



The German Space Operations Center takes over operation of the Swedish PRISMA satellite mission

15 March 2011

On 15 March 2011, the German Space Operations Center (GSOC) at the German Aerospace Center (Deutsches Zentrum für Luft- und Raumfahrt; DLR) in Oberpfaffenhofen took over operation of the Swedish PRISMA satellite mission. The Swedish Space Corporation (SSC) implemented the transfer of control as part of a bilateral agreement. DLR will be responsible for mission operations for a period of five months and has the opportunity to carry out additional experiments.

The PRISMA mission was launched on 15 June 2010 and consists of two satellites, Mango and Tango. The aims of the mission are the demonstration of autonomous satellite formation flying and preparation for future inspection and repair missions in orbit.

Operational tasks

"We are now responsible for ensuring that the basic operational requirements for the overall mission are being met. This includes controlling the network of ground stations, monitoring and commanding the two satellites and conducting the programme of experiments," said Ralf Faller, the lead flight director for PRISMA at GSOC.

The network of ground stations consists of the DLR antennas at Weilheim and the antennas operated by SSC in Sweden. Ten times a day, the two PRISMA satellites, Mango and Tango, transmit signals to the receiving stations and receive new commands from Oberpfaffenhofen. Three teams work there in shifts, looking after the flight control systems.

GSOC will be drawing on its experience with numerous national and international satellite missions as it takes over operations for the next few months. Specific preparation for this task took place at the SSC Operations Center in Stockholm. Even so, operating PRISMA will be a particular challenge for all those involved. According to Faller, this is because: "PRISMA is the first European satellite mission to demonstrate autonomous formation flying at distances between 30 kilometres and two metres."

Autonomous formation flying

The main satellite, Mango, and its partner satellite, Tango, fly around one another in varying formations as they orbit the Earth. The satellites perform orbit control and navigation independently. The first step in this process takes place on the ground; DLR researchers first define a formation and upload the commands for this to the Mango satellite. After this, the onboard navigation and control software 'takes over' and the satellite carries out the planned formation flight with Tango without further input.

For autonomous formation flying, the satellite needs information concerning its own position and speed in relation to the other object. Extremely precise determination of the position and relative movement of the satellites is carried out using an innovative GPS receiver developed by DLR. The systems for onboard calculation of orbital manoeuvres and control of the satellites were developed by SSC and are based on special algorithms. These systems allow Mango to 'know' precisely when it has to fire its thrusters and when to shut them down again in order to implement the required flight formation.

Plans and objectives

The formation flying of the PRISMA satellites provides an ideal testbed for the manoeuvres needed for rendezvousing with objects in space. So, as well as taking control of operations, GSOC is also carrying out research tasks in the form of the mission-related SAFE (Spaceborne Autonomous Formation-flying Experiment) and AOK (Autonomous Orbit Keeping) experiments prepared by DLR. SAFE is used to test out autonomous satellite formation flying, whereas AOK explores orbit control of a single spacecraft. After handing back control of the mission in the summer of 2011, cooperation with the SSC on additional experiments on board the PRISMA satellites is planned. Uses to which the DLR will put the knowledge and experience it gains include preparation for the German Orbital Servicing Mission (Deutsche Orbitale Servicing Mission; DEOS) planned for 2015, which is intended to demonstrate the capture and controlled disposal of obsolete satellites.

About PRISMA

The PRISMA satellite mission was conceived and implemented by the Swedish National Space Board, beginning in 2005. Swedish aerospace company SSC acted as the developer and manufacturer of the satellites and has been successfully controlling mission operations until now. As an experimenter, SSC has been collaborating with other Swedish aerospace companies, ECAPS and NanoSpace, to develop advanced propulsion systems. The French space agency CNES (Centre National d'Etudes Spatiales), the Spanish research centre CDTI (Centro para el Desarrollo Tecnológico Industrial) and the Danish Technical University (Danmarks Tekniske Universitet; DTU) are also participating as international mission partners. GSOC has been involved with the PRISMA mission from the beginning, developing hardware and software for the space segment and preparing data processing systems for precise orbit determination by the ground segment. In addition to these key tasks, DLR is currently responsible for overall mission control.

Contacts

Bernadette Jung
German Aerospace Center (DLR)
Public Affairs and Communications
Tel.: +49 8153 28-2251
Fax: +49 8153 28-1243
Bernadette.Jung@dlr.de

Ralf Faller
Deutsches Zentrum für Luft- und Raumfahrt (DLR)
Mission Operations
Tel.: +49 8153 28-1261
Fax: +49 8153 28-1455

The Tango satellite flying in formation, seven metres away from partner satellite Mango



PRISMA is the first European satellite mission to demonstrate autonomous formation flying at distances between 30 kilometres and two metres. The main satellite, Mango, and its partner satellite, Tango, fly around one another in varying formations as they orbit the Earth. The satellites carry out orbit control and navigation independently.

Credit: SSC.

Controlling the satellites at the German Space Operations Center in Oberpfaffenhofen



Ten times a day, the two PRISMA satellites, Mango and Tango, transmit signals to the receiving stations and receive new commands from the German Space Operations Center (GSOC) in Oberpfaffenhofen. Three teams work there in shifts, looking after the flight control systems.

Credit: DLR (CC-BY 3.0).

Contact details for image and video enquiries as well as information regarding DLR's terms of use can be found on the DLR portal imprint.