Geophysical Research Abstracts
Vol. 17, EGU2015-162-2, 2015
EGU General Assembly 2015

The Huygens Descent Trajectory Working Group and the Reconstruction of the Huygens Probe Entry and Descent Trajectory at Titan

David H Atkinson (1,2), Bobby Kazeminejad (3), Jean-Pierre Lebreton* (4,5)

(1) University of Idaho, Department of Electrical and Computer Engineering, Moscow, Idaho, United States (atkinson@uidaho.edu), (2) NASA Jet Propulsion Laboratory / California Institute of Technology, (3) ESTEC/European Space Agency, Keplerlaan 1, 2200 AG Noordwijk, The Netherlands, (4) LESIA, Paris Observatory, CNRS, UPMC, Univ. Paris-Diderot, Meudon, France, (5) LPC2E, CNRS-Université d'Orléans

Cassini/Huygens, a flagship mission to explore the rings, atmosphere, magnetic field, and moons that make up the Saturn system, is a joint endeavor of NASA, the European Space Agency, and Agenzia Spaziale Italiana. Comprising two spacecraft - a Saturn orbiter built by NASA and a Titan entry/descent probe built by the European Space Agency - Cassini/Huygens was launched in October 1997 and arrived at Saturn in 2004. The Huygens probe parachuted to the surface of Titan in January 2005. During the descent, six science instruments provided measurements of Titan's atmosphere, clouds, and winds, and photographed Titan's surface.

It was recognized early in the Huygens program that to correctly interpret and correlate results from the probe science experiments and to provide a reference set of data for ground truth calibration of the Cassini orbiter remote sensing observations, an accurate reconstruction of the probe entry and descent trajectory and surface landing location would be necessary. The Huygens Descent Trajectory Working Group (DTWG) was chartered in 1996 as a subgroup of the Huygens Science Working Team. With membership comprising representatives from all the probe engineering and instrument teams as well as representatives of industry and the Cassini and Huygens Project Scientists, the DTWG presented an organizational framework within which instrument data was shared, the entry and descent trajectory reconstruction implemented, and the trajectory reconstruction efficiently disseminated. The primary goal of the Descent Trajectory Working Group was to develop retrieval methodologies for the probe descent trajectory reconstruction from the entry interface altitude of 1270 km to the surface using navigation data, and engineering and science data acquired by the instruments on the Huygens Probe, and to provide a reconstruction of the Huygens probe trajectory from entry to the surface of Titan that is maximally consistent with all available engineering and science data sets.

The official project entry and descent trajectory reconstruction effort was published by the DTWG in 2007. A revised descent trajectory was released in 2010 that accounts for updated measurements of Titan's pole coordinates derived from radar images of Titan taken during Cassini flybys after 2007. The effect of the updated pole positions on Huygens is a southward shift of the trajectory by about 0.3 degrees with a much smaller effect of less than 0.01 degree in the zonal (west to east) direction.

The revised Huygens landing coordinates of 192.335 degrees West and 10.573 degrees South with longitude and latitude residuals of respectively 0.035 degrees and 0.007 degrees, respectively, are in excellent agreement with results of recent landing site investigations using visual and radar images from the Cassini VIMS instrument.

Acknowledgements
*J.-P.L's work was performed while at ESA/ESTEC. DA and BK would like to express appreciation to the European Space Agency's Research and Scientific Support Department for funding the Descent Trajectory Working Group. The work of the Descent Trajectory Working Group would not have been possible without the dedicated efforts of all the Huygens principal investigators and their teams, and the science and engineering data provided from each experiment team, including M. Fulchignoni and the HASI Team, H. Niemann and the GCMS Team, J. Zarnecki and the SSP Team, M. Tomasko and the DISR Team, M. Bird and the DWE Team, and G. Israel and the ACP Team. Additionally, special thanks for many years of support to D.L. Matson, R.T. Mitchell, M. Pérez-Ayúcar, O. Witasse; J. Jones, D. Roth, N. Strange on the Cassini Navigation Team at JPL; A.-M. Schipper and P. Couzin at Thales Alenia; C. Sollazzo, D. Salt, J. Wheadon and S. Standley from the Huygens Ops Team;

and R. Trautner and H. Svedhem on the Radar Team at ESTEC.