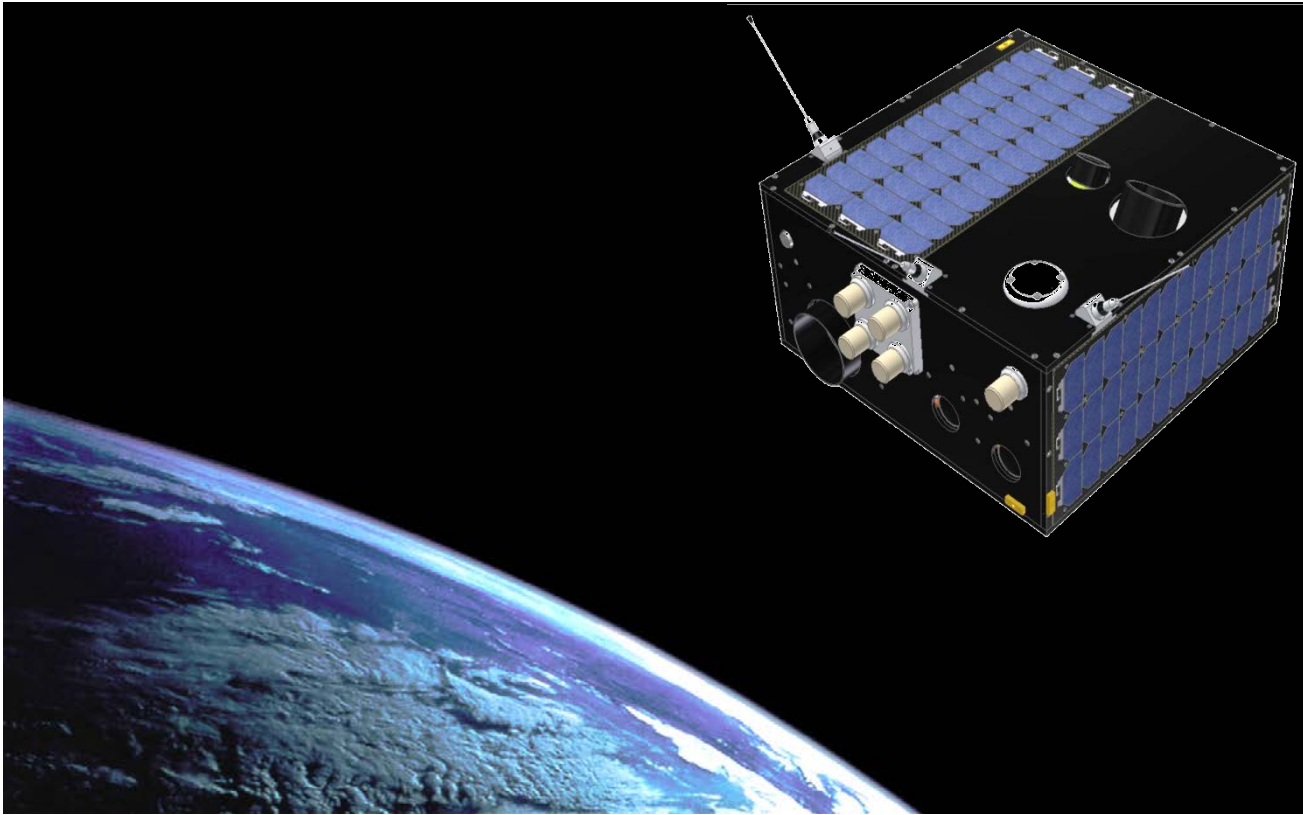


## Kent Ridge 1

A Hyper Spectral Micro Satellite to Aid Disaster Relieve



Tom Segert, Matthias Buhl, Björn Danziger

Kee-Chaing Chua, Cher Hiang Goh, Swee-Ping Yeo

# Berlin Space Technologies

## Who we are



Berlin Space Technologies is:

An expert for low cost and COTS based small satellite technology following the TUBSAT™ approach.

Focussed on commercial missions mainly for export and training programs.



- All major subsystems produced in-house
- Missions:  
Kent-Ridge-1,  
UrtheCast, Aalto-1
- Experience:  
DLR-, MAROC-, and LAPAN-  
TUBSAT, LAPAN-Orari and  
LAPAN-A2
- Technology transfer and  
training in cooperation  
with TU Berlin

# Berlin Space Technologies

## What we do



### LAPAN-TUBSAT

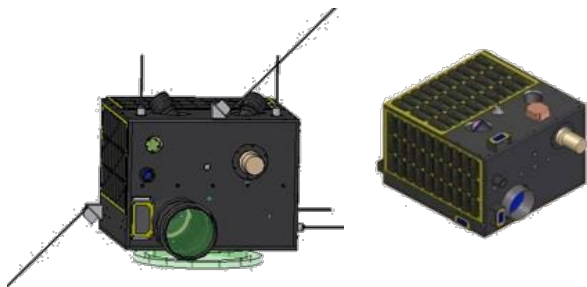
(TUB: 2005-2009)



AIV, Operation, Training

### LAPAN-Orari and LAPAN-A2

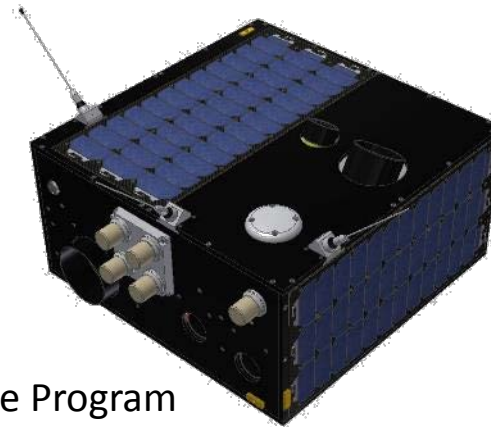
(BST\*: 2008-2010)



Training, Consultancy,  
ACS Subsystems

### Kent-Ridge-1

(BST: 2013-2015)



Complete Program

### Aalto-1

(BST: 2012-2014)



Complete ADCS Solution

### UrtheCast: ISS

(BST: 2012-2014)



2x Star Tracker, 6x Gyros  
and Control Unit

# Berlin Space Technologies

## Where to find us

## BST Headquarter in Berlin Adlershof



- 1 Server Room
- 2 Optics Labs
- 3 Mechanics and Optics Development Office
- 4 Electronics Development Office
- 5 Software Development Office
- 6 CEO Office
- 7 Satellite Pre-Integration
- 8 Satellite Integration
- 9 Components Pre-Integration



- 625 m<sup>2</sup> of laboratories, offices and clean rooms
- Dedicated training area
- Clean rooms up to class 1000 on demand



# Kent Ridge 1

A Hyper Spectral Micro Satellite to Aid Disaster Relieve

# Berlin Space Technologies

## Kent Ridge 1 Mission



BST is:

an experienced provider of small satellite systems and technology

building on the experience of the famous TUBSAT™ satellites

Conducting successful small satellite training programs in cooperation with Technische Universität Berlin



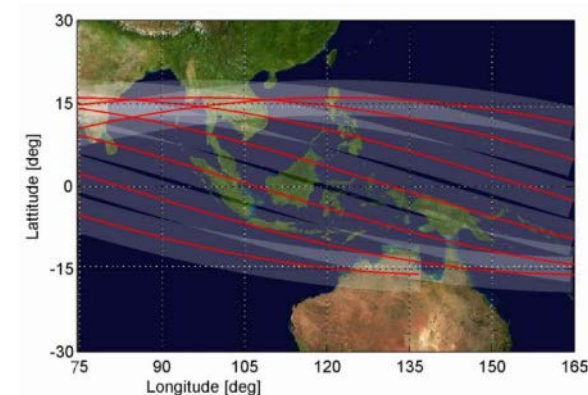
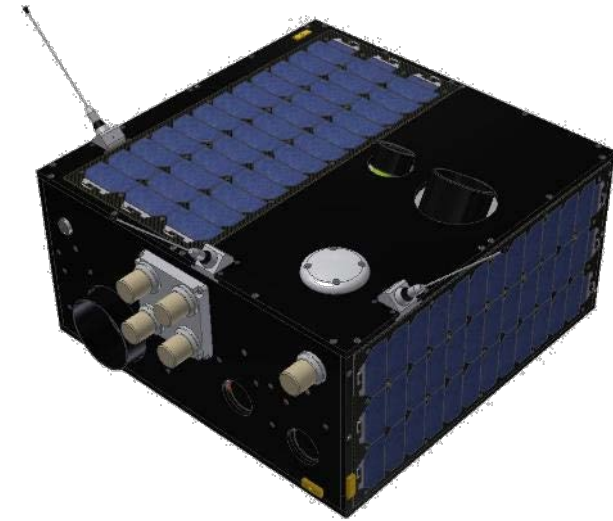
NUS is:

Singapore's flagship university and one of the world's leading institutions for higher learning and research

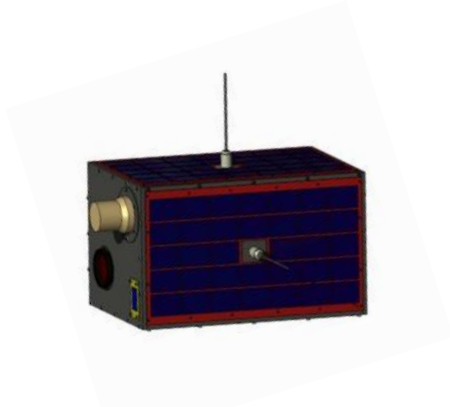
Interested to build a sustainable small satellite program within the faculty of electrical engineering

Kent Ridge 1 is:

- a small satellite of National University of Singapore
  - build in cooperation with Berlin Space Technologies
  - Part of a training program jump starting a micro satellite program at NUS
- Pathfinder for Fourier Transform Hyper Spectral
  - Technology developed in Singapore at DSO
  - Enables miniaturized hyper spectral instruments
- to be launched in to NEqO in Q4 2015
  - Frequent revisits to facilitate disaster relive missions



### LEOS-30



### Payload Performance



400 x 200 x 200 mm



5 - 8 kg

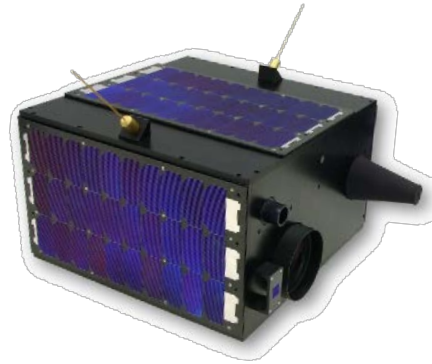


60W peak 15W av.



2 years

### LEOS-50



400 x 400 x 200 mm

15 - 25 kg

120W peak 20W av.

5 years

### LEOS-100



500 x 500 x 500 mm

30 - 50 kg

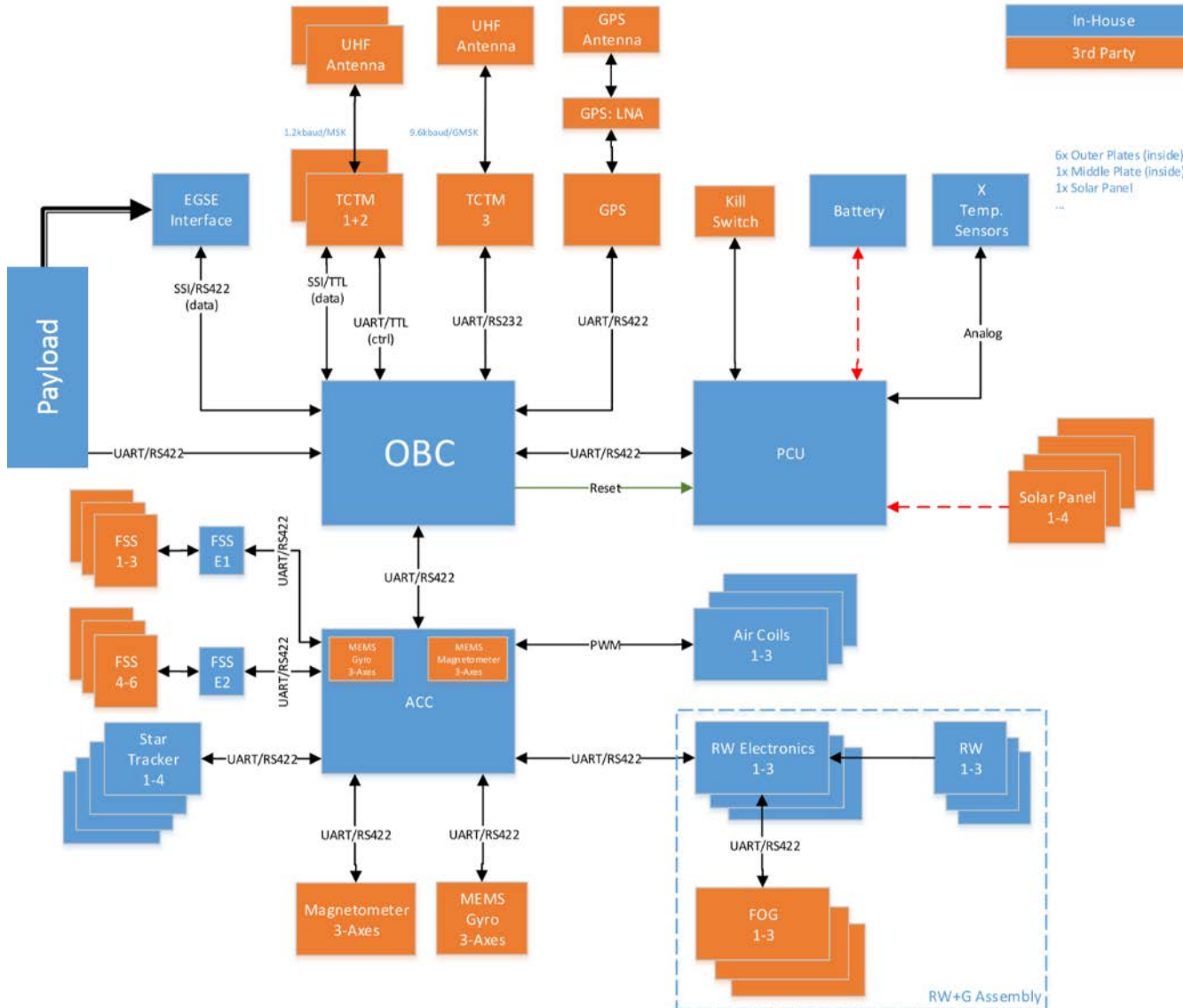
240W peak 60W av.

5 years

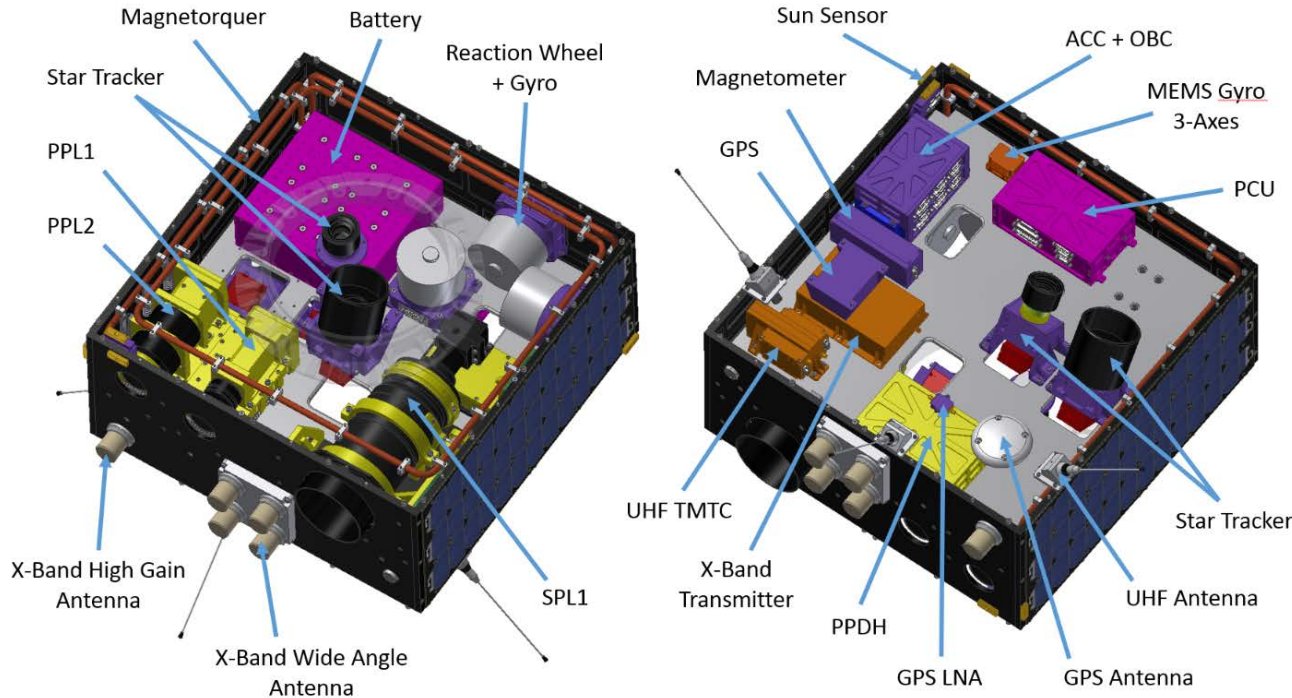


# Berlin Space Technologies

## Satellite Bus



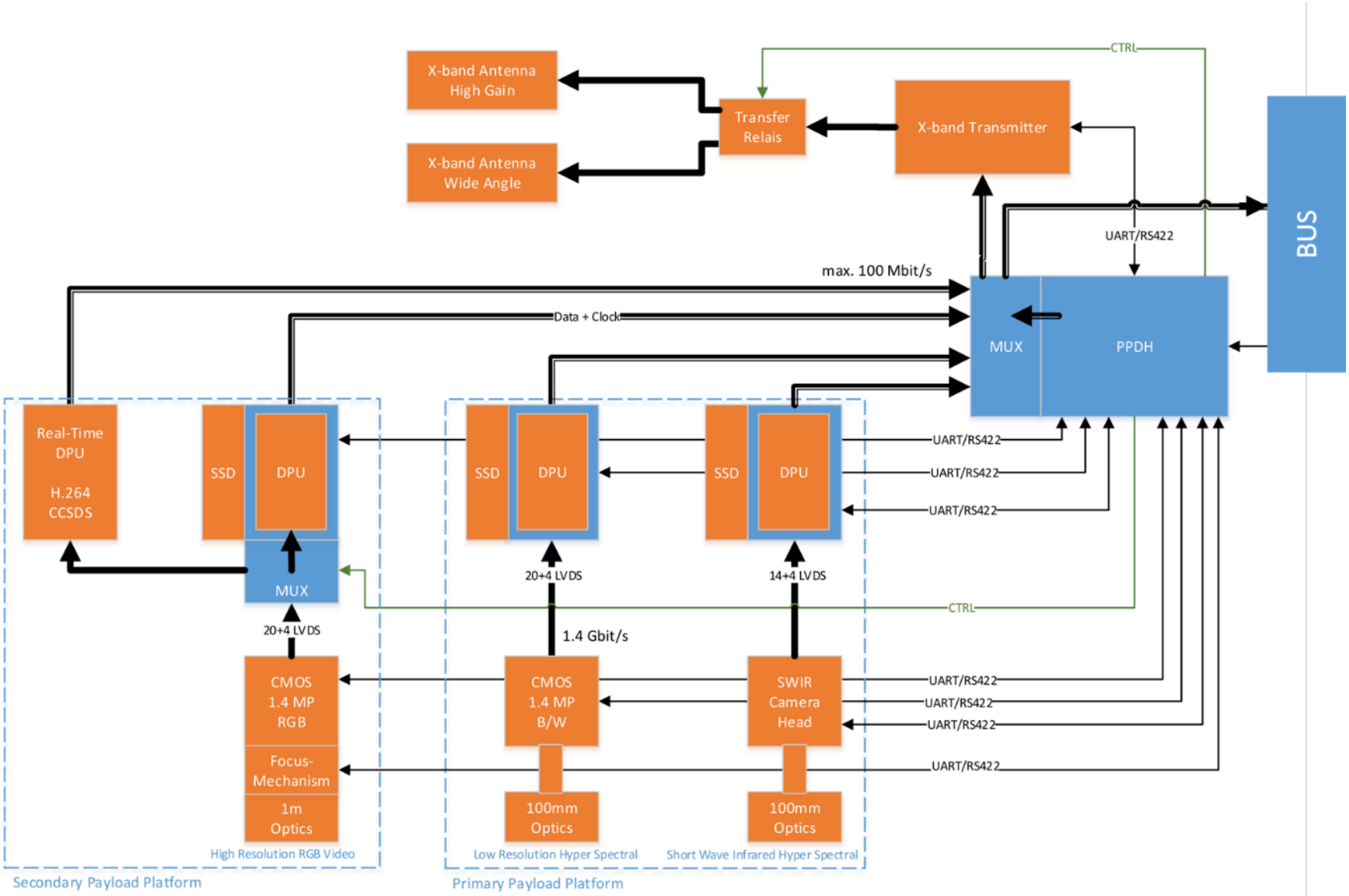
- All major subsystems produced in-house
- Cooperation with local partners
- Low cost satellite bus fully qualified Made in Berlin
- Reasonable Quality Assurance and Documentation



## High Performance Payload Platform

- Based on LEOS-50 Platform
- Can to accommodate 3 payloads
- High Data Rate → 2.2 Gbit/s raw data rate
- High Throughput transmitter → 100Mbit/s

- Size: 575 x 572 x 384 mm
- Mass: 79kg
- 1 arcmin pointing
- 15"/s Jitter
- Peak Power: 120W
- Payload Power: > 20W av.
- UHF TMTc
- X-Band with 100 Mbit/s

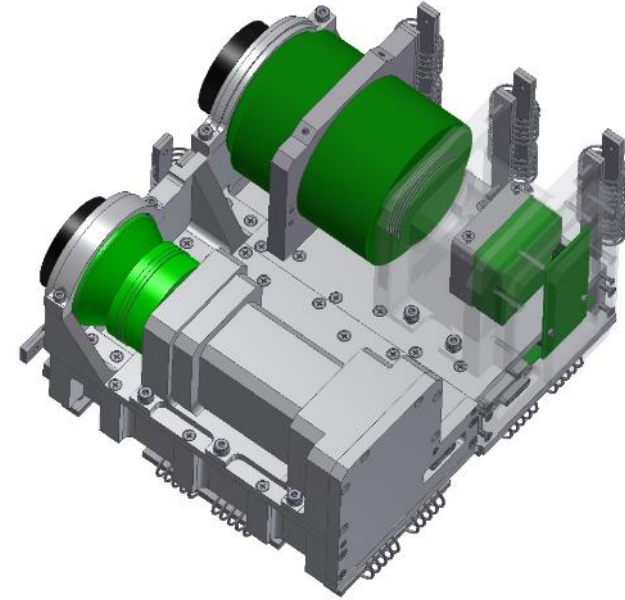


# Berlin Space Technologies

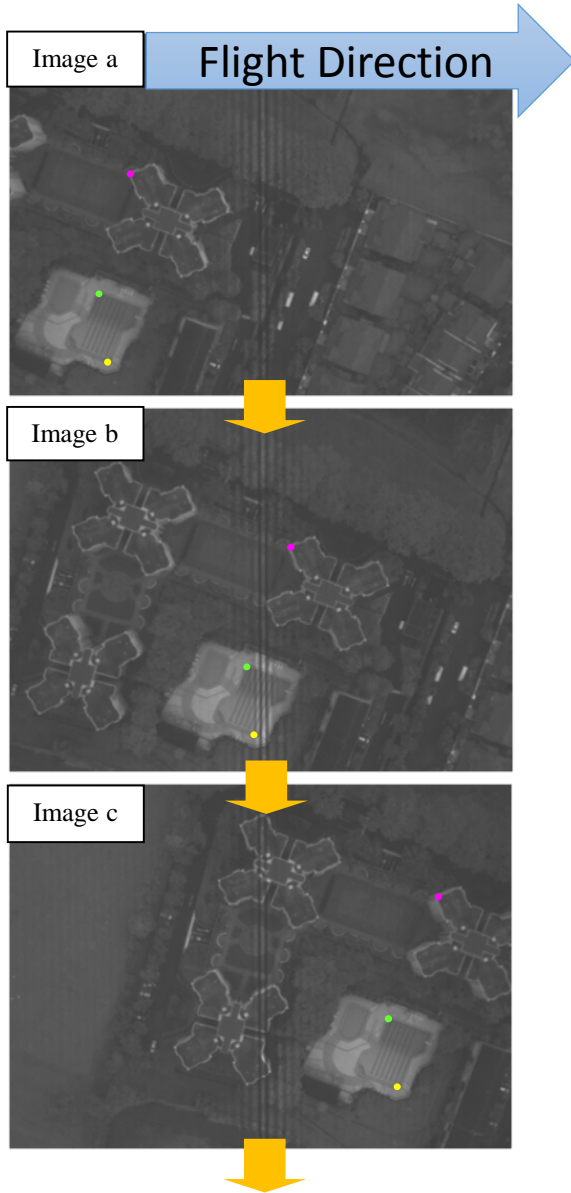
## PPL1 & PPL 2 Specification



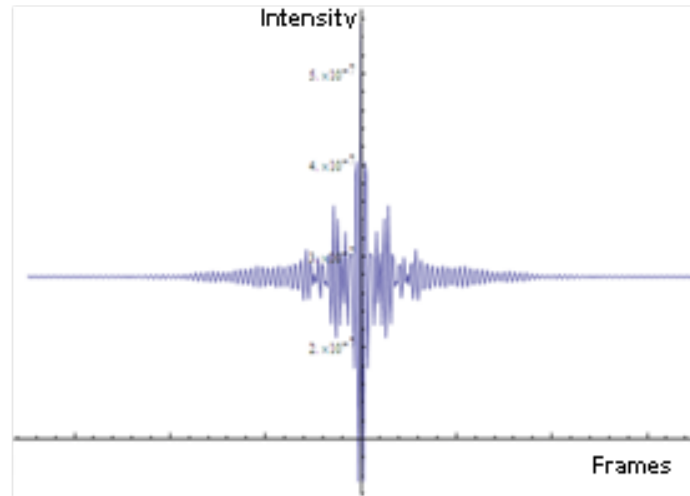
| Parameter                   | PPL1          | PPL2         |
|-----------------------------|---------------|--------------|
| Resolution                  | 44 m          | 110 m        |
| Swath                       | 47 km         | 56 km        |
| Spectral Band               | 500 - 900nm   | 950 - 1650nm |
| Channels                    | 20 - 30 (TBD) | 20-30 (TBD)  |
| Bit Depth                   | 10 / 12 bit   | 16 bit       |
| Compression Type            | JPEG2000      | JPEG2000     |
| Compression Rate            | 4x/8x         | 4x/8x        |
| MTF @ Nq.                   | > 0.2         | > 0.2        |
| SNR @ 15% Target Reflection | > 200         | > 250        |
| Data Rate                   | 1.4 Gbit/s    | 532 Mbit/s   |



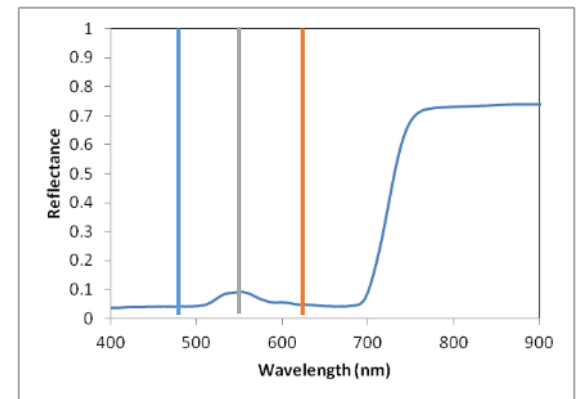
## Payloads: How does Fourier Transform Hyper Spectral work



Interferogram of a single image point

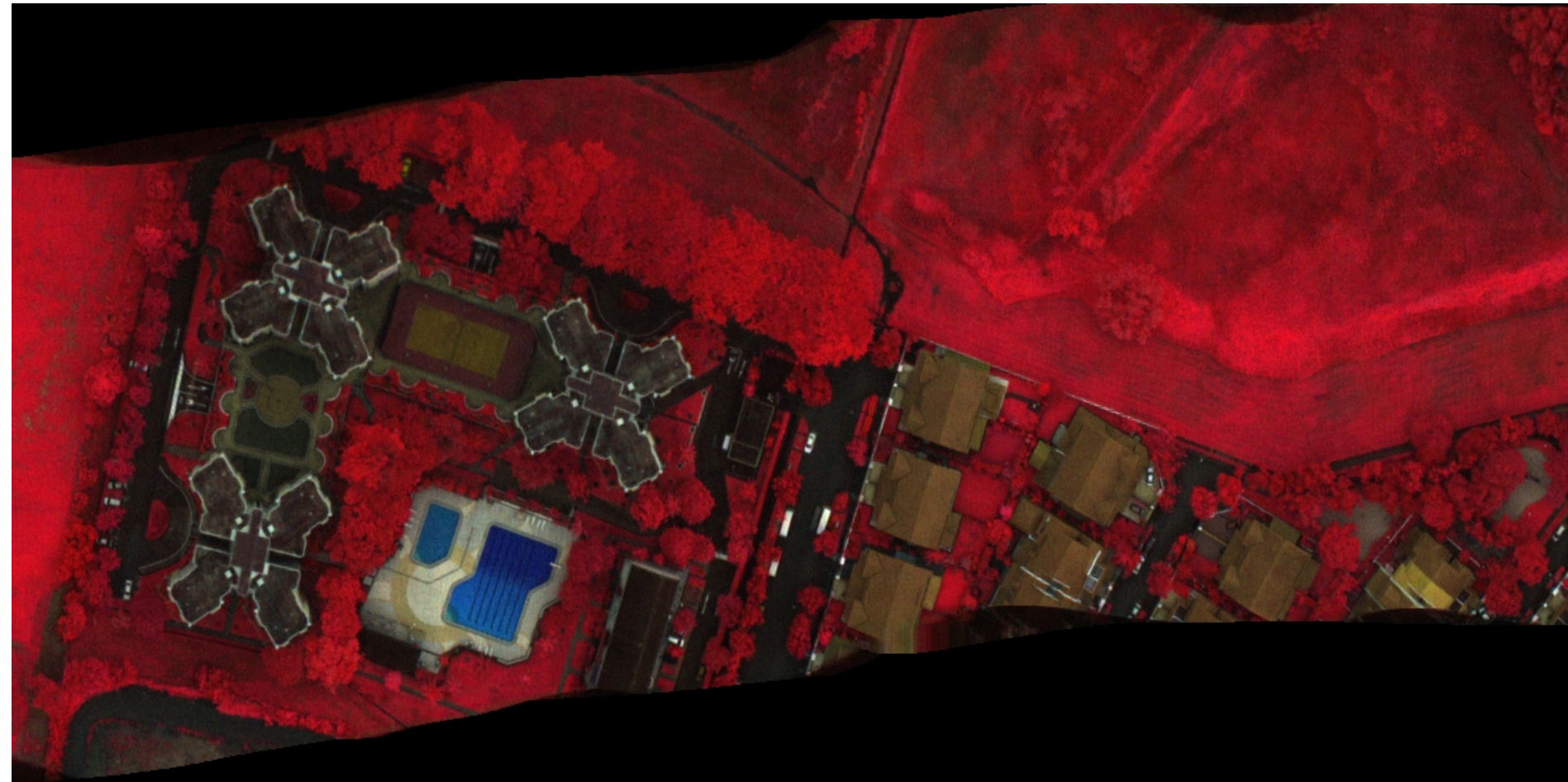


Spectrum of a traced image point



# Berlin Space Technologies

Examples of Fourier Transform Hyper Spectral

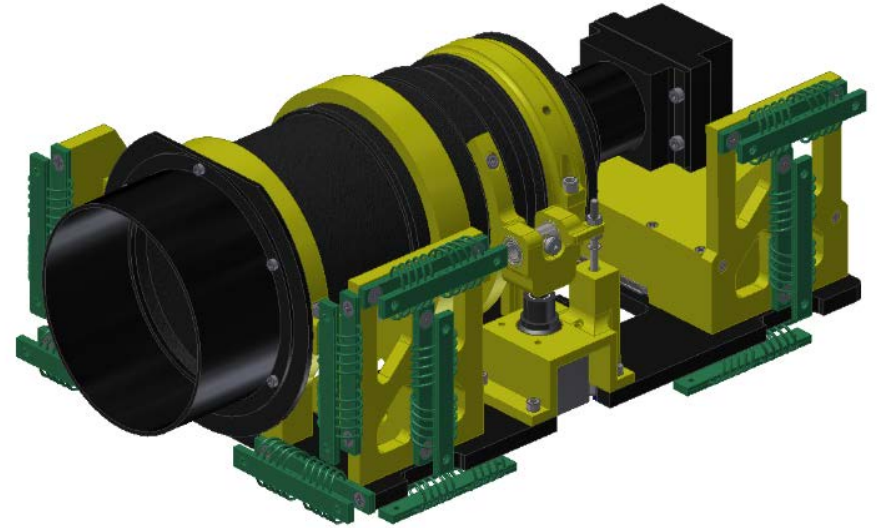


Examples of Balloon Campaign

# Berlin Space Technologies

## Specification

| Parameter        | Unit                      |
|------------------|---------------------------|
| Resolution       | 6 m                       |
| FoV              | 5.75 x 4.75 km            |
| Spectral Band    | 450 – 630 nm              |
| Channels         | 3                         |
| Bit Depth        | 8 / 12 bit                |
| Compression Type | H.264<br>JPEG2000<br>None |
| Compression Rate | 40x<br>10x<br>None        |
| Lens             | 1000mm f11                |
| MTF @ Nq.        | >0.1                      |
| SNR@30% albedo   | 100                       |



# Berlin Space Technologies

Examples of LAPAN TUBSAT

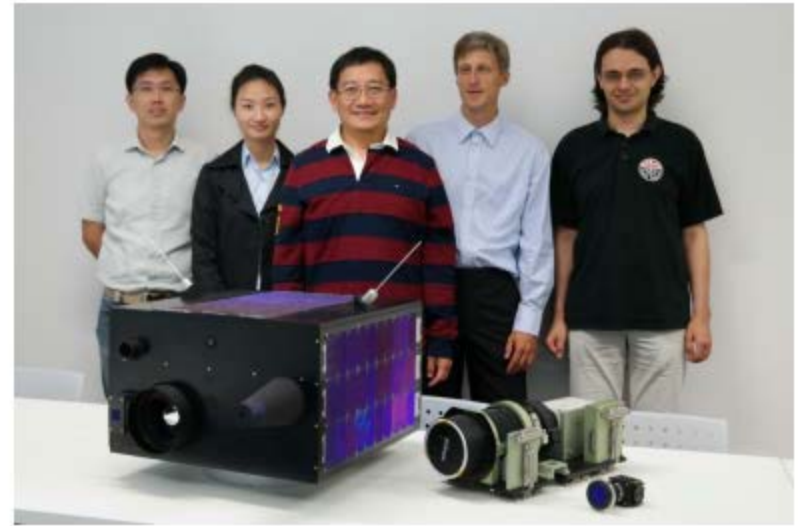


Visit LAPAN TUBSAT Video Archive on [www.Berlin-Space-Tech.com](http://www.Berlin-Space-Tech.com)



The Training Program has three main features

- University Training (Jan14 – Aug14)
  - Conducted by TU Berlin
  - Tele learning
  - 6 month duration
- Industry Training (Oct14 – Mar15)
  - Satellite system design classes
  - Trainees
  - 6 month duration in Berlin
- Hands-On Training (Oct14 – Mar15)
  - Trainees work with real flight hardware
  - All tools all steps like BST



### Kent Ridge 1 is

- A joint project of NUS and BST
- A micro satellite to demonstrate new FTH Hyperspectral Cameras
- To be launched into an NEqO in Q4/15
- Fast revisit times to aid disaster relieve
- Build around a comprehensive Training Program



### Contact:

**Berlin Space Technologies GmbH**

Max-Planck-Str. 3 - 12489 Berlin, Germany

Tel: +49 30 639280219 - Mobil: +49 176 70085941

Email: [info@berlin-space-tech.com](mailto:info@berlin-space-tech.com)

Web: [www.berlin-space-tech.com](http://www.berlin-space-tech.com)