LUNAR GEOSCIENCE OBSERVER SPACECRAFT

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The Lunar Geoscience Observer (LGO) spacecraft is nearly identical to the Mars Observer spacecraft. To meet LGO requirements a tailored MO spacecraft bus which can either be scaled down in areas such as achievable data rate, power capability and mass margins or left unchanged to provide large margins in key system resource parameters for expansion of the instrument accommodation capabilities.

The expected instrument complement for the LGO closely parallels that of MO currently under development, with the addition of an x-ray spectrometer and an electron reflectometer. Neither of these instruments are anticipated to present accommodation problems which will impact the spacecraft bus design. A complete listing of anticipated LGO instruments can be found in reference 1.

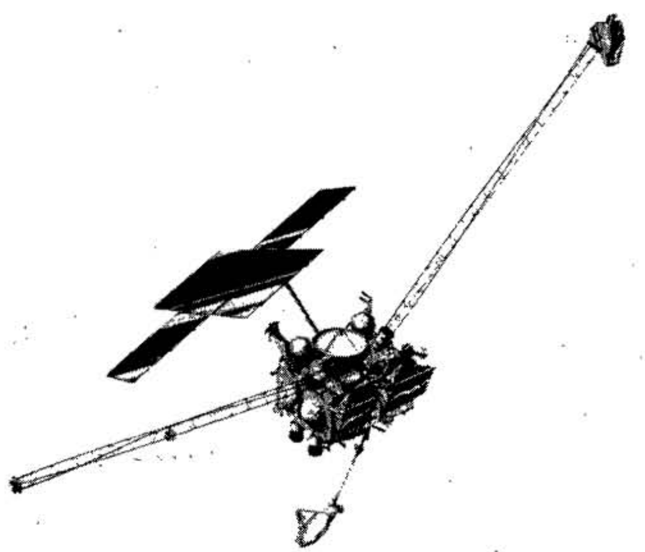

Figure 1. Fully deployed Mars Observer spacecraft

1. Wallace, R. A. (1987), LGO Mission Science Summary, Lunar and Planetary Science XVIII, Houston (Poster Talk).

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Figure 1 shows the MO spacecraft in the fully deployed state. The instrument booms are used for the magnetometer and Gamma Ray Spectrometer mounting, with the remainder of the instruments being mounted on the nadir oriented panel. Advantage is taken of the sun synchronicity of the MO orbit to assure that instrument coolers are maintained in a cold space facing orientation. Since the Lunar orbit is not sun synchronous, this advantage is lost for LGO. To the first order this does ot present a spacecraft problem since the spacecraft itself does not require any particular orientation with the exception of maintaining the array solar pointing. For the LGO this will be achieved by the addition of a two dimensional degree of freedom array (MO has a one dimensional array) and may require periodic maneuvers of the spacecraft to maintain proper orientation.

The spacecraft bus to be used for the LGO will most likely be the MO option #1 spacecraft. To reconfigure the MO option spacecraft for the LGO only minimal modifications will be required. These can be summarized on a subsystem by subsystem basis as follows. Structure, Power and C&DH systems will require little or no modification (although the solar array may be downsized by deletion of two panels, not required at 1A.U.). The mechanisms will require the addition of the second degree of freedom for the array as described above. The telecommunications system can either be used as is, resulting in a down link data rate capacity far in excess of the nominal 128 kbps requirement, or simplified significantly by the deletion of the high gain antenna.

The thermal subsystem would be modified to allow a significantly greater sun angle range than the MO case, not a difficult problem for the spacecraft but perhaps somewhat more challenging for those instruments requiring coolers. The attitude control system would likely be modified to replace the static Mars Horizon Sensor (MHSA) with a different design, perhaps a modification of the MHSA or perhaps a differential limb crossing type sensor as flown on the the SATCOM series. In either case a straight forward modification form the systems point of view.

The propulsion system available on the MO spacecraft is potentially larger than needed (~2.7km/sec ΔV capability) and can be significantly off loaded and/or used to augment the upper stage depending on the launch vehicle

chosen. If the TOS is used, the same stage as MO, it could be off-loaded by as much as 50% and still use a significantly off-loaded bi-propellant system. Alternatively, a smaller upper stage, such as a PAM-DII could be used. In this case, the PAM would not provide sufficient impulse to reach the moon, but the spacecraft can easily make up the required ΔV with a subsequent periapsis burn and still have sufficient residual fuel for the lunar insertion burn.