TAGCAMS In-Flight Dataset Summary

July 29, 2019

1. Launch +14 Day Checkout Dataset

- 7 NavCam 1 images – only 3 images of great utility (1.6, 2 and 20 s)
- 7 NavCam 2 images – only 3 images of great utility (1.6, 2 and 20 s)
- 5 StowCam images

2. March 2, 2017 StowCam Outgass Monitoring Dataset

- Redo of Launch +14 Day Checkout StowCam images to look for SRC outgassing activity.
- 5 StowCam images, no NavCam images

3. Launch +6 Month Calibration Part 1 Dataset

- Detailed plan and as-run information provided in: "NavCamOnOrbitCal_TargetsTemps_20170504.xlsx" and "TAGCAMS imaging order actual.xlsx".
- DOY100: NavCam 2, 8-bit mode, Gain 1 and 1.25 images of Fomalhaut to characterize PSF across FOV and check linearity of response.
- DOY101: NavCam 1 and 2, 12-bit mode, Gain 1.25 images of Megrez (RA 12h15.424m; Dec 57°1.96) at ***cold*** temperature to characterize pointing and optical distortion.
- DOY103: NavCam 1 and 2, 12-bit mode, Gain 1 and 1.25 images of Fomalhaut to characterize PSF across FOV and check linearity of response.
- DOY106: NavCam 1 and 2, 12-bit mode, Gain 1.25 images of star field (RA 38.99559°; Dec -8.44186°) at ***hot*** temperature to characterize pointing and optical distortion.
    - NavCam 1 images are saturated by direct sunlight into the baffle and are unusable for original purpose.
    - Sunlight angle of incidence on the deck is 45°
- DOY107: NavCam 1 and 2, 12-bit and 8-bit mode, Gain 1 and 1.25 images of dark sky patch (RA 12h40.455m; Dec 19°33.529') at ***hot*** temperature (achieved with heaters alone) to characterize hot pixels and dark current.
- Includes 5 StowCam images from DOY 102

4. Launch +6 Month Calibration Part 2 Dataset

- Detailed plan provided in the section NAVCAMS OPTICAL DISTORTION AND BORESIGHT – WARM of: "NavCamOnOrbitCal_TargetsTemps_20170504.xlsx".
- DOY163: NavCam 1 and 2, 12-bit mode, Gain 1.25 images of star field (RA 159.88141° Dec 40.07990°) at ***warm*** temperature to characterize pointing and optical distortion.
- Sunlight angle of incidence on the deck is 55°

- Includes 11 StowCam images with spacecraft deck in direct sunlight.

5. Launch +10 Month Checkout Dataset

- 25 images total
- Rerun of Launch +14 Day Checkout NavCam 1 and 2 images but with more advantageous camera pointing.
- DOY215/216: NavCam 1 and 2, 12-bit and 8-bit mode, Gain 1.25 images of star field (RA 205.82748°; Dec: 30.01255°) at ***chilly*** temperature to characterize pointing and optical distortion – no mosaic, 3 useful images in each camera (1.6, 2 and 20 s).
- 11 StowCam images identical to DOY163 Launch +6 Month Calibration Part 2 images.

6. EGA +1, +3 and +6 Days Calibration Dataset

- 108 images total over 3 days
- Detailed plan provided in the OpNav checklist: "OpNav_Checklist_170922_170928_v4.xlsx" – except for 11 StowCam images which were deleted from the checklist and then added ad hoc by MSA.
- EGA +1 Day
    - 25 0 s, 12-bit NavCam 1 images with Earth disk imaged at 25 different positions to check for dead/under-responsive pixels.
    - Three 12-bit NavCam 1 and three 12-bit NavCam 2 images with Earth disk in center of frame to assess in-flight scattered light during OpNav.
    - Three 8-bit NavCam 1 and three 8-bit NavCam 2 images with Earth disk in center of frame to assess extended source linearity in 8-bit mode.
    - Two sets of NavCam 1 Lunar limb imaging (2, 0 and 2 s exposures)
        - One set with Moon in FOV center
        - One set with Moon in FOV corner
- EGA +3 Days
    - Three sets of 12-bit NavCam 1 Lunar limb imaging (2, 0 and 2 s exposures)
        - One set with Moon in FOV center
        - Once set with Moon in upper FOV corner
        - Once set with Moon in lower FOV corner
    - Six sets of NavCam 2 Lunar limb imaging (2, 0 and 2 s exposures)
        - Two sets with Moon in FOV center, 8-bit and 12-bit mode
        - Two sets with Moon in upper FOV corner, 8-bit and 12-bit mode
        - Two sets with Moon in lower FOV corner, 8-bit and 12-bit mode
    - 11 StowCam images identical to Launch +10 Month Checkout
- EGA +6 Days
    - Three sets of 12-bit NavCam 1 Lunar limb imaging (2, 0 and 2 s exposures)
        - One set with Moon in FOV center
        - Once set with Moon in upper FOV corner

        - Once set with Moon in lower FOV corner
    - Six sets of NavCam 2 Lunar limb imaging (2, 0 and 2 s exposures)
        - Two sets with Moon in FOV center, 8-bit and 12-bit mode
        - Two sets with Moon in upper FOV corner, 8-bit and 12-bit mode
        - Two sets with Moon in lower FOV corner, 8-bit and 12-bit mode

7. January 17, 2018 OCAMS Stray Light Part II Ride-Along Dataset

- 80 NavCam 1 images with 0.4 s exposures
- 40 different camera pointing positions (identical camera pointing for every two exposures)
- 18 images of the Earth-Moon system
- 6 images of Jupiter and Mars

8. Launch +18 Month Calibration Dataset

- 447 images in all
- StowCam images of SRC with approximate stow-like illumination (+Y-side of spacecraft)
    - DOY 67 – March 8, 2018
    - 11 images with various exposures and image modes (identical to previously acquired 11 image sets)
- StowCam Checkout
    - DOY 71 – March 12, 2018
    - 11 images with various exposures and image modes (identical to previously acquired 11 image sets)
- NavCams Cold Optical Distortion and Boresight Calibration
    - DOY 74 – March 15, 2018
    - Total of 78 images, all 10 s exposures
    - Mosaic of Megrez: 3x3 grid with a smaller 2x2 grid overlaid
- NavCams Dark Image Crosscheck
    - DOY 78 – March 19, 2018
    - Total of 50 images, 0 s and 2 s exposures
    - Three pointing positions with a small dither (3°) down and a small dither (3°) to the right.
- NavCams PSF Characterization, Linearity and QE Check
    - DOY 79 – March 20, 2018
    - Total of 117 images, 0.1, 0.3, 0.5, 1 and 5 s exposures
    - Mosaic of a bright star (Pollux): 3x3 grid with a larger 2x2 grid overlaid
- NavCams Warm Optical Distortion and Boresight Calibration
    - DOY 80 – March 21, 2018
    - Total of 78 images, 4 s exposures for NavCam 1, 10 s exposures for NavCam 2
    - MSA-only planned, 2° rolls about the solar illumination vector (67° angle of incidence on spacecraft deck).

- NavCams Hot Optical Distortion and Boresight Calibration with Transient Temperature Monitoring
    - DOY 80 and 81 – March 21-22, 2018
    - Total of 102 images, 1.6 s exposures for NavCam 1, 10 s exposures for NavCam 2
    - MSA-only planned, 2° rolls about the solar illumination vector (45° angle of incidence on spacecraft deck).

9. Launch +22 Month Checkout Dataset

- 25 images total acquired on July 22, 2018.
- NavCam 1 and NavCam 2 images of star fields, only 3 images of great utility in NavCam 1 and NavCam 2 (1.6, 2 and 20 s).
- 11 StowCam images identical to DOY163 Launch +6 Month Calibration Part 2 images and Launch +10 Month Checkout.

10. Asteroid Approach Phase August 17, 2018 to December 2, 2018

- 292 images total
    - 286 NavCam 1 images
    - 6 NavCam 2 images
    - 0 StowCam images
- 4 images acquired per day October 30-31, 2018
- 8 images acquired per day November 1-13, 2018
- 28 images acquired on November 14, 2018 due to retransmit of 8 images corrupted by a radiation-induced upset.
- November 14, 2018 images included 6 NavCam 1 images and 6 NavCam 2 images of the TAGSAM deployment.
- 8 images acquired per day November 15-30, 2018.
- 16 images acquired per day December 1-2, 2018.

11. Preliminary Survey Phase December 3-31, 2018

- 948 images total
    - 948 NavCam 1 images
    - 0 NavCam 2 images
    - 0 StowCam images
- 28 images acquired on December 3, 2018.
- 42 images acquired on December 4, 2018.
- 36 images acquired on December 5, 2018.
- 32 images acquired per day December 6-7, 2018.
- 42 images acquired on December 8, 2018.
- 36 images acquired on December 9, 2018.
- 32 images acquired per day December 10-11, 2018.

- 38 images acquired on December 12, 2018.
- 36 images acquired on December 13, 2018.
- 29 images acquired on December 14, 2018.
- 32 images acquired on December 15, 2018.
- 42 images acquired on December 16, 2018.
- 28 images acquired on December 17, 2018.
- 31 images acquired on December 18, 2018.
- 32 images acquired per day December 19-20, 2018.
- 28 images acquired on December 21, 2018.
- 32 images acquired per day December 22-25, 2018.
- 28 images acquired on December 26, 2018.
- 36 images acquired on December 27, 2018.
- 28 images acquired per day December 28-29, 2018.
- 32 images acquired on December 30, 2018.
- 28 images acquired on December 31, 2018.

12. Orbit A Phase January 1 – February 17, 2019

- 4,674 images total
    - 4,663 NavCam 1 images
    - 0 NavCam 2 images
    - 11 StowCam images
- 36 images acquired on January 1, 2019.
- 32 images acquired on January 2, 2019.
- 36 images acquired per day January 3-5, 2019.
- 36 images acquired on January 6, 2019 containing first detected particle ejection event by Bennu.
- 36 images acquired per day January 7-9, 2019.
- 28 images acquired on January 10, 2019.
- 94 images acquired on January 11, 2019, commencement of Bennu particle search images.
- 132 images acquired per day on January 12-16, 2019.
- 106 images acquired on January 17, 2019.
- 94 images acquired on January 18, 2019.
- 132 images acquired on January 19, 2019 containing second detected particle ejection event by Bennu.
- 132 images acquired per day on January 20-23, 2019.
- 106 images acquired on January 24, 2019.
- 94 images acquired on January 25, 2019.
- 132 images acquired on January 26-27, 2019.
- 129 images acquired on January 28, 2019.
- 116 images acquired per day on January 29-30, 2019.

- 93 images acquired on January 31, 2019.
- 83 images acquired on February 1, 2019.
- 116 images acquired per day on February 2-4, 2019.
- 114 images acquired on February 5, 2019.
- 116 images acquired on February 6, 2019.
- 104 images acquired on February 7, 2019, 11 StowCam images of the spacecraft deck were included in this and were acquired as the sole activity for the Launch +30 Month Checkout activity.
- 83 images acquired on February 8, 2019.
- 116 images acquired per day on February 9-10, 2019.
- 116 images acquired on February 11, 2019 containing third detected particle ejection event by Bennu.
- 116 images acquired on February 12, 2019.
- 114 images acquired on February 13, 2019.
- 93 images acquired on February 14, 2019.
- 86 images acquired on February 15, 2019.
- 75 images acquired on February 16, 2019.
- 114 images acquired on February 17, 2019.