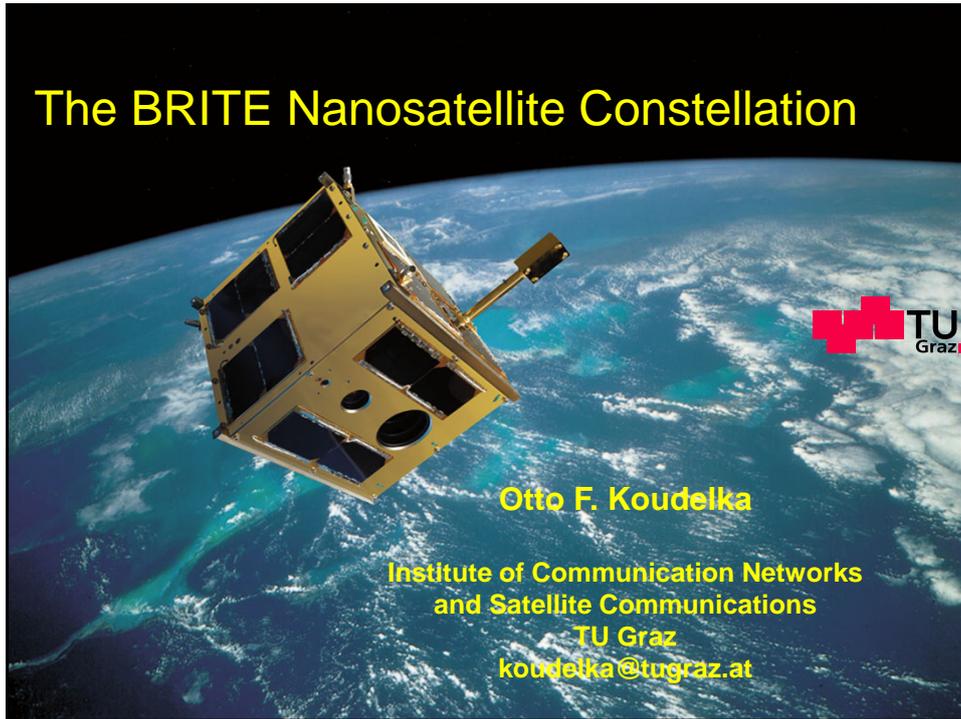


The BRITE Nanosatellite Constellation

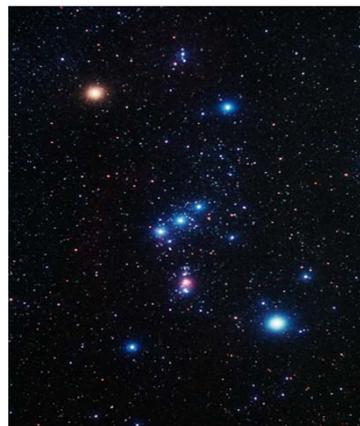


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BRITE (BRiGht Target Explorer)

- Scientific goal: investigation of brightness variations of massive luminous stars with precise star camera
- „Space telescope“ needed: avoiding interference by Earth atmosphere



SCIENTIFIC GOAL

- Measurement of brightness variations of luminous stars (magnitude +3.5) by differential photometry
- Differential measurement made (at least 2 stars in field of view during exposure)
- Physical properties and processes on these stars (e.g. mass ejection, rotation of star,...) can be derived from these brightness oscillations
- Recording of time-series (100...200 days)

- Mission duration: at least 2 years

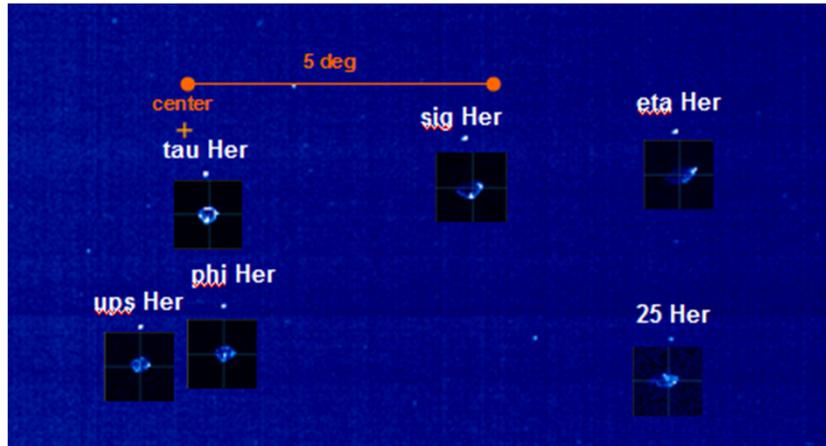
INSTRUMENT

- Telescope with CCD sensor
- 2 types of filters: blue and red spectral ranges
- Type 1: blue filter, type 2: red filter



BRIGHTNESS VARIATIONS

- Resolution: 0.001 magnitudes required



TUG SAT-1

5

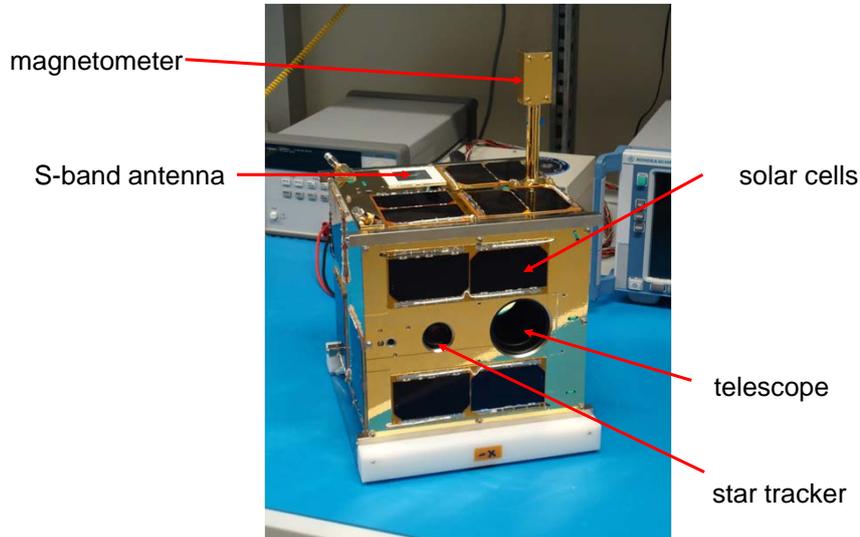
BRITE CONSTELLATION

- 6 satellites, operating in pairs
 - red/blue filter instrument
- 2 Austrian: TUGSAT-1/BRITE-Austria & UniBRITE
- 2 Polish: BRITE-PL1 (LEM) & BRITE-PL2
- 2 Canadian: BRITE-CAN 1 & BRITE-CAN 2

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6

TUGSAT-1/BRITE-Austria FLIGHT MODEL



TUG SAT-1

BRITE CHARACTERISTICS

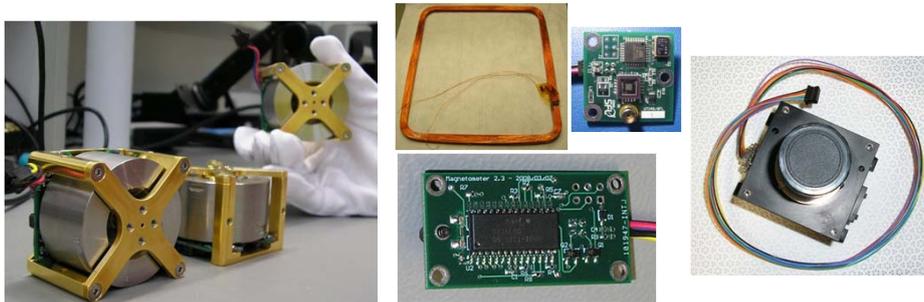
- Nanosatellite: 20 x 20 x 20 cm
- Mass: 7 kg
- Electrical power: 6...11 W
- Transmit power: 0.5 W
- Frequency bands: S-band downlink / UHF uplink
- Data rates: 32...256 kbit/s downlink, 9.6 kbit/s uplink
- Science data volume: 2...10 MB / day



TUG SAT-1

ATTITUDE CONTROL SYSTEM

- Precise alignment of camera to target stars
- 3 miniature momentum wheels, magnetorquer, sun sensors, magnetometer, star sensor and attitude control computer provide alignment at arc minute level



TUG SAT-1

ON-BOARD COMPUTERS

Subsystems can be powered/switched off under computer control



3 nearly identical computers on board:

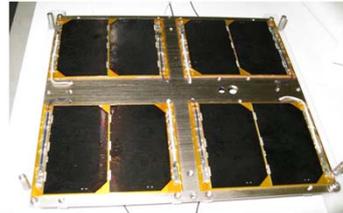
- housekeeping
- attitude control
- instrument

TUG SAT-1

POWER SUBSYSTEM

36 solar cells

- mounted on 6 panels
- 6 W average
- 11 W peak



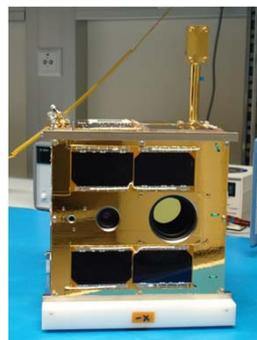
Batteries

- Energy storage during eclipses
- 2nd battery for redundancy



TECHNOLOGY

based on pioneering developments by the
Space Flight Lab of the University Toronto
GNB (generic nanosatellite bus)



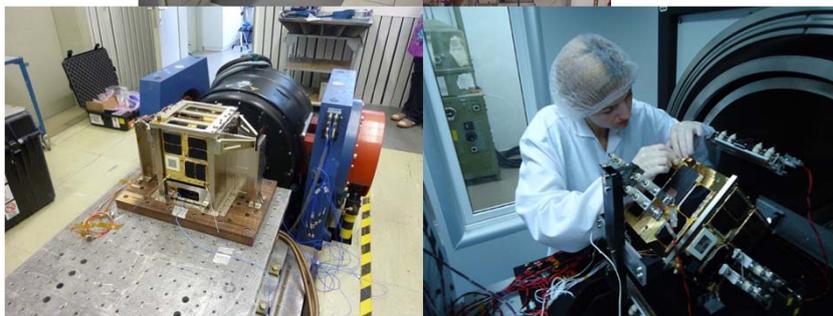
„FLATSAT“ TESTS



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13

QUALIFICATION TESTS



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14

TESTS OF HARDWARE/SOFTWARE



TUG SAT-1

GROUND STATION AND MISSION CONTROL CENTRE GRAZ



3 m tracking antenna
for S-Band & UHF bands



TUG SAT-1

GROUND STATIONS

- Graz, Austria (Control of BRITE-Austria)
- Vienna, Austria (Control of UniBRITE in 2014)
- Toronto, Canada (Control of BRITE-CAN)
- Warsaw, Poland (Control of BRITE-PL)

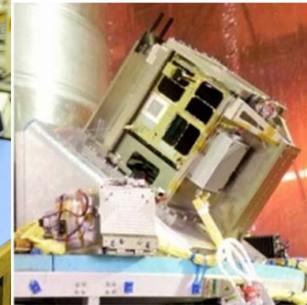
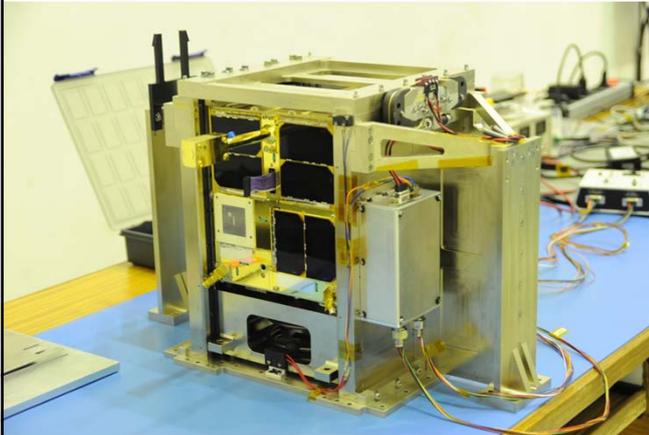
- All stations could track and collect data from all BRITE spacecraft (redundancy)
- Automatic ground station operations
- Science teams can retrieve verified raw data from servers

LAUNCHER

- TUGSAT-1/BRITE-Austria and UniBRITE will be launched by PSLV-C20 of ISRO/ANTRIX on 25 February 2013 from the Satish Dhawan Space Centre in Sriharikota
- Sun-synchronous LEO orbit



SPACECRAFT IN LAUNCH TUBE (XPOD)



Source: ISRO/SFL/TUG

SUMMARY

BRITE Constellation will be the world's first nanosatellite constellation dedicated to an astronomy mission

Always a pair of satellites will measure in the blue and red spectral ranges, providing not only temporal, but also spectral information on the brightness variations of massive luminous stars

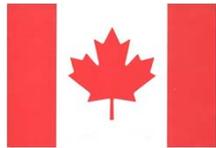
SUMMARY (2)

- 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

SUMMARY (3)

- Since 28 December 2011 Austria has Space Law implemented
- Regulating registration, authorisation, liability and space debris mitigation issues
- BRITE was important stimulus

INTERNATIONAL COOPERATION



Canada



Austria



Poland



We are at T – 4 days
Next week a BRITE future begins!
Thank you for your attention!