significant amounts of highly structured clay and evaporites within a predominately amorphous matrix.

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ONBOARD SIGNAL PROCESSING: WAVE OF THE FUTURE FOR PLANETARY RADIO SCIENCE? E. A. Marouf, Department of Electrical Engineering, San Jose State University, San Jose CA 95192-0084, USA.

Future spacecraft-based radio observations of planetary surfaces, rings, and atmospheres could significantly benefit from recent technological advances in real-time digital signal processing (DSP) hardware. Traditionally, the radio observations have been carried out in a "downlink" configuration in which about 20-W spacecraft-transmitted RF power illuminates the target of interest and the perturbed signal is collected at an Earth receiving station. The downlink configuration was dictated by the large throughput of received data, corresponding to a relatively large recording band width (about 50 kHz) needed to capture the coherent and scattered signal components in the presence of trajectory, ephemeris, and measurement uncertainties. An alternative "uplink" configuration in which powerful Earth-based radio transmitters (20–200 kW) are used to illuminate the target and data are recorded onboard a spacecraft could enhance the measurements' signal-to-noise ratio by a factor of about 1000, allowing a quantum leap in scientific capabilities. The recorded data must be preprocessed to reduce its volume while preserving its salient information content. The latter include time-history of estimates of the amplitude and phase of the coherent signal and dynamic power spectra of the scattered signal, computed at adaptable resolutions. The "compressed" data is later relayed to the Earth for further detailed processing and analysis. Onboard data compression can readily be accomplished either by a DSP processor that is a part of an Uplink Radio Science Instrument, or by a configurable spacecraft "DSP subsystem" that serves as a preprocessing engine for multiple spacecraft instruments. In either case, the hardware architecture must be sufficiently flexible to allow implementation of a broad class of preprocessing algorithms, adaptable to a given observation geometry and corresponding signal dynamics. Specific signal compression needs and expected scientific gain are illustrated for potential future uplink observation of planetary ring systems. A similar argument can be made for radio observations of the tenuous atmosphere of Pluto and for radio imaging of the martian surface, two potential targets for the Pluto FFM and the Mars MESUR missions.

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SPACEBORNE PASSIVE RADIATIVE COOLER. S. Mathias, Arthur D. Little, Inc., Cambridge MA 02140, USA.

Radiative coolers are passive refrigeration devices for satellites and space probes that provide refrigeration for an infrared or other type of detector that operates at cryogenic temperatures. Typically a cooler can supply 20 mW of cooling at about 85 K, and over 500 mW of cooling at about 165 K. The exact cooler temperatures and heat loads are dependent upon the clear field of view of the cooler to space.

Some features of the Arthur D. Little passive radiative cooler are (1) the cooler has no moving parts leading to very long life and high reliability; (2) the cooler weight is approximately 3 lb; (3) the detector may be easily replaced without disassembling the cooler; (4) the alignment of the detector is insensitive to induced launch vibration and thermal cycling; (5) a movable field lens provides a simple method of adjusting the system focus during testing at operating temperatures; (6) the optical axis is referenced to the room-temperature mounting flange interface, eliminating the need for iterative optical adjustments in thermal vacuum chambers at the system level; (7) heater and temperature sensors provide precise detector temperature control; (8) the design offers protection against overheating of the sensitive detector element during nonoperational spacecraft attitude acquisition; (9) a modular "bolt-on" concept provides simple integration and interface definition of the cooler with an optical system; and (10) there is maximum protection of the low-temperature optical elements from contamination.

N93-28803

SYSTEMATIC PROCESSING OF CLEMENTINE DATA FOR SCIENTIFIC ANALYSES. A. S. McEwen, U.S. Geological Survey, Flagstaff AZ 86001, USA.

If fully successful, the Clementine mission will return about 3,000,000 lunar images and more than 5000 images of Geographos. Effective scientific analyses of such large datasets require systematic processing efforts. Described below are concepts for two such efforts.

Global Multispectral Imaging of the Moon: The lunar orbit has been designed to enable global coverage with the UV/VIS and near-IR cameras. Global coverage will require 120 frames per orbit × 300 orbits × 16 frames (6 near-IR filters and double coverage in 5 UV/VIS filters to improve S:N), for a total of 576,000 image frames. Lunar scientists cannot analyze half a million small images. We will need a single global 11-wavelength image cube with full geometric and radiometric calibrations and photometric normalizations. Processing steps could include (1) decompressing the data, (2) radiometric calibration, (3) removal of camera distortions, (4) co-registration of each set of 16 images to 0.2 pixel, (5) replacing bad or missing data, (6) merging UV/VIS double coverage, (7) identifying three control points per orbit, (8) along-track frame matching (geometry and brightness), (9) reprojecting images, (10) photometric function normalization, (11) mosaicking into single-orbit strips, (12) brightness matching of orbit strips, and (13) mosaicking orbit strips into map quadrangles. The final global dataset at a scale of 100 m/pixel will require a set of 70 CD-ROMS (650 Mbytes/CD) for archiving and distribution. Once systematic processing is completed, a series of global maps can be derived that show the distribution and abundances of pyroxenes, olivine, anorthosite, shocked anorthosite, norite, troctolite, glassy materials, and titanium.

Videos of Geographos: Clementine is expected to acquire continuous imaging throughout the closest approach sequence at Geographos with frame rates of 4.5 or 9 frames/s. (For comparison, the highest frame rate on Galileo is 0.4 frame/s, and there was no imaging near closest approach to Gaspra.) The high frame rates and continuous imaging are ideal for production of computer "movies" of the flyby, which can be recorded onto video tapes. These movies