NEW HORIZONS 2

WHY NEW HORIZONS 2?

- PROVIDE BACKUP FOR THE HIGHEST PRIORITY NF OBJECTIVE OF THE DECADAL SURVEY.

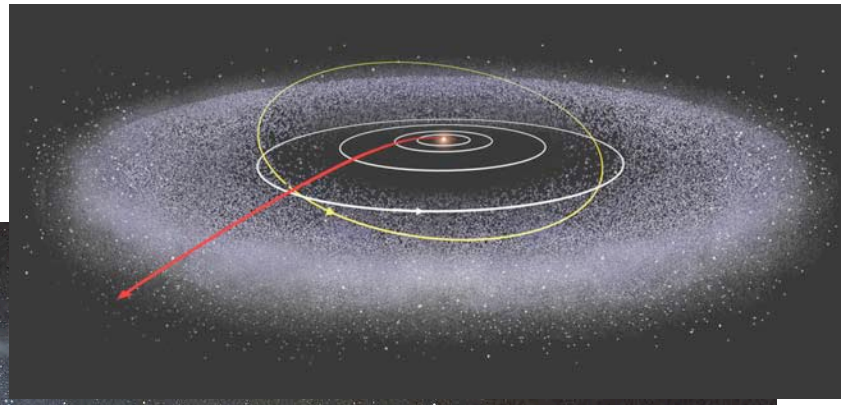
- ENABLE THE FIRST EXPLORATION OF A LARGE (500 KM CLASS) KBO--A PLANETARY EMBRYO.

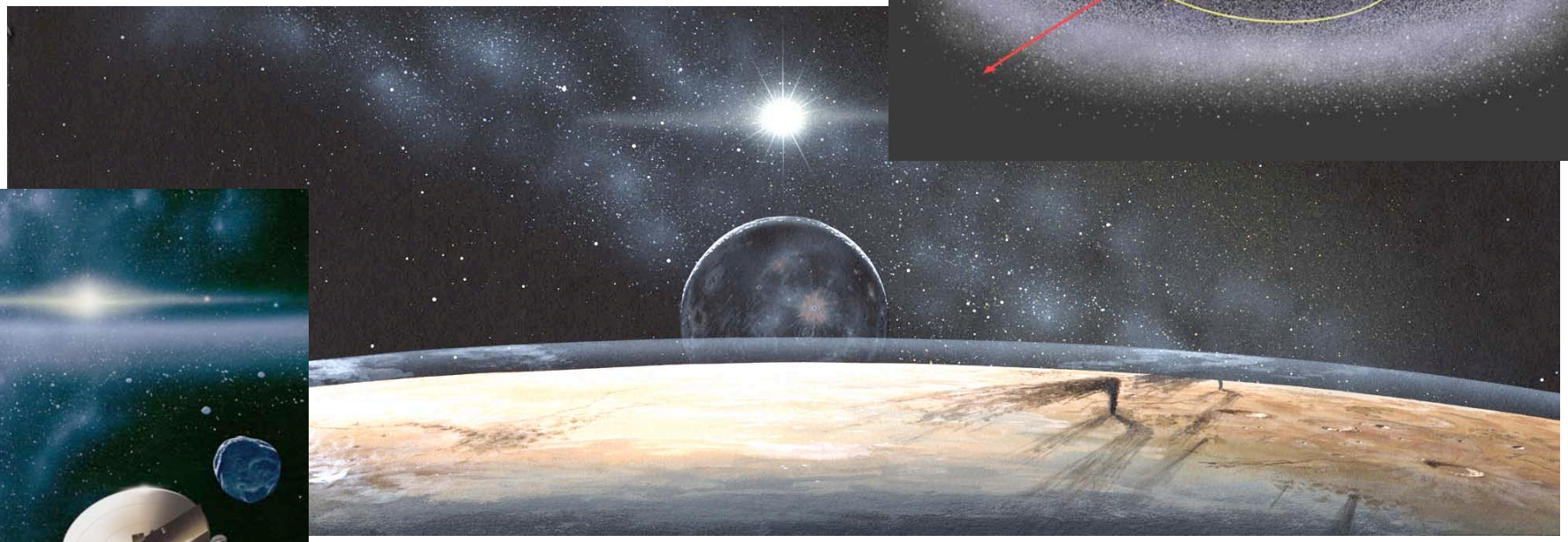
- RECONNOITER ADDITIONAL, SMALLER (40-80 km) KBOs.

Toward New Horizons

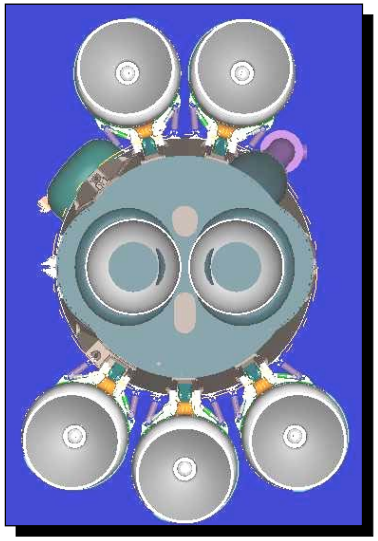
The Highest Priority New Frontiers Start Recommendation of the Planetary Decadal Survey (2002):

The Reconnaissance of the Kuiper Belt and Pluto-Charon





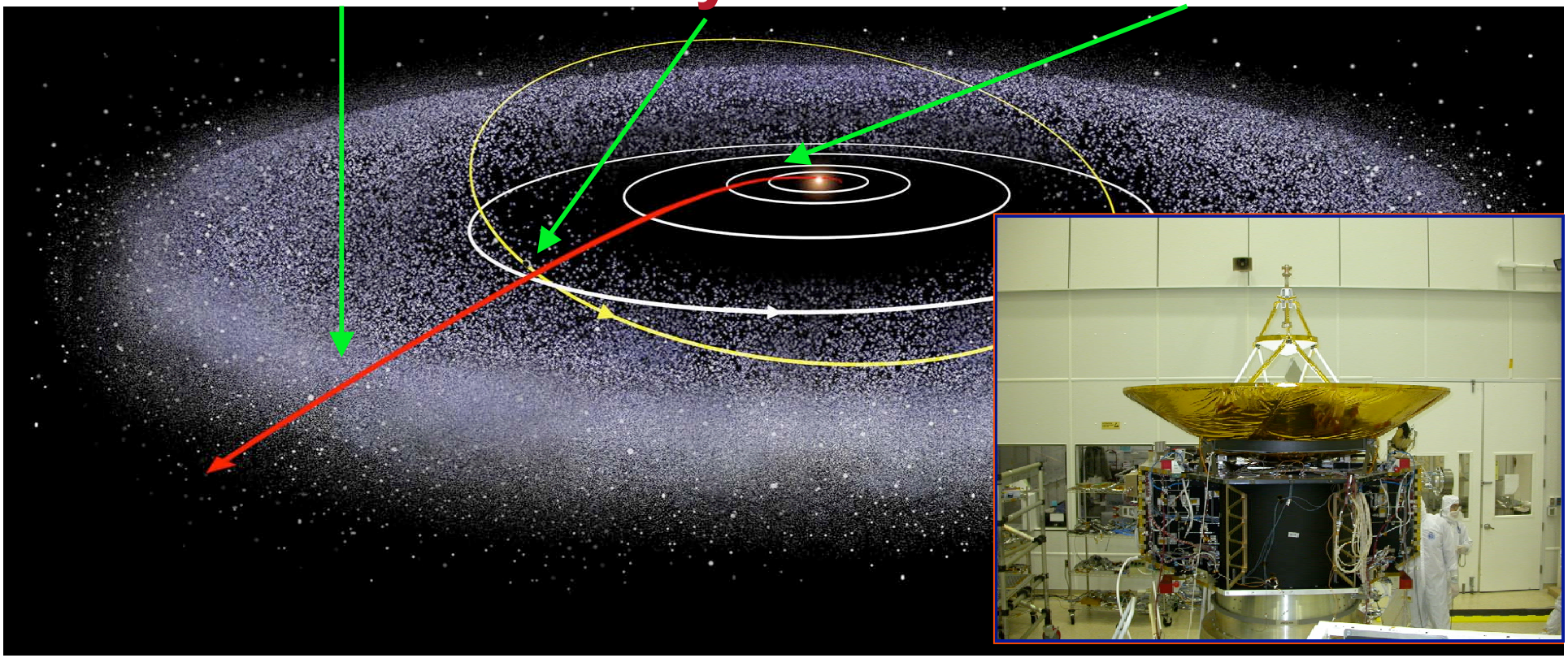
The New Horizons Atlas V 551 Launch Vehicle



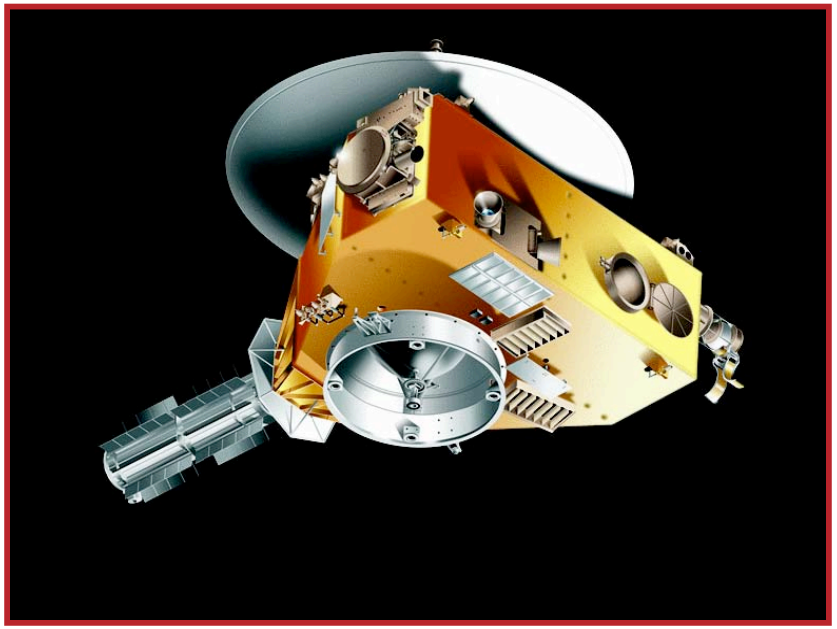
New Horizons is New Frontiers 1

First Time Exploration
of The Solar System's "Third Zone"

KBOs 2016-2020 **Pluto-Charon July 2015** **Jupiter System March 2007**



Development Status



New Horizons was selected by NASA on 29 Nov 2001.

New Horizons was funded and approved to enter into full-scale development in March 2003.

New Horizons is now in Phase C/D; it is designated New Frontiers 1.

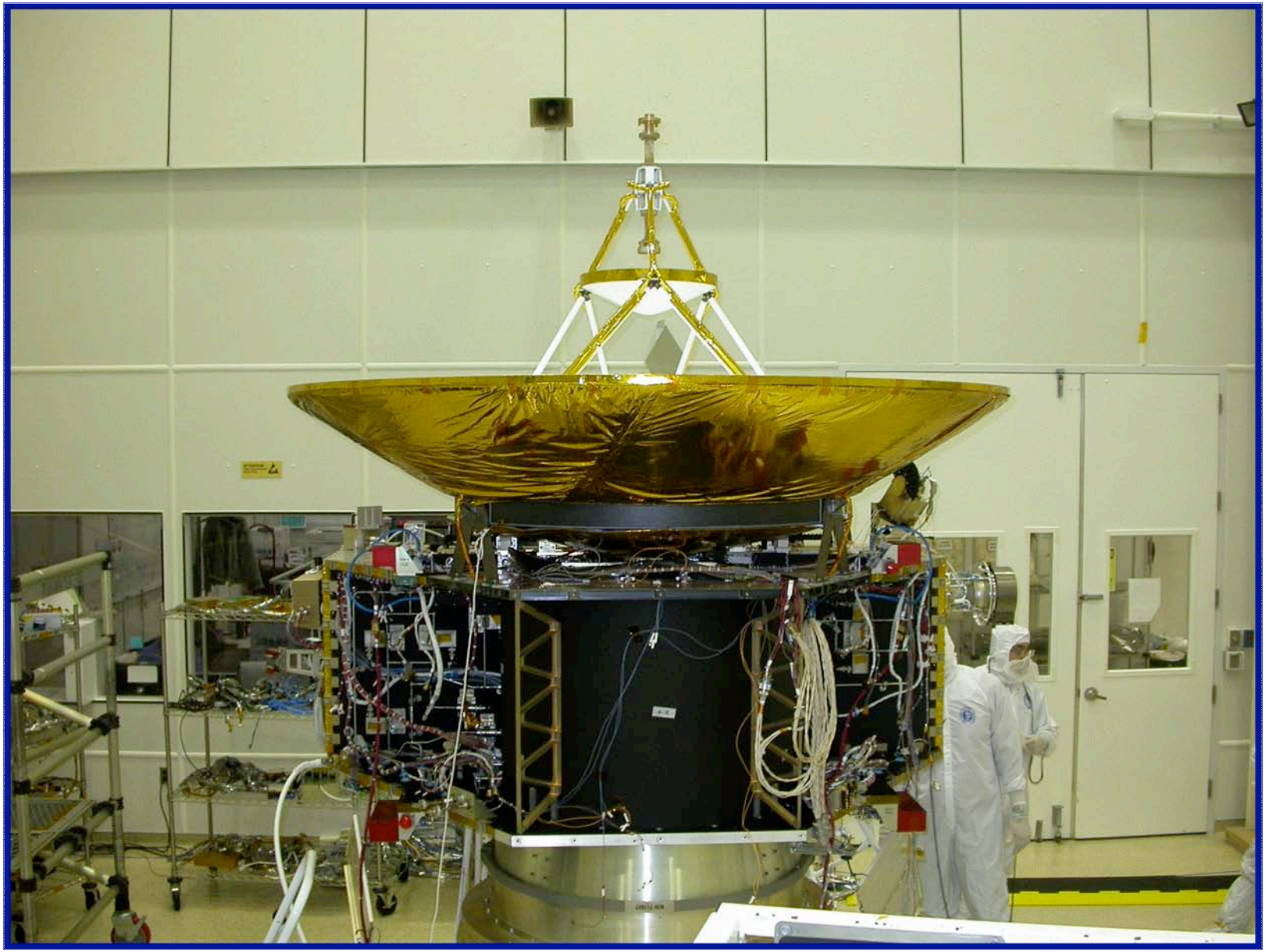
- ✓ Concept Proposal Phase – Jan-Apr 2001
- ✓ Phase A Study – Jun-Oct 2001
- ✓ Selection – Nov 2001
- ✓ Phase B Start – Jan 2002
- ✓ Requirements Review (SRR) – May 2002
- ✓ Prelim Design Review (PDR) – Oct 2002
- ✓ Non-Advocate Review (NAR) – Dec 2002
- ✓ Phase C/D Start (ATP) – Apr 2003
- ✓ Critical Design Review (CDR) – Oct 2003

- ✓ Start Integration & Test – June 2004

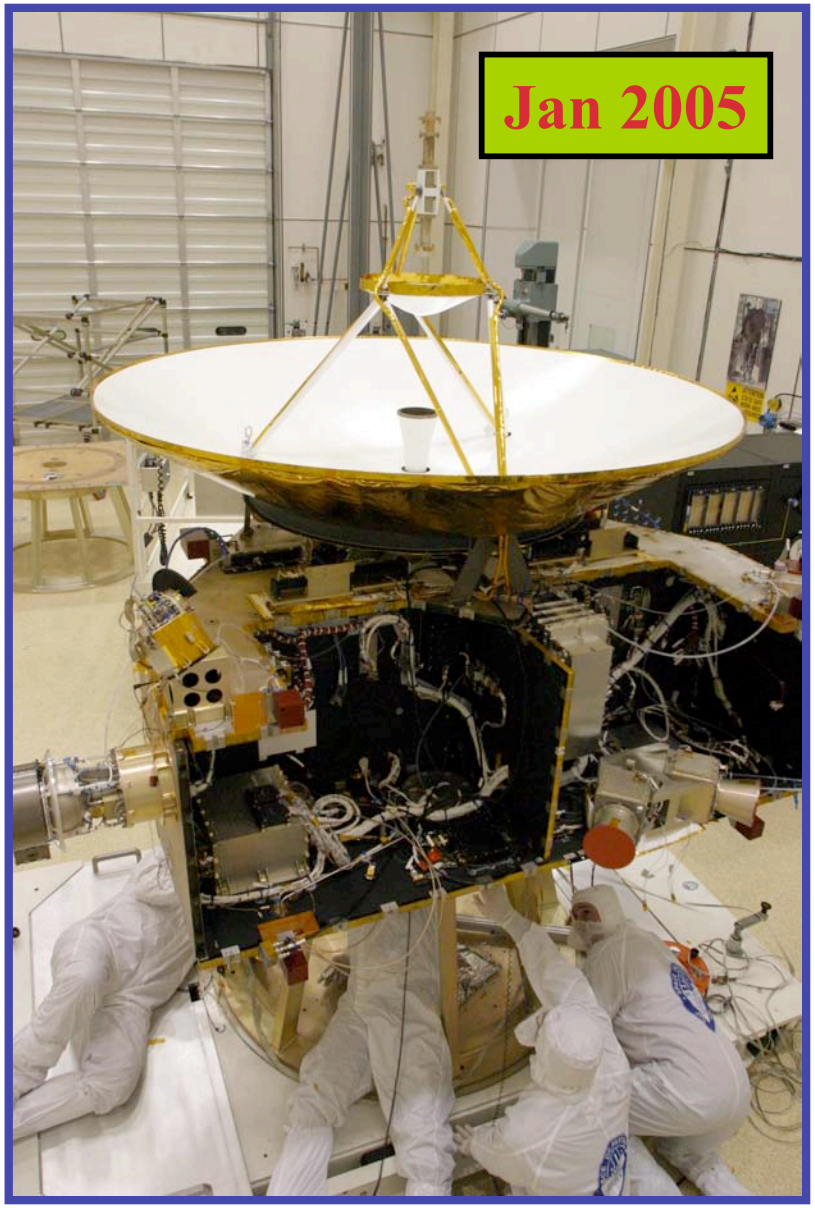
- ➢ Start S/C Assembly/I&T – Aug 2004
- ➢ Instrument Deliveries – Aug '04-Mar '05
- ➢ Thermal-Vac Testing – March-June 2005
- ➢ Pre-Ship Review – September 2005
- ➢ Launch Readiness Review – Dec 2005

- ➢ Launch Window Open– Jan-Feb 2006

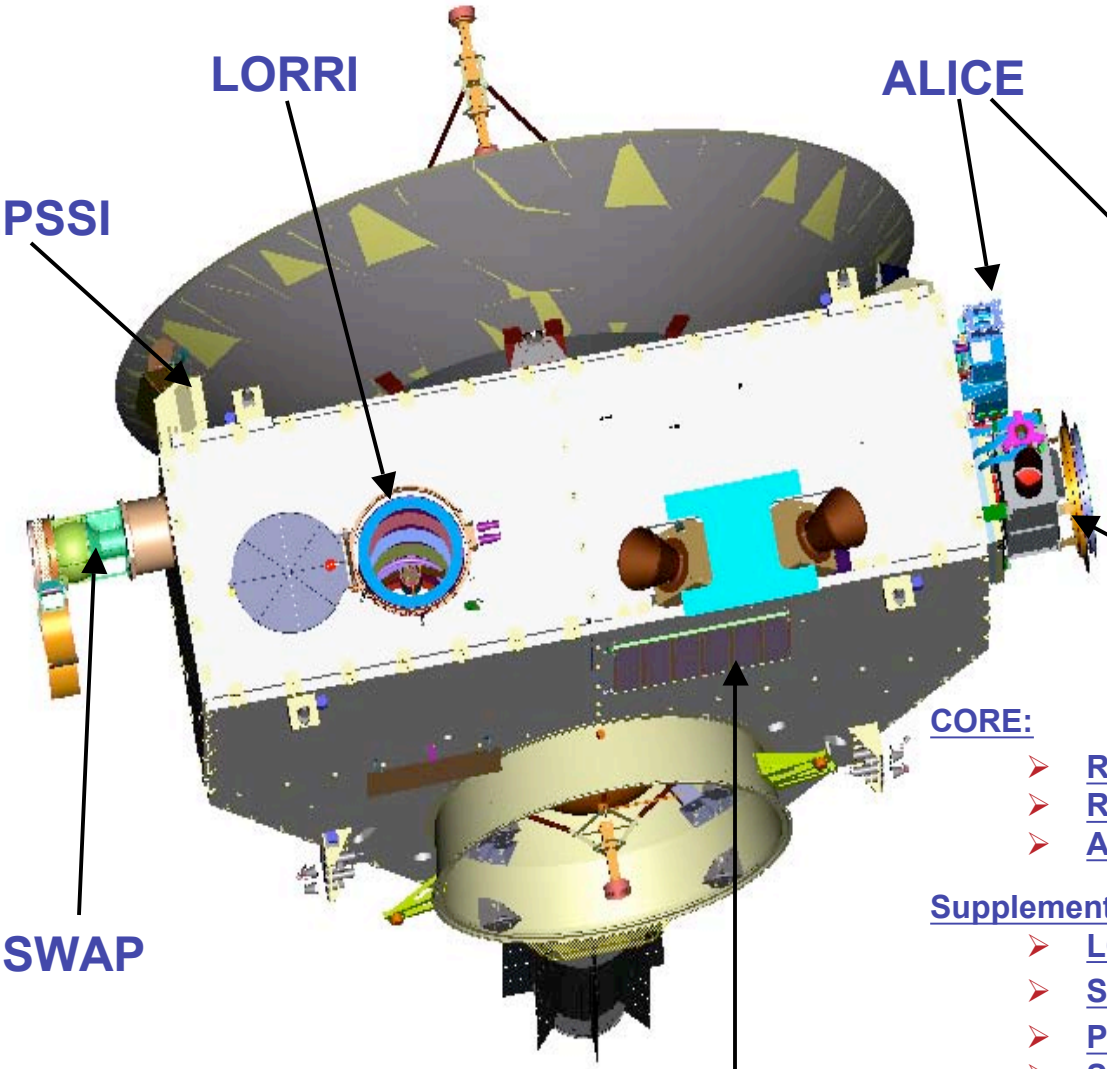
New Horizons Under Construction



New Horizons in Build



Instrument Payload



CORE:

- REX Uplink radio science & passive radiometry
- RALPH VIS/IR imaging & spectroscopy
- ALICE UV imaging spectroscopy

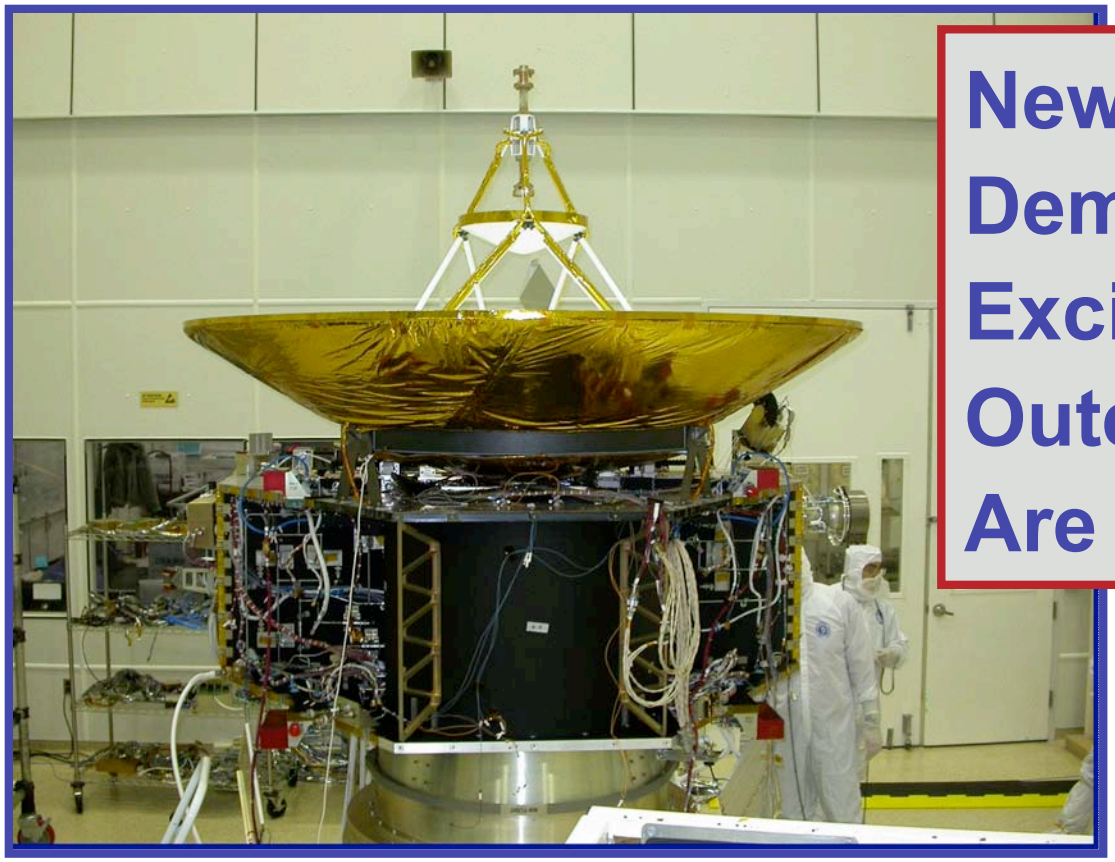
Supplemental:

- LORRI High-resolution imager
- SWAP plasma spectrometer
- PEPSSI energetic particle spectrometer
- SDC EPO Student Dust Counter

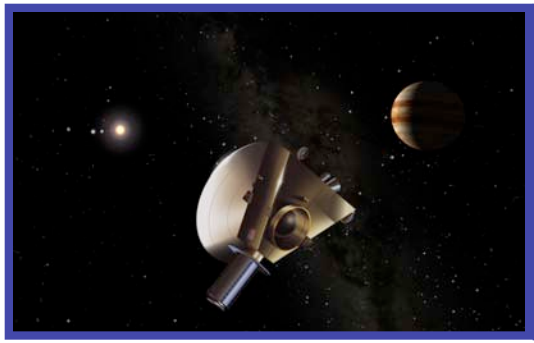
New Horizons Payload Characteristics

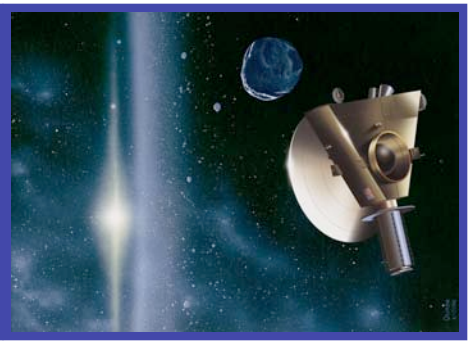
	Type	Characteristics
Ralph	Imager/Imaging Spectrometer	➢ Panchromatic & 4-color CCD imagery (20 _rad resolution); ➢ 1.25-2.50 _m IR imaging spectroscopy (62 _rad, R=300-600).
Alice	UV Imaging Spectrometer	➢ __=520-1870 Å, 3 Å resolution, airglow & occultation capabilities
REX	Radio Science, Radiometery	➢ Atmosphere P,T to: 0.1_bar, 1 K ➢ Surface Temp to 0.3 K
LORRI	Hi-Res Imager	➢ Panchromatic CCD imagery (5 _rad resolution)
SWAP	In Situ Plasma Spectrometer	➢ Solar wind ions up to 6.5 KeV
PEPSSI	In Situ Particle Spectrometer	➢ Ions: 1-5000 KeV ➢ Electrons: 20-700 KeV
SDC	In Situ Dust Counter	➢ 0.10 meters^2 active area, ➢ Threshold Mass ~10^{-12} gm

Toward New Frontiers



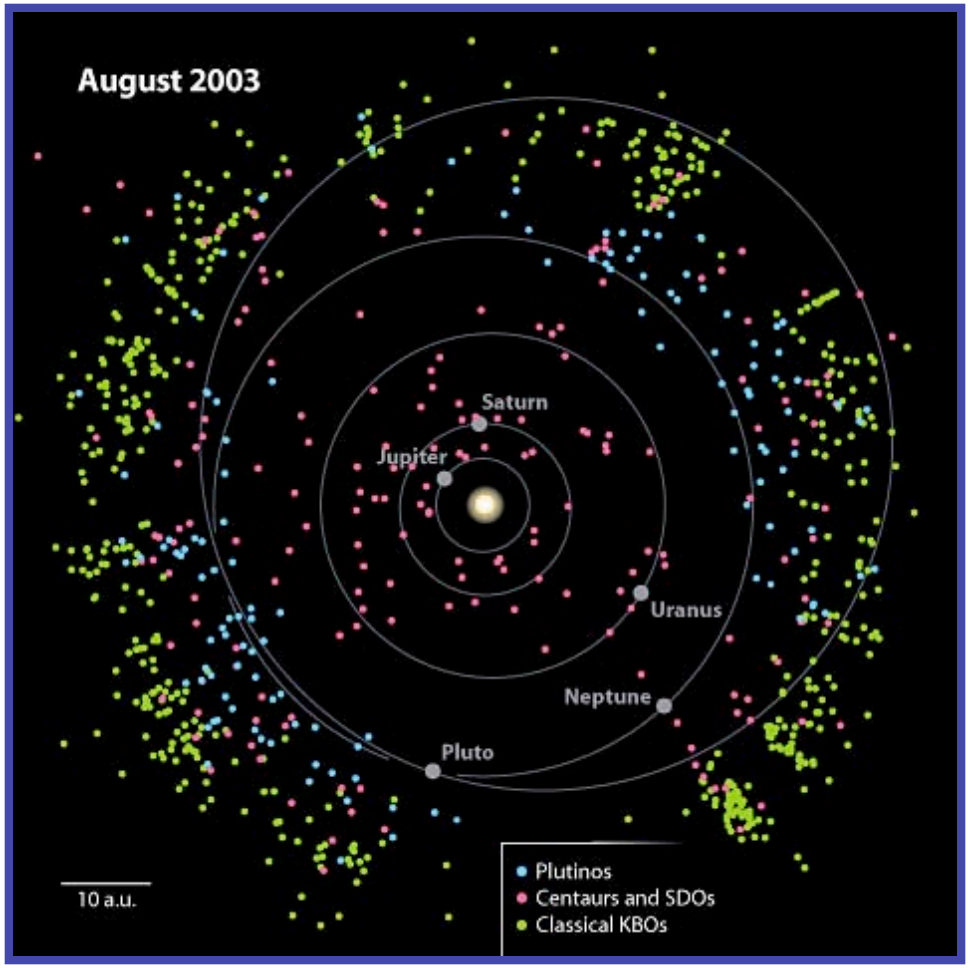
New Horizons is Demonstrating That Exciting Low Cost Outer Planet Missions Are Indeed Feasible.





NH 2: Exploring Large KBOs

Sampling the *Diversity* of the Kuiper Belt Was The Highest Priority New Frontiers Recommendation of the Decadal Survey



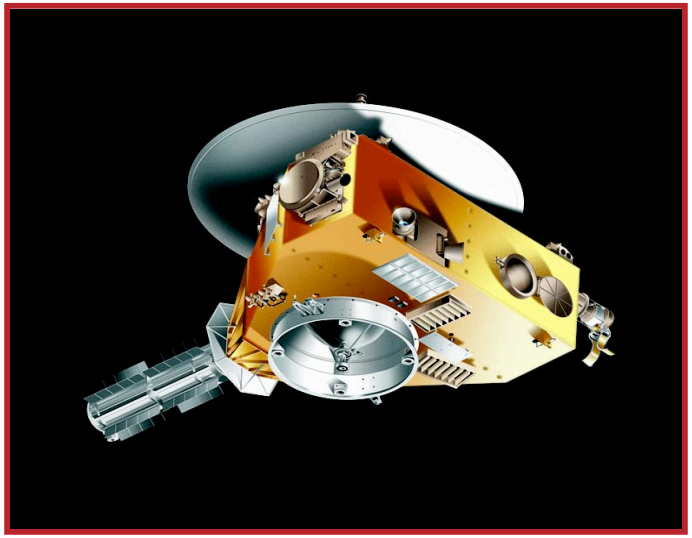
NASA New Horizons Mission Requirements

- Despite the Wishes of the Decadal Survey, NASA's Requirements for New Horizons 1 Make Clear That Kuiper Belt Exploration is only a Goal.

- Requirement: Flyby Pluto-Charon before the end of 2020.
- Desirement: NASA desires to visit one or more KBOs if an extended mission is approved after Pluto.

NEW HORIZONS 2: STUDY GROUNDRULES

- ✓ EXAMINE A LARGE KBO (D>300 KM) TO COMPARE TO PLUTO AND 1-2 ADDITIONAL 50 KM-CLASS KBOs.
- ✓ MINIMIZE COST: USE SAME SPACECRAFT AND PAYLOAD AS NH 1.
- ✓ EMPLOY THE SAME OR A SMALLER ELV.
- ✓ INSIST ON EXPANDED COMMUNITY PARTICIPATION (DOUBLE THE SCIENCE TEAM SIZE).



New Horizons 2 Other Example Mission Designs

Numerous Mission Scenarios Found. Many Also Allow Uranus Flybys En Route, But Only Until 2009: Then Uranus Moves Out of Position With Jupiter

Mission Scenario	Launch		JGA Flyby			UGA Flyby			KBO Encounter		
	Date	C3 (km2/s2)	Date	Speed (km/s)	C/A Range (Rj)	Date	Speed (km/s)	C/A Range (Ru)	KBO Name	Date	Speed (km/s)
1	3/19/2008	102.6	8/12/2009	12.2	23.6	10/7/2015	10.8	2.36	1999 TC36	9/15/2020	11.9
2	3/19/2008	100.4	8/21/2009	11.9	26.8	5/8/2016	9.7	3.01	1999 TC36	10/24/2021	10.6
3	4/30/2009	141.3	6/6/2010	16.6	101.9	7/30/2016	10.3	2.23	1999 TC36	9/15/2021	11.2
4	4/29/2009	135.1	6/16/2010	16	119.4	5/22/2017	8.9	3	1999 TC36	4/8/2023	9.6
5	3/21/2008	114	7/3/2009	13.9	14.4	3/25/2014	15.0	1.31	2002 UX25	9/15/2020	17.8
6	3/20/2008	106.6	7/27/2009	12.9	19.4	1/13/2015	12.6	1.94	2002 UX25	7/15/2022	14.9
7	5/1/2009	149.8	5/24/2010	17.5	80.4	10/18/2015	12.1	1.85	2002 UX25	7/16/2023	14.1

Uranus Equinox Flyby Opportunity

- NH2 Can Reach the KB Via a Jupiter Gravity Assist in Any Year.
- However, for Launches in 2007-2009, a Bonus Opportunity to Explore Uranus at Equinox Exists.
- Neptune is not in Position to Be An Alternative.

NEW HORIZONS II: A URANUS-EQUINOX OPPORTUNITY

FURTHER LEVERAGE THE EXISTING NASA INVESTMENT IN NEW HORIZONS TO ALSO:

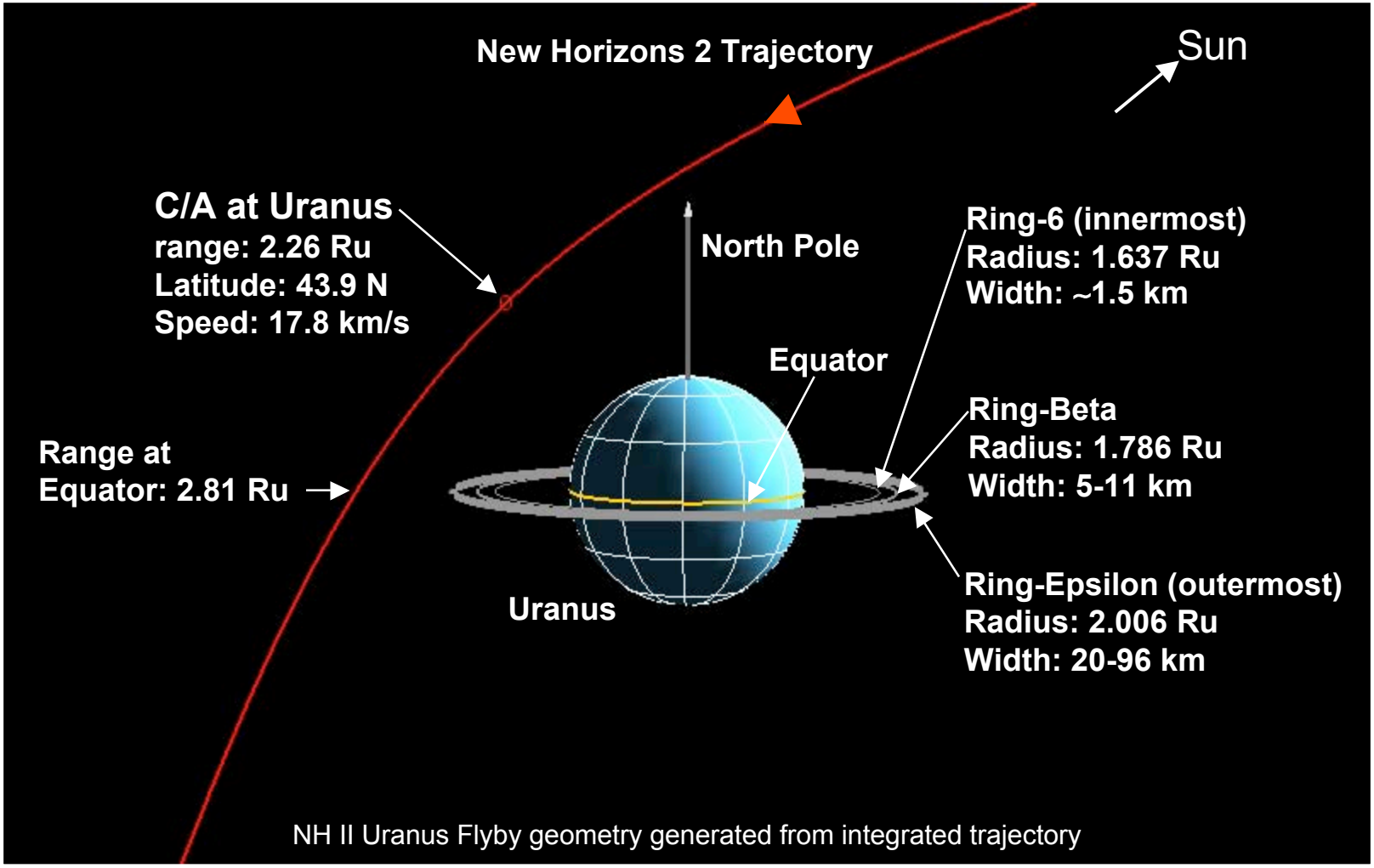
INCLUDE A PERISHABLE OPPORTUNITY TO EXPLORE URANUS NEAR EQUINOX

- ONLY OCCURS EVERY 42 YEARS (1960s, 2010s, 2050s).
- COMPLELY DIFFERENT LIGHTING, INSOLATION, & MAGNETOSPHERIC GEOMETRY THAN VOYAGER 2.
- WITH MAJOR INSTRUMENTATION CAPABILITIES

Exploring Uranus: Diverse, Time-Perishable Science

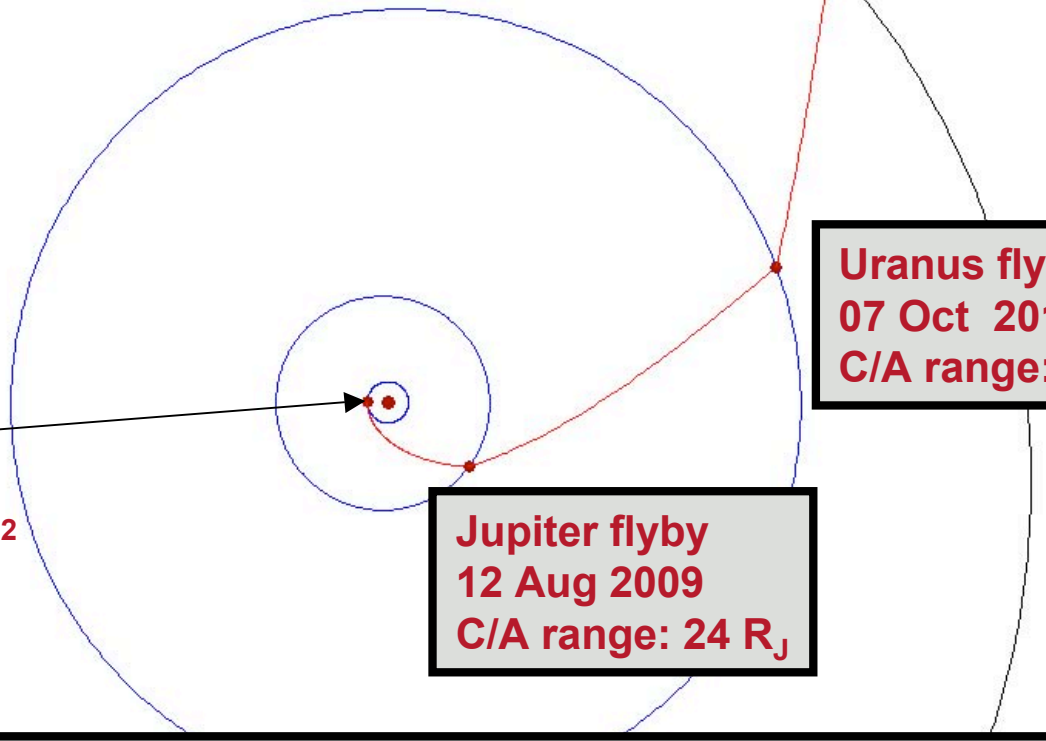
Example New Horizons 2 Uranus Flyby

Example Uranus Flyby Geometry



New Horizons 2 Example Mission Design

Target: KBO 1999 TC36
A Huge KBO Binary

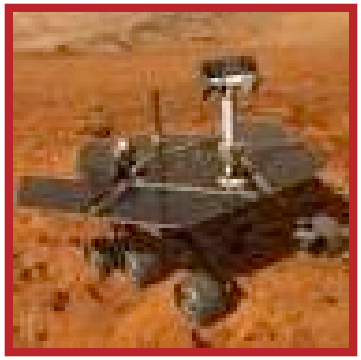


- 1999 TC36: 400 Diameter with 200 km Satellite
- Both 2008 and 2009 Launch Windows Exist

BY PROVIDING A BACKUP TO NH1, NH2 WILL BETTER INSURE SUCCESS FOR THE DECADAL SURVEY'S HIGHEST PRIORITY NEW FRONTIERS OBJECTIVE: KB SCIENCE

SPACECRAFT PAIRS ARE A WELL ESTABLISHED WAY TO IMPROVE BOTH THE LIKELIHOOD OF MISSION SUCCESS, AND OVERALL MISSION SCIENCE RETURN.

- ❑ PARTICULARLY FOR LONG, CHALLENGING MISSIONS.
- ❑ NOTABLE MISSION SAVES INCLUDE MARINERS 2, 4, 9 (when Mariners 1, 3, and 8, each failed)…
- ❑ STRIKING AND VALUABLE DUAL SUCCESSES OCCURRED FOR VIKINGS I & II, VOYAGERS I & II, AND MERs A & B.



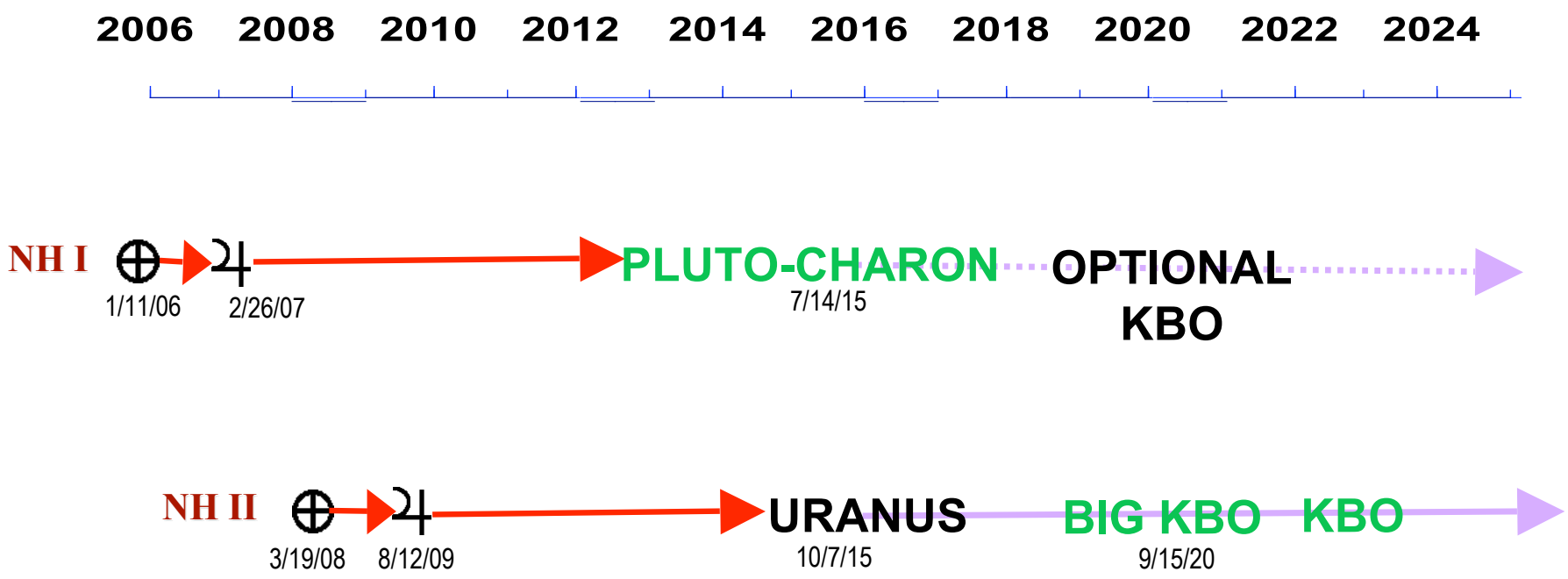
NH2 Cost Will Be Low

- In 2004, the New Horizons Mission Team Has Conducted a Feasibility Study for NH2.
- HQ Has Tasked GSFC to Run a More Extensive Study.

- Achieving a Large Savings for NH2 over NH1 Depends Critically on Building a Spacecraft Clone: Zero Changes

- Making These Assumptions, NH2 Looks to be Feasible for $450M-$500M (full mission cost; ~$375M to launch).

New Horizons 1 and 2: What a Combination!



WHY NEW HORIZONS 2?

LEVERAGE THE EXISTING NASA INVESTMENT IN NEW HORIZONS 1 TO FURTHER OPEN THE DEEP OUTER SOLAR SYSTEM FRONTIER

- ACHIEVE FIRST EXPLORATION OF A 500 KM CLASS KBO
- FLYBY ADDITIONAL SMALLER KBOs.
- OBTAIN ADDITIONAL JUPITER FLYBY SCIENCE

Toward a Better Future

- Other than NH, No New Outer Planets Mission Is Planned to Deliver Data Until After 2020.
- NH2 can Reach Uranus by 2014-2015, and the KB by 2019.
- NH2 is an immediate opportunity to add depth to outer planets exploration by appealing for a time-critical mission of opportunity.

NH2 Time Criticallity

An NH2 New Start is Time Critical Because:

- The Uranus at Equinox Flyby Launch Window Closes in Early 2009.
- Building an NH-1 Clone is Only Possible if It Directly Follows on NH1– Not Years Later.
- No Existing AO for New Frontiers is Available to Propose to.
- Discovery Does Not Allow RTG