CAMBOT L0 Raw Imagery, Version 1: Technical Documentation

1 FORMAT

The data files are in JPEG (.jpg) image format.

Ancillary files are provided in Comma Separated Value format (.csv) and contain associated aircraft position and attitude data compiled for all images captured on a given day.

2 FILE NAMING CONVENTION

Example file names:

IOCAM0_2019_GR_NASA_20190910-153458.4217.jpg
IOCAM0_2019_GR_NASA_20190910_ancillary_data.csv

Files are named according to the following convention:

IOCAM0_YYYY_LO_NASA_yyyymmdd-HHMMSS.DDDD.xxx

Table 1. File Name Variables and Descriptions

Variable	Description
IOCAM0	Data set ID
YYYY_LO_NASA	NASA campaign identifier: YYYY: 4-digit campaign year LO: location; AN = Antarctica, GR = Greenland/Arctic Example: 2019_GR_NASA
yyyymmdd	Year, month, and day of image capture
HHMMSS	Hour, minute, and second of image capture in UTC time
_ancillary_data	Ancillary file related to a given day's images
DDDD	Fraction of a second of image capture
.xxx	File type: .jpg (JPEG image file) .csv (comma-separated value data file)

3 SPATIAL RESOLUTION

As level 0 images have yet to be georeferenced or orthorectified, the spatial size of each pixel is not provided, however the resolution of each image is still dependent upon aircraft altitude, attitude, and terrain.

4 COORDINATE REFERENCE SYSTEM

Latitude/longitude in WGS84, elevation in meters above WGS84 ellipsoid; EPSG:4326

5 SENSORS AND DATA COLLECTION METHOD

CAMBOT is a digital image acquisition system that supports analysis of laser altimeter data collected by the Airborne Topographic Mapper (ATM). The CAMBOT images provide a qualitative assessment of the surface structure and lower atmosphere conditions sensed by the ATM. CAMBOT is a passive instrument that uses sunlight as the source of illumination. As such, CAMBOT has some limitations including: shadows, daytime-only operation, and reduced data value under high-cloud or low mist conditions. However, the images provide a high-resolution record of ice structures, nunataks, snow, crevasses, sastrugi, leads, and sea ice type.

The CAMBOT raw images are collected by an Allied Vision Prosilica GT4905C camera. The Prosilica GT4905C, a 16 MP machine vision camera designed for extreme environments, operates over ethernet via the GigE command interface. The camera is fitted with a Zeiss Distagon 28 mm f/2 ZF.2 lens to yield an image width below the aircraft that is marginally wider than the ATM wide-scan lidar swath. The camera is rigidly mounted in each science aircraft platform above a down-looking optical window (either glass or acrylic) to provide nadir imagery of the surface below. Finally, the camera is connected to three components: a power supply, an acquisition/control computer, and an intervalometer. The CAMBOT data acquisition and control computer is a SuperLogics Microbox PC that provides an ethernet connection to the camera for transferring data and managing the camera settings. Custom software is used to set up the camera, transfer images, display QA thumbnails, and organize collected images into 1-minute duration tar files.

The intervalometer used to trigger the CAMBOT image collection is a Javad Delta/Sigma GPS receiver set to output two pulses per second (PPS). The 2 PPS signal is delivered on every half second, which provides accurate timing of each image acquired.

6 PROCESSING STEPS

The ancillary data file is generated using an Applanix-smoothed best estimate of trajectory (SBET) and a range-to-surface measurement provided by the ATM lidar. The Applanix SBET is a post-

processed Precise Point Positioning (PPP) solution created from the GPS/IMU data collected by an Applanix POS AV 610 sensor, which provides the position (latitude, longitude, altitude) of the aircraft GPS antenna and attitude (pitch, roll, heading) of the ATM system/camera within the aircraft. The ATM lidar instruments measure the time-of-flight of laser pulses that are transmitted from the instrument to the ground surface below and back. Once calibrated and averaged, an estimated range, is provided for each image. Lever-arm offsets in x, y and z are provided in the header of each ancillary file, describing the offset between the aircraft GPS antenna and CAMBOT camera system.

7 RELATED DATA SETS

IceBridge CAMBOT L1B Geolocated Images, Version 1

IceBridge CAMBOT L1B Geolocated Images, Version 2

8 REFERENCES

Harpold, R., Yungel, J., Linkswiler, M., & Studinger, M. (2016). Intra-scan intersection method for the determination of pointing biases of an airborne altimeter. International Journal of Remote Sensing, 37(3), 648-668. https://doi.org/10.1080/01431161.2015.1137989