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The Gas Chromatograph Mass Spectrometer (GCMS) experiment on the Cassini-Huygens probe, results, lessons learned, needs for follow up experiments.

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Abstract

The Huygens Probe of the Cassini-Huygens Mission to the Saturnian System, descended to the surface of the moon Titan on January 14, 2005. It provided the first in situ measurements of the atmosphere and surface of Titan. The Gas Chromatograph Mass Spectrometer (GCMS), part of the instrument complement of the probe, obtained nearly continuous data from the atmosphere during the probe descent and, after landing, returned composition data of gases evaporated from the surface for more than seventy minutes. Height profiles of methane and molecular hydrogen were determined during the descent. On the surface, the instrument detected traces of a broad spectrum of organics and carbon dioxide. CH_4, C_2H_6, C_2H_2, C_2N_2 and CO_2 showed distinct evaporation from the surface and an abundance of additional, less easily identifiable, compounds were observed near the detection limit of the instrument. Although the probe landed in a dry plain, the methane data in the atmosphere above the surface before landing and on the surface show evidence that methane precipitation must have occurred recently.

Isotope ratios were determined for $^{15}N/^{14}N$ in molecular nitrogen, for $^{12}C/^{13}C$ in methane to and for D/H in molecular hydrogen. Argon 36, Neon 22, and radiogenic Argon 40 were the only noble gases detected in the atmosphere.

Krypton and Xenon were below the detection threshold of the instrument.

Science data were not retrieved from the gas chromatograph subsystem. The abundance of the organic trace gases in the atmosphere and on the ground did not reach the detection threshold.

The GCMS also supported the Aerosol Collector and Pyrolyser (ACP) experiment for detection and identification of the pyrolysis products.

Experience gained from the mission, the pros and cons of in situ chemical composition measurements will be discussed. Justification for both entry Probe and Lander experiments will be presented and requirements for possible future instruments and mission support.