

#boscoverysat

#tlpinnova



A satellite with homespun electronics

July 2016

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Current I+D process



Problem

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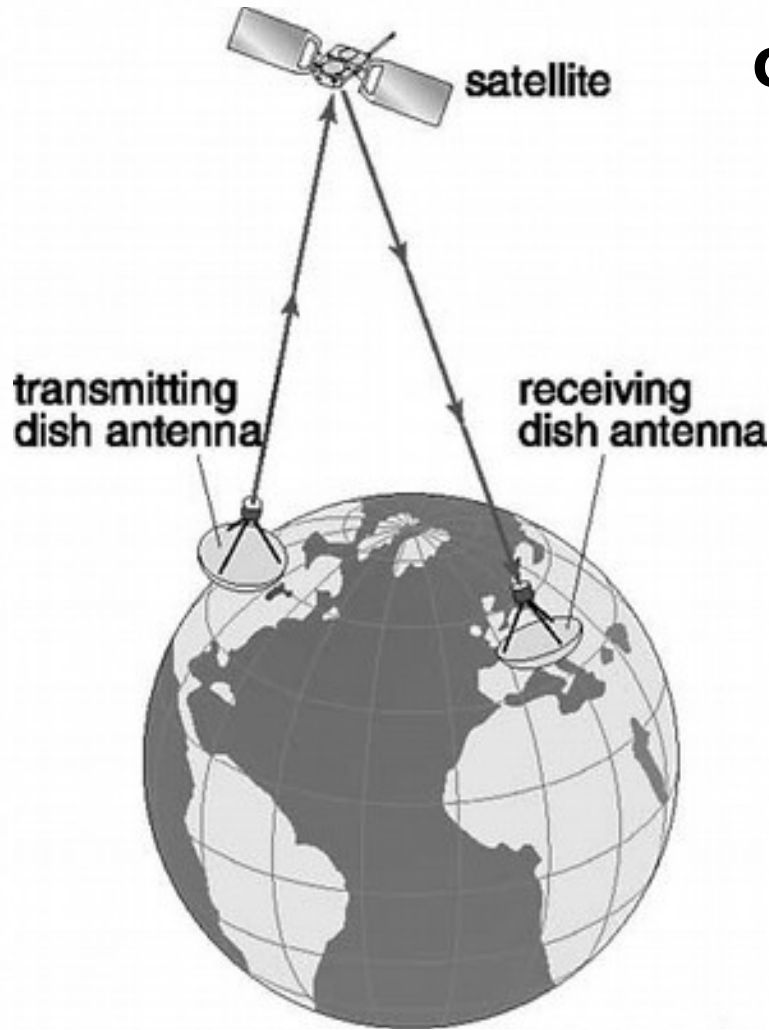
Current I+D process



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COLEGIO SAN JUAN BOSCO LA CUESTA

PROBLEM



Classic Satellite Communications usual problems

High costs
Unaccessible
Private owners
Low bandwidth
Maintenance



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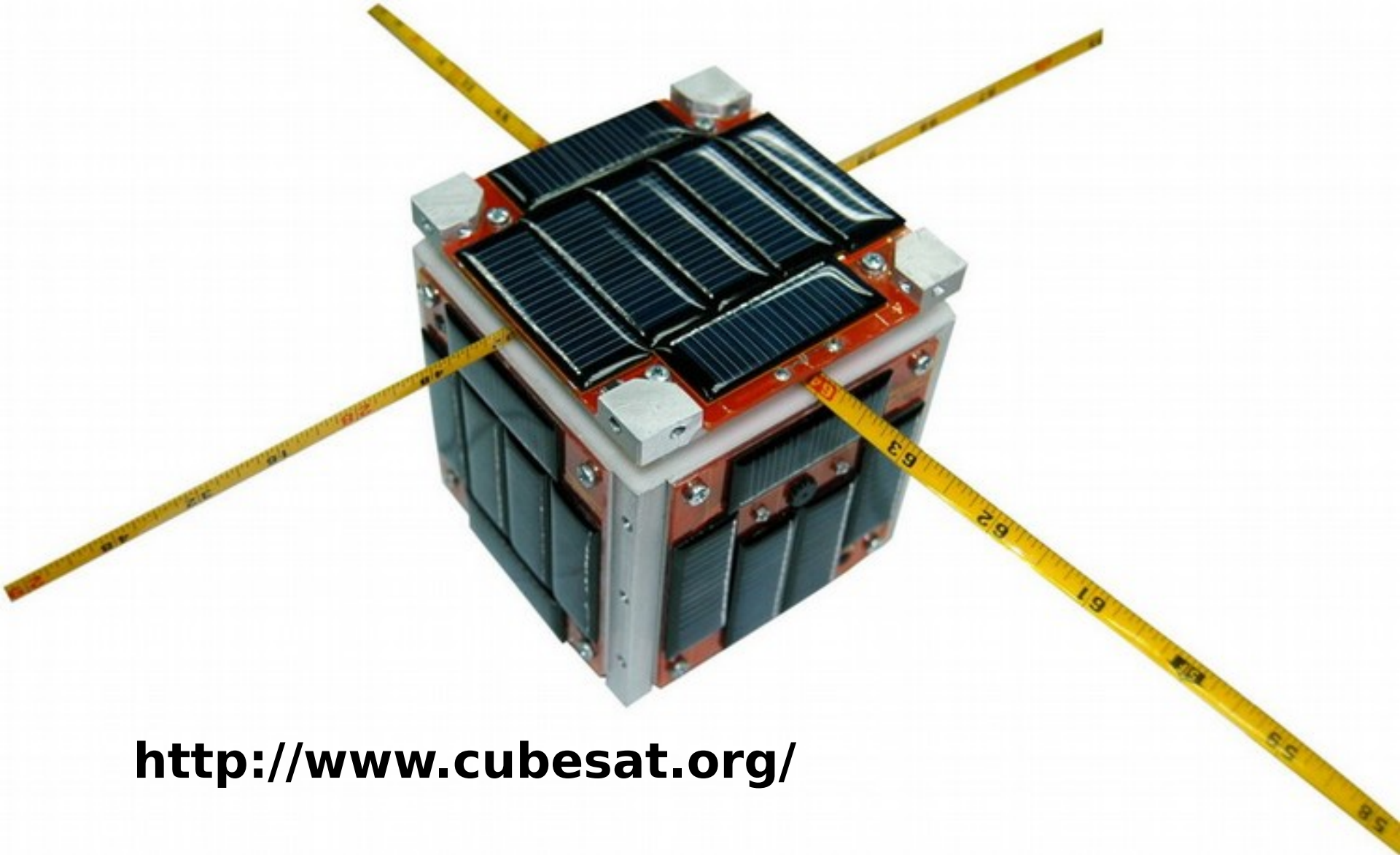
Current I+D process



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SOLUTION



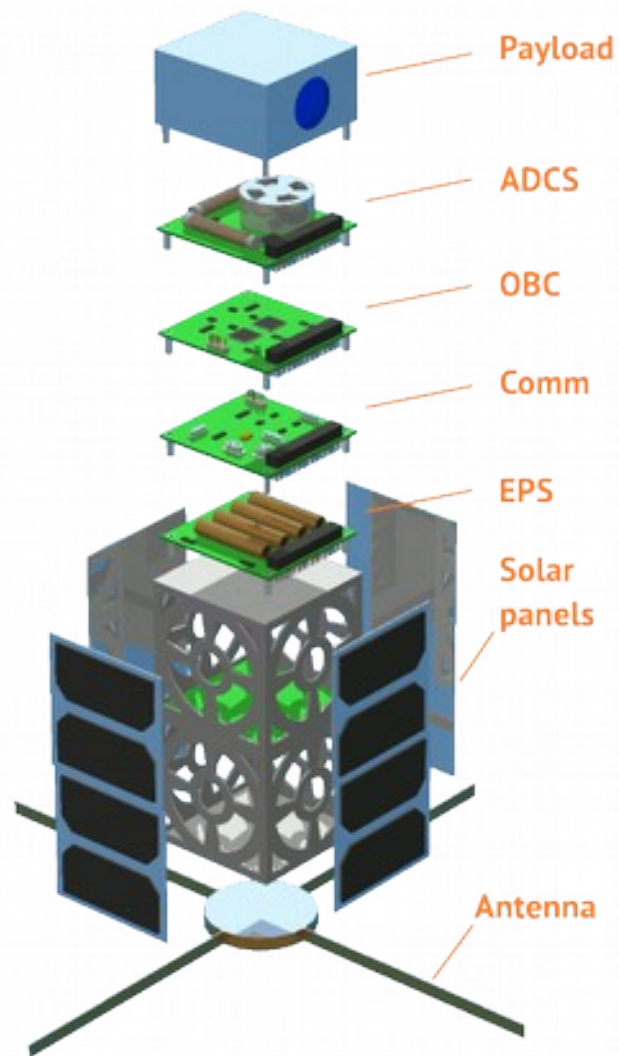
<http://www.cubesat.org/>



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SOLUTION



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SOLUTION

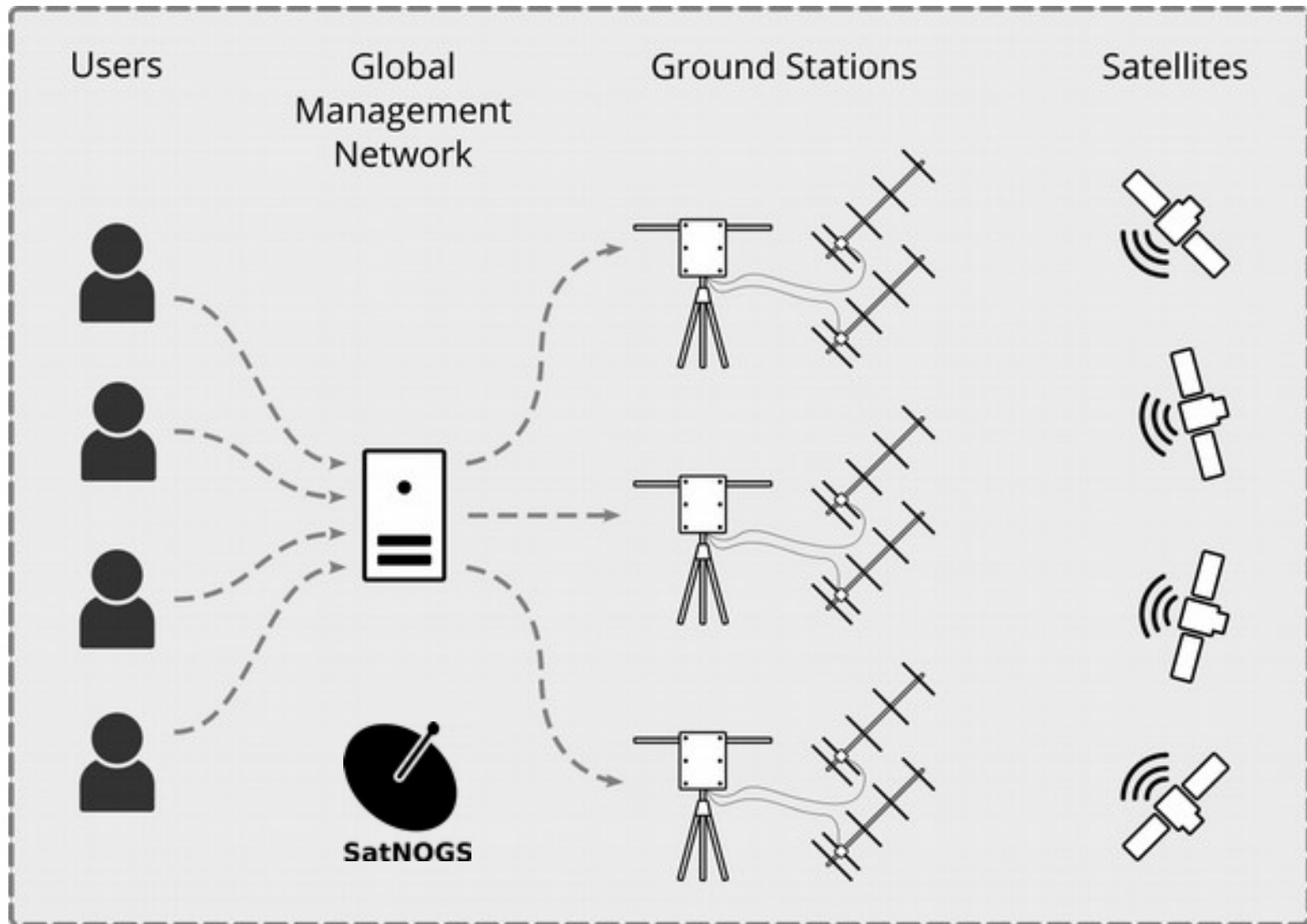
<https://satnogs.org/>



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SOLUTION



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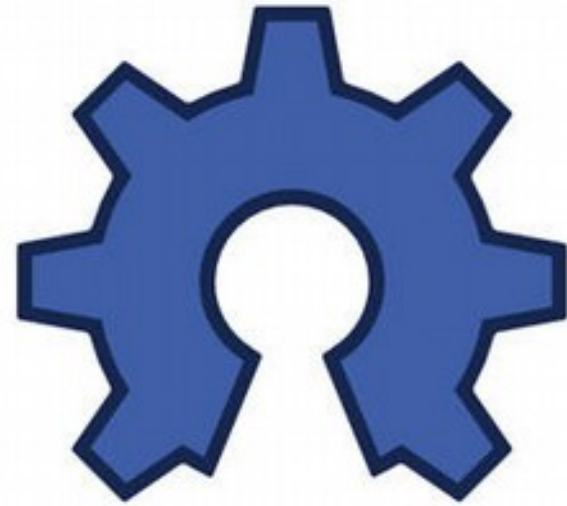
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PROJECT PHILOSOPHY



open source



open hardware



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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



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ACHIEVEMENTS

RADIO STATION (SATELLITE TRACKER)

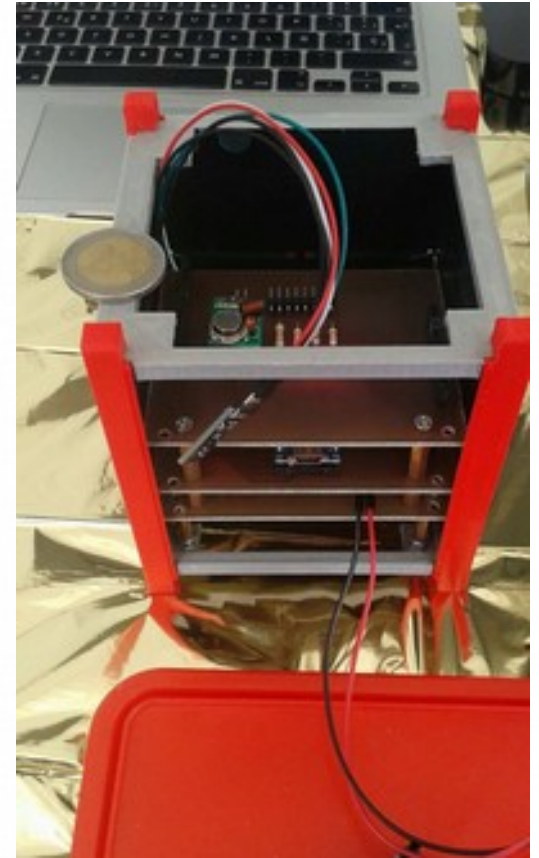
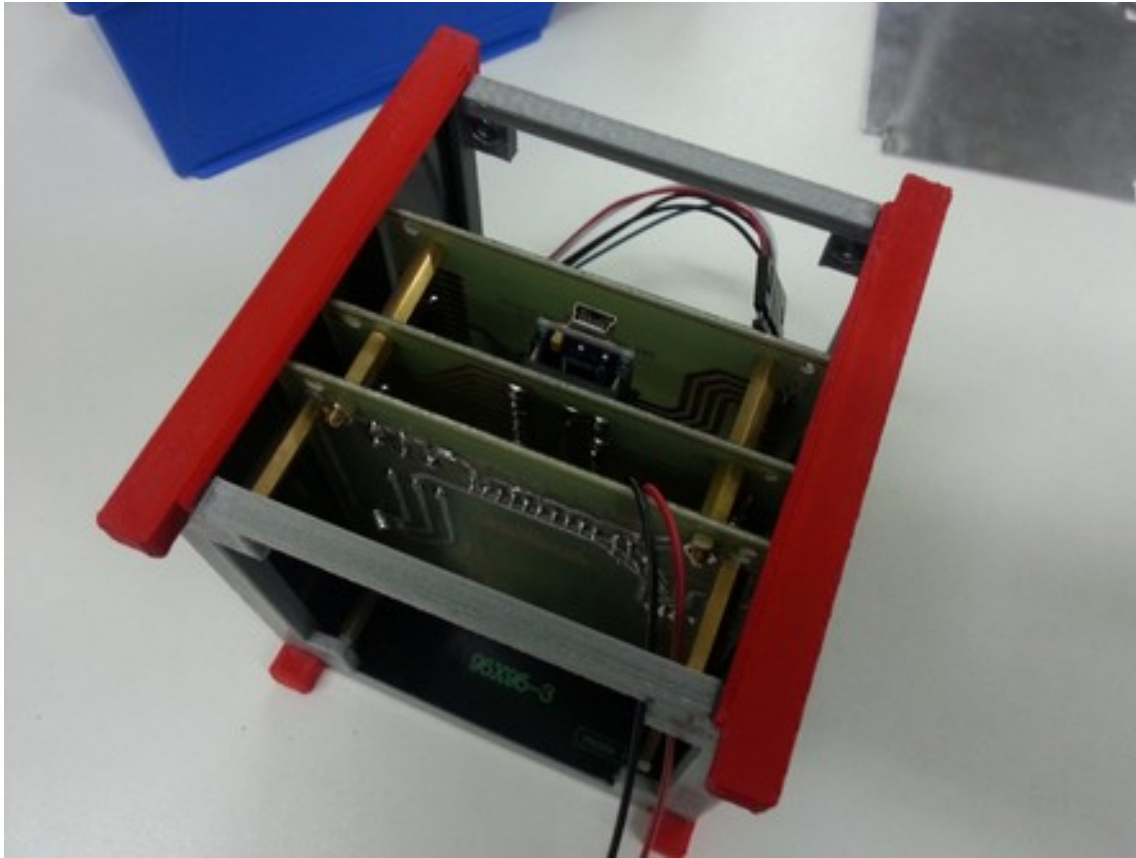


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ACHIEVEMENTS

SATELLITE



MARK I - ALPHA 1

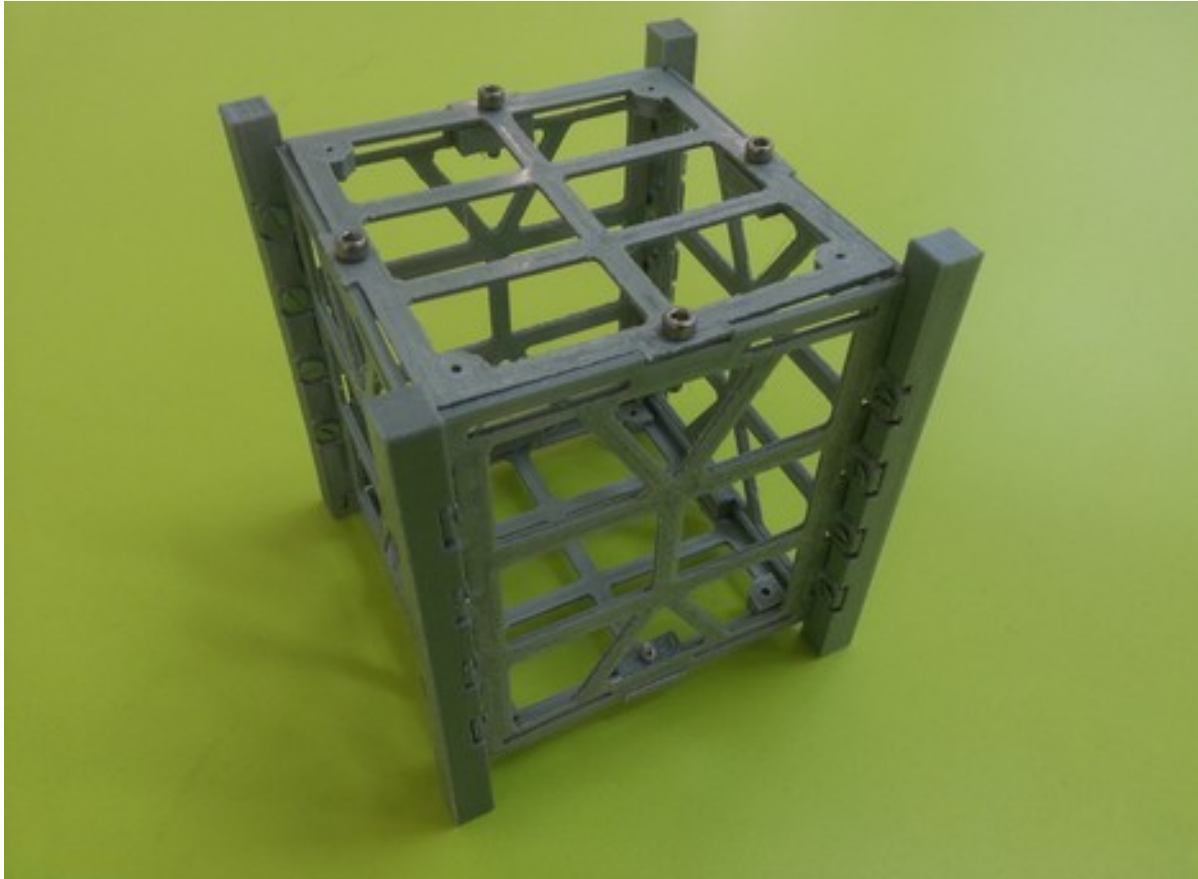


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ACHIEVEMENTS

SATELLITE



MARK I - ALPHA 2

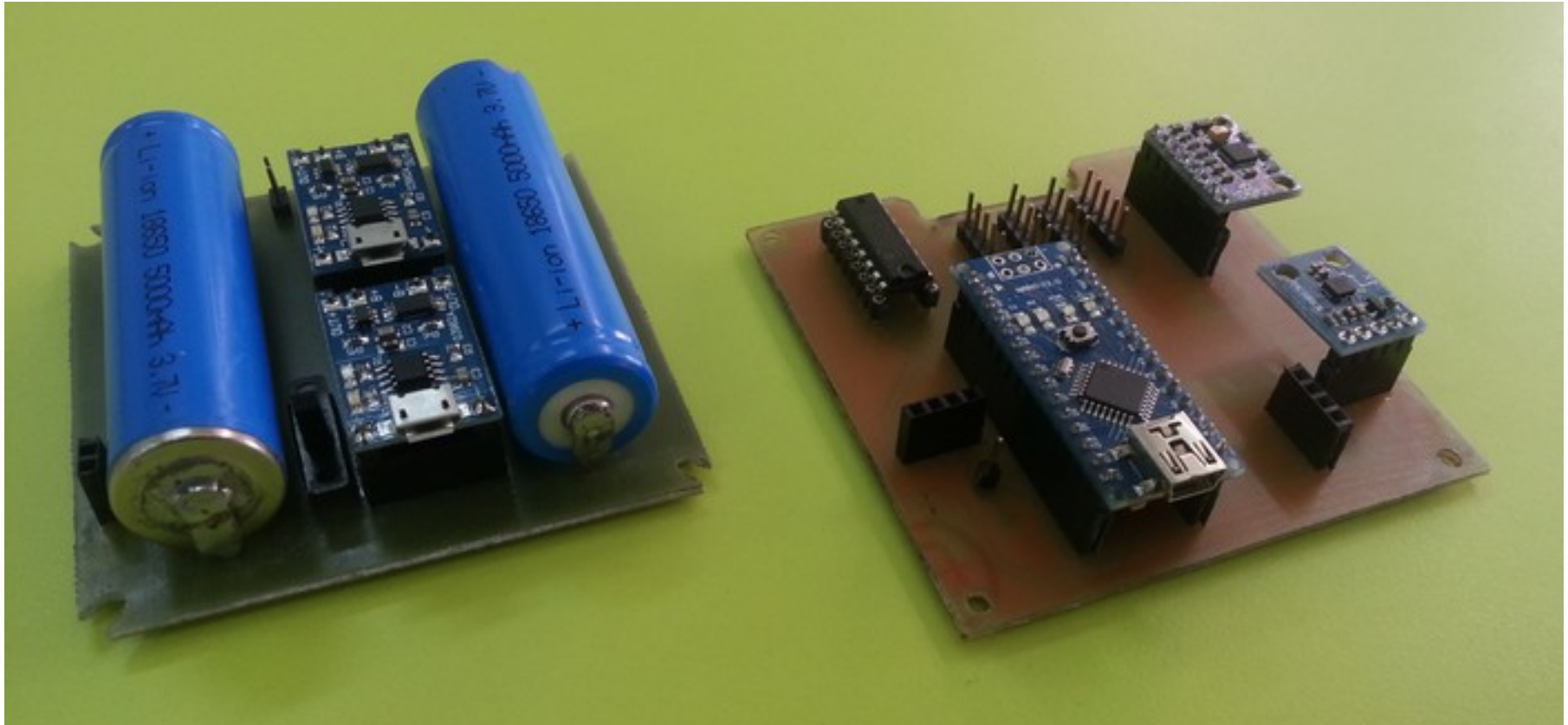


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ACHIEVEMENTS

SATELLITE



MARK I - ALPHA 2

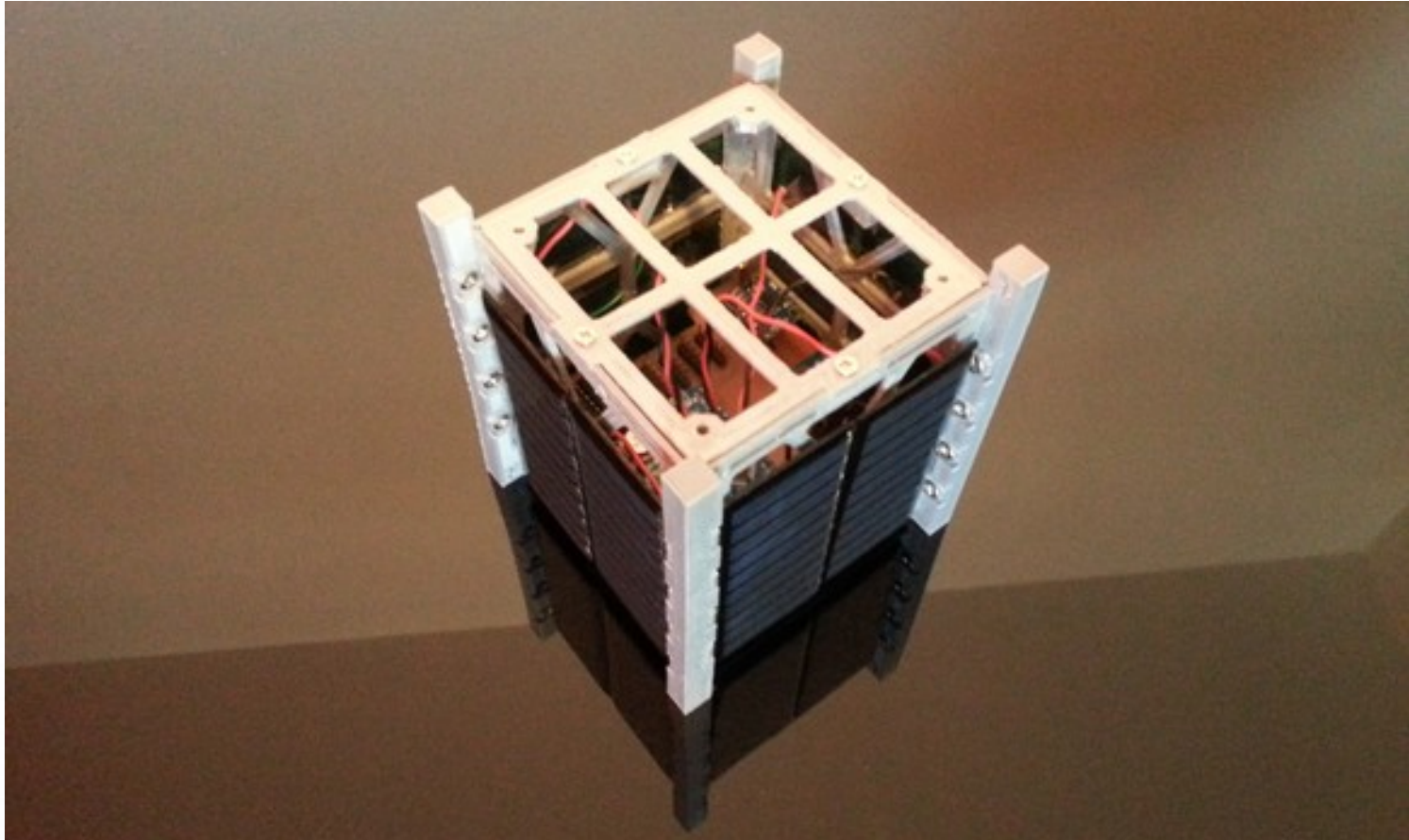


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ACHIEVEMENTS

SATELLITE



MARK I - ALPHA 2




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ACHIEVEMENTS

DOCUMENTATION (GitHub Repository)






[Pull requests](#) [Issues](#) [Gist](#)



Boscovery SAT
boscoverysat

 Tenerife, España
 boscoverysat@gmail.com
 Joined on 27 Aug 2015

2


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0


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Following






 Contributions

 Repositories


 Public activity

 Edit profile

Popular repositories

 bsat.sat.transmision_400mhz	0 ★
Análisis, pruebas y documentación del sistema de transmisión en 400MHz empleado en el proyecto.	
 bsat.doc.documentacion_de_...	0 ★
Este repositorio contendrá los documentos de referencia que iremos empleando a lo largo del proyecto.	
 bsat.doc.git_y_github	0 ★
En este repositorio se recogerá toda la documentación relativa a la instalación, configuración, operaciones y dem...	
 bsat.doc.presentaciones	0 ★
Repositorio donde se recogerán las presentaciones preparadas para el proyecto.	
 bsat.gst.control_de_rotor	0 ★
Este repositorio contiene el código fuente y la electrónica de control para el rotor de antena.	

Contributions



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



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COLEGIO SAN JUAN BOSCO LA CUESTA

TOOLS

COMMUNICATION



Gmail



Whatsapp



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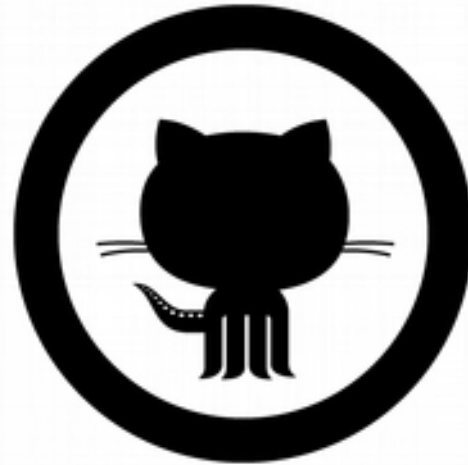
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TOOLS

TEAMWORK



Google Drive



GitHub



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COLEGIO SAN JUAN BOSCO LA CUESTA

TOOLS

MANAGEMENT



Google
Calendar



Trello



TOOLS

DEVELOPMENT (SW & HW)

Editors and IDEs



Prog. Languages



Version Control



Operative Systems



Satellite & Tracker



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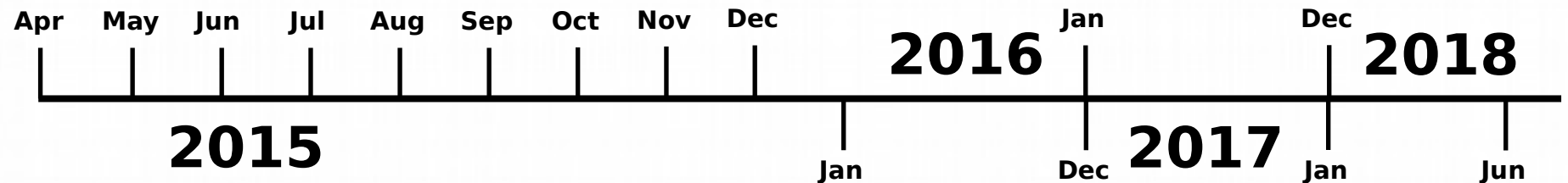


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COLEGIO SAN JUAN BOSCO LA CUESTA

ROADMAP

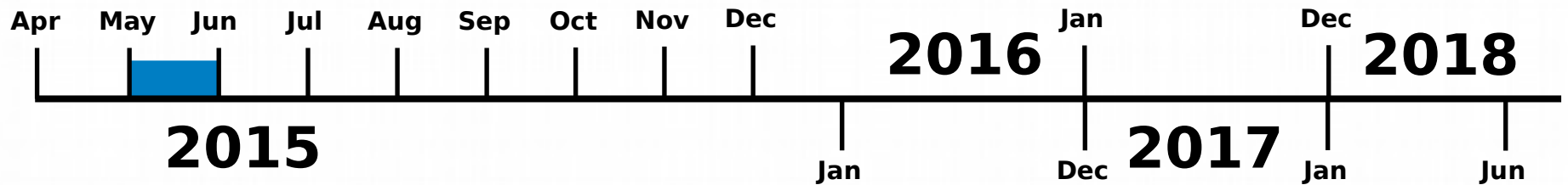
It is a long time project



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COLEGIO SAN JUAN BOSCO LA CUESTA

ROADMAP



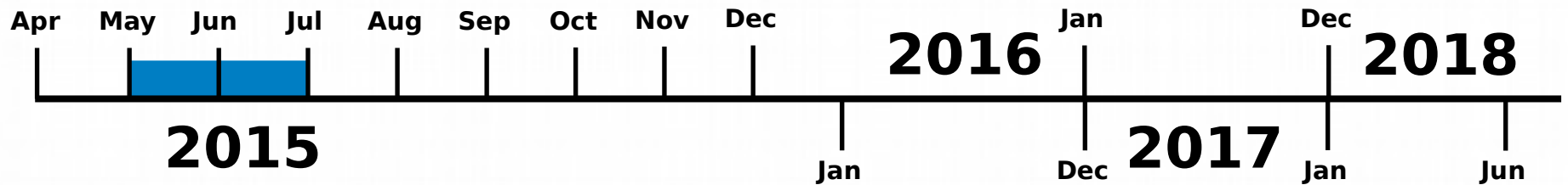
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COLEGIO SAN JUAN BOSCO LA CUESTA

ROADMAP



**San Juan Bosco
La Cuesta School**
*Projects Week 2015
Satellite Tracker*



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COLEGIO SAN JUAN BOSCO LA CUESTA

ROADMAP



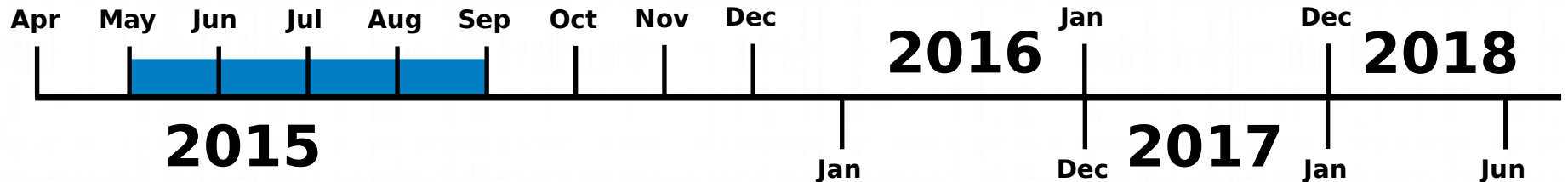
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Satellite Tracker

First systems development



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ROADMAP



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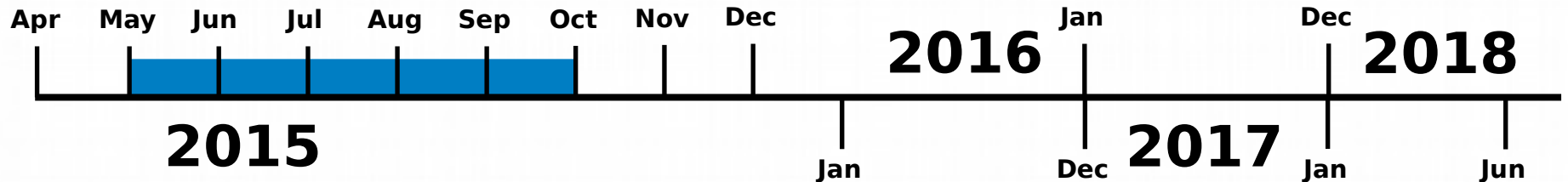
Satellite Tracker

First systems development



Satellite

Orbital sensors testing



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Satellite Tracker*



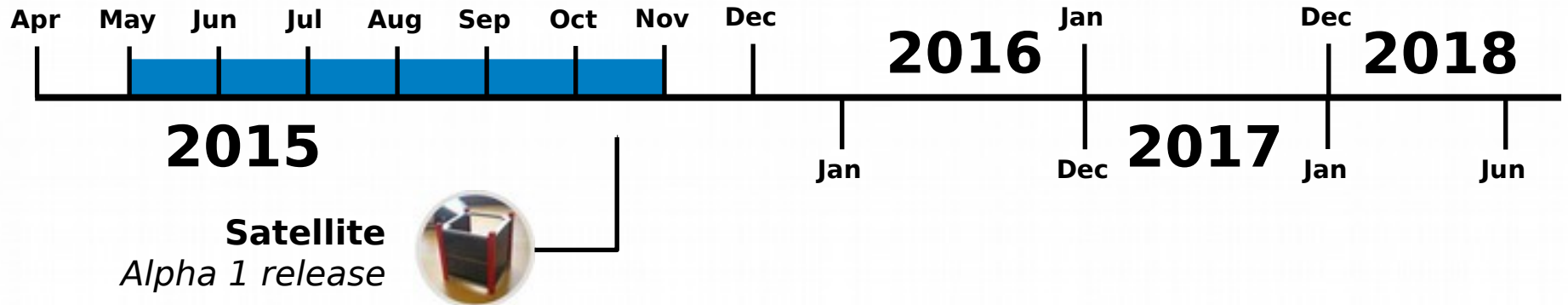
Satellite Tracker

First systems development



Satellite

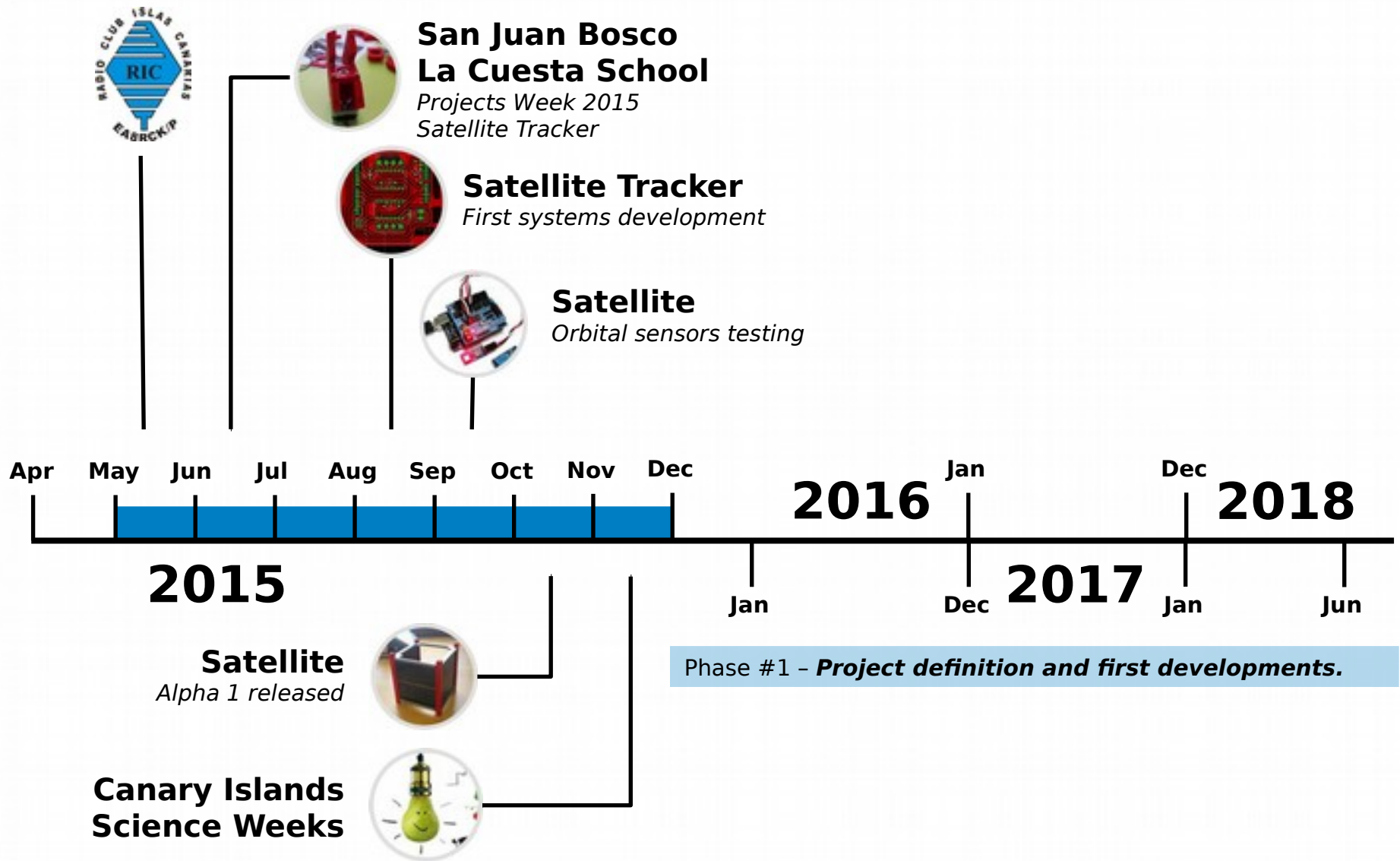
Orbital sensors testing



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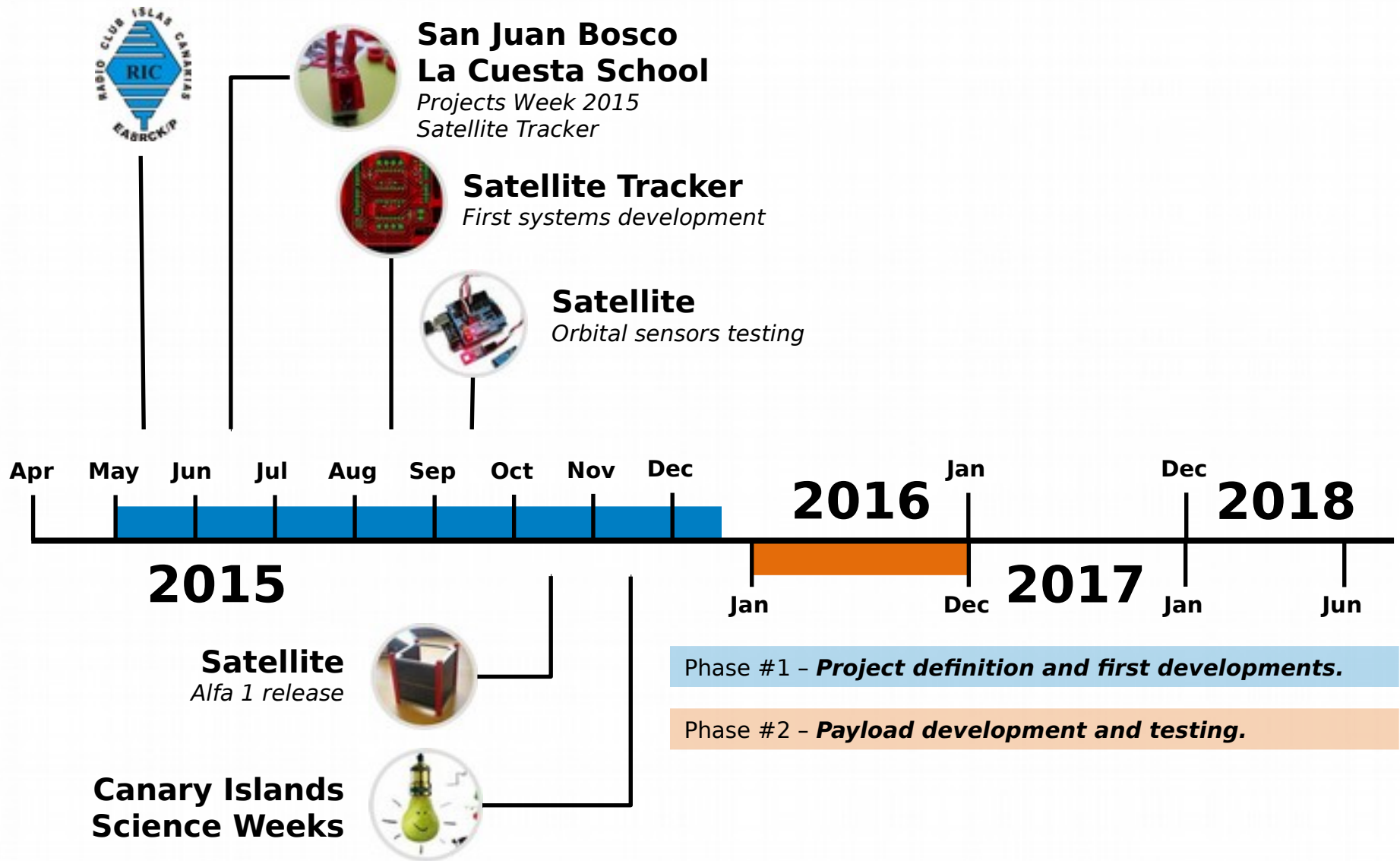
ROADMAP



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2016



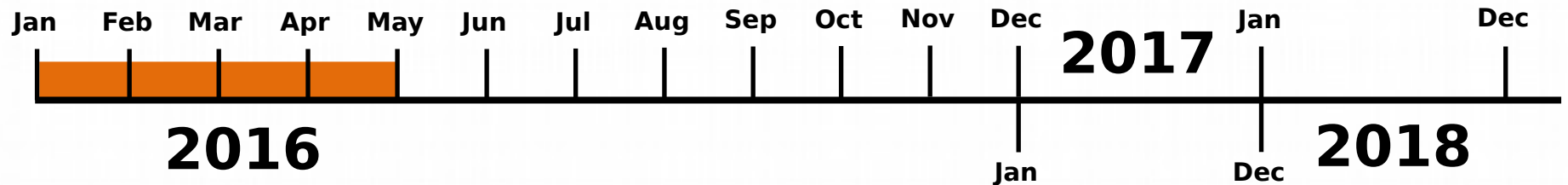
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ROADMAP



**Research &
Documentation**



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

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



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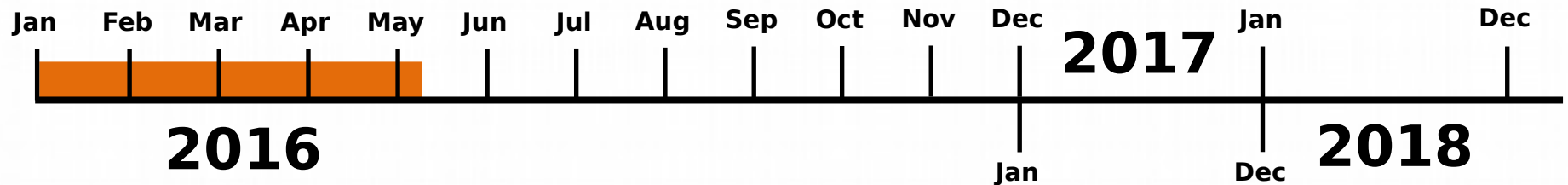
ROADMAP



**Research &
Documentation**



**III Science and Technology
National Award**
St. Louis University Madrid



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

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



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ROADMAP



**Research &
Documentation**



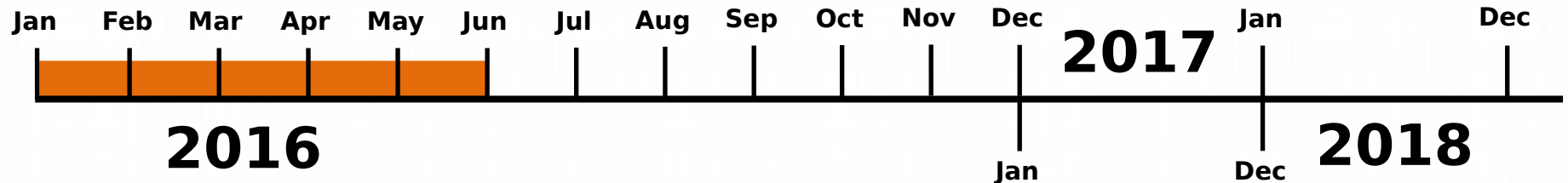
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National Award**

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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**Research &
Documentation**



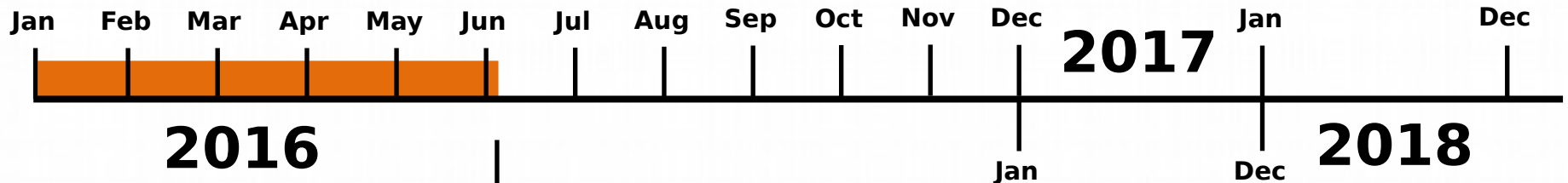
**III Science and Technology
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**Structure & Electronics
design**

3D printed prototype and shields



2016

**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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ROADMAP



**Research &
Documentation**



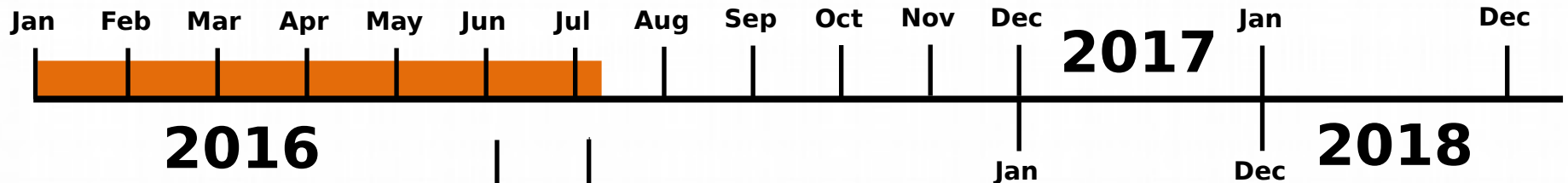
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**Structure & Electronics
design**

3D printed prototype and shields



2016

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*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

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**Research &
Documentation**



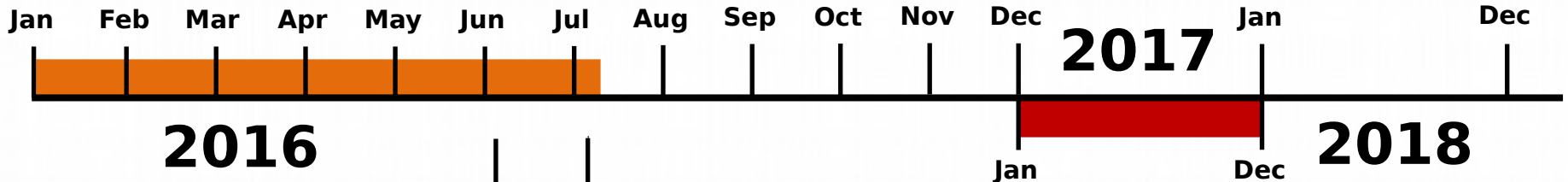
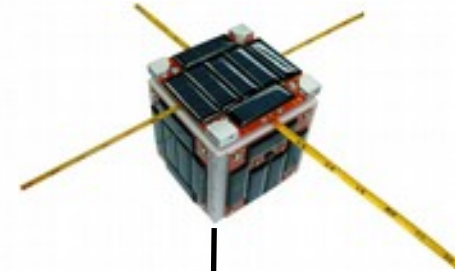
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**Structure & Electronics
design**

3D printed prototype and shields



**San Juan Bosco
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*Projects Week 2016
Satellite Structure Testing*

Satellite

Alpha 2 released



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**



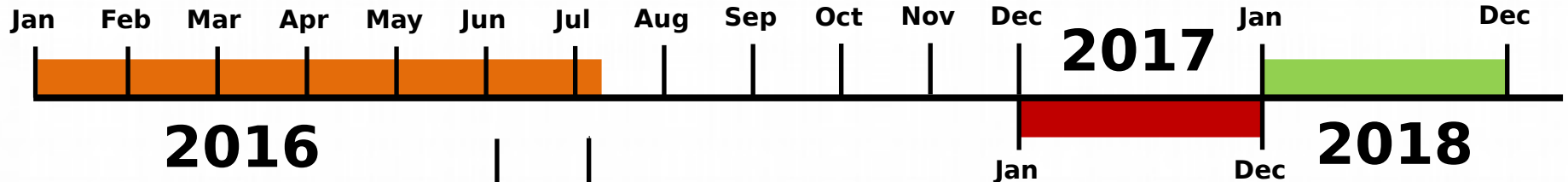
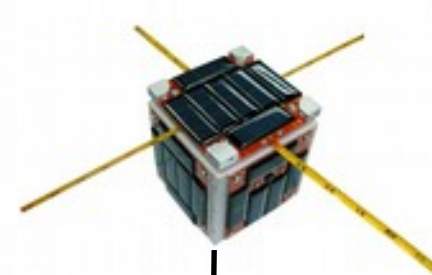
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**Structure & Electronics
design**

3D printed prototype and shields



**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.**

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

Phase #4 - **Satellite launching.**



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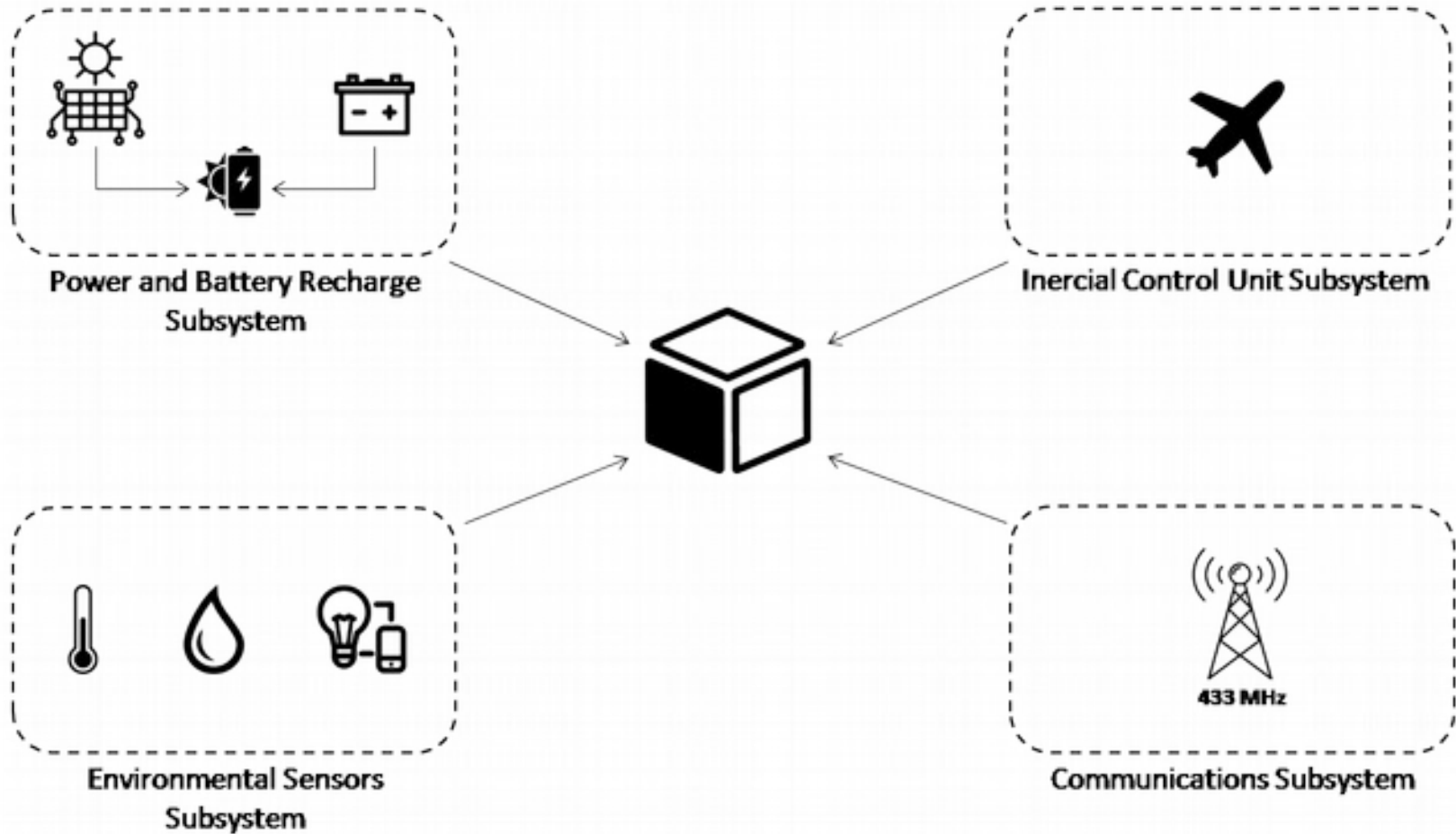
Current I+D process



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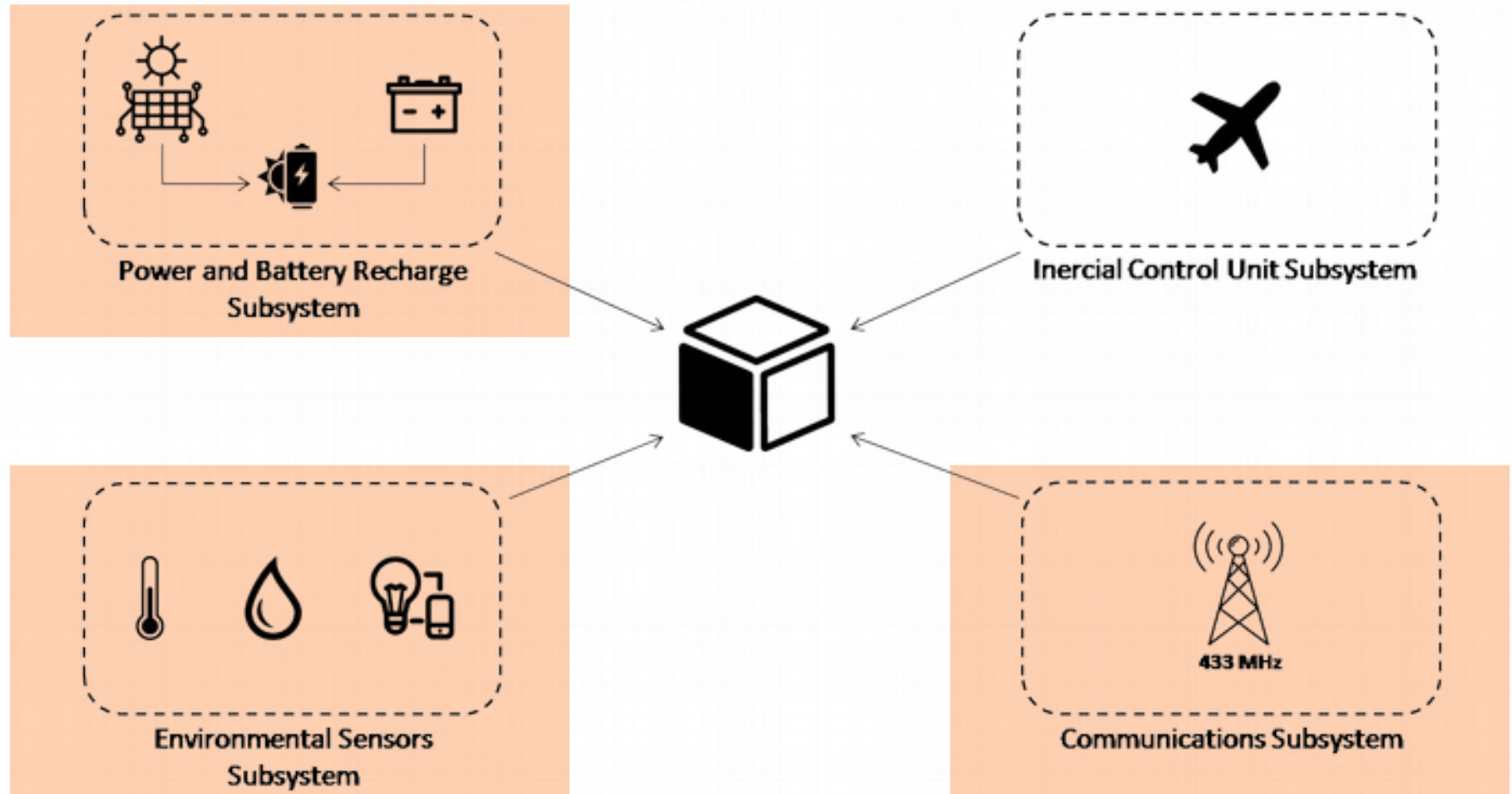
CURRENT I+D PROCESS



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CURRENT I+D PROCESS



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boscoverysat.github.com



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A satellite with homespun electronics

July 2016

Satellites' Orbits and Positioning

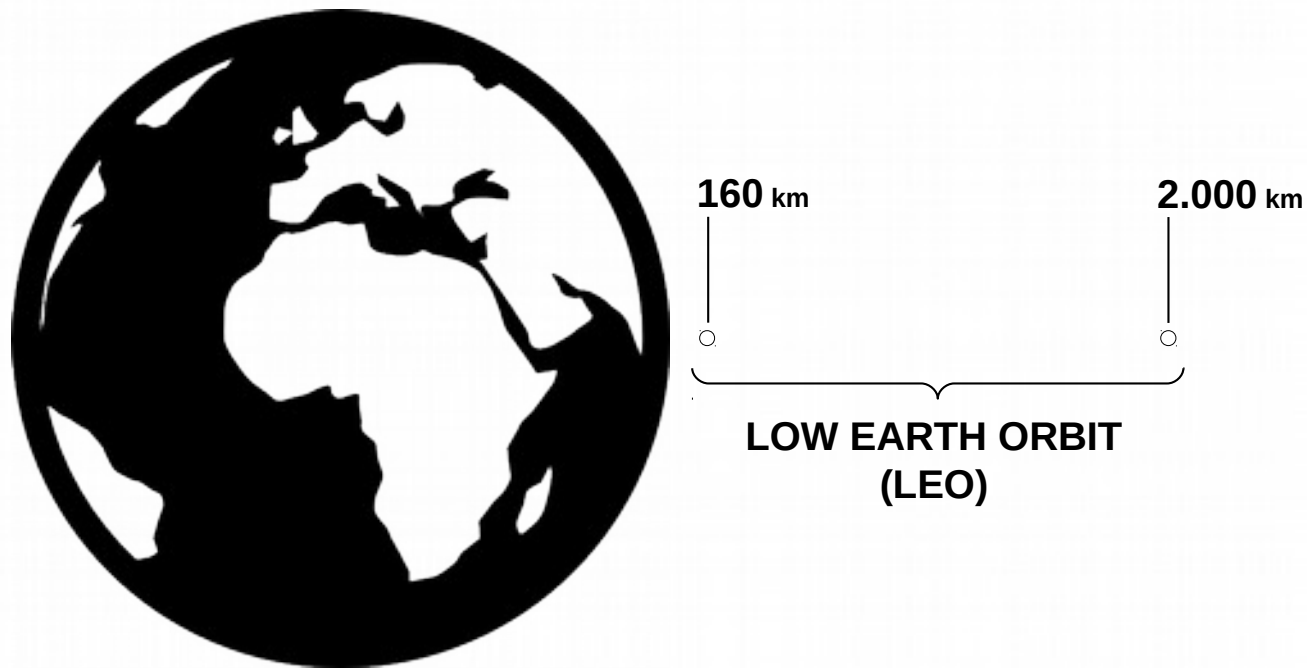


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SATELLITES' ORBITS AND POSITIONING

Based on HEIGHTs

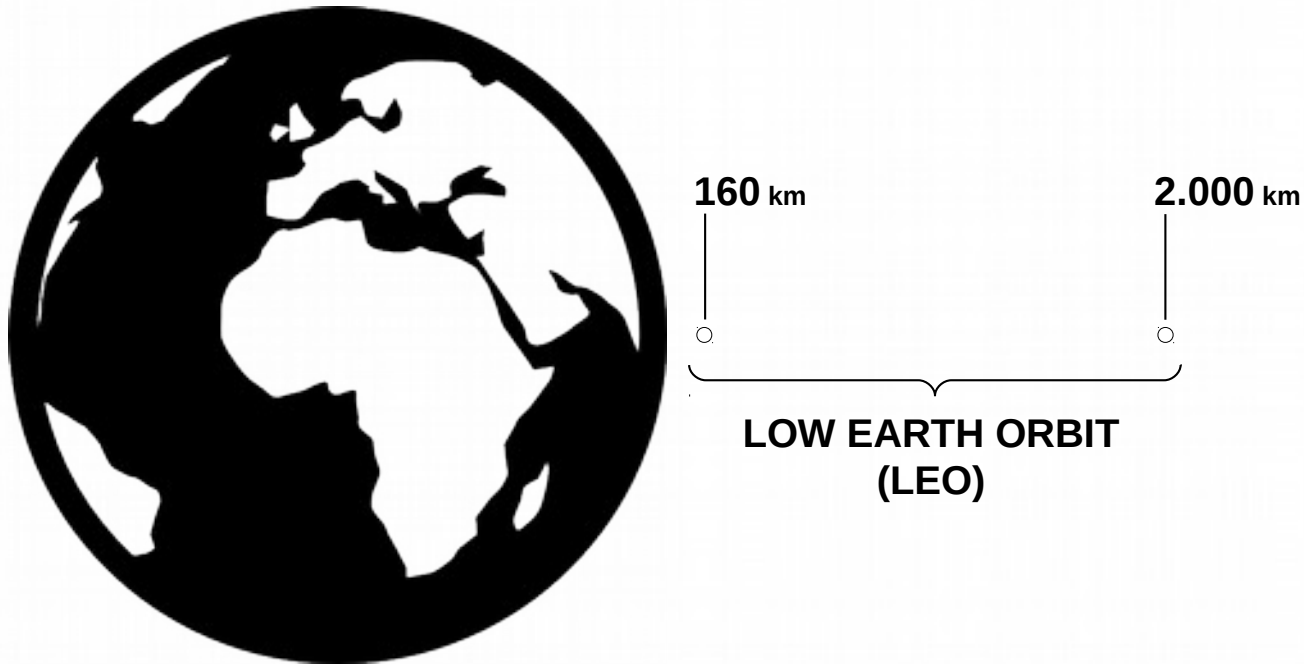


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SATELLITES' ORBITS AND POSITIONING

Based on HEIGHTs



LOW EARTH ORBIT DATA:

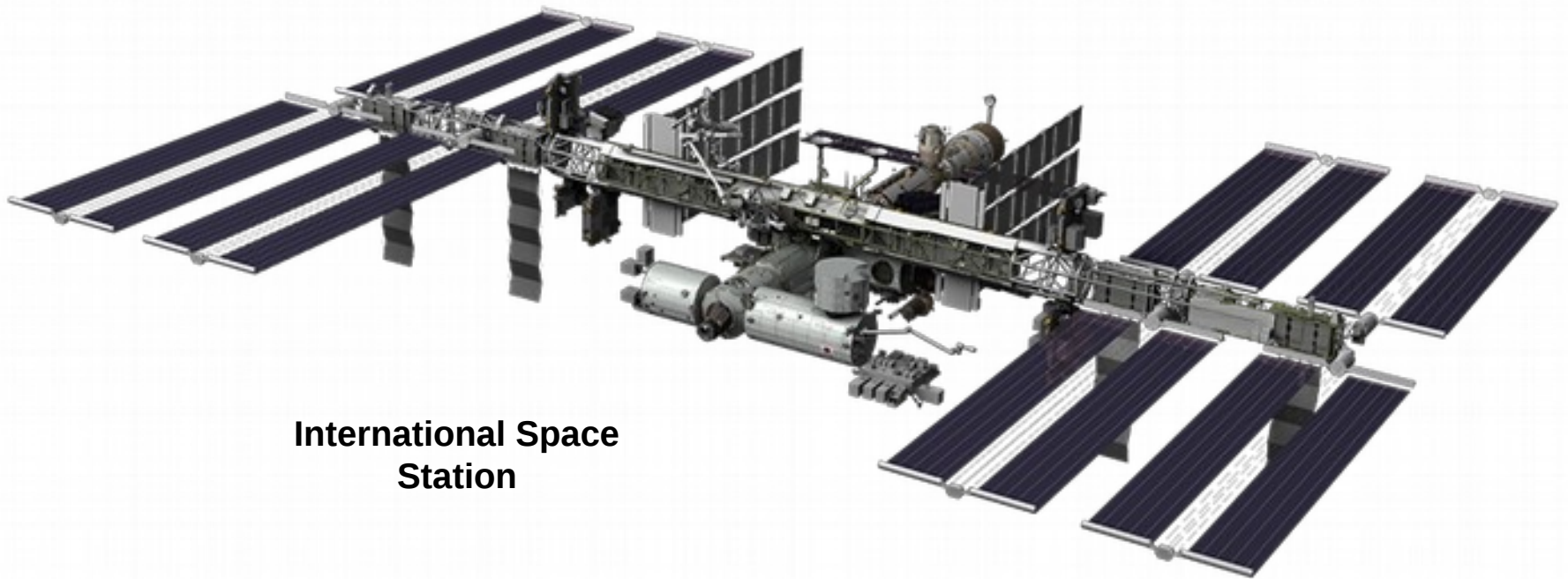
Average speed:	7,8km/s (28.080km/h)
Average orbit time:	99 minutes
Usual deployments:	Scientific missions



SATELLITES' ORBITS AND POSITIONING

Based on HEIGHTs

Missions deployed at LEO orbit



International Space
Station

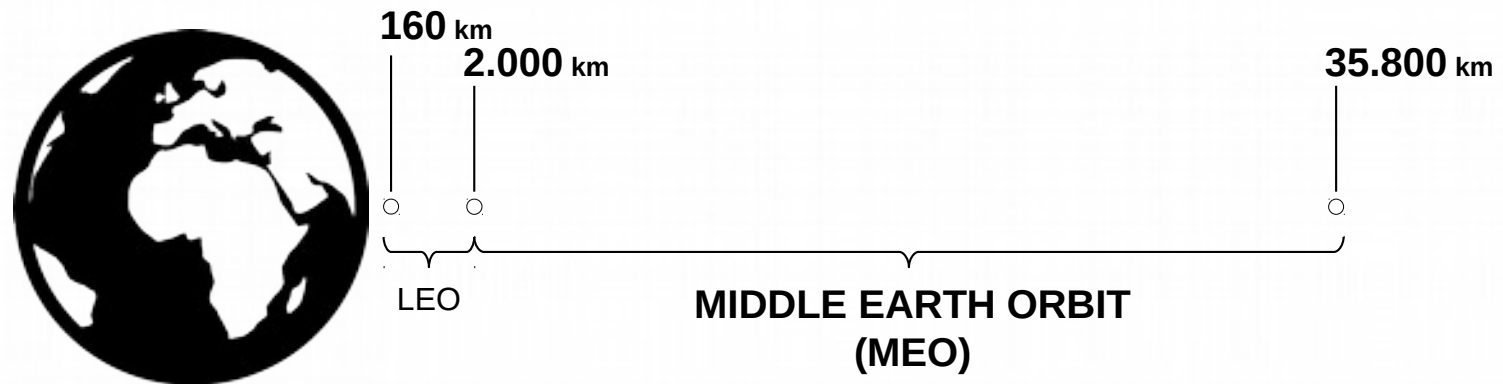


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SATELLITES' ORBITS AND POSITIONING

Based on HEIGHTs

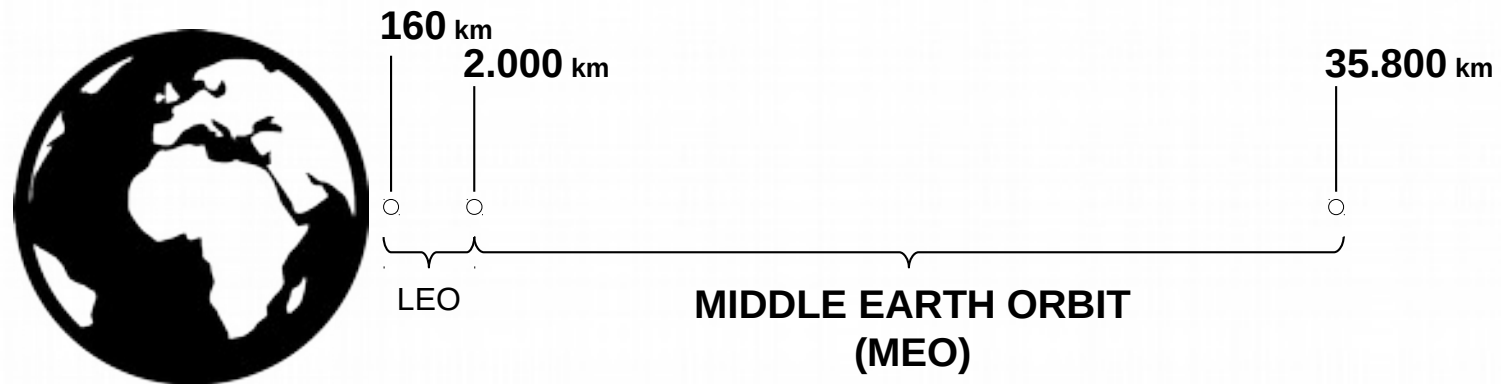


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SATELLITES' ORBITS AND POSITIONING

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**



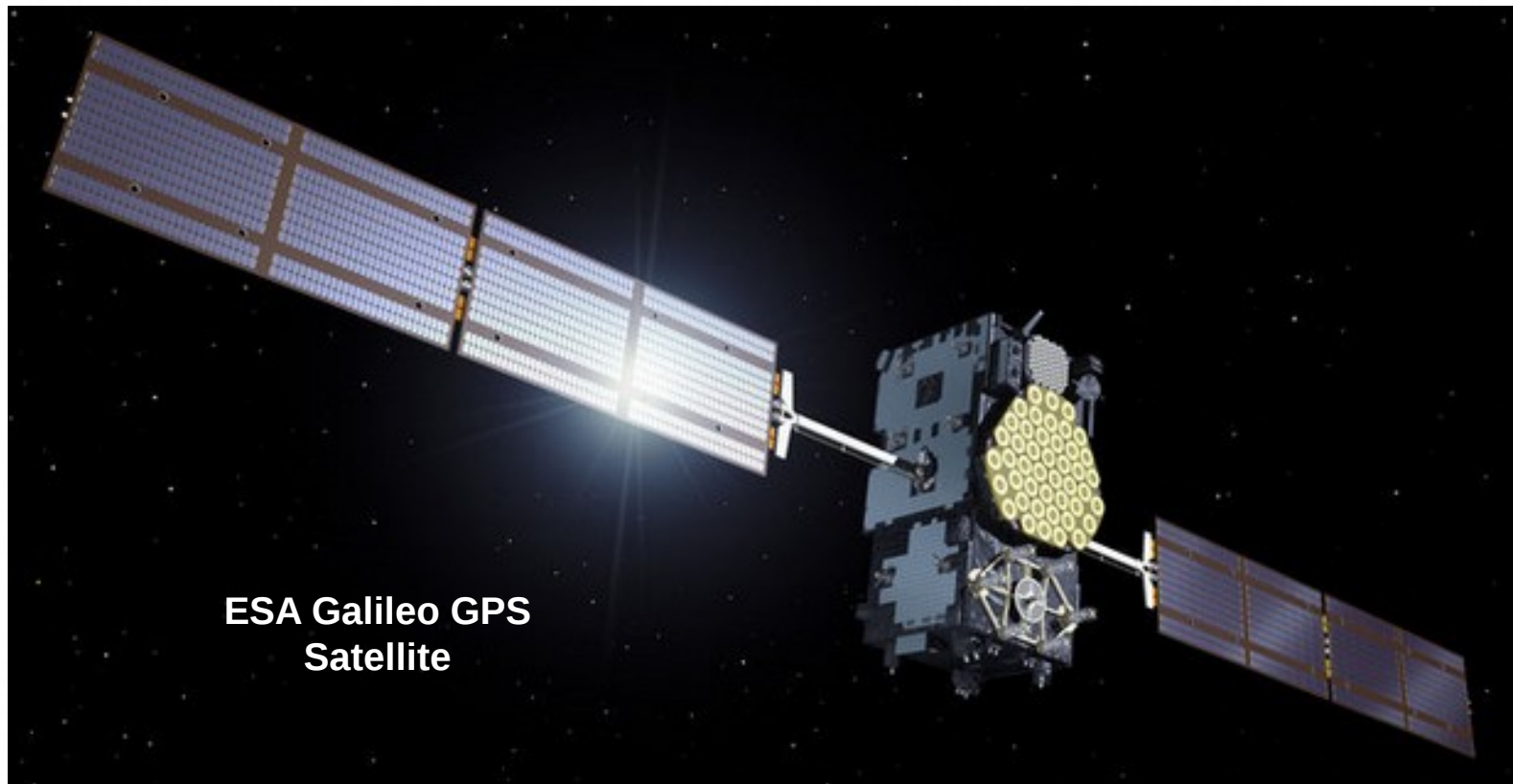
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SATELLITES' ORBITS AND POSITIONING

Based on HEIGHTs

Missions deployed at MEO orbit



ESA Galileo GPS
Satellite

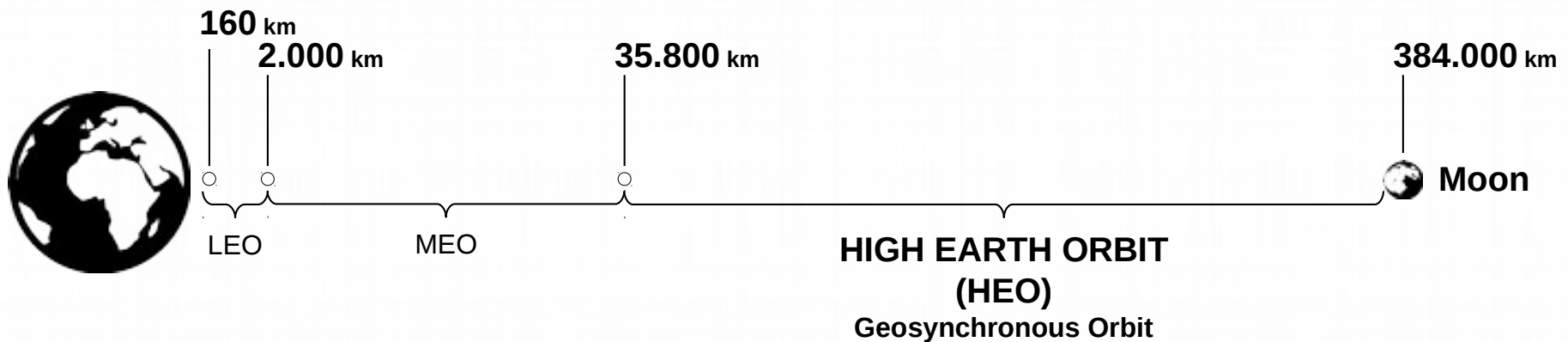


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SATELLITES' ORBITS AND POSITIONING

Based on HEIGHTs

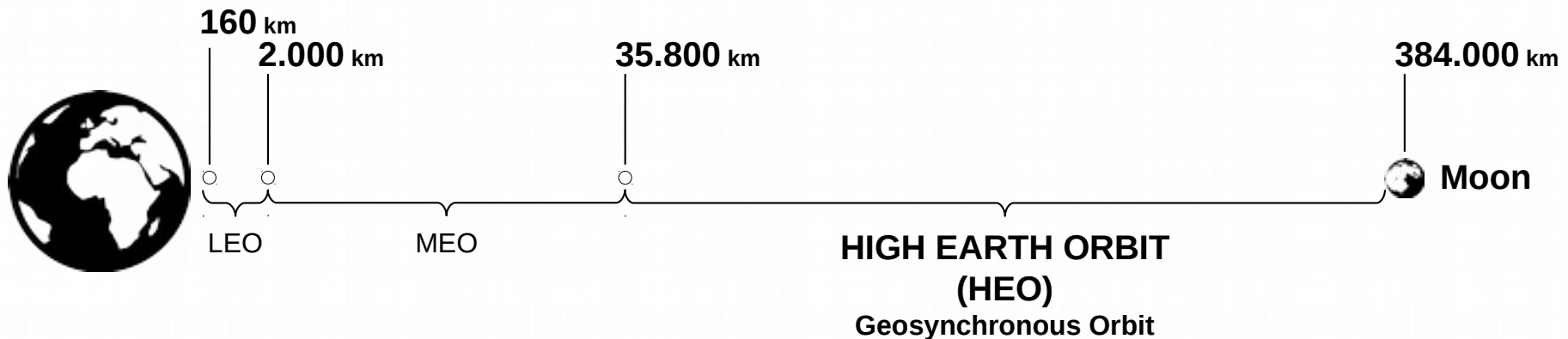


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SATELLITES' ORBITS AND POSITIONING

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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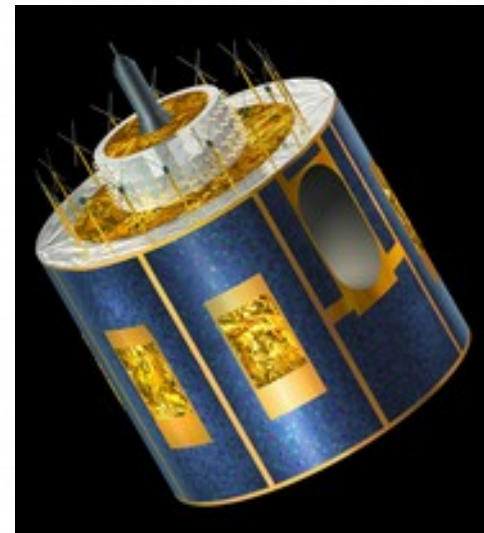
SATELLITES' ORBITS AND POSITIONING

Based on HEIGHTs

Missions deployed at HEO orbit



Hispasat AG1



Meteosat

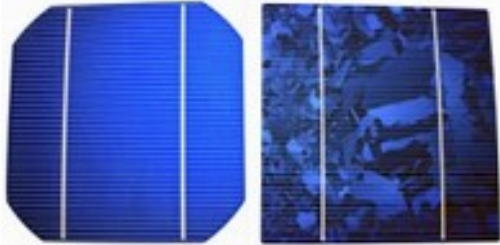


Power and Battery Recharge Subsystem



POWER AND BATTERY RECHARGE SUBSYSTEM

Facts



9,5 – 11 VDC/Side
50 – 60mA/Side



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

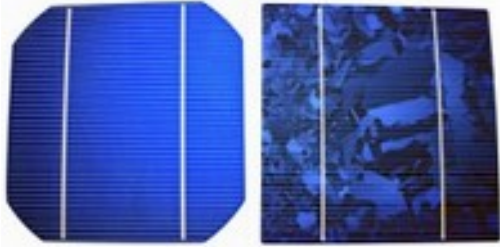


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POWER AND BATTERY RECHARGE SUBSYSTEM

Facts

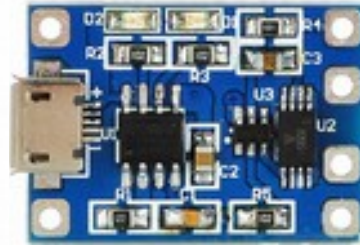


9,5 – 11 VDC/Side
50 – 60mA/Side



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

Fails



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

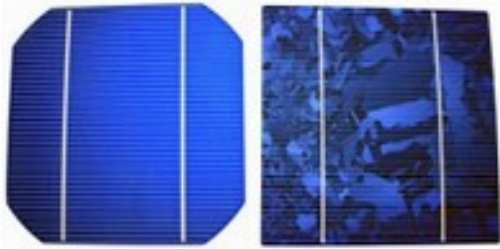


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COLEGIO SAN JUAN BOSCO LA CUESTA

POWER AND BATTERY RECHARGE SUBSYSTEM

Facts

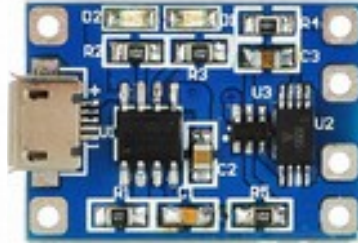


9,5 – 11 VDC/Side
50 – 60mA/Side



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

Fails



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

Researching



MAX1873REEE
Up to 4 Li+ Batts
-40°C to +85°C



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COLEGIO SAN JUAN BOSCO LA CUESTA

Environmental Sensors Subsystem



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.



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COLEGIO SAN JUAN BOSCO LA CUESTA

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.



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COLEGIO SAN JUAN BOSCO LA CUESTA

Communications Subsystem



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COLEGIO SAN JUAN BOSCO LA CUESTA

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 deployment system.



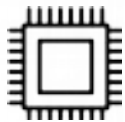
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COLEGIO SAN JUAN BOSCO LA CUESTA

Budget



TOTAL RESOURCES INVESTED UP TODAY



Electronics

190,00 €



3D Printing

75,00 €



Mechanical components

25,00 €



Other materials

30,00 €

TOTAL AMOUNT

220,00 €



Total spent time (aprox.)

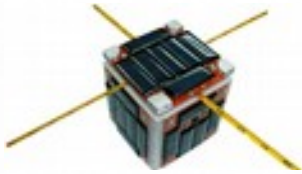
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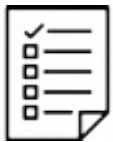
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COLEGIO SAN JUAN BOSCO LA CUESTA

DEPLOYMENT BUDGET



500,00 €



10.000,00 €



60.000,00 €

Unexpected expenses

2.500,00 €

TOTAL AMOUNT

73.000,00 €



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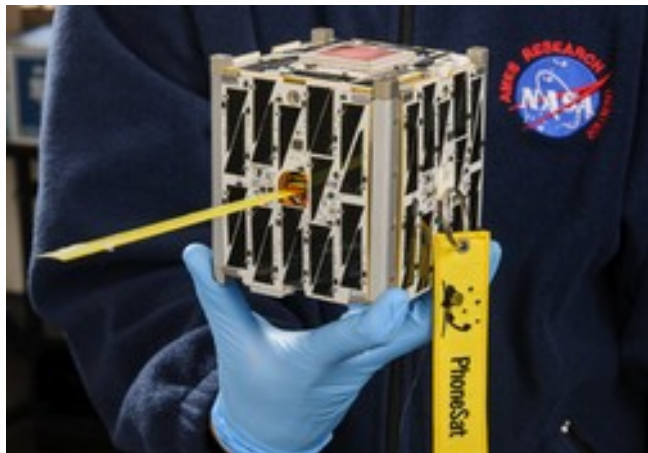
Real deployed CubSat based projects on



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REAL DEPLOYED CUBSAT BASED PROJECTS ON



Maybe...

But we are not alone.



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COLEGIO SAN JUAN BOSCO LA CUESTA

REAL DEPLOYED CUBSAT BASED PROJECTS ON

50\$ Sat



Built by three
amateur radio
operators.



7 months in orbit.



Dniepper russian
rocket.



www.50dollarsat.info



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COLEGIO SAN JUAN BOSCO LA CUESTA

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/>



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COLEGIO SAN JUAN BOSCO LA CUESTA

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



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#boscoverysat

#tlpinnova



A satellite with homespun electronics

July 2016