

December 7, 2006

TO: Robert Mitchell

FROM: Dennis L. Matson

SUBJECT: T32: Selection of Flyby Plan

Two candidate plans have been developed for the scientific observations to be carried out on Titan flyby T32. One plan features the collection of INMS data and the other emphasizes ORS observations, in particular a solar occultation egress measurement by UVIS and VIMS. Attempts to “merge” the plans in some way were not successful. Furthermore, TOST was unable to form a consensus as to which plan to choose.

The two plans offer excellent science at Titan. With respect to Titan’s surface and sensible atmosphere it is difficult to find a scientific criterion for choosing one over the other. However, once one considers the mission as a whole, the situation becomes more tractable.

Recalling the scientific objectives of the mission in the NASA AO for Cassini, we have:

Titan

- Determine abundances of atmospheric constituents (including any noble gases; establish isotope ratios for abundant elements; constrain scenarios of formation and evolution of Titan and its atmosphere
- Observe vertical and horizontal distributions of trace gases; search for more complex organic molecules; investigate energy sources for atmospheric chemistry; model the photochemistry of the stratosphere; study formation and composition of aerosols;
- Measure winds and global temperatures; investigate cloud physics, general circulation and seasonal effects in Titan’s atmosphere; search for lightning discharges;
- Determine the physical state, topography and the composition of the surface; infer the internal structure of the satellite;
- Investigate the upper atmosphere, its ionization, and its role as a source of neutral and ionized material for the magnetosphere of Saturn

Magnetosphere

- Determine the configuration of the nearly axially symmetric magnetic field and its relation to the modulation of Saturn Kilometric Radiation (SKR).
- Determine current systems, composition, sources, and sinks of magnetosphere charged particles.
- Investigate wave-particle interactions and dynamics of the dayside magnetosphere and the magnetotail of Saturn and their interactions with the solar wind, the satellites, and the rings.
- Study the effect of Titan’s interaction with the solar wind and magnetospheric plasma.
- Investigate interactions of Titan’s atmosphere and exosphere with the surrounding plasma.

Both plans address, to some degree, the 1st, 2nd, and 5th Titan objectives. With respect to the magnetospheric objectives, the INMS plan addresses the 4th and 5th objectives. The ORS plan does not significantly address any of the magnetospheric objectives. This,

then, provides a clear way to resolve the “tie” and provides a reason for selecting the INMS plan because it addresses more of the mission’s objectives. Thus, T32 will use the INMS plan.

Another factor which was considered, but not used in this case as a basis for selection, is that this may be the only opportunity for INMS to sample the north polar region. It is important to do this now because there is a strong desire to design the extended mission so that RADAR can obtain a significant amount of SAR coverage in Titan’s southern hemisphere. Thus, such northern opportunities for INMS may not exist in the extended mission. On the other hand, though it is not assured, there are foreseeable opportunities that probably will exist in the extended mission for additional solar occultations, including occultations of Titan’s northern polar region.