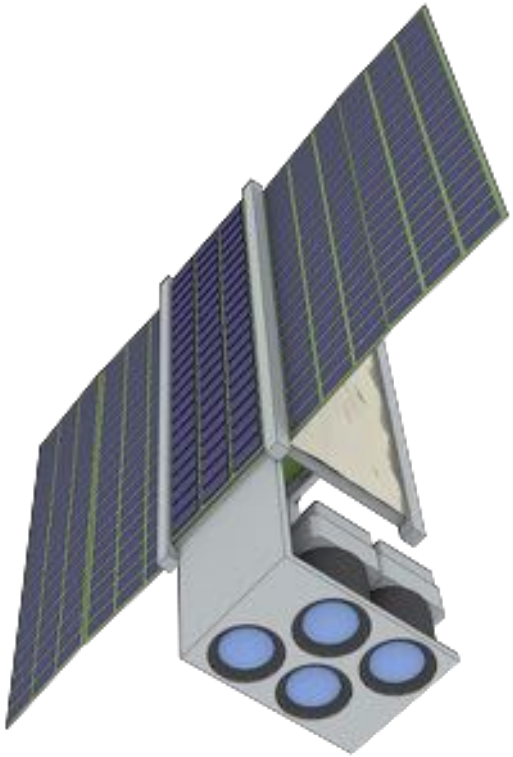


POLIS

Polar Orbit thermaL Infrared Satellite

Pierros Papadeas - pierros@libre.space
ESA Φ-week 2018-11-15 ESRIN

Urban Heat Islands (UHI)

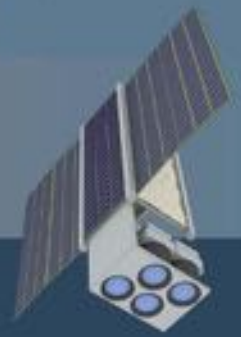
Source: NASA

POLIS

POLIS focuses on the impacts of the excess heat of urban areas [The Urban Heat Island Effect]

POLIS exploitation plan will take advantage of unpreceded **spatially and temporally detailed** urban temperatures to support applications on thermal discomfort, any outdoor activity, smart cities, energy demand and health.

The data will be available in near real-time. | They will offer high spatial and temporal resolution. | They will be availabe online. They will be generated for numerous cities around the Globe.



DATA PRODUCTS

Temperture Data

Energy Demand Index

Thermal Discimfort Indices

Heatwave Hazard

Can enable the development of numerous applications

FITNESS / SPORTS

SMART CITIES

HUMAN HEALTH

CIVIL PROTECTION

ENERGY DEMAND

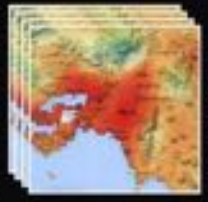
NEAR REAL-TIME DATA PRODUCTS

LST

The **skin temperature** of the surface. Closely related to the surface energy balance.

LSE

The land surface emissivity is an intrisnic proporty of land surfaces



TA

The **air temperature** at 2 m above ground. Drives the heat transfer process of the human body.

Cooling Degrees

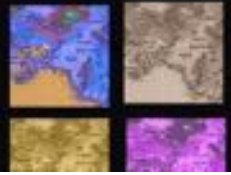
The difference between TA and a threshold above which people use air-conditioning to sustain the indoor temperature to comfortable levels.

Therma Indices

Indices that quantify peoples' discomfort due to temperature and humidity.

Heatwave Hazard

TA discrepancy from a city specific threshold above which a day is considered Hot.



ACPs

The Annual Cycle Parameters can be used for mapping the urban thermal landscape

APPS

Indicative Apps for cubesat constellation.

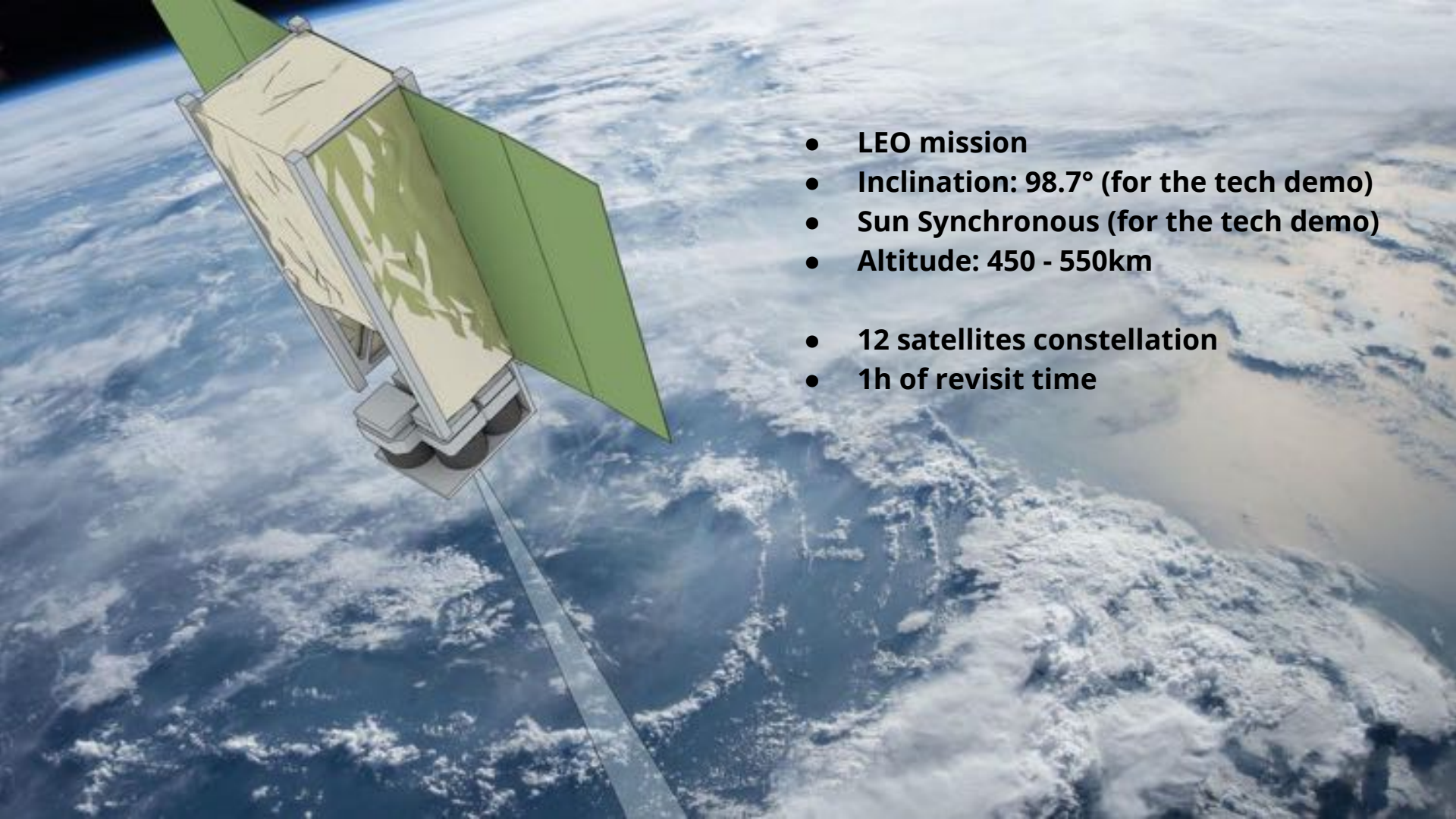
PERSONALIZED HEATWAVE RISK ESTIMATOR

URBAN Heat Fluxes and Emissions

OUTDOOR Activities

Current UHI data acquisition

	Spatial Resolution	Temporal Resolution	Real time	Operational use	Coverage
Geostationary	4-5km	5-15’	Yes	Yes	Earth disc
Current Polar orbiters	60m - 1km	12 hr - 2wk	No	No	Several km (path)
Global Models	25km	1 hr	NA	Yes	Global
Weather stations	Point (n/a)	10’	Yes	Yes	Point



- **LEO mission**
- **Inclination: 98.7° (for the tech demo)**
- **Sun Synchronous (for the tech demo)**
- **Altitude: 450 - 550km**

- **12 satellites constellation**
- **1h of revisit time**

3U Cubesat

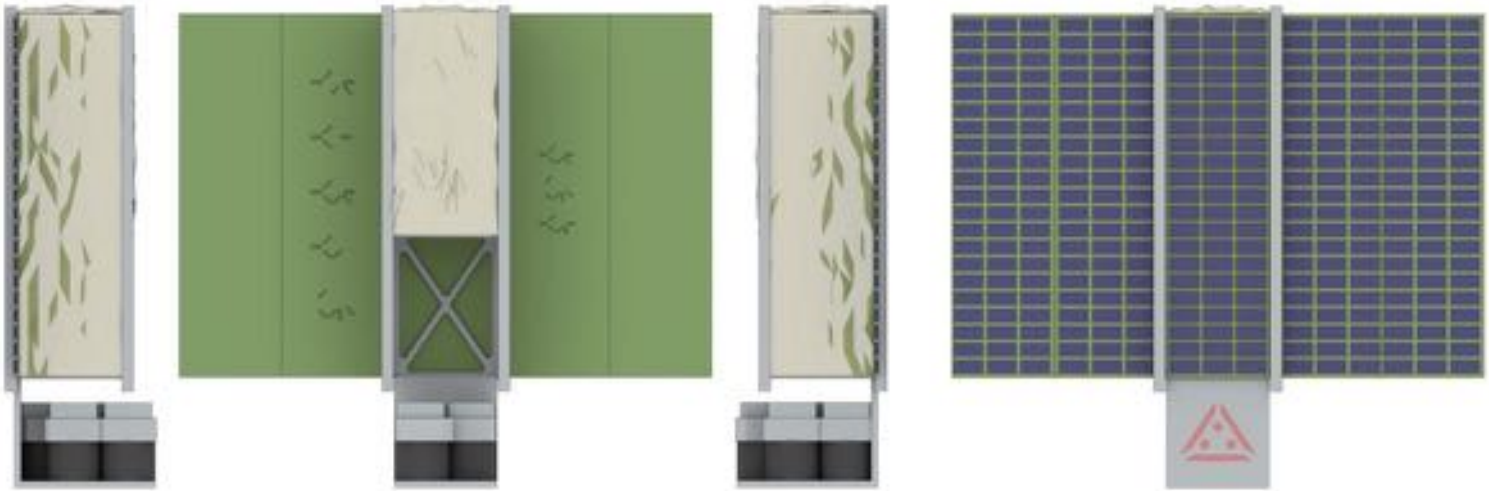
15W Power

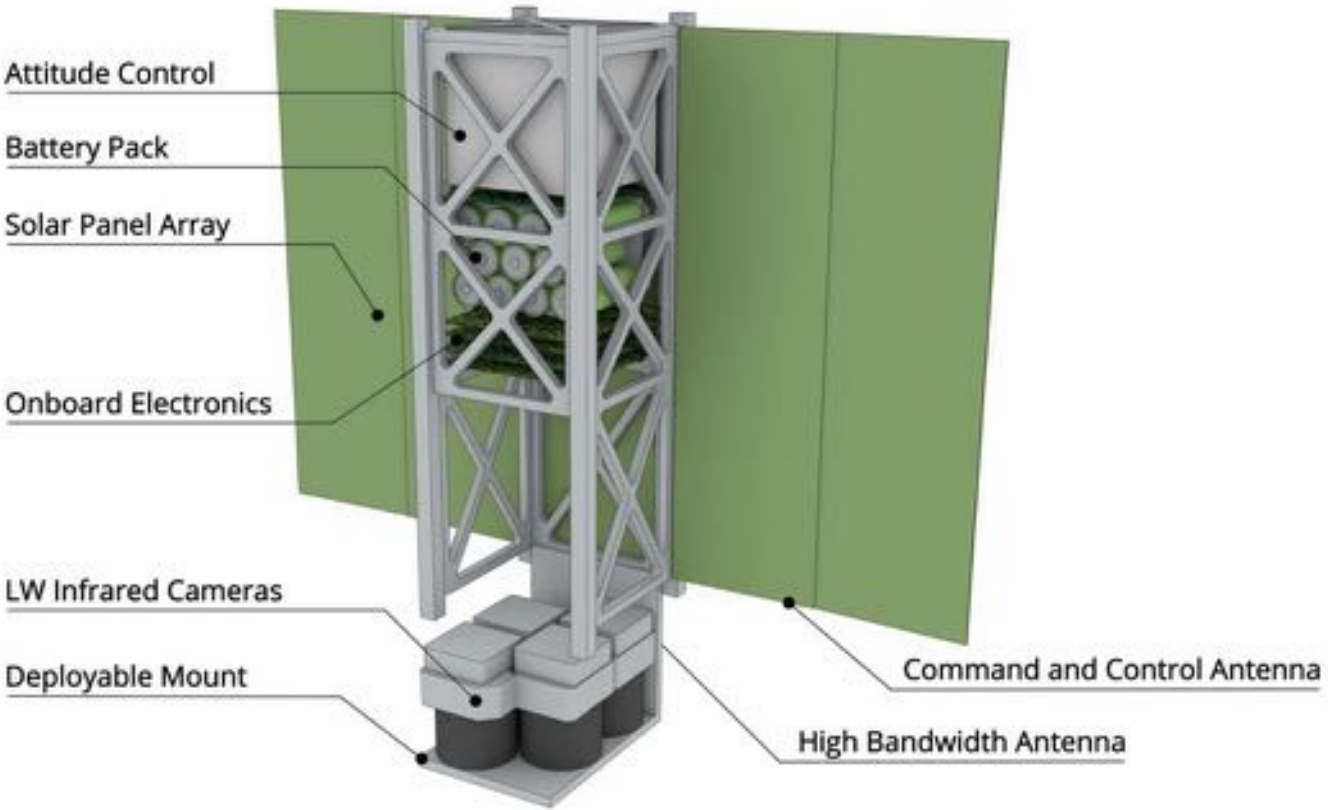
4x LWIR COTS imagers (2 bands)

ADCS (± 27° pointing)

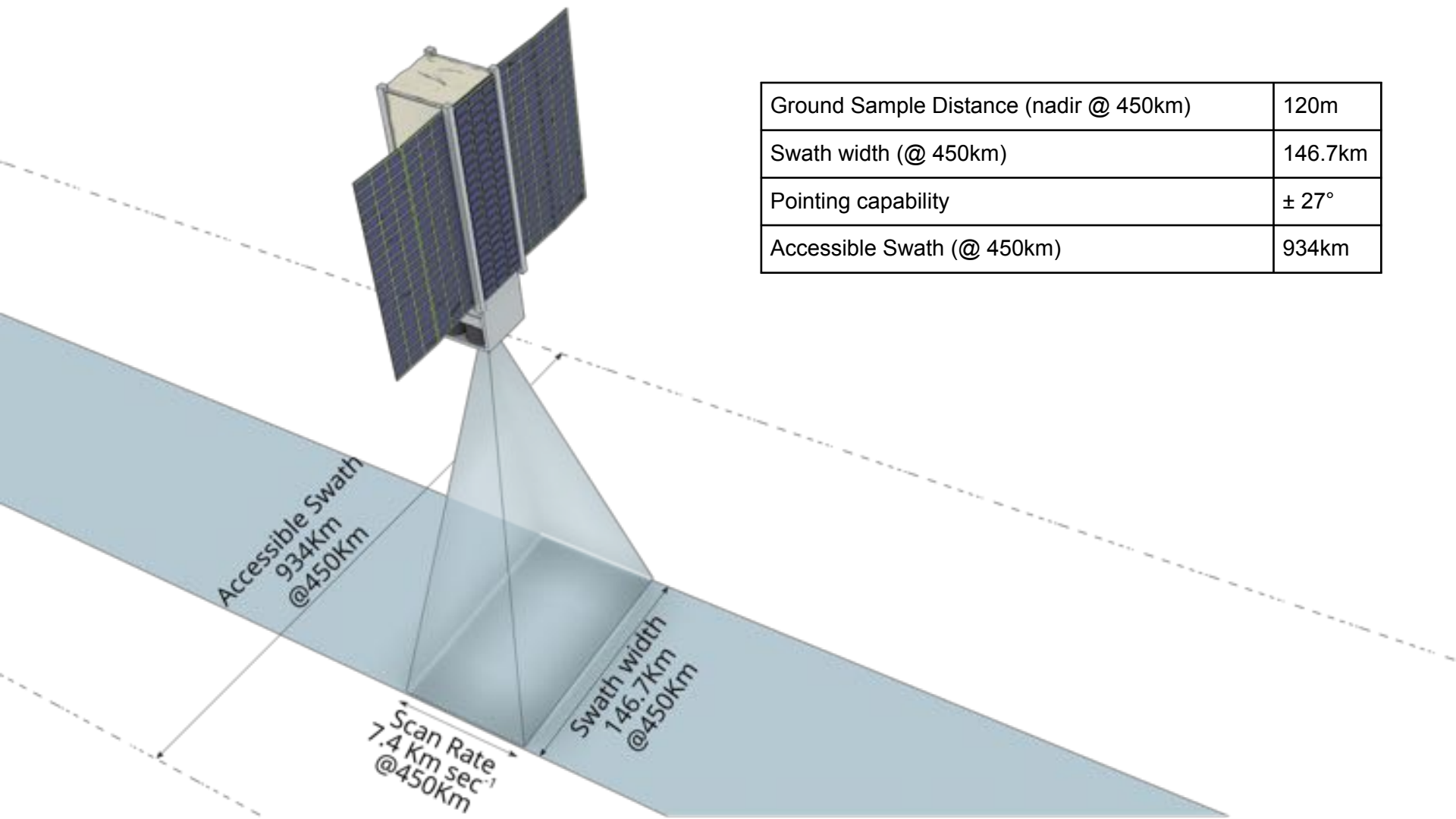
COMMS (S-Band)

EPS




Attitude Control
Battery Pack
Solar Panel Array
Onboard Electronics
LW Infrared Cameras
Deployable Mount
Command and Control Antenna
High Bandwidth Antenna

Ground Sample Distance (nadir @ 450km)	120m
Swath width (@ 450km)	146.7km
Pointing capability	± 27°
Accessible Swath (@ 450km)	934km



POLIS vs Current UHI data acquisition

	Spatial Resolution	Temporal Resolution	Real time	Operational use	Coverage
Geostationary	4-5km	5-15’	Yes	Yes	Earth disc
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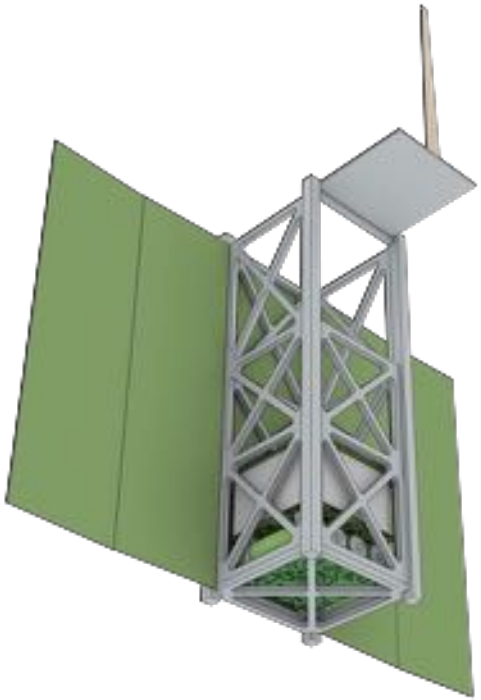
Global Models	25km	1 hr	NA	Yes	Global
Weather stations	Point (n/a)	10’	Yes	Yes	Point
POLIS IOD	140m	10 hr	Yes	Yes	50 major urban areas
POLIS Constellation	140m (70m SR)	1-2 hr	Yes	Yes	All major urban areas

Open Source Cubesat Bus



3U Cubesat

Open Source Hardware and Software

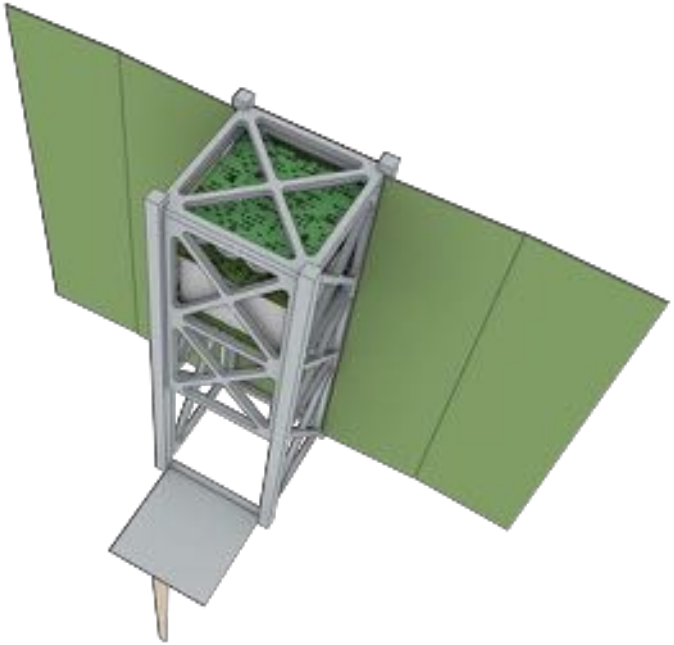
ADCS - EPS - COMMS

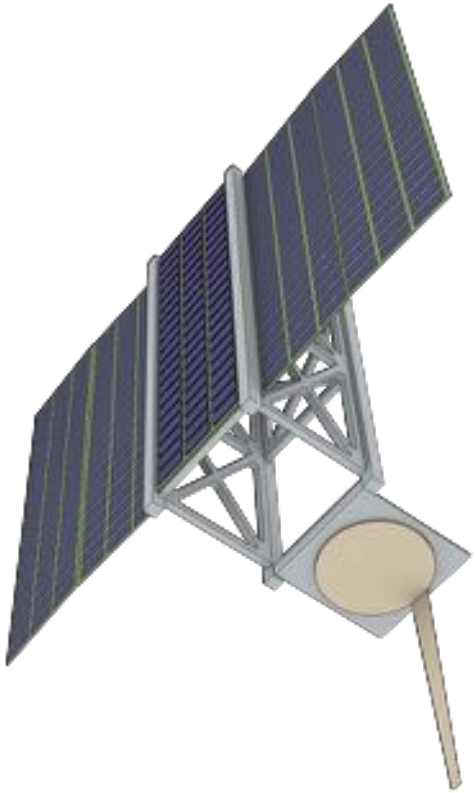
SatNOGS compatible

2U payload facilitation

Up to 30W

Cost: 20k EUR





Heritage

UPSat - 2U Cubesat mission

Open Source Software and Hardware

OBC - ADCS - EPS - COMMS - Structure

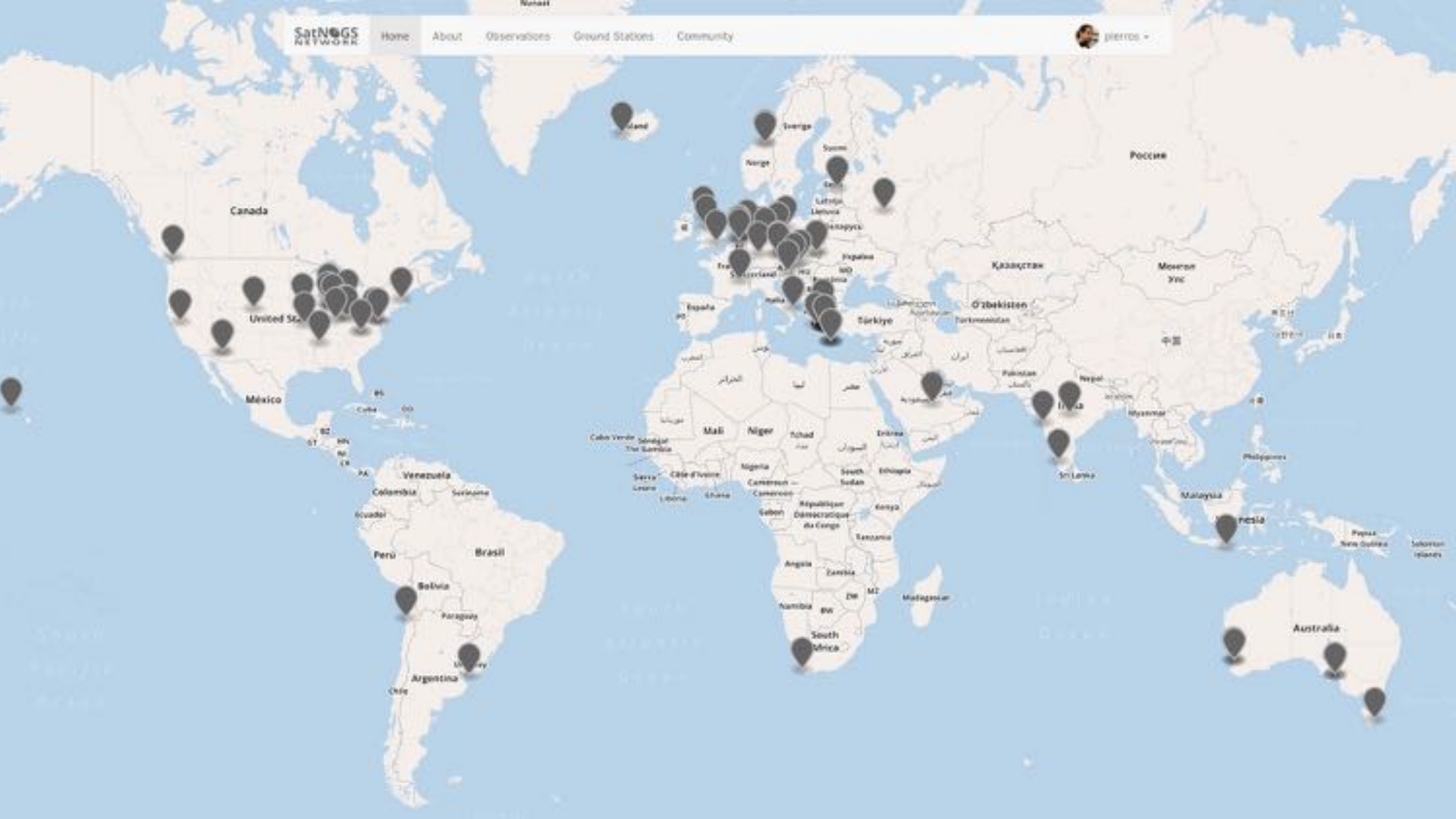
Launched May 2016

R&D (TRL 5-7):

S-Band COMMS

Deployable structure

Solar Panels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Chile
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Norge
Suomi
Россия
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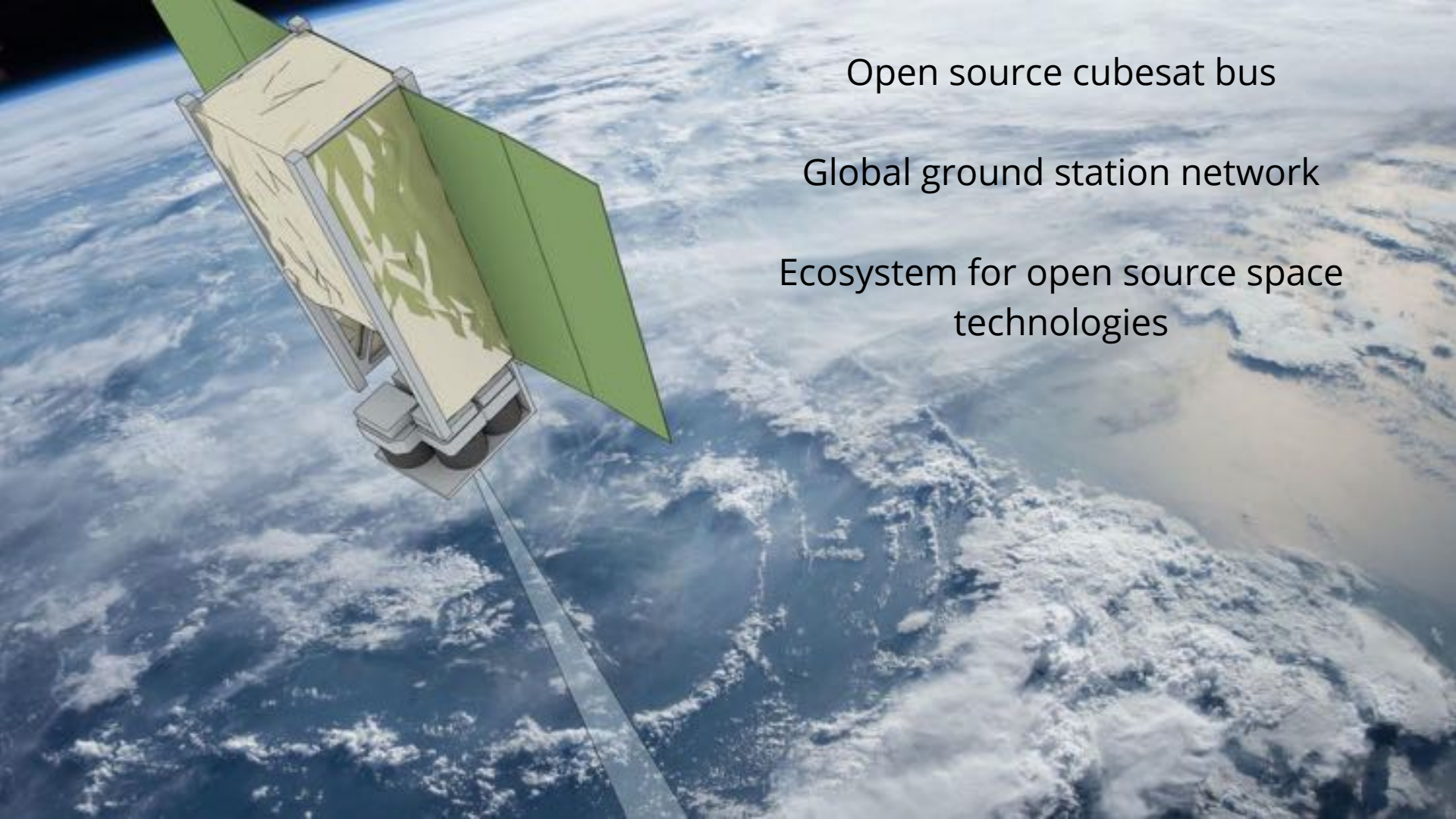
Solomon Islands



Open source cubesat bus

Global ground station network

Ecosystem for open source space technologies

https://libre.space
pierros@libre.space