

BayernSat

BayernSat is a small satellite mission of the Institute of Astronautics of the Technische Universität München. Mission Goal is the demonstration of new technology, namely telepresence.

Rationale

Today, communication opportunities (or “windows”) of satellites in low Earth orbit are typically strongly limited. The ground station is only visible for a few minutes per overflight, and that occurs only a few times per day on average. Hence, the download of mission / science data and the upload of telecommands has to take place during this short time slot. This however results in stringent requirements for the com subsystem (increased data rate) and the power subsystem (increased peak power usage) of typical LEO satellites.

This is unacceptable for missions that require extended communication windows or realtime data transmission. The solution is here the utilization of geostationary satellites (as done by e.g. EnviSat, Spot-4). The advantage is that the com window can be extended from a few minutes to approximately half the orbit period (some 45 minutes) and more. In more than half of the cases the satellite can be reached immediately. When more than one geostationary satellite is used, the coverage can be - in principle - increased to 100%.

Telepresence

BayernSat goes even one step further. The communication windows are not only enlarged time wise, but can also be utilized to enable telepresence in orbit.

In astronautics, there are several applications for this. Stranded satellites can be repaired or fueled. Docking maneuvers can be simplified significantly; many applications can be undertaken - instead of by astronauts in space - from robot-controllers on the ground (and hence much cheaper). This however requires telepresence in orbit. Demonstrating the feasibility of this technology is the aim of BayernSat.

Further Technologies

Apart from telepresence, there are a couple of other technologies that are to prove their usability. There are for example the most efficient solar cells that have ever been flown on a satellite (Penta-Junction, 34% efficiency), on-board high performance computing using a silicon-on-insulator computer and a parallel processor architecture, a high-resolution color video camera, as well as a number of low-cost systems that will feature comparable performance at a much lower price.

Public Outreach

Even with its high-level technical challenge, BayernSat should not be appealing to just a small group of space experts. The aim is to demonstrate the above-mentioned technologies in a way that fascinates the broad public, namely by interactive live images of Planet Earth as she is “now”. The BayernSat satellite shall, whenever illumination and com windows allow, transmit a live feed of Earth remote sensing data to the ground station at the Institute of Astronautics. But apart from that, this stream of images shall be put online in the internet to be accessed by the public. Bavarian TV broadcaster “Bayerische Rundfunk” has offered to also show the live video feed in its telecast “SpaceNight”. Furthermore, randomly selected internet users shall have the opportunity to take control of the camera via their keyboard at home and see the resulting changes within short time on the internet / on TV.

This approach aims at making BayernSat appealing to a broad public without losing the opportunity to undertake the needed technology tests. The ultimate goal is the development of a telepresence module, which allows other space missions to utilize telepresence.

The Satellite

BayernSat is basically a cube with a side length of little more than 45cm and a mass of 50kg. It can transmit data at least ten times faster than a computer modem. Furthermore, it is able to communicate to geostationary communication satellites as well as transmitters and receivers on the ground. The ground resolution of its video camera is less than 150 meters per pixel.

