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The Aurora Mars Sample Return Mission

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The Mars Sample Return (MSR) mission is the second flagship mission of the ESA Aurora Exploration programme.

This mission has been assessed at the ESTEC Concurrent Design Facility (CDF) at the beginning of 2003 and has later undergone, throughout 2004, a phase A1 study from two parallel industrial teams.

The MSR mission is considered an important precursor to demonstrate, at reduced scale, technologies and operations for future exploration missions.

Because of this emphasis, requirements relevant to the sample are reduced to a minimum while a dominant role is given to the technology and engineering aspects.

The reference sample mass is 0.5 kg including atmospheric, surface and core subsamples.

The mission architecture proposed includes two separate Ariane 5 ESC-A launches in 2011 bringing two separate composite spacecraft to Mars.

The composite launched as first, features an Orbiter inserted in a 500 km low Mars orbit and an Earth Return Capsule (ERC). The Orbiter acts as Data Relay in the communications between Mars surface and Earth and performs the rendezvous with a Mars Ascent Vehicle (part of the second launch) carrying the sample container from Mars surface.

The second composite has a Carrier and a Descent Module for landing the Mars Ascent Vehicle and the platform that performs the sample collection.

The sample is collected from the subsurface by means of a drill system. A mole could be accommodated as a back-up device.

After sample collection, the sample is sealed within a container and the container is transferred to the Mars Ascent Vehicle that carries it into Mars orbit. There, the upper stage of the ascent vehicle docks to the Orbiter. The sample container is mechanically transferred inside the Orbiter to the Earth Return Capsule.

When all these operations have been performed, the Orbiter returns back to Earth and after the sealing of the container has been checked, releases the Earth Return Capsule into an Earth re-entry trajectory. The Earth Return Capsule undergoes a parachute-less descent and a hard landing and it is finally recovered.

The paper describes the present status of mission definition.