

Mission Examples

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Mars Express, Airborne HRSC

Mars Express (ME) - Mission

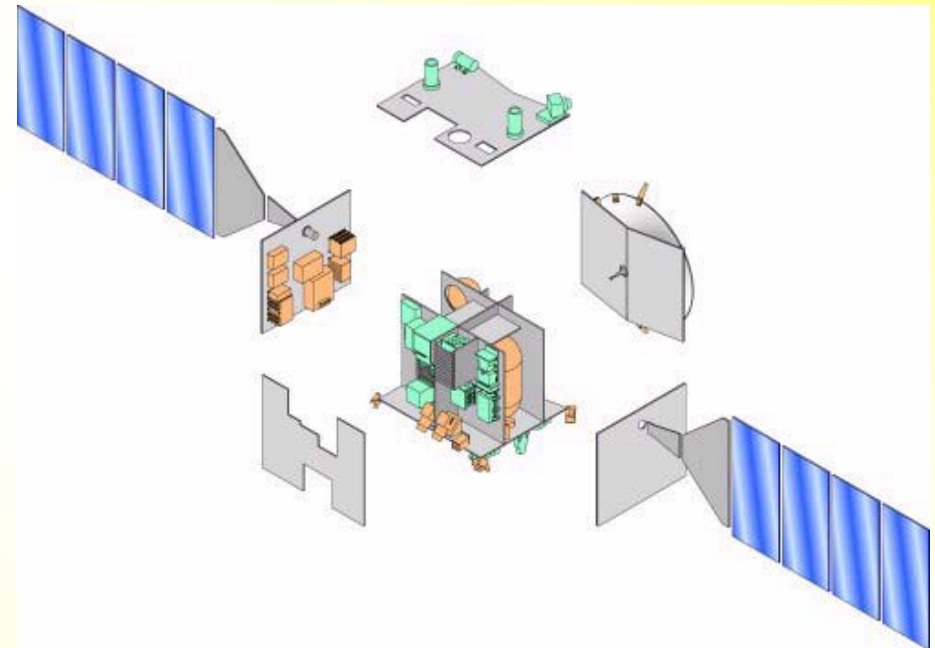
- Monitoring of global climate and surface (water)
- Launch in May 2003 with Russian Soyus-Fregat; arrival in Dec. 2003
- Customer: ESA
- Prime contractor: Matra Marconi Space (Toulouse)
- Cost for design and development at 60 Million Euro



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ME Spacecraft Characteristics

- Mass at launch: 1070 kg
- Dimension: 1.5 m * 1.8 m * 1.4 m
- Payload mass: 116 kg + 60 kg (lander)
- Orbit: 250 km * 10140 km with 86° inclination
- Power: 600 W
- Propulsion: Hydrazin/NTO
- Design life: 2+2 years

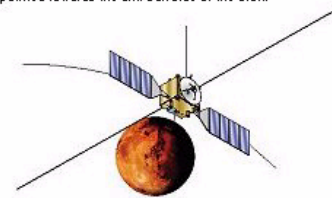


Mission Operations

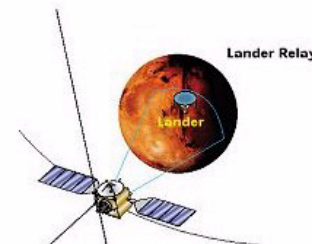
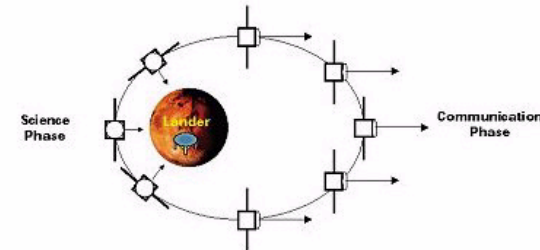
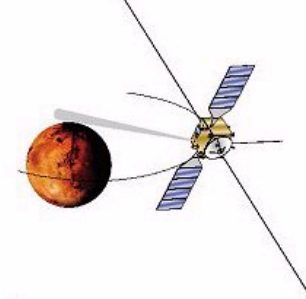
- Science Operation
 - nadir pointing
 - limb pointing
 - lander pointing

- Communication Operation
 - Earth pointing

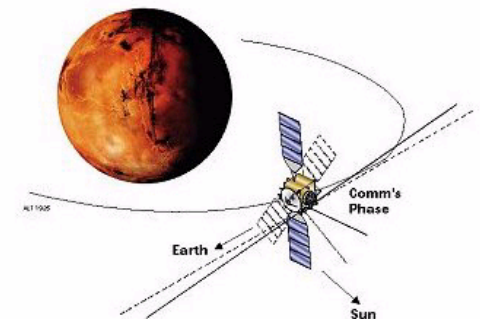
Nadir pointing is used during pericenter passes to collect science data. The orbiter is flying with the solar arrays in the orbit plane, normal to the nadir direction. The flying attitude is chosen such that the instrument radiators are kept pointed towards the anti Sun side of the orbit.



Limb pointing for SPICAM measurements. The spacecraft orientation is very close to nadir pointing. The solar arrays are in the orbit plane. The instrument radiators are kept pointed towards the shadow side of the orbit plane.



During lander relay phases away from pericenter passes, the spacecraft face supporting the relay antenna is pointed towards the Mars surface (eventually biased to avoid direct Sun illumination of other instruments). The solar arrays are Sun pointed and the instrument radiators are kept pointed away from the Sun.



During Earth communications sessions around Mars, the spacecraft uses the same pointing mode as during the interplanetary cruise. A small tilt around the Earth direction is implemented to avoid occultation of the star tracker by Mars.

Mars Express - Payloads

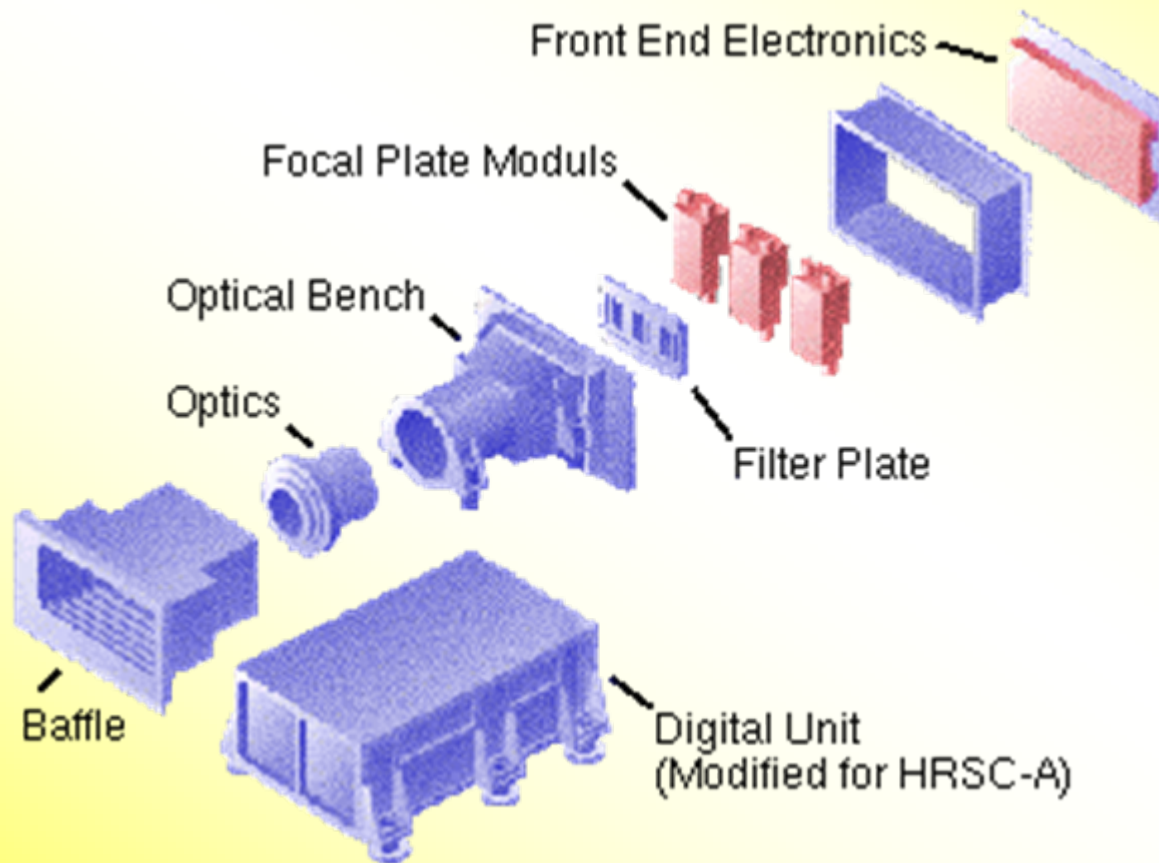
- ASPERA-3 Energetic Neutral Atoms Analyser Sweden
- HRSC High Resolution Stereo Camera Germany
- MaRS Mars Radio Science Germany
- MARSIS Subsurface Sounding Radar Altimeter Italy
- OMEGA IR Mapping Spectrometer France
- PFS Atmospheric Fourier Spectrometer Italy
- SPICAM UV Atmospheric Spectrometer France
- Beagle 2 Lander UK

High Resolution Stereo Camera (HRSC)

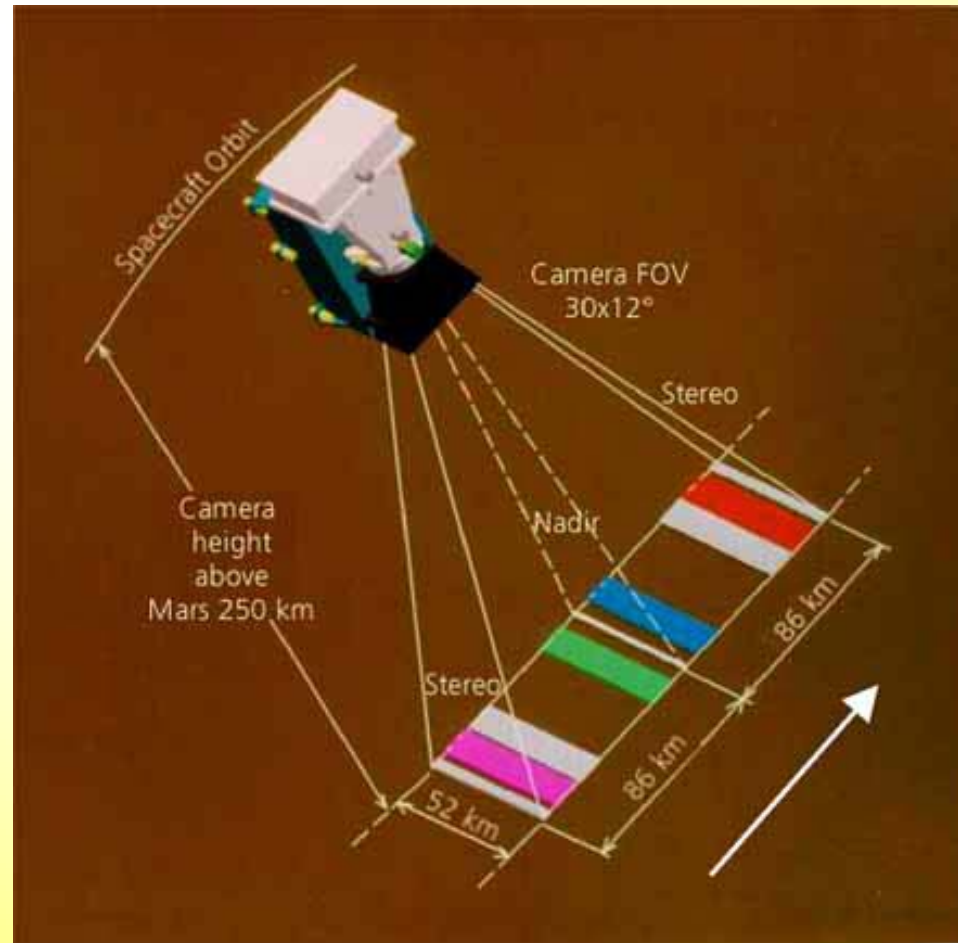
- Mars 96 flight spare model
 - Simultaneous imaging in stereo, color and at different phase angles at high resolution
 - 10 m/pixel resolution and 52 km swath at 250 km altitude
- Super Resolution Channel (SRC)
 - Based on HRSC digital unit
 - 2.3 m/pixel and 2.3 km * 2.3 km images at 250 km
 - New light-weight optics



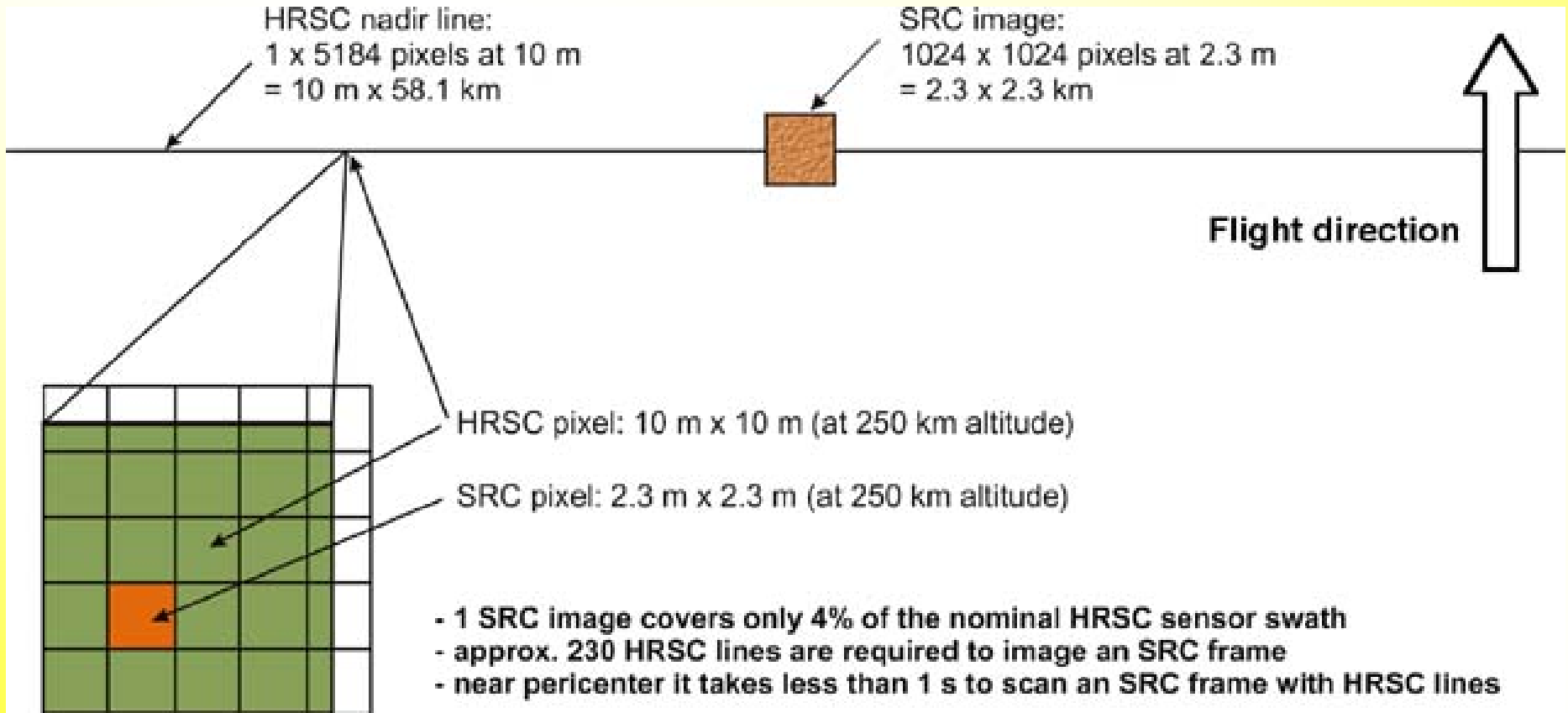
HRSC: Camera Head Unit



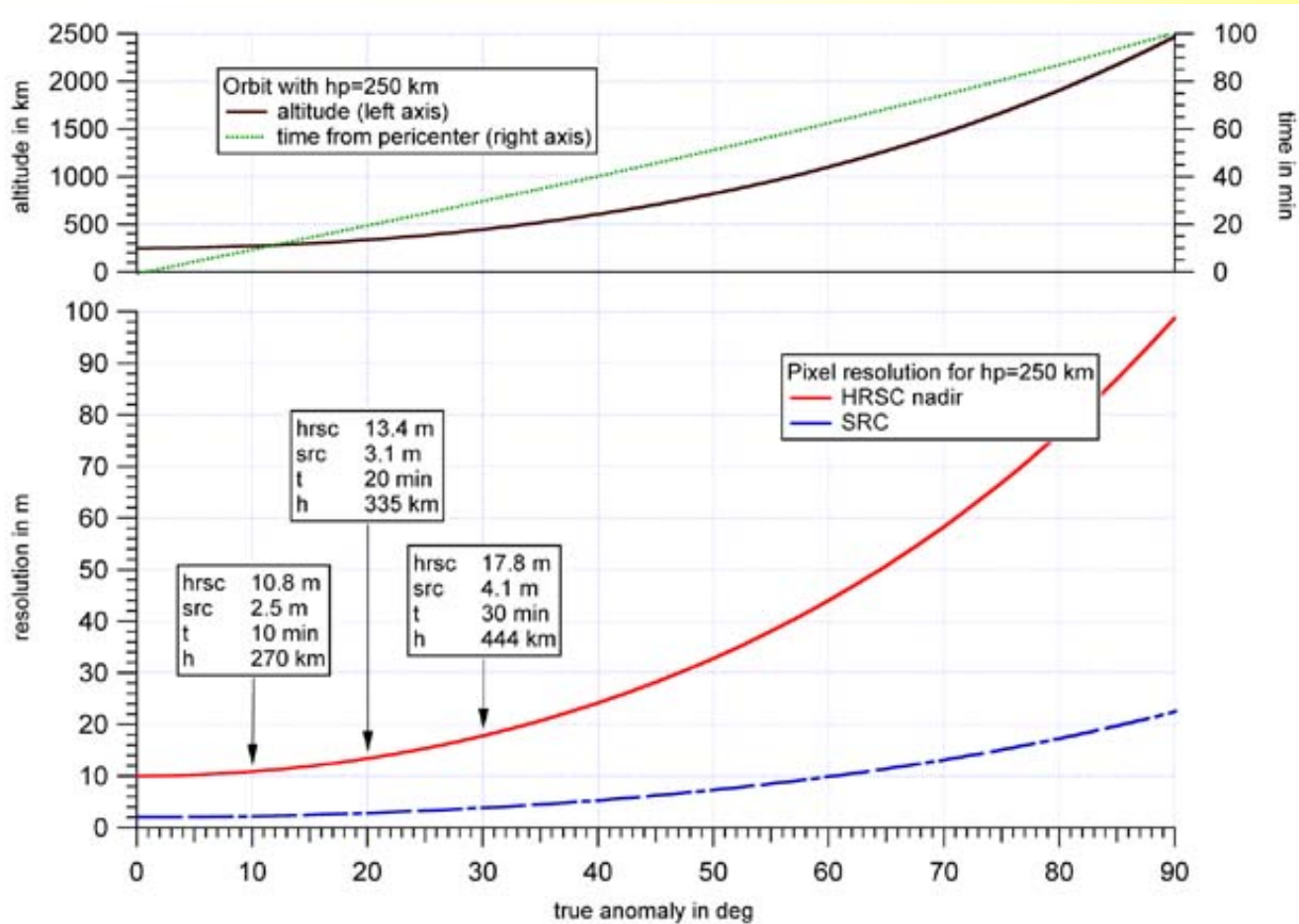
HRSC - Imaging Principle



HRSC - Sensor Footprints



Resolution with regard to Altitude



HRSC - Airborne

High Resolution Stereo Camera Airborne (HRSC-A)

- 175 mm Focal Length
- 5 Stereo CCD Lines
- $\pm 18,9^\circ$ and $\pm 12,8^\circ$ Stereo Angle
- 4 Multispectral CCD Lines
- $11,9^\circ$ Field of View
- 2,24 - 54,4 ms Exposure Time
- 80 MBit/s Data Rate

