

Boulder Counting Algorithm Description

Overview

The Boulder Counting Algorithm creates the Size Frequency Distribution (SFD) database which will describe the size frequency distribution of regolith grains on the surface of Bennu. The SFD database will be used to choose a site suitable for TAG and to characterize candidate sites for science value. It will also serve as a long-term science product.

Algorithm Description

Timeline

The SFD database will be populated and revised throughout the mission. Data will come primarily from the following mission phases:

Mission Phase	Data	Function
Preliminary Survey	MapCam global 1 meter resolution images	Identify hazardous objects (larger than 1 meter)
Detailed Survey	PolyCam near-global map at 21 cm resolution	Selection of up to 12 candidate sample sites
Orbital B	Polycam detailed mapping of up to 12 candidate sample sites at 5 cm resolution	Downselection to 2 candidate sample sites
Reconnaissance	Polycam detailed imaging of 2 candidate sample sites at 2 cm resolution	Selection of primary, secondary,...etc sample site(s).
On-going	All accumulated data	Create an SFD map of Bennu with as much detail as possible

Software

For sample site selection, boulders will be counted manually using software. Three programs are currently being evaluated for this purpose.

- Small Body Mapping Tool
- JMars (JAsteroid)
- ArcGIS

The boulder counting process is similar for each program and is described below.

Boulder Counting

Boulders are marked manually using pre-existing tools within each program. An image of a boulder field within Copernicus crater on the Moon illustrates this process in JMars below. The lines are created by clicking and dragging across the desired dimension of each object. The line objects created are called polylines and may be exported as a separate layer for each image.



Information about each polyline is stored by the program and can be exported as a comma separated value (csv) file. Since the images are georegistered, the program will calculate the absolute lengths of each line as well as the lat/lon of each. Additionally, each program is capable of running scripts on the polyline layer data (either internally or externally) to calculate any values of interest for each set of polylines. In this way, the SFD may be calculated for each image and for the entirety of each image set.

Long-Term Science/Automation

Obtaining the highest possible resolution SFD maps for Bennu will likely be time-consuming and labor intensive. High resolution boulder counts for the entire surface of Bennu could be expedited through the use of automated boulder counting software and/or crowdsourcing.

Input Parameters

Georegistered MapCam and PolyCam images with header data

Output Parameters

Size Frequency Distribution Database