

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

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THE EARTH RETURN ORBITER MISSION CONCEPT AS PART OF AN INTERNATIONAL MARS  
SAMPLE RETURN CAMPAIGN**Abstract**

Mars Sample Return has remained a top priority of the international Mars science community for several decades. Recent accomplishments in robotic Mars exploration have increased confidence in the technical feasibility of returning samples to Earth at a reasonable cost, such that it is now the logical next step for future Mars mission planning and exploration initiatives. ESA and NASA are working together to explore concepts for a potential international Mars Sample Return campaign, notionally comprising three missions, with the joint objective of safely returning to Earth Martian samples for analysis in terrestrial laboratories. ESA's Earth Return Orbiter (ERO) mission concept could be a critical element of this proposed campaign. NASA's Mars 2020 mission is designed to gather samples of Mars and leave them on the Martian surface. A subsequent Sample Return Lander (SRL) mission could fetch these samples and launch them into Mars orbit. The ERO mission would be responsible for locating and capturing the Mars Orbiting Sample (OS) container, and ensuring its safe return to Earth. This paper provides an overview of the ongoing activities of ESA's future Mars mission studies team and elements of the NASA/JPL Mars mission studies team who are working to define this potential future cornerstone activity. The notional mission architecture and its place in the overall potential MSR campaign is discussed, in addition to the mission concept's key design challenges and critical technologies. These relate to the autonomous rendezvous and capture of a payload in Mars orbit, the unique design considerations arising from the strict planetary protection requirements (ensuring the non-contamination of Earth by unsterilized Martian material), and the development of a propulsion and staging strategy to ensure the successful first-ever return to Earth of a planetary mission. Details of the Rendezvous Orbital Sample Capture System (ROCS) technology, currently being studied by JPL, are also presented. The current design status of the mission concept and ongoing assessment studies are described, in addition to the key steps toward the 2019 ESA Ministerial Council, where there may potentially be a decision made whether to progress to the implementation phase. The information presented about potential Mars sample return architectures is provided for planning and discussion purposes only.