CASSINI ISS OBSERVATIONS OF TITAN'S TRAILING HEMISPHERE. J. E. Perry[1], E. P. Turtle[2], A. S. McEwen[1], D. D. Dawson[1], and C. C. Porco[3] [1]Lunar and Planetary Lab., Univ. of Arizona, 1541 E. University Blvd., Tucson, AZ, 85721, [2]John Hopkins Univ. Applied Physics Lab., 11100 John Hopkins Rd., Laurel, MD, 20723, [3]CICLOPS, Space Science Institute, 4750 Walnut St., Boulder, CO, 80301. perry@pirl.lpl.arizona.edu

Introduction: Cassini's early 2007 flybys of Titan have provided an opportunity to image the trailing hemisphere of this fascinating satellite. Until February 2007, the trailing hemisphere had been poorly resolved, with the best images having pixel scales greater than 35 km, taken in June 2004. Starting with flyby "T25" (February 22, 2007) and running through T32 (June 13, 2007), Cassini's Imaging Science Subsystem (ISS) and Visual and Infrared Spectrometer (VIMS) observed the trailing hemisphere in daylight, filling in a gap in imaging coverage between 210° and 300° West. The sub-spacecraft latitude during these encounters from 2.3° to 51.6° North, while the sub-spacecraft longitude ranged from 215° to 237° West. The sub-spacecraft point for the ISS observations shifted to south and east with each successive encounter during this sequence.

Imaging Strategy and Processing: To acquire images of Titan's surface, a narrowband filter centered at 938 nm (CB3), in the middle of a methane absorption band, was used in conjunction with a filter centered at 619 nm (MT1), outside of a methane window [1,2]. By either ratioing or subtracting all or a portion of the MT1 image from a sum of the corresponding CB3 frames, a final product with greater contrast than the original CB3 frames can be achieved. These narrow-angle camera observations provide images with pixel scales ranging from 500 m to 2 km, although the actual resolution is likely several times coarser due to atmospheric scattering. A more complete discussion of the processes used is given in [3].

Observations: The region observed (Fig. 1a) covers three major albedo terrains: the 1700-km bright region known as Adiri (Fig. 1b and bottom center in Fig. 1a), equatorial dark terrain (Belet and Shangri-la), and northern and southern mid-latitude bright terrain. Cassini's RADAR captured a SAR (synthetic aperture radar) swath over Adiri and Belet during T8 (October 28, 2005), showing that the very dark terrain in these regions is filled with longitudinal dunes, akin to those seen in many deserts on Earth [4]. The bright terrain in Adiri consists of bright plains and linear mountain chains [5]. The mountains chains are only delineated in ISS images where they are surrounded by the small, dark patches of longitudinal dunes in the center of Adiri. The dark regions Belet and Shangri-la are dotted with numerous bright features known as faculae (discussed below). The mid-latitude bright regions have very low albedo contrasts with only a few albedo structures visible, such as the dark lineaments seen in the northern mid-latitudes (discussed below) and a chaotic mix of bright and intermediate albedo features near 23° North, 205° West (Fig. 1c).

Dark lineaments. A series of parallel, NW-SE trending, dark lineaments in Titan's northern mid-latitude bright terrain was first observed during the T25 encounter (Fig. 1d). These lineaments range in length from 160 km to 540 km and average approximately 25 km in width. While the northern termini of these features don't have any unique morphology, the southern ends of these features often appear to branch or widen in width. In one case, in a lineament centered at 41° North, 246° West, the lineament appears to bifurcate leaving a small, 26-km long, 18-km wide bright "island" in the middle. The morphology of these features suggests that they were created through fluvial processes, but it is not known if liquid still flows within these features, or whether the flow is from the north or south. However, their parallel nature suggests that these features maybe tectonic structures, graben partially filled with organic sediment. Co-analysis with RADAR observations of these structures may help improve our understanding of how these strange structures formed.

Circular Features. Previous ISS observations of Titan have revealed several circular structures that may be impact features [1]. Several of these have been revealed by RADAR to be impact structures, including the multi-ring basin Menrva and the 80-km-diameter crater Sinlap [6]. However, due to the lack of topographic shading in ISS Titan data, we can not conclusively say that the other circular features are impact structures. However, as more of these features are observed by both RADAR and ISS, we can better get a handle of how to recognize impact structures in the ISS data and tell them apart from possible cryovolcanic features.

In ISS observations of the trailing hemisphere, two Suspiciously Circular Features (SCFs) have been observed. The first is a 95-km-diameter structure located at 7.2° North, 198.8° West, within the dark terrain north of Adiri (Fig. 1e). This feature bears a striking resemblance to Sinlap, with a dark interior, an intermediate albedo ring surrounding the dark material, and a bright, irregular structure surrounding that. Extrapolating from Sinlap, the dark material likely represents the organic sediment-covered crater floor, the intermediate albedo ring represents the crater wall and rougher terrain along the periphery of the crater floor, and the bright irregular structure represents the raised rim and ejecta blanket of the crater.

The second SCF is a 75-km structure located at 39.6° North, 214.6° West (Fig. 1f), within the northern mid-latitude bright terrain. This feature consists of a dark ring surrounding a bright spot 20 km wide. If this feature is an impact crater, then the bright spot may represent the crater's central peak while the dark ring represents the sediment-covered crater floor.

Faculae. Numerous bright features, or faculae, are visible within the Belet and Shangri-la dark terrain regions. These faculae likely represent positive relief features poking up above the surrounding dunes. In several places, the faculae appear elongated with preferred orientation, such as those south of Adiri shown in Fig. 1g. These faculae act as preferred wind direction indicators, as longitudinal dunes wrap around the faculae [4]. In those south of Adiri, this would suggest wind flowing from northwest to southeast, as if Titan's winds are diverting south around Adiri. Several faculae lined up in chains north of Adiri also warrant further investigation.

Conclusion: Cassini's observations of Titan's trailing hemisphere have revealed a number of intriguing features. Some of these are variants of terrain types observed in other regions; others are quite unique (like the dark lineaments. Additional observations planned for two upcoming encounters in May and June 2007 may provide additional insights into the southern mid-latitudes that have only been imaged at high emission angles thus far.

References: [1] Porco C. C. et al. (2005) *Nature, 434,* 159-168. [2] Porco, C.C. et al. (2004) *Space Sci. Rev. 115*, 363-497. [3] Perry, J. E. et al. (2005) *LPS XXXVI,* Abstract #2312. [4] Lorenz, R. D. et al. (2006) *Science*, *312*, 724-727. [5] Radebaugh, J. et al. (2006) LPS XXXVII, Abstract #1007. [6] Lorenz, R. D. et al. (2007) *GRL 34,* doi:10.1029/2006GL028971..

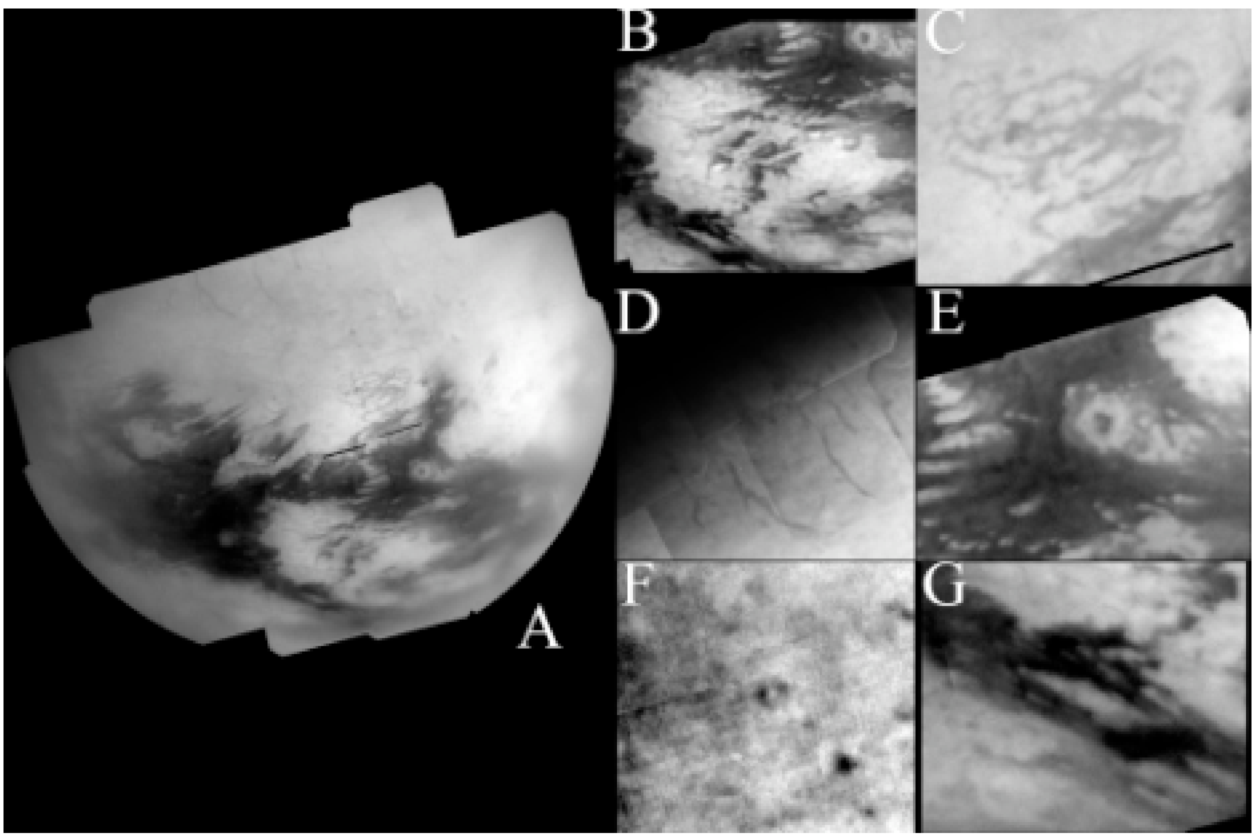

Figure 1: A summary of observations from Cassini's early 2007 encounters with Titan. Inset A shows a 25-image mosaic from the T28 encounter (April 10, 2007) covering much of the region observed during these encounters. Insets B-G highlight specific features observed during these encounters and are discussed in the text.