LATEST RESULTS FROM THE MARS PATHFINDER ATMOSPHERIC STRUCTURE INVESTIGATION. J.A. Magalhães (NASA Ames/SJSUF, Mail Stop 245-3, Space Science Division, Moffett Field, CA 94035, U.S.A.; jmagalhaes@mail.arc.nasa.gov).

Introduction: The Mars Pathfinder Atmospheric Structure Investigation (ASI) obtained information on Martian atmospheric structure from three science accelerometers, which measured the deceleration of the probe at all levels in the atmosphere. Entry, descent, and landing occurred within 850 km of the Viking 1 landing site and somewhat later in northern summer. Pathfinder entered at 3 AM Local Mars Time (LMT), which provided the first opportunity to study Mars' nighttime atmospheric structure, and Viking 1 entered at 4:15 PM LMT. Magalhães *et al* [1] and Schofield *et al* [2] have previously reported on the analysis of accelerometer measurements from the entry phase, which ended at about 8.5 km. The derived temperature profile extends from 140 km altitude down to 8.9 km, with a vertical resolution ranging from 250 meters to 50 meters, respectively. Here we report on a refined analysis of the Pathfinder entry phase ASI data in which the effects of the small angular motions of the entry vehicle have been removed, thus enabling a search for small amplitude and small vertical wavelength structures. In addition, we will report on the atmospheric structure at altitudes below 8 km which is being derived from the accelerometer data acquired during the parachute descent phase.

Results: The high spatial resolution of the ASI data makes it well suited to the study of atmospheric waves and other phenomena with small spatial scales. The Pathfinder entry profile shows oscillatory structures with a wide range of vertical wavelengths and amplitudes. Between 90 and 60 km, large amplitude (10-20˚K) long wavelength (20-40 km) oscillations are consistent with the vertical scale expected for the diurnal tidal mode. These oscillations show a remarkable correspondance to equivalent structures found in the Viking 1 profile at the same pressures. The anticorrelation of the extrema of the oscillations in the two profiles is consistent with the phase change expected for a diurnal tidal mode over the ~ 12 hour local time difference between the two profiles. Below 60 km a weaker signature of the diurnal tide appears to be evident in the data as well. The rate of amplitude growth with altitude indicates the diurnal tide is saturated above 60 km, suggesting "wave breaking" and energy and momentum deposition by this tidal mode.

At levels above 60 km, wave-like oscillations with an apparent vertical wavelength of ~5 km are evident. The amplitudes of these oscillations show a positive correlation with the background static stability of the atmosphere, consistent with an atmospheric gravity wave interpretation. Comparison with analytical gravity wave theory indicates that gravity waves with a true vertical wavelength of ~5 km would likely be subject to critical-level absorption due to slow phase speeds and expected wind shears. However since the motion of the Pathfinder lander was mainly horizontal at altitudes above ~30 km, the ASI experiment samples horizontal phase variation as well as vertical phase variation. Gravity waves with a true vertical wavelength of ~20-40 km and a true horiztonal wavelength of ~10-20 km could produce the observed apparent vertical wavelength and would be more likely to propagate vertically. The amplitude growth with altitude of these oscillations appears to be saturated, suggesting energy and momentum deposition and turbulent mixing.

References: [1]Magalhães, J. A., J.T. Schofield, and A. Seiff (1999). *J. Geophys. Res. 104*, 8943-8955. [2]Schofield, J.T., J.R. Barnes, D. Crisp, R.M. Haberle, S. Larsen, J.A. Magalhães, J.R. Murphy, A. Seiff, and G. Wilson (1997). *Science 278*, 1752-1758.