Dawn at Vesta: Accomplishments and Plans. C. T. Russell[1], C.A. Raymond[2], R. Jaumann[3] and H. Y. McSween[4] and the Dawn Science Team, [1] University of California, Institute of Geophysics and Planetary Physics, Los Angeles, California 90095-1567, USA, [2]Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA 91109-8099, USA, [3]DLR, Inst. of Planet. Expl. Rutherfordstrasse 2, 12489 Berlin, Germany, [4]UTK, Earth and Planetary Sciences, Knoxville, TN 37996-1410 USA.

Introduction: Shortly after entering Vesta's gravitational field in July 2011, Dawn was maneuvered by its ion propulsion system into Survey orbit at 2735 km altitude providing a complete map of the sunlit surface at low resolution. The fields of view of the Dawn instrument and the orbital phases are illustrated in Figure 1 and 2.

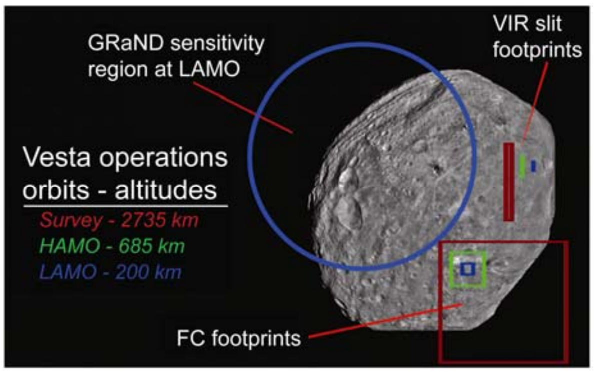

Figure 1. The field of view of the framing camera (FC), the Visible and IR Mapping Spectrometer (VIR) and the Gamma Ray and Neutron Detector (GRaND) at each of the three orbital phases

In October Dawn entered its High Altitude (HAMO) orbit at 685 km altitude where it again mapped the entire surface at optical and infrared wave lengths at greater resolution. STEREO measurements were obtained with different views from neighboring orbits. These observations provided the data to construct shape models of the entire sunlit surface, to provide clear filter and color filter images of the entire surface and to obtain visible and infrared images with the Visible and Infrared Mapping Spectrometer for mineral identification. Radiometric tracking allowed determination of Vesta's mass and the gravitational moment J_2.

Under the assumption that the HED meteorites were excavated from Vesta together with the Vestoid family asteroids, these meteorites were used to develop a model of the origin and interior structure of Vesta. In this model Vesta formed within about 2 million years at the start of solar system formation, trapping short-lived radionuclides in its interior, leading to melting, fractionation and the formation of an iron core. The gravity data, the mineral composition of Vesta's surface and its topography are totally consistent with this protoplanetary hypothesis based on the HED meteorites. In particular, Vesta's gravity data are consistent with a 110 km radius iron core.

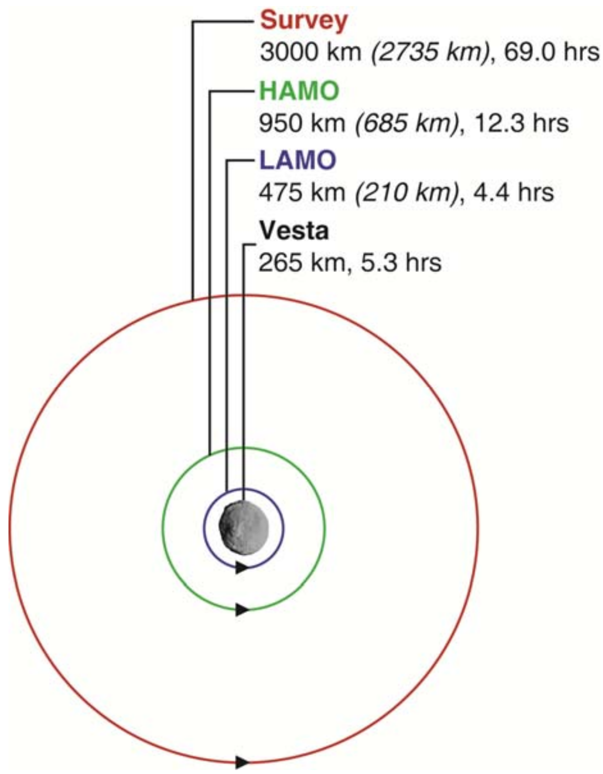

Figure 2. The three mapping orbits of the Dawn mission at Vesta. Similar orbits will be chosen for mapping Ceres in 2015

On December 12, Dawn entered its lowest altitude orbit LAMO at 210 km above the surface obtaining high resolution gravity data as well as gamma ray and neutron data with the GRaND instrument. Higher resolution camera and mapping spectrometer data were also obtained. The Lunar and Planetary Science Conference is the first meeting at which these data will be presented. We have one more mapping phase to undertake before leaving Vesta. This is a second High Altitude mapping orbit to take advantage of changed lighting conditions.

The surface of Vesta has been full of surprises. This very bright asteroid is not only uniformly bright but it has many brighter spots across its bright surface.

At the same time it has dark spots of extremely low albedo. The source of these two materials is not understood at this writing although many hypotheses have been put forward. The surface is very hilly with much greater relief than other planetary bodies. In fact the largest mountain on Vesta rivals in the size Olympus Mons on Mars. This mountain is at the center of the large Rheasilvia basin near the South Pole and is accompanied by circumferential troughs near the equator. A second set of troughs at an angle to the the former troughs is associated with an earlier basin offset from the Rheasilvia basin. The excavated region is quite distinct in mineralogy from the north.

The Sun will not shine on the Northern hemisphere until after August 20, 2012. This prevents us from seeing the entire body until it is time to leave Vesta, but we must leave Vesta soon thereafter to reach Ceres in 2015. The lack of an associated meteorite population leaves Ceres a very mysterious place. Once at Ceres we repeat the mapping done at Vesta but at higher altitudes above this much larger body.

The mission instruments, science plans, educational program and the science of Dawn have been described in a recent volume of Space Science Reviews [1 – 17]

References: [1] C. T. Russell and C. A. Raymond (2011) *Space Sci Rev*,163-1, 2-23, DOI 10.1007/s11214-011-9836-2. [2] A. Coradini, et al. (2011) *Space Sci Rev*, DOI 10.1007/s11214-011-9792-x. [3] D. P. O'Brien and M. V. Sykes (2011) *Space Sci Rev*, DOI 10.1007/s11214-011-9808-6. [4] T. B. McCord et al., (2011) *Space Sci Rev*, DOI 10.1007/s11214-011-9836-2. [5] M. T. Zuber et al., (2011) *Space Sci Rev*, DOI 10.1007/s11214-011-9806-8. [6] A. S. Rivkin et al., (2011) *Space Sci Rev*, DOI 10.1007/s11214-010-9677-4. [7] C. M. Pieters et al., (2011) *Space Sci Rev*, DOI 10.1007/s11214-011-9809-5. [8] H. Y. McSween Jr., et al., (2011) *Space Sci Rev*, DOI 10.1007/s11214-010-9637-z. [9] Valerie C. Thomas et al., (2011) *Space Sci Rev*, DOI 10.1007/s11214-011-9852-2. [10] J. Brophy (2011) *Space Sci Rev*, DOI 10.1007/s11214-011-9848-y. [11] H. Sierks et al. (2011) *Space Sci Rev*, DOI 10.1007/s11214-011-9745-4. [12] M.C. De Sanctis et al. (2011) *Space Sci Rev*, DOI 10.1007/s11214-010-9668-5. [13] T. H. Prettyman et al. (2011) *Space Sci Rev*, DOI 10.1007/s11214-011-9862-0. [14] A. S. Konopliv et al. (2011) *Space Sci Rev*, DOI 10.1007/s11214-011-9794-8. [15] C. A. Raymond et al. (2011) *Space Sci Rev*, DOI 10.1007/s11214-011-9863-z. [16] C. A. Polanskey et al. (2011) *Space Sci Rev*, DOI 10.1007/s11214-011-9855-z. [17] L. A. McFadden et al. (2011) *Space Sci Rev*, DOI 10.1007/s11214-011-9840-6.