

**LATEST CASSINI RADAR RESULTS FROM T41 TITAN FLYBY, FEBRUARY 2008 : HUYGENS LANDING SITE AND HOTEI ARCUS** R. D. Lorenz<sup>1</sup> (*Ralph.lorenz@jhuapl.edu*), Y. Z. Anderson<sup>2</sup>, B. Stiles<sup>2</sup>, S. D. Wall<sup>2</sup>, H. A. Zebker<sup>3</sup>, L. C. Wye<sup>3</sup>, R. L. Kirk<sup>4</sup>, J. I. Lunine<sup>5</sup> and the Cassini RADAR Team, <sup>1</sup>JHU Applied Physics Laboratory, Laurel, MD 20723, <sup>2</sup>Jet Propulsion Laboratory, Pasadena, CA., USA, <sup>3</sup>Stanford University, Stanford, CA <sup>4</sup>USGS, Flagstaff, AZ, Univ. Arizona, <sup>5</sup>LPL, U. Arizona. Tucson, AZ.

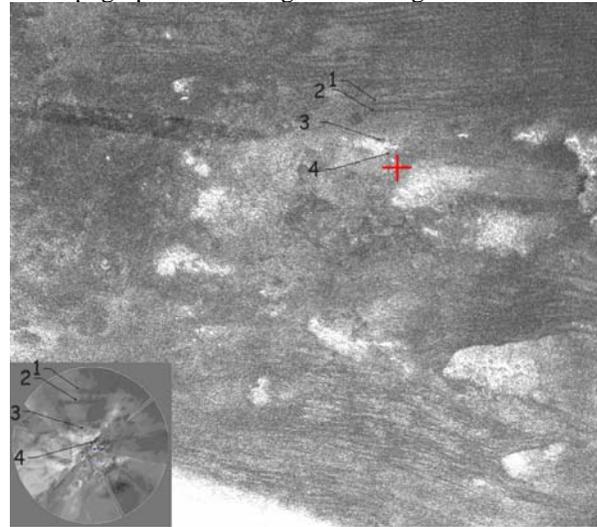
**Introduction:** We will make a preliminary report of results from the latest radar pass that occurs before the LPSC meeting, T41 on February 22, 2008. This pass includes high-resolution SAR imaging of the Huygens landing site, three years after the probe's arrival, as well as the first SAR of the Hotei Arcus 'smile' that bounds an anomalous, possibly volcanic, 5-micron bright region. We also summarize data on the landing site from prior encounters, including new information on the topography around the landing site.

**Huygens Landing Site:** Imaging the Huygens landing site was always a priority for Cassini's remote sensing instruments, and because of its favorable geometry, T41 was allocated to RADAR for this purpose during pre-SOI planning. However, improved performance of RADAR imaging at Titan in fact permitted the landing site to be also observed earlier in the tour, on a stretched portion of the T8 SAR swath in October 2005 [1,2]. Despite the degraded resolution at this more distant opportunity, the imaging was highly successful. Correlation of the SAR image, and in particular two sand dunes, with the mosaics acquired by the probe's descent camera DISR, allowed the landing site to be located in the radar image, and thereby in an astronomically-determined reference frame.

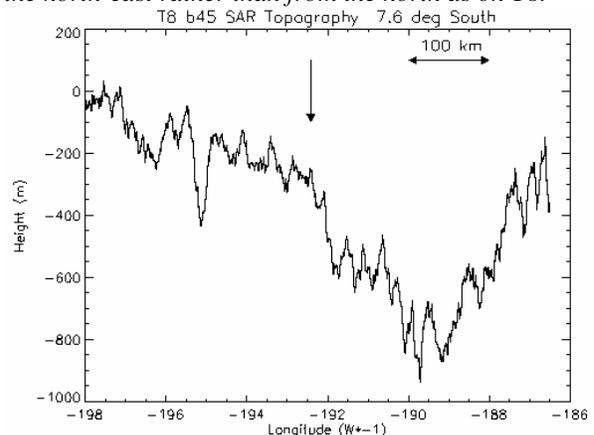
The area is characterized by long sand dunes [3] as well as bright mountains [4] that appear in isolated patches or in chains ~100km long. Overall the site has intermediate/bright radar properties ( $\sigma_0 \sim 0.4$ ,  $T_b \sim 83K$  e.g. [5].) The T41 observation will be at shorter range, and so should achieve higher spatial resolution, although perhaps with fewer looks. The different look direction (from NE on T41 rather than N) may yield a different appearance of some features (e.g. a comparable change in geometry on T21/T8 showed dunes merely as dark streaks rather than showing topographic glints seen broadside-one.) This geometry diversity may refine interpretations of some features. It is expected that accurate feature position matches will nonetheless be possible, and the 2.5-year baseline between T8 and T41 will allow improved measurement of Titan's rotation state [6,7].

Large-scale liquid flow from the west is interpreted as being a major agent of geological change at the landing site [2] and topographic information using a new technique that allows a profile to be reconstructed

within a SAR image [8] seems to indicate that slopes trend in this direction. T41 data will vastly improve our topographic knowledge of this region.



**Figure 1.** Part of the T8 SAR image from [1] showing the landing site (red cross). Features that match with the Huygens DISR mosaic (inset, lower left) are numbered: dunes 1 & 2 are 30km to the north of the landing site. Part of this scene will be re-imaged at higher resolution by T41, with a look direction from the north-east rather than from the north as on T8.



**Figure 2.** 'SARtopo' profile along T8 (October 2005) about 150km to the north of the landing site, whose longitude is flagged by vertical arrow. The topography generally trends downwards to the East : height is relative to 2575.0km from Titan center.

**Hotei Arcus:** A region that is bright at 5-microns was identified in VIMS data [9] to the southeast of Xanadu, and is bounded by a near-semicircular bright arc seen in ISS data at 940nm, named Hotei Arcus. The feature is at  $\sim 25^{\circ}\text{S}$ ,  $70\text{-}80^{\circ}\text{W}$  (see map below). Although microwave radiometry [9] showed the 5-micron brightness was not at that time due to a thermodynamically hot surface, there is some evidence (e.g. [10]) that small features first identified in radar data as probable cryovolcanic lava flows [11] may be compositionally bright at 5 microns too and thus Hotei Arcus may bound a recently-active volcanic region. Furthermore, it has been suggested that the near-IR brightness of this area may be time-variable [12]. T41 will be an important first high-resolution radar look at

a large area that has these unusual near-IR characteristics.

**References:** [1] Lunine, J. I. et al., *Icarus*, in press [2] Soderblom, L. A., et al., *Planetary and Space Science*, 55, 2025-2036 (2007) [3] Lorenz, R.D. et al., *Science*, 312, 724-727, (2006) [4] Radebaugh, J. et al., *Icarus*, 192, 77-91, 2007 [5] Paganelli et al, *Icarus*, 191, 211-222 (2007) [6] Stiles, B., *AJ*, submitted [7] Lorenz, R. et al., *Science*, submitted [8] Stiles, B., in preparation [9] Barnes, J. W. et al., *Science*, 310, 92-95, (2005) [10] Le Corre, LPSC XXXVIII Abstract #1828 (2007) [11] Lopes, R. et al., *Icarus*, 186, 395-412, (2007). [12] Nelson, R. M. et al., LPSC XXXVIII Abstract #2158 (2007)

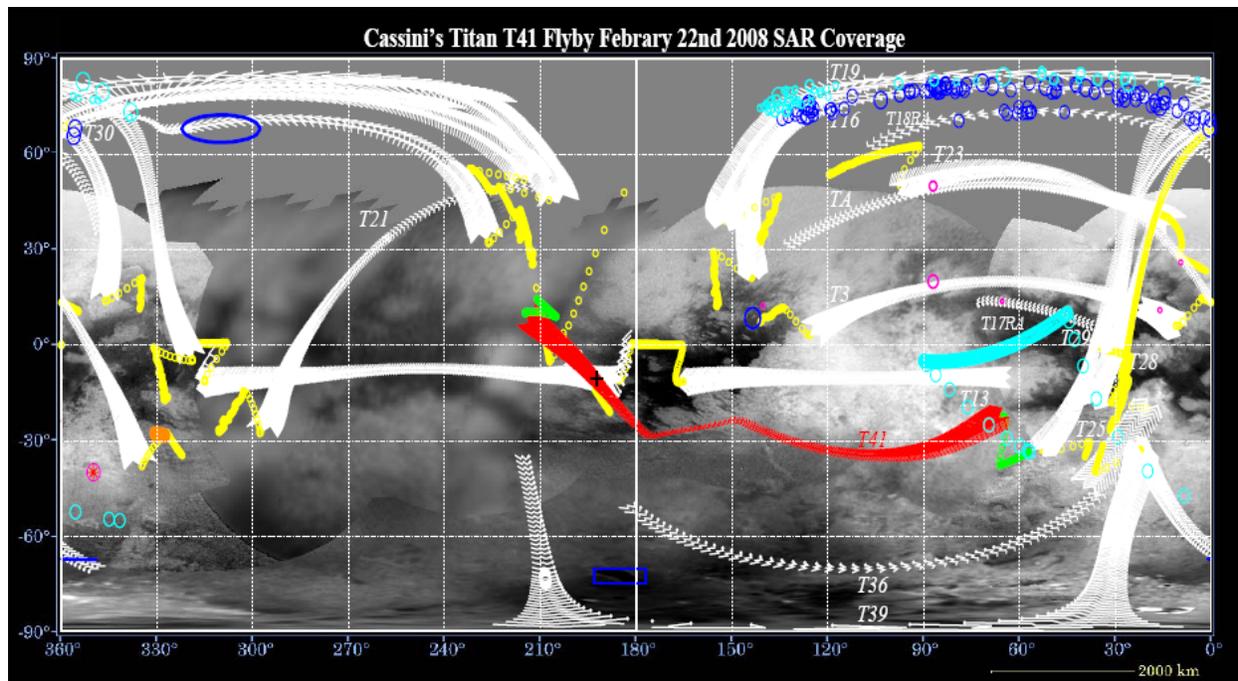


Figure 3. The T41 SAR swath is shown in red (inbound from right) on this ISS near-IR basemap, with prior SAR shown as white swaths. Note that T41 is unique in switching from right-look to left-look midway through the pass in order to acquire priority targets. Yellow streaks are slews and altimetry tracks from prior flybys – T41 outbound SAR will image previously-profiled areas, facilitating their interpretation. Huygens landing site is shown by a cross; lakes by blue circles and boxes, some other features of interest by cyan marks. A High-altitude SAR observation (lower resolution, from a large distance using beam 3 only) is shown as a light blue arc, and the altimetry to be acquired by T41 is shown in green. Hotei Arcus is just below the legend 'T13' on this map.