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BRITE-Austria/TUG Sat1: Project Overview

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Abstract

This proceeding paper was generated using a Power-Point presentation from the workshop.

Presentation Slides

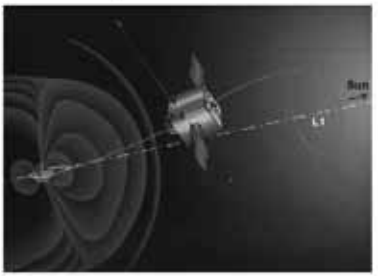
PLANNED SATELLITE PROJECTS (1)

- GRAZIJA:
  - Small scientific sub-satellite to be released from MIR Space Station during AUSTROMIR mission 1991
  - nicht realised to due time constraints

Quelle: ESA

PLANNED SATELLITE PROJECTS (2)

- ALPSAT:
  - Cooperation Switzerland / Austria
  - Very challenging mission, satellite positioned at Lagrange-Point
  - Not realised due to budget constraints



PROJECT IDEAS

- Workshops for potential small satellite missions
- Indication by FFG/ALR for support of a small satellite project
- CUBESAT studies by TU Graz
- BRITE proposal by UTIAS and Univ. of Vienna
- Joint proposal by TUG, UV, TUW submitted to FFG/ALR in September 2005

TUG SAT-1 /BRITE AUSTRIA

- Design, Development, Construction, Test, Launch and Operations of the first Austrian Satellite
- Finaned within framework of Austrian National Space Program by Austrian Science Promotion Agency (FFG)
- Training of students
  - Hands-on experience in conduct of a challenging space projects
- Synergies between several scientfic fields
  - Electrical engineering and telematics
  - Astronomy
  - Mechanical engineering and thermodynamics
  - Satellite geodesy

BRITE AUSTRIA – The Partners

- Ministry of Transport, Innovation and Transport
  - National Space Programm
- Science Promotion Agency FFG/ALR
  - Initiator of the project
  - Operations of the national Space Program
- TU Graz (Prof.O.Koudelka)
  - Project Management TUGSAT-1/BRITE-AUSTRIA
  - System studies, building/testing of TUGSAT-1/BRITE-AUSTRIA
  - Launch, operations of Graz station
- University of Vienna Wien (Prof.W.Weiss)
  - Astronomy, Science Cooperation
- TU Wien (Prof.A.Scholtz)
  - Operations of Vienna Ground Station
- Space Flight Labortory, University of Toronto
  - Design
  - Delivery of key components

TU Graz | universität wien | TU VIENNA | UTIAS SFL Space Flight Laboratory

TUG SAT-1 / BRITE AUSTRIA Bright Target Explorer

- Scientific Goal: Investigation of massive luminous stars with precise star camera
- Opens up new dimension for astronomers
- Observation of stars without interference of earth atmosphere
- With small low-cost spacecraft

SCIENTIFIC GOAL

- Measurement of oscillation of luminous stars (magnitude +3.5)
- Recording of time-series (minutes to months)

SATELLITE CONSTELLATION

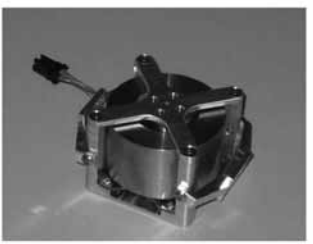
- Pair of satellites:
  - Different spectral filters (red and blue)
  - Colour information in addition to brightness
  - No moving parts
  - Longer observation times
  - Minimisation of risk
  - Reduction of development costs

INSTRUMENT

- Telescope with CCD sensors
- Simultaneous observation of several stars
- Differential photometry
- Nominal exposure time 15 Minuten (orbit duration 100 minutes)
- Sequences of > 100 days

TUG SAT-1 / BRITE-AUSTRIA

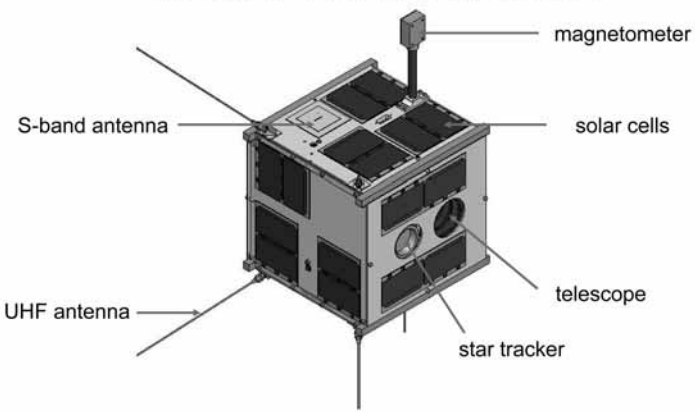
- „Nanosatellite“
- Mass: approx. 6 kg
- Innovation: precise three-axis stabilisation
  - Arcminute level
  - Nano momentum wheels
  - Attitude control computer
  - Coarse and fine sun sensors
  - Magnetometer
  - Magnetorquer



TECHNICAL DATA

- Power supply: 6 W (solar cells)
- Data rate: 32 kbit/s (min.), 256 kbit/s (max.)
- Data volume/ day: typ. 2 MByte
- Frequencies:
  - 2234.4 MHz (S-Band downlink)
  - 437.365 MHz (UHF uplink)
  - 145.89 MHz (VHF beacon)
- Transmit power:
  - 0.5 W (for S-band downlink)
  - 0.1 W (for VHF beacon)

TUGSAT-1 /BRITE-AUSTRIA



ORBIT

- Sun-synchronous or polar orbit
- Approx. 800 km

COSTS / TIME PLAN

- Development and testing: 2 years
- Costs for development: 450 k€ (FFG/ALR) + 50 k€ for ground station Graz (TUG)
- First part of Phase 2: 250 k€
  - Launch opportunities
  - Software development (ground support and science software)
- Mission duration: min. 2 years

STATUS

- PDR in October 2007
- CDR before summer 2007
- Building starts in summer
- Completion of spacecraft by Q3/2008
- Launch planned for end 2008 / begin 2009

SUMMARY

- Challenging scientific and technological mission
- Sustainability: development of a cost-efficient satellite platform for future missions
- Added value for education:
  - Training for students
  - Young engineers and scientists
- Raising interest of the public for space research and technology

INFORMATION

www.iks.tugraz.at www.tugsat.at

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O. Koudelka and W. W. Weiss inaugurating the workshop dinner at the Institute of Astronomy.

Engineering