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SHARAD radar sounder for the Mars Reconnaissance Orbiter Mission

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SHARAD (SHAllow RADar) is a nadir looking synthetic aperture subsurface sounding radar and altimeter provided by ASI as a Facility Instrument to NASA's 2005 Mars Reconnaissance Orbiter Mission. The primary scientific objective of the SHARAD investigation is to map, in selected locales and with a vertical resolution of ˜ 10 m and a horizontal resolution of a few hundred meters (300 m-1 Km), dielectric interfaces to depths of up to one kilometer in the martian subsurface and to interpret these interfaces in terms of the occurrence and distribution of selected materials, including rock, regololith, water and ice. Probing the upper crust of Mars with radar in the 10's of MHz frequency range is a unique way to study the planet, compared to all other investigations completed, in progress, or planned for the future. An instrument able to penetrate a few hundreds of meters below the surface would provide a unique insight into the Martian stratigraphy. Key elements for the radar design are represented by the identified center frequency, 20 MHz, the bandwidth of the radar pulse equal to 10 MHz. The radar is able to radiate, through its antenna, frequency modulated radar pulses of 85 microseconds length and bandwidths 10 MHz. To cope with the spatial resolution requirement, SHARAD shall actually operate as a nadir looking synthetic aperture radar sounder. The SHARAD instrument consists of one antenna assembly and an electronics assembly. The antenna assembly consists of a dipole antenna, parallel to the surface and perpendicular to the direction of motion, used to receive echoes reflected by the Martian surface and subsurface.