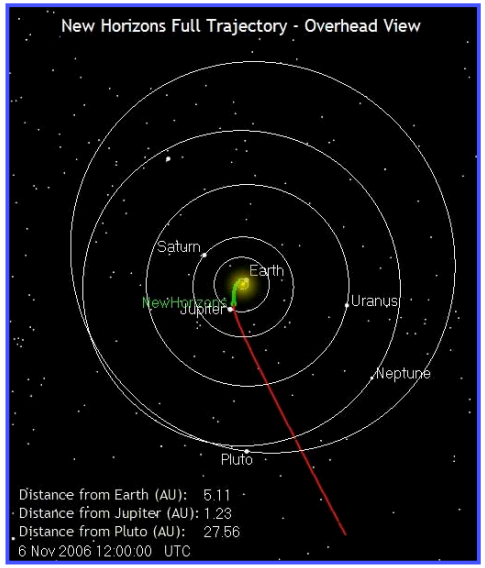
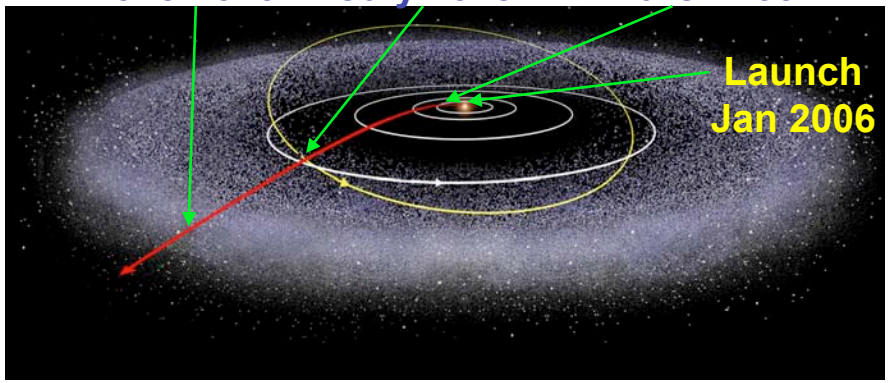
PI's OPAG Overview: New Horizons



ROUTE OF FLIGHT

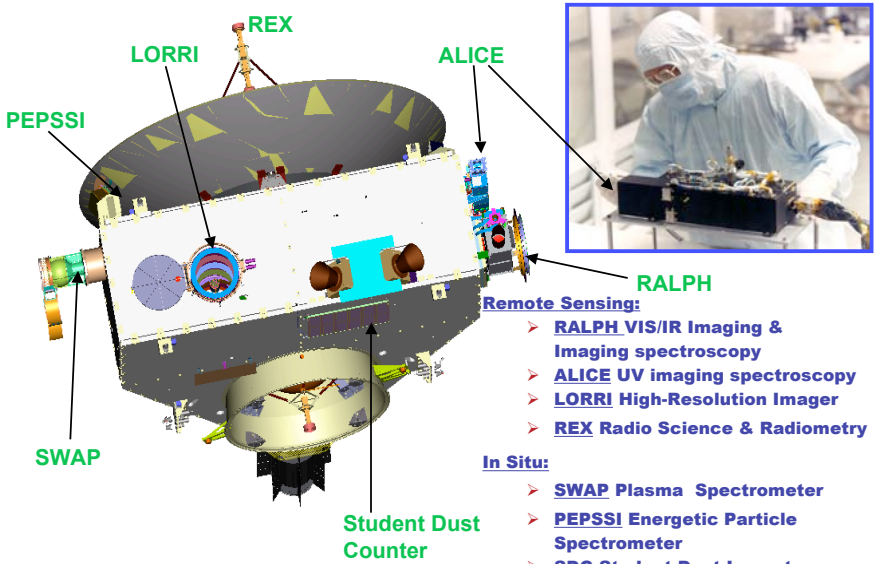
The First Reconnaissance Of The Solar System's "Third Zone"

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



SPACECRAFT AND SCIENCE TEAM

SPACECRAFT AND PAYLOAD



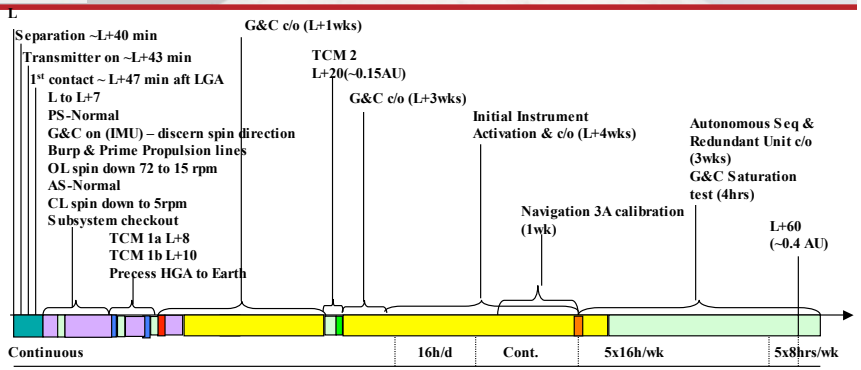
Remote Sensing:

- **RALPH** VIS/IR Imaging & Imaging spectroscopy
- **ALICE** UV imaging spectroscopy
- **LORRI** High-Resolution Imager
- **REX** Radio Science & Radiometry

In Situ:

- **SWAP** Plasma Spectrometer
- **PEPSSI** Energetic Particle Spectrometer

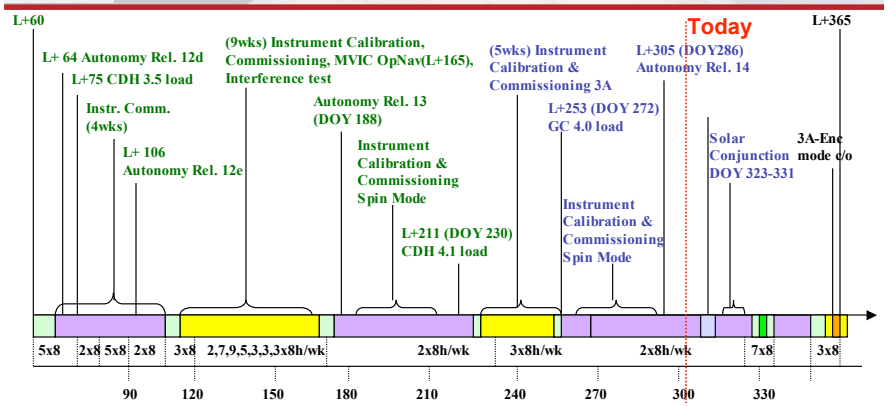
EARLY OPERATIONS



PS-Hibernation	AS-Normal	3A-Normal
PS-Normal	AS-TCM	3A-
PS-TCM	AS-EA	Encounter
	AS-SA	3A-TCM

Notes:
1. Timeline not to scale.
2. Activities allowed in Nav. block that do not change attitude of Observatory.
3. +Y to Sun <100°, OK. Need to evaluate thermal environment if +Y to Sun >100° at <2AU.
4. AU is Obs. distance from Earth

CRUISE 1 OPS



PS-Hibernation	AS-Normal	3A-Normal
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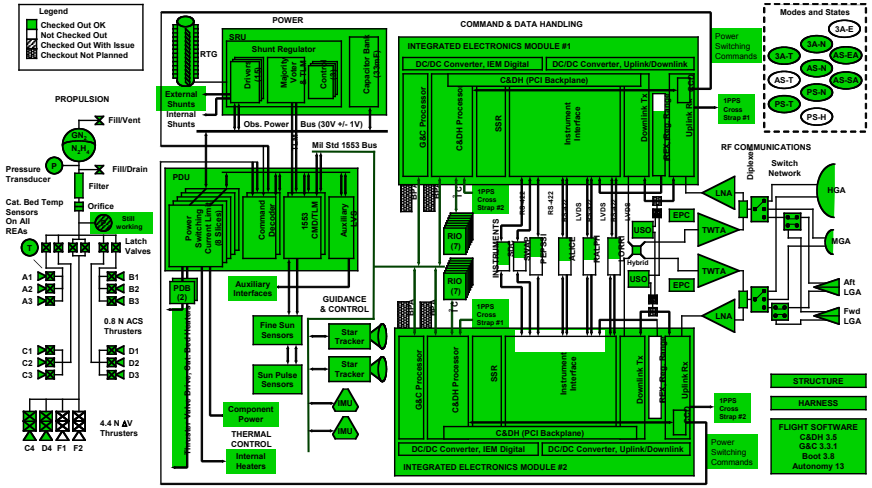
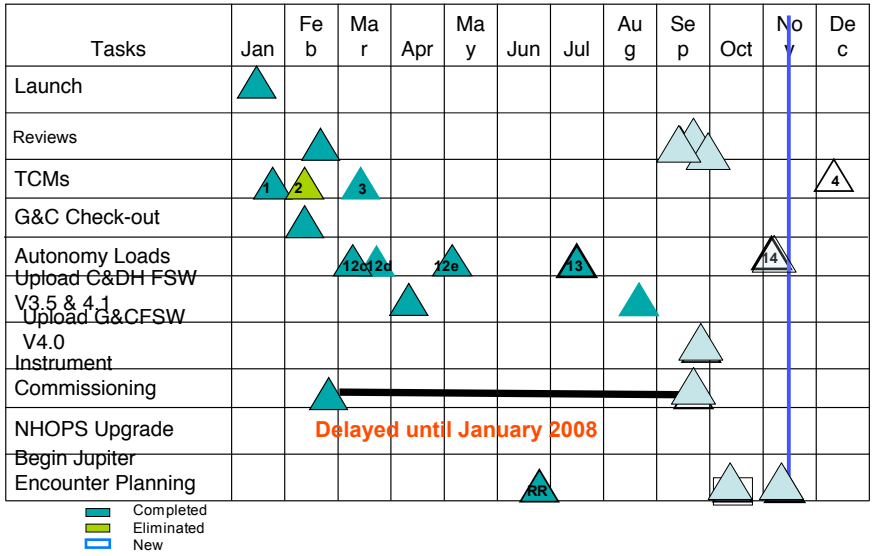
PS-TCM	AS-EA	Encounter
	AS-SA	3A-TCM

Notes:
1. Timeline not to scale.
2. AU is Obs. distance from Earth

SPACECRAFT CHECKOUT STATUS



EARLY OPS MILESTONES

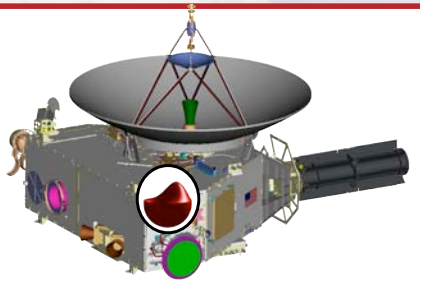


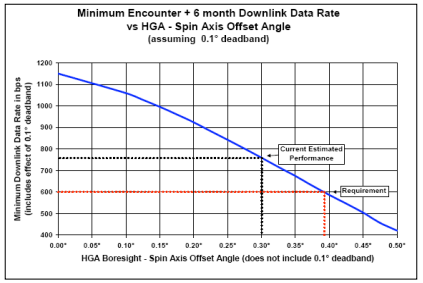
SUBSYSTEM STATUS TRACKER

	Jun	JUL	Aug	Sep	Oct	Nov
Mission Ops	G	G	G	Y	Y	Y
Systems Eng	G	G	G	G	G	G
Autonomy	G	G	G	G	G	G
RF	G	G	G	G	G	G
Thermal	G	G	G	G	G	G
Propulsion	G	G	G	G	G	G
C&DH	Y	G	G	G	G	G
G&C	Y	Y	G	G	G	G
Navigation	G	G	G	G	G	G
Mission Des	G	G	G	G	G	G
Ground Sys	G	G	G	G	G	G
Alice	G	G	G	G	G	G
Ralph	G	G	Y	Y	G	G
REX	G	G	G	G	G	G
LORRI	G	G	G	Y	G	G
SWAP	G	G	G	G	G	G
PEPSSI	G	G	G	G	G	G
SDC	G	G	G	G	G	G
PA	G	G	G	G	G	G

SPACECRAFT ISSUES

- **Post launch change in spin axis of 0.256 deg, likely due to fuel shape change: Some impact on downlink rates, spinning science.**
- **Two onboard thrusters have high valve counts: Taking action to mitigate their usage.**



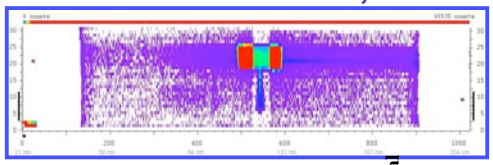


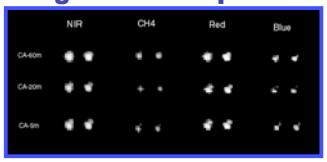
REMAINING CHECKOUTS

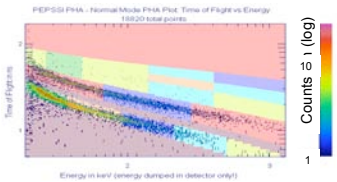
- **Instruments:**
  - **C&DH Side B interfaces**
  - **REX Side B**
  - **Alice Solar Occultation Channel**
  - **Payload EMI/EMC Tests**
- **RF: Regenerative Ranging.**
- **Propulsion: F1/F2 Thrusters, Two TCM Modes.**
- **Internal Shunts: Planned to be checked out late in**

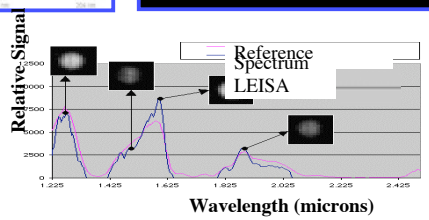
PAYLOAD STATUS 1

- **All instruments functional; commissioning >87% complete.**









- **Two minor anomalies exist, but both are non-critical.**
- **6 of 7 mechanisms now open; Alice-SOCC opening spring '07.**

PAYLOAD STATUS 2

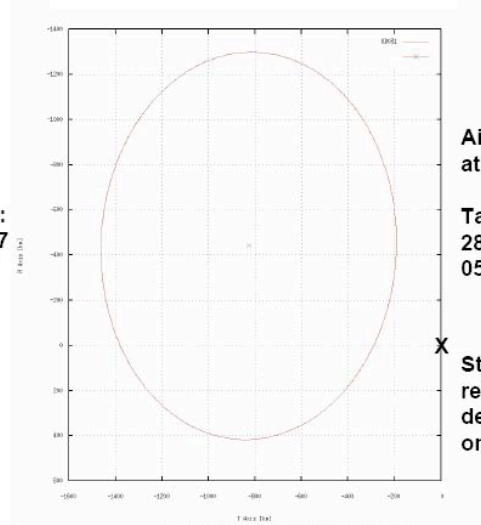
Instrument	Status	Issues
Ralph	Very Good	LEISA-Only Light Leak: Small, No Effect At Pluto
Alice	Excellent	None
REX	Excellent	None
LORRI	Excellent	None
PEPSSI	Excellent	Misalignment Error: No Effect At Pluto
SWAP	Excellent	
V-SDC	Excellent	Spacecraft Noises

NH OD031 B-plane 1-sigma Error Ellipse

OD031 Solution

Time of C/A:
28-FEB-2007
05:44:39 ET

1-sigma:
33 sec



Aim Point at Origin

Target Time:
28-FEB-2007
05:42:52 ET

Still using JME2000 ref frame for TCM design, NEED to move on to EME2000

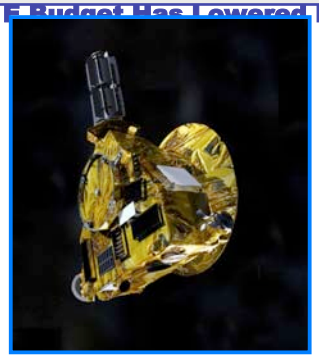
TCM-04 Estimate based on OD031 (Dec 19, 2006 19:00 UTC)

- TCM-04 delta-V Magnitude
  - 38 cm/sec +/- 24 cm/sec (1-sigma)
- TCM-04 delta-V Direction
  - RA 205 deg
  - Dec -21 deg
- Delta-V Earth Look-Angle
  - 142 deg (Away from S/C -> Earth line)
- Delta-V offset Angle from S/C Vel. Vector
  - 60 deg (Speeding Up)

19 Oct 2006: TCM-4 CANCELLED

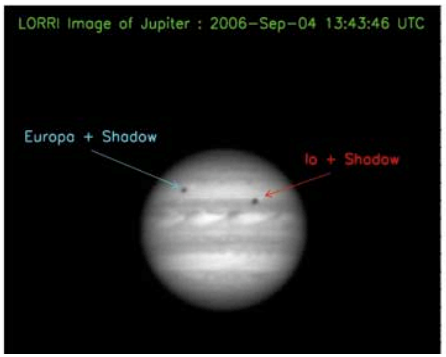
MISSION STATUS: "PINCH ME, I'M DREAMING"

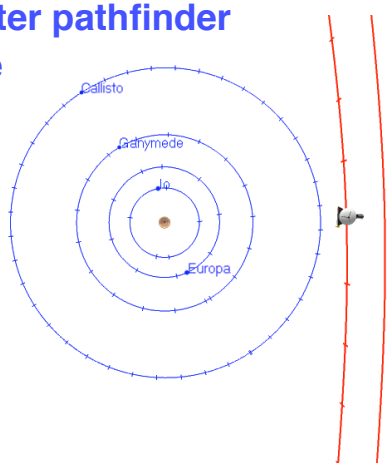
- ❑ **Spacecraft and Payload Are Performing Well.**
- ❑ **Fuel and Power Situation Also Look Good.**
- ❑ **Payload Commissioning ~4/5 Complete, Results: Good.**
- ❑ **Trajectory: Good, TCM's Not Expected on Jupiter Approach.**
- ❑ **High Ops Team Workload Continues.**
- ❑ **Increase in Phase E Budget Has Lowered Risk: Very Good**



JUPITER FLYBY OBJECTIVES

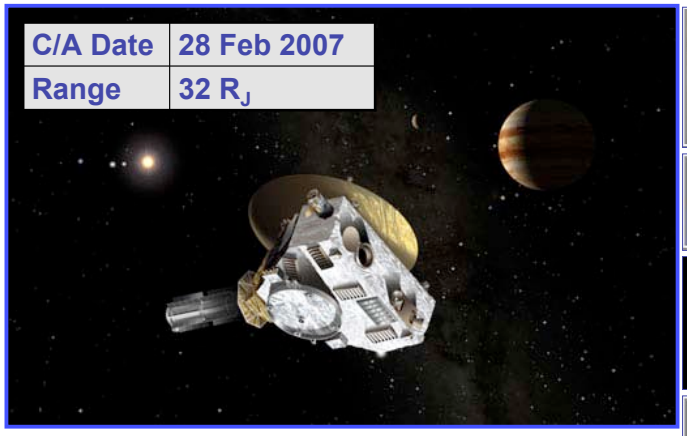
- ❑ Achieve the Pluto JGA
- ❑ Protect the spacecraft and instruments
- ❑ Serve as a flyby/encounter pathfinder
- ❑ Do good Jupiter science

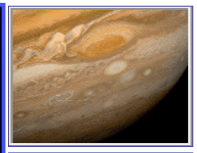


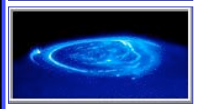


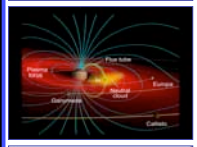
JUPITER FLYBY

C/A Date	28 Feb 2007
Range	32 R_J



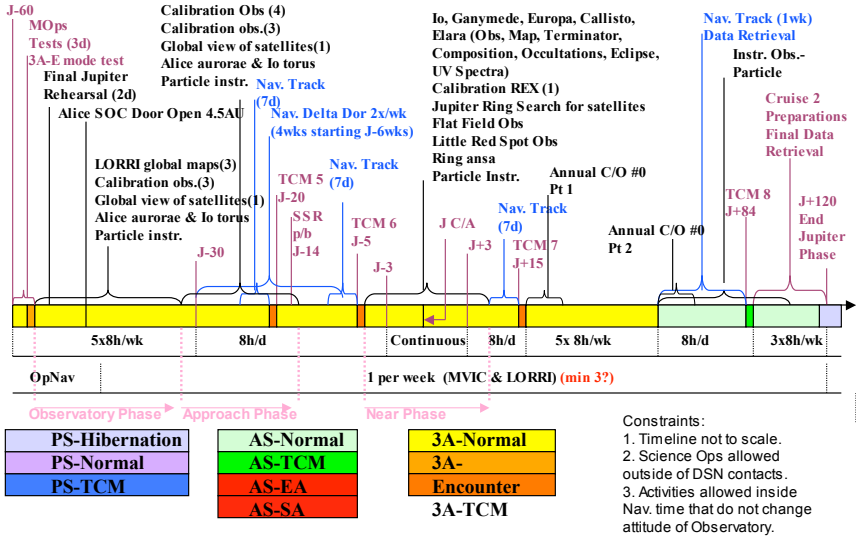






Jupiter science will include studies of Jovian meteorology, satellite geology and composition, Auroral phenomena, and magnetospheric physics.

BASELINE JUPITER OPS

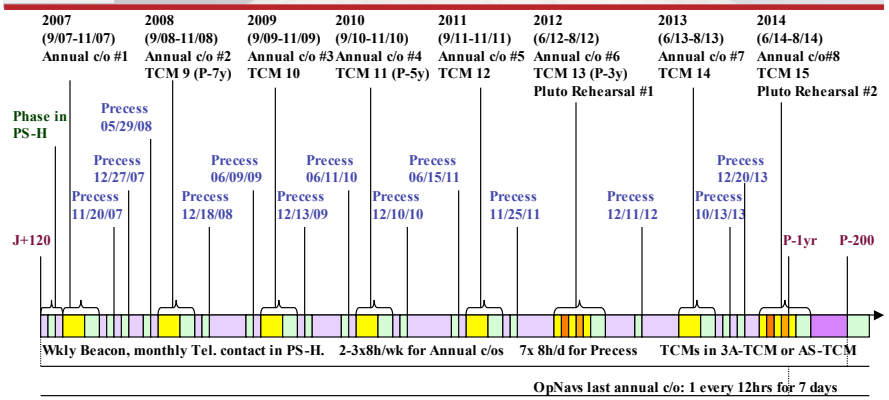


Constraints:
1. Timeline not to scale.
2. Science Ops allowed outside of DSN contacts.
3. Activities allowed inside Nav. time that do not change attitude of Observatory.

PRELIM JDAP PLANS

- ➢ 2-Year JDAP effort to be funded by NASA ROSES-07.
- ➢ All NH-Jupiter Level-2 data in PDS by Nov 2007.
- ➢ Space Sci. Revs. Article preprints to be posted early-2007 at: www.boulder.swri.edu/pkb
- ➢ Approx >$1M/year.
- ➢ Proposals Due: 1 Feb 2008 (Earlier?).
- ➢ Selection: Mid-2008.

CRUISE 2 OVERVIEW

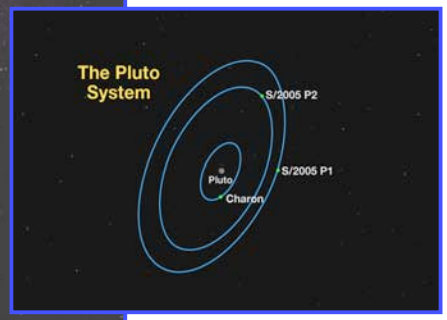


PS-Hibernation	AS-Normal	3A-Normal
PS-Normal	AS-TCM	3A-
PS-TCM	AS-EA	Encounter
	AS-SA	3A-TCM

Constraints:
1. Timeline not to scale.
2. Precesses outside of A/C to maintain 10bps MGA to 70m .
3. OpNavs per direction of NAV
4. Precess at end of each A/C
5. TCMs per direction of MD/NAV

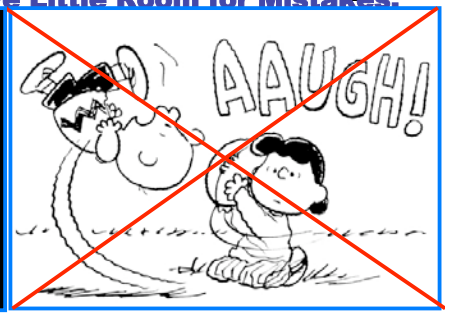
AND THEN IN 2015: WHAT WE CAME FOR

- ❑ Mar-May: Obs Phase
- ❑ Closest Approach: 14 July
- ❑ Downlink: Aug-Dec



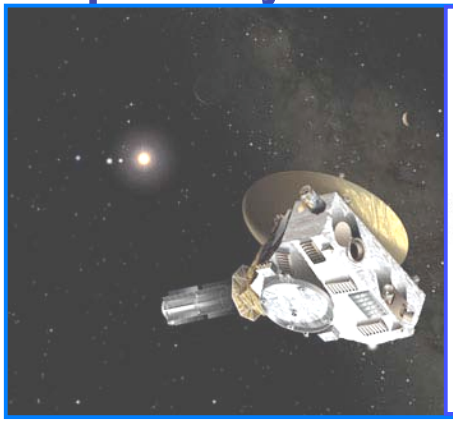
PI's TOP CONCERNS

- ❑ Ops Team Staffing is Thin, Ops Pace is High, Threats to Jupiter Science Have Resulted.
- ❑ Longevity & Personnel Retention Issues Continue.
- ❑ Funds Adequate, But Leave Little Room for Mistakes.



RECAP

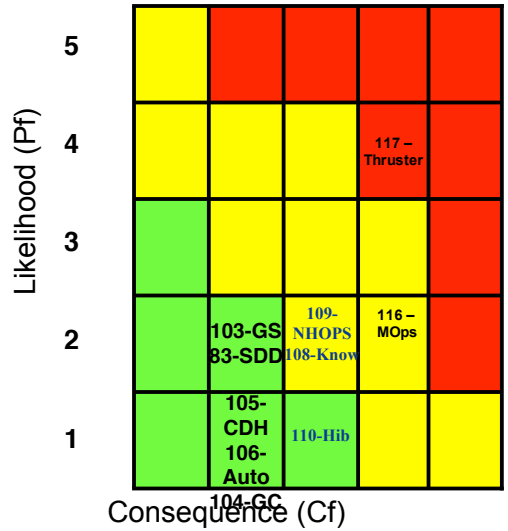
- ❑ New Horizons Is Doing Well.
- ❑ Hard Work and Vigilance Remain Required.
- ❑ Jupiter A'Hoy!



NEW HORIZONS
Shedding Light on Frontier Worlds
Lockheed Martin • Boeing • Aerojet • SSG • Galileo • Honeywell • Thales • Adcole • Swales • Orbital • Arctic Slope • Futron • KinetX

ONWARD!

Risk Matrix



117 Thruster Use (C4,L4)
116 MOps Process (C4,L2)
109 NHOPS failure (C3,L2)
108 Knowledge retention during hibernation (C3,L3)
109 110 Hibernation (C3,L1)
103 Unplanned Ground System upgrade (C2,L2) ($)
83 Software design documentation (C2,L2)
107 RF degradation (C2,L1)
105 Unplanned C&DH build (C2,L1) ($)
106 Unplanned Autonomy build (C2,L1) ($)
104 Unplanned G&C build (C2,L1) ($)