CASSINI RADAR MISSION: RECONNAISSANCE OF TITAN

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The Cassini Radar will provide surface mapping of Saturn's satellite Titan at 14 GHz (Ku band) with resolution as fine as 0.5 km, unaffected by solar illumination, atmospheric opacity or scattering. The radar's SAR mode provides medium-to-high resolution synthetic aperture radar images; its altimeter mode measures the relative surface elevation of the suborbital tracks; its scatterometer mode measures Titan's surface backscatter coefficients at various angles; and its radiometer mode measures surface brightness temperature. In addition to characterization of gross morphology and landforms, the radar will reveal statistical measures of wave structures on liquid surfaces and solid surface roughness at spatial scales near the radar wavelength. Given a nominal mission profile, the sensor is capable of mapping almost 100% of Titan's surface using its radiometer and 30% at SAR resolution. This combination will permit identification of major terrain units and characterization of principal surface modification processes.

The principal science objective of the radar is to provide regional-scale characterization of Titan's surface. SAR mode will naturally be used to characterize the surface spatially at the highest resolution. The high-resolution images will be comparable to the Magellan images of high latitudes of Venus or to the Mariner 9 optical images of Mars. However, due to the limited observation times, the radiometer will be employed in a novel scanning mode to generate global mosaics at 100 km resolution - both to provide a synoptic view and to plan the more detailed observations. Altimetry and scatterometry modes will be used to provide information on surface height and statistical roughness.

The radar instrument is a joint NASA/ASI effort, sharing the 4-meter high-gain antenna with telecommunications and radio science systems, each of which have separate RF feeds. The radar feed provides five beams to increase Titan surface coverage on each pass. Nominally, the side-looking beams will be used in imaging modes only. Useful imaging operation is anticipated from 15 to 28 degree incidence angles, with SAR noise-equivalent backscatter varying from about -30 dB to -15 dB at 2 to 7 looks. SAR pulse interleaving is not employed, but SAR, radiometer and altimeter collection periods are interleaved so that any combination of data types can be used. In order to isolate high pulsed load currents from the spacecraft, energy is stored in a large capacitor bank.

This presentation will include a review of the Cassini radar design and summarize its as-built capabilities. We will show analysis of radar data from the recent Earth flyby and will also discuss scientific objectives and mission observation plans for accomplishing them. Parts of the research described in this paper were carried out by the Jet Propulsion Laboratory, California Institute of Technology, under contract with the National Aeronautics and Space Administration.

Topic: Remote Sensing
Session Organizer: F. Posa
Oral presentation is preferred