2011 Summer CubeSat Developers' Workshop

"Improving the Pointing Performance of CubeSats"

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Utah State University Campus - Logan, UT, USA

Outline:

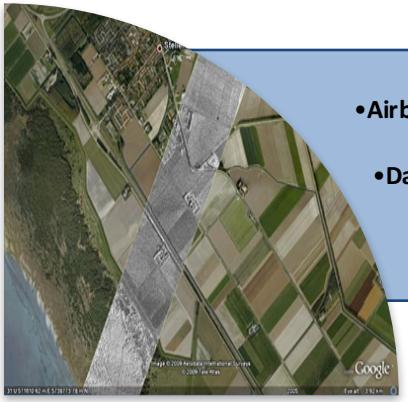
- **Company Overview**
  - Space Segment
- **CubeSat Sun Sensor**
  - Features and Performance
- **ADCS Subsystem**
  - Components
- **Conclusions**

Company Overview:

- Established as Satellite Services BV (SSBV) in 1985
- Operating for over 25 years
- Focus on the International Space Industry
- Headquarters in The Netherlands
- Main Subsidiary in United Kingdom
- Multi-national organisation
- Flexibility
- High-performance
- Cost-effective

Areas & Activities

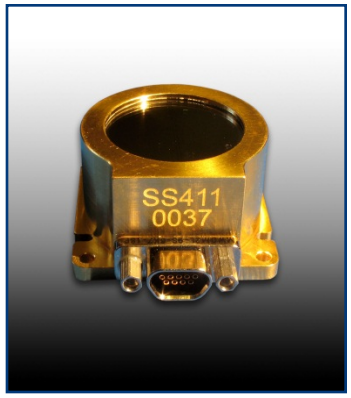
- Smallsat Sensors
- Smallsat Sub-Systems
- Mini-SAR sensor
- PowerFFT
- Purpose Built Microsats



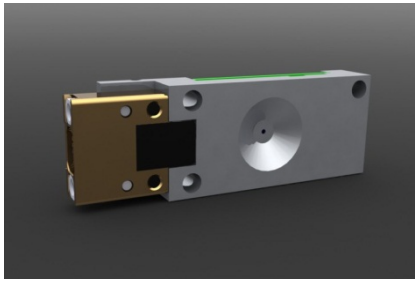
- Airborne & Space based Sensing
- Ground Station Hosting
- Data reception & TTC Services
- Data (pre) Processing
- Test Services

- EGSE / SCOE
- Special Test Benches
- Payload/Platform Simulators
- Real-Time Simulators (HIL)
- Avionics, Power, TM/TC & RF Testing

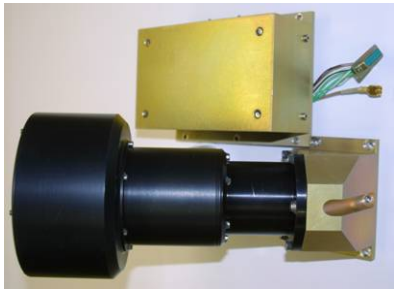
- EO / TTC Ground Stations
- TTC & High-Rate Modems
- SIGINT Data recorders
- Data ingest/Processing
- Spectrum Monitoring



Fine Sun Sensor

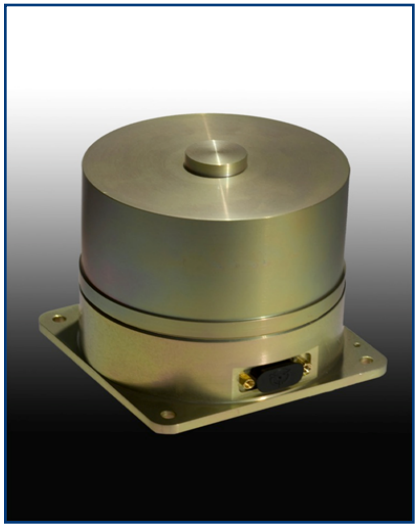


Cubesat Sun-Sensor

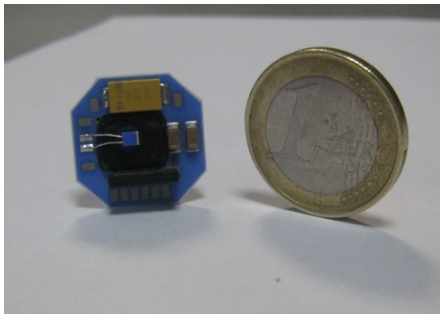


Star Mapper

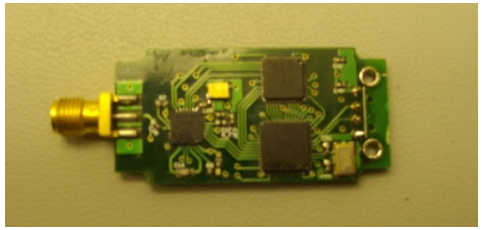
Earth Horizon Sensor



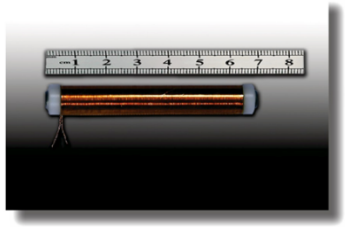
Reaction Wheel



Magnetometer



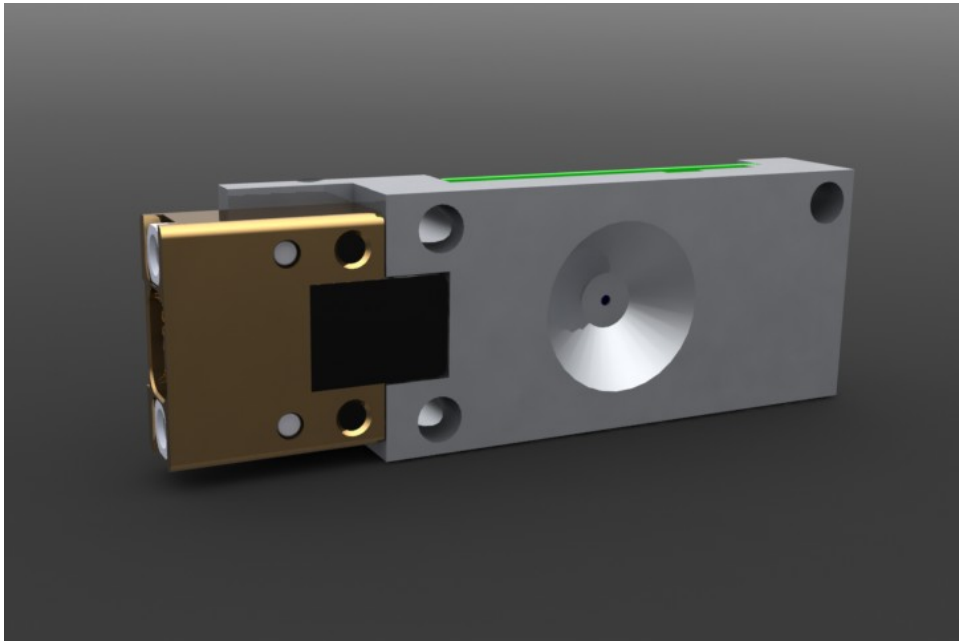
GPS Receiver



Magnetorquer Rods

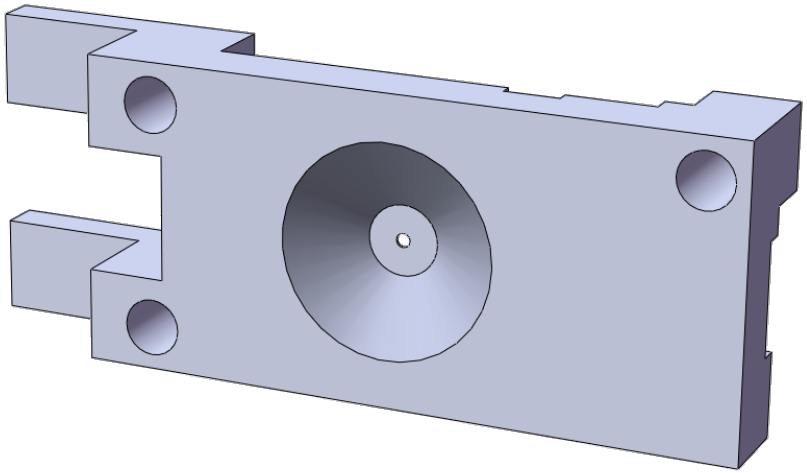
Cubesat Sun Sensor:

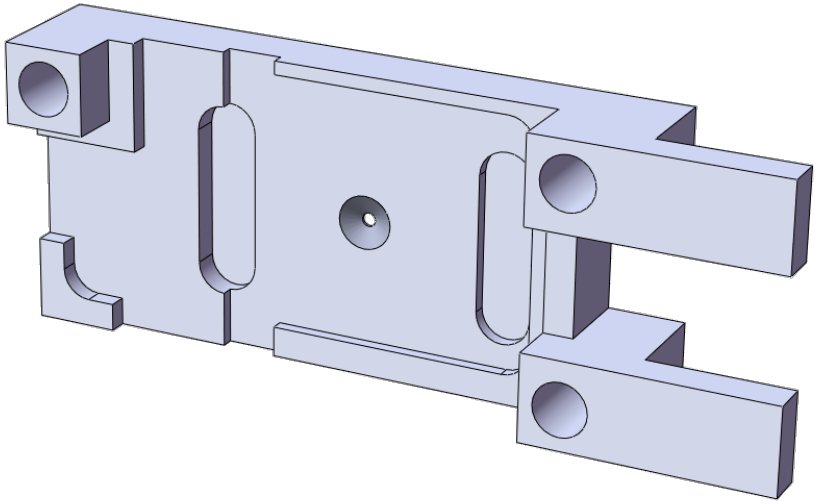
- Pinhole Camera
- Position Sensitive Detector
- Technical Simplicity
- Off the Shelf Components
- Small Size
- Low Cost
- Competitive Levels of Accuracy and Resolution



Cubesat Sun Sensor:

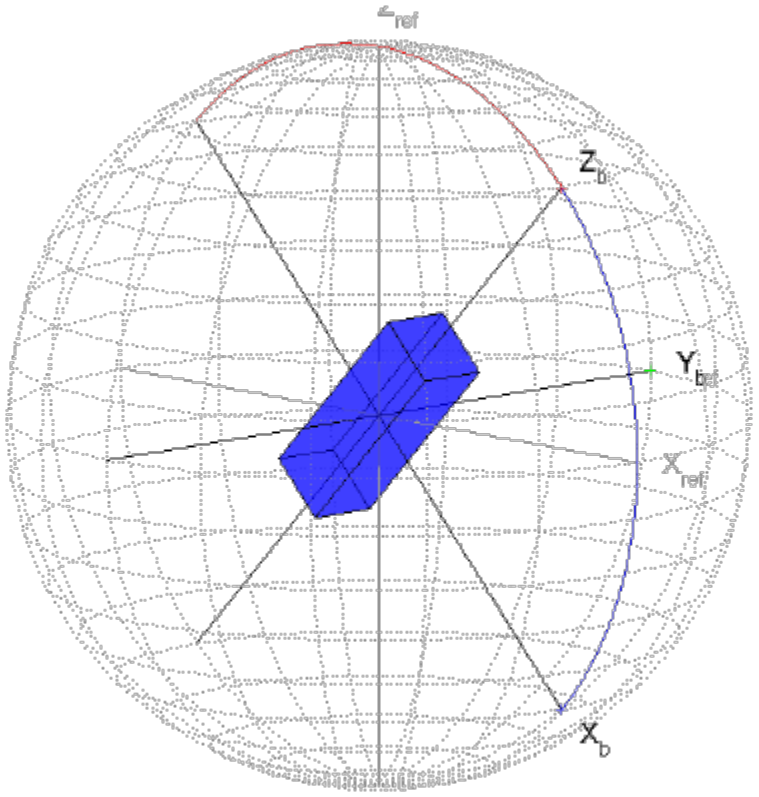
- **Dark Chamber**
  - Metal Shield
  - Enclosure for the Detector
- **Mechanical Tolerances**
  - Detector Alignment
- **Thermal Issues**
  - Surface Treatments
  - Conductive Path





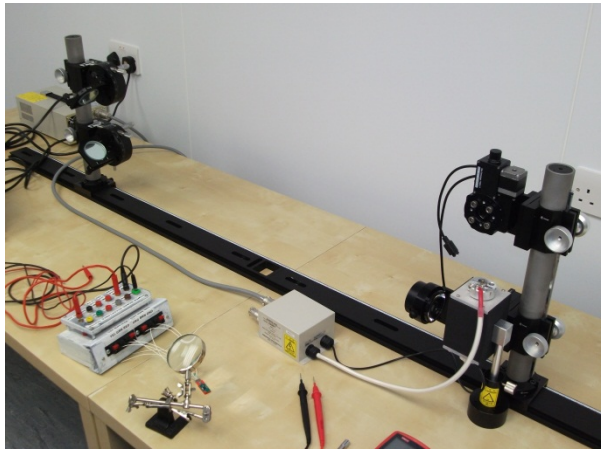
Cubesat Sun Sensor:

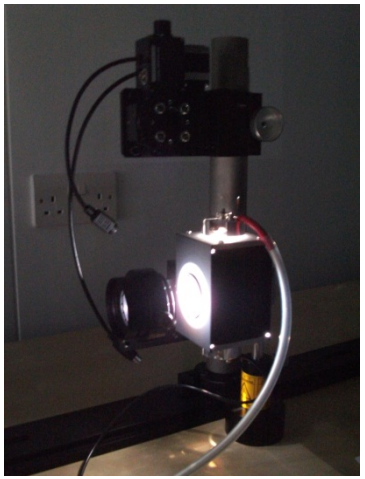
- **Output**
  - Current Conversion into Voltages
  - Simple Electronic Interface
- **Calibration Algorithm**
  - Voltages Conversion into Sun Vector
  - Accuracy of +/-0.2 degrees



Sun Sensor Calibration:

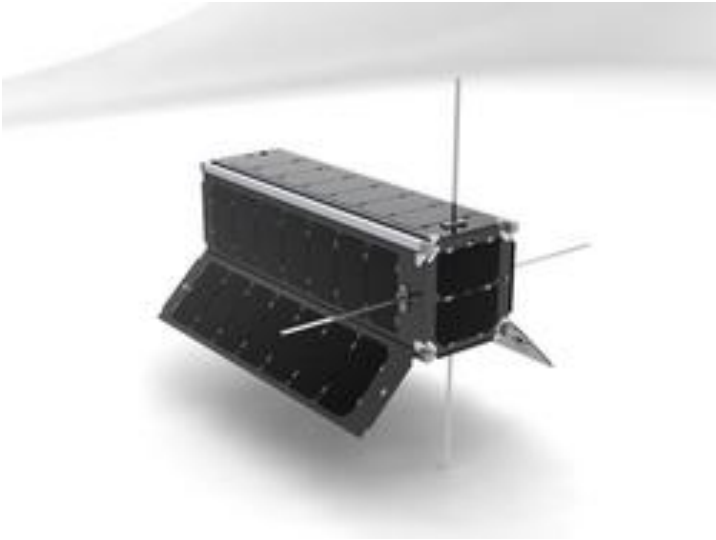
- **Optical Table**
  - Collimated Light
  - Optical Path
  - Mirrors at 45°
  - Translational Stages
  - Rotary Stages





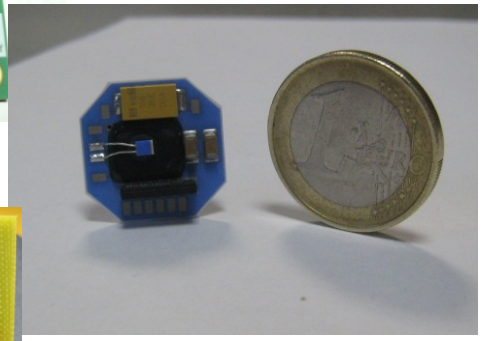
Ukube-1:

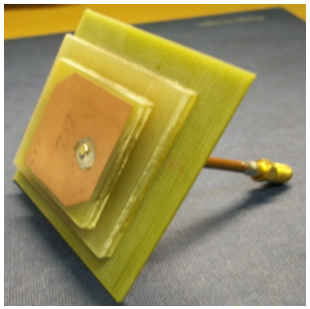
- Scheduled for 2012
- Platform provided by Clyde Space
- Competition for Payloads
- Technology Test
- Quick and Efficient Space Research
- Pilot for Full National CubeSat Program

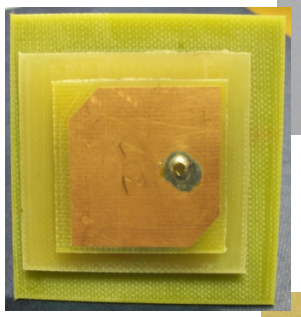


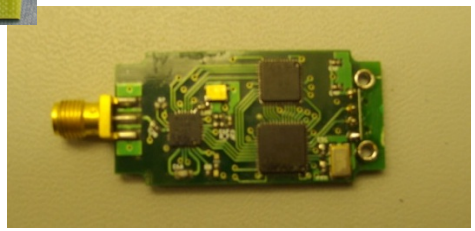
ADCS Board:

- **Sensors**
  - 6 Sun-Sensors
  - Magnetometer
  - 3 MEMS Rate Sensors
  - Stellar Gyro
  - GPS Receiver
- **Actuators**
  - 3 Torquerods
  - (Momentum Wheel)
- **3 Axis Attitude Determination and Control**
- **Due to Fly on TechDemoSat-1 in 2012**









Conclusions:

- **CubeSat Sun Sensor**
  - Main Features
  - High Accuracy Pointing Solution for CubeSats Missions
  - ADCS Board Integration
- **University/Industry Collaboration**
  - High Level of Innovation, Technology and Research
  - Potential Requirements of the Scientific Community
  - Releasing the potential of CubeSats Missions


Thank You for Your Attention

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