ExoMars Rover Vehicle

European Industry Day

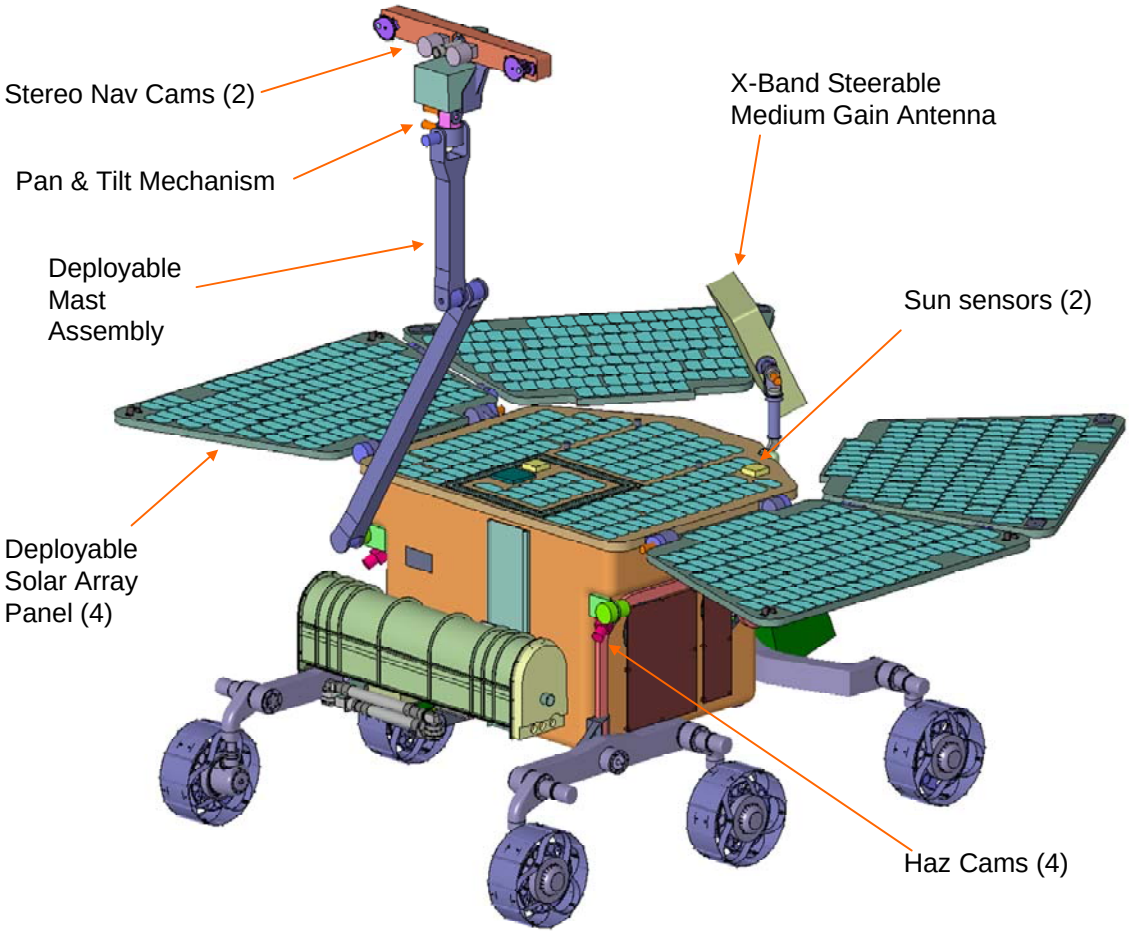
TAS-I, Turin

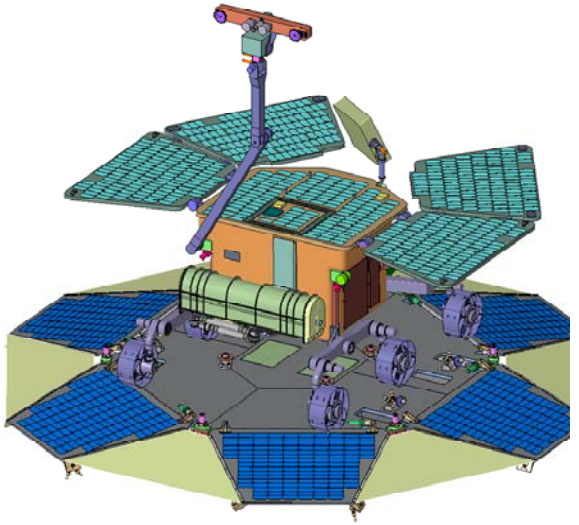
29 May 2008

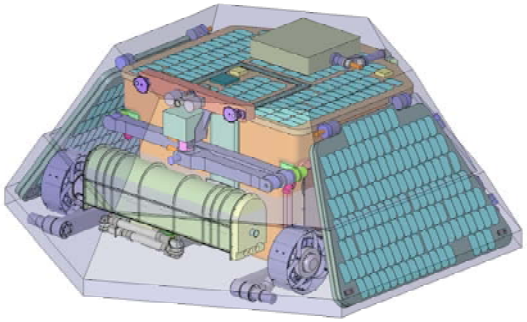
Mark Roe
Rover Vehicle Project Manager

All the space you need

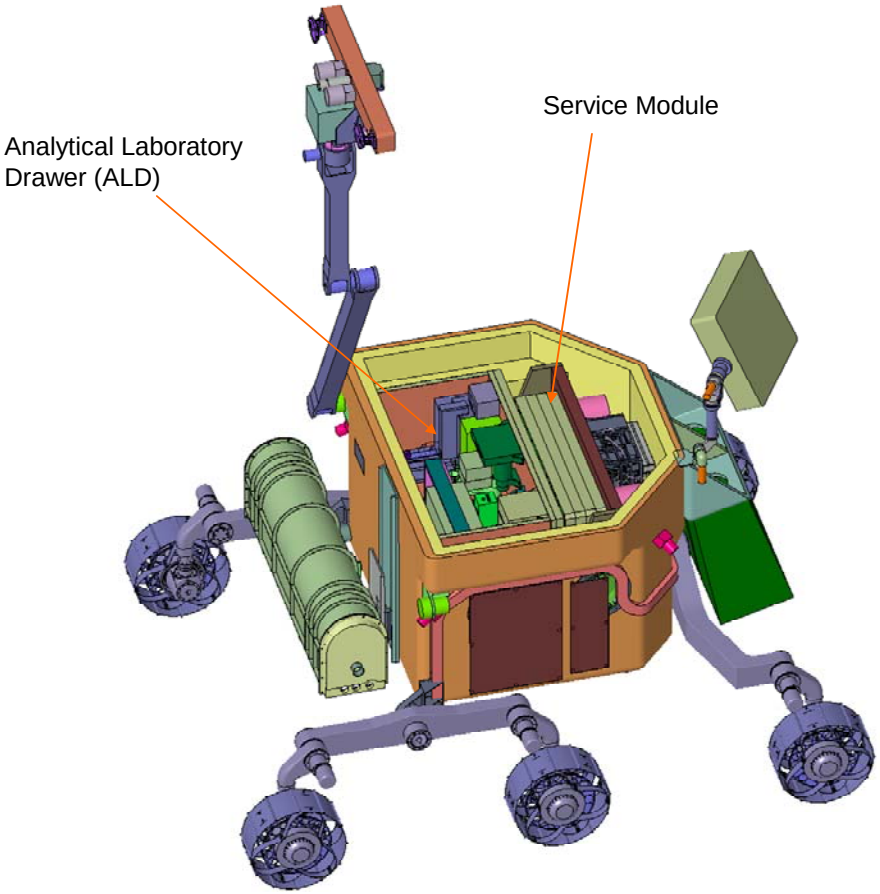
Rover Vehicle Configuration (1)

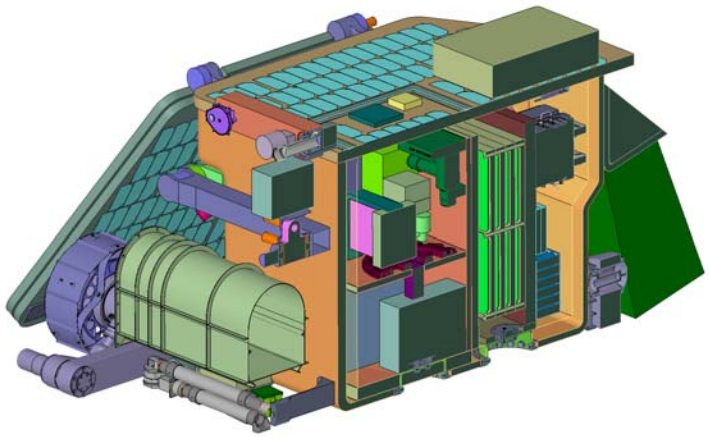




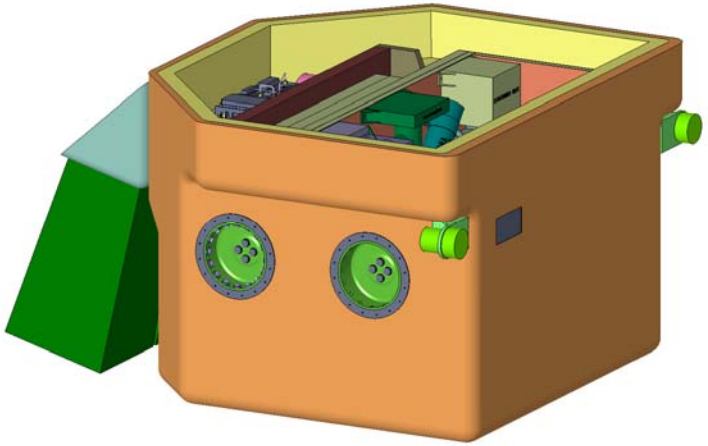


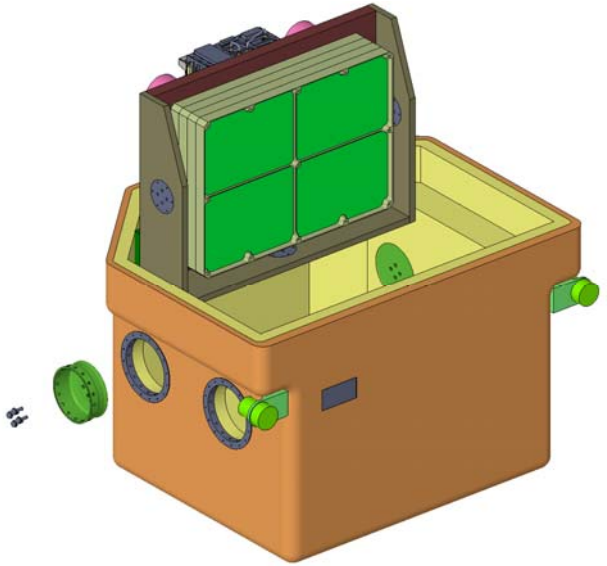
Rover Vehicle Configuration (2)

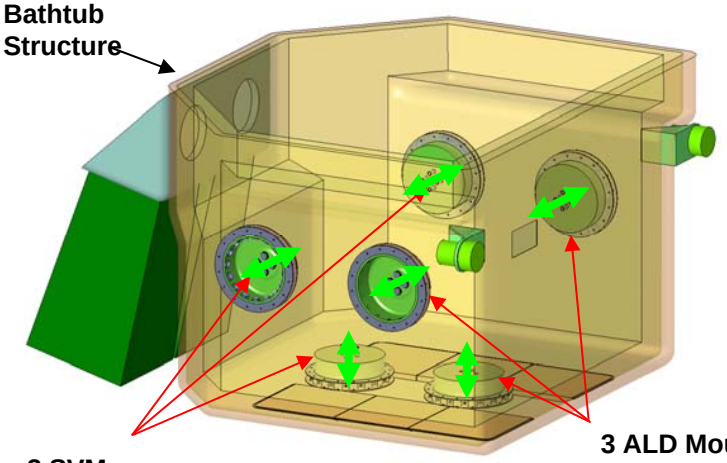




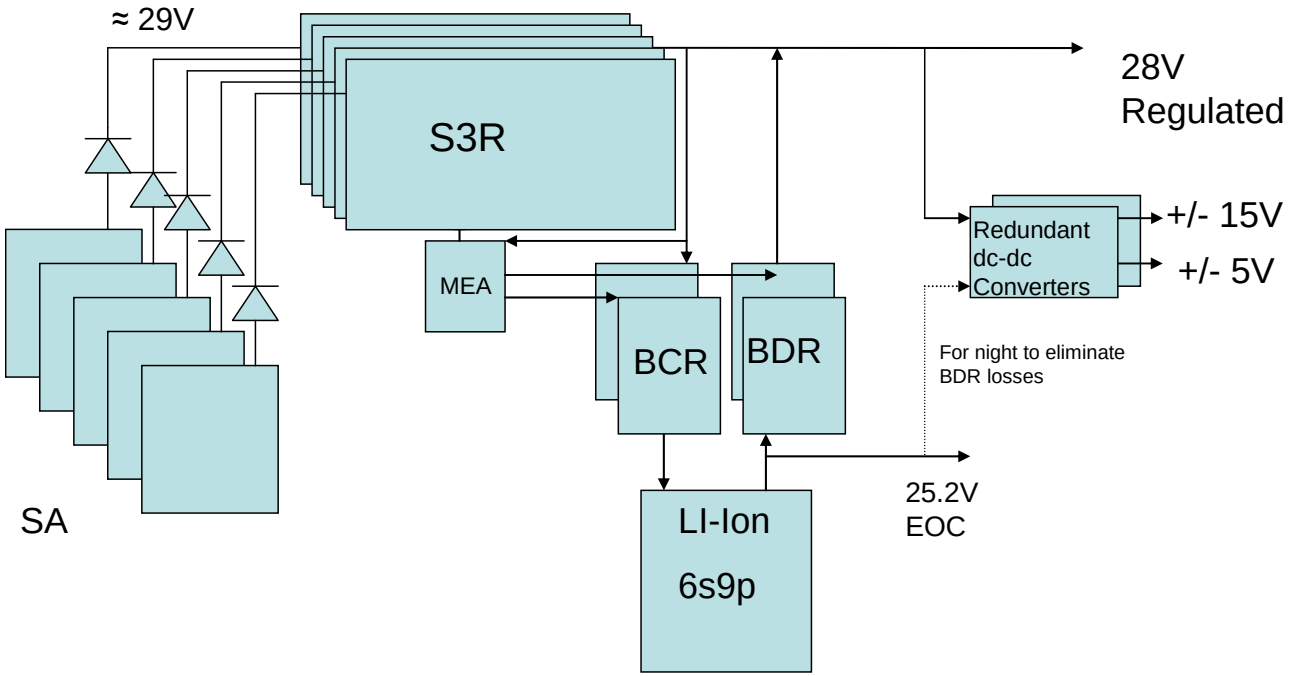
Body Structure







Power Sub-system Architecture

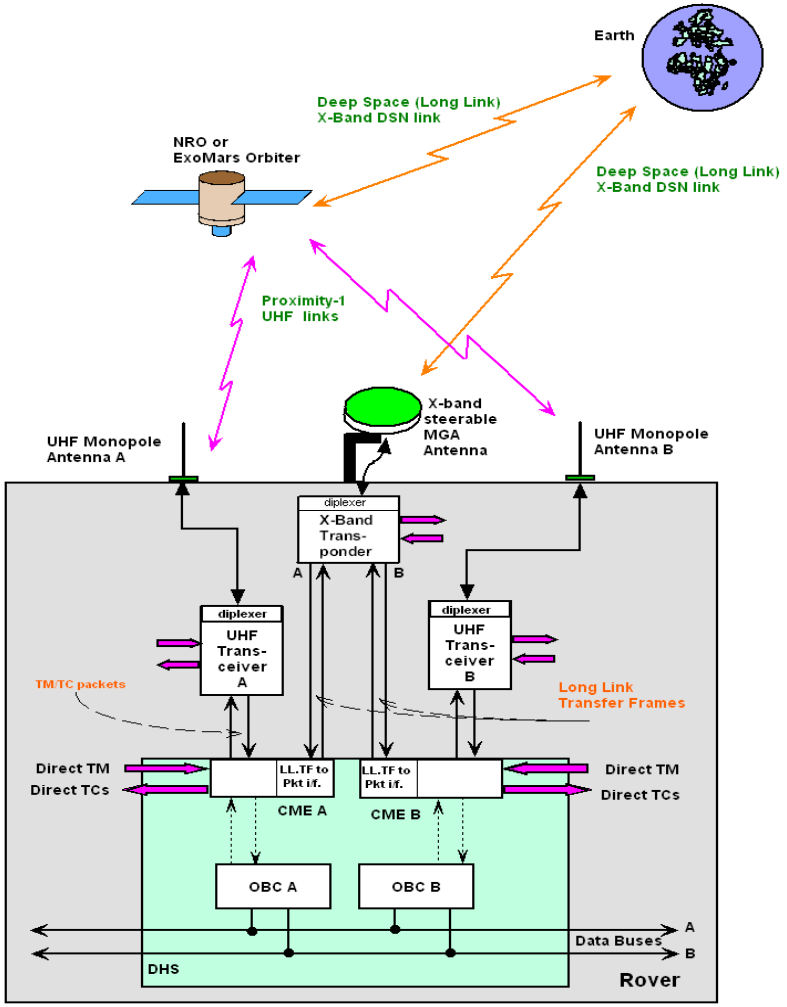


- Battery
  - li-Ion
  - Direct Negotiation
- Solar array
  - 2.6m2 total area
  - Total of 5 panels
  - 300watts
- PCDE
  - Direct Energy Transfer
  - LCL's 20+20

Communications Architecture

- UHF
  - Redundant UHF Transceiver
  - Redundant RF Path
  - Proximinty-1 standard
  - 2 Monopole UHF antennae
  - Transceiver ITT released May08

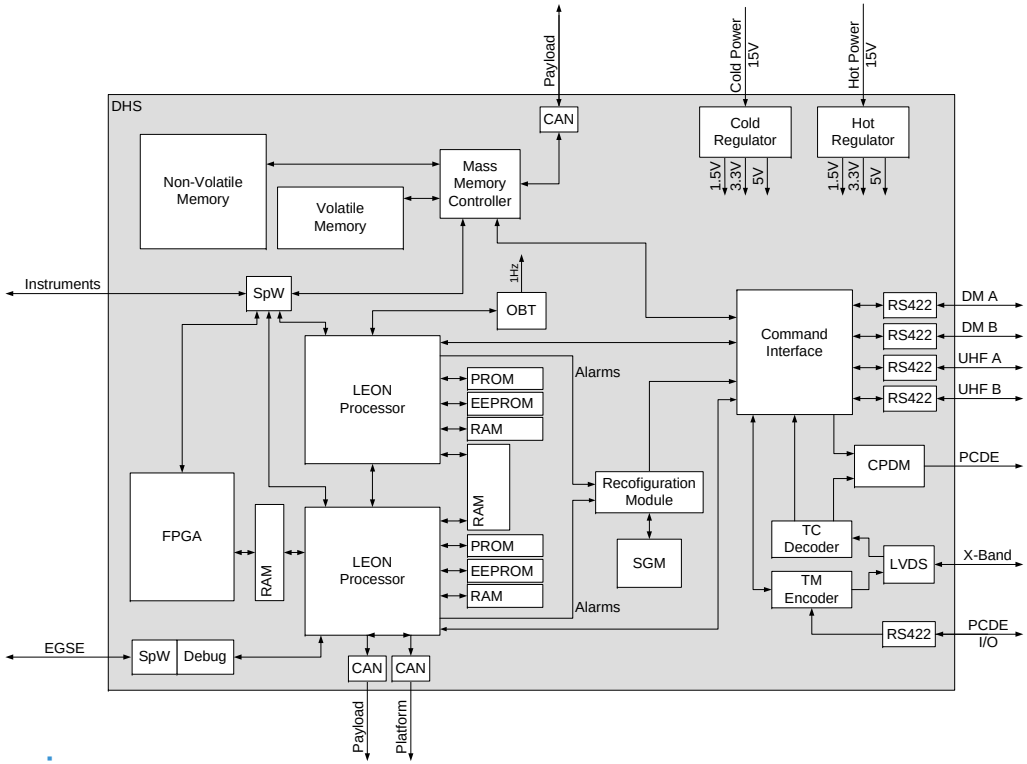
- X band
  - Single MGA on 2-axis APM
  - Single rf chain
  - Transceiver



Onboard computer

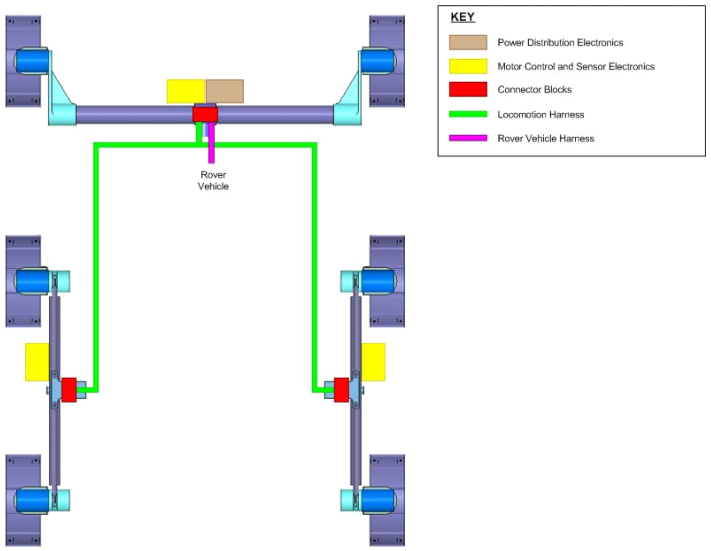
- Processor module
  - LEON based processor(s)
  - FPGA based algorithm co-processor(s)
  - SpW for high speed instruments
  - CAN, RS 422 data bus
  - RTEMS & TBD SOIS services
  - Hardware “Co-processing”

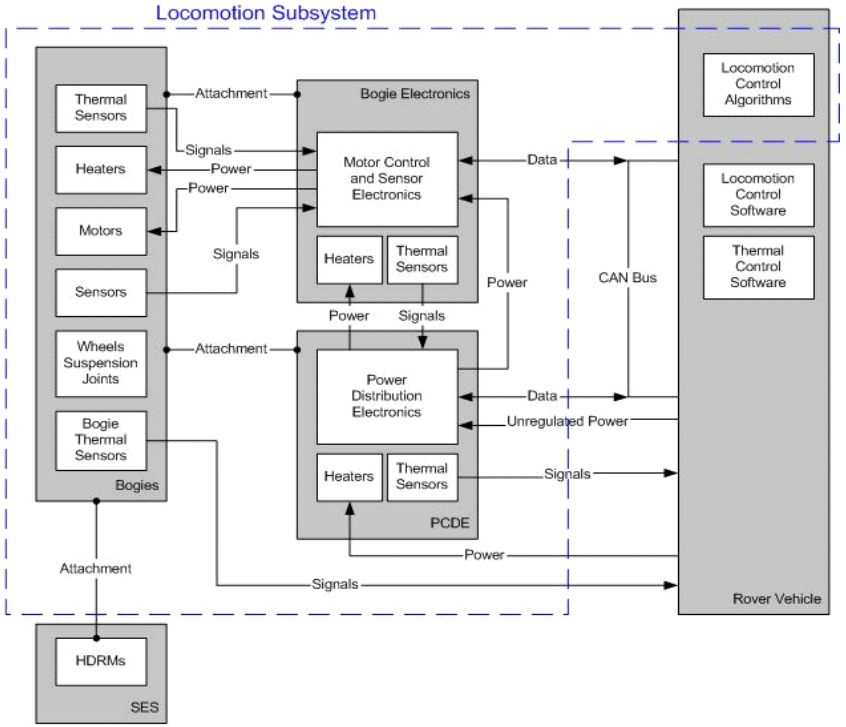
- Mass Memory Electronics
  - Predominantly non-volatile
  - Multiple software images
  - Volatile for temp instru. data storage
  - Partitioned for FAT file mgmt. sys
  - Data storage as files or packets
  - CAN & SpW i/fs
  - EDAC protection



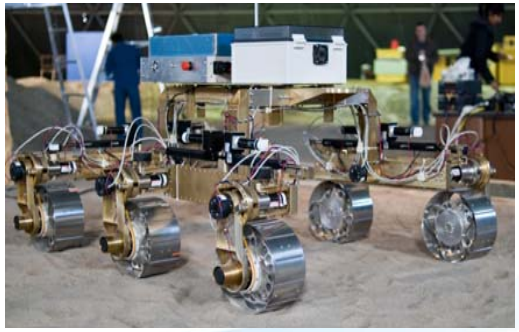
- Command and Monitoring Electronics
  - Transceiver interfaces & switching Telecommand decoding
  - High priority telecommand to PCDE
  - HKTM packet encoding
  - OBC reconfiguration
  - On Board Time

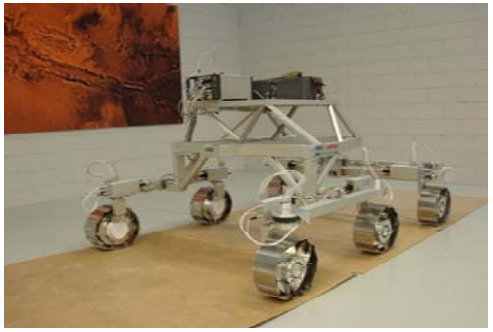
Locomotion Subsystem





- 6 wheel, 21 DOF system
- Includes Electronics Drive system
- Flexible wheels baselined
- *Building on existing BB activities*

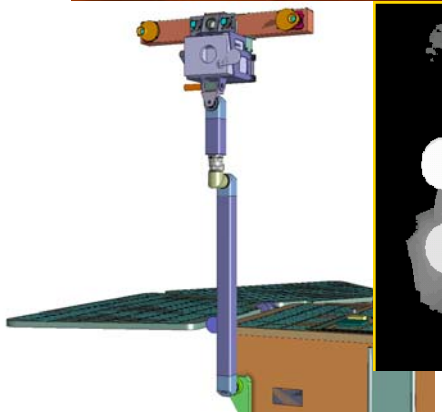


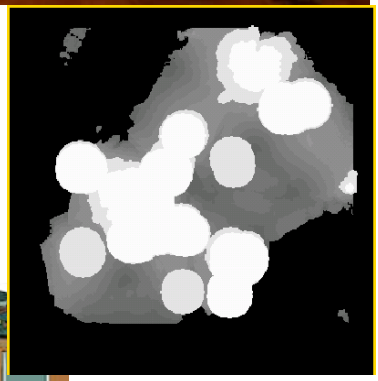


Traverse and Navigation

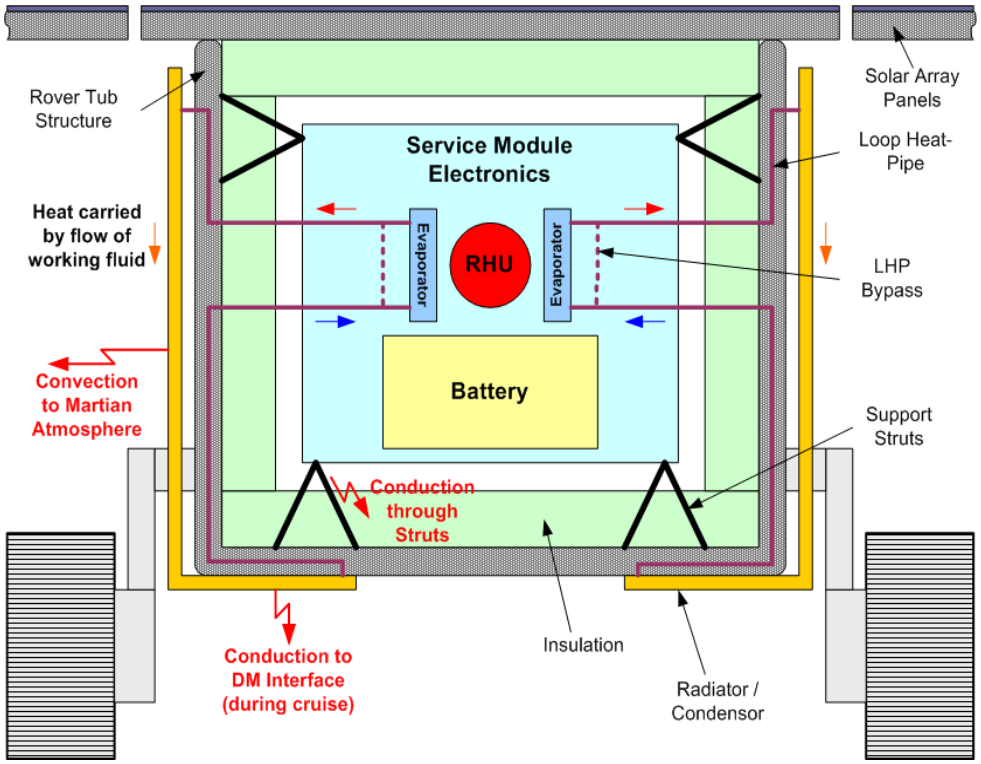
Navigation concept relies on a wide set of equipment consisting of:

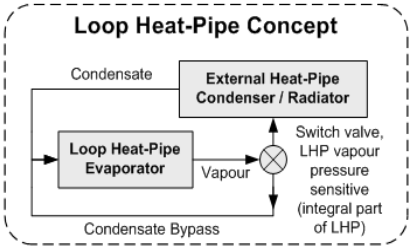
- Navigation Cameras (mounted 2m above the surface at the top of the mast)
- Visual Odometry
- Inertial Measurement Unit
- Sun Sensor
- Mast and Pan & Tilt assembly

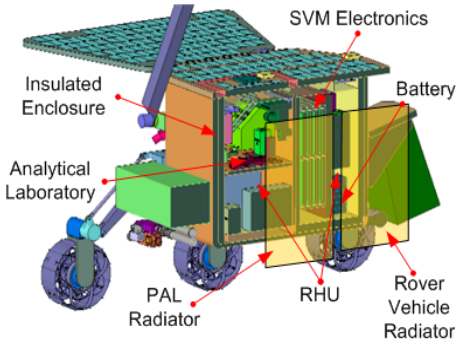




Thermal Subsystem





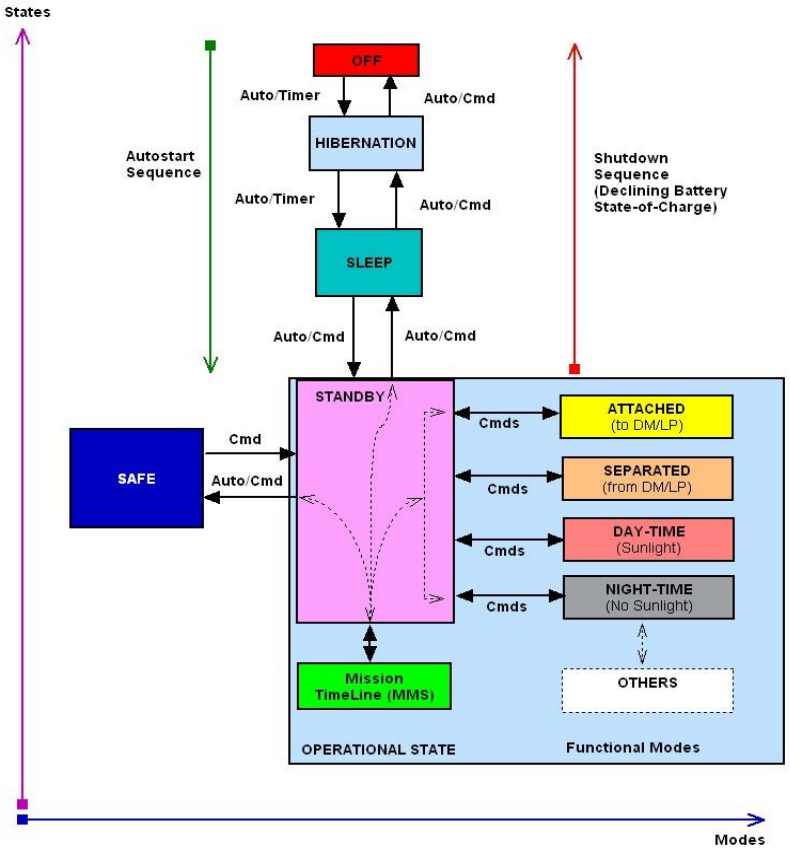


- Loop Heat Pipe system (~15watt)
- Standard Heater elements (mats, etc) supporting electronic control loops

Onboard SW and Operations

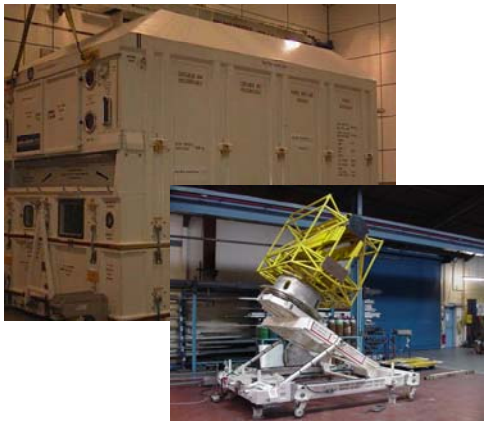
- Architecture and Requirements Definition ongoing
- Features:
  - RTEMS OS
  - Data Handling Software (providing PUS TC/TM service functionality and some architectural services)
  - On-Board 'File Management' (image storage & retrieval etc)
  - OBCP Interpreter
  - Vehicle Application SW to perform vehicle locomotion control, localisation data processing, 'platform level' management (thermal, power etc)
  - Developed using the C language
  - ECSS standards

- Software subcontracting
  - To be released as 3-4 separate Subcontracts
  - Co-engineering of solution
  - Will combine several functions
  - Sub-Contracting at Code level
  - subcontractor will be responsible for the code and unit test activities
  - Integration support to Astrium



Ground Support Equipment

- MGSE
  - Transport Containers (Asceptic)
  - Turn-over Trolley
  - Vertical Stands



- EGSE
  - Based on “Open Centre “
  - Simulator Front-End Custom interface modules (Sim-FEE)
  - SCOEs (Power, TMTC, Comms)

RV Schedule challenges

- Schedule driven by
  - Launch window (~2years cycle)
  - Integration sequence complexity (PP, CCC etc)
  - *Necessary* model Philosophy

Jun 2009…	Development models & GNC benches
Jun 2010	Qualification Models
Oct 2010	Flight Models

RV Procurement Schedule

Product	Procurement	ITT Release
Locomotion SS	RC (Oerlikon/MDA)	Feb-08
Instrument Arm	OC	Jun-08
UHF Transceiver	OC	Apr-08
X-Band Transceiver	OC	May-08
OBC	OC	Jun-08
PCDE	OC	Jun-08
IMU	OC	Jun-08
Deployable Mast Ass	OC	Jul-08
Rover Body Structure	OC	Sep-08
X-Band Antenna	OC	Jul-08
S/A Assembly	OC	Jul-08
MDE (Option)	OC	Aug-08
Sol Array Hinges	OC	Aug-08
Battery	DN (ABSL)	Sep-08
Radiators + LHP	OC	Sep-08
RAT	OC	Oct-08
Camera System	OC	Oct-08
Sun Sensor	OC	Jan-09
MGSE (Various)	OC	1H-09
EGSE		
SCOE-Power	OC	1Q-09
SCOE-TM/TC	OC	1Q-09
SimFEE	OC	1H-09
Software		
SW Group #1	OC	Q4-08
SW Group #2	OC	1H-09
SW Group #3	OC	1H-09

Contact Details

Mark Roe
Vehicle Project Manager
Tel: +44 (0)1438.77.3330
Email: mark.roe@astrium.eads.net

Chris Draper
Vehicle Industrialisation Manager
Tel: +44 (0)1438.77.3495
Email: chris.draper@astrium.eads.net