CASSINI-HUYGENS IN THE EUROPEAN CONTEXT

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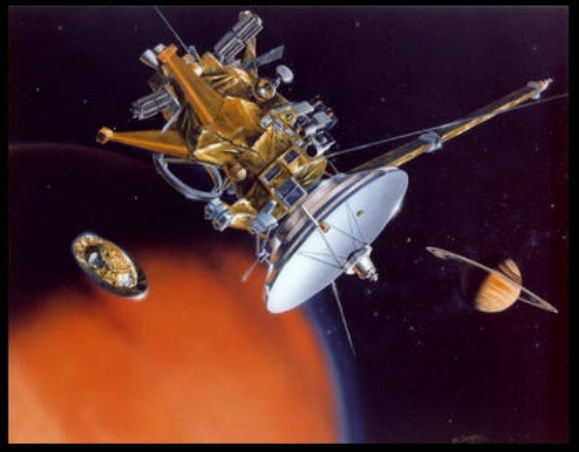
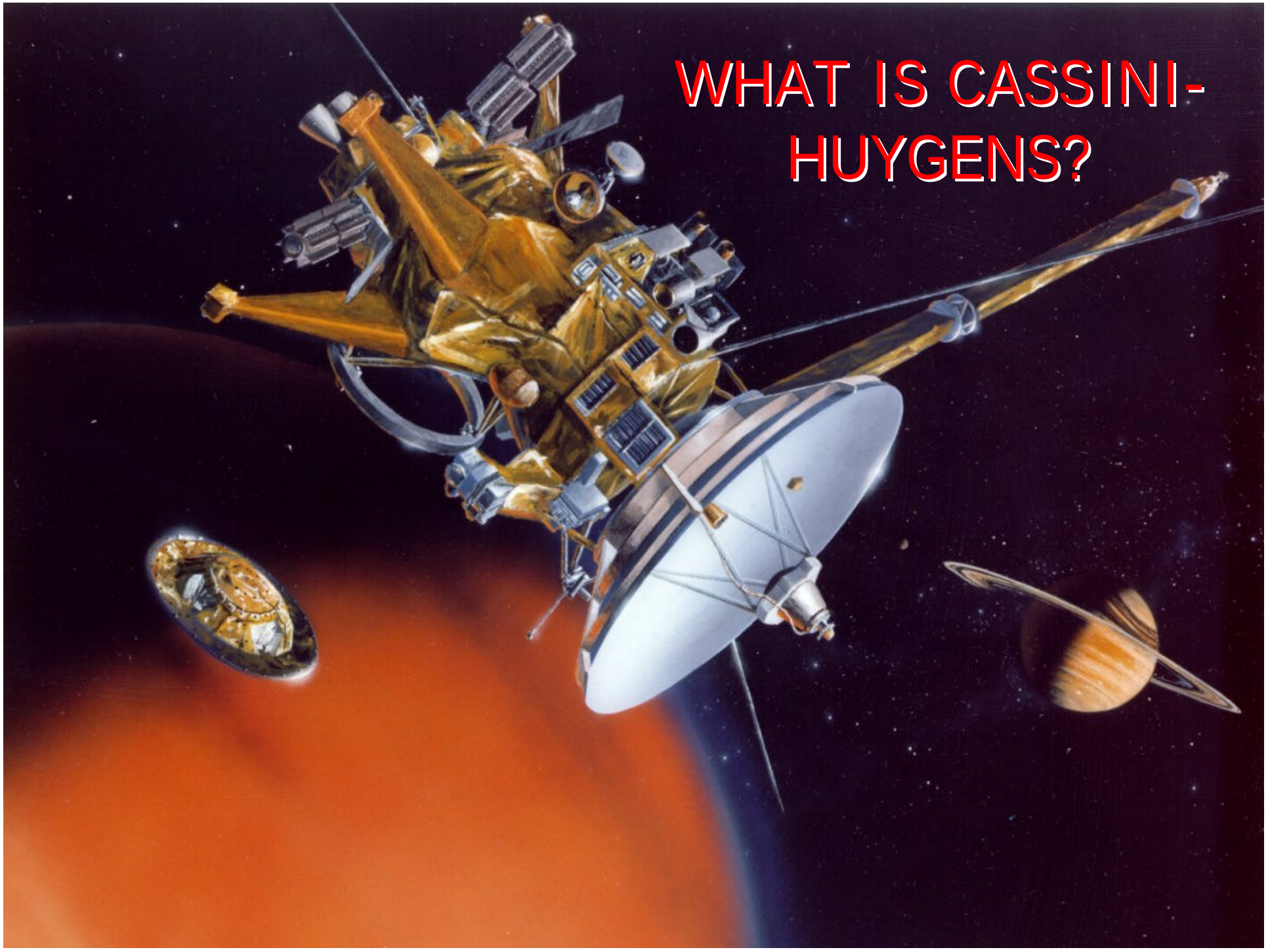
ESTEC 13/04/04

Cassini

Huygens



Cassini-Huygens

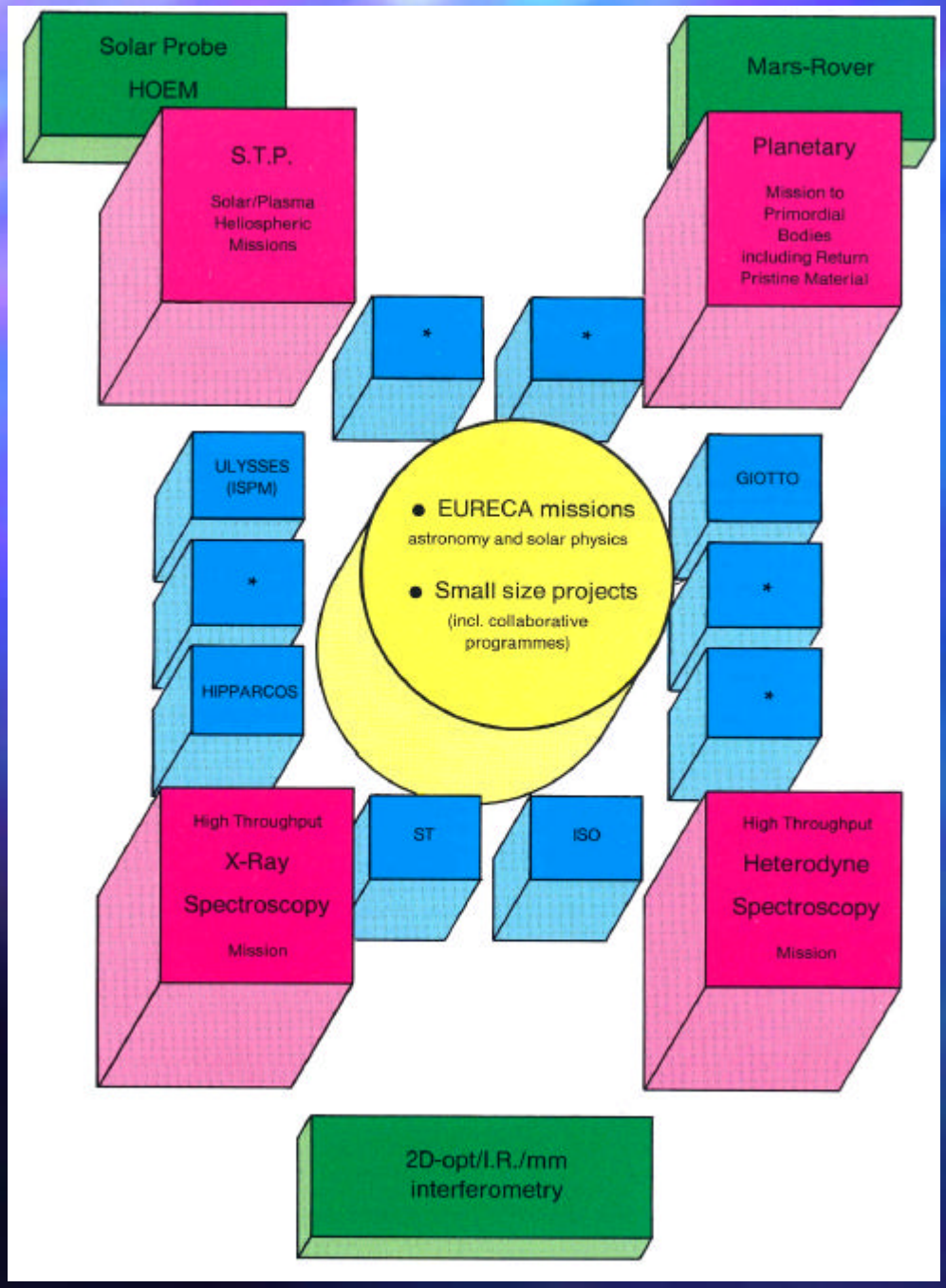

WHAT IS CASSINI-
HUYGENS?

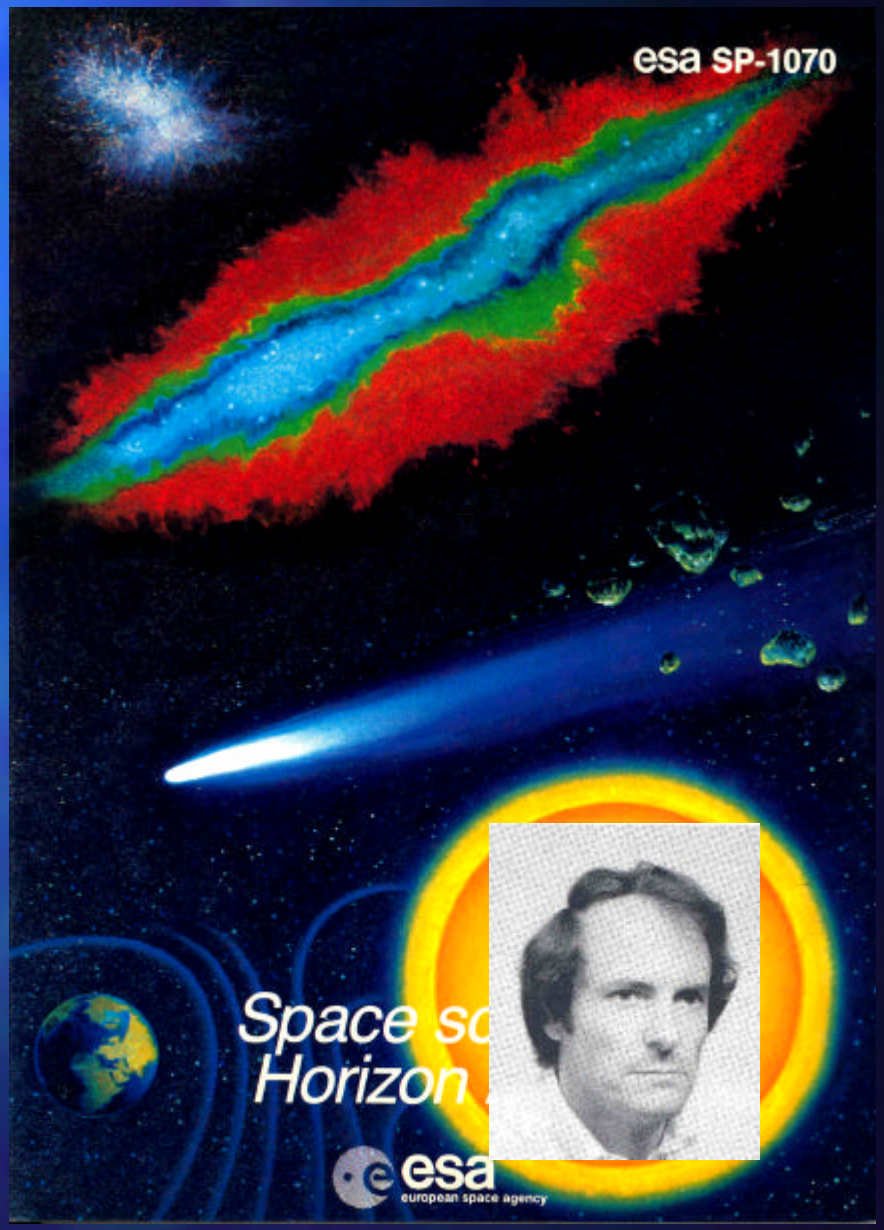
WHAT IS HUYGENS?

Planetary Exploration within ESA

- In 1970, ESRO's LPAC decides not to plan any planetary mission because too expensive
- Cooperation with NASA (or USSR) was the only option for Europe to participate in the exploration of the Solar System
- First change in that policy was ESA's SPC 1980 decision to launch a fast fly-by mission to Halley's comet (March 1986)
- In 1982, a group of European and US scientists propose a Titan Probe as an element of the US Cassini mission

Then came Horizon 2000





Horizon 2000 and planetary exploration

- Although not identified as a new strategic orientation, Planetary Expl. becomes possible through the CNSR cornerstone mission (now Rosetta) and the medium ("blue") missions
- The Titan Probe is selected by ESA's SPC in Nov. 1998 as the first "blue" mission of Horizon 2000 and renamed Huygens
- The CNSR and Huygens were the only planetary missions of Horizon 2000

How was “Huygens” named Huygens?

At the end of the (SPC) meeting the Director of the Science Programme reminded delegations that the Saturn moon Titan had been discovered in 1655 by the Dutch astronomcr Huygens. In response to the Swiss request, he therefore proposed that the European contribution to the American Cassini project henceforth be known as "Huygens".
The Netherlands Delegation very much appreciated this proposa1 to pay hommage to a Dutch astronomer. The Chairman of the SSAC (Prof. Balsiger, Switzerland), speaking on behalf of the scientific comnunity, happily accepted the proposa1 to cal1 the next European mission "Huygens".

Planetary Exploration in Horizons 2000

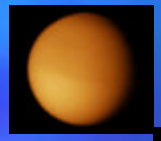
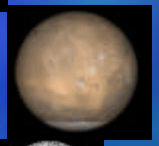
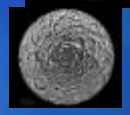
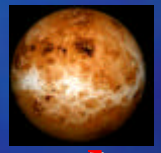
- In 1994, the new Survey Committee identified a Cornerstone mission to Mercury,
- A Mars orbiter,
- Then came Smart-1 and Venus Orbiter.
- **The outer Solar System could only be reached via cooperation with NASA:**

Huygens is "the" model!

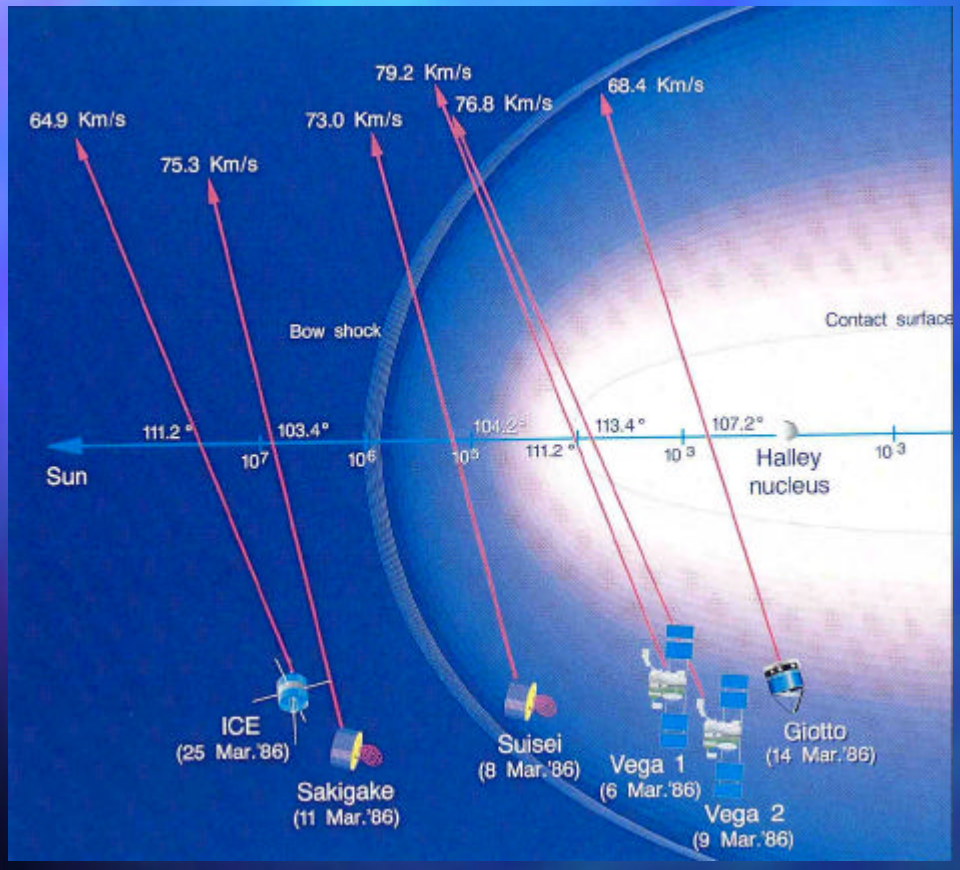
Selection process in ESA's Science program: the Huygens Model

- 1982 : call for ideas
- 1983 : pre-selection by SSWG
- 1984-1985: feasibility study
- 1986 : selection for Phase-A and ESA-NASA studies
- 1987-1988: phase-A
- 1988 : selection by SPC (against VESTA, LYMAN, QUASAT, GRASP)
- 1989-1990: payload selection
- 1990 : selection of Aerospatiale as Prime Contractor
- 1991 : start of Phase-B
- 1997 : launch
- 2005 : landing on Titan

Planetary Exploration within present ESA's scientific program

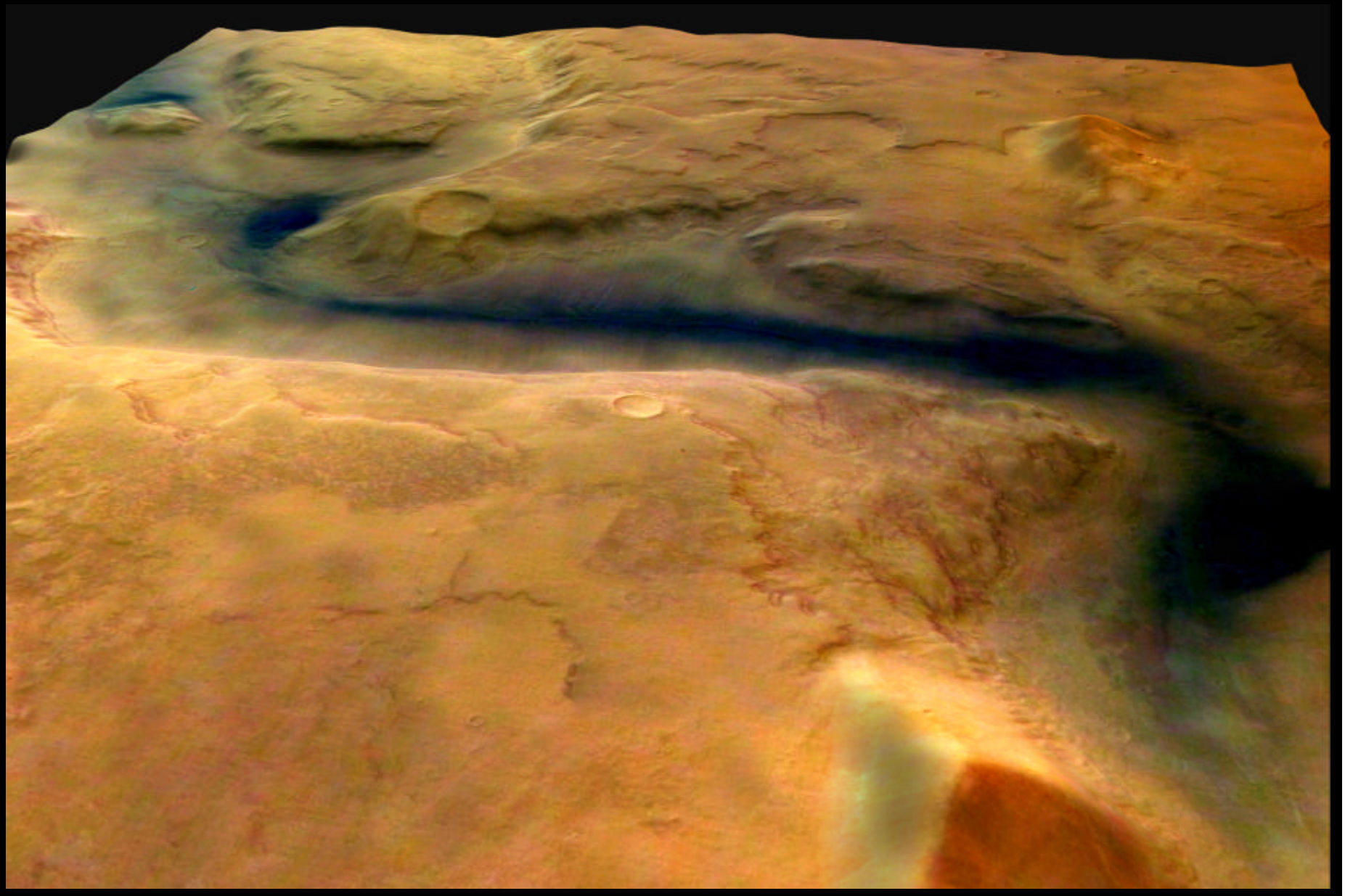
- Giotto, 1986,1992: two comets 
- Huygens, 2005: Titan 
- Mars express, 2004: Mars 
- Smart-1, 2005: the Moon 
- Venus Express, 2006: Venus 
- Rosetta, 2014: two asteroids and one Comet 
- Bepi-Colombo 2015(?): Mercury 
- What else? Cosmic Vision

GIOTTO


64.9 Km/s
75.3 Km/s
73.0 Km/s
79.2 Km/s
76.8 Km/s
68.4 Km/s
Bow shock
Contact surface
111.2 °
103.4°
104.2°
113.4 °
107.2°
Sun
10 7
10 6
10 5
111.2 °
10 3
10 3
Halley nucleus
ICE
(25 Mar.'86)
Sakigake
(11 Mar.'86)
Suisei
(8 Mar.'86)
Vega 1
(6 Mar.'86)
Vega 2
(9 Mar.'86)
Giotto
(14 Mar.'86)

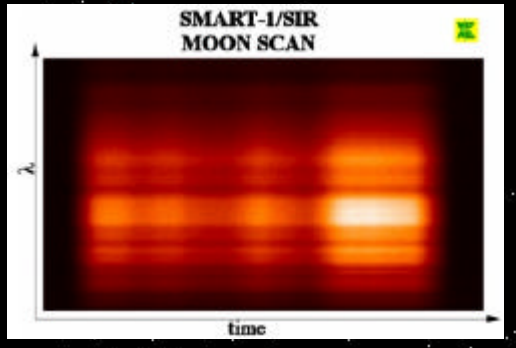

SUN
SCALE
134.2
km
DISTANCE
200 000
km

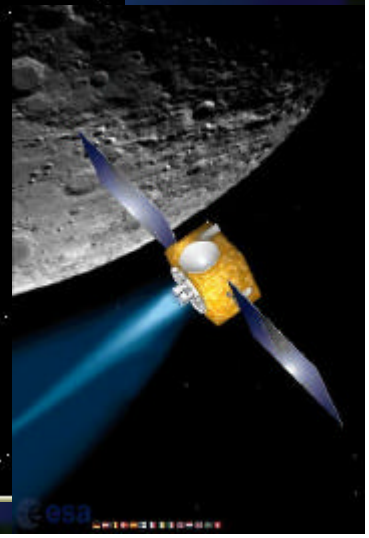
Mars Express



15 Oct 2003 15:48:35 UT

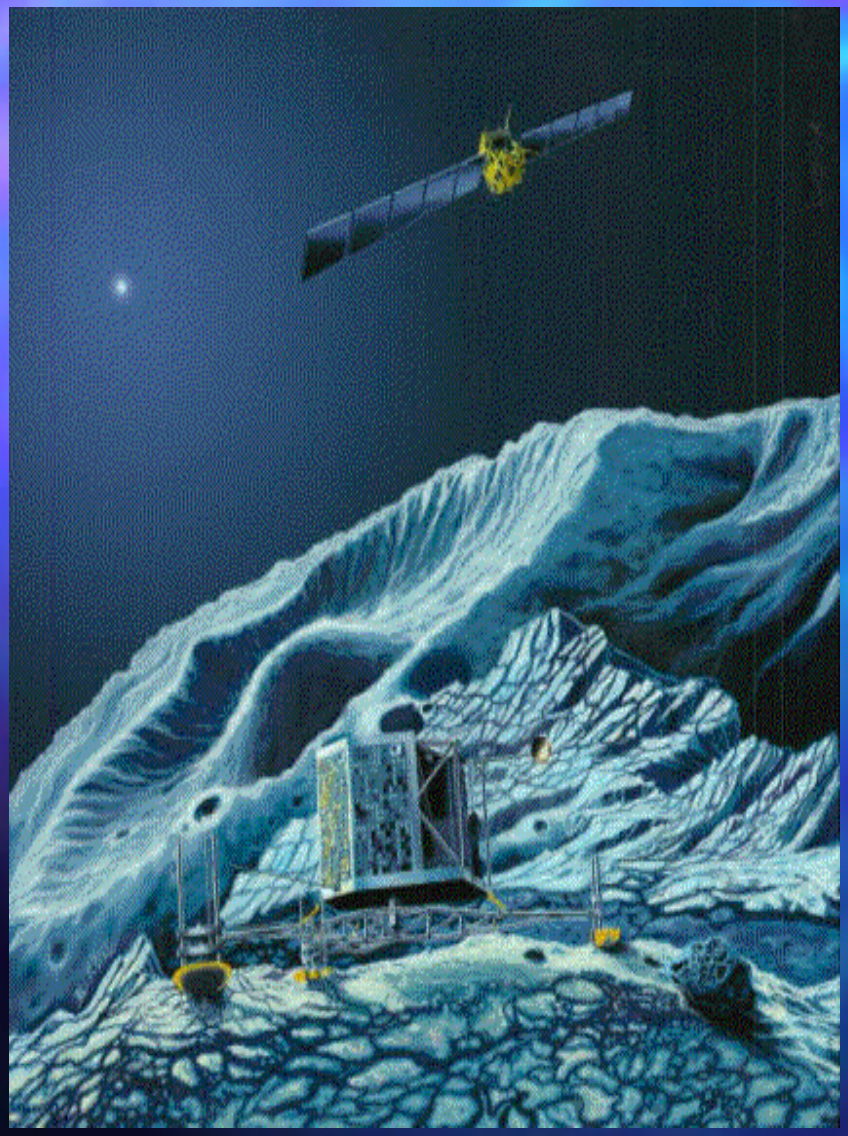
Smart-1

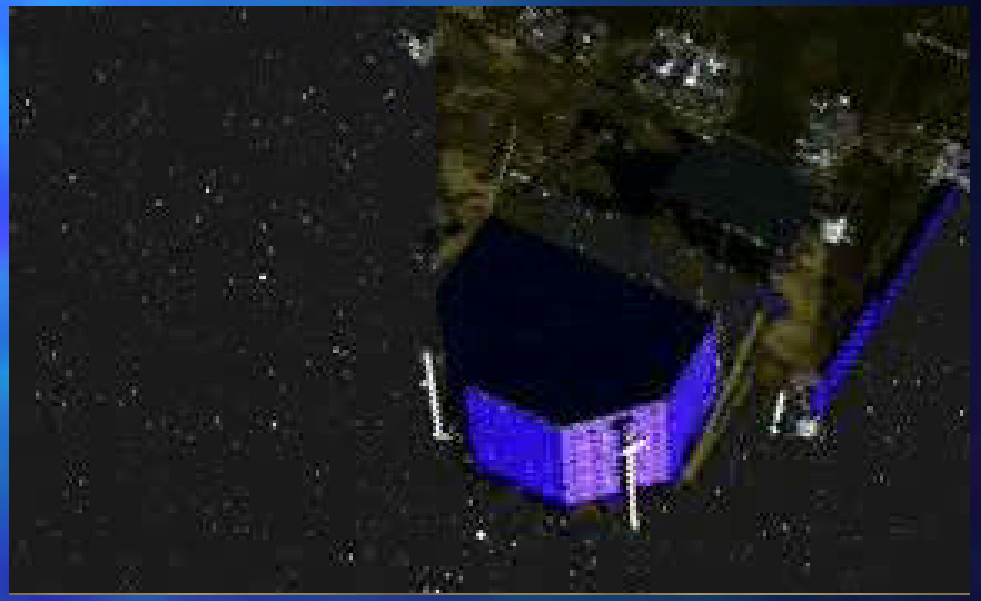




Rosetta

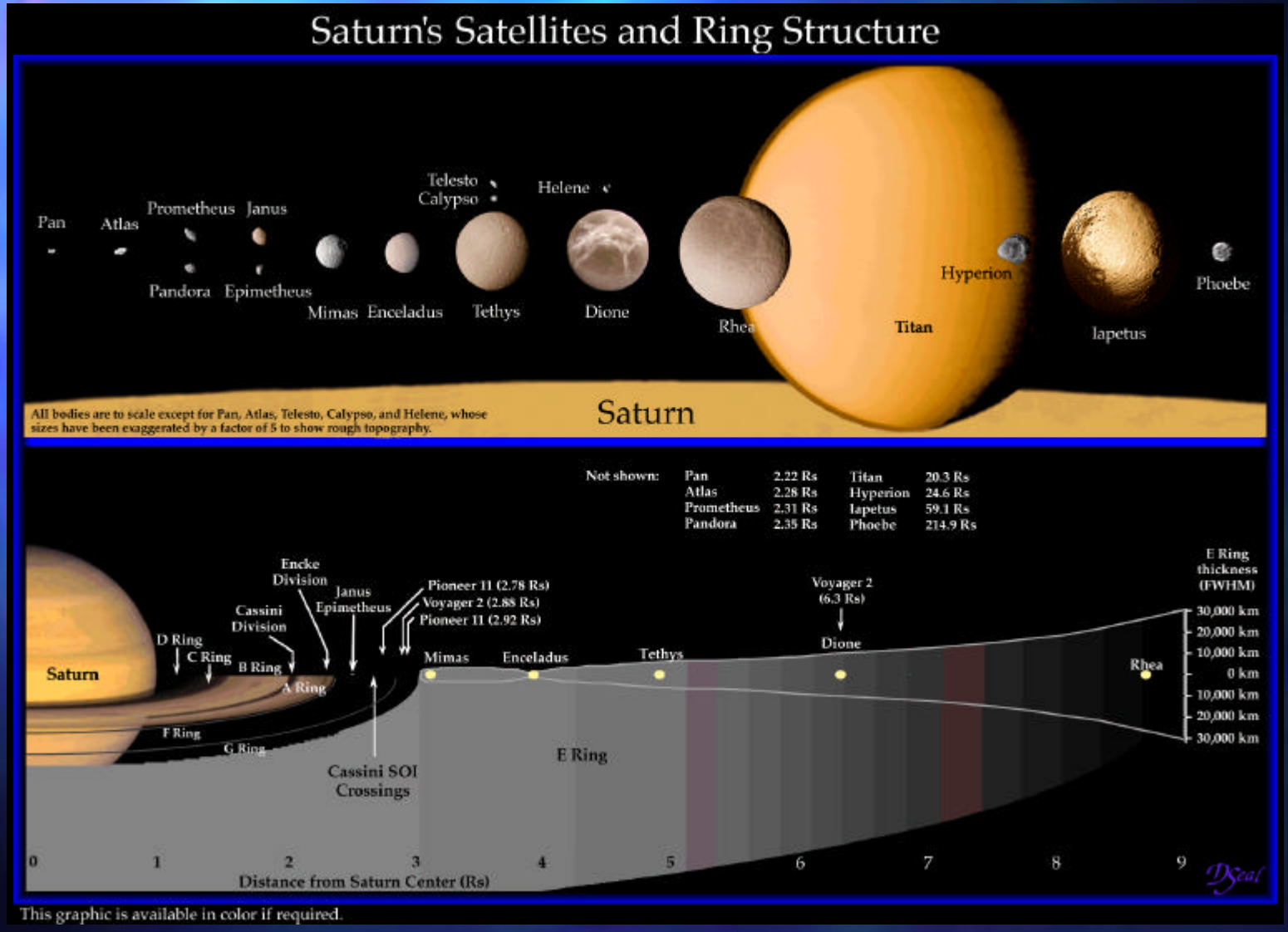
Rosetta





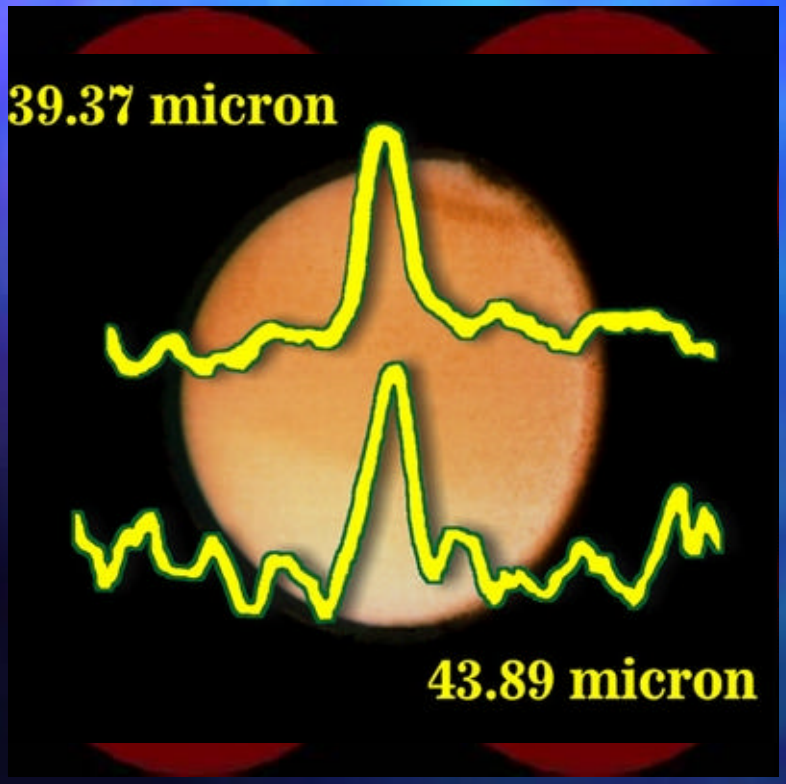
Encounter with and landing on Comet 67P/ Churyumov-Gerasimenko in 2014!

Why Titan?


Saturn's Satellites and Ring Structure
Pan
Atlas
Prometheus
Janus
Pandora
Epimetheus
Mimas
Enceladus
Telesto
Calypso
Tethys
Helene
Dione
Rhea
Titan
Hyperion
Iapetus
Phoebe
All bodies are to scale except for Pan, Atlas, Telesto, Calypso, and Helene, whose sizes have been exaggerated by a factor of 5 to show rough topography.
Saturn
Not shown:
Pan 2.22 Rs
Atlas 2.28 Rs
Prometheus 2.31 Rs
Pandora 2.35 Rs
Titan 20.3 Rs
Hyperion 24.6 Rs
Iapetus 59.1 Rs
Phoebe 214.9 Rs
Encke Division
Cassini Division
Janus
Epimetheus
Pioneer 11 (2.78 Rs)
Voyager 2 (2.88 Rs)
Pioneer 11 (2.92 Rs)
D Ring
C Ring
B Ring
A Ring
F Ring
G Ring
Saturn
Mimas
Enceladus
Tethys
Voyager 2 (6.3 Rs)
Dione
Rhea
E Ring thickness (FWHM)
30,000 km
20,000 km
10,000 km
0 km
10,000 km
20,000 km
30,000 km
Cassini SOI Crossings
E Ring
0
1
2
3
4
5
6
7
8
9
Distance from Saturn Center (Rs)
This graphic is available in color if required.

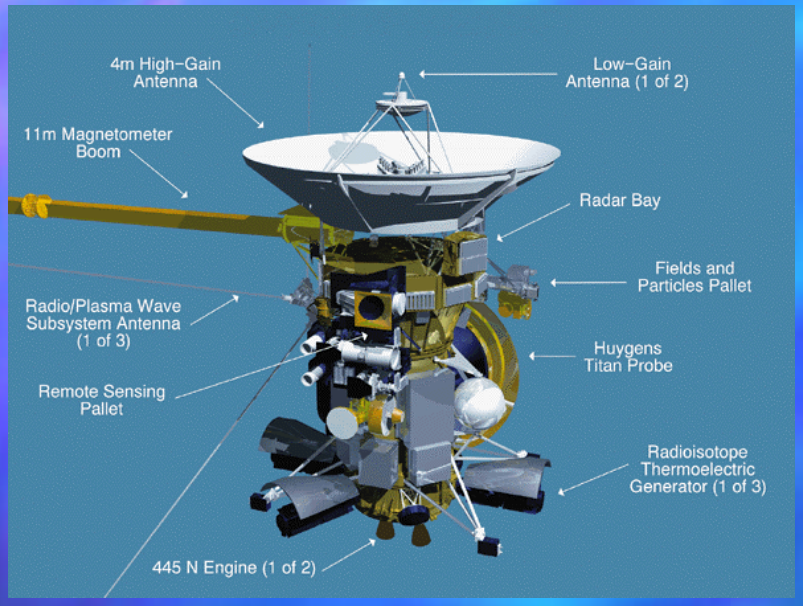
What is Titan?

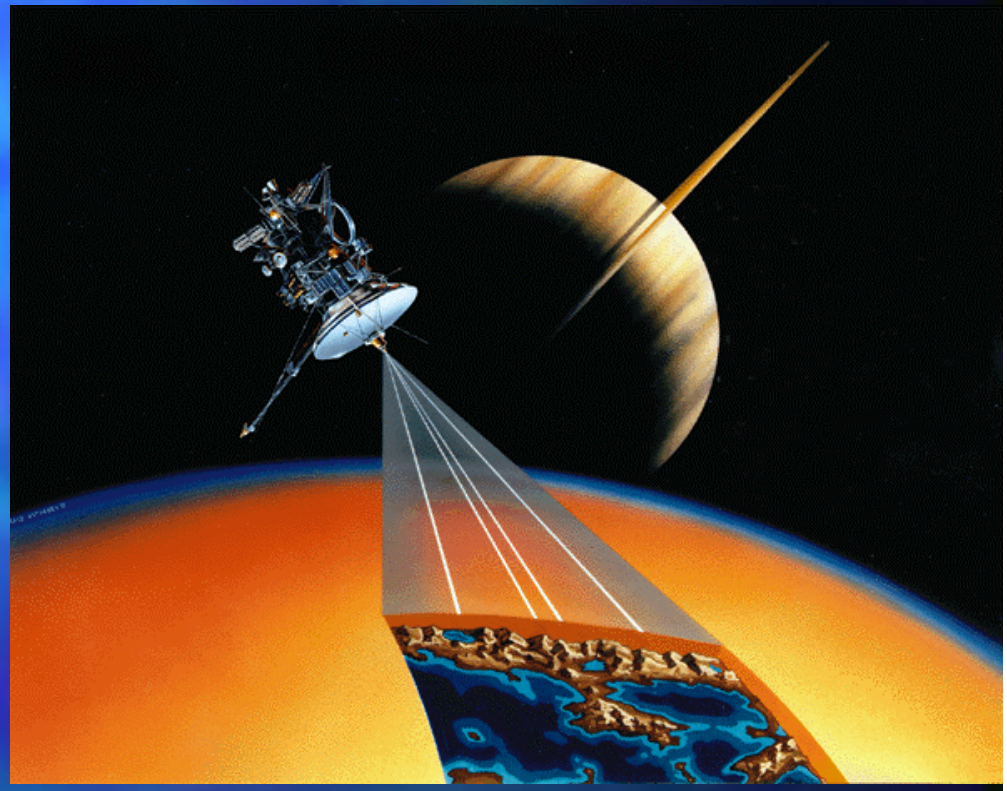
- The biggest moon of Saturn
- An Earth "in the fridge"
- A unique laboratory for pre-biotic studies in the S.S.



- However, its surface cannot be seen

International Cooperation



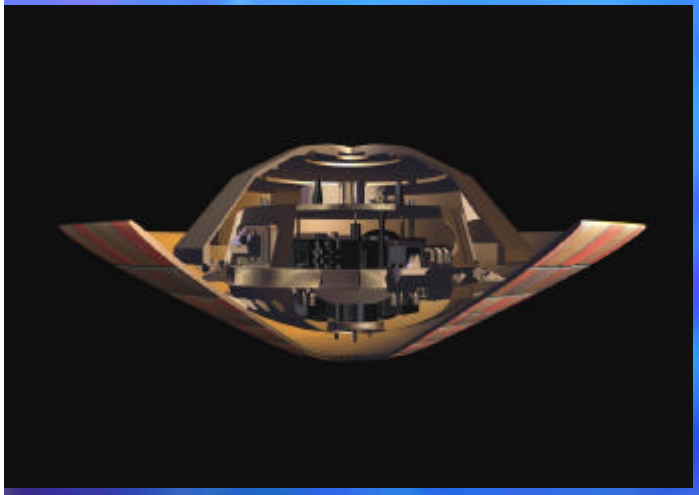


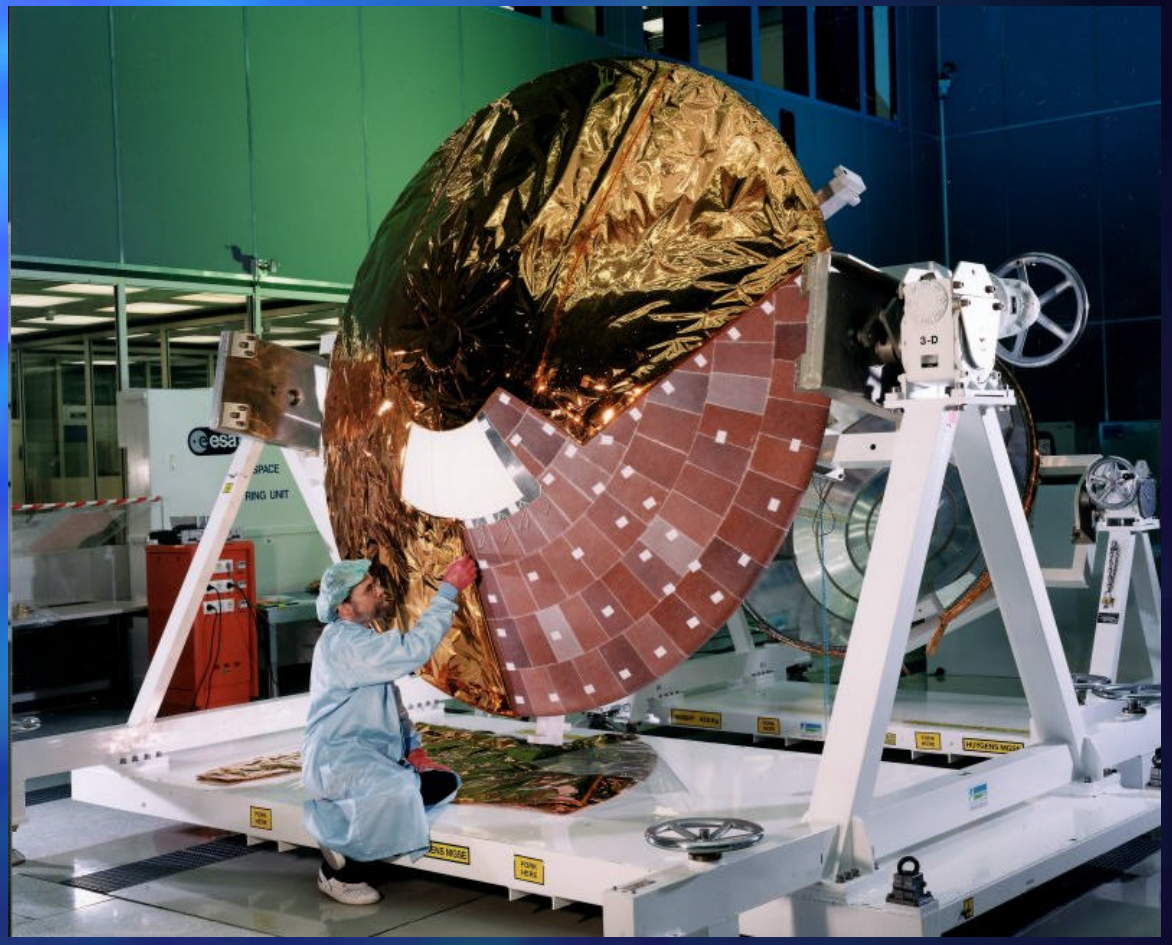
Without Huygens, Cassini, most likely, would have been dropped by NASA!

International Cooperation

- The Cassini Payload
  - 12 instruments, all of them involving international teams
  - 2 European Principal Investigators:
    - D. Southwood (UK), Dual Technique Magnetometer
    - E. Gruen (Germany), Cosmic Dust Analyzer
- The Huygens Payload:
  - Huygens Atmospheric Structure Instrument M. Fulchignoni,Italy
  - Gas Chromatograph Mass Spectrometer H.B. Niemann, USA
  - Aerosol Collector and Pyrolyser G. Israel, France
  - Descent Imager/Spectral Radiometer M.G Tomasko, USA
  - Doppler Wind Experiment M.K. Bird, Germany
  - Surface Science Package J.C Zarnecki, UK

The Technological Challenge

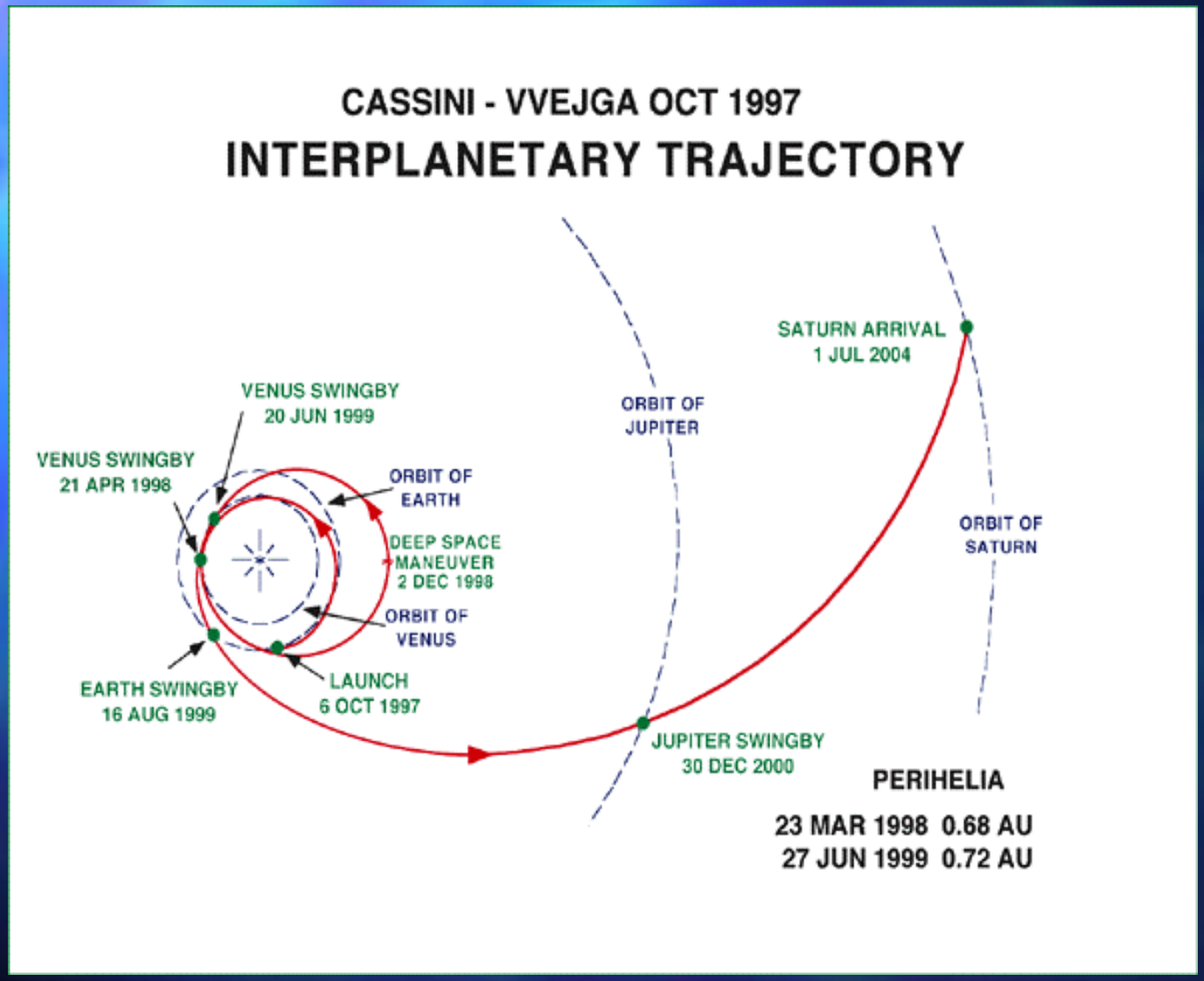




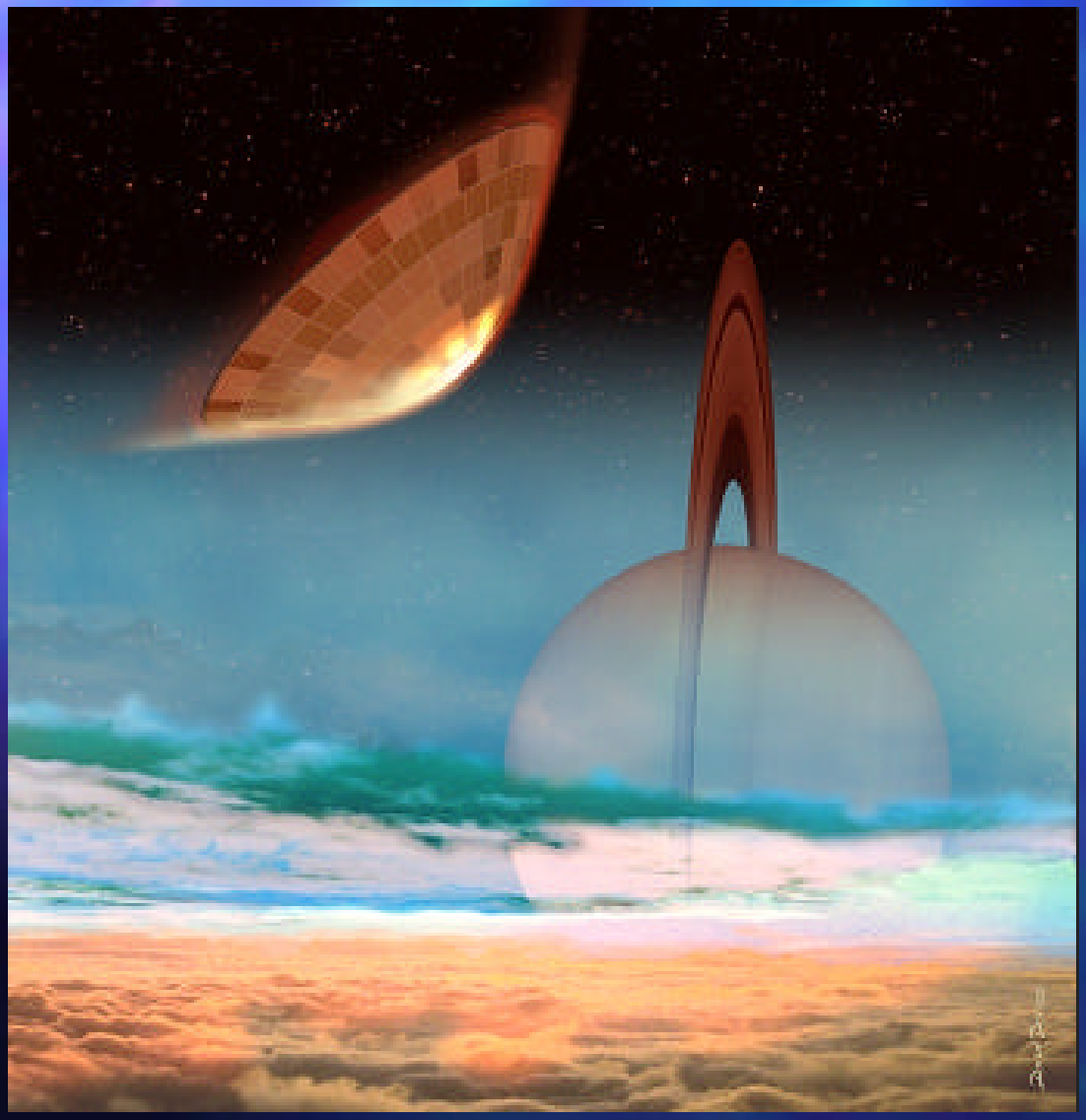
Synergy with military technology was key in selecting the Prime Contractor

Industrial Cooperation

The Long Journey



Exciting times are coming…



1. 25/12/04: release Huygens from Cassini,
2. 14/01/05 Entry of Huygens in Titan's atmosphere,
3. 2,5 hours later: landing?

The Last Phase of Huygens' Journey

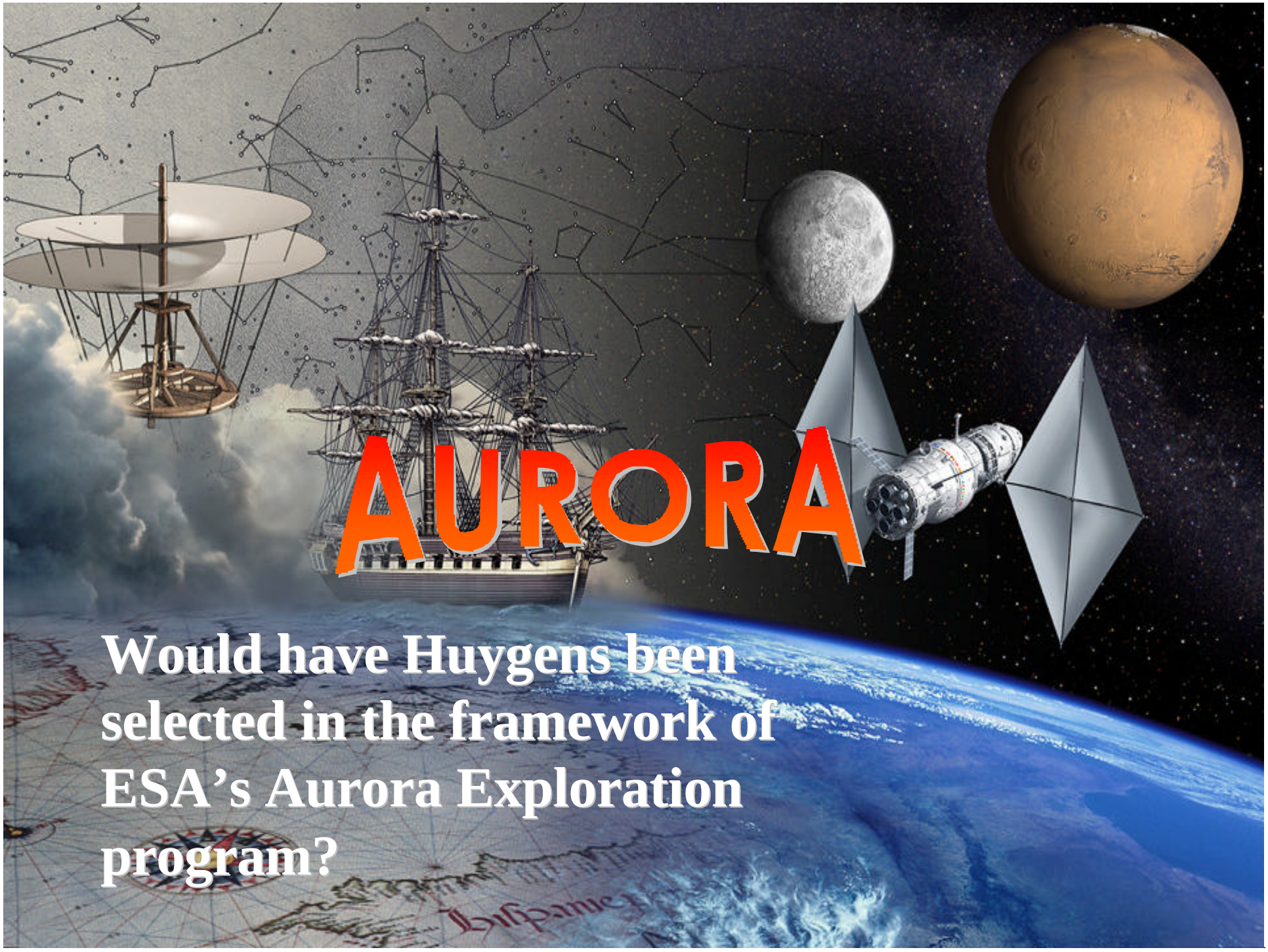
The societal aspect of Huygens

- On board Huygens ESA has embarked a CD carrying several hundreds of testimonies from Europeans of all ages, and of citizens from all around the world: drawings, paintings, texts, poems, messages etc…
- No attempt was made to filter these testimonies so that they constitute a “snap-shot” of the way of thinking and of the imagination of our civilization in the mid 1990’s
- May be, one day, another mission (civilization?) will recover this CD and may even attempt to decipher it!

What after Huygens?

Im out

RT


AURORA
Would have Huygens been selected in the framework of ESA's Aurora Exploration program?


The End