



Technology Experiments in Space: Latest from TET

21 March 2013

Temperatures alternating between extreme heat and cold, electromagnetic radiation and weightlessness – environmental conditions prevailing in space are harsh. Nevertheless, satellite components and those of the International Space Station ISS and other systems must withstand these conditions and continue to function reliably. Within the national "On-Orbit-Verification"- (OOV)-Programme- the Deutsche Zentrum für Luft- und Raumfahrt (DLR) is testing the maturity of space technologies under real conditions in their intended space environment. The core element of this programme is the small satellite TET-1 built by the prime contractor Kayser-Threde GmbH of Munich.

The Technology Experiment Carrier (TET) has been in operation since July 2012 with a total of eleven experiments on board. Results already available from the current mission will be presented together with possibilities for future applications during the TET Customer Day being held from 21st – 22nd March 2013 in Oberpfaffen. The event shall be organised by Kayser-Threde on behalf of DLR and shall provide space agencies, research institutes and industries an opportunity for the exchange of ideas and experience. The insights and knowledge gained will then be introduced into the planning of future missions.

"In the past six months all eleven experiments were activated according to schedule and many operation scenarios were completed", says the TET-Project Manager at DLR Space Management, Michael Turk, demonstrating his satisfaction with the status of the mission. During payload operation scheduled to last over a period of one year the experiments on board TET will be switched on and tested alternately. This process will be controlled by the German Space Control Centre of DLR, GSOC, in Oberpfaffenhofen The actual technology experiments were developed and constructed by research facilities and industry.

Experiments & Results

Among other contributors to the mission, DLR's German Space Operations Center has submitted the "Navigation and Occultation Experiment" (NOX).

The goal of this experiment is to demonstrate precise orbit determination of a satellite in low Earth orbit using a commercial-off-the-shelf GPS receiver. This receiver offers a simple and inexpensive solution but is presently only designed for terrestrial applications. In a second step the suitability of the dual frequency receiver for sounding the Earth's atmosphere shall be tested. The evaluation of data recovered to date shows that the receiver delivers good position and velocity solutions and enables orbit determination at the sub-decimeter level. So far, no detrimental influences of the space environment on the employed experiment hardware could be observed.

The ASP-Equipment GmbH contributes an experiment to the TET-1 Mission aimed to test a commercial rechargeable battery which has been space-graded using their own brand of processing technology. The battery has been equipped with a special battery management system and thus offers an overall inexpensive solution for space applications. Measurement data received from the experiment have shown that up to now the battery has suffered no type of degradation – there is no loss of function when operated in space. ASP will suggest a further experiment for a future TET mission: the concept of a "Commercial Off The Shelf" (COTS) converter. With the aid of a special interconnection European transistors shall, in future, be able to obtain comparable grades of efficiency similar to that of the so-called "MosFets" – American field effect transistors which are extremely powerful but underly specific export control regulations.

A further technology experiment is the "Sensor Bus" developed by Kayser-Threde, the aim of which, is to reduce the amount of wiring on board satellites. This shall lead to a reduction of mass and complexity of prevailing electrical systems. This solution shall allow for more flexibility and simplify systems integration in satellites. On TET-1 the sensor bus will be compared to the prevailing classical power harness system used in the power supply system. Data evaluation shows that the classical sensor wiring harness can be substituted by the sensor bus. The advanced system, the Hybrid Sensor Bus (HSB), is prepared for on-orbit verification on the SmallGEO carrier satellite for the planned German research satellite "Heinrich Hertz". This technology shall also be employed in the further technical evolution of the TET satellite bus.

TET Future Plans

The concept of a "TET Family" shall offer institutional and commercial clients the opportunity to have a custom-made satellite tailored to suit their individual applications: for classical OOV applications, for Earth observation, as well as for early detection of forest fires. For this reason, Kayser-Threde, together with their project partner Astro- und Feinwerktechnik Adlershof GmbH and under contract from DLR is working on a preliminary assessment for a follow-up satellite mission: TET-2.

About the Project

The TET-1 satellite was built in Germany by a consortium led by Kayser-Threde in cooperation with Astro- und Feinwerktechnik Adlershof GmbH and DLR Institutes. The overall satellite mission TET-1 was headed by the DLR Space Agency. The TET-1 was supported by the DLR Programme Directorate Space Research and Technology. The project was financed with the aid of funds from the Bundesministerium für Wirtschaft und Technologie (Federal Ministry of Economy and Technology) followed by a resolution from the German Bundestag.

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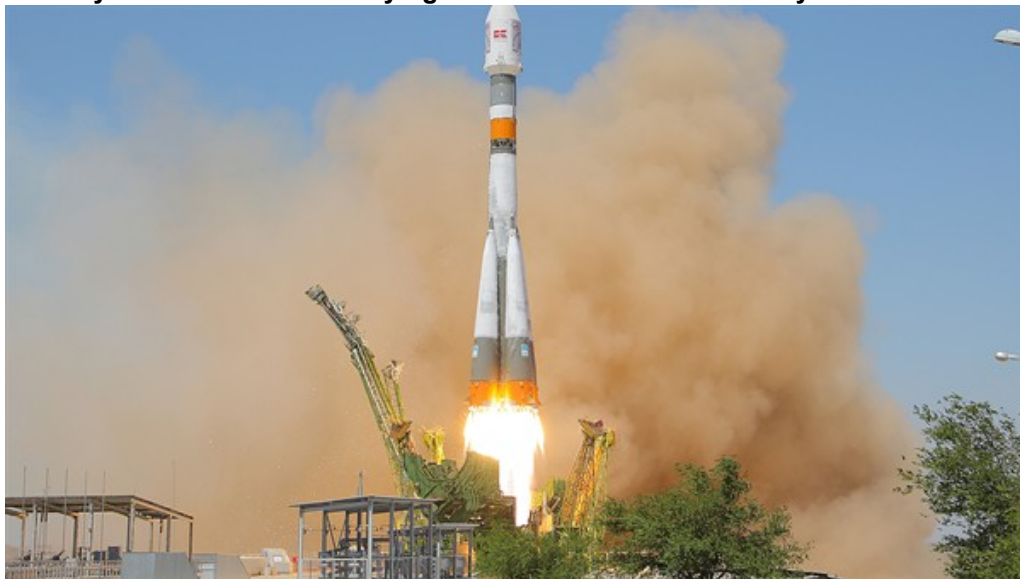
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The Soyuz launch vehicle carrying TET-1 after launch on 22 July 2012



On 22 July 2012 at 08:41:39 CEST, the first small German satellite in the 'On-Orbit-Verification' (OOV) programme was carried into orbit from the Cosmodrome in Baikonur, Kazakhstan by a Russian Soyuz launch vehicle. TET-1 is a technology testbed with 11 experiments on board that will be operated in space for a year.

Credit: DLR.

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