SEARCH FOR MOONS OF VESTA: UPPER LIMITS FROM HUBBLE IMAGES. F. Bastien[1], L.-A. McFadden[1], D. P. Hamilton[1], J.-Y. Li[1], Wm. J. Parker[2], A. Bieryla[2], M. Mutchler[3], [1]Department of Astronomy, University of Maryland, College Park, MD 20742, [2]Department of Space Studies, Southwest Research Institute, Boulder, CO 80302, [3]Space Telescope Science Institute, Baltimore, MD 21218.

Introduction: With the Dawn spacecraft due to reach asteroid 4 Vesta in 2011, we wished to characterize the environment around the asteroid before its arrival. We used the Hubble Space Telescope (HST) to observe Vesta on 14 and 16 May 2007 (1). A total of eight images contained all of Vesta's orbital stability zone (2); these are the images used to search for potential satellites. No satellites have been found to an absolute magnitude of 22.5, which corresponds to a 50m diameter sphere with Vesta's albedo of 0.47 at 700nm.

Procedure: We do not expect a potential satellite to move from image to image because the time between exposures is too short. This allows us to use two search strategies: blinking back and forth between images taken sequentially in time to look for objects that remain in the same position relative to Vesta, and median filtering the images to remove items, such as stars, that move relative to Vesta. This latter technique, which effectively removes cosmic rays and other image artifacts, was also used to determine detection limits.

We calculated the theoretical detection limits by converting the background noise of the images into magnitudes. Dividing an image into sections and then performing the calculation in each section allowed us to map the theoretical detection limits as a function of position (fig. 2). The magnitude of the background ranges from 22 to 27, depending on the position relative to the saturated image of Vesta.

To determine the visual detection limits, which we expected to be lower than the theoretical limits, we randomly implanted artificial satellites of magnitude 19 or fainter into the median filtered images. We asked individuals with little to no experience with the data to look for the implanted objects in order to both set a lower bound on our detection limits and simulate an actual satellite search where the observers are not able to easily distinguish a true detection from an image artifact. We define as our detection limit the magnitude at which one half or fewer of the volunteers are able to detect a satellite. Our volunteers were able to consistently find objects of magnitude 22.5 or brighter, whereas those more familiar with the data were able to find objects as faint as 24th magnitude. Assuming that our satellites have, like Vesta, the high albedo of 0.47 at 700nm and translating these detection limits into photometric diameters, taking into account the magnitude of the Sun through the F702W filter, we calculate a detection limit of 50m.

Acknowledgements: This work is supported by NASA and the Space Telescope Science Institute, operated by the Association of Universities for Research in Astronomy, Inc. GO program 10799.

References: (1) McFadden et al., (2007) AAS/Division for Planetary Sciences Meeting Abstracts 39.003. (2) Hamilton, D., Burns, J., (1991) *Icarus* 92, 118.

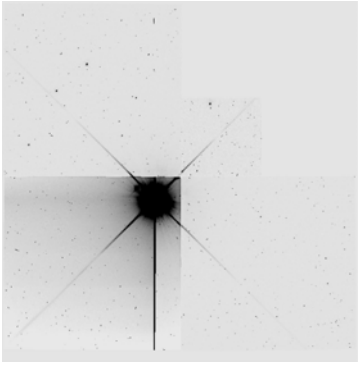

Figure 1. HST image of asteroid 4 Vesta on 14 May 2007 intentionally overexposed to allow us to search more deeply. The object to the upper left of Vesta is a star.

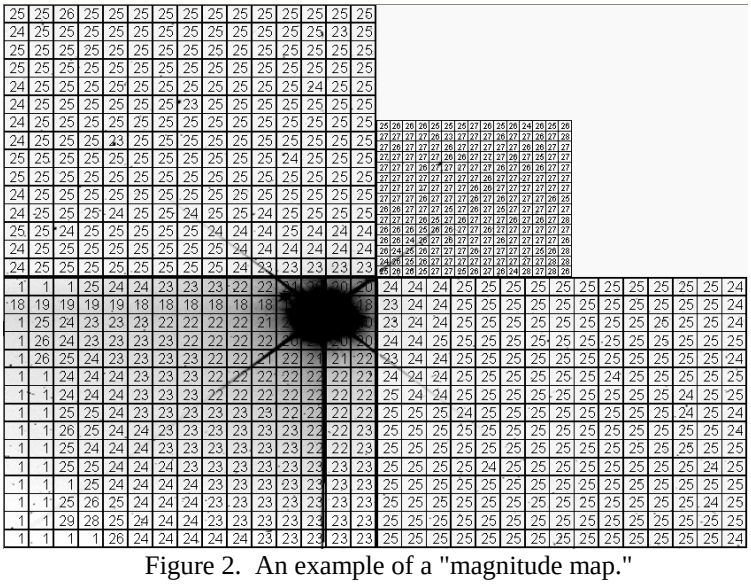

Figure 2. An example of a "magnitude map." Theoretical detection limits are shown as a function of position. The 1's correspond to regions where the average pixel value is negative.