Europe in the Solar System

Marcello Coradini
ESA

GIOTTO was the “ice” breaker, demonstrating that Europe could leave the Earth gravity:

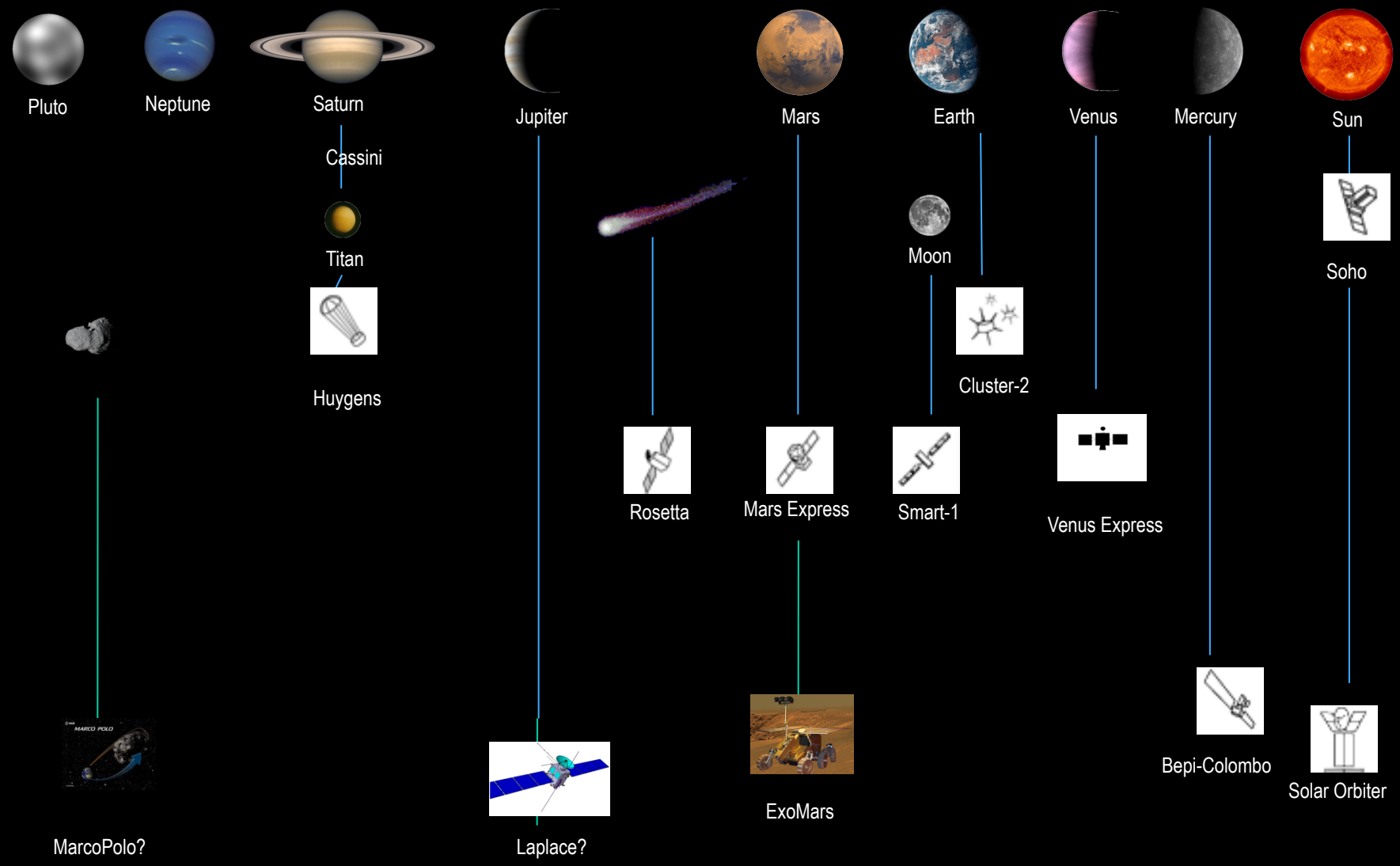
02-Jul-1985 /23-July-1992

26 years later European spacecraft have visited almost every corner of the Solar System from the Sun to the outer planets.

We have achieved this with an yearly average budget of some 150 M€ (plus a few tens a year invested by MS in scientific payloads).

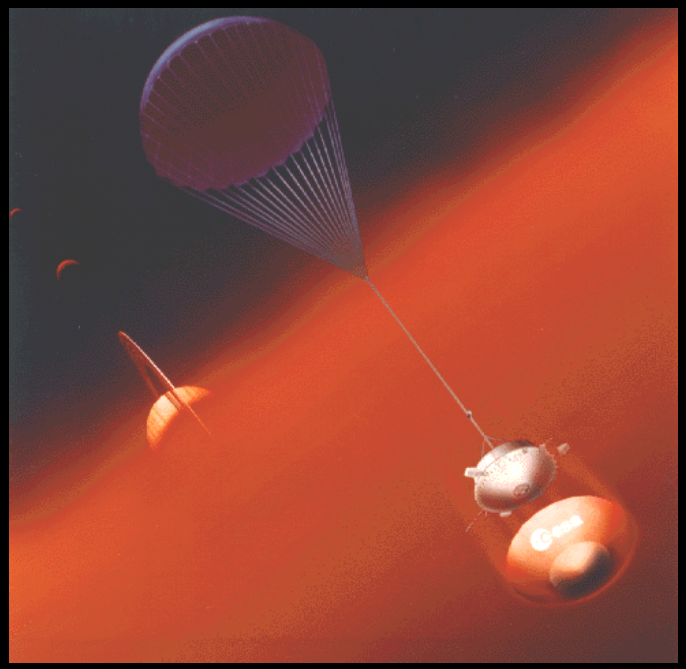
This compares to a jetliner a year, to a cup of coffee per year per European, to a few hours of stock exchange crisis…

ESA Planetary Programme



22 years ago a group of scientists whishing to extend the incredible success of Voyager proposed to ESA and NASA a crazy mission: The Saturn Orbiter & Titan probe.

ESA had never launched a spacecraft beyond the Earth orbit at that time…NASA was still harvesting on the magnificent missions of the 70's… but the first signs of an expected crisis were visible at the horizon.



Horizons 2000 in 1986

ROSETTA

FIRST

ISO

ULYSSES

HST

SOHO CLUSTER

XMM

Giotto

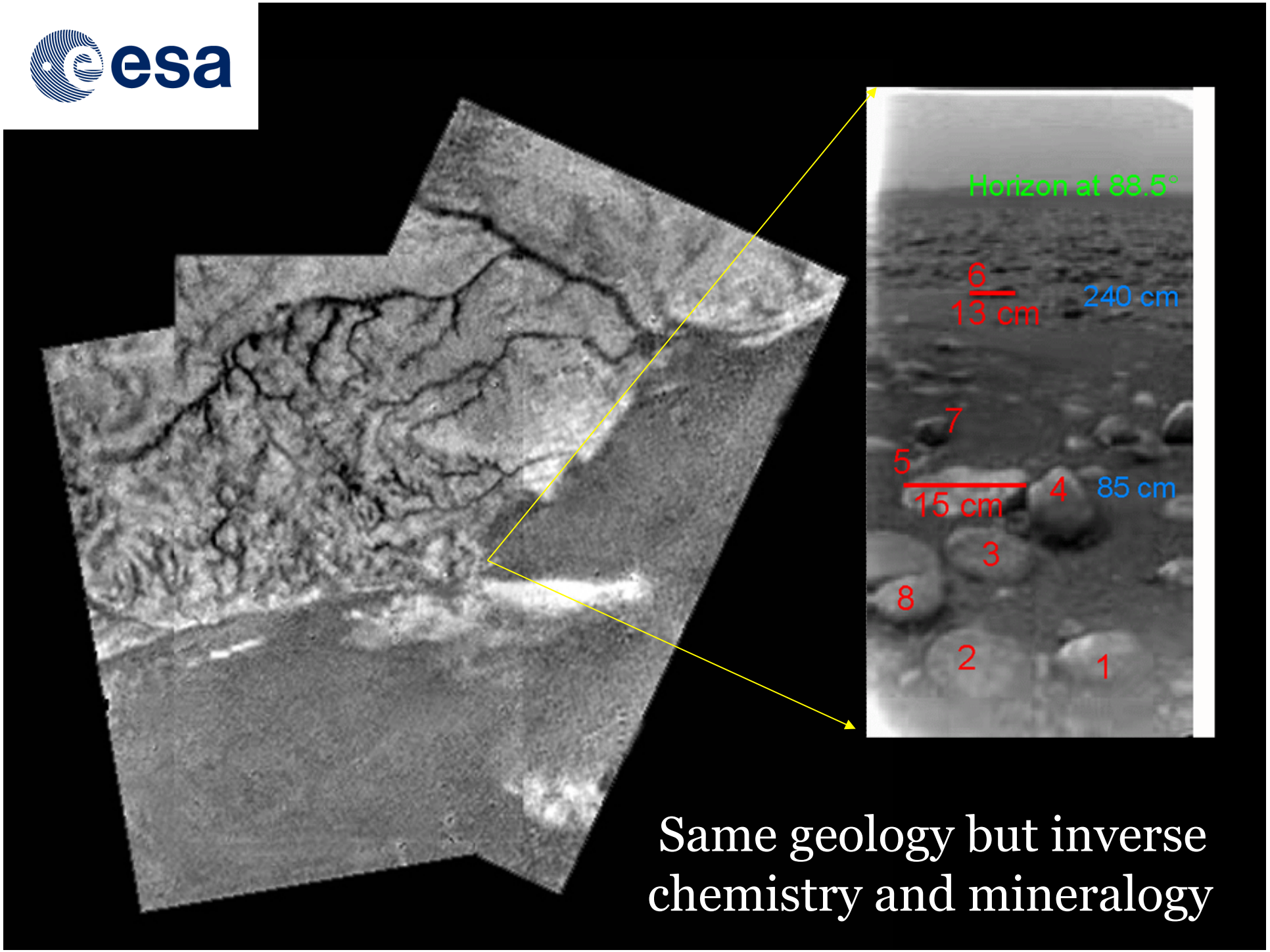
The programmatic considerations at my arrival at ESA were:

-Cassini cannot be selected because, after what happened on Ulysses, NASA is not a reliable partner;

-Vesta cannot be selected because we do not know how (*read we do not want*) to work with the Soviets and CNES;

-CAESAR is too complex and not enough appealing.

The obvious conclusion was that an Astronomy mission should be selected!



Same geology but inverse chemistry and mineralogy

Horizon 2000

To learn how to design & manage ambitious missions

To build a sound “user” community

To raise competence & competitiveness of European Space Industry

Horizon 2000

CS missions ⟶ 2 yrs of Science Budget

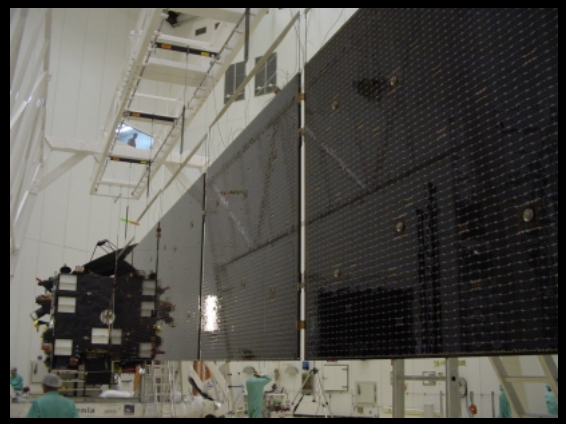
Great success!

Medium missions ⟶ 1 yr of Science Budget

Great problems!

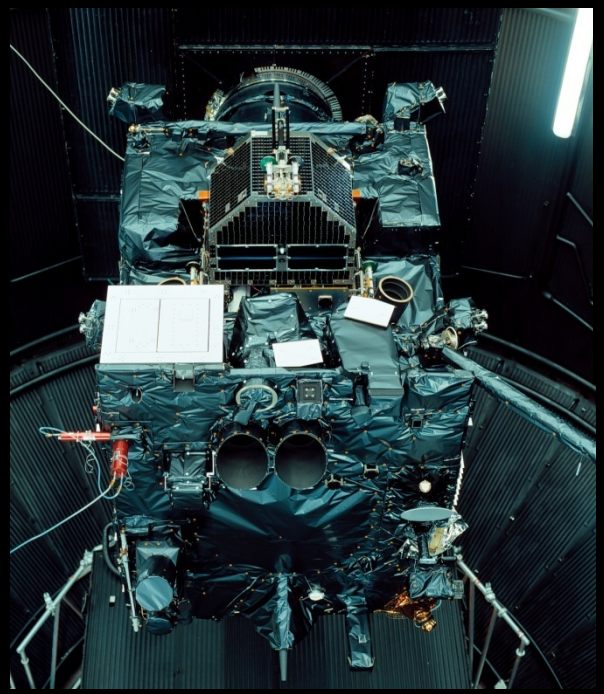
WHY?

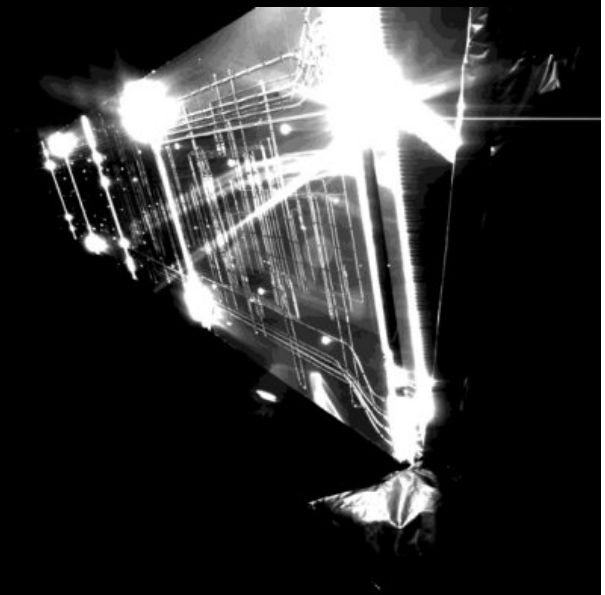
The Rosetta Stone shed light on the origins of the human languages



The Rosetta Mission will shed light on the origin of the Solar System

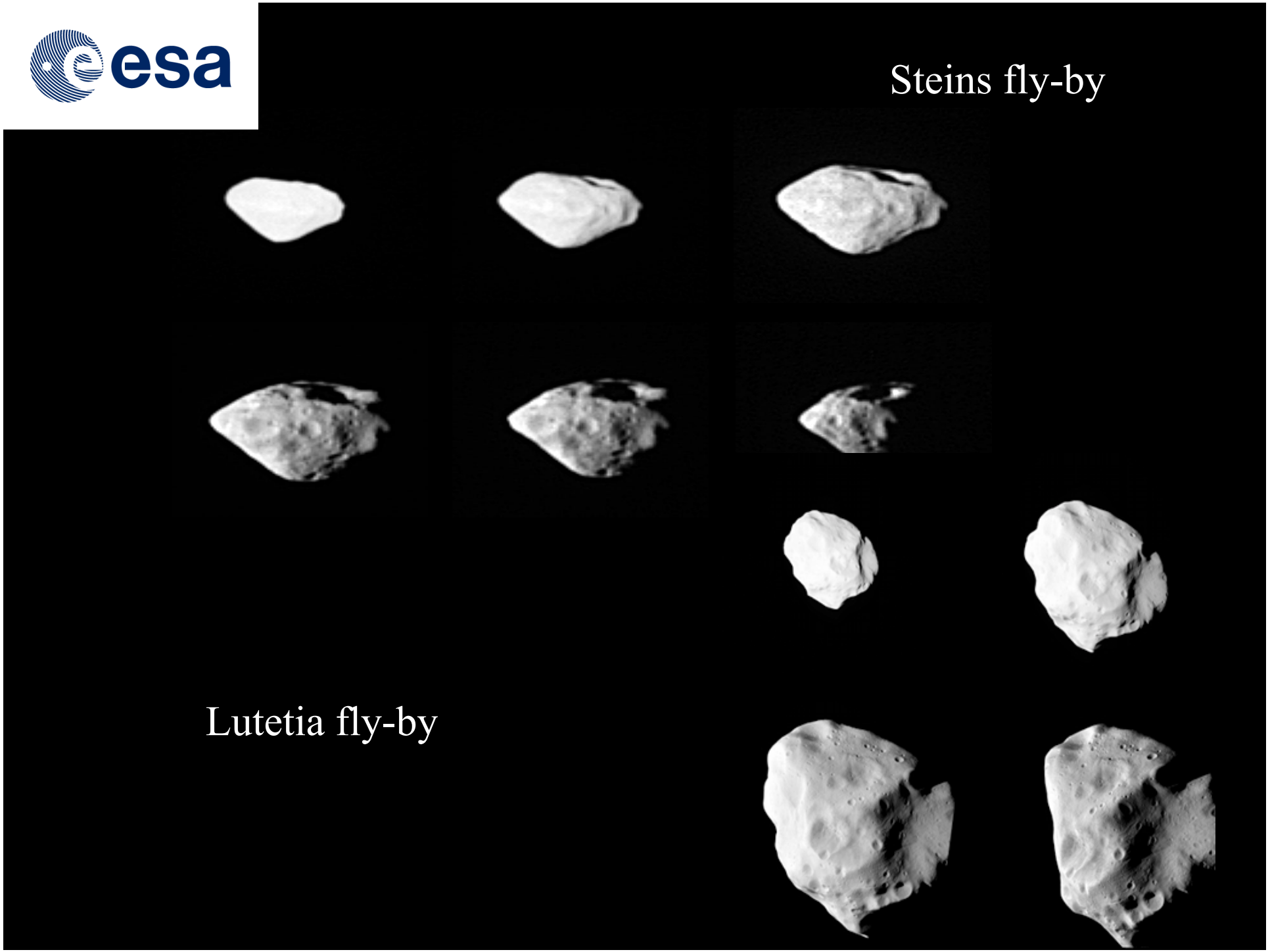
Ariane 5 Launch, 2 March 2004





Solar Arrays as seen from lander, April 2004

The Philae lander built by a consortium of countries in Europe


Steins fly-by
Lutetia fly-by

The MISTAKE

was the adoption of the same implementation schedule and procedures for both CS and M missions:

½ yr….call for mission ideas
½ yr….assessment study
½ yr….ITT phase A
1 yr.…phase A study
½ yr….ITT phase B
1 ½ yr….phase B study
½ yr….ITT phase C/D
5-6 yr….phase C/D activity

At least 10 years to accomplish one element of the so-called flexible part of the programme and no use of cheap launchers!

-Making use of the same company(ies) and the same team(s)

-No major design change

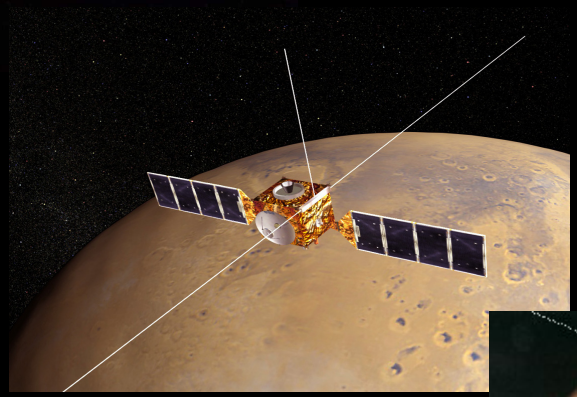
-No qualification programme

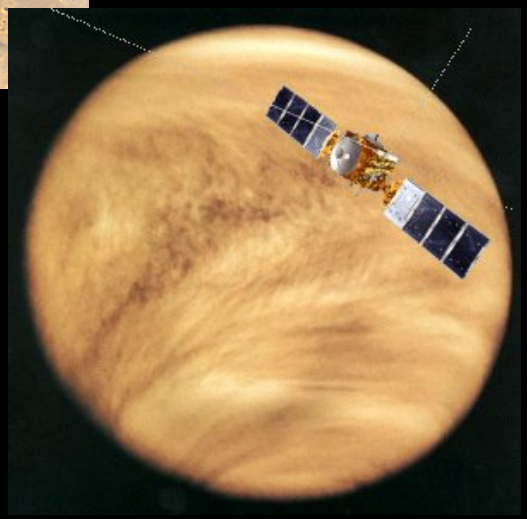
-Maximum re-use of components & subsystems

-Re-use of existing payload (or refurbishment of spares)

Hence, no need for long study phases, AO's & ITT's, i.e. drastic reduction of the of the non-hardware phases.

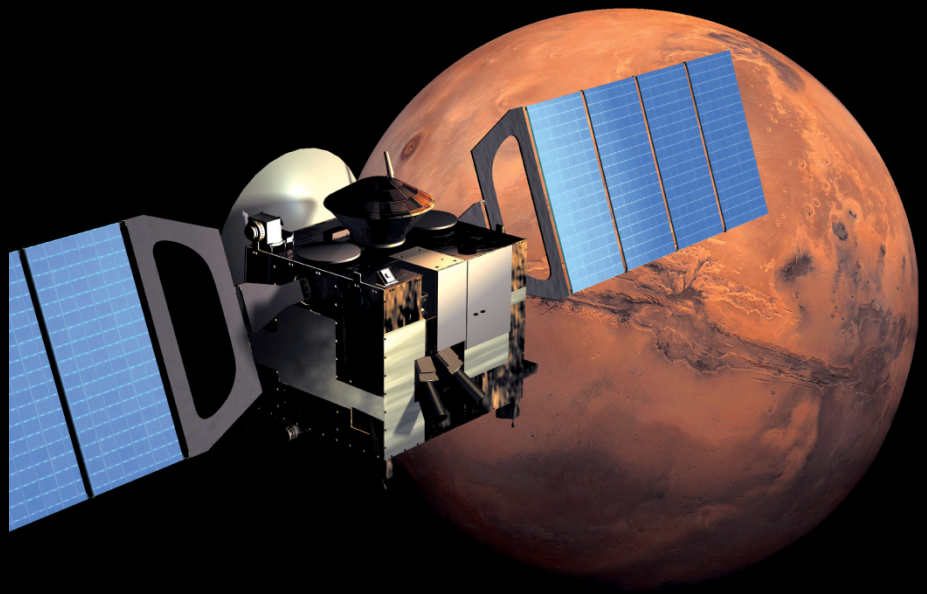
The Rosetta CS takes up the Technical & financial burden



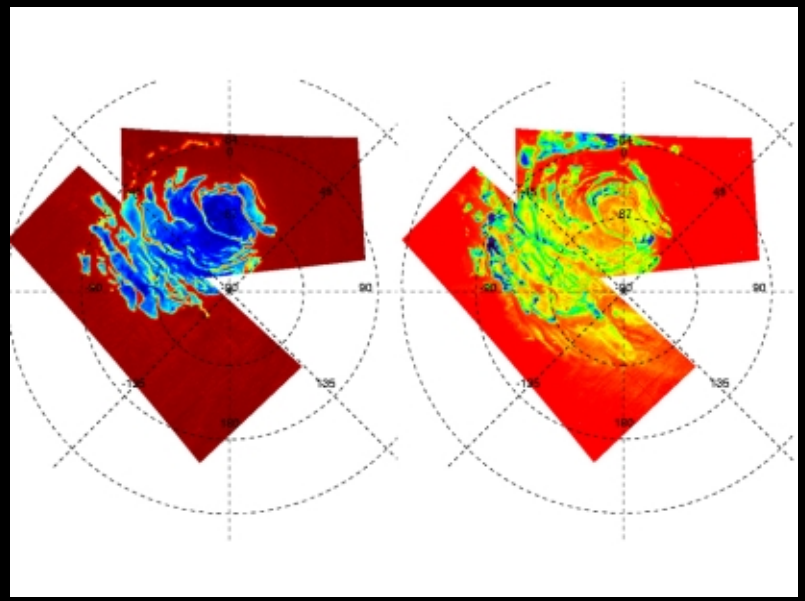


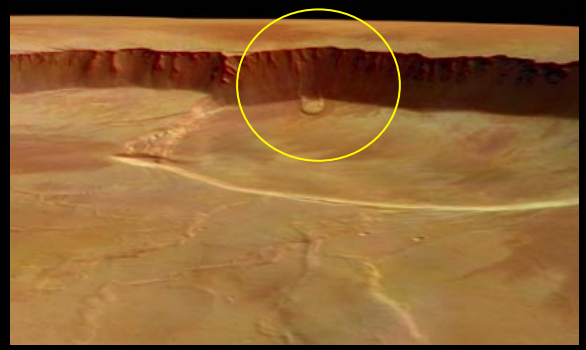
MEX & VEX make intensive use of the Rosetta subsystems and minimize design changes and qualifications.
MEX p/l from Mars 96.
VEX p/l from MEX and Rosetta.

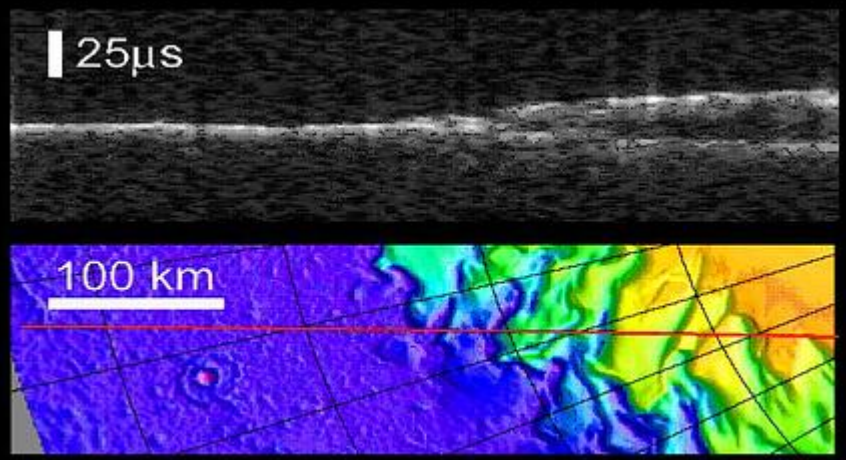
Mars Express

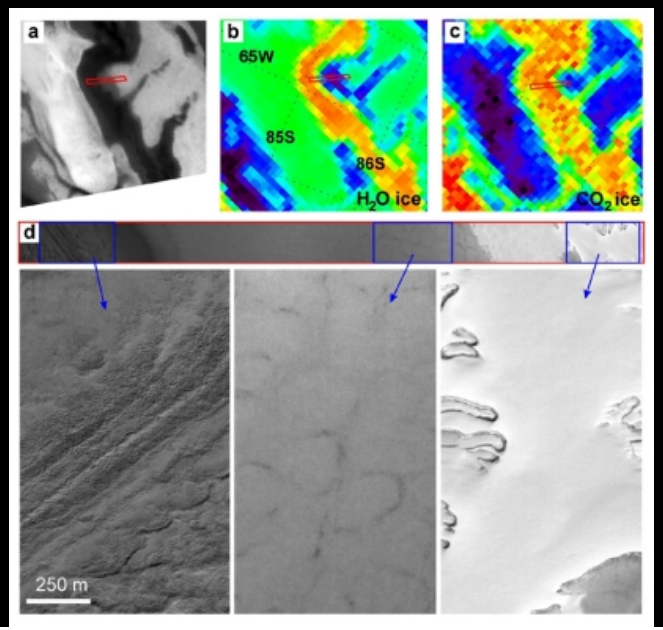


Understanding the thermodynamics of the Martian surface and subsurface

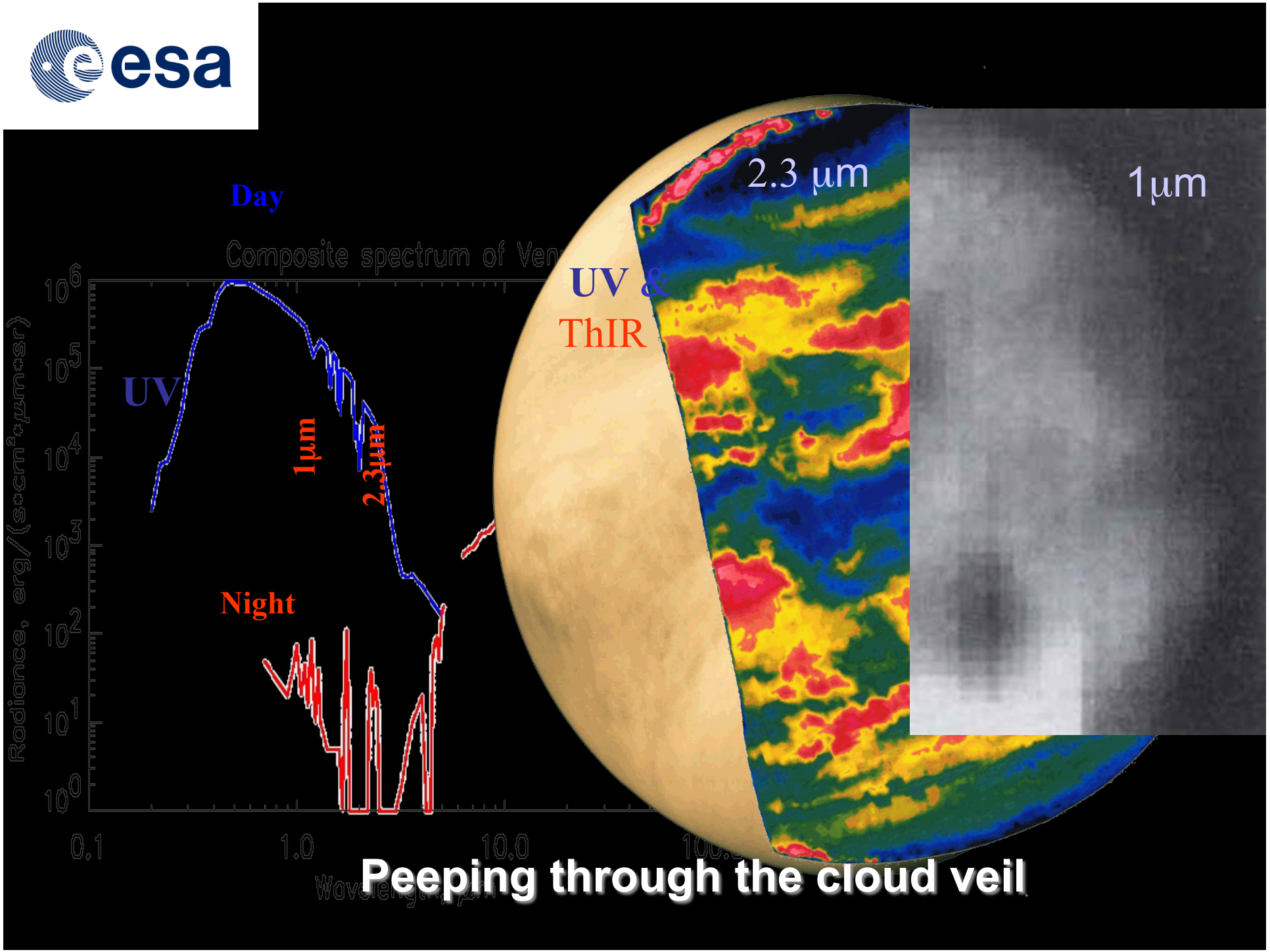








Venus express: why such an uncontrolled greenhouse effect?



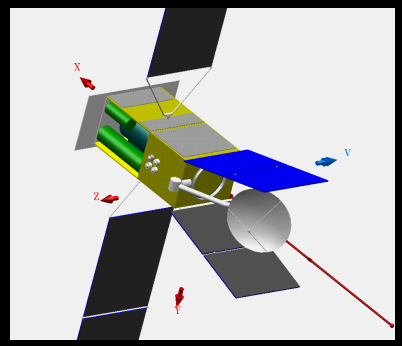
Peeping through the cloud veil

Periodically a major investment in spacecraft and payload
technology is required.
This can be a technology demonstration mission (such as SMART-1) or a classic large mission of the CS type or both.

Max time interval between two “investments” is about 10 yr

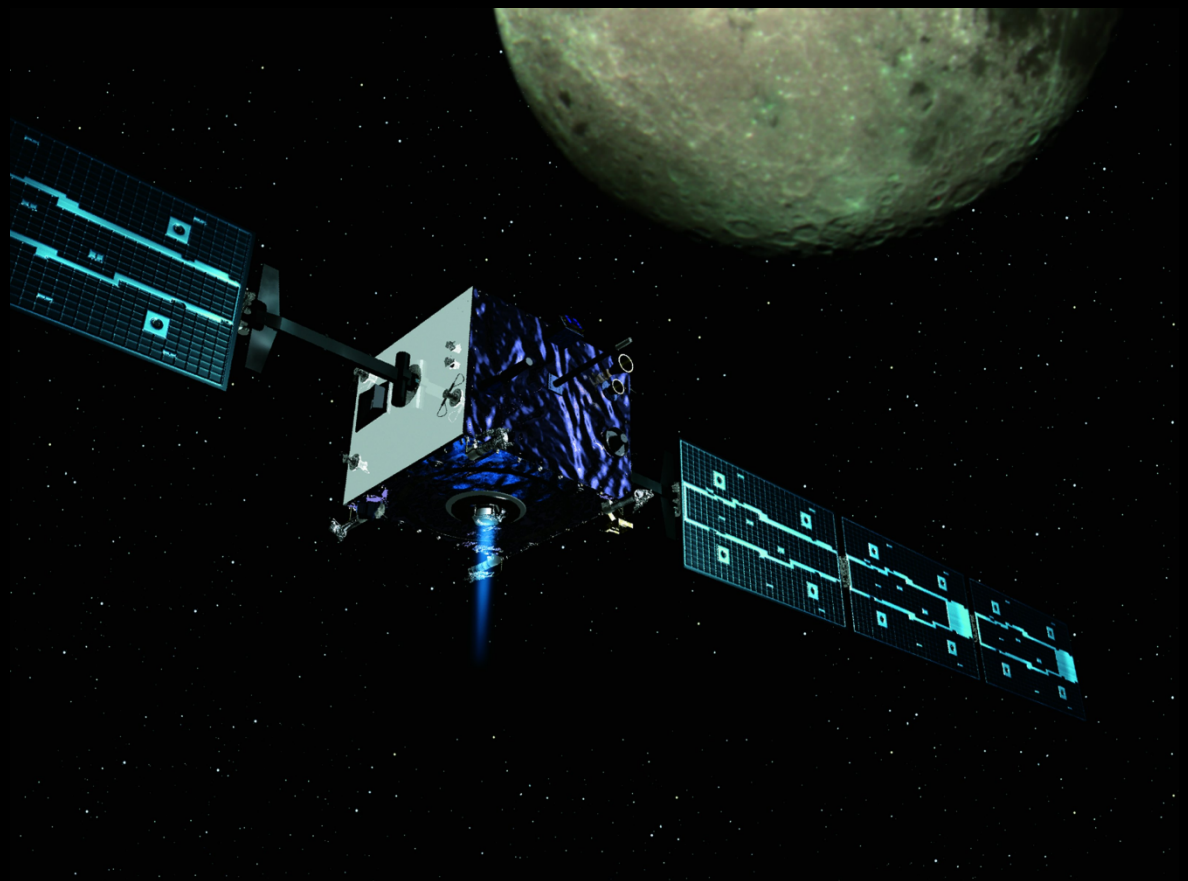
SMART-1

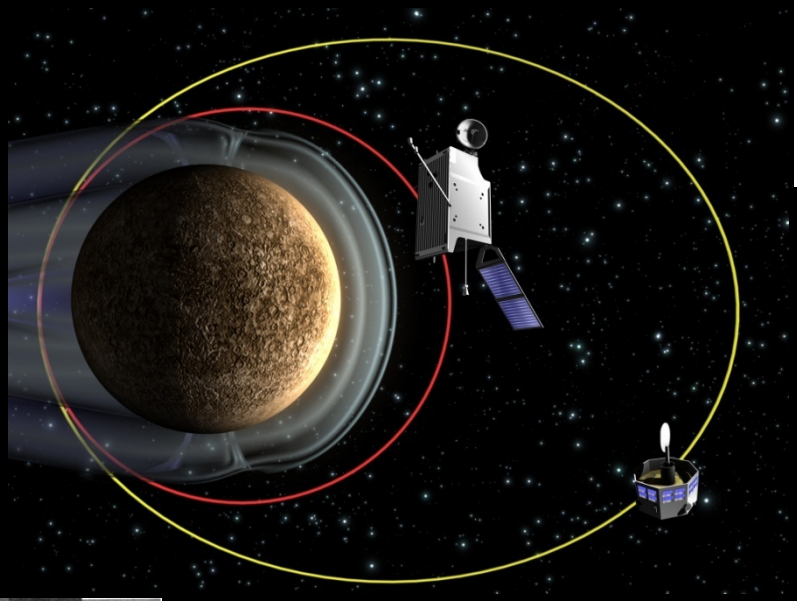
BepiColombo

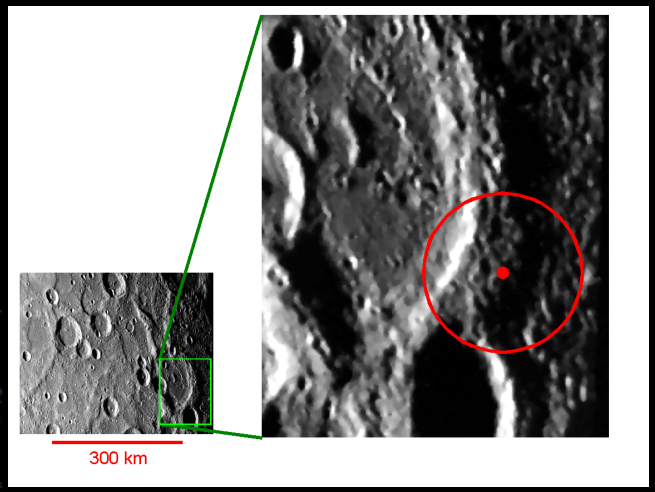


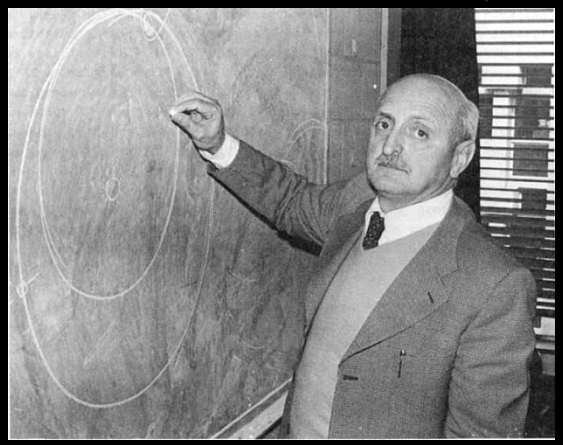
Solar Orbiter

SMART-1: testing electric propulsion in space & many other technologies and even producing science!

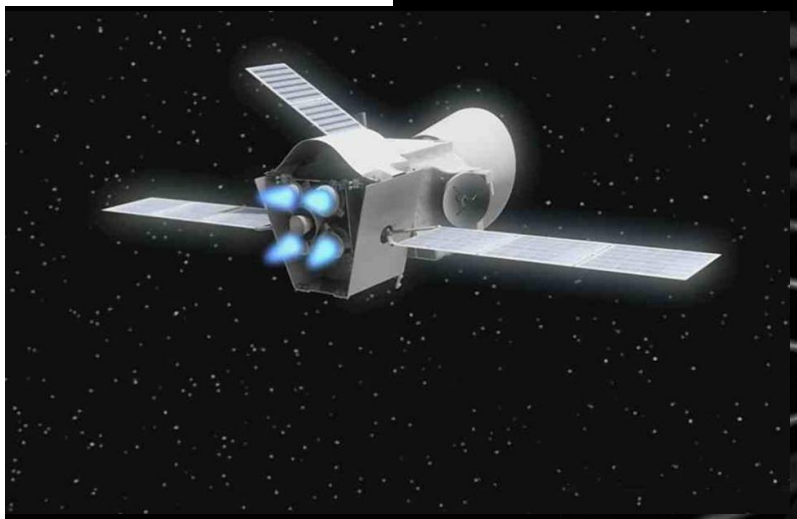


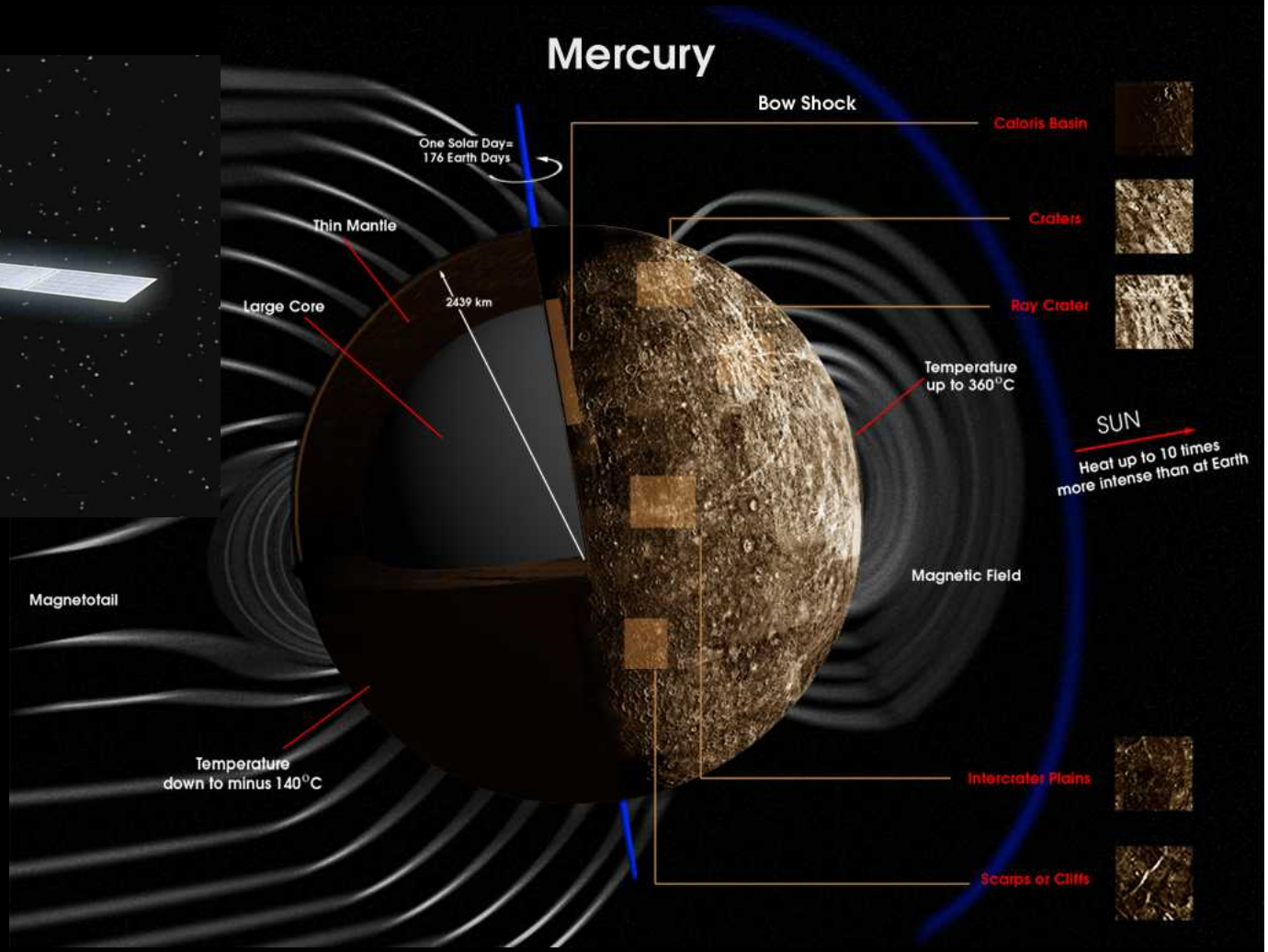






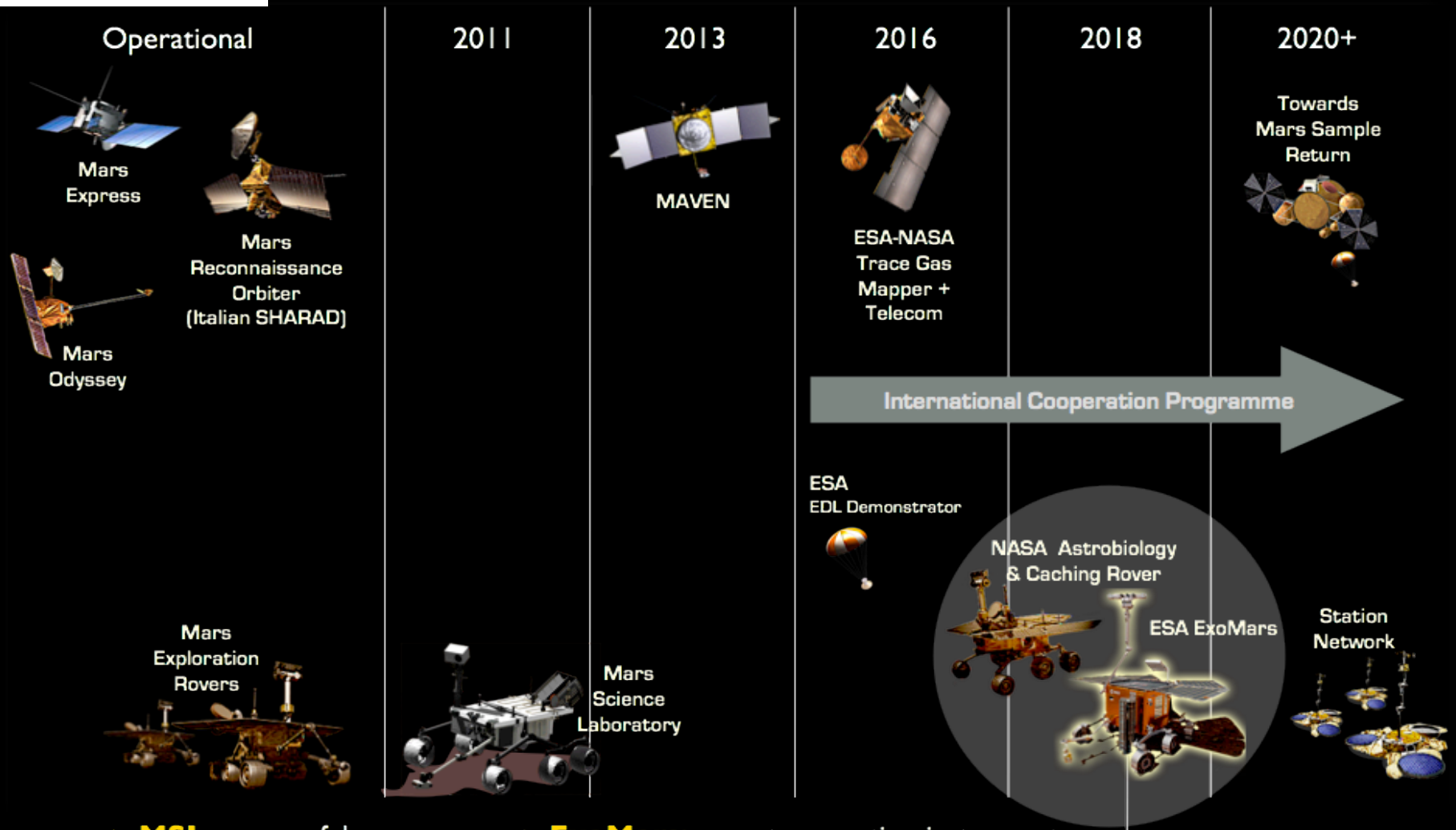
BepiColombo: the man, the mission





BepiColombo is a joint mission with

JAXA-ISAS



- **MSL**: powerful rover; large 2-D mobility.
- **ExoMars:** next-generation instruments; 3-D access.

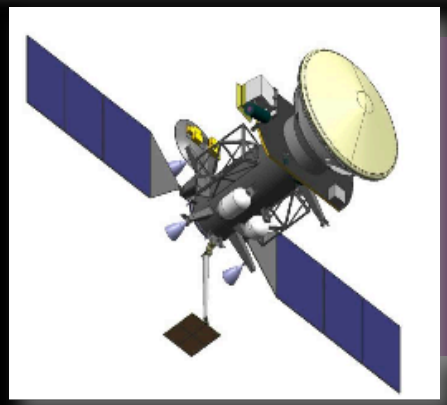
Following on the results of MSL, the ExoMars Rover is the logical next step in Mars surface exploration.

- ESA and NASA have agreed to embark on a joint Mars robotic exploration programme:

➡ Initially, seek agreement on mission configurations for 2016, 2018, and 2020 opportunities;

➡ ExoMars becomes a key element of the 2016 and 2018 scenario;

➡ ExoMars spreads its objectives over two opportunities.



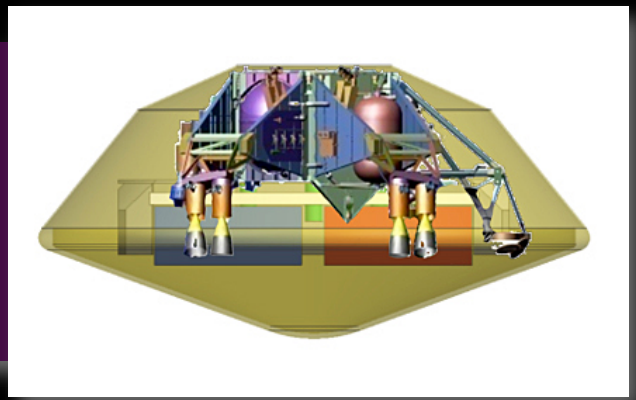
2016 — ESA-led mission

Launcher:	NASA – Atlas V 421
Orbiter:	ESA
Payload:	ESA-NASA
Lander:	ESA

!

2018 — NASA-led mission

Launcher:	NASA – Atlas V 531
Cruise & EDL:	NASA
Rover 1:	ESA
Rover 2:	NASA



TECHNOLOGY OBJECTIVES

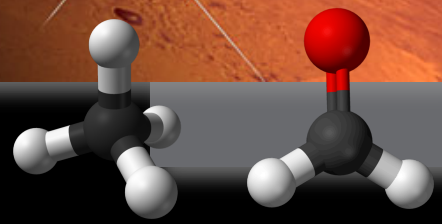
➡ Provide data relay services to landed missions until 2022;

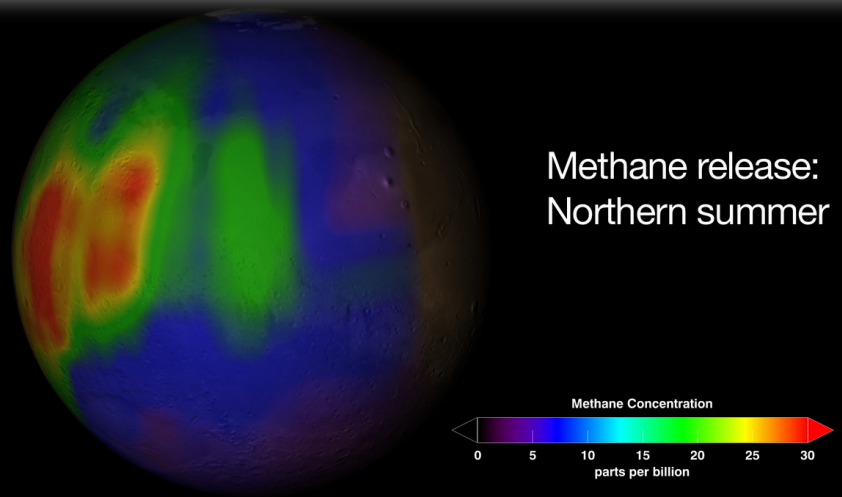
➡ Entry, Descent, and Landing (EDL) of a payload on the surface of Mars

2016

SCIENTIFIC OBJECTIVE

➡ To study Martian atmospheric trace gases and their sources.





Methane release:
Northern summer

The EDLS Demonstrator

- Maximum Mass at launch 600Kg
- Semi-soft (almost soft) lander with liquid retro-propulsion
- Landing gears (TBD) crushable material, vented airbags, legs
- Minimum Payload operated on primary battery (5-7 sol lifetime)
- Mass less than 5Kg and no deployment mechanisms
- Science Goals: mostly environmental assessment

TECHNOLOGY OBJECTIVES

➡Surface mobility with a rover (having several kilometres range);

➡Access to the subsurface to acquire samples (with a drill, down to 2-m depth);

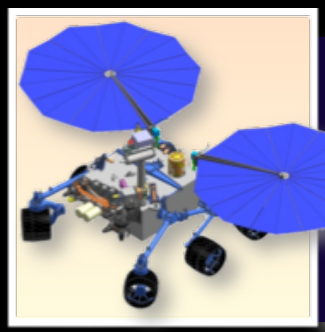
➡Sample acquisition, preparation, distribution, and analysis.

2018

SCIENTIFIC OBJECTIVES

➡To search for signs of past and present life on Mars;

➡To characterise the water/subsurface environment as a function of depth in the shallow subsurface.



OBJECTIVE

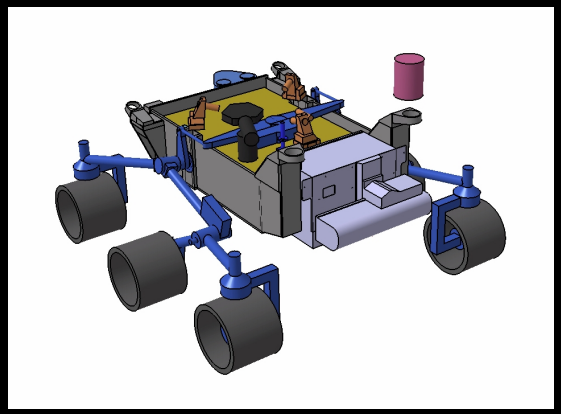
➡To identify, acquire, document, and cache "outstanding" samples in a manner suitable for collection by a future Mars Sample Return mission.

Joint Rover configurations under study

Option # 1

ALD & Drill on rear side

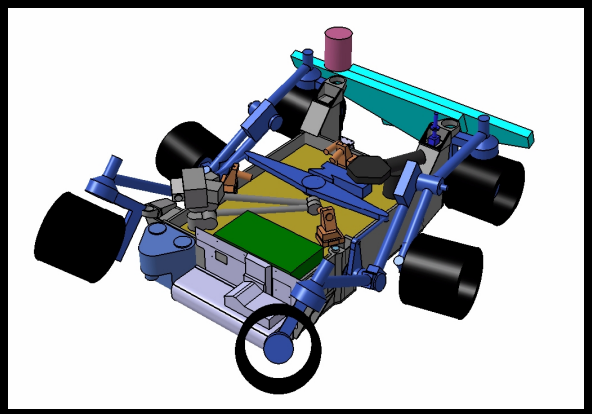
Arm & Cache on front side

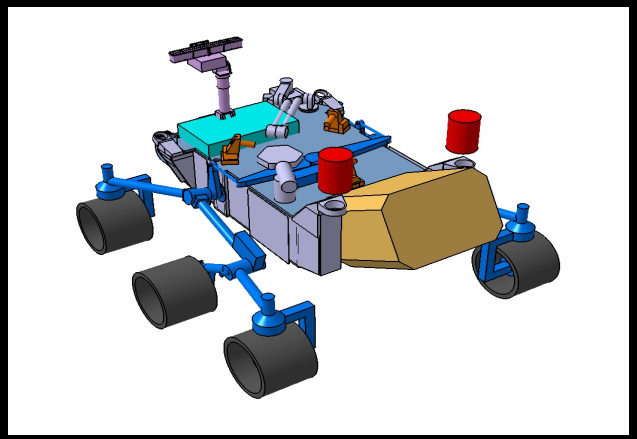


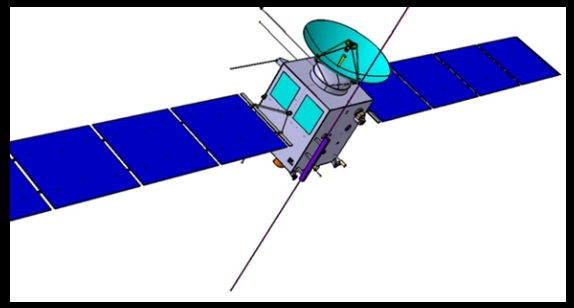
X

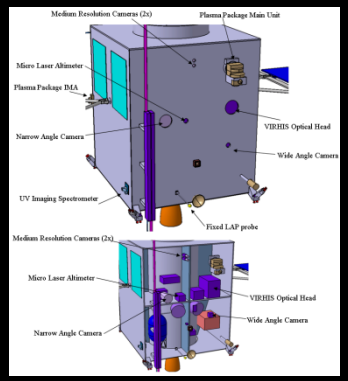
Option # 2

ALD & Drill and Arm & Cache on front side

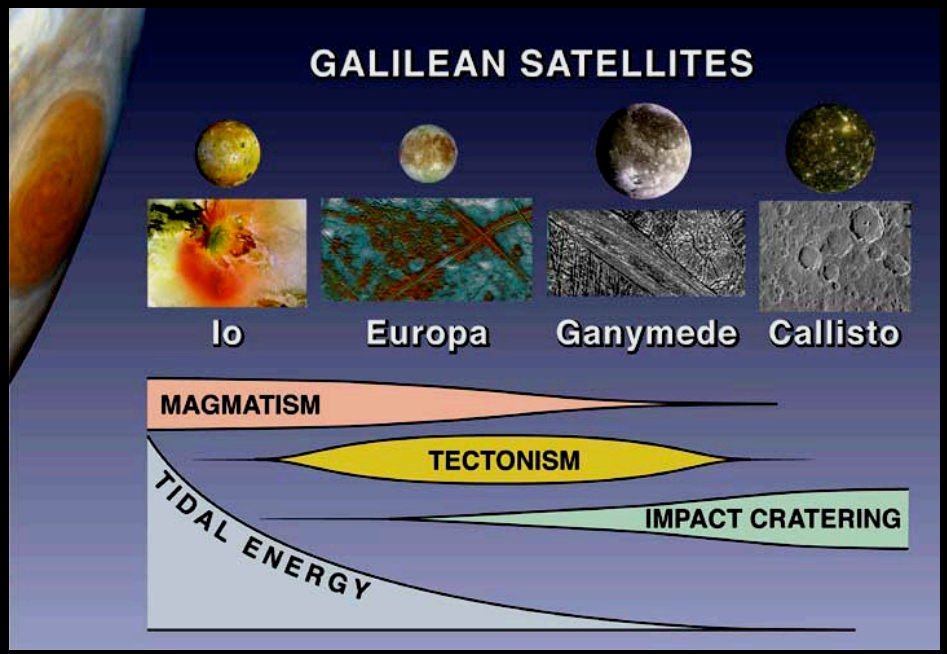


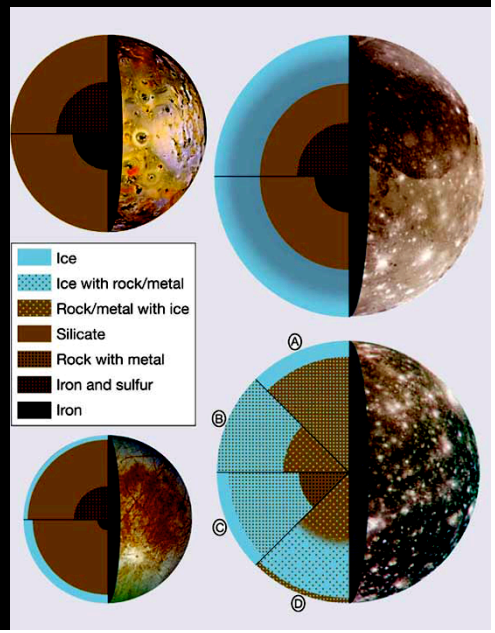




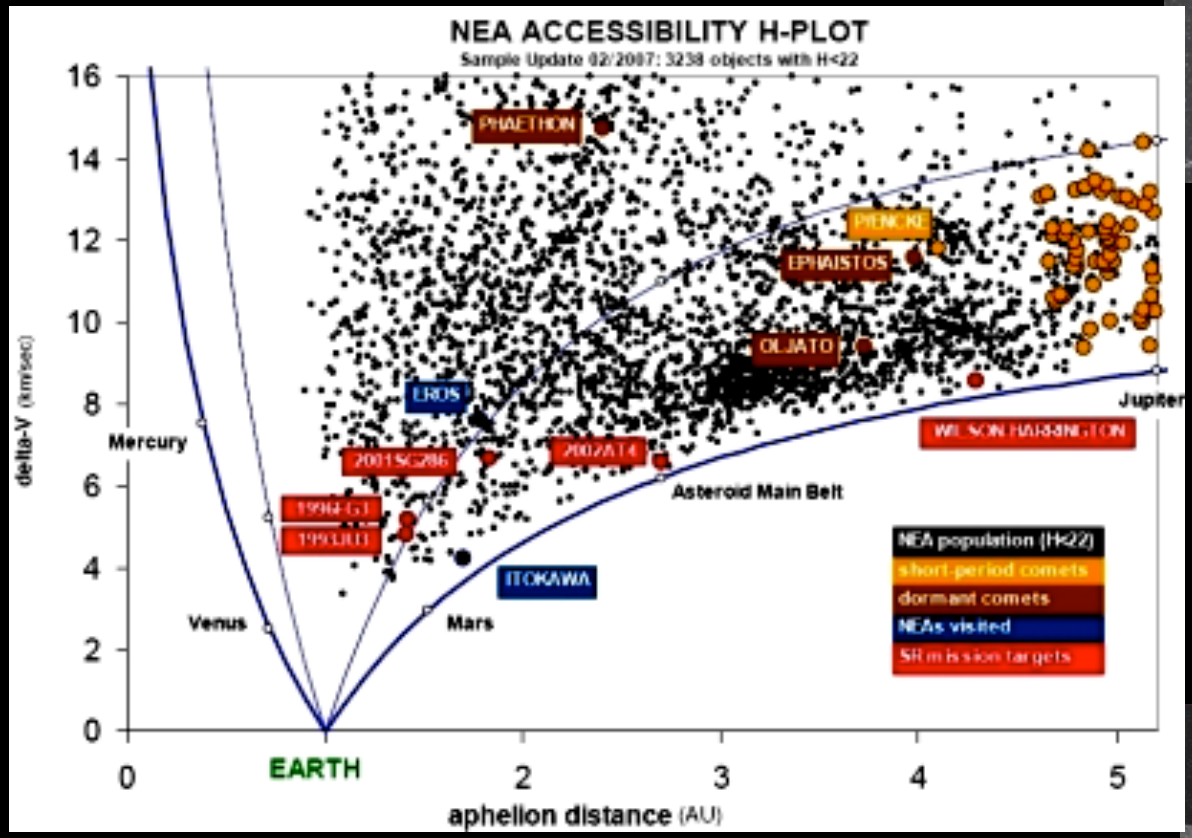


Laplace: the new ESA mission to Jupiter & Ganimede





MarcoPolo:asteroid sample return



In these days of depressed world economy, space agencies are also depressed. The nice aspect of being very senior is that one has seen them all…and one knows that one way or the other we'll see the light at the end of the tunnel…how long is the tunnel?

That I really don't know…kind of long I suspect!

However, one thing is certain:

we will keep going to the planets

THANK YOU