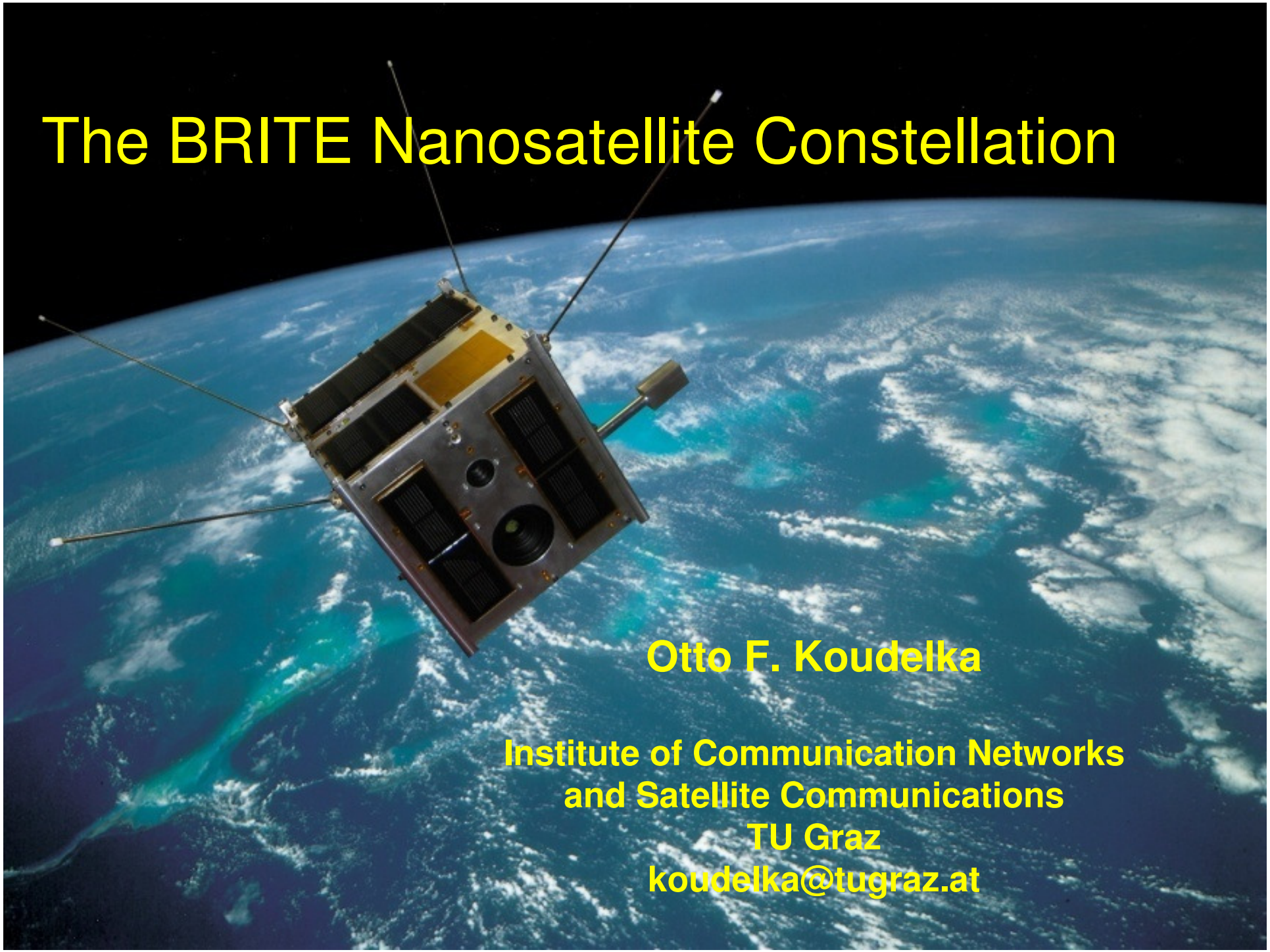
The BRITE Nanosatellite Constellation



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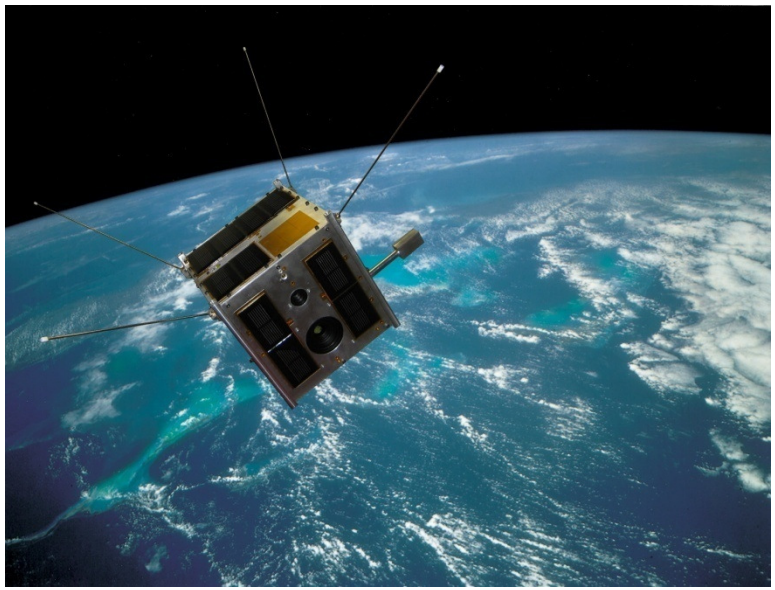
BRITE (BRIght Target Explorer)

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



SCIENTIFIC GOAL

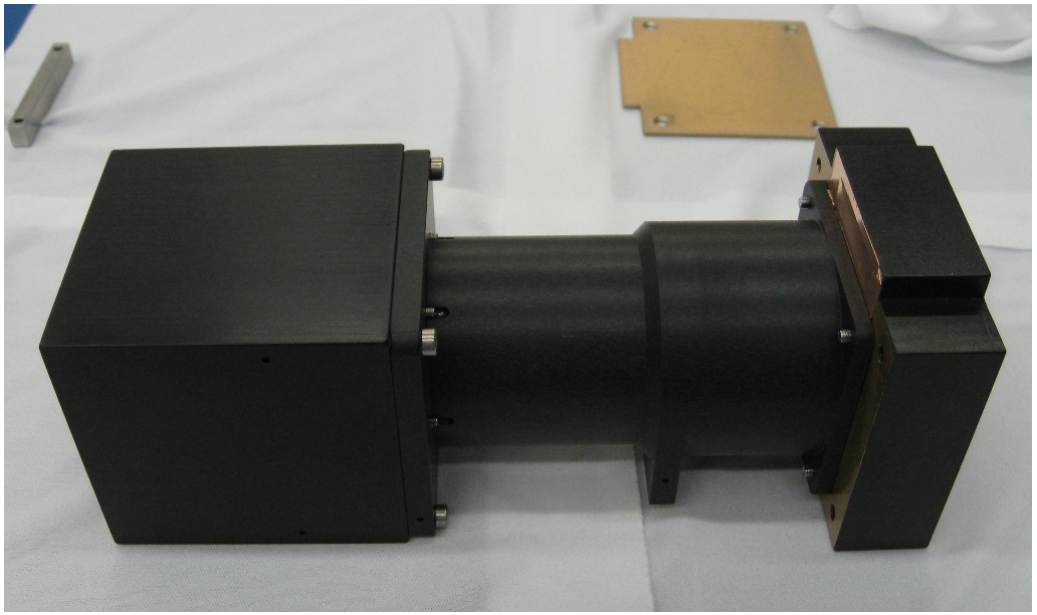
- Measurement of brightness variations of luminous stars (magnitude +3.5) by differential photometry
- Differential measurement made (at least 2 stars in field of view during exposure)
- Physical properties and processes on these stars (e.g. mass ejection, rotation of star,…) can be derived from these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

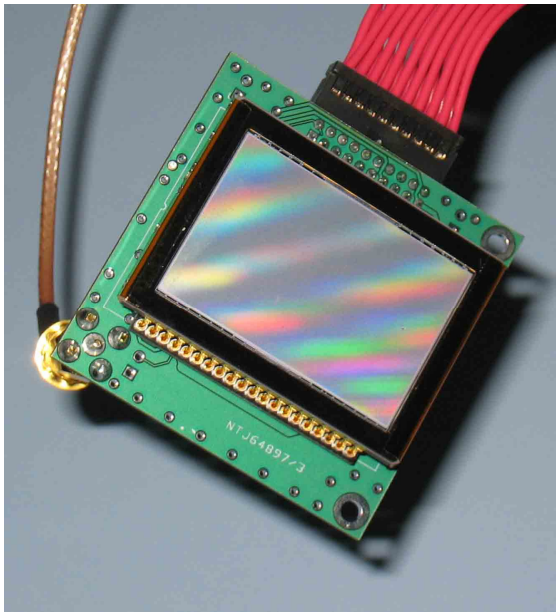
- Mission duration: min. 2 years

BRIGHTNESS VARIATION

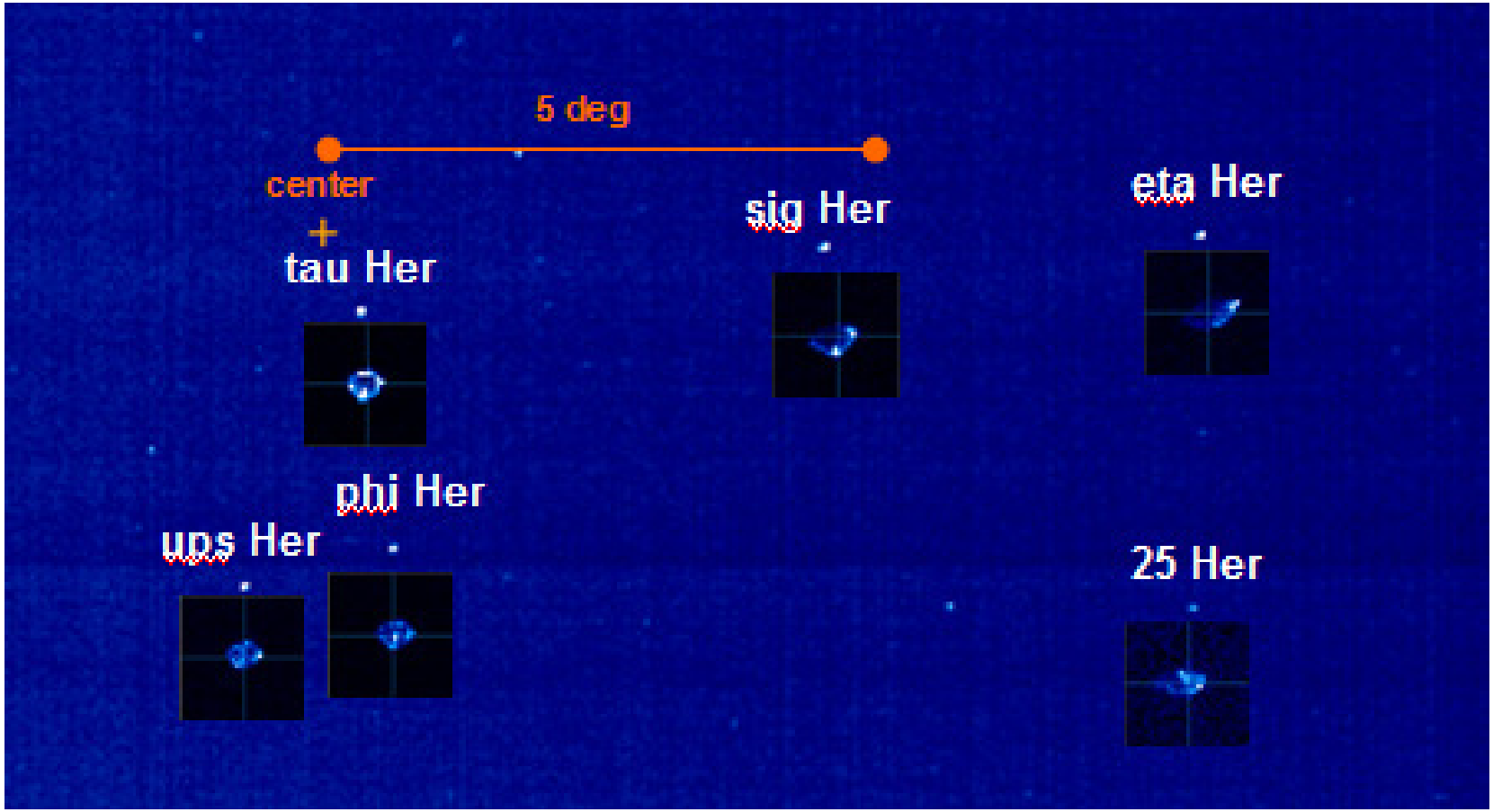
INSTRUMENT

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

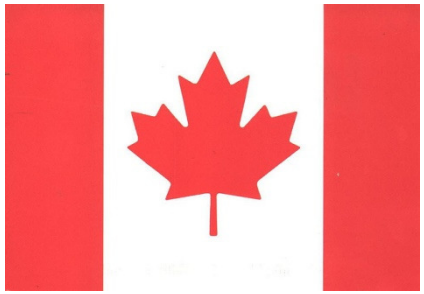




STAR PICTURES

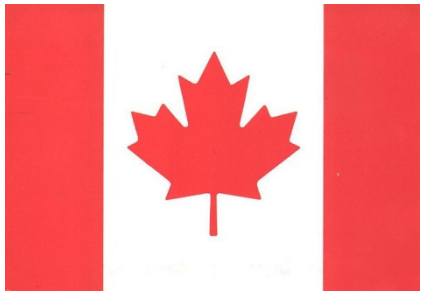


COOPERATION



Maple leaf meets red-white red

COOPERATION



Canada

Austria

Poland

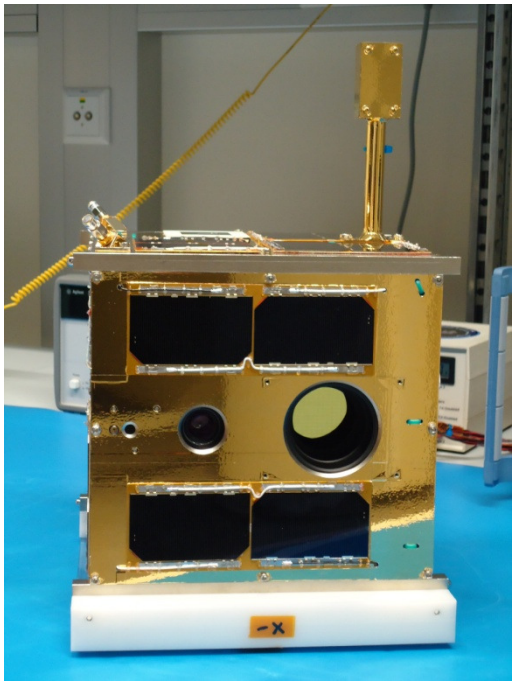
BRITE CONSTELLATION

- 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

TECHNOLOGY

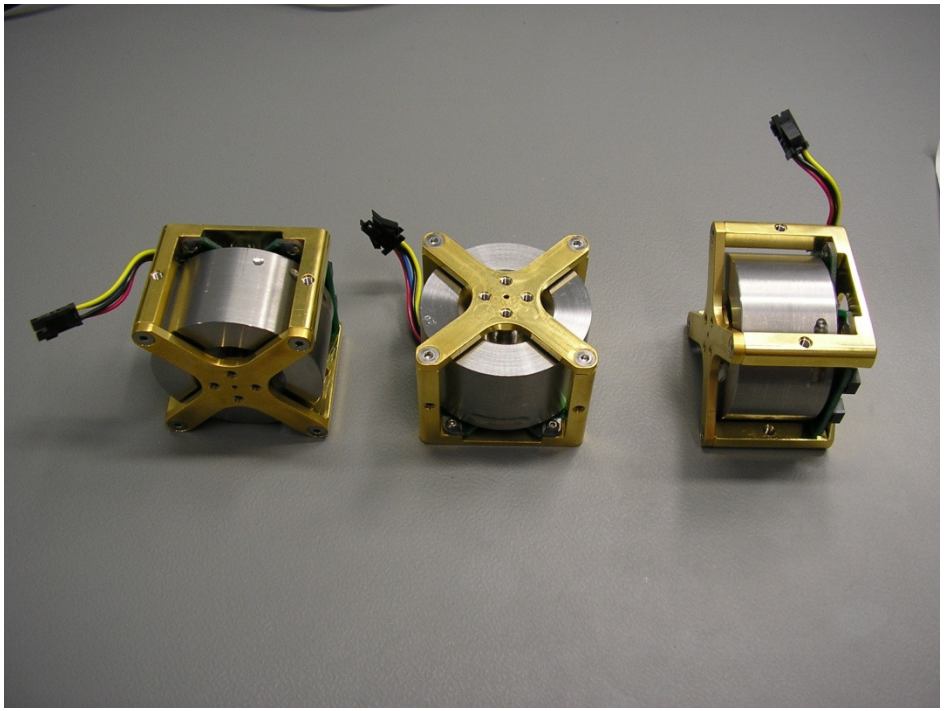
Based on pioneering developments by the Space Flight Lab of the University Toronto

GNB (generic nanosatellite bus)



BRITE CHARACTERISTICS

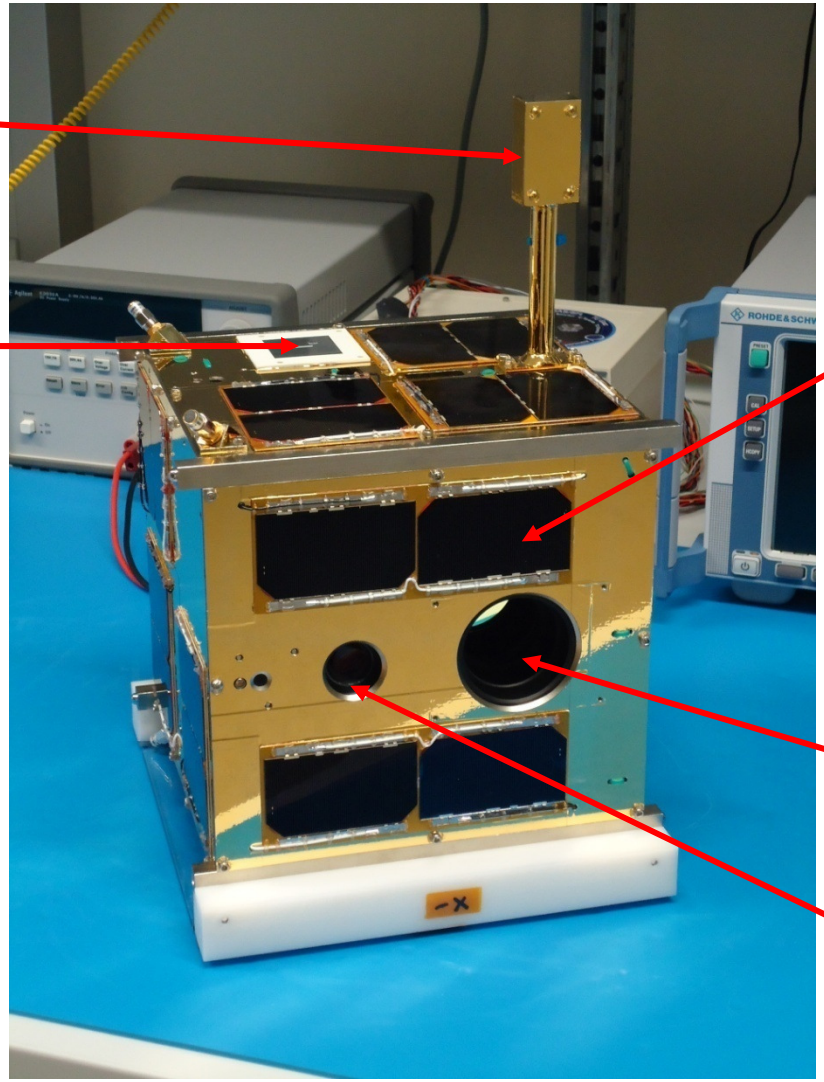
- „Nanosatellite“: 20 x 20 x 20 cm
- Mass: 7 kg
- Innovation: precise three-axis stabilisation
  - Arcminute level
  - Nano momentum wheels
  - Attitude control computer
  - Coarse and fine sun sensors
  - Magnetometer
  - Magnetorquer



TECHNICAL DATA

- Power supply: 6 W average (solar cells), peak: 11 W
- Data rate: 32 kbit/s (min.), 256 kbit/s (max.)
- Data volume/ day: 2…8 MByte / day
- Frequencies:
  - S-Band downlink
  - UHF uplink
- Transmit power:
  - 0.5 W (for S-band downlink)

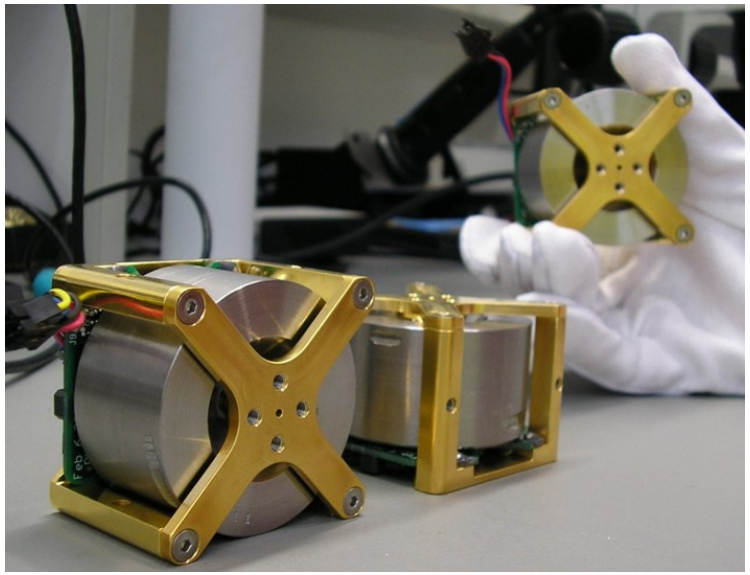
TUGSAT-1 FLIGHT MODEL

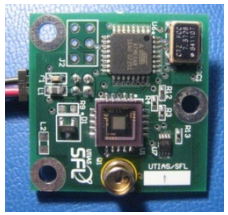


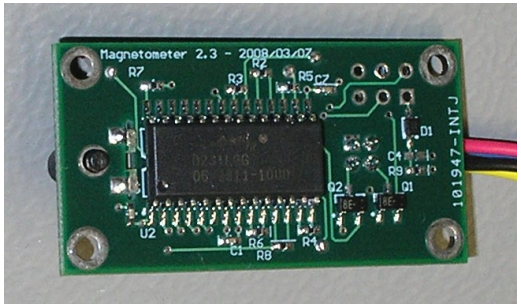
ATTITUDE CONTROL SYSTEM

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

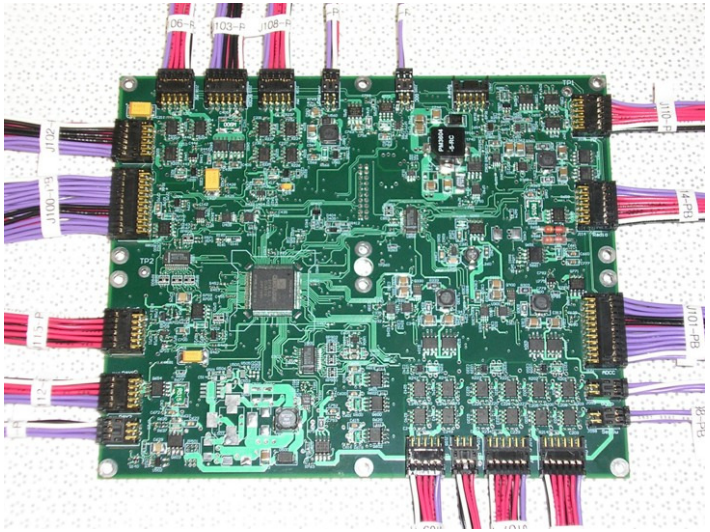


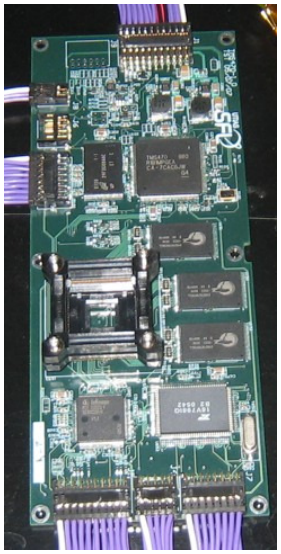




ON-BOARD COMPUTERS

Subsystems can be powered/switched off under computer control





3 nearly identical computers on board:

- housekeeping
- attitude control
- instrument

ORBIT

- Sun-synchonous LEO orbit
- Austrian BRITEs launched by PSLV-C20 by ISRO/ANTRIX in mid 2012

GROUND STATIONS

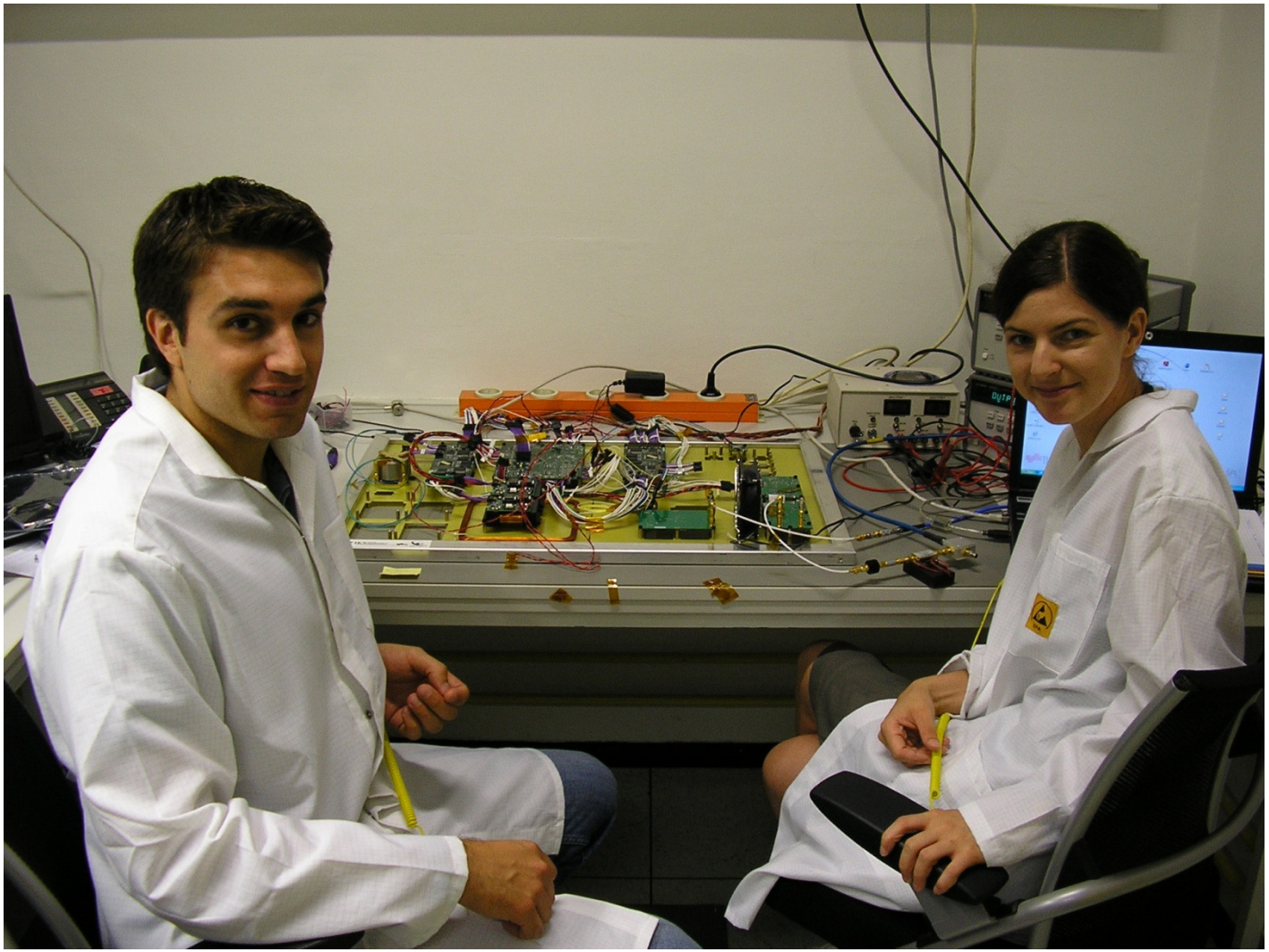
- Graz, Austria (Mission Control for BRITE-Austria and UniBRITE)
- Vienna
- Toronto, Canada (Mission Control for BRITE-CAN)
- Warsaw, Poland (Mission Control for BRITE-PL)

- All stations will track and collect data from all BRITEs
- Distributed automatic ground station operations
- Science teams can retrieve verified raw data from servers

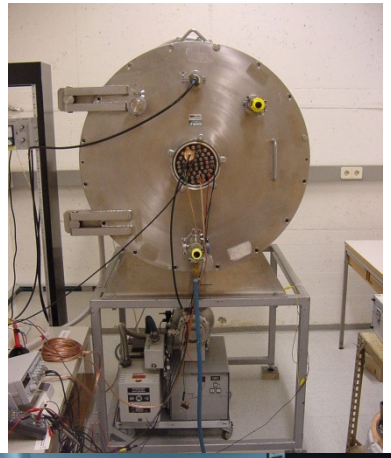
GROUND STATION AND CONTROL CENTRE GRAZ

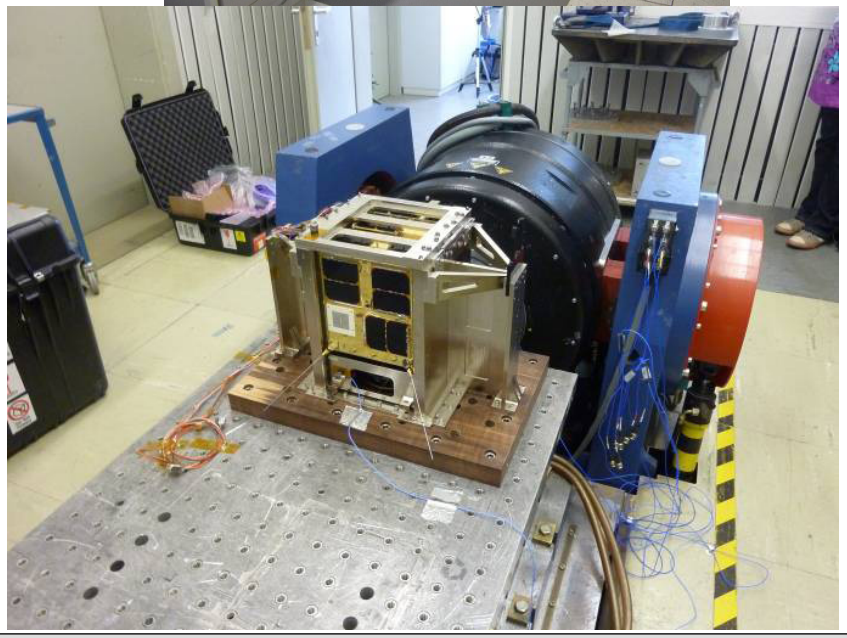
3 m tracking antenna
for S-Band,
UHF and
VHF-Bands

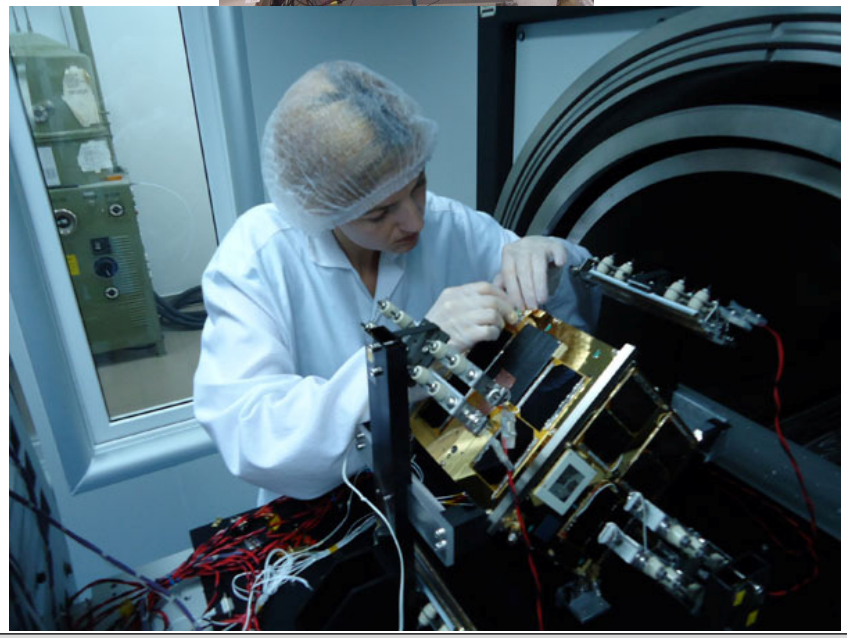
TESTS OF HARDWARE/SOFTWARE



QUALIFICATION TESTS







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 of students,
    young engineers and scientists
- Raising interest of the public for space research and technology

SUMMARY (3)

- Since 27 December 2011 Austria has Space Law implemented
- Regulating registration, authorisation, liability and space debris mitigation issues
- BRITE was important stimulus


TU
Graz


UTIAS
SFL
Space Flight Laboratory


CBK
PAN


universität
wien


CSA ASC


CAMK
PAN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VIENNA


bmvit


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FFG

We are looking forward to a BRITE future!

Thank you for your attention!