Touch and Go Camera Suite Stow Camera JPEG Image Description
Version 1.0
March 27, 2023

The TAGCAMS instrument suite consists of three similar camera heads: NavCam 1, NavCam 2 and StowCam, each suited for a particular purpose. NavCam 1 is the primary Navigation Camera (NavCam) and is a wide-angle framing camera used for optical navigation. NavCam 2 is the primary Natural Feature Tracking Camera (NFTCam) used for landmark identification and autonomous feature tracking to aid in sample acquisition. Finally, the Stowage Camera (StowCam) is used to document the insertion of the sample collection head into the Sample Return Capsule (SRC). The OSIRIS-REx Science Processing and Operation Center located at the University of Arizona produces these data products and distributes them to the OSIRIS-REx Flight Dynamics Team, the Lockheed Martin Mission Support Area, the Science Team, and the Planetary Data System. This document will describe the StowCam images used for SRC monitoring purposes.

The following paragraphs are a short description of StowCam from Bos et al., 2018, the full text of which can be found in the TAGCAMS document collection (`urn:nasa:pds:orex.tagcams:document:tagcamsinstdesc`):

> StowCam is identical to the NavCams with two exceptions. StowCam includes a Bayer filter array on the camera's detector so that approximate true-color images can be acquired. The lens-to-detector distance is also different, to optimize the focus for imaging the SRC located on the spacecraft deck. The primary purpose of the StowCam is to provide imagery that confirms the proper seating of the asteroid sample head under the three latches located in the SRC. Two of the three latches are within the StowCam's field of view, while the third is obstructed by the sample head itself. The orientation of the sample head in StowCam imagery will allow engineers to infer proper engagement of the obstructed latch. This imaging task required the StowCam to have a field of view of least 40° × 30° and to resolve objects separated by 1 mrad with a contrast of at least 10% over a depth of field from 0.7 m to 1.3 m.
>
> Images can be acquired in uncompressed form in either 12-bit or 8-bit mode and stored in flash for subsequent playback. Images can be played back in their original form or, optionally, processed in a variety of ways: 12-bit images can be packed to reduce their data volume from two bytes/pixel to 1.5 bytes/pixel; 8-bit images can be compressed using a simple, lossless Huffman-encoded predictive algorithm, summed 2 × 2 in software to reduce their data volume, or compressed using JPEG at a selected quality factor in either color or grayscale mode. In 8-bit mode, the compression can be applied at acquisition time to save flash memory space; if this is done, further processing is not possible.

Figure 1.The diagram is Figure 5 from Bos et al., 2018 showing the OSIRIS-REx spacecraft instrument deck. Note the position of the StowCam in relation to the Sample Return Capsule (SRC).

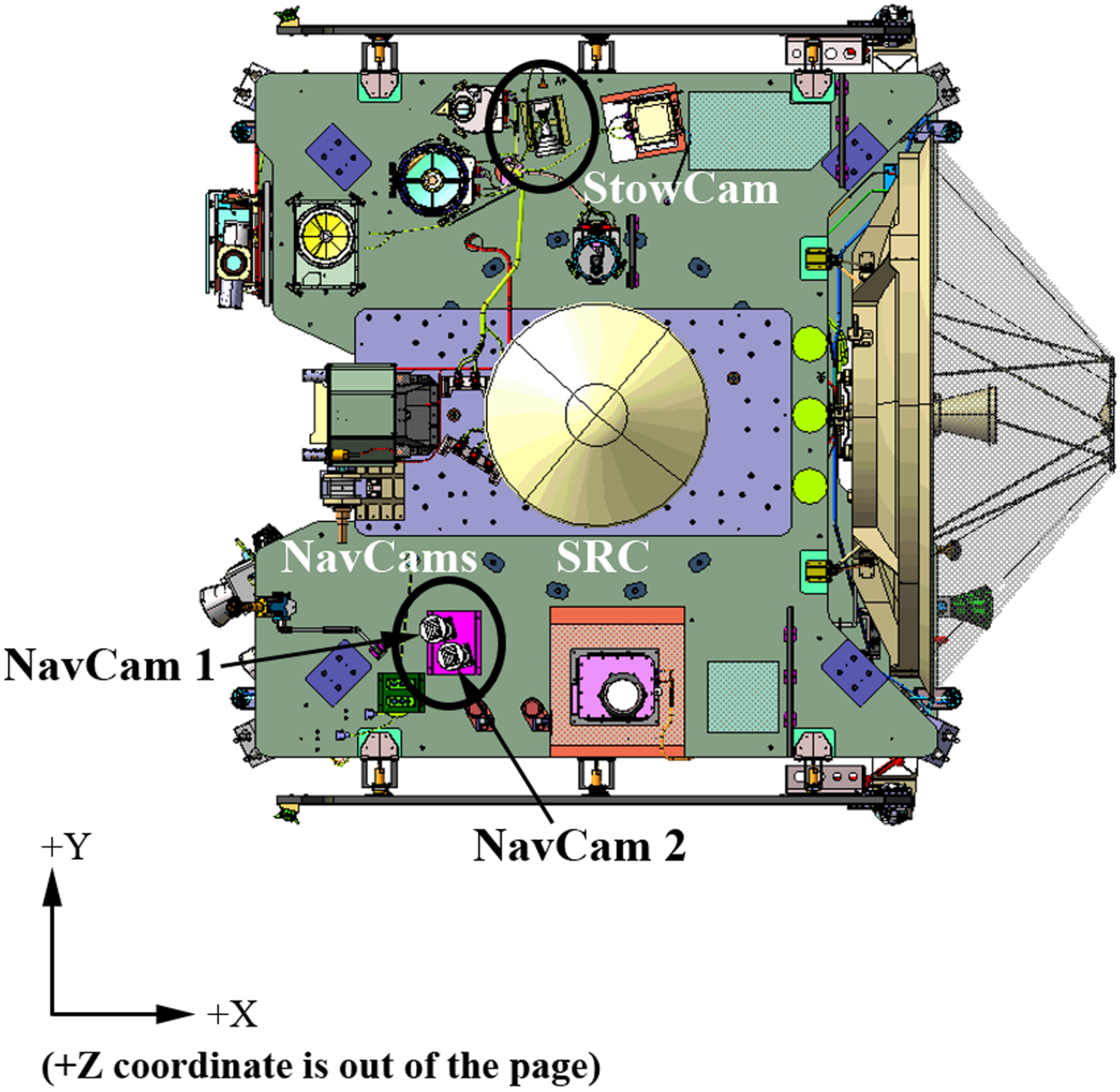
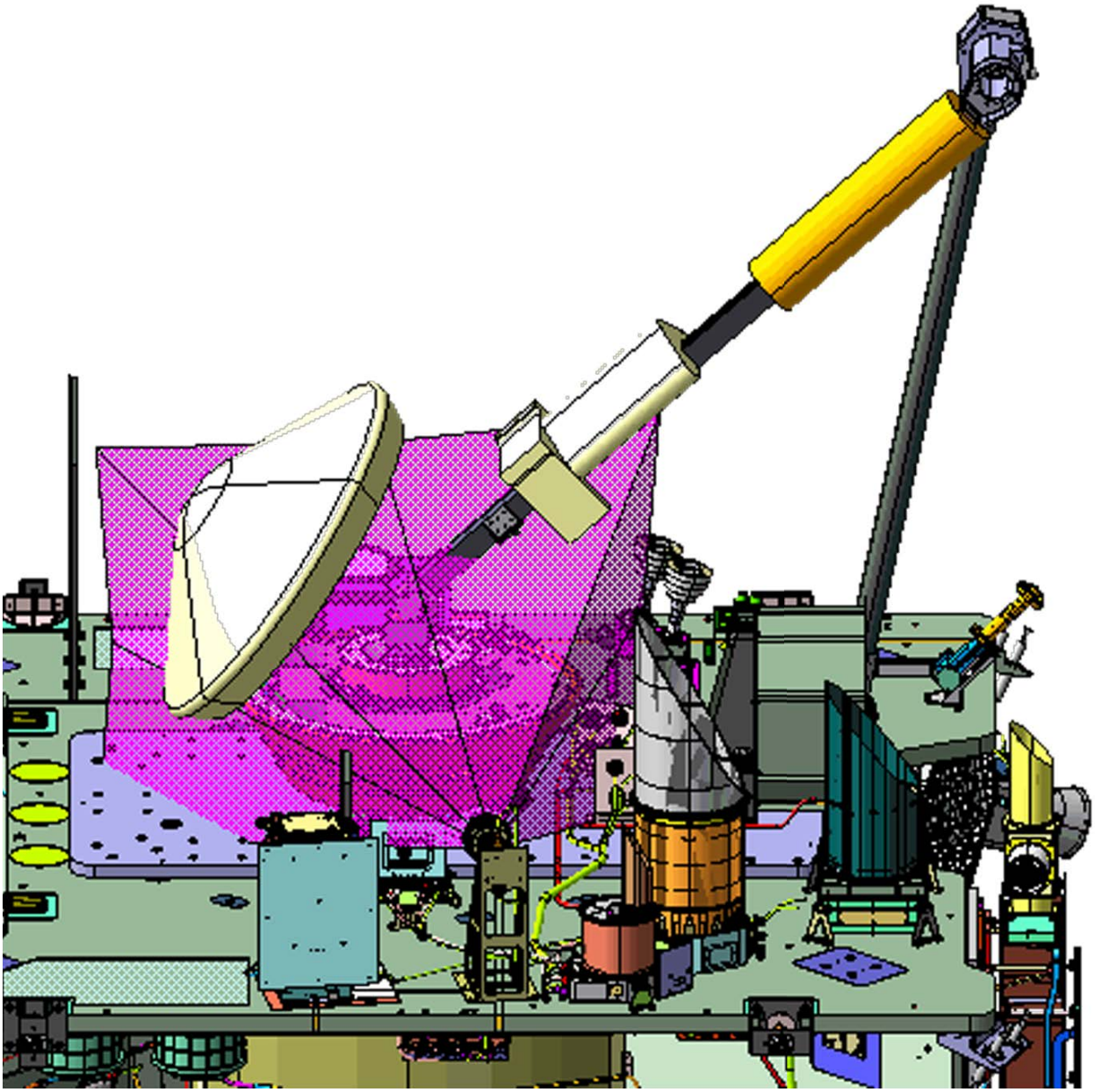


Figure 2. The diagram is Figure 20 from Bos et al., 2018, showing the StowCam field of view in pink. The Sample Return Capsule is shown in the open position to receive the sample head. The Sample Return Capsule is in the closed position for all monitoring images.



The SRC employed by OSIRIS-REx is based on that of Stardust. The SRC is a blunt-nosed cone, 81 centimeters in diameter, 50 centimeters tall, and composed of five principal components: the heatshield, back shell, sample canister, parachute system, and avionics. The total mass of the capsule is 46 kg.

The OSIRIS-REx Spacecraft team commanded StowCam to acquire images of the SRC and spacecraft deck on a regular cadence throughout the mission. The purpose of these images was

to visually monitor the SRC over the mission lifetime. The commanding mode used for SRC monitoring image acquisition was 8-bit mode compressed to color JPEG. These images were transmitted to the ground in JPEG format, and subsequently ingested into the OSIRIS-REx Science Processing and Operations Center (SPOC). The native JPEG StowCam images are archived with the TAGCAMS bundle in the miscellaneous collection. TAGCAMS JPEG images are labeled as Product_Ancillary. The reason these images are classed as “Ancillary” is that they are not used for primary science, and they are in the JPEG format, which is not an allowable data type for PDS4 observational products.

Each SRC monitoring image is similar to the two images presented below, which are the first SRC monitoring image (9/22/2016) and the most recent image as of PDS Peer Review (8/23/2022). The SRC is approximately 50cm tall (from bottom of brown back shell to top of white heatshield nose cone) and 81cm in diameter. The SRC “clam shell” closes along the white heat shield and brown back shell interface.

Figure 3. Annotated StowCam image 20160922t173627s862_sto_l0.jpg

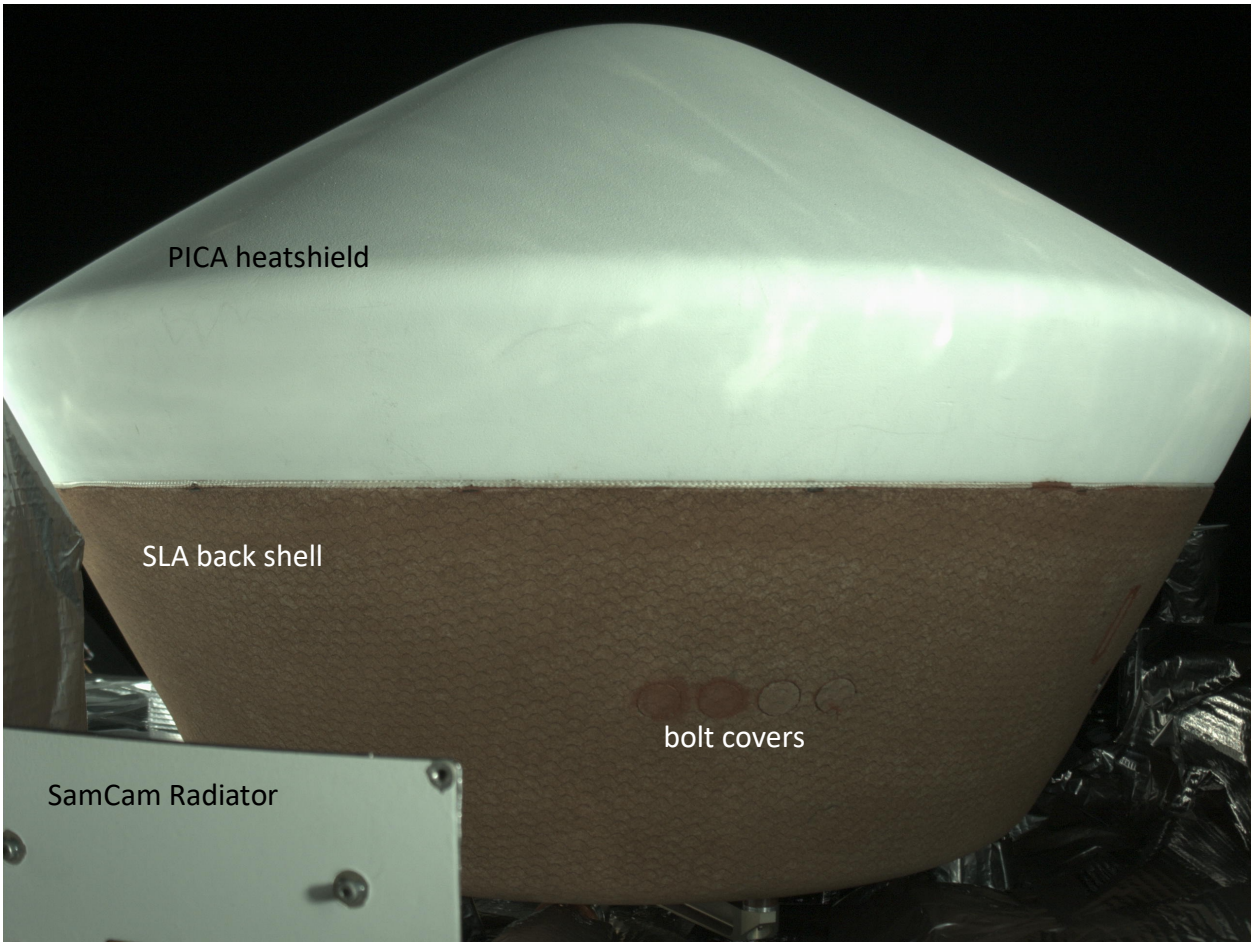
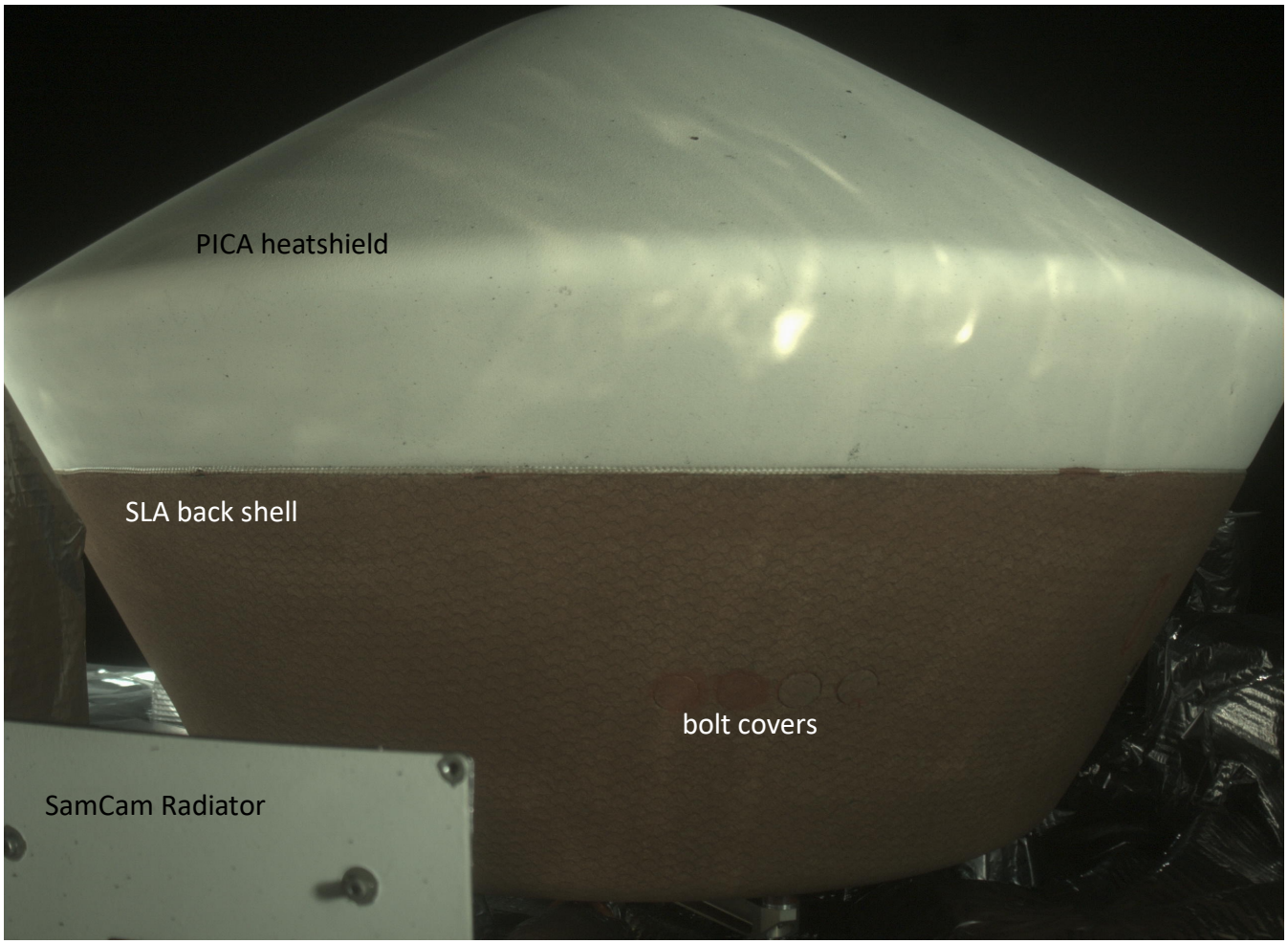


Figure 4. Annotated StowCam Image 20220823t010217s545_sto_l0.jpg. Note small black spot on the upper center of the heat shield. The mark is ~2mm in size and thought to be caused by a micrometeorite strike.



Note that the SRC monitoring JPEG images are not the same type of images as the sample stowage images, which are found in the TAGCAMS data_raw collection. The StowCam observational images are acquired in 12-bit mode and are formatted on the ground as FITS images. The SRC sample head stowage sequence images were acquired between 10/25/2020 and 10/28/2020.

All StowCam image files are named in accordance with the TAGCAMS SIS, which can be found in the TAGCAMS document collection (`urn:nasa:pds:orex.tagcams:document:tagcamssis`).