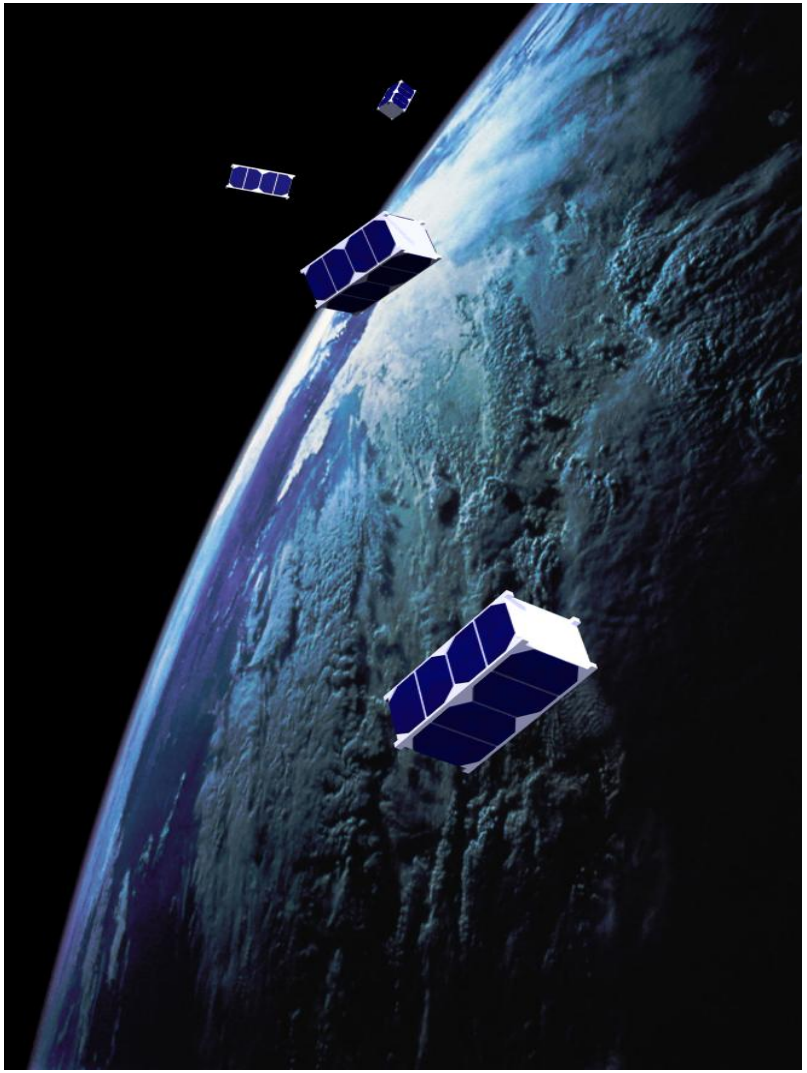
QB50
Data Download, Communication Infrastructure



J. Thoemel, T. Scholz,
R. Reinhard, G. March
*v*on Karman Institute for Fluid Dynamics
Rhode-Saint-Genèse (Brussels)

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

GENSO Status

ESA, 8th April 2013:

"At the Education Office we have the intention to improve GENSO, and we intend to engage in that effort. However, at the present time I would not recommend that you rely on GENSO to support a mission like QB50."

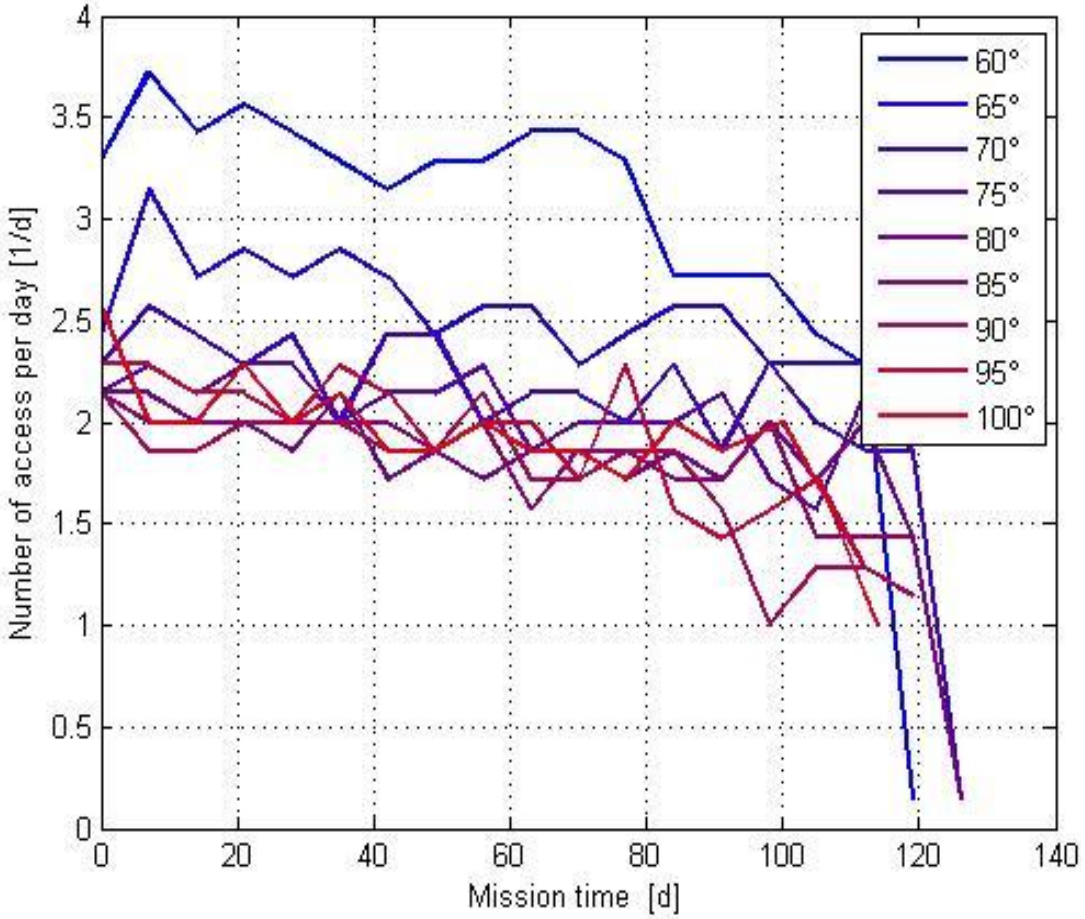
Driving Requirements

Capability to download

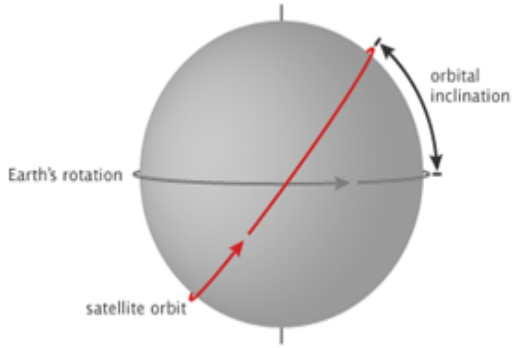
- 2 Mbit science data/day (QB50-SYS-1.5.2.) for INMS, mNLP
- (0.3 Mbit/day for FIPEX)
- additional mission data (implicit requirement)

How many ground stations are needed?

Orbital Inclination Analysis



VKI GS: 50.75 lat., 4.38 long
Data rate: 9.6 kbps
initial altitude: 350 km
download only
weekly averages



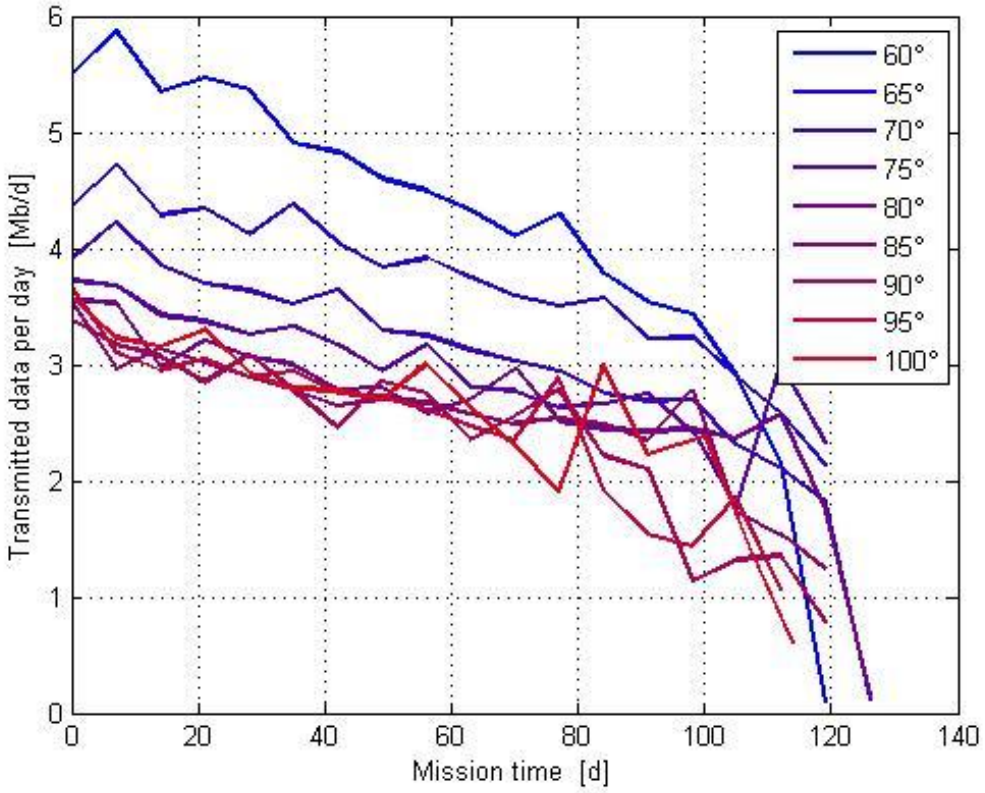
60°< i < 100°

Lower inclinations ensure higher number of access.

There is a maximum increase of access numbers above 75% for low inclinations.

Orbital Inclination Analysis

Transmitted data per day:



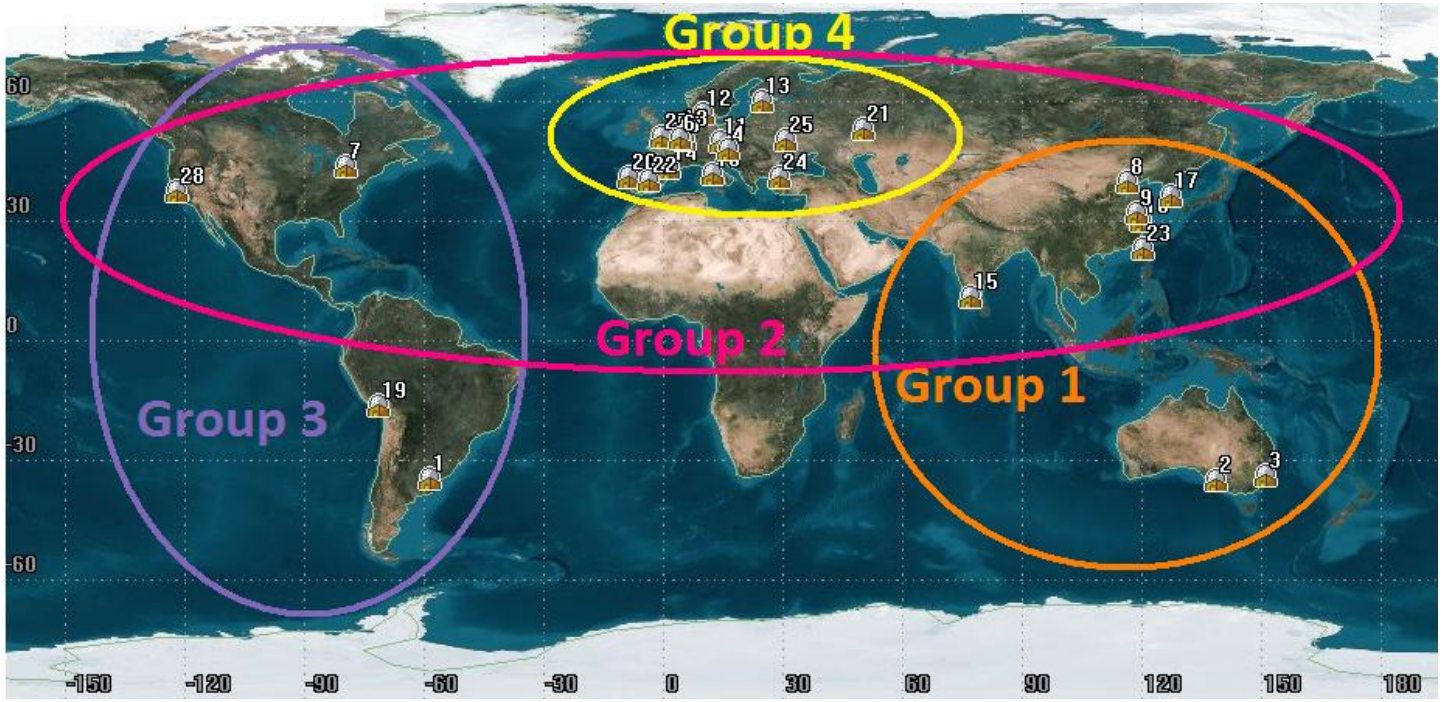
Therefore inclinations close to latitude of GS favorable.

(Ideal case for 1 CubeSat, no uplinking, no protocol overhead)

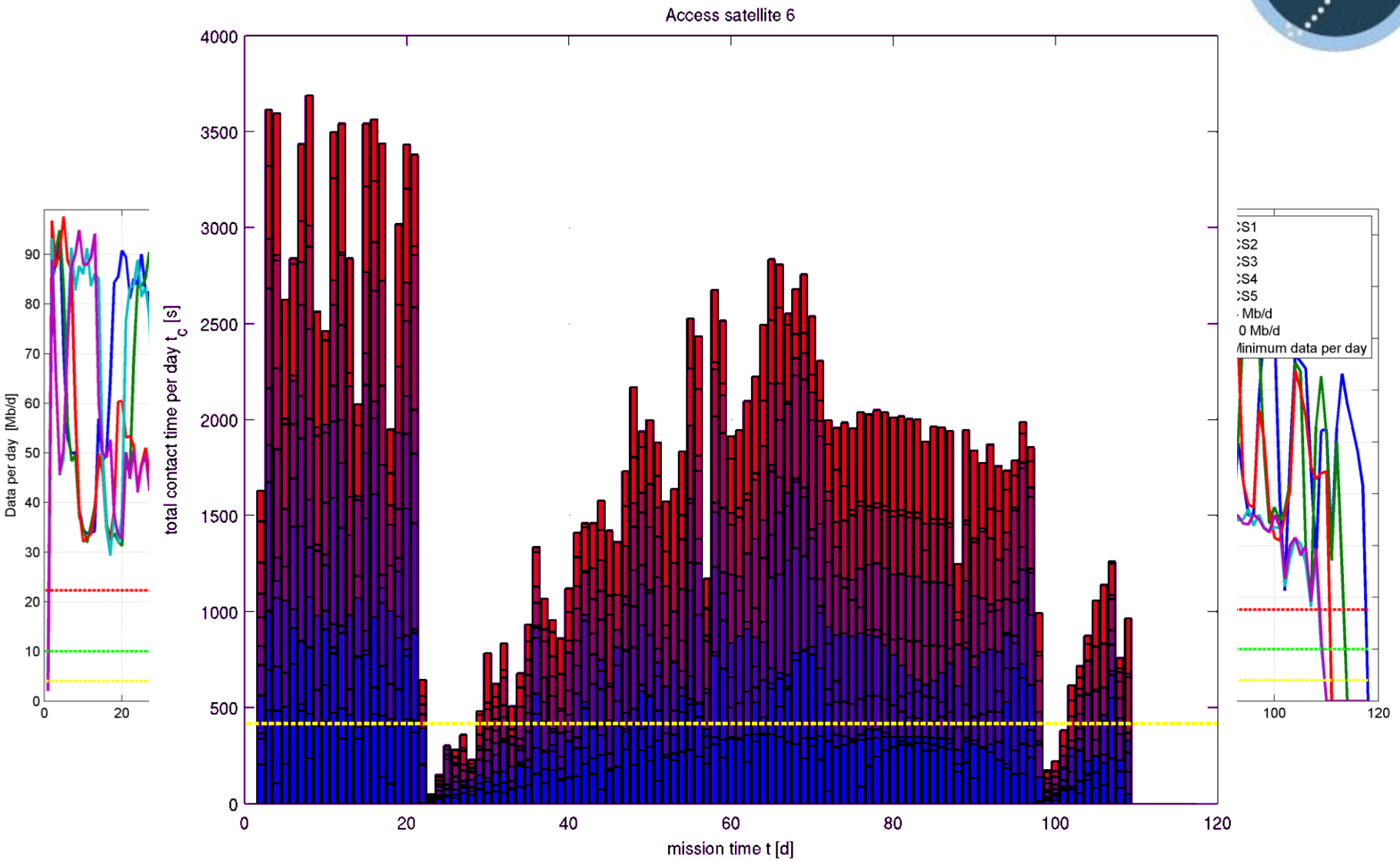
Towards a network: multiple GS

- *Group 1*: Asia N/S
- *Group 2*: Northern hemisphere W/E
- *Group 3*: America N/S
- *Group 4*: Europe

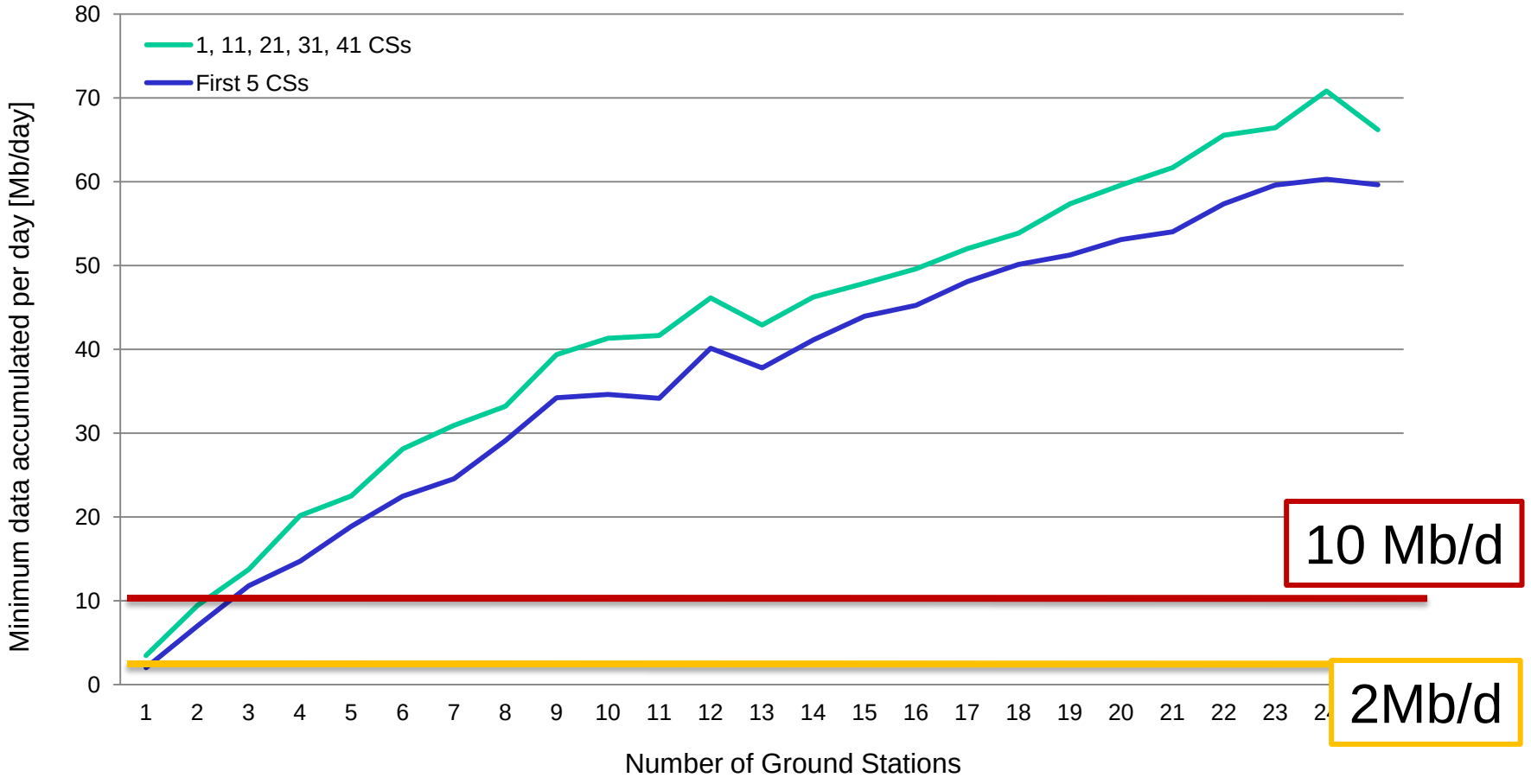
- CS Orbit inclinations: 98°
- Data rate: 9.6 kbps
- 28 GSs in 4 groups
- Min. contact time for calculations: 20 s



Multiple CubeSat Communications



Preferable Ground Stations Number



groups of 3 GS and 5 CS sufficient

QB50 Download Communication Infrastructure Baseline/Recommendation

Based on Cubesat Teams ground segments

- Decentralised with QB50/EPFL Satellite Control S/W enables creation of mini-networks, requires currently AX25)

Options:

a) Decentralised without QB50/EPFL SCS

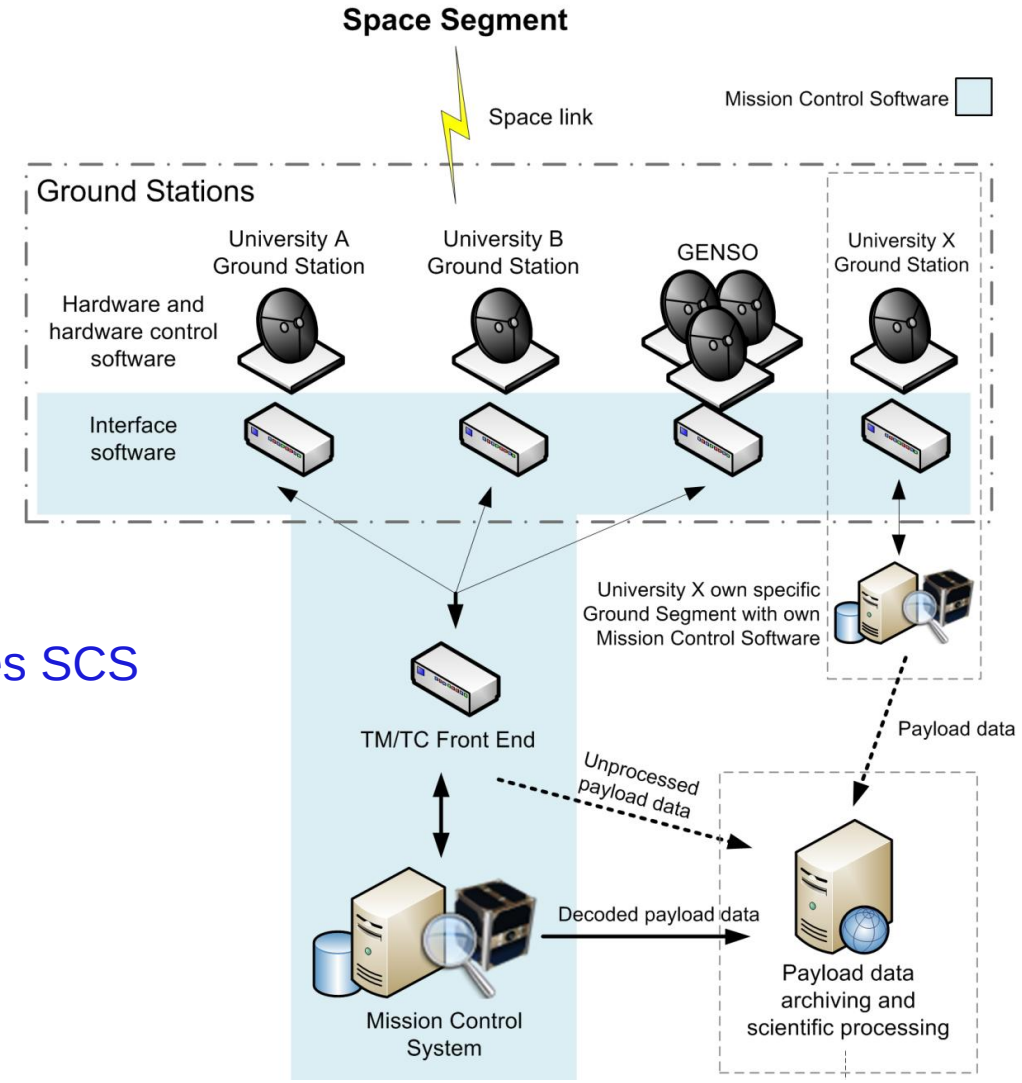
b) GENSO like download focused Ground Station Network S/W – under assessment

Baseline: Decentralized Communication using EPFL SCS

Based on:

- university accessed ground station (QB50-SYS-1.5.9.)
- QB50 SCS S/W provided by EPFL
  (exact requirements to defined)

- Option a): Cubesat team provides SCS



Option b: New Ground Station Network

Envisaged Schedule

- July - December 2013: preparatory phase led by the GSWG
- January - June 2014: GSN-C software development
  - January: kick-off
  - March: mid-term review
  - June: final presentation
- GSN-C test phase in the second half of 2014 at the time of the QB50 precursor flight
- End 2014: fine-tune the software
- January 2015: roll-out

Thank you for your attention.

Option b: GENSO like, download focused new development called GSN-C

Envisaged Schedule

- June - December 2013: preparatory phase led by the GSWG
- January - June 2014: GSN-C software development
  - January: kick-off
  - March: mid-term review
  - June: final presentation
- GSN-C test phase in the second half of 2014 at the time of the QB50 precursor flight, involving 20 ground stations (as during the successful GENSO operational test phase in 2007) and a few CubeSats, including the test CubeSats on the precursor flight
- End 2014: fine-tune the software
- January 2015: roll-out of the GSN-C software to 120-150 ground stations