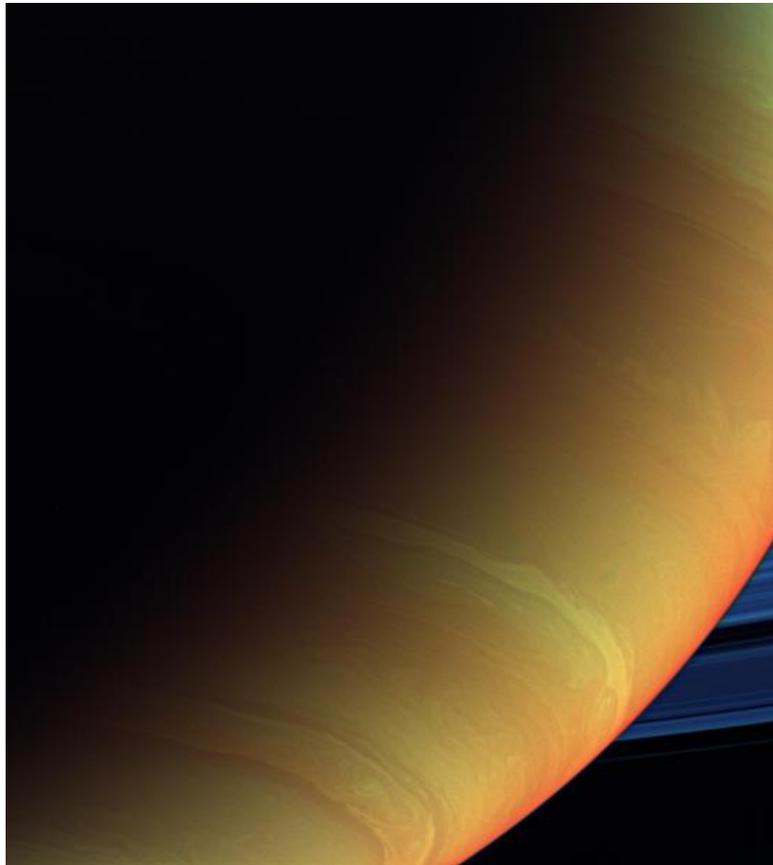


C A S S I N I



TITAN 038TI (T24)
MISSION DESCRIPTION

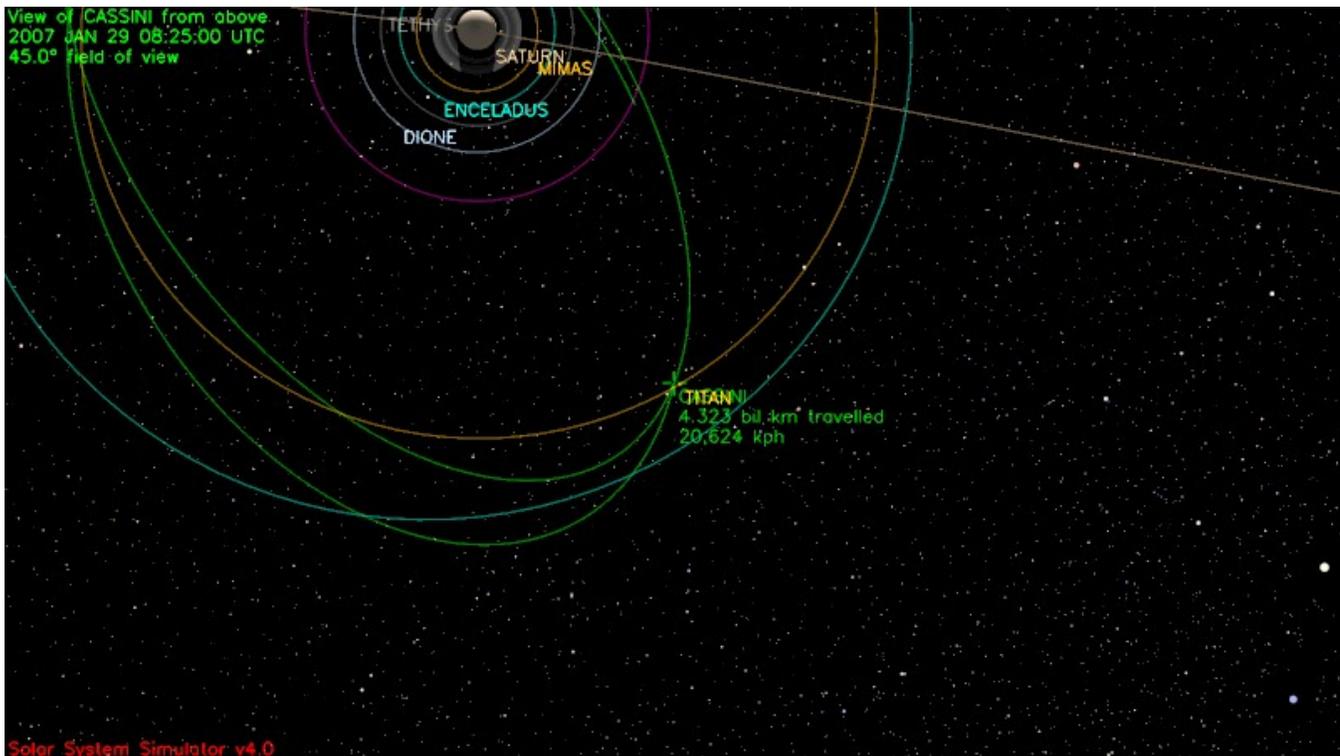
January 2007

Jet Propulsion Laboratory
California Institute of Technology

1.0 OVERVIEW

Just 16 days after Titan-23, Cassini returns to Titan for its twenty-fifth targeted encounter. The closest approach to Titan occurs on Monday, January 29, at 2007-029T07:15:55 spacecraft time (January 29 at 12:24AM Pacific Time) at an altitude of 2631 kilometers (about 1634 miles) above the surface and at a speed of 5.8 kilometers per second (13,041 mph). The latitude at closest approach is 33.0 degrees N and the encounter occurs on orbit number 38.

This encounter is set up with two maneuvers: an apoapsis maneuver on Jan. 21, and an approach maneuver, scheduled for Jan. 26. This inbound encounter occurs about three days before 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 -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-24 SCIENCE HIGHLIGHTS

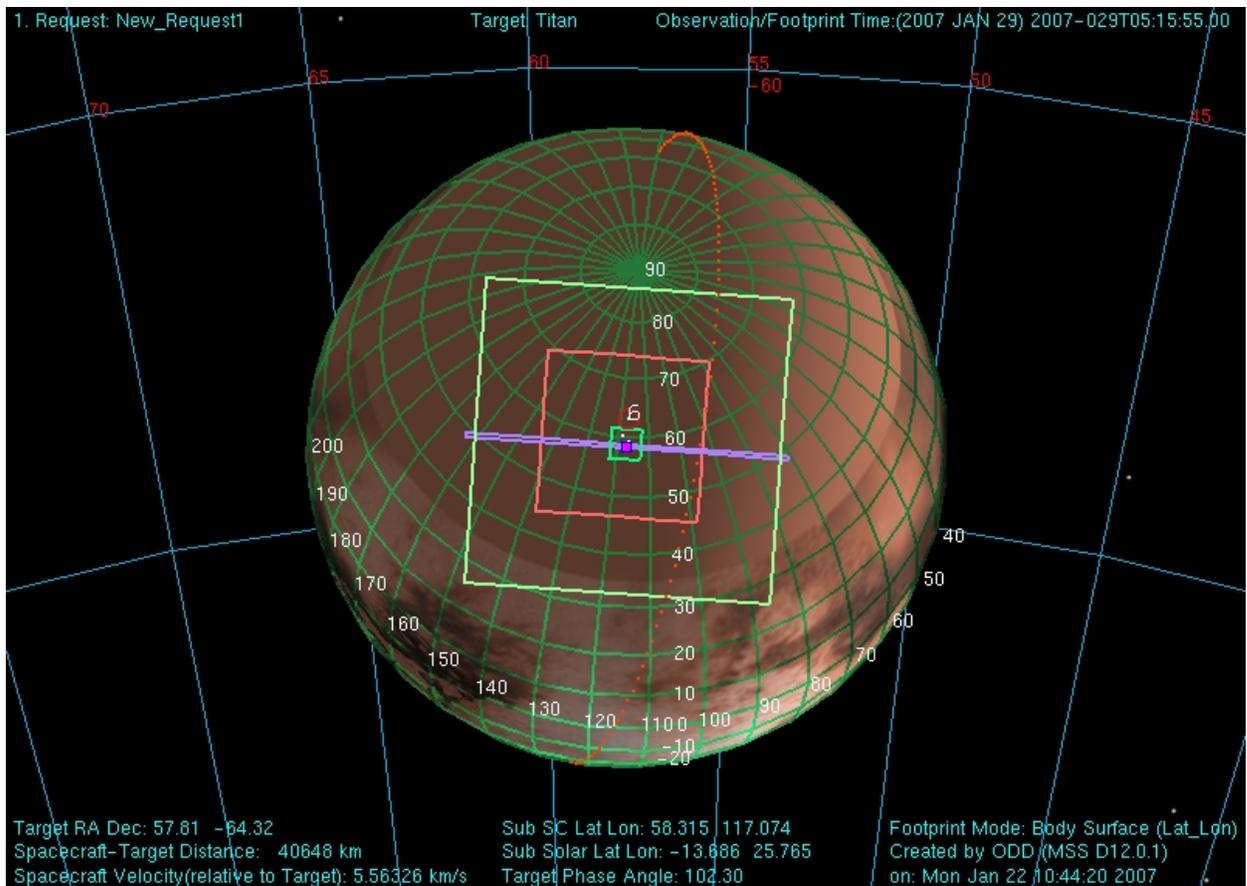
- VIMS: Stellar occultation to study the structure and composition of the atmosphere. A high resolution observation with the goal of identification of geologic features including volcanoes, eolian features, liquids and erosional features due to liquids, and craters.
- CIRS: T24 features surface temperature maps and composition integrations. The former aim to detect surface temperature variations, while the latter are designed to map the spatial variation of CO, H₂O, and HCN via far-infrared rotational lines.
- UVIS: Several slow scans across Titan's visible hemisphere to form spectral images.
- ISS: Extend high-resolution coverage eastward.

1.3 SAMPLE SNAPSHOTS

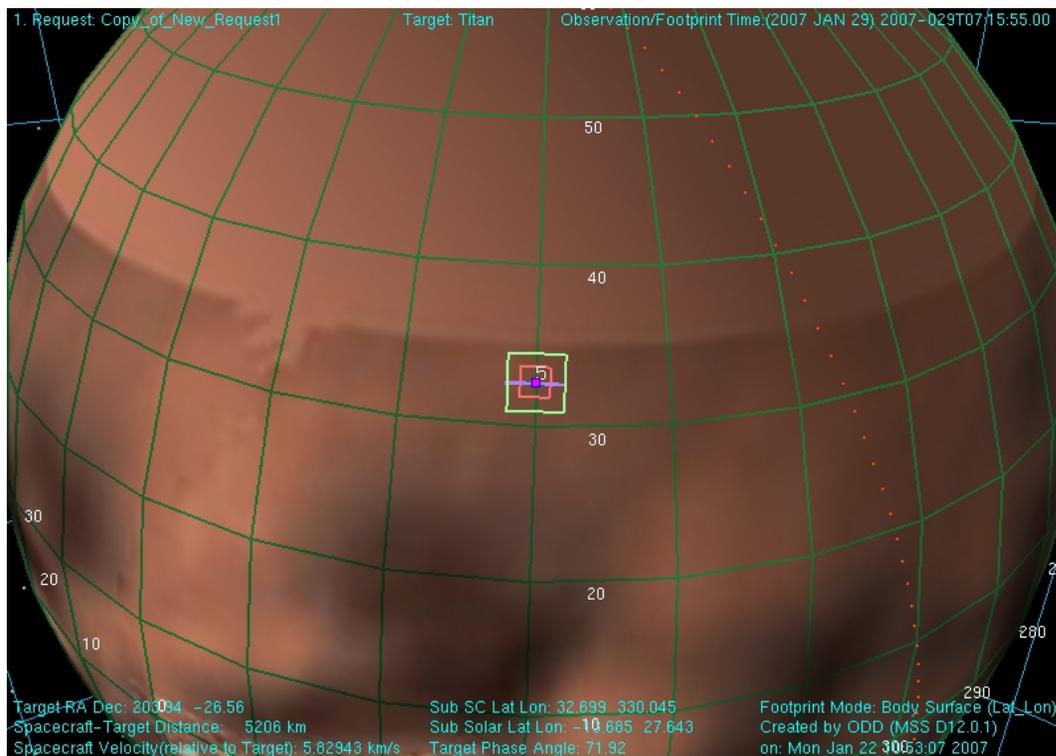
Three views of Titan from Cassini before, during, and after closest approach to Titan are shown below. The views are oriented such that the direction towards the top of the page is aligned with the Titan North Pole. The optical remote sensing instruments' fields of view are shown assuming they are pointed 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

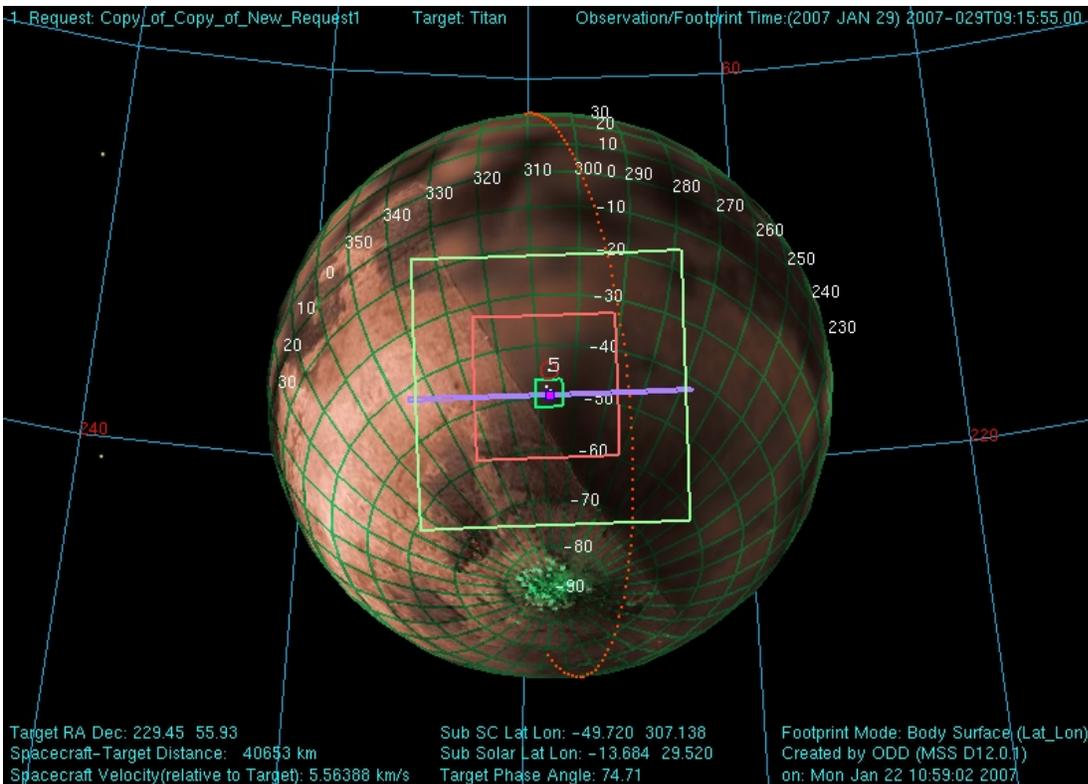
Instrument Field of View	Depiction in Figure
ISS WAC (imaging wide angle camera)	Largest square
VIMS (visual and infrared mapping spectrometer)	Next largest pink square
ISS NAC (imaging narrow angle camera)	Smallest green square
CIRS (composite infrared spectrometer) – Focal Plane 1	Small red circle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



View of Titan from Cassini two hours before Titan-24 closest approach



View of Titan from Cassini at Titan-24 Closest Approach



View of Titan from Cassini two hours after Titan-24 closest approach

The T24 timeline is as follows:

Cassini Titan-24 Timeline - December 2006

Colors: yellow = maneuvers; blue = geometry; pink = T24-related; green = data playbacks

Orbiter UTC	Ground UTC	Pacific Time	Time wrt T22	Activity	Description
005T13:50:00	Jan 05 14:59	Fri Jan 05 06:59 AM	T24-23d17h	Start of Sequence S27	Start of Sequence which contains Titan-22.
017T21:02:00	Jan 17 22:11	Wed Jan 17 02:11 PM	T24-11d10h	Ascending Ring Plane Crossing	
026T03:21:00	Jan 26 04:30	Thu Jan 25 08:30 PM	T24-03d04h	OTM #91 Prime	Titan-24 minus 3 day targeting maneuver.
027T03:21:00	Jan 27 04:30	Fri Jan 26 08:30 PM	T24-02d04h	OTM #91 Backup	
028T12:12:00	Jan 28 13:21	Sun Jan 28 05:21 AM	T24-19h03m	Turn cameras to Titan	
028T12:42:00	Jan 28 13:51	Sun Jan 28 05:51 AM	T24-18h33m	Deadtime	~19 minutes long; used to accommodate changes in flyby time
028T13:00:55	Jan 28 14:09	Sun Jan 28 06:09 AM	T24-18h15m	Titan Atmospheric Observations	Obtain information on the thermal structure of Titan's stratosphere.
028T15:15:55	Jan 28 16:24	Sun Jan 28 08:24 AM	T24-16h00m	ISS Imaging	Nightside imaging.
028T16:15:55	Jan 28 17:24	Sun Jan 28 09:24 AM	T24-15h00m	Titan atmospheric Observations	Obtain information on trace constituents in Titan's stratosphere.
028T21:15:55	Jan 28 22:24	Sun Jan 28 02:24 PM	T24-10h00m	ISS Imaging	WAC photometry and NAC global mapping.
028T22:15:55	Jan 28 23:24	Sun Jan 28 03:24 PM	T24-09h00m	EUVFUV Imaging	Several slow scans across Titan's visible hemisphere to form spectral images.
029T04:15:55	Jan 29 05:24	Sun Jan 28 09:24 PM	T24-03h00m	ISS Imaging	Nightside imaging.
029T05:15:55	Jan 29 06:24	Sun Jan 28 10:24 PM	T24-02h00m	Titan Atmospheric Observations	Vertical sounding of stratospheric compounds on Titan
029T06:52:55	Jan 29 08:01	Mon Jan 29 12:01 AM	T24-00h23m	Stellar Occultation	Stellar Occultation of Gamma Cru.
029T06:58:55	Jan 29 08:07	Mon Jan 29 12:07 AM	T24-00h17m	High resolution infrared surface observation.	Identification of geologic features, and their correlation with composition.
029T07:15:55	Jan 29 08:24	Mon Jan 29 12:24 AM	T24+00h00m	Titan-24 Flyby Closest Approach Time	Altitude = 2631 km (1634 miles), speed = 5.8 km/s (13,041 mph); 72 deg phase at closest approach
029T07:38:00	Jan 29 08:47	Mon Jan 29 12:47 AM	T24+00h23m	Descending Ring Plane Crossing	
029T09:15:55	Jan 29 10:24	Mon Jan 29 02:24 AM	T24+02h00m	ISS Imaging	NAC regional map.
029T11:15:55	Jan 29 12:24	Mon Jan 29 04:24 AM	T24+04h00m	Titan Atmospheric Observations	Obtain information on surface & tropopause temperatures
029T12:15:55	Jan 29 13:24	Mon Jan 29 05:24 AM	T24+05h00m	Titan Atmospheric Observations	Obtain information on trace constituents in Titan's stratosphere.
029T21:15:56	Jan 29 22:24	Mon Jan 29 02:24 PM	T24+14h00m	Titan Atmospheric Observations	Obtain information on the thermal structure of Titan's stratosphere.
030T02:29:55	Jan 30 03:38	Mon Jan 29 07:38 PM	T24+19h14m	Deadtime	12 minutes 5 seconds long; used to accommodate changes in flyby time
030T02:42:00	Jan 30 03:51	Mon Jan 29 07:51 PM	T24+19h27m	Turn to Earth-Line	
030T03:12:00	Jan 30 04:21	Mon Jan 29 08:21 PM	T24+19h57m	Playback of T24 Data	Goldstone 70M
030T12:12:00	Jan 30 13:21	Tue Jan 30 05:21 AM	T24+01d05h	End Playback of T24 Data	
032T09:58:00	Feb 01 11:07	Thu Feb 01 03:07 AM	T24+03d03h	Saturn Periapse	Saturn periapse, r = 15.6 Rs, lat = -58 deg, phase = 58 deg

1.4 FLYBY GEOMETRY

A flyby geometry table is not available for T-24.

1.5 PLAYBACK TIMELINE

A playback timeline is not available for T-24.