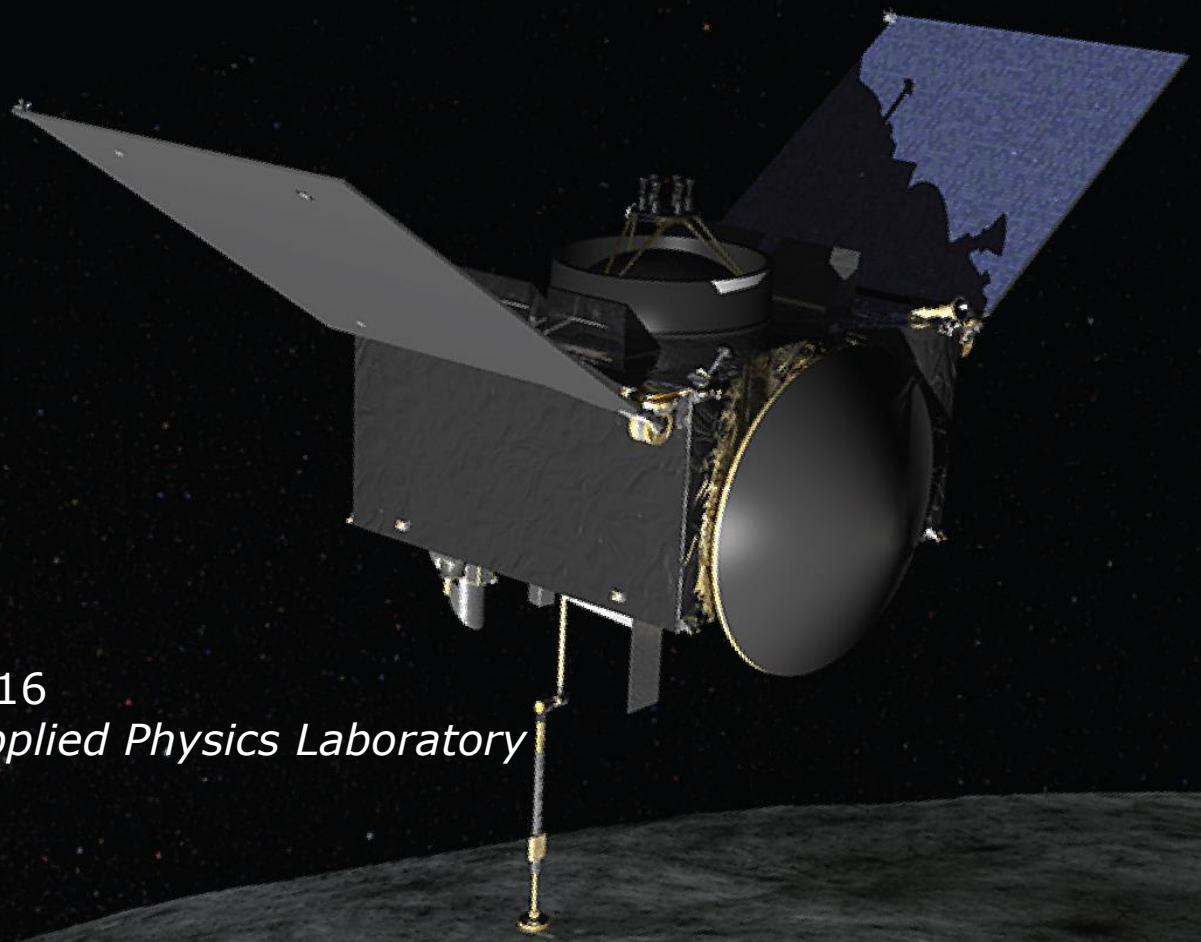
DTM Summit Meeting Agenda

Final

OSIRIS-REx™

ASTEROID SAMPLE RETURN MISSION



February 1-2, 2016

Johns Hopkins Applied Physics Laboratory

Laurel, MD

Meeting Location, WebEx/Call-in Information

- February 1-2

  Johns Hopkins Applied Physics Lab,
  Building 200
  11100 Johns Hopkins Road, Laurel, MD 20723-6099
  Room number W202
  Meeting begins at 8 AM each day
  Bring a drivers license or other form of government ID

- Webex/Callin

  https://osiris-rex.webex.com/osiris-rex/j.php?MTID=m9481023e7328248acbaf2f2908ad6d88
  Meeting number: 626 673 420
  Meeting password: wvD5G6Nt
  1-650-479-3208 Call-in toll number (US/Canada)
  Access code: 626 673 420

Meeting Overview and Background

Discuss the impact of recent developments on our ability to meet the DTM requirements to support safety maps, navigation, and TAG as described in MRD Rev K (currently in review). Developments driving the meeting and its agenda include:

- There are concerns about the ability to provide tilt information to the safety in time for site-selection key decision points.
- It has been determined that DRM Rev C will not provide the imaging data to allow SPC to meet all requirements. An extended imaging campaign will be required.
- OLA has passed its acceptance tests and is now on the spacecraft, and the way is clear to baseline OLA contributions to the production of the needed DTMs.
- With ORR six months away, we must assess the work to go and the V&V campaign required to demonstrate the ability to provide the needed DTMs.

Meeting Objective

- To develop a set of tasks, including tentative work assignments and a schedule, that will deliver a credible, but admittedly incomplete, V&V plan for ORR that *creates confidence* that we can create the DTM products that will support navigation in the proximity of Bennu and support TAG using NFT.
- To develop a set of tasks, including tentative work assignments and a schedule, that will deliver a complete V&V plan that *demonstrates* that we have a system that will create the DTM products needed for navigation in the proximity of Bennu and the support of TAG using NFT.

Recommended Approach

- Review FD and NFT Requirements
  - Make sure performance requirements are well understood
  - Make sure requirements are reasonable and defensible. Propose (small) changes that can simplify DTM production.
- Review SPC and OLA status
  - What have we shown already
  - What do we think we can do
  - Work to go
- Assess current capabilities *with* DRM Rev C observing plan
  - Identifies where work is needed (see next page)
  - Objective: A matrix that shows what Rev K requirements are met by DRM Rev C
- Plan by ORR to demonstrate requirements can be met piecewise (requirement by requirement) rather than using an end-to-end program
  - DRM Rev C may be inadequate and there is no time before ORR to prepare a Mission Plan that is fully validated
  - Use existing designs or small modifications that do not stress existing analysis or require new analysis
    - No new trajectories or maneuvers
    - Longer time in existing phases, circularization of orbits, or use of additional recon-style passes, etc. ok.
  - Prepare a revised matrix showing how requirements can be met with these modifications

75 cm DTM Verification Matrix — DRM Rev C

Requirement	SPC	SPC+OLA	OLA
For > 80% of the asteroid surface, produce a set of DTMs at < 0.75 m in ground sample distance (sample resolution).	X	X	X
For > 80% of the asteroid surface, produce a set of DTMs with post-fit residual RMS < 0.38 m (1-sigma) for each maplet		X	X
For > 80% of the asteroid surface, produce a set of DTMs with a 3D RMS accuracy < 1m (1-sigma).		X	X
Provide the global 75cm DTM product to FDS within 14 days of downlink of all Preliminary Survey OCAMS and OLA data.	X	X	

35 cm DTM Verification Matrix — DRM Rev C

Requirement	SPC	SPC+OLA	OLA
For > 80% of the asteroid surface, produce a set of DTMs at < 0.35 m in ground sample distance (sample resolution).	X		X
For > 80% of the asteroid surface, produce a set of DTMs with post-fit residual RMS < 0.18 m (1-sigma) for each maplet			
For > 80% of the asteroid surface, produce a set of DTMs with a 3D RMS accuracy < 0.75 m (1-sigma).			
Provide the global 35cm DTM product to FDS within 14 days of downlink of all Detailed Survey "Baseball Diamond" OCAMS and OLA data.			

NFT Verification Matrix — DRM Rev C

Requirement	SPC	SPC+OLA	OLA
For each of a set of pre-defined NFT features, produce a DTM with a 3D RMS accuracy < 0.75 m (1-sigma).			
For a 3-sigma TAG delivery error ellipse around each of up to 2 sampling sites, produce a DTM with vertical RMS error < 0.14 m (1-sigma).			
For a 3-sigma TAG delivery error ellipse around each of up to 2 sampling sites, produce a DTM with vertical RMS error < 0.14 m when compared to each of the NFT features (1-sigma).			
Up to 300 NFT Feature DTM products to MSA within 30 days of downlink of required Orbital B OCAMS and OLA data.			

Proposed Agenda Day 1

- Introduction (Mink/Beshore, ~1 hour) 8:00A – 9:00A
  - Review of path forward
  - Concept of piecewise demonstration for ORR vs end-to-end
  - Review of agenda, discussion of approach for meeting objective
  - Systems engineering discussion
- NFT review (Ryan Olds, 90 min) 9:00A – 10:30A
  - Current status
  - Concept of operations for NFT
  - NFT and DTM requirements review
- FD review (Moreau, 45 min) 10:30A – 11:15 A
  - Concept of operations for incorporating DTMs into landmark navigation
  - DTM requirements review
- Lunch 11:15A – 12:45P
- SPC Review (Palmer, 90 min) 12:45P – 2:15P
  - Current status
  - Concept of operations for SPC
  - Current difficulties in supporting MRD Rev K
    - Fill in the requirements matrix for DRM Rev C
    - Proposed observations to support MRD Rev K with SPC alone

Proposed Agenda Day 1

- OLA Review (Barnouin, 90 min) (2:15P – 3:45P)
  - Current status
  - DRM Rev C concept of operations for OLA
  - How OLA can support MRD Rev K
    - Proposed observations to support MRD Rev K with SPC alone
    - Fill in the requirements matrix for DRM Rev C as support for SPC and for OLA independently
- Wall Test as Risk Reduction (Hughes) (1 hour) (3:45P – 4:45P)
  - Discussion of role of wall test
  - Wall test preparations and execution
- Review Work Plan for Tuesday (4:45P - 5:15P)

Proposed Agenda Day 2

- Development of Plan of Work (All) (All day)
  - Review of the capabilities matrix for DRM C
    - Where are we good, where are we close, where are we broken?
    - What is the most promising approach for fixing those items where we are close? Where we are broken?
  - Clear statement of approach to V&V
    - Piecemeal vs end-to-end
    - What is ready by ORR, Launch, Post-Launch?
  - Identify technical/observation approach, concerns
    - Identify where SPC is prime, where OLA is prime, how OLA ranges might speed SPC development time or fidelity
      - Discuss capabilities and known shortcomings of SPC and OLA
      - Discuss needed investigations to verify capabilities
    - Discuss proposed changes to the DRM
      - Use existing, or minimally adjusted, trajectories as building blocks
      - Shift order and priority of observations
  - Proposed capabilities matrix consistent that proposed observations plan
  - Discuss V&V Test Plan
    - Organize tasks as before- and post-ORR
    - Task breakdown, schedule
    - Resource concerns, technical risk discussion