Kurt Lindstrom:

Overview of New Horizons

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Overview of the NEPA Process

Kurt Lindstrom

Overview of New Horizons

New Horizons Mission to Pluto

- New Horizons Mission is scheduled to Launch from NASA's Kennedy Space Center in Florida in January 2006.
- Leaving Earth in 2006, New Horizons will swing by Jupiter for a gravity assist in 2007.
- Arriving as early as 2015, New Horizons will become the first-ever spacecraft exploration of Pluto.
- Potential Backup Launch Opportunity in February 2007 with arrival in 2019 or 2020
- The Principal Investigator for this mission is Dr. Alan Stern of the Southwest Research Institute in Boulder, CO
- The Johns Hopkins Applied Physics Laboratory in Laurel, MD is building the spacecraft.

New Horizons Mission to Pluto

- Because this is a deep-space mission and traditional power systems (e.g. solar power) that far from the sun are not useful, New Horizons will utilize a radioisotope thermoelectric generator (RTG) to supply the electrical power for the spacecraft.
- RTGs enable spacecraft to operate on missions where solar power systems would not be feasible.
- An RTG is uniquely capable of powering this reconnaissance mission to distant Pluto where the Sun is no more than a bright point of light in the sky.
- RTGs have a proven record of safety and remain unmatched for reliability and durability over any other power technology for outer solar system missions.

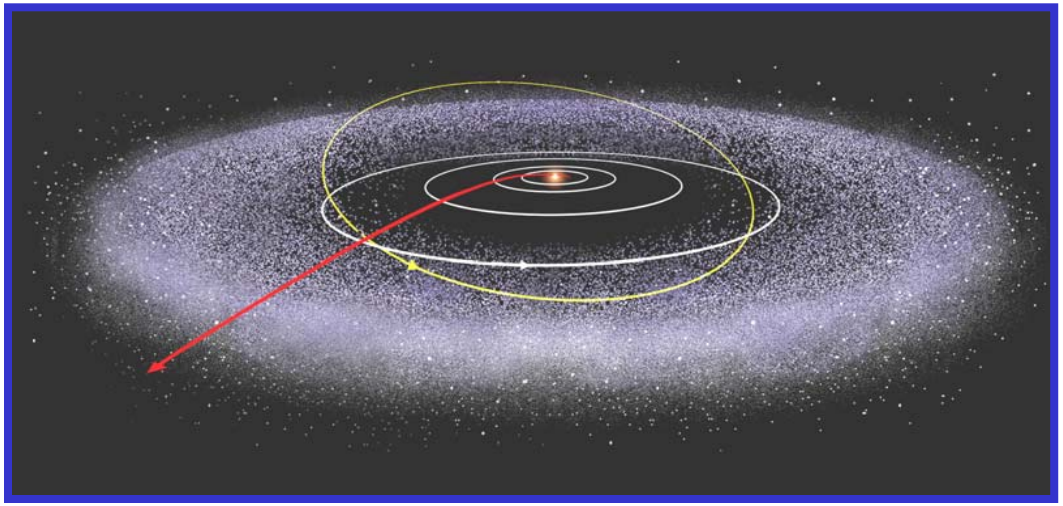
New Horizons Mission to Pluto

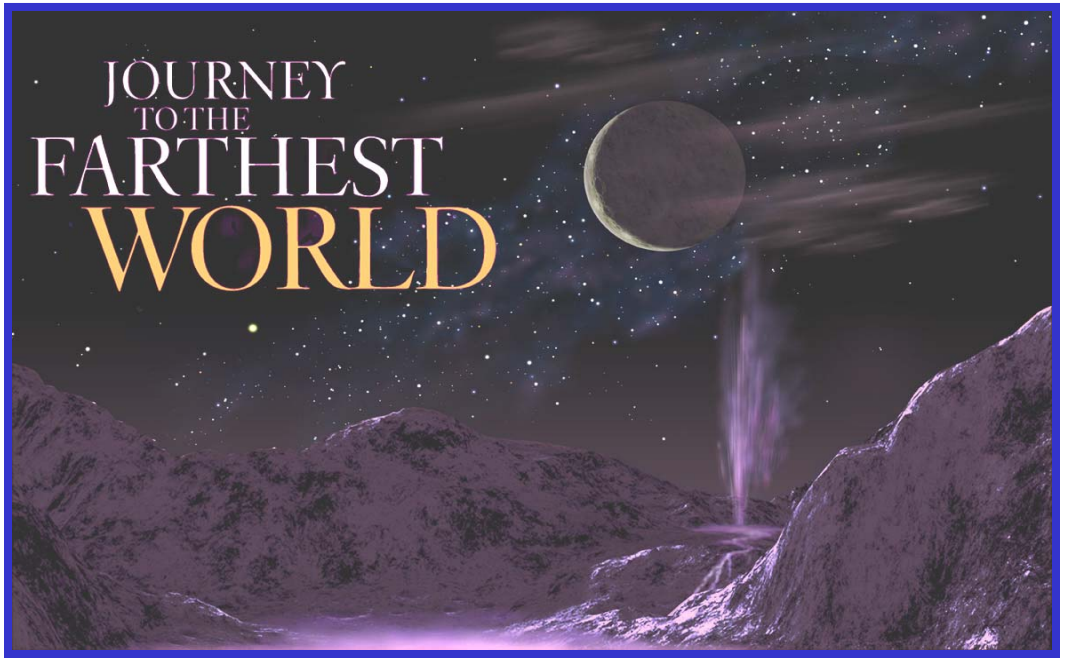
- The primary science requirements for this mission are to characterize the global geology and morphology of Pluto and Charon (Pluto's moon), map their surface compositions and temperatures, and examine Pluto's complex atmosphere.
- New Horizons is the first mission under NASA's New Frontiers Program.
- NASA confirmed the mission for development in March 2003.

Hal Weaver

Overview of the Science

New Horizons:
NASA's Pluto-Kuiper Belt Mission



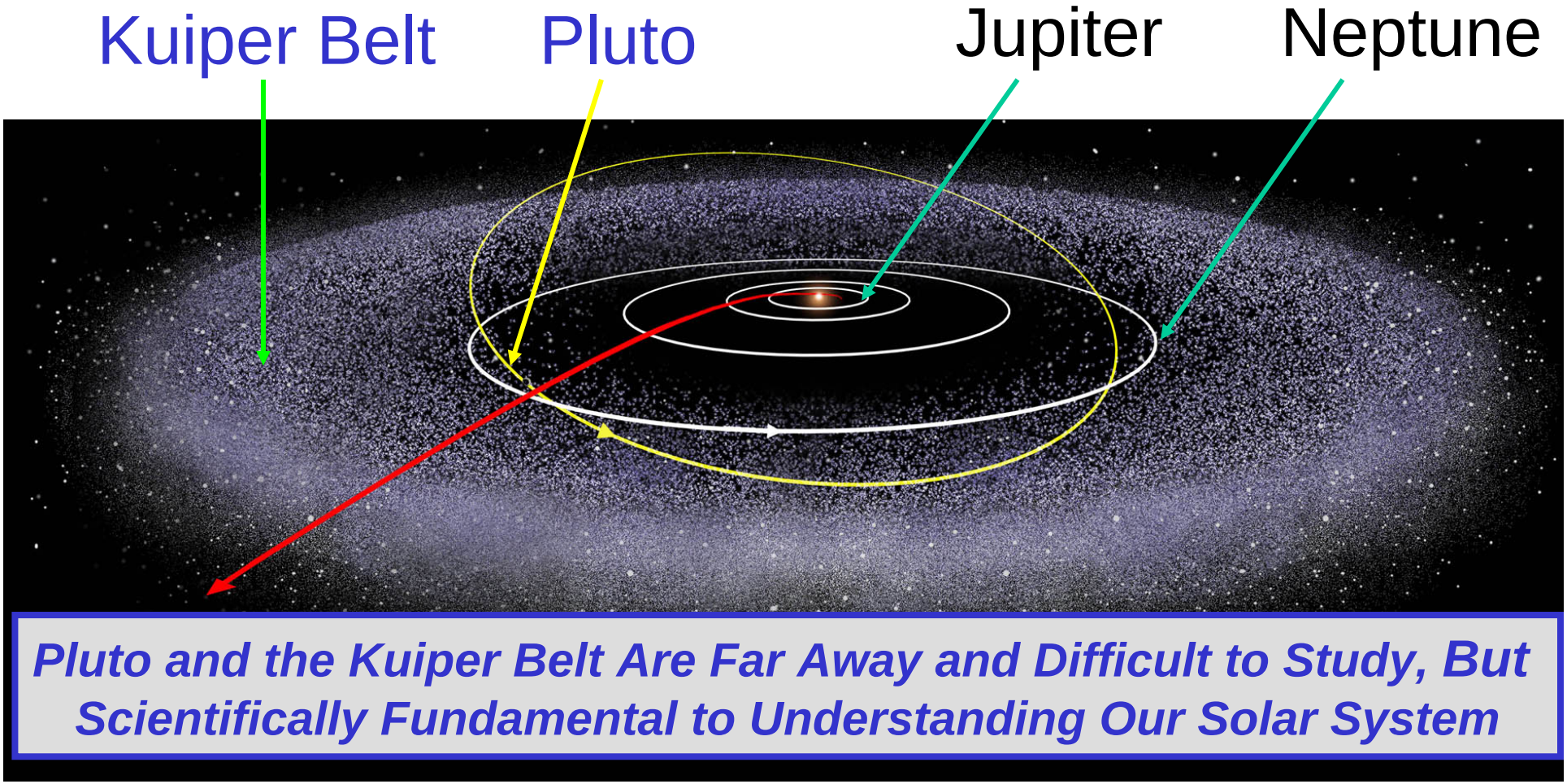


Dr. Alan Stern: Principal Investigator
Department of Space Studies
Southwest Research Institute

Dr. Hal Weaver: Project Scientist
Space Department
JHU Applied Physics Laboratory

The Solar System's Third Zone: The Kuiper Belt

The Kuiper Belt Was Unknown Before the 1990s!



Pluto and the Kuiper Belt Are Far Away and Difficult to Study, But Scientifically Fundamental to Understanding Our Solar System

Pluto-Charon: A Little Background

PLUTO AND CHARON

PARAMETER	*PLUTO*	*CHARON*
ROTATION PERIOD	6.3872 days	6.3872 days
RADIUS	1150 - 1215 km	600 - 640 km
DENSITY	about 2 g/cm^3	1 - 2 g/cm^3
BRIGHTNESS	13.6 magnitude	15.5 mag
GEOMETRIC ALBEDO	0.55, variable	0.32
COLOR (V-I)	0.93 magnitude	0.83 mag
KNOWN SURFACE ICES	CH_4 , N_2 , CO, ?	H_2O, ?
ATMOSPHERE	CONFIRMED	DOUBTFUL

PLUTO

Buie, Tholen and Horne [1992]

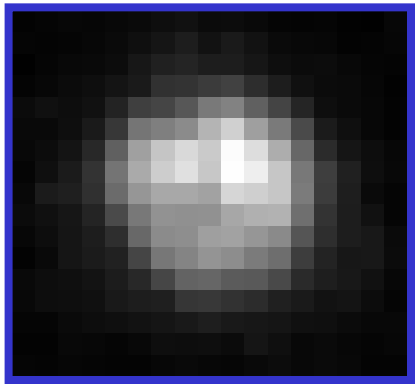
Young and Binzel [1993]

2 Models ⟶ similar large features

Interpretation:
- Spotty object
- Light areas - fresh frost
- Dark areas - dirty ice or rock
- Asymmetric polar caps

Unknown:
- Details on scales < 500 km

The Best Hubble Images of Pluto Are Still Crude



Pluto & Charon: Small, But Unique in Three Important Ways

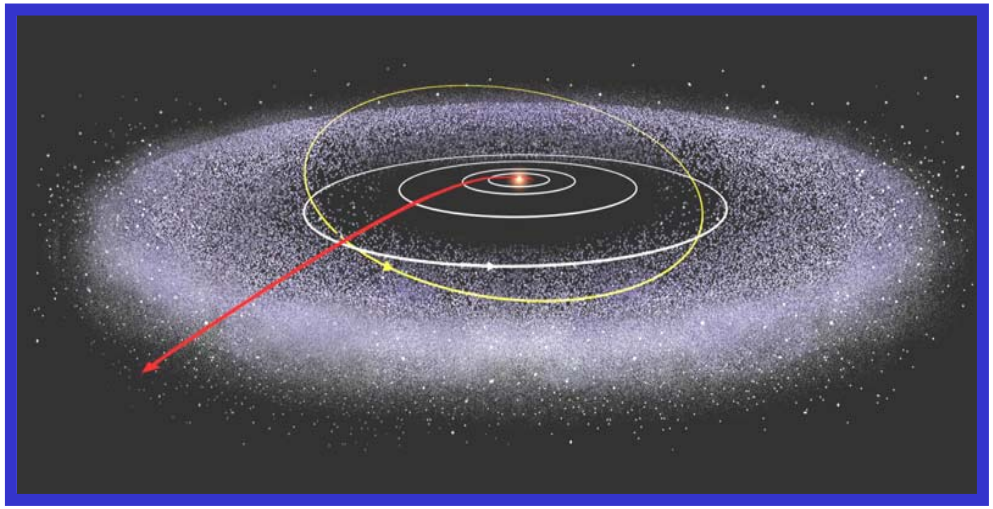
- **Pluto and Charon are neither Terrestrial Planets nor Gas Giant Planets: They belong to a wholly new type of body, *Ice Dwarfs*, which are common to the deep outer solar system, a region not yet explored.**

- **Pluto-Charon is the solar system's only known *Binary Planet*, with important implications for understanding the formation of the Earth-Moon system.**

- **Pluto's Rapidly Escaping *Atmosphere* is a transitional case between a cometary and a classical planetary atmosphere, and is the only expected site of planetary hydrodynamic escape that occurred on the early Earth.**

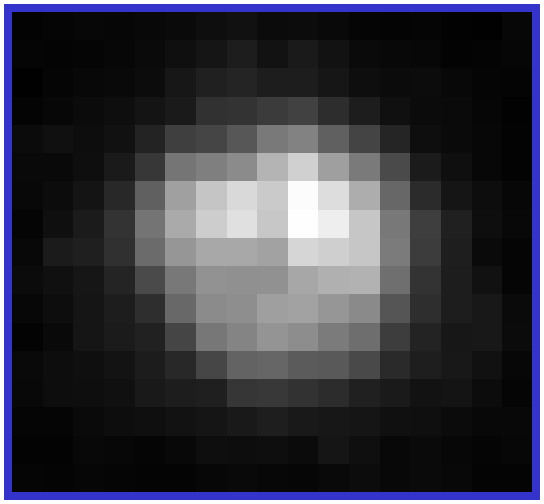
Tracing the Origin and Evolution of the Solar System

- **Pluto's and Charon's surfaces record the details of outer solar system bombardment history, leading to an improved understanding of the rate at which Earth impacts occur.**
- **The Kuiper Belt is the best known "archeological site" to explore mid-stage accretion in the outer solar system.**
- **The Kuiper Belt is the source of the short-period comets, which seeded the Earth with water and organic chemicals.**

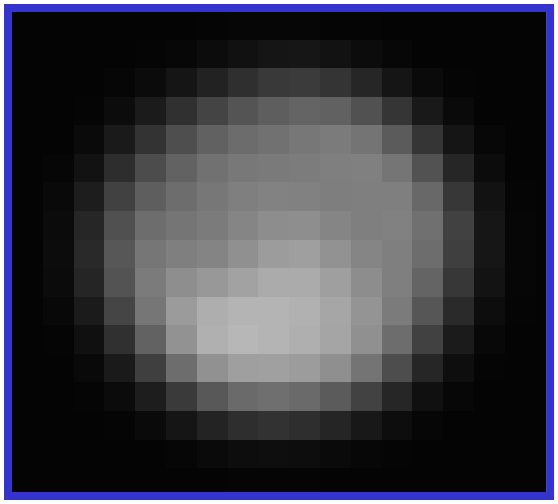


But Progress Will Be Limited *Until We Visit*

This is the fundamental historical lesson of planetary exploration.



Pluto at best Hubble Resolution

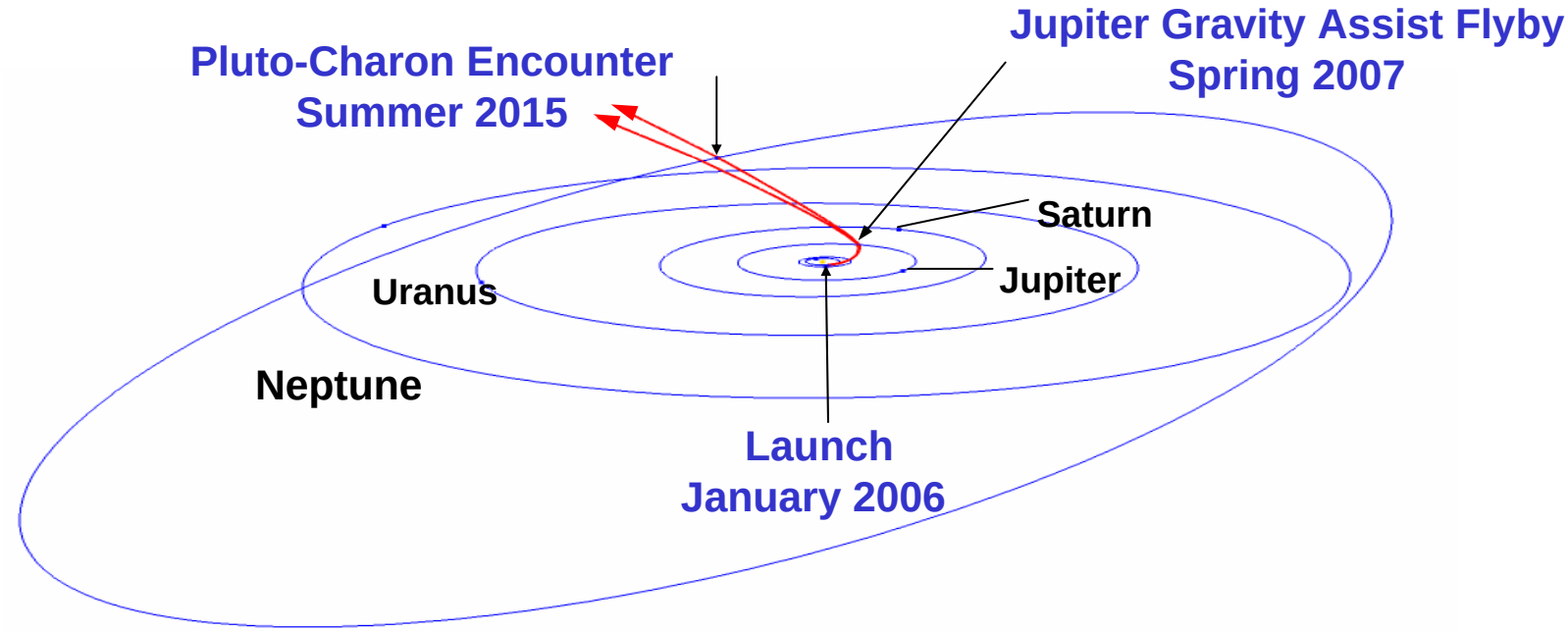


Earth's Moon at the Same Resolution

Earth's Moon at 5 km per pixel

Why Go to Pluto Now?

Mission Trajectory



Time-Criticality Factors:

- JGA Pluto trajectory is available in 2006 but, after that, not until 2018.
- Atmospheric collapse probability increases with time.
- Pluto's approaching winter solstice nightfall costs ~200,000 km^2/yr

New Horizons: An Historic Journey

The First Mission to Explore The Solar System's "Third Zone" and "The First Mission to the Last Planet"

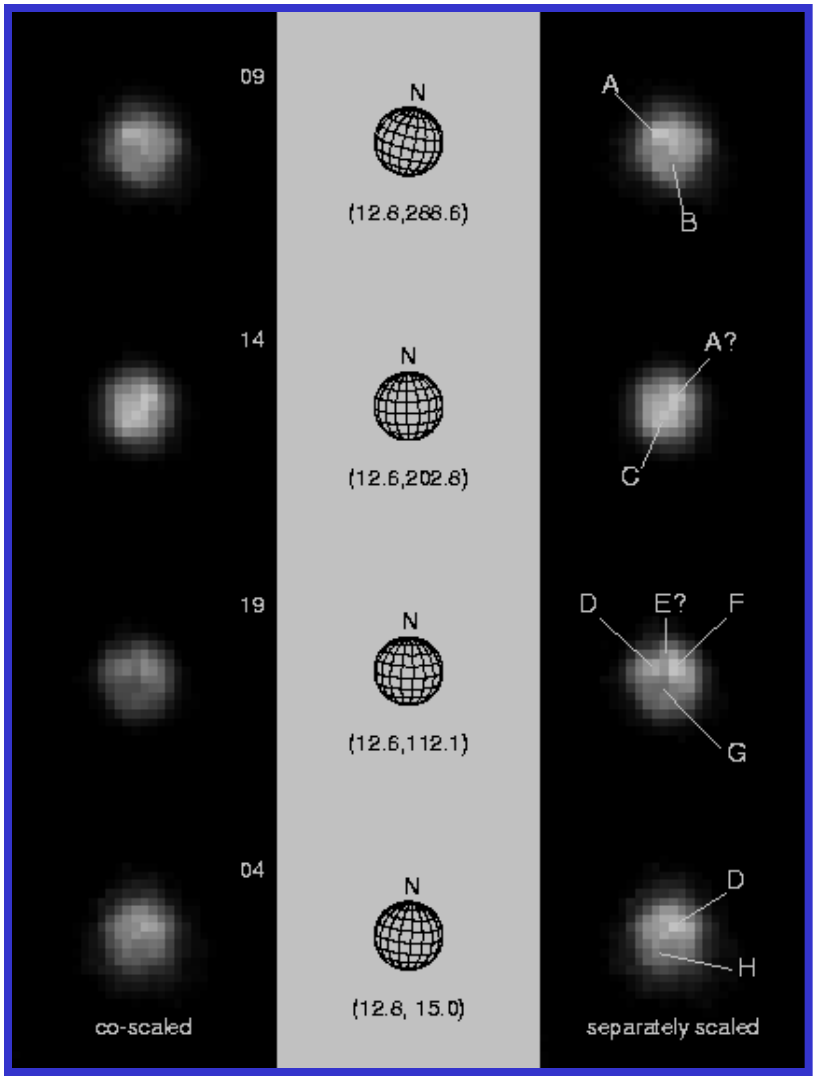
A Reconnaissance Expedition to the Kuiper Belt and Pluto-Charon: **Recommended as the Highest Priority Mid-Size Mission by the National Research Council's Planetary Decadal Survey (2002)**

Pluto-Charon Science Highlights

- Six months of encounter science.
- Exceed Hubble resolution for months!
- Map entire sunlit surfaces of Pluto and Charon.
- Make global composition maps of Pluto and Charon.
- Map the surface temperatures of Pluto and Charon.
- Directly measure the escape rate and composition of Pluto's atmosphere.

The most exciting discoveries will probably be the ones we can't even anticipate!

Hubble's Best Pluto Images ⟶



Unexplored Territory

We Plan to Make This 1990 U.S. Stamp Obsolete!

Glen Fountain

Overview of the Mission

New Horizons – A Journey to New Frontiers

Mission Overview

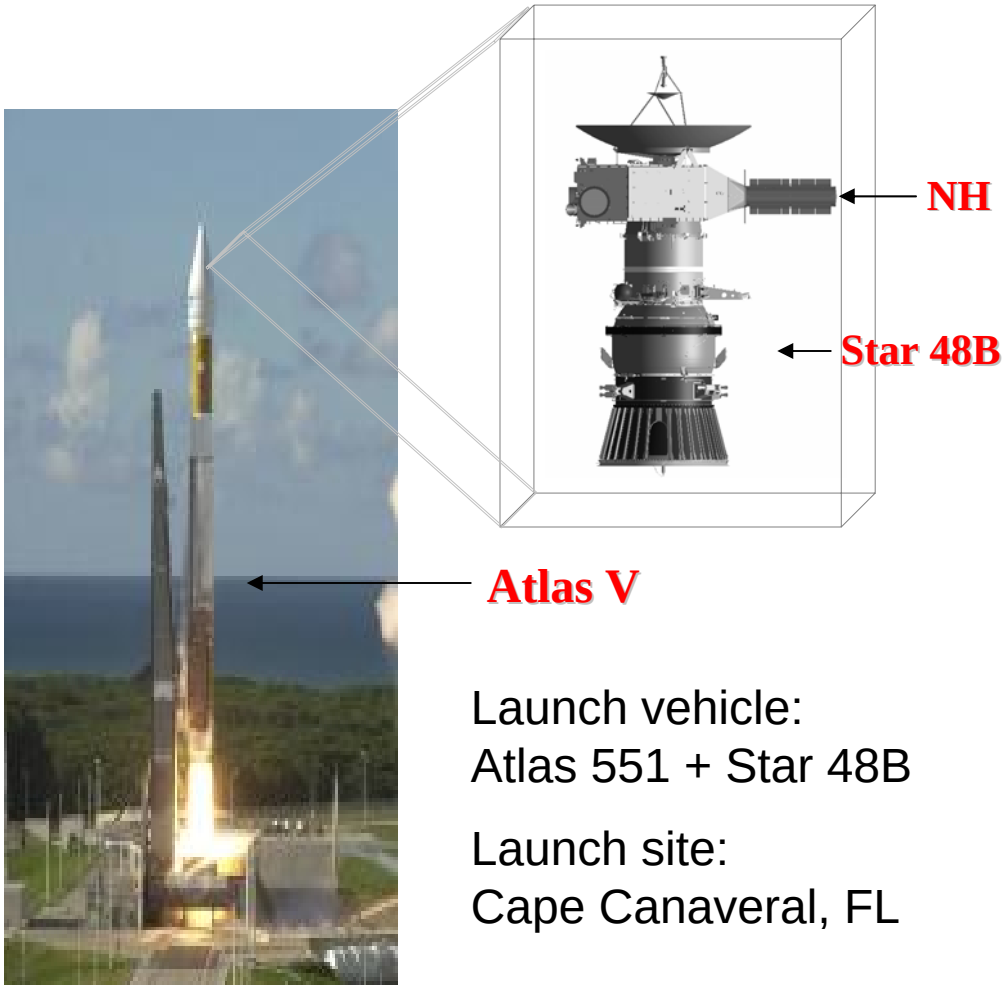
Glen Fountain

Project Manager

New Horizons Launch Options

- **2006 Planned Baseline**
  - **Launch date:**
    Jan 11- Feb 14, 2006
  - **Launch period: 35 days**
  - **Max C_3: 164 km^2/s^2**
  - **S/C launch mass: 481 kg**
  - **Pluto arrival: 2015-2020**

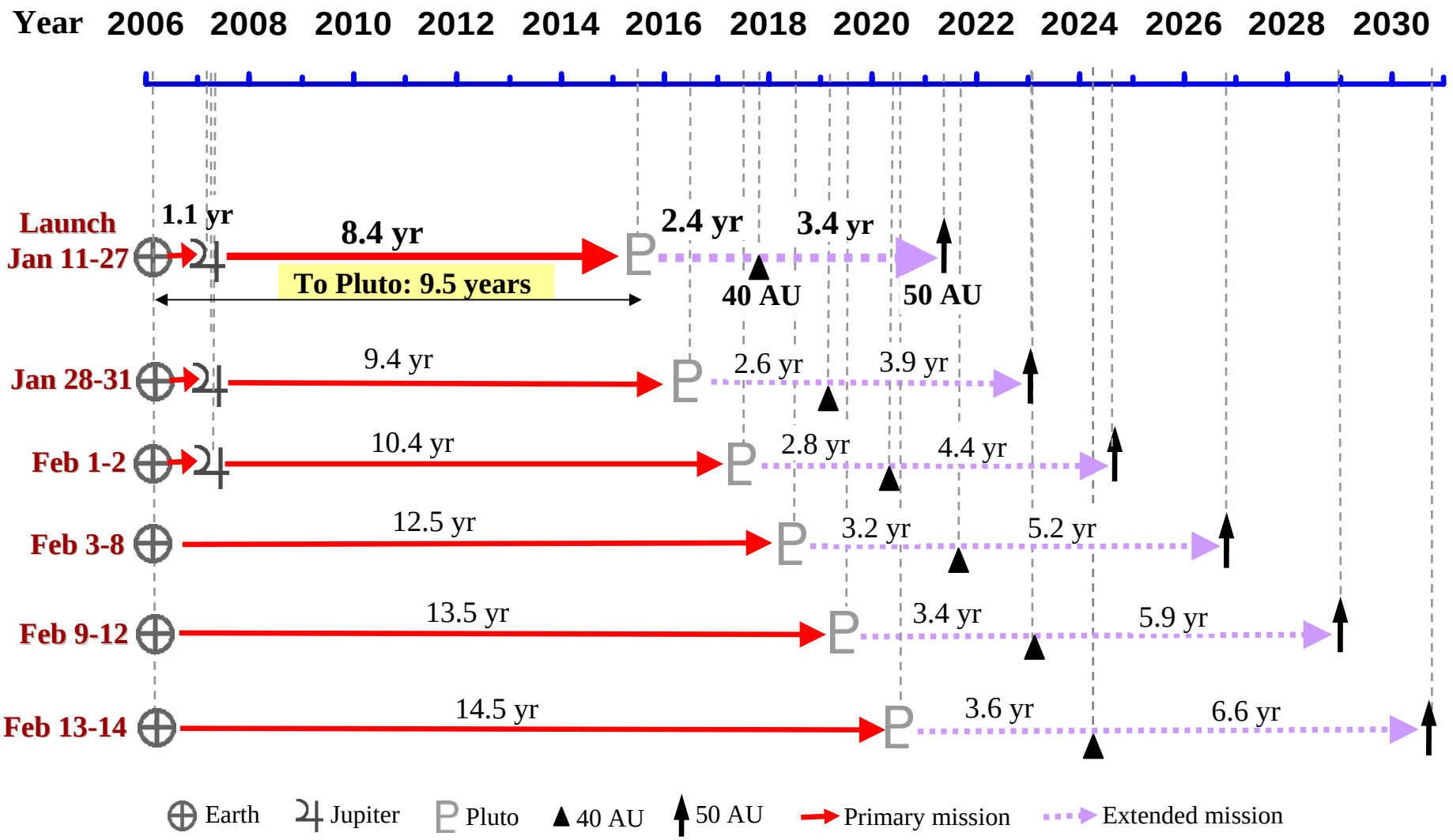
- **2007 Planned Backup**
  - **Launch date: Feb 2-15, 2007**
  - **Launch period: 14 days**
  - **Max C_3: 166.2 km^2/s^2**
  - **S/C launch mass: 461 kg**
  - **Pluto arrival: 2019-2020**



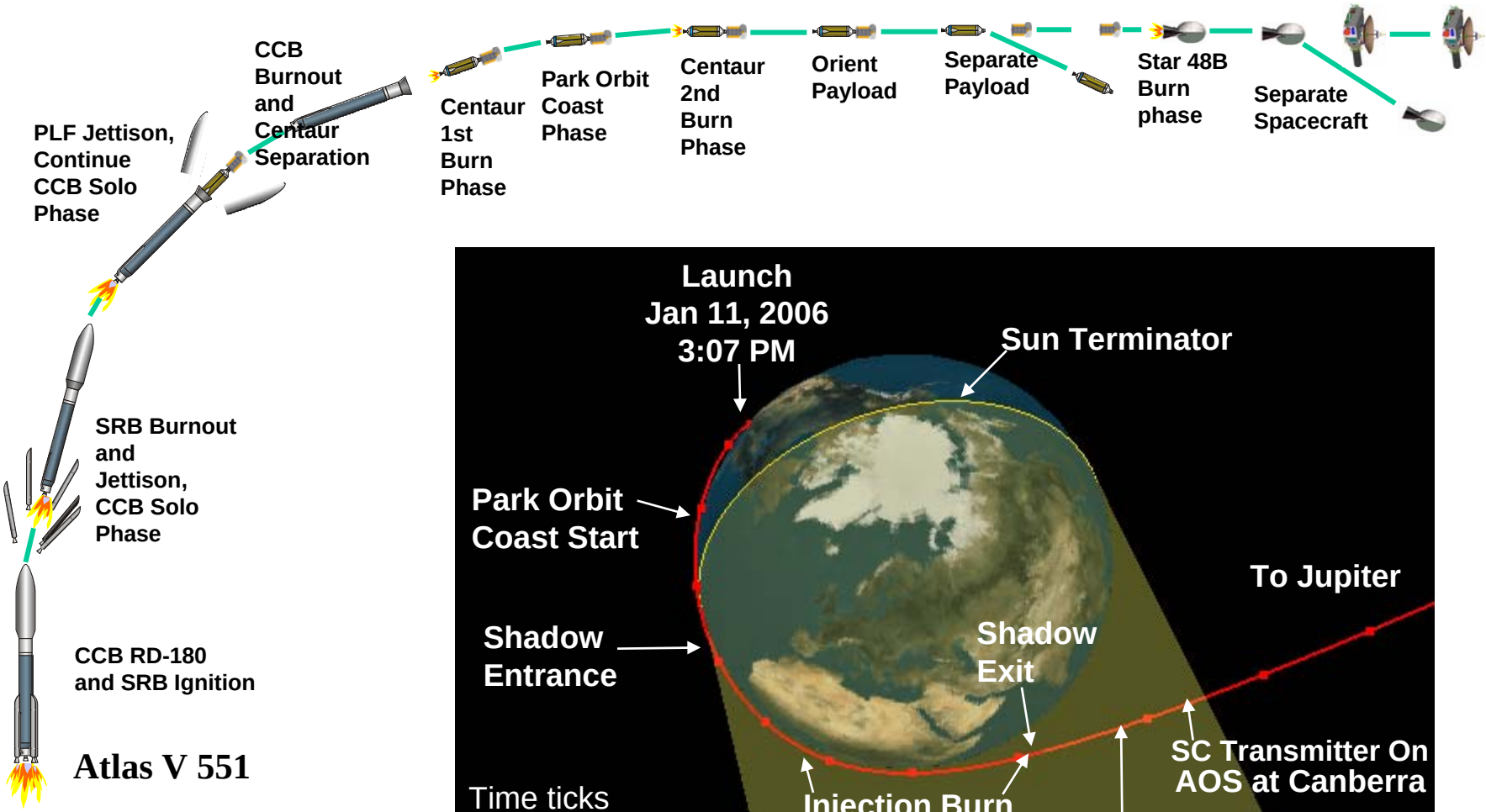
Launch vehicle:
Atlas 551 + Star 48B

Launch site:
Cape Canaveral, FL

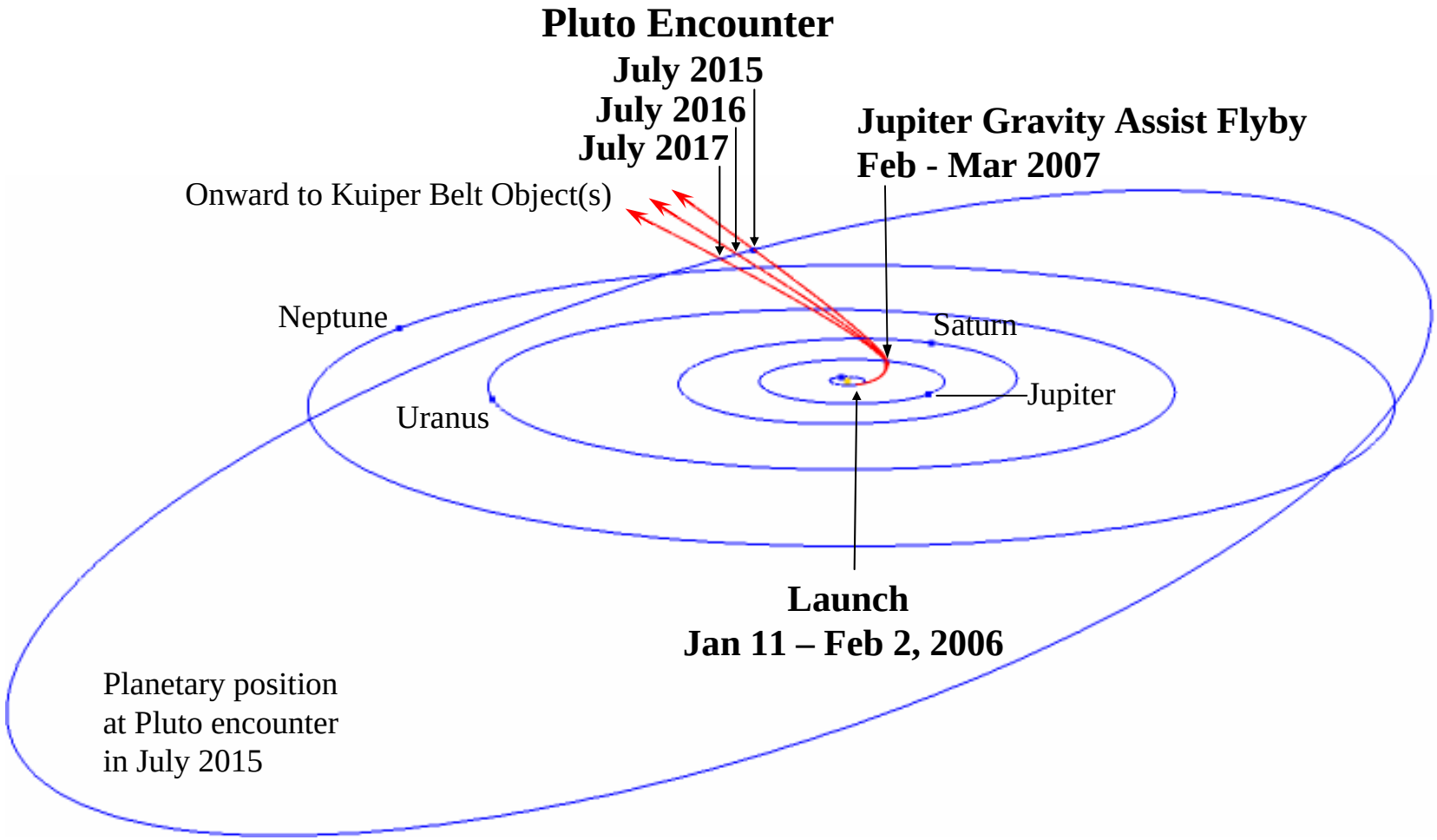
New Horizons Mission Timeline (2006 Baseline Plan)



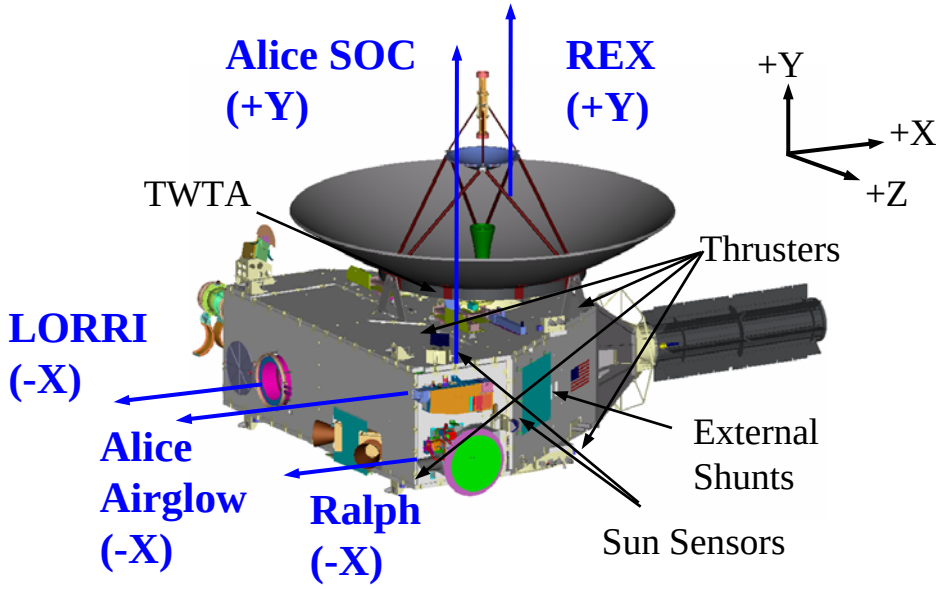
Launch Sequence & Trajectory (Jan 11)

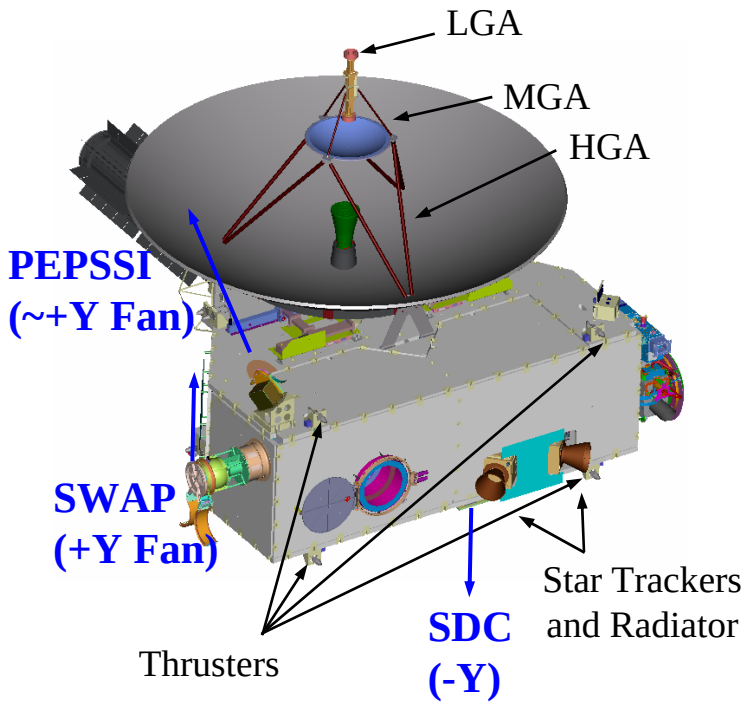


Jupiter Gravity Assist Trajectory



Baseline Spacecraft



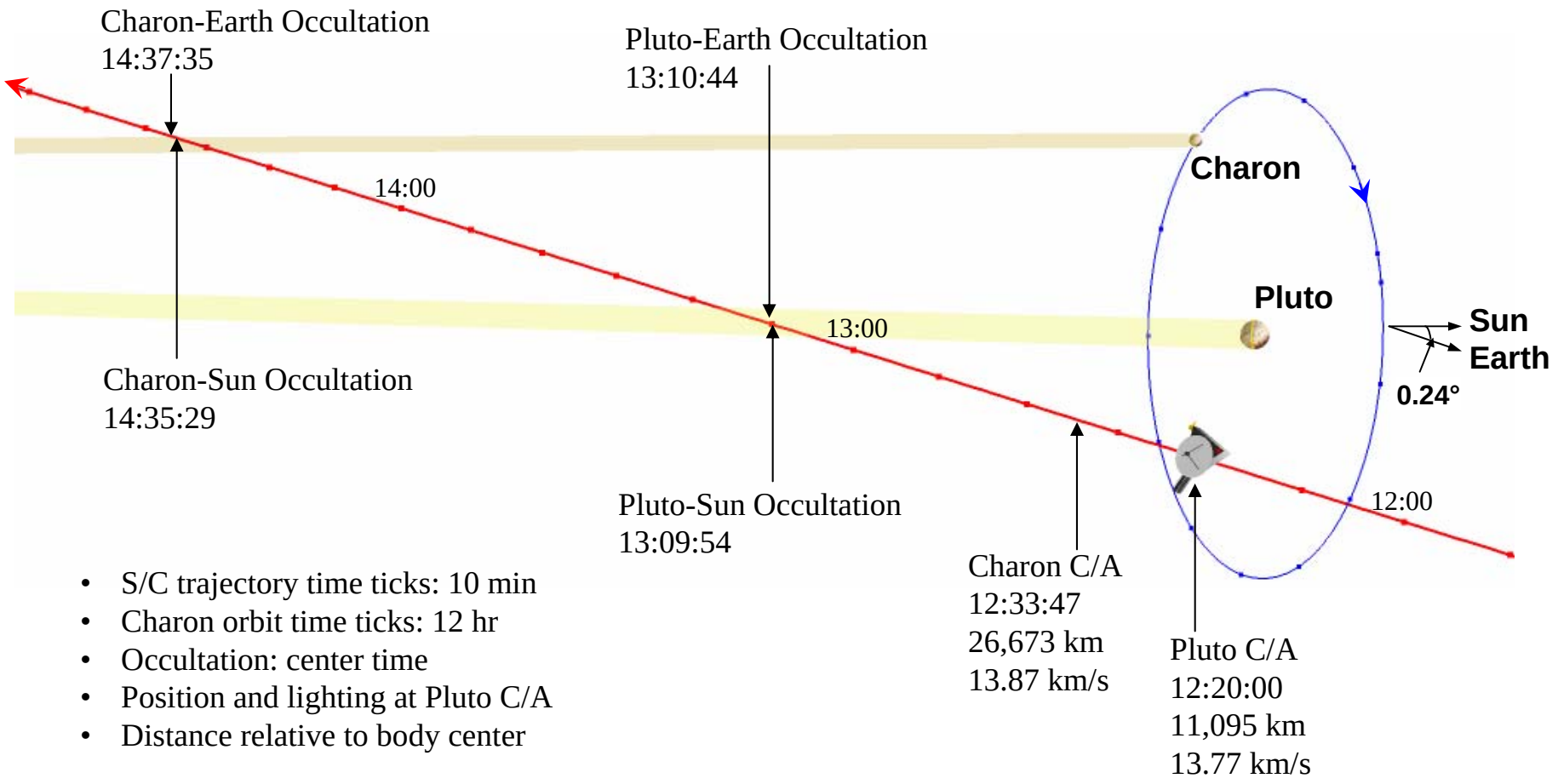


Legend

Instruments
(View Directions)
Spacecraft Components

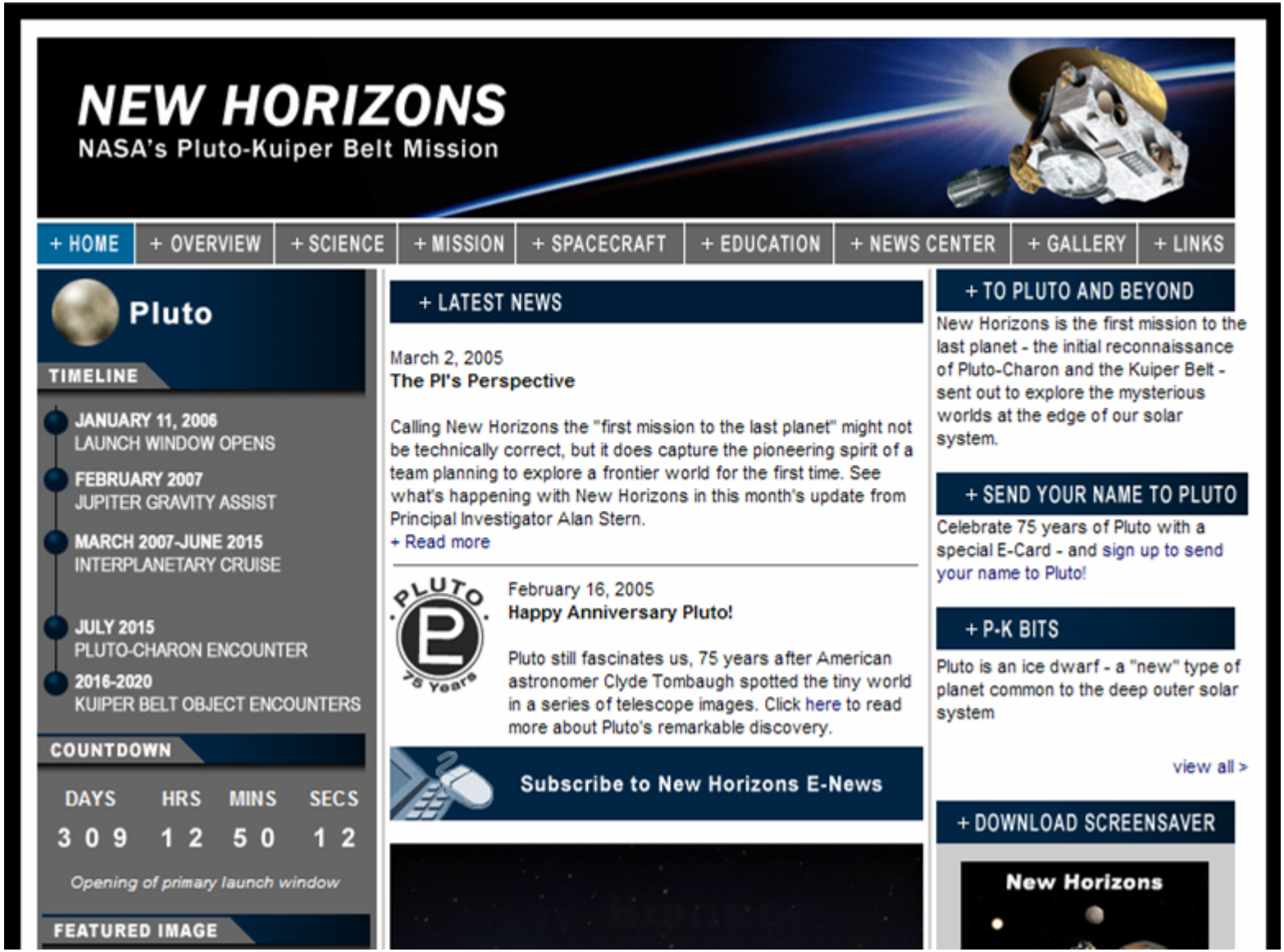
1 meter

Pluto-Charon Encounter (July 14, 2015)



- S/C trajectory time ticks: 10 min
- Charon orbit time ticks: 12 hr
- Occultation: center time
- Position and lighting at Pluto C/A
- Distance relative to body center

Web site - http://pluto.jhuapl.edu



Kurt Lindstrom

Overview of the New Horizons DEIS

New Horizons Mission to Pluto

- NASA will not launch if it is not SAFE!
- Over the past 40 years, RTGs have been used safely and reliably. Some of these successes include:
  - Six Apollo Flights to the Moon
  - Two Pioneer Spacecraft to Jupiter and Saturn
  - Two Mars Viking Landers
  - Two Voyager Missions to the Outer Planets
  - Galileo Mission to Jupiter
  - Ulysses Mission to the Sun's Poles
  - Cassini-Huygens Mission to Saturn

Draft EIS Summary of Results

- Impacts of a successful launch – the most likely outcome – would come mainly from the Atlas V solid propellant booster exhaust emissions; these would include:
  - Temporary effects on local air quality near the launch site.
  - Short-term ozone degradation along the vehicle's flight path.

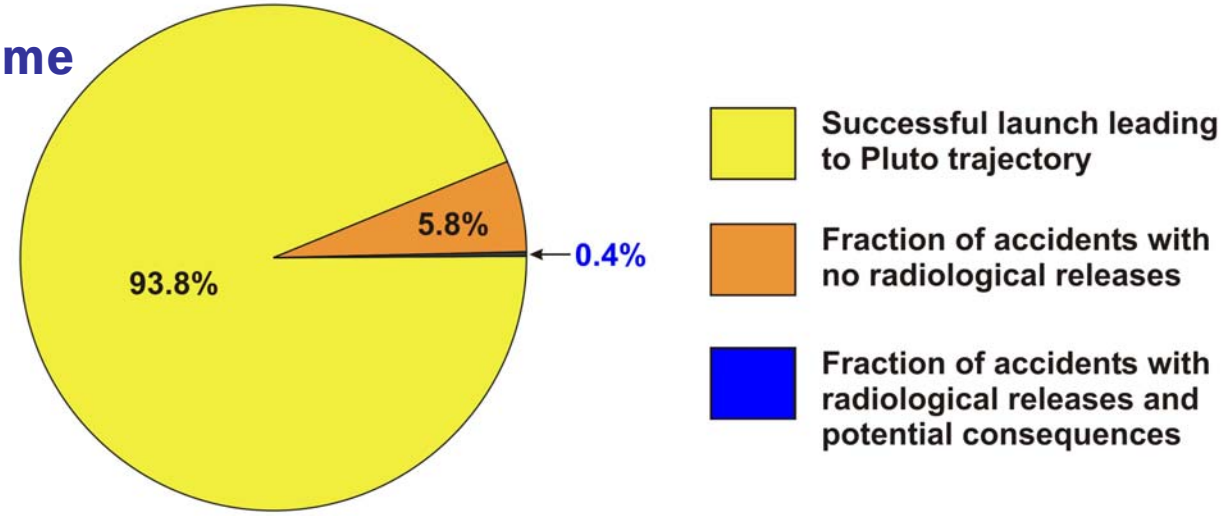
These impacts are common for many launch vehicles that use solid propellant boosters.

Draft EIS Summary of Results

- Unlikely accidents could occur during preparation for and launch of the spacecraft. The two accidents of principal concern are:
  - A liquid propellant spill during fueling operations, which would be minimized via remotely operated actions that would shut down the system.
  - A vehicle failure in or near the launch area during the first few seconds of flight, resulting in:
    - Emissions of combusted propellants that chemically resemble those from a normal launch and would not reach levels that threaten public health.
    - Debris that would likely fall on or near the launch pad or into the Atlantic Ocean.
  - Very unlikely accidents are also addressed.

Draft EIS Summary of Results

The most likely outcome (938 out of 1,000) is a successful launch to Pluto



- There is a 99.6% probability that the mission will result in no release of radiological material.
- Less than half of accidents with a release (0.16%) would result in more than 0.1 latent cancer fatalities
- There is a 1 in 1.1 million chance of an accident with a release that would result in more than 0.5 latent cancer fatalities

Kenneth Kumor

Overview of the NEPA Process

NEW HORIZONS MISSION
NEPA PROCESS

Draft EIS Public Comment Period

- Period extends from 2/25/05 to 4/11/05
- Comments should be limited to environmental concerns and alternatives to the proposal
- Except for oral presentations at the public meetings, comments must be in writing

Draft EIS Public Comment Period

- Written comments can be:
  - Hardcopy letters (preferred)
  - Comment forms submitted at meetings (preferred)
  - Electronic mail
- Letters must be postmarked by April 11, 2005
- Written comments should be submitted with the understanding that NASA will publish them

Final EIS

- Will contain:
  - Text changes, as appropriate, to reflect comments on the Draft EIS
  - An Appendix with
    - Copies of written comments and NASA's responses
    - Summaries of concerns expressed orally and NASA's responses
  - Will be sent to those on the mailing list and also available over the internet

Record of Decision

- Issued no sooner than 30 days after issuance of the Final EIS
- Sent to those on the mailing list and will be on the internet
- Contains
  - NASA's decision
  - All alternatives considered
  - The environmentally preferable alternative
  - The factors that entered into the decision
  - The mitigation measures adopted