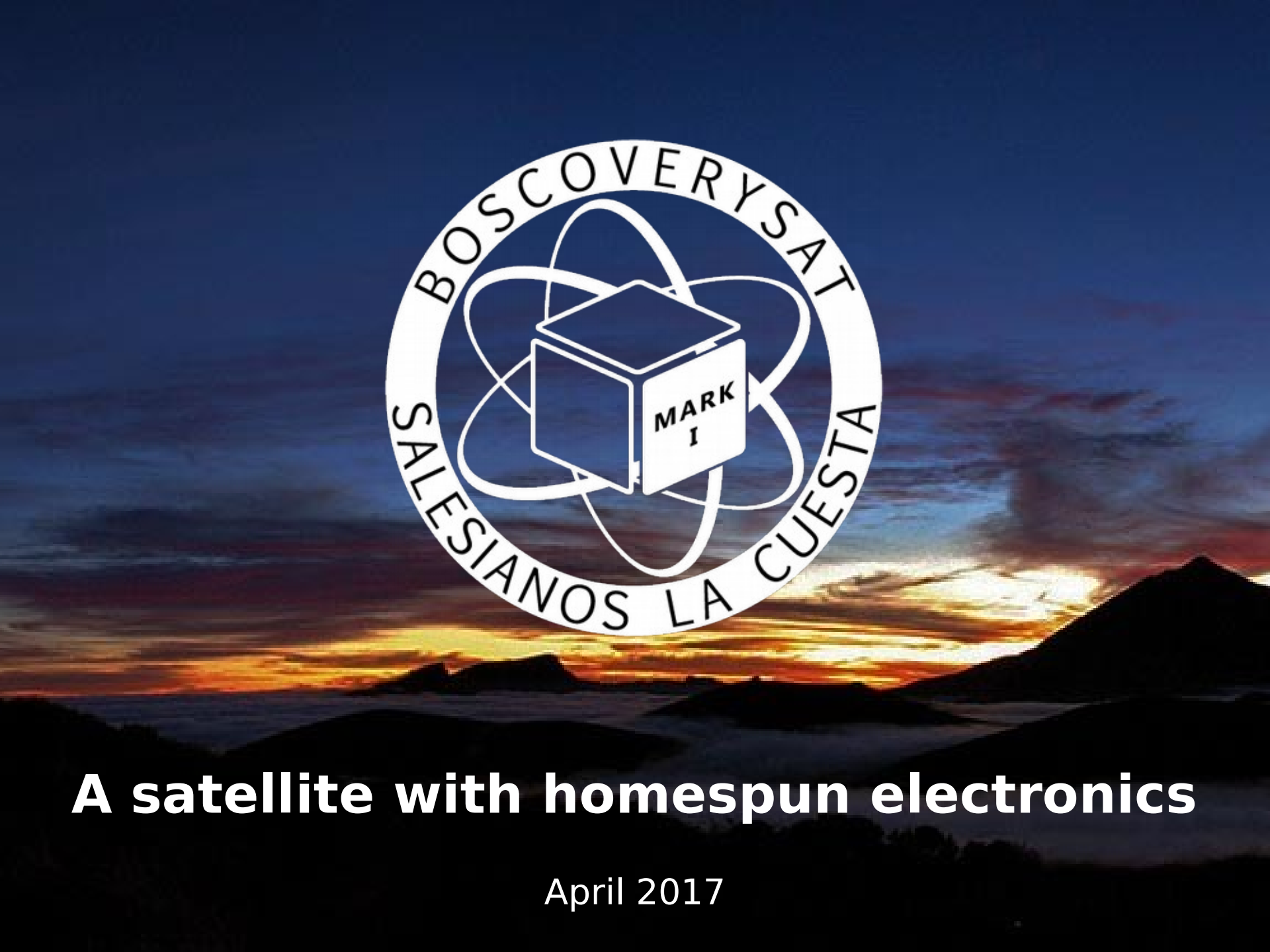


A satellite with homespun electronics

April 2017

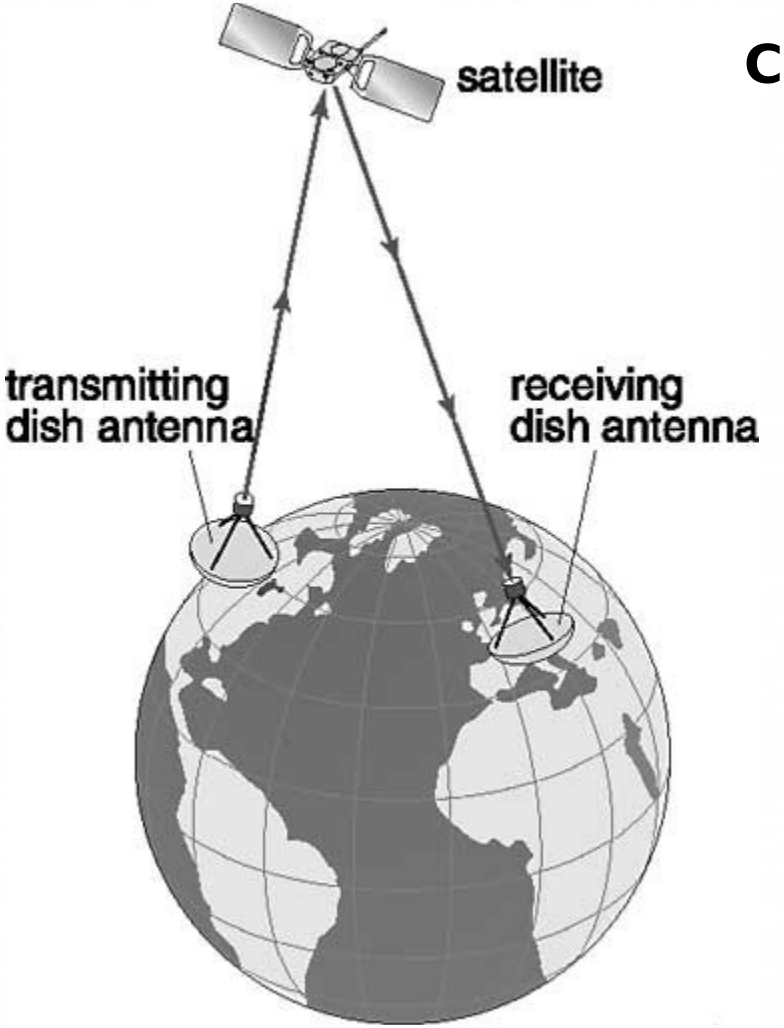
INDEX

salesianos
COLEGIO SAN JUAN BOSCO LA CUESTA

INDEX

salesianos
COLEGIO SAN JUAN BOSCO LA CUESTA

PROBLEM



Classic Satellite Communications usual problems

High costs
Unaccessible
Private owners
Low bandwidth
Maintenance

INDEX

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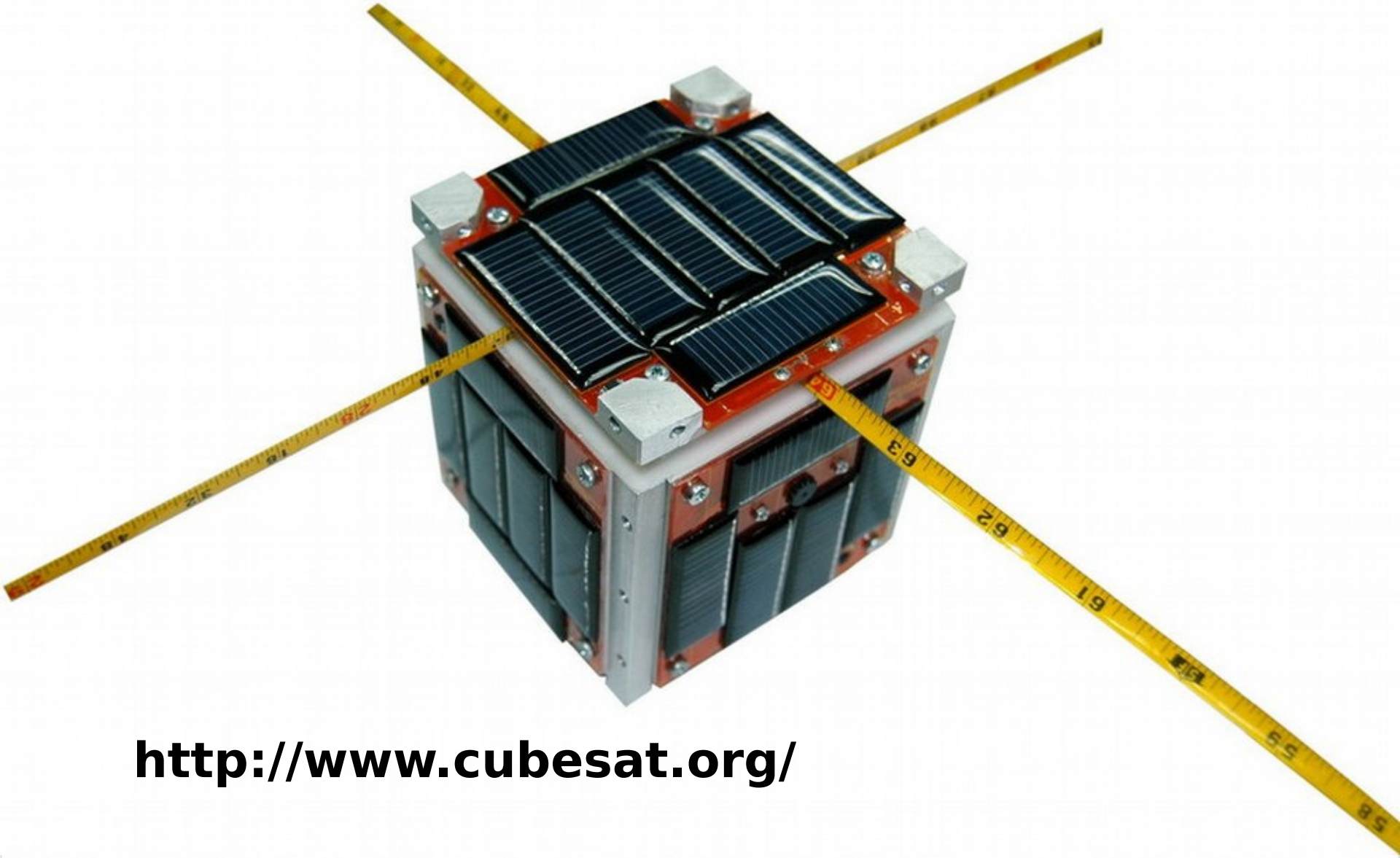
COLEGIO SAN JUAN BOSCO LA CUESTA

SOLUTION



http://www.cubesat.org/

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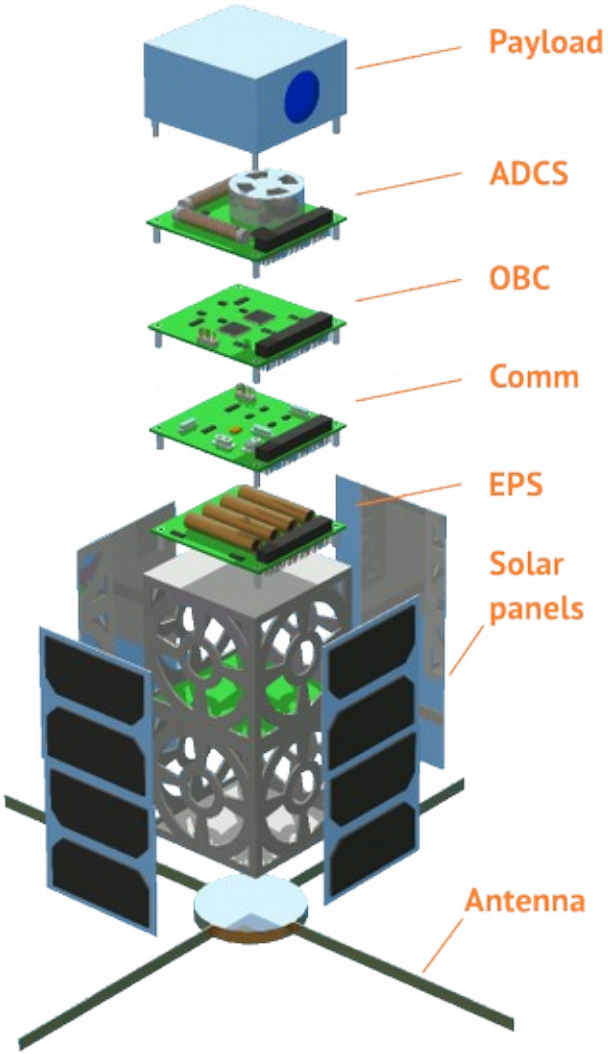
SOLUTION



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SOLUTION

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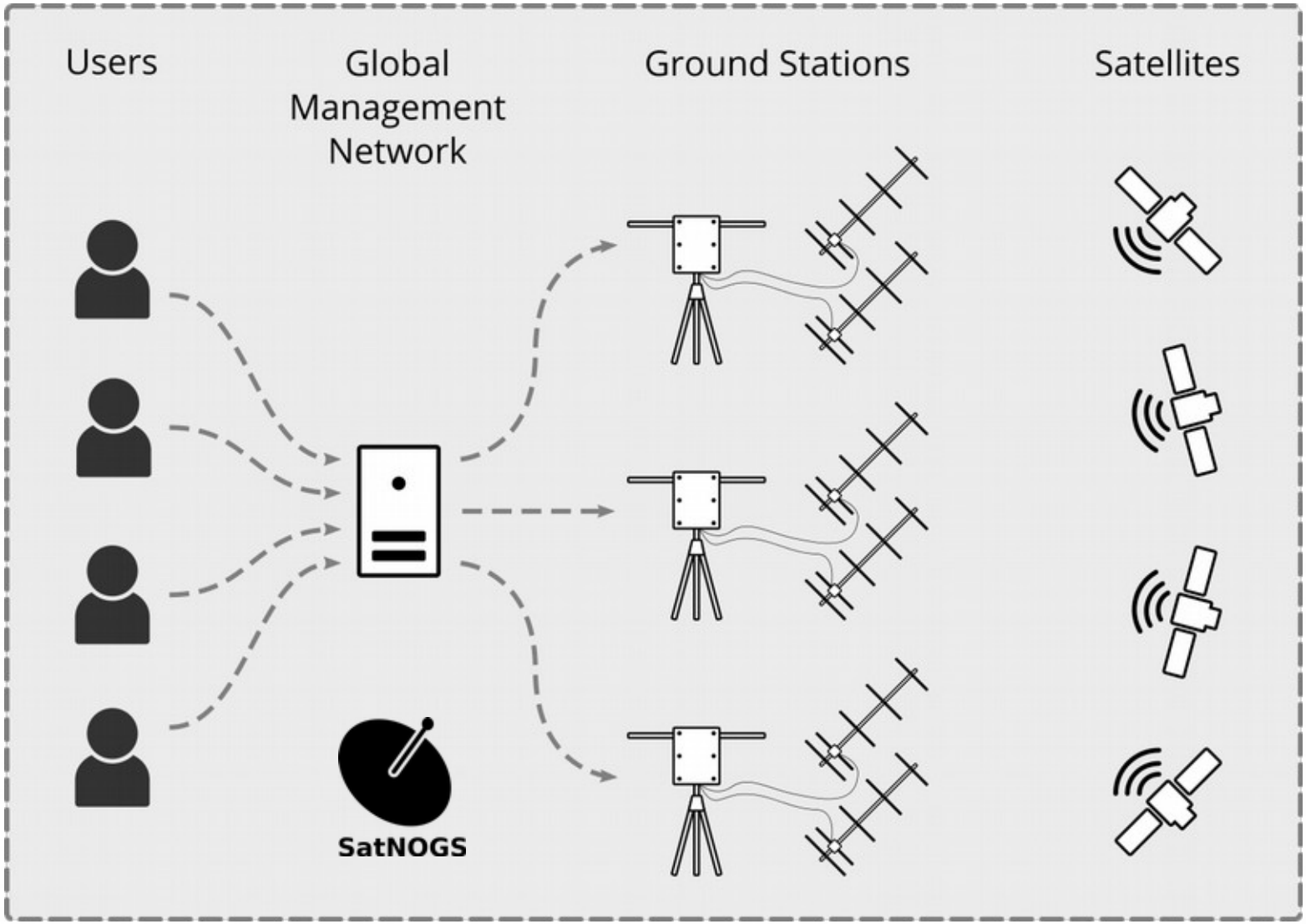
SOLUTION



salesianos
COLEGIO SAN JUAN BOSCO LA CUESTA

INDEX

salesianos
COLEGIO SAN JUAN BOSCO LA CUESTA

PROJECT PHILOSOPHY

open source

open hardware

INDEX

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COLEGIO SAN JUAN BOSCO LA CUESTA

TEAM

Eduardo González Hernández

Héctor Melián Plasencia

Luis Herrera Medranda

Ernesto Padrón Velázquez

Goyo Regalado Pacheco

Dailos Díaz Lara

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COLEGIO SAN JUAN BOSCO LA CUESTA

TEAM

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LA CUESTA

RADIO CLUB ISLAS CANARIAS
RIC
EA8RCK/P

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COLEGIO SAN JUAN BOSCO LA CUESTA

INDEX

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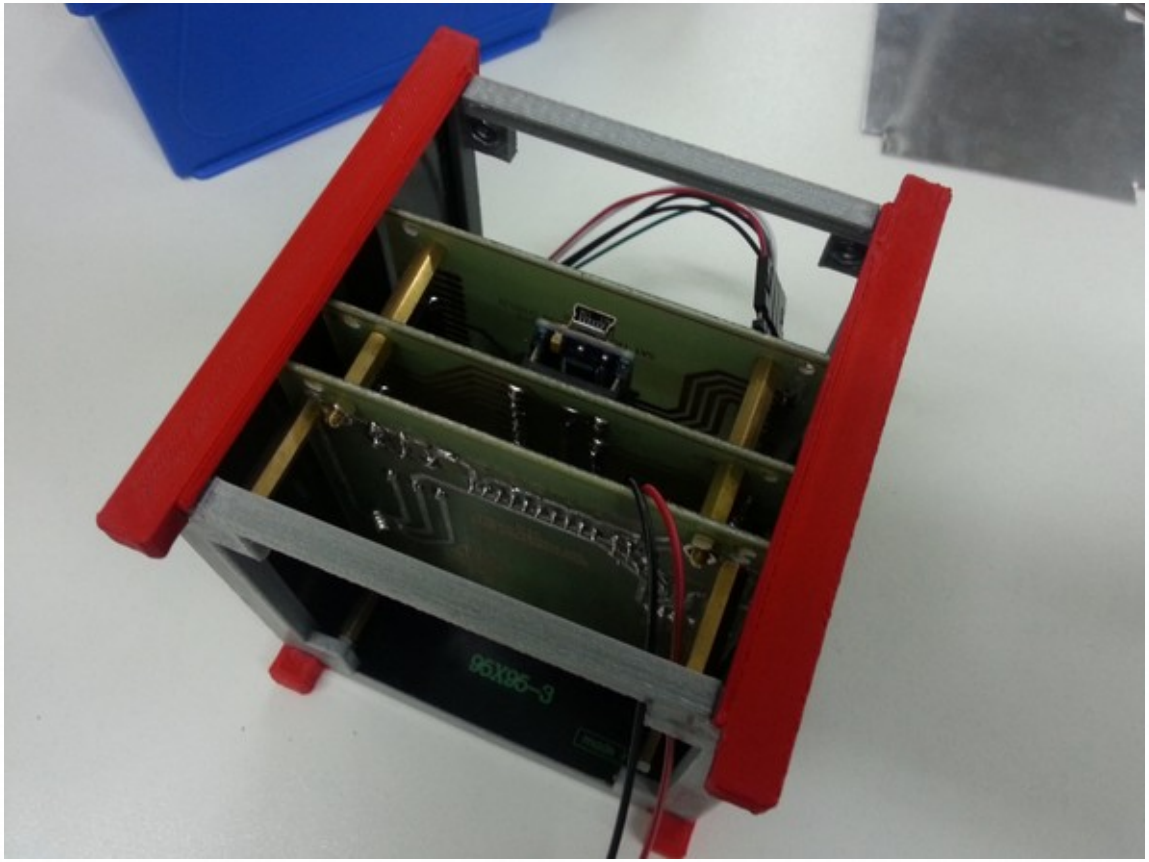
COLEGIO SAN JUAN BOSCO LA CUESTA

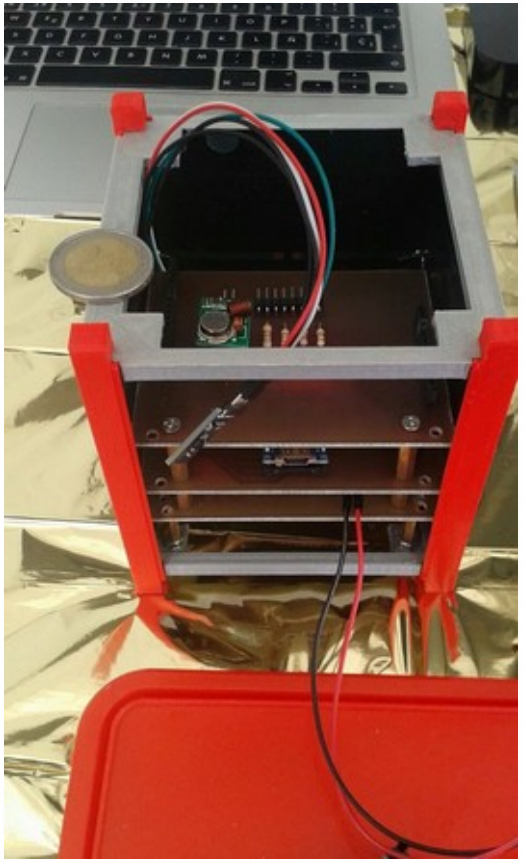
ACHIEVEMENTS

RADIO STATION (SATELLITE TRACKER)

ACHIEVEMENTS

SATELLITE



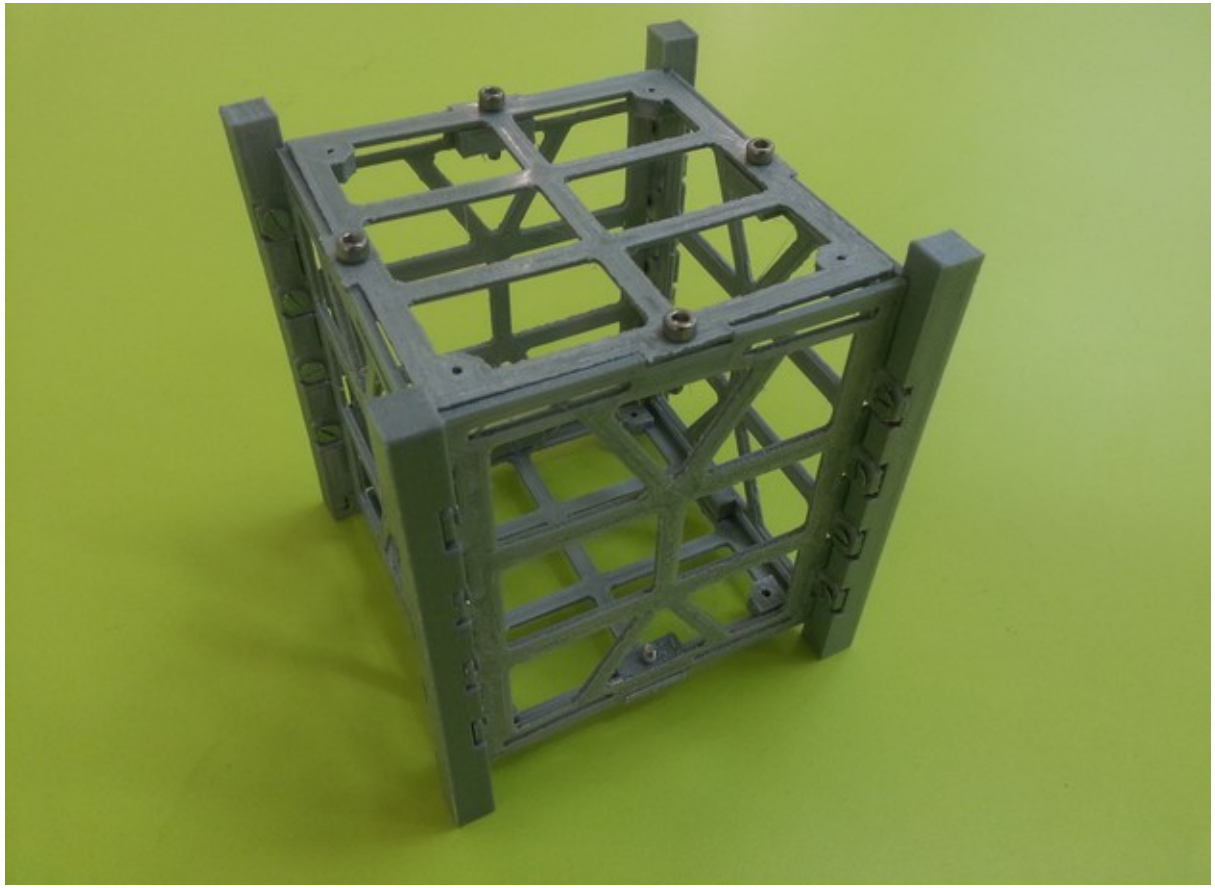


MARK I – ALPHA 1

salesianos
COLEGIO SAN JUAN BOSCO LA CUESTA

ACHIEVEMENTS

SATELLITE

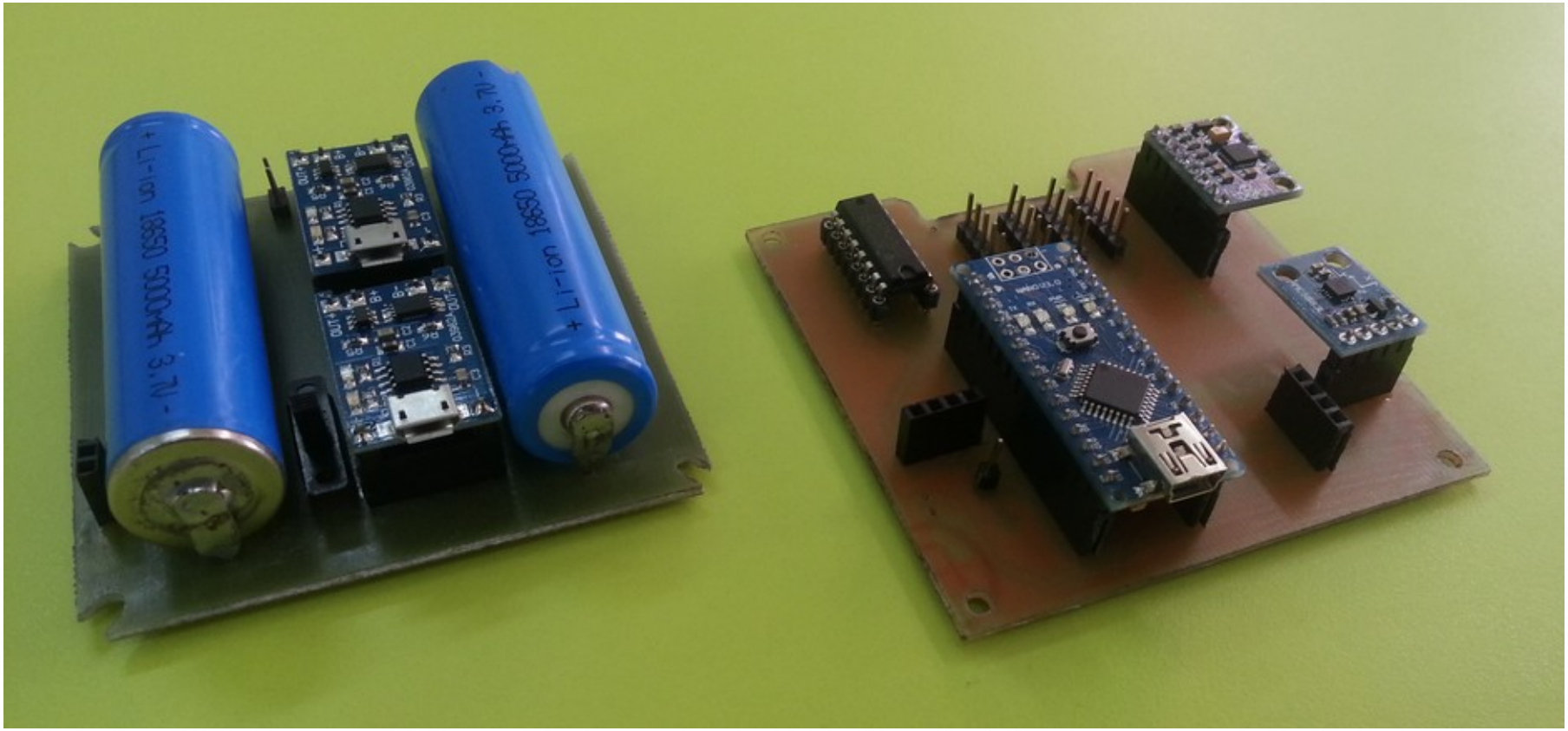


MARK I – ALPHA 2

salesianos
COLEGIO SAN JUAN BOSCO LA CUESTA

ACHIEVEMENTS

SATELLITE

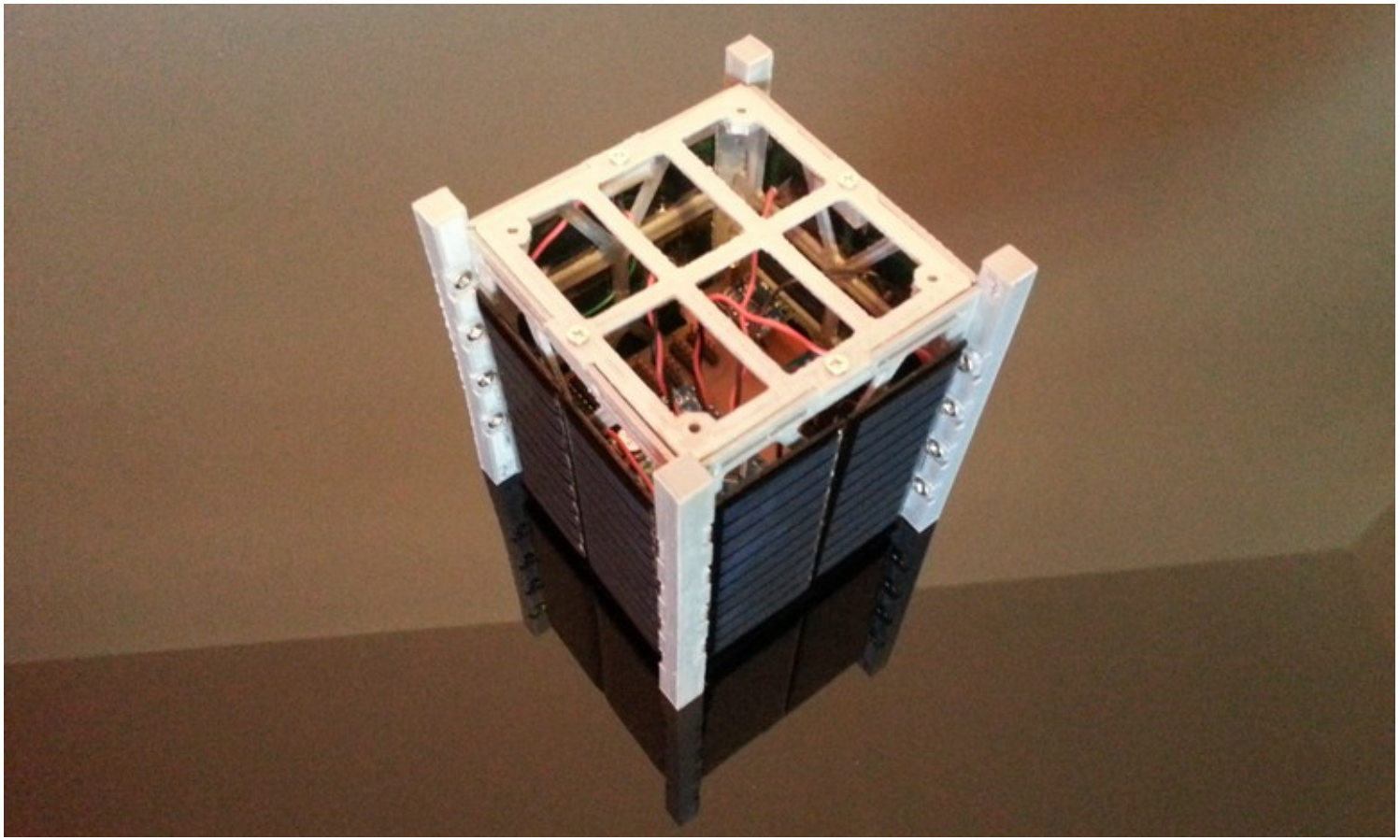


MARK I – ALPHA 2

salesianos
COLEGIO SAN JUAN BOSCO LA CUESTA

ACHIEVEMENTS

SATELLITE

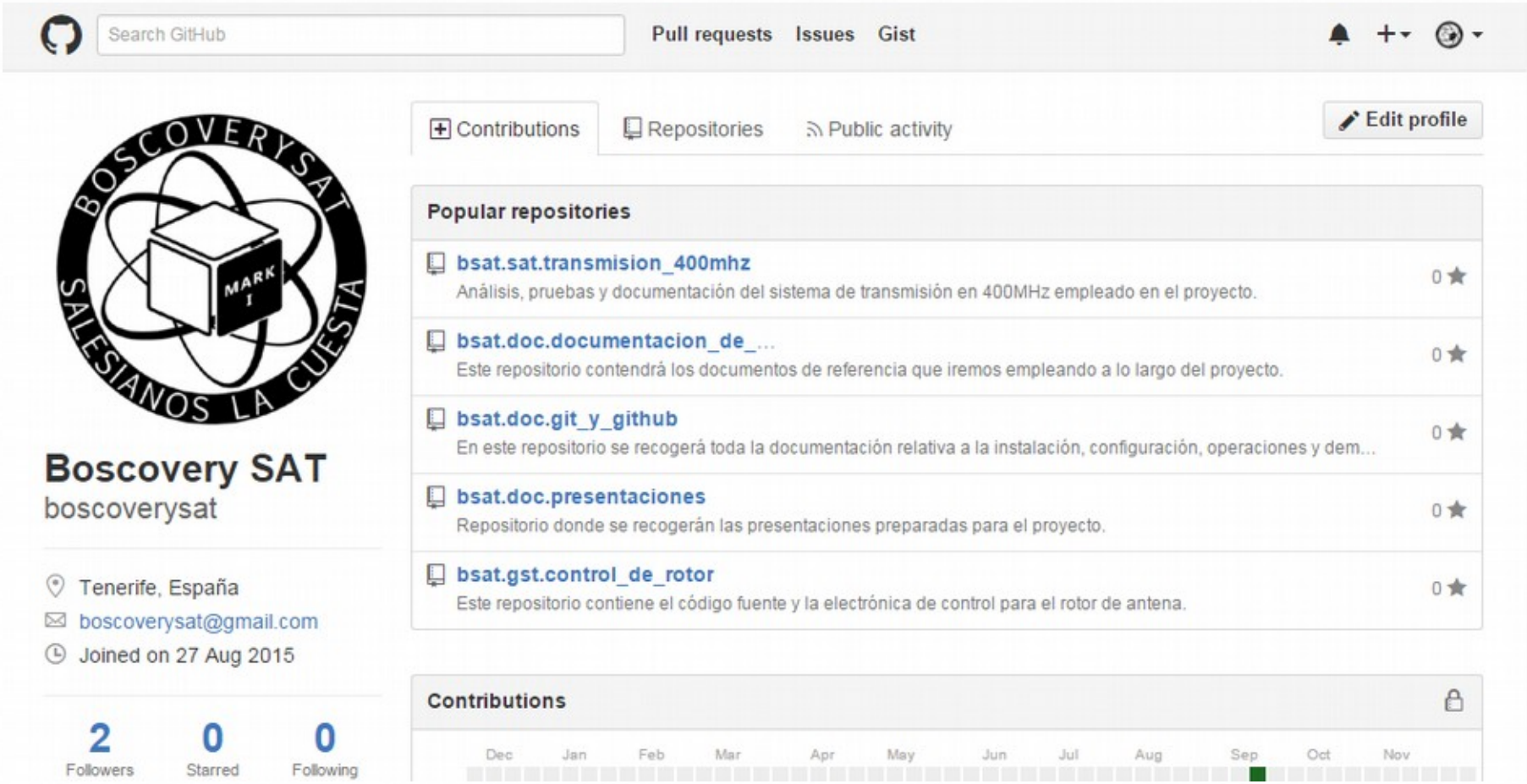


MARK I – ALPHA 2

salesianos
COLEGIO SAN JUAN BOSCO LA CUESTA

ACHIEVEMENTS

DOCUMENTATION (GitHub Repository)



salesianos
COLEGIO SAN JUAN BOSCO LA CUESTA

INDEX

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COLEGIO SAN JUAN BOSCO LA CUESTA

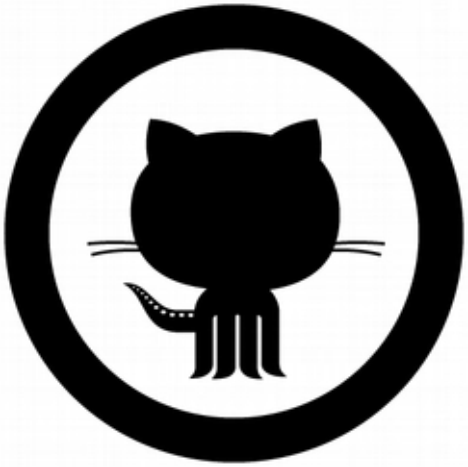
COMMUNICATION

Gmail

Whatsapp

TEAMWORK

Google Drive



GitHub

MANAGEMENT

Google Calendar

Trello

TOOLS

DEVELOPMENT (SW & HW)

Editors and IDEs

Prog. Languages

Version Control

Operative Systems

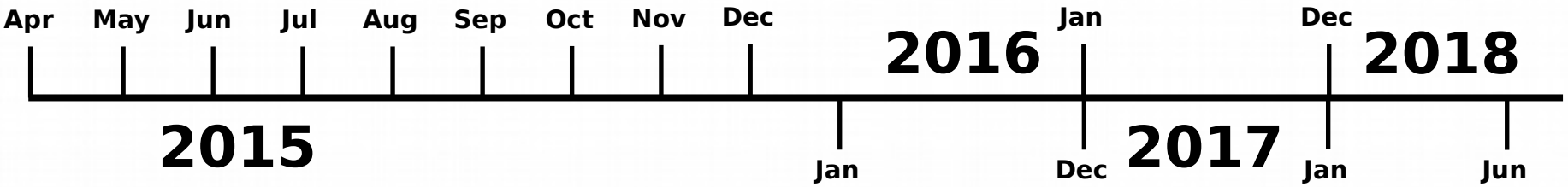
Satellite & Tracker

INDEX

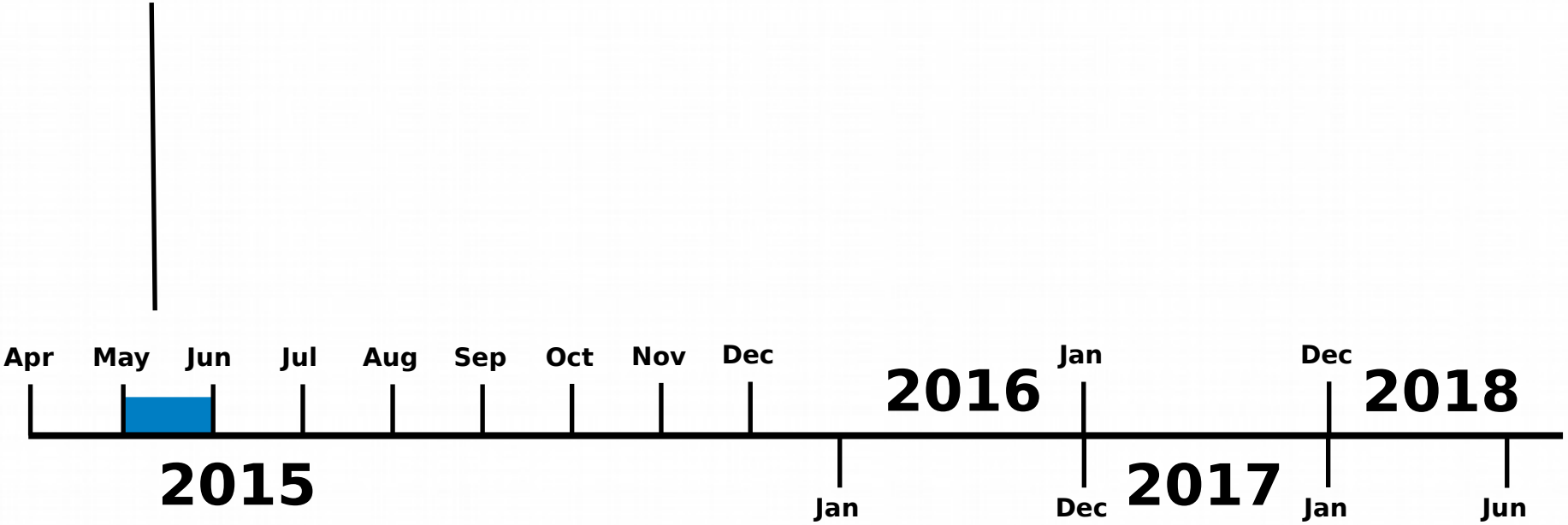
salesianos
COLEGIO SAN JUAN BOSCO LA CUESTA

ROADMAP

It is a long time project

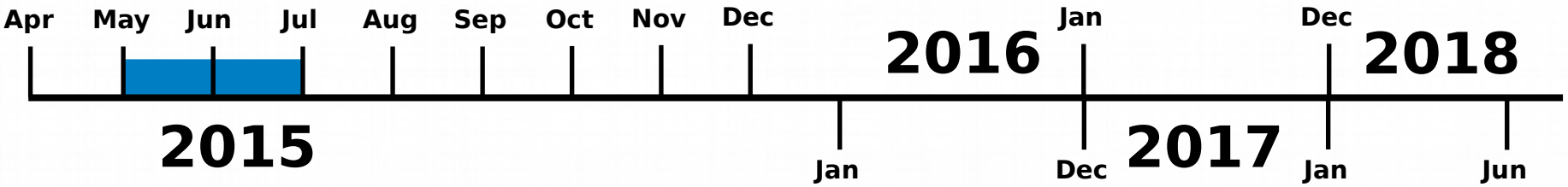


ROADMAP


Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
2015
2016
Jan
Dec
2017
Jan
Dec
2018
Jan
Jun

ROADMAP

San Juan Bosco
La Cuesta School
Projects Week 2015
Satellite Tracker



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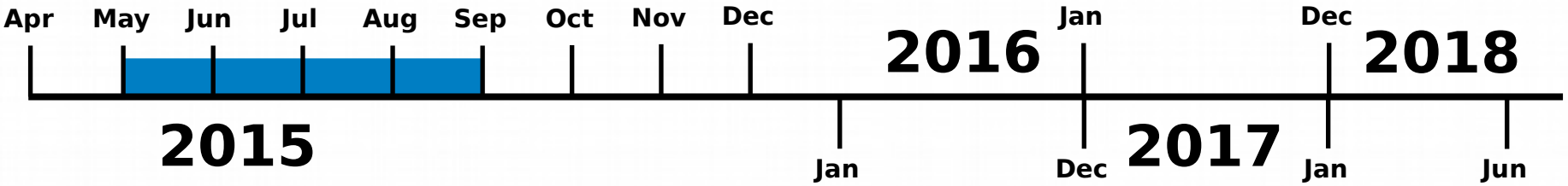
COLEGIO SAN JUAN BOSCO LA CUESTA

ROADMAP

San Juan Bosco
La Cuesta School
Projects Week 2015
Satellite Tracker

Satellite Tracker
First systems development



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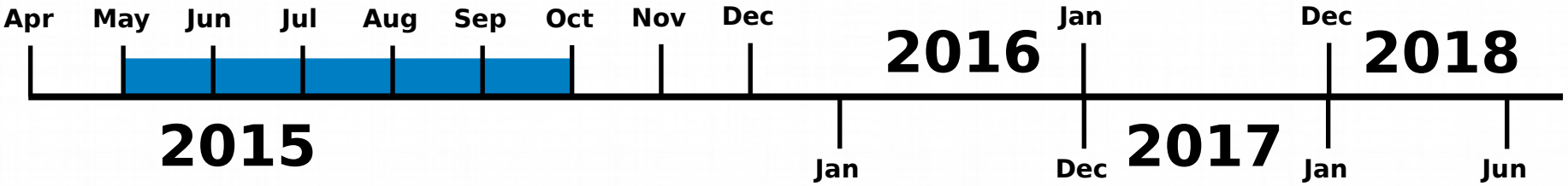
COLEGIO SAN JUAN BOSCO LA CUESTA

ROADMAP

San Juan Bosco
La Cuesta School
Projects Week 2015
Satellite Tracker

Satellite Tracker
First systems development

Satellite
Orbital sensors testing



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COLEGIO SAN JUAN BOSCO LA CUESTA

ROADMAP

San Juan Bosco
La Cuesta School
Projects Week 2015
Satellite Tracker

Satellite Tracker
First systems development

Satellite
Orbital sensors testing

Apr May Jun Jul Aug Sep Oct Nov Dec Jan Dec Jan Dec Jun

2015 2016 2017 2018

Satellite
Alpha 1 release

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COLEGIO SAN JUAN BOSCO LA CUESTA

ROADMAP

San Juan Bosco
La Cuesta School
Projects Week 2015
Satellite Tracker

Satellite Tracker
First systems development

Satellite
Orbital sensors testing

Apr May Jun Jul Aug Sep Oct Nov Dec **2015** Jan **2016** Dec Jan **2017** Dec Jan **2018** Jun

Satellite
Alpha 1 released

Canary Islands
Science Weeks

Phase #1 – ***Project definition and first developments.***

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COLEGIO SAN JUAN BOSCO LA CUESTA

ROADMAP

San Juan Bosco
La Cuesta School
Projects Week 2015
Satellite Tracker

Satellite Tracker
First systems development

Satellite
Orbital sensors testing

Apr May Jun Jul Aug Sep Oct Nov Dec **2015** Jan **2016** Dec Jan **2017** Dec Jan **2018** Jun

Satellite
Alfa 1 release

Canary Islands Science Weeks

Phase #1 – ***Project definition and first developments.***

Phase #2 – ***Payload development and testing.***

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ROADMAP

2016

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COLEGIO SAN JUAN BOSCO LA CUESTA

ROADMAP

Research & Documentation

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Jan Dec

2016 2017 2018

Jan Dec

Phase #1 – ***Project definition and first developments.***

Phase #2 – ***Payload development and testing.***

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ROADMAP

Research & Documentation

III Science and Technology National Award
St. Louis University Madrid

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Jan Dec

2016 2017 2018

Jan Dec

Phase #1 – ***Project definition and first developments.***

Phase #2 – ***Payload development and testing.***

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COLEGIO SAN JUAN BOSCO LA CUESTA

ROADMAP

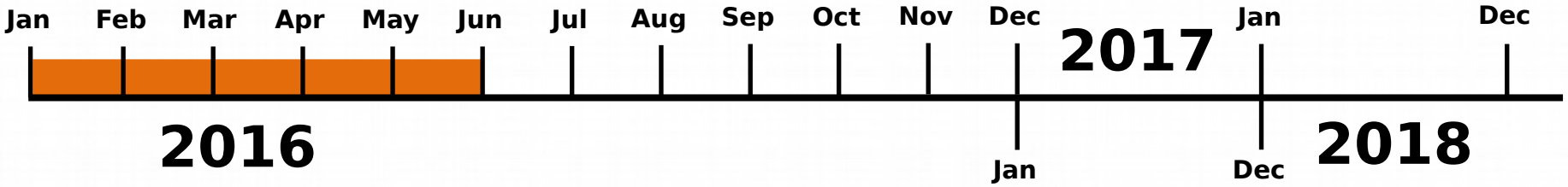
Research & Documentation

III Science and Technology National Award

St. Louis University Madrid

Structure & Electronics design

3D printed prototype and shields



Phase #1 – ***Project definition and first developments.***

Phase #2 – ***Payload development and testing.***

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COLEGIO SAN JUAN BOSCO LA CUESTA

ROADMAP

Research & Documentation

III Science and Technology National Award
St. Louis University Madrid

Structure & Electronics design
3D printed prototype and shields

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Jan Dec

2016 | **2017** | **2018**

Jan Dec

San Juan Bosco La Cuesta School
Projects Week 2016
Satellite Structure Test

Phase #1 – ***Project definition and first developments.***

Phase #2 – ***Payload development and testing.***

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COLEGIO SAN JUAN BOSCO LA CUESTA

ROADMAP

Research & Documentation

III Science and Technology National Award

St. Louis University Madrid

Structure & Electronics design

3D printed prototype and shields

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec **2017** Jan Dec

2016 Jan

2018 Dec

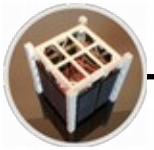
San Juan Bosco La Cuesta School

Projects Week 2016

Satellite Structure Testing

Satellite

Alpha 2 released



Phase #1 – ***Project definition and first developments.***

Phase #2 – ***Payload development and testing.***

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COLEGIO SAN JUAN BOSCO LA CUESTA

ROADMAP

Research & Documentation

III Science and Technology National Award

St. Louis University Madrid

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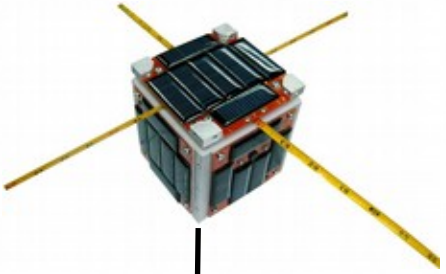


Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec **2017** Jan Dec

2016

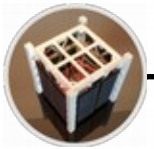
San Juan Bosco La Cuesta School

Projects Week 2016

Satellite Structure Testing

Satellite

Alpha 2 released



2018

Phase #1 – ***Project definition and first developments.***

Phase #2 – ***Payload development and testing.***

Phase #3 – ***Official tests and certifications.***

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COLEGIO SAN JUAN BOSCO LA CUESTA

ROADMAP

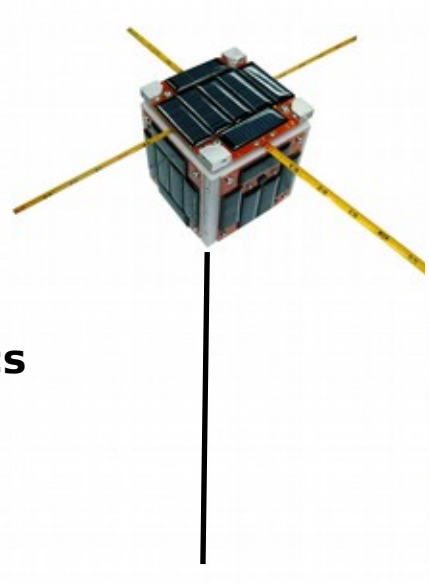
Research & Documentation

III Science and Technology National Award

St. Louis University Madrid

Structure & Electronics design

3D printed prototype and shields



Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec **2017** Jan Dec

2016

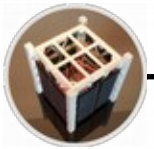
San Juan Bosco La Cuesta School

Projects Week 2016

Satellite Structure Testing

Satellite

Alpha 2 released



Jan Dec **2018**

Phase #1 – ***Project definition and first developments.***

Phase #2 – ***Payload development and testing.***

Phase #3 – ***Official tests and certifications.***

Phase #4 – ***Satellite launching.***

salesianos
COLEGIO SAN JUAN BOSCO LA CUESTA

INDEX

Current I+D process

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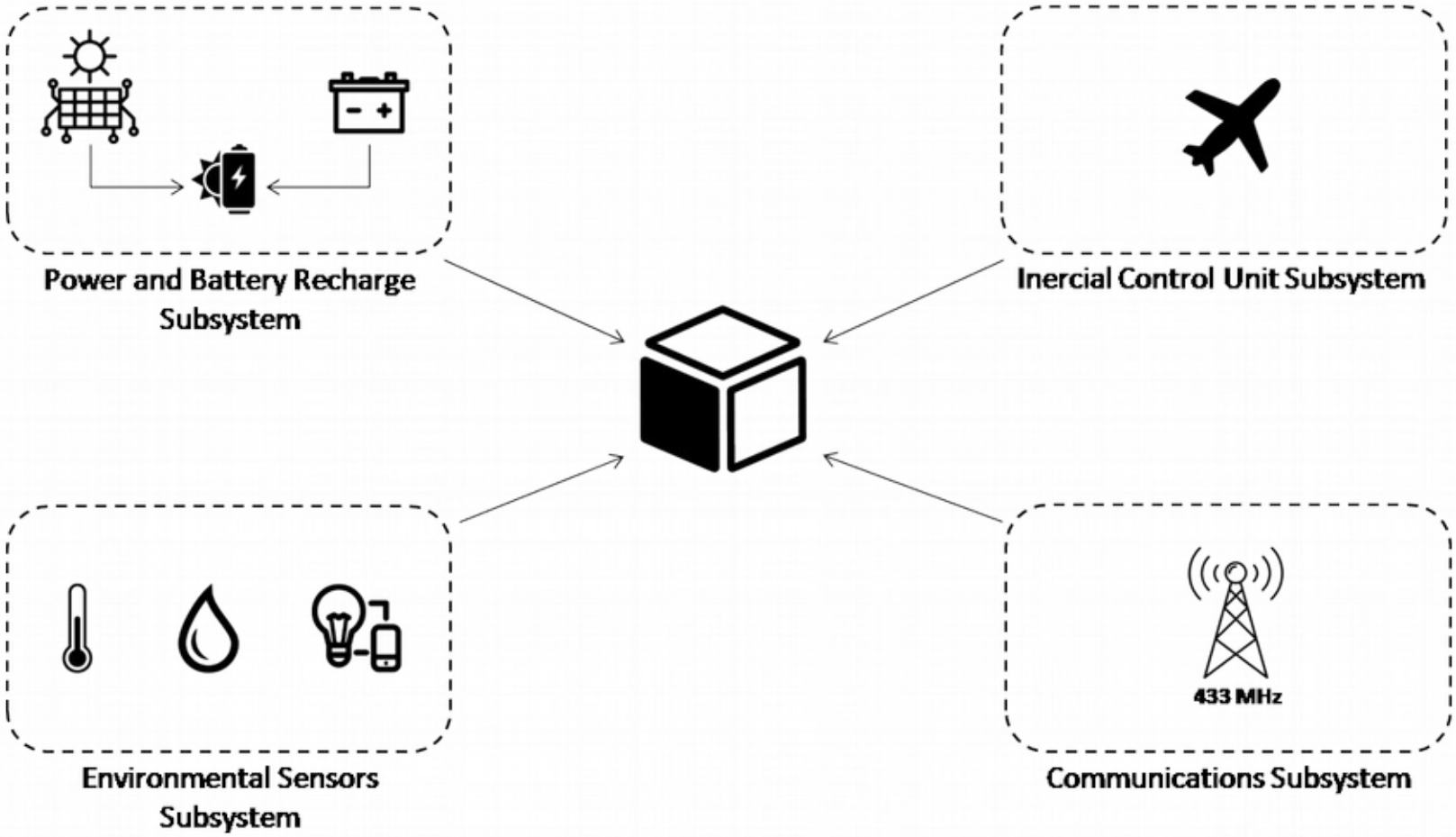
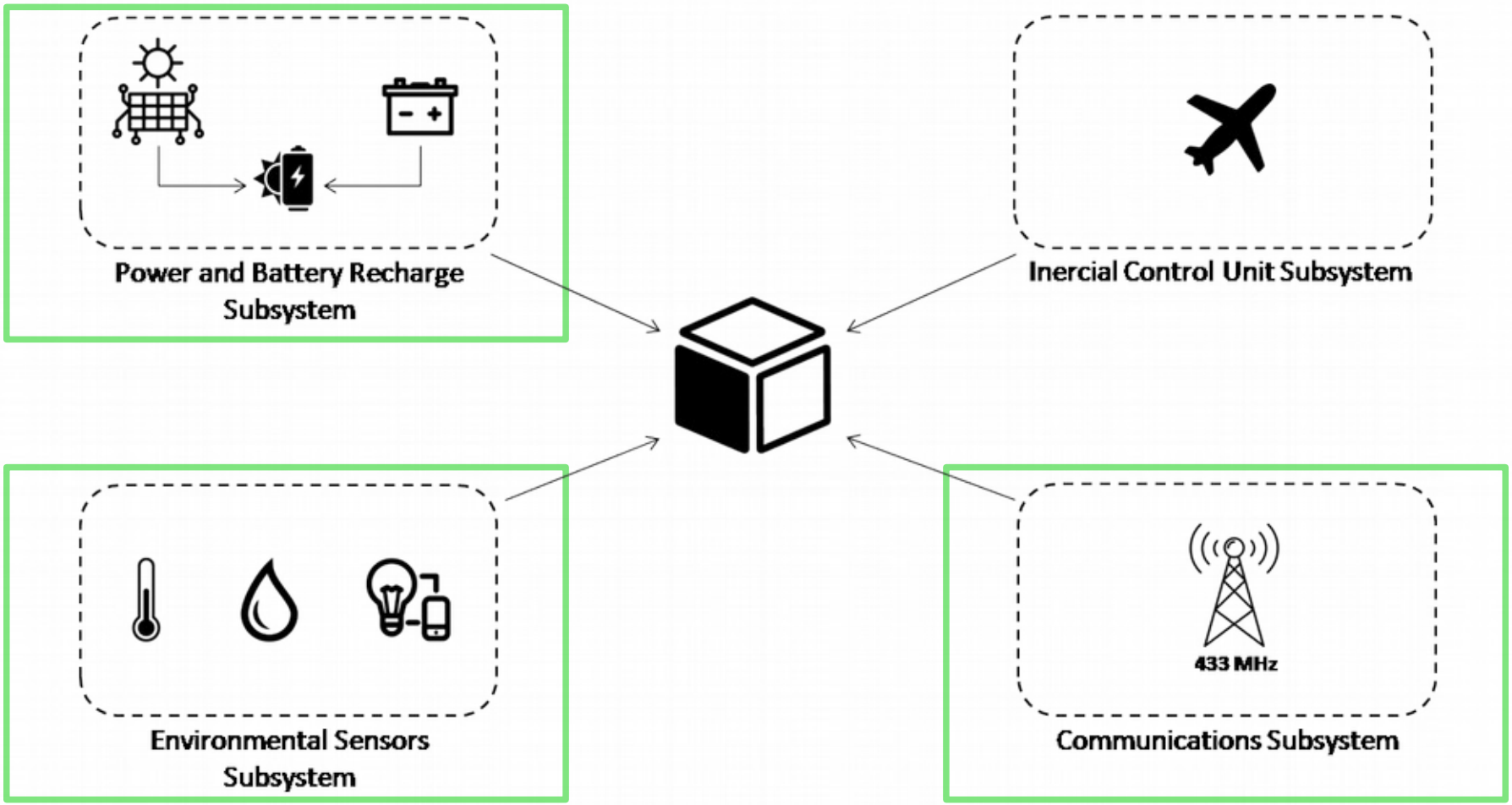
COLEGIO SAN JUAN BOSCO LA CUESTA

CURRENT I+D PROCESS



CURRENT I+D PROCESS



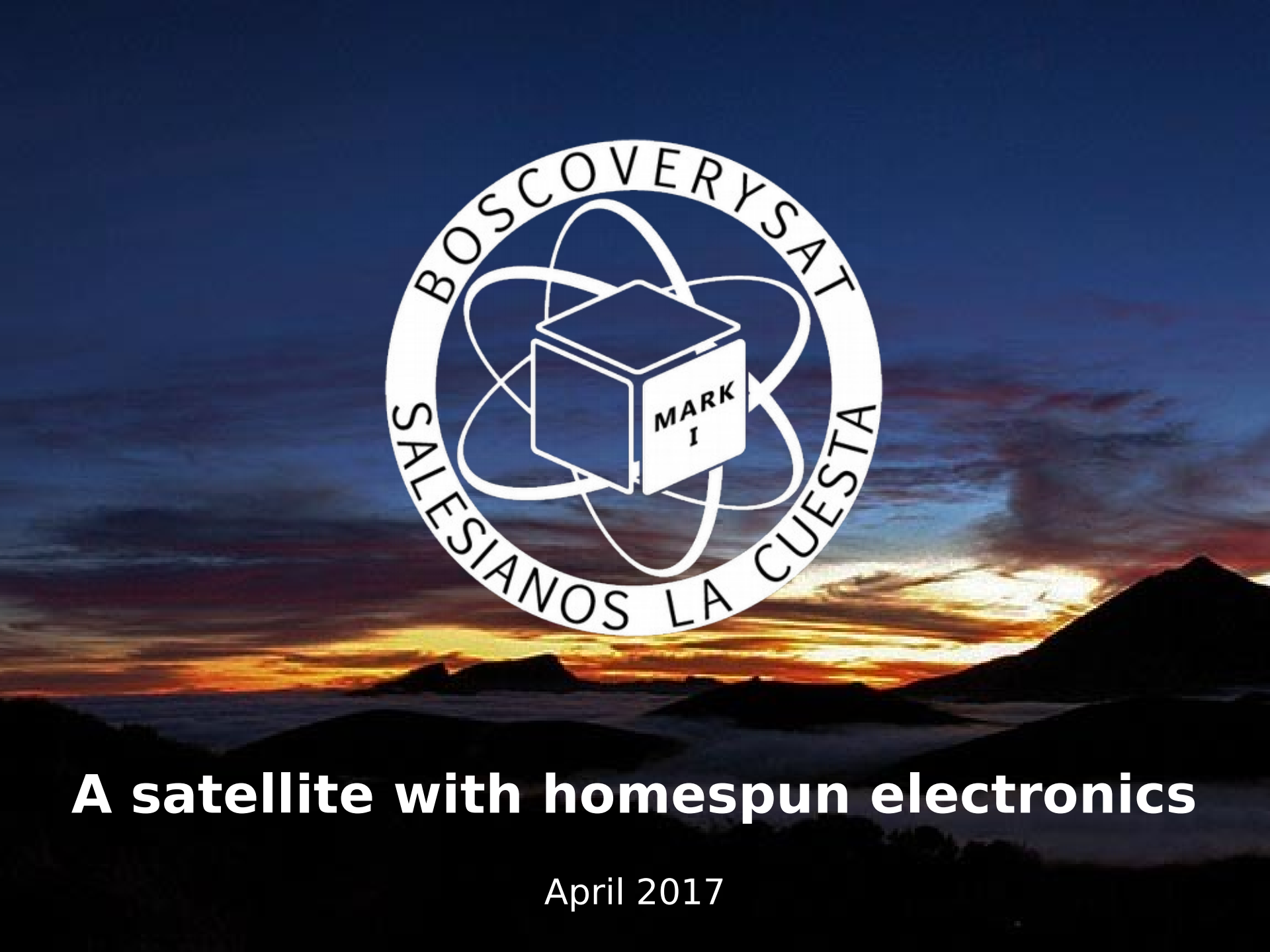
boscoverysat@gmail.com

@boscoverysat

boscoverysat

boscoverysat.github.com

BoscoverySAT



A satellite with homespun electronics

April 2017

Satellites' Orbits and Positioning

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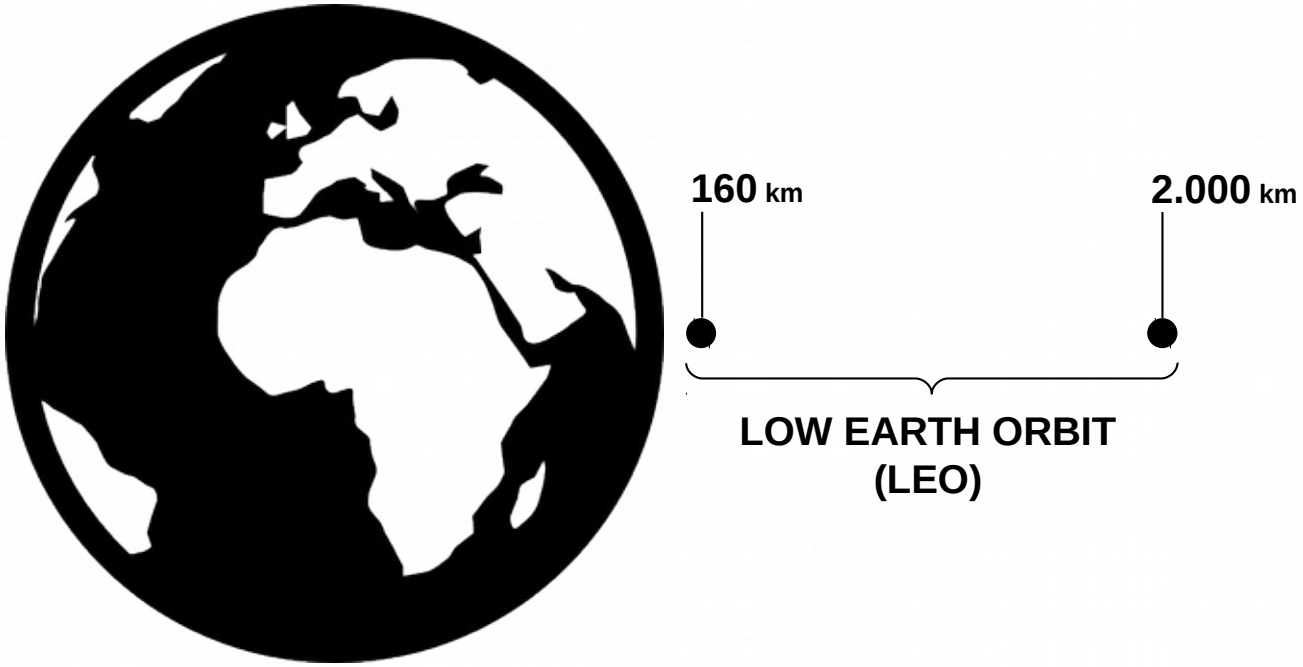
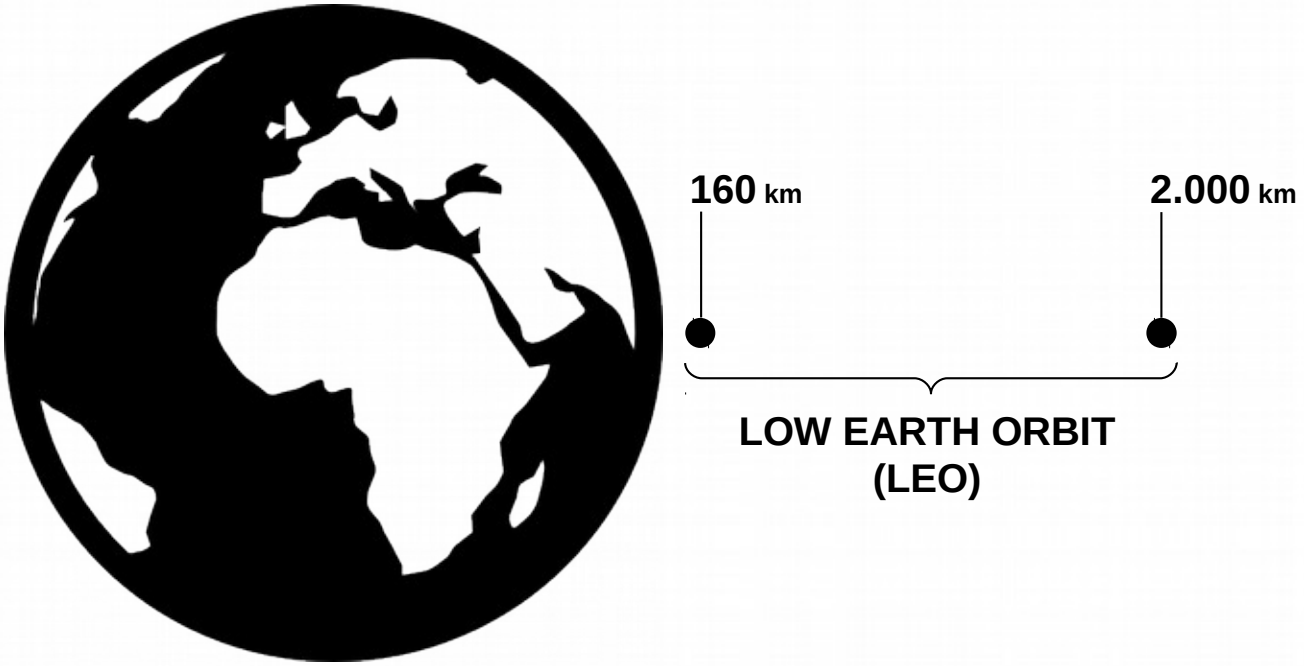
SATELLITES' ORBITS AND POSITIONING

Based on HEIGHTs



SATELLITES' ORBITS AND POSITIONING

Based on HEIGHTs



LOW EARTH ORBIT DATA:

Average speed:	**7,8km/s (28.080km/h)**
Average orbit time:	**99 minutes**
Usual deployments:	**Scientific missions**

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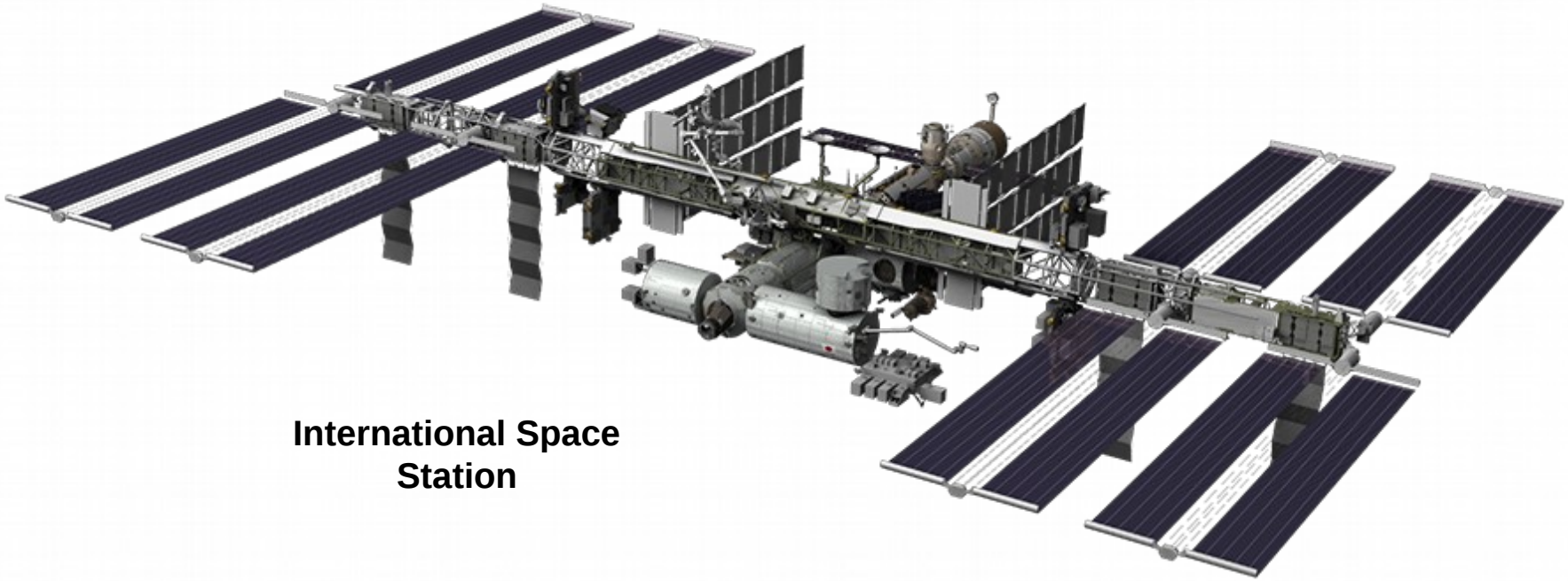
Based on HEIGHTs

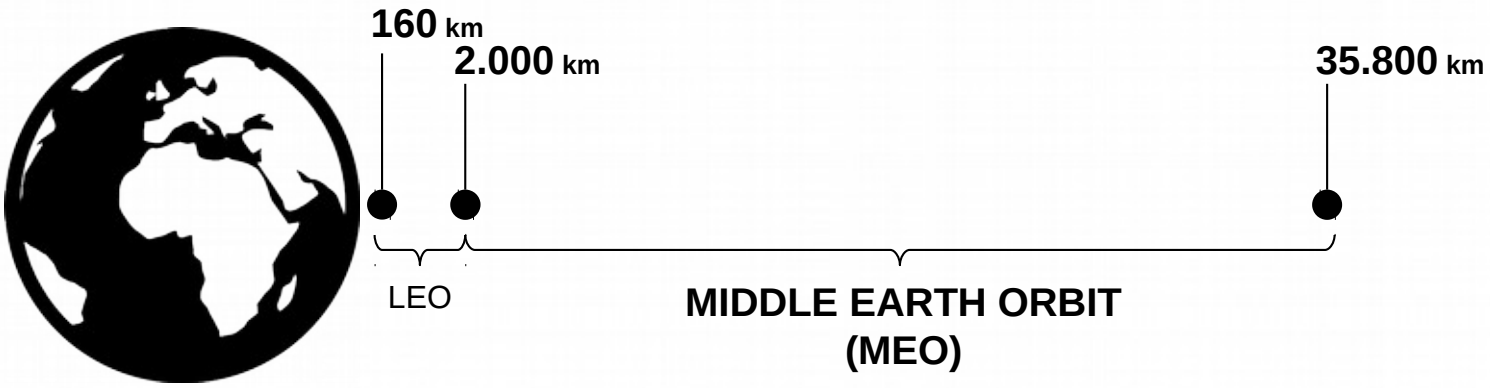
Missions deployed at LEO orbit



International Space Station

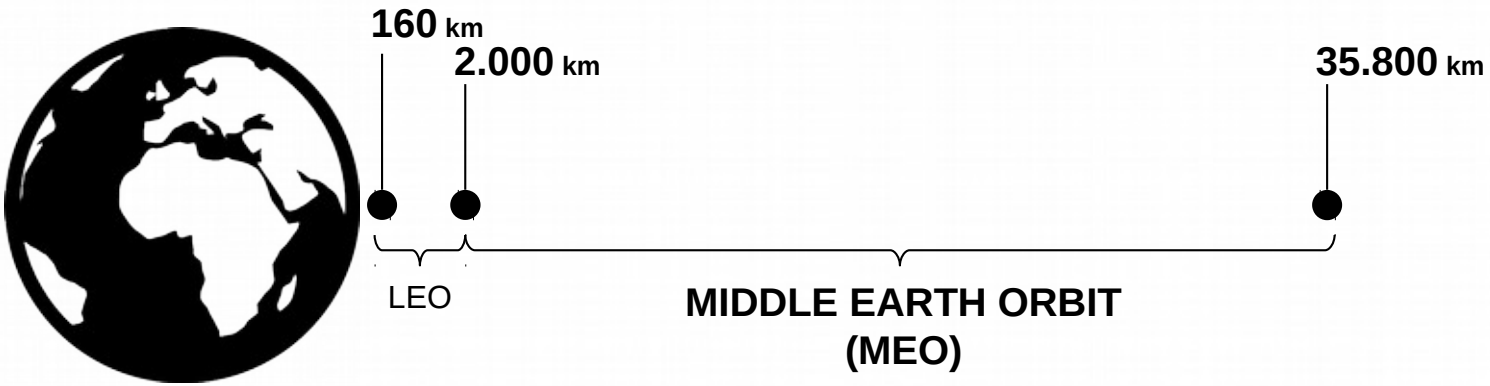
SATELLITES' ORBITS AND POSITIONING

Based on HEIGHTs



SATELLITES' ORBITS AND POSITIONING

Based on HEIGHTs



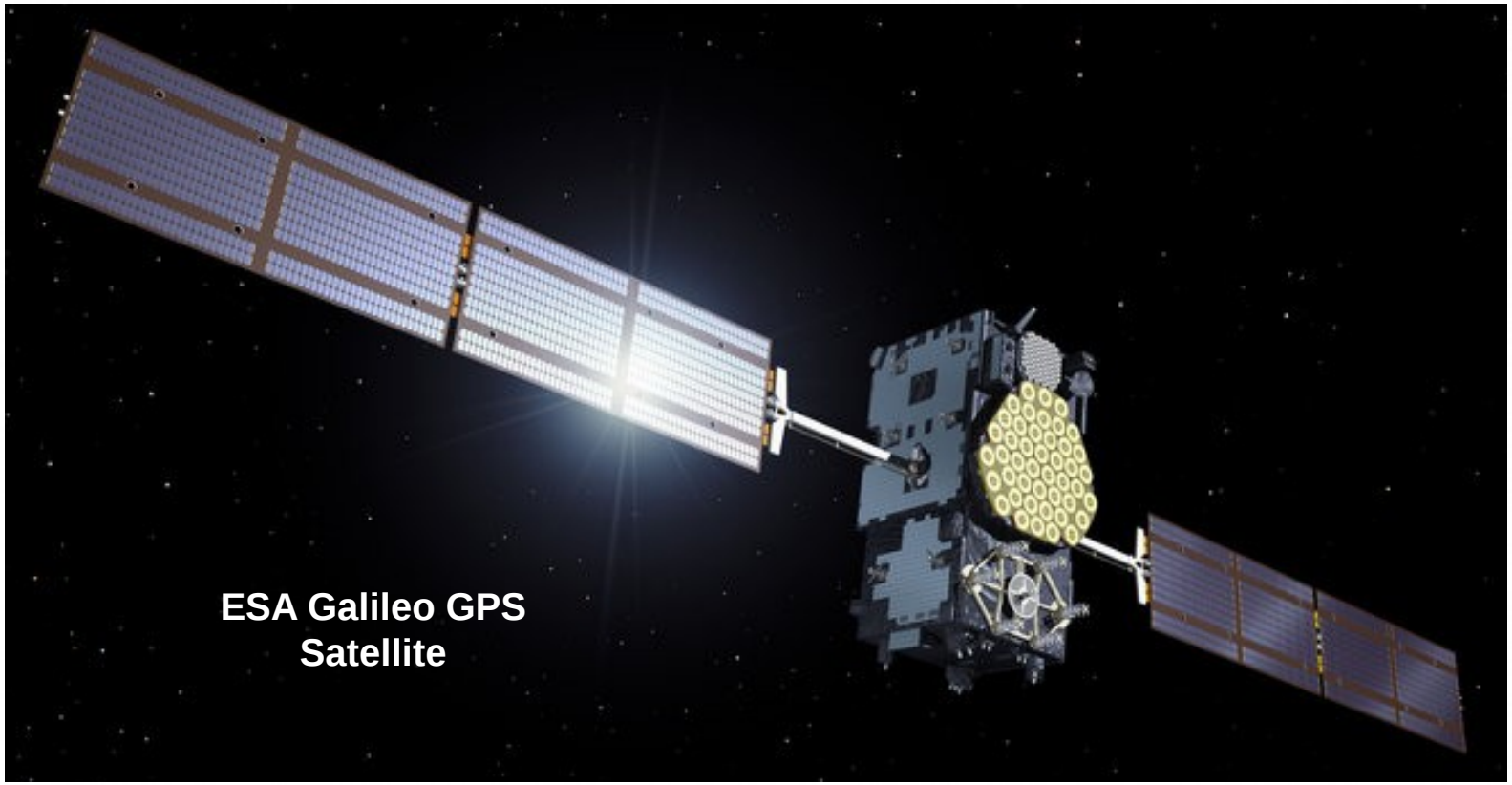
MIDDLE EARTH ORBIT DATA:

Average speed:	**3,9km/s (14.040km/h)**
Average orbit time:	**12 - 24 hours**
Usual deployments:	**GPS (20.200km) and special use for regions tracking**

SATELLITES' ORBITS AND POSITIONING

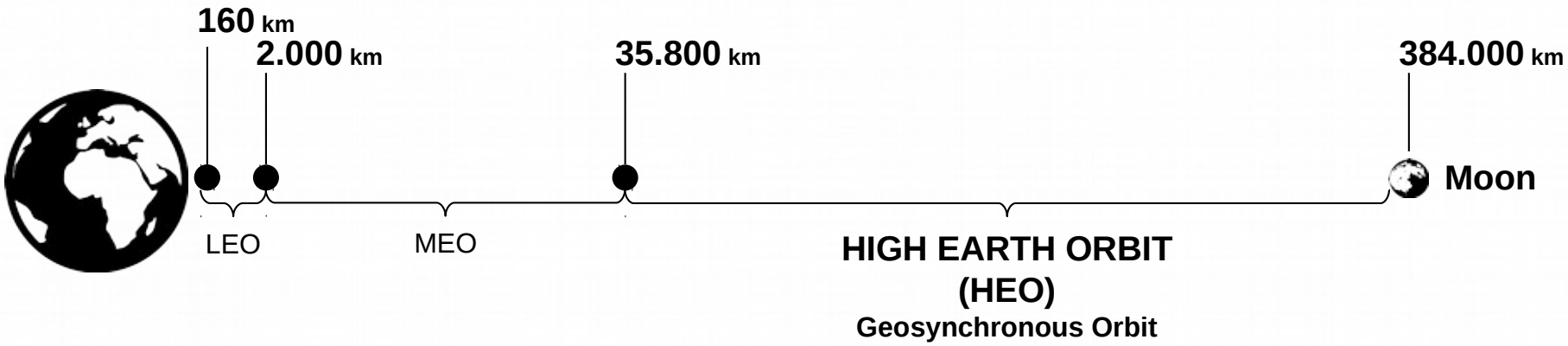
Based on HEIGHTs

Missions deployed at MEO orbit



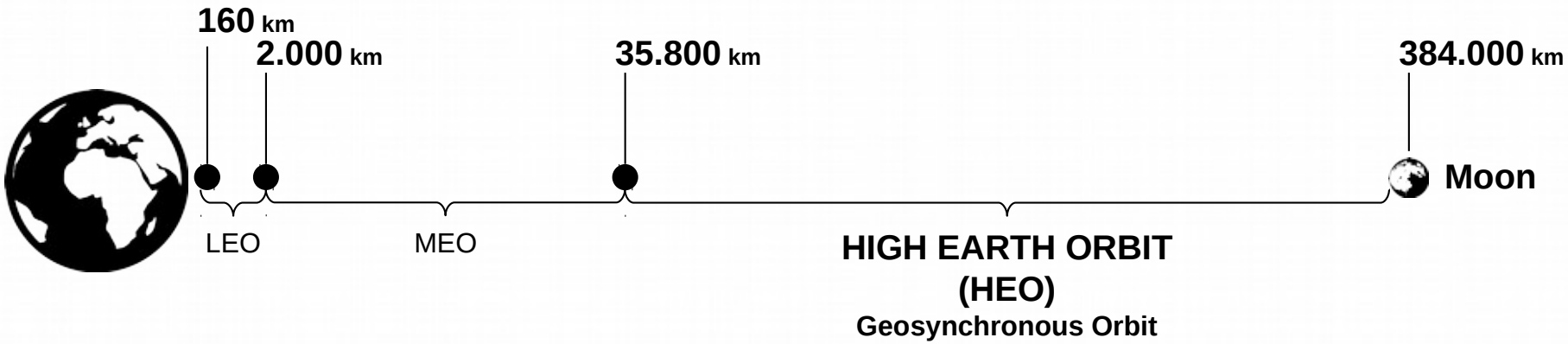
SATELLITES' ORBITS AND POSITIONING

Based on HEIGHTs



SATELLITES' ORBITS AND POSITIONING

Based on HEIGHTs



MIDDLE EARTH ORBIT DATA:

Average speed:	**3,08km/s (11.088km/h) = Earth's rotation speed**
Average orbit time:	**Years (geostationary orbit)**
Usual deployments:	**Communications and weather stellites**

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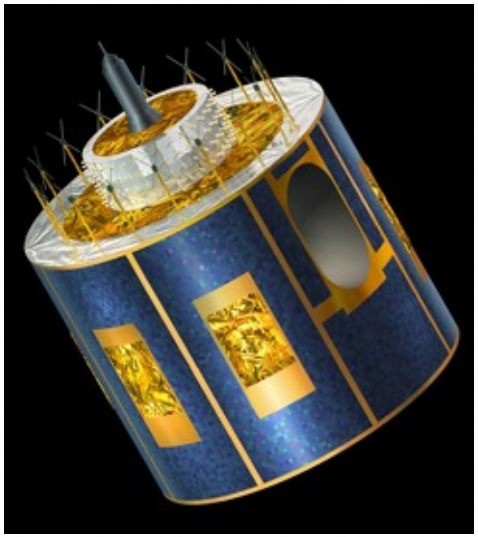
Based on HEIGHTs

Missions deployed at HEO orbit

Hispasat AG1



Meteosat

Power and Battery Recharge Subsystem

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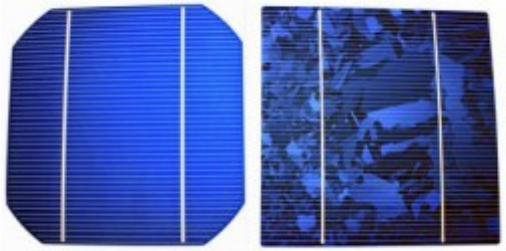
POWER AND BATTERY RECHARGE SUBSYSTEM

Facts

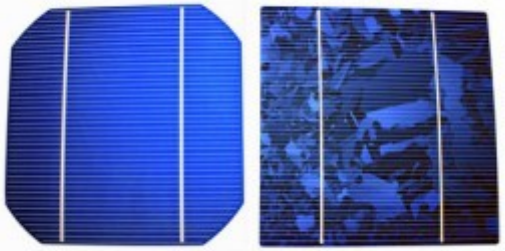


9,5 – 11 VDC/Side
50 – 60mA/Side

2 x 18650 Batt type
3,7V @ 5000mAh

POWER AND BATTERY RECHARGE SUBSYSTEM

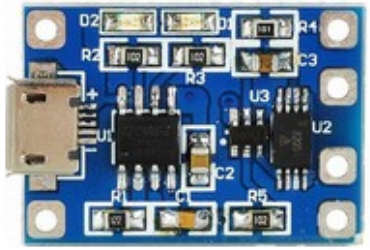
Facts



9,5 – 11 VDC/Side
50 – 60mA/Side

2 x 18650 Batt type
3,7V @ 5000mAh

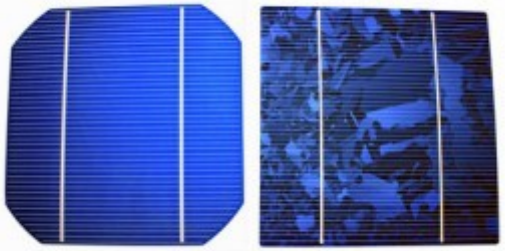
Fails



2 x TP4056
4,1V @ 1A
Battery Charger

POWER AND BATTERY RECHARGE SUBSYSTEM

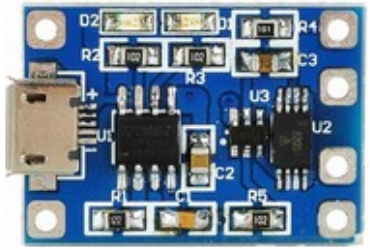
Facts



9,5 – 11 VDC/Side
50 – 60mA/Side

2 x 18650 Batt type
3,7V @ 5000mAh

Fails



2 x TP4056
4,1V @ 1A
Battery Charger

Researching

MAX1873REEE
Up to 4 Li+ Batts
-40ºC to +85ºC

Environmental Sensors Subsystem

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ENVIRONMENTAL SENSORS SUBSYSTEM

Facts

HTU21D
Temperature

Battery, Cockpit, Side 1 – 6,
Control Unit

BH1750L
Light Intensity

Side 1 – 6

ENVIRONMENTAL SENSORS SUBSYSTEM

Facts

HTU21D
Temperature

Battery, Cockpit, Side 1 – 6, Control Unit

BH1750L
Light Intensity

Side 1 – 6

Issues

Multiple I2C devices with the same address.

ENVIRONMENTAL SENSORS SUBSYSTEM

Facts

HTU21D
Temperature

Battery, Cockpit, Side 1 – 6, Control Unit

BH1750L
Light Intensity

Side 1 – 6

Issues

Multiple I2C devices with the same address.

Researching

Multiplexing SDA wire.

Dual CMOS 4-channel analog multiplexer, demultiplexer.

Communications Subsystem

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COMMUNICATIONS SUBSYSTEM

Facts

Telemetry & Configuration

UHF 430 – 440 MHz

Radio Communication

VHF 144 – 148 MHz

COMMUNICATIONS SUBSYSTEM

Facts

Telemetry & Configuration

UHF 430 – 440 MHz

Radio Communication

VHF 144 – 148 MHz

Issues

Buffer overflow on packages transmission for telemetry and configuration.

COMMUNICATIONS SUBSYSTEM

Facts

Telemetry & Configuration

UHF 430 – 440 MHz

Radio Communication

VHF 144 – 148 MHz

Issues

Buffer overflow on packages transmission for telemetry and configuration.

Researching

Error control by parity bits.

Antenna deploymen system.

Budget

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TOTAL RESOURCES INVESTED UP TODAY

Electronics	190,00 €
3D Printing	75,00 €
Mechanical components	25,00 €
Other materials	30,00 €
TOTAL AMOUNT	**320,00 €**
Total spent time (aprox.)	1.790 h

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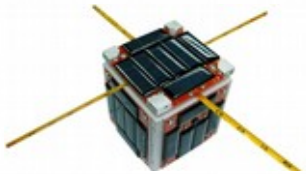
DEPLOYMENT BUDGET

	500,00 €
	10.000,00 €
	60.000,00 €
Unexpected expenses	2.500,00 €
TOTAL AMOUNT	**73.000,00 €**

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Real deployed CubSat based projects on

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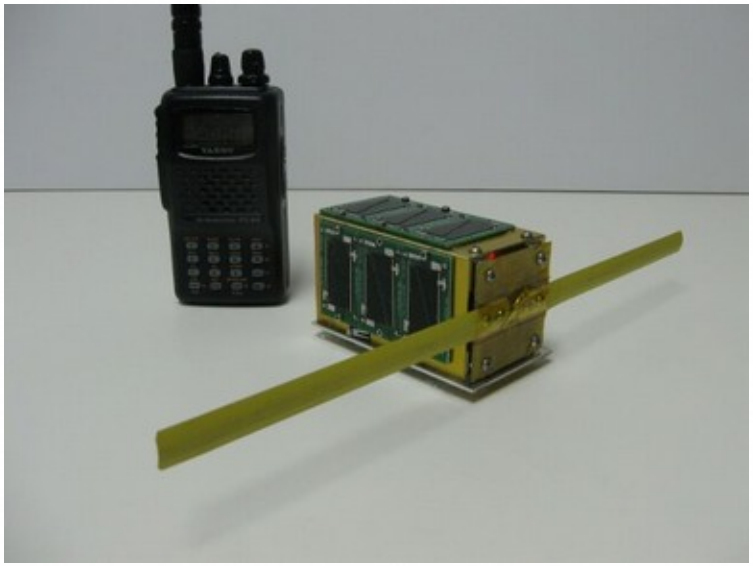
REAL DEPLOYED CUBSAT BASED PROJECTS ON

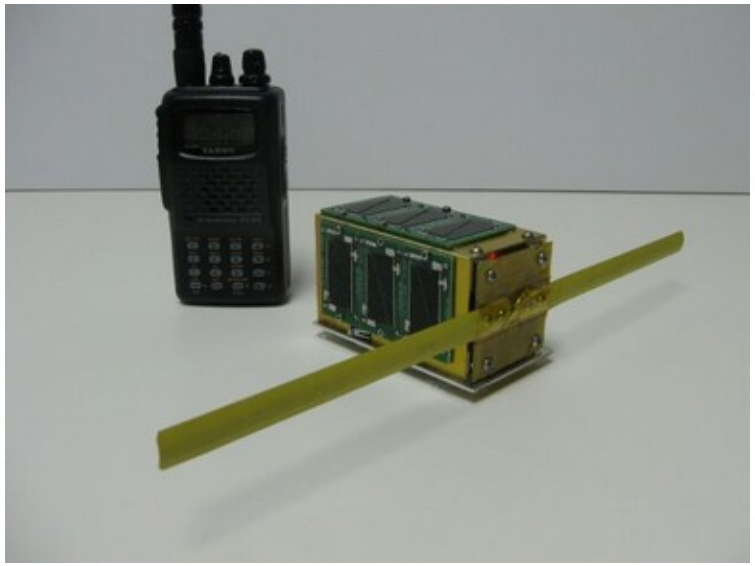


Maybe...

But we are not alone.

REAL DEPLOYED CUBSAT BASED PROJECTS ON

50$ Sat



- Built by three amateur radio operators.
- 7 months in orbit.
- Dniepper russian rocket.
- www.50dollarsat.info

REAL DEPLOYED CUBSAT BASED PROJECTS ON

PicoDragon

Built by VNSC
(Vietnam National Satellite Center)

In orbit during 4 months.

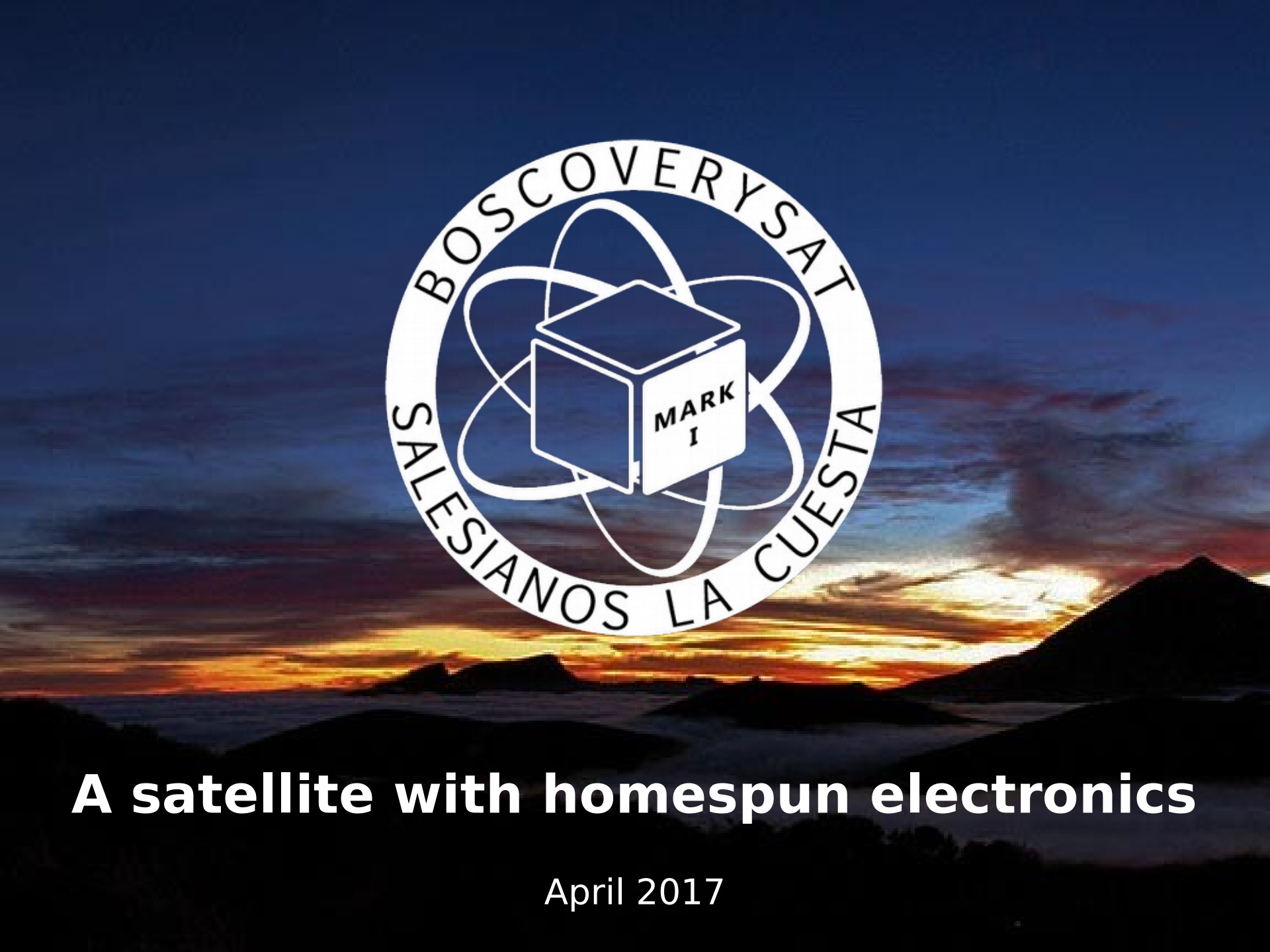
ISS

https://vnsc.org.vn/en/projects/profile-of-the-picodragon-satellite/

REAL DEPLOYED CUBSAT BASED PROJECTS ON

PhoneSat Series

- Built by NASA.
- Actually in orbit.
- It’s payload is an android phone.
- Falcon 9.
- phonesat.org



A satellite with homespun electronics

April 2017