THE DAWN MISSION TO VESTA AND CERES. M. V. Sykes[1], C. T. Russell[2], C. Raymond[3], F. Capaccioni[4], M. T. Capria[4], U. Christensen[5], A. Coradini[4], M. C. De Sanctis[4], W. Feldman[1], Ralf Jaumann[6], H. U. Keller[5], A. Konopliv[3], T. B. McCord[7], L.-A. McFadden[8], H. McSween[9], S. Mottola[6], G. Neukum[10], C. Pieters[11], T. Prettyman[1], D. Smith[12], B. Williams[13], M. Zuber[14], [1]Planetary Science Institute, [2]University of California Los Angeles, [3]Jet Propulsion Laboratory, Caltech, [4]Instituto di Astrofisica Spaziale, [5]Max-Planck-Institut für Sonnensystemforschung, [6]Deutsches Zentrum für Luft- und Raumfahrt, [7]The Bear Fight Center, [8]University of Maryland, [9]Universty of Tennessee, [10]Freie Universität Berlin, [11]Brown University, [T2]NASA Goddard Spaceflight Center, [13]KinetX, [14]Massachusetts Institute of Technology

Introduction: Dawn is the first multiple rendezvous planetary mission, made possible by the utilization of ion propulsion. It successfully launched on September 27, 2007. Dawn will pass within 500-2000 km of Mars for a gravity assist in February 2009, will rendezvous with Vesta in August 2011 to study it for approximately 9 months, then continue on to Ceres, arriving in February 2015. Given Dawn's trajectory within the asteroid belt, there are numerous flyby opportunities to be assessed (Figure 1).

Instrument Complement: Dawn flies a double Framing Camera (FC), provided by the Max Planck Institute for Solar System Research in Germany, which serves as both a navigation camera and a surface imager. Target shape and topography will be derived from its images. The FC filter wheel contains 7 filters that are 20 nm wide, centered on 430, 540, 650, 750, 830, 920, and 980 nm. There is also a clear filter (450-920 nm). The 1024x1024 CCD detector in each camera has a 6°x6° field of view.

Mineralogies will be mapped with the Visible Infrared Spectrometer (VIR), provided by the Italian IFSI-INAF (Instituto Nazionale di Astrofisica). Its detectors span 350 - 5000 nm, covering the spectral features of a wide range of planetary materials at a resolution of (2 nm in the visible and 9 nm in the IR). It has a cross-scan angular view of 3.7° spanned by 256 pixels.

The Gamma-Ray and Neutron Detector (GRaND), built by Los Alamos National Lab and now managed by the Planetary Science Institute, will provide elemental composition information of Vesta and Ceres, mapping the near-surface abundance of major rock forming elements, long-lived radioactive elements, and volatiles such as H, C, N and O which are the major constituents of ices. The presence of near-surface water will be tested and mapped for both Vesta and Ceres. While traveling to our targets, GRaND will characterize the background space radiation environment.

Since launch the Dawn instruments have been tested in their different operational modes and found to be functioning as expected.

Mars Gravity Assist: Dawn's first major encounter event will be with Mars. This gravity assist will primarily effect a change in the orbital plane of spacecraft to more closely align with that of our first science target, Vesta (Figure 1). Observations of Mars will be obtained with all instruments to test them under operational conditions and to compare the observations with those that have or will be acquired by numerous past and present Mars missions from orbit.

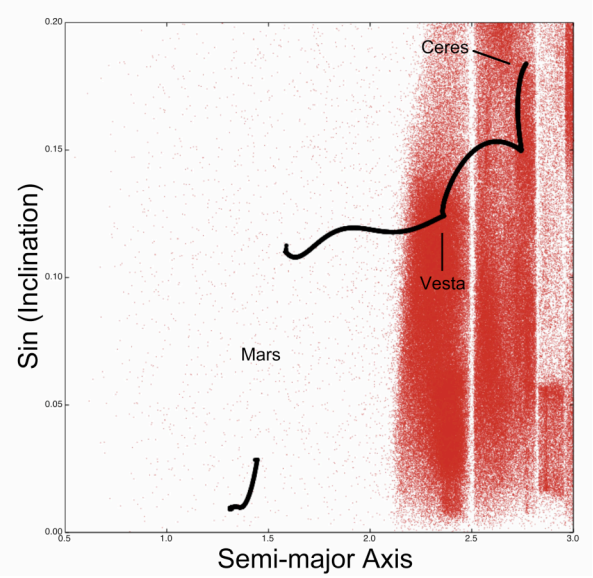

Figure 1. Dawn spacecraft orbital elements as a function of time (courtesy P. Tricarico, PSI), moving from left to right, illustrating the effect of Mars Gravity Assist and the path of Dawn through the main asteroid belt (red dots).

Then on to Vesta and Ceres: Dawn will be thrusting nearly continuously between Mars and Vesta, then Vesta and Ceres - demonstrating the robustness of the ion propulsion system. Upon arrival at each target, Dawn will search for dust and satellites, then enter into a survey orbit to begin initial mapping. Using the ion thrusters, it will decrease its orbital radius to high-altitude mapping and low-altitude mapping orbits. Both FC and VIR observations will be made at higher resolution in each of these phases, and GRaND will make its measurements at the lowest altitudes where the instrument is most sensitive. At the end of mission, Dawn will move to a quarantine orbit to avoid contaminating Ceres, whose potential subsurface ocean raises the question of life.