MARS EXPRESS: OVERVIEW AND SCIENTIFIC INVESTIGATIONS. A.F. Chicarro, Space Science Department., ESA/ESTEC, 2200 AG Noordwijk, The Netherlands.

The European Space Agency and the scientific community have performed concept and feasibility studies for the last ten years on potential future ESA missions to the red planet (*Marsnet, Intermarsnet*), focusing on a network of surface stations complemented by an orbiter. The ESA Mars Express mission includes an orbiter spacecraft and a small lander module. The mission, to be launched in 2003 by a Soyuz rocket, will recover some of the lost scientific objectives of both the *Mars-96* mission and the *Intermarsnet* study, following the recommendations of the International Mars Exploration Working Group (IMEWG) after the failure of *Mars-96*, and also the endorsement of ESA's Advisory Bodies that Mars Express be included in the Science Programme of the Agency.

The scientific objectives for the orbiter spacecraft include: global high-resolution photogeology at 10 m resolution, global mineralogical mapping at 100 m resolution, global atmospheric circulation and mapping of the atmospheric composition, subsurface structure at km scale down to the permafrost, surface-atmosphere interactions and interaction of the atmosphere with the interplanetary medium. For the lander module, the objectives include: geology, geochemistry, meteorology and exobiology (i.e. search for signatures of life) of the landing site.

Preliminary design estimates allow for an orbiter scientific payload of about 106 kg and 60 kg total lander mass (at launch) compatible with the approved mission scenario. The Beagle small lander concept, dedicated to geochemistry and exobiology with a number of robotic devices, was selected due to its innovative scientific goals. Beagle will deploy a sophisticated robotic-sampling arm , which could manipulate different types of tools and retrieve samples to be analyzed by the geochemical instruments mounted on the lander platform. One of the tools to be deployed by the arm is a 'mole' capable of subsurface sampling to reach soil unaffected by solar-UV radiation.

A Soyuz class launcher will inject a total of about 1100 kg into Mars transfer orbit in June 2003, which is the most favourable launch opportunity to Mars in terms of mass in the foreseeable future. The orbiter will be 3-axis stabilised and will be placed in an elliptical martian orbit (250 × 10142 km)of 86.35 degrees inclination and 6.75 hours period, which has been optimised for communications with potential landers from IMEWG partners to be launched both in 2003 and 2005. The lander module, will be independently targeted from separate arriving hyperbolic trajectory, enter and descend through the martian atmosphere in about 5 min, and land with an impact velocity <40 m/sec and an error landing ellipse of 100 × 20 km. The nominal mission lifetime of one martian year (687 days) for the orbiter investigations will be extended by another martian year for lander relay communications and to complete global coverage.

ESA will provide the launcher, the orbiter and the operations, while the lander module is expected to be delivered by space organisations of ESA member states. The orbiter instruments, which were selected in June 1998 from proposals in response to an Announcement of Opportunity, are to be provided by scientific institutions through their own funding. The Mars Express mission is now in Phase-B, for which Matra Marconi Space has been selected as Prime Contractor. International collaboration, either through the participation in instrument hardware or through scientific data analysis is very much valued to diversify the scope and enhance the scientific return of the mission.

In particular, arriving at Mars at the very end of 2003, Mars Express will be followed by the Japanese Nozomi spacecraft a few days later. Both missions are highly complementary in terms of orbits and scientific investigations; Nozomi focusing on the study of the upper atmosphere of Mars as well as the interaction of the solar wind with the ionosphere from an highly elliptic equatorial orbit. Close cooperation including scientific data exchange and analysis is foreseen by the Nozomi and Mars Express teams within a joint ESA-ISAS programme of Mars exploration.

BEAGLE LANDER PAYLOAD	**Mass (kg)**
Instruments:	
Gas chromatography / mass spectrometry	3.51
Sample handling system	0.86
Panoramic cameras	0.44
Wide-angle camera	0.05
Microscope	0.30
Mossbauer spectrometer	0.50
X-ray spectrometer	0.30
Environmental sensors	0.18
Total Instruments	6.14
Mechanisms:	
Robotic arm	2.64
Mole and grinder	1.50
Total Mechanisms	4.14
Total Mass	**10.28**
An UK-led consortium (including D, Fi…) will provide the lander with C. Pillinger as Beagle P.I.	

MARS EXPRESS SELECTED ORBITER PAYLOAD				
Acronym	**Instrument**	**Principal Investigator**	**Countries**	**Mass (kg)**
HRSC	High-Resolution Stereo Colour Imager	G. Neukum	D, F, RU, US, Fi, I, UK	20.4
OMEGA	IR Mapping Spectrometer	J.P. Bibring	F, I, RU	28.6
PFS	Atmospheric Fourier Spectrometer	V. Formisano	I, RU, PL, D, F, E, US	30.8
MARSIS	Subsurface-Sounding Radar/Altimeter	G. Picardi	I, US, D, CH, UK,DK	13.7
ASPERA	Energetic Neutral Atoms Analyzer	R. Lundin	S, D, UK, F, FI, I, US, RU	7.9
SPICAM	UV and IR Atmospheric Spectrometer	J.L. Bertaux	F, B, RU, US	4.7
MaRS	Radio Science Experiment	M. Paetzold	D, F, US, A	-
Total Mass				**106.1**