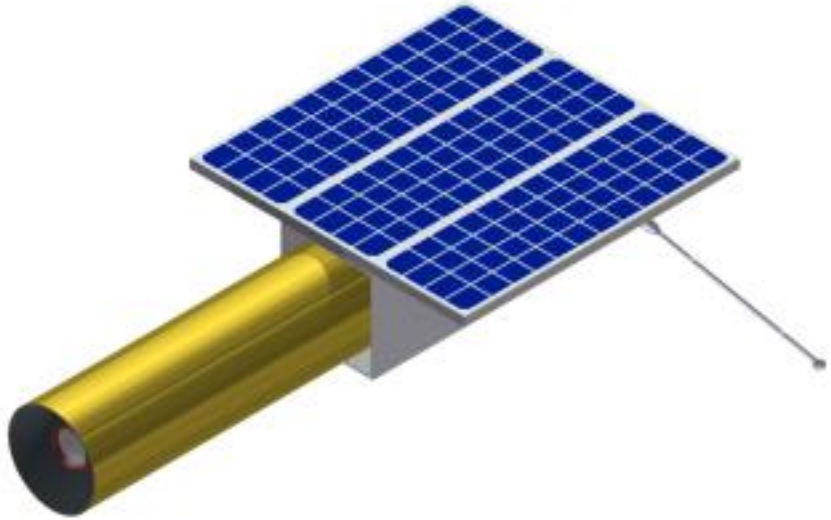
Newton Small Space Telescope



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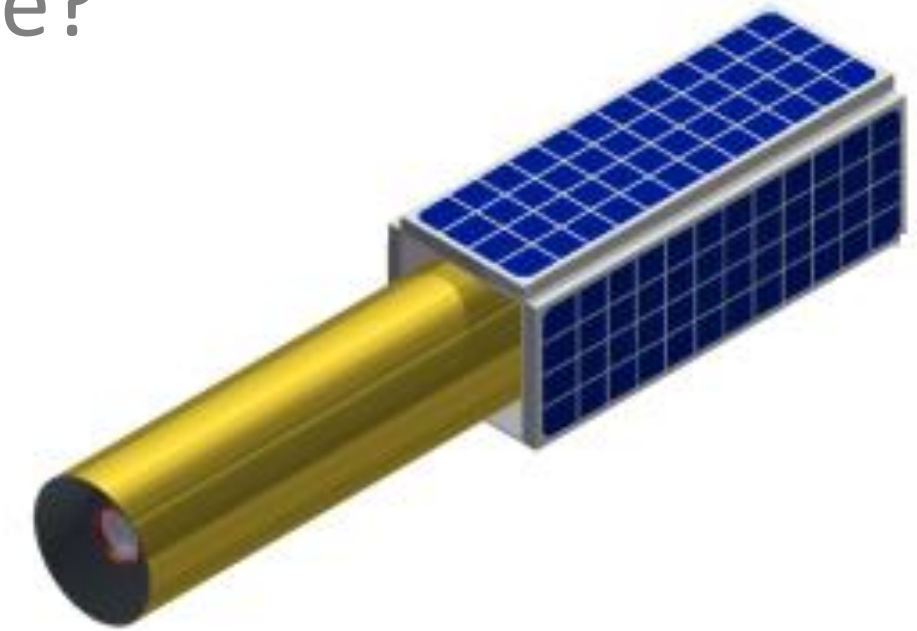
NPC new production concept

SPACE MIND

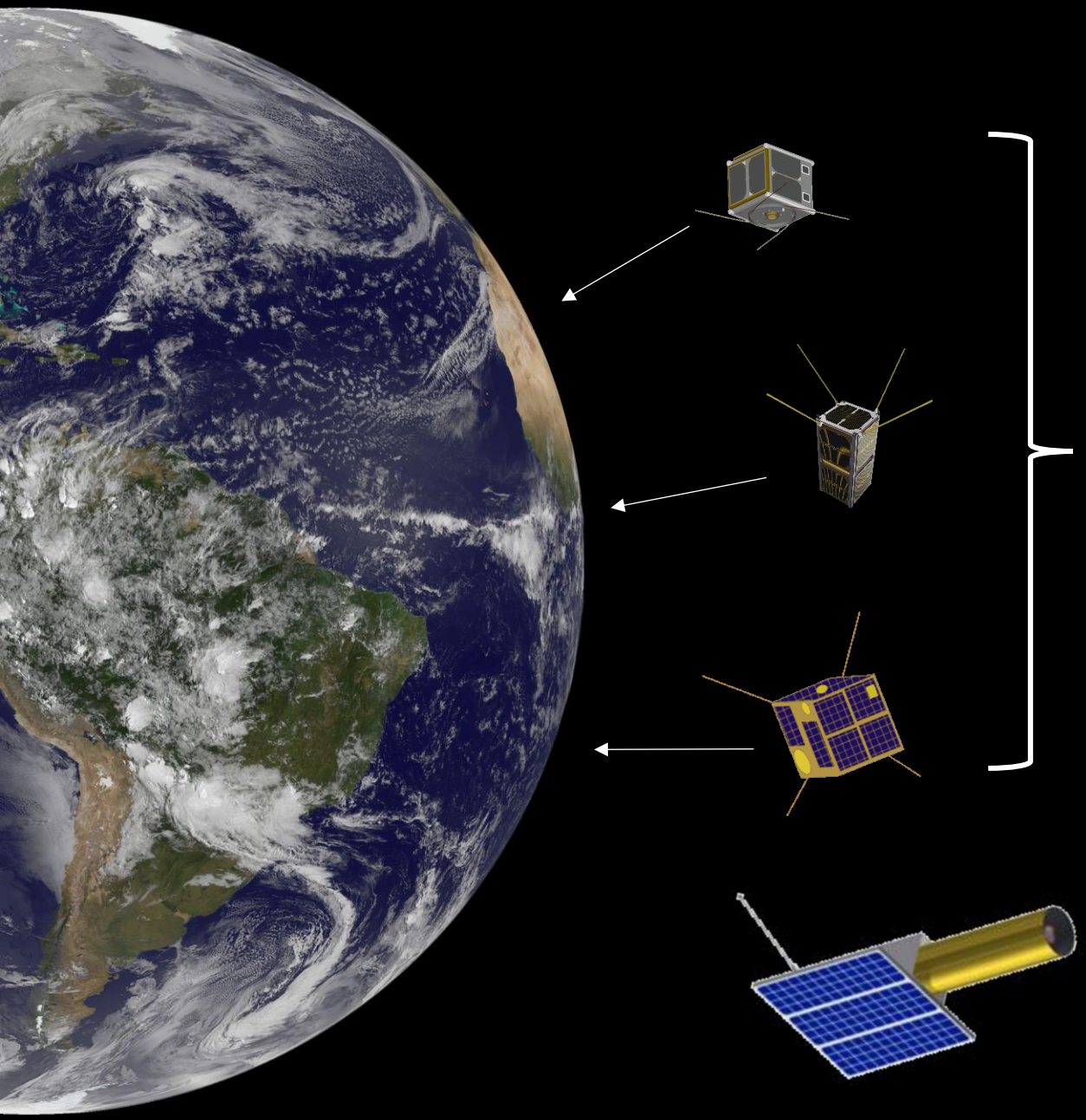
Satellite Business Network

Brief

- Changing the focus
- Why a amateur space telescope?
- Project componentes
- Project evolution
- Technical risk analyses



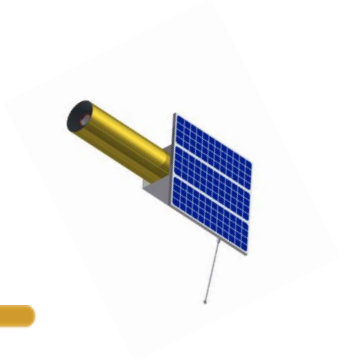
Changing the focus



Space to Earth
Traditional focus of small satellite programs

Space to Space
A new frontier for small satellites

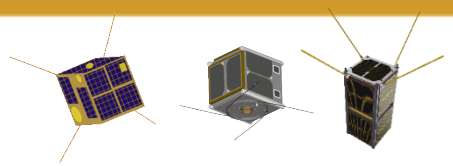
A marketing vision of Nano satellites



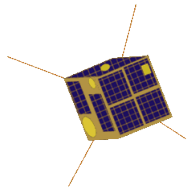
- ✓ Deep space missions
- ✓ Space to Space

- ✓ Proof of concept
- ✓ Space Education

2000



Today



- ✓ Late builders

- ✓ Business models

Telecom | **Remote sensing** | **Constellations** | **Etc..**

Why an amateur space telescope?

- Thousands of amateur astronomers in the world.
- They use limited tools as small telescopes and binoculars.
- More than 30 amateurs astronomers associations in major countries of the world.

Why an amateur space telescope?

Some exponents amateur astronomers

- George Alcock, **discovered several comets** and novae.
- Robert Burnham, Jr. author of **the Celestial Handbook**.
- Robert Owen Evans: record for **visual discoveries of supernovae**.
- David H. Levy: Discovered or co-discovered **22 comets.**
- Tim Puckett: Discovery over **200 supernovae** since 1998.

We are in the Collaborative and sharing times

SETI INSTITUTE

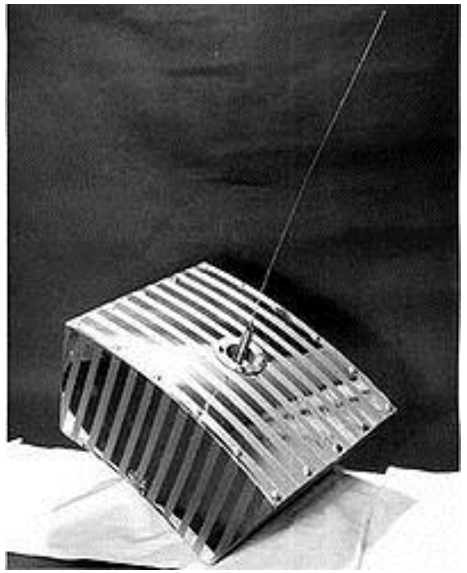
UNISEC GLOBAL
University Space Engineering Consortium

WIKIPEDIA
The Free Encyclopedia

THE PLANETARY SOCIETY

OSCAR Program, a benchmarking

- A community of engaged users (Radio Amateurs)
- Simple and creative technical solutions.
- Divided project in gradual steps (Phases).

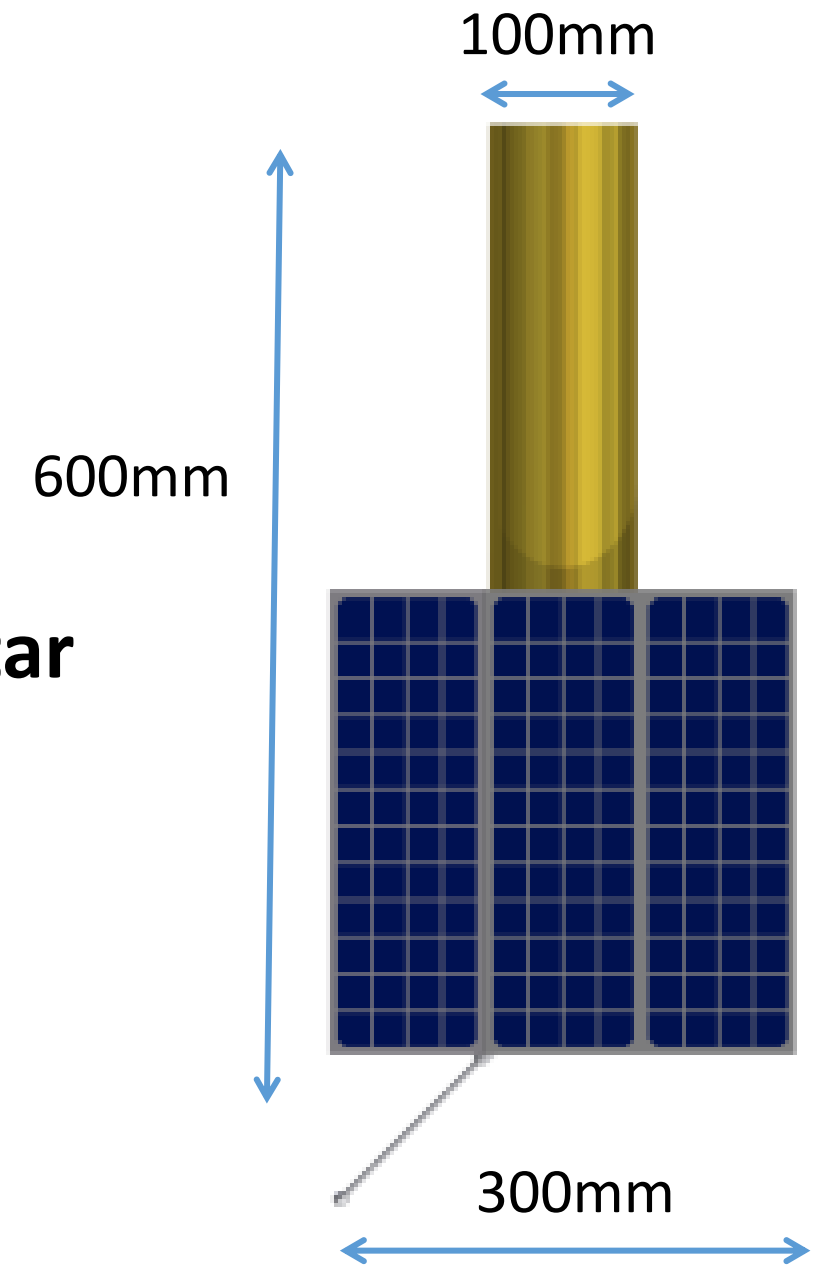


OSCAR 1 (1961)

Success, more than 70 OSCAR satellites launched in 54 years.

Newton Spacecraft overview

- **6U CubeSat structure**
- **COTS Design**
- **3 axes, based in reaction wheel and star tracker technology.**
- **95mm optical telescope**



Newton Spacecraft overview

Solar panels

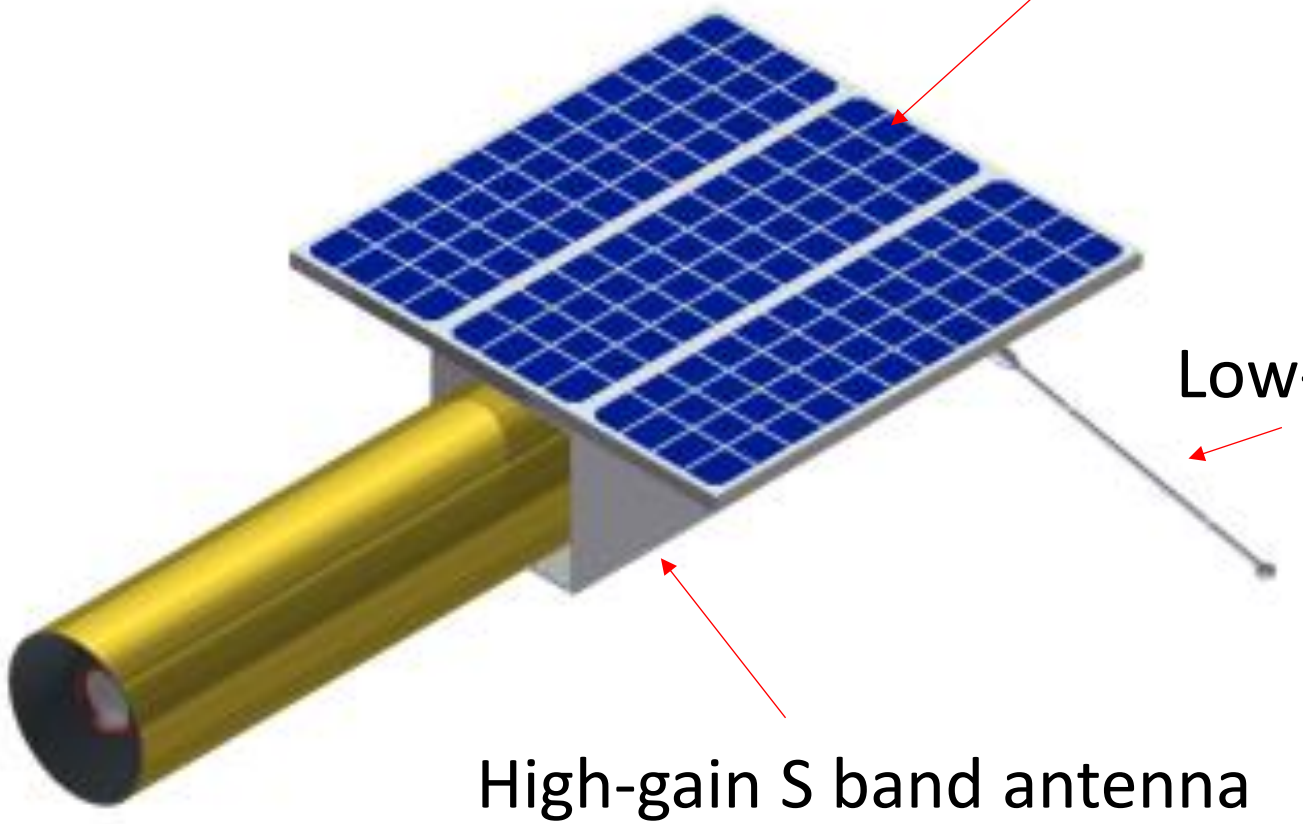
900 cm^2

22,7 W.h (peak)

95mm telescope

300 mm focal length

200X magnification



Low-gain UHF antenna

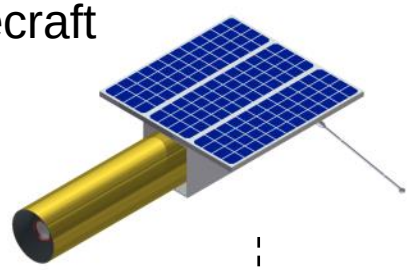
1.5 kbps up/downlink

High-gain S band antenna

375 kbps downlink

Project components

Spacecraft



Ground Station

IT Infraestrucuture

Users

Technological committee

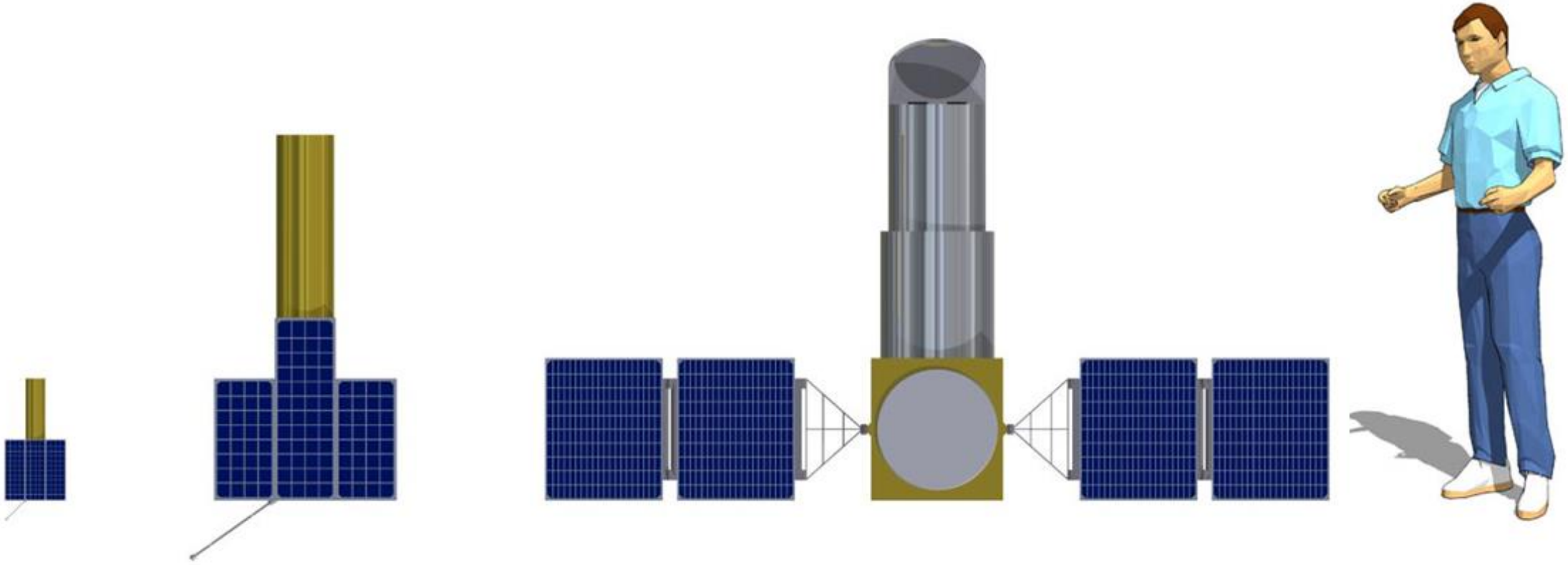
Scientific committee

Program evolution

95mm

220mm

500 mm ← Mirror diameter



< 6kg

< 25kg

< 65kg

Phase I

Phase II

Phase III

Program evolution

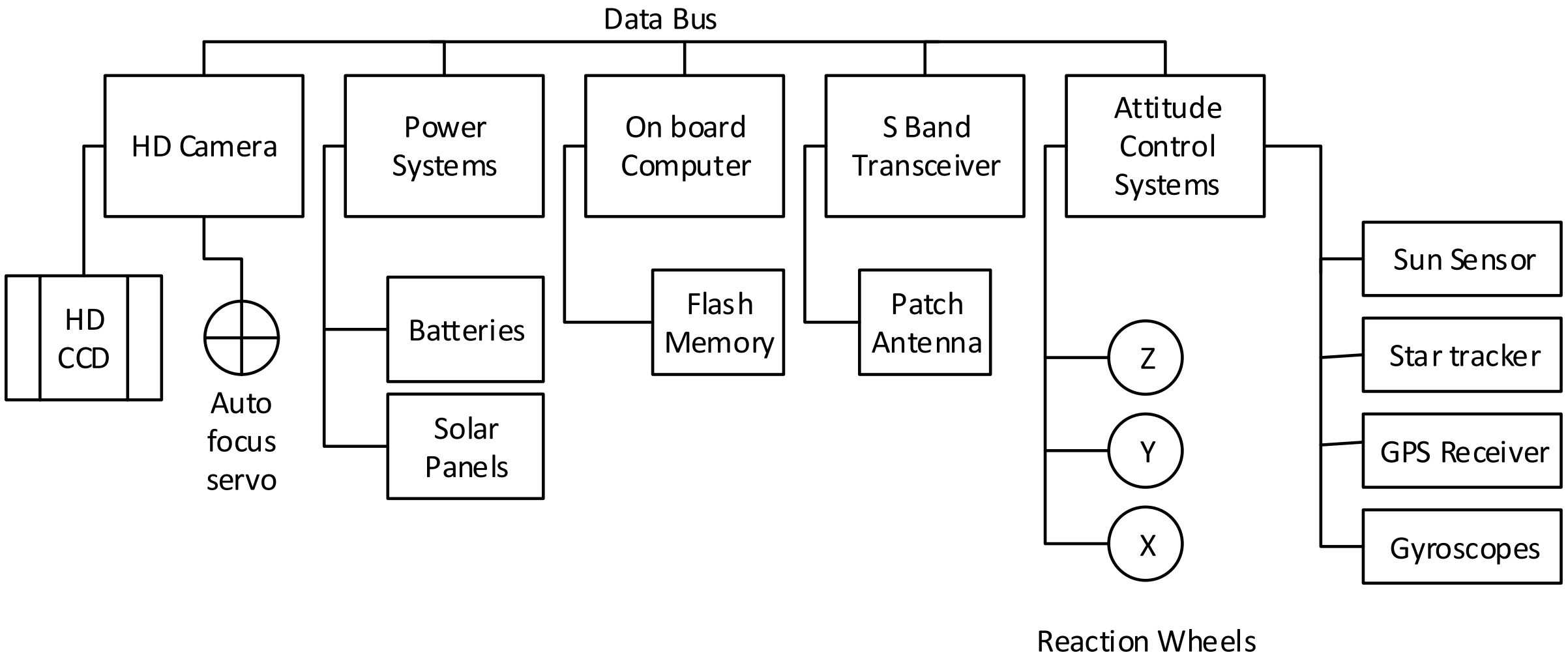
- The first step will have the duty to perform the mission and rise the interest and the contributors to the project
- Using a standard for the first mission is very important: in this case 6U cubesat
- 6U cubesat it is a good starting solution: lower development costs and increase the possibility of launch.

Program evolution

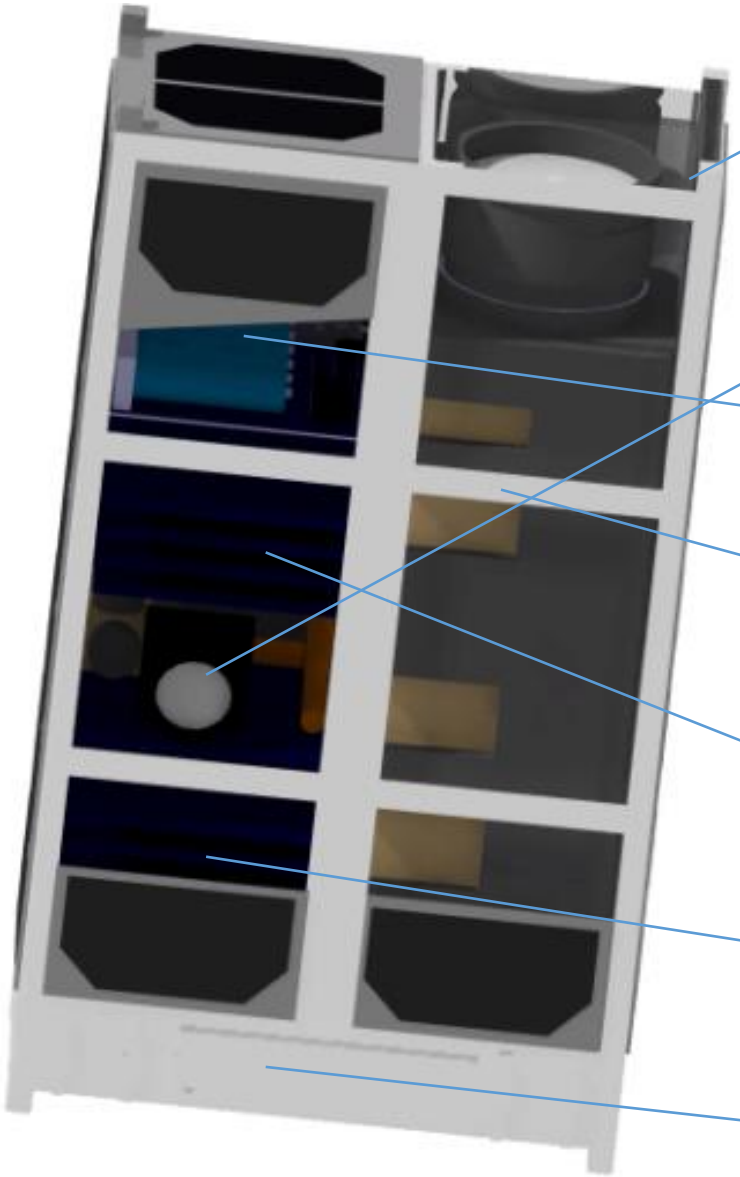
PRINCIPAL REQUIRMENTS FOR THE FEASIBILITY MISSION

- The system shall provide image from space (100% mission complete)
- The system shall provide information about the pointing attitude in order to determinate what is looking
- The system shall stabilize its attitude
- The system shall transmit image to the ground
- The system shall respect the IADC guidelines on space debris

Newton Spacecraft overview



Space Segment Description



6U Structure

ADCS (Magnetorquer and momentum wheels star tracker)

Power System (solar panel and battery)

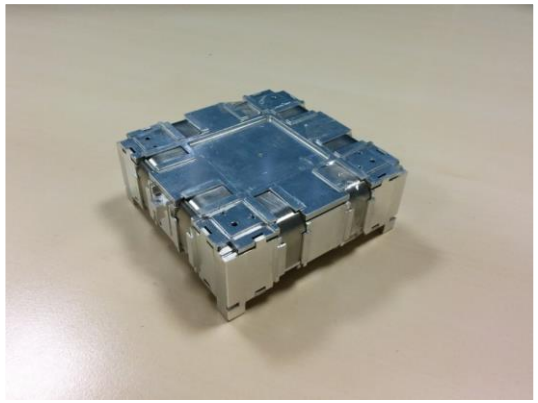
Extension System for the optics (thermal cutter and spring)

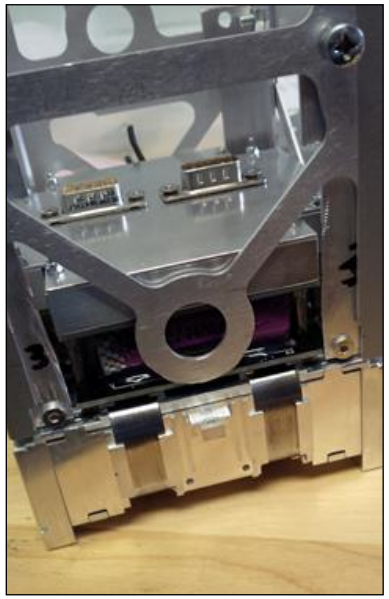
On Board Computer

Data Link (Down link)

De-orbiting system

Space Segment Description



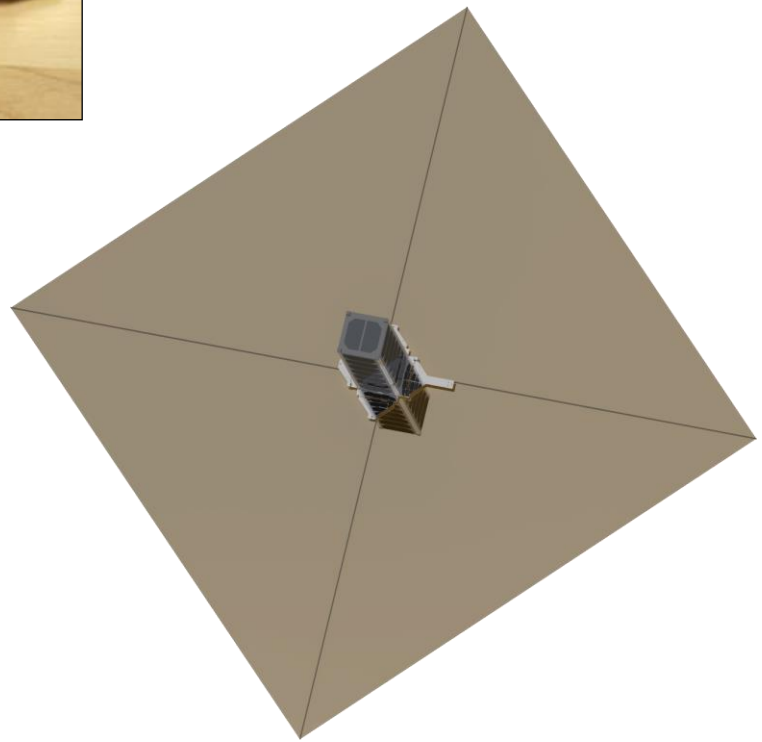


Deorbiting System ARTICA:

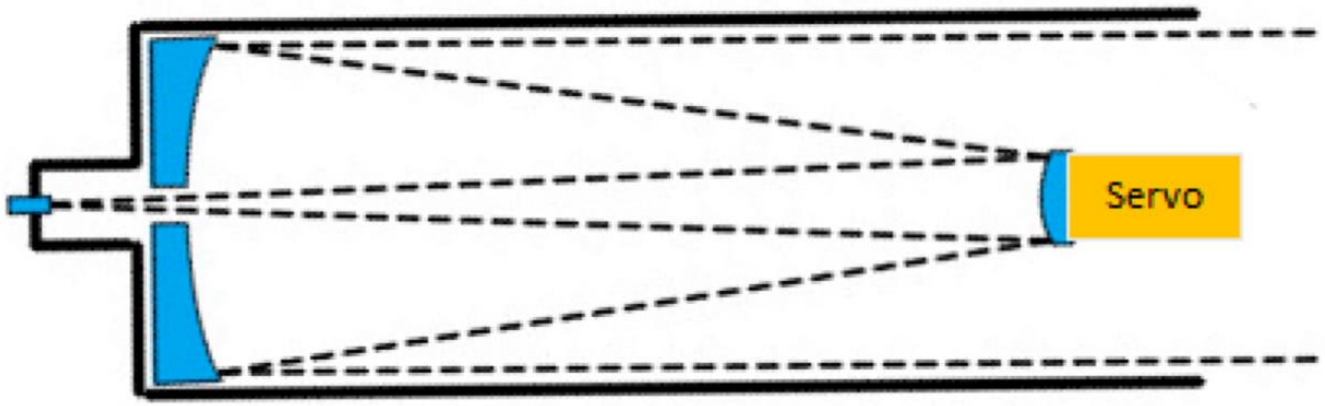
- Plug and Plat Philosopy

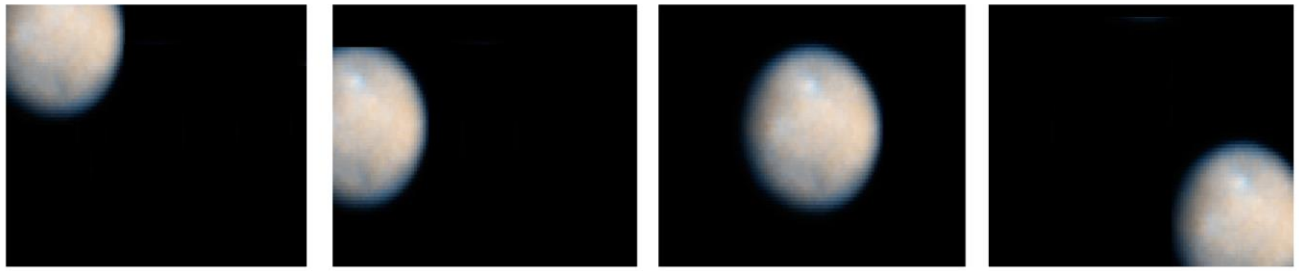
- Stand alone philosopy (not depend from satellite)

- Easy Integration



Space Segment Description





Frame 1 | Frame 2 | **Frame 3** | Frame 4

Selected

Telescope:

-95 mm primary mirror

-300 mm focal length with 200X highest useful magnification (1.3arc*sec resolving power)

- CCD servo Aligning system, check by laser

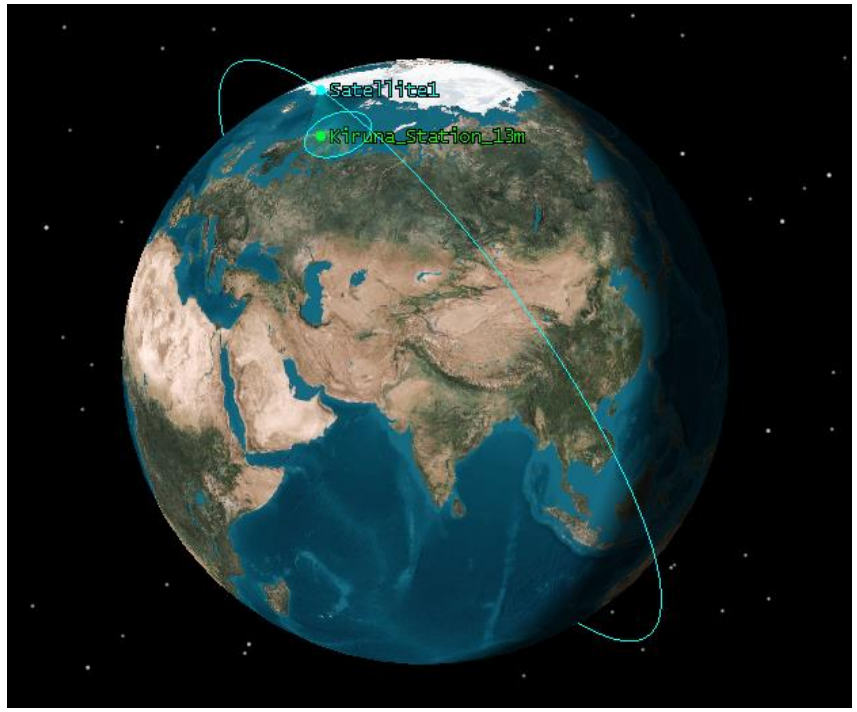
- Image fusion algorithms. This technique a sequence of photos is obtained (as a short movie) and the onboard computer selects the best framework of the photographed object

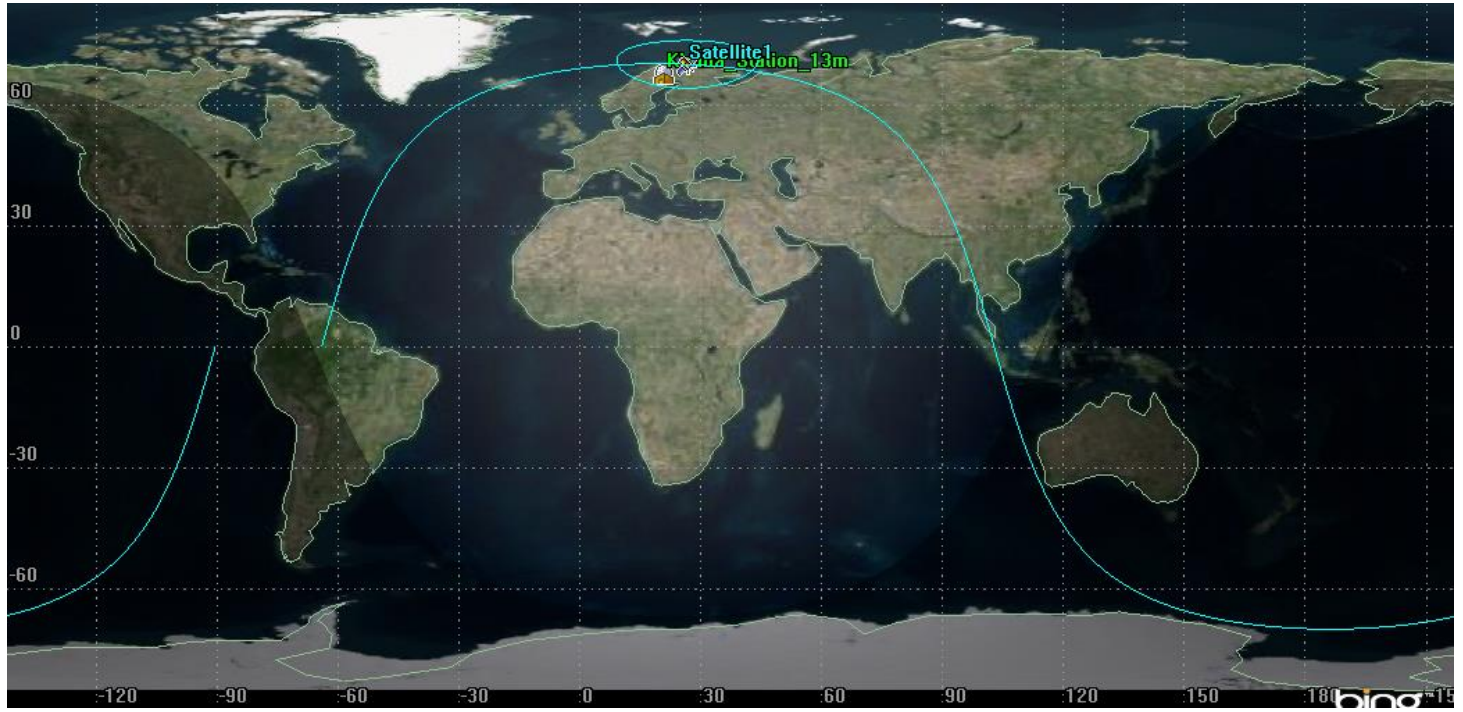
Space Segment Description (Rough Budgets calculation)

SPACECRAFT (launch excluded)					
Component	**Description/Function**	**Mass (g)**	**Power**	**Dimension**	**Cost**
Structure	Aluminum	1000	/	200x100x300	10K
Telescope	Primary Payload	1500	1.54 W	100x100x300	TBC
ADCS	Air Coil Magnetorquer Reaction wheels, Star tracker	2000	<2 W 3 W	60x60x50 mm	50K
TX/RX	VHF /UHF /S-BAND	500	10 W	100x100x100mm	20K
Thermal Control	Passive	/	/	-	
OBC	Specific design	300	<1 W	-100x100x100	TBC
Power System	Batteries Solar panels (4 side)	1000	2A@24V Battery 1A@5V	200x200x200 mm 300x300	TBC
Deorbiting Sys	Deorbiting passive sys	500g	StandAlone	25x200x100	NPC suplly
TOTAL		< 7 Kg			200k E TBC

POWER SYSTEM	
Average Power	< 2 W
Peak Power	< 12 W (during transmission)
Battery Pack	2A@24V ca 50W peak available power
Solar Panels	1A@5V

Orbit and ground station consideration





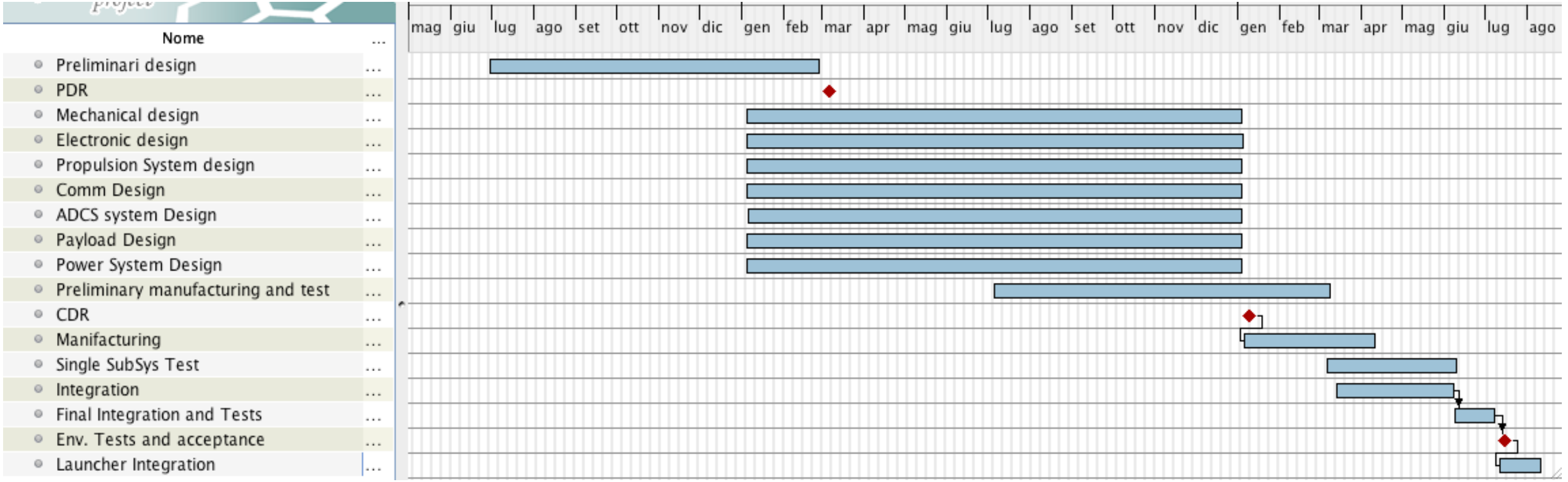
ORBIT:

- One ground station in the north (Kiruna)
- It needs to be almost 70°
- Possible download window: 4 access with average time for each of 200 sec (3,3 min)
- For each access we can expect about 1.5MB (350 kbps) (or many poor quality or less photos)
- More ground station = More photo = More quality

Risk Register

RISK	GRADE	MITIGATION
CCD Failure	HIGH	Space Heritage material
Attitude determination System Failure	MEDIUM	Space Heritage material and solar pannel information
Attitude Control System Failure	MEDIUM	Magneto torque Stabilizations (very long)
Failure transmission Image	MEDIUM	Improve Ground station number
Deorbiting system not deploy	LOW	Locking system have ablative failsafe redundancy

Schedule tentative



Future steps and conlcusion

FIND PARTNERS:
- Commercial Partner (even publicity partner)
- Technical Partner

FIND UTILIZATORS:
- Increase the Hype around the mission
- Increase the number of ground station (even buld?)

MORE SATELLITE:
- Increase number of satellites
- Increase the dimension of the telescope

OUTREACH PROGRAMME


Thank You For Your Attention