

The HASI Permittivity, Waves and Altimetry Analyser (PWA) onboard of the Huygens Probe

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The Permittivity, Waves and Altimetry Analyser (PWA) onboard of the ESA Huygens Probe is a subsystem of the HASI instrument. PWA processes the measurements from three main sets of electrical sensors located on 2 deployable booms, from an acoustic sensor mounted close to the HASI stub on the Huygens Probe and also the down-modulated return signals from both Huygens Radar Altimeters.

Both booms are identical and hold following PWA electrical sensors:

- A transmitting electrode (TX) operated in the range of low (45 Hz - 5760 Hz) frequencies and a receiving (RX) one. These sensors are used to measure the mutual impedance (MI, voltage detected to current emitted ratio) between the two couples of electrodes. When no signal is emitted, the receiving electrodes allow for detection of the natural AC electric field which is analyzed on board by means of Fast Fourier Transforms (FFT) performed by a Digital Signal Processor (ADSP2100).

- Each boom holds also a Relaxation Probe (RP) electrode preset to potential values, typically +5V or -5V, and then let return to equilibrium with the medium. The discharge of the electrode potential is measured with a high impedance electrometer amplifier, which leads to the ionic conductivities through the time constants of relaxation. When the RP-electrodes are let in equilibrium with the medium, the potential of the electrodes can allow characterizing the DC electric field around the probe.

The PWA acoustic sensor (ACU) signal is also analyzed by Fast Fourier Transforms to investigate the natural acoustic noise during the Probe decent in the atmosphere of Titan and after impact on the surface. The Huygens Probe is also equipped with two redundant Ku-band Frequency Modulated Continuous Wave (FMCW) radar altimeters. Their down-modulated returned surface echo signals are also routed to the PWA-DSP for further analysis of the Probes relative altitude to the surface, topographical features and the surface reflectivity.

This paper describes in further detail the Permittivity, Waves and Altimetry Analyser, which successfully operated during the spectacular descent and after landing of the Huygens Probe on 14 January 2005.