Geophysical Research Abstracts,
Vol. 11, EGU2009-11804, 2009
EGU General Assembly 2009

Strategies for the return of science data from in situ vehicles at Titan

T. R. Spilker (1), K. R. Reh (1), C. Erd (2), J. O. Elliott (1), D. Mohr (1), and N. J. Strange (1)

(1) Jet Propulsion Laboratory, MS 301-165, Pasadena, CA 91109, United States (thomas.r.spilker@jpl.nasa.gov, 001-818-39), (2) ESA-ESTEC, Noordwijk, The Netherlands

Collaborative studies of the Titan Saturn System Mission (TSSM) in 2008 by ESA and NASA have included examination of strategies for optimizing the science return from that mission concept's proposed in situ elements. The current baselined mission concept calls for an orbiter provided and launched by NASA that would deliver to Titan and support two ESA-provided in situ elements, a lake lander whose science mission duration would be about nine hours, and a montgolfière (hot-air balloon) that would operate at ∼10 km altitude in Titan's lower atmosphere for 6-12 months. This architecture has much in common with the highly successful Cassini-Huygens mission. The short-lived lake lander in particular would have a mission profile very similar to that of the Huygens probe, with all science data communications occurring while the NASA orbiter is relatively near Titan. Practical mission profile options for the montgolfière include extended periods when the NASA orbiter is farther from Titan, reducing data rates. Over long periods of time the montgolfière cannot be considered fixed over one location on Titan's surface, and in fact is expected to circumnavigate Titan in less than six months. Thus the schedule of communications windows between the in situ elements and the orbiter cannot be precisely determined far in advance, varying as the balloon literally "rides the wind".

Other issues played critical roles in evaluating the many options available early in the studies. Some options for the timing of delivery of the in situ elements yielded more mass capability available for those elements, but their reduced data return due to orbit geometry outweighs the added mass capability. Another delivery option, delivery from Titan orbit, yields reduced delivery mass capability but was thought (before studies) to offer better data relay capability. Studies revealed that this strategy actually decreases the return from the lake lander as compared to options delivering the in situ elements from hyperbolic flybys.

This presentation will describe options examined in the TSSM communications strategy studies. Particular attention is given to that chosen for the baseline strategy, with potential returned data volumes that provide generous margins over anticipated data requirements. Many of the results are not unique to Titan alone, but are applicable to in situ missions at any satellite of a giant planet.

These collaborative studies were funded by, and performed under the cognizance of, NASA and ESA.