QB50 Project Status and Ground Segment

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Overview

QB50

• will send 50 double CubeSats into LEO
  – 400 km, 98 deg
  – End of 02/2016

• carry out an unprecedented science campaign to probe the middle and lower thermosphere with
  – distributed sensors on 43 satellites
  – of 3 different types:
    • Ion and Neutral Mass Spectrometer (INMS)
    • AO and O2 sensor (FIPEX)
    • Langmuir Probe (MNLP)

• supports teams with
  – provision of Sensor Units and ADCS
  – provision of satellite control software (opt.)
  – guidance on satellite design

• Carries out a test flight in June 2014
objectives: improve thermosphere modeling

sensor means: ~ 43 distributed sensors
- 19 AO, O2: FIPEX
- 11 electron density: multi Needle Langmuir probes (MNLP)
- 13 ion and neutral mass spectrometers (INMS)

science team:
- Mullard Space Science Laboratory (MSSL, UK)
  • ->sensor Development/Procurement, Science Lead
- von Karman Institute (VKI, B)
  • ->sensor output predictions
- Institute for Atmospheric Physics (IAP)
  • ->ground based sensors

key requirement on science CubeSats:
- acquire and downlink 2Mbit/day for 60 days
- baseline operations: poles and equator
Launch Segment

- deployment system made of versatile QuadPack modules, designed and manufactured by ISIS B.V., NL
- launch will take place February 2016
- unprecedented launch campaign
- orbit:
  - 400 km altitude
  - 98 deg inclination
  - LTAN: 6 am
Ground Segment

QB50 Ground Segment
- consists of
  - 50 amateur ground stations located at the QB50 team premises
  - DPAC server: Central functions for TLE distribution, Science Data collection and WOD storage, Archiving
  - Radio Amateurs collaboration (frequency spectrum and ground stations)
- dissemination via Data Processing & Archiving Centre (DPAC)
- passed CDR review carried out by
  - DLR/GSOC
  - Morehead State University
- assisting in early discrimination of the 50 CubeSats
Distribution of ground station and coverage for 380 and 200 km altitude
DPAC overview

Data Processing/Archiving Center

• Web-based application for universal/simple access
• Display satellite positions and potential ground stations
DPAC overview

Data Processing/Archiving Center

- Web-based application for universal/simple access
- Display satellite positions and potential ground stations
- Display of CubeSat status and detailed information
  - University and operator details
  - RF Frequencies and beacon format description
  - Dissemination of received WOD

### Whole Orbit Data

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DPAC overview

Data Processing/Archiving Center

• Web-based application for universal/simple access
• Display satellite positions and potential ground stations
• Display of CubeSat status and detailed information
  – University and operator details
  – RF Frequencies and beacon format description
  – Dissemination of received WOD
• Display of registered ground stations and pass propagation
• Upload/Download interface for QB50 teams/RA
Registration and freq. filing

VKI follow-up with the legal obligations

• CubeSats are registered as Belgium satellites
• IARU (RA spectrum usage):  
  – Collaboration with RA on QB50 precursor satellites (AMSAT-FR/NL)  
  – Coordination of frequencies together with IARU supported by AMSAT-UK
• ITU (combined filing performed by VKI via Belgium BIPT)  
  – Notification of local administrations about proposed filing of the satellites  
  – Preparation of the API’s for all CubeSats (currently on-going)  
  – CR/notification after integration/shipping to launch site  
  – Exceptions:  
    • CubeSats with non-RA bands  
    • teams where local administrations rejected  

Successful ITU filing (API) to be checked at FRR by QB50

• Processes verified using QB50 precursor campaign
Precursor Derisking Campaign

in less than 12 months:

• consortium and collaborators management
• subsystems definition, design, manufacturing:
  – INMS, FIPEX (MSSL, TU-Dresden)
  – ADCS (SSC)
  – thermal payload and thermal analysis (VKI)
  – communication payloads (AMSAT)
• satellite design, assembly and management (ISIS)
• frequency allocation and space object registration (VKI)
Precursor Derisking Campaign

Current status:

• Beacon of P1/P2 received ~10min after launch
• CubeSats are thermal and power safe
• Recovered from tumbling rates up to 30°/s
• OBC software in-flight updated
• Commissioning of ADCS performed (MTQ and reaction wheel)
• Currently on-going: SU
  – current draws/in-rush
  – HSK/STM packets received
  – Science data from instrument
• Afterwards hand-over to AMSAT with enabling of transponders
Precursor Derisking Campaign

- Beacon format and transponder information
  

- Upload interface for radio amateur participation
  
  https://upload.qb50.eu/

- Received over >350 MB beacon data

- Bugs & questions: scholz@vki.ac.be

Your help & support is appreciated!
Thank you for your interest. Do you have any questions?

7th EUROPEAN CUBESAT SYMPOSIUM
Liège, Belgium
9-11 September 2015
http://www.cubesatsymposium.eu

9th QB50 WORKSHOP
Liège, Belgium
8 September 2015
(by invitation only)
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