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INTERIM TECHNICAL REPORT

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Research Participation in the Mars Orbiter Laser Altimeter Experiment Technical Report for January 15 2002 —January 14, 2003

This report describes the tasks that have been completed by the Principal Investigator, Gordon Pettengill, and his team during the first year of this grant. Dr. Pettengill was assisted by Dr. Peter Ford and Ms. Joan Quigley.

Our main task has been to analyze the polar clouds detected by MOLA during the nominal mission of the Mars Global Surveyor (MGS) in 1999-2001 and to correlate the results with other data sets, in particular that from TES, the MGS thermal emission spectrometer. Starting with the Martian cloud database that we constructed prior to the start of this grant, we have examined all TES footprints that overlap MOLA clouds in time and space, correlating the thermal signature against specific categories that we assign to MOLA clouds on the basis of visual inspection.

We are particularly interested in clouds in the region of "cold spots", areas of anomalously low thermal brightness temperature that have been detected in the polar winter by several instruments beginning with IRIS on Mariner 9. They are thought to indicate regions of active CO_2 sublimation or snowfall, and it is hoped that MOLA measurements may tell us more about these regions.

Three models have been put forward to explain the cold spots. They could result from CO_2 ice clouds, from a deep layer of CO_2 frost, or from surface layers of CO_2 slab ice. In each case, the emissivity is lowered by volume scattering, but in very different conditions. To choose between these models, we have made maps of the spectral slope, $\partial E/\partial\lambda$, for $20\mu m < \lambda < 25\mu m$ at intervals of 5° in L_s, the sub-solar longitude. The cold spots show up clearly as isolated minima.

Having identified a particular cold spot, we have noted the first time at which TES detected it and the last time, if any, at which TES observed that region without detecting any anomaly. From this,

an estimate of the average lifetime of a cold spot can be determined. We go on to correlate MOLA clouds with TES cold spots to see whether the two are related, and whether particular types of cloud are responsible.

A second task, principally performed by Ms. Quigley, was to keep our copy of the MOLA database current against changes made by the MOLA team at GSFC. She also processed several updated TES data sets. A switch in coordinate system made during the course of the year also required us to reprocess all data and to recreate our cloud database.

On January 28-31, Dr. Ford paid a visit to the Laboratoire de Météorologie Dynamique in Paris to discuss Mars climate modeling with Dr. François Forget. Arrangements were made to run the Paris climate model from MIT via Internet, and this has been tested throughout the year.

Dr. Pettengill attended MOLA team meetings in Annapolis, MD, on May 9-10, and in St. Louis, MO, on August 28-29. Dr. Ford also attended the Annapolis meeting and the Caltech meeting on November 4-5. At each meeting, we presented new results from our comparison of MOLA and TES observations.

No inventions were made during the reporting period.

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