The Huygens Mission at Titan: Results Highlights

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After a 7-year interplanetary journey onboard the Cassini Orbiter, the Huygens Probe was released on 25 December at 02:00 UTC. It entered in the atmosphere of Titan on 14 January at about 09:06 UTC. Following the 4-min entry, 3 parachutes were deployed in sequence. The descent under parachute lasted slightly less than 2 ½ hours. After a soft landing at about 5 m/s, the probe continued to function for several hours on the surface. During the descent under parachute and on the surface, Huygens transmitted its data at 8 kbps on two redundant channels to the over-flying Orbiter which approached Titan at a closest distance of 60000 km about ½ hour before landing. Data were successfully received only on one channel due to a configuration error of the receiver of the channel which was driven by the ultra-stable oscillators (USO) of the Doppler Wind Experiment (DWE). The Orbiter received data during the descent under parachute and for 72 minutes on the surface until its path moved it outside the beam of the transmitting antennas of the probe resting on the surface and at the same time as the Orbiter went below the Horizon.

The Huygens mission was supported by Earth-based radio telescope observations with the aim of measuring the carrier frequency of the received signal of one of the Huygens channel driven by the DWE USO. The radio telescope observations included a unique ESA-sponsored Very Long Baseline Interferometry (VLBI) experiment involving a network of 17 telescopes distributed in USA, Australia, Japan and China. The VLBI experiment was managed by JIVE, Dwingeloo, The Netherlands. In parallel to the VLBI observation, single-dish Doppler measurements were also performed at several radio telescopes of the VLBI network by JPL's Radio Science Team. The main objective of the VLBI experiment is to determine the trajectory of the Huygens Probe during its whole descent with a 1-km accuracy.

Data on the structure, the composition, and the meteorology of the atmosphere were obtained. 350 images were returned which allowed making stunning surface panoramas that revealed a surface with hydrological and geological processes similar to that occurring on Earth now, but involving liquid methane, water ice and organics deposits as the main elements. Direct surface measurements performed during and after the landing provided unique data on the structure and the composition of the landing site. The initial analysis of the Huygens data set, complemented by the ground-based radio observations results, shows that all Huygens science objectives are expected to be met. This paper gives an overview of the Huygens mission and reviews the early results.