Science Weekly Debrief

For slides and the WebEx recording on ODOCS, click here then follow the path: Folders -> Documents and Drawings -> OSIRIS-REx Bennu Proximity Operations -> Science Status -> Science Weekly -> 2019-02-28.

Site Selection Board report-out – Mike Nolan

The Site Selection Board met earlier this week to review the current versions of the top maps (Safety, Sampleability, Deliverability, Science Value). Configuration management emerged as the main issue affecting these products. The imminent delivery of SBMT with shape model v20 and rotation state v14 should help with this going forward.

The Safety and Sampleability groups identified about 20 candidate TAG sites in addition to those previously circulated by the PI. The SSB will take up to ~50 candidate TAG sites into consideration. Anyone can propose a TAG site. Proposals should be delivered to Mike Nolan by 14 March.

Kevin Walsh showed two versions of the combined Safety and Sampleability (a.k.a. “treasure”) map, reflecting different scalings of the safety. A site that scores well in the maps and looks promising in images is the area where material is flowing onto the south side of the large dark outcrop. Kevin will post a comprehensive set of treasure maps on the Science Team Wiki, including FITS files to enable use in SBMT.

A clarification on the “bullseye” TAG approach: We cannot be sure of a 98% chance of hitting a TAG site, but we can use natural feature tracking to determine shortly before TAG whether or not the spacecraft is in the TAG site. If it is not, we can abort TAG, using a non-emergency burn capability that is already built in. In the event of an aborted TAG attempt, it would probably take about a month before we could re-attempt, although this time interval is still under analysis.

The next SSB meeting will be at the end of May, when Detailed Survey products will be coming online.

Working Group updates

- AWG: particle and satellite monitoring – Carl Hergenrother

In addition to the three major particle events observed so far, numerous small events have also been detected, generally between 3 and 10 particles. Our observations are only sensitive to small events between 11 January and 18 February. Two small events were detected on 8 February: one on the sunlit side, and one unexpectedly on the night side.

The number of detected satellite tracklets peaked on 17 January, then decreased, and is now slowly increasing again. 115 satellite tracks (with 3+ positions) have been identified. The AWG is reviewing Preliminary Survey data for evidence of satellites.

Mike Nolan reported that an approach to coordinating particle and satellite–related data is under development, potentially including a database and weekly reports. Steve Chesley will be the technical lead on data exchange and management. Mike Moreau's group is working on ideas for interfacing the source data with the value-added data. We will also need to address the financial and contractual considerations associated with this endeavor.

- <u>SAWG: instrument and pipeline status</u> – Vicky Hamilton

The final OVIRS cal/val updates ahead of Equatorial Stations have been deployed. The best OVIRS data, to be used for MRD science, will come from the 10am Equatorial Station.

No OVIRS pipeline updates are anticipated for resampled calibrated radiance, I/F, bond albedo, or spectral indices (a manuscript on the lattermost by Hannah Kaplan et al. is in preparation). Photometric modeling updates will come after the latest OVIRS calibration. The existing thermal tail removal (TTR) code does not fully remove thermal emission from Preliminary Survey data. An updated TTR algorithm from Josh Emery, soon to be captured in a CR, involves fitting the thermal tail directly with a single temperature and scaling as needed. With caveats for spectral slope, this approach is expected to be sufficient for basic analysis. For science that depends on TTR, users should evaluate the data carefully and may wish to implement their own TTR.

The final OTES cal/val updates ahead of Equatorial Stations have been pushed to SPOC for testing and final verification (anticipated this week). The best OTES data, to be used for MRD science, will come from the 12:30pm Equatorial Station. An initial multitemperature E-T separation is in testing; it may need further updates, but likely not for Detailed Survey. No updates are anticipated for the dust cover index or derived mineralogy.

Both instruments are performing well, and the data are well calibrated, but users should be careful to understand how different observing conditions affect the data.

- <u>IPWG: recent OCAMS images</u> – Dani DellaGiustina

OCAMS images collected between 22 and 25 February are intended as context data. MapCam achieved close to global coverage at 0.1 m/pixel. The brightest areas in the MapCam images are saturated, as expected for the aggressive exposure time used, which has the advantage of revealing detail in shadowed areas. PolyCam achieved better resolution but had patchier coverage. Overlaying the PolyCam footprints on the treasure maps will help with assessments of regions of interest for TAG. RDWG is working on generating ortho-images.

A volcano-like feature has been identified on the asteroid surface, and circular pit-like features have been noted elsewhere as well. Particles have been observed resting atop boulders; Kevin Walsh is determining particle size frequency distributions for boulder surfaces.

- <u>RDWG: search for interesting features</u> – Kevin Walsh

Anyone is welcome to search the recent OCAMS images for interesting features and report them to RDWG for tracking and investigation. Kevin shared features identified thus far by Tim

McCoy, including, among others: a boulder showing apparent planar exfoliation, a barrel-like boulder with a curvilinear feature, small craters nested in a large crater, a cauliflower-like texture evident on numerous boulders, and a boulder with regolith trapped on it and a ring of regolith surrounding it, suggesting exhumation. The PI noted that both angular and rounded boulders are evident.

- RSWG: justification for Orbital B radio science experiment – Jay McMahon

Gravity field data will help us understand the interior structure of Bennu and inform hypotheses about its formation and evolution, as well as supporting FDS operations. The planned RS experiment for Orbital B involves closely tracking the spacecraft over a long arc, making it possible to separate out the different forces acting on the spacecraft and thus constrain the contribution from the asteroid's gravity field.

A question under consideration is whether to drop this experiment in favor of particle monitoring, from which we may be able to get the same gravity information—if we gather enough data on enough (at least 15) particles. Whether particle observations can compete with the RS experiment also depends on the uncertainty in the particle modeling. Although there are scenarios under which particle monitoring would perform comparably to or outcompete the RS experiment, relying on particle monitoring for the gravity field information comes with the risk of not obtaining it.

Data product status – Jon Cutts

MRDs 132 (Bennu volume) and 544 (integrated thermal inertia) are now formally satisfied. A number of MRDs related to the coordinate system, poles, and rotation state are pending kernel delivery. We discussed the question of whether MRD-678 should be considered satisfied by both parts a and b, versus either part a or b. Part b is a validation step. The discussion will continue further offline.

Bashar Rizk will present an analysis of natural satellite contingency planning at the next SOPG meeting. The analysis is focused on whether we can capture and characterize a satellite with OCAMS.

See Jon's slides for the Approach–Orbital A and Detailed Survey Gantt charts, the 1-month look-ahead, and a summary of completions to date.

Upcoming meetings

The next Science Weekly meeting is Thursday 7 March.