

Guía del autoestopista para el Sistema Solar



Dr. Santiago Pérez-Hoyos
Grupo de Ciencias Planetarias
Universidad del País Vasco / Euskal Herriko Unibertsitatea

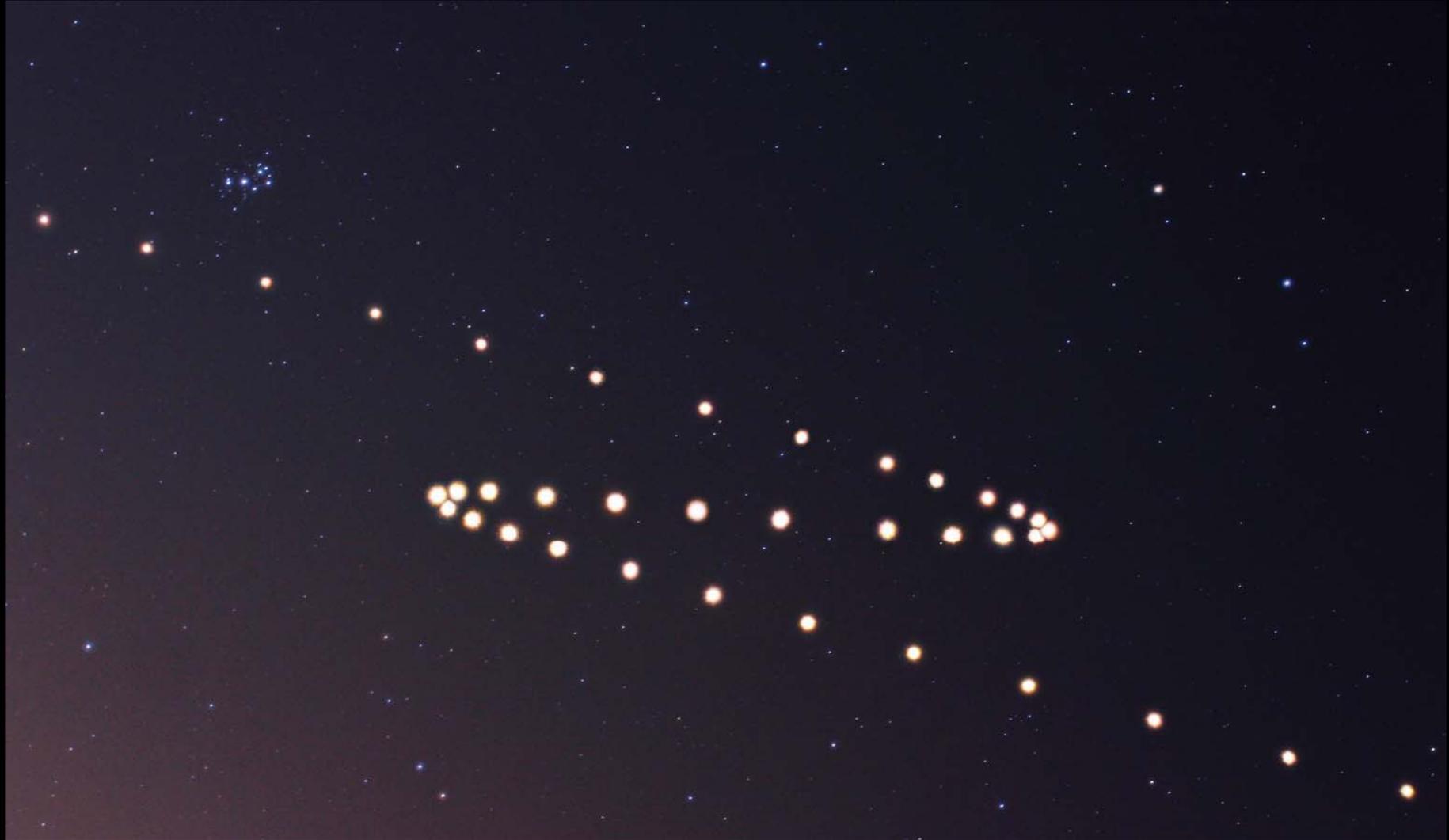


Grupo de Ciencias Planetarias
Zientzia Planetarioen Taldea

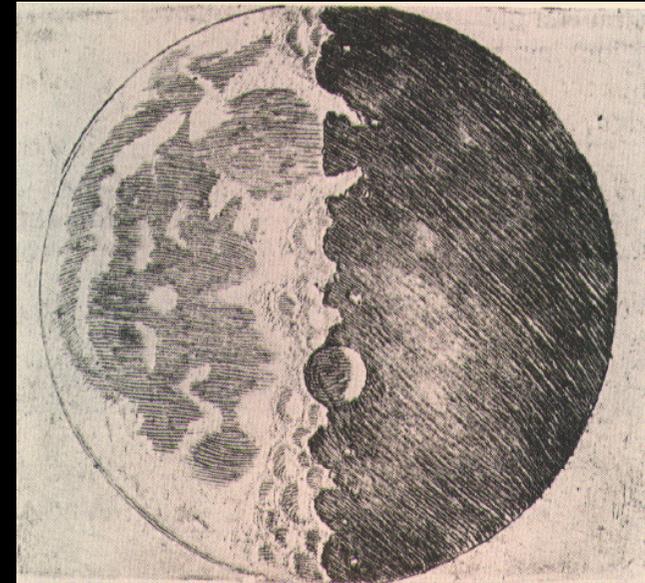
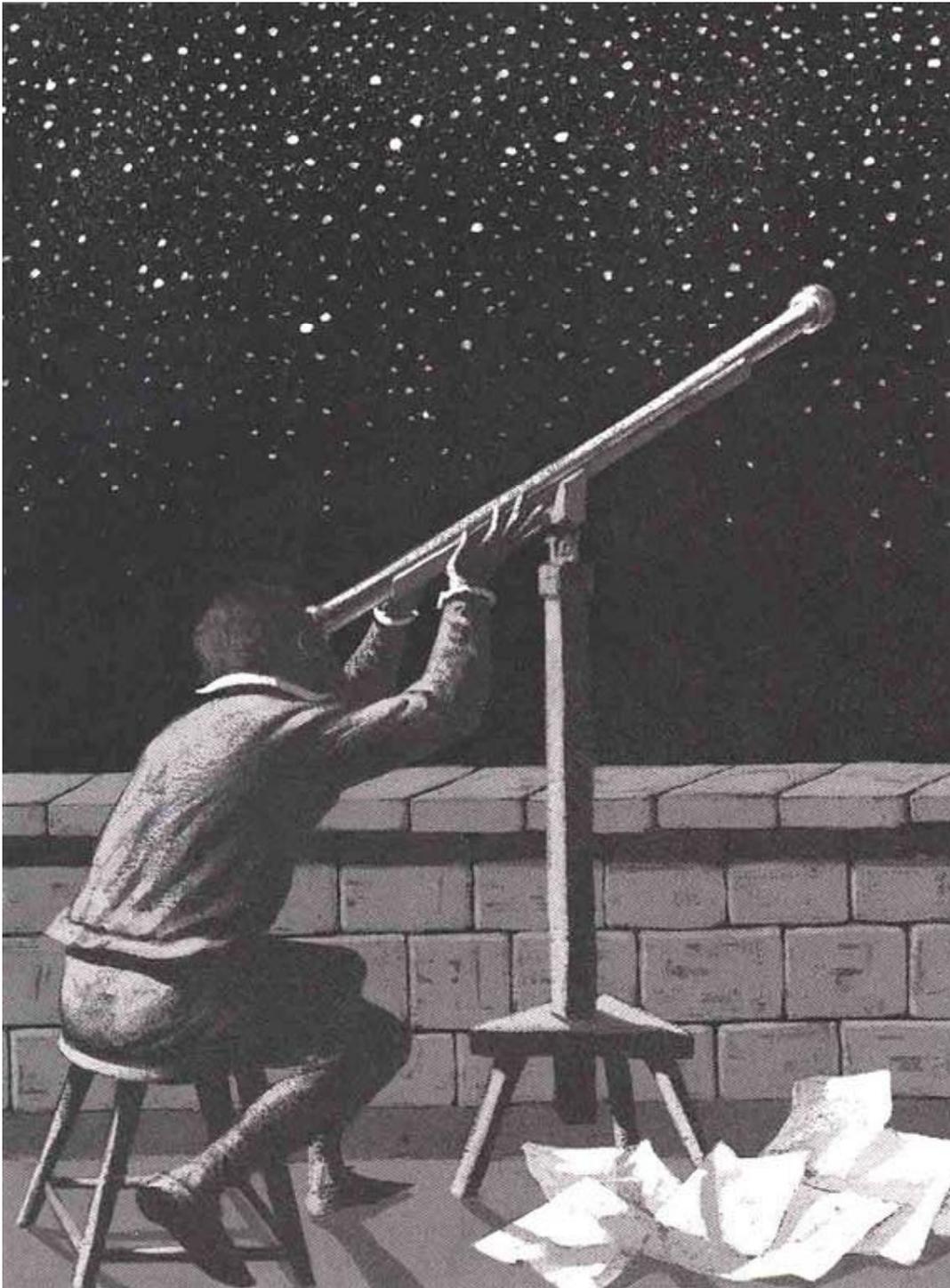
Los confines del Universo



Estrellas errantes



Revolución tecnológica



MOEDICEORVM PLANETARVM
ad invicem, et ad IOVEM Constitutiones, subre in Mensibus Martio
et Aprile An. M. DCXIII à GALILEO G. L. earundem
Stellarū, nec non Periodicorum ipsarum motuum
Repetiore primo Calculis collecte ad
Meridianum Florentia.

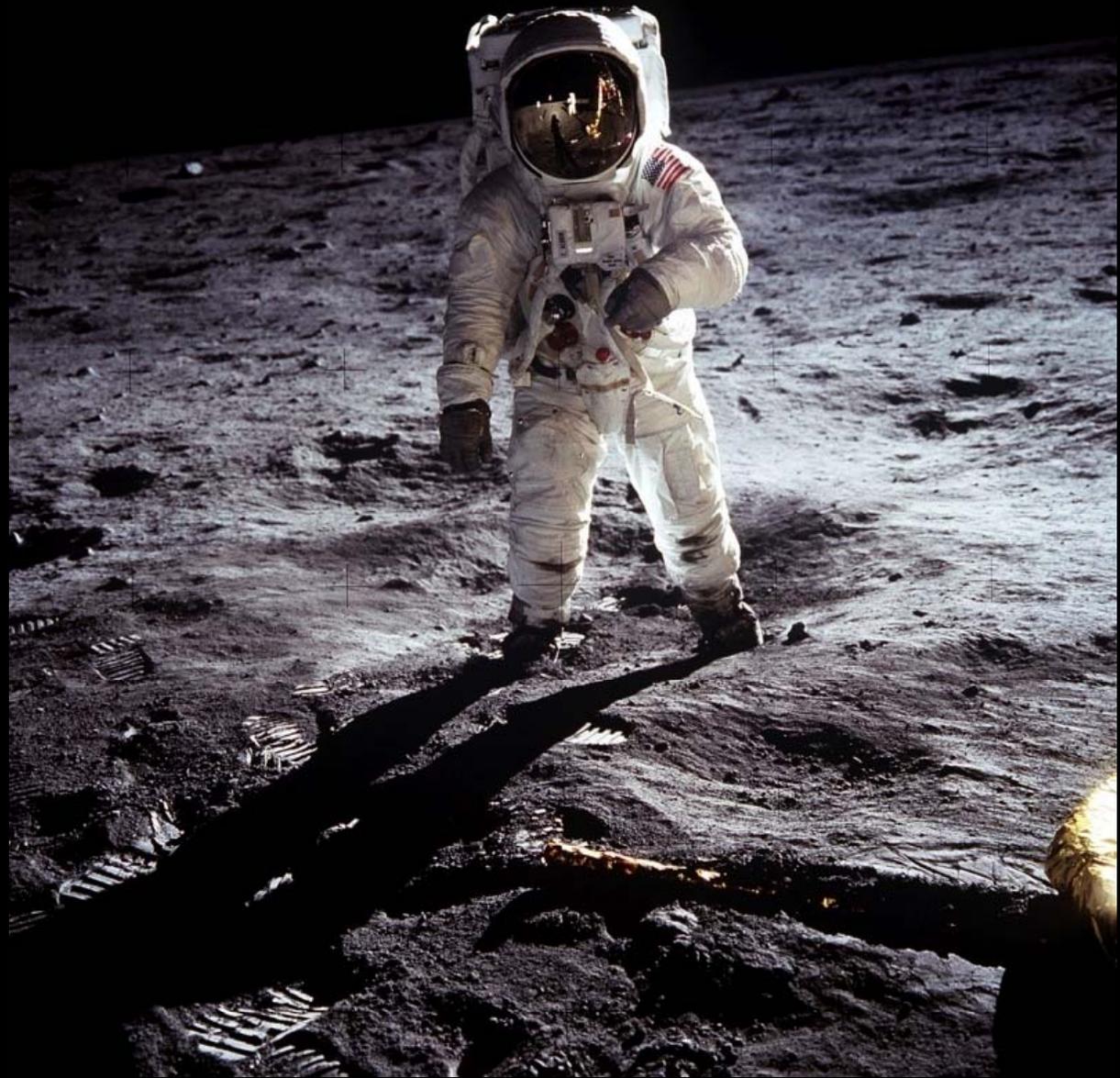
Martii
Die 1. Hor 3



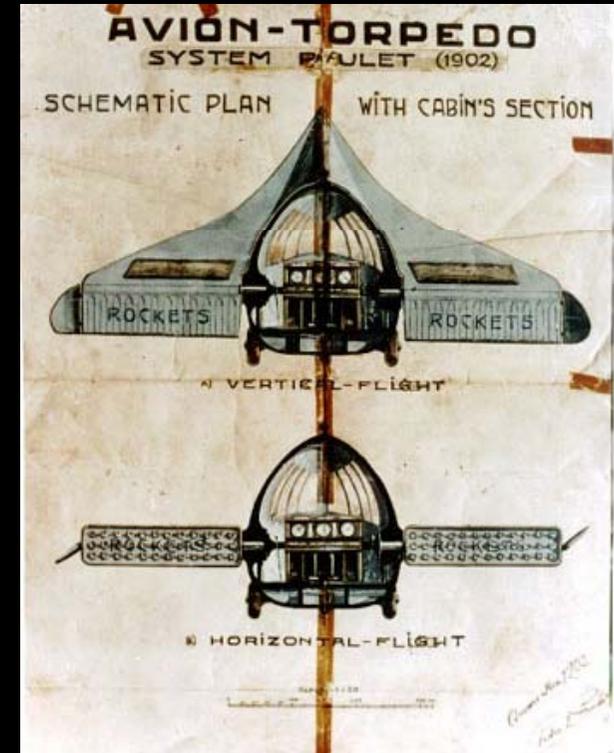
**La CIENCIA nos dio el
conocimiento**



La TECNOLOGÍA nos llevó allí

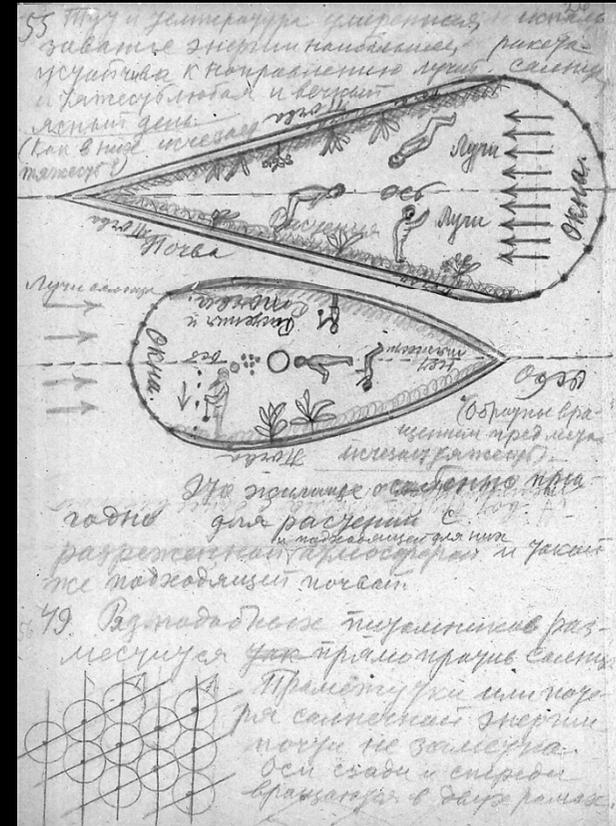
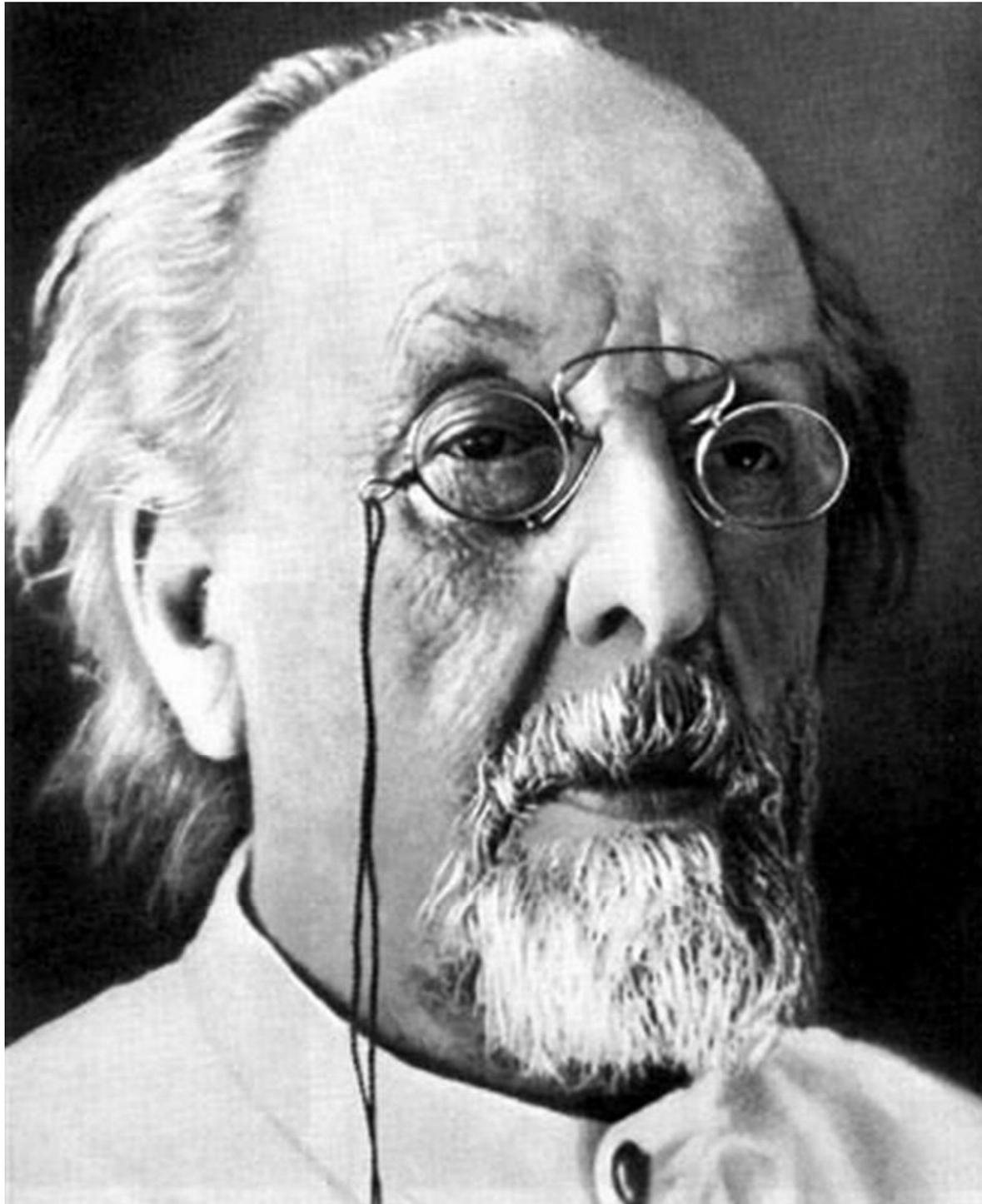


Los pioneros



Pedro Paulet
1874 – 1945

Los pioneros



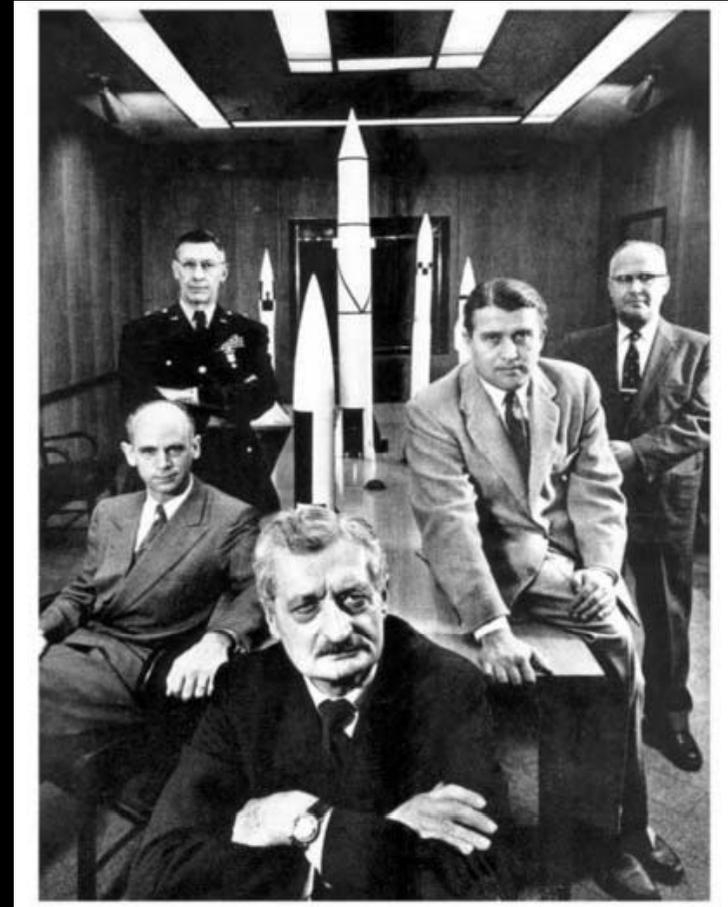
Konstantin Tsiolkovsky
1857 – 1935

Los pioneros



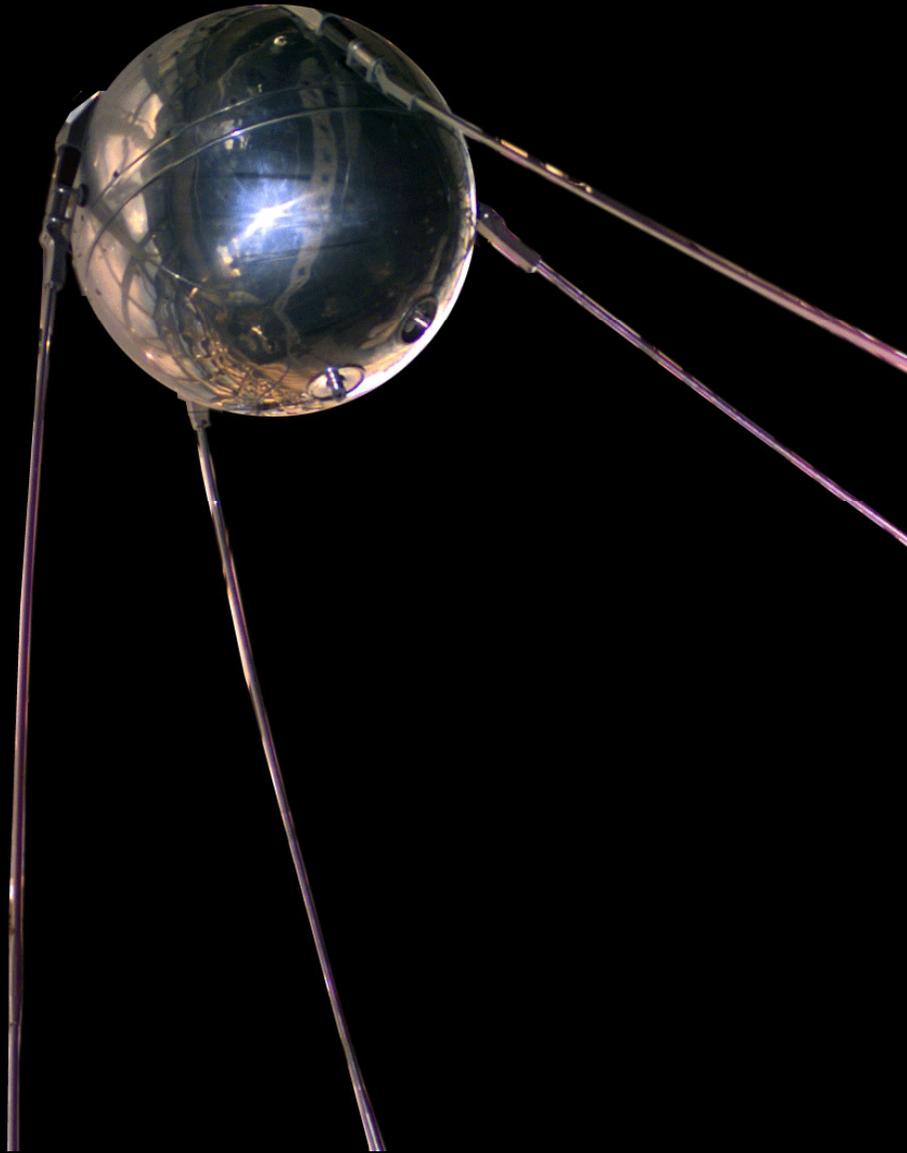
Robert H. Goddard
1882 - 1945

Los pioneros

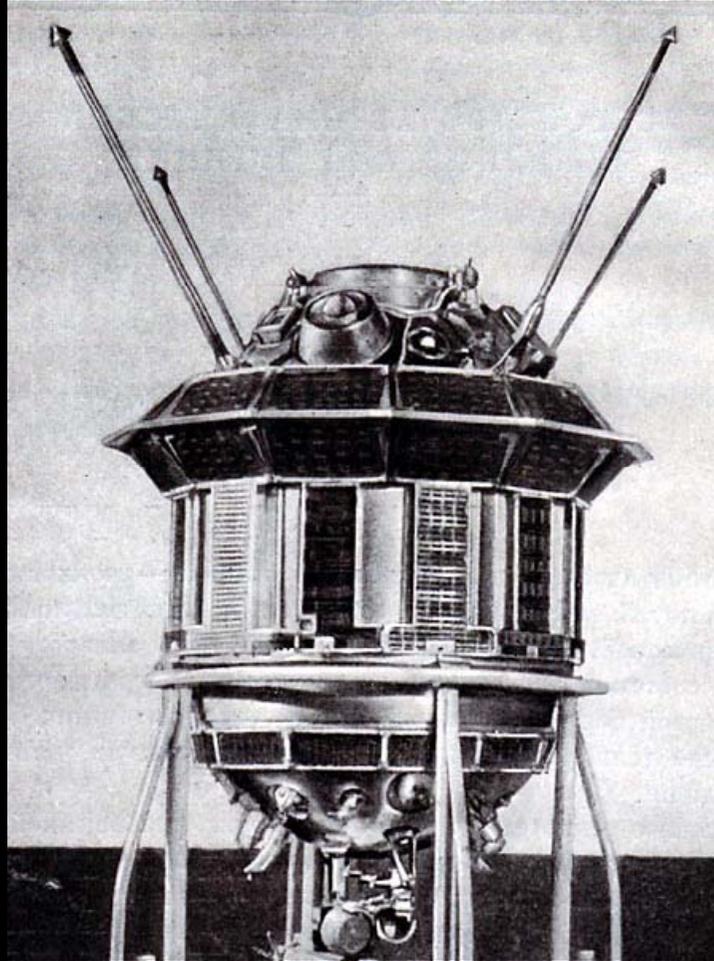


Hermann Oberth
1894 – 1989

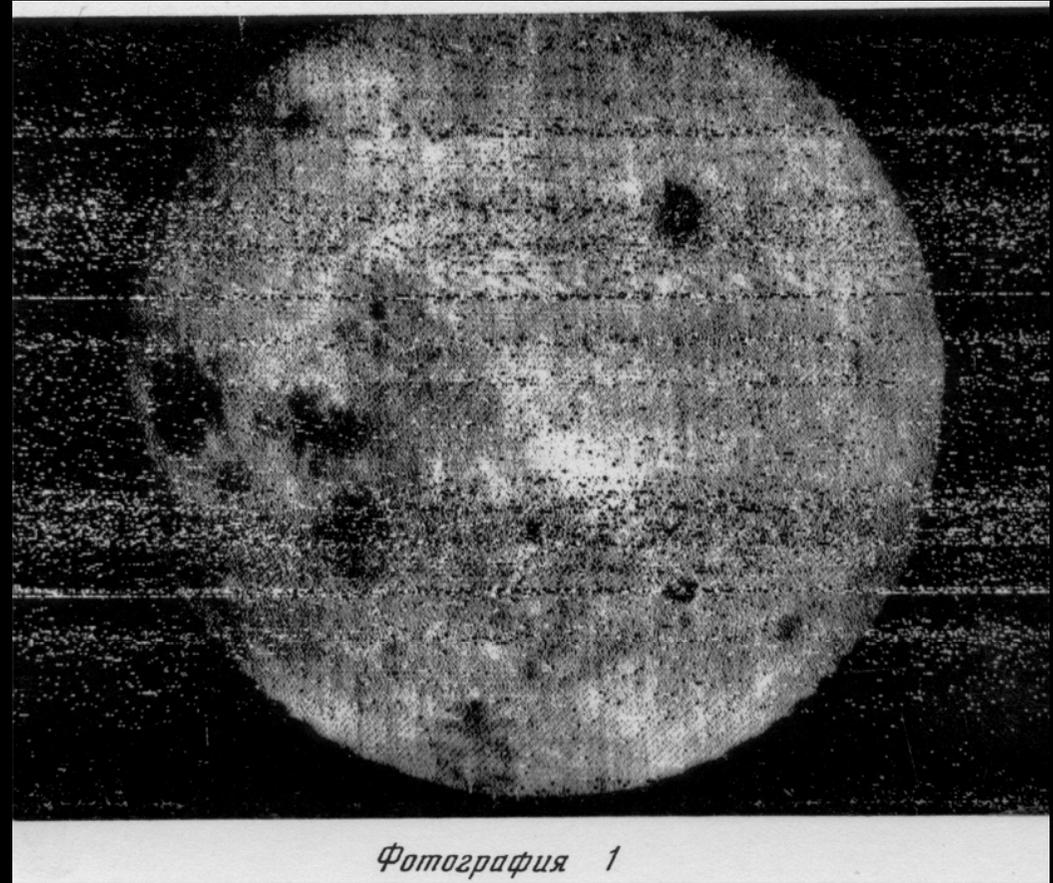
La carrera espacial



Viaje a la Luna



Misión Luna 3
URRSS 1959





Misión Lunar Reconnaissance Orbiter
USA 2009 -

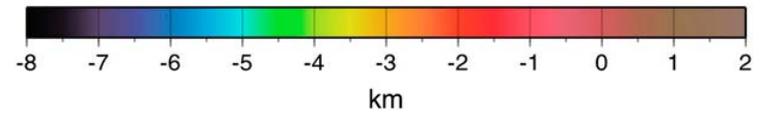
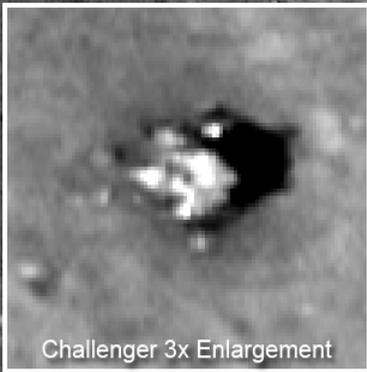
Apollo 17 Landing Site
LROC NAC M168000580LR
Low Periapse orbit

100 meters

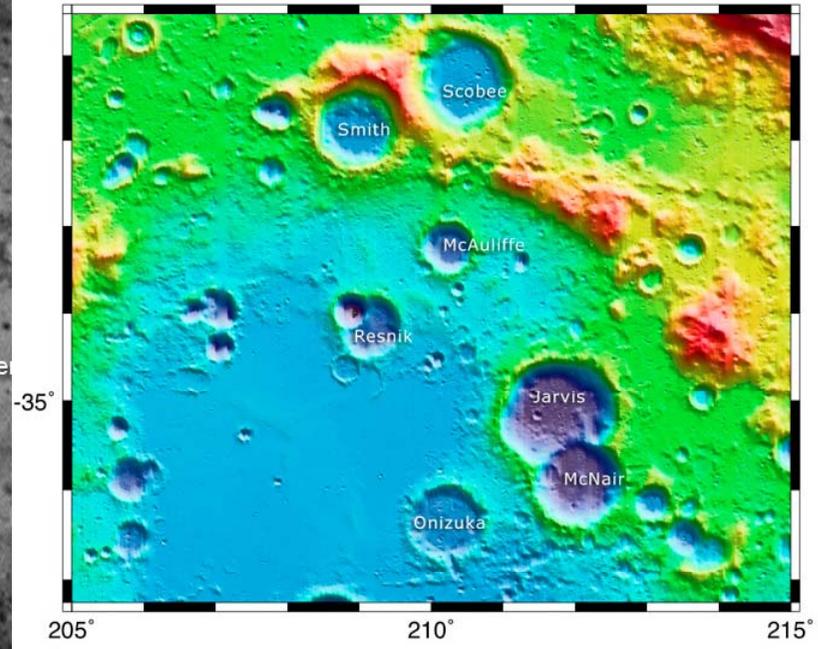
ALSEP Equipment

Geophone Rock

Challenger Descent



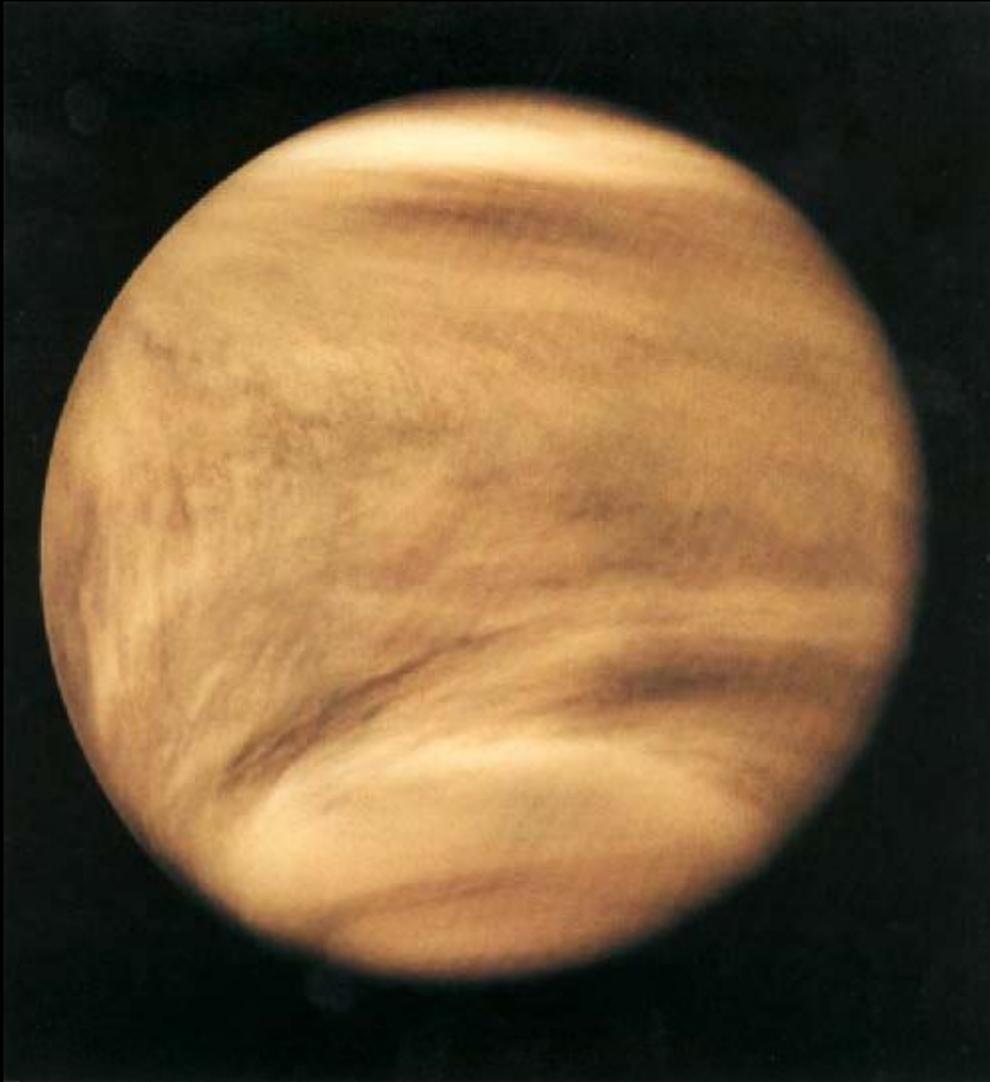
Challenger Astronauts Craters



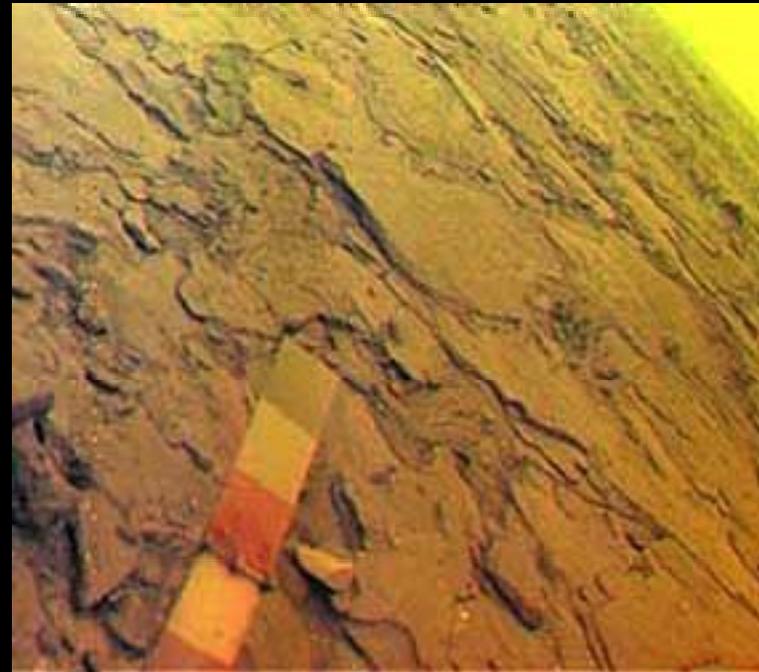
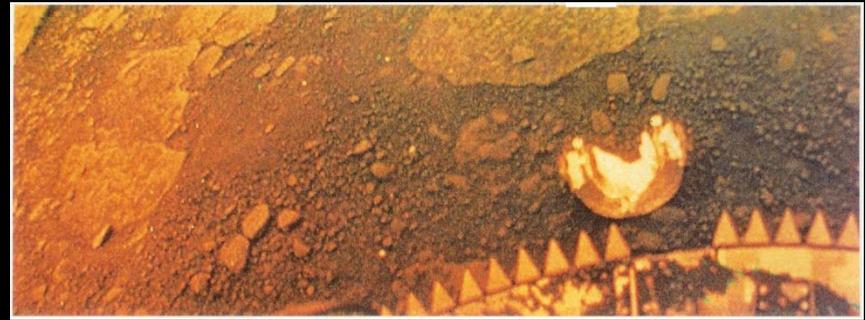
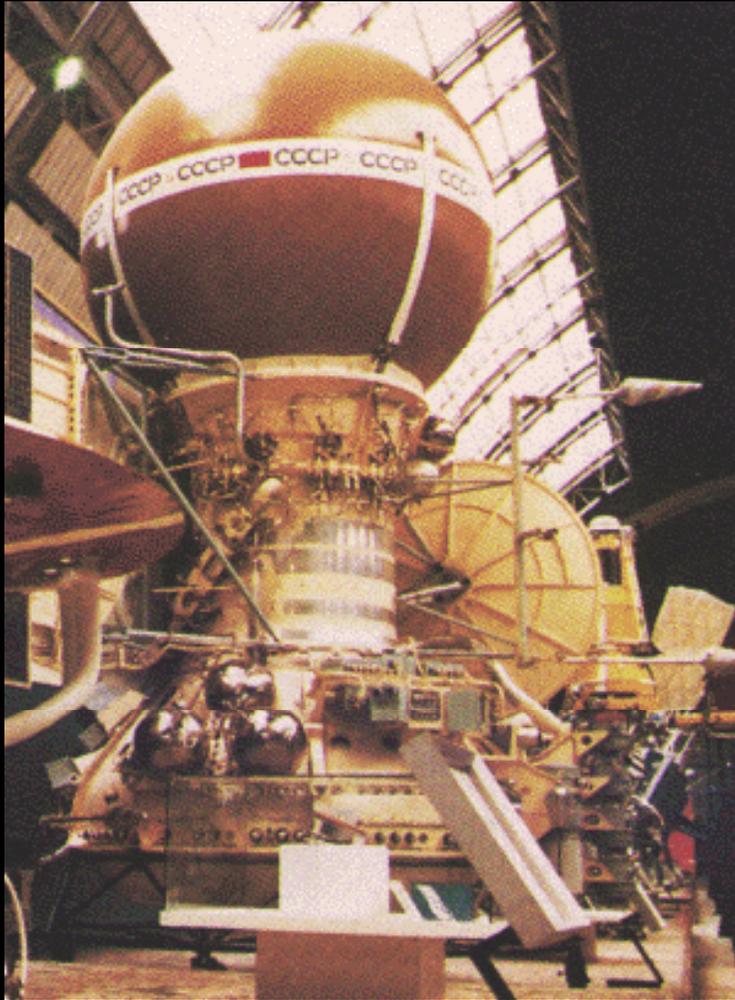


Misión Chang'e 3
China 2013

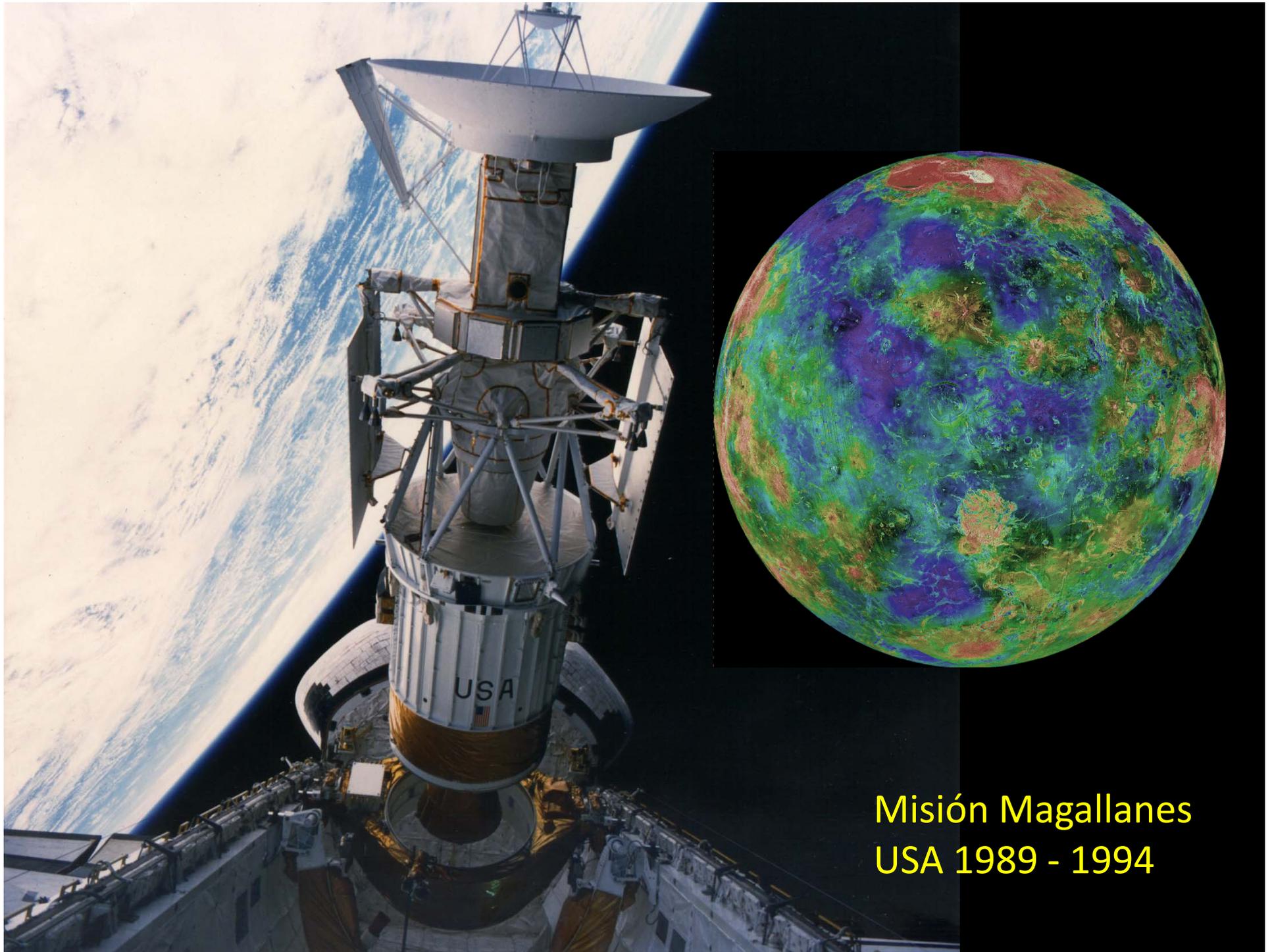
Rumbo al infierno



Misión Pioneer Venus
USA 1978 - 1988

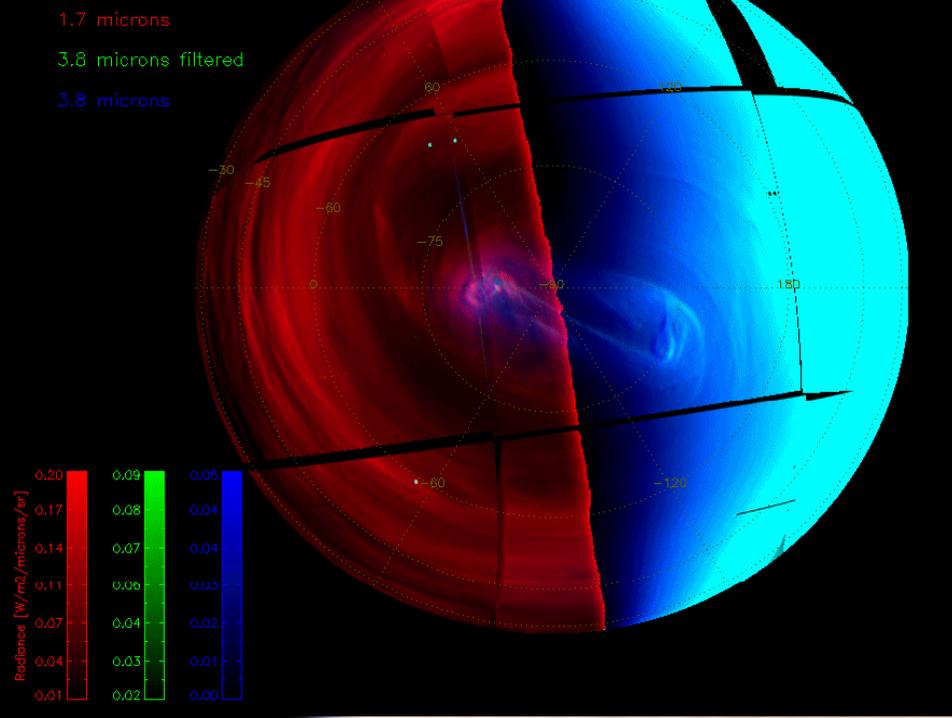


Misión Venera 13
URRSS 1982



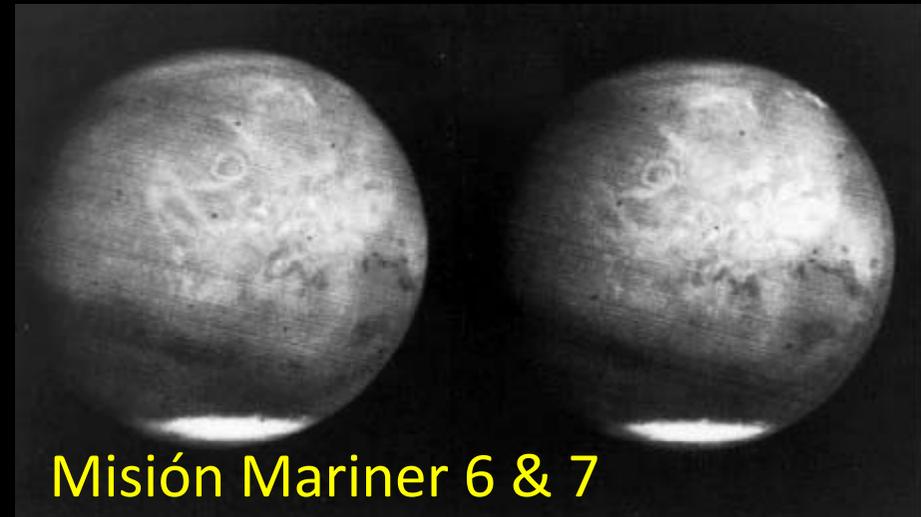
Misión Magallanes
USA 1989 - 1994

Misión Venus Express ESA 2006 -



La maldición del planeta rojo

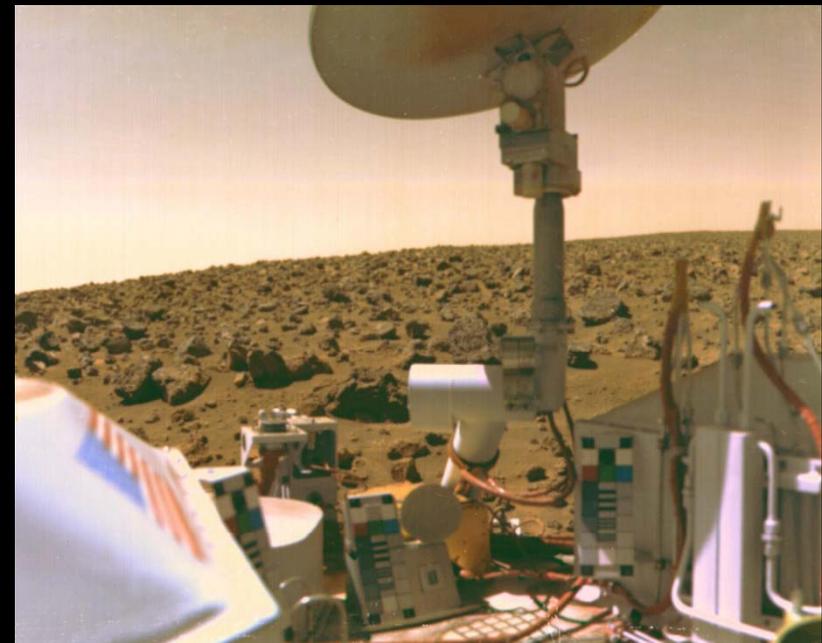


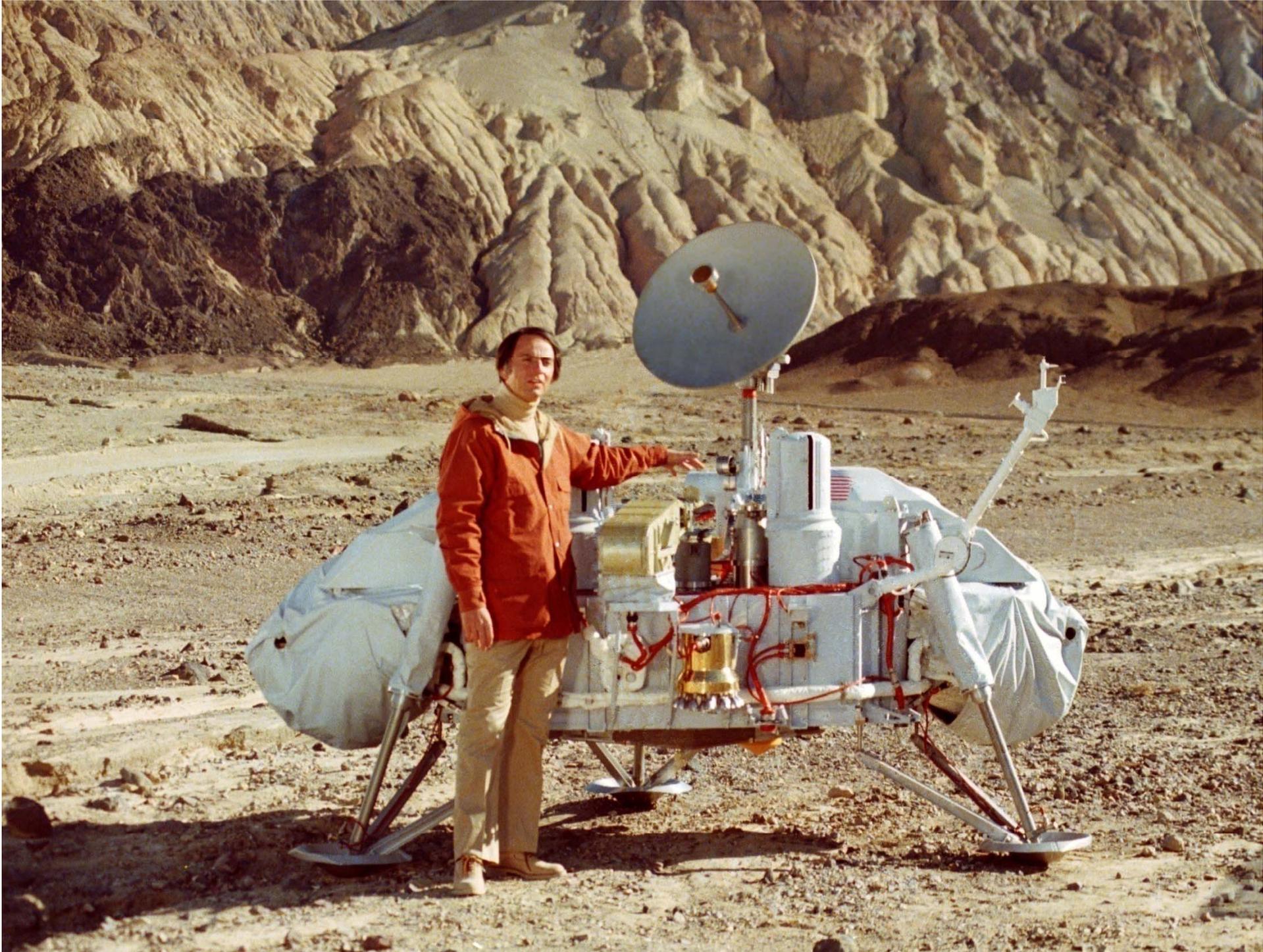


Misión Mariner 6 & 7
USA 1969



Misión Viking 1 & 2
USA 1978 - 1980



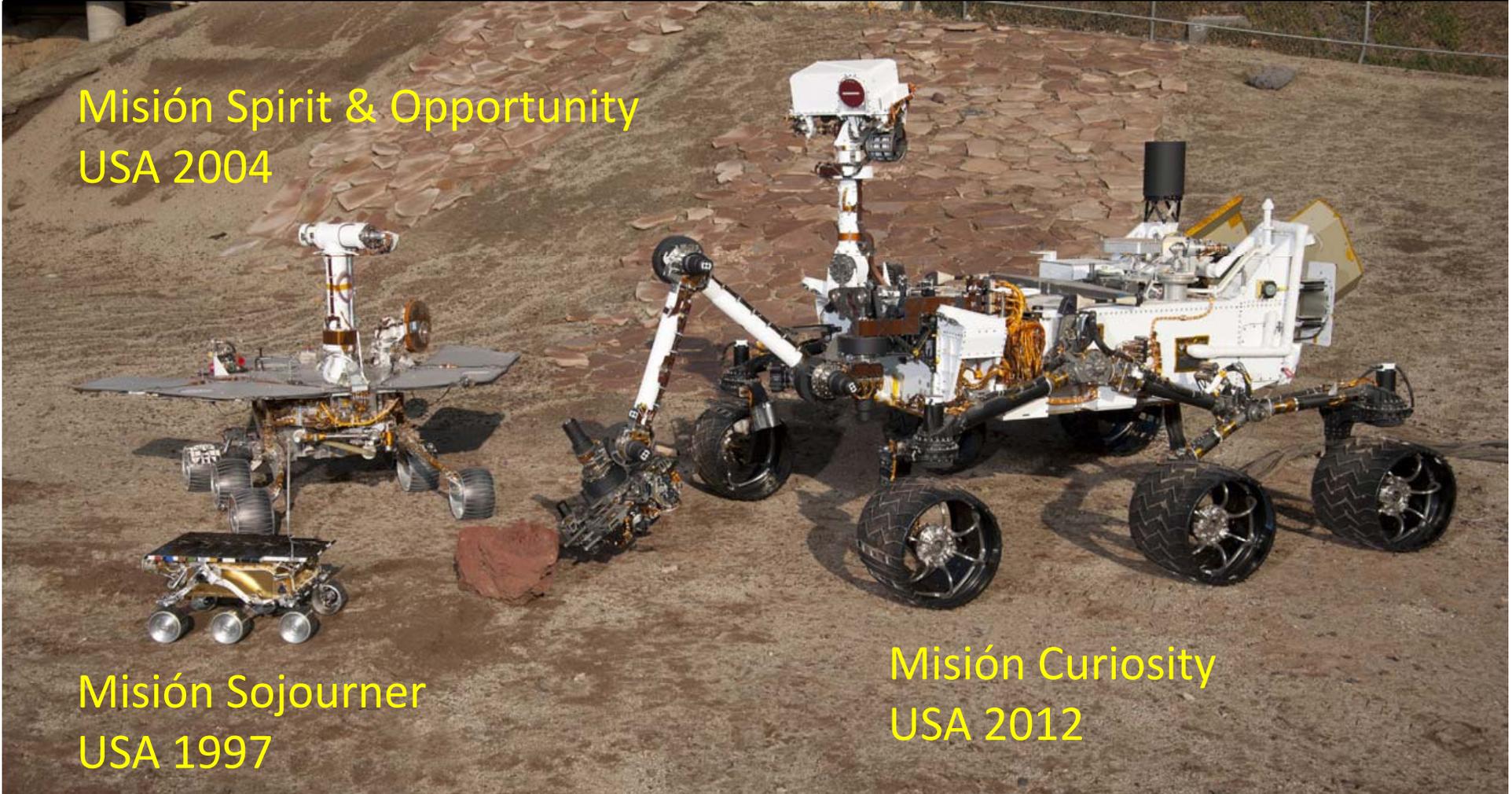


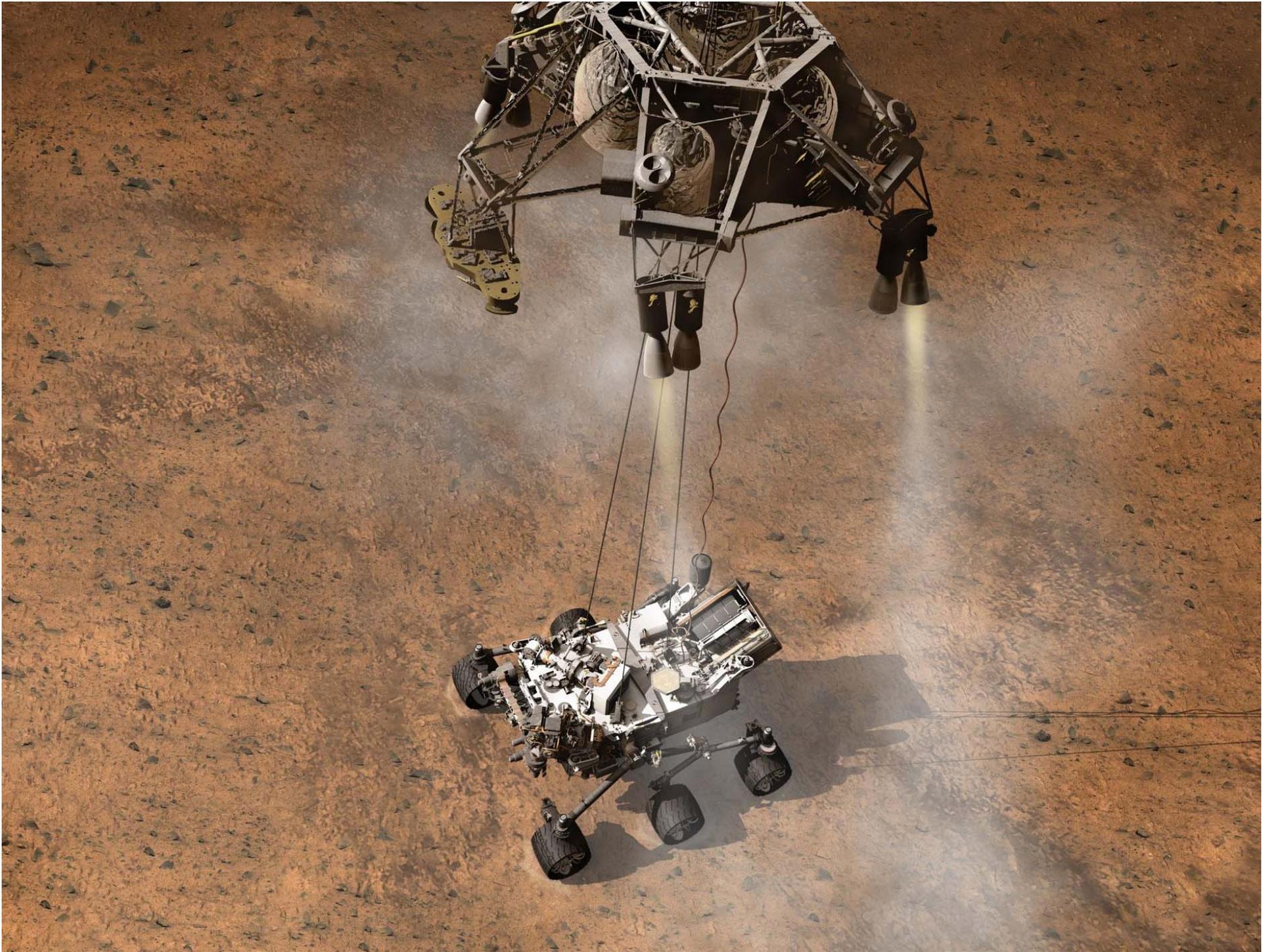
Conduciendo en Marte

Misión Spirit & Opportunity
USA 2004

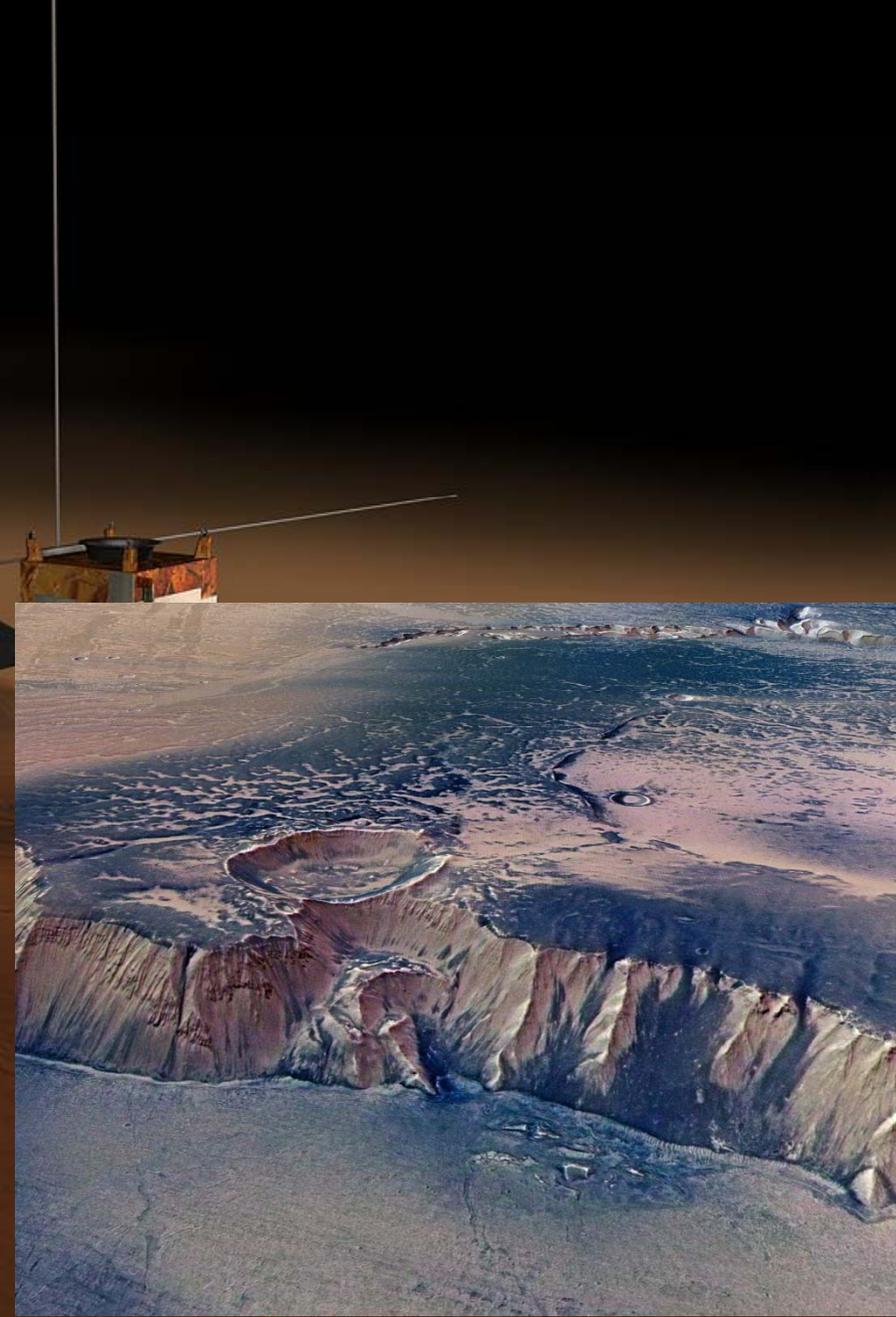
Misión Sojourner
USA 1997

Misión Curiosity
USA 2012



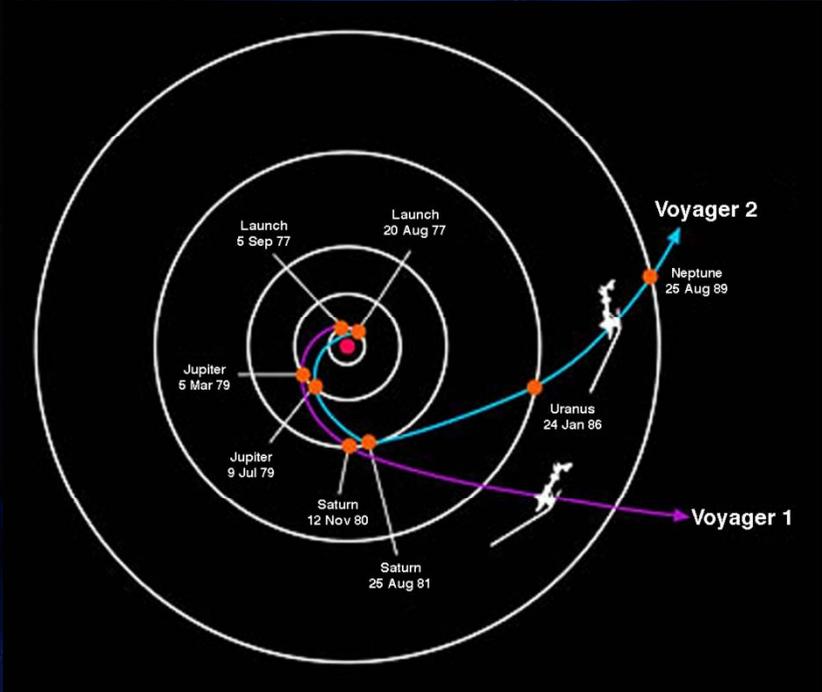
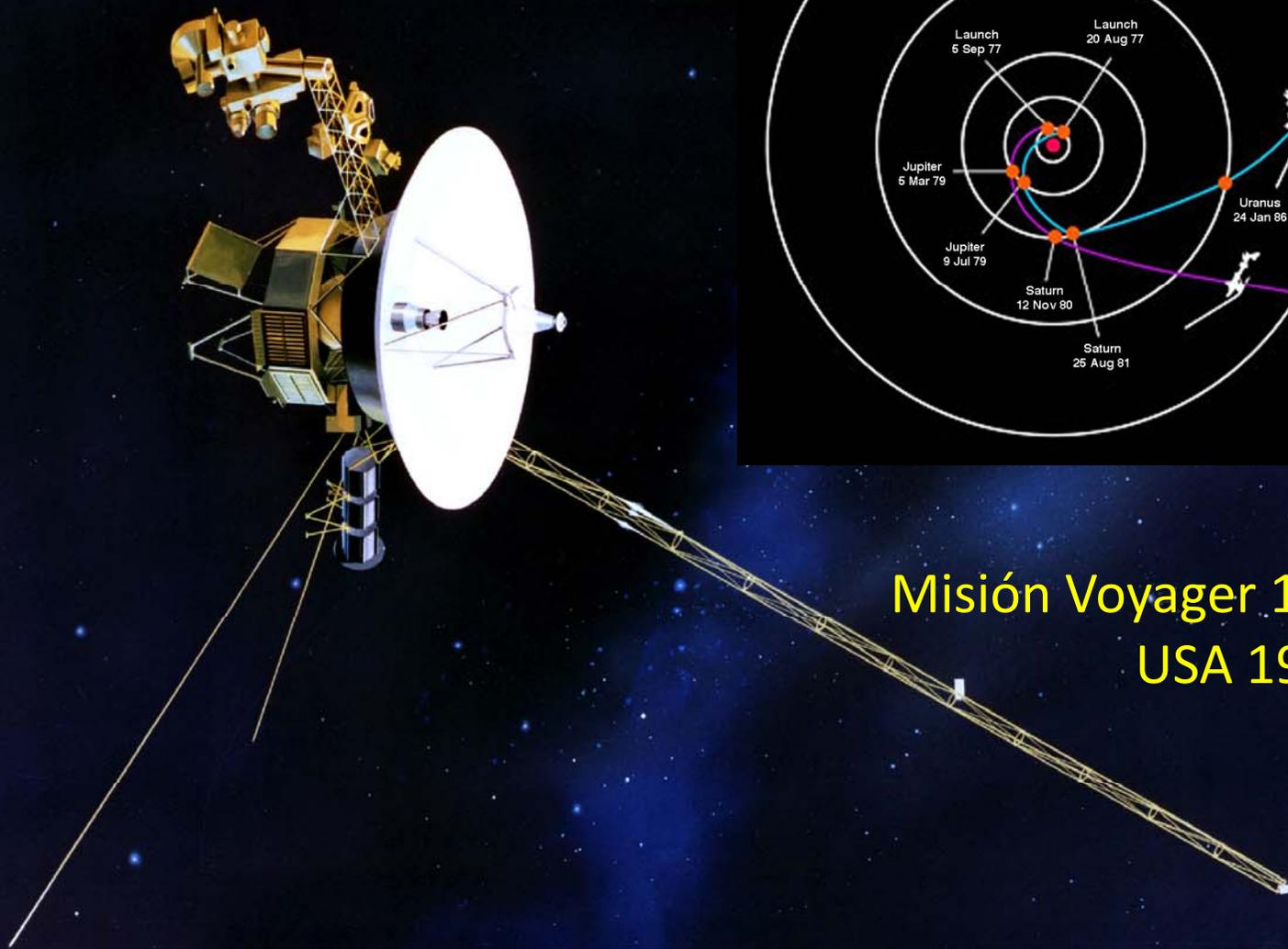




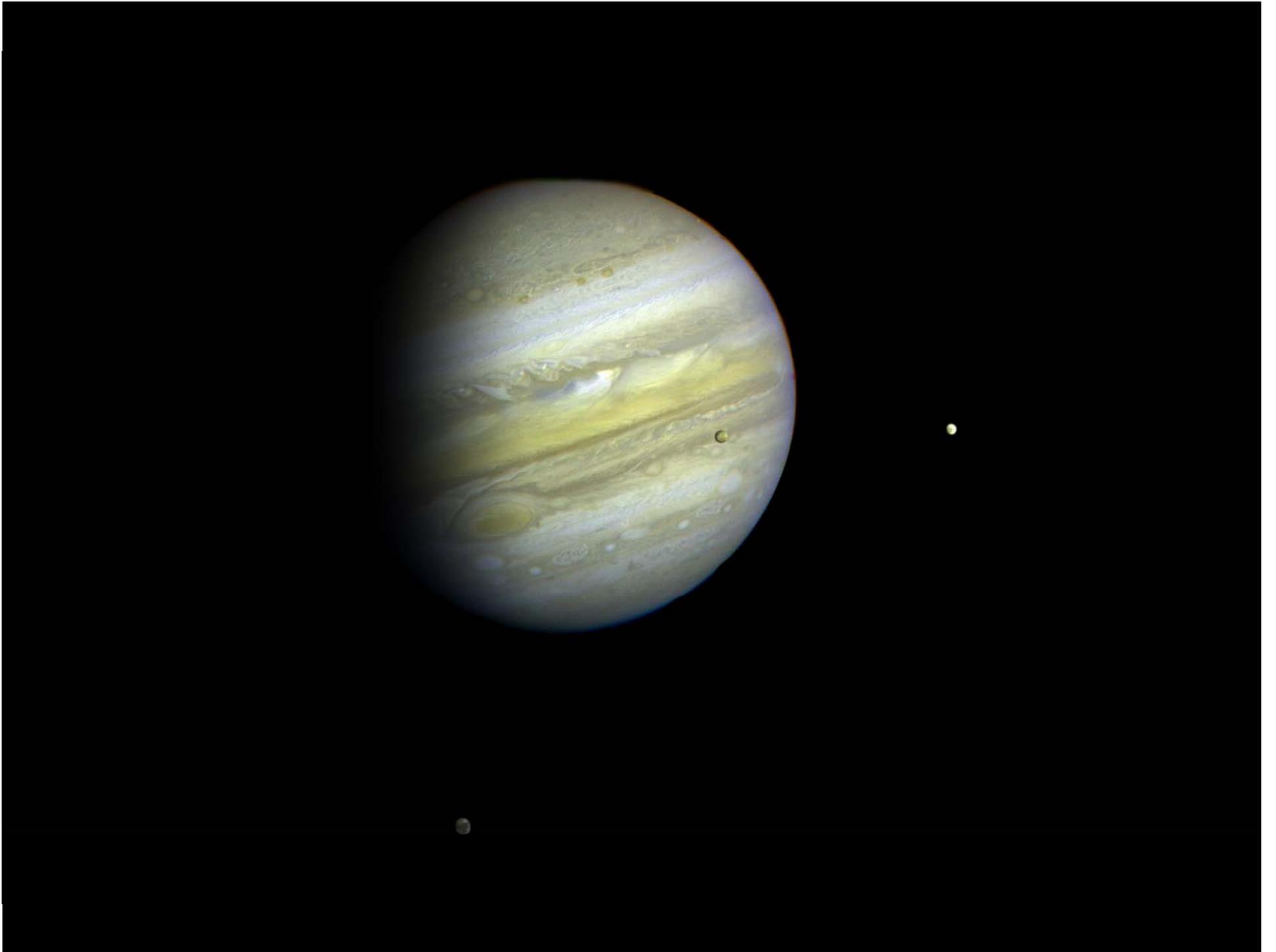


Misión Mars Express
ESA 2003 -

Los grandes viajeros



Misión Voyager 1 & 2
USA 1977 -



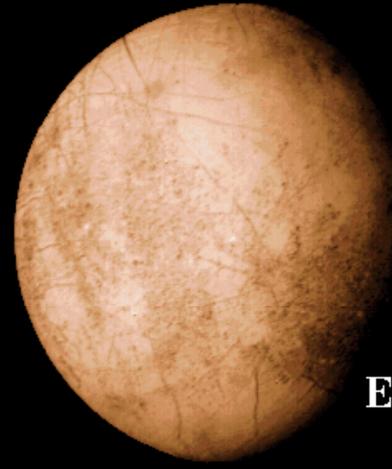




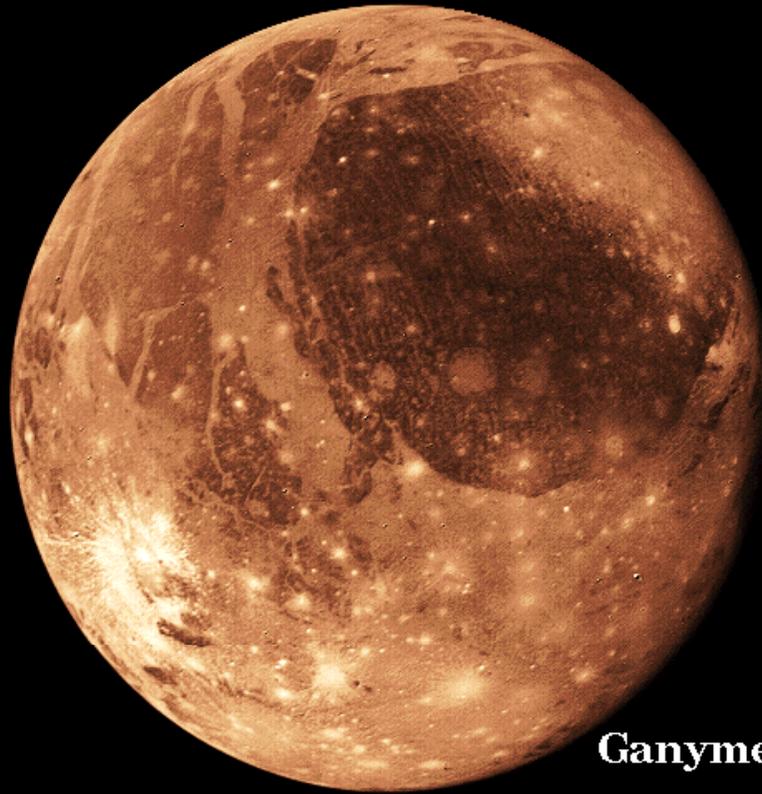
Io



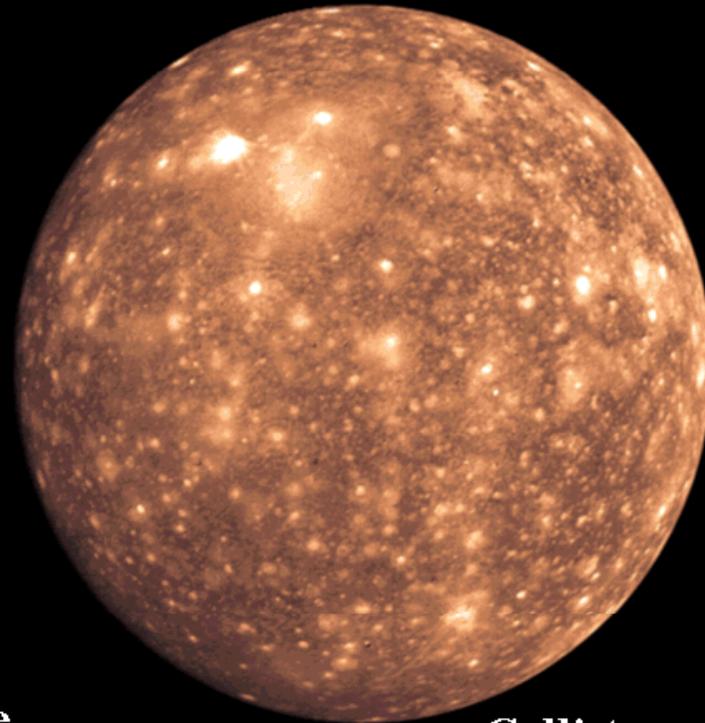
Europa

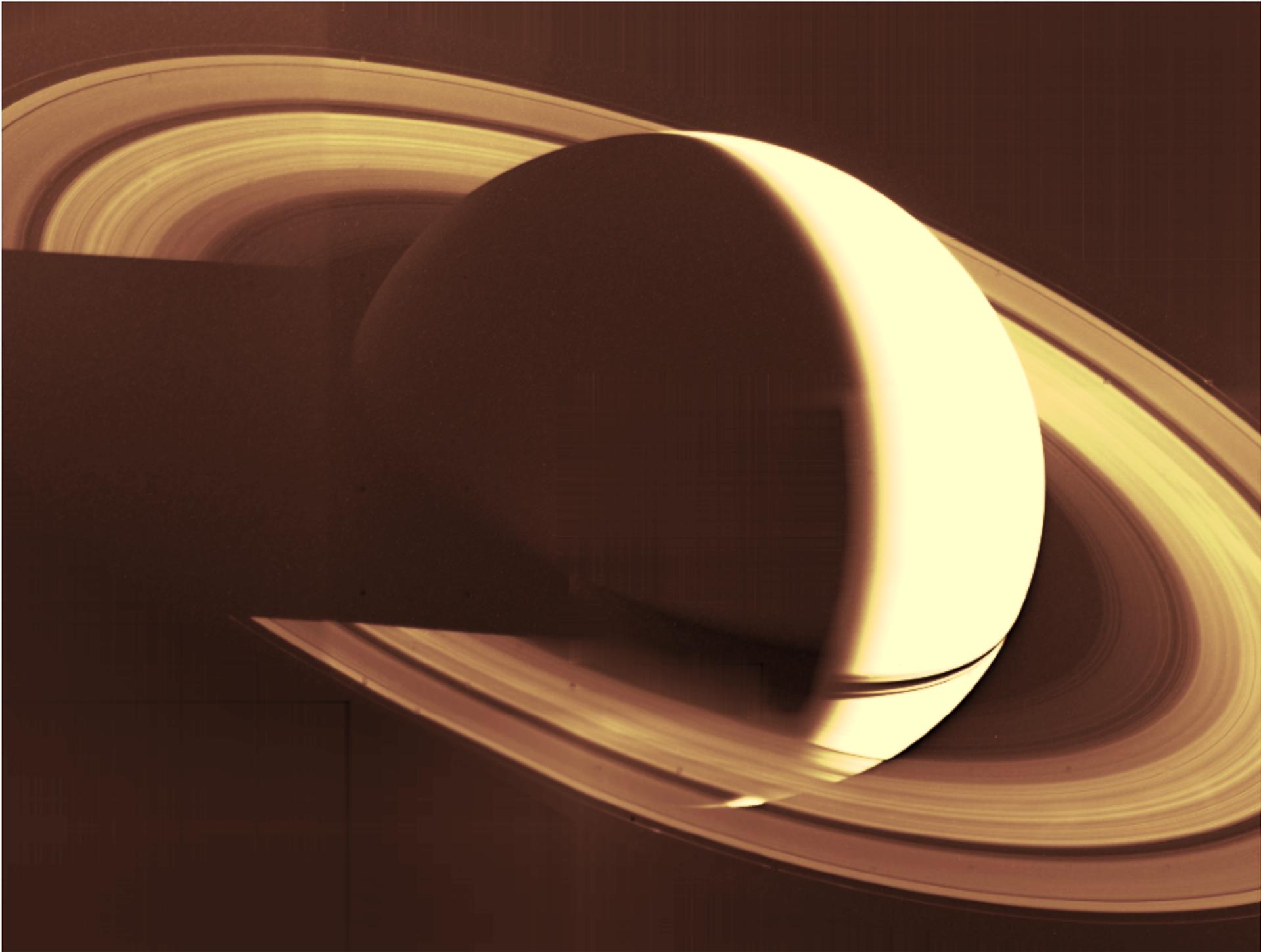


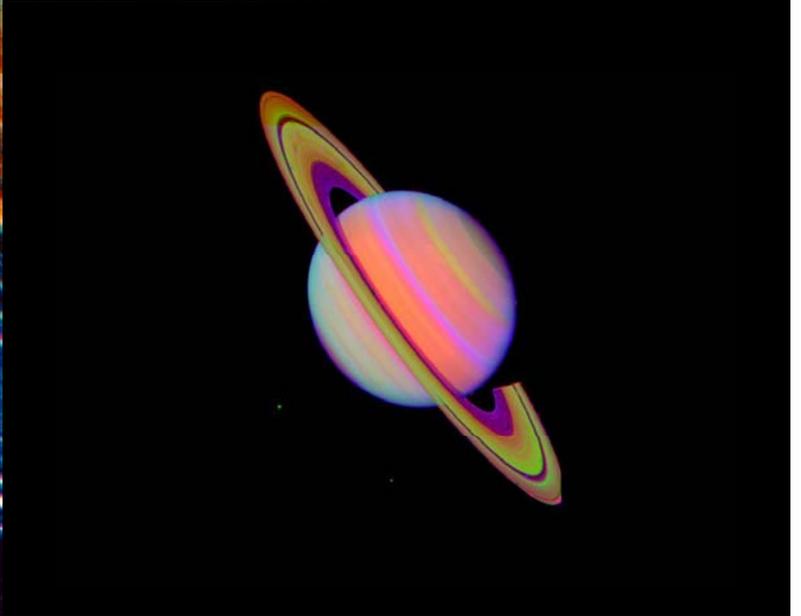
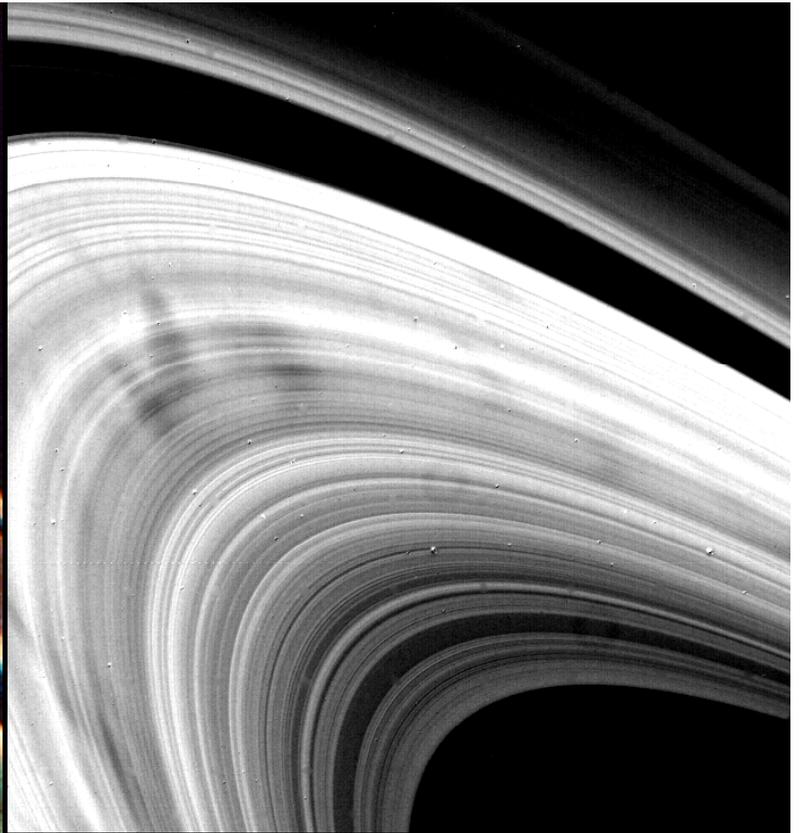
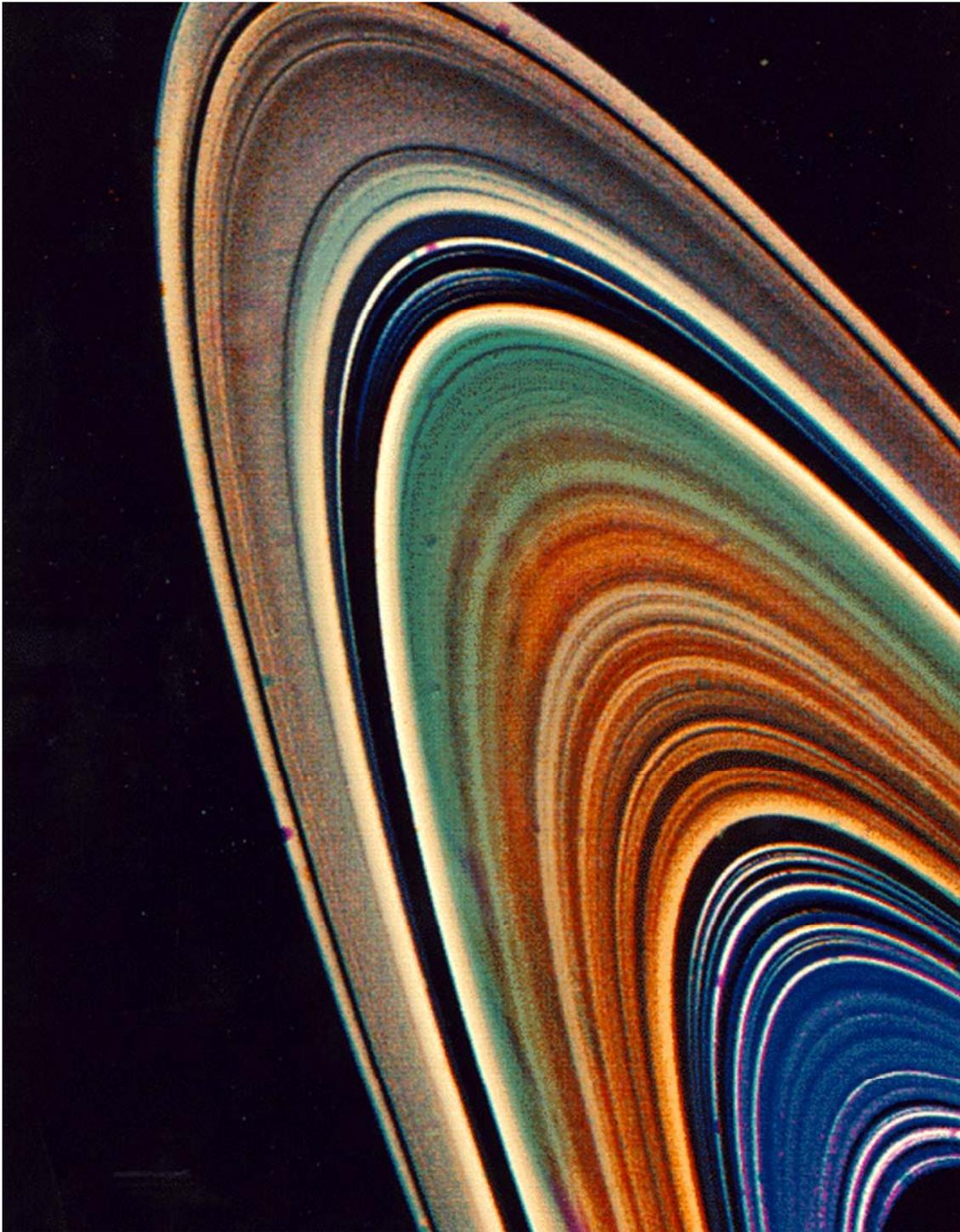
Ganymede

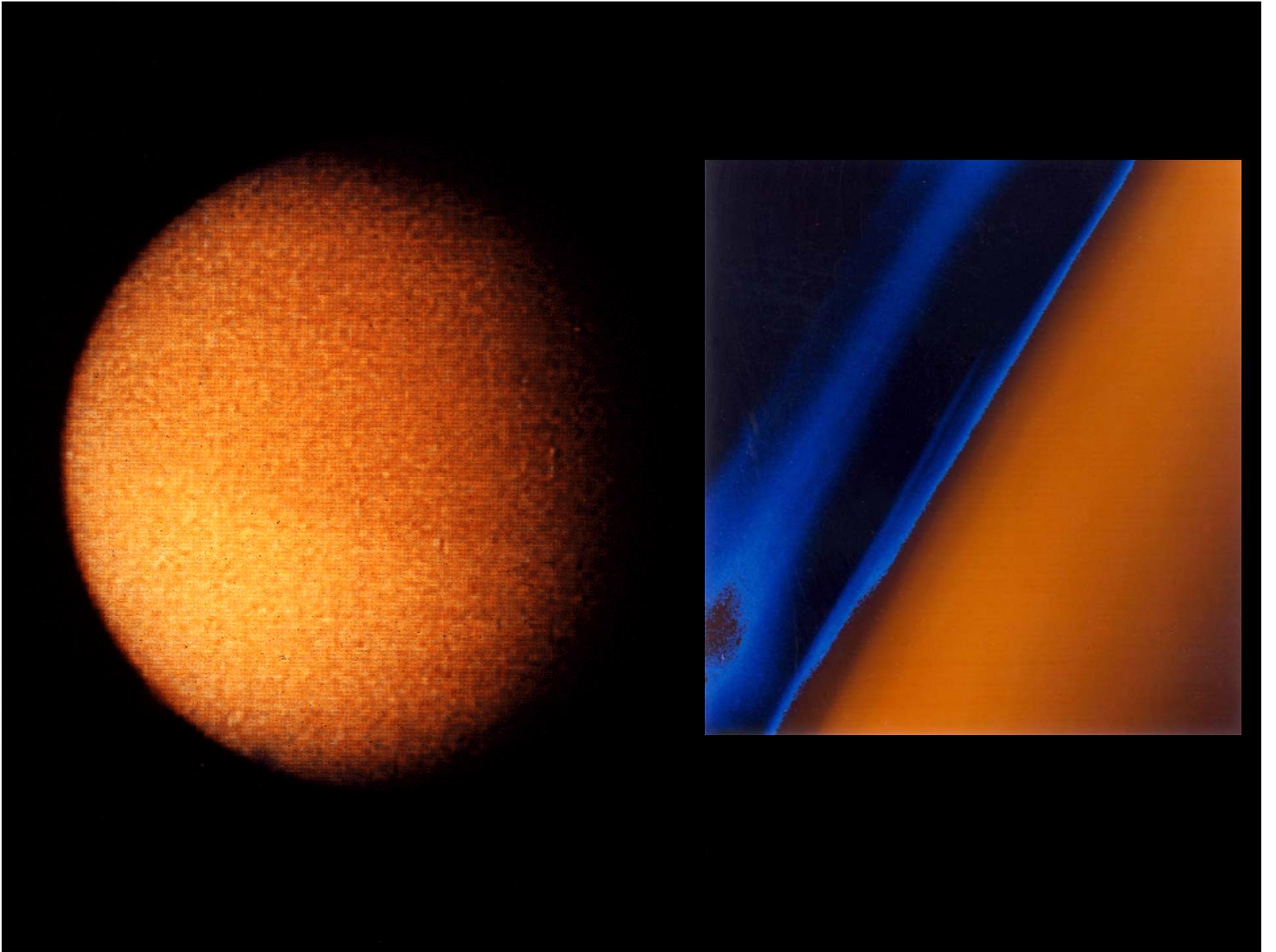


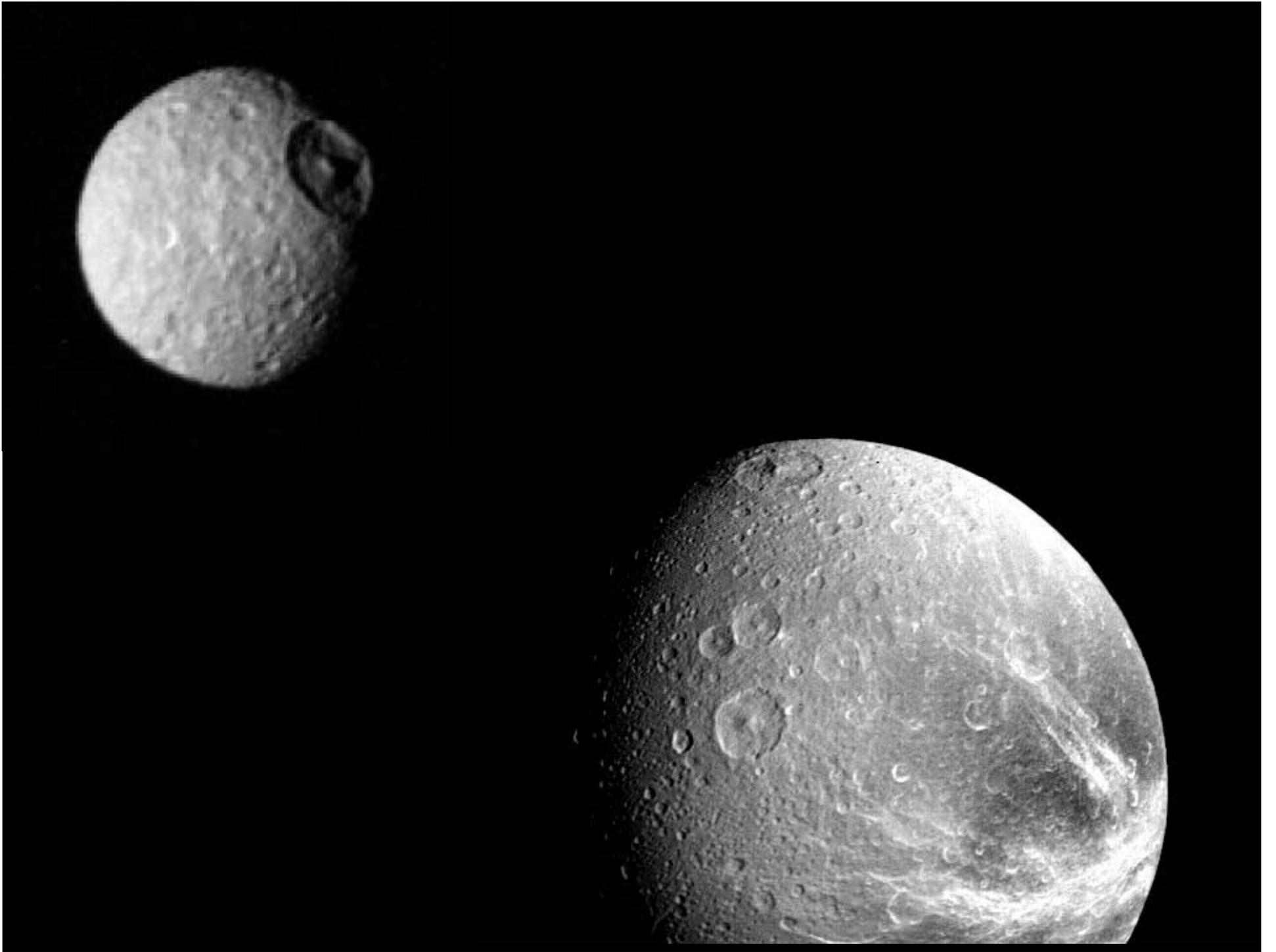
Callisto

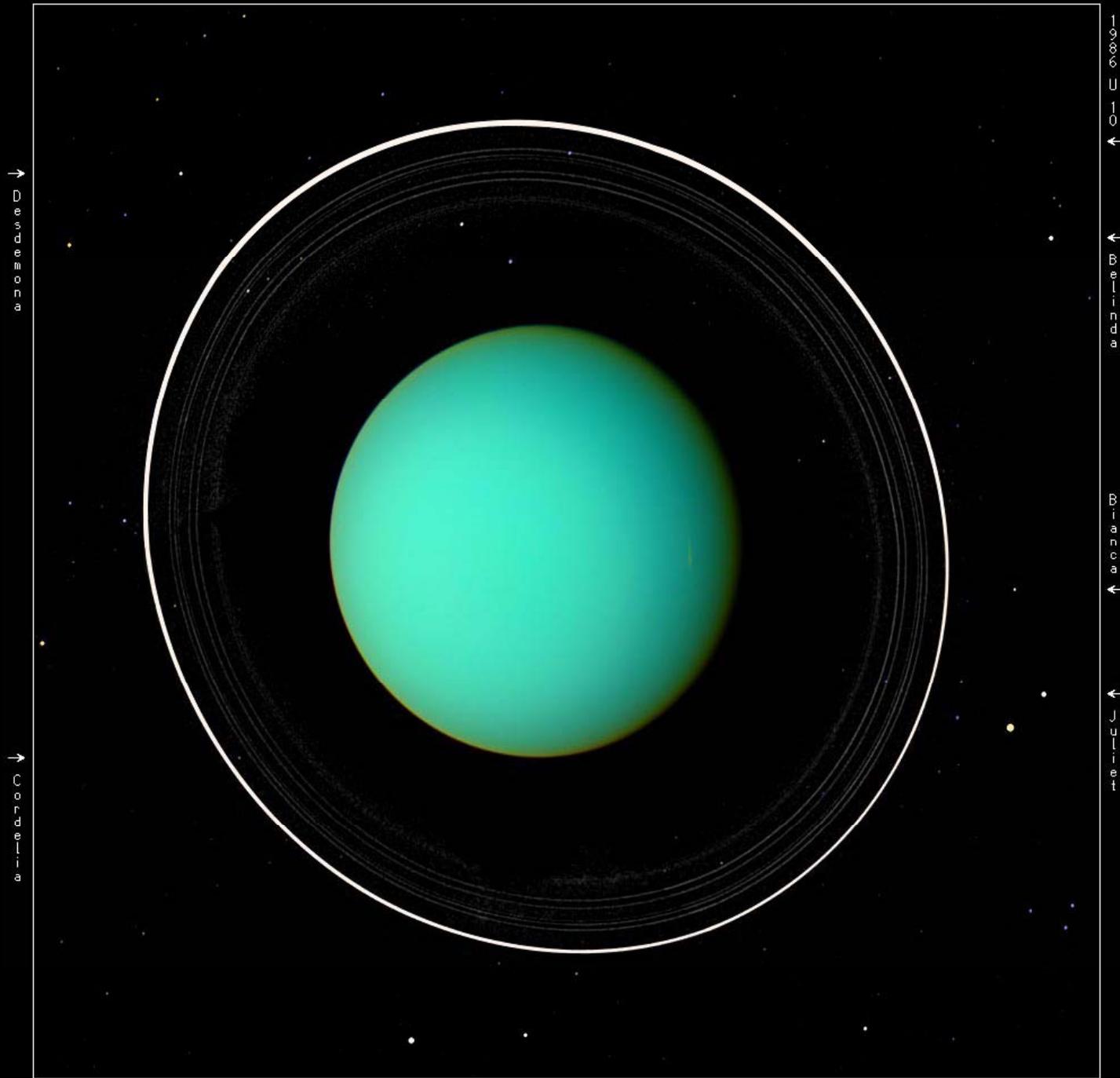












Cressida ↓

Cressida ↓

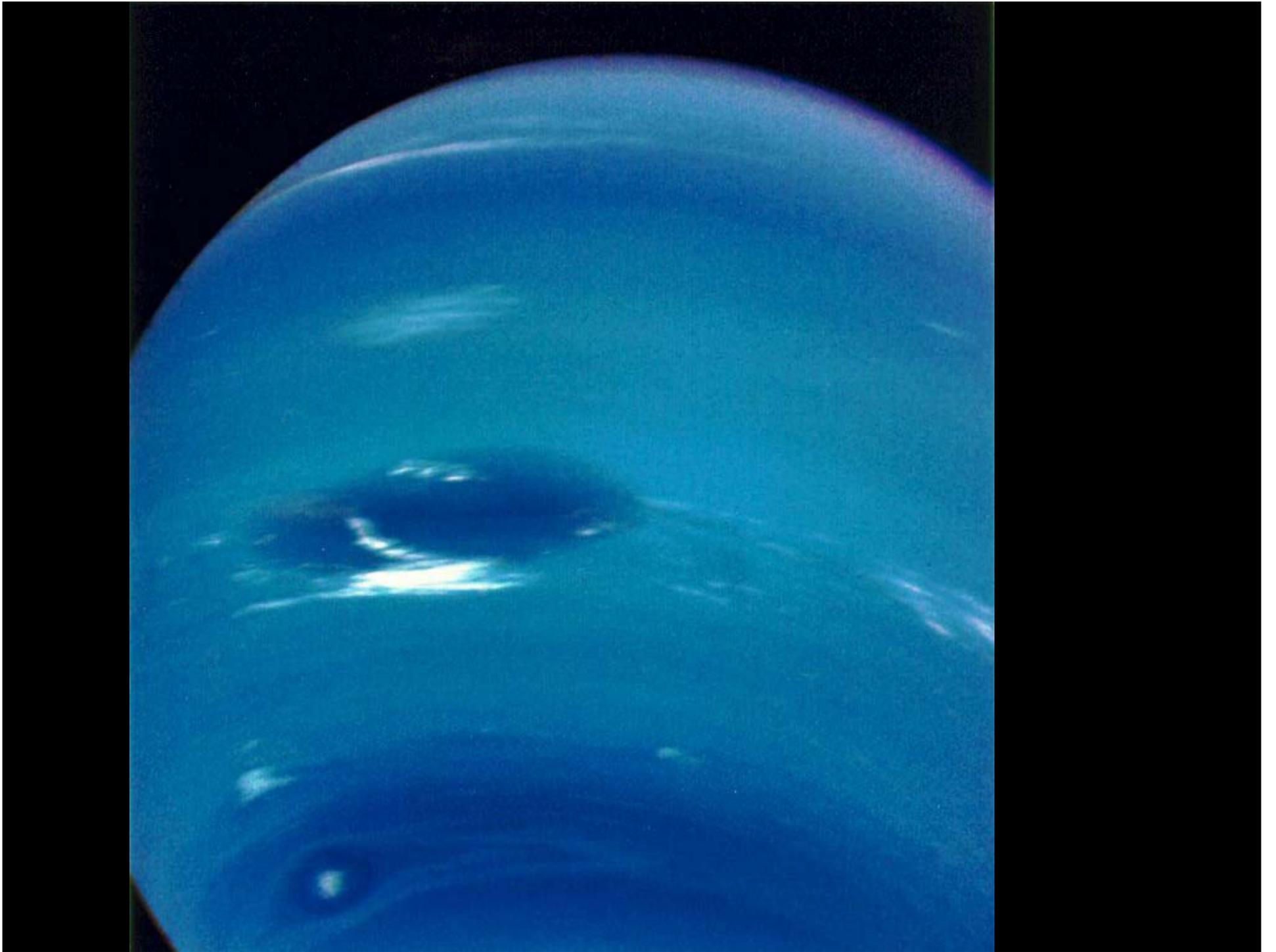
1986 U 10 ↓

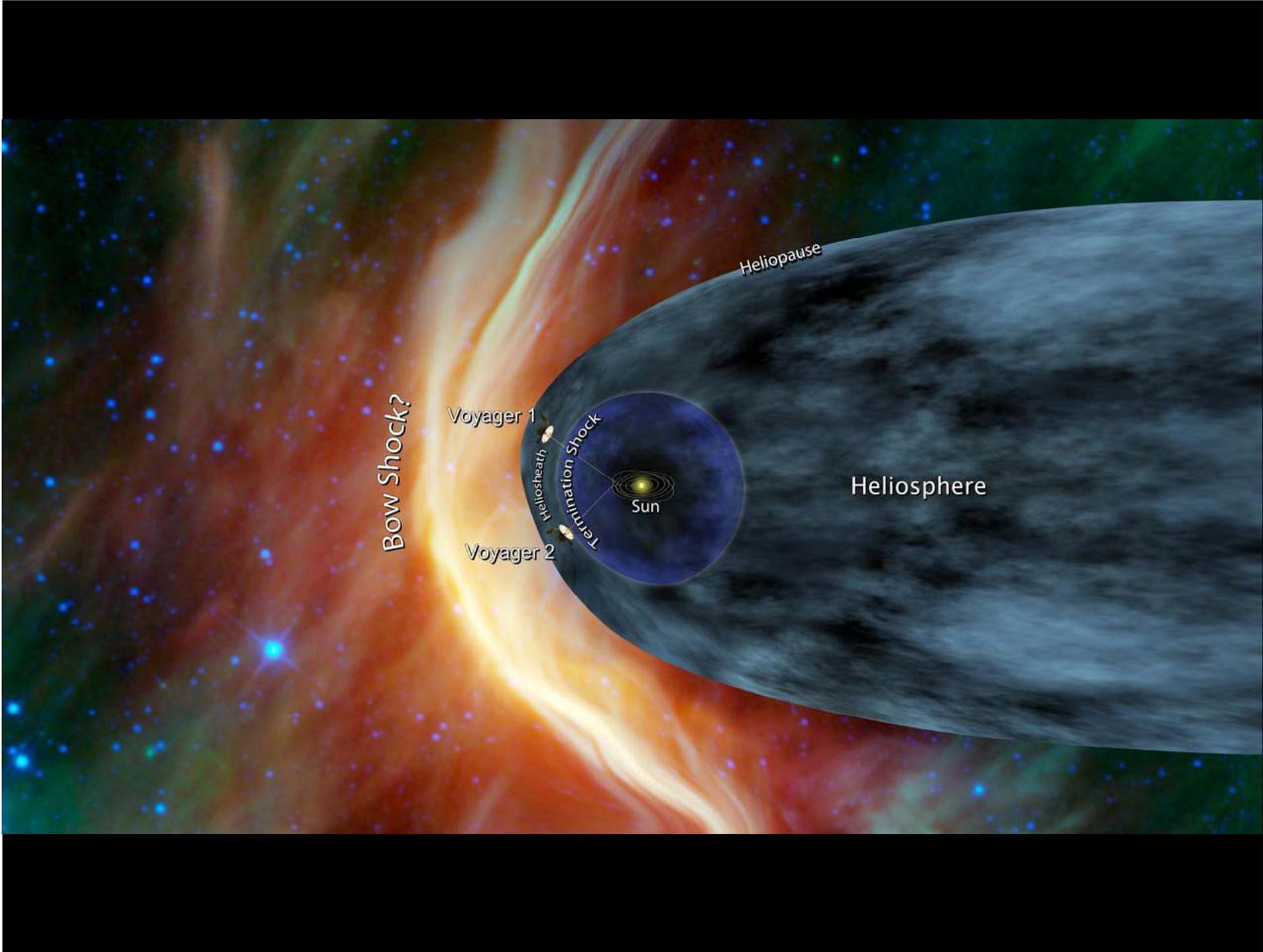
Belleville ↓

Belleville ↓

Belleville ↓

Portia ↑ Cressida ↑ ↑ Ophelia ↑ Rosalind





Bow Shock?

Voyager 1

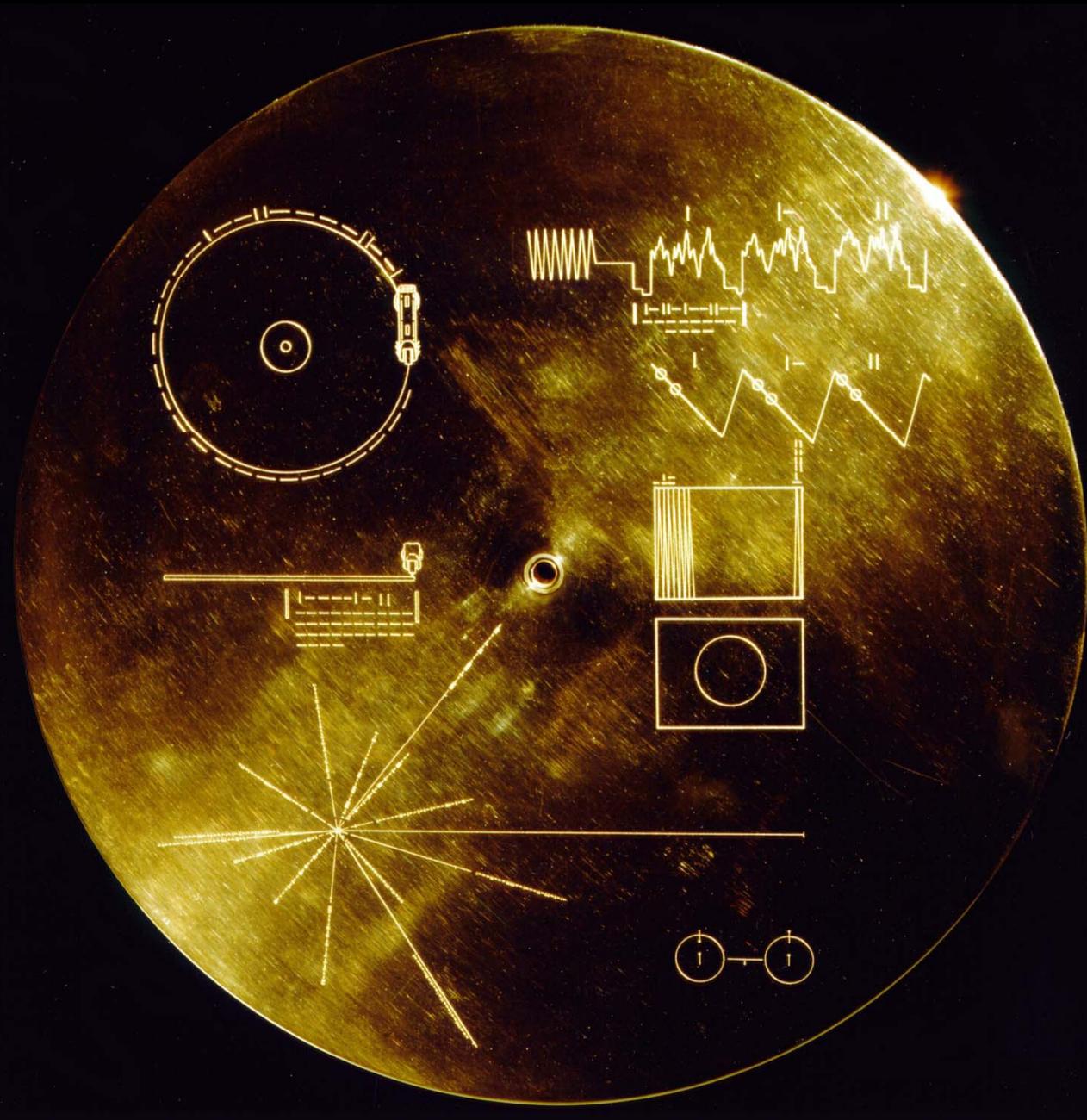
Voyager 2

Termination Shock

Sun

Heliopause

Heliosphere



Entrando en Júpiter



Misión Galileo
USA 1995 - 2003



Navegando por Saturno

Misión Cassini-Huygens
USA /ESA 2004 -

10:15'97



Dec 5, 2010



Jan 2, 2011



Feb 25, 2011



Apr 22, 2011

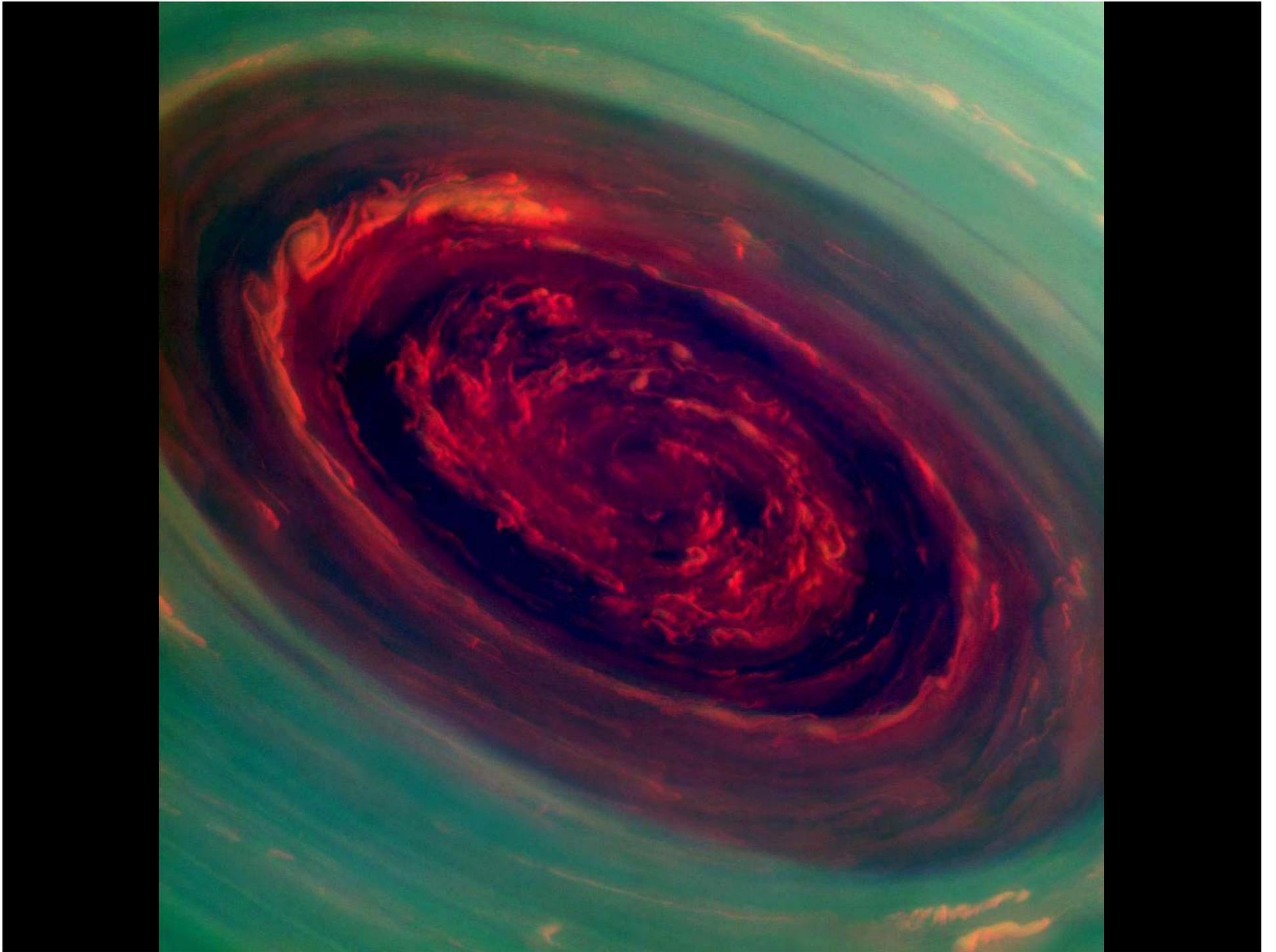


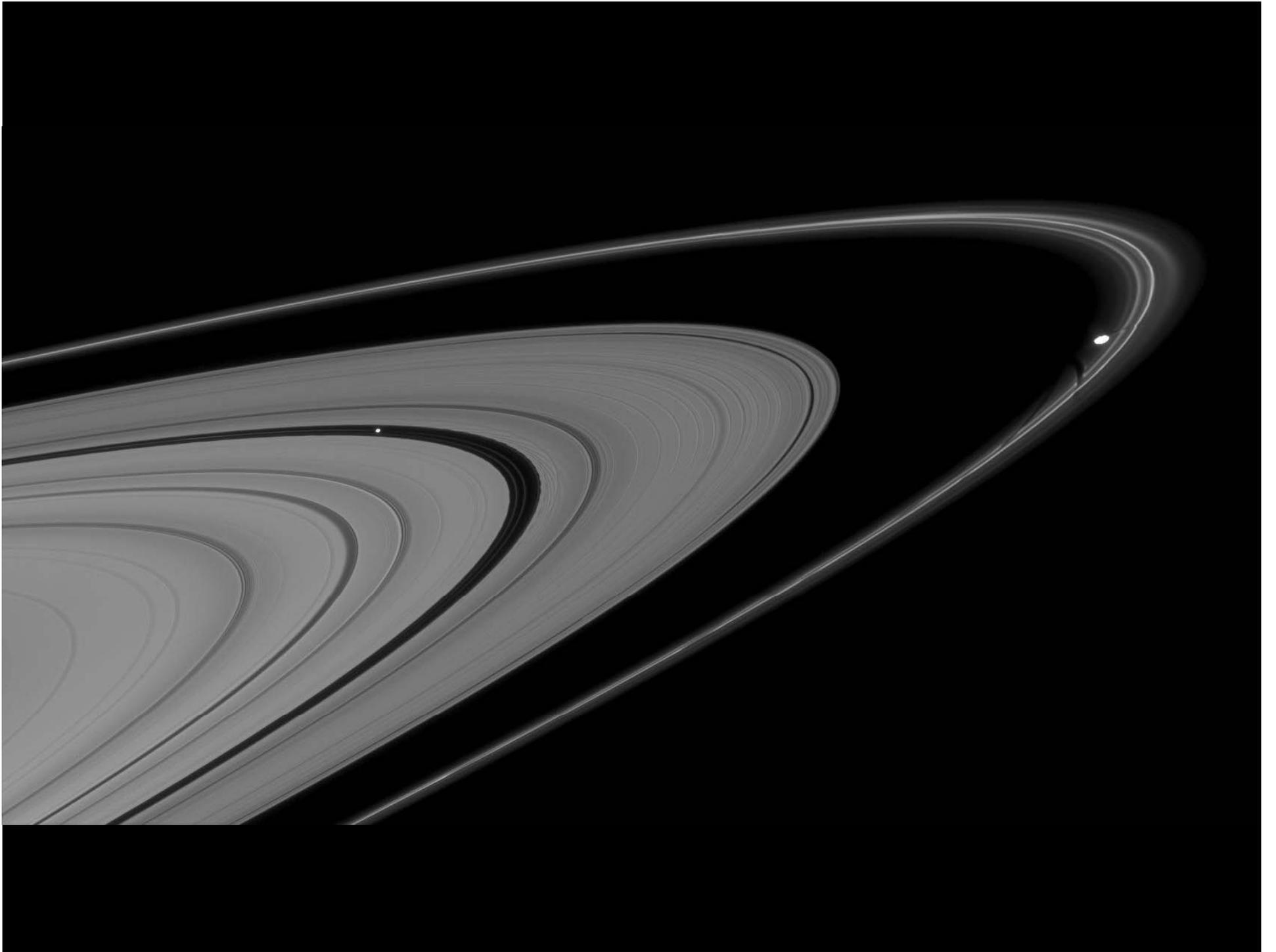
May 18, 2011

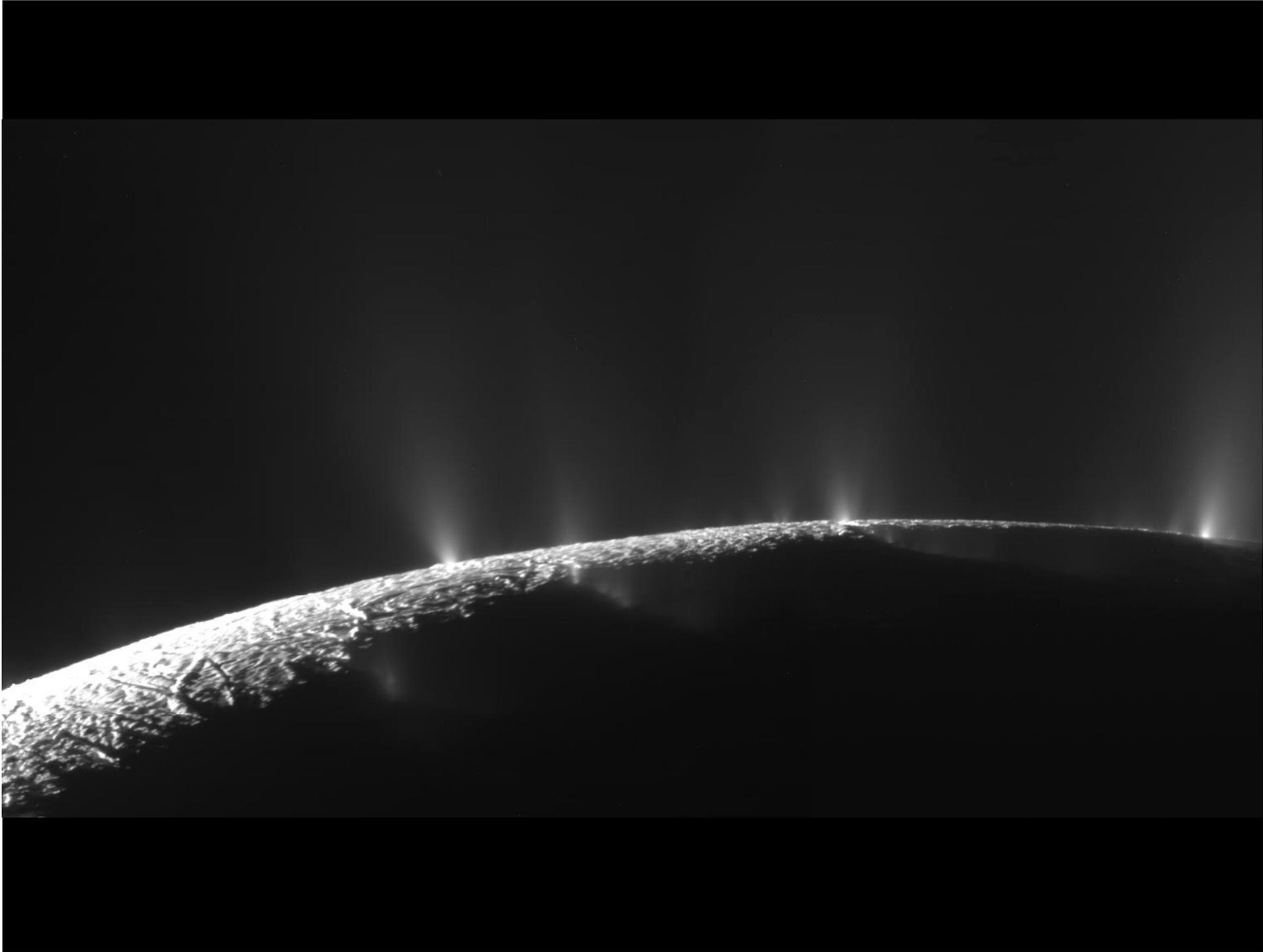


Aug 12, 2011

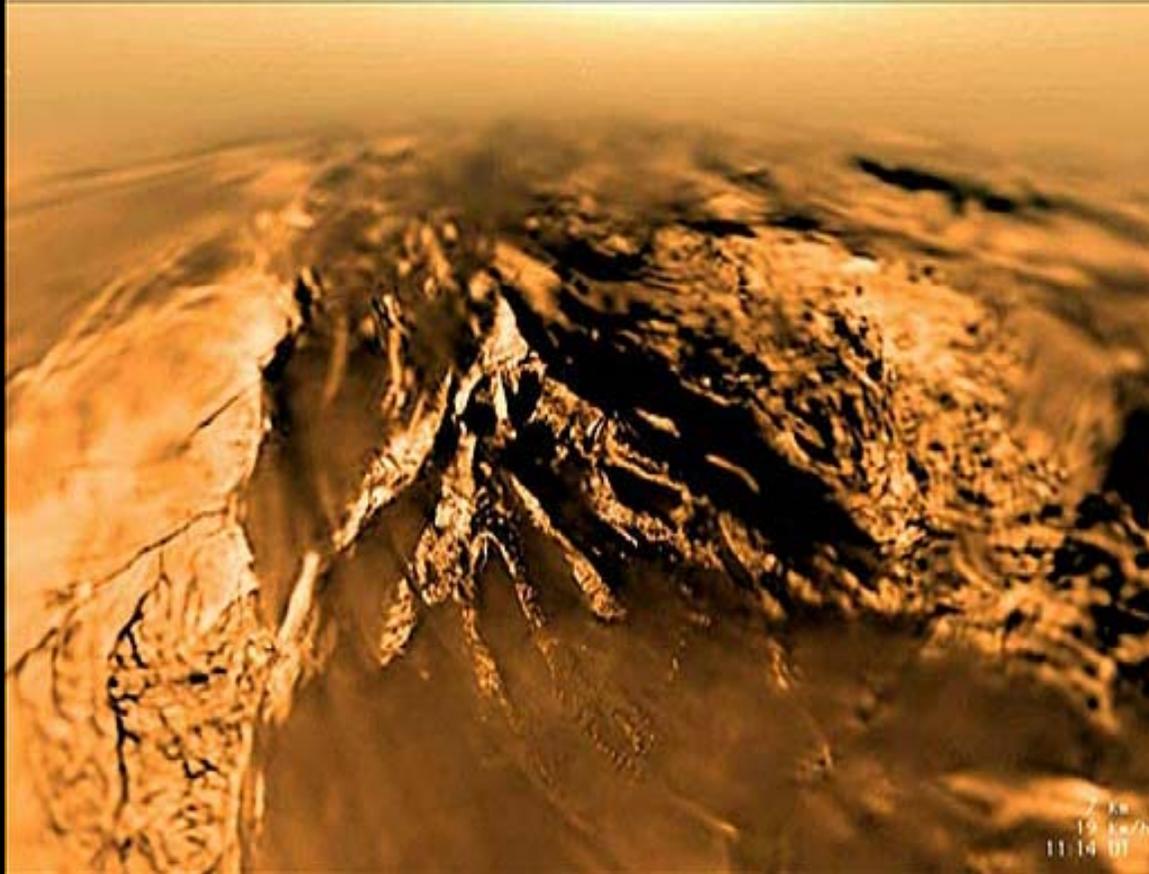






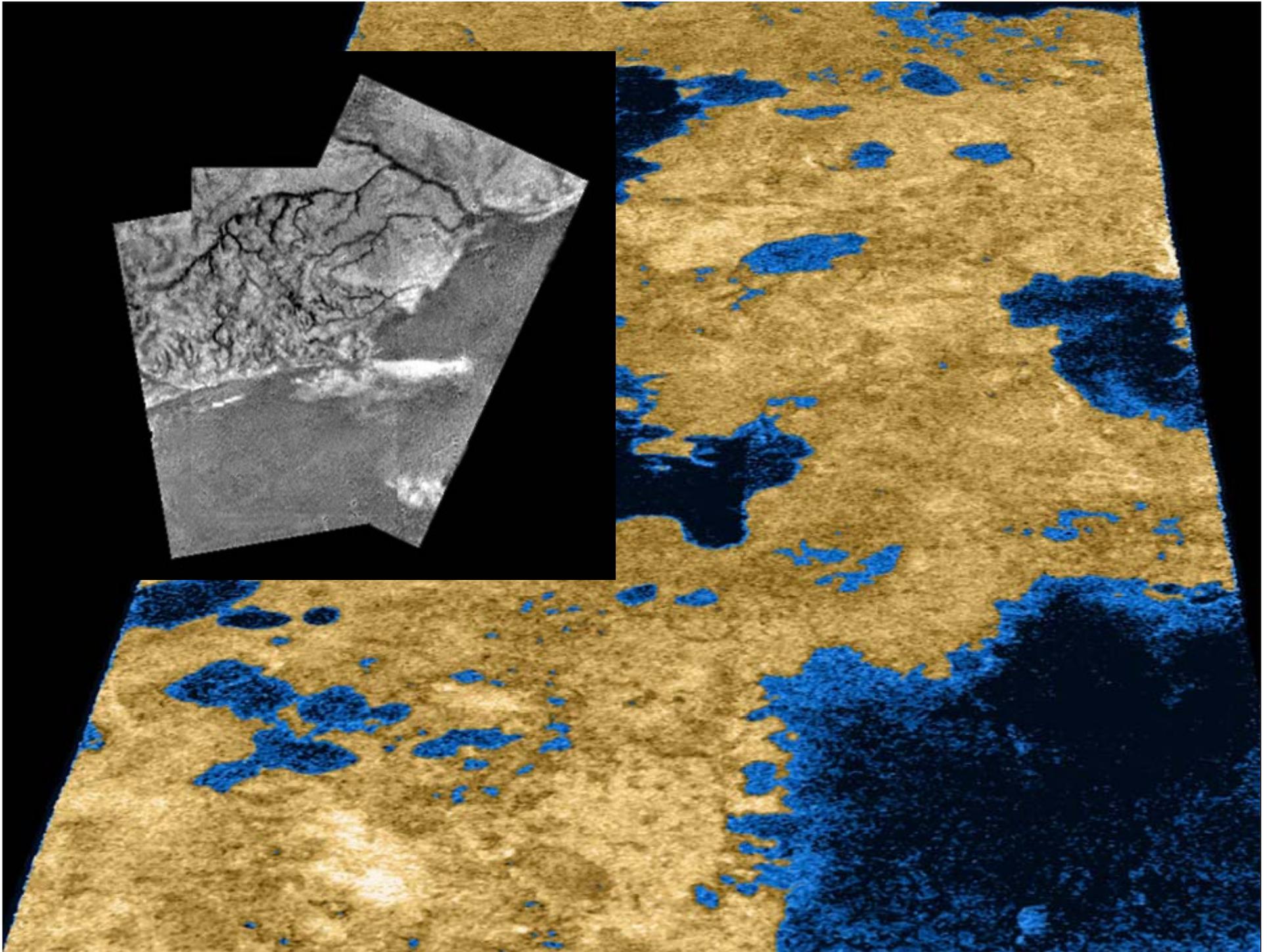


El aterrizaje más complicado de la historia

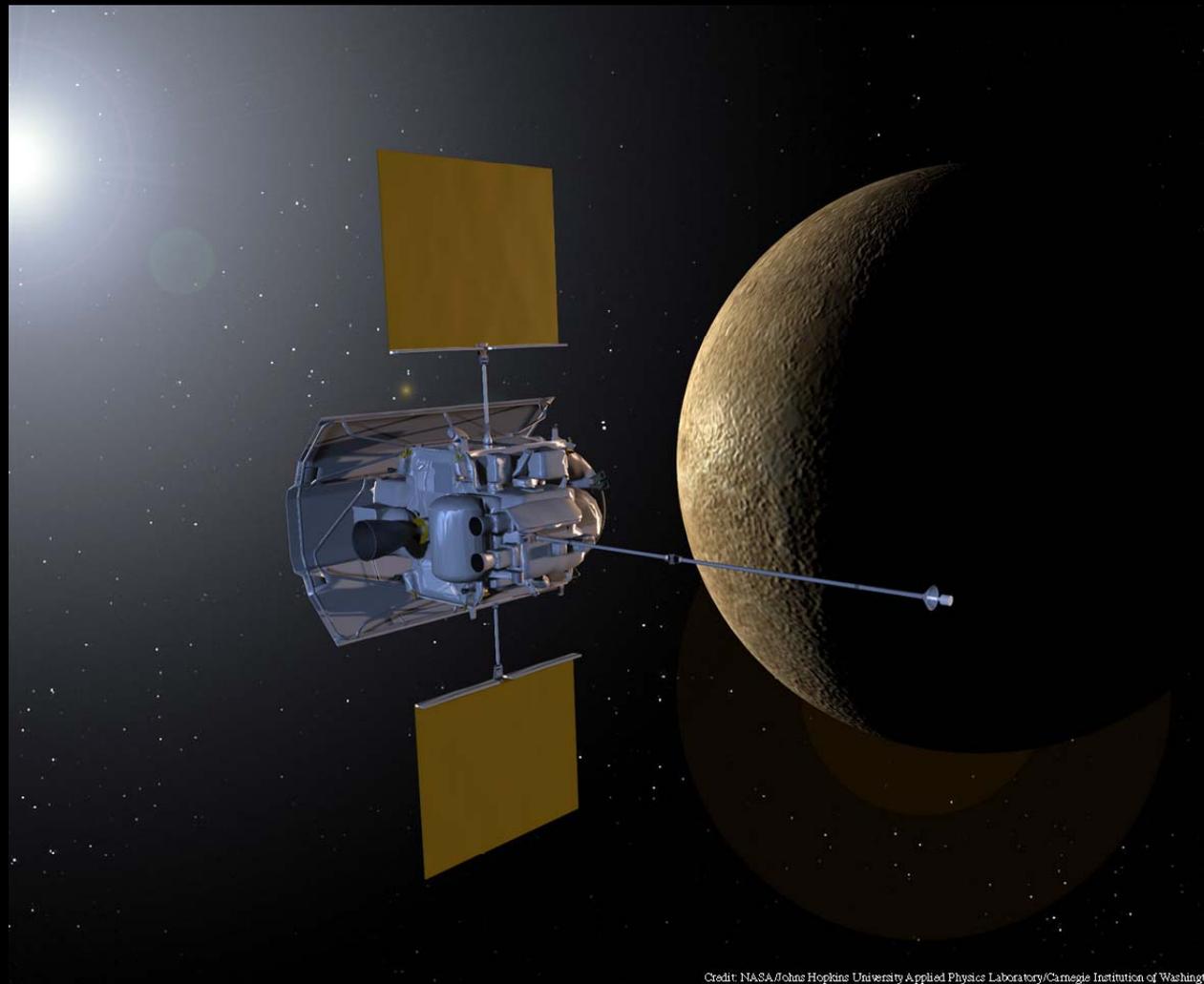


Misión Cassini-Huygens
USA /ESA 2004 -



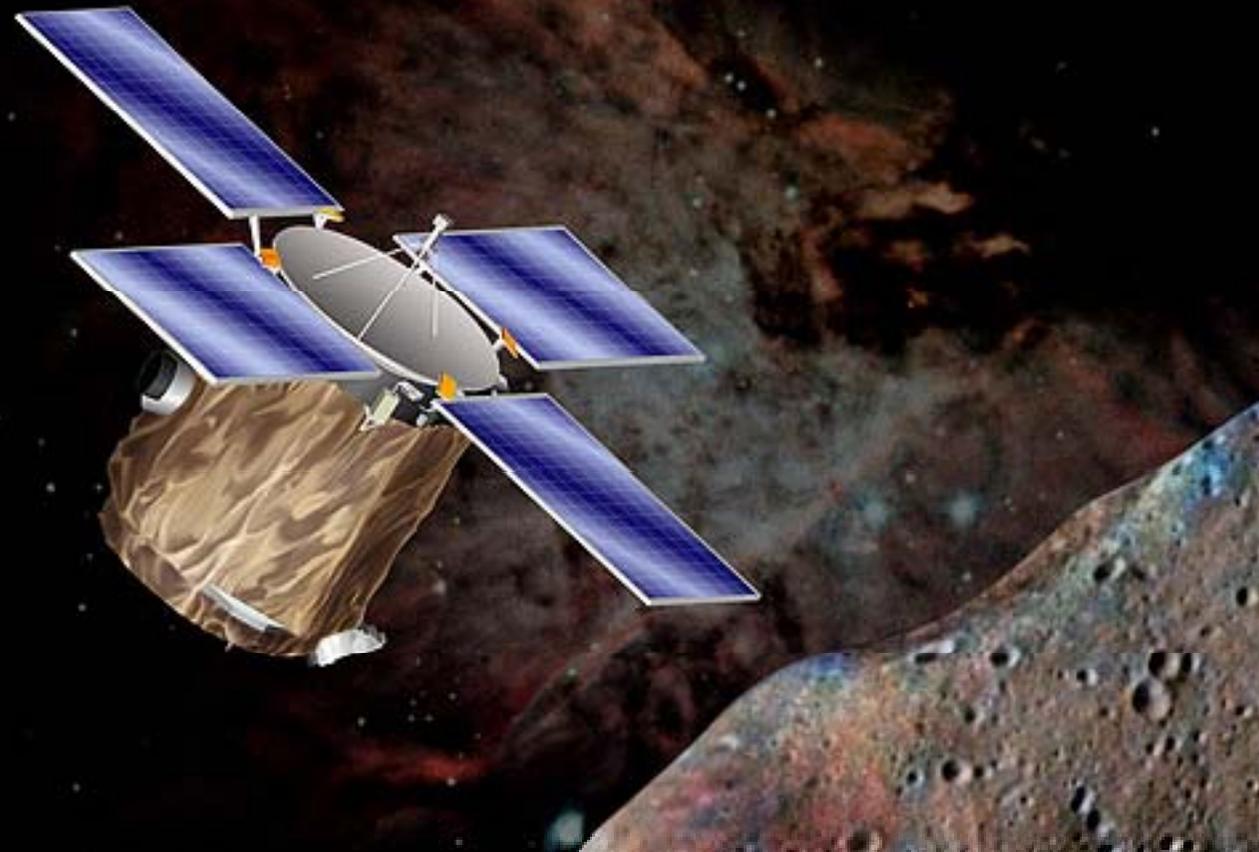


Otros vecinos



Credit: NASA/Johns Hopkins University Applied Physics Laboratory/Carnegie Institution of Washington

Misión MESSENGER
USA 2008 -



Misión NEAR Shoemaker
USA 1996 - 2000

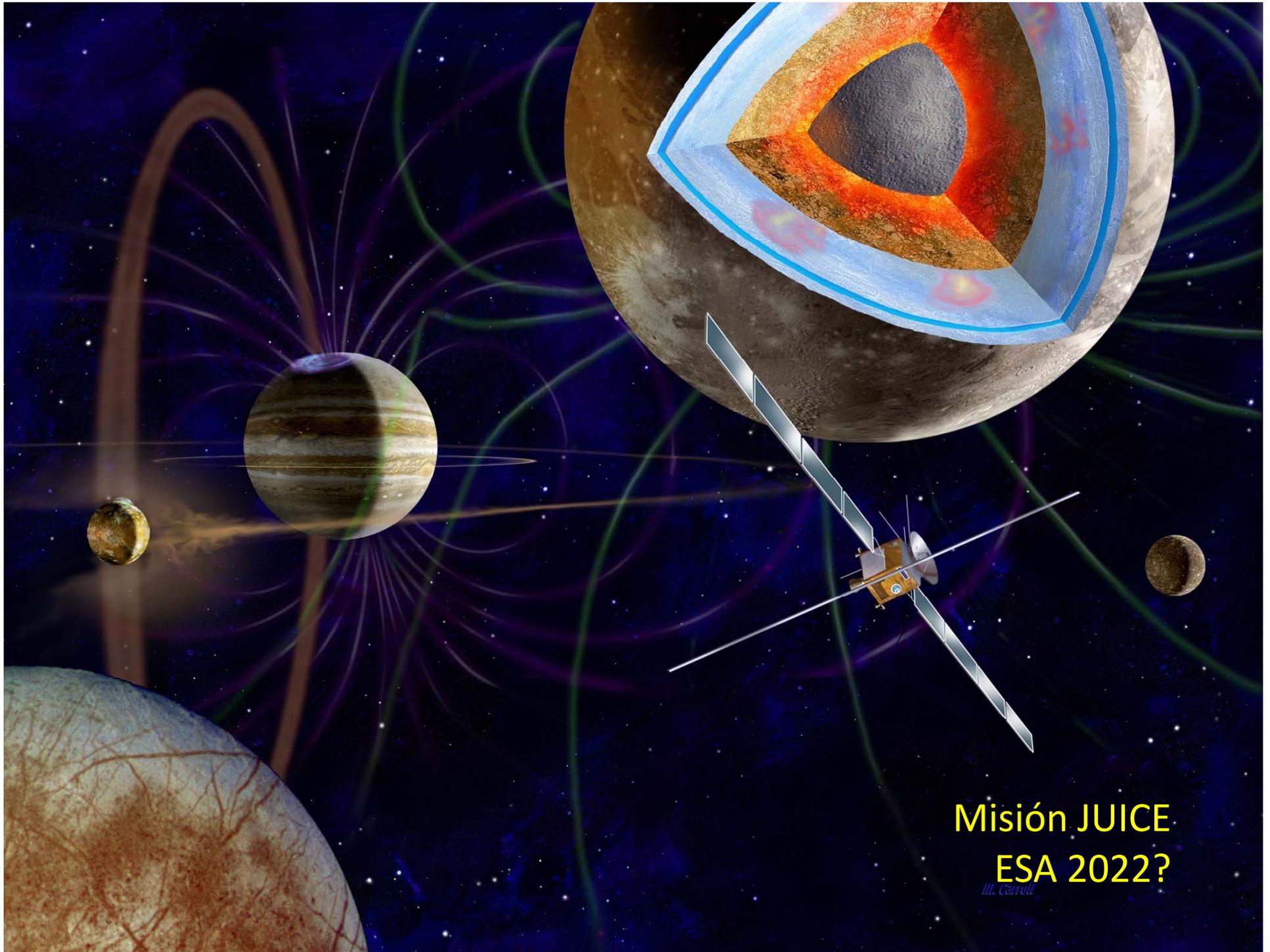
Lo que queda por descubrir



Misión ROSETTA
ESA 2014 - 2015



Misión Juno
USA 2016 -



Misión JUICE
ESA 2022?

M. Camilla

THE SPACE ECONOMY: A MODERN DAY GOLD RUSH

Asteroid Mining Will Create A Trillion-Dollar Industry

As our **population grows** we need to find a **sustainable supply of natural resources** to fuel exploration in space and prosperity on Earth.



PLATINUM-RICH ASTEROID

Could contain more Platinum Group Metals than **what's been mined on Earth** in all of history

NEAR-INFINITE SUPPLY OF PRECIOUS RESOURCES

WATER-RICH ASTEROID

One water-rich asteroid could produce **enough fuel** for every rocket launched in history.

ONE SINGLE 500M water-rich asteroid

\$ 5 trillion would produce over \$5 trillion worth of water for use in space.

It currently costs **\$20,000** to send a liter of water from Earth to Deep Space

USES OF PLATINUM GROUP METALS ON EARTH

REDUCE COST OF ELECTRONICS



ELECTRIFY TRANSPORTATION



DRIVE INNOVATION, AND CREATE A GREENER EARTH



ONE SINGLE 500M platinum-rich asteroid

At current market prices, one ounce of platinum is valued over **\$1,500**

Worth \$2.9 Trillion

174 times more than the yearly world output of platinum

50%

More than the known world-reserves of PGMs

Asteroid mining will open a trillion-dollar industry and provide a **near-infinite supply** of Platinum Group Metals and water to **support our growth** both on this planet and off.

MORE ASTEROIDS DISCOVERED NEAR EARTH EVERYDAY



USES OF WATER IN SPACE



ROCKET FUEL



BREATHABLE AIR



DRINKABLE WATER



SpaceShipOne



The First Non-Government Manned Spacecraft

Primary structure assembly



CTN installation



Removable nose/fin



View from within cabin



Beavone Actuated by Pilot's Center Stick
(Primarily for subsonic pitch and roll control)
(Blue control linkages)

Upper Rudders Actuated by Pilot's Pedals
(for subsonic yaw control)
(Red control linkages)

Redundant Cold-Cast Roll RCS
Thrusters At Each Wing Tip
(cyan)

Feather Actuation & Lock
Pneumatic operated
Diaphragm control linkages)

Hybrid Kerosene Propulsion System
Nitrous Oxide and Rubber Propellant
Ablative Nozzle

Redundant Pitch and Yaw RCS
Thrusters
Top, Bottom and Sides of Fuselage
(cyan)

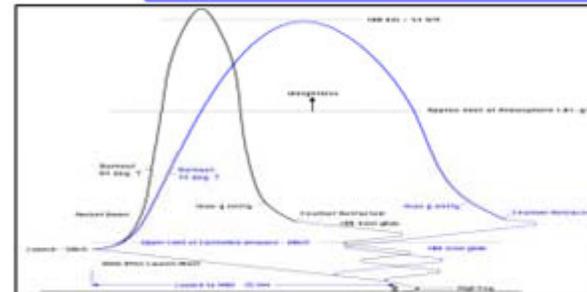
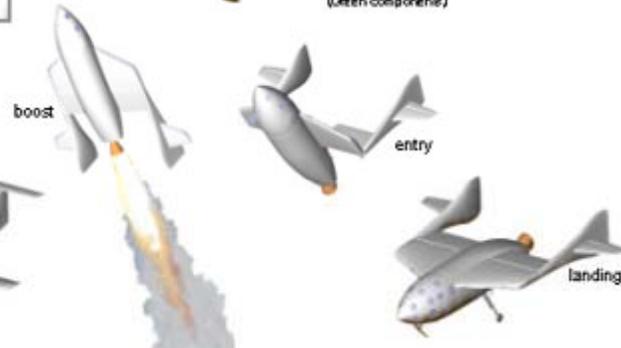
Electric Servo Full-Flying Horizontal Stabilizers & Lower Rudders
(for lift and supersonic flight control)
(Yellow control linkages)

Main Landing Gear
Hydraulic Brakes
(extend only) gas (spring damped)
(green components)

Whee Skid
Aids Runway Braking
(extend only) gas (spring damped)
(green components)

Basic Features

- Airborne launch
- INS/GPS nav & flight director
- Rubber-Nitrous hybrid rocket propulsion system
- Graphite/Epoxy primary structure
- 3-place "Sea-Level, shirt-sleeve" cabin environment
- Cabin nose removes for egress. Side plug door
- Dual-pane windows, dual seals on doors & controls
- New, low maintenance Thermal Protection System
- Care-Free, "feather" atmospheric entry



Cabin environmental test



Main gear leg load test



Tail boom load test



Feather activation



Wing mate



Nitro tank bulkhead

Falcon 9 Launch Vehicle



SPACEX

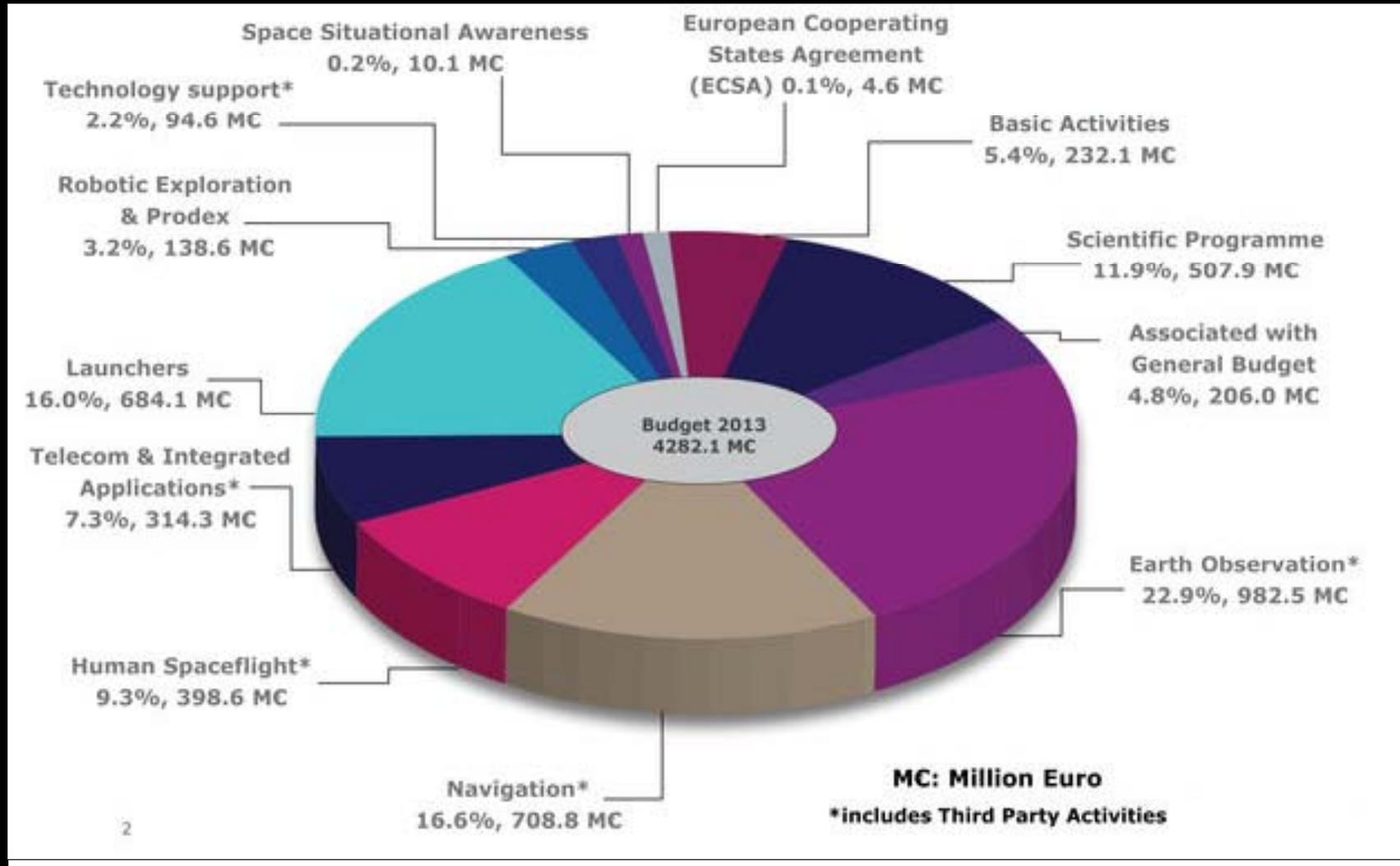


Dragon Cargo

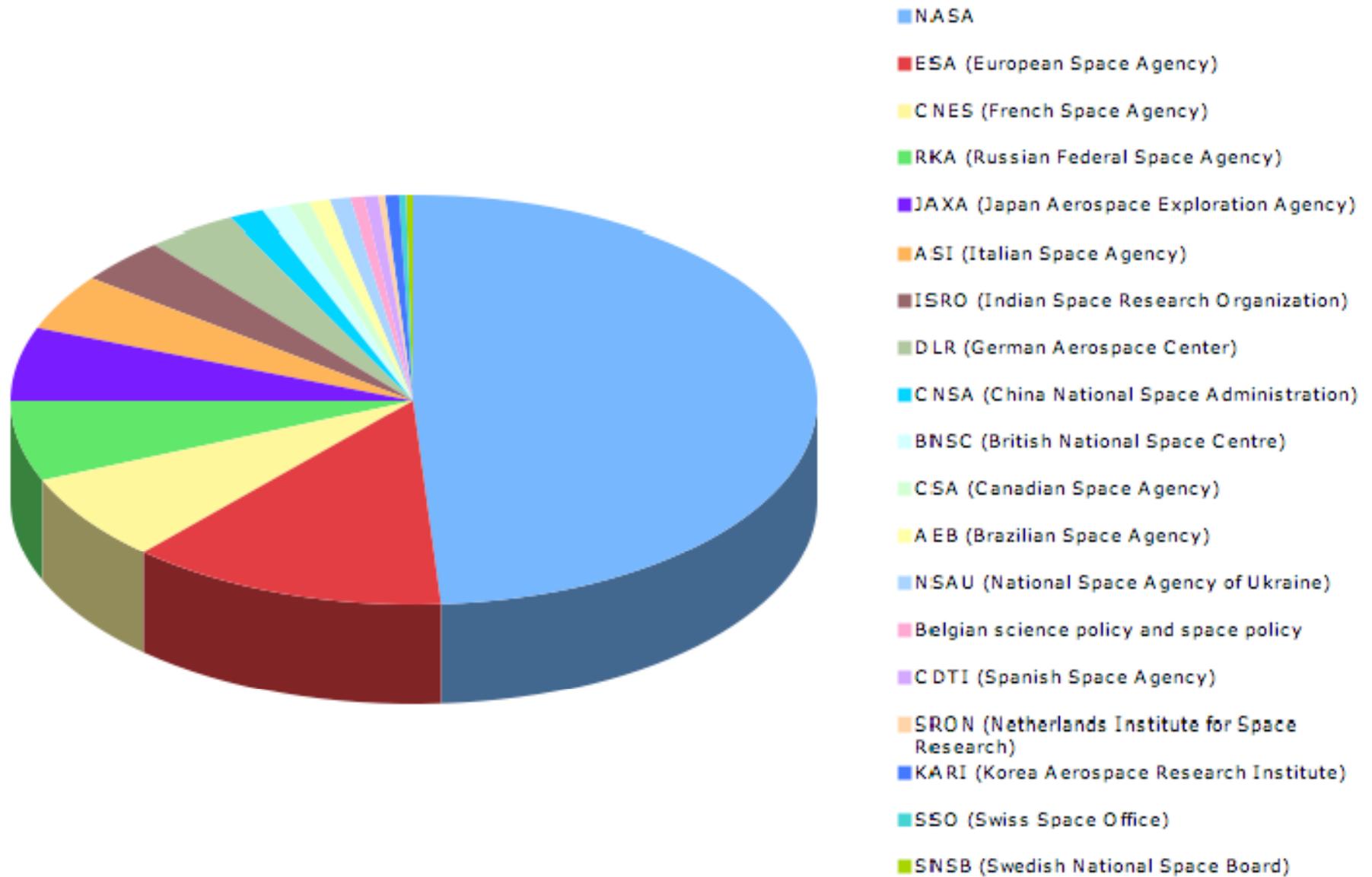


Dragon Crew

Que me devuelvan el dinero



Global Space Budget by Country



La vista atrás

