DENSITY VARIATIONS IN THE MARTIAN MIDDLE AND LOWER ATMOSPHERE. J. T. Bergstralh, M. Natarajan[1], and R. Tolson[2] [1]NASA Langley Research Center, Mail Code 401, Hampton, VA 23681-2199, [2]North Carolina State University, Raleigh, NC 27695.

Background: The Mars Science Laboratory (MSL) mission has a performance goal of landing within a 20 km diameter error circle. By contrast, the estimated landing error ellipses for the MER rovers extended approximately 70 km along the major axis. If it can be achieved, this roughly four-fold improvement in landing precision should, at the very least, put MSL closer to its intended target and thereby reduce transit time from landing site to target. It might also enable landings in places that are more constricted by terrain than Meridiani Planum and the floor of Gusev Crater.

Problem: The largest source of landing uncertainty is density variations in the Martian middle atmosphere (roughly between 20 and 50 km altitude). For example, MER-A landed about 25 km down-track from its nominal target (*i.e.* the center of the projected error elipse) because the densities it actually encountered in the middle atmosphere were systematically lower than models had predicted. The purpose of the research reported here is to estimate the range of atmospheric density variations in the vicinities of high-priority targets for MSL, and to compare these with model predictions.

Approach: To do this, we first calculated densities (kg m^{-3}) using temperatures retrieved at a fixed set of pressures from Mars Global Surveyor Thermal Emission Spectrometer (MGS-TES) nadir-viewing radience data [1], at locations close to the targets and approximately at solar longitudes (Ls) corresponding to the projected MSL landing dates at each of these targets. Using Viking Lander 1 seasonal pressure data [2], we calculated pressure at the MOLA areoid for the appropriate value of Ls. From these, we calculated approximate heights (km) above the areoid for each of the fixed pressure levels, yielding density *vs.* altitude profiles (height measured from the areoid, of course, provides a common fiducial point for comparing different profiles).

Because the MGS-TES temperature retrievals typically ended at altitudes around 37 km, we extrapolated temperatures to higher altitudes using the relationship $T = T_0(p/p_0)^{0.02}$ [1], where T_0 and p_0 are the temperature and pressure measured at the highest altitude at which temperature was retrieved.

Results: Although millions of temperature profiles were retrieved from MGS-TES radiance data, coverage at any specific latitude, longitude, and Ls is often sparse. Nevertheless, we have found several cases where there is coverage of the same location, at about the same Ls, in different years. They show evidence of interannual variations at these locations. We have also found indications of variations along the track of a hypothetical entry trajectory. Finally, we have compared these empirical profiles with profiles predicted by the Mars WRF model and the MarsGram database, and found differences.

References: [1] Conrath, B. J., Pearl, J. C., Smith, M. D., Maguire, W. C., Christensen, P. R., Dason, S., and Kaelberer, M. S. (2000) *JGR*, *105*, 9509–9519. [2] Tillman, J. E., Johnson, N. C., Guttorp, P. and Percival, D. (1993) *JGR., 98*, 10,963-10,971.