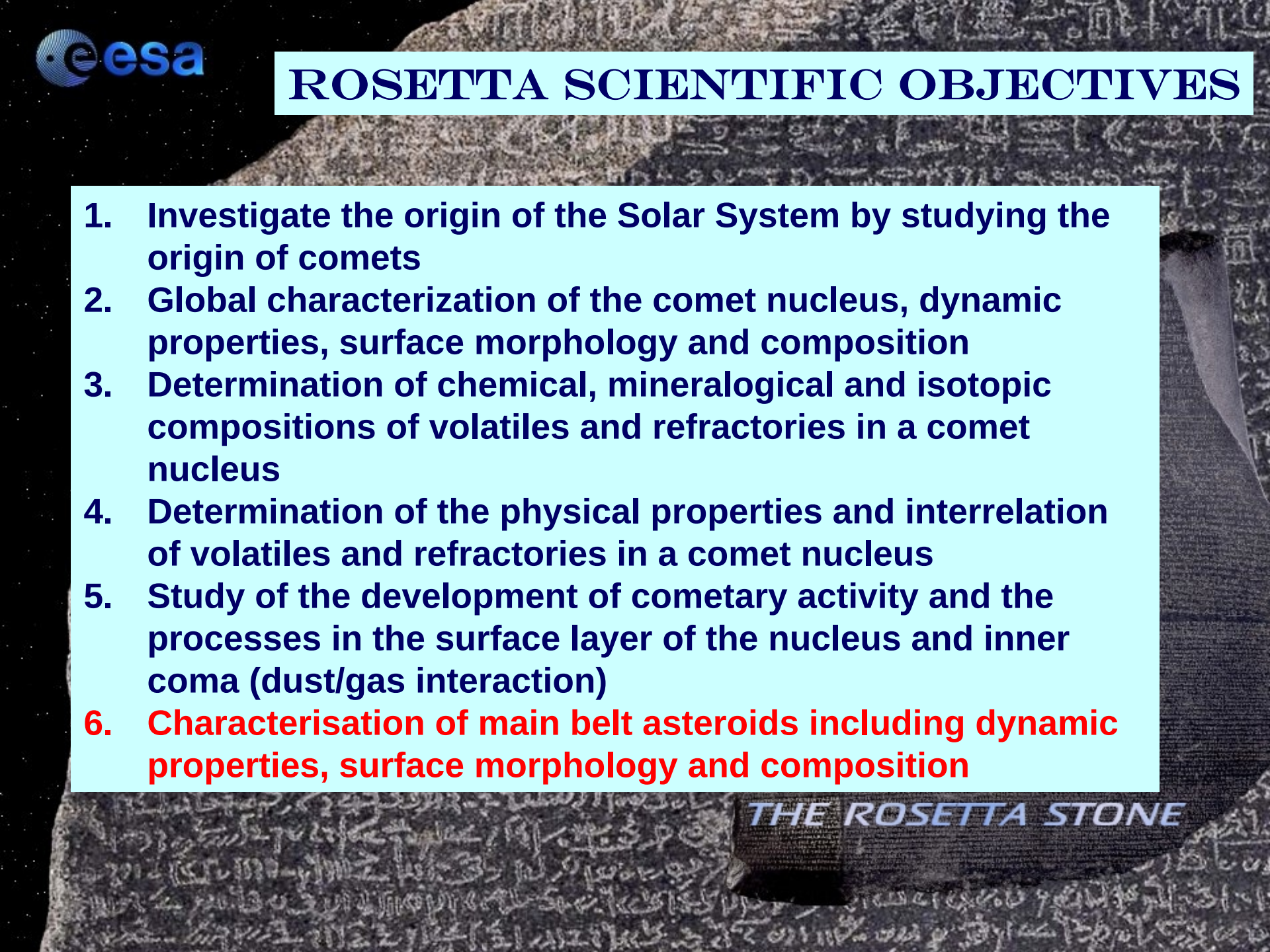
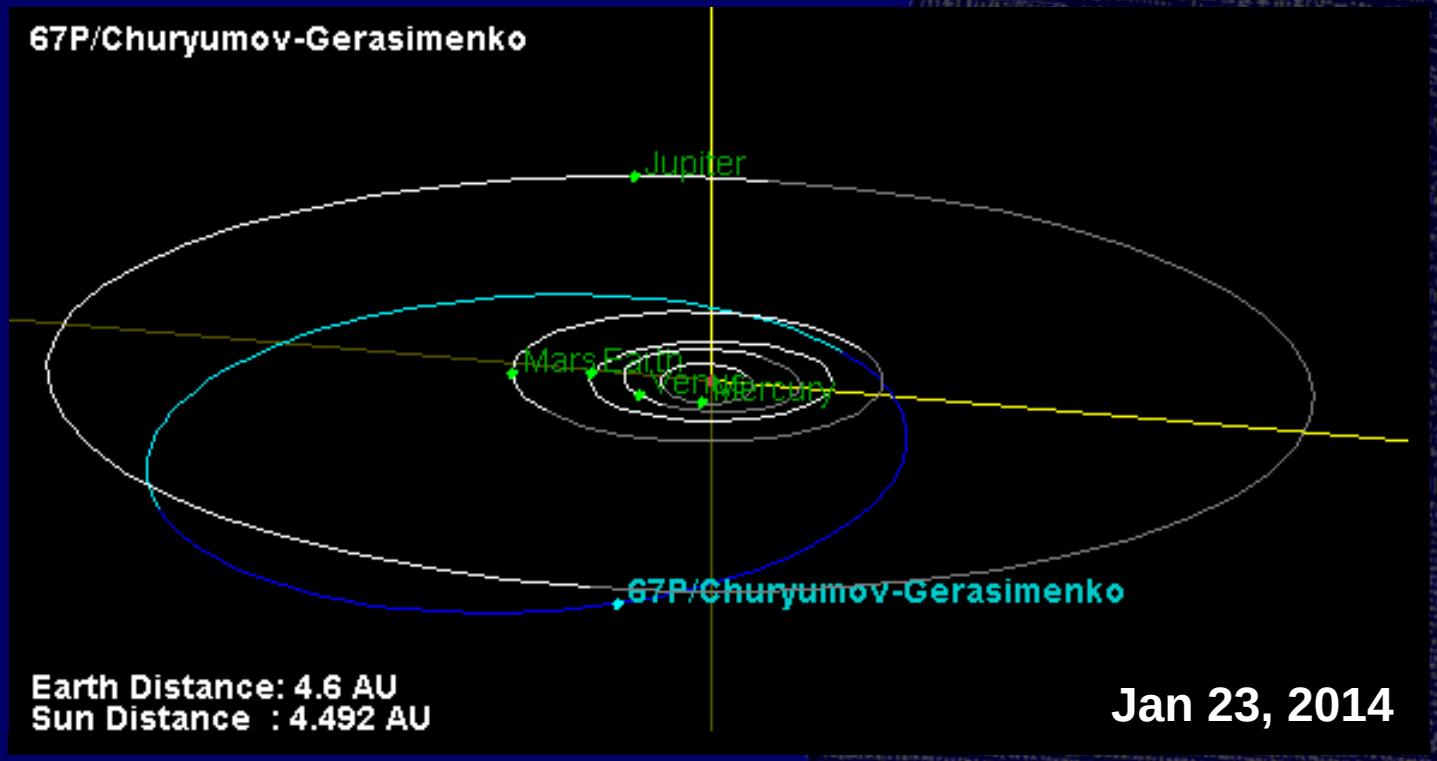

ROSETTA
A COMET RENDEZVOUS MISSION

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

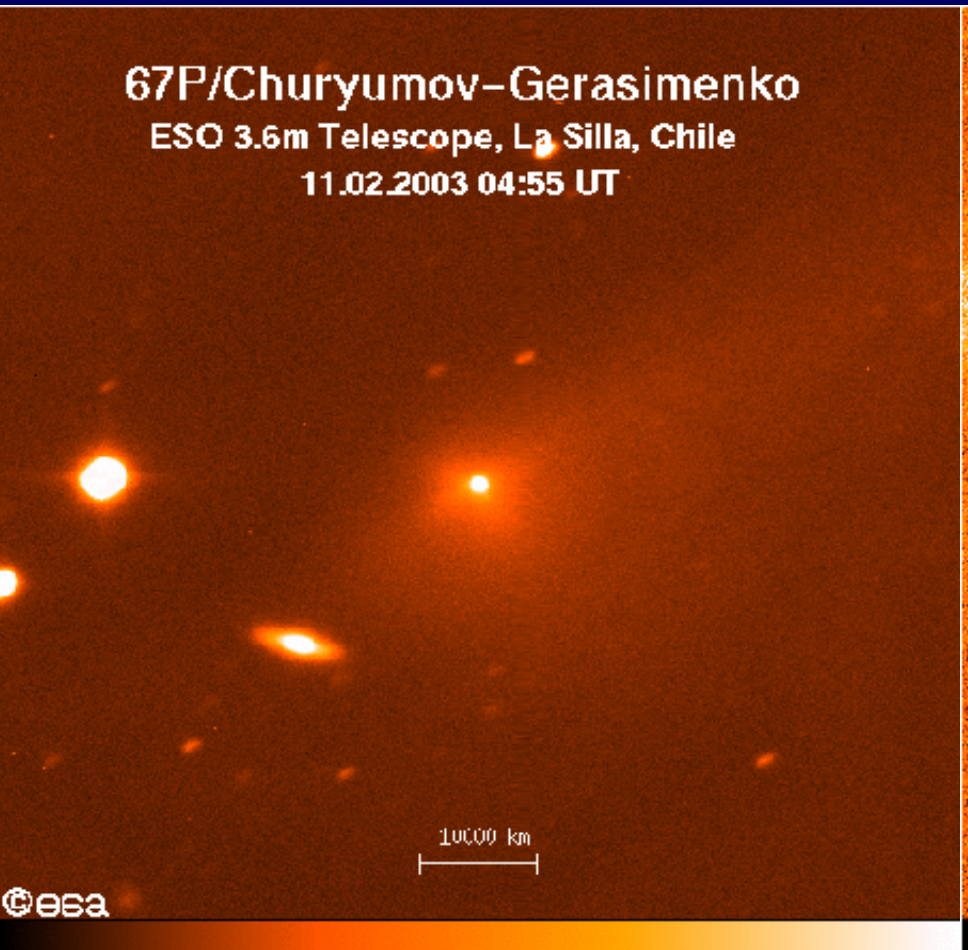


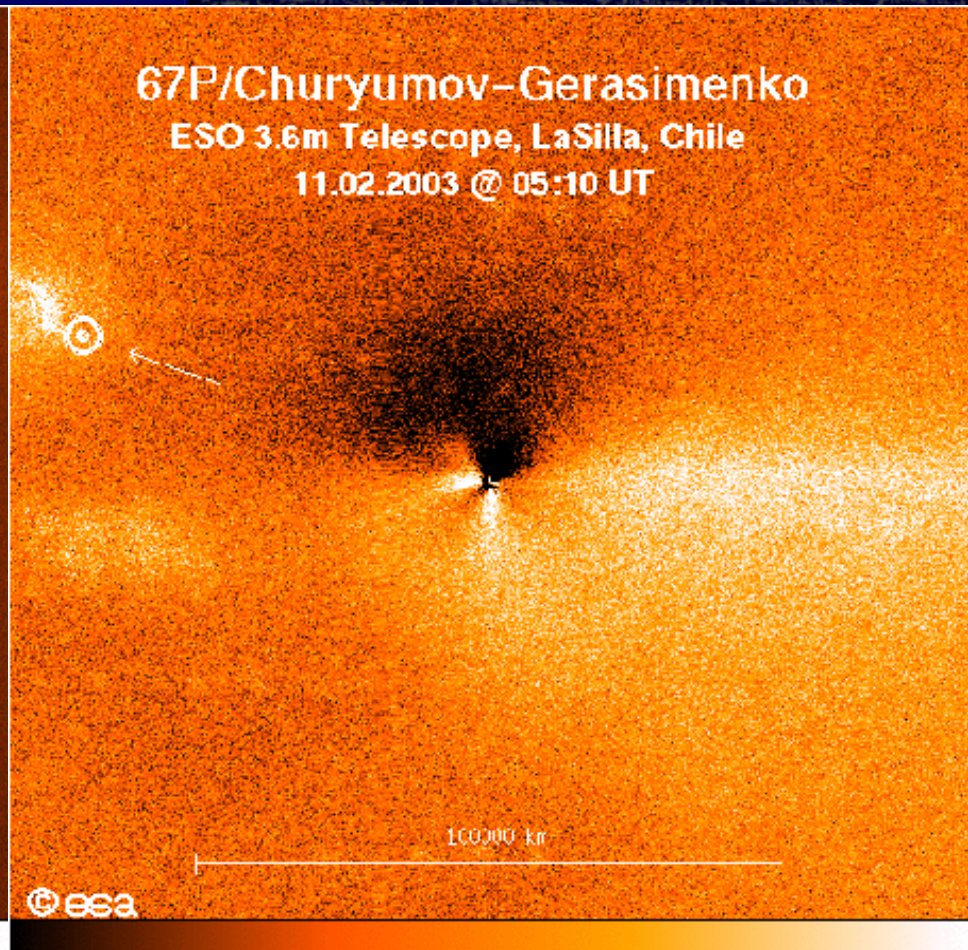
Rosetta arrival at the comet



67P/Churyumov-Gerasimenko

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





Scientific Payload

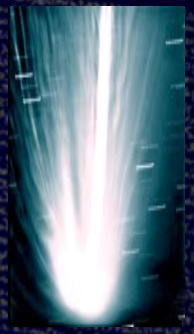
Rosetta

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

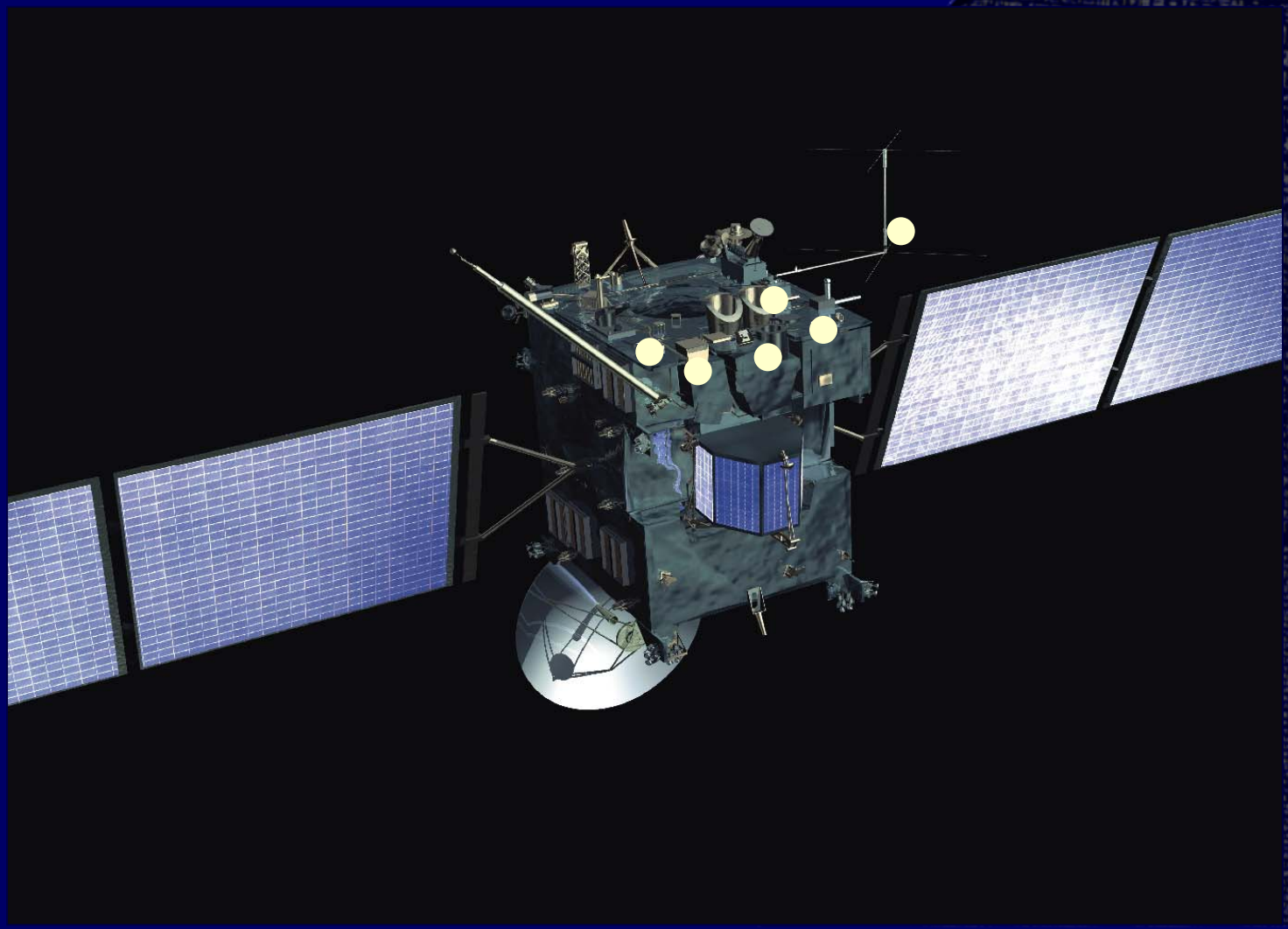
The Rosetta Orbiter:

Remote sensing	ALICE, OSIRIS, VIRTIS, MIRO
Composition analysis	ROSINA, COSIMA
Nucleus large-scale structure	CONSERT
Dust flux and physical properties	GIADA, MIDAS
Comet plasma environment	RPC
Radio science	RSI

The Lander Philae

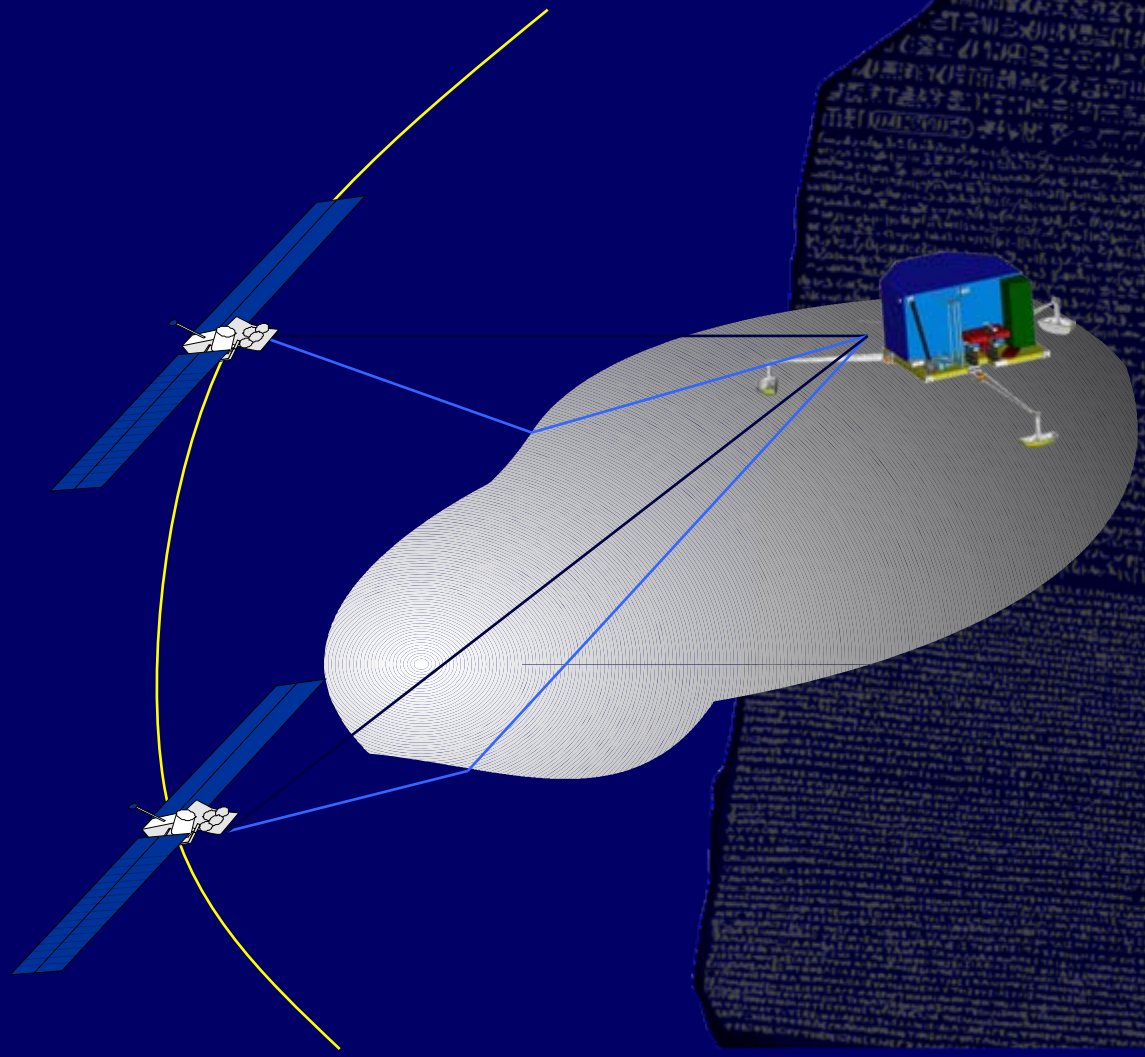
Imaging	CIVA, ROLIS
Composition analysis	APX, COSAC, Ptolemy
Physical properties	MUPUS, SESAME
Nucleus large-scale structure	CONSERT
Magnetic field and plasma	ROMAP
Drill and sampling device	SD2

Rosetta Spacecraft and Payload

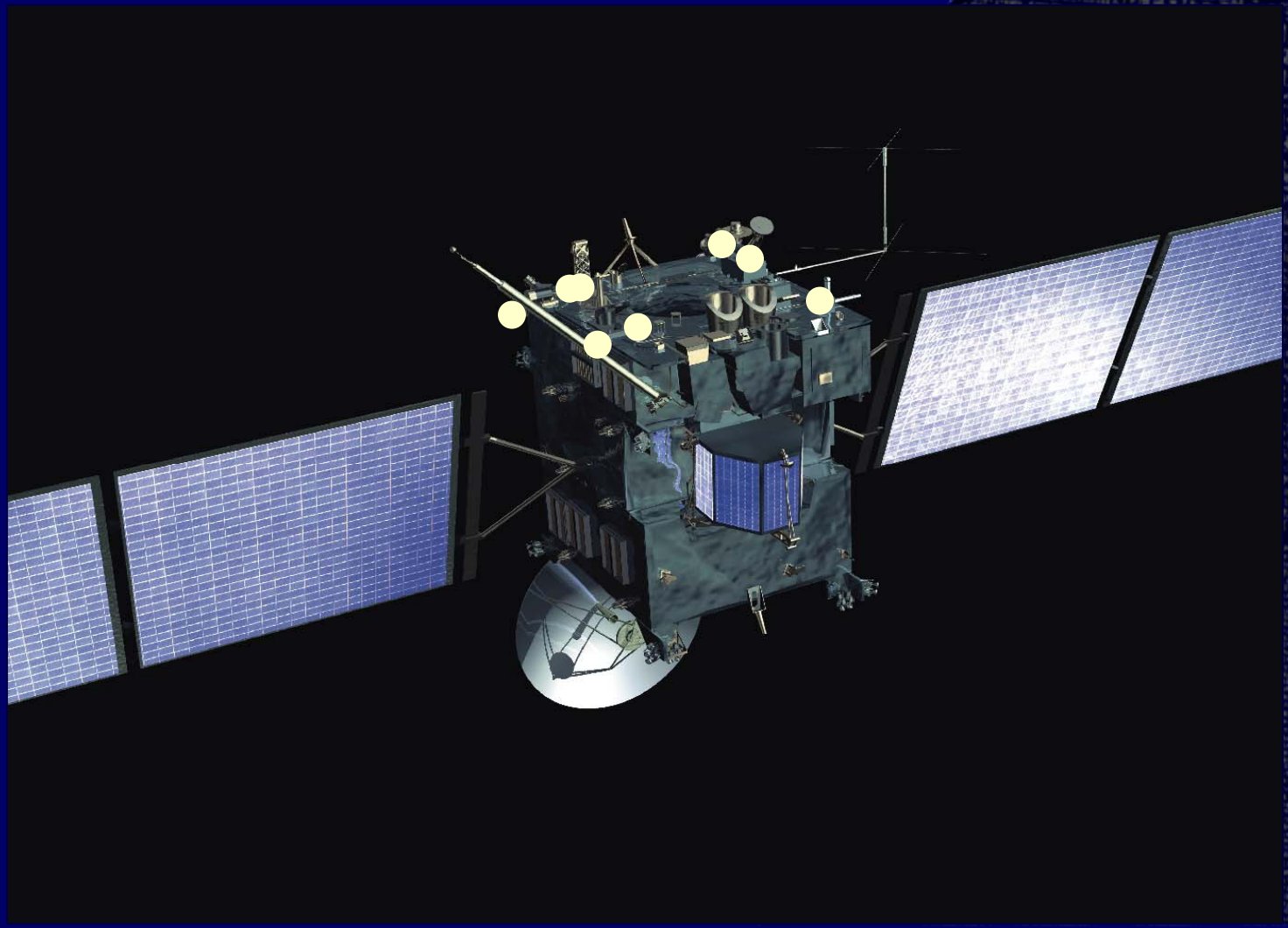


- OSIRIS (Optical, Spectroscopic and Infrared Remote Imaging System) (MPAE, Lindau, Germany)

CONSERT Experiment

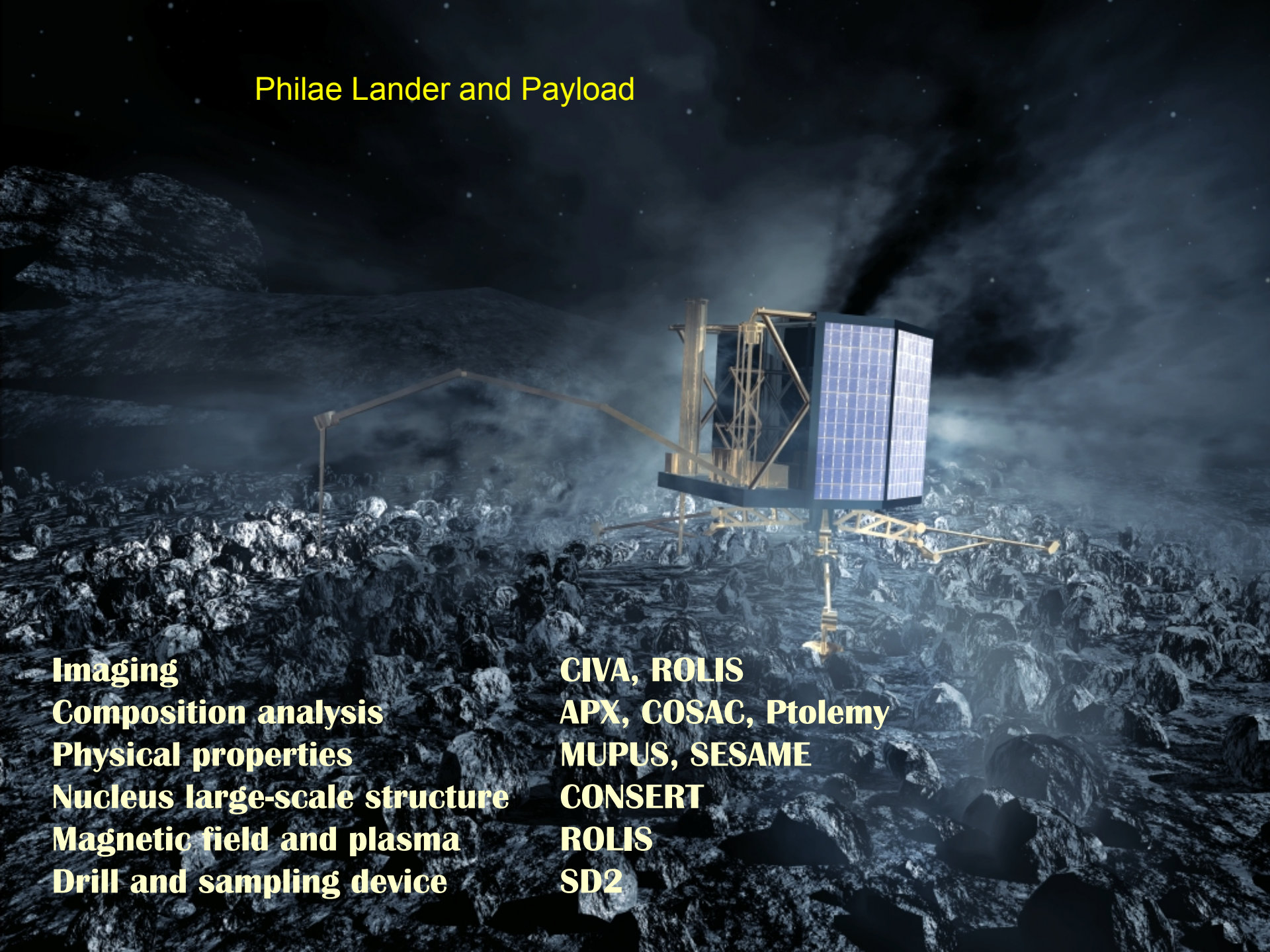


Rosetta Spacecraft and Payload



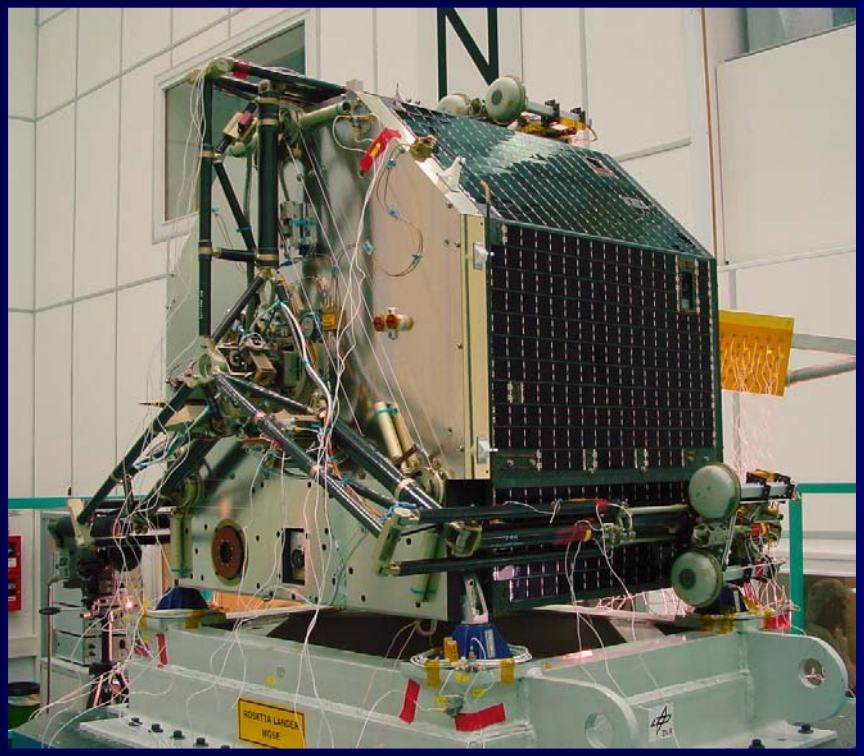
ROSINA (Rosetta Orbiter Spectrometer for Ion and Neutral Analysis) (University of Bern, Switzerland)

Philae Lander and Payload



Imaging	CIVA, ROLIS
Composition analysis	APX, COSAC, Ptolemy
Physical properties	MUPUS, SESAME
Nucleus large-scale structure	CONSERT
Magnetic field and plasma	ROLIS
Drill and sampling device	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)

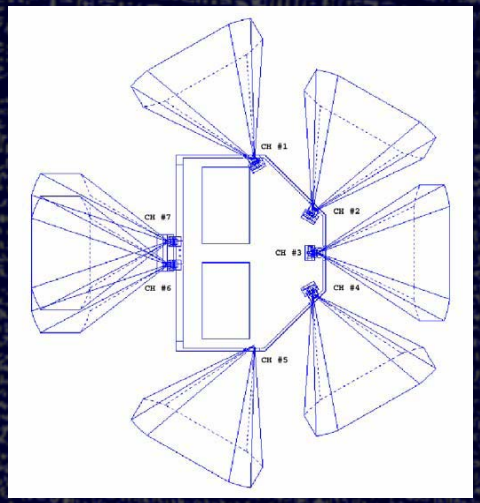
Comet Infrared and Visible Analyser (CIVA) Camera System

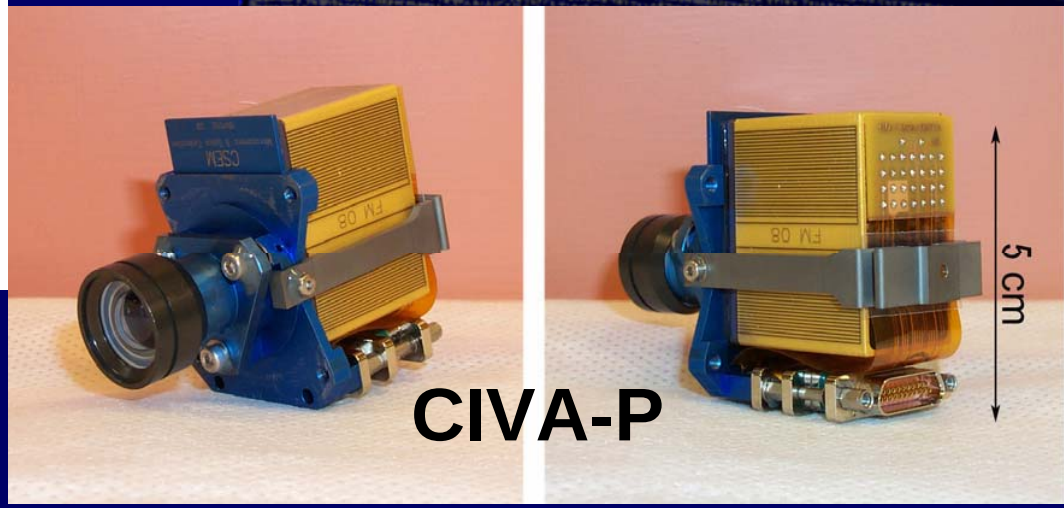
7 Cameras for 360° panorama plus stereo view in one direction (CIVA-P)

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

Optical microscope spatial sampling: 7 µm
IR spectral range (1-4 µm), 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^3)
CIVA-M/I: 455g, 8.4 W (size: 80x50x120 mm^3)



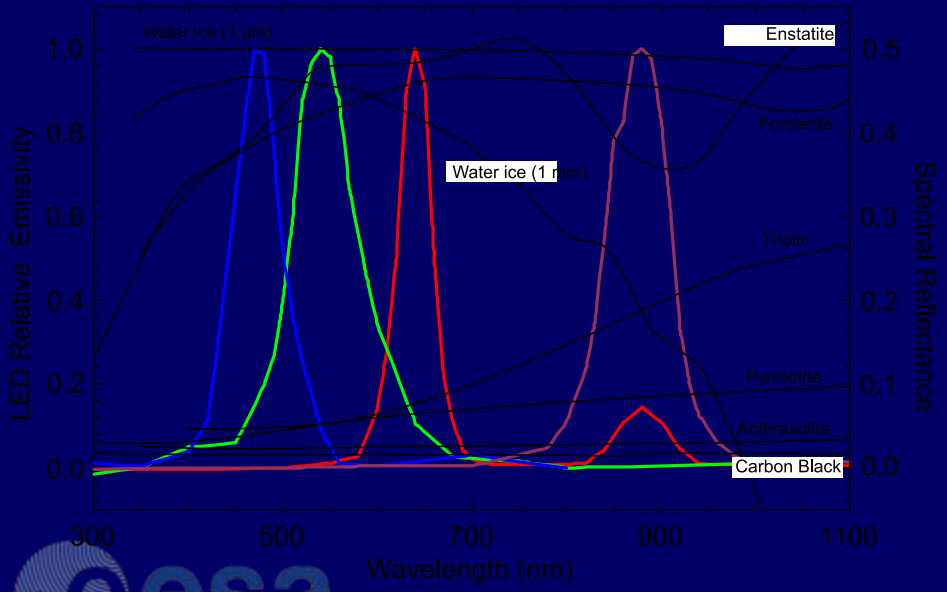


Rosetta Lander Imaging System (ROLIS)

Decent and Down locking Camera

Multispectral imaging in four spectral channels (FOV) of 57.7° x 57.7°

Mass: 405g, power consumption: 2.2 W.



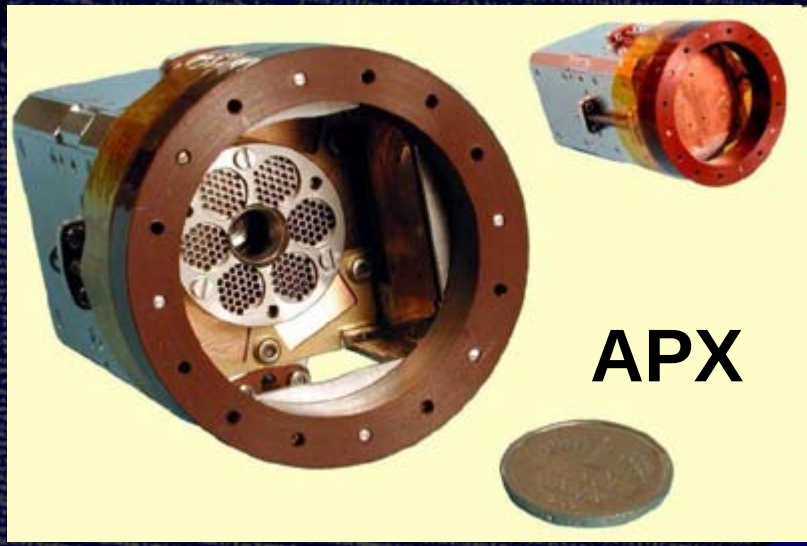
Alpha X-Ray Spectrometer (APXS)

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

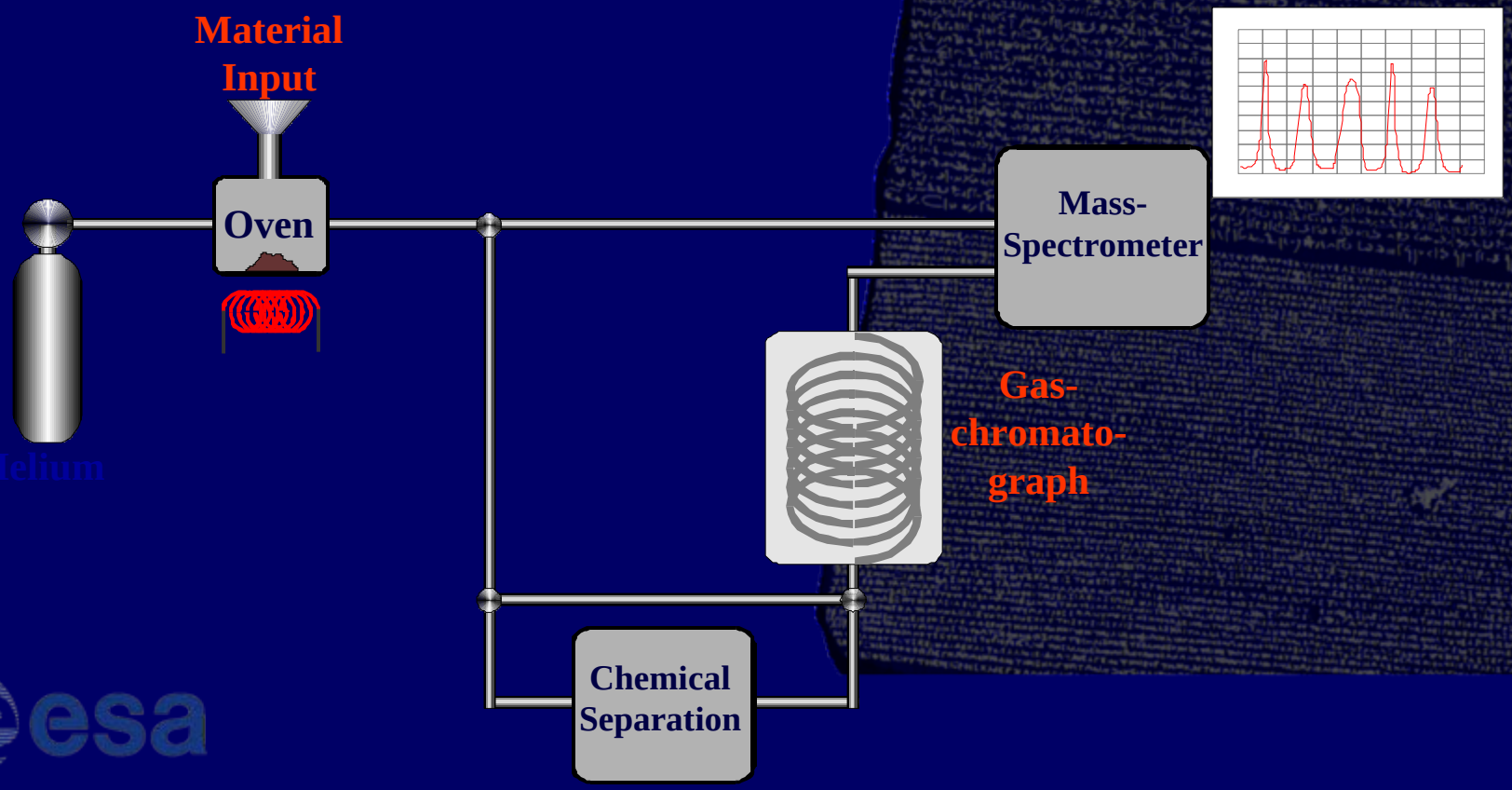
Mass-resolution 3000

Up to 1000 amu

Pyolemy

Isotope analysis (H, C, N, O)

Chemical separation

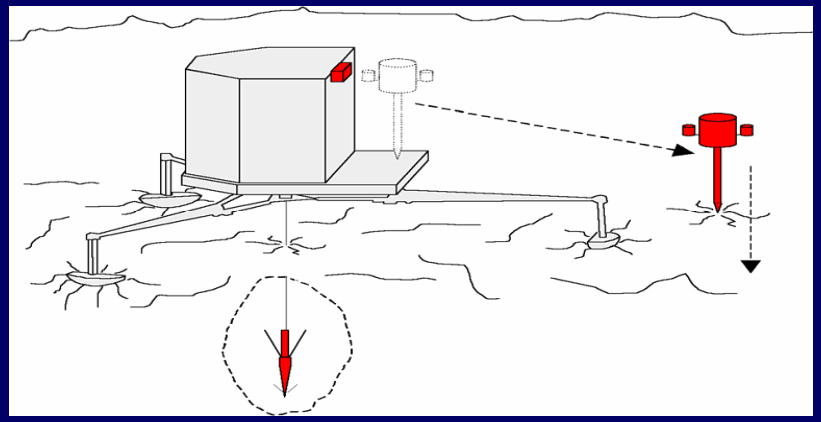


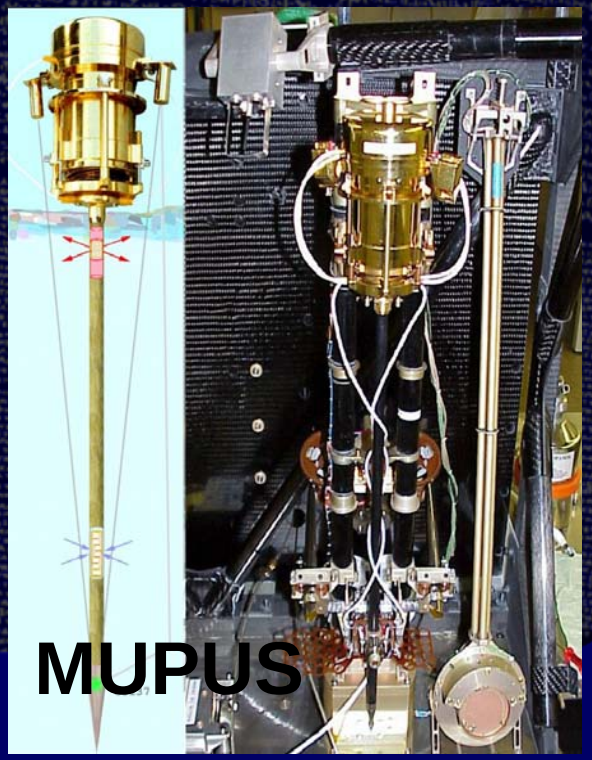
Multi Purpose Sensor package (MUPUS)

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

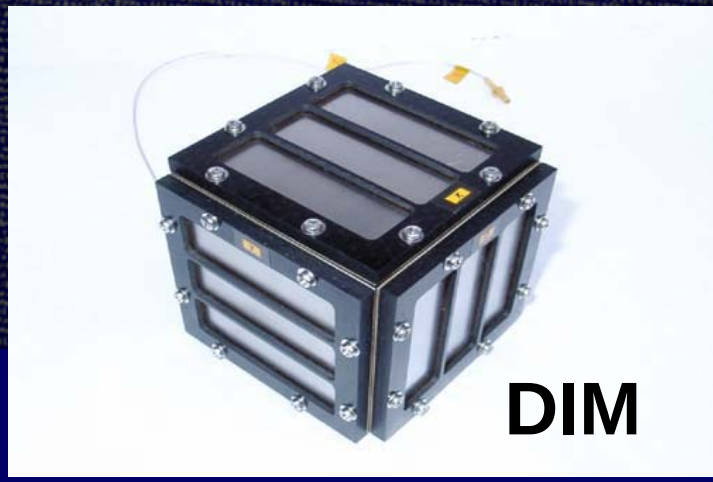
Penetrator on deployment arm,
temperature sensors, in anchors, housing and pen.
Mass: 2.35kg, power consumption: 2.2 W.





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

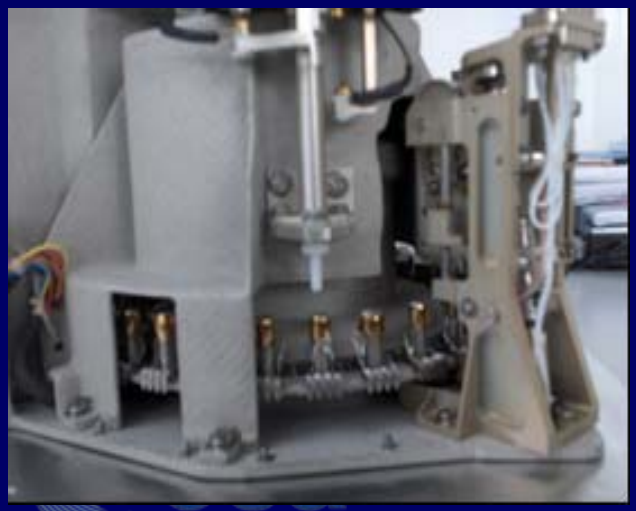
Pirani and Penning pressure sensors
- cover 10^{-8} – 10 mbar

The sensors are situated on a short boom.
Mass: 1kg, power consumption: 1 W.

Sampler Drill and Distribution System (SD^2)

Drill sampling tube

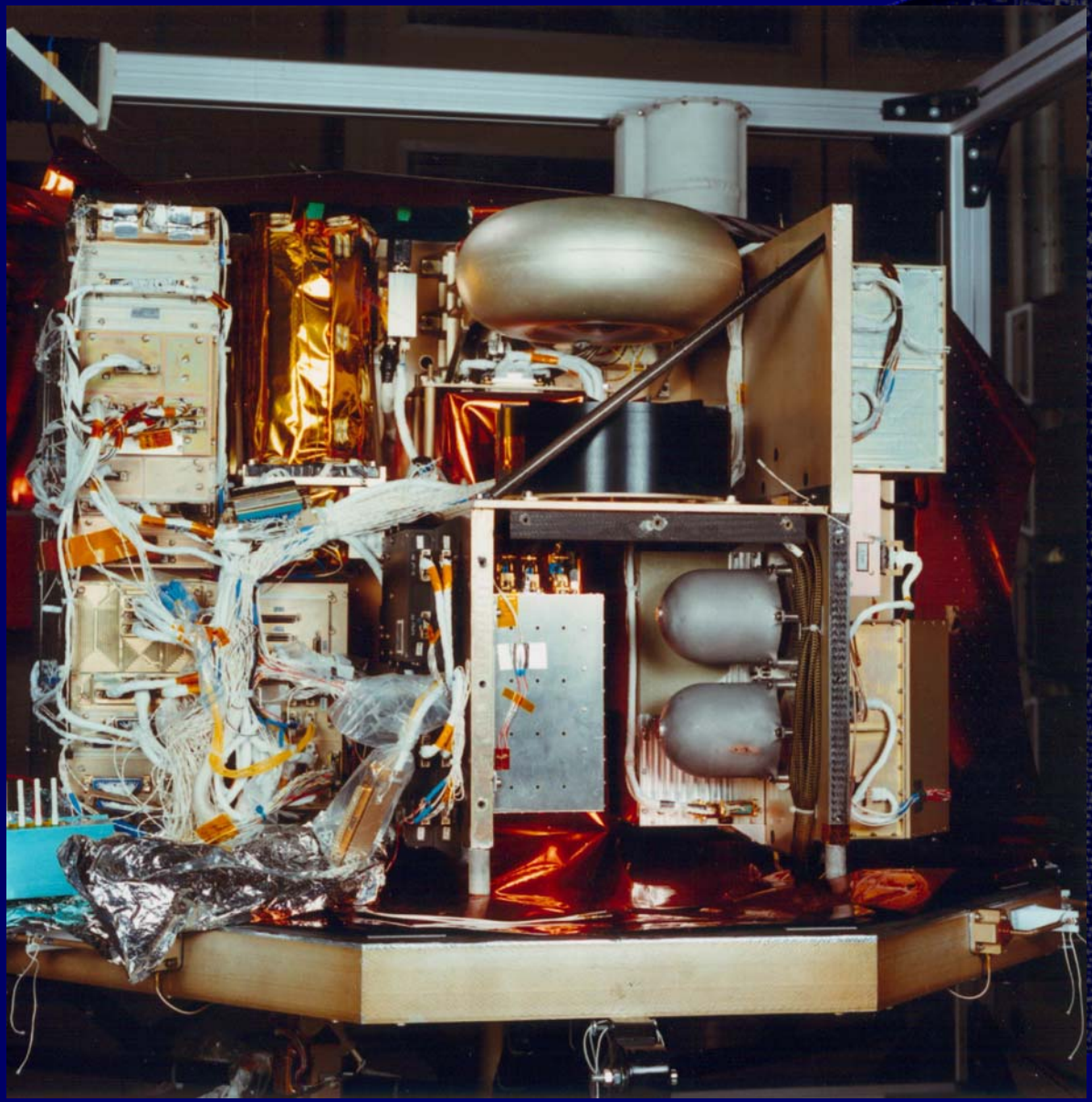
Medium temp. oven with sample

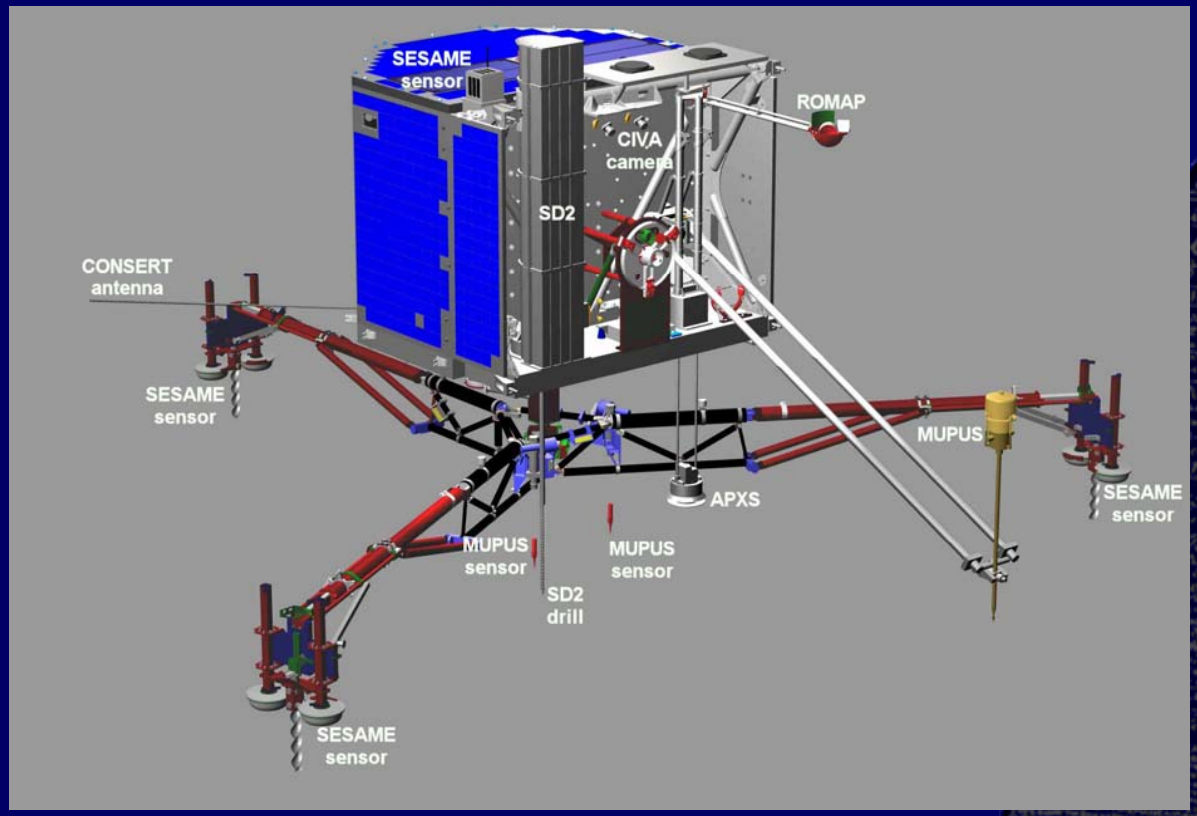


Carousel, ovens, tapping station

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


Drill (SD²)
SESAME sensor
CIVA camera
CIVA camera
CIVA camera
CIVA camera
ADS
COSAC
Batteries
Flywheel
TxRx
PTOLEMY
COSAC
CONSERT antenna
CONSERT antenna





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

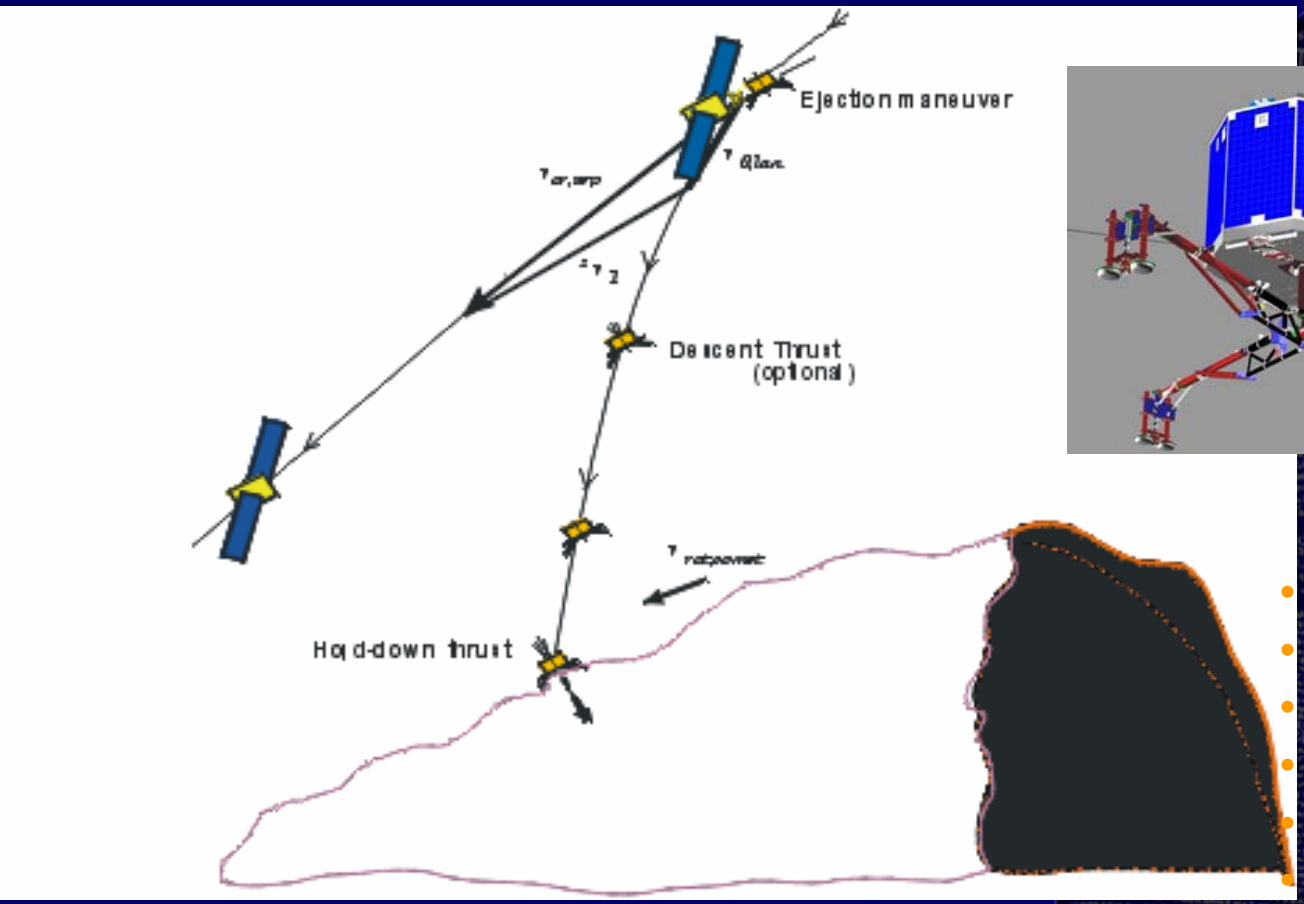
Energy- und Thermal-Concept

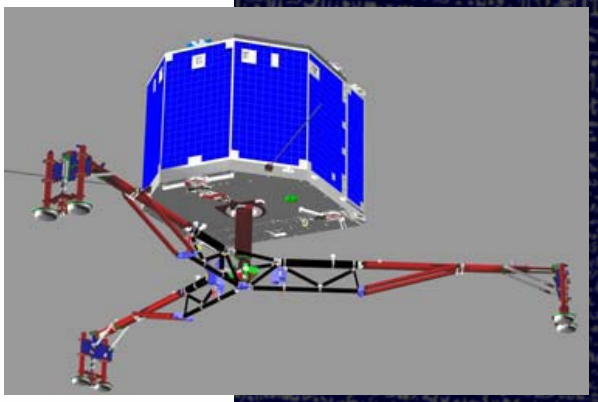
Solar generator 11 W (at 3AU)
Primary and secondary batteries
„warm“ und „cold“ Areas

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