Releasing the Cloud
A Deployment System Design for the QB50 CubeSat Mission

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ISIS – Innovative Solutions In Space

• Spin-off of Delfi-C3 nanosatellite project of TU Delft
• Founded January 06, 2006
• Office locations:
  – Delft (NL), near Delft University of Technology Campus
  – Noordwijk (NL), in the European Space Incubator at ESTEC
  – Somerset West (ZA), from January 2012
• Current employment: ~40 engineers
• In house AIV facilities
QB50

“An international network of 50 CubeSats for multi-point, in-situ, long-duration measurements in the lower thermosphere and for re-entry research.”

- Consortium led by VKI – Von Karman Institute
- ~50 participants

- ISIS involved for:
  - System Engineering
  - Launch Configuration
  - Orbit Dynamics Analysis
  - Payload Deck,
  - Deployment System
  - Launch Campaign
Technical Challenge

Demonstrate low cost access to space for small scale research missions

Deploy 50 CubeSats in LEO from a dedicated Launch vehicle to fullfill science objectives

Making the system re-usable for other missions
The real challenge
Main functionalities of the Deployment System

- To **protect** the CubeSats from hazards coming from other CubeSats and Launch Vehicle and vice versa
- To provide the **interface** between the 50 CubeSats, the Gossamer-1 Solar Sail Demonstrator and the Launch Vehicle
- To **contain** and **retain** the CubeSats during launch
- To **deploy** and **sequence** the 50 CubeSats in orbit
- To provide a deployment **confirmation** feedback
- To allow interfacing with the 50 CubeSats while integrated
Launch Vehicle

Volume: ‘fit’ inside Shtil 2.1 fairing. Available envelop
- Diameter: 750-1000 mm
- Length: 1247 mm (max)
- Volume: 0.7-0.8 m³

Mass: Mass to target orbit: 220-230 kg
- 80 kg (+20 kg margin)

Environment: Shtil-2.1 Launcher imposes R&C

Ongoing discussions Shtil-2.1 LV operator (Makeyev)
Configuration

Using an existing deployer, e.g. ISIPOD
- Readily available
- Proven

Create a custom integrated platform for QB50
- Suitable for tens of 2U, 3U CubeSats and Gossamer-1
- Optimized for cumulative mass and volume

Create a modular, reusable solution
- Building Blocks
- Operable on multiple launch vehicles
- ‘best of both worlds’
Scalable Quadpack Dispenser

- Modularity
- Low mass
QB50 CubeSats and Quadpacks

- Mass limited
- Extended Volume allowed
Baseline Flight Configuration

Payload
- 40 x 2U CubeSats
- 10 x 3U CubeSats ‘science/technology demo’ set 1
- 1 x Gossamer-1 solar sail demo

Dispensers
- 10 x Quadpack with 4 x 2-Unit CubeSats each
- 3 x Quadpack for 10 x 3Unit CubeSats

Support elements
- Load carrying structure
- 50 channel deployment sequencing
- Cable harness
- Sensors and telemetry system
- Extended battery pack for Gossamer-1 operation
Accessibility - making life easy

Accessibility to the spacecraft

- Through the door hatch

Electrical

- Feed through connectors through dispenser
- Battery Charging after integration (Netherlands)
- Final Checkout after integration (Netherlands)
- Check/Test before launch (Russia)
- Check after launch/before deployment (Space)

Remote Access

- Teams to perform checkout over internet
- Live Demo of I2C access over IP available at ISIS Booth (conditional to Murphy’s Law)
Summary

QB50 project
• Payload configuration to be selected in Q4 2012
• Confirmation of launch vehicle configuration and schedule in Q4 2012

Key elements to be demonstrated in 2013 precursor mission
• Quadpack dispenser
• Sequencer
• Telemetry system

Design
• Modular, reusable design
• Final configuration optimized for QB50 mission
• Added functionality to accommodate logistics challenges