

Airbus to bring first Mars samples to Earth: ESA contract award

A new decade of European exploration – to the Moon and Mars
Airbus to design and build the Earth Return Orbiter (ERO) for Mars
Sample Return (MSR) campaign
ERO will reach Mars orbit, capture orbiting samples launched from the
Red Planet and bring them back to Earth

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Toulouse, 14 October 2020 – Airbus has been selected by the European Space Agency (ESA) as prime contractor for the Mars Sample Return's Earth Return Orbiter (ERO) – the first ever spacecraft to bring samples back to Earth from Mars. Mars Sample Return (MSR) is a joint ESA-NASA campaign and the next step in the exploration of Mars. ERO and the Sample Fetch Rover (SFR) are the two main European elements of MSR, both are set to be designed and built by Airbus. A manipulating arm, referred to as the Sample Transfer Arm (STA), that will transfer the samples from the SFR to the Mars Ascent Vehicle (MAV), is the third European contribution to the MSR program. The value of the ERO contract is € 491 million.

The five year mission will see the spacecraft head to Mars, act as a communication relay with the surface missions, perform a rendezvous with the orbiting samples and bring them safely back to Earth. Prior to launch from the Mars surface onboard the MAV, the Martian samples will be stored in sample tubes and collected by the SFR, for which Airbus has already commenced the study phase.

For ERO, Airbus will use its autonomous rendezvous and docking expertise built up over decades of experience in optical navigation, using technologies from the successful ATV (Automated Transfer Vehicle) and recent developments from JUICE, Europe's first mission to Jupiter.

"We're bringing the full force of our experience gained on Rosetta, Mars Express, Venus Express, Gaia, ATV, BepiColombo, and JUICE to ensure this mission succeeds. Bringing samples back to Earth from Mars will be an extraordinary feat, taking interplanetary science to a new level and Airbus is excited to take on this challenge as part of this joint international mission." said Jean-Marc Nasr, Head of Airbus Space Systems.

To be launched on an Ariane 6 in 2026, the 6 ton, 6 m high spacecraft, equipped with 144m² solar arrays with a span of over 40 m – some of the biggest ever built – will take about a year to reach Mars. It will use a mass-efficient hybrid propulsion system combining electric propulsion for the cruise and spiral down phases and chemical propulsion for Mars orbit insertion. Upon arrival, it will provide communications coverage for the NASA Perseverance

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Rover and Sample Retrieval Lander (SRL) missions, two essential parts of the MSR Campaign.

For the second part of its mission, ERO will have to detect, rendezvous with, and capture a basketball-size object called the Orbiting Sample (OS), which houses the sample tubes collected by SFR; all this over 50 million km away from ground control. Once captured, the OS will be bio-sealed in a secondary containment system and placed inside the Earth Entry Vehicle (EEV), effectively a third containment system, to ensure that the precious samples reach the Earth's surface intact for maximum scientific return. It will then take another year for ERO to make its way back to Earth, where it will send the EEV on a precision trajectory towards a pre-defined landing site, before itself entering into a stable orbit around the Sun.

After landing, the samples will be transferred to a specialised handling facility where they will be quarantined. Once the sample tubes are opened, initial measurements will be taken to generate a detailed catalogue, enabling specific parts of the samples to then be targeted for specialist science investigations.

Airbus will have overall responsibility for the ERO mission, developing the spacecraft in Toulouse, and conducting mission analysis in Stevenage. Thales Alenia Space Turin will also have an important role, assembling the spacecraft, developing the communication system and providing the Orbit Insertion Module. The mission enabling RIT-2X ion engines will be provided by ArianeGroup.

About Mars Sample Return

Mars Sample Return is a set of three separately launched missions, which will together achieve the objective of returning Mars samples to Earth before the end of 2031.

The NASA-led Mars 2020 rover, known as Perseverance, was launched in July 2020 to land on Mars in February 2021. Perseverance will acquire Mars samples, cache them into sample tubes, and leave the tubes in one or more depots for later collection by the SRL mission and its European Sample Fetch Rover.

The NASA-led SRL is to be launched in 2026 and comprises a surface platform with a European robotic Sample Transfer Arm (STA), the Sample Fetch Rover (SFR), and a Mars Ascent Vehicle (MAV). The surface platform will land in the near vicinity of the sample tube depot in the Jezero crater. SFR will navigate, locate and collect the sample tubes, and return to the lander platform. The STA will transfer the sample tubes into the Orbiting Sample (OS) then load the OS aboard the MAV. The MAV will launch the OS into Mars orbit, where ERO will be waiting to rendezvous and capture it.

The ESA-led Earth Return Orbiter (ERO) is also to be launched in 2026 and will have onboard the NASA-led Capture, Containment and Return System (CCRS), which will handle and bio-seal the OS as well as provide the Earth Entry Vehicle (EEV). ERO will arrive in

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Mars orbit on time to provide communications coverage for the SRL entry, descent and landing, surface operations, and the MAV launch placing the OS into Mars orbit. ERO will have to detect, rendezvous with, and capture the OS. The OS will then be bio-sealed and transferred to the EEV before ERO heads back to Earth.

Upon approach to Earth, ERO will release the Earth Entry System on an Earth entry trajectory. After landing in the desert of Utah, the samples are transferred to a sample receiving and curation facility.

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About Airbus

Airbus is a global leader in aeronautics, space and related services. In 2019, it generated revenues of € 70 billion and employed a workforce of around 135,000. Airbus offers the most comprehensive range of passenger airliners. Airbus is also a European leader providing tanker, combat, transport and mission aircraft, as well as one of the world's leading space companies. In helicopters, Airbus provides the most efficient civil and military rotorcraft solutions worldwide.

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