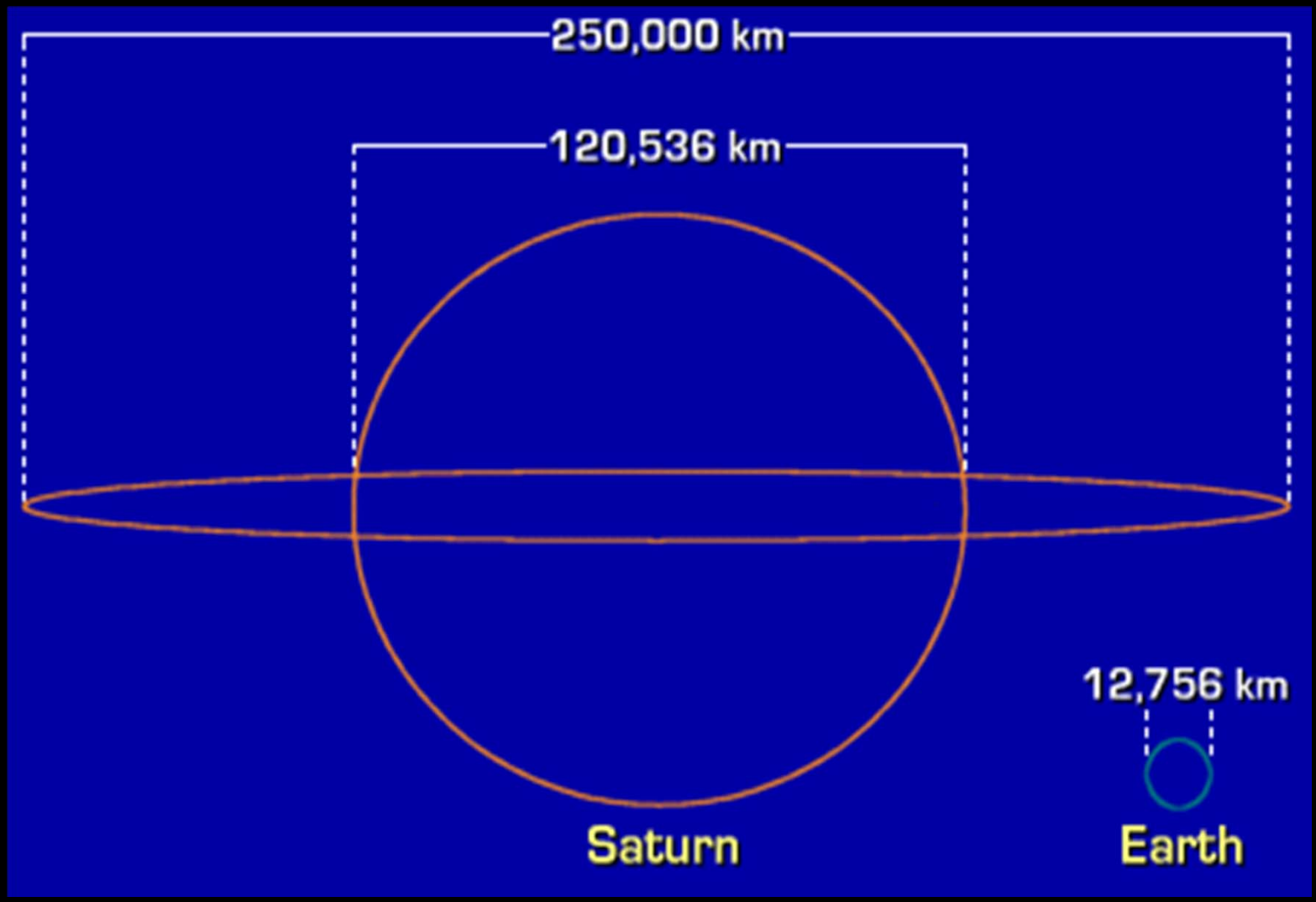
https://ntrs.nasa.gov/search.jsp?R=20120013396 2019-08-30T21:34:34+00:00Z

National Aeronautics and Space Administration

Cassini—Unlocking Saturn's Secrets

www.nasa.gov

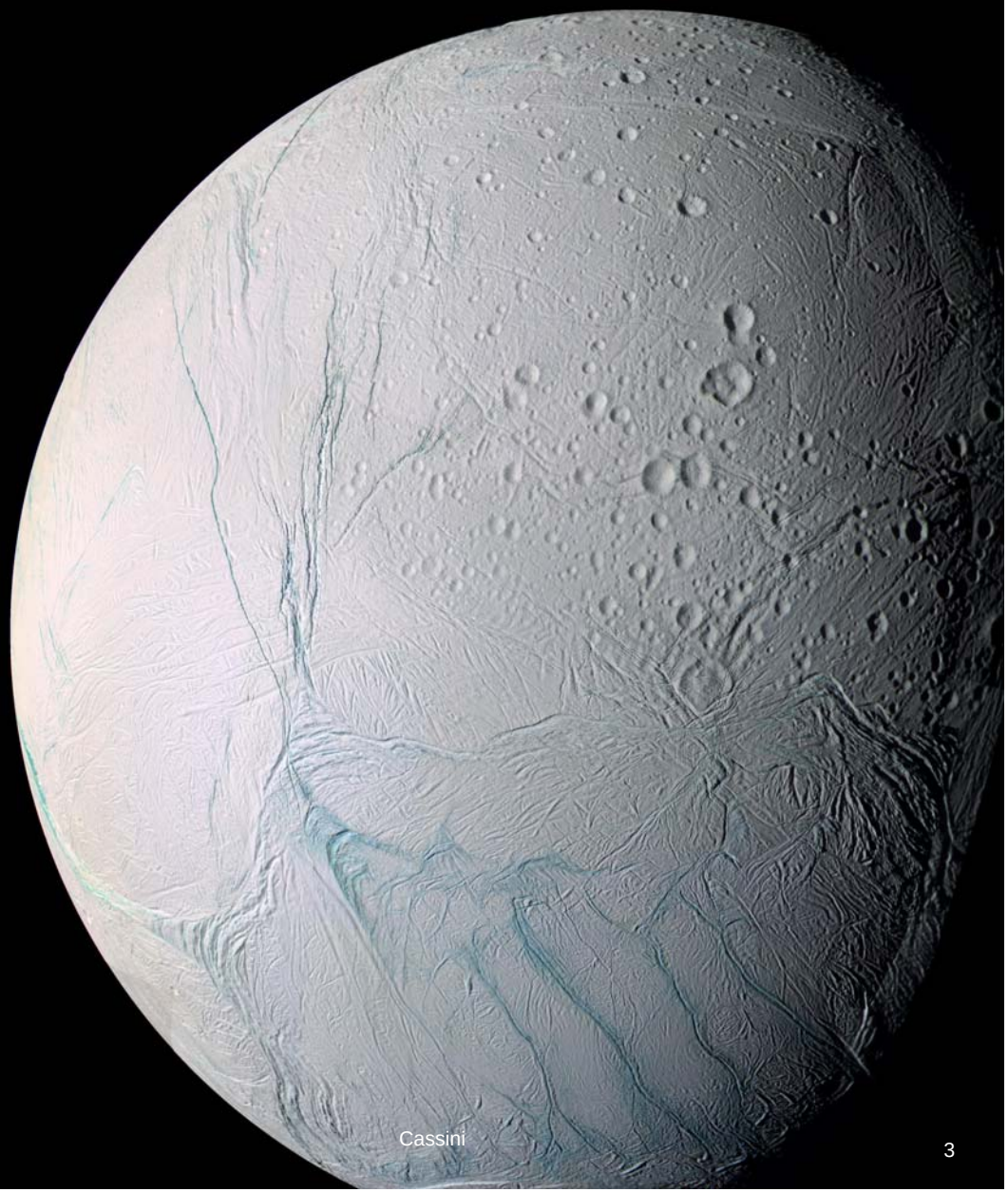
Saturn

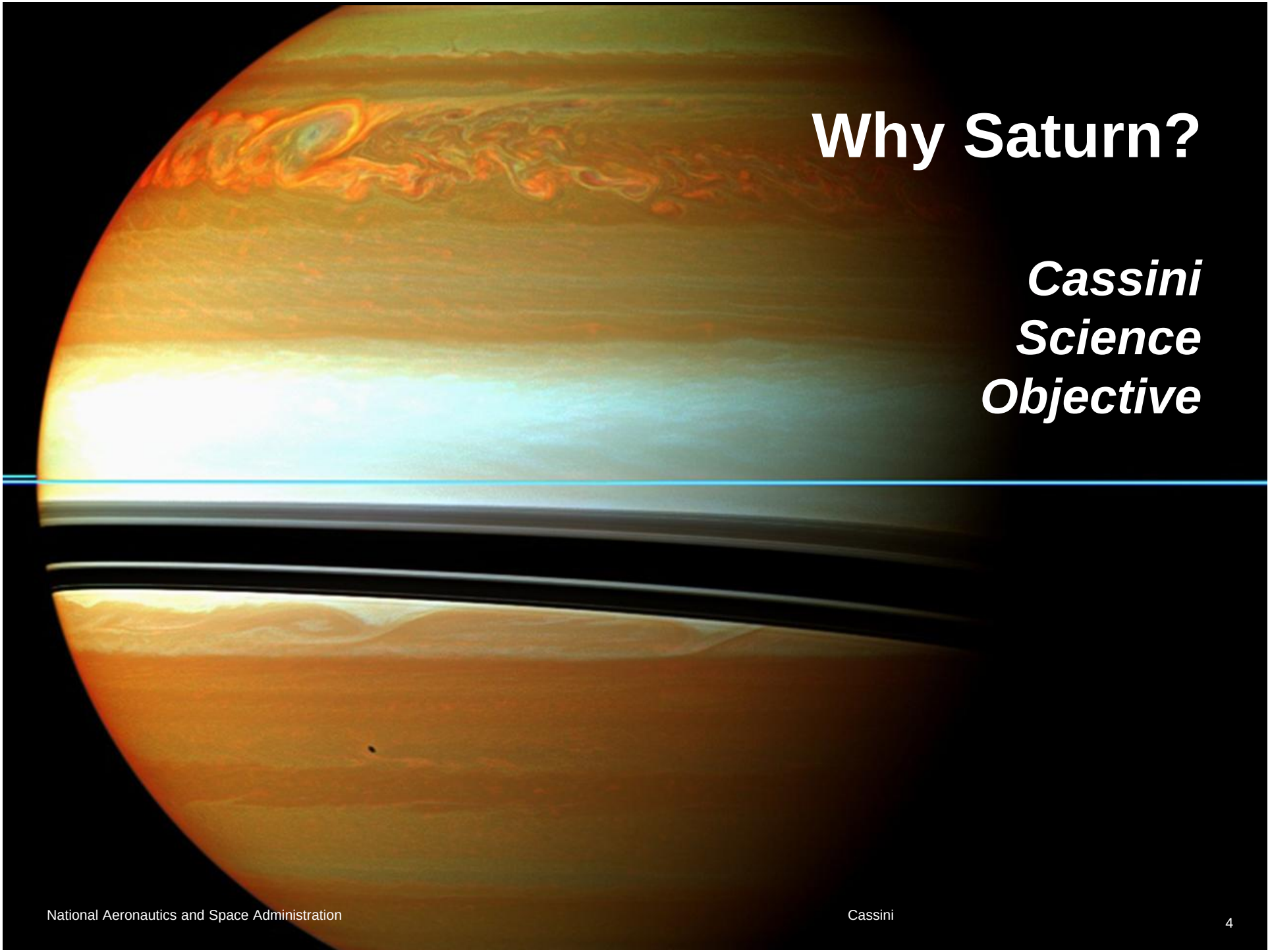


Titan

Saturn's largest Moon

2nd largest in the solar system





Why Saturn?

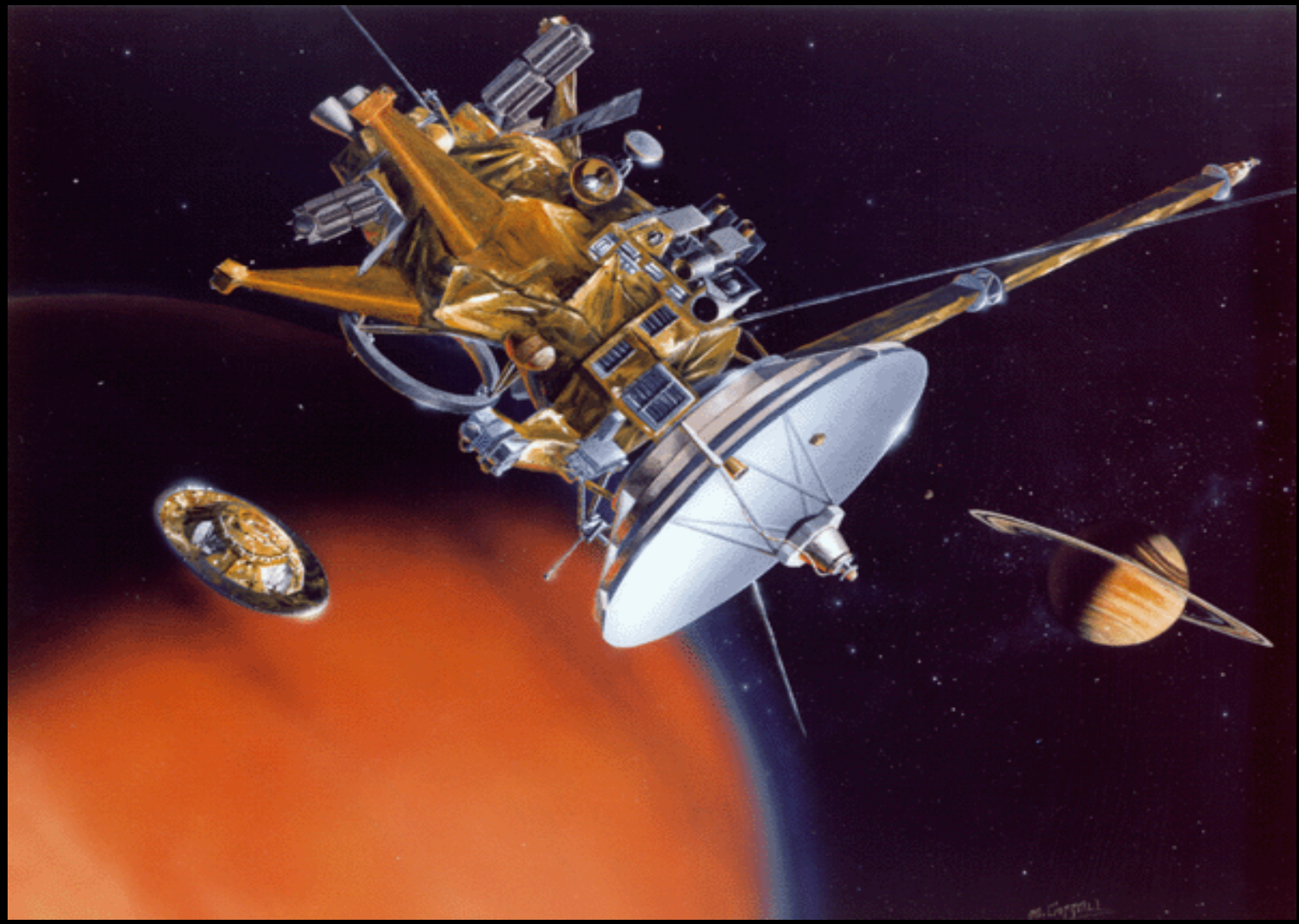
Cassini Science Objective

Why Titan?

Huygens Science Objective

Cassini Mission

- **Launched 10-15-97 from CCAS on a Titan IV-B**
- **Arrived to Saturn: July 1, 2004 (traveled 2 billion miles)**
- **Mission was scheduled to end: June 30, 2008**

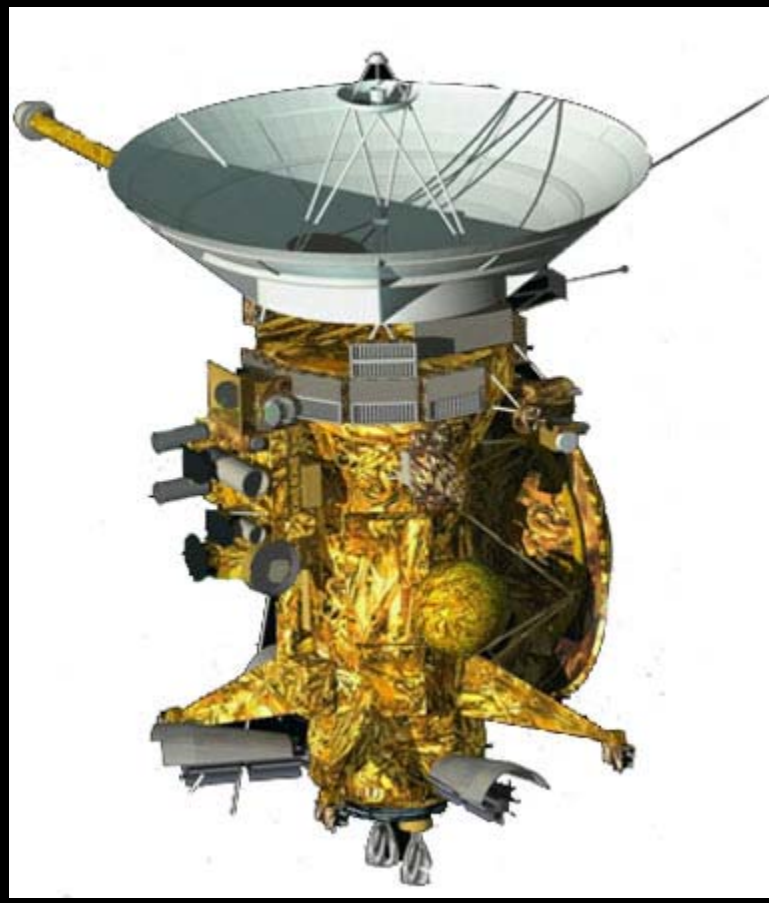


Cassini & Huygens Probe

Key Facts

HUYGENS PROBE	
Mass	350 kg
Height	2.7 m
Mission duration	2 hours and 30 minutes
Onboard experiments	6
CASSINI ORBITER	
Mass	5,300 kg
Height	6.8 m
Mission duration	4 years
Orbit	Variable
Onboard experiments	12

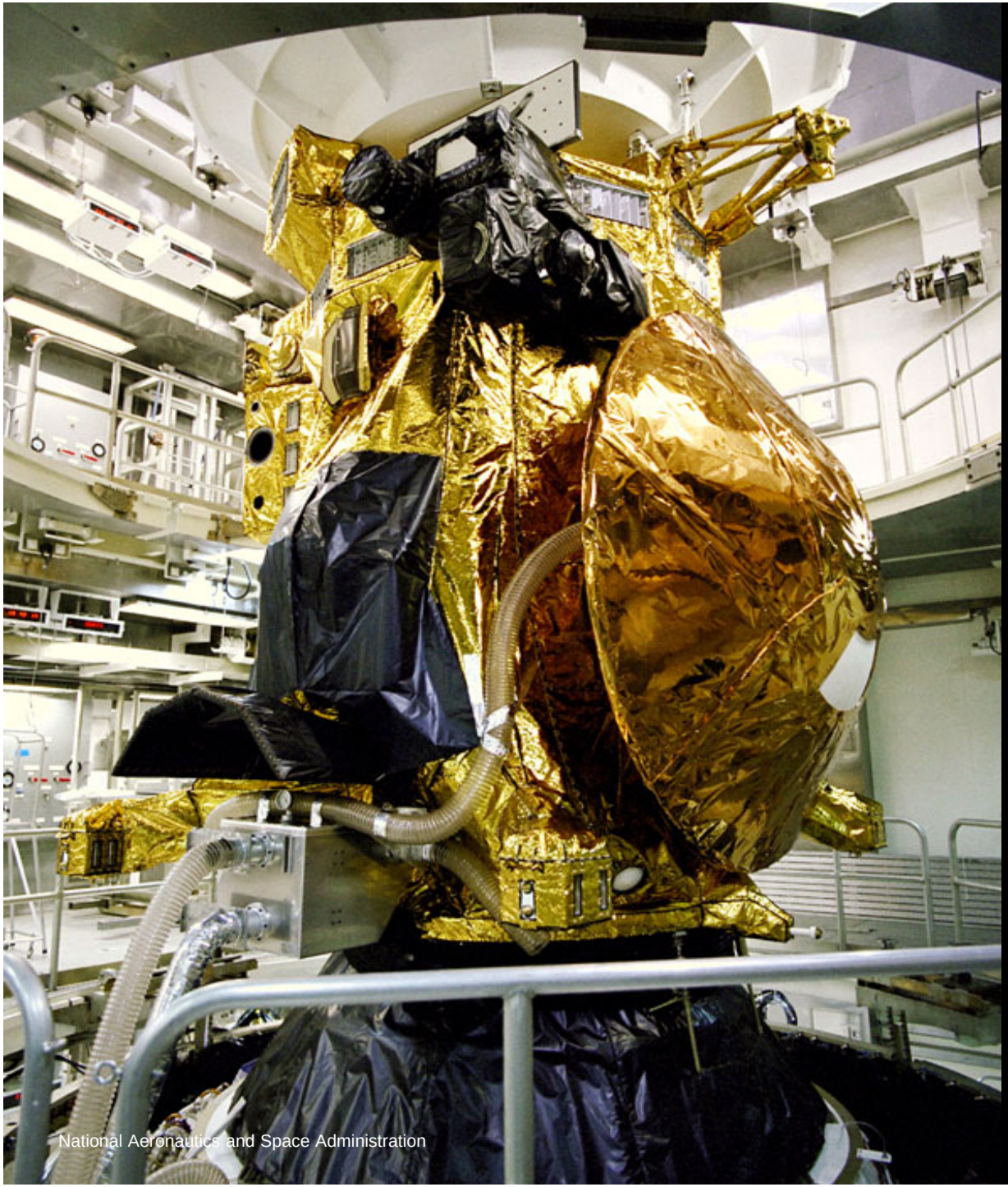
Orbiter & Probe Mass:
5655 Kg (12,470 lbs- ~6.2 tons)



RTGs are the spacecraft power systems that provide power through the natural radioactive decay of plutonium (mostly Pu-238, a non-weapons-grade isotope). The heat generated by this natural process is changed into electricity by solid-state thermoelectric Converters

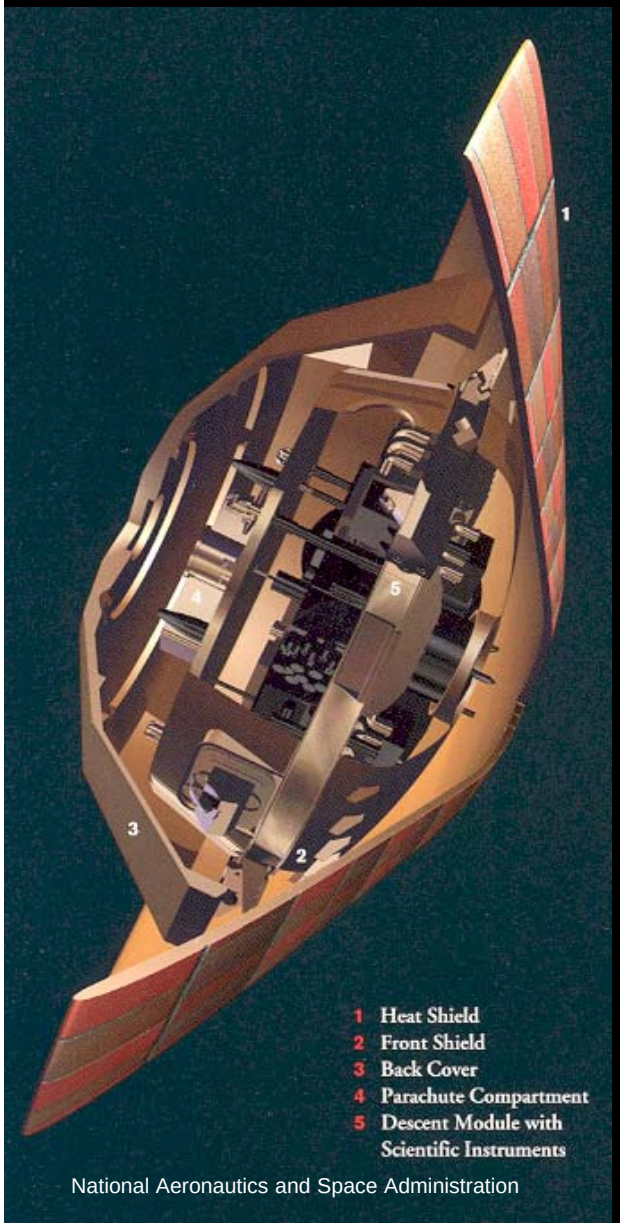
The United States has an outstanding record of safety in using RTGs on 24 missions over the past three decades.

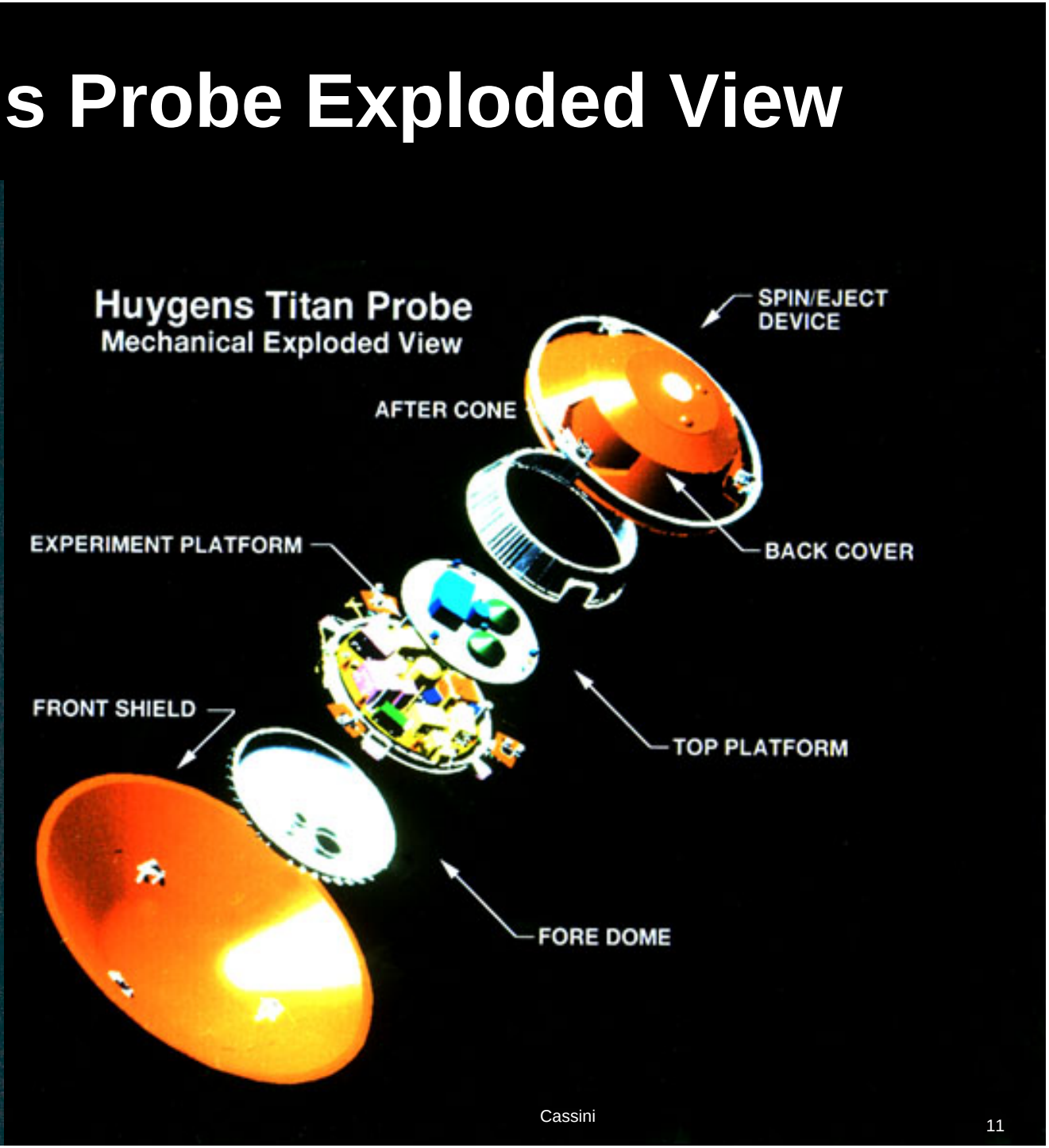
More than 30 years have been invested in the engineering, safety analysis and testing of RTGs. Safety features are incorporated into the RTGs' design, and extensive testing has demonstrated that they can withstand physical conditions more severe than those expected from most accidents.



Huygens Probe @ the Pad

Huygens Probe Exploded View





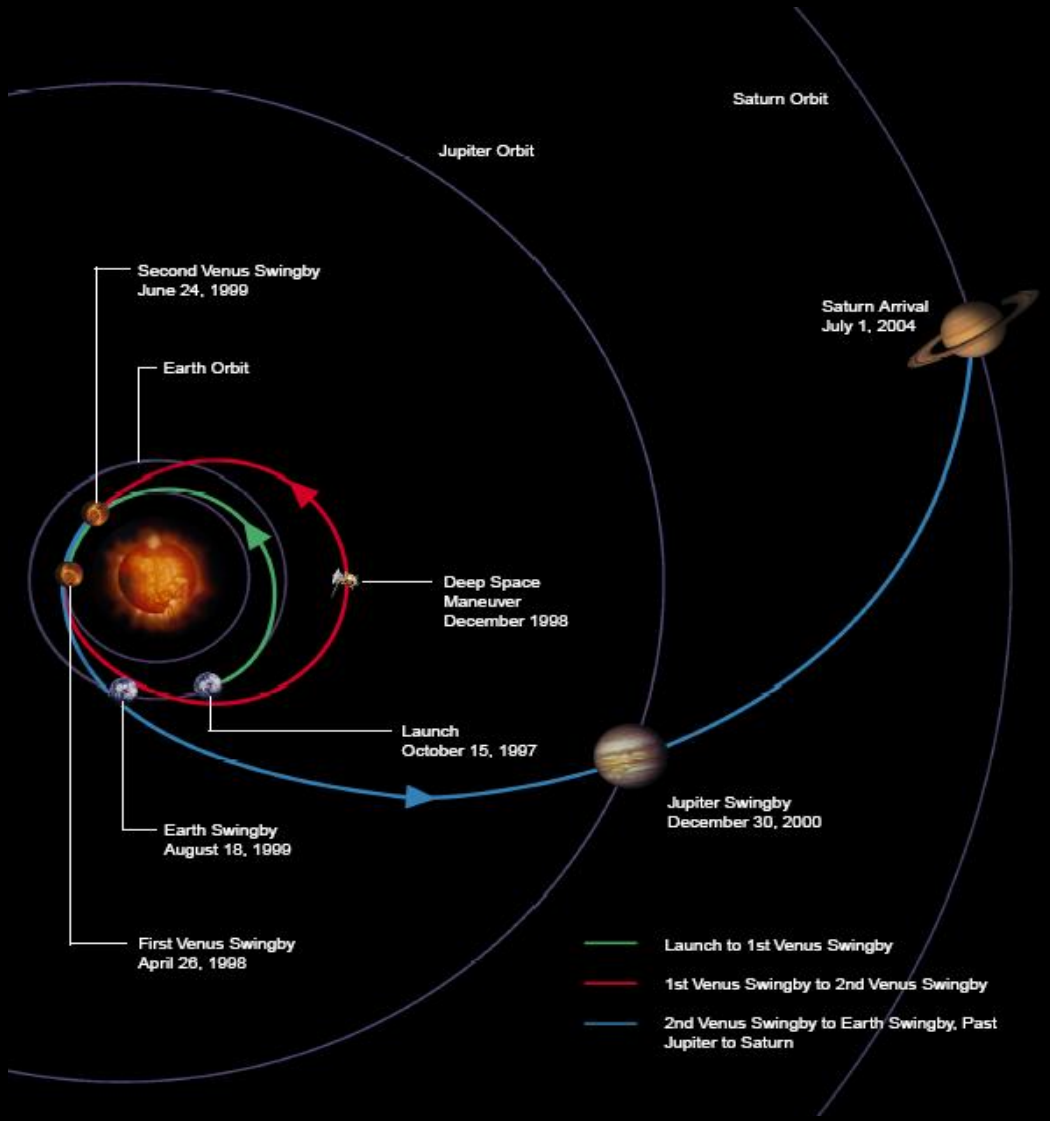
Cassini Processing At the PHSF/ KSC

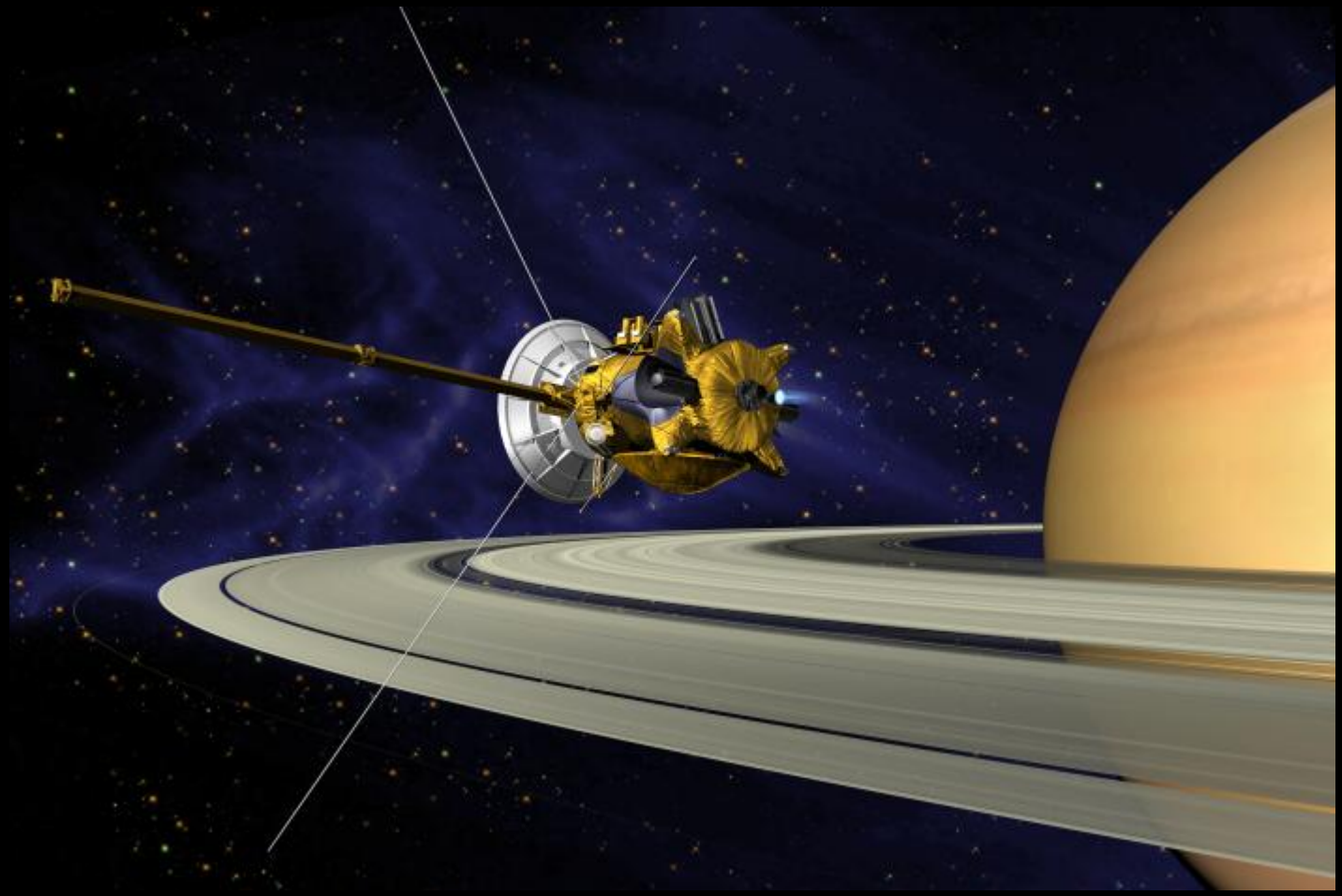
Cassini processing in the ES at LC-40/CCAS

TITAN IV B Launched CASSINI on 10-15-97 from CCAS

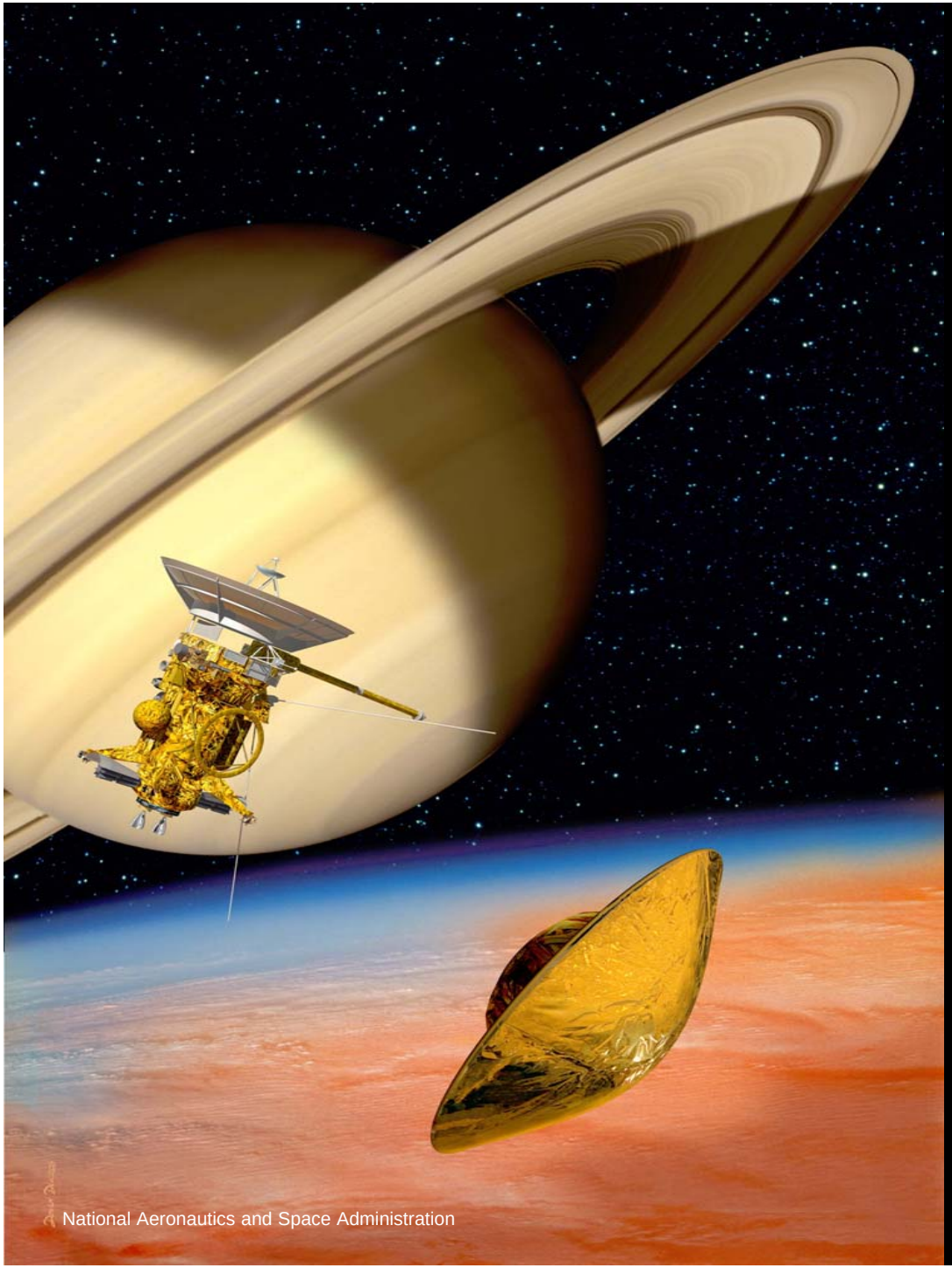
Cassini's VVEJGA Trajectory

V:1998
V:1999
E:1999
J:2000
S:2004





SOI maneuver (90 minutes long) allowed Cassini to be captured by Saturn's gravity into a 5-month orbit.



Huygens will be the first spacecraft to land on a world in the outer Solar System

22 day cruise toward Titan

In January 15, 2005 Huygens landed on the surface of Titan

The Huygens data may offer clues about how life began on Earth.

One of the Landing Scenarios

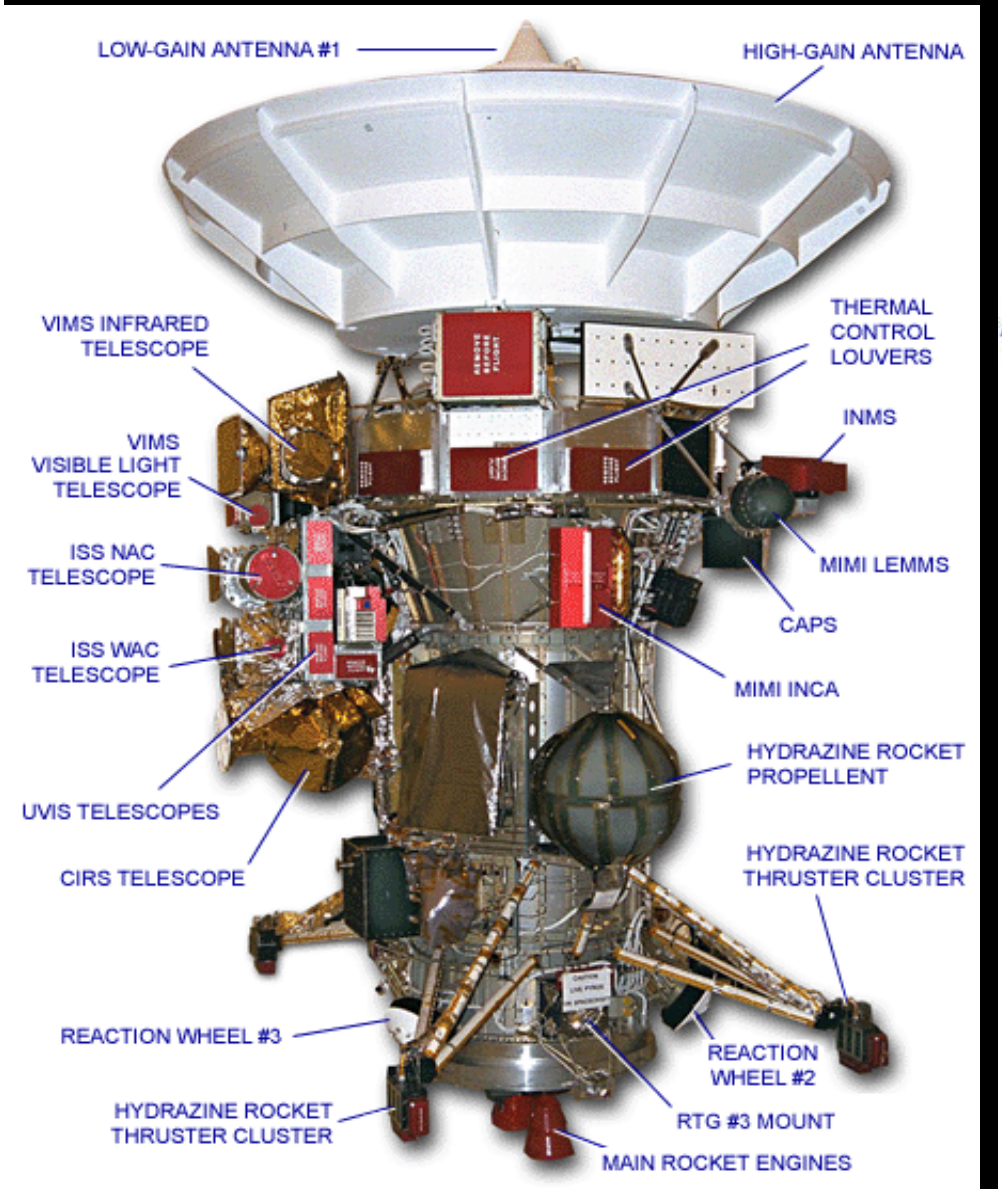
Cassini Orbiter Instruments

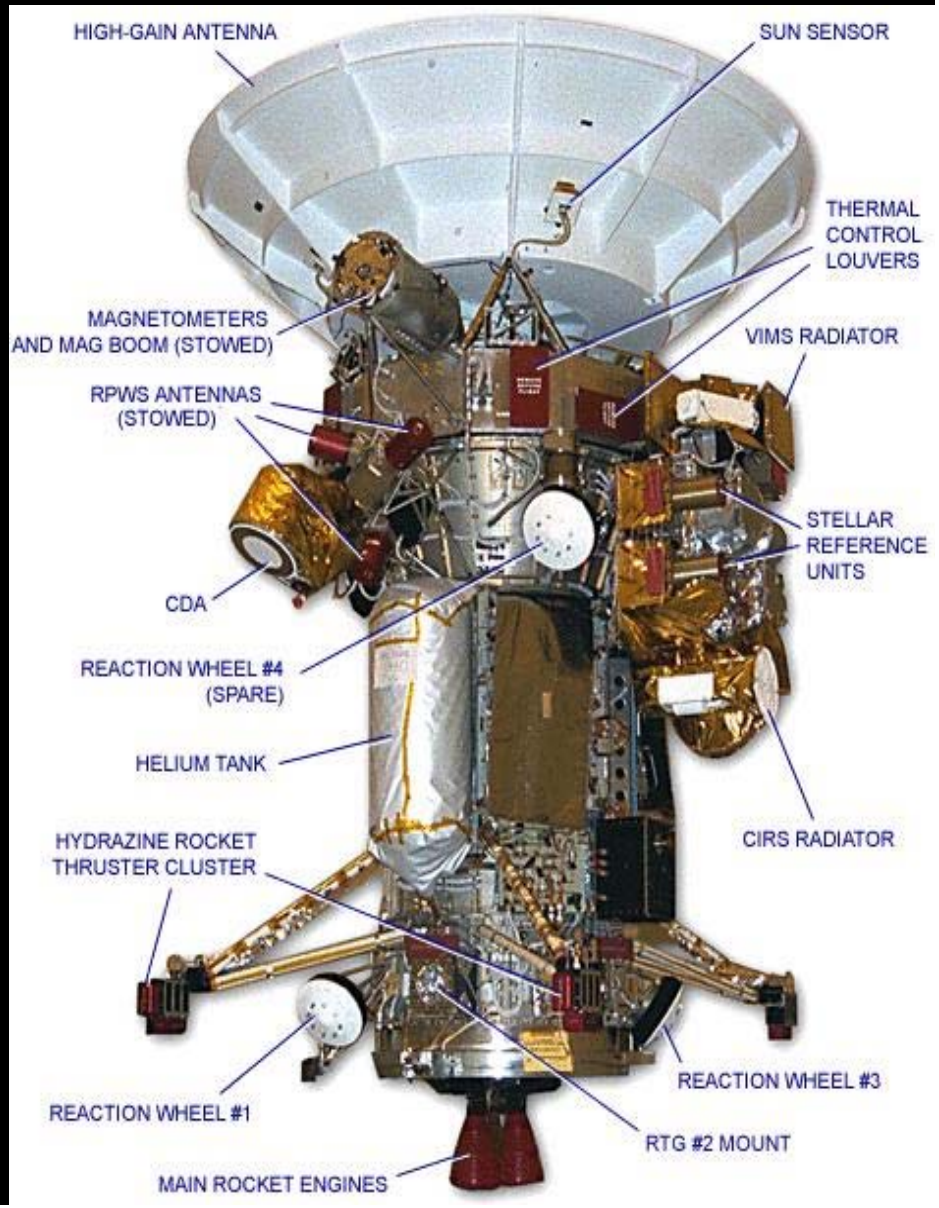
12 Instruments that Survey, sniff, analyze, scrutinize and take stunning images in various visible spectra.

Optical Remote Sensing
Mounted on the remote sensing pallet, these instruments study Saturn and its rings and moons in the electromagnetic spectrum.

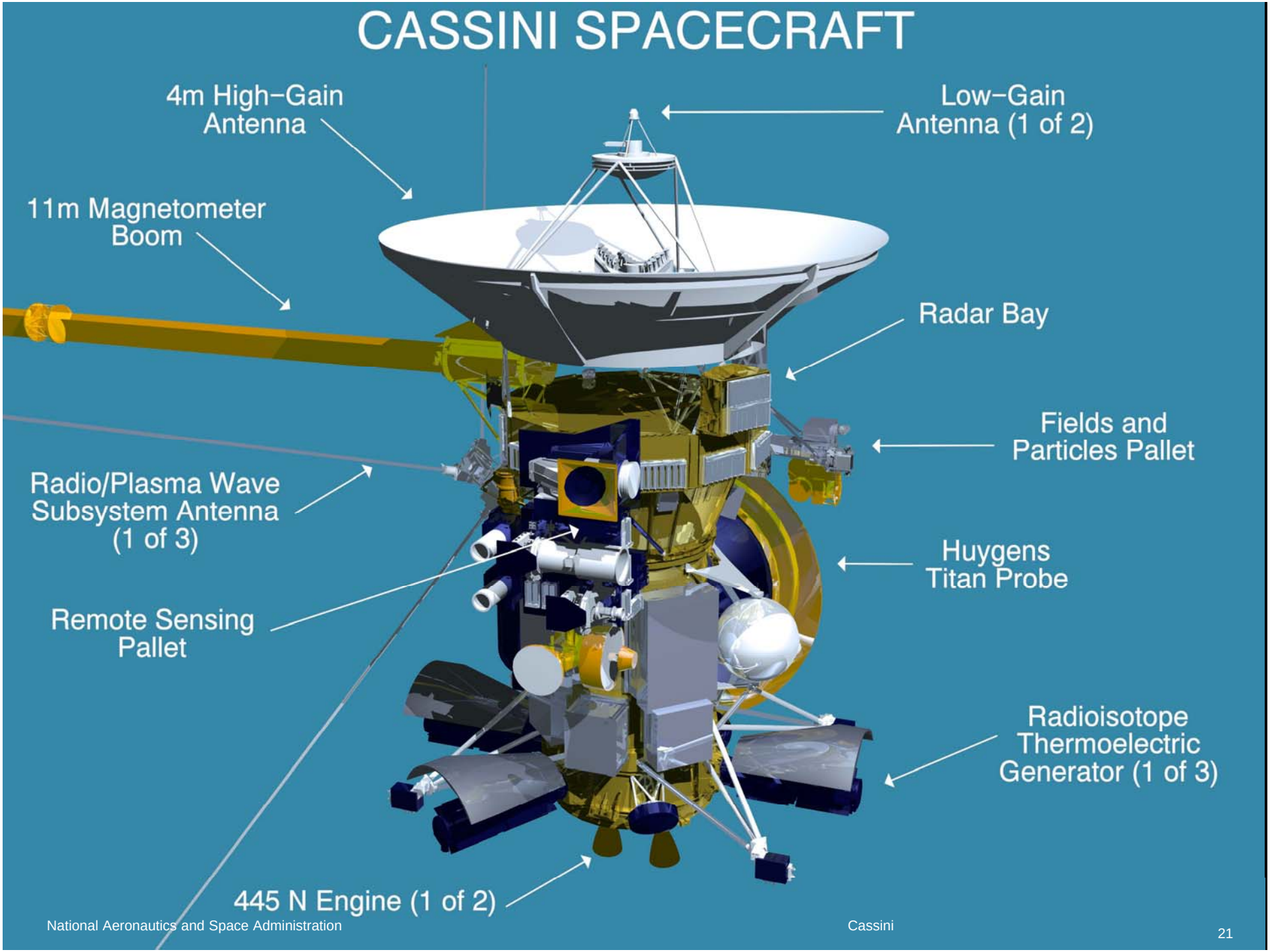
1.Composite Infrared Spectrometer (CIRS)
2.Imaging Science Subsystem (ISS)
3.Ultraviolet Imaging Spectrograph (UVIS)
4.Visible and Infrared Mapping Spectrometer (VIMS)

Cassini Spacecraft

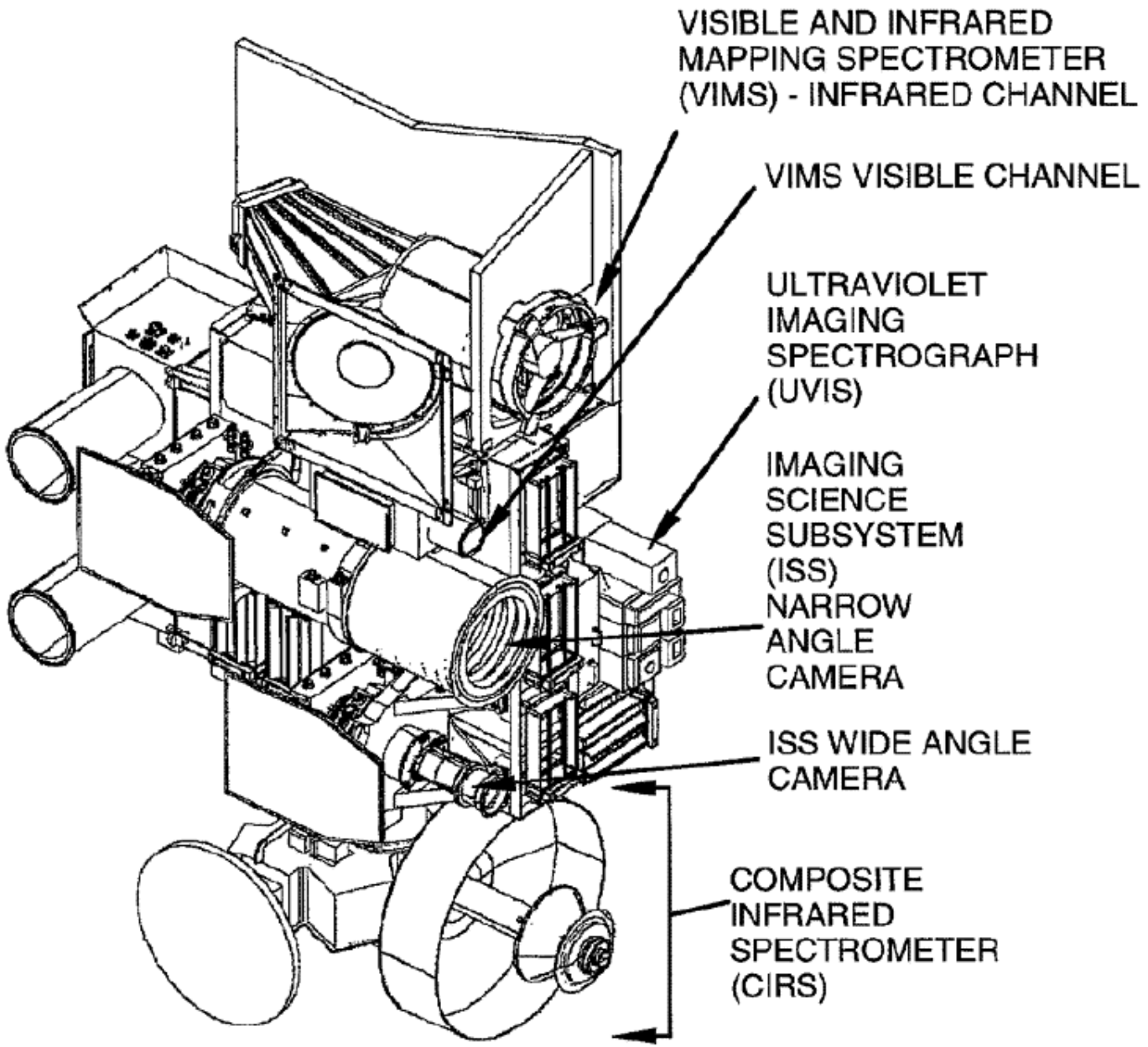




CASSINI SPACECRAFT



REMOTE SENSING PALLET

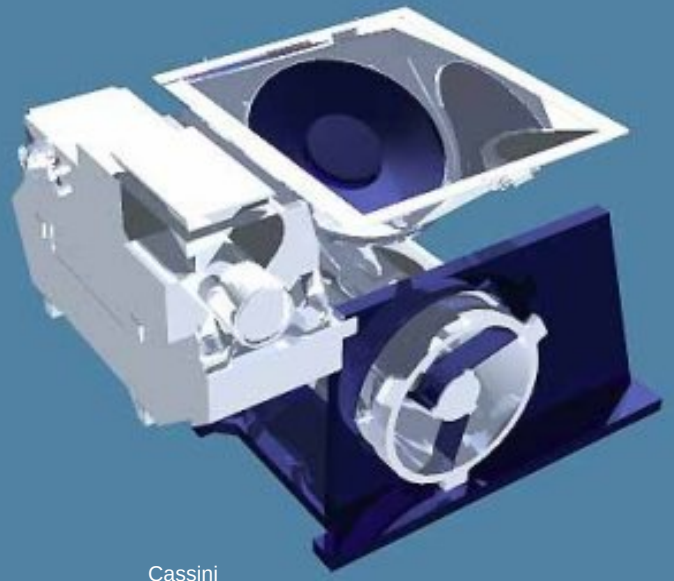


Cassini's Most Important instrument

Space Science Institute

VIMS

Visible and Infrared Mapping System



Creates maps of the color properties of the atmosphere of Saturn & Titan, the surfaces of the moons and the rings to study their composition and structure

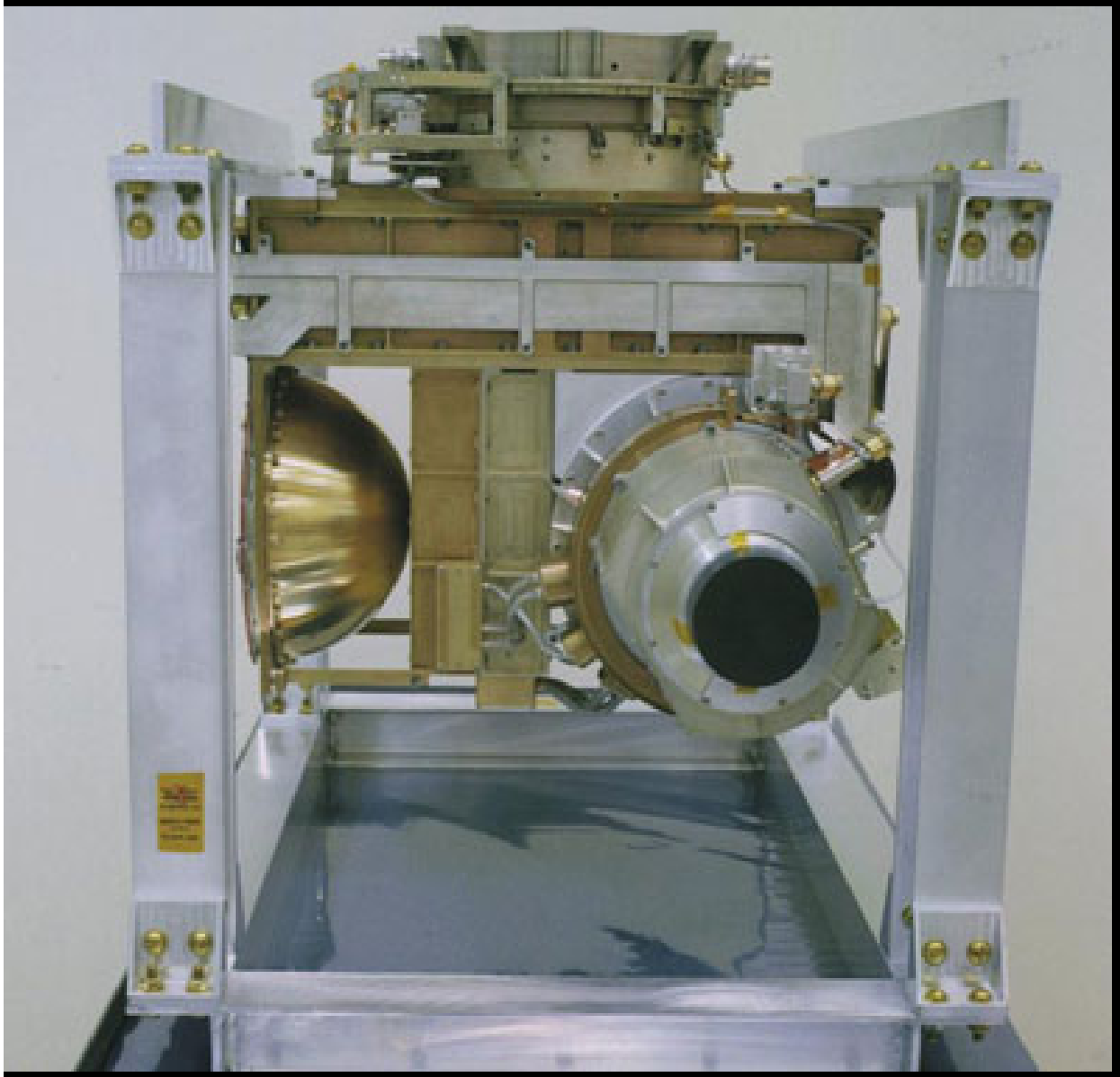
Search for volatiles: Water Ice,CO2
Search for minerals and organics

University of Arizona

Fields, particles and Waves

Study the dust, plasma and magnetic field around Saturn.
While most don't produce pictures the information they collect is critical to scientists Understanding of this rich environment

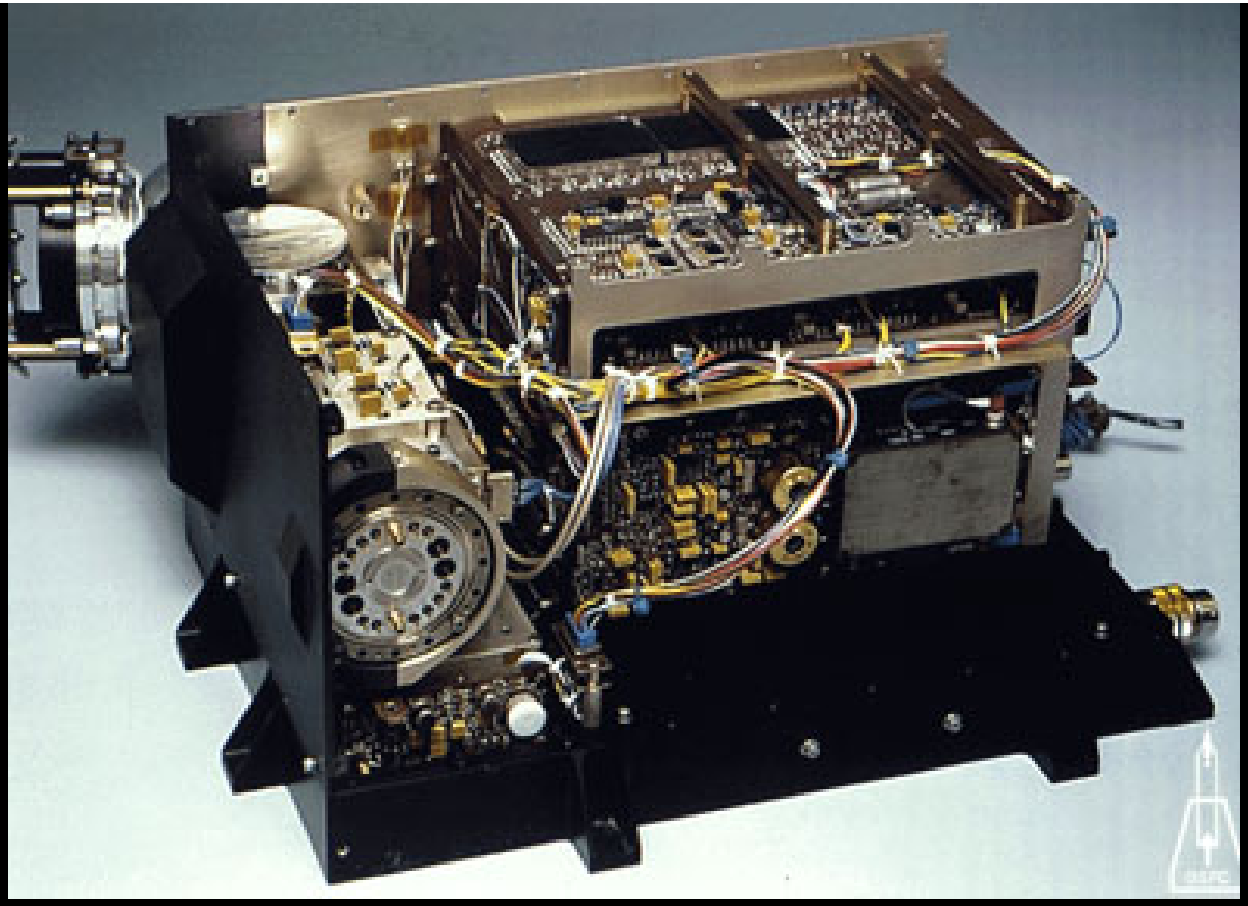
1.Cassini Plasma Spectrometer (CAPS)
2.Cosmic Dust Analyzer (CDA)
3.Ion and Neutral Mass Spectrometer (INMS)
4.Magnetometer (MAG)
5.Magnetospheric Imaging Instrument (MIMI)
6.Radio and Plasma Wave Science (RPWS)



CAPS Cassini Plasma Spectrometer

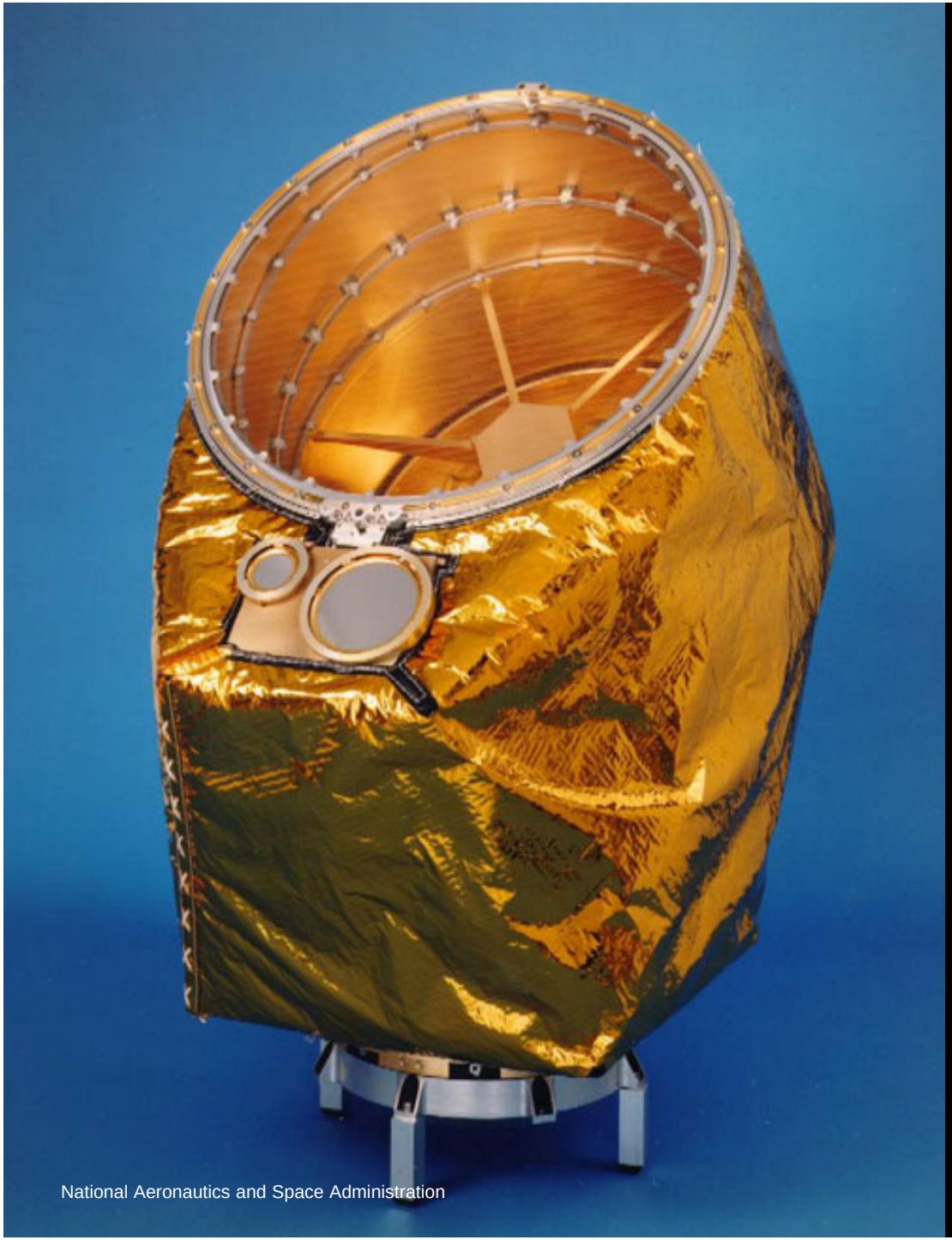
Scoops up plasma and measure its composition, density, speed, and temp. throughout Saturn 3 dimensional magnetic field.

Southwest Research Institute



INMS (Ion and neutral Mass Spectrometer)

Can detect neutral atoms and positively charged ions.
Scoops up material and determines the compositions and isotopic abundances of chemical and elements in the upper reaches of Saturn and Titan's atmosphere and Saturn E ring
Southwest Research Institute



Cosmic Dust Analyzer (CDA)

Max Planck Institut fur kernphysik

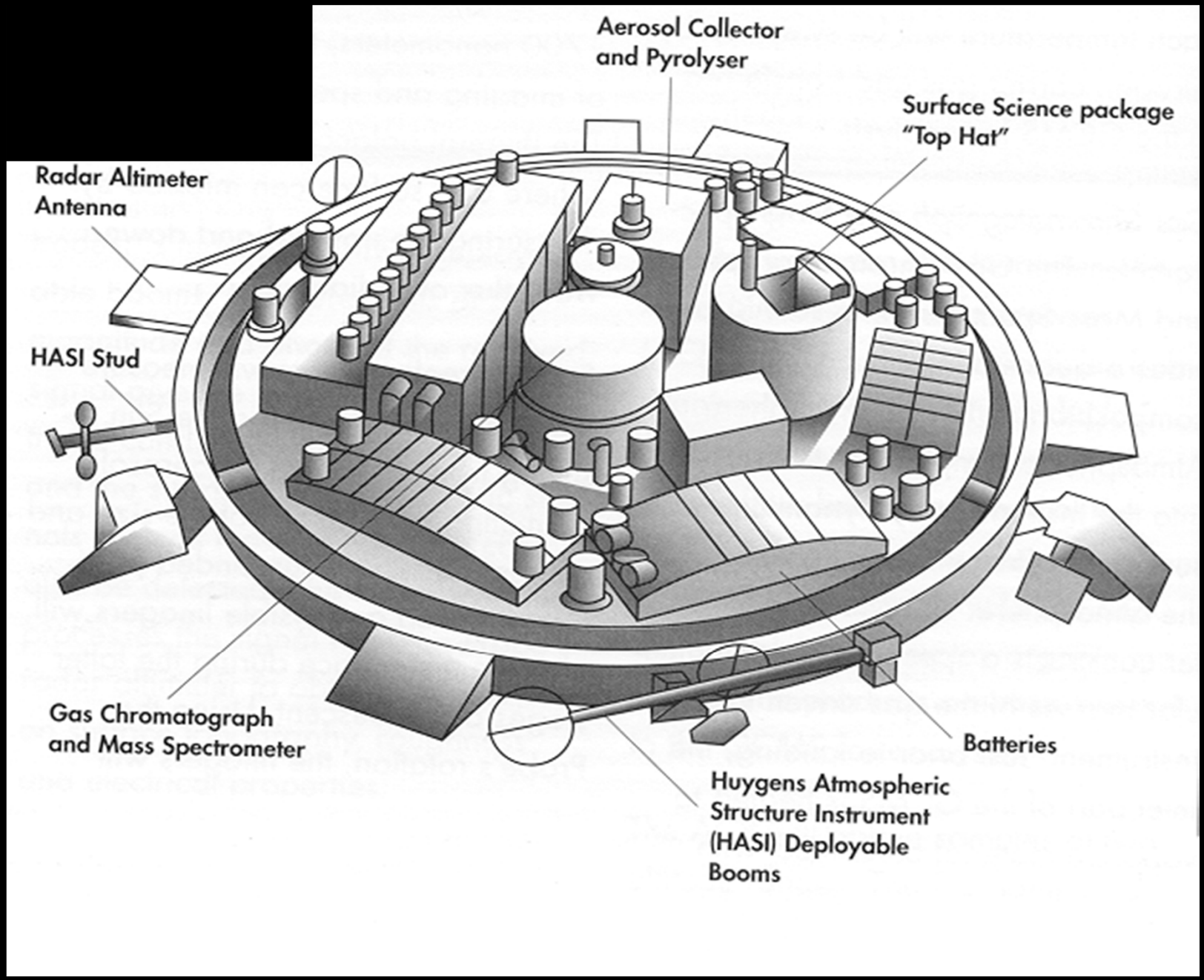
Microwave Remote Sensing

Using Radio waves these instruments map atmospheres, determine the mass of moons, Collect data on ring particle size, and unveil the surface of Titan

1.Radar
2.Radar Science (RSS)

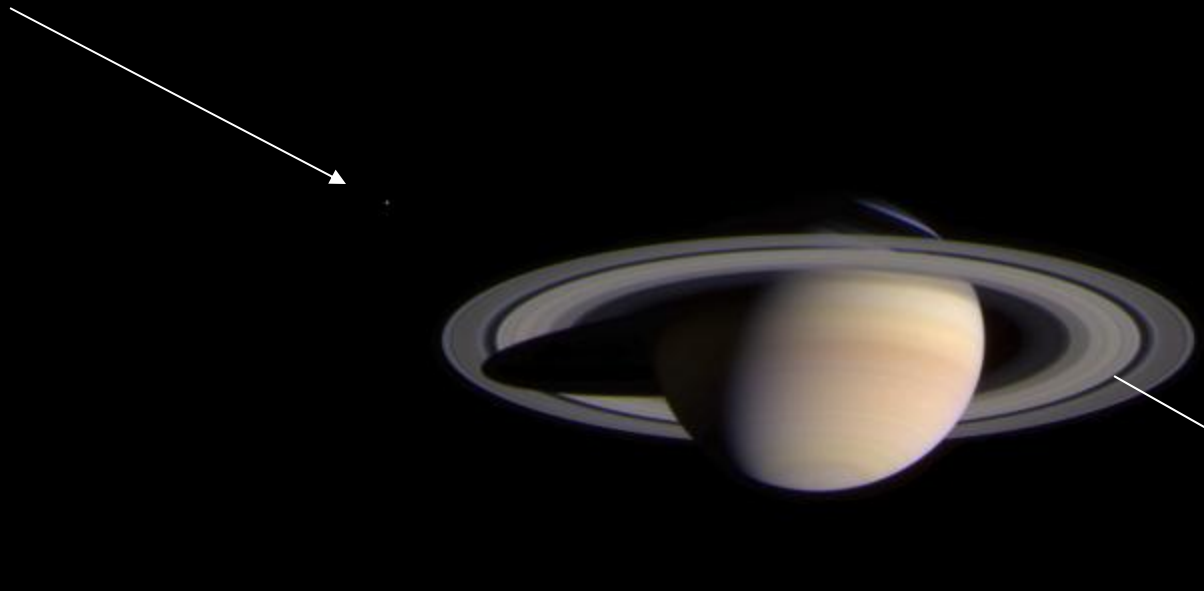
Huygens Instruments

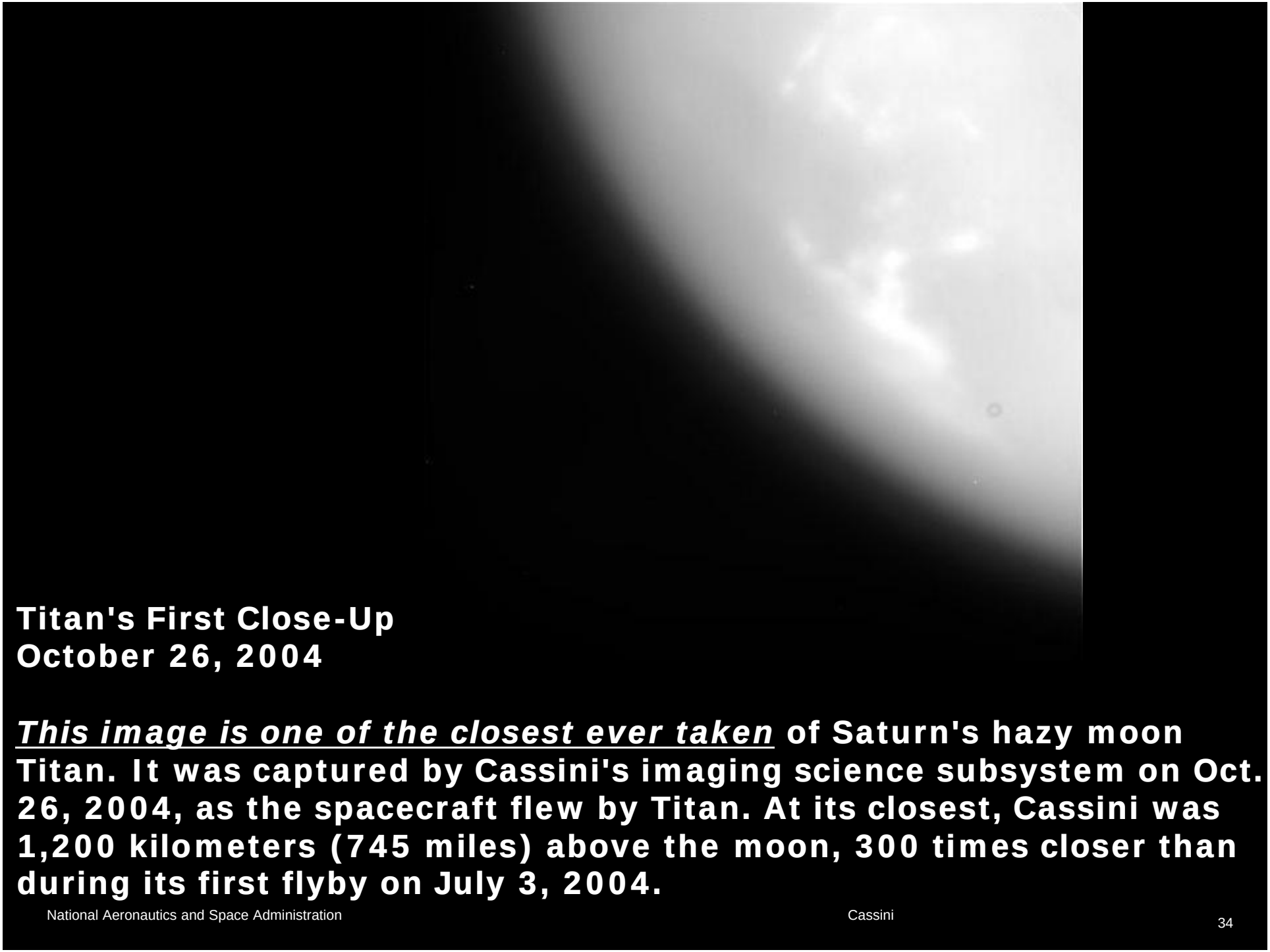
Aerosol Collector and Pyrolyser (ACP)
Collect aerosols for chemical-composition analysis
Descent Imager / Spectral Radiometer (DISR)
Images and spectra of the surface material
Doppler Wind Experiment (DWE)
Uses Radio signals to deduce atmospheric properties
Gas Chromatograph and Mass Spectrometer (GCMS)
Chemical analyzer designed to identify and quantify various atmospheric constituents
Huygens Atmospheric Structure Instrument (HASI)
Comprises sensors for measuring the physical and electrical properties of the atmosphere and an on board microphone to send back sounds from Titan
Surface Science Package (SSP)
Suites of sensors to determine the physical properties at the surface at the impact site


Aerosol Collector and Pyrolyser
Surface Science package "Top Hat"
Radar Altimeter Antenna
HASI Stud
Gas Chromatograph and Mass Spectrometer
Batteries
Huygens Atmospheric Structure Instrument (HASI) Deployable Booms

FINDINGS FROM CASSINI & HUYGENS

Approach to Saturn Feb 9, 2004



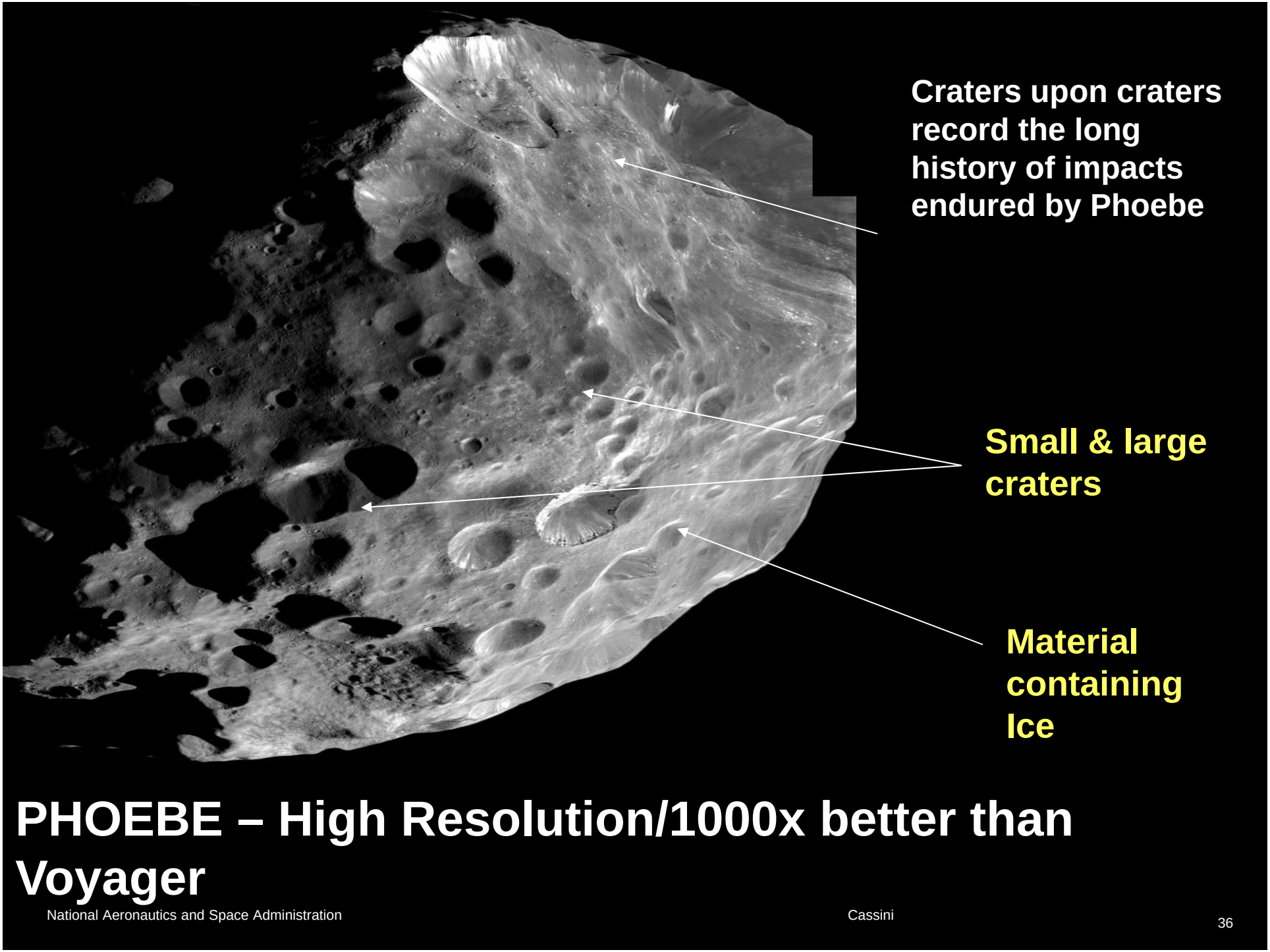


Titan's First Close-Up
October 26, 2004

This image is one of the closest ever taken **of Saturn's hazy moon Titan. It was captured by Cassini's imaging science subsystem on Oct. 26, 2004, as the spacecraft flew by Titan. At its closest, Cassini was 1,200 kilometers (745 miles) above the moon, 300 times closer than during its first flyby on July 3, 2004.**

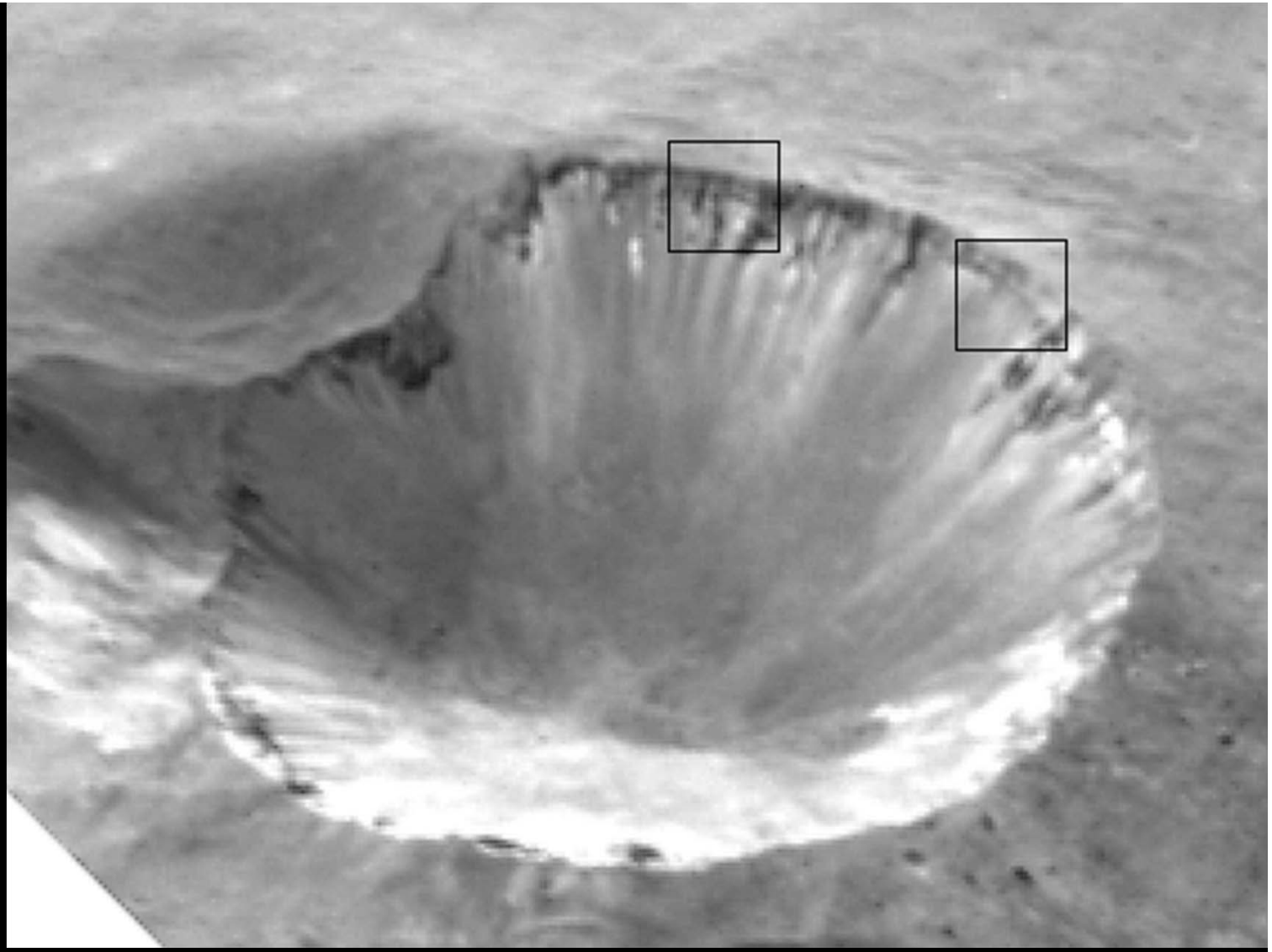
Two pairs of Storms
June 4, 2004

Cassini narrow angle detected



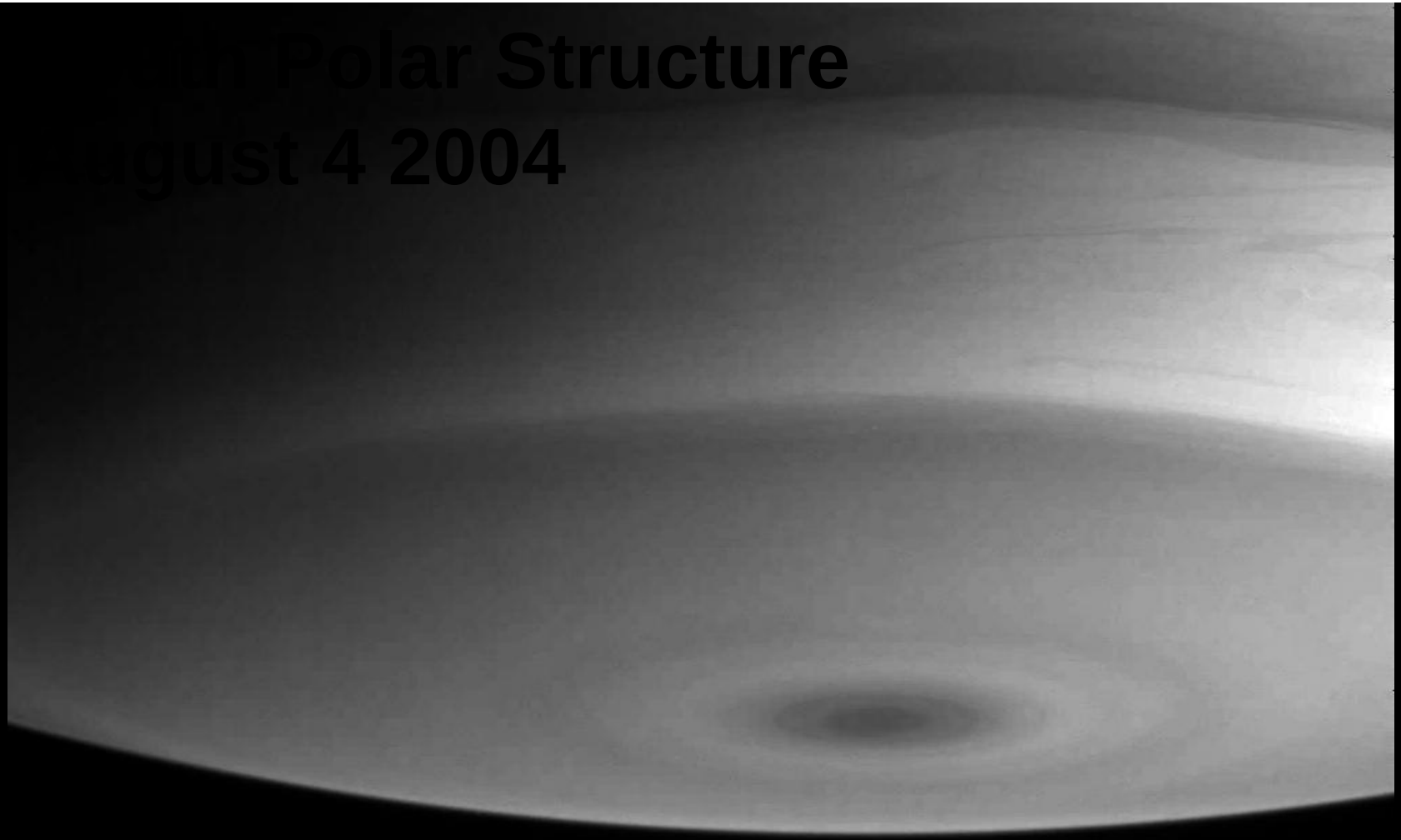
PHOEBE – High Resolution/1000x better than Voyager

Large Crater on Phoebe



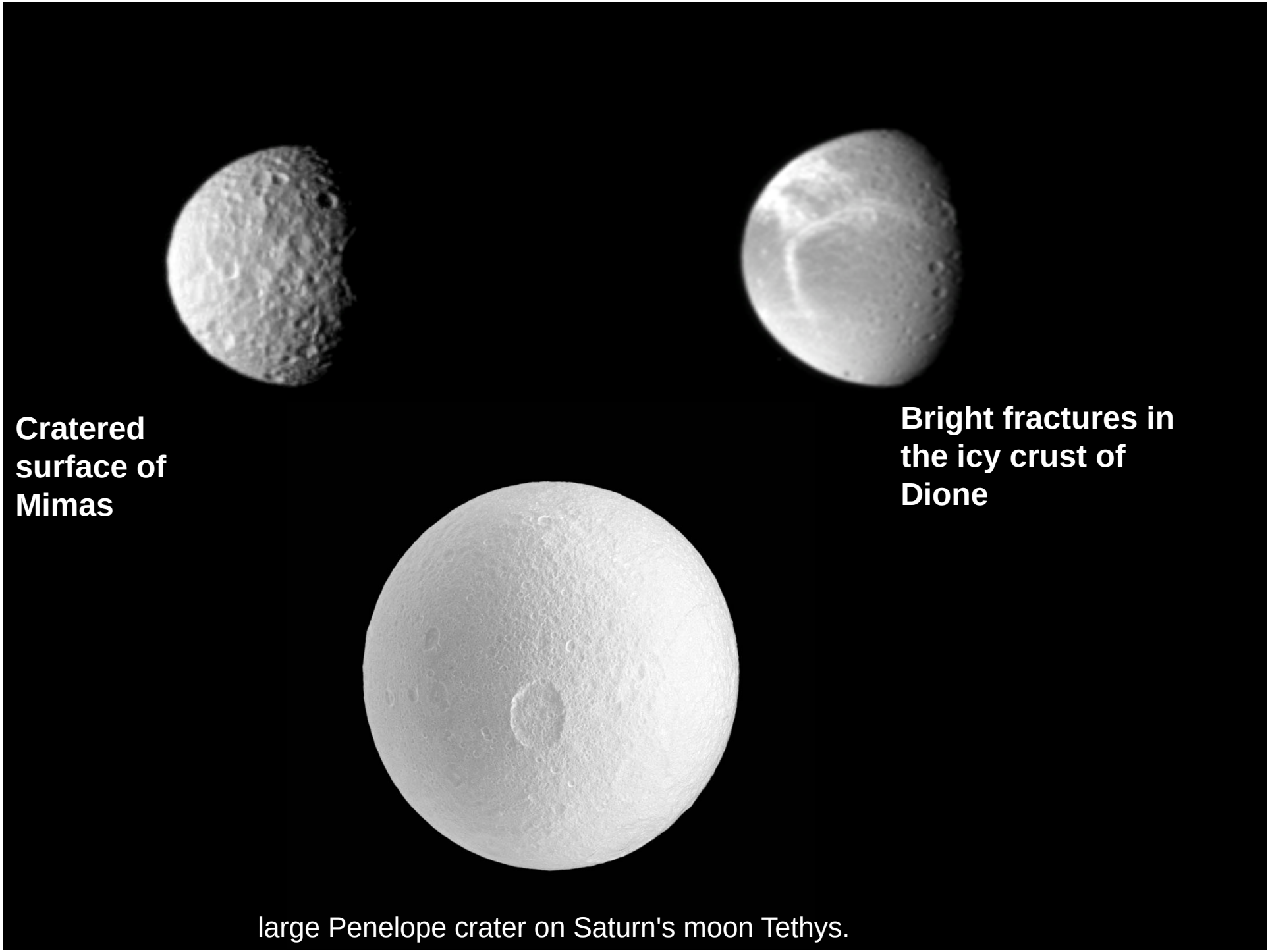
Crater Close-up on Phoebe June 13, 2004

Saturn Polar Structure
August 4 2004



Saturn's southern polar region exhibits concentric rings of clouds which encircle a dark spot at the pole. To the north and toward the right, wavy patterns are evident, resulting from the atmosphere moving with different speeds at different latitudes.

The image was taken with the Cassini spacecraft narrow angle camera from a distance of 5 million kilometers (3.1 million miles) from Saturn,.


Cratered surface of Mimas
Bright fractures in the icy crust of Dione
large Penelope crater on Saturn's moon Tethys.

The surface is stained by roughly north-south trending wispy streaks of dark material.

The absence of an atmosphere on Iapetus means that the material was deposited by some means other precipitation, such as ballistic emplacement of material from elsewhere on the moon, or deposition of infalling material from elsewhere in the Saturn system.

Images taken in infrared, green, and ultraviolet light filters were combined to create this image. The view was obtained from a distance of about 172,900 kilometers (107,435 miles) from Iapetus.

Dark-stained Iapetus in unrivaled clarity
December 31,2004

Lightning Strikes on Saturn

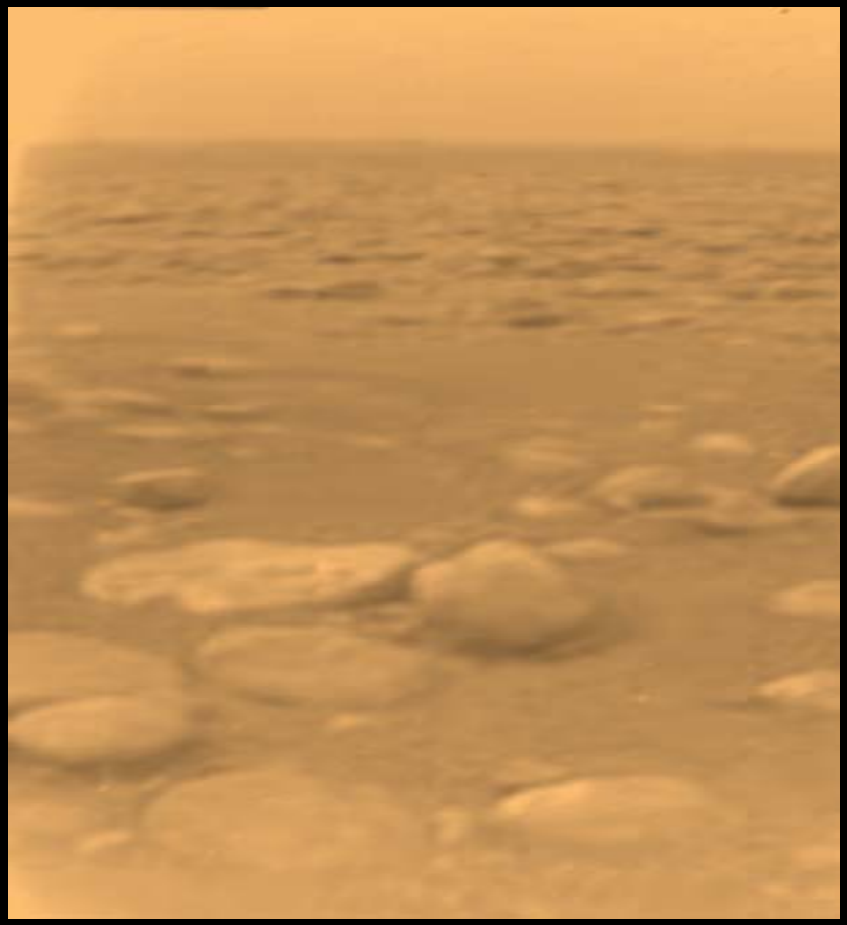
Giant oval in the ringed planet's southern hemisphere that is somewhat smaller than, but resembles in appearance, Jupiter's long-lived Great Red Spot.

Dark belt

bright zones

boundary turbulence due to wind shear and density differences between adjacent bands

1st Picture of Titan



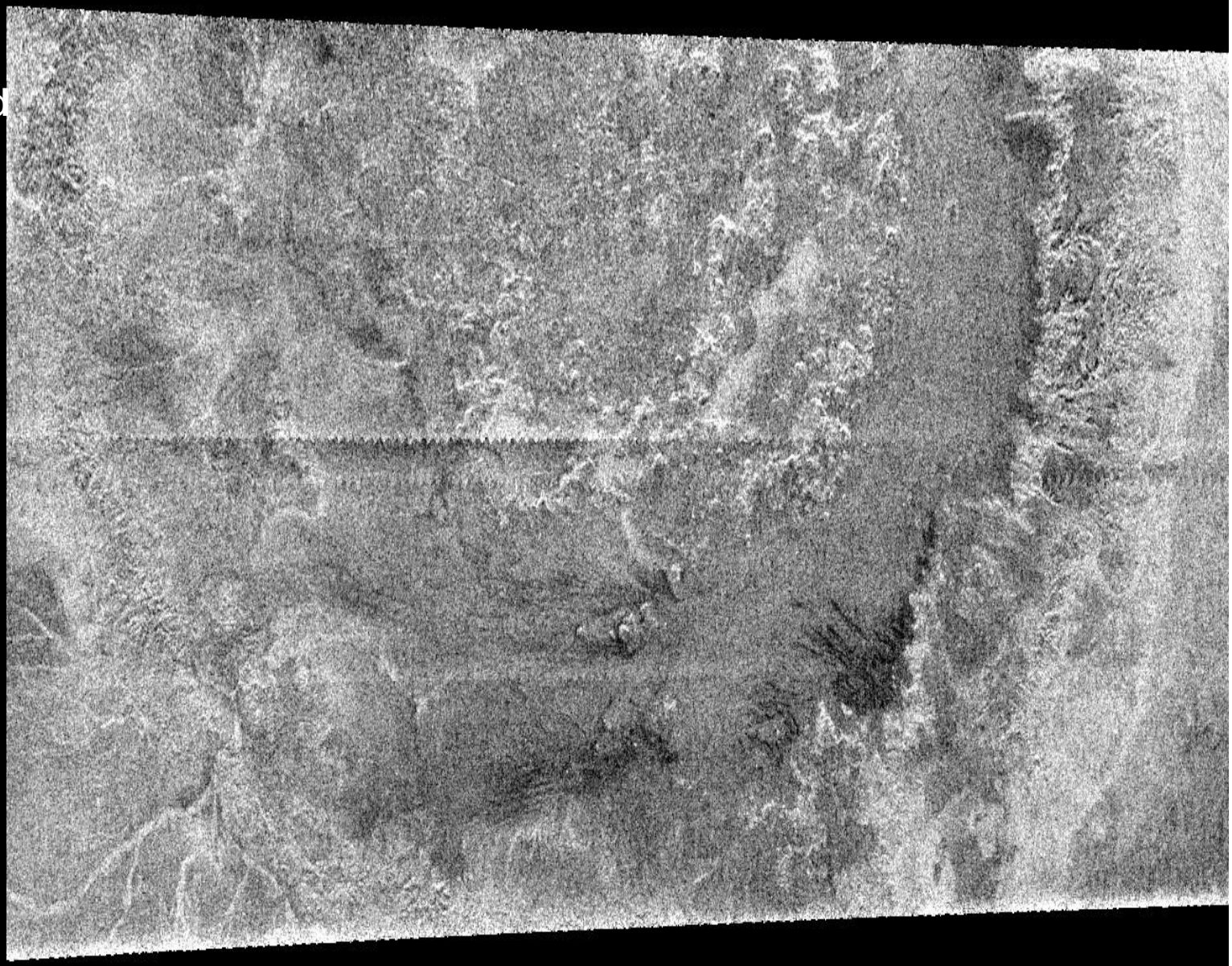
One of the first images taken by Huygens. Titan's surface is darker than scientists expected and is likely a mixture of water ice and hydrocarbons.

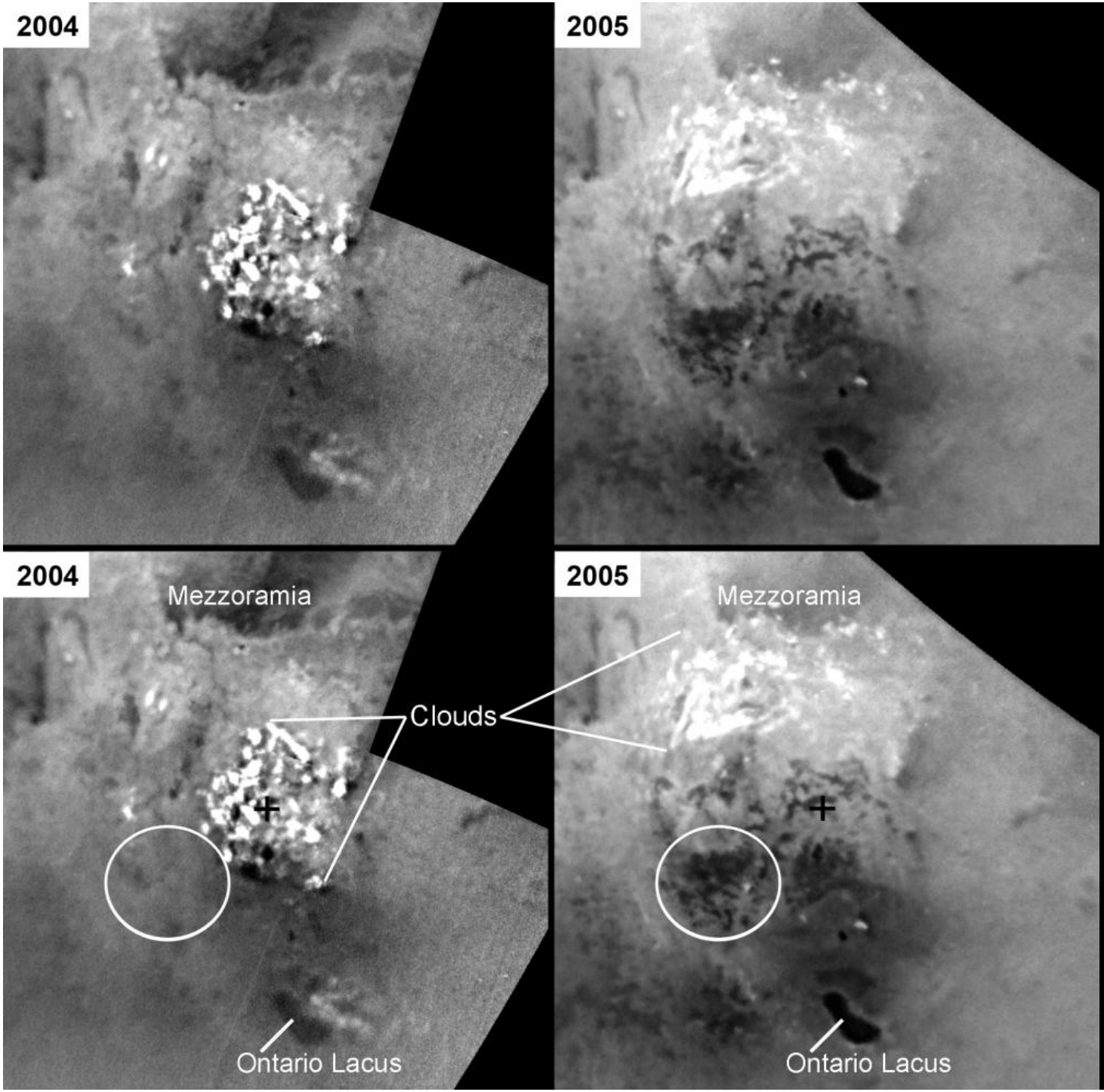
Circus Maximus- February 16, 2005

first impact feature identified in radar images of Titan.

huge annular feature with an outer diameter of ~ 440 kilometers (273 miles).

Resembles a large crater or part of a ringed basin, either of which could be formed when a comet or asteroid tens of kilometers in size slammed into Titan.





These mosaics of the south pole of Saturn's moon Titan, made from images taken almost one year apart, show changes in dark areas that may be lakes filled by seasonal rains of liquid hydrocarbons.

In the 2005 images, new dark areas are visible and have been circled in the labeled version. The very bright features are clouds in the lower atmosphere. Titan's clouds behave similarly to those on Earth, changing rapidly on timescales of hours and appearing in different places from day to day.

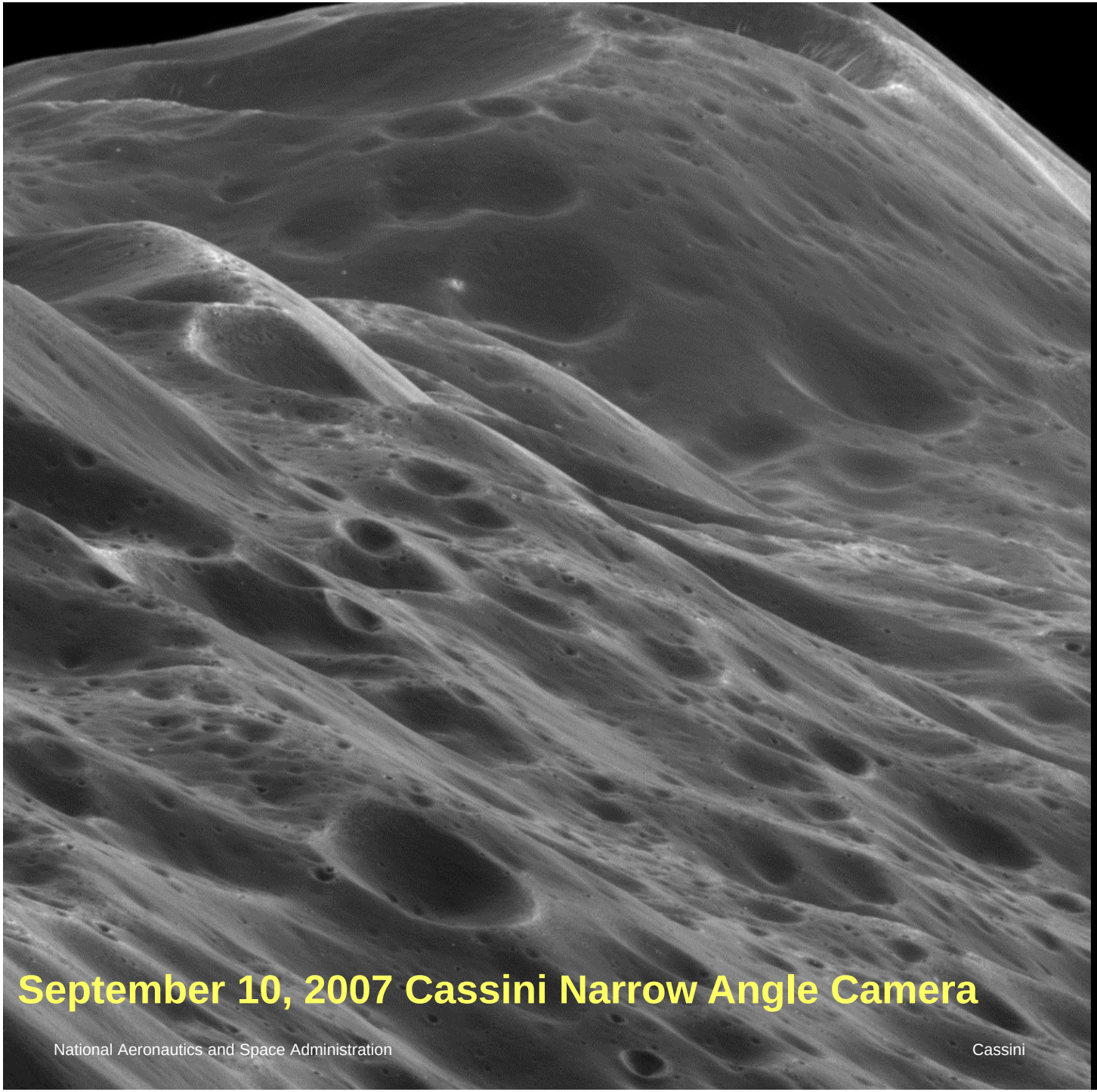
Mimas Blues

Mimas drifts along in its orbit against the azure backdrop of Saturn's northern latitudes in this true color view.

Images taken using infrared (930 nanometers), green (568 nanometers) and ultraviolet (338 nanometers) spectral filters were combined. The colors have been adjusted to match closely what the scene would look like in natural color.

The images were obtained using the Cassini spacecraft narrow angle camera on Jan. 18, 2005, at a distance of approximately 1.4 million kilometers (870,000 miles) from Saturn.

Jan 18, 2005



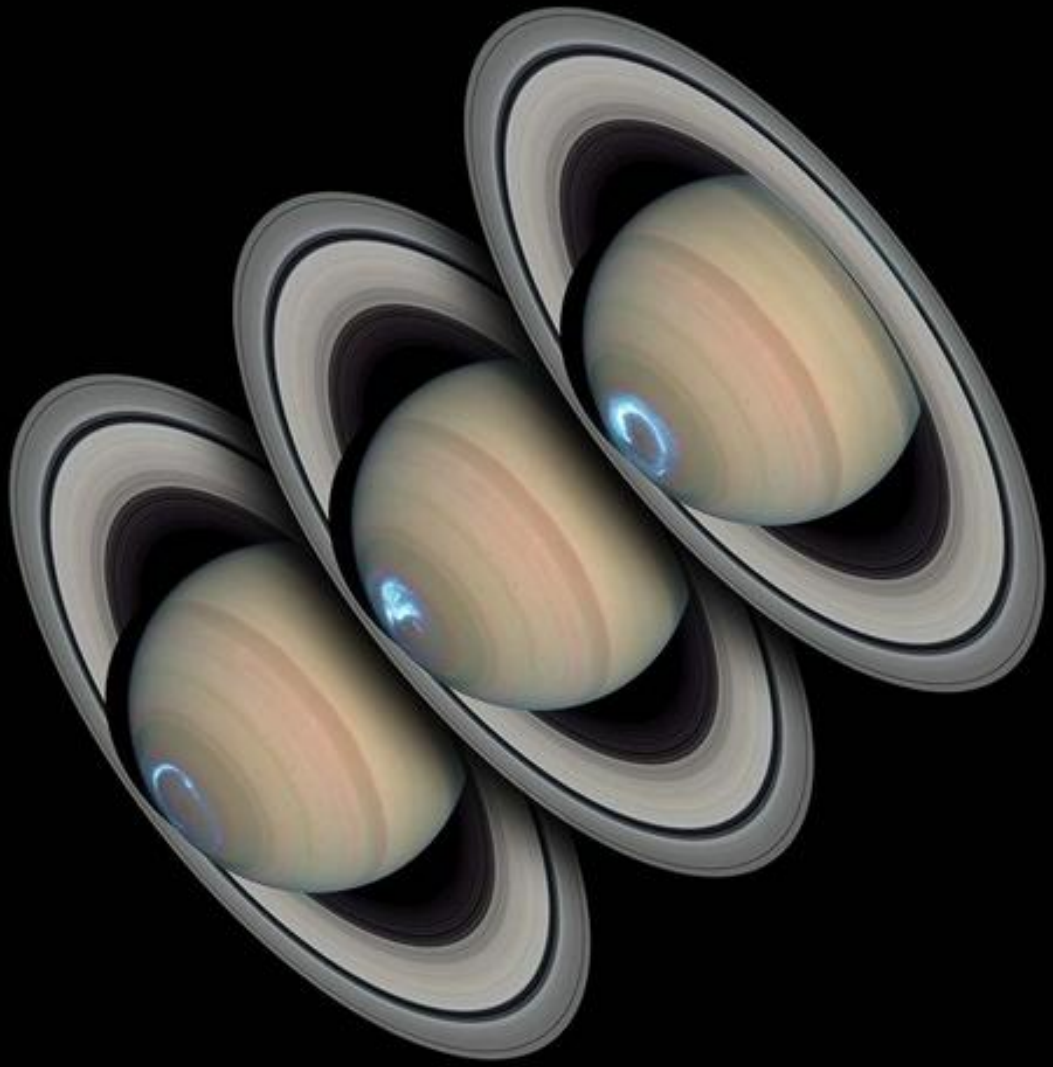
September 10, 2007 Cassini Narrow Angle Camera

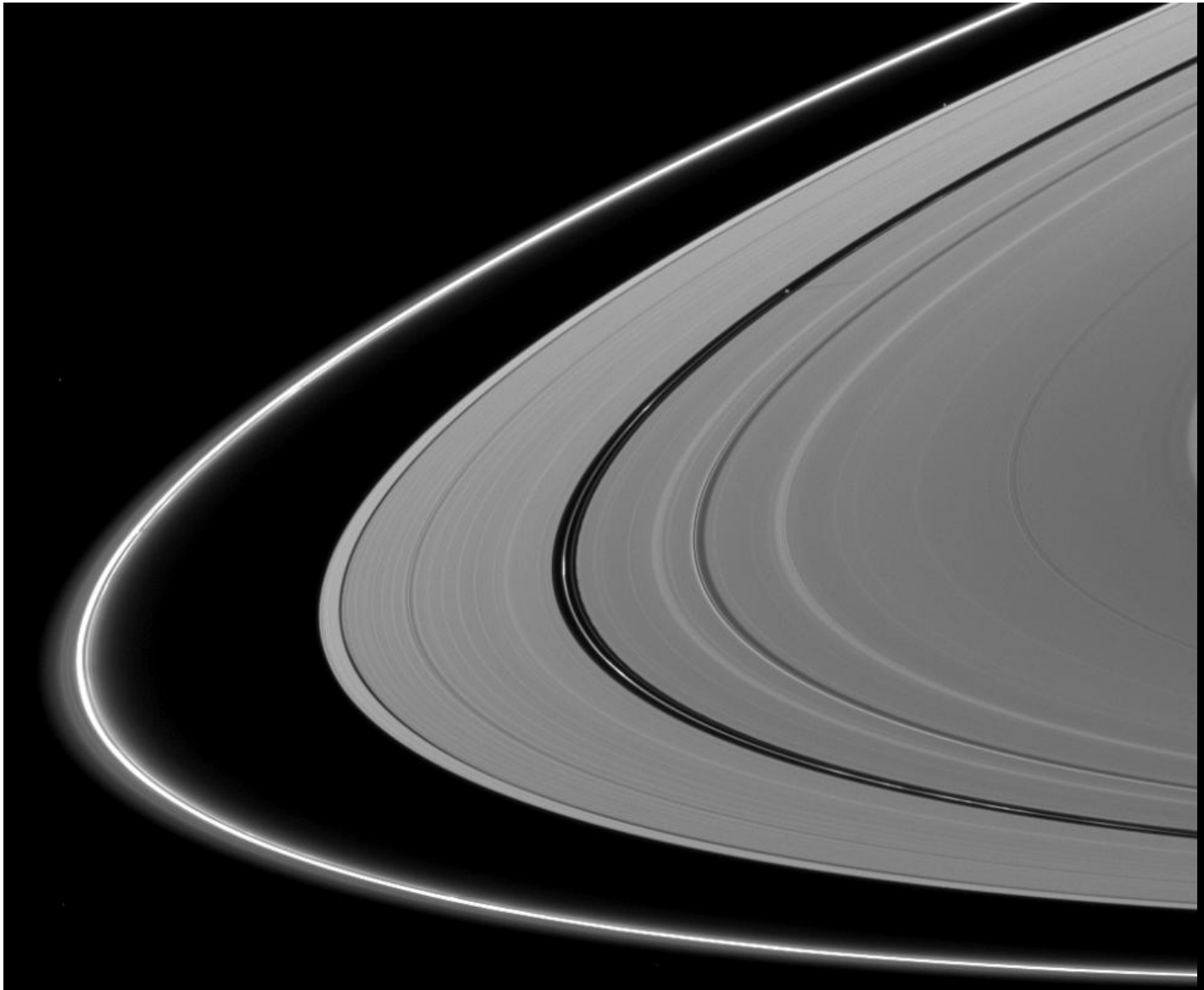
IAPETUS

This stunning close-up shows mountainous terrain reaching about 10 km in height on Iapetus.

Above the middle of the image can be seen a place where an impact has exposed the bright ice beneath the dark overlying material

Saturn's Auroras
February 16, 2005

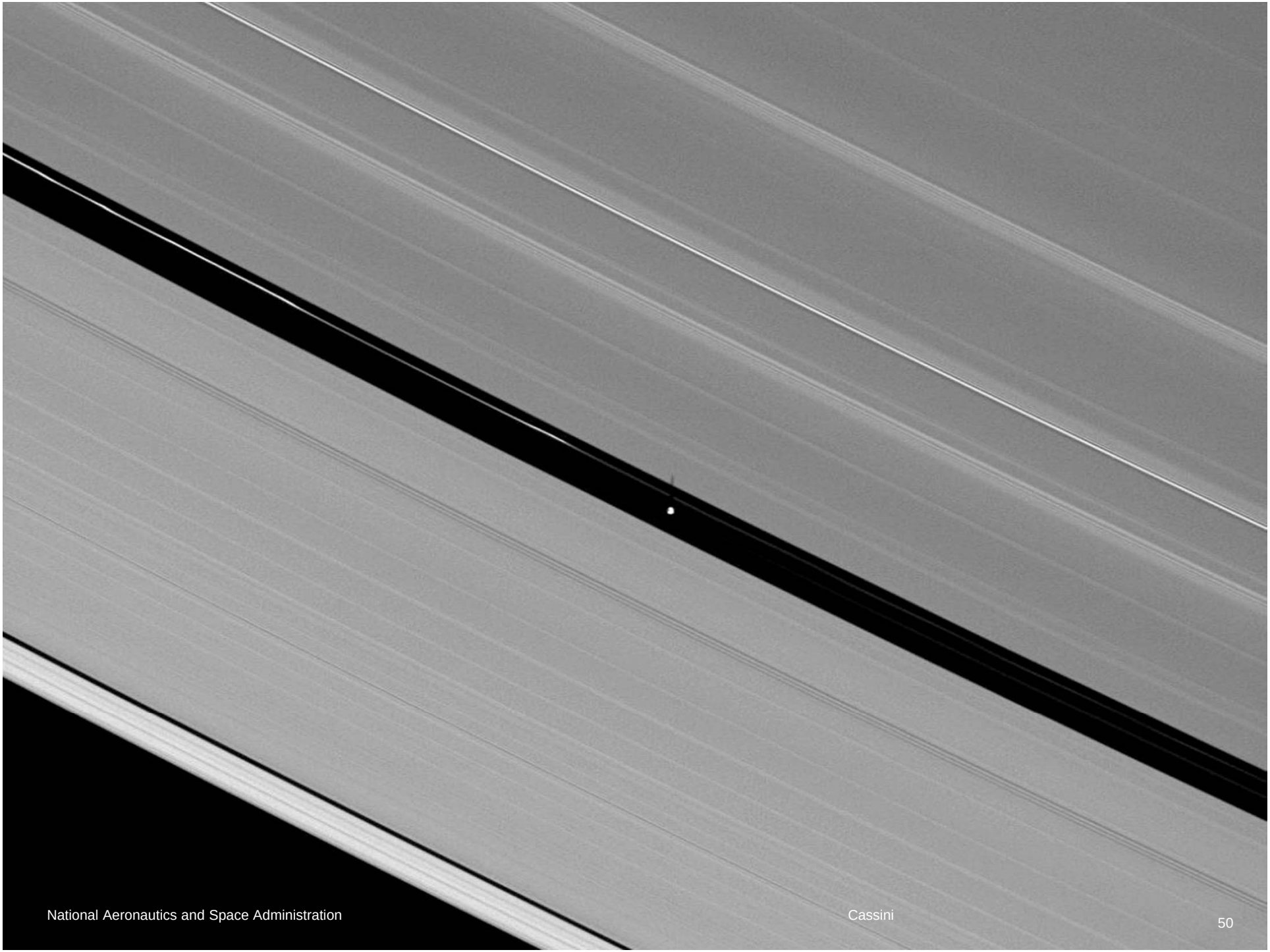


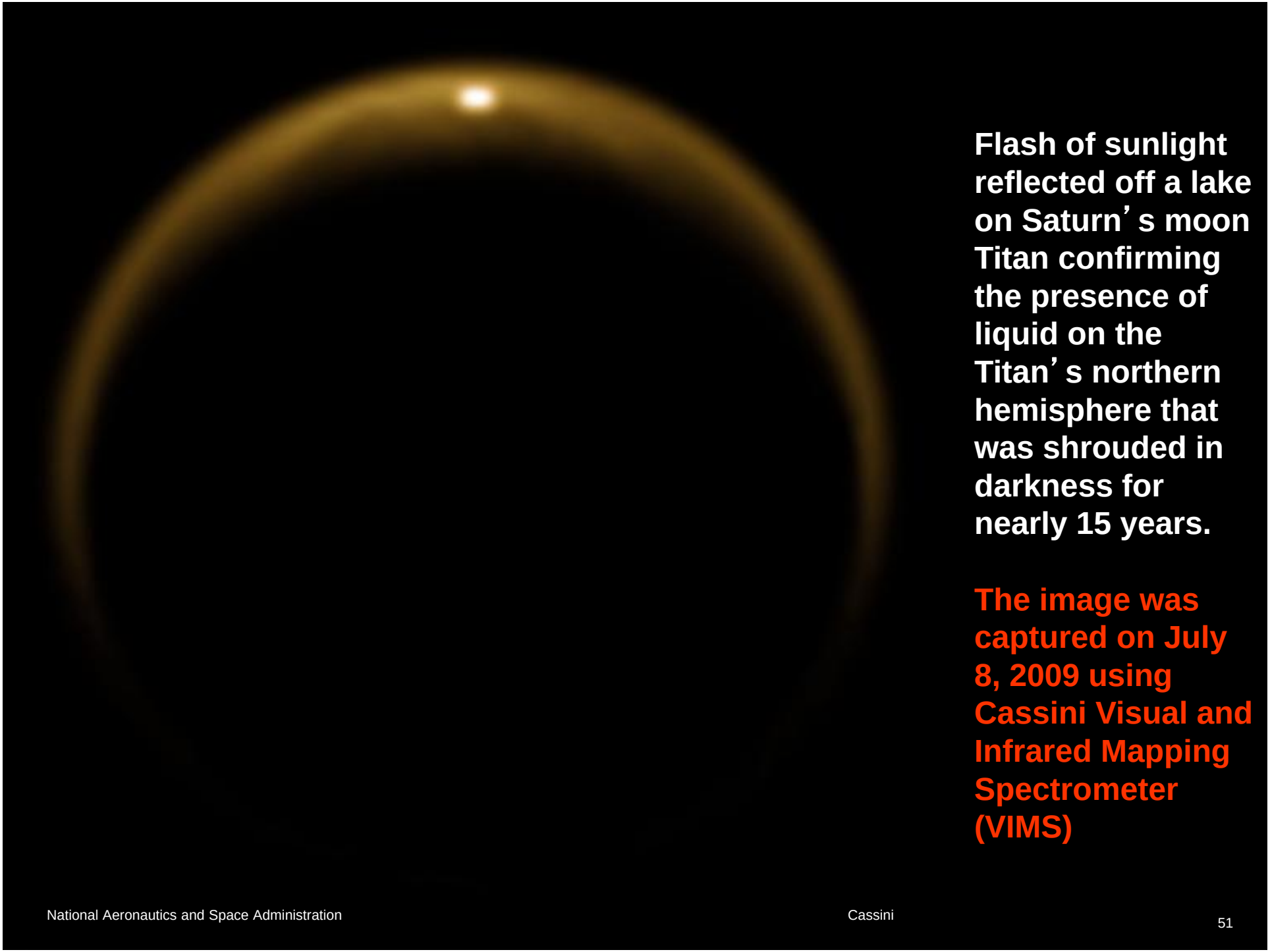


Pan (17 miles across) orbits in the Encke Gap, which runs through the center of the image. The small moon can be seen casting a faint, narrow shadow on the A ring above and to the right of the center of the image.

Janus (111 miles across) can be seen at the bottom right.

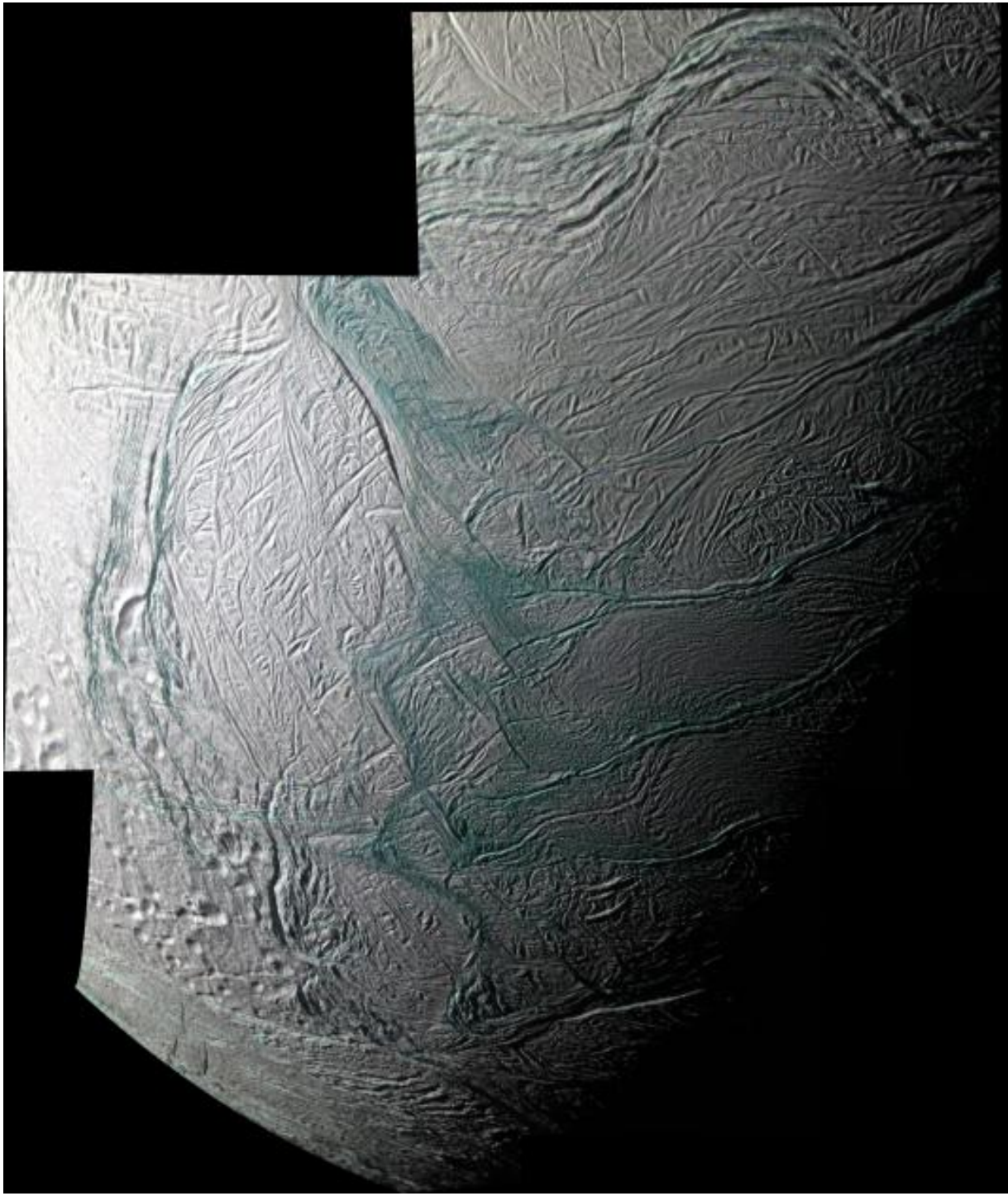
Picture taken by Cassini Narrow angle camera on September 13, 2009





Flash of sunlight reflected off a lake on Saturn's moon Titan confirming the presence of liquid on the Titan's northern hemisphere that was shrouded in darkness for nearly 15 years.

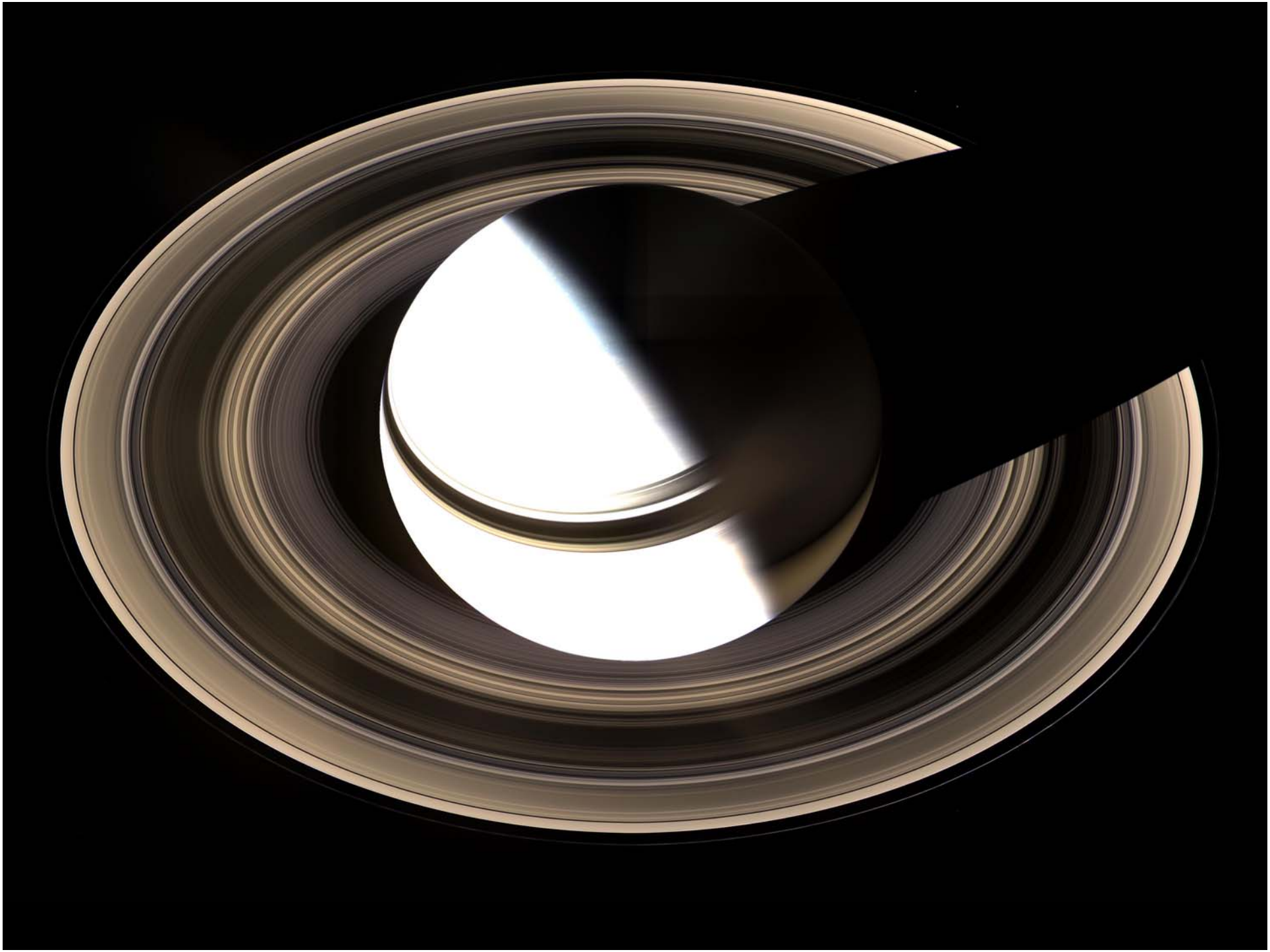
The image was captured on July 8, 2009 using Cassini Visual and Infrared Mapping Spectrometer (VIMS)

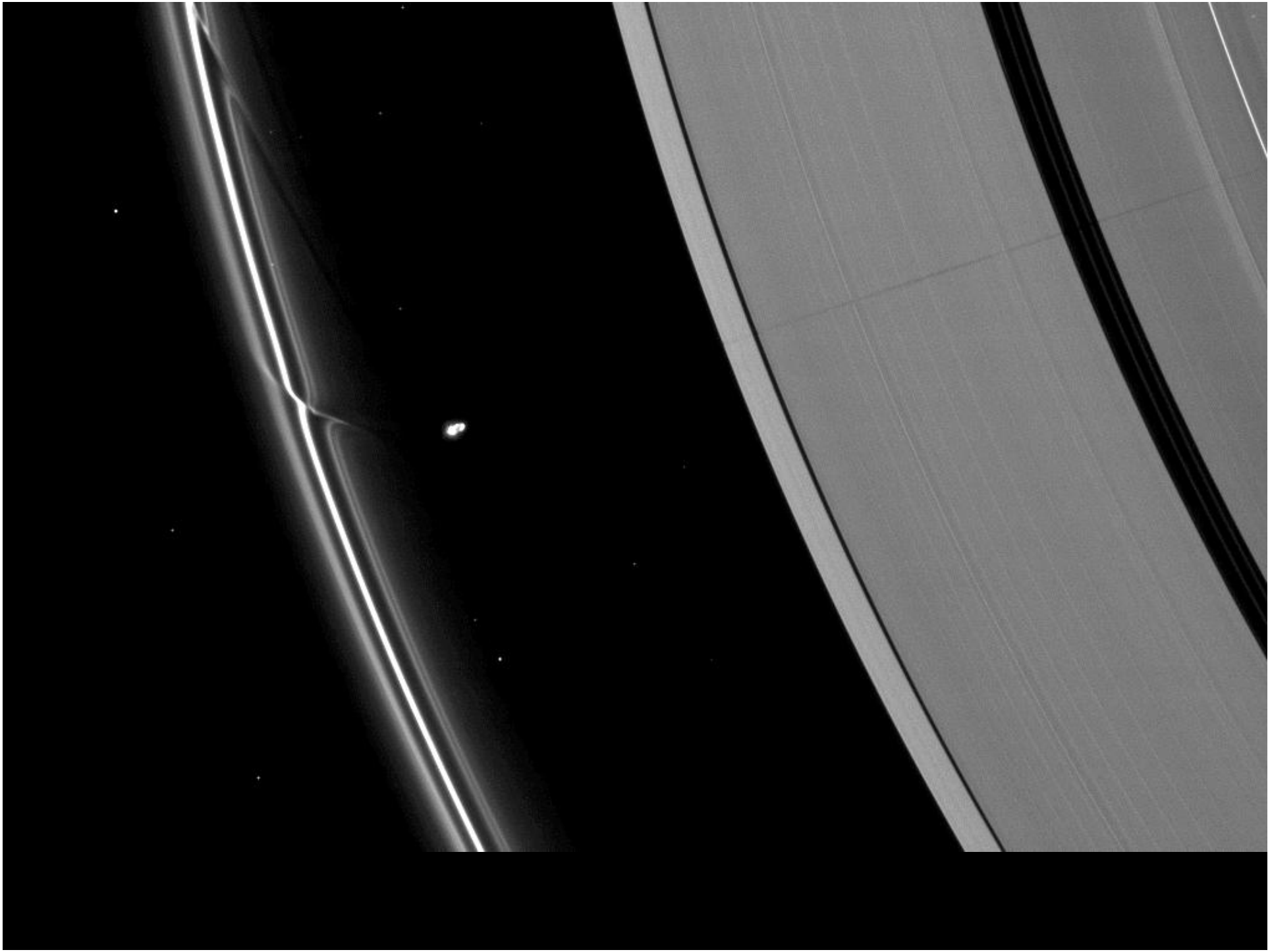


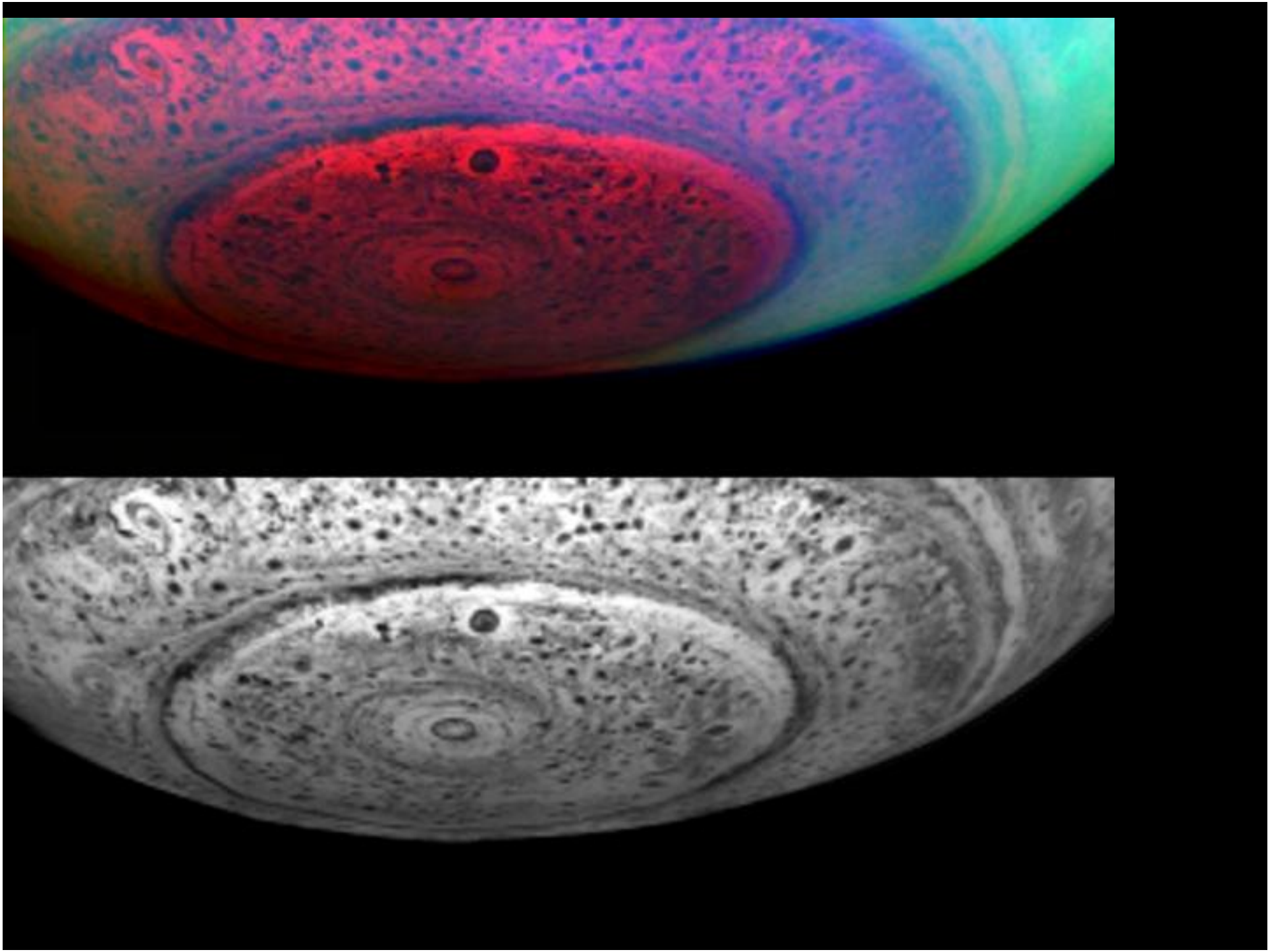
Imaging Science Subsystem (ISS) narrow-angle camera images obtained through ultraviolet, green, and near-infrared camera filters.

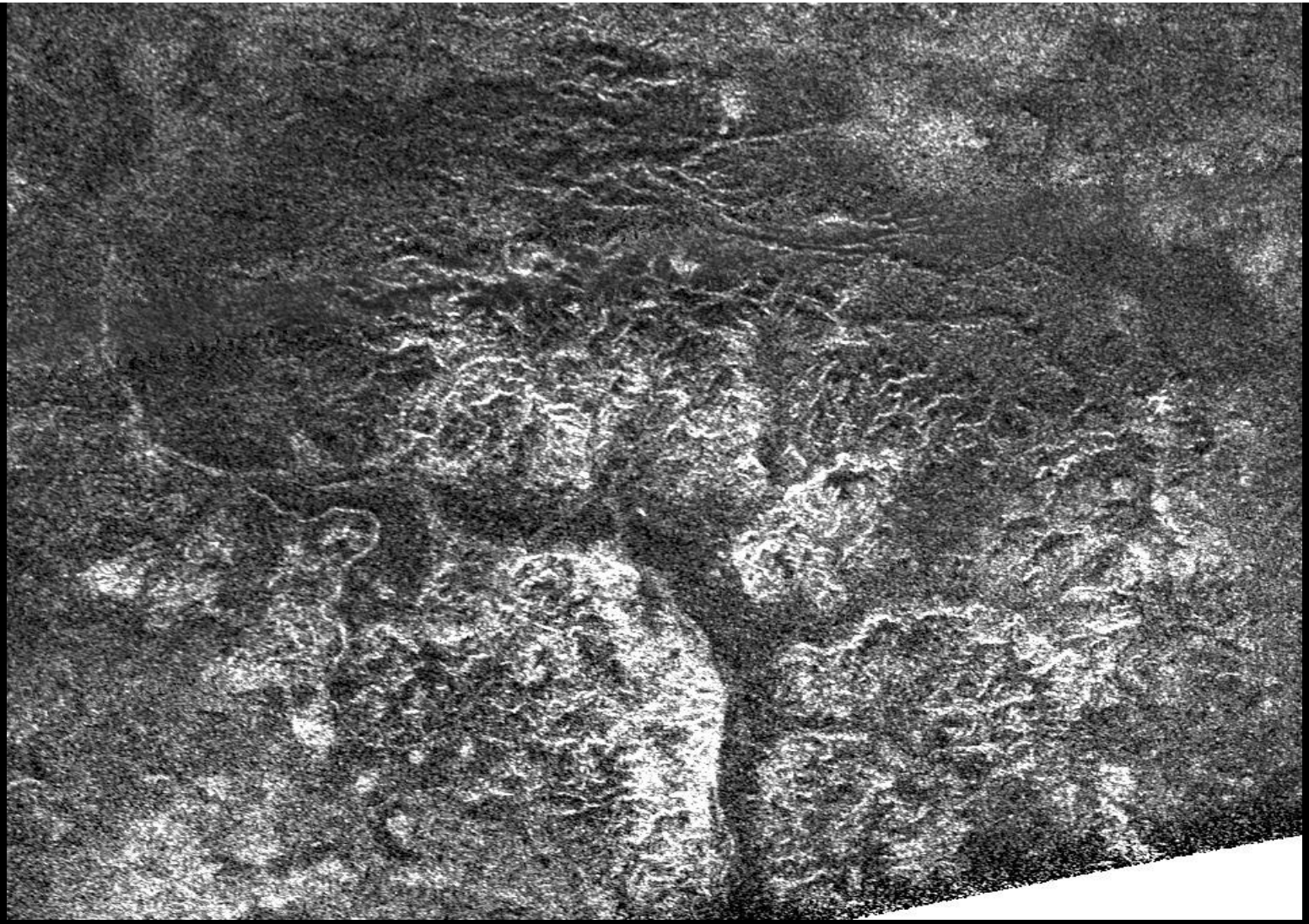
The original images ranged in resolution from 28 to 154 meters (92 to 505 feet) per pixel and were taken at distances ranging from 5,064 to 25,949 kilometers (3,140 to 15,468 miles) from Enceladus.

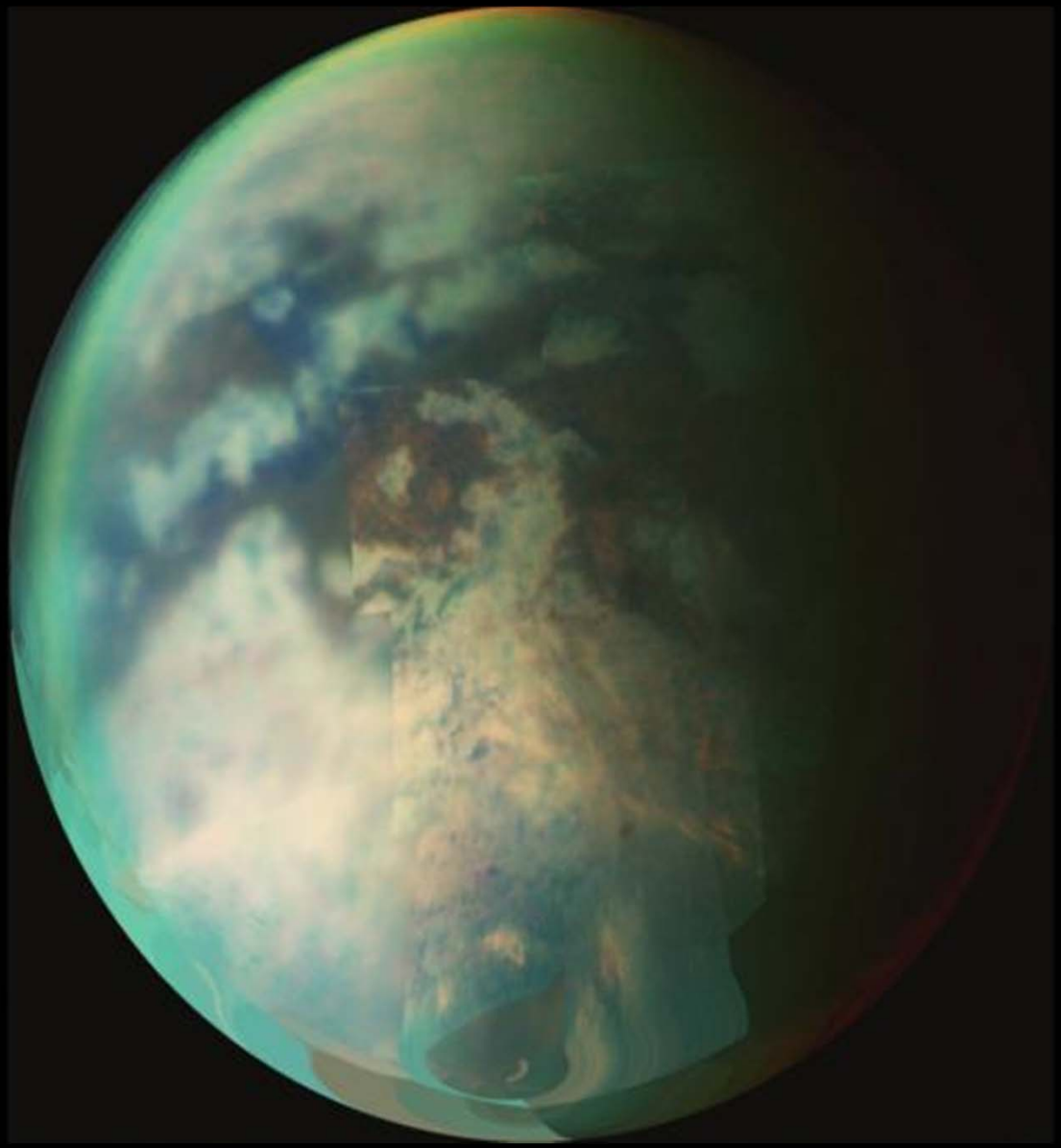
Areas that are greenish in appearance are believed to represent deposits of coarser grained ice and solid boulders. Whitish deposits represent finer grained ice. The mosaic shows that coarse-grained and solid ice are concentrated along valley floors and walls.



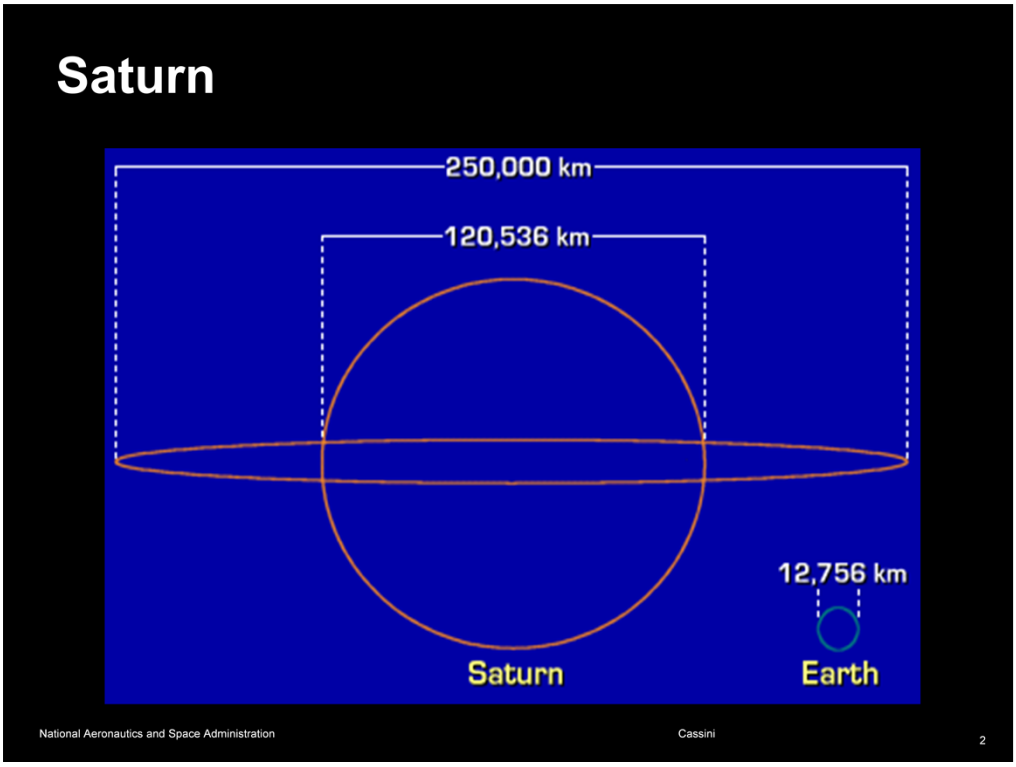









National Aeronautics and Space Administration
Cassini—Unlocking Saturn's Secrets
www.nasa.gov



Associated Greek God: Kronos

6th planet from the Sun

2nd Largest Planet in our Solar System (Gas Giant)

Atmosphere: 75% Hydrogen, 25% Helium, traces of Methane, Ammonia and other hydrocarbons (Saturn has clouds, rain, snow, winds, lightning and storms)

Density: 0.7 gm/cm*3 (Least dense of the planets)

Orbit from the Sun: 9.54 AU

Diameter: 120,536 km (74,975 mi)

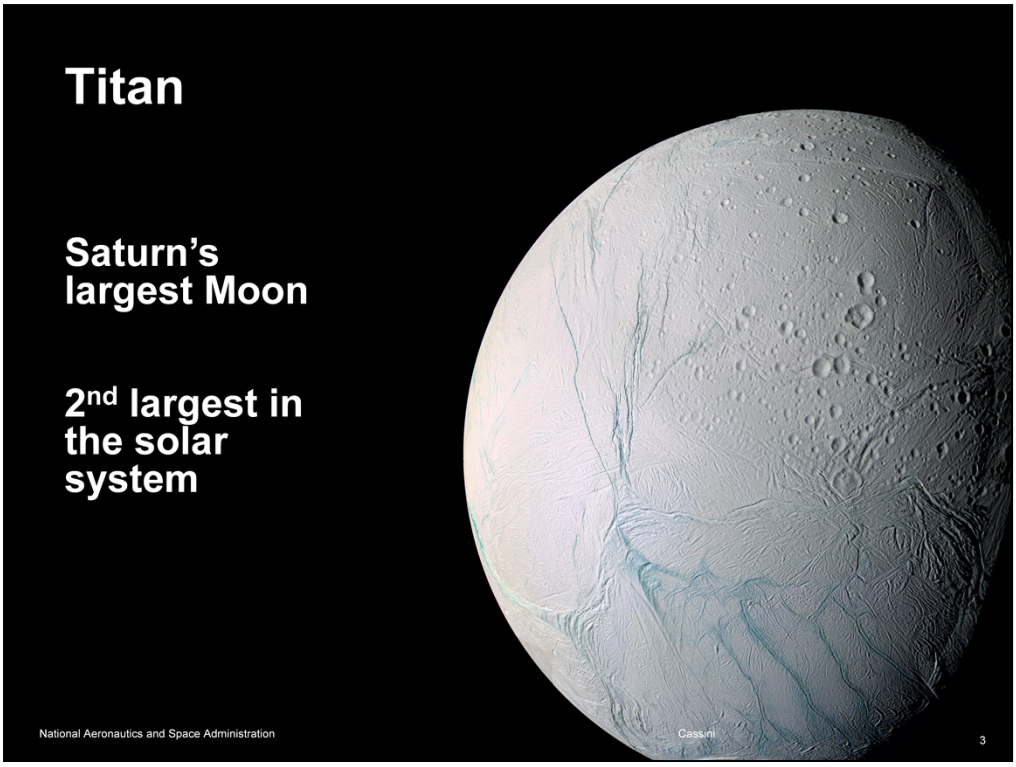
Length of day: 10 hr & 40 min (to spin around its axis)

Length of year: 29.42 (~ 30) Earth year

Rings : 7 (composed of water ice & rocky particles with icy coatings) – may disappear one day.

Moons: 60

1st visited by Pioneer 1 (1979), Voyager 1 & 2



Saturn's largest Moon
2nd largest in the solar system (after Ganymede of Jupiter)
Discovered in 1655 by Christiaan Huygens
Distance from Saturn: 1,221,870 km (759,200 mi)
Diameter: 5150 km (3199 mi)
Mass: 1/45 that of Earth
Density: 1.881 times that of Earth
Surface Temperature: -181 degree C (-294 degree F)
Surface Pressure: 1.5 bars (1.5 times that of Earth)
Composition: Nitrogen, Methane, traces of Ammonia, Argon, Ethane
Orbital Period: 16 Earth day
Only moon to have clouds & a thick planet-like atmosphere
Has an active atmosphere and complex Earth like processes that shape its surface

This false-color mosaic from NASA's Cassini spacecraft shows the tail of Saturn's huge northern storm.

Determine Titan's atmospheric composition

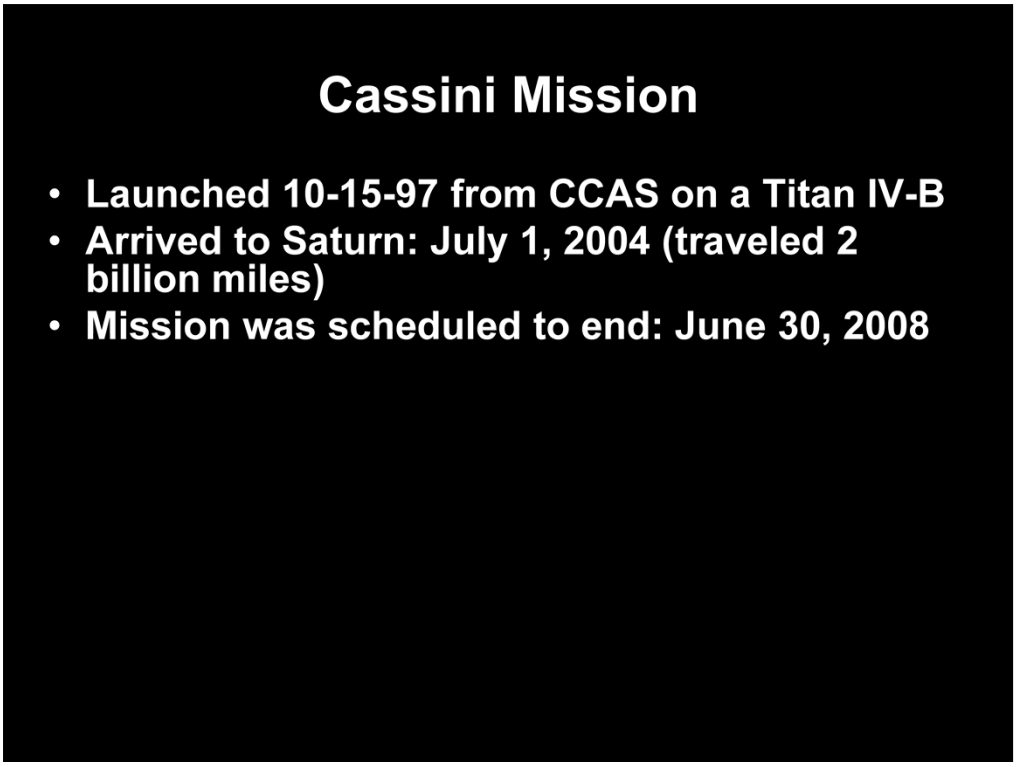
Investigate energy sources for atmospheric chemistry

Study aerosol properties and cloud physics

Measure winds and global temperatures

Determine properties of Titan surface and internal structure

Investigate the upper atmosphere and ionosphere



Launched 10-15-97 from CCAS on a Titan IV-B

Arrived to Saturn: July 1, 2004 (traveled 2 billion miles)

Mission was scheduled to end: June 30, 2008

Mission received a 27-month extension to Sept. 2010

Mission received a second extension to 2017 FY 2011 provided $60 Million per year

- Allows mission to continue until a few month past Northern Summer Solstice in May 2017 (Beginning of summer in Northern Hemisphere and winter in the southern Hemisphere)
- Mission started in 2004 just after Saturn's Northern Winter Solstice

International effort : NASA, ESA, ISA & 17 nations

Largest interplanetary SC ever launched

Spacecraft & Huygens Probe

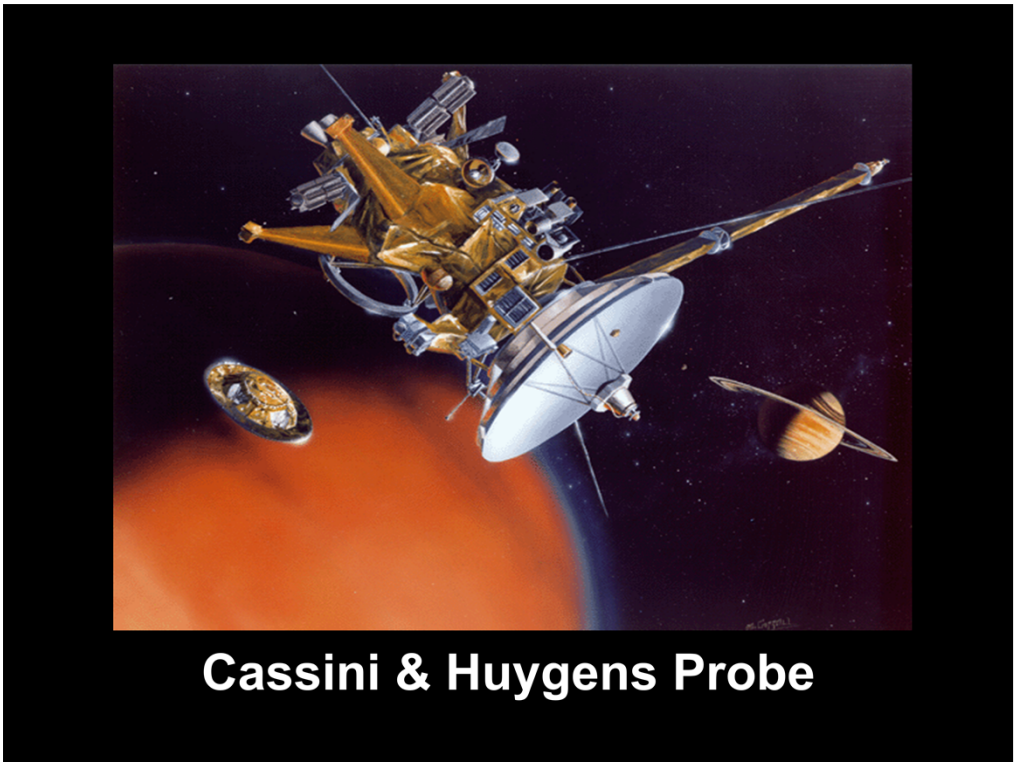
Spacecraft Named after Italian Astronomer Jean Dominique Cassini who discovered Iapetus, Rhea, Tethys and Dione. He discovered the narrow gap separating Saturn's rings known today as the "Cassini Division'.

Probe named after Christian Huygens who in 1655 discovered Titan

12 science instruments

Mission Cost : $ 3.27 Billion (US contribution $2.6 billion / $660 million from European)

Work carried out in 33 US States / > 5000 people worked on it

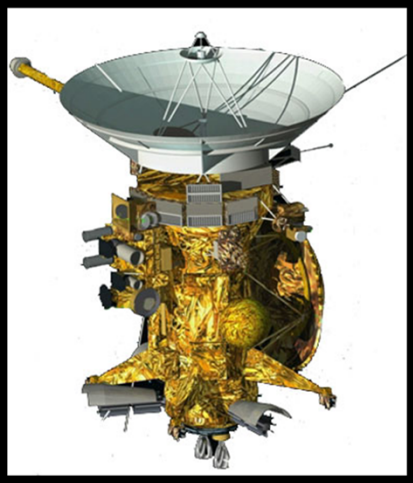


Cassini & Huygens Probe

Key Facts

HUYGENS PROBE	
Mass	350 kg
Height	2.7 m
Mission duration	2 hours and 30 minutes
Onboard experiments	6
CASSINI ORBITER	
Mass	5,300 kg
Height	6.8 m
Mission duration	4 years
Orbit	Variable
Onboard experiments	12

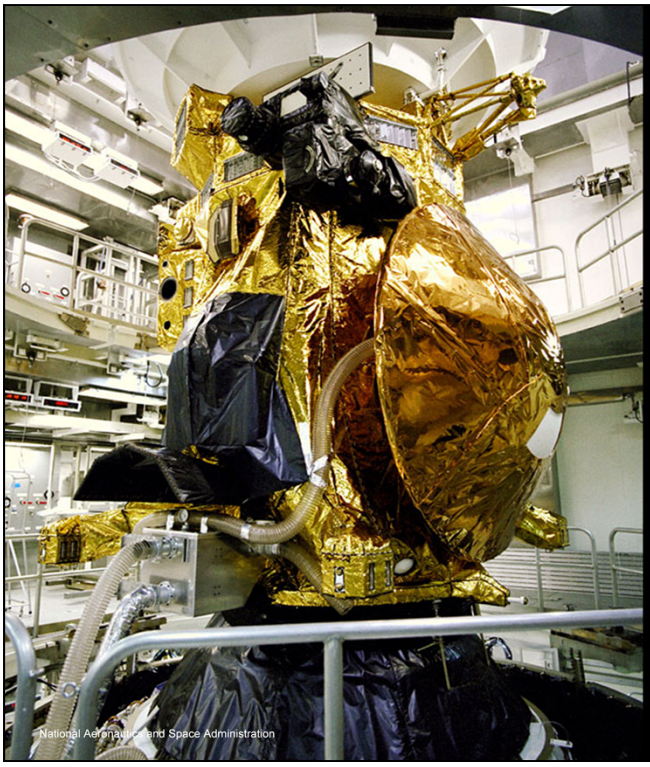
Orbiter & Probe Mass:
5655 Kg (12,470 lbs- ~6.2 tons)



RTGs are the spacecraft power systems that provide power through the natural radioactive decay of plutonium (mostly Pu-238, a non-weapons-grade isotope). The heat generated by this natural process is changed into electricity by solid-state thermoelectric Converters

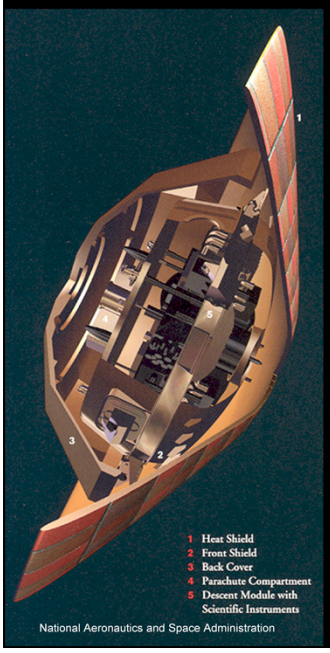
The United States has an outstanding record of safety in using RTGs on 24 missions over the past three decades.

More than 30 years have been invested in the engineering, safety analysis and testing of RTGs. Safety features are incorporated into the RTGs' design, and extensive testing has demonstrated that they can withstand physical conditions more severe than those expected from most accidents.

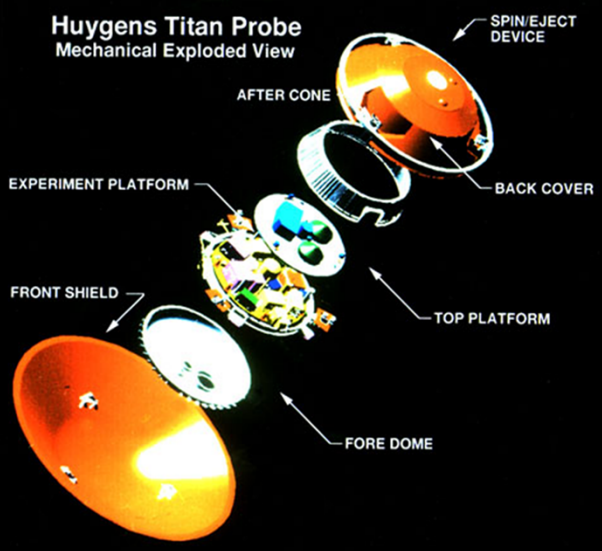


Huygens Probe @ the Pad

Huygens Probe Exploded View



National Aeronautics and Space Administration



Cassini

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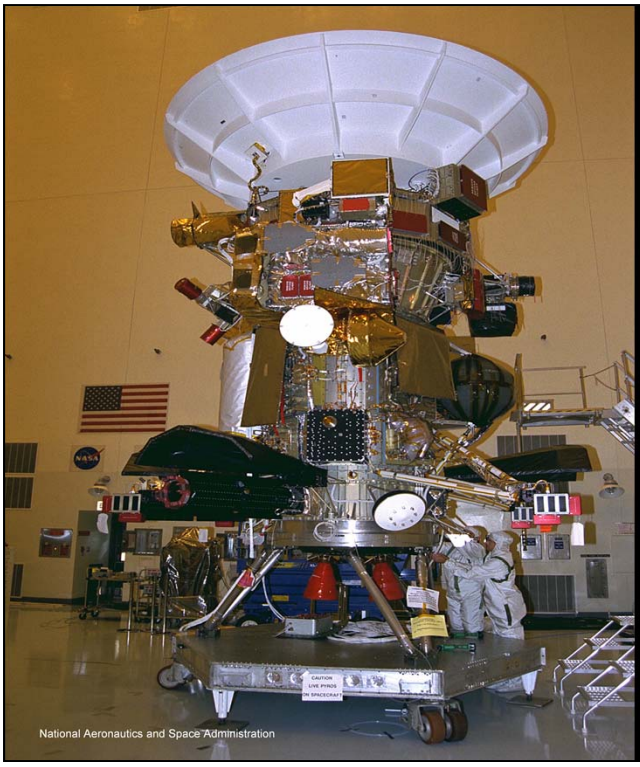


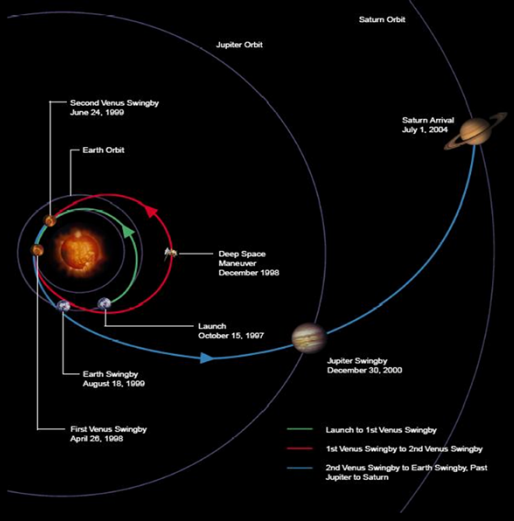
Cassini Processing At the PHSF/ KSC

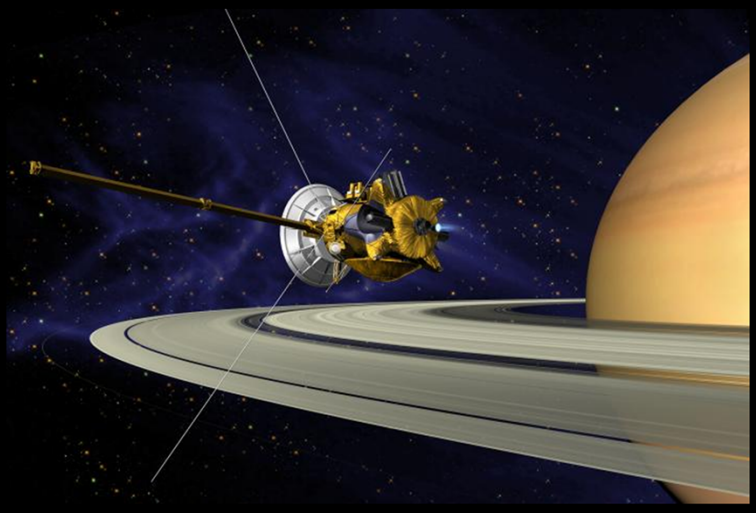
Cassini processing in the ES at LC-40/CCAS

TITAN IV B Launched CASSINI on 10-15-97 from CCAS

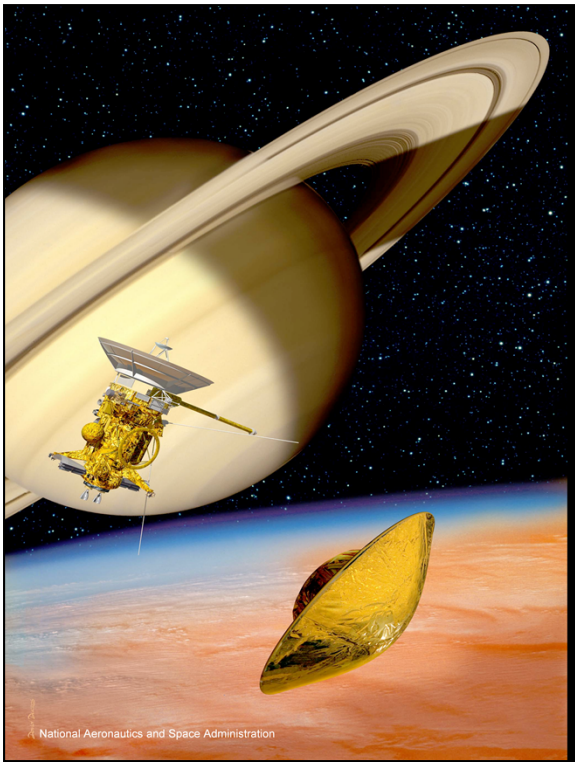
Cassini's VVEJGA Trajectory

V:1998
V:1999
E:1999
J:2000
S:2004





SOI maneuver (90 minutes long) allowed Cassini to be captured by Saturn's gravity into a 5-month orbit.



Huygens will be the first spacecraft to land on a world in the outer Solar System

22 day cruise toward Titan

In January 15, 2005 Huygens landed on the surface of Titan

The Huygens data may offer clues about how life began on Earth.


One of the Landing Scenarios
National Aeronautics and Space Administration
Cassini
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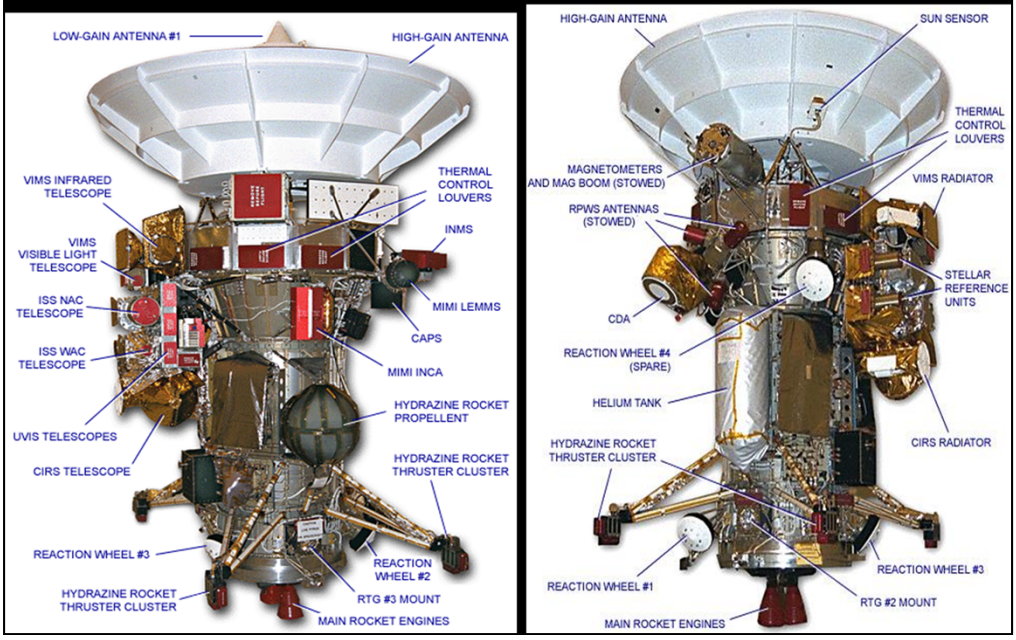
Cassini Orbiter Instruments

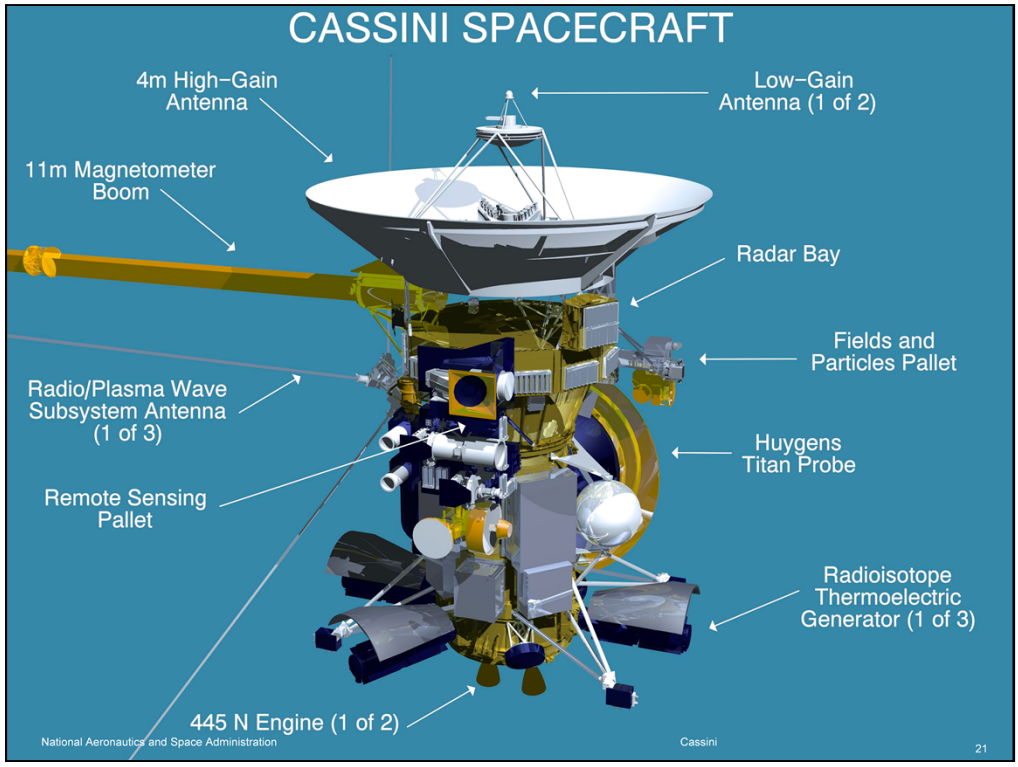
12 Instruments that Survey, sniff, analyze, scrutinize and take stunning images in various visible spectra.

Optical Remote Sensing
Mounted on the remote sensing pallet, these instruments study Saturn and its rings and moons in the electromagnetic spectrum.

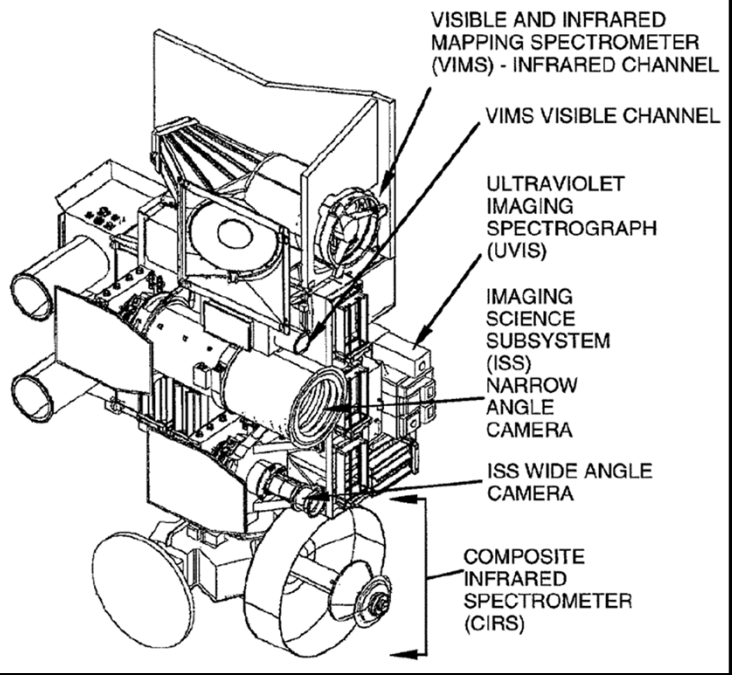
1.Composite Infrared Spectrometer (CIRS)
2.Imaging Science Subsystem (ISS)
3.Ultraviolet Imaging Spectrograph (UVIS)
4.Visible and Infrared Mapping Spectrometer (VIMS)

Cassini Spacecraft




CASSINI SPACECRAFT
4m High-Gain Antenna
Low-Gain Antenna (1 of 2)
11m Magnetometer Boom
Radar Bay
Fields and Particles Pallet
Radio/Plasma Wave Subsystem Antenna (1 of 3)
Huygens Titan Probe
Remote Sensing Pallet
Radioisotope Thermoelectric Generator (1 of 3)
445 N Engine (1 of 2)
National Aeronautics and Space Administration
Cassini
21

REMOTE SENSING PALLET

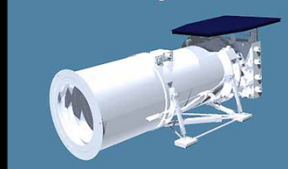


22

Cassini's Most Important instrument

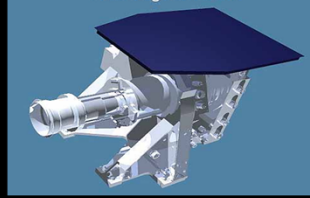
ISS NAC

Imaging Science Subsystem
Narrow Angle Camera



ISS WAC

Imaging Science Subsystem
Wide Angle Camera



Space Science Institute

National Aeronautics and Space Administration

Cassini

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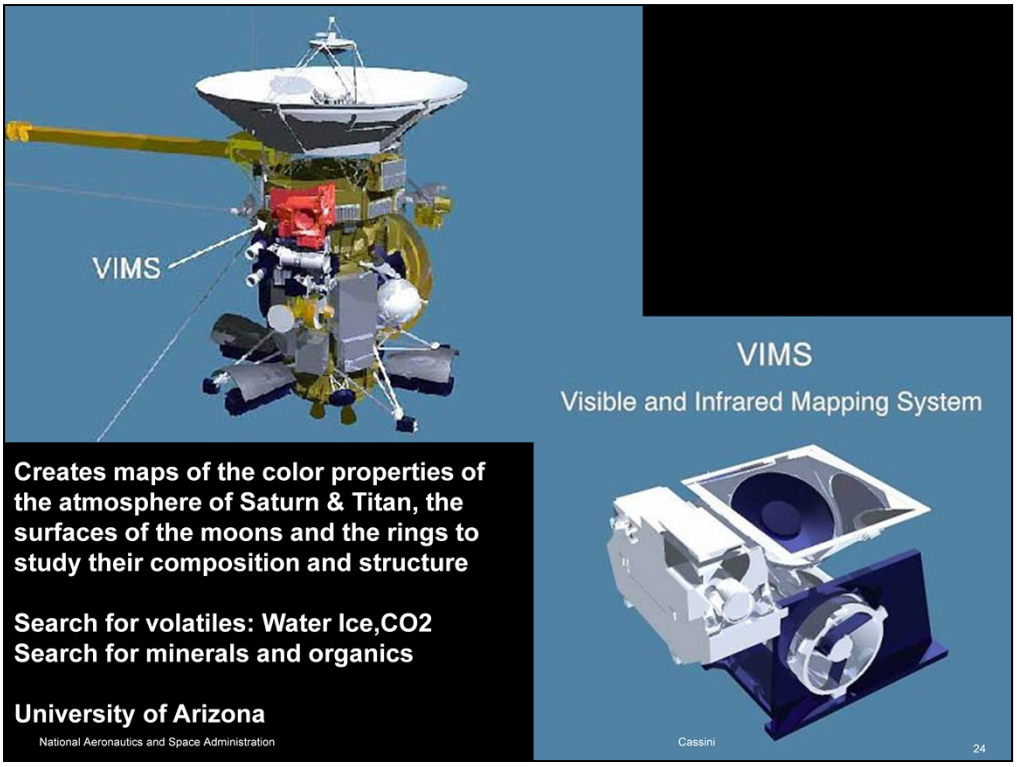
VIMS
VIMS
Visible and Infrared Mapping System
Creates maps of the color properties of the atmosphere of Saturn & Titan, the surfaces of the moons and the rings to study their composition and structure
Search for volatiles: Water Ice,CO2
Search for minerals and organics
University of Arizona
National Aeronautics and Space Administration
Cassini
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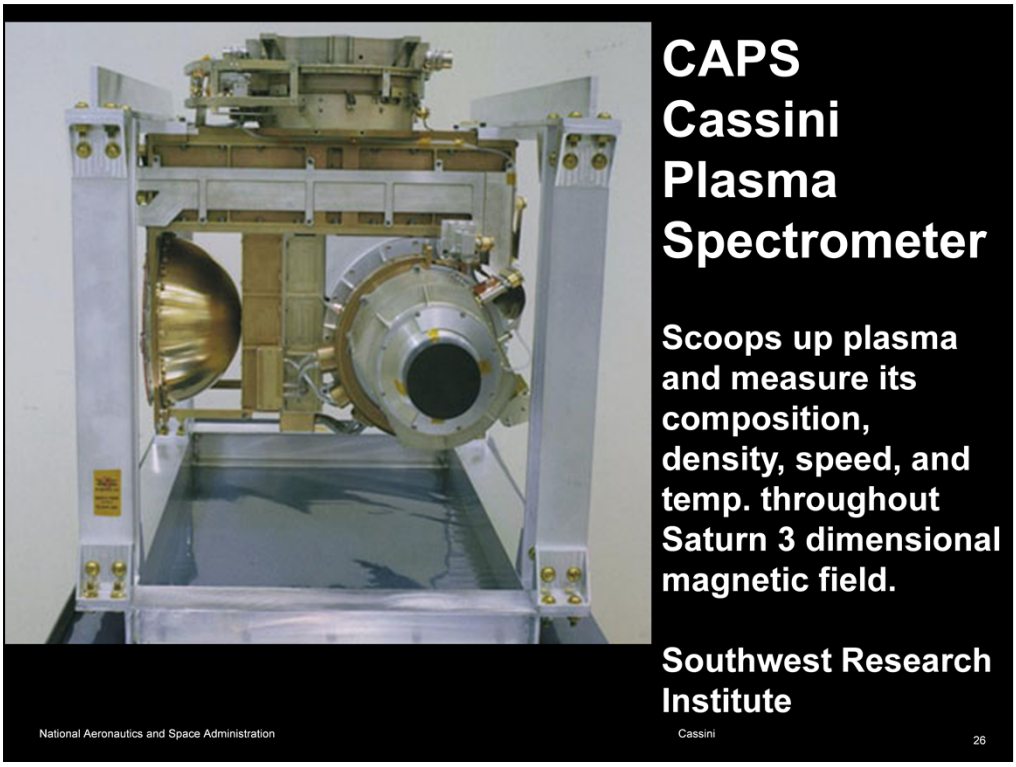
Fields, particles and Waves

Study the dust, plasma and magnetic field around Saturn.
While most don't produce pictures the information they collect is critical to scientists Understanding of this rich environment

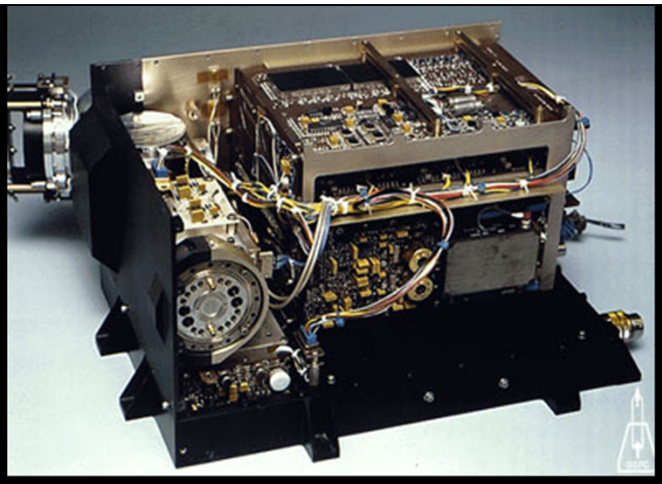
1. Cassini Plasma Spectrometer (CAPS)
2. Cosmic Dust Analyzer (CDA)
3. Ion and Neutral Mass Spectrometer (INMS)
4. Magnetometer (MAG)
5. Magnetospheric Imaging Instrument (MIMI)
6. Radio and Plasma Wave Science (RPWS)



CAPS Cassini Plasma Spectrometer

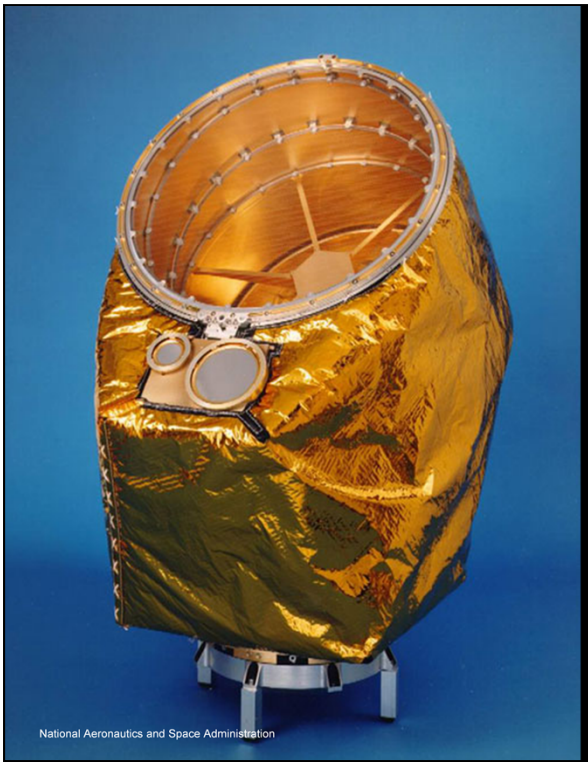
Scoops up plasma and measure its composition, density, speed, and temp. throughout Saturn 3 dimensional magnetic field.

Southwest Research Institute



INMS (Ion and neutral Mass Spectrometer)

Can detect neutral atoms and positively charged ions.
Scoops up material and determines the compositions and isotopic abundances of chemical and elements in the upper reaches of Saturn and Titan's atmosphere and Saturn E ring
Southwest Research Institute



Cosmic Dust Analyzer (CDA)

Max Planck Institut fur kernphysik

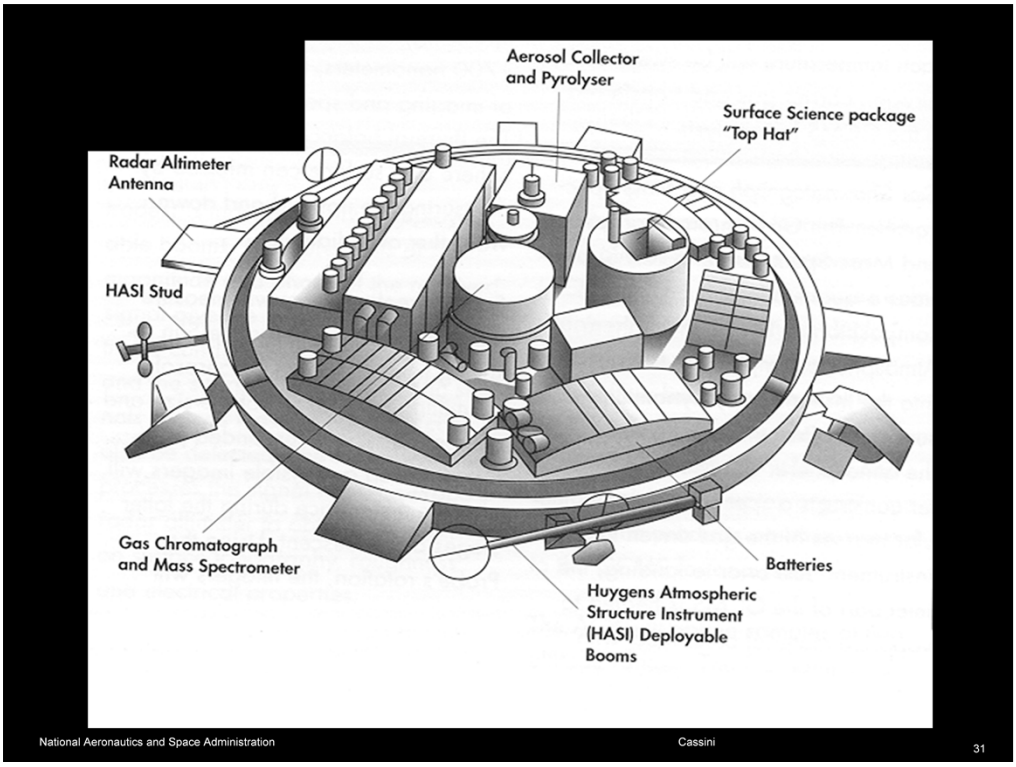
Microwave Remote Sensing

Using Radio waves these instruments map atmospheres, determine the mass of moons, Collect data on ring particle size, and unveil the surface of Titan

1.Radar
2.Radar Science (RSS)

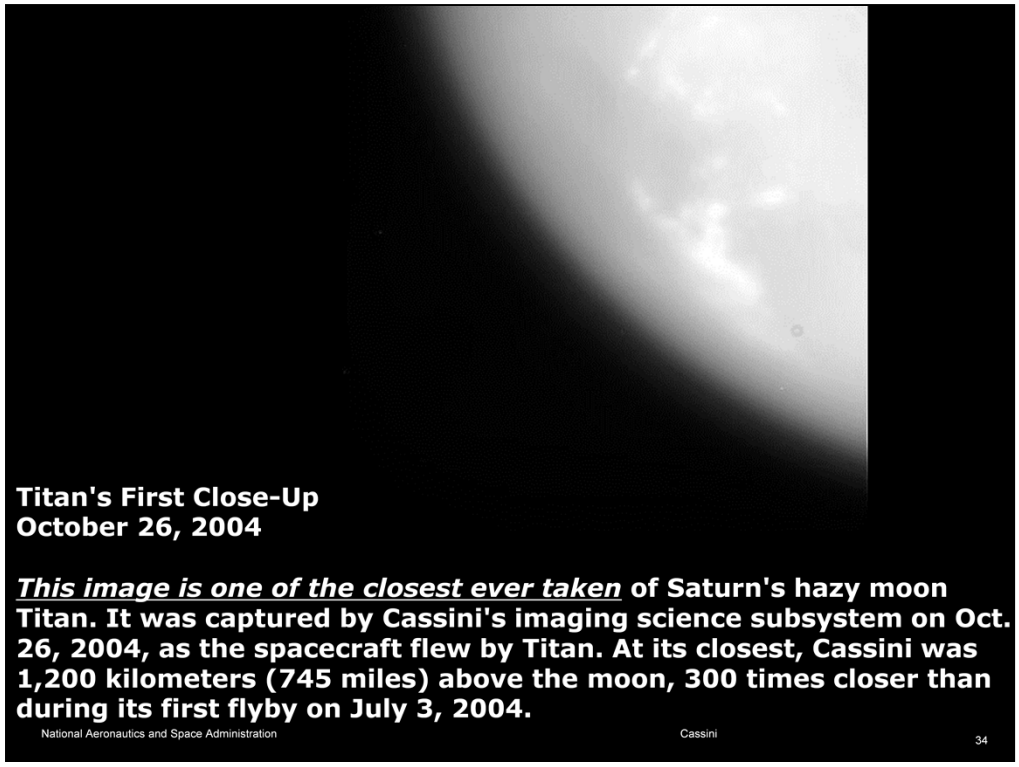
Huygens Instruments

Aerosol Collector and Pyrolyser (ACP)
Collect aerosols for chemical-composition analysis
Descent Imager / Spectral Radiometer (DISR)
Images and spectra of the surface material
Doppler Wind Experiment (DWE)
Uses Radio signals to deduce atmospheric properties
Gas Chromatograph and Mass Spectrometer (GCMS)
Chemical analyzer designed to identify and quantify various atmospheric constituents
Huygens Atmospheric Structure Instrument (HASI)
Comprises sensors for measuring the physical and electrical properties of the atmosphere and an on board microphone to send back sounds from Titan
Surface Science Package (SSP)
Suites of sensors to determine the physical properties at the surface at the impact site


Aerosol Collector
and Pyrolyser
Surface Science package
"Top Hat"
Radar Altimeter
Antenna
HASI Stud
Gas Chromatograph
and Mass Spectrometer
Batteries
Huygens Atmospheric
Structure Instrument
(HASI) Deployable
Booms

FINDINGS FROM CASSINI & HUYGENS

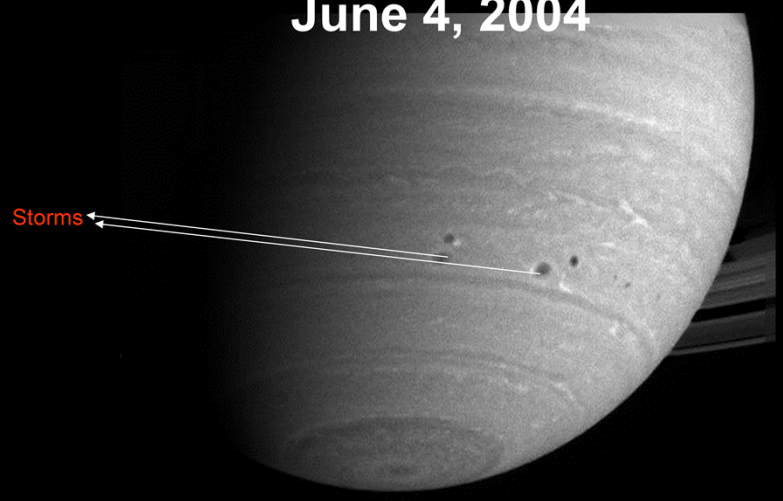
Approach to Saturn Feb 9, 2004



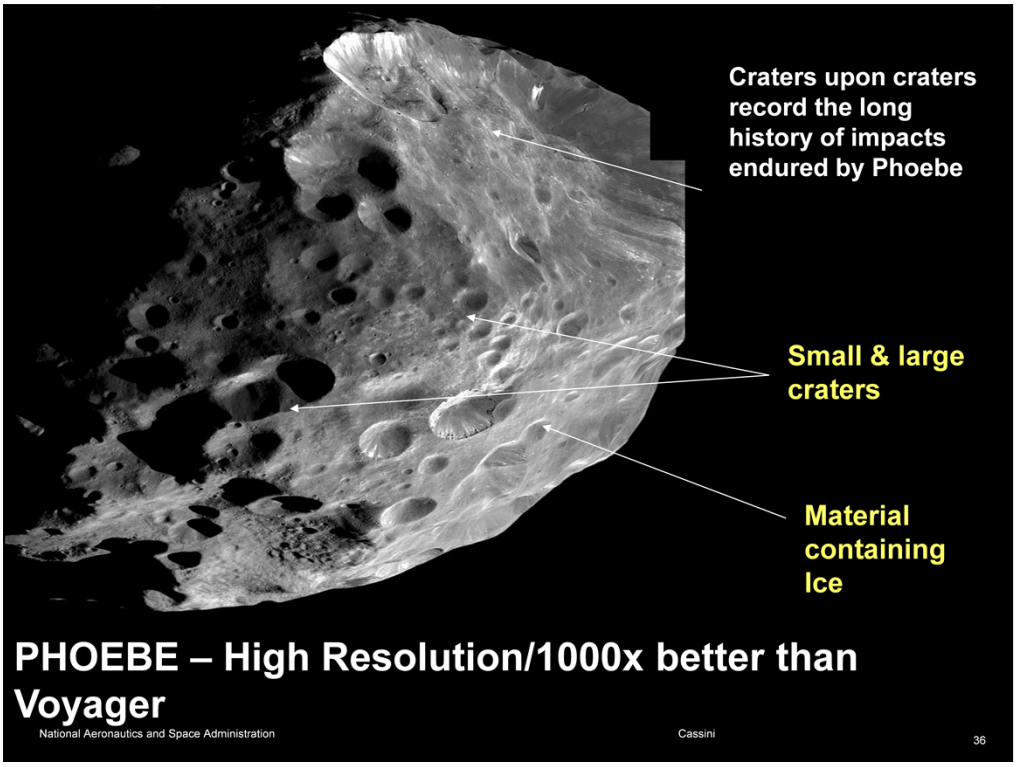
Titan's First Close-Up
October 26, 2004

This image is one of the closest ever taken **of Saturn's hazy moon Titan. It was captured by Cassini's imaging science subsystem on Oct. 26, 2004, as the spacecraft flew by Titan. At its closest, Cassini was 1,200 kilometers (745 miles) above the moon, 300 times closer than during its first flyby on July 3, 2004.**

Two pairs of Storms
June 4, 2004

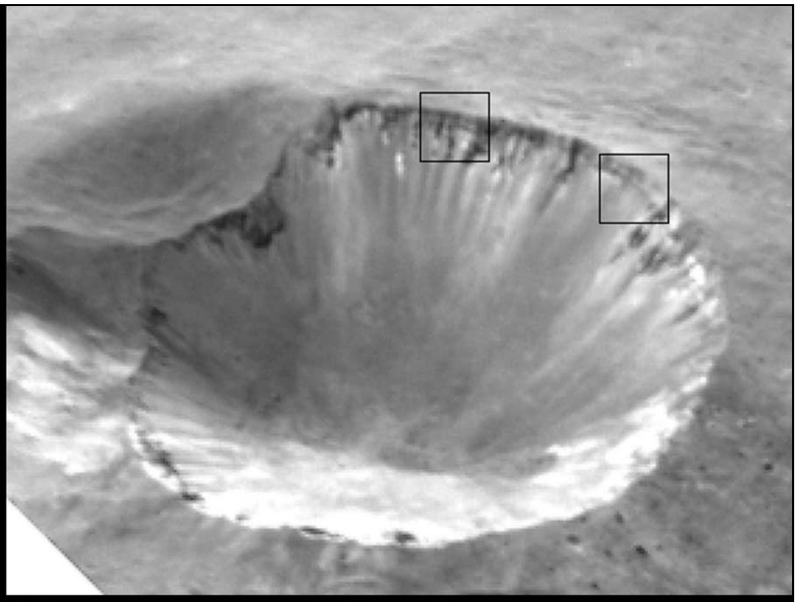


Cassini narrow angle detected

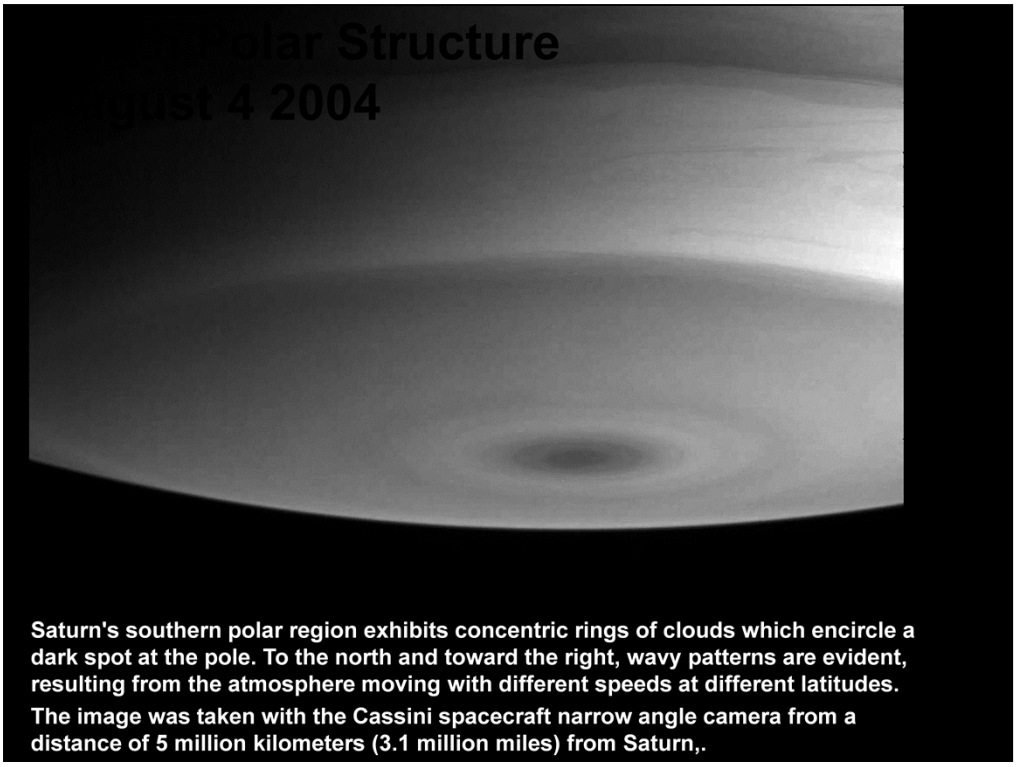


PHOEBE – High Resolution/1000x better than Voyager

Large Crater on Phoebe

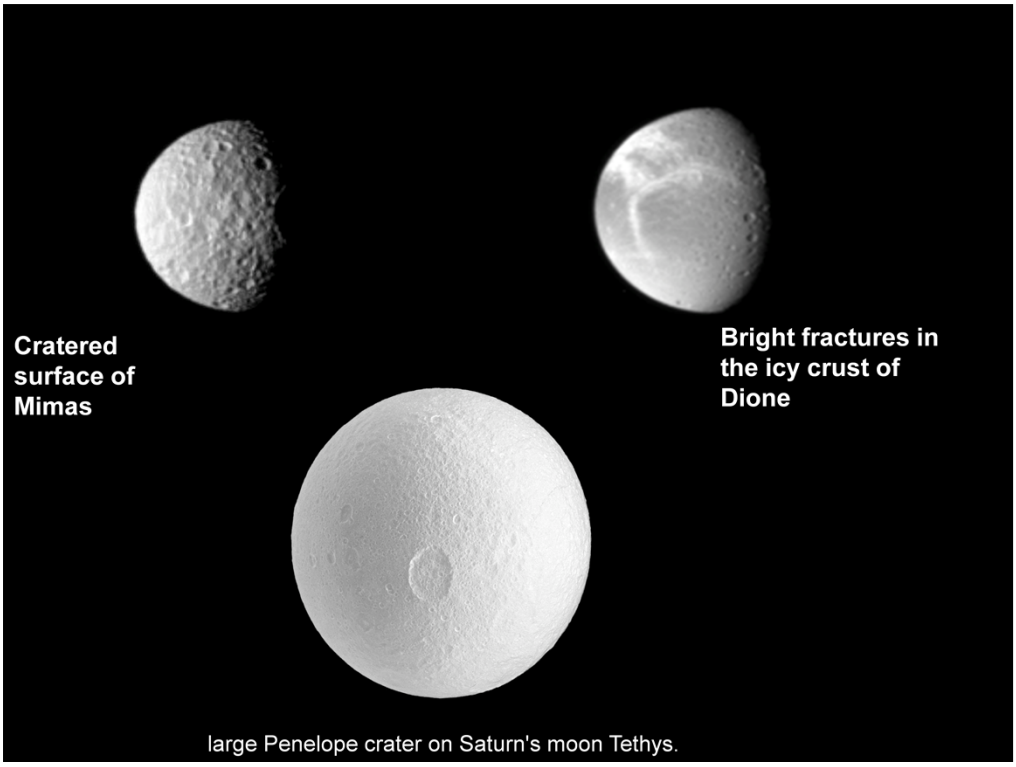


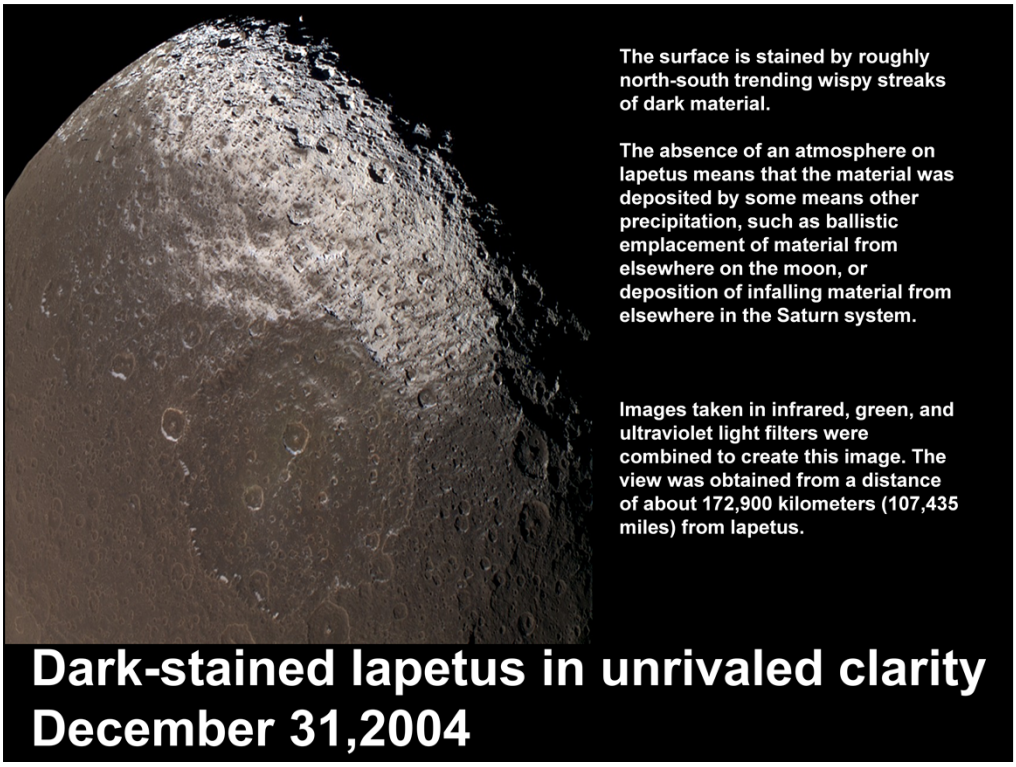
Crater Close-up on Phoebe
June 13, 2004



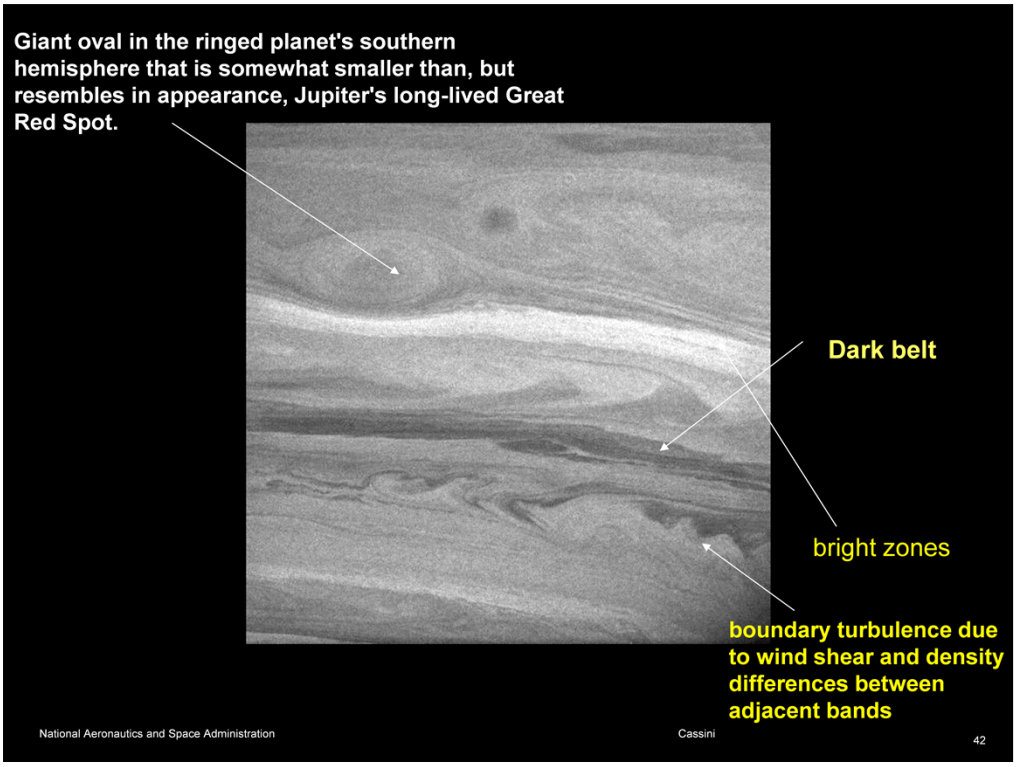
Saturn's southern polar region exhibits concentric rings of clouds which encircle a dark spot at the pole. To the north and toward the right, wavy patterns are evident, resulting from the atmosphere moving with different speeds at different latitudes.

The image was taken with the Cassini spacecraft narrow angle camera from a distance of 5 million kilometers (3.1 million miles) from Saturn,.

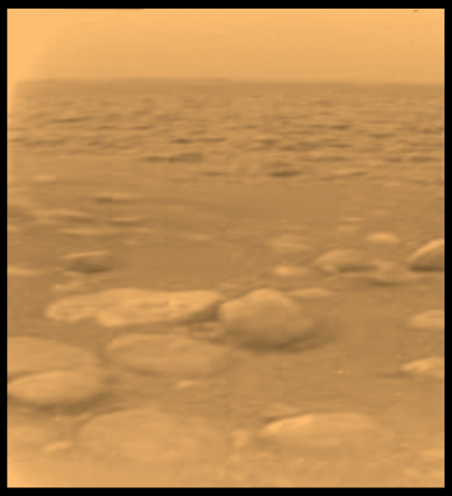

Cratered surface of Mimas
Bright fractures in the icy crust of Dione
large Penelope crater on Saturn's moon Tethys.


The surface is stained by roughly north-south trending wispy streaks of dark material.
The absence of an atmosphere on Iapetus means that the material was deposited by some means other precipitation, such as ballistic emplacement of material from elsewhere on the moon, or deposition of infalling material from elsewhere in the Saturn system.
Images taken in infrared, green, and ultraviolet light filters were combined to create this image. The view was obtained from a distance of about 172,900 kilometers (107,435 miles) from Iapetus.
Dark-stained Iapetus in unrivaled clarity
December 31,2004

Lightning Strikes on Saturn


Giant oval in the ringed planet's southern hemisphere that is somewhat smaller than, but resembles in appearance, Jupiter's long-lived Great Red Spot.
Dark belt
bright zones
boundary turbulence due to wind shear and density differences between adjacent bands
National Aeronautics and Space Administration
Cassini
42

1st Picture of Titan



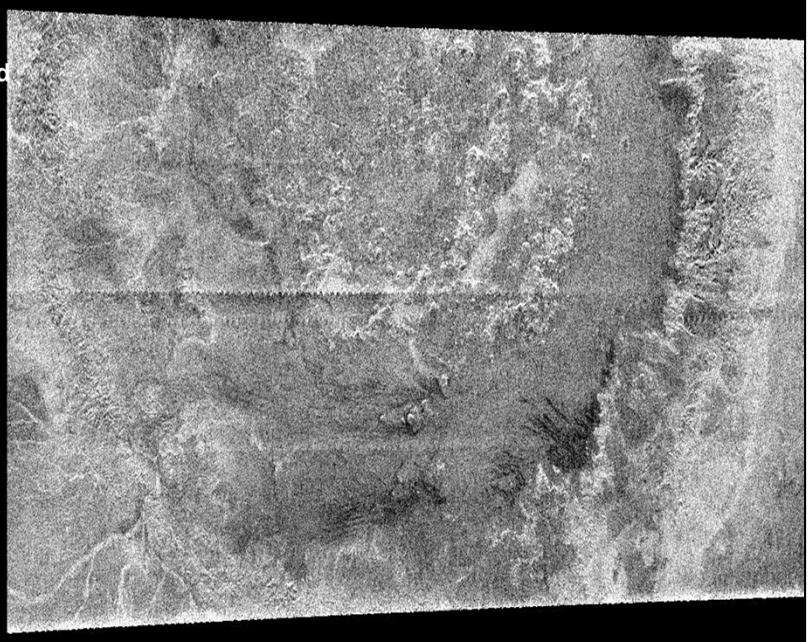
One of the first images taken by Huygens. Titan's surface is darker than scientists expected and is likely a mixture of water ice and hydrocarbons.

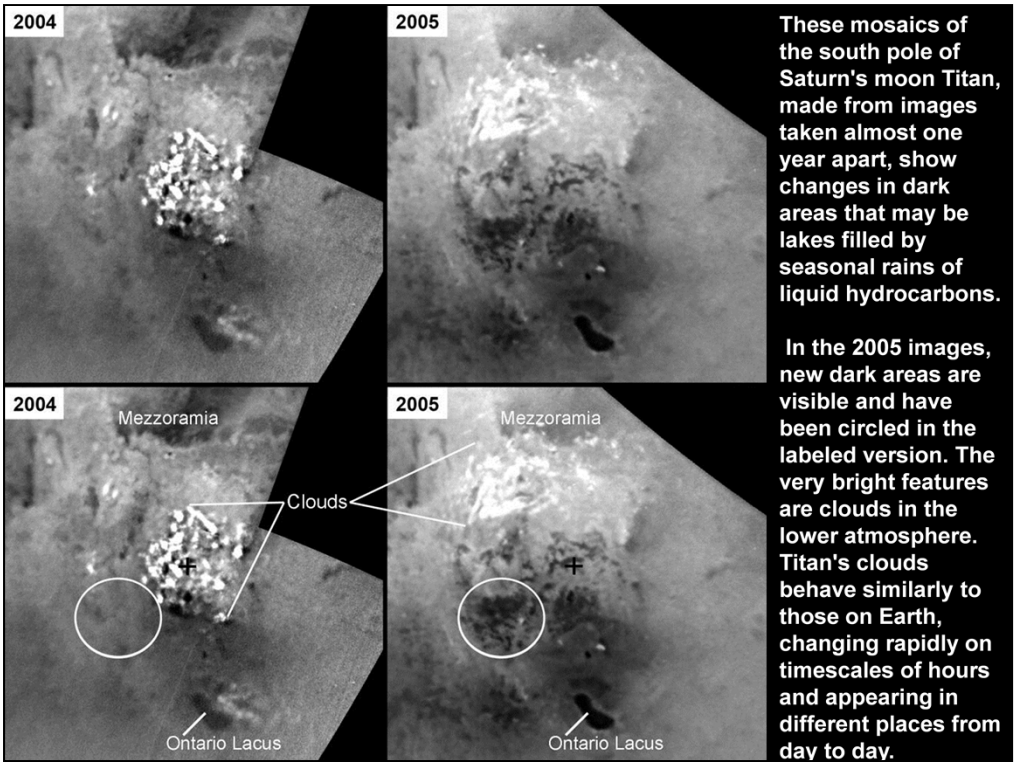
Circus Maximus- February 16, 2005

first impact feature identified in radar images of Titan.

huge annular feature with an outer diameter of ~ 440 kilometers (273 miles).

Resembles a large crater or part of a ringed basin, either of which could be formed when a comet or asteroid tens of kilometers in size slammed into Titan.





These mosaics of the south pole of Saturn's moon Titan, made from images taken almost one year apart, show changes in dark areas that may be lakes filled by seasonal rains of liquid hydrocarbons.

In the 2005 images, new dark areas are visible and have been circled in the labeled version. The very bright features are clouds in the lower atmosphere. Titan's clouds behave similarly to those on Earth, changing rapidly on timescales of hours and appearing in different places from day to day.

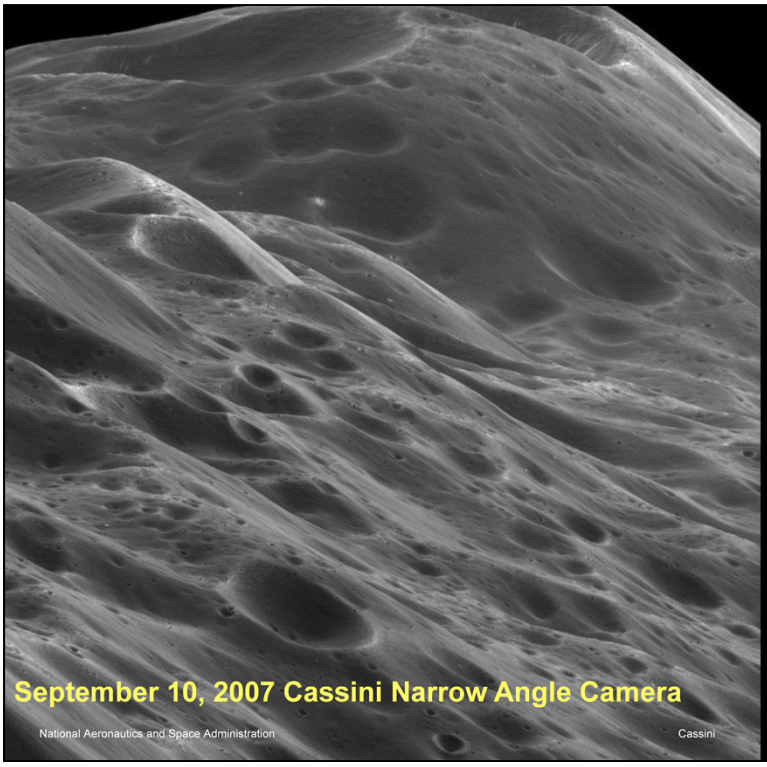
Mimas Blues

Mimas drifts along in its orbit against the azure backdrop of Saturn's northern latitudes in this true color view.

Images taken using infrared (930 nanometers), green (568 nanometers) and ultraviolet (338 nanometers) spectral filters were combined. The colors have been adjusted to match closely what the scene would look like in natural color.

The images were obtained using the Cassini spacecraft narrow angle camera on Jan. 18, 2005, at a distance of approximately 1.4 million kilometers (870,000 miles) from Saturn.

Jan 18, 2005

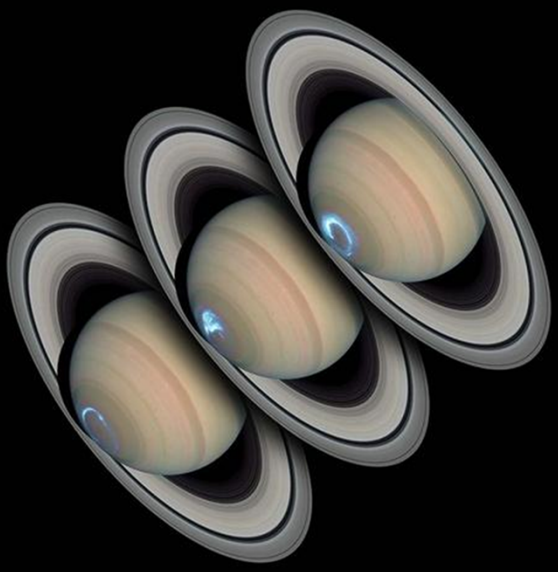


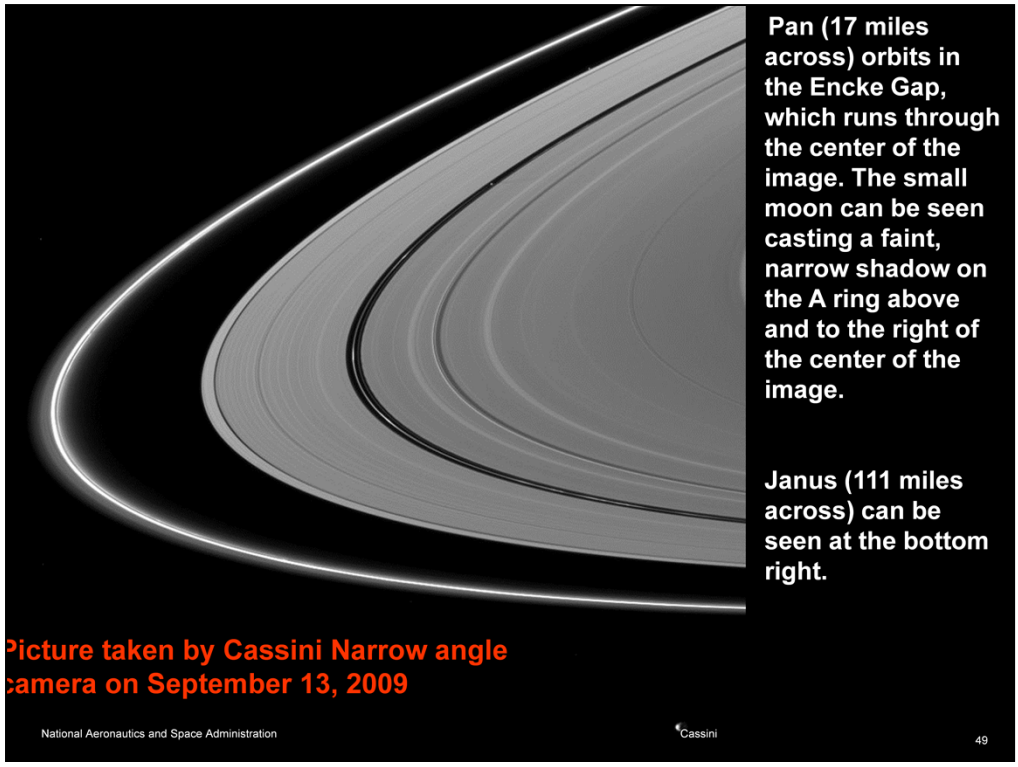
IAPETUS

This stunning close-up shows mountainous terrain reaching about 10 km in height on Iapetus.

Above the middle of the image can be seen a place where an impact has exposed the bright ice beneath the dark overlying material

Saturn's Auroras
February 16, 2005

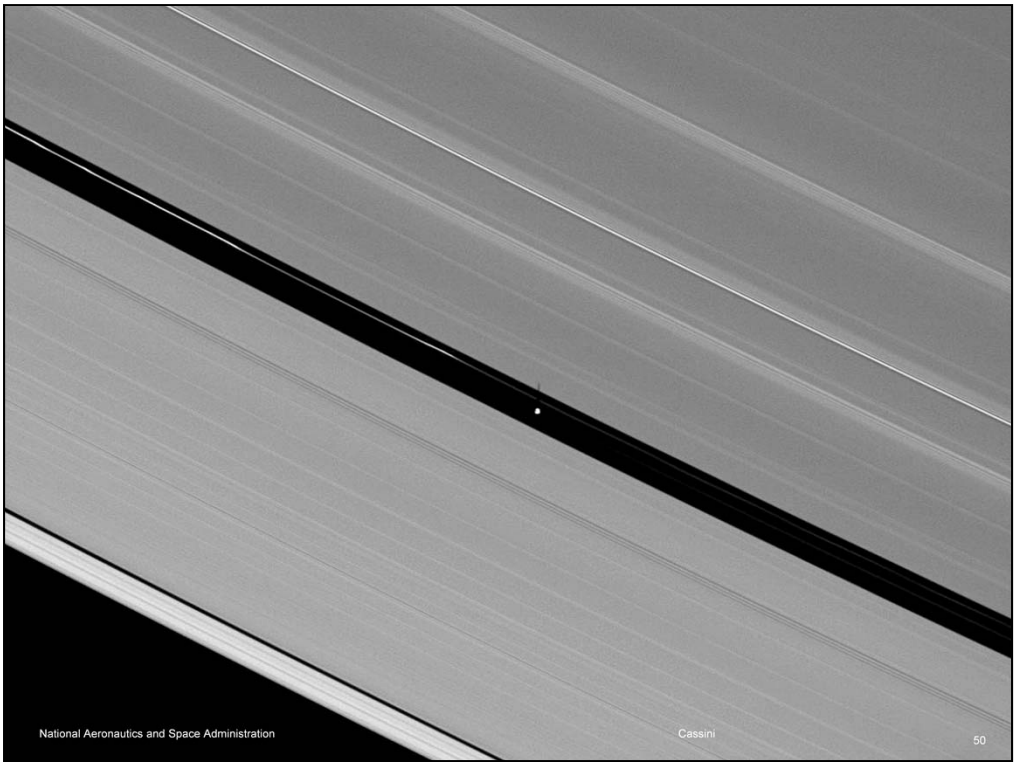




Pan (17 miles across) orbits in the Encke Gap, which runs through the center of the image. The small moon can be seen casting a faint, narrow shadow on the A ring above and to the right of the center of the image.

Janus (111 miles across) can be seen at the bottom right.

Picture taken by Cassini Narrow angle camera on September 13, 2009


National Aeronautics and Space Administration
Cassini
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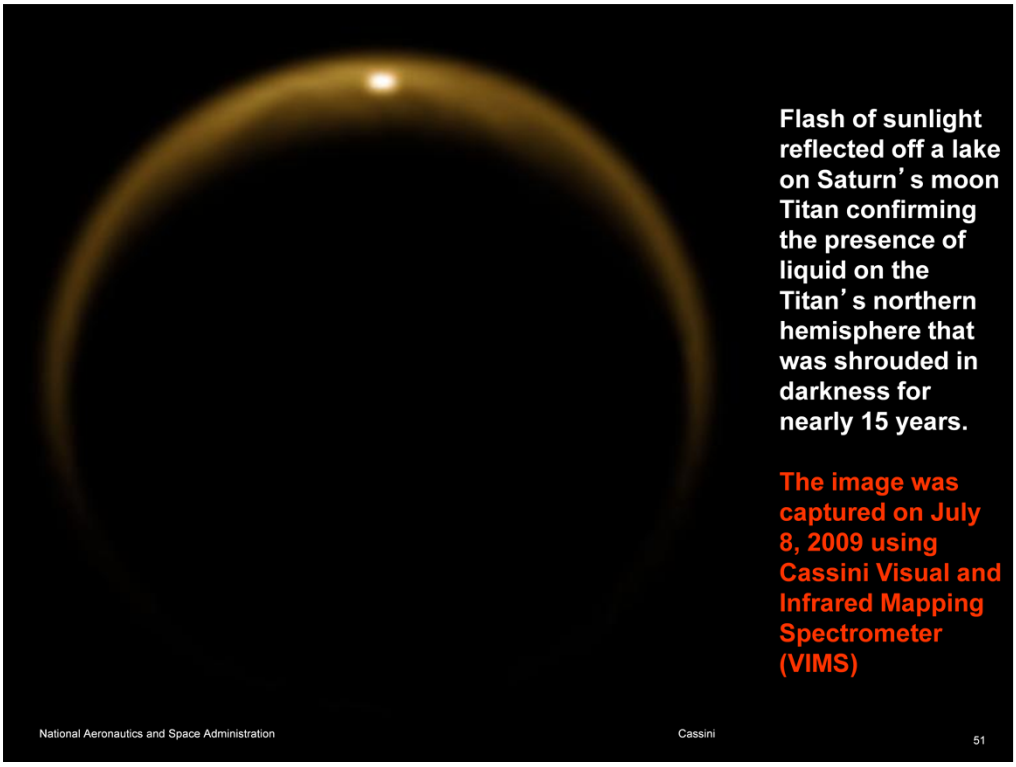
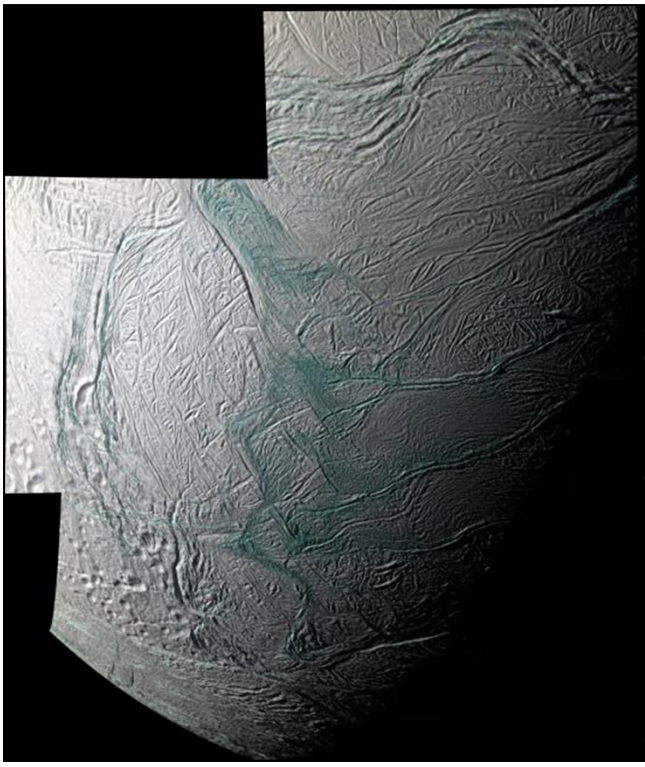


Flash of sunlight reflected off a lake on Saturn's moon Titan confirming the presence of liquid on the Titan's northern hemisphere that was shrouded in darkness for nearly 15 years.

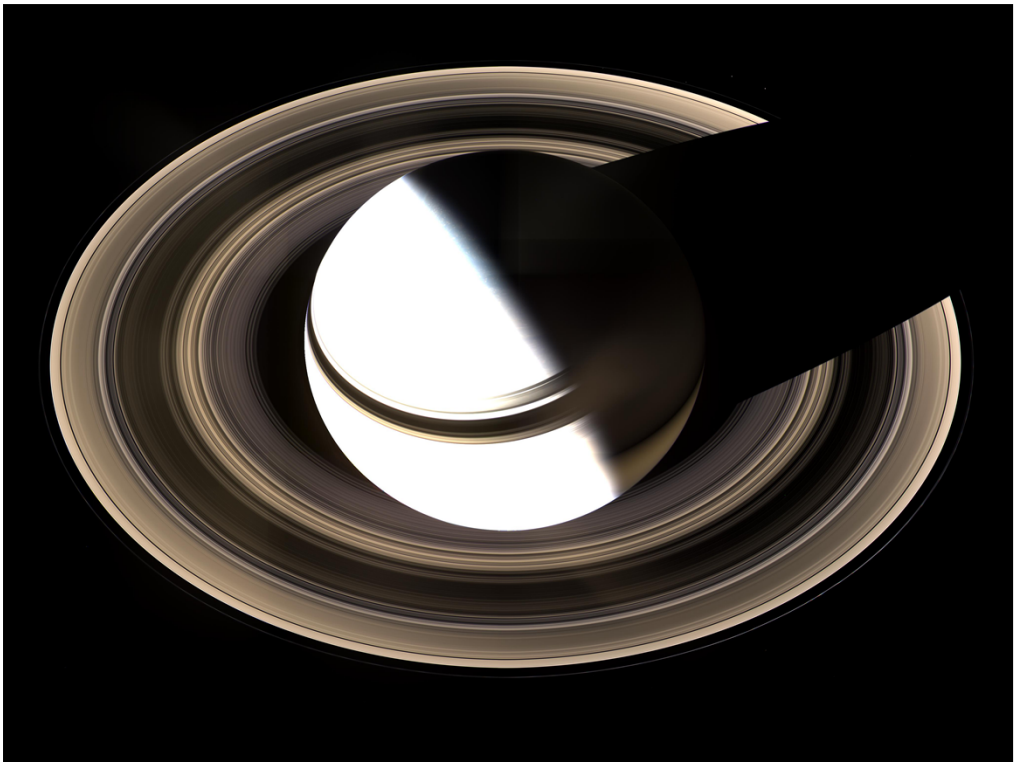
The image was captured on July 8, 2009 using Cassini Visual and Infrared Mapping Spectrometer (VIMS)



Imaging Science Subsystem (ISS) narrow-angle camera images obtained through ultraviolet, green, and near-infrared camera filters.

The original images ranged in resolution from 28 to 154 meters (92 to 505 feet) per pixel and were taken at distances ranging from 5,064 to 25,949 kilometers (3,140 to 15,468 miles) from Enceladus.

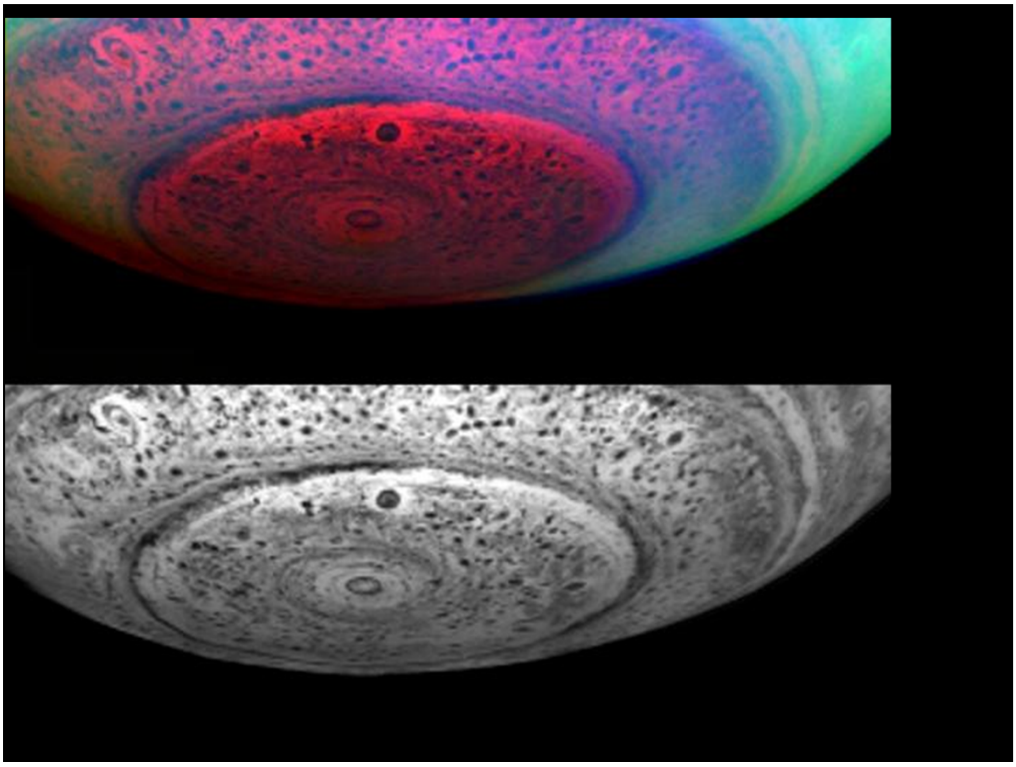
Areas that are greenish in appearance are believed to represent deposits of coarser grained ice and solid boulders. Whitish deposits represent finer grained ice. The mosaic shows that coarse-grained and solid ice are concentrated along valley floors and walls.



Surely one of the most gorgeous sights the solar system has to offer. Cassini scanned across the entire main ring system on 19 January 2007, at a distance of approximately 1.23 million km from Saturn. Between the blinding light of day and the dark of night, there is a strip of twilight on the globe where colorful details in the atmosphere can be seen. Saturn's shadow stretches completely across the rings in this view

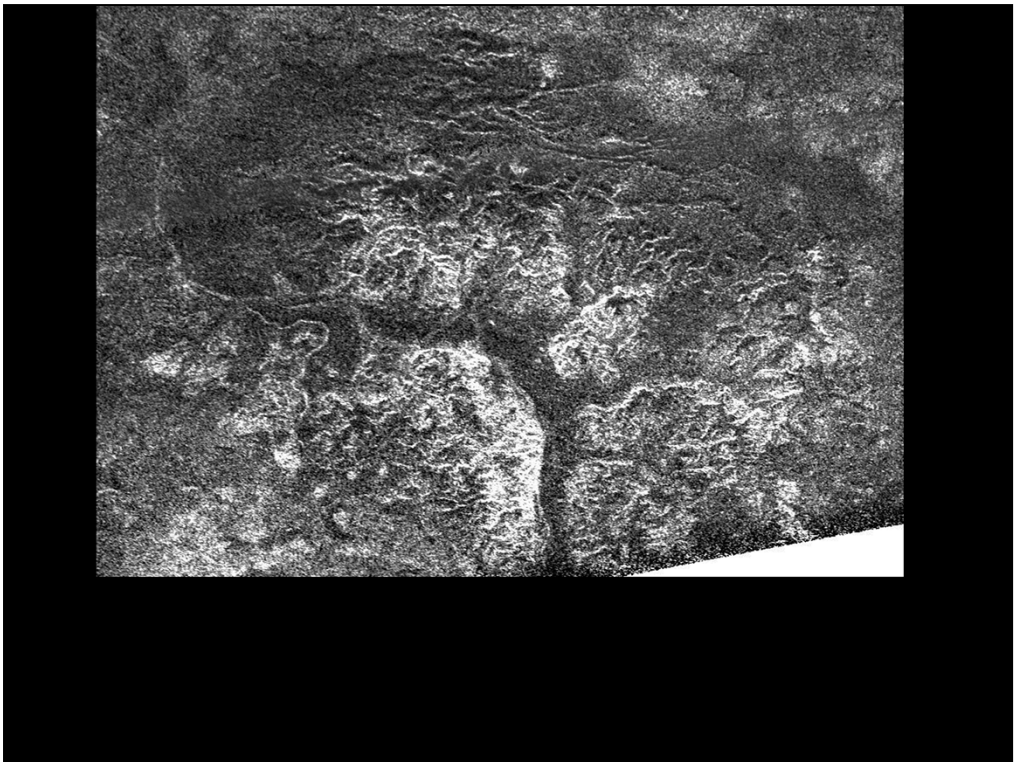
PROMETHEUS …..The effects of the small moon Prometheus loom large on two of Saturn's rings in this image taken a short time before Saturn's August 2009 equinox.

A long, thin shadow cast by the moon stretches across the A ring on the right. The gravity of potato-shaped Prometheus (86 kilometers, or 53 miles across) periodically creates streamer-channels in the F ring, and the moon's handiwork can seen be on the left of the image.



Saturn's South Polar Region Revealed October 13, 2008

These two images of Saturn show the entire dynamic atmosphere of the south polar region. Earth-like storm patterns seem to be powering this vortex. The eye of the polar vortex is bright, showing that it is nearly cloud free. Dark spots throughout the region reveal the presence of thick convective clouds lurking in the depths of Saturn



May 21, 2009 (Radar Image) / Complex and unique canyon systems appear to have been carved into older terrain by the ample flow of liquid methane rivers on Saturn's moon Titan. The channels seen here indicate that fluids flowed from high plateaus on the right to lowland areas on the left. In the center of the image, the wide distribution of the channels' tributaries suggests that rainfall is effectively eroding the surface. The bright terrain toward the bottom of the image is interpreted as high cliffs and broken bedrock. These canyon systems remind us that Titan is (or has recently been) a dynamic world with a complicated geological history.