



The 'Volare' mission begins

28 May 2013

His muscles are of interest to the scientists, as is his internal clock and the radiation dose to which he will be exposed during his work in the European Columbus research laboratory. On 28 May 2013 at 22:31 CEST, the European Astronaut Luca Parmitano will depart from the Baikonur Cosmodrome in Kazakhstan on board the Soyuz TMA-09M spacecraft, beginning his journey to the International Space Station (ISS), as part of the Expedition 36/37 crew. Parmitano is flying both as the subject of some investigations and as the custodian of space experiments that will provide scientists with important data. Fourteen experiments are being overseen by the German Aerospace Center (Deutsches Zentrum für Luft- und Raumfahrt; DLR) and the DLR Space Administration. Contact with the ground during the course of his stay will take place mainly through the Columbus Control Center at DLR Oberpfaffenhofen.

Declining muscle strength in space and on the ground

The flight that will bring Parmitano, together with NASA astronaut Karen Nyberg and Russian cosmonaut Fyodor Yurchikin, to their new home in space will only last six hours. After four Earth orbits, the Soyuz spacecraft will dock with the ISS. For Parmitano, six months of work in microgravity will begin. The astronaut has already completed the first experiments on Earth: a tissue sample has been taken from one of his muscles. "With the Sarcolab experiment, we want to find out why muscle strength declines so much in microgravity," explains project leader Jörn Rittweger from the DLR Institute of Aerospace Medicine. In space, muscles lose not only volume, but also a disproportionate amount of strength – despite regular training. "There is either a weakening of each individual muscle fibre or a change in the structure of the entire muscle – these are possible explanations for muscle atrophy both in space and on Earth." With extensive comparative measurements before and after the astronaut's six-month stay in space, the team wants to find out why the strength of muscles declines so rapidly.

How microgravity affects the structure and anatomy of the knee joint is the subject of another German experiment in which Parmitano is a test subject, before and after his flight. The 'Cartilage' experiment, funded and supervised by the DLR Space Administration, wants to obtain new research findings on bone metabolism. While on Earth, gravity exerts an appropriate, low stress on the human motor system; unusual conditions, such as those of space or during a lengthy hospital stay, can damage connective tissue.

The human internal clock is the subject of the German experiment 'Circadian Rhythm'. During and after Parmitano's ISS stay, the heat sensor THERMOLAB will investigate the periodic change in his core body temperature. This has an influence on various systems in the body, for example, sleep, as well as affecting attentiveness and mental performance.

Research laboratory with ovens and radiation measuring instruments

For materials physicists, Parmitano will operate a number of furnaces on the Space Station. In several experiments, different aluminium alloys will be melted in microgravity and then solidified. Back on Earth, the hardened samples will be examined by the DLR Institute of Material Physics in Space. For the experiment MICAST, for example, Lawrence Ratke, from DLR, and an international team will be analysing aluminium alloys containing a small amount of iron. "Iron, in particular, ensures that aluminium is less susceptible to fracture, because it forms very thin plates within the solidified material." By understanding these processes better, industrial casting processes, for example those employed in the automotive industry, could be optimised.

While Parmitano is working with the various experiments in the European research module, 13 detector systems will be measuring the radiation exposure in his surroundings. For the past year, the 'DOSE 3D' experiment, which is being conducted by DLR Institute of Aerospace Medicine, has been determining how high the radiation exposure is in the flying laboratory. The aim is to produce a three-dimensional map of the radiation in the ISS with the data acquired. The results will be especially important for future long-duration manned space missions, where adequate shielding will be necessary.

Conference call from the control centre to space

The contact persons for Luca Parmitano in his work in and around the Columbus research module will be at DLR Oberpfaffenhofen – around the clock, seven days a week. Every morning and evening, the team will talk to the German Space Operations Center, and then with the crew on the Space Station. "We will discuss the tasks for the day, changes which mean that Luca must adjust his work schedule and, in the evening, perhaps any remaining open questions that we have for the astronauts – we will be in regular contact," says Thomas Uhlig, one of the flight directors at the Columbus Control Center. When the European astronaut floats to work every day in the research laboratory, the team on the ground and the man in space will be working together as a team. As Flight Engineer, Parmitano is responsible for the experiments and for other maintenance and repair work in the laboratory. "He will receive instructions from our control room."

After 166 days, on 10 November 2013, the European astronaut will return to Earth. "I am sure I will return with a memory of something that changed me for life," says Luca Parmitano. The scientists will have gained something else: a great deal of data that will be evaluated in the following months.

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Prepared for launch



The Soyuz rocket has been rolled out to the launch pad in the Baikonur Cosmodrome in Kazakhstan. On 28 May 2013 at 22:31 CEST, ESA astronaut Luca Parmitano, NASA astronaut Karen Nyberg and Russian cosmonaut Fyodor Yurchikin will begin their flight to the International Space Station.

Credit: NASA.

The team of ISS Expedition 36/37



Six months in space: the European astronaut Luca Parmitano (right), together with US astronaut Karen Nyberg (left) and Russian cosmonaut Fyodor Yurchikin will live and work on the International Space Station.

Credit: ESA.

View of the control room at the German Space Operations Center (GSOC) in Oberpfaffenhofen



Located at Oberpfaffenhofen near Munich, the German Space Operations Centre (GSOC) is part of DLR's Space operations and Astronaut Training division, the key institution for implementing space missions in Germany. Its tasks include satellite missions for Earth observation, communication, and reconnaissance as well as human spaceflight and exploration missions in the Solar System.

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