

THE ON-ORBIT-VERIFICATION-PROGRAMME OF THE GERMAN SPACE AGENCY

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OVERVIEW

The paper summarizes the status of the On-Orbit-Verification-programme (OOV) of the German Space Agency.

The goal of the programme is to qualify new technological solutions for their application in space projects. It focuses on the in-flight demonstration and verification of highly advanced technologies. The core element of the programme is the micro-satellite TET as a platform for the verification flight.

1. THE NEED FOR ON-ORBIT-VERIFICATION

It is necessary to validate new, unproved techniques and technologies before using them in advanced missions. The OOV-programme fills the gap between a technology which has been qualified on the ground and its application in space. In order to support German industry and research institutes, the German Space Agency provides flight opportunities to qualify in-flight new technological solutions in all areas of space craft technology such as power generation and storage, propulsion, guidance, navigation and control.

The first part of the programme is scheduled for the years 2005-2012. The overall budget of the programme within this time span is about 34 M€. The programme will be conducted in cooperation with the DLR Space Research (PD-W).

More information about the OOV-programme can be found in [1].

2. FLIGHT OPPORTUNITIES

Flight opportunities for technology demonstration and verification should ideally be provided on a regular basis, independent, cost efficient and safe. A market survey of German industries' and institutes' technologies has shown that about 75 % of the experiments can be verified using a micro-satellite.

The OOV-programme is structured into two main parts with respect to the flight opportunities offered. The first comprises the micro-satellites TET (Technologieerprobungsträger) with a planned flight every two years. For payloads which do not fit on TET, the DLR Space Agency cooperates with national and international partners in order to provide flight opportunities on other carriers.

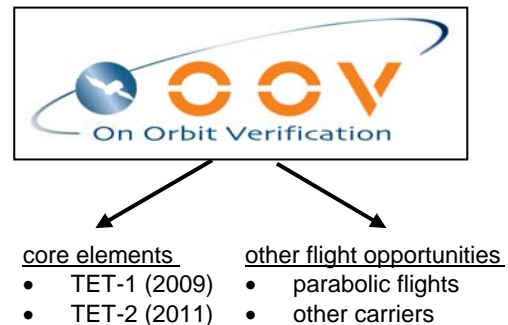


FIG 1. Structure of the OOV-Programme

2.1 The micro-satellite TET

2.1.1. Satellite bus

TET is a German-built satellite bus with an overall mass of about 110 kg and a payload capacity of 40 kg. The satellite bus is based on BIRD, a successfully flown German fire detection mission launched in 2001 [2]. Fig. 2 shows TET with a representative payload package. Currently, two micro-satellites are planned in the OOV-programme: TET-1 to be launched in 2009 and TET-2 in 2011.

TET will be launched as a secondary payload to a low earth orbit. The planned mission duration is one year. Besides the satellite itself, the German Space Agency provides the assembly, integration and test of the payloads on TET as well as mission operations and data transfer to the user. A summary of the TET-system is given in Tab. 1.

Currently, Phase B of the project is completed and phase C is foreseen to start early next year.

2.1.2. TET-1 payload accommodation

The dimensions of the payload compartment are 46 by 46 cm with a height of 40 cm. A payload management system (PMS) controls the payloads. It provides power, thermal stability and handles the communication between ground control center and the flight unit. For safety reasons, the PMS operates the payload independently from the bus control.

orbit	LEO
average orbital height	450 – 850 km
possible inclinations	53 ° to sunsynchronous
stabilisation	3-axis stabilisation
alignment accuracy	5 arcmin
jitter	2 arcmin/s
alignment of payloads	Sun, earth, nadir, zenith, deep space, in-flight

TET - envelope (l x w x h)	650 mm x 500 mm x 880 mm
payload compartment (l x w x h)	460 mm x 460 mm x 400 mm
payload mass	40 kg
TET satellite bus – total mass	ca. 110 kg

average power for payload	0 – 20 W
peak power for payload	160 W for 20 min (max. 5 x per day)
nominal operational voltage	20 V DC (min. 18 V, max. 24 V)
max. current	8 A
temperature stabilization	from – 10 ° C to + 30 ° C
data transfer (uplink)	4,8 kBit/s
data transfer (downlink)	2,2 Mbit/S

TAB. 1: TET satellite bus specifications

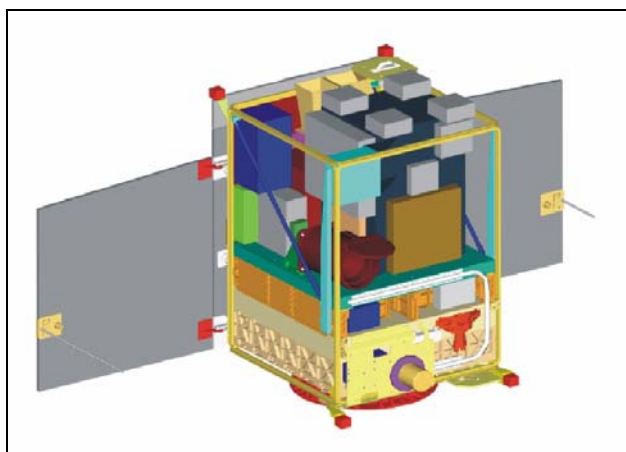


FIG 2. The TET satellite bus with an example payload

For TET-1 a highly integrated payload compound of 11 different payloads was selected, such as novel solar cells, an on-board computer, GPS receivers and a propulsion system.

2.2. Other flight opportunities

For payloads which cannot be integrated into TET or which do not fit the flight schedule, other flight opportunities are offered which fulfil the payload's requirements as best as possible.

Currently, two payloads, a magnetometer and a space debris detector are planned to be verified on the international satellites Proba2 and Spektr-R.

In order to respond to used needs and to have a broad range of flight opportunities available, the OOV-programme continuously seeks for new cooperation with international partners.

3. APPLICATIONS TO THE PROGRAMME

Applications for participation in the OOV-programme can be submitted at any time. All applications are going to be reviewed and prioritized. The selection of payloads for flight is then based on the availability of a flight opportunity, priority, available funding at the time of the foreseen launch, the required launch date and orbital operation time as well as the payload's technical requirements, such as mass, volume and data rates.

4. REFERENCES

- [1] Webpage of the On-Orbit-Verification-Programme at the German Space Agency:
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- [2] E. Lorenz, W. Bärwald, K. Briess et al.,
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