horizons topped the list of projects considered the highest priority among the scientific community in the medium-size category; ahead of missions to the Moon, and even Jupiter. Weiler stated that it was a result that "[his] administration was not going to fight". Funding for the mission was finally secured following the publication of the report.

Stern's team was finally able to start building the spacecraft and its instruments, with a planned launch in January 2006 and arrival at Pluto in 2015. Alice Bowman became Mission Operations Manager (MOM). New Horizons is the first mission in NASA's New Frontiers mission category, larger and more expensive than the Discovery missions but smaller than the missions of the Flagship Program.

The cost of the mission, including spacecraft and instrument development, launch vehicle, mission operations, data analysis, and education/public outreach, is approximately $700 million over 15 years (2001-2016). The spacecraft was built primarily by Southwest Research Institute (SwRI) and the Johns Hopkins Applied Physics Laboratory. The mission's principal investigator is Alan Stern of the Southwest Research Institute (formerly NASA Associate Administrator). After separation from the launch vehicle, overall control was taken by Mission Operations Center (MOC) at the Applied Physics Laboratory in Howard County, Maryland.

The science instruments are operated at Clyde Tombaugh Science Operations Center (T-SOC) in Boulder, Colorado. Navigation is performed at various contractor facilities, whereas the navigational positional data and related celestial reference frames are provided by the Naval Observatory Flagstaff Station through Headquarters NASA and JPL. KinetX is the lead on the New Horizons navigation team and is responsible for planning trajectory adjustments as the spacecraft speeds toward the outer Solar System.

Coincidentally the Naval Observatory Flagstaff Station was where the photographic plates were taken for the discovery of Pluto's moon Charon. The Naval Observatory itself is not far from the Lowell Observatory where Pluto

was discovered. New Horizons was originally planned as a voyage to the only unexplored planet in the Solar System. When the spacecraft was launched, Pluto was still classified as a planet, later to be reclassified as a dwarf planet by the International Astronomical Union (IAU).

For communication it carries a 2.1-meter Cassegrain high-gain dish whose beam is barely a degree wide.

In August 2018, NASA confirmed, based on results by Alice on the New Horizons spacecraft, a "hydrogen wall" at the outer edges of the Solar System that was first detected in 1992 by the two Voyager spacecraft.

The drive to reach Pluto began long before anyone had drawn the spacecraft. Percival Lowell spent his final years hunting a supposed ninth planet from his Arizona observatory, and though Clyde Tombaugh found Pluto there in 1930 by comparing photographic plates, the world remained little more than a wandering point of light for half a century. Its first moon, Charon, was only spotted in 1978, the mutual eclipses of the pair in the late 1980s gave astronomers their first honest estimates of their sizes, and the Hubble Space Telescope's coarse maps of the 1990s still showed a blur. When small moons began turning up in Hubble images in 2005, the case for visiting the system in person was no longer arguable.

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ABOUT THE AUTHOR

Aira Astralis is a science writer specializing in astronomy and space exploration. Her work spans the full breadth of humanity's relationship with the cosmos -- from the earliest naked-eye observations to the engineering marvels of modern space missions.

Her books are built on a foundation of primary sources: peer-reviewed research, mission archives, and direct engagement with the scientific community. She writes for readers who want to understand not just what we know about the universe, but how we came to know it.

She believes that the most important frontier is not out there but in the gap between what scientists discover and what the public understands. Her books exist to close that gap.