

### New Horizons Pluto Encounter Baseline Review

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- Effort engaged Navigation, Engineering, and Science teams.
- Operations was understandably very busy supporting ongoing operations however operations management was able to participate.
- Have rough schedule leading up to encounter testing. Needs further review and buy in from supporting teams.
- Began dissecting key building blocks of flyby architecture consistent with science and navigation requirements:
  - TCM placements and parameter updates
  - OpNav schedule and knowledge updates to S/C
  - Encounter mode entry
  - Data resource management
- Further defined OpNav schedule and associated resource conflicts, started to work concepts for mitigating conflicts.





 Identified ground options that will need to be tightly choreographed and tested to support actual operation. First cut at each included in operations portion today. Look forward to engaging rest of ops team in working the problems.

There is still much work to do as the PDR is not until next year !





- This review does not conclude the concept development phase of planning the Pluto encounter. Continued analysis and trades are needed to arrive at an optimal solution.
- We know many flybys of planetary objects have been successfully conducted to date. We have begun to learn about those operations and borrow from them.
- However, we are finding the Pluto flyby is a very unique flyby in terms of geometry and goals that will require its own unique approaches.
- Hopefully everyone feels their ideas are welcome and will be seriously evaluated in terms of applicability, complexity, potential gains, and risk.

### "Think outside the (Jupiter) box"





#### 11/5/2007

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IORIZ!





ORIZ





IORIZ



# **Trade Studies Part 2**



#### Examples of concept development requiring further analysis :

### Resources

Nav

- Improve our understanding of flight resource usage to better quantify areas of oversubscription. Develop plan for general allocation between Science, Navigation, and Operations/Engineering use, then apply successful Jupiter practices.
- Maximize downlink bandwidth available. Minimize downlink required.
- Minimizing the uncertainties associated with the a priori Pluto system
- ephemerides ("Pluto Project").
  - Define late update process to safely minimize the uncertainties (TOF and B-Plane remaining.
  - Further choreographing and rehearsing of ground processes involved in time critical operations (OpNav, TCMs, ephem, timing).

- Conops Contingency handling. Improving probability single faults will not ruin encounter. Improve flight and ground responses to most probable unplanned events.
  - Minimizing dependency on a single opportunity for knowledge uplink.
  - Prioritize work in order needed next to keep existing work on schedule.
  - Continue trades and concept development to PDR.



## **SSR** Management



### From Mark T's e-mail on 11/2:

"Record Raw data on Segments 1-14

Compress Segments 1 and 2 high-rate data onto Segment 15, and playback Playback Segments 1 and 2 low-rate data Erase Segments 1 and 2 Compress Segments 3 and 4 high-rate data onto Segment 16, and playback Playback Segments 3 and 4 low-rate data Erase Segments 3 and 4 ...

This is an improvement in volume that can be recorded over our current strategy, which is (slightly oversimplified):

Record Raw data on Segments 1-10

Compress selections onto segments 11-15 and playback"





- Analysis-to-date is demonstrating we might gain by increasing bandwidth on Pluto approach.
- New Horizons has used signal strength increases due to higher elevations as a way to relax the S/C pointing deadband and decrease thruster usage.
- MESSENGER is testing an approach that can effectively double average down link rates during a DSN pass by increasing TLM rates with elevation angle.
- Understanding is Cassini now uses this operationally.
- MESSENGER will utilize this capability to significantly increase science return at Mercury.
- Suggest we consider adopting similar practice to maximize downlink rates when necessary. Use GDS as backup station.



## **Generic DSN Station Elevation Profile**





Note: This elevation profile, which should hold relatively constant through encounter operation, demonstrates the relative importance of the CAN station in carrying out the encounter and subsequent data recovery.

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## **Concept Development**





### **Concept Development**



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#### Combined Strategy for TCM & Knowledge Updates







- Press ahead with trades and encounter concept development.
- Continue to incorporate lessons learned from past missions and new ideas into baseline architecture.
- As science plans mature, formulate an integrated flyby architecture.
- Plan to have an integrated low risk architectural solution that meets or exceeds mission requirements by PDR, now scheduled for June 08.





# Back up slides





11/5/2007

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