

Mission to Mars via Antarctica

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A few weeks before leaving for the Antarctic Concordia Station, the Italian-French crew that will spend over one year in one of the harshest, isolated environments on Earth, attended two days of preparatory training at ESA's Headquarters in Paris, France. During their stay at the research station the crew will participate in a number of ESA experiments – the outcome of which will help prepare for long-term missions to Mars.

Image: The Concordia Station is a scientific base built in Antarctica by the French Polar Institute (IPEV) and the Italian Antarctic Programme (PNRA). Credits: IPEV

As part of the Aurora Exploration Programme, ESA is considering participating in a human mission to Mars by the year 2030. Research projects are planned or are already underway to develop the technology and knowledge needed. By being involved in programmes that have requirements similar to those of a mission to Mars, ESA will gain experience on how best to prepare for such a challenging mission.

"The Concordia Station is an ideal location as it replicates certain aspects of a Mars mission," explains Oliver Angerer, ESA's coordinator for the Concordia research programme. "The crew lives in an extreme environment in one of the most remote places on Earth. During the winter the base is completely cut off with no visitors and no chance for rescue. In such an isolated location, the crew has to learn to be fully self-sufficient."

Built and operated jointly by the French Polar Institute (Institute Paul Emile Victor, IPEV) and the Italian Antarctic Programme (Consorzio per l'attuazione del Programma Nazionale di Ricerca in Antartide, PNRA S.C.r.l.), the Concordia Station was completed in 2004. A letter of intent was signed with IPEV and PNRA in 2002 that enabled ESA to cooperate on some aspects of the project.

Capable of providing home to up to 16 crewmembers in the winter, the station consists of three buildings, which are interlinked by enclosed walkways. Two large cylindrical three-storey buildings provide the station's main living and working quarters, whilst the third building houses technical equipment, like the electrical power plant and boiler room.

Last November, the first crew finished their winter-over which was dedicated to the technical qualification of the station. The summer season sees a swelling in the number of inhabitants as short-stay scientists take advantage of the less extreme weather (however, mean air

temperature is about -30°C during this time!). With the second crew now starting to gather at the remote research station, the summer season also marks a change over of the crew.

Briefings

Three scientists who are part of the next Concordia winter-over crew have already made the long journey to Antarctica. The rest of the crew, who will leave for the Antarctic research station during December, gathered at ESA's Headquarters in Paris for two days of pre-departure training. They received briefings about life at Concordia, including aspects such as safety and the implications of the Antarctic Treaty for activities at the station.

The seven crewmembers also heard about research at the station, including two special experiments for which they will act as subjects during their stay. In 2003, ESA coordinated together with the Concordia partners a Research Announcement for medical and psychological research, from which six proposals were selected.

The two experiments, which are the first to be implemented in the coming season, look at psychological adaptation to the environment and the process of developing group identity; issues that will also be important factors for humans travelling to Mars. For this research the crew will complete questionnaires at regular intervals throughout their stay.

ESA's Mistacoba experiment, which already started a year ago when the first crew started living at the station, will also continue after the crew rotation. Starting from a newly built clean environment, samples are taken from fixed locations in the base as well as from crewmembers themselves. The Mistacoba experiment will provide a profile of how microbes spread and evolve in the station - an isolated and confined

environment - over time.

Water-recycling

To protect the Antarctic environment, all waste materials must be removed from the Continent. For the Concordia Station, this means that all waste materials have to be appropriately treated. Regarding water, based on ESA life support technologies, ESA developed, together with PNRA and IPEV, a system to recycle the so-called 'grey water' collected from showers, laundry and dishwashing, which has been operating for a year in line with the requirements of the Concordia partners.

Other ESA activities for Concordia include the ongoing development of a system to monitor the health and well being of the crew, part of the Long Term Medical Survey (LMTS). Physiological parameters, collected using a vest-like item of clothing, will provide valuable data about the health and fitness of crew during long-term stays in harsh environments.

Real environment

In mid-February the last plane of summer visitors will depart from Concordia leaving the crew to their own devices. "For those nine winter months the crew will experience extreme isolation," adds Oliver Angerer. "Concordia is a real operational environment, something we would never be able to simulate in a laboratory. This will enhance and complement our research and give us valuable insight we need to prepare for Mars."

Source: ESA

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