EXOMARS

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4th IPPW

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ALCATEL ALENIA SPACE
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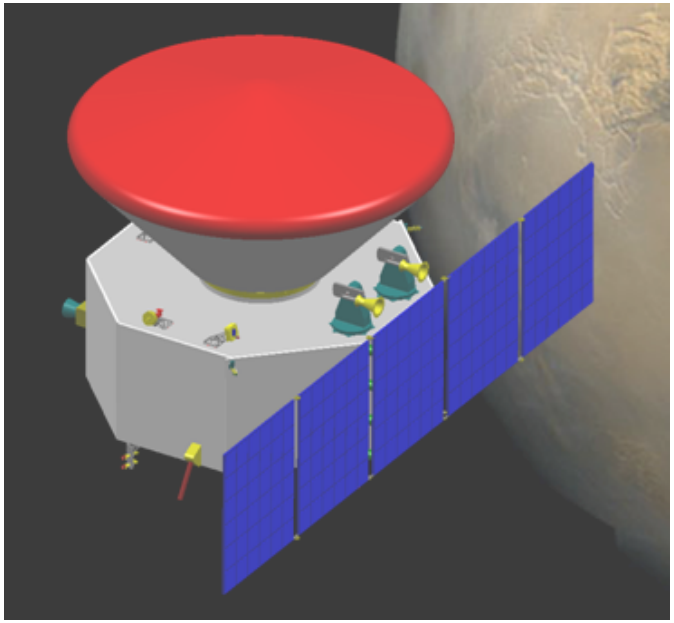
MISSION OBJECTIVES AND ARCHITECTURE

EXOMARS is the first ESA robotic Mission to Mars. The program has been approved in Dec 2005 Italy being through ASI, the major contributor. The main objectives of the mission are:



- ➔ search for signs of past and present life on Mars
- ➔ technology development/validation, in particular: EDLS, Rover, Drill/SPDS

The mission architecture consists of:

- Carrier / Orbiter
- Descent Module carrying the GEP (Geophysical and Environmental Package and the Rover with Pasteur Payloads

MISSION SCENARIOS (1)

The following mission scenarios are considered to be traded off at the end of 2006:

a. a single Soyuz 2b launch of the Composite Spacecraft formed by a Carrier Module and a Descent Module (including the GEP and the Rover with its Pasteur Payload). For this scenario the function of data relay spacecraft is performed by the NASA Mars Reconnaissance Orbiter (MRO).

b. use, as data relay spacecraft, of a European Mars Orbiter launched with a second Soyuz launch. The Composite Spacecraft is the same as per scenario a. above.

c. a single Ariane 5 ECA launch, with a larger DM (including the Rover with its Pasteur Payload) released by an Orbiter carrying a scientific payload and acting as data relay spacecraft.

Launch with Soyuz from Kourou in 2011; the mission shall be compatible with launch in 2013.

Launch with Ariane 5 from Kourou in 2013;

MISSION SCENARIOS (2)

Arrival	June 2013 with 2011 launch (delayed trajectory in order to avoid the dust storm season)
Landing	Direct entry from hyperbolic trajectory (Soyuz) Entry from hyperbolic or Mars orbit (AR5)
Landing Range	Latitudes between 15º S and 45º N, all longitudes - Altitude ≤ 0 km, relative to the MOLA zero level
Landing Accuracy	+/- 25 km
Mars Surface Mission Duration	6 month minimum lifetime for Rover with Pasteur Payload Several years for the GEP Payload

DESCENT MODULE

The DM will perform the Coasting and EDL, carrying two passengers onto the Mars surface :

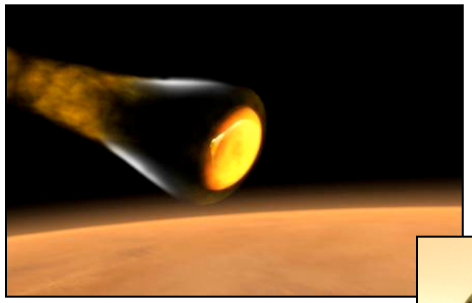
- the high-mobility Rover Module, which carries the Pasteur Payload
- the GEP (Geophysical and Environmental Package)

- DM Mass for Soyuz mission ~ 1000 kg (including 20% system margin)
- DM Mass for AR5 mission: an increase in the order of 10-15% with respect to the Soyuz configuration will be studied in order to increase volume and mass allocation to Payload
- Energy ~700 Wh for EDL
- X-band tones to Earth and UHF link with MRO during coasting and EDL

Two landing solutions are being studied:

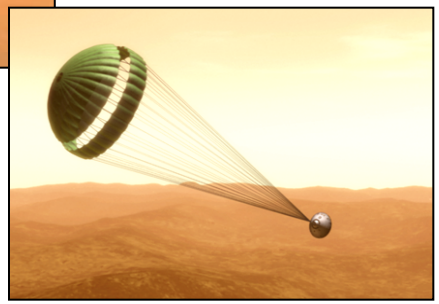
- Non-vented Airbags
- Vented Airbags

DESCENT MODULE: EDL



Entry

Energy dissipation via aerodynamic drag;
Velocity Range: start ~5.4 km/s end ~430 m/s (TBC).

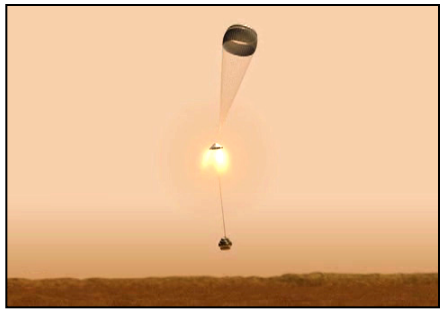


Parachute Descent

Energy dissipation via aerodynamic drag;
Velocity Range: start ~430 m/s end ~85 m/s (TBC).

Retrorockets

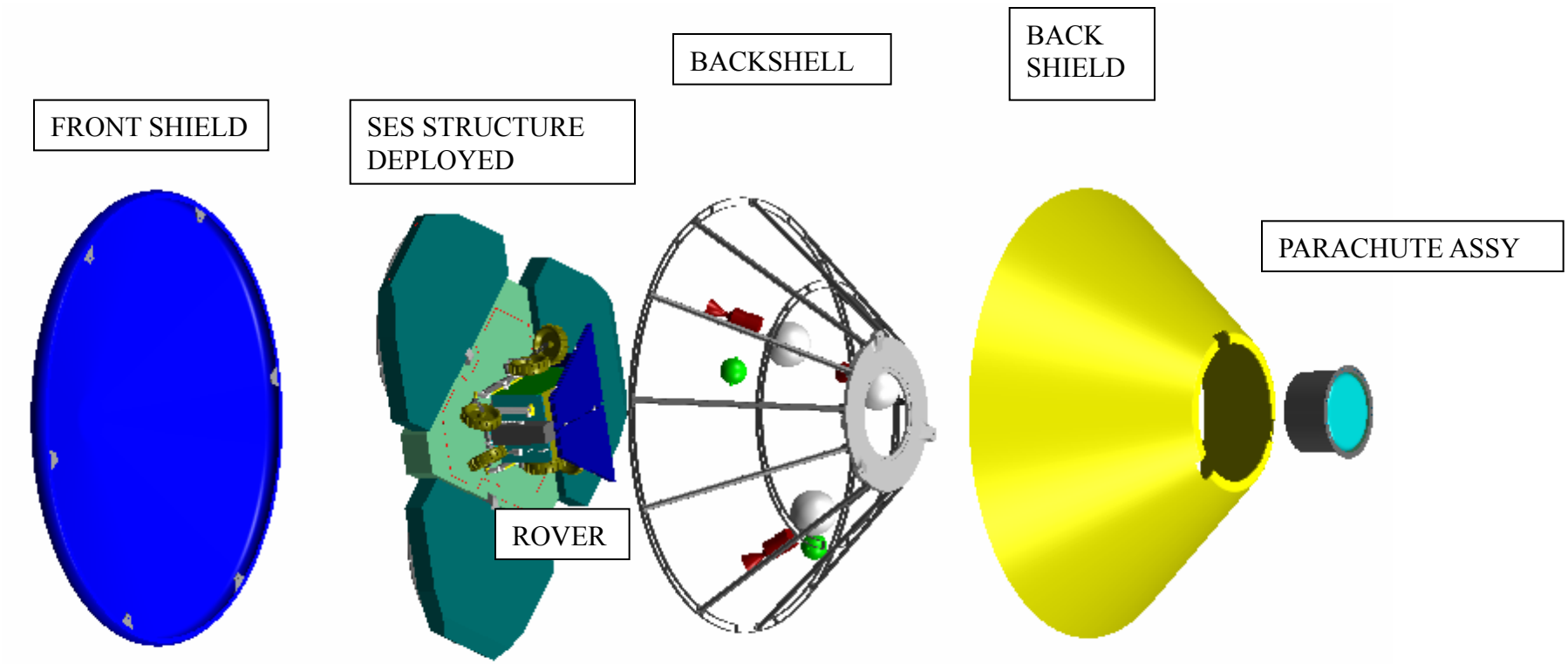
Energy dissipation via propulsive impulse;
Velocity Range: start ~85 m/s end ~10-15 m/s (TBC).



Landing

Landing with airbags
Velocity Range: start ~10–15 m/s end 0 m/s (TBC).

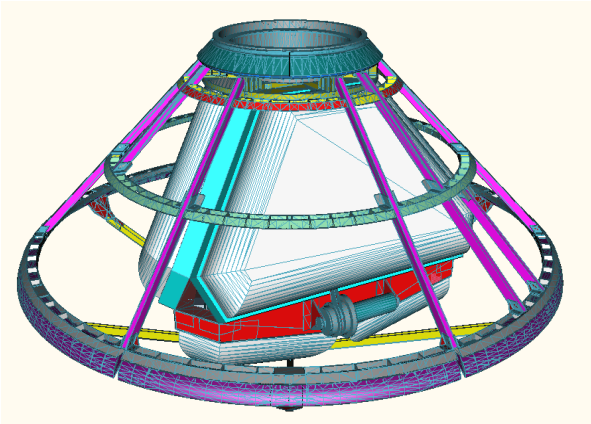
DESCENT MODULE CONFIGURATION

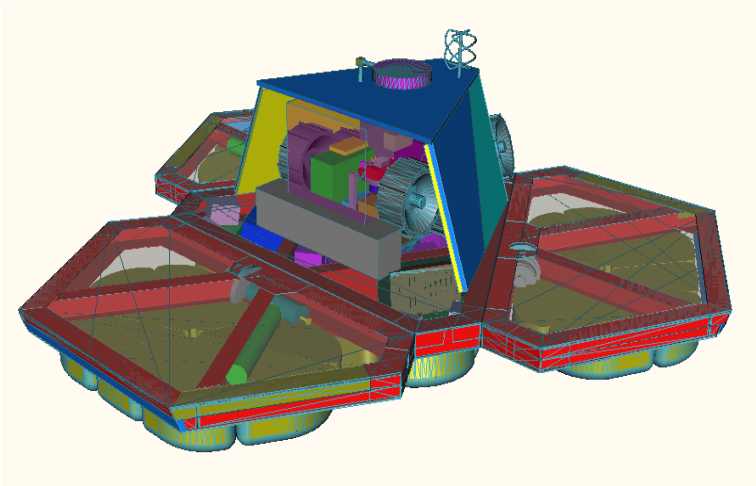


DESCENT MODULE

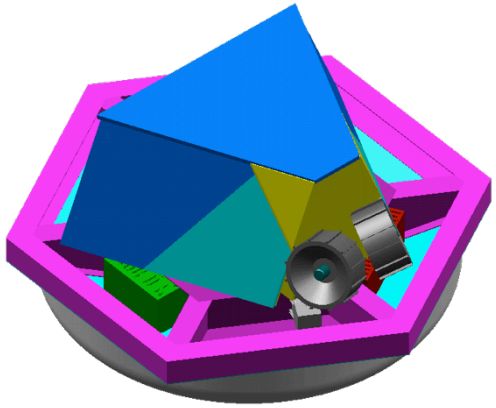
Support and Egress System:

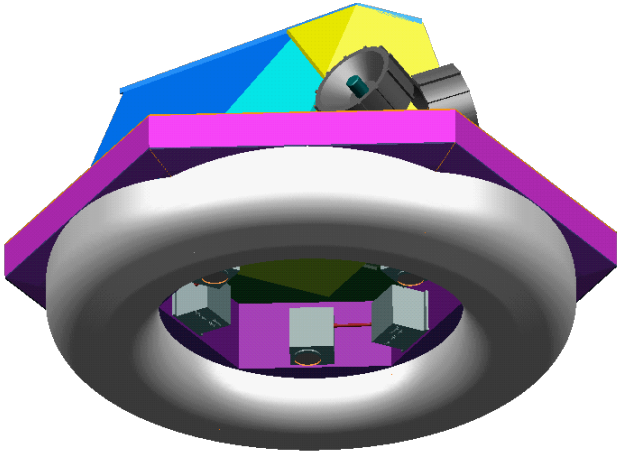
Vented





Non Vented





ROVER and Science

Remote

Contact Suite

Analytical Lab.

CONTEXT
PanCam
IR Spectrometer
Ground Penetrating Radar

Close-up Imager
Mössbauer
Raman-LIBS external optical heads

Microscope IR
Raman & LIB
Spectrometers
XRD

ORGANICS/LIFE
MOD/MOI
GC-MS
Life Marker Chip

ENVIRONMENT
Dust & H_2O
Ionising Rad.
UV Rad.
P, T, Wind

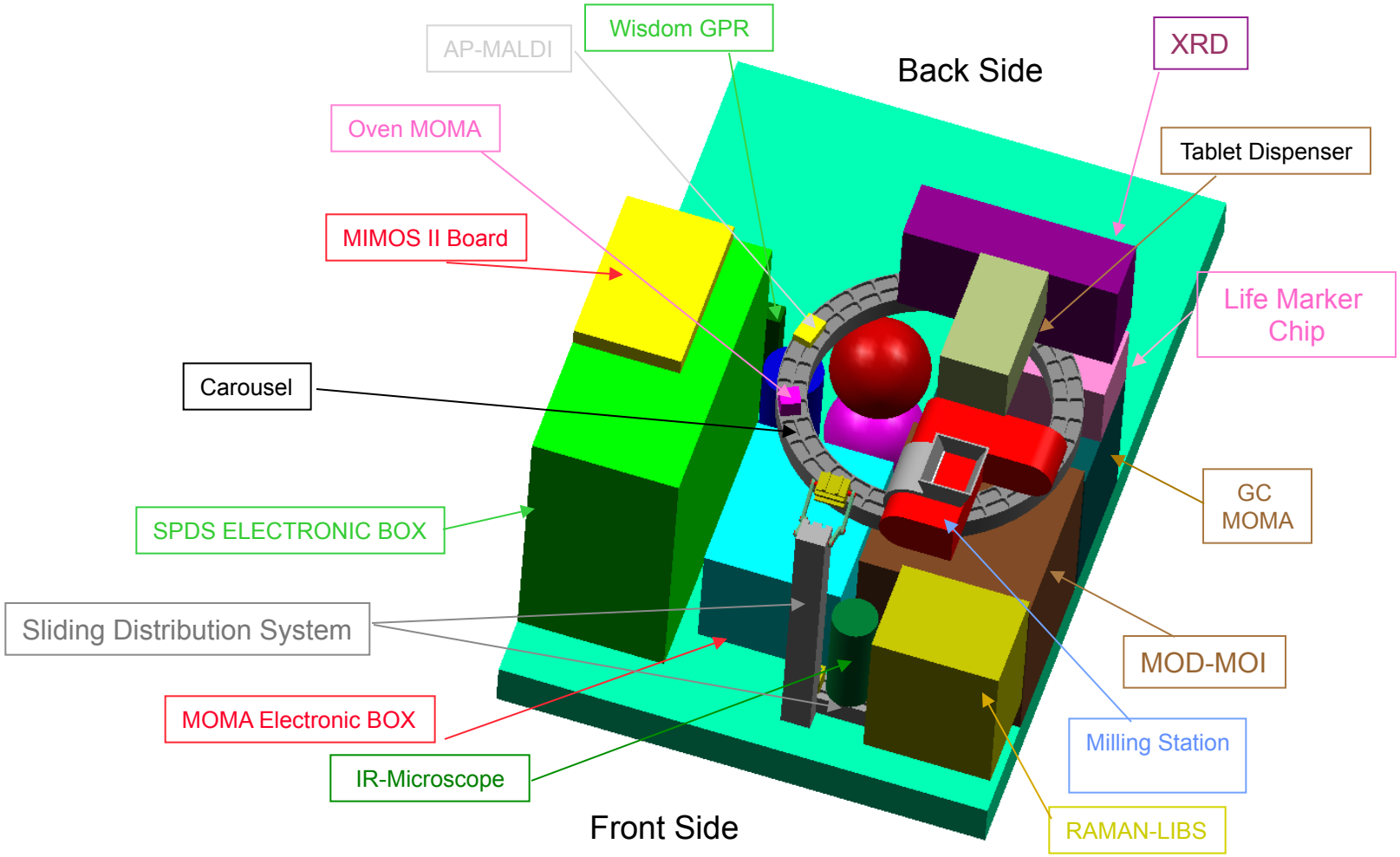
INSTRUMENTS SUPPORT EQUIPMENT

Drill System
(Surface and 2 m depth)
Includes Borehole IRS

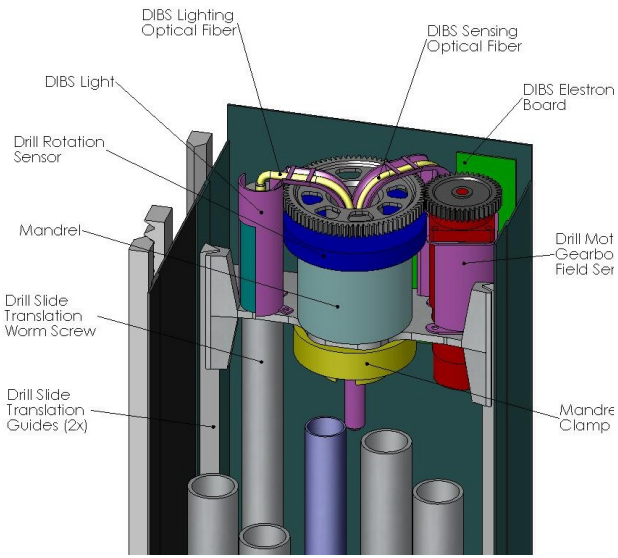
Sample Preparation & Distribution System (**SPDS**)

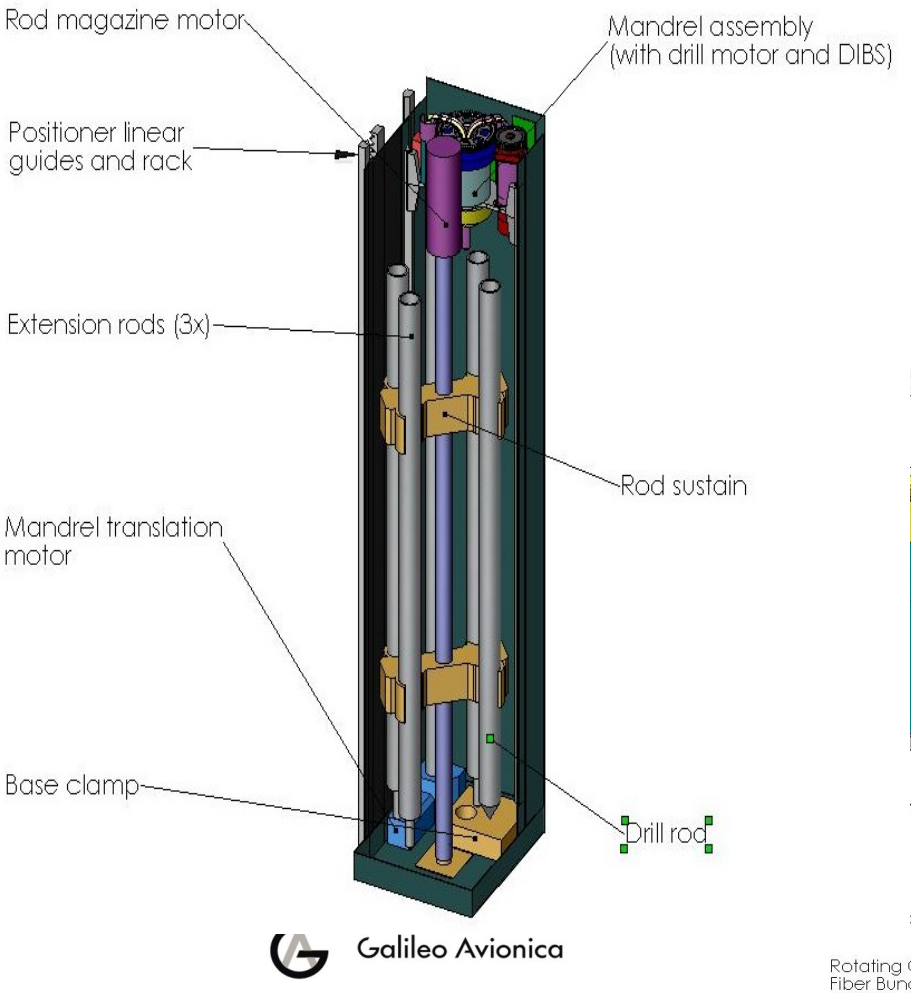
To be accommodated into GEP

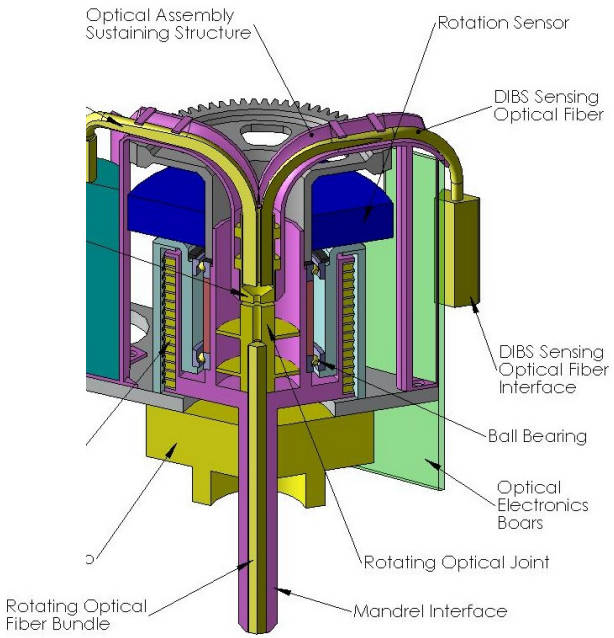
ROVER - Instruments Accommodation



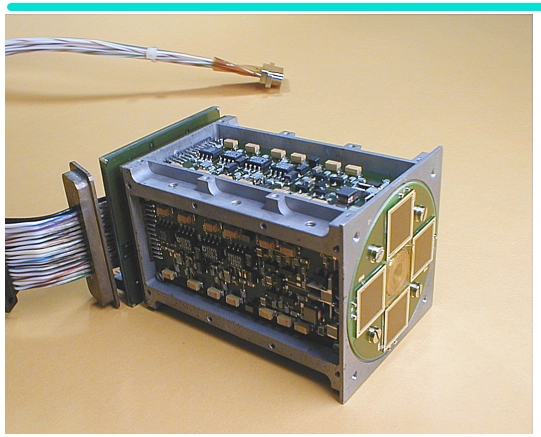
DRILLER


DIBS Lighting
Optical Fiber
DIBS Sensing
Optical Fiber
DIBS Light
DIBS Elestron
Board
Drill Rotation
Sensor
Mandrel
Drill Mot
Gearbo
Field Ser
Drill Slide
Translation
Worm Screw
Drill Slide
Translation
Guides (2x)
Mandre
Clamp

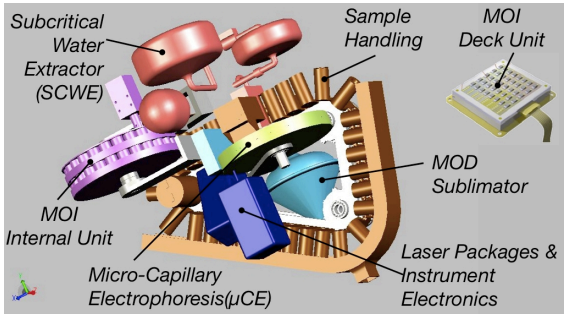

Rod magazine motor
Mandrel assembly
(with drill motor and DIBS)
Positioner linear
guides and rack
Extension rods (3x)
Rod sustain
Mandrel translation
motor
Base clamp
Drill rod
Galileo Avionica


Optical Assembly
Sustaining Structure
Rotation Sensor
DIBS Sensing
Optical Fiber
DIBS Sensing
Optical Fiber
Interface
Ball Bearing
Optical
Electronics
Boars
Rotating Optical Joint
Rotating Optical
Fiber Bundle
Mandrel Interface

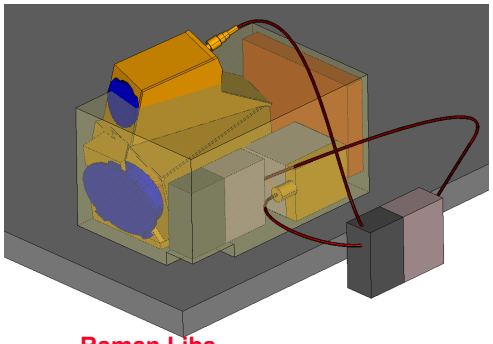
EXOMARS INSTRUMENTS



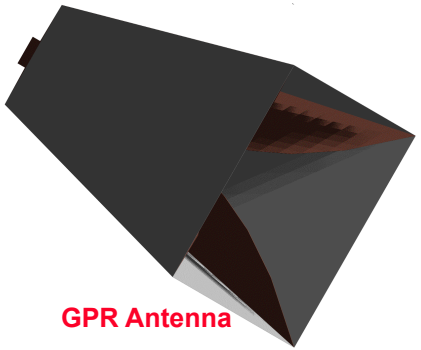
Mossbauer optical head



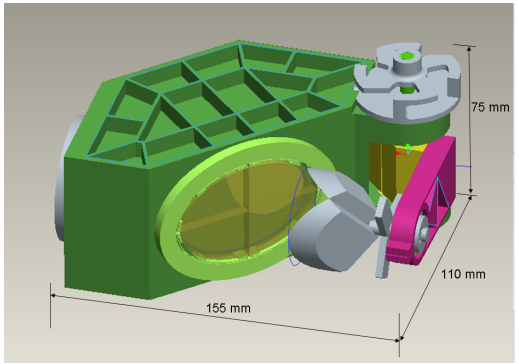
MOD MOI



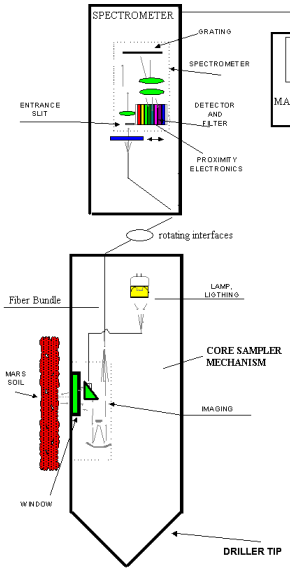
Raman Libs



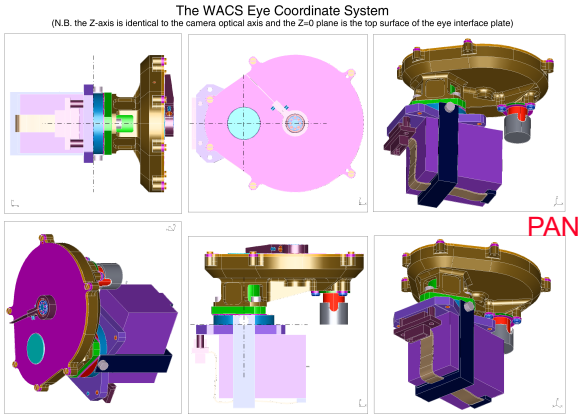
GPR Antenna



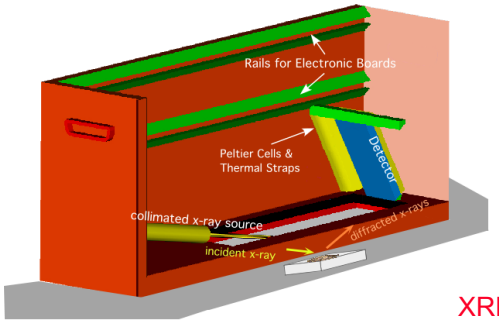
MIMA



DIBS



PAN CAM



XRD

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EXOMARS

PHASE B1 PROGRAMMATICS

- Prime Contractor is Alcatel Alenia Space - Italia
- Kick-off of phase B1 was in October 2005 completion by Mar 2007
- Spacecraft Composite Requirements Review completed in February 2006
- Mission System Requirements Review planned for December 2006

PHASE B1 OBJECTIVES

- Requirements consolidation of the mission and the main system elements
- Design definition for the mission, the main system elements and S/Sand accommodation of the Scientific P/Ls
- *Bread-boarding of:*
  - *Airbags (vented and non-vented)*
  - *Rover Chassis and Navigation*
  - *Drill/Sample Handling System*
  - *DM GNC*

TRANSITION TO PHASE C/D

- Phase C/D Committing Programmatic and Financial Data Package to be delivered to ESA by the end of 2006
- The ESA / Member States Mission Implementation Review planned early 2007 shall finally decide on:
  - The mission scenario (among the different options described above).
  - The final payload configuration
  - The launch date for the mission
- B2 – C/D K.O. expected second quarter 2007, following the Implementation Review