# Building our new view of Titan

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Two and a half years after the historic landing of ESA's Huygens probe on Titan, a new set of results on Saturn's largest moon is ready to be presented. Titan, as seen through the eyes of the European Space Agency's Huygens probe, still holds exciting surprises, scientists say. The results are presented in a special edition of Planetary and Space Science Journal and at a press conference held June 1st in Athens.

On 14 January 2005, after a seven-year voyage on board the NASA/ESA/ASI Cassini spacecraft, ESA's Huygens probe spent 2 hours and 28 minutes descending by parachute to land on Titan. It then sent transmissions from the surface for another seventy minutes before Cassini moved out of range.

Professor John Zarnecki of The Open University led the Surface Science Package (SSP) on Huygens "Huygens has provided us with a rich seam of data to mine – and we shall be digging through it for some time to come. The Surface Science Package returned immediate information about Titan about the landing Huygens made but it is also a part of the longer term picture, piecing together the whole environment on Titan."

UK participation in the Cassini-Huygens mission was funded by the Science and technology Facilities Council.

By driving their computer models of Titan to match the data returned from the probe, planetary scientists can now visualise Titan as a working world. "Even though we have only four hours of data, it is so rich that after two years of work we have yet to retrieve all the information it

contains," says François Raulin, Huygens Interdisciplinary Scientist, at the Laboratoire de Physique et Chimie de l'Environnement, Paris.

The new details add greatly to the picture of Saturn's largest moon. "Titan is a world very similar to the Earth in many respects," says Jean-Pierre Lebreton, ESA Huygens Project Scientist.

The journey Huygens took to the surface is the subject of the most intense scrutiny, with many papers on the subject. When an anomaly robbed scientists of data from the Doppler Wind Experiment (DWE), it was followed by a painstaking analysis of data collected by radio telescopes on Earth that were tracking Huygens. Engineers and scientists succeeded in recovering the movement of the probe, providing an accurate wind profile and helping them place some of the images and data from Huygens into their correct context.

Now corroborating evidence, resulting from a thorough analysis of many instruments and engineering sensors on Huygens, is adding unprecedented detail to the movement of the probe during its descent.

The team combined temperature and pressure measurements from the Huygens Atmosphere Structure Instrument (HASI) with other measurements from the Surface Science Package (SSP), the Gas Chromatograph and Mass Spectrometer (GCMS), Descent Imager/Spectral Radiometer (DISR) and the Doppler Wind Experiment (DWE) to arrive at their trajectory.

Ralph Lorenz, Johns Hopkins University Applied Physics Lab, Maryland, a co-investigator on the SSP shows that the SSP revealed a turbulent atmospheric layer between 20 and 30 kilometres from the surface. By comparing the motions in this layer with those recorded on terrestrial balloons, Lorenz and his SSP colleagues suggest that the turbulence may have been associated with clouds.

Another report by Lorenz indicates that the density and temperature structure of the atmosphere can be corroborated using data from the engineering sensors on Huygens.

Huygens found that the atmosphere was hazier than expected because of the presence of dust particles – called 'aerosols'. Now, scientists are learning how to interpret their analysis of these aerosols, thanks to a special chamber that simulates Titan's atmosphere.

When the probe dropped below 40 kilometres in altitude, the haze cleared and the cameras were able to take their first distinct images of the surface. They revealed an extraordinary landscape showing strong evidence that a liquid, possibly methane, has flowed on the surface, causing erosion. Now, images from Cassini are being coupled with the 'ground truth' from Huygens to investigate how conditions on Titan carved out this landscape.

As the probe descended, Titan's winds carried it over the surface. A new model of the atmosphere, based on the winds, reveals that Titan's atmosphere is a giant conveyor belt, circulating its gas from the south pole to the north pole and back again.

Also, the tentative detection of an extremely low frequency (ELF) radio wave has planetary scientists equally excited. If they confirm that it is a natural phenomenon, it will give them a way to probe into the moon's subsurface, perhaps revealing an underground ocean.

Source: Science and Technology Facilities Council