

A detailed illustration of the Rosetta spacecraft in orbit around the comet 67P/Churyumov-Gerasimenko. The spacecraft is shown from a side-on perspective, with its long mast and various instruments clearly visible. The comet's nucleus is dark and irregularly shaped, with a prominent jet of gas and dust emanating from one end. The background is a deep blue space filled with stars and a bright, glowing nebula or star cluster. The overall scene is set against a dark blue gradient background.

# ROSETTA

A COMET RENDEZVOUS MISSION

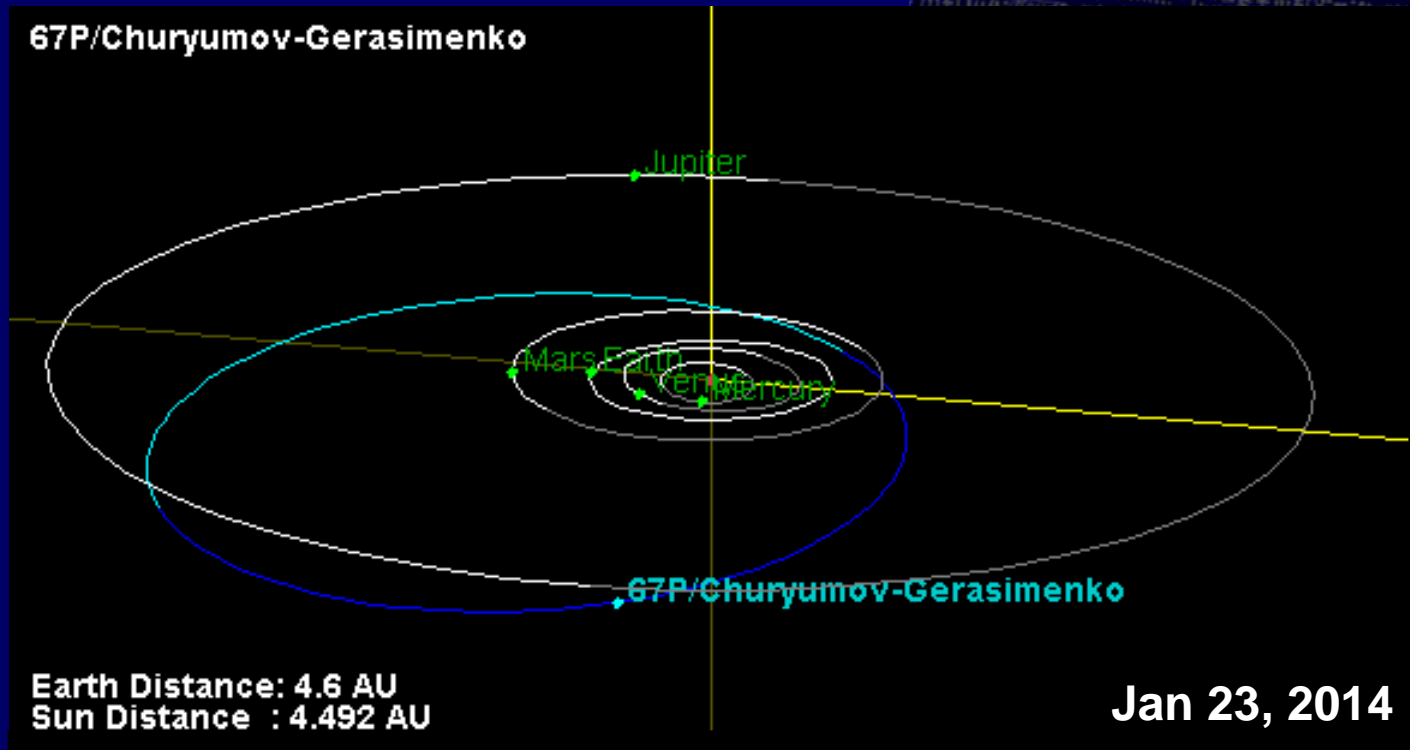


# ROSETTA SCIENTIFIC OBJECTIVES

1. Investigate the origin of the Solar System by studying the origin of comets
2. Global characterization of the comet nucleus, dynamic properties, surface morphology and composition
3. Determination of chemical, mineralogical and isotopic compositions of volatiles and refractories in a comet nucleus
4. Determination of the physical properties and interrelation of volatiles and refractories in a comet nucleus
5. Study of the development of cometary activity and the processes in the surface layer of the nucleus and inner coma (dust/gas interaction)
6. **Characterisation of main belt asteroids including dynamic properties, surface morphology and composition**

THE ROSETTA STONE

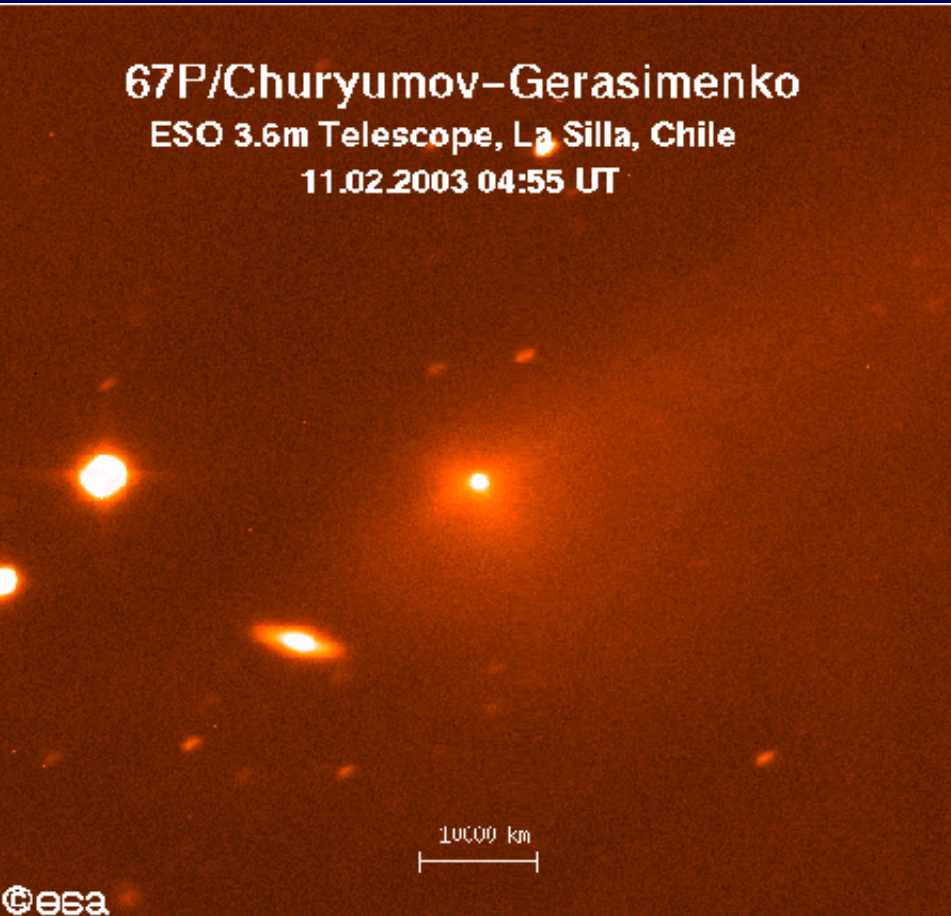
# Rosetta arrival at the comet



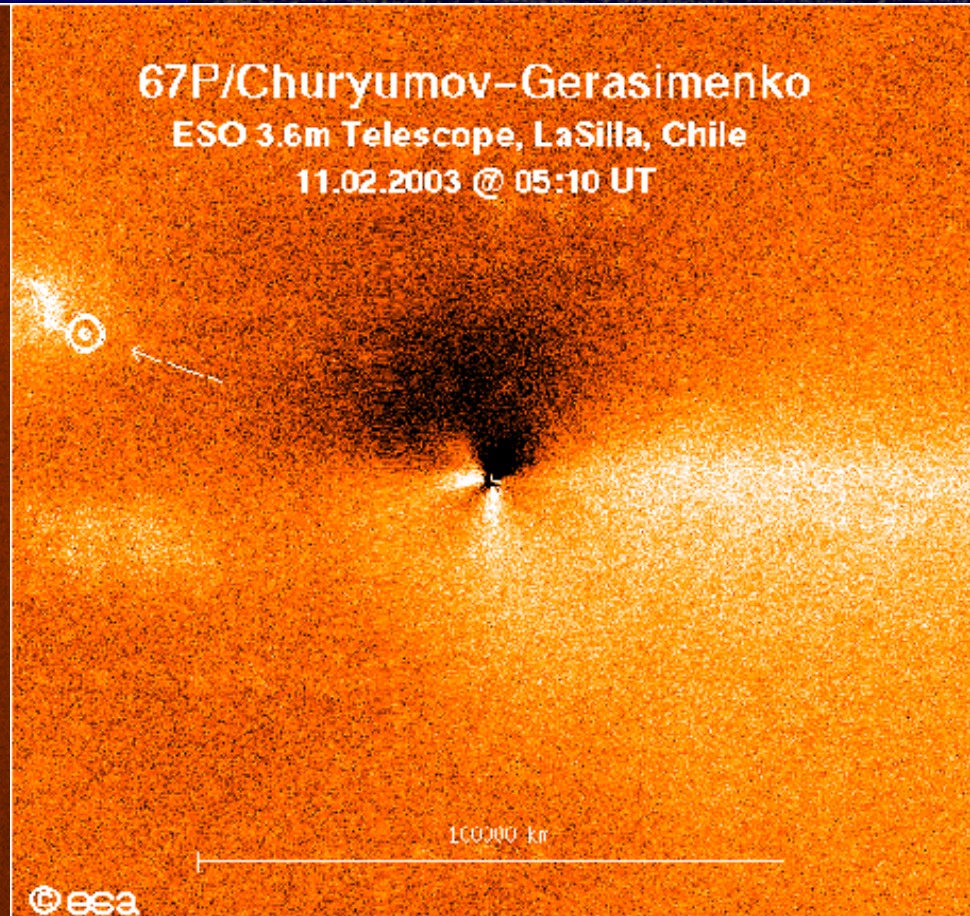
# 67P/Churyumov-Gerasimenko

Heliocentric Period: 6.59 years  
Perihelion: 1.30 AU  
Aphelion: 5.73 AU  
Discovery: 1969

67P/Churyumov-Gerasimenko  
ESO 3.6m Telescope, La Silla, Chile  
11.02.2003 04:55 UT



67P/Churyumov-Gerasimenko  
ESO 3.6m Telescope, La Silla, Chile  
11.02.2003 @ 05:10 UT



# Scientific Payload

## Rosetta

11 Orbiter Instruments/  
(Instrument Packages)

⇒ 18 Experiments

**Payload Mass: ~170 kg**

**+ Lander: ~110 kg**

10 Lander Instruments/  
(Instrument Packages)

⇒ 16 Experiments

**Payload Mass: ~27 kg**



# Rosetta Scientific Payload

## The Rosetta Orbiter:

Remote sensing

Composition analysis

Nucleus large-scale structure

Dust flux and physical properties

Comet plasma environment

Radio science

## The Lander Philae

Imaging

Composition analysis

Physical properties

Nucleus large-scale structure

Magnetic field and plasma

Drill and sampling device

ALICE, OSIRIS, VIRTIS, MIRO

ROSINA, COSIMA

CONCERT

GIADA, MIDAS

RPC

RSI

CIVA, ROLIS

APX, COSAC, Ptolemy

MUPUS, SESAME

CONCERT

ROMAP

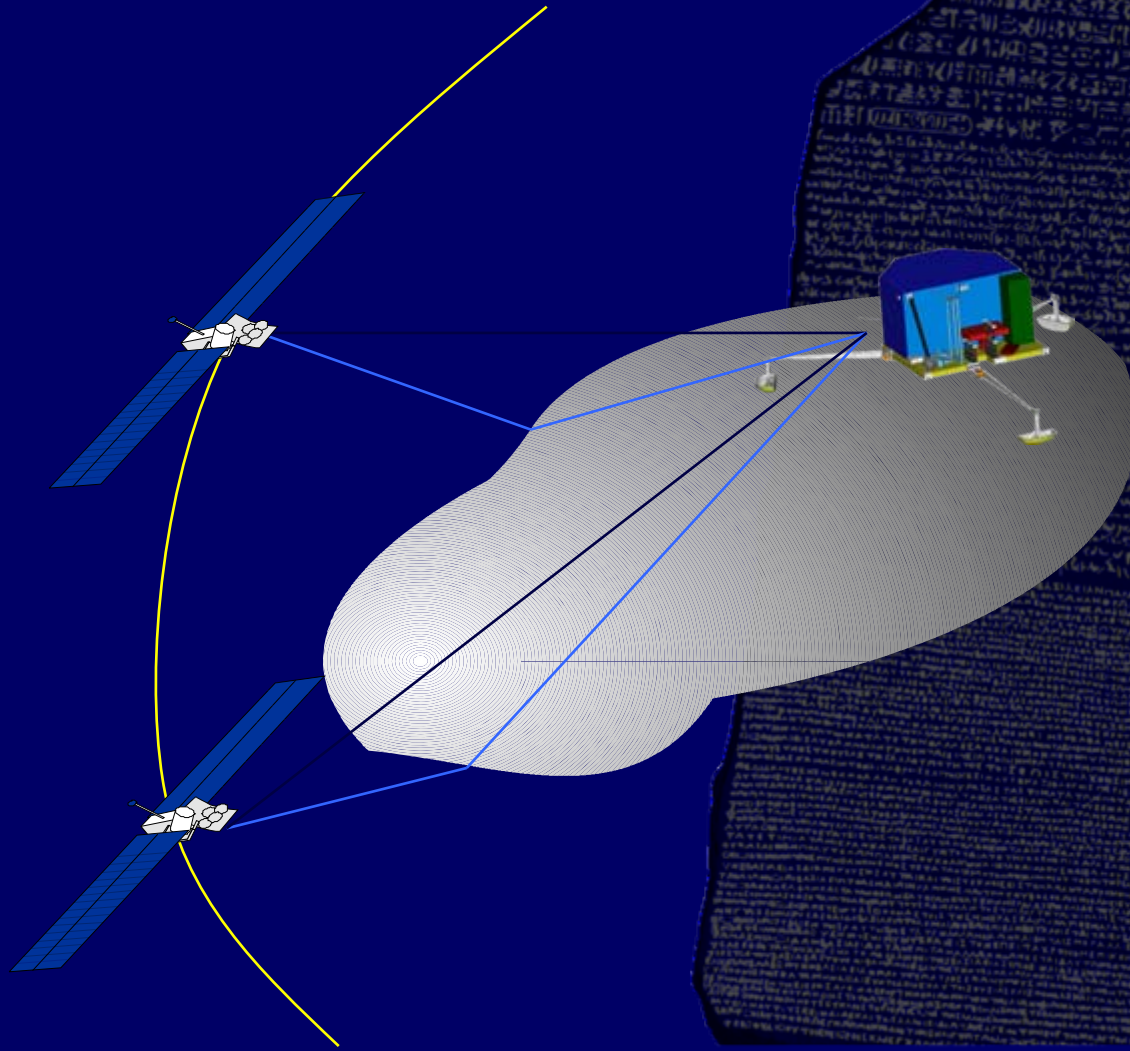
SD2

# Rosetta Spacecraft and Payload



● OSIRIS (Orbiting Space Infrared Spectrograph) (Italy)  
● OCS (Orbiting Camera Spectrometer) (France)  
● MIP (Micrometeoroid and Interplanetary Dust Instrument) (USA)  
● MIDAS (Micrometeoroid and Dust Analyzer) (USA)  
● AIDA (Autonomous Identification and Discrimination) (USA)  
● ROSINA (Rosetta Orbiter Spectrometer for Ion and Neutral Analysis) (Germany)  
● COSYCORP (Cometary Outgassing Spectrometer) (USA)  
● COPS (Cometary Outgassing Payload for the Surface) (USA)  
● VIRT-M (Visible and Infrared Thermal Mapper) (USA)  
● MIPFAR (Micrometeoroid and Interplanetary Dust Analyzer) (USA)  
● MIPFAR-2 (Micrometeoroid and Interplanetary Dust Analyzer) (USA)  
● MIPFAR-3 (Micrometeoroid and Interplanetary Dust Analyzer) (USA)  
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● MIPFAR-49 (Micrometeoroid and Interplanetary Dust Analyzer) (USA)  
● MIPFAR-50 (Micrometeoroid and Interplanetary Dust Analyzer) (USA)

# CONSORT Experiment







## Philae Lander and Payload

**Imaging**

**Composition analysis**

**Physical properties**

**Nucleus large-scale structure**

**Magnetic field and plasma**

**Drill and sampling device**

**CIVA, ROLIS**

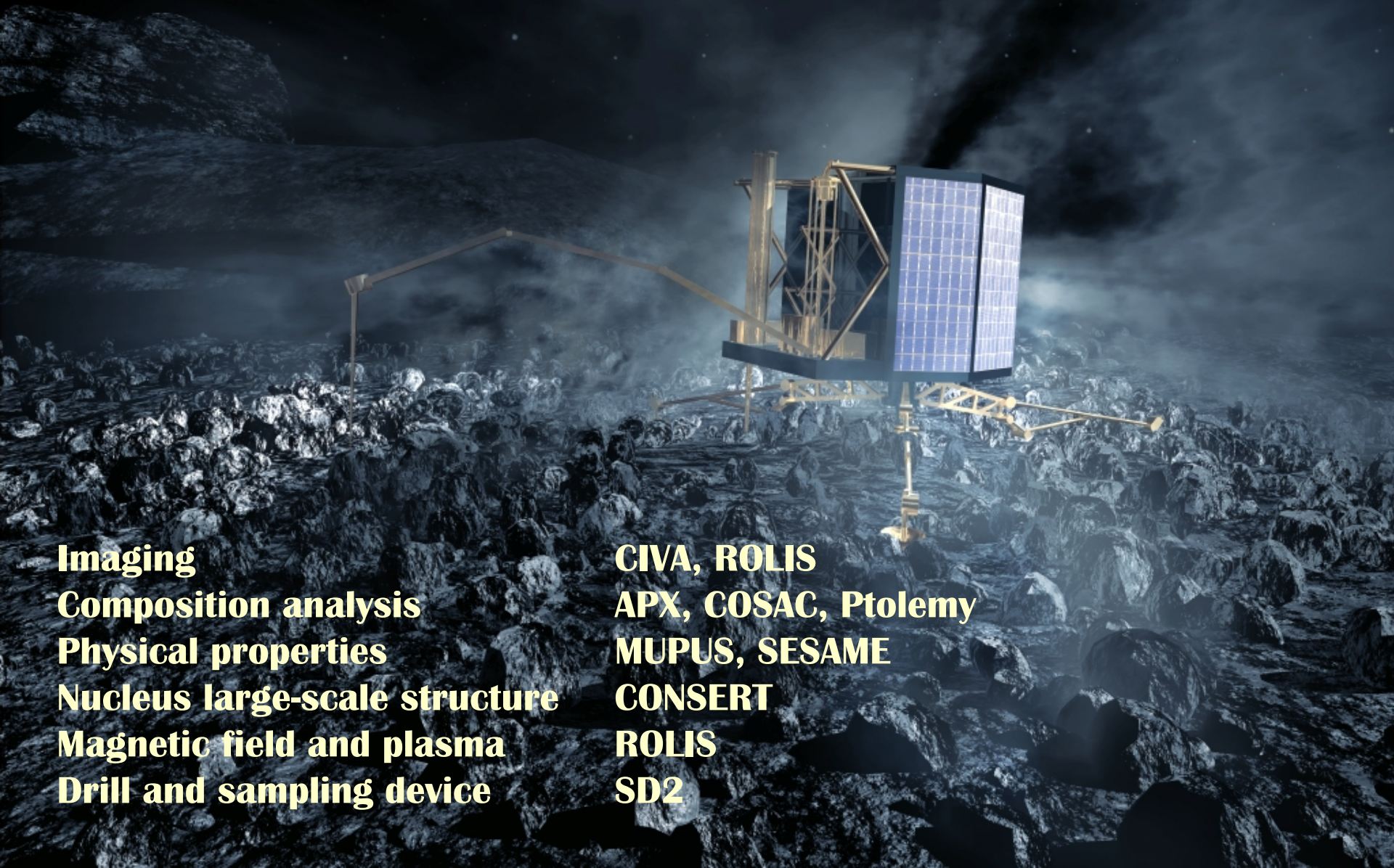
**APX, COSAC, Ptolemy**

**MUPUS, SESAME**

**CONSERT**

**ROLIS**

**SD2**



## The Lander



## Payload

Imaging	CIVA, ROLIS
Composition analysis	APX, COSAC, Ptolemy
Physical properties	MUPUS, SESAME
Interior structure	CONSERT
Magnetic field/plasma	ROMAP
Drill & sampling	SD2

**Fixed first science sequence defined in detail (for 60 hours)**

# Comet Infrared and Visible Analyser (CIVA) Camera System

7 Cameras for 360° panorama plus stereo view in one direction (CIVA-P)

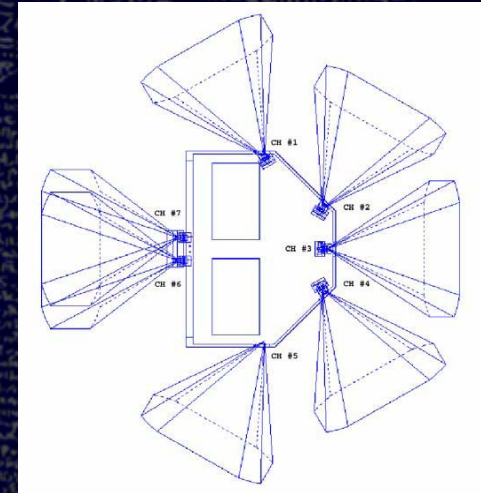
Optical microscope coupled to near-IR microscopic hyper spectral imager (CIVA-M)

Optical microscope spatial sampling: 7  $\mu\text{m}$   
IR spectral range (1-4  $\mu\text{m}$ ), spectral sampling (5 nm)

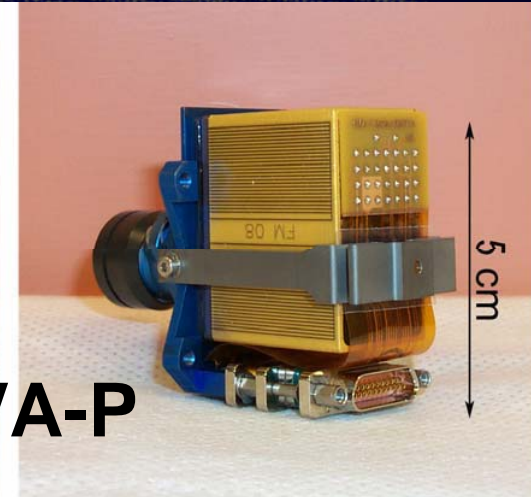
**CIVA-P: 1,65 kg, 1.4 W x 7**

**CIVA-M/V: 276 g, 2.2 W (size: 70x50x94 mm<sup>3</sup>)**

**CIVA-M/I: 455g, 8.4 W (size: 80x50x120 mm<sup>3</sup>)**



**CIVA-P**

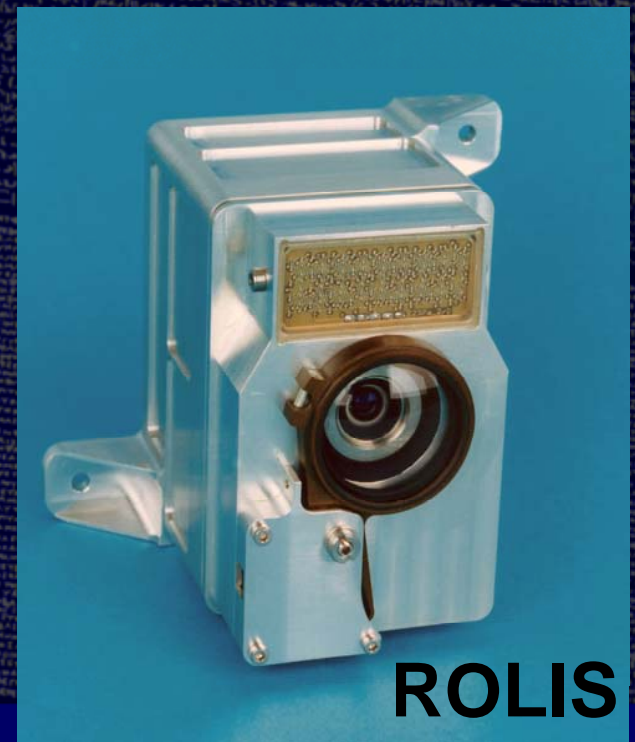
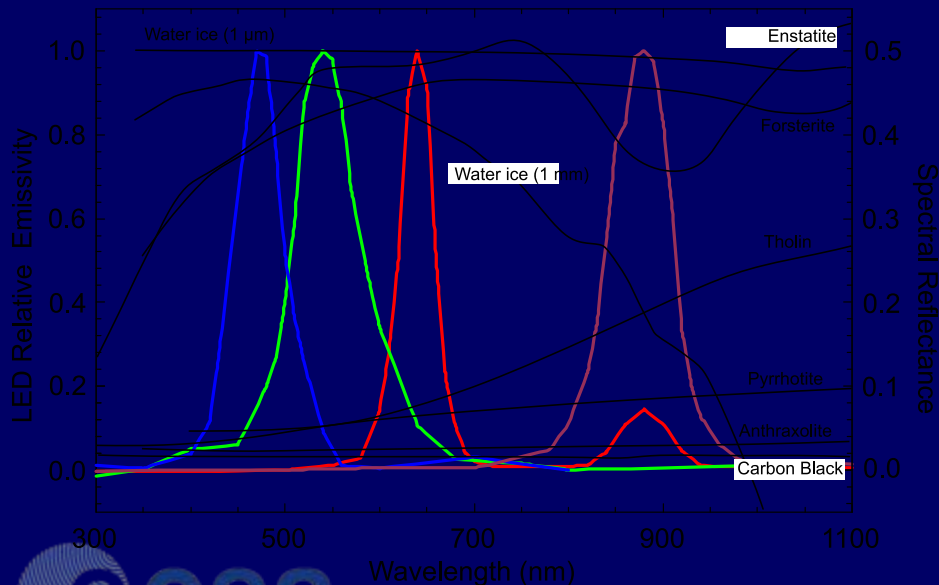


# Rosetta Lander Imaging System (ROLIS)

Decent and Down locking Camera

Multispectral imaging in four spectral channels  
(FOV) of  $57.7^\circ \times 57.7^\circ$

Mass: 405g, power consumption: 2.2 W.



**ROLIS**

# Alpha X-Ray Spectrometer (APXS)

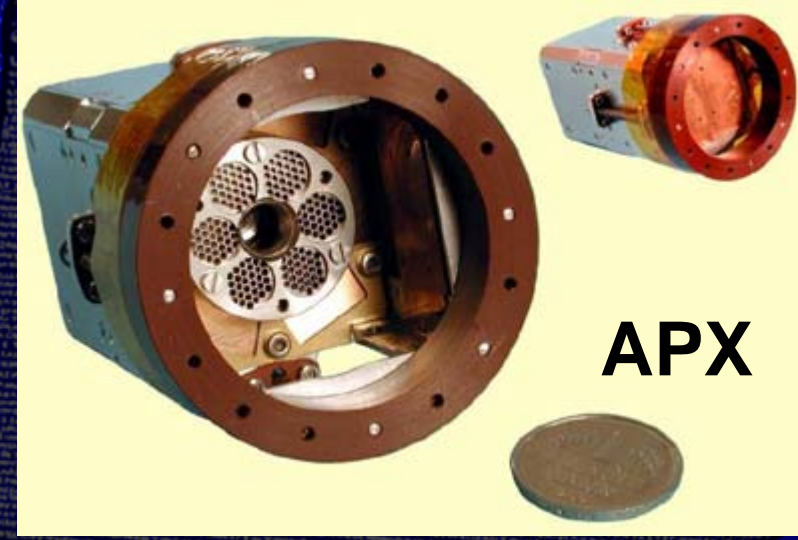
alpha mode for alpha backscatter spectroscopy (Rutherford scattering)

X-ray mode for alpha- and x-ray induced x-ray spectroscopy.

**Determine all elements from carbon to nickel.**

Heritage from Mars-96 and Mars Pathfinder,  
but high-resolution silicon drift detector  
(resolution about 160 eV at 6.4 keV)

**Mass: 640, power consumption: 1.5 W.**



# Cometary Sampling\* and Composition experiment (COSAC)

Evolved Gas Analyser, GCMS

GC: carrier gas Helium, 8 chromatographic columns

MS: high-resolution multi-pass TOF instrument

Heritage from Mars-96 and Mars Pathfinder,  
but high-resolution silicon drift detector  
(resolution about 160 eV at 6.4 keV)

Mass: 640, power consumption: 1.5 W.



# COSAC

Organic Molecules

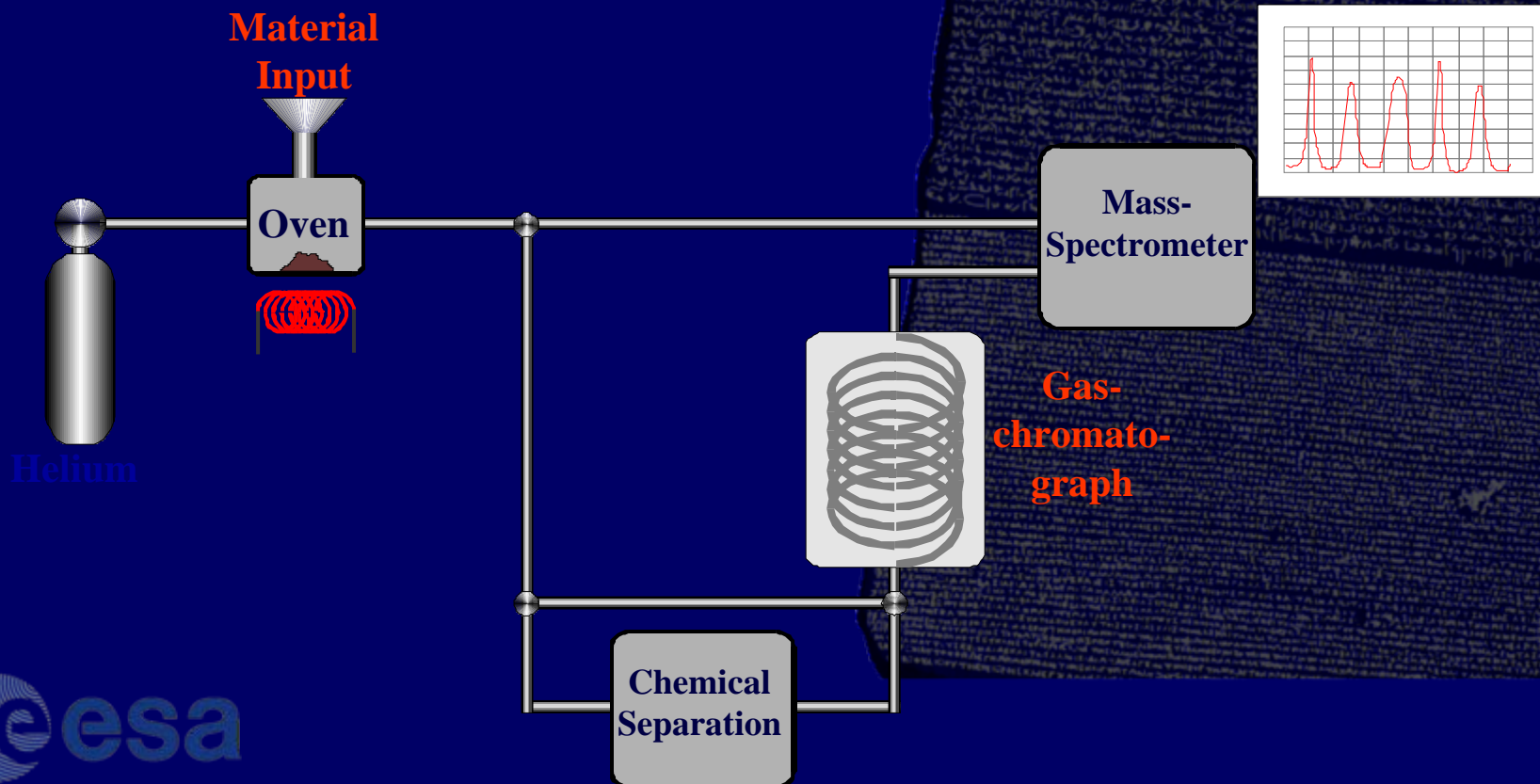
Mass-resolution 3000

Up to 1000 amu

# Pyolemy

Isotope analysis (H, C, N, O)

Chemical separation



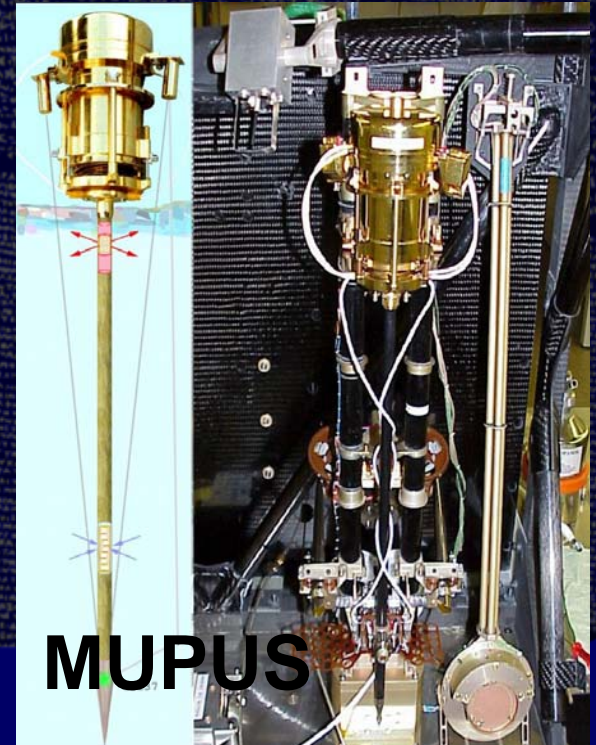
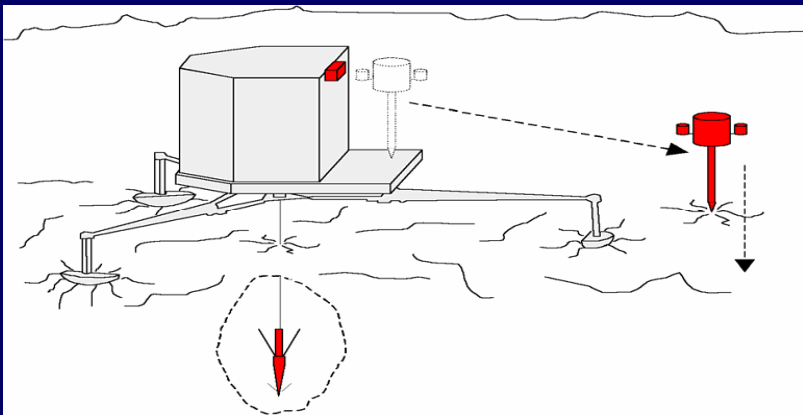


# Multi Purpose Sensor package (MUPUS)

Penetrator, Thermal probe & sensors, Accelerometer, Hammer

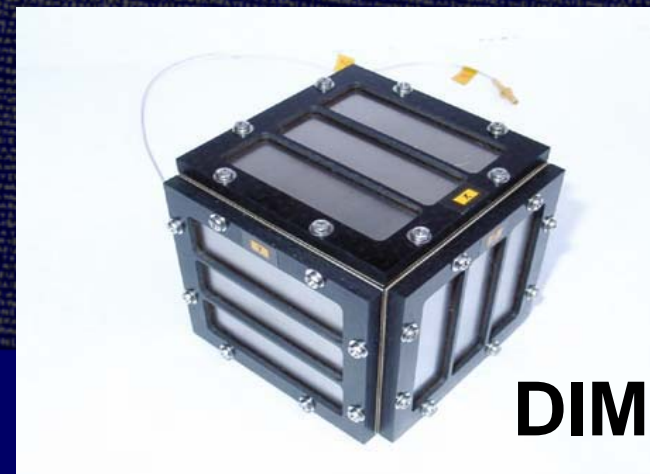
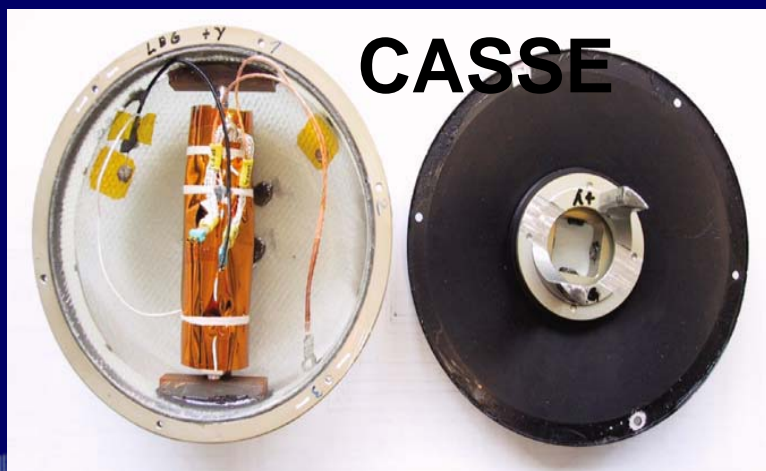
measures temperature, thermal diffusivity, and conductivity as functions of depth and time in the near-surface layers – up to about 30 cm depth

Penetrator on deployment arm,  
temperature sensors, in anchors, housing and pen.  
**Mass: 2.35kg, power consumption: 2.2 W.**



## CASSE, DIM, and PP (SESAME)

measures mechanical and electrical properties and study particles emitted of the surface



# Rosetta Lander Magnetometer and Plasma Monitor (ROMAP)

Fluxgate magnetometer (prototype, SPRUTMAG, was flown on MIR)

- **Magnetic field from 0 to 32 Hz**

Electrostatic analyzer with integrated Faraday cup

- **ions up to 8000 keV**

- **Electrons up to 4200 keV**

Pirani and Penning pressure sensors

- **cover  $10^{-8}$  – 10 mbar**

The sensors are situated on a short boom.

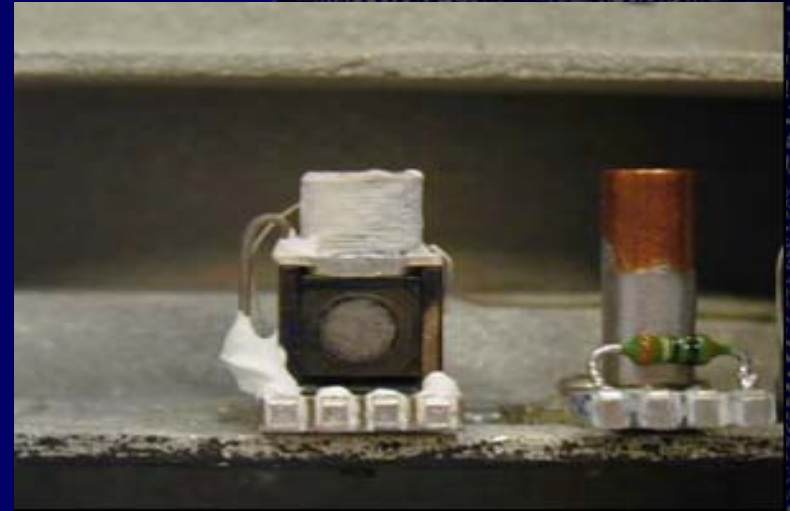
**Mass: 1kg, power consumption: 1 W.**



# Sampler Drill and Distribution System (SD<sup>2</sup>)



**Drill sampling tube**



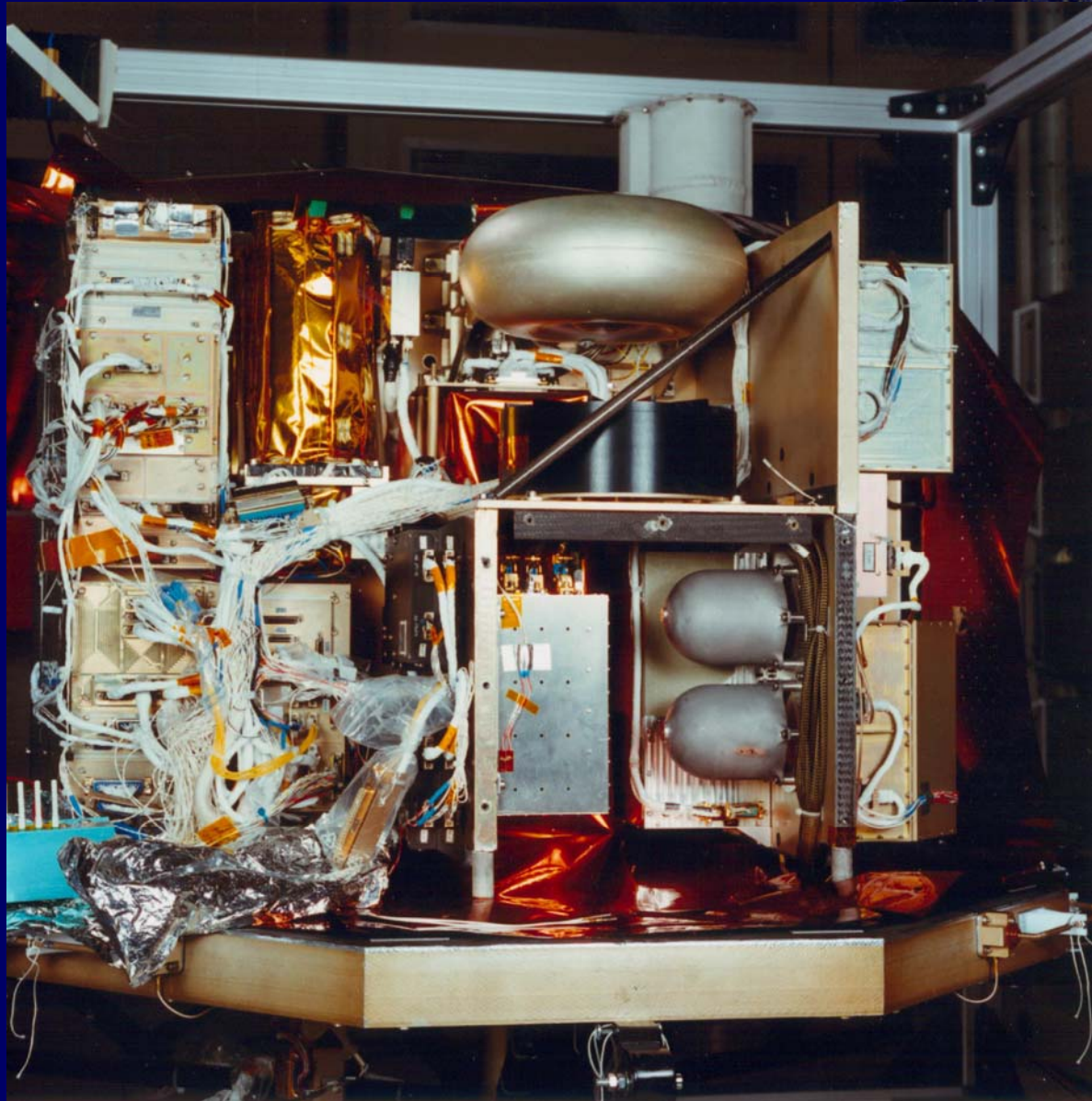
**Medium temp. oven with sample**

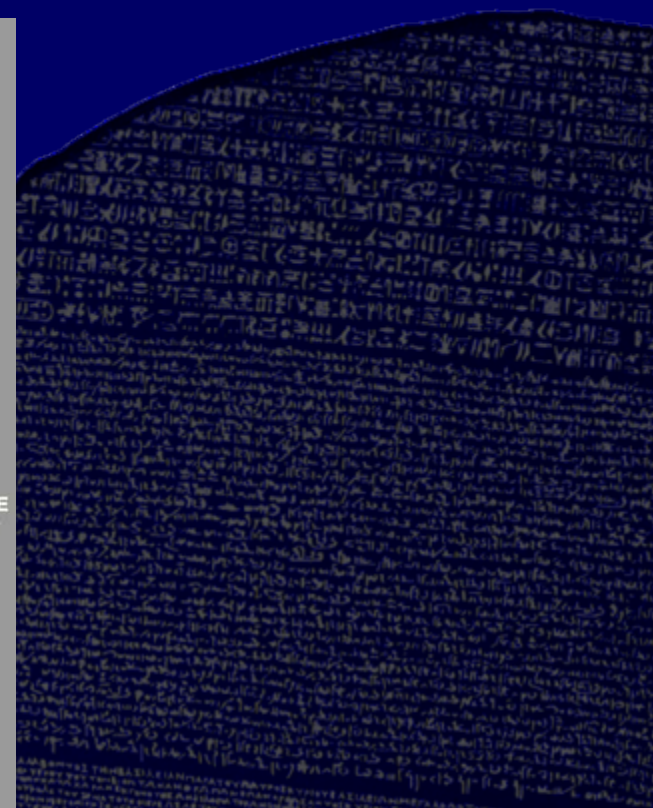
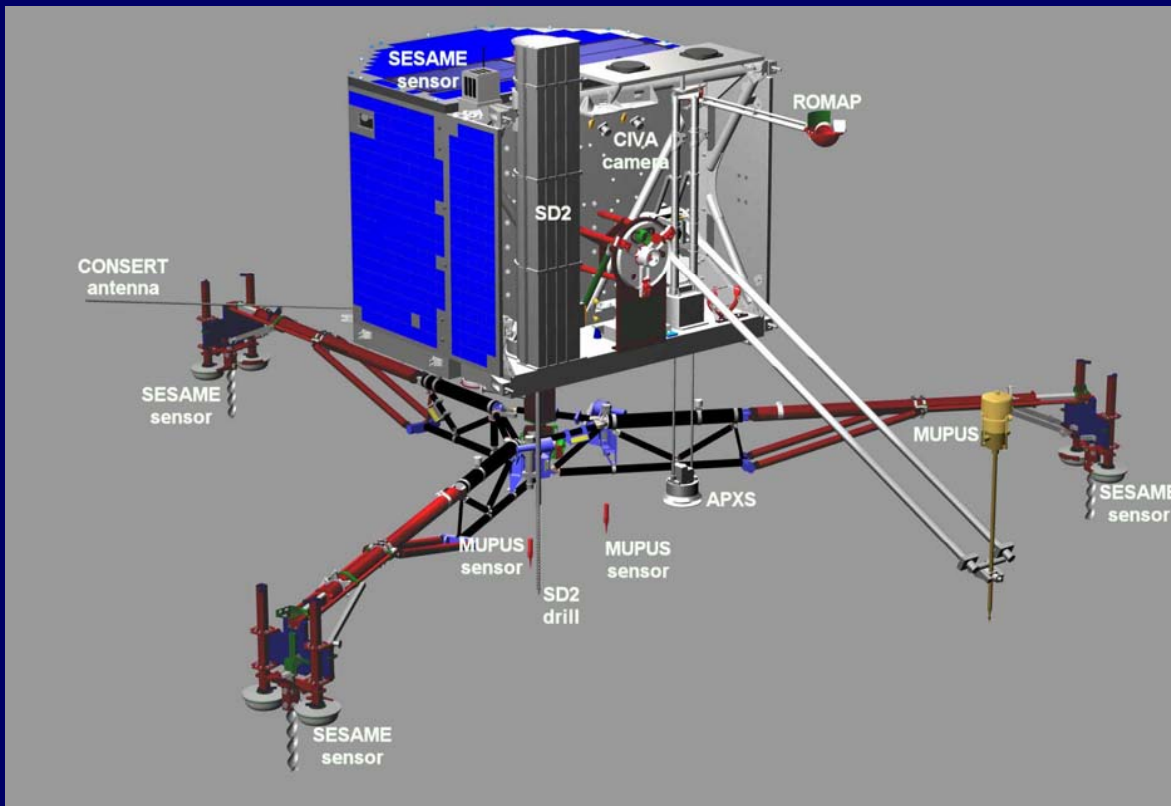


**Carousel, ovens, tapping station**

**Mass: 5.1 kg**  
**power consumption:**  
**1.5 W (stand by)**  
**6.0 W (average during drilling/sampling operations)**  
**14.5 W (max during drilling/sampling operations)**







## Landing system

Damping of Landing  
 Rotation und Hight Adjustment  
 Anchoring with Harpune  
 „Hold-down Thruster“

## Drill /Sampling Device

Drill depth 20 cm  
 multiple sampling  
 low temperature modifications

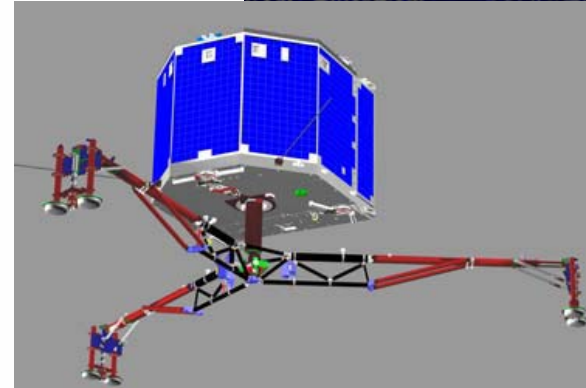
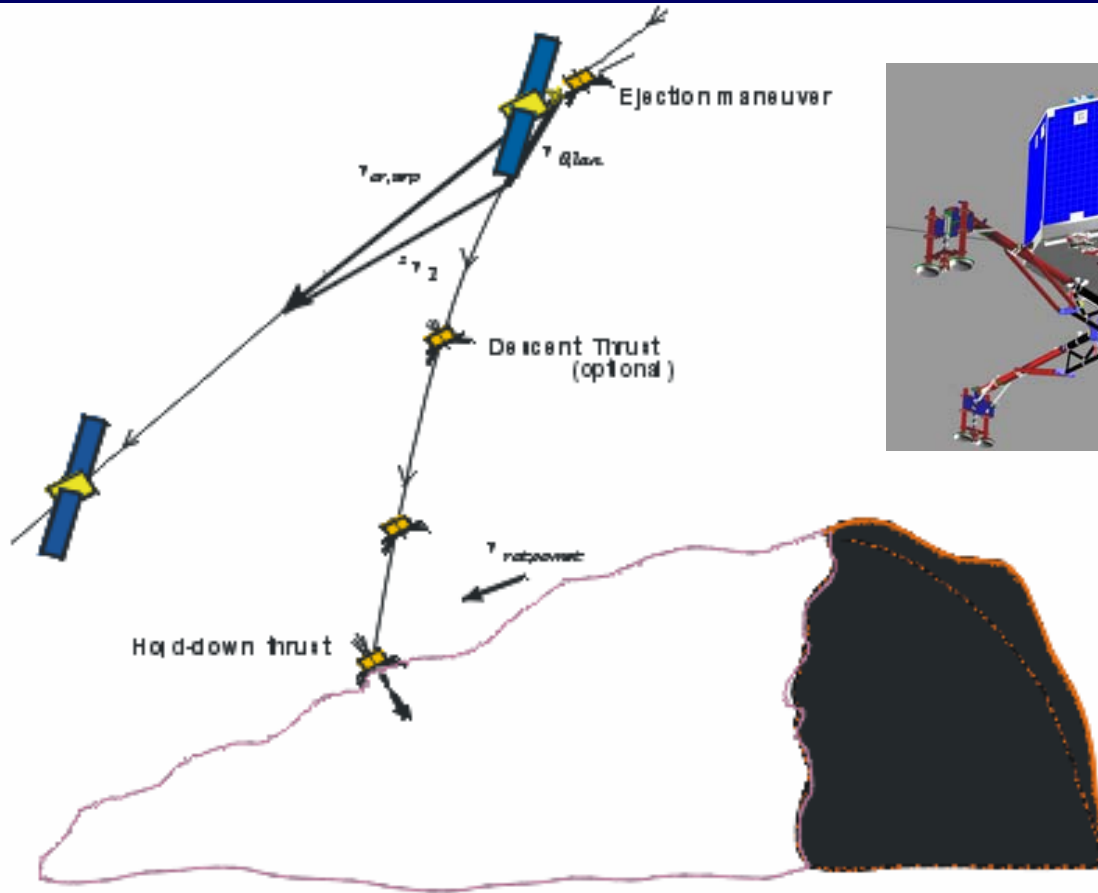
**Energy- und Thermal-Concept**  
 Solar generator 11 W (at 3AU)  
 Primary and secondary batteries  
 „warm“ und „cold“ Areas

## Data

Central computer  
 Data relay via Orbiter (16 kb/s)



# Landing Scenario



- Separation from the Orbiter
- Descent (gravity)
- Activation of cold gas system (optional)
- Attitude control with flywheel
- Soft landing
- Fixation to ground



