

National Aeronautics and
Space Administration



New Horizons Explores Pluto



Launch Location
CCAFS

Launch Vehicle
Atlas 5 551

Launch Date
01/19/2006

www.nasa.gov

NP-2015-07-310-KSC

PLUTO

What do I see when I picture Pluto?

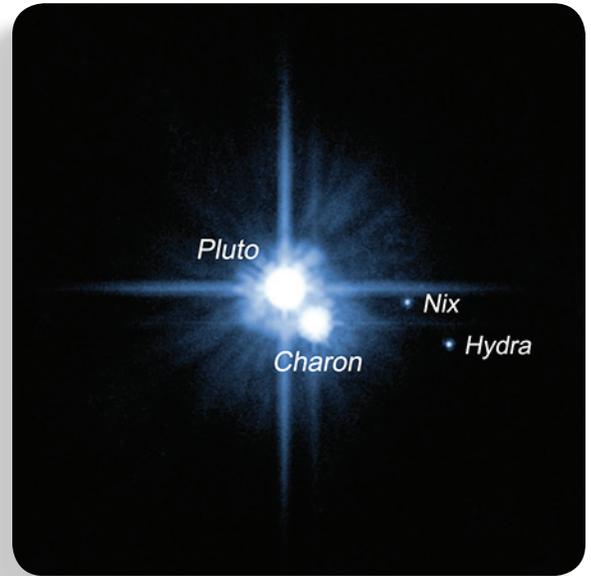
All we can say is we haven't been able to see much, just yet- not even with the best telescopes either based on the ground or in space. This fascinating image taken by the Hubble Space Telescope in 2005 doesn't reveal much. Pluto moves along a distant path, 2.5 billion to 4.5 billion miles from the sun. That's quite a distant and lopsided orbit, as compared to those of the solar system's eight planets.

Three of Pluto's five known moons are portrayed in the Hubble picture to the right.

In 2006, the International Astronomical Union decided to downgrade Pluto from the solar system's ninth planet to "dwarf planet". A major reason was the number of similar and bigger bodies circling the Sun at the confines of the solar system.

Nix and Hydra are roughly 5,000 times fainter than Pluto, and located about two to three times farther from Pluto than its large moon, Charon, discovered in 1978.

Pluto's weather is rather constant and easy to predict: clear, dim skies, freezing temperatures and glacial conditions. Despite receiving only 1/1000 the amount of light we get on Earth, Pluto's environment still is luminous enough for the human eye to see without particular problems.



Amazing Facts about Pluto

- How cold is it on Pluto? Extremely cold. The temperature is minus 387 degrees Fahrenheit. That's minus 233 degrees Celsius (i.e. centigrade).
- How come Pluto is now called a dwarf planet? Pluto now falls into the dwarf-planet category on account of its size and the fact that it resides within a zone crowded by similarly-sized objects, known as the Trans-Neptunian region.
- What is a dwarf planet? A dwarf planet is an object orbiting the sun, large and massive enough to have its own gravity tug, which turned it into a bumpy, spherical shape. Generally, a dwarf planet is smaller than Mercury. It also may orbit in a zone filled by other objects. For example, the asteroid belt is a huge collection of rocky debris and boulders, in some cases as big as mountains, circling the sun in a vast region between the orbits of Mars and Jupiter.
- Does Pluto have a moon? Yes – indeed it has five known moons (possibly even 10)! Pluto's largest moon, Charon, is half the size of Pluto itself. Side by side, Pluto and Charon would fit across the diameter of our Moon.

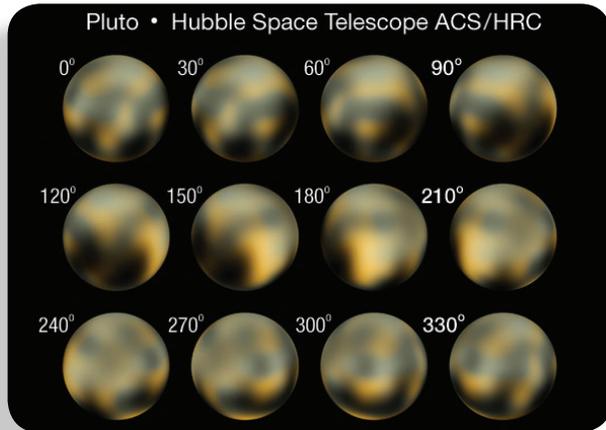
Dwarf Planets Educator Guide

Dwarf Planets as a New Way of Thinking about an Old Solar System

How NASA/Launch Services Program Relates to our Solar System



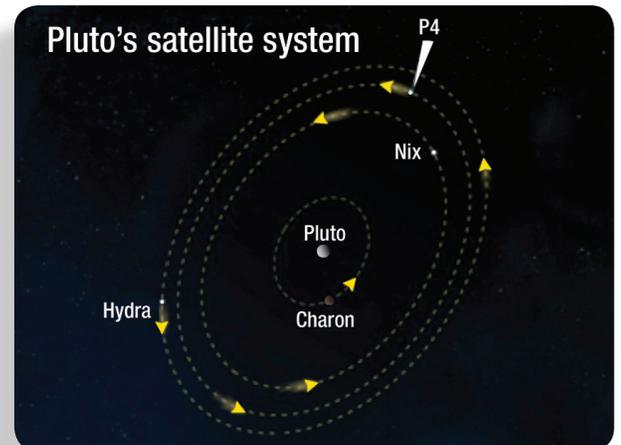
- Could there be life on Pluto? Given Pluto's extremely low surface temperature, {for degree figures, please see below} scientists think it is unlikely life could exist there. At such glacial temperatures, water (a vital component for life as we know it) exists only in a rock-hard state. Pluto's interior is warmer, however, and some theorize there could be an ocean deep beneath its shiny white, frozen surface.



A distant, detailed view of the entire surface of the dwarf planet Pluto, as constructed from multiple NASA Hubble Space Telescope photographs taken between 2002 and 2003. The center disk (180 degrees) has an intriguing bright spot unusually rich in carbon monoxide frost. Pluto is so small and distant from the sun that discerning its surface is as challenging as trying to see the markings on a soccer ball 40 miles away.

How Did Pluto Get Its Name?

- Pluto is the only world to be named by a young girl. In 1930, Venetia Burney, an 11-year-old girl living in Oxford, England, suggested to her grandfather that the newly discovered celestial body be named for the Roman god of the underworld. He proposed the name to the Lowell Observatory, which picked it.
- Pluto's moons are named for other mythological figures associated with the underworld. Charon is named for the river Styx's boatman who ferries souls to the underworld; Nix is named for Charon's mother, who also is the goddess of darkness and night, while Hydra is named for the nine-headed serpent guarding the underworld.



For additional information on the Dwarf Planets Teacher Guide (national standards) use this QR code or link to [Solarsystem.nasa.gov/doc/Dwarf Planets Guide](http://Solarsystem.nasa.gov/doc/DwarfPlanetsGuide)

Reaching Pluto: New Horizons

Fun Facts on the New Horizons Spacecraft

- New Horizons is the first spacecraft launched to explore Pluto, its moons, and the Kuiper Belt.
- New Horizons passed three to four times closer to Jupiter than the Cassini probe did to reach Saturn. New Horizons flew within a distance equal to 16 times the diameter of the giant planet. Jupiter's gravity tug gave New Horizons the final and essential boost, flinging it toward Pluto. Scientists sometimes refer to this clever technique as the "slingshot effect."
- New Horizons' size is about that of a grand piano and weighs about a thousand pounds.
- New Horizons is the fifth spacecraft bridging the whole solar system and intended to reach interstellar space in several more decades after its Pluto encounter.
- As the first stage of the Atlas V launch vehicle and its five solid-fuel boosters stood in Hurricane Wilma's path; its fierce winds blew the processing facility door off the hinges, flinging debris against the Atlas rocket. The damage was serious enough to force the replacement of one of the solid-fuel boosters.
- Before this mission, Charon was Pluto's only known moon. Then, about six months before launch, came the discovery of two new moons. They were named Nix and Hydra – the same initials as in New Horizons, honoring the mission and the search for other moons.

General Mission Information about New Horizons

The spacecraft is planned to fly by Pluto in July 2015 – almost a decade after its launch. Approximately six months before arrival, New Horizons will start collecting data in hopes of answering many questions about Pluto, including the following:

- What is Pluto's atmosphere made of?
 - How do conditions change?
- What does the surface of Pluto look like?
- Are there any big geological structures?
- How do sub-atomic particles, mainly protons and electrons ejected from the sun (so-called the solar wind) interact with Pluto's atmosphere?

Challenges

The mission needed a unique launch vehicle arrangement that incorporated a stage from a Delta II rocket mounted on top of the most powerful in the Atlas V rocket family. Integrating the spacecraft and its Atlas V third stage required a significant effort, mandating thorough planning and integration meetings to turn the mission into a success. The integration team included representatives from the Johns Hopkins Applied Physics Lab (APL), Boeing's Delta II experts, Lockheed Martin's Atlas V vehicle engineers, and Kennedy Space Center's Integration and Launch Vehicle Engineers. Since the Atlas V 551 configuration had never flown before, a significant amount of effort was needed to certify all of its systems were ready for a successful mission to Pluto.

Launch Services Program Role

How the Spacecraft arrived at KSC

Both New Horizons and its launch vehicle arrived at the Kennedy Space Center (KSC) by air.

The space probe arrived on a C-17 cargo plane from APL. New Horizons is relatively small and lightweight, specifically to shorten the time of its journey to Pluto. This made the probe fairly easy to transport and handle. Meanwhile, the Atlas V rocket arrived from Denver, Colo., aboard a huge Russian Antonov transport airplane.

Preparing the Spacecraft for Flight

New Horizons was processed at KSC's Payload Hazard Servicing Facility (PHSF), which meets the cleanliness needs of the spacecraft: no more than 100,000 impurity particles per cubic foot of air. Use of the PHSF was mandated by the need to process New Horizons close to the launch site.

That was necessary given the unique deep-space mission requirements and use of a Radioisotope Thermoelectric Generator (RTG).

The third stage was processed by the Delta II team, and then brought to the PHSF for attachment to the spacecraft.

The spacecraft RTG power source drove a number of special handling and processing requirements. Launch approval efforts were a significant part of the overall planning to ensure the mission could begin safely.

Handling the RTG required the reactivation of the RTGF processing facility. Following delivery and servicing the generator went to the PHSF for a fit check. Only after the spacecraft was mated to the launch vehicle, the RTG was installed onto the spacecraft late in the processing flow. A specially designed large door was placed on the rocket payload fairing for technicians to get access and handle the equipment inside it. This all was carefully rehearsed prior to processing, since the workers were only allowed to get limited exposure from the RTG.



The Atlas V for New Horizons' launch to Pluto lands in Florida



LAUNCH

The Atlas Rocket

This was the first flight of an Atlas V 551 – a mesh of the Atlas first stage; Centaur second stage; and Delta II STAR 48B – a reliable solid-fuel rocket working as third stage. Addition of this top segment was needed since a mission to Pluto was beyond the boost power of existing rockets. It was the first merger of this kind ever prepared for launch. NASA engineers expressed their confidence this untested version of the Atlas V would work perfectly. The launch was a perfect success!



*YouTube video of NASA's
Launch of the New Horizons Spacecraft*



Go for Launch!

Location and Window

Nested and shrouded on the top of the Atlas, New Horizons lifted off Cape Canaveral's Pad 41 right at 2 p.m., on January 19, 2006. Within half a-minute, the vehicle was streaking high over the Atlantic, on its way to orbit – with final destination Pluto. Launch Complex 41 is the only Atlas V-compatible structure on the East Coast. The year 2006 was optimal for New Horizons' launch, as it provided a 21-day launch window that would make the spacecraft reach Pluto in as little as 9 ½ years! Had NASA missed that opportunity, it would have had to wait another year before trying again, besides adding four extra years to New Horizons' trek across the cosmic abyss. The scientific community is just looking forward to ripping the cloak of mystery off Pluto and its entourage of enigmatic moons.



Post Launch Events

Half a minute after the go for launch, all five solid fuel boosters came to life. The Atlas first stage separated four minutes later, from the Centaur second stage, which started its hydrogen engine. This put the spacecraft into Earth orbit. Finally, the 3rd stage spun up and ignited, freeing the spacecraft of both Earth's and sun's gravitational pull.



New Horizons Mission Movie

After separation, the third stage and New Horizons hurtled toward Jupiter, which gave the spacecraft a successful gravity assist, a sort of slingshot effect. Meanwhile the third stage maneuvered to miss Pluto and its moons by millions of miles in order to avoid hitting and possibly contaminating them.

NASA Employees' Personal Experience

Before and after the New Horizon launch, Mike Stelzer had many opportunities to speak about the mission to the general public, particularly students.

He enjoyed talking about the thrill of being part of an exploration mission of our solar system never carried out before. Mike especially remembers how he used creativity to explain to students how it would take nine years for New Horizon to reach Pluto.



*New Horizons Mission
Highlights
A personal account
by Mike Stelzer*

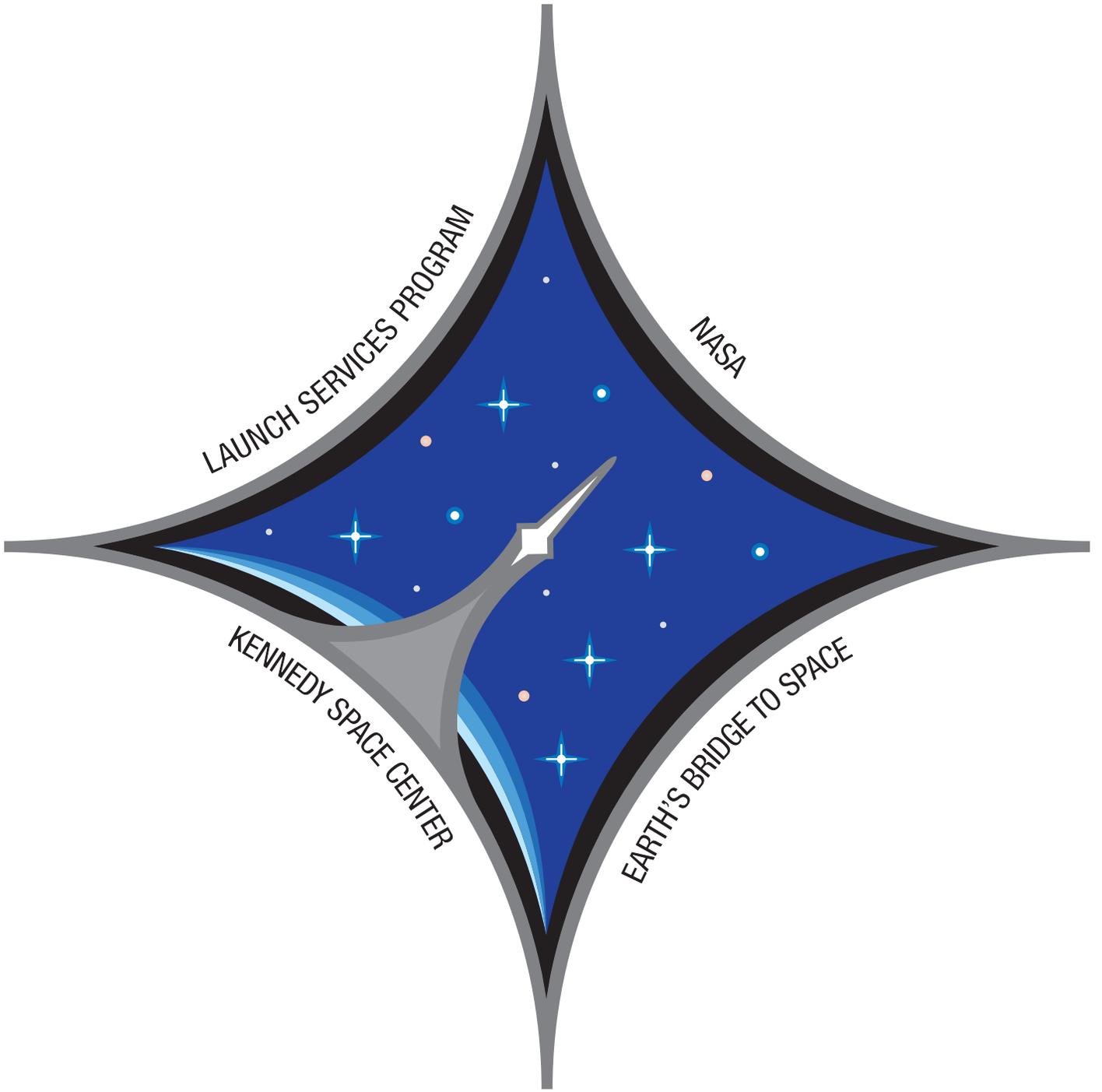
One of the activities used was measuring the students' height so that in 2015, they could see how much they had grown. Several students have come back to tell Mike about the impact that this activity (back in 2004 – 2006) had on them.

Mike's title was New Horizons' Mission Integration Manager. All these years later, he still recalls the memorable moments that included the many technical challenges that came with the new, special rocket design needed for the New Horizon mission.

Many new steps had to go exactly right before and on launch day. Witnessing each part of the countdown and launch vehicle ascent was an indescribably rewarding experience.

Getting back to the students, Mike said such special moments, like realizing you made a difference in those children's lives, along with their understanding of the solar system, are what made all the work worthwhile.

Almost a decade later, as the 2015 Pluto encounter draws near, Mike is preparing to share his experiences again – with identical, undiminished enthusiasm.



LAUNCH SERVICES PROGRAM

NASA

EARTH'S BRIDGE TO SPACE

KENNEDY SPACE CENTER