ALG-AP-004b: Validation of moving objects from natural satellite search

Authors:

o   Carl Hergenrother

History:

o   2013-July-30 - Draft

o   2013-Nov-05 - Baseline

o   2016-Mar-28 - minor modifications

Description:

A science team member will manually validate natural satellite candidates identified by the moving object detection algorithm. A natural satellites and its surrounding region of sky will be automatically registered to the stellar background and blinked. A science team member will examine each candidate moving object to validate its reality.

Parameters:

infile – Internal Astrometrica file containing astrometry and photometry of satellite candidates

outfile – Two files of verified natural satellites of Bennu including astrometry and photometry (data product format is in UA-SIS-9.4.4-308 - OSIRIS-REx Astrometry and Photometry Derived Products SIS)

Algorithm equations:

The Astrometrica software has been used for ~20 years to support ground-based astronomical observations of asteroids, comets and stars. As a COTS product, it is one of the primary tools used by asteroid observers. The software was also used by the NASA Dawn mission to conduct

their search for natural satellites around asteroid Vesta (McFadden et al. 2016). The algorithms used by Astrometrica for the detection of moving objects have been tested and proven over ~20 years of asteroid detection. Since the software is extensively used and has been vetted by the astronomical community, the algorithms to be used do not need to be specifically presented here.

Two methods will be used to detect and validate candidate natural satellites.

The first will utilize Astrometrica's automated ability to detect moving objects. This method has some inherent weaknesses that could result in missing real moving objects. One, objects not moving in a linear fashion could be missed. This is a problem for satellites in close orbits around Bennu that will be traveling on curved paths as observed from the viewpoint of the OSIRIS-REx spacecraft. Two, Astrometrica could miss objects that are "involved" with another field object such as a star on one of the five field repeat images.

Due to the weaknesses in Astrometrica's automated detection capability listed above, a second method of will be utlilized within Astrometrica. The user will use Astrometrica's ability to register images relative to the background star field and blink the 5 images of each field. Blinking will allow the user to detect moving objects missed by the automated routine.

Proposed software:

Astrometrica (http://www.astrometrica.at/)

Additional references:

McFadden et al. 2016. Vesta's missing moons: comprehensive search for natural satellites of Vesta by the Dawn spacecraft. Icarus 257, 207-216.