

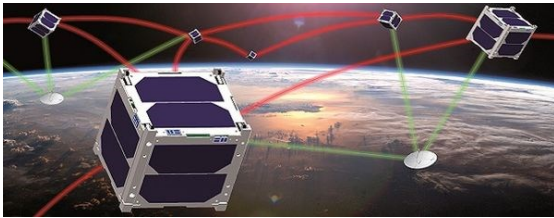
# Small Satellites

*Light weight, strong impact: small satellites for telecommunication and Earth observation*



## Content description:

Space technology is considerably changing. The paradigm shift in the field is comparable to what has been happening in the world of data processing over the last 30 years, in which large mainframe computer systems encountered an evolution towards web-connected smart phones. Small and very small satellites are now able to complement the traditional large satellites. Brought into orbit in a cooperating formation, they can generate 3D images for Earth observation that are well suited to enable joint monitoring of environment pollution, harvesting status, critical infrastructures, and natural crises (forest fire, volcano activity, earthquake).



The scientific challenge behind this evolution is two fold:

- Bringing into orbit a formation of about 4 to 5 networked, cooperating, “smart” small satellites, operating autonomously with minimum ground station interaction;
- Developing modular, robust small satellites.

The state of the art in small satellites research is so far a formation of only two satellites. Using expertise available in satellite research, space communication (navigation, guidance, control), miniaturization, and mechatronics, the RLS research group will work on an empowered model of 4 to 5 pico-satellites in orbit, and deliver new applications in telecommunication and Earth observation.

Essential subsystems needed for a formation are: an altitude and orbit determination and control system, a communications system capable of inter-satellite communication and satellite-to-ground communication, as well as electrical propulsion for orbit control and maintaining formation.

**Key Words:** Cube-sats, miniaturization, 3-D Earth observation

## Objectives and added-value for the RLS:

The main objective is to promote technology leadership through multilateral cooperation in the field of very small satellites.

The RLS regions have the necessary expertise: they can either contribute a full satellite or key components. Their cooperation will maintain research and training excellence in their RLS network, and provide a regional advantage in the increasing international science and innovation competition around small satellites.

Several international calls for proposals target these technology developments, and demonstrate the need for innovative solutions.

Building on their regional strengths, the RLS regions can in the mid-term help to bring a new regional technology into market for innovative 3-D Earth observation, and telecommunication (internet in space).

In the long-run, this project will have a symbolic dimension, showing that cooperation on the ground can lead to technological achievements in space.

**Duration:** 2-3 years until launch of the first enhanced joint formation, depending on the resources available

## Participants:

### Bavarian lead partner:

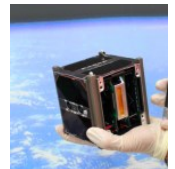
Zentrum für Telematik (ZfT) in Würzburg coordinates this self-organized research project. Thanks to the European Research Council Advanced Grant Project „NetSat“ (2014-2019), ZfT has gained extensive experience in small satellites clusters operating in formation. The Würzburg small satellites UWE have already demonstrated their robustness and increasing capabilities in orbit. As an example, UWE-3 has been in operation for more than 2.5 years without interruption.

**Lead researcher:** Prof. Dr. Klaus Schilling



### RLS-Partners:

Center for Space Systems/Georgia Tech (Georgia)  
Université de Sherbrooke (Québec)  
Université de Montréal (Québec)  
Canadian Space Agency (Québec)  
National Institute for Space Research INPE (São Paulo)  
Shandong Institute of Aerospace Electronic Research (Shandong)  
Shandong University (Shandong)  
Johannes Kepler Universität Linz (Upper Austria)  
Cape Peninsula University of Technology (Western Cape)  
Stellenbosch University (Western Cape)  
Technical University Munich (Bavaria)  
German Aerospace Center DLR (Bavaria)  
University Würzburg (Bavaria)



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**Next Steps:** Project Kick-Off Meeting in Munich, July 15<sup>th</sup> 2016

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