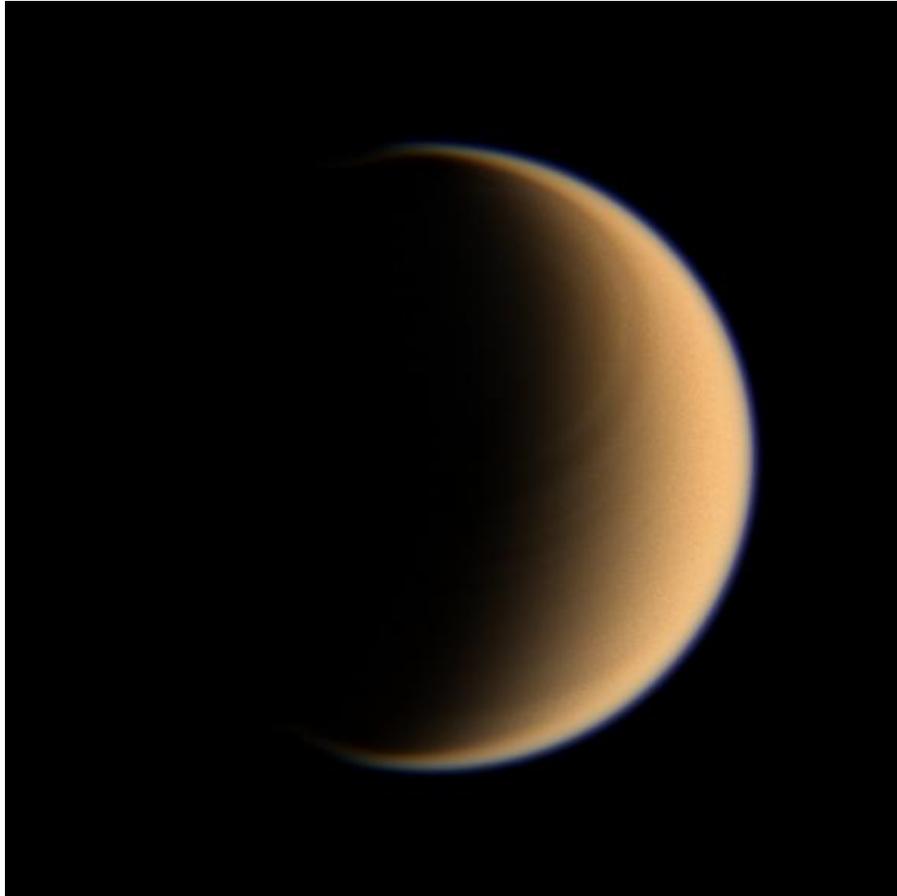


C A S S I N I



TITAN 041TI(T27)
MISSION DESCRIPTION

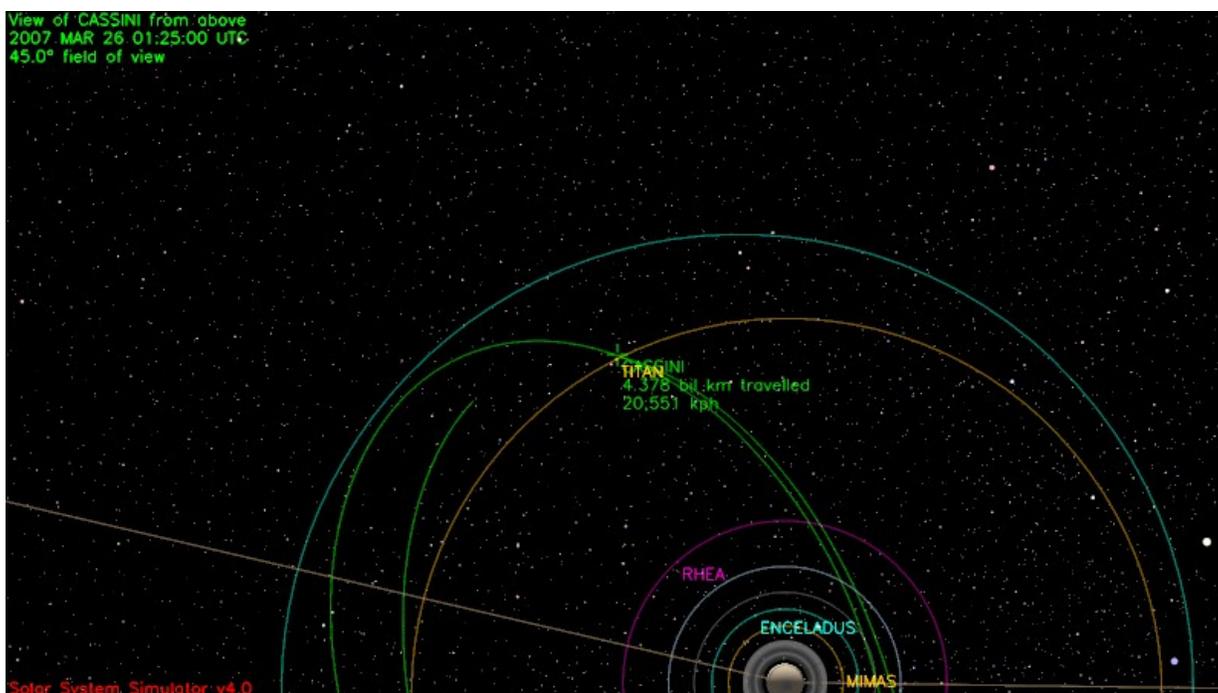
March 2007

Jet Propulsion Laboratory
California Institute of Technology

1.0 OVERVIEW

Just 16 days after Titan-26, Cassini returns to Titan for its twenty-eighth targeted encounter. The closest approach to Titan occurs on Monday, March 26, at 2007-0085T00:23 spacecraft time at an altitude of 1010 kilometers (~628 miles) above the surface and at a speed of 6.2 kilometers per second (13,869 mph). The latitude at closest approach is 41.1 degrees N and the encounter occurs on orbit number 41.

This encounter is set up with two maneuvers: an apoapsis maneuver on March 17, and an approach maneuver, scheduled for March 22. This is the third in a series of outbound Titan encounters (until T34) and occurs about 3 days after Saturn closest approach



1.1 ABOUT TITAN

If Titan were a planet, it would likely stand out as the most important planet in the solar system for humans to explore. Titan, the size of a terrestrial planet, has a dense atmosphere of nitrogen and methane and a surface covered with organic material. It is Titan that is arguably Earth's sister world and the Cassini-Huygens mission considers Titan among its highest priorities.

Although it is far colder and lacks liquid water, the chemical composition of Titan's atmosphere resembles that of early Earth. This, along with the organic chemistry that takes place in Titan's atmosphere, prompts scientists to believe that Titan could provide a laboratory for seeking insight into the origins of life on Earth. Data from the Huygens probe, which touched down on Titan's surface in January 2005, and the Cassini orbiter has shown that many of the processes that occur on Earth also apparently take place on Titan – wind, rain, volcanism, tectonic activity, as well as river channels, and drainage patterns all seem to contribute in shaping Titan's surface. However, at an inhospitable negative 290 degrees Fahrenheit (-179 degrees Celsius), the chemistry that drives these processes is fundamentally different from Earth's. For example it is methane that performs many of the same functions on Titan that water does on Earth.

The Huygens probe landed near a bright region now called Adiri, and photographed light hills with dark river beds that empty into a dark plain. It was believed that this dark plain could be a lake or at least a muddy material, but it is now known that Huygens landed in the dark region, and it is solid. Scientists believe it only rains occasionally on Titan, but the rains are extremely fierce when they come.

Only a small number of impact craters have been discovered. This suggests that Titan's surface is constantly being resurfaced by a fluid mixture of water and possibly ammonia, believed to be expelled from volcanoes and hot springs. Some surface features, such as lobate flows, appear to be volcanic structures. Volcanism is now believed to be a significant source of methane in Titan's atmosphere. However, there are no oceans of hydrocarbons as previously hypothesized. Dunes cover large areas of the surface.

The Cassini-Huygens mission, using wavelengths ranging from ultraviolet to radio, is methodically and consistently revealing Titan and answering long-held questions regarding Titan's interior, surface, atmosphere, and the complex interaction with Saturn's magnetosphere. While many pieces of the puzzle are yet to be found, with each Titan flyby comes a new data set that furthers our understanding of this world as we attempt to constrain scenarios for the formation and evolution of Titan and its atmosphere.

1.2 TITAN-27 SCIENCE HIGHLIGHTS

- RSS: A T27 ingress/egress occultation of Titan's atmosphere will provide a high-spatial-resolution electron number density profile of the ionosphere, temperature-pressure and absorption profiles of the neutral atmosphere, as well as information about the small-scale structure of the atmosphere. The ingress latitude is -71.3 deg and the egress latitude is 54 deg. The previous two RSS Titan occultations had ingress latitudes of -29 deg and -30.9 deg. The previous egress latitudes were -49 deg and -32.5 deg. T31 will be the fourth and final RSS Titan occultation and it will have an ingress latitude of -75.4 deg and an egress latitude of 74.6 deg

Inbound and outbound RSS bistatic scattering observations of Titan's surface will provide information about the dielectric constant, nature, and roughness of the region probed. This RSS bistatic observation is in the deep southern hemisphere, over one of the very large dark regions shown in the imaging data. In the north, these large dark regions have turned out to be seas and lakes.

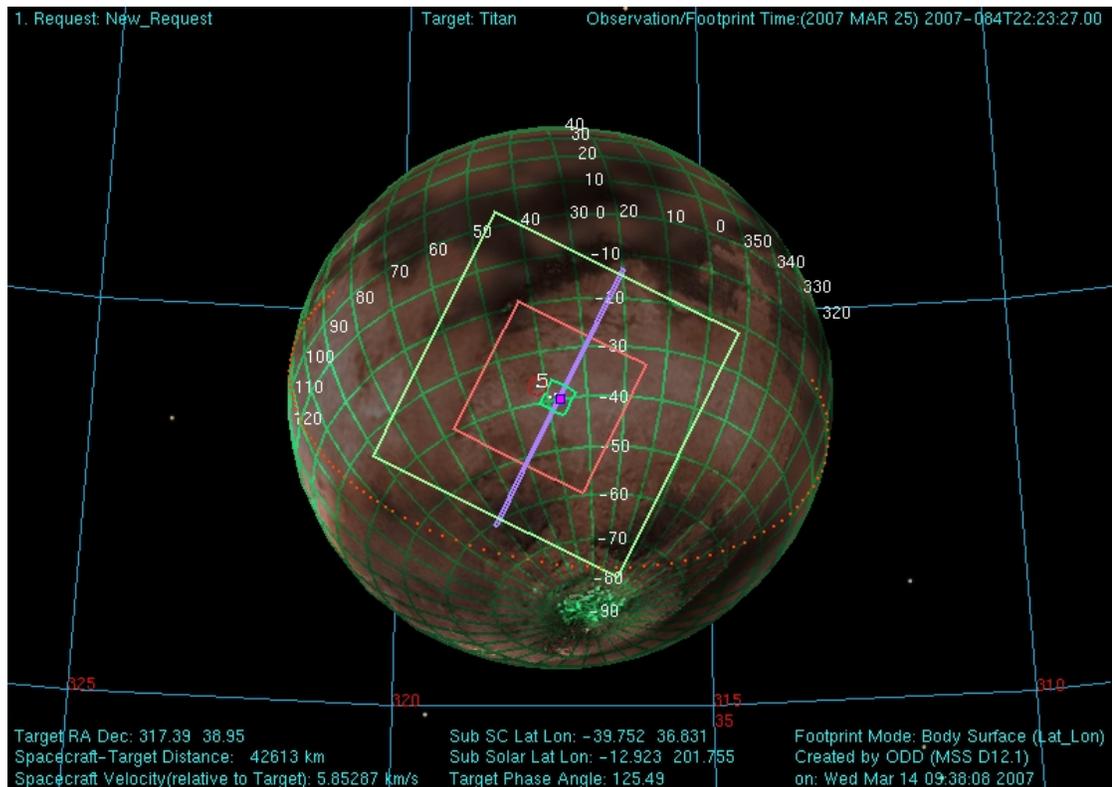
- UVIS: Several slow scans across Titan's visible hemisphere to form spectral images
- ISS: Extending coverage north of Belet and Adiri.
- CIRS: Inbound CIRS is doing a far-IR composition integration and a mid-IR limb composition integration. Outbound CIRS is doing a far-IR limb composition integration, far-IR surface temperature scan, and a mid-IR composition integration.

1.3 SAMPLE SNAPSHOTS

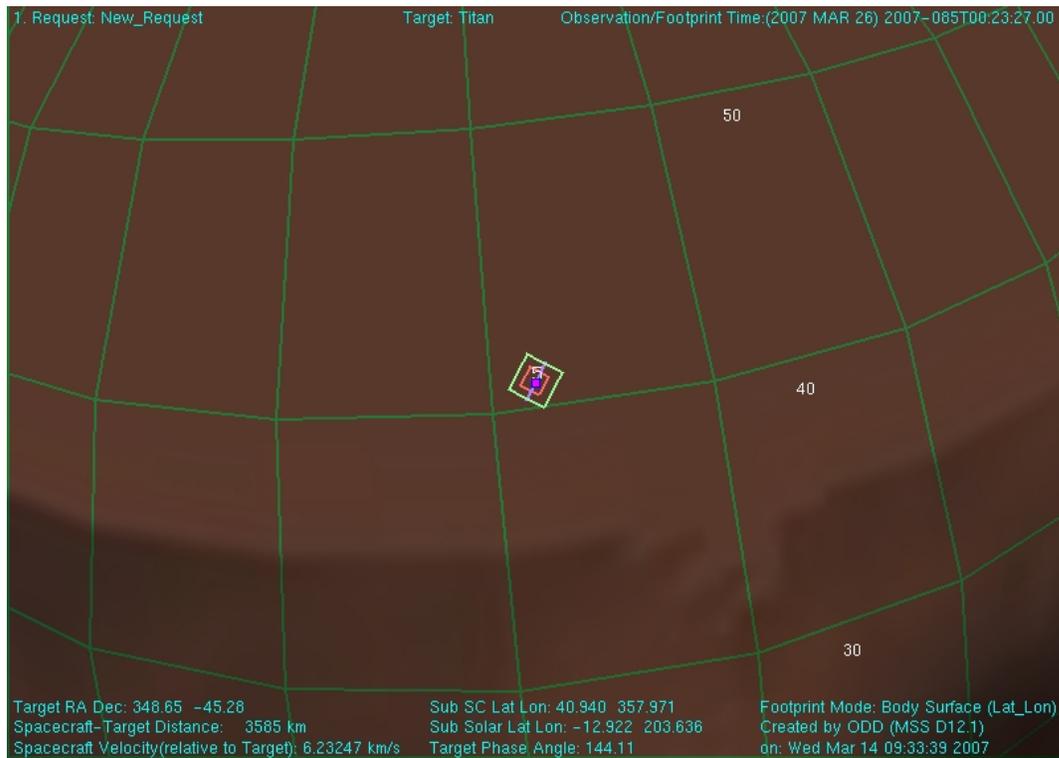
Three views of Titan from Cassini before, during, and after closest approach to Titan are shown below. The views are oriented such that the direction towards the top of the page is aligned with the Titan North Pole. The optical remote sensing instruments' fields of view are shown assuming they are pointed towards the center of Titan. The sizes of these fields of view vary as a function of the distance between Cassini and Titan. A key for use in identifying the remote sensing instruments fields of view in the figures is listed at the top of the next page.

Key to ORS Instrument Fields of View in Figures

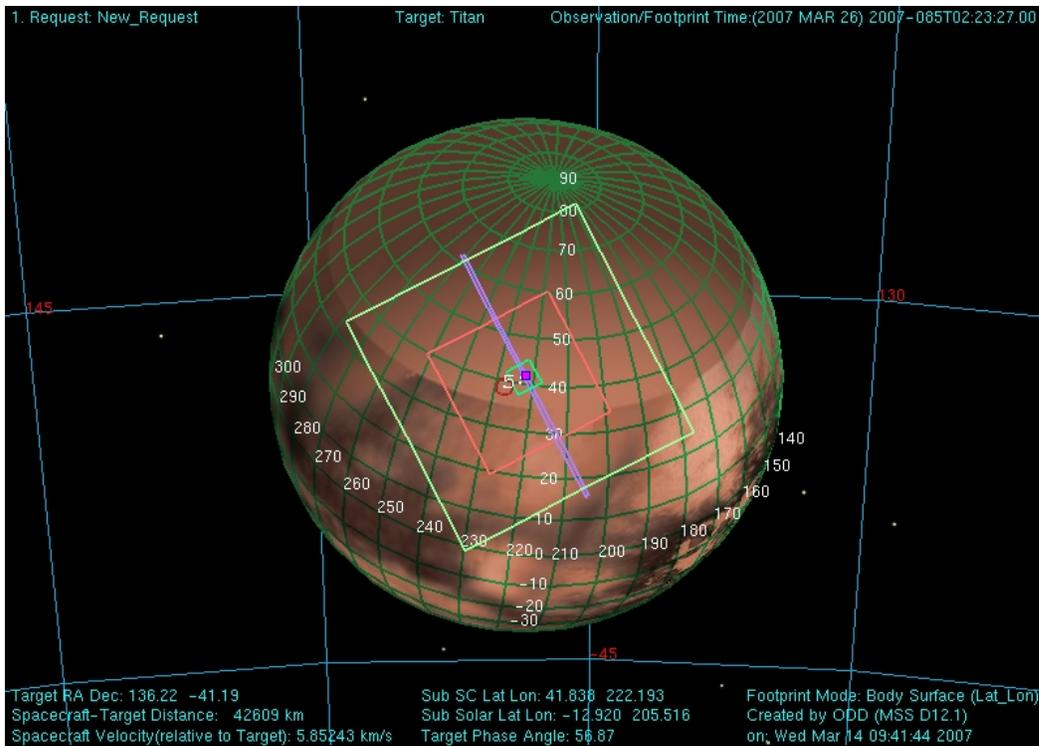
Instrument Field of View	Depiction in Figure
ISS WAC (imaging wide angle camera)	Largest square
VIMS (visual and infrared mapping spectrometer)	Next largest pink square
ISS NAC (imaging narrow angle camera)	Smallest green square
CIRS (composite infrared spectrometer) – Focal Plane 1	Small red circle near ISS_NAC FOV
UVIS (ultraviolet imaging spectrometer)	Vertical purple rectangle centered within largest square



View of Titan from Cassini 2 hours before Titan-27 closest approach



View of Titan from Cassini at Titan-27 Closest Approach



View of Titan from Cassini 2 hours after Titan-27 closest approach

The T27 timeline is as follows:

Cassini Titan-27 Timeline - March 2007

Colors: yellow = maneuvers; blue = geometry; pink = T27-related; green = data playbacks

Orbiter UTC	Ground UTC	Pacific Time	Time wrt T27	Activity	Description
048T10:52:00	Feb 17 12:02	Sat Feb 17 04:02 AM	T27-36d14h	Start of Sequence S28	Start of Sequence which contains Titan-27.
081T14:30:00	Mar 22 15:40	Thu Mar 22 07:40 AM	T27-03d10h	OTM #100 Prime	Titan-27 targeting maneuver.
081T15:46:00	Mar 22 16:56	Thu Mar 22 08:56 AM	T27-03d09h	Descending Ring Plane Crossing	
082T11:57:00	Mar 23 13:07	Fri Mar 23 05:07 AM	T27-02d12h	Saturn Periapse	Saturn periapse, r = 12.1 Rs, lat= -54 deg, phase = 83 deg
082T23:20:00	Mar 24 00:30	Fri Mar 23 04:30 PM	T27-02d01h	OTM #100 Backup	
084T08:50:00	Mar 25 10:00	Sun Mar 25 02:00 AM	T27-15h33m	Turn cameras to Titan	
084T08:50:00	Mar 25 10:00	Sun Mar 25 02:00 AM	T27-15h33m	Deadtime	17 minutes 27 seconds long; used to accommodate changes in flyby time
084T09:07:27	Mar 25 10:17	Sun Mar 25 02:17 AM	T27-15h16m	Titan atmospheric Observations	Obtain information on the thermal structure of Titan's stratosphere.
084T11:23:27	Mar 25 12:33	Sun Mar 25 04:33 AM	T27-13h00m	Titan atmospheric Observations	Obtain information on trace constituents in Titan's stratosphere.
084T14:23:27	Mar 25 15:33	Sun Mar 25 07:33 AM	T27-10h00m	ISS Imaging	WAC photometry.
084T15:23:27	Mar 25 16:33	Sun Mar 25 08:33 AM	T27-09h00m	Titan atmospheric Observations	Obtain information on trace constituents in Titan's stratosphere.
084T19:23:27	Mar 25 20:33	Sun Mar 25 12:33 PM	T27-05h00m	ISS Imaging	Search for and monitor lightning/aurora.
084T20:23:27	Mar 25 21:33	Sun Mar 25 01:33 PM	T27-04h00m	Transition to Thruster Control	
084T20:49:27	Mar 25 21:59	Sun Mar 25 01:59 PM	T27-03h34m	Titan Atmospheric Observations	Several slow scans across Titan's visible hemisphere to form spectral images.
084T23:12:27	Mar 26 00:22	Sun Mar 25 04:22 PM	T27-01h11m	New Waypoint	
084T23:25:27	Mar 26 00:35	Sun Mar 25 04:35 PM	T27-00h58m	RSS Observations	Bistatic scattering measurements at three radio wavelengths to determine the physical properties of Titan's surface, including reflectivity, dielectric constant, and roughness.
085T00:00:03	Mar 26 01:10	Sun Mar 25 05:10 PM	T27-00h23m	RSS Occultation	RSS occultation of Titan's atmosphere on ingress, atmosphere and ionosphere on egress.
085T00:23:27	Mar 26 01:33	Sun Mar 25 05:33 PM	T27+00h00m	Titan-27 Flyby Closest Approach Time	Altitude = 980 km (609 miles), speed = 6.2 km/s (13,869 mph); 150 deg phase at closest approach
085T00:28:00	Mar 26 01:38	Sun Mar 25 05:38 PM	T27+00h05m	Ascending Ring Plane Crossing	
085T00:35:25	Mar 26 01:45	Sun Mar 25 05:45 PM	T27+00h12m	RSS Observations	Bistatic scattering measurements at three radio wavelengths to determine the physical properties of Titan's surface, including reflectivity, dielectric constant, and roughness.
085T01:23:27	Mar 26 02:33	Sun Mar 25 06:33 PM	T27+01h00m	New Waypoint	
085T01:56:27	Mar 26 03:06	Sun Mar 25 07:06 PM	T27+01h33m	Titan Atmospheric Observations	Vertical sounding of stratospheric compounds on Titan, including H2O. Integrations at 2 locations on the limb displaced vertically.
085T02:38:27	Mar 26 03:48	Sun Mar 25 07:48 PM	T27+02h15m	Titan Atmospheric Observations	Obtain information on surface & tropopause temperatures
085T03:23:27	Mar 26 04:33	Sun Mar 25 08:33 PM	T27+03h00m	Titan Atmospheric Observations	Several slow scans across Titan's visible hemisphere to form spectral images
085T08:23:27	Mar 26 09:33	Mon Mar 26 01:33 AM	T27+08h00m	ISS Imaging	Global map and WAC photometry.
085T09:23:27	Mar 26 10:33	Mon Mar 26 02:33 AM	T27+09h00m	Titan Atmospheric Observations	Obtain information on trace constituents in Titan's stratosphere.
085T11:23:27	Mar 26 12:33	Mon Mar 26 04:33 AM	T27+11h00m	ISS Imaging	Monitoring for surface/atmosphere changes
085T13:23:27	Mar 26 14:33	Mon Mar 26 06:33 AM	T27+13h00m	Titan Atmospheric Observations	Global mapping.
085T21:38:27	Mar 26 22:48	Mon Mar 26 02:48 PM	T27+21h15m	Deadtime	13 minutes 33 seconds; used to accommodate changes in flyby time
085T21:52:00	Mar 26 23:02	Mon Mar 26 03:02 PM	T27+21h29m	Turn to Earth-Line	
085T22:22:00	Mar 26 23:32	Mon Mar 26 03:32 PM	T27+21h59m	Playback of T27 Data	Goldstone 70M

1.4 FLYBY GEOMETRY

A flyby geometry table is not available for T-27.

1.5 PLAYBACK TIMELINE

A playback timeline is not available for T-27.