Paper ID: 51814
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IAF SPACE EXPLORATION SYMPOSIUM (A3)
Mars Exploration – missions current and future (3A)

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POTENTIAL EUROPEAN CONTRIBUTIONS TO THE INTERNATIONAL MARS SAMPLE RETURN CAMPAIGN

Abstract

The physical return of samples from Mars has been a top priority of the international Mars science community for over a decade. Today, the key science objectives of Mars concern searches for evidence of past life understanding the planetary evolution of Mars and preparation for potential future human exploration . NASA and ESA are currently collaborating to study options for an international MSR campaign, capable of delivering a variety of atmospheric and soil samples collected on Mars for analysis on Earth. In April 2018, the two agencies signed a joint statement of intent, to work together to study complimentary mission options to deliver a possible international Mars Sample Return campaign in the 2020s. ESA has awarded contracts to Thales Alenia Space to lead and develop solutions for two potential European contributions to this campaign, the Sample Fetch Rover (SFR) and the Earth Return Orbiter (ERO). The SFR would be responsible for the retrieval of sample tubes deposited on the surface of Mars by the M2020 rover, and ensuring their return to a NASA-developed Mars Ascent Vehicle (MAV). Subsequently, the ERO would be responsible for locating and capturing a container of Mars samples, launched into Low Mars Orbit by the MAV, and ensuring their safe return to Earth. Both missions are targeting separate launches in 2026, with the lightweight SFR launching onboard the NASA Sample Return Lander (SRL) mission concept. This paper provides an overview of the current designs of solutions for SFR and ERO developed by Thales Alenia Space. It includes descriptions of the key mission requirements, an overview of the critical design trades, and an evaluation of the best candidate options for the mission concepts. Details are also provided of the key-enabling technologies for these missions, including autonomous surface navigation and orbital rendezvous, advanced locomotion, and highly-efficient Solar Electric Propulsion enabled by lightweight, flexible solar arrays. The objective of this TAS lead activity is to select, design, and mature the design of the two mission concepts, with the aim to prepare a mission implementation proposal for the ESA Ministerial Council in December 2019.