Low Frequency Radar Sounding of Mars Subsurface and Ionosphere

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In early 2004, Mars Express will arrive at the red planet's orbit carrying with it a low frequency radar sounder that is designed to remotely explore below the surface of Mars. Mars Advanced Radar for Subsurface and Ionospheric Sounding (MARSIS), which is the result of an international collaboration between NASA, the Italian Space Agency (ASI), and European Space Agency (ESA), is designed to sense planets interior to a depth of up to 5 km. MARSIS' main objective is to search for water if it exists in liquid form under the surface. It will also attempt to map and characterize the subsurface geological structure of Mars, which is hidden under a layer of surface dust. In addition to its subsurface exploration goals, MARSIS will study the ionosphere of Mars providing the most extensive amount of data on Martian ionosphere to date. To achieve these goals, MARSIS is designed as a high relative bandwidth low frequency radar with a frequency range from 0.2 MHz to 5.5 MHz with five distinct operating 1 MHz sub-bands. Operation at low frequency is dictated by the need to penetrate deep inside Mars, however, operation at such low frequencies means MARSIS has to be capable of dealing with distortions that are introduced by the ionosphere. Also due to limitations in the data transfer rate, a significant amount of on-board signal processing is required to reduce the data redundancy and maintain a reasonable data rate in order to achieve the goal of global coverage. This presentation will provide an overview of the MARSIS instrument, its capabilities and the project's current status.