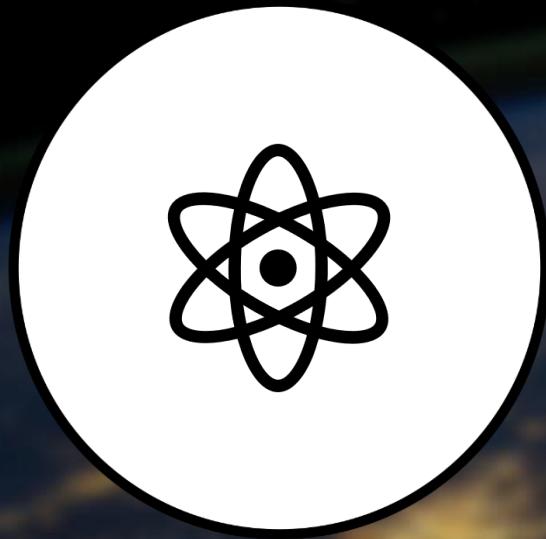




PERUN
CROATIAN CUBESAT

Mission statement and approach



The **Perun I** is composed by a 2U CubeSat with 3 MpxRGB camera

Mission objectives

PRIMARY OBJECTIVES

- Collect data from satellites for educational purposes
- Initiate the first Croatian satellite
- Initiate the first Croatian space program

SECONDARY OBJECTIVES

- Share images to schools, universities and to the public
- Include students for development of future missions
- Organize public events for education in space technologies

Prelaunch phase

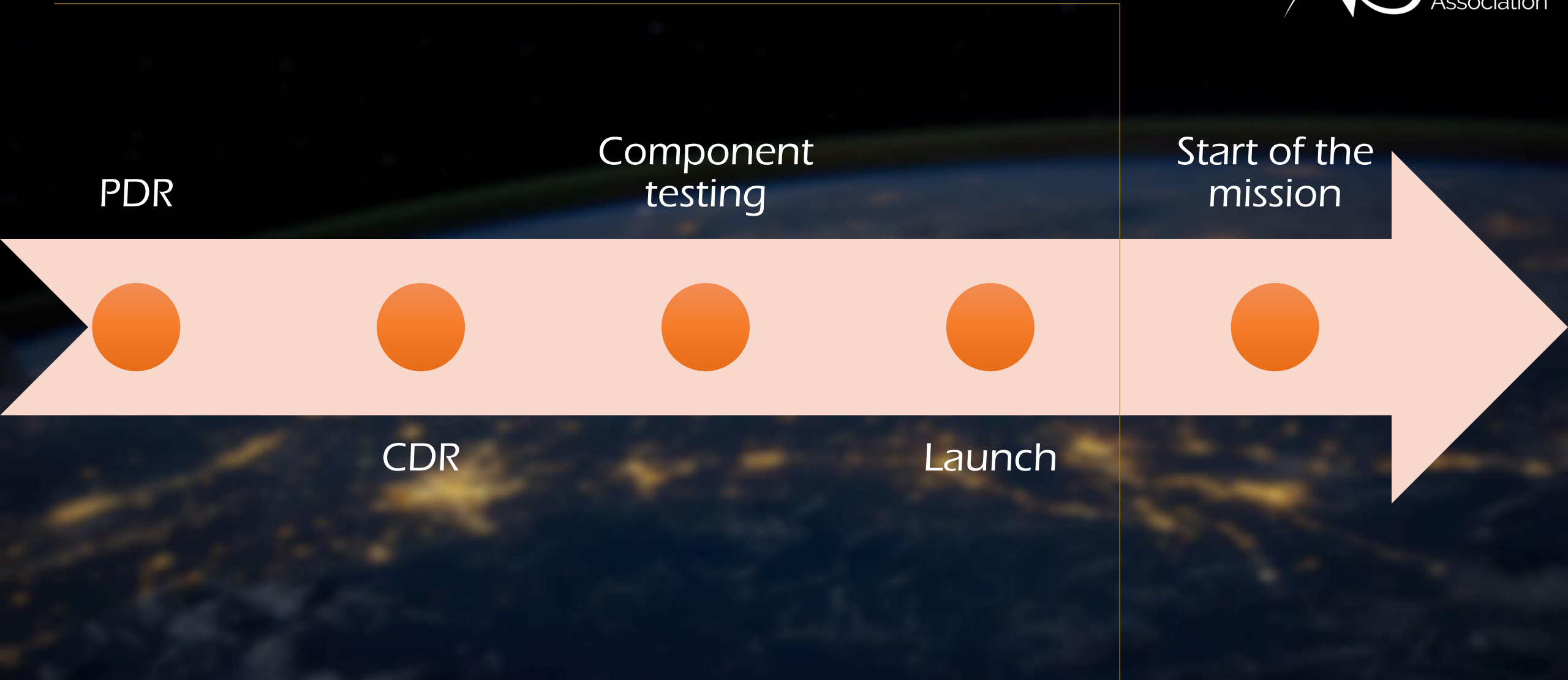
PDR

Component
testing

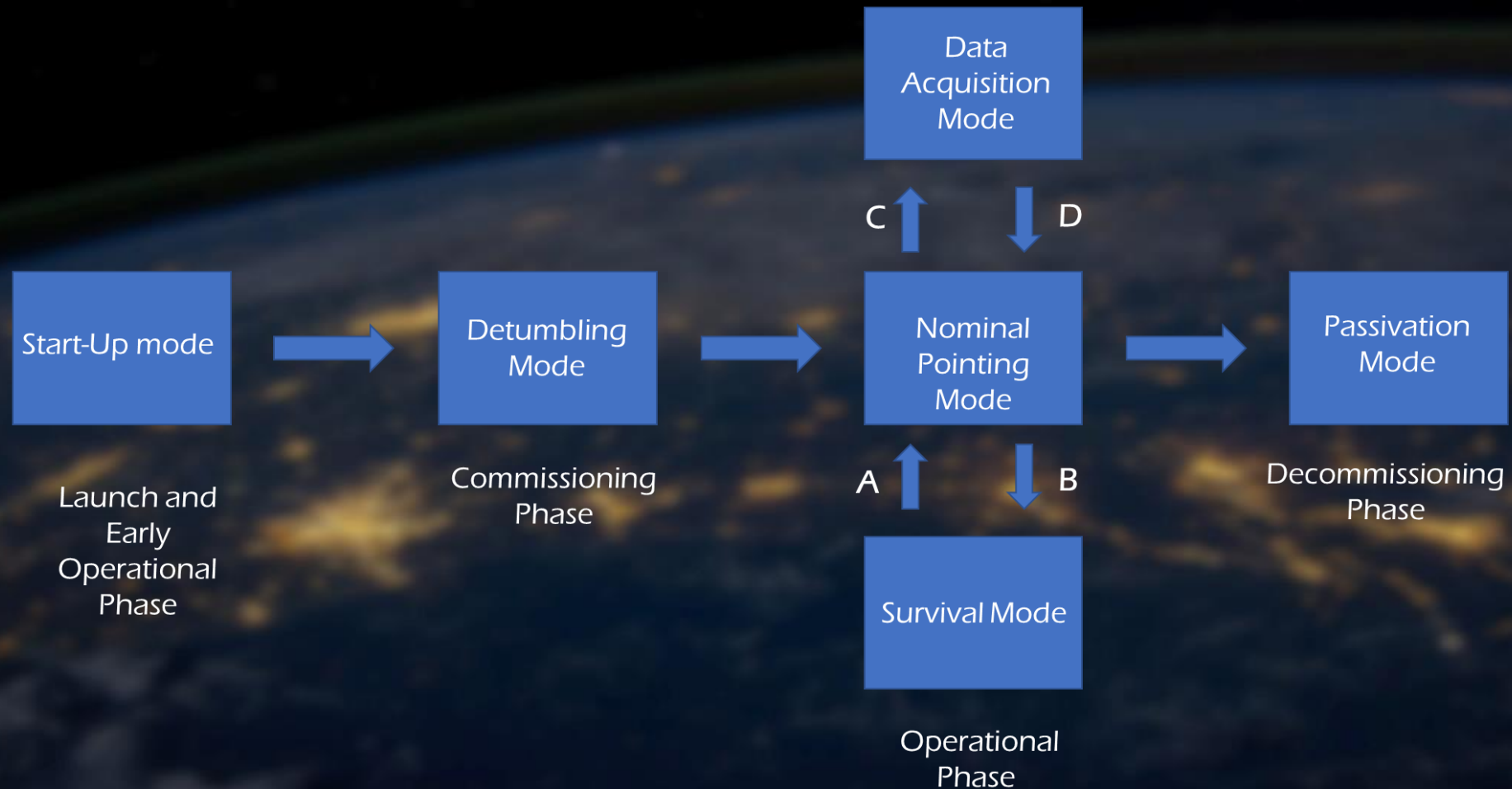
Start of the
mission

CDR

Launch



Mission Phases



Structure

- The satellite skeleton
- Determine the loads and pressures by the environmental conditions
- Two constraint systems: Rail system and Tabs system

IMPORTANT:

- The maximum mass allowed for both cases is usually around 12 Kg and the material used for the structure is Aluminum 7075, 6061, 6082, 5005, and/or 5052.
- Structure need to be tested and certified by the ESA standard ECSS-E-ST-10-03C and GEVS: GSFC-STD-7000A.

Structure

PROPERTY	VALUE	UNIT
Primary Structure Mass	165.0	gram
Primary + Secondary Structure Mass	206.0	gram
Outside Envelope (l x w x h)	100 x 100 x 227.0	mm
Inside Envelope (l x w x h) per module (2x)	~ 98.4 x 98.4 x 98.4	mm
Thermal Range (min – max)	-40 to +80	°C



Payload

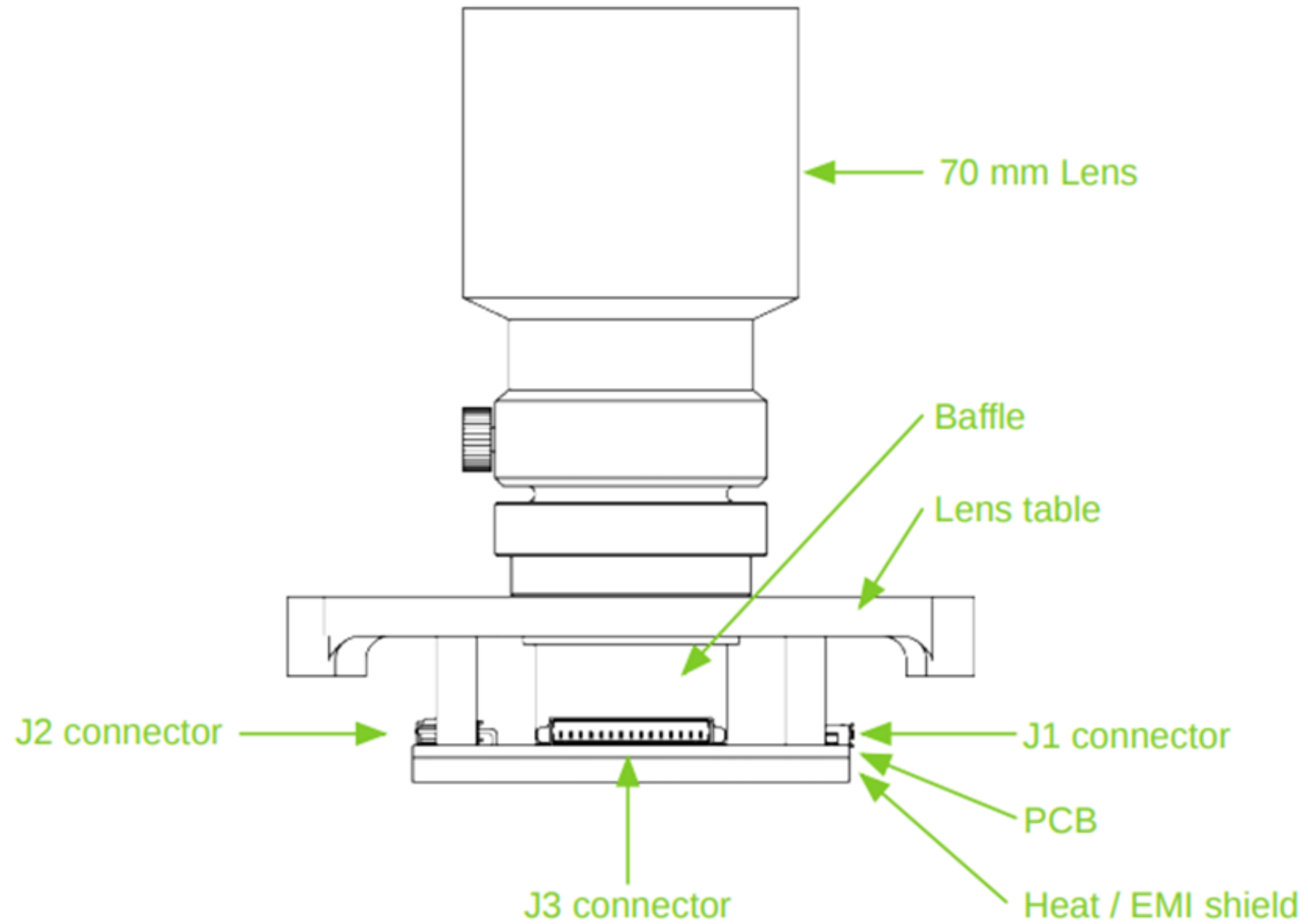
- The NanoCam C1U camera system
- Manufacturer: GOMSpace

Consisting of:

- Lens
- Lens table
- Image acquisition
- Processing board
- Software

Features

- Industrial lens
- 3 Mpx color sensor
- 2048 x 1536 resolution
- 10-bit RGGB Bayer pattern
- 35mm f/1.9
- <60m/pixel from 650km
- 2GB onboard storage
- RAW, BMP and JPEG output formats



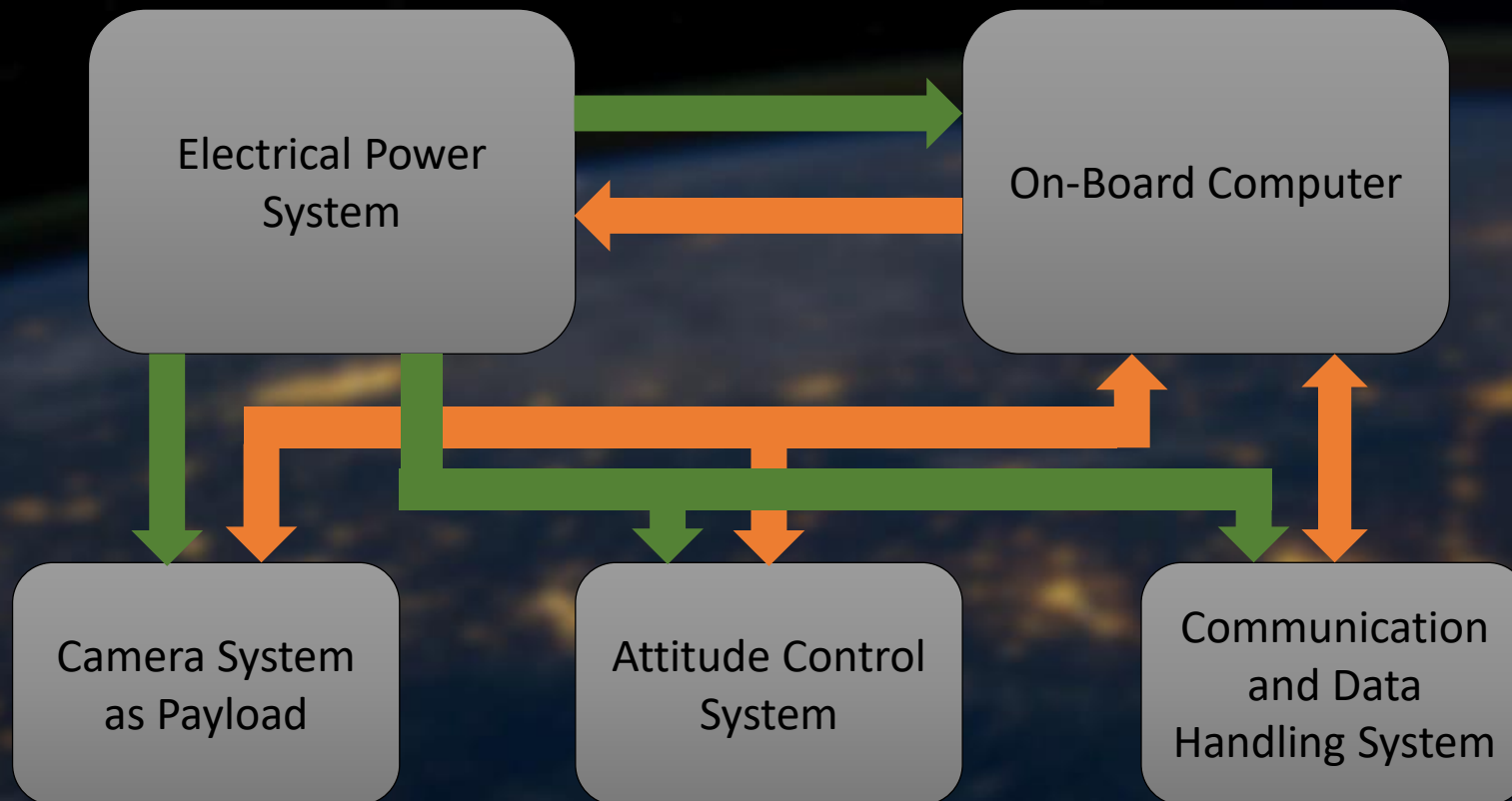
System architecture

Shall contain:

- On-Board Computer
- Electrical Power System
- Attitude Control System
- Communication and Data Handling System
- Camera System as Payload

Scheme

- Data 
- Power 



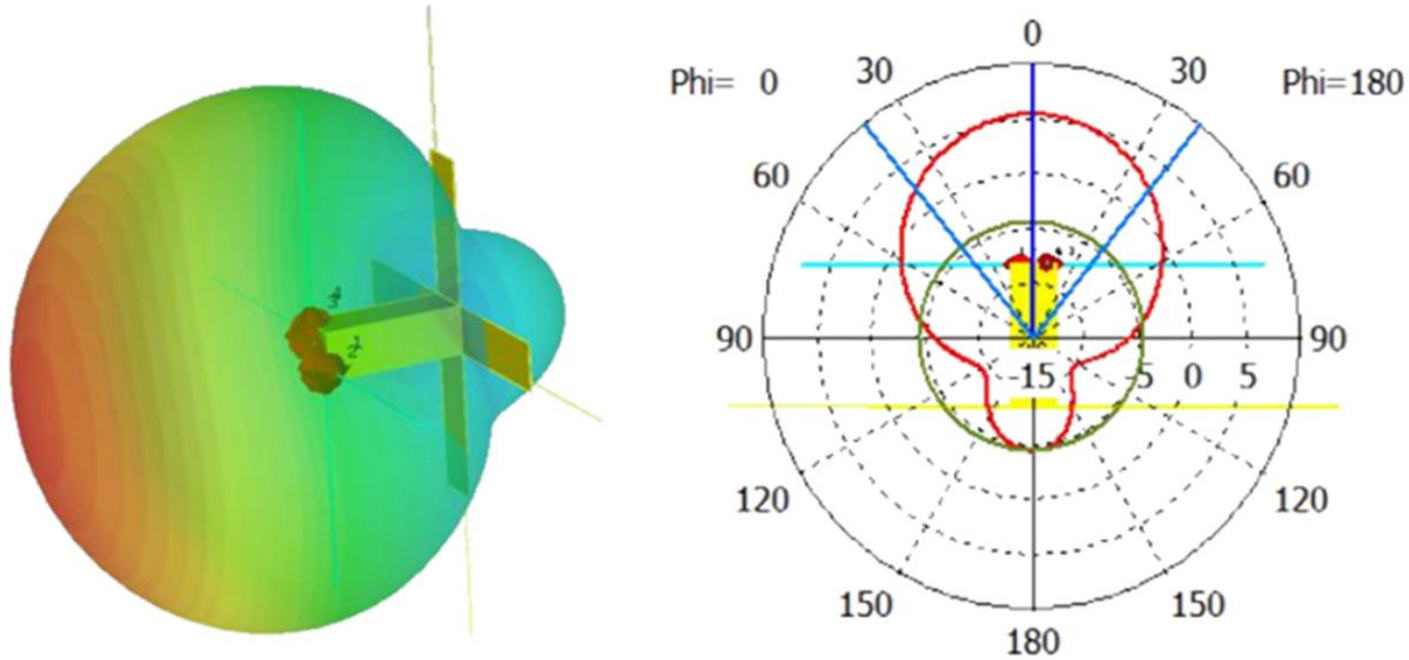
Communication and Data Handling System

- Ground Station communication via UHF/VHF and S-band antennas
- Send and receive information and commands
- Possible ground station location on the top of Algebra LAB building (Ilica 242)

Communication and Data Handling System

System is combined of:

- S-band patch
- S-band transmitter
- UHF/VHF deployable turnstile antenna
- UHF/VHF transceiver for the satellite
- S-band downlink ground station



Antenna radiation pattern simulation

Specifications

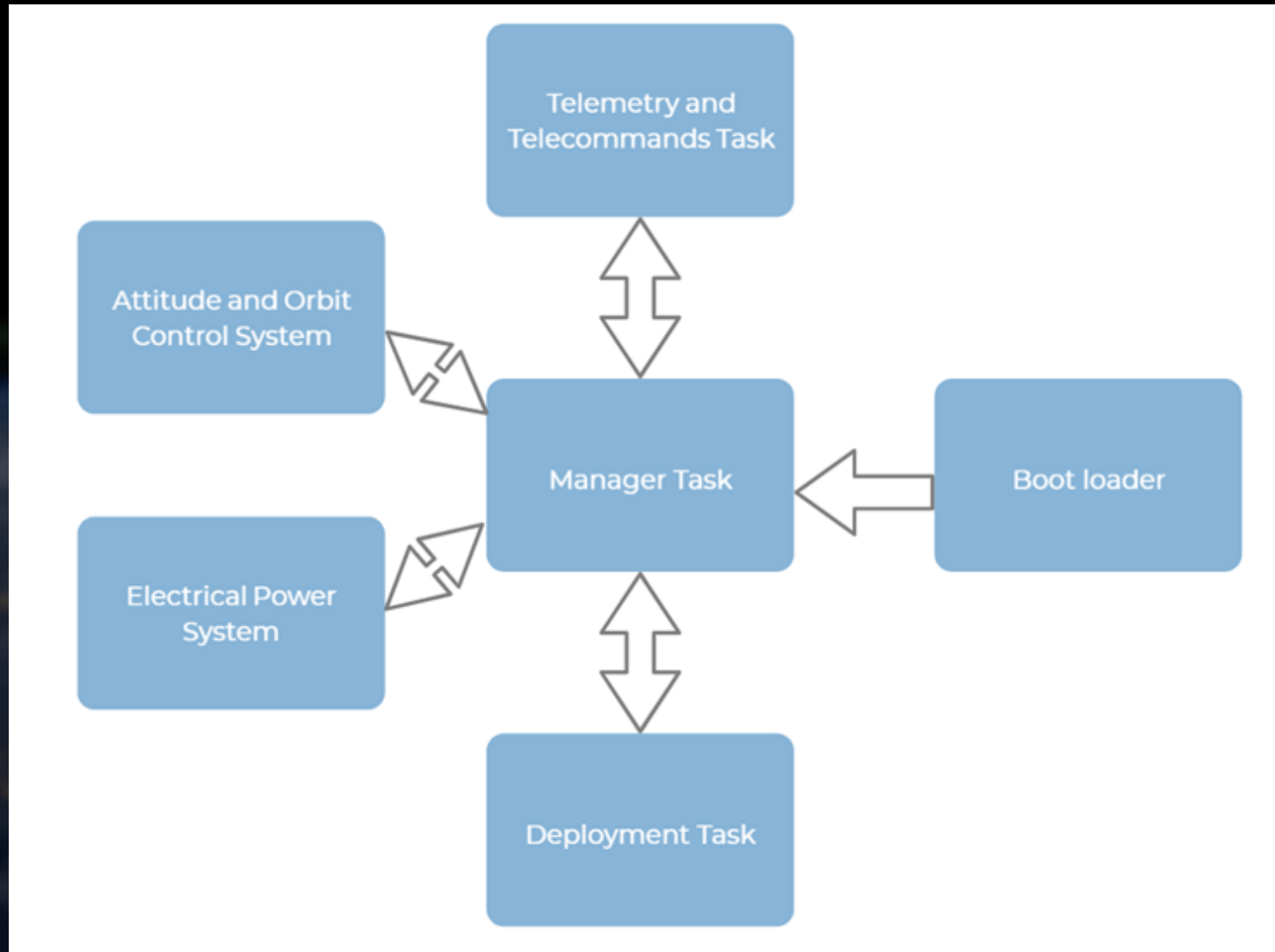
- S-band patch has frequency range of 2200MHz to 2300MHz
- Right hand circular polarization
- Specially designed for HISPICO transmitter
- Communication speed up to 1Mbit/s

On-board Computer

- GOMSpace NanoMind A3200
- The brain of the satellite
- Fully autonomous in real time
- Monitors whole system
- Star configuration

Specifications

- 64MHz, AVR32 MCU, 32-bit RISC processor
- FreeRTOS operating system
- Temperature sensors
- 3-axis gyroscope

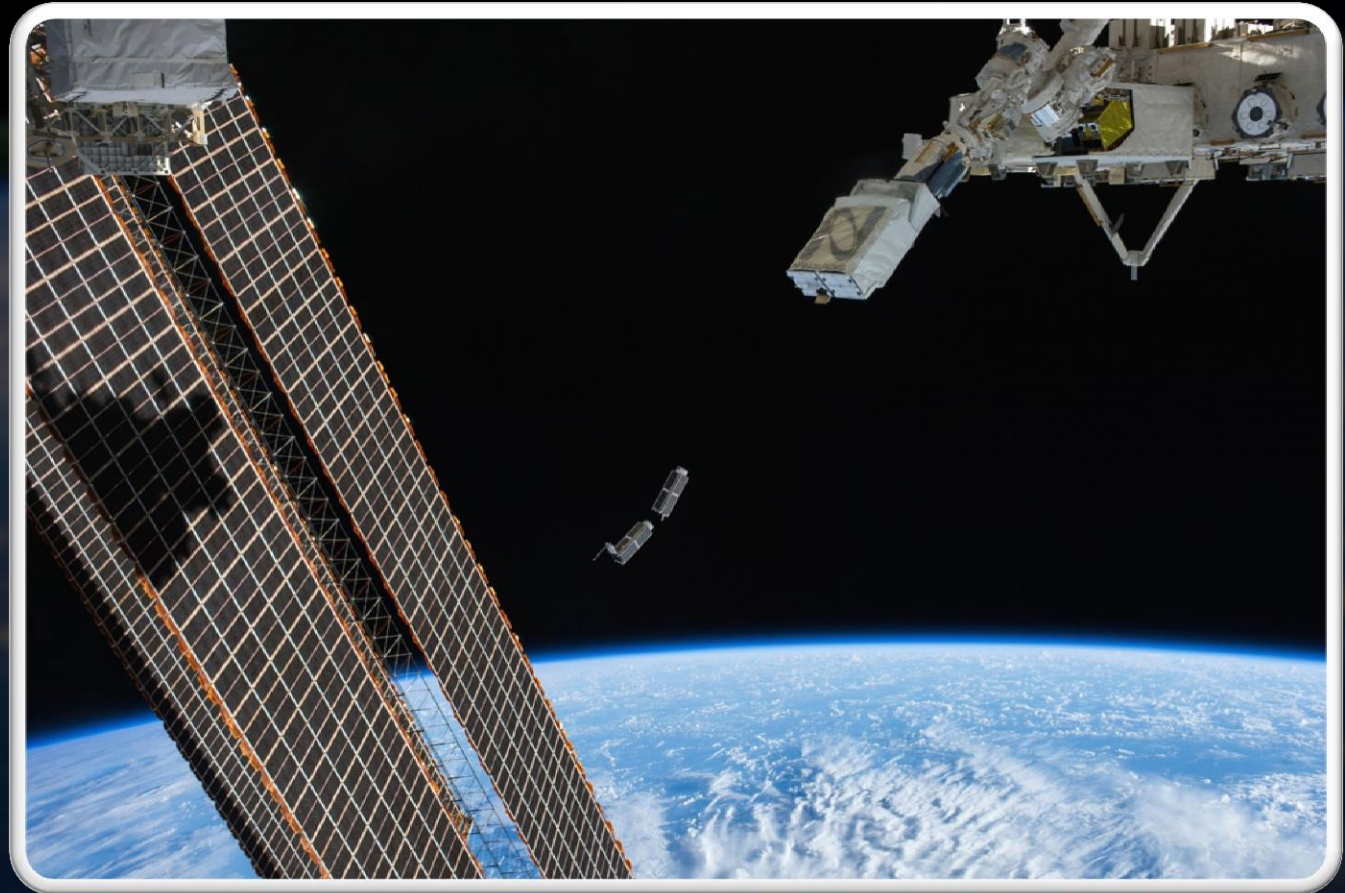


Block diagram of On-Board Computer

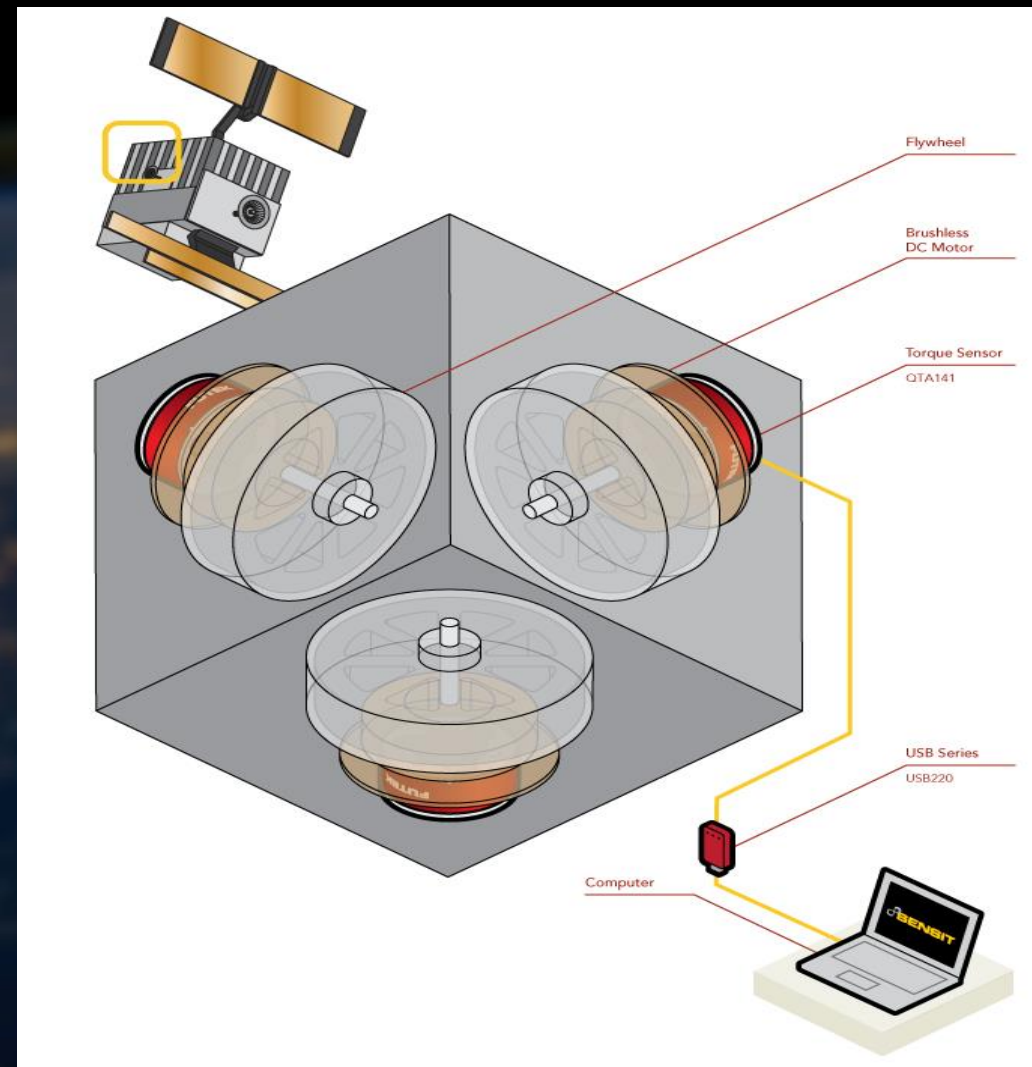
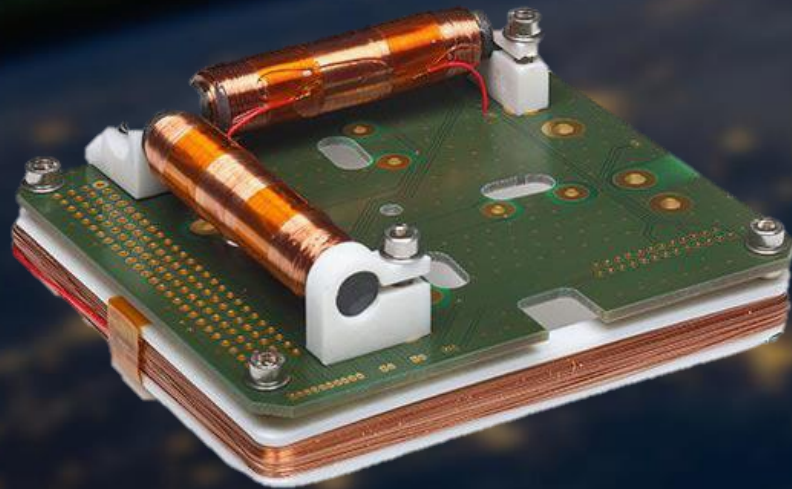
Attitude Control System

Attitude determination sensors

- Magnetometers
- Star trackers
- Sun sensors
- Gyroscopes

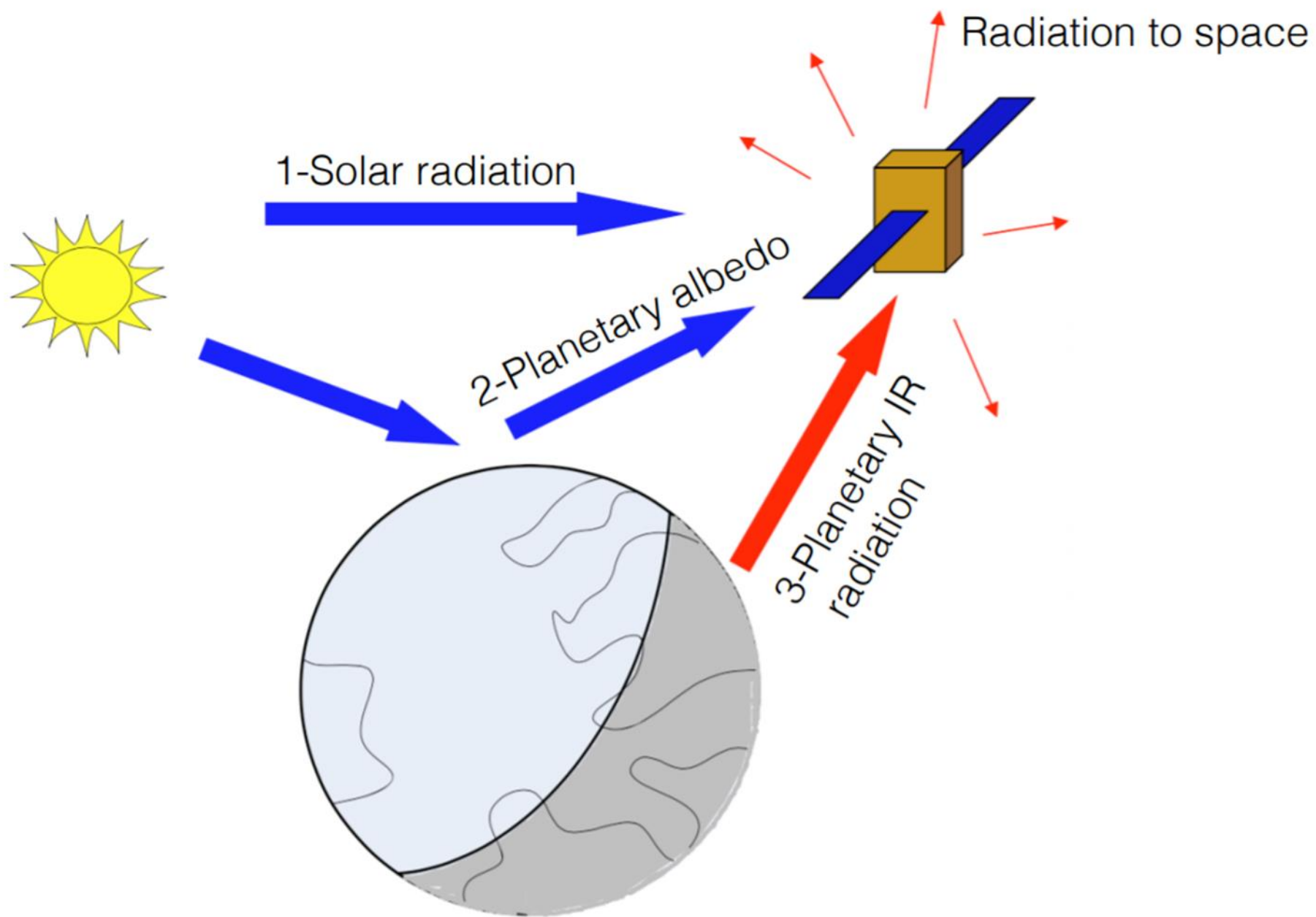


Actuator selection



Thermal Control System

- Low Earth Orbit
- Frequent temperature oscillations
- Temperature of satellite: → Sun
 - Earth
 - electrical components in satellite



Also: internal heat dissipation

(Isabel Pérez Grande)

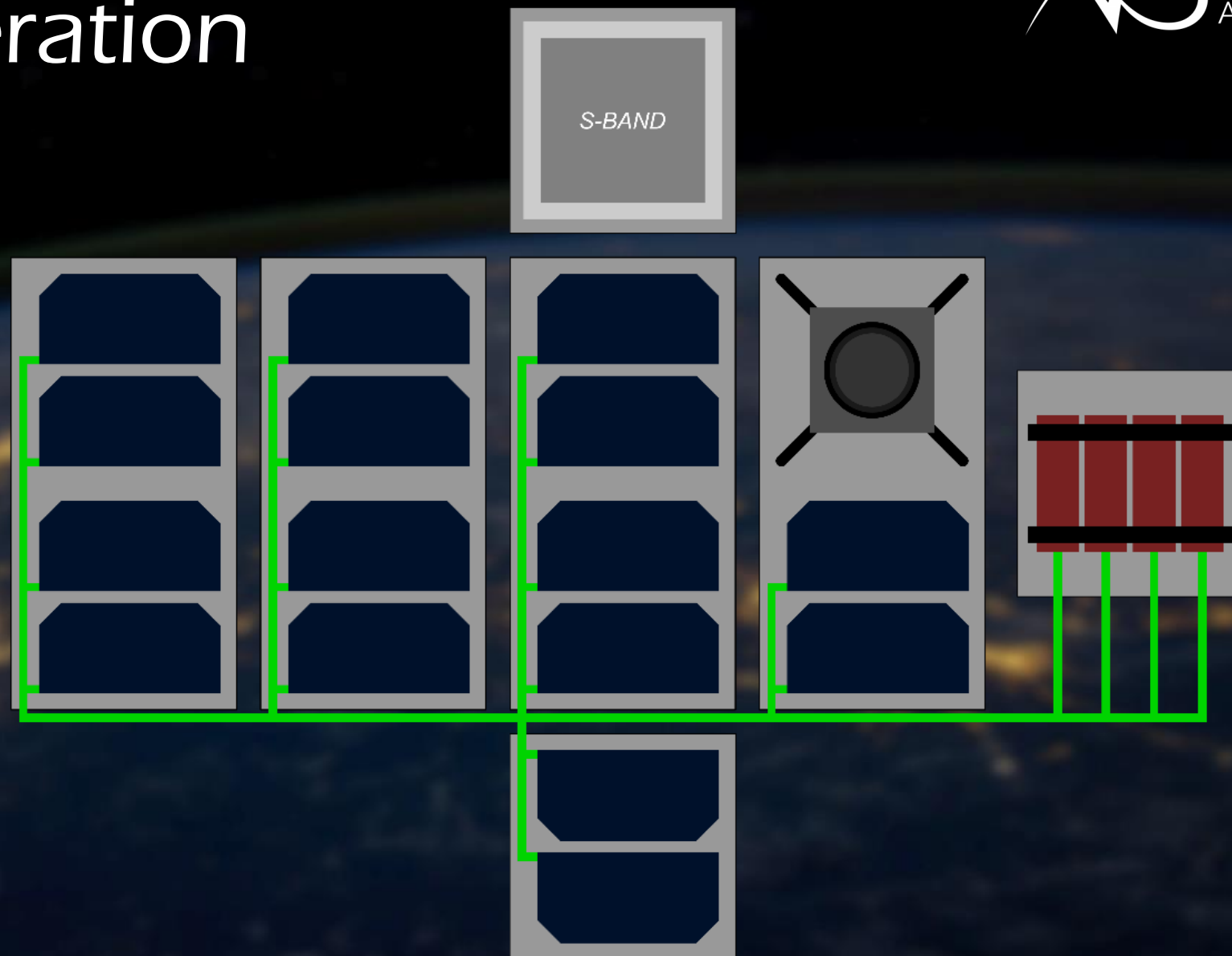
Thermal Control System

- Active and passive
- Aluminum foil
- Multilayer



Electrical Power System

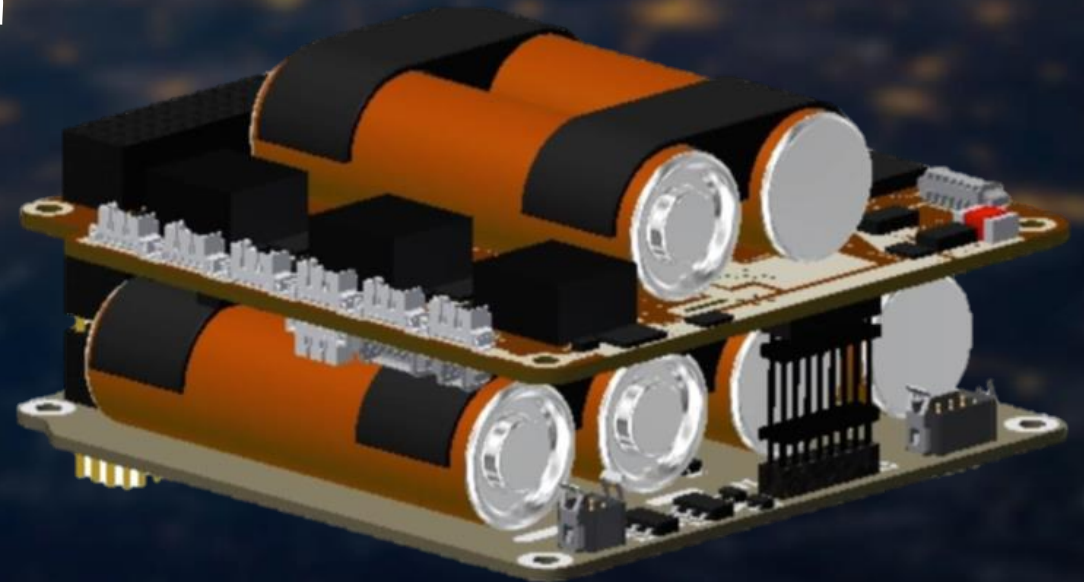
Power generation



Power storage

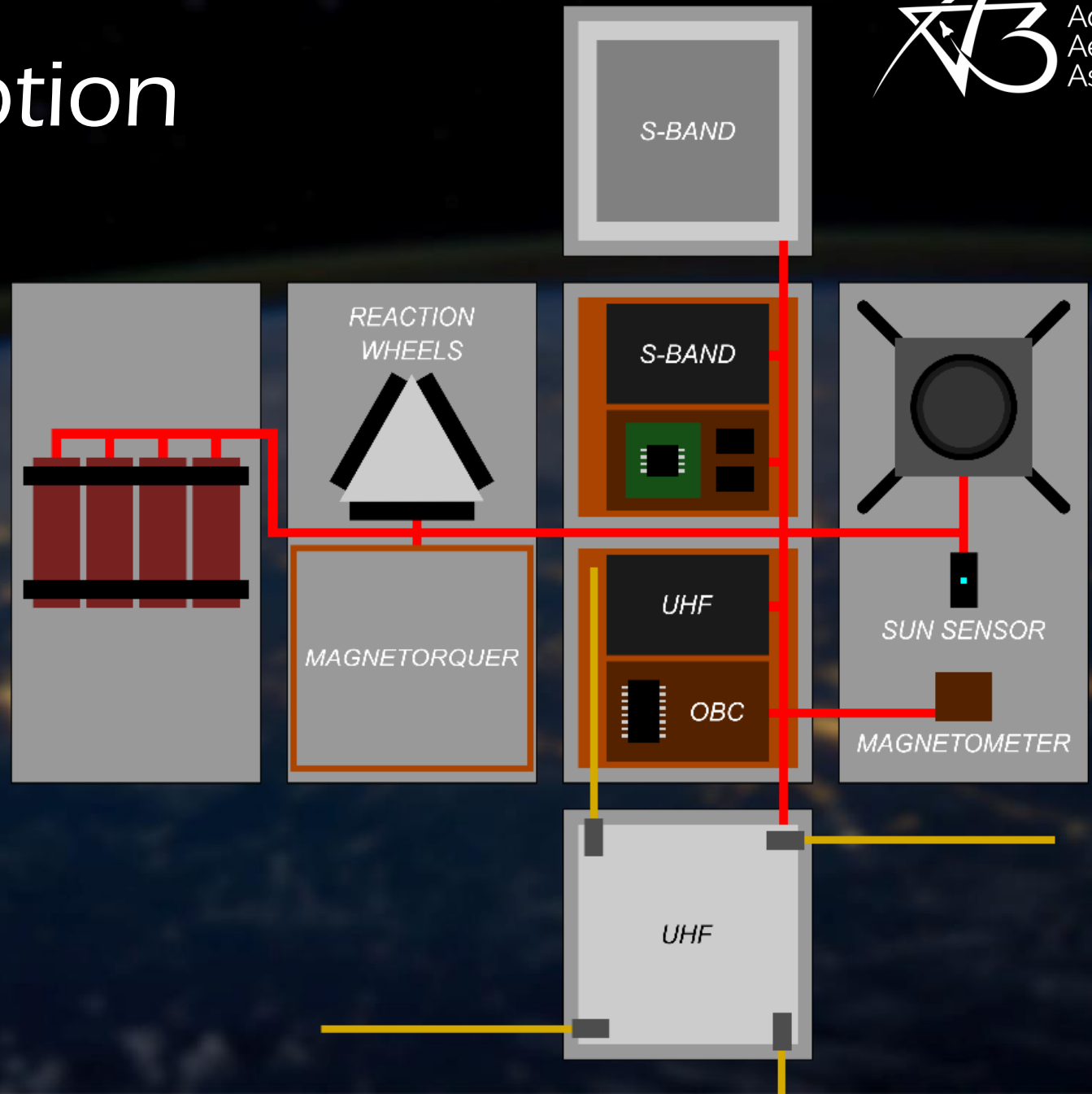
Battery:

- 4x 2600 mAh LithiumIon cells
- 2P2S or 1P4S battery configuration
 - battery voltage: 8.4V or 16.8V



Power consumption

- camera 1,3 W
- S-band transceiver: 10,07 W
- S-band antenna: 10,7 W
- UHF transceiver: 1 W
- UHF antenna: 10 W
- OBC: 1,1 W
- Sun sensor: 0,85 W
- magnetometer: 0,025 W
- magnetorquer: 13,7 W
- reaction wheels: 2,2 W



Thank you!

a3space.org

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