Mars Atmospheric Science Orbiter

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A Mars orbiter, a successor of PLANET-C Venus mission (P-C: to be launched in 2010), is being planned. A tentative name is Meteorological Satellite for Mars (MeMS) and will be launched in the 2nd half of 2010's by applying know-hows we obtain through P-C. Mars, once was considered a 'dry and cold' planet, is considered a 'frozen and wet' planet now. It is suspected that relocation of ice, due to climate changes, could be discernible in the form of transport of water vapor, very important to understand evolution of planetary environment. However, the data on Mars meteorology are insufficient as previous spacecraft observations were done at fixed local times (because of the Sun-synchronous orbits with rather low altitudes) and and primarily at sub-spacecraft points. These obviously lack the spatial resolution and local-time coverage required to study meteorology.

With such background, our plan is to put MeSM in near-equatorial orbit (slightly tilted to better observe the poles). MeSM utilizes the multi-wavelength imaging to globally quantitize water vapor, temperatures (atmosphere and surface), ice clouds, dust and ozone at a spatial resolution of 5-10 km. A time series of images is used to obtain the planet-wide wind vectors. Vertical profile of water vapor and temperature will be obtained by sub-mm soundings (presented elsewhere) and the thermal structure, from near the surface to high in the troposphere, will be probed by radio occultation observations. The first and precise water-vapor map will tell us where the water (ice) under the ground evapolates or sinks and how water vapor is transported. With such information, it will be possible to study local equilibrium of ice. Waves and turbulences give us information about transport of energy and momentum as well as hierarchy of phenomena of various scales. This, through comparison with what we know about the Earth, becomes an important clue to improve the current meteorology. The mechanism of dust lifting will be studied by observing the life of ice clouds, which is related to vertical motion of atmosphere. Continuous observation of a dust storm, from its beginning in local scales to global scale, will also be done for the first time.

Owing to P-C's heritage, we expect to develop most of MeSM instruments in relatively short time. Japan will make a great contribution to atmospheric science of telluric planets, by carrying out unique missions to Venus, the hot world due to strong greenhouse effect, and Mars, the cold and frozen world. Recovery of 'Nozomi' science (atmospheric escapes) is, needless to say, an important aim of the new Mars mission and is presented elsewhere.