QB50

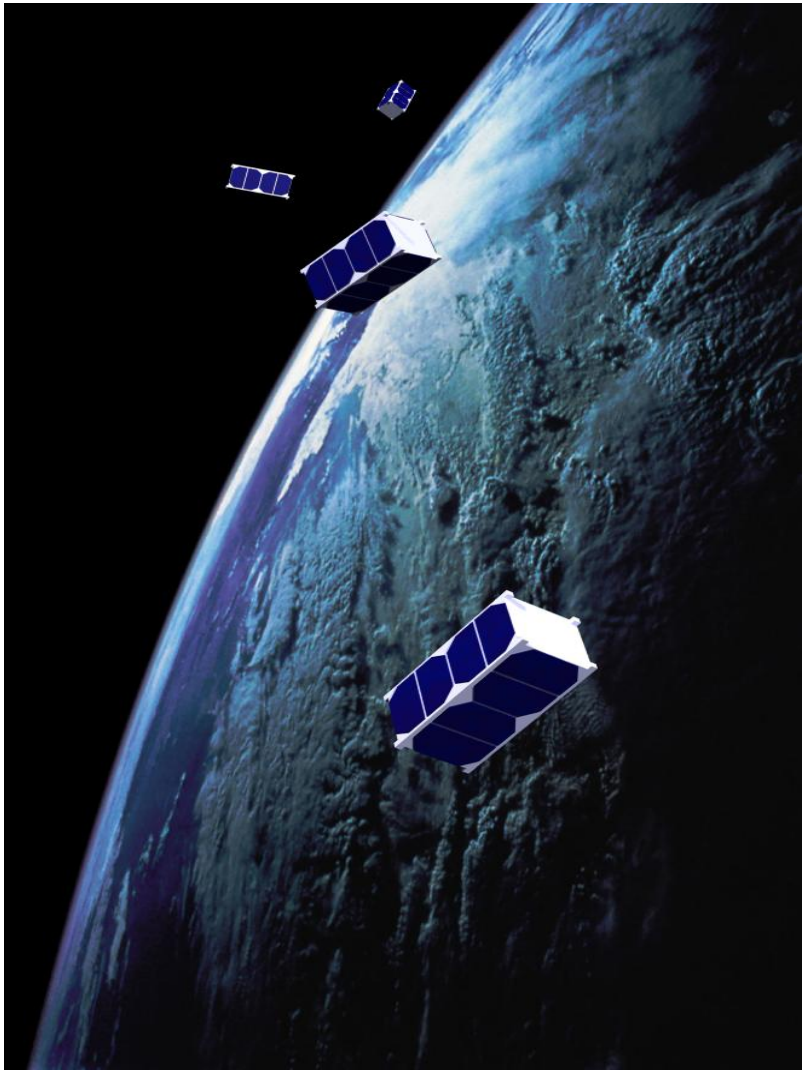
Welcome

Practical Aspects

Status of the project

J. Muylaert
*v*on Karman Institute for Fluid Dynamics
Rhode-Saint-Genèse (Brussels)

6th QB50 Workshop
6 June 2013
Rhode-Saint-Genèse, Belgium



QB50 WORKSHOPS

- First QB50 Workshop: Nov 2009
- Second QB50 Workshop: July 2011
- Third QB50 Workshop: 2 Feb 2012
  - Give info on the upcoming Call for Proposals
- Fourth QB50 Workshop: 12-13 June 2012
  - Face-to-face meetings with all participating CubeSat teams
- Fifth QB50 Workshop: 29 Jan 2013
  - QB50 Requirements & Interface Control Docs
  - Procedures for the PDR
- **Sixth QB50 Workshop: 6 June 2013**
  - **right after the European CubeSat Symposium 3-5 June 2013**
  - **post-PDR and procedures for CDR**

Programme

Chairperson: J. Thoemel

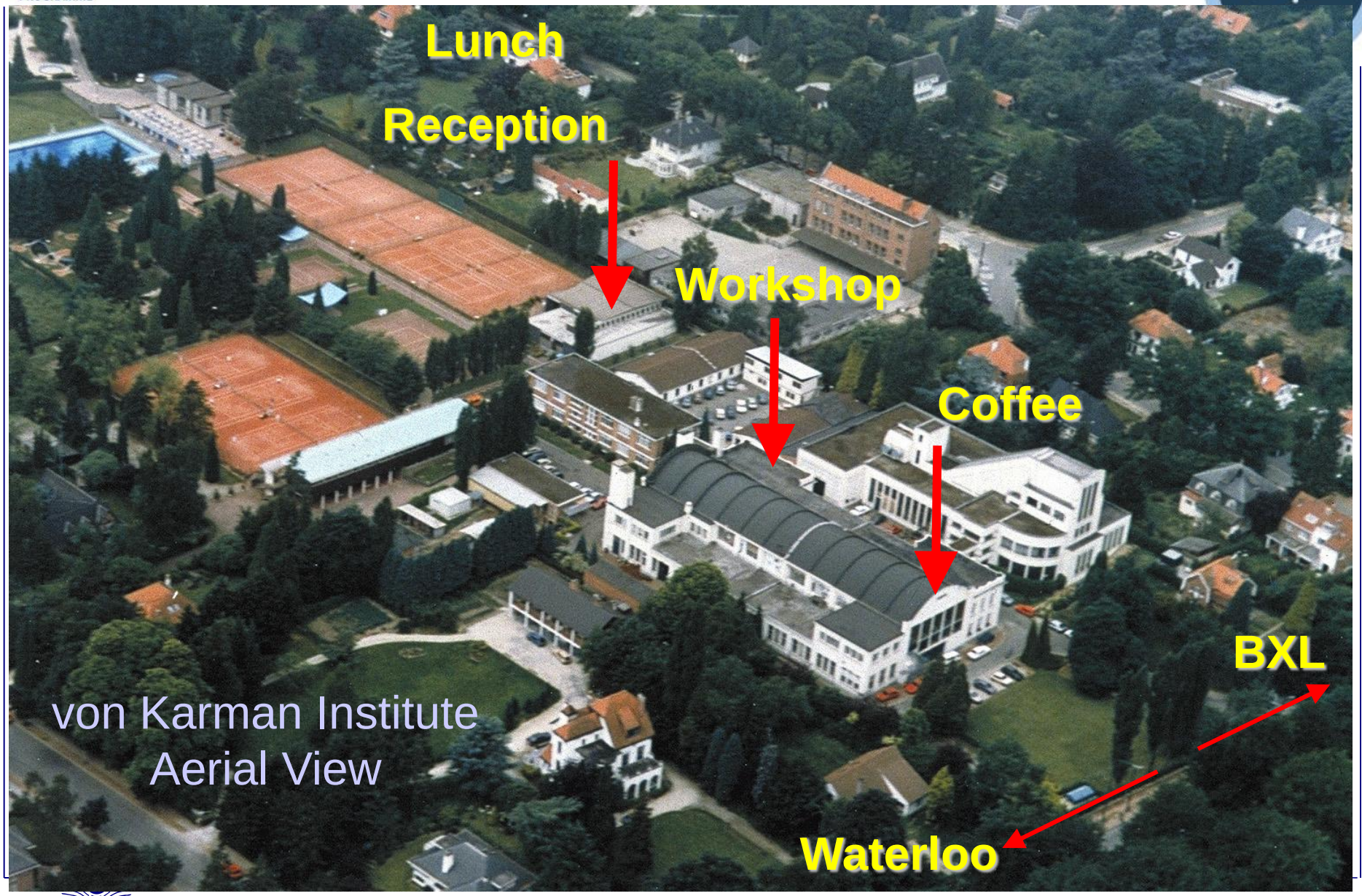
09:00 – 09:40	**Registration + Coffee - VKI Canteen**
09:45 – 10:15	**Welcome and the Status of the QB50 Project** [J. Muylaert]
10:20 – 10:40	**Contractual and Legal Issues** [K. Vanderhauwaert]
10:45 – 11:10	**PDR Results** [C. Asma]
11:15 – 11:40	**System Requirements** [F. Singarayar]
11:45 – 12:10	**Deployment Systems** [C. Bernal]
12:15– 13:30	**Lunch – VKI Sports Centre**

Programme

Chairperson: J. Thoemel

13:35 – 14:15	**Science Units** [D. Kataria]
14:20 – 14:40	**Surrey ADCS** [L. Visagie]
14:45 – 15:15	**Coffee Break – VKI Canteen**
15:20 – 15:50	**QB50 Ground Segment** [J. Thoemel, T. Scholz, M. Richard]
15:55– 16:15	**CDR Procedures** [F. Singarayar]
16:20 – 16:30	**Concluding Remarks** [J. Muylaert]
16:30 – 17:30	**GAMANET Splinter Session (Meeting Room Florine)**
16:30 – 17:50	**RECEPTION (Canteen)**
18:00 – 18:30	**Bus transfer from VKI to Royal Military School**

Practical Aspects



von Karman Institute
Aerial View

Practical Aspects

WIRELESS INTERNET

WIFIGUEST

Userid: QB50

Password: I<3CubeSats

SMOKING?

No smoking anywhere in non-open air workspaces (Belgian Law)

OTHER QUESTIONS?

The VKI Receptionist (taxi, directions, contacting people)

The VKI Secretariat (CubeSat Lectures registration)

Cem Asma (The Workshop Secretary)

VKI QB50
Core Team Members

Jan Thoemel

Project Manager

Fiona Singarayar

Systems Engineer

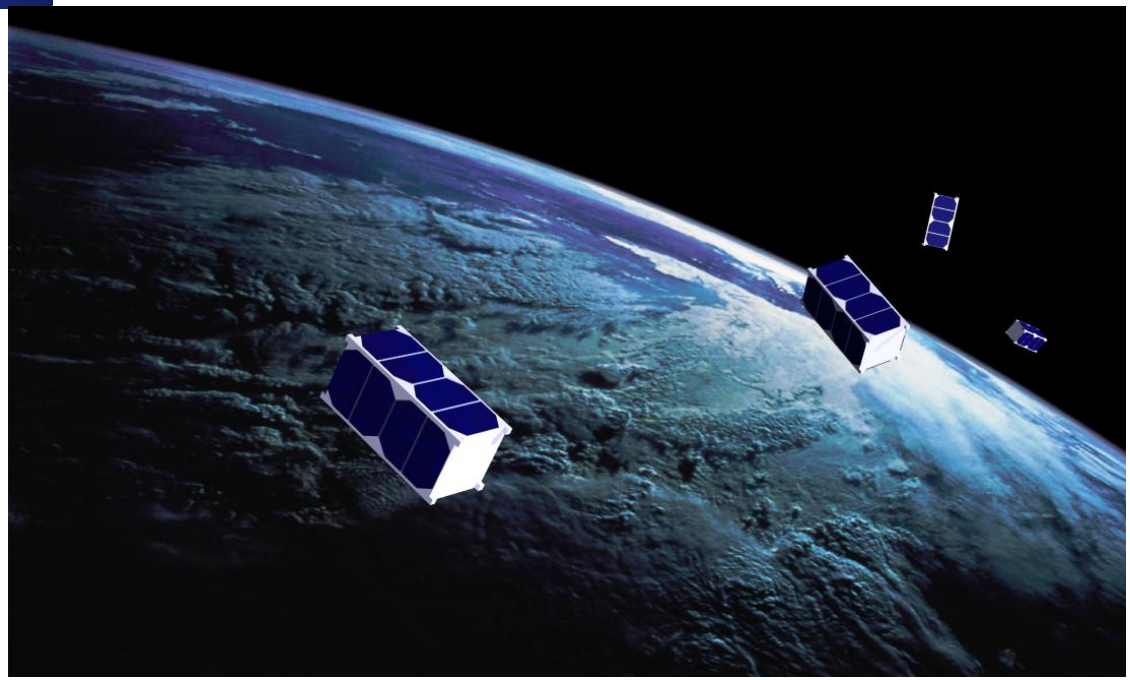
Thorsten Scholz

Ground Segment Engineer and Mission Analyst

Cem O. Asma

CubeSat Coordintator

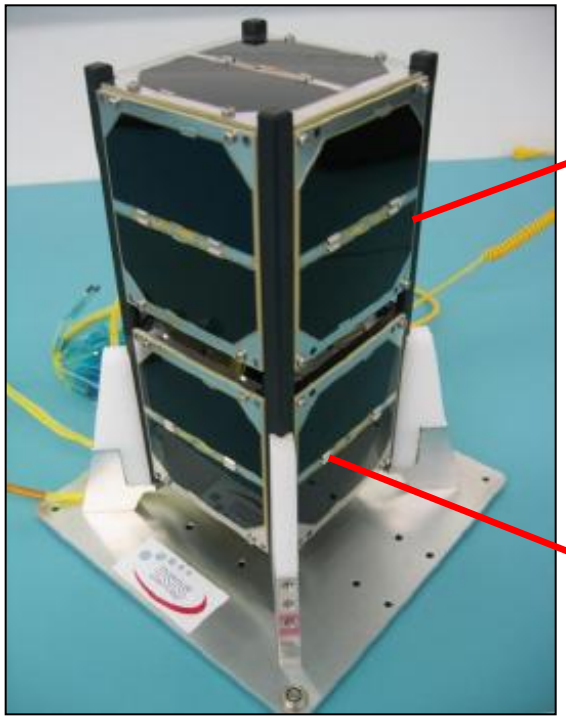
QB50 - THE IDEA



- An international network of 50 CubeSats for multi-point, in-situ, long-duration measurements and in-orbit demonstration in the lower thermosphere
- A network of *50 CubeSats* sequentially deployed
- Initial altitude: 350 km (circular orbit, high inclination)
- Downlink using the QB50 Network of Ground Stations

QB50 - The CubeSat

On a Double CubeSat (10 x 10 x 20 cm³):



Science Unit:

Lower Thermosphere Measurements

Sensors designed by MSSL

Standard sensors for all CubeSats

Functional Unit:

Power, CPU, Telecommunication

Optional Technology or Science Package

Universities are free to design the functional unit

Sensor Selection

Set 1
Ion-Neutral Mass Spectrometer (INMS)
2 corner cube laser retroreflectors (CCR)*
Thermistors/thermocouples/RTD (TH)

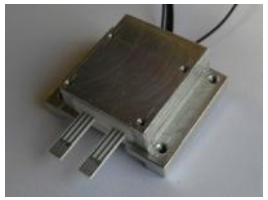
Set 2
Flux-Φ-Probe Experiment (FIPEX)
2 corner cube laser retroreflectors (CCR)*
Thermistors/thermocouples/RTD (TH)

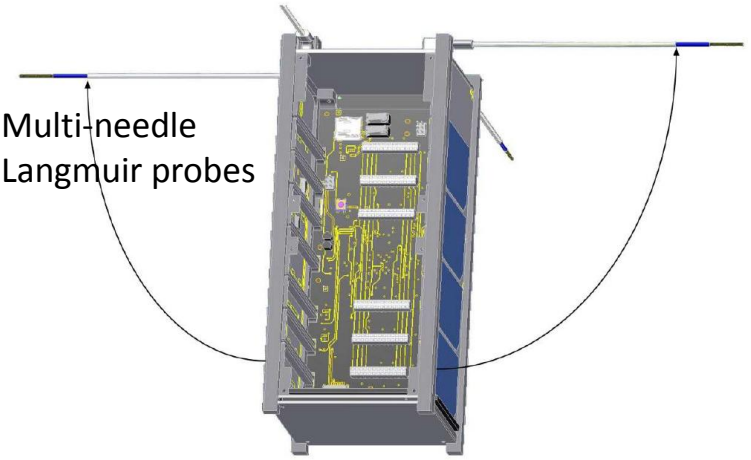
Set 3
A set of 4 Langmuir probes (MNLP)
2 corner cube laser retroreflectors (CCR)*
Thermistors/thermocouples/RTD (TH)

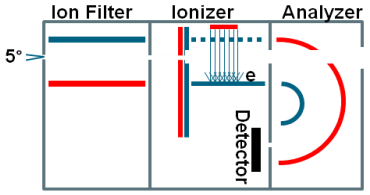
* Offered as an option

Detailed info will be given by D. Kataria

FIPEX sensor



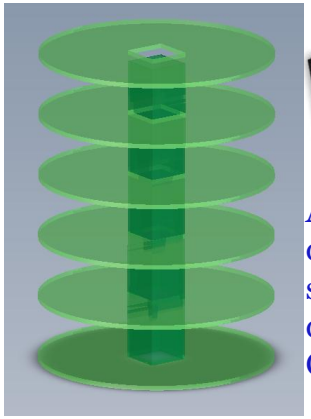




Schematic of the principle of working of the INMS

Miniaturised charged particle analyser along with the Improved Plasma Analyser

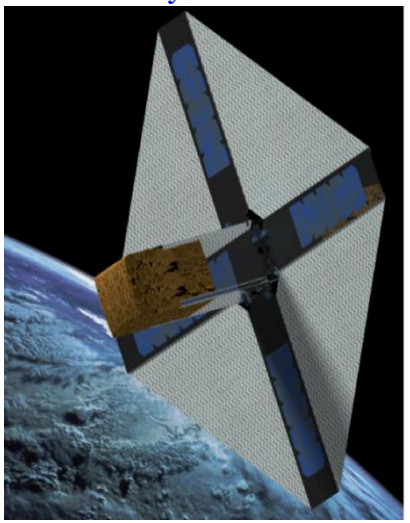
In-Orbit Demonstration



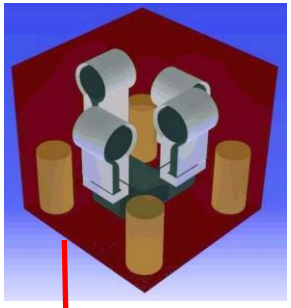
A modular deployment system for double and triple CubeSats

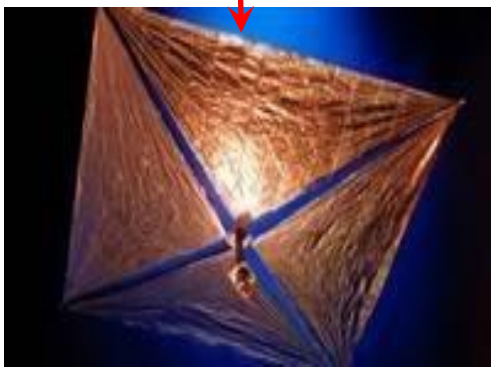
De-orbiting and aerodynamic stability

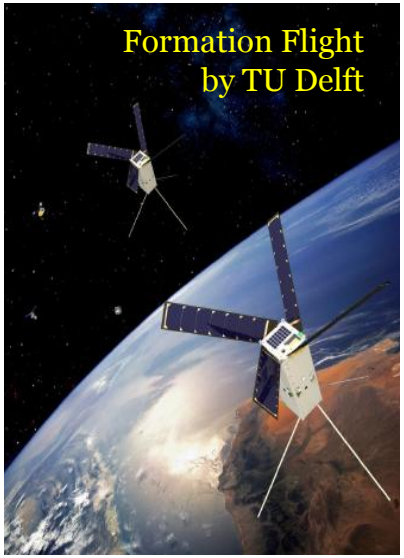
AeroSDS by VKI

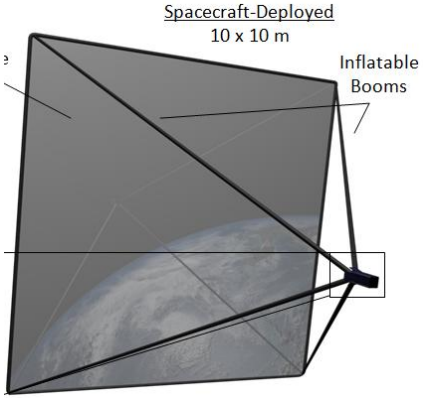


Gossamer-1 Solar Sail demonstration packagem DLR









InflateSail demonstration mission, SSC

Other In-Orbit Demos:

- End of life analysis, Debris
- Micro-propulsion systems
- Micro-g experiment

Selection of CubeSat Teams

- More than 70 proposals received
- Selection of the 50 CubeSats
  - about 40 double CubeSats for atmospheric research to be selected from 50 proposals,
  - about 10 double and triple In-Orbit-Demonstration CubeSats to be selected from 20 proposals, 4 of them already pre-selected (Delta, Phi, QARMAN, Inflatesail) including Gossamer
- Draft Contractual Agreement between the QB50 Consortium and the proposing universities

  (this includes the payment of a contribution to the mission cost of 20-90 k€, depending on CubeSat category)
- Programmatic and technical merits are the criteria for selection
- The teams that pass the Preliminary Design and sign the contract will be selected
- There will be backup CubeSat teams as well

PDR Results

Out of **79 potential CubeSat teams**

2 never submitted a proposal or PDR

5 withdrawn because of lack of funding

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72 remaining

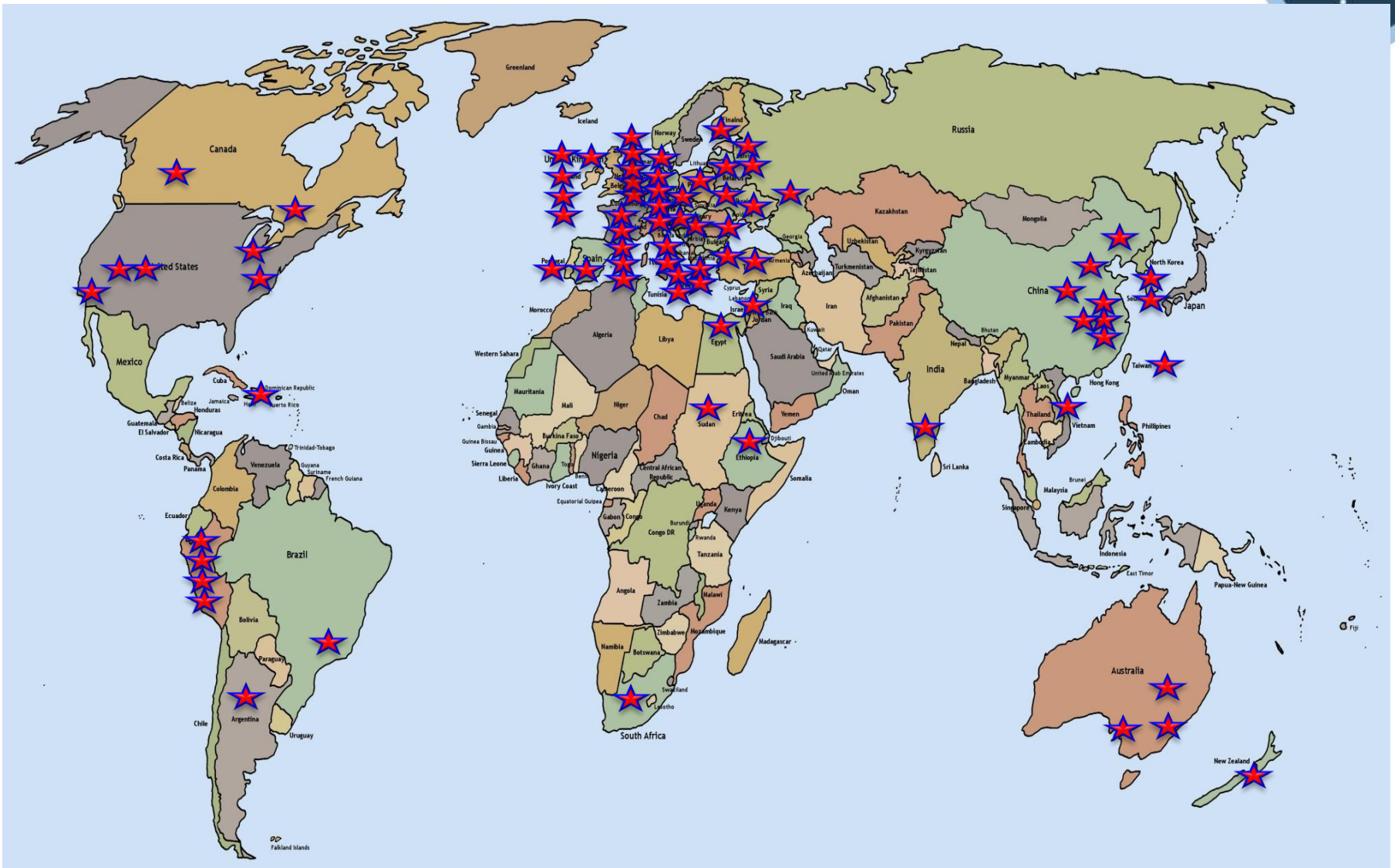
2 Belgium IODs within QB50 but at higher orbits

7 non active teams (QB50 is in contact with them to get feedback)

65 active CubeSat teams, although some delayed

European CubeSat Teams

QB50 – CubeSat Teams



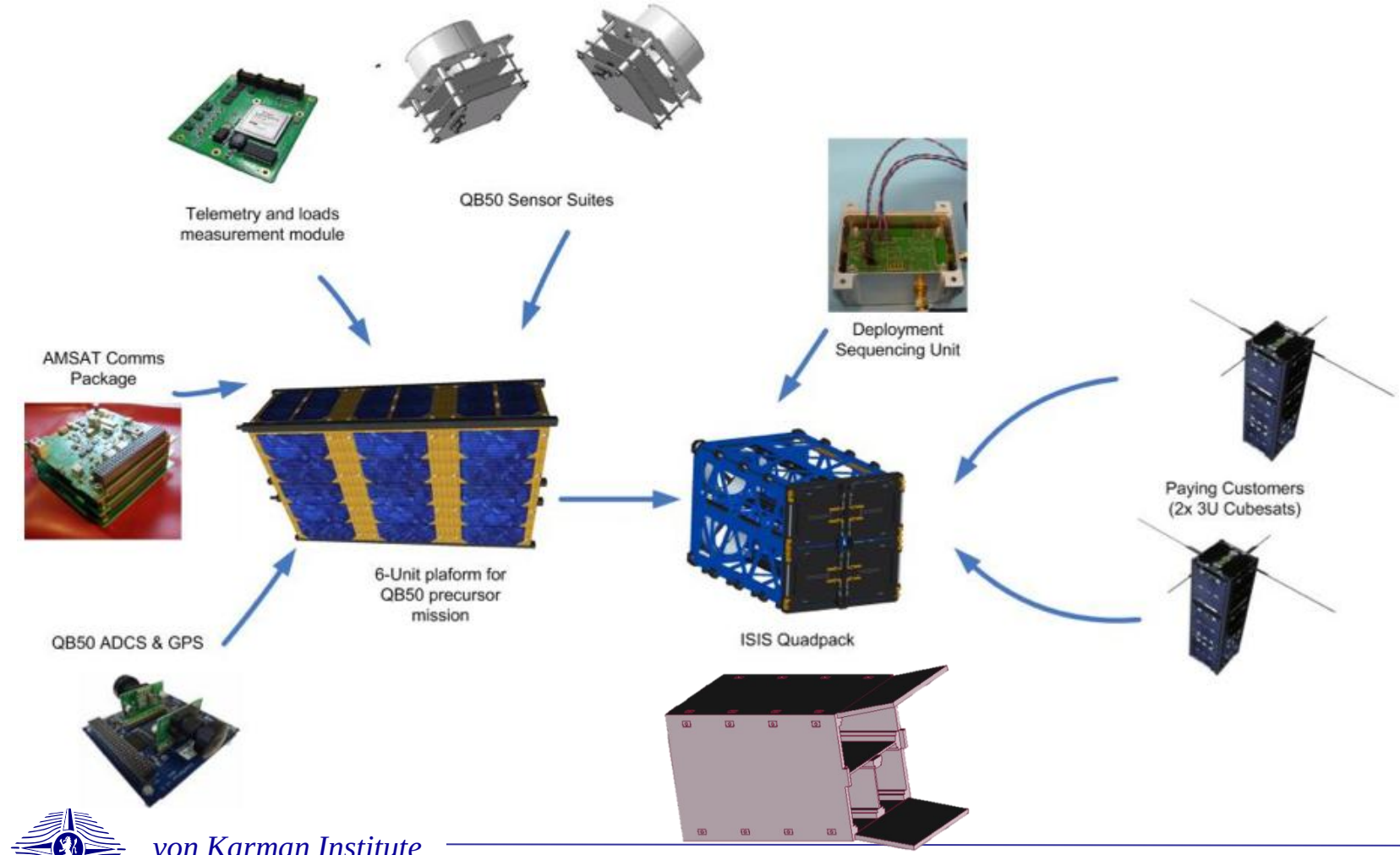
QB50 & EC/REA

- QB50 Project is funded by the European Union's 7th Framework Programme (FP7) and is therefore strictly controlled by the Research Executive Agency (REA) of the European Commission (EC).
- All deliverables of the QB50 Project are submitted to EC/REA for approval and acceptance. Besides continuous communication with the EC/REA Project Officer, monthly progress meetings are held.
- QB50 Project has been reviewed in May 2012 (6-monthly progress review meeting), in Dec 2012 (12-monthly progress review meeting) and in May 2013 (18-monthly progress review meeting). Following these reviews supported by independent experts, the QB50 Project is given the green light to go ahead with valuable feedback for better progress.

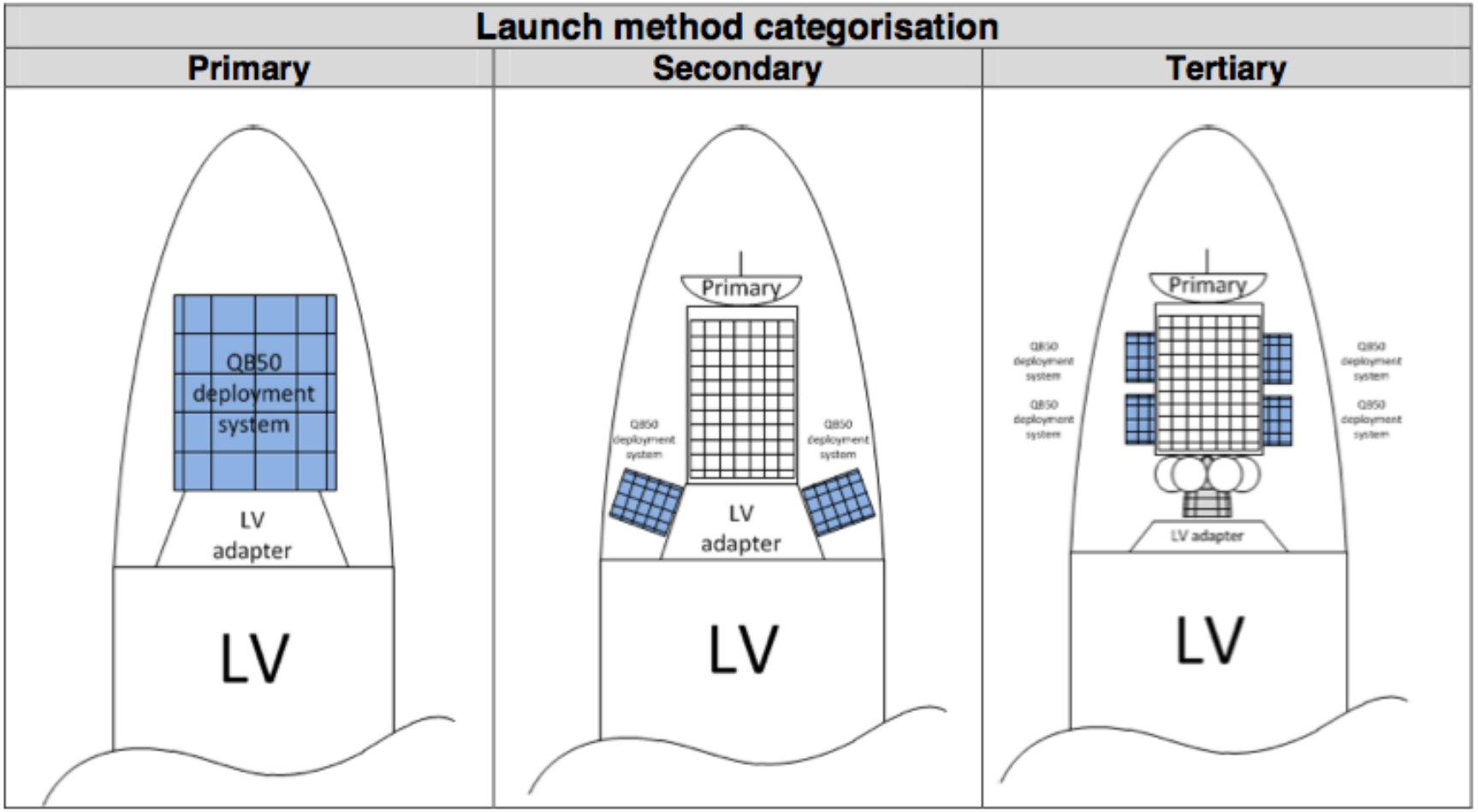
- Currently, the QB50 Project is waiting for the approval by EC/REA for the selection of the Launch Vehicle.

Alternative Launch Study

- Assessment performed by ISIS & VKI
  - Various Launch Vehicles considered (18)
  - Accommodation studies performed
  - Costing exercises performed
  - Technical and programmatic discussions ongoing with various providers
  - Constraints:
    - Budget (precursor and main launch less than 3.5M)
    - Timing (Q2-Q3 2015)
    - Orbit (circular at high incidence >70deg, minimum 320 km altitude)
    - Technical aspects (loads, payload mass and volume)
    - In-line with the original objectives, repeatable launch
- Several candidates available for both QB50 flight and precursor flight.


Telemetry and loads measurement module
QB50 Sensor Suites
Deployment Sequencing Unit
AMSAT Comms Package
6-Unit plaform for QB50 precursor mission
ISIS Quadpack
Paying Customers (2x 3U Cubesats)
QB50 ADCS & GPS

Launch method



Conclusions on Launcher selection

- Original missions concept is maintained
  - Demonstrate low cost sustained access to space
    - Risk Reduction Precursor flight (Passenger)
    - QB50 main flight 350-390 km close to SSO
    - Follow flights possible for the future
  - We have signed and binding proposals for the QB50 flight compliant with basic objectives
  - EC will respond formally to the recommendation issued by the CB in the next weeks

Contractual Agreement

- A Contractual Agreement is to be signed between VKI and the participating CubeSat teams.
- The contract is finalised after receiving feedback from the CubeSat teams and the Space Law experts
- All CubeSats will be registered in Belgium and frequency allocations will be made by the Belgian authorities
- The signing of the contracts are expected to be finalised in June 2013