

Science Objective Summary and Science Monthly Debrief

DOY 292: The spacecraft will perform a high-pass reconnaissance flyby of the candidate sample site Kingfisher (CQ13). PolyCam elliptical raster scans will acquire local-scale data on topography, albedo, and sampleability to support NFT and TAG. MapCam point-and-stare observations will provide data for color maps of the site. OVIRS and OTES (riding along) will collect data for local mineral, dust cover index, and thermal inertia maps.

Each day of the week (DOY 287–294): NavCam 1 will collect images every 2 hours for particle monitoring.

Science Monthly 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 \ 2019-10-17.

Working group & instrument team updates (Recon A)

- OVIRS – Amy Simon

Sandpiper data (including context/bonus observations) are blessed through L3c. These observations were acquired at a longer exposure time than used for Detailed Survey and in the SP=2 mode. The instrument was at about 107 K. A search for pyroxene identified rocks in Sandpiper and the adjacent context area with weak detections that may be more consistent with olivine. The 3.1-micron band may be present in a few locations in Sandpiper and in the Roc/Slab area; this features shows variation from spectrum to spectrum but some consistency in adjacent spots. The 3.4-micron band is variable across all observations.

- OTES – Vicky Hamilton

Sandpiper data are blessed through L3c, and Osprey data will be submitted for blessing today. Instrument temperatures ranged from 225 to 315 K, cooler than in Detailed Survey, resulting in a slightly poorer signal-to-noise ratio. Spectral differences are evident between the Roc and the Slab (with the transit leg between them resembling the latter) and between Sandpiper and large adjacent rocks. These differences might be related to particle size, but further assessment is needed. Temperatures in the Osprey area span from about 250 K (north) to 300 K (south), with associated spectral differences—but note the emission angle was fairly high.

For both OVIRS and OTES, the PI requested an early look at the bonus observations of Nightingale obtained during the Osprey flyover.

- IPWG – Dathon Golish, Carina Bennett, Peter Smith, Dani DellaGiustina

See the WebEx recording for a preview of Osprey images and color data, as well as the bonus looks at Nightingale and Gargoyle (DL10 and BB21 also appear). Registration is more

challenging for Osprey than for Sandpiper. An object resembling the pyroxene-bearing boulders is apparent in the color data; a similar signature is observed for a bright object south of the site resting on (or included in) a larger boulder. The dark area in the center of the Osprey site is redder than the rest of the site and the global average. The fact that it is both dark and redder than average suggests that it is a (mostly submerged?) boulder, as this combination of properties is mainly observed in boulders.

The Nightingale data are more oblique than is desirable for rock-counting; IPWG recommends waiting for the dedicated observations. Rock counts for Sandpiper reveal only one unresolved area, about 50 cm long.

Principal components analysis (PCA) of the Baseball Diamond Flyby 2(+refly) MapCam data decorrelates the color information from other factors such as albedo and slope more rigorously than using color ratios. PCA results confirm that Bennu is blueish overall, with several spectrally flat (redder than average) areas, consistent with previous analyses. The pyroxene-bearing boulders stand out sharply. The analysis provides more detailed information about craters than previously available and supports the interpretation of Boulder Town as a crater rim. PCA at the local scale would be a nice-to-have for textural analysis but is not part of the nominal plan.

- TAWG – Andy Ryan

Analysis of Recon A thermal data and context images is underway. Some variations in thermal inertia (TI) are apparent, but for a more definitive assessment, the degeneracy between TI and roughness needs to be broken using observations from multiple times of day.

- AltWG – Olivier Barnouin

A 2-cm SPC-based DTM, currently under AltWG evaluation, shows promise for providing information at a finer scale than the OLA data. At the Science Weekly next week, AltWG will present a roughness assessment of specific, isolated areas of interest for comparison with rock counts.

Science productivity & deliverables updates

- Publications status – Cat Wolner

See the slides on ODOCS for papers recently added to the publication plan, submitted to journals, and accepted for publication. EPSC-DPS posters and talks are [now available](#) on the Science Team Wiki, as well as on ODOCS under 04.0 Science and Technology \ Science Team Meetings...

- In-prep manuscript: Geology of Bennu's equatorial ridge – Kevin Walsh

This FY21 manuscript is developing gradually through ongoing discussion and analysis and will be a topic at the Asteroid Science workshop in November. Bennu's equatorial ridge is an old feature, where "old" means predating the large superposed craters. Most of Bennu's large craters

(>50 m) occur in the equatorial region, and this area exhibits a decrease in surface slopes and a lack of large boulders. The reason for the lack of boulders is uncertain; although evidence of mass movement toward the equator has been observed, it is not on a scale that could bury the biggest boulders, and it is further unclear how such boulders could be buried without erasing the craters. The observations might indicate that Bennu was born with or quickly developed a ridge wherein boulders were rapidly buried but cratering persisted, although the specifics how such a scenario would arise are not obvious.

The absolute age of the ridge and Bennu's surface overall is under debate, with different interpretations depending on the relative influence of the strength regime, the gravity regime, and the armoring effect on crater scaling. Crater depth/diameter ratios, microraters, surface fractures, and the differences in ridge shape between Bennu and Ryugu could be informative on this question.

- In-prep manuscript: Depth/diameter ratios – Terik Daly

Small craters exhibit scatter in their depth/diameter (d/D) ratios, whereas at larger crater sizes, the range of d/D ratios narrows. The large craters tend to be flat. Previous experiments suggest that impacts onto a curved surface with interior stiffness or strength could produce jagged or flat surfaces, rather than depressions. Efforts are in progress to improve the assessment of craters that occur on slopes (most craters on Bennu) and to understand what craters with mounds in the center (such as at Osprey) indicate about the interior structure. This paper will be timed in coordination with Beau Bierhaus's FY20 crater paper and will be discussed at the Asteroid Science workshop in November.

Upcoming meetings

The next meeting will be a Science Weekly on Thursday 24 October.