Synergistic Imaging Observations of Titan by the Cassini Mission

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in October 1997, the Cassini spacecraft will be launched on a mission to explore Saturn and its moons under joint sponsorship of NASA, the European Space Agency and the Italian Space Agency. Titan, Saturn's largest moon, boasts organic chemistry that may hold clues to bow life formed on the primitive Earth. Cassini will arrive at Saturn in July 2004, and in November will release the European-built 1 luygens probe to descend through Titan's atmosphere to its surface, likely surviving several minutes. The first of some five dozen orbits of the saturnian system will t hen begin, including close fl ybys of rings and moons -- with perhaps as many as 50 of Titan.

Titan's surface temperature is about -180 C. Methane appears below its saturation pressure near the surface, raising tbc possibility of lakes of ethane with dissolved methane. Methane is photolyzed into ethane, acetylene, ethylene, and hydrogen cyanide, tbc latter a building block of amino acids. Titan's 200 km-deep atmospheric has surface pressure of about 1.6 bars, predominantly consisting of nitrogen with other hydrocarbons. Its surface is non-uniform and has a large continent-]ike feature that is bright in in frared. Seasonal changes in disk images have been noted.

Regional-scale characterization of Titan's sur face and surface-atmosphere interactions are principal Cassini objectives. The 1 luygens probe may be able to characterize its own local environment, and the orbiter's twelve remote sensing instruments will contribute to more broad discovery. 1 lowever, mapping of the surface depends principally on three orbiter imaging investigations: a mapping spectrometer, a camera, and a radar. The VI MS spectrometer (actual l y one oft wo) operates in visual and infrared, acquiring multiple-channel images simultaneously to identify atmospheric composition at varying depths and to image surface features; the camera (1SS) acquires high-resolution images in visual, near ultraviolet and near IR. The radar acts as a Ku band (14 GHz) synthetic aperture radar (SAR), radiometer, altimeter and scatterometer. Observations taken by any of these alone would doubtless produce significant new knowledge about the surface. 1 lowever, both common sense and severe limitations placed by the mission (e. g., observing time, power or data) require that a synergistic approach be taken, combining the strengths of each investigation and producing a whole that exceeds the sum of its parts, Atmospheric mapping to determine atmospheric variability, phase angle maps and probe (atmosphere) entry-point observat ions will be shared by VI M S and 1 SS. Nightside mapping is the province of VIMS and the radar, while global coverage for regional mapping will be done by all, shared by spectral band.] lere, basic phisiography, probe (surface) impact point context, and geologic processes will be determined by radar and VI MS; surface composition, lightning and volcanism characterization by VI MS and 1SS. This paper will describe synergistic approaches which maximize science in the data return.