



# **A satellite with homespun electronics**

July 2016

# INDEX

---

**Problem**

**Solution**

**Project Philosophy**

**Team**

**Achievements**

**Tools**

**Roadmap**

**Current I+D process**



**salesianos**

COLEGIO SAN JUAN BOSCO LA CUESTA

**Problem**

Solution

Project Philosophy

Team

Achievements

Tools

Roadmap

Current I+D process

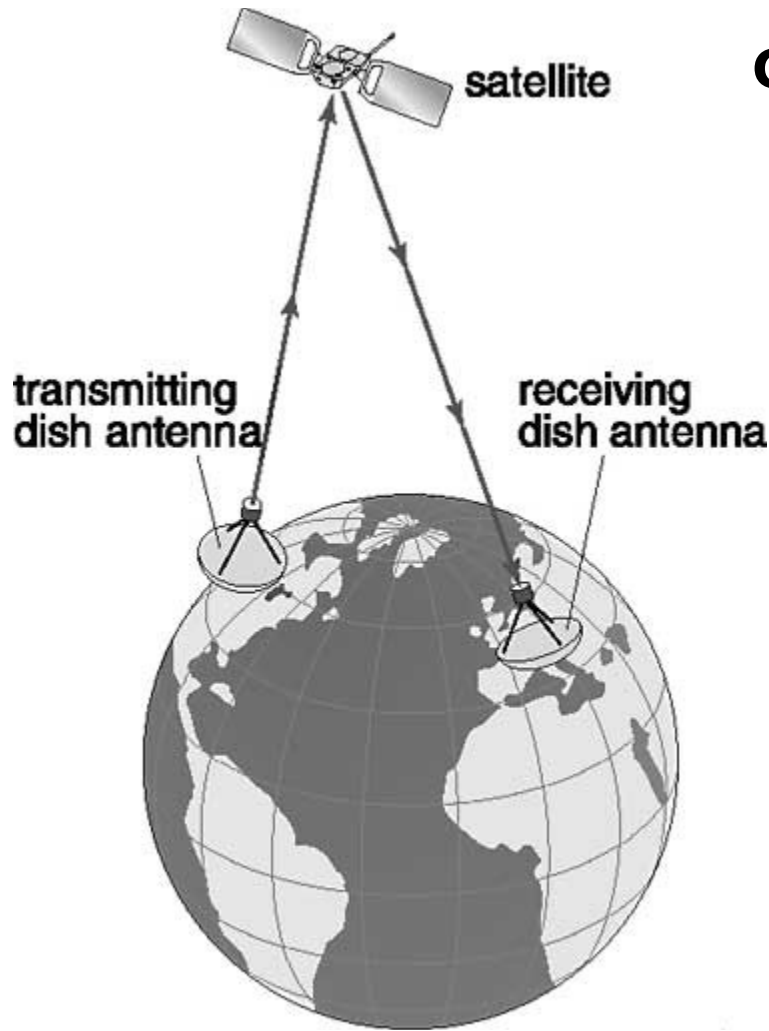


**salesianos**

COLEGIO SAN JUAN BOSCO LA CUESTA

# PROBLEM

---



## Classic Satellite Communications usual problems

High costs  
Unaccessible  
Private owners  
Low bandwidth  
Maintenance



**salesianos**

COLEGIO SAN JUAN BOSCO LA CUESTA

# INDEX

---

Problem

**Solution**

Project Philosophy

Team

Achievements

Tools

Roadmap

Current I+D process

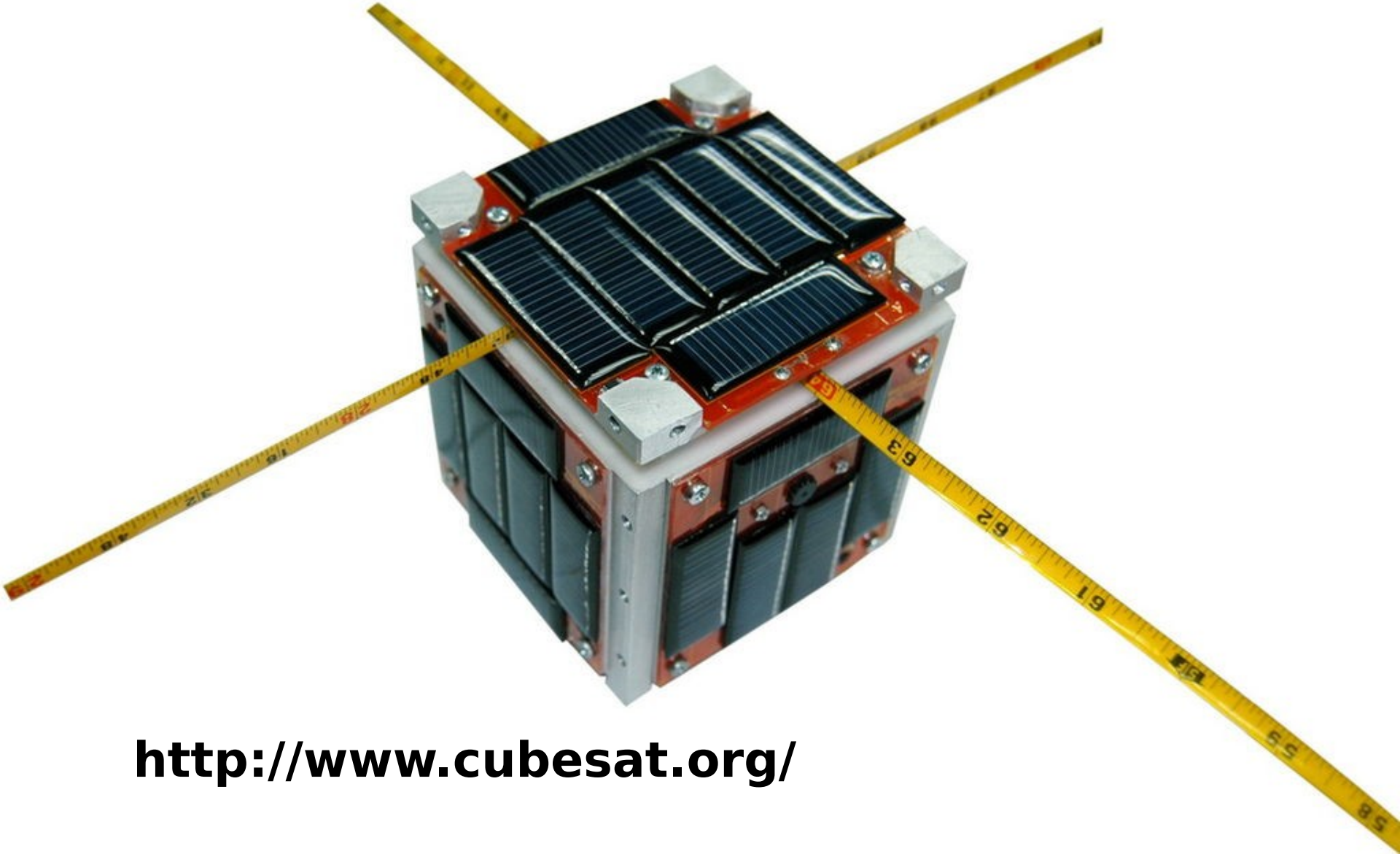


**salesianos**

COLEGIO SAN JUAN BOSCO LA CUESTA

# SOLUTION

---



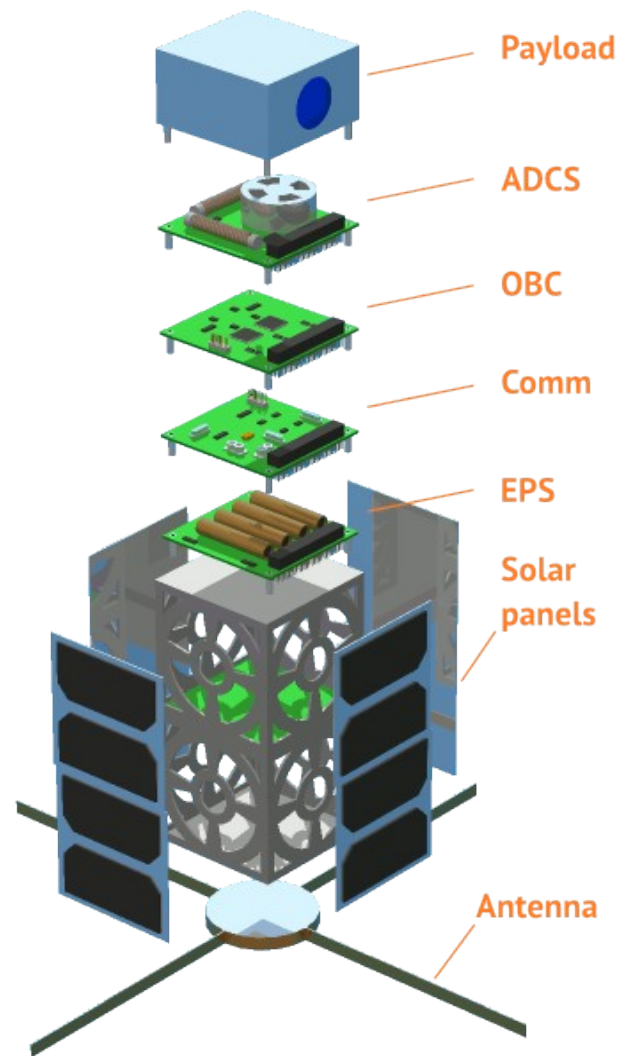
<http://www.cubesat.org/>



**salesianos**

COLEGIO SAN JUAN BOSCO LA CUESTA

# SOLUTION



**salesianos**

COLEGIO SAN JUAN BOSCO LA CUESTA

# SOLUTION

---

<https://satnogs.org/>

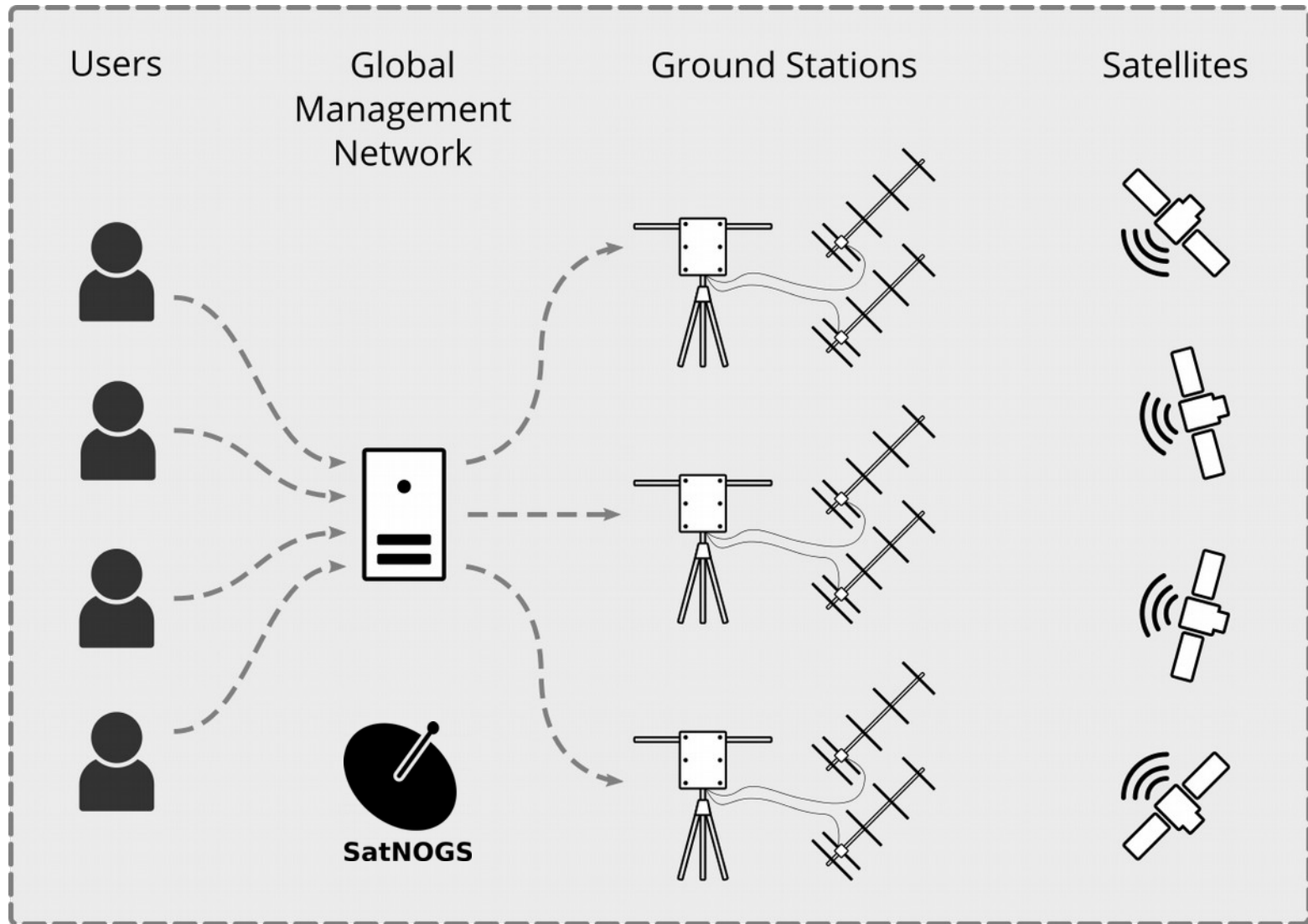


**salesianos**

COLEGIO SAN JUAN BOSCO LA CUESTA



# SOLUTION



**salesianos**

COLEGIO SAN JUAN BOSCO LA CUESTA

Problem  
Solution

# Project Philosophy

Team  
Achievements  
Tools  
Roadmap  
Current I+D process



# PROJECT PHILOSOPHY

---



**open** source



**open** hardware



**salesianos**

COLEGIO SAN JUAN BOSCO LA CUESTA

# INDEX

---

Problem

Solution

Project Philosophy

**Team**

Achievements

Tools

Roadmap

Current I+D process



**salesianos**

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**



**salesianos**

COLEGIO SAN JUAN BOSCO LA CUESTA

# TEAM

---



**salesianos**

**LA CUESTA**



**salesianos**

COLEGIO SAN JUAN BOSCO LA CUESTA

# INDEX

---

Problem

Solution

Project Philosophy

Team

## Achievements

Tools

Roadmap

Current I+D process



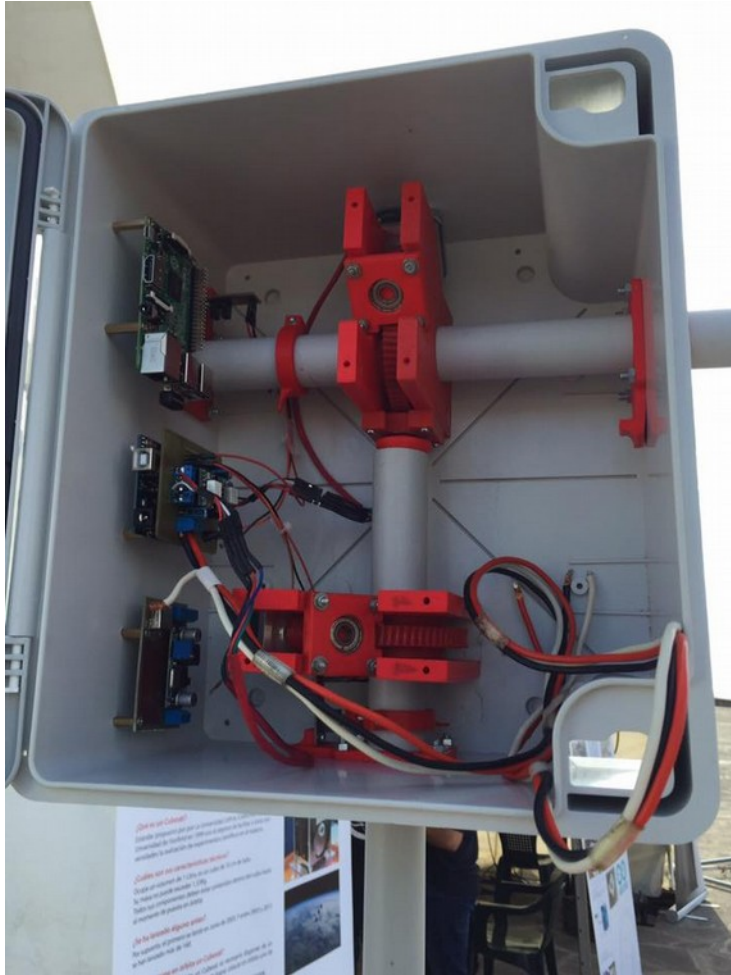
**salesianos**

COLEGIO SAN JUAN BOSCO LA CUESTA



# ACHIEVEMENTS

## RADIO STATION (SATELLITE TRACKER)



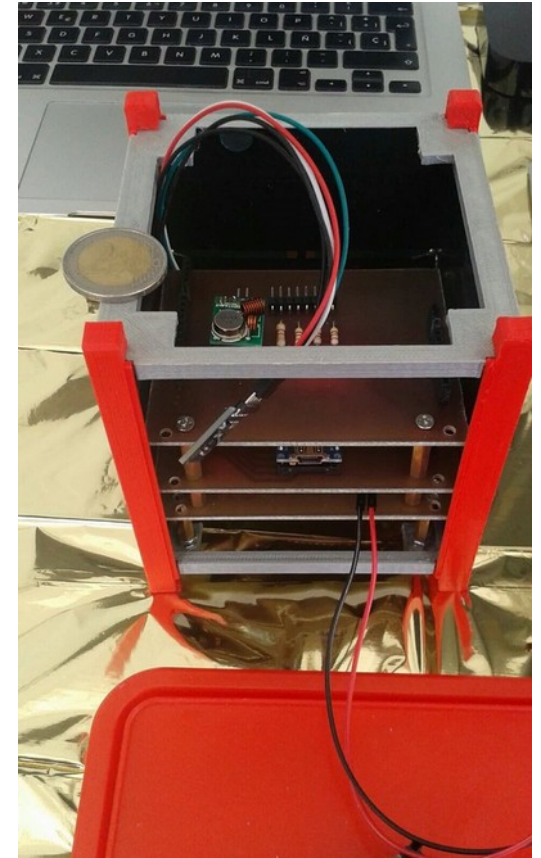
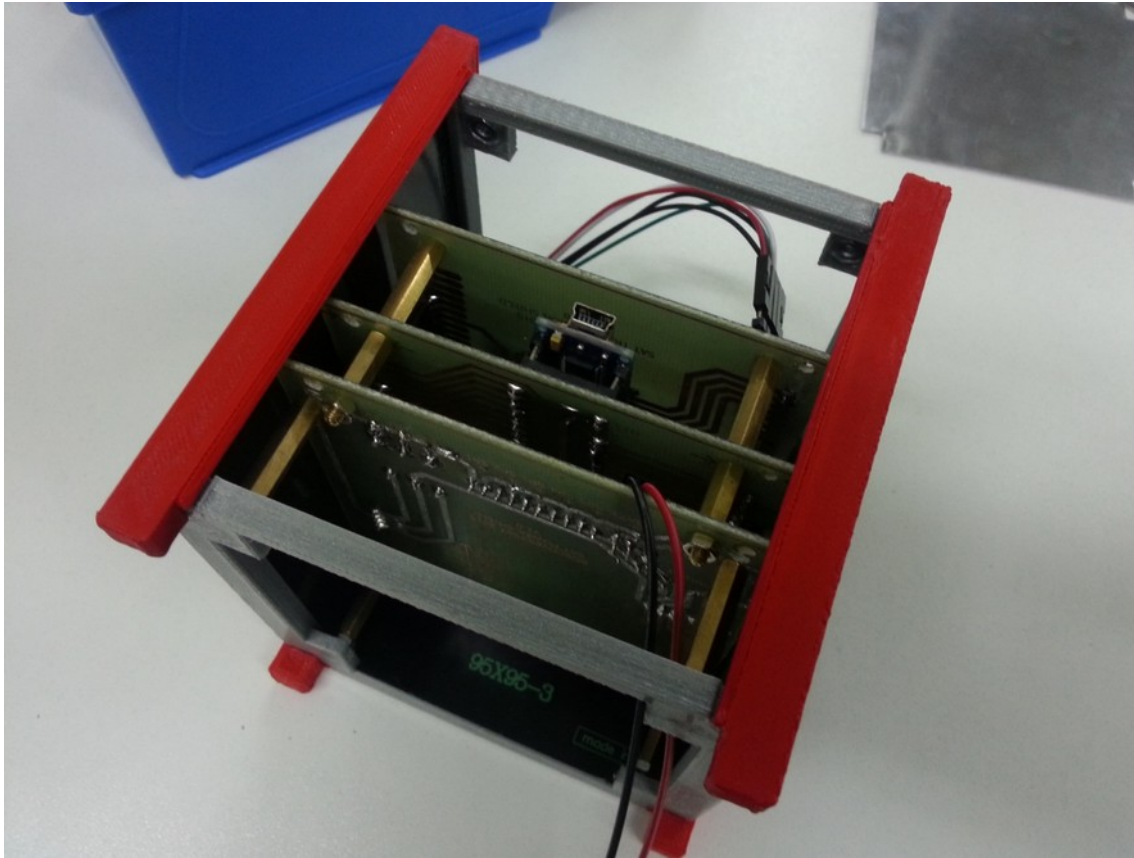
**salesianos**

COLEGIO SAN JUAN BOSCO LA CUESTA



# ACHIEVEMENTS

## SATELLITE



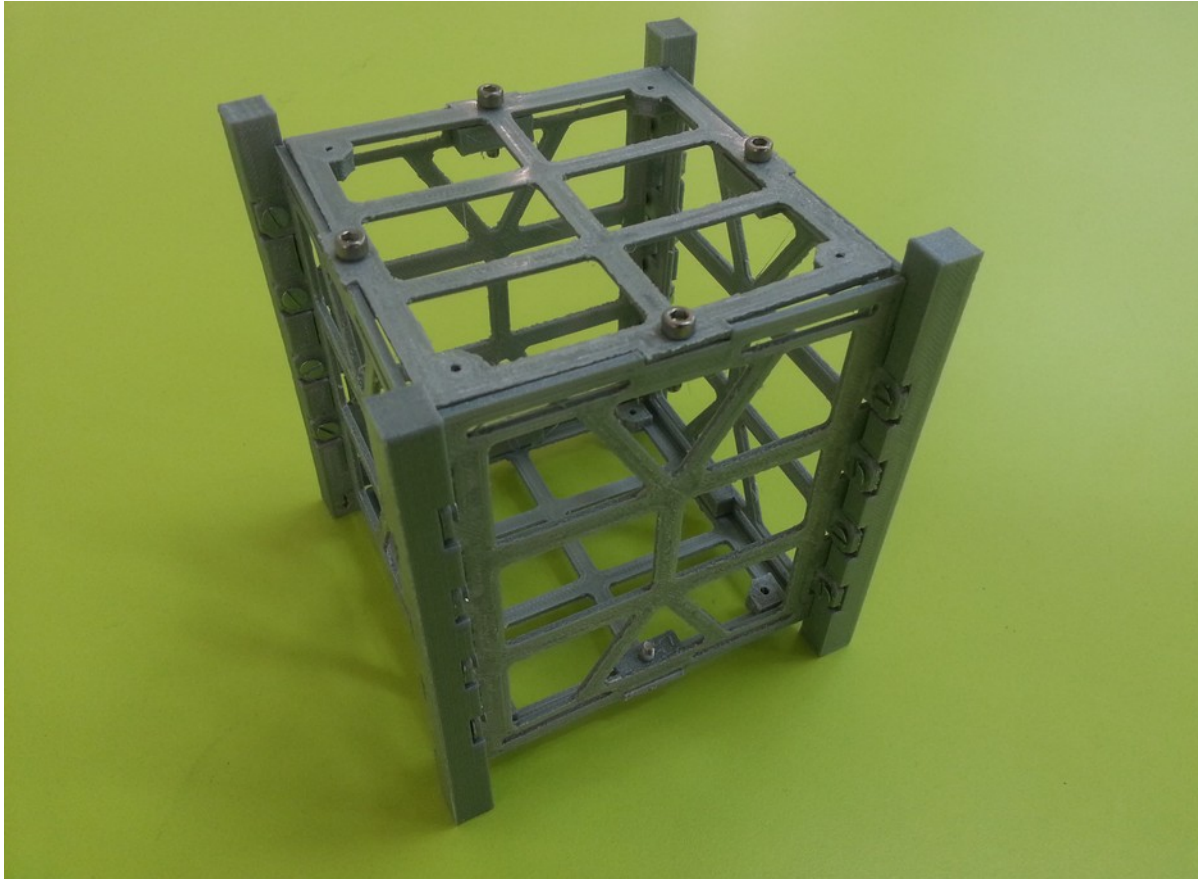
### MARK I - ALPHA 1



# ACHIEVEMENTS

---

## SATELLITE



### MARK I - ALPHA 2

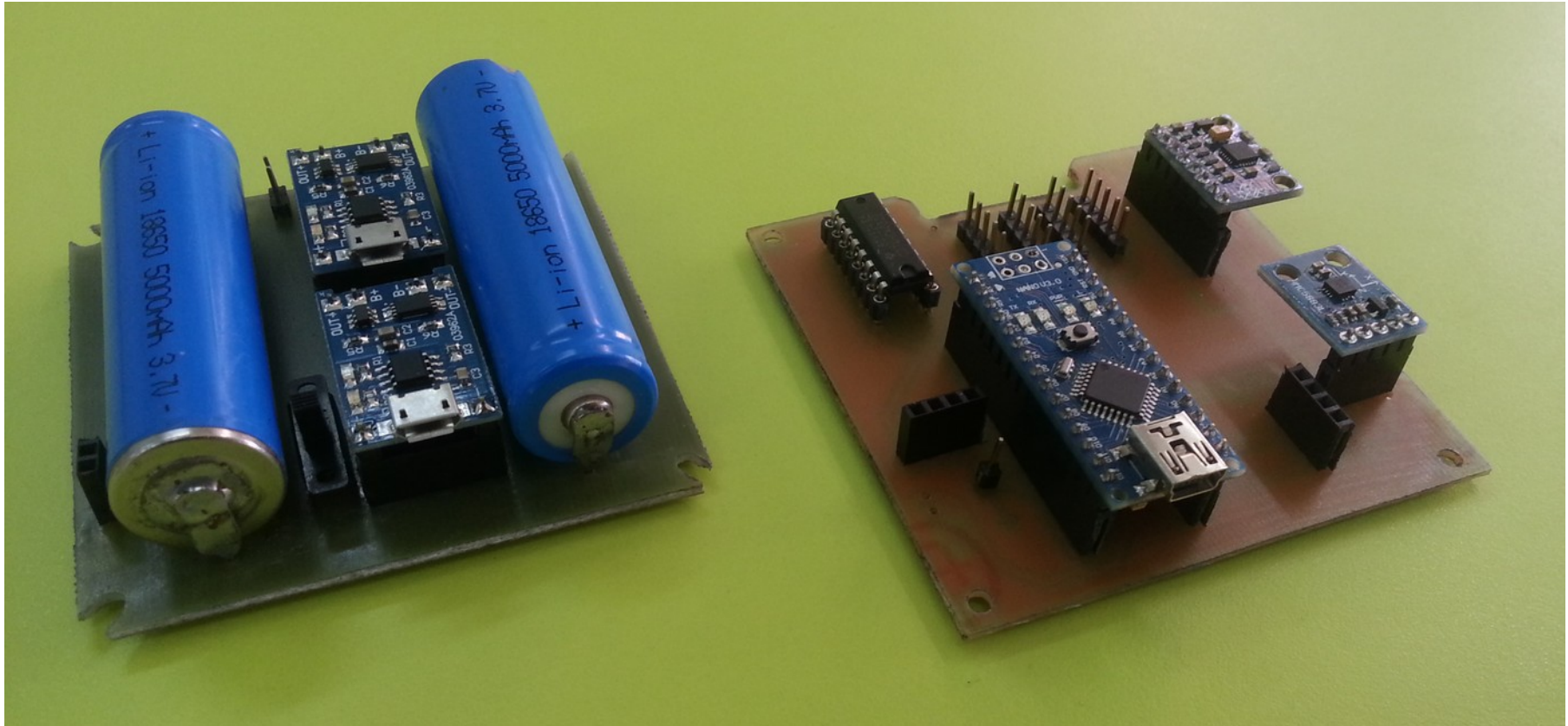


**salesianos**  
COLEGIO SAN JUAN BOSCO LA CUESTA

# ACHIEVEMENTS

---

## SATELLITE



### MARK I - ALPHA 2



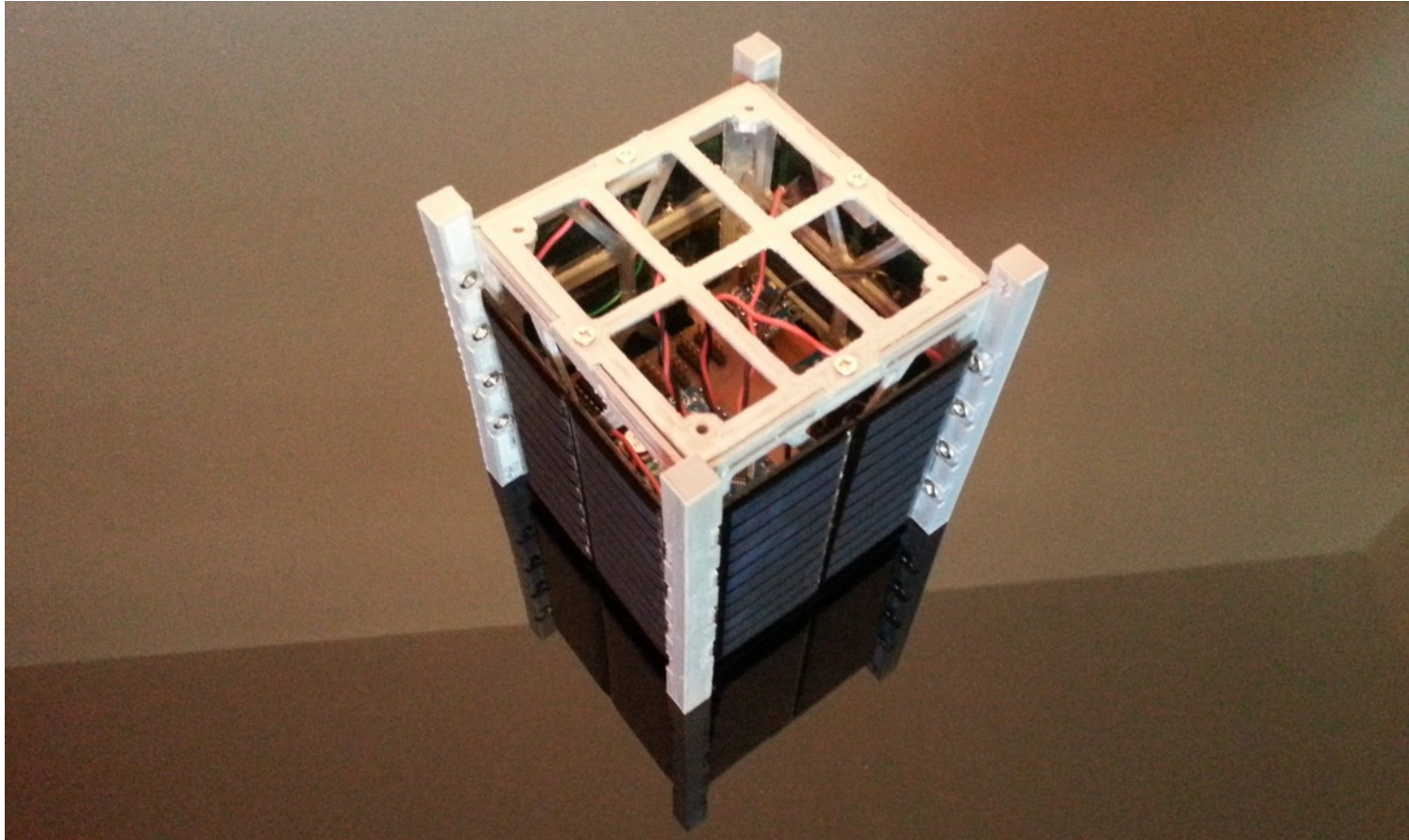
**salesianos**  
COLEGIO SAN JUAN BOSCO LA CUESTA



# ACHIEVEMENTS

---

## SATELLITE




**MARK I - ALPHA 2**






**salesianos**  
COLEGIO SAN JUAN BOSCO LA CUESTA

# ACHIEVEMENTS

## DOCUMENTATION (GitHub Repository)






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



**Boscovery SAT**  
boscoverysat

 Tenerife, España  
 [boscoverysat@gmail.com](mailto:boscoverysat@gmail.com)  
 Joined on 27 Aug 2015

2


Followers


0


Starred


0

Following






 Contributions

 Repositories


 Public activity

 Edit profile

### Popular repositories

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



**salesianos**  
COLEGIO SAN JUAN BOSCO LA CUESTA

# INDEX

---

Problem

Solution

Project Philosophy

Team

Achievements

**Tools**

Roadmap

Current I+D process



**salesianos**

COLEGIO SAN JUAN BOSCO LA CUESTA

# TOOLS

---

## COMMUNICATION



Gmail



Whatsapp



**salesianos**

COLEGIO SAN JUAN BOSCO LA CUESTA

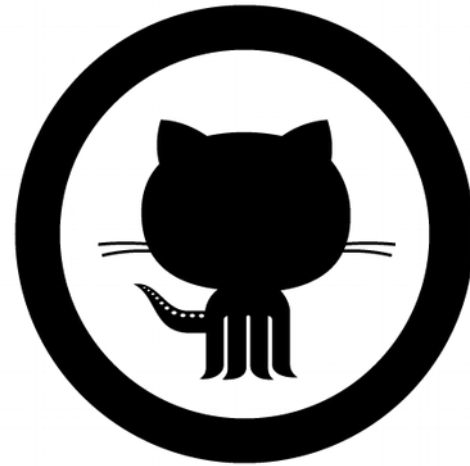
# TOOLS

---

## TEAMWORK



Google Drive



GitHub





# TOOLS

---

## MANAGEMENT



Google  
Calendar



Trello



**salesianos**

COLEGIO SAN JUAN BOSCO LA CUESTA

# TOOLS

---

## DEVELOPMENT (SW & HW)

Editors and IDEs



Prog. Languages



Version Control



Operative Systems



Satellite & Tracker



# INDEX

---

Problem

Solution

Project Philosophy

Team

Achievements

Tools

**Roadmap**

Current I+D process



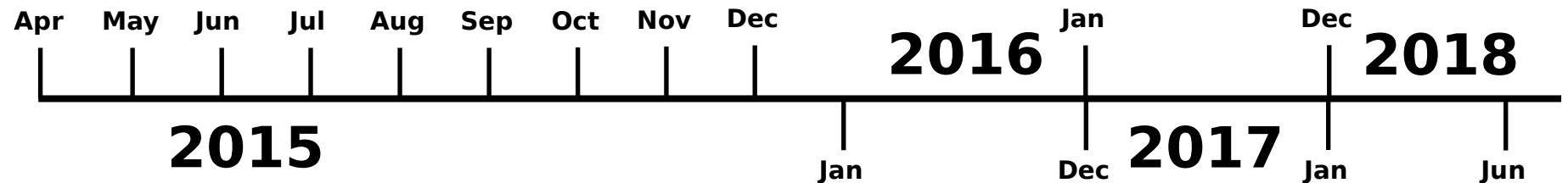
**salesianos**

COLEGIO SAN JUAN BOSCO LA CUESTA

# ROADMAP

---

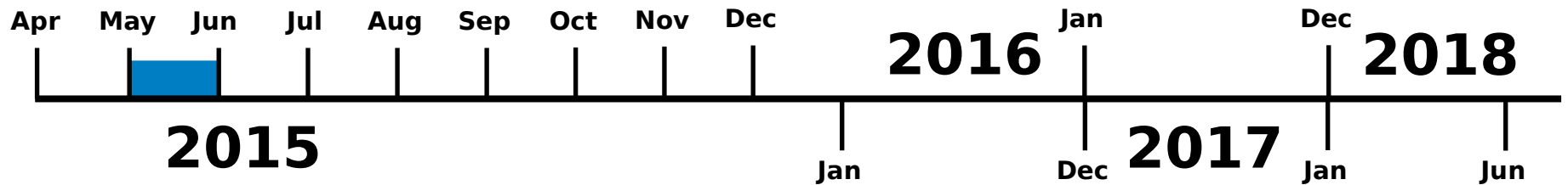
## It is a long time project



**salesianos**

COLEGIO SAN JUAN BOSCO LA CUESTA

# ROADMAP



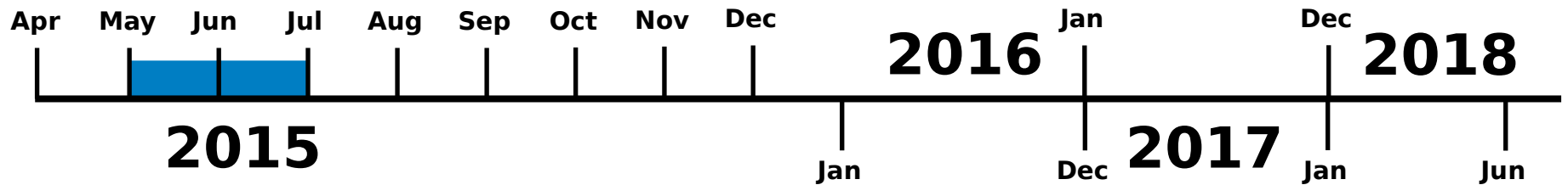
**salesianos**

COLEGIO SAN JUAN BOSCO LA CUESTA

# ROADMAP



**Saint John Bosco  
La Cuesta School**  
*Projects Week 2015  
Satellite Tracker*



**salesianos**

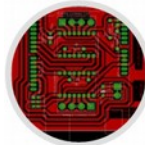
COLEGIO SAN JUAN BOSCO LA CUESTA

# ROADMAP



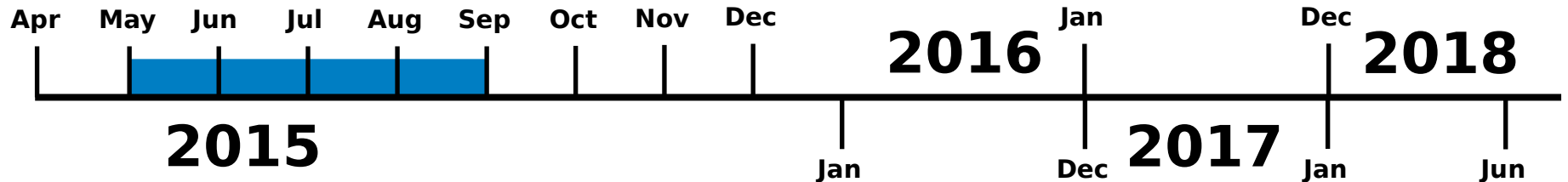
## Saint John Bosco La Cuesta School

*Projects Week 2015  
Satellite Tracker*



## Satellite Tracker

*First systems development*



**salesianos**

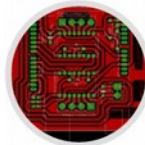
COLEGIO SAN JUAN BOSCO LA CUESTA

# ROADMAP



## Saint John Bosco La Cuesta School

*Projects Week 2015  
Satellite Tracker*



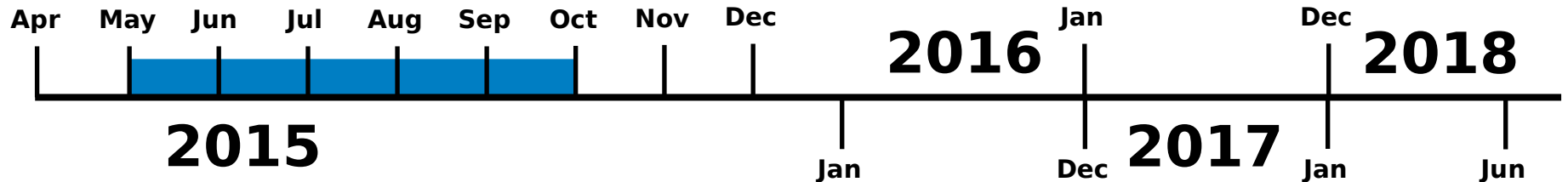
## Satellite Tracker

*First systems development*



## Satellite

*Orbital sensors testing*



**salesianos**

COLEGIO SAN JUAN BOSCO LA CUESTA

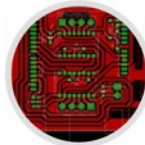


# ROADMAP



## Saint John Bosco La Cuesta School

*Projects Week 2015  
Satellite Tracker*



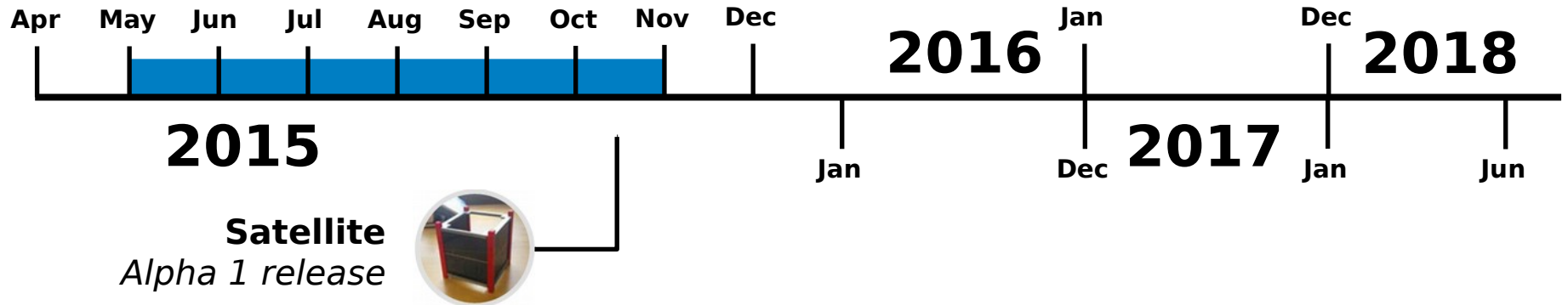
## Satellite Tracker

*First systems development*



## Satellite

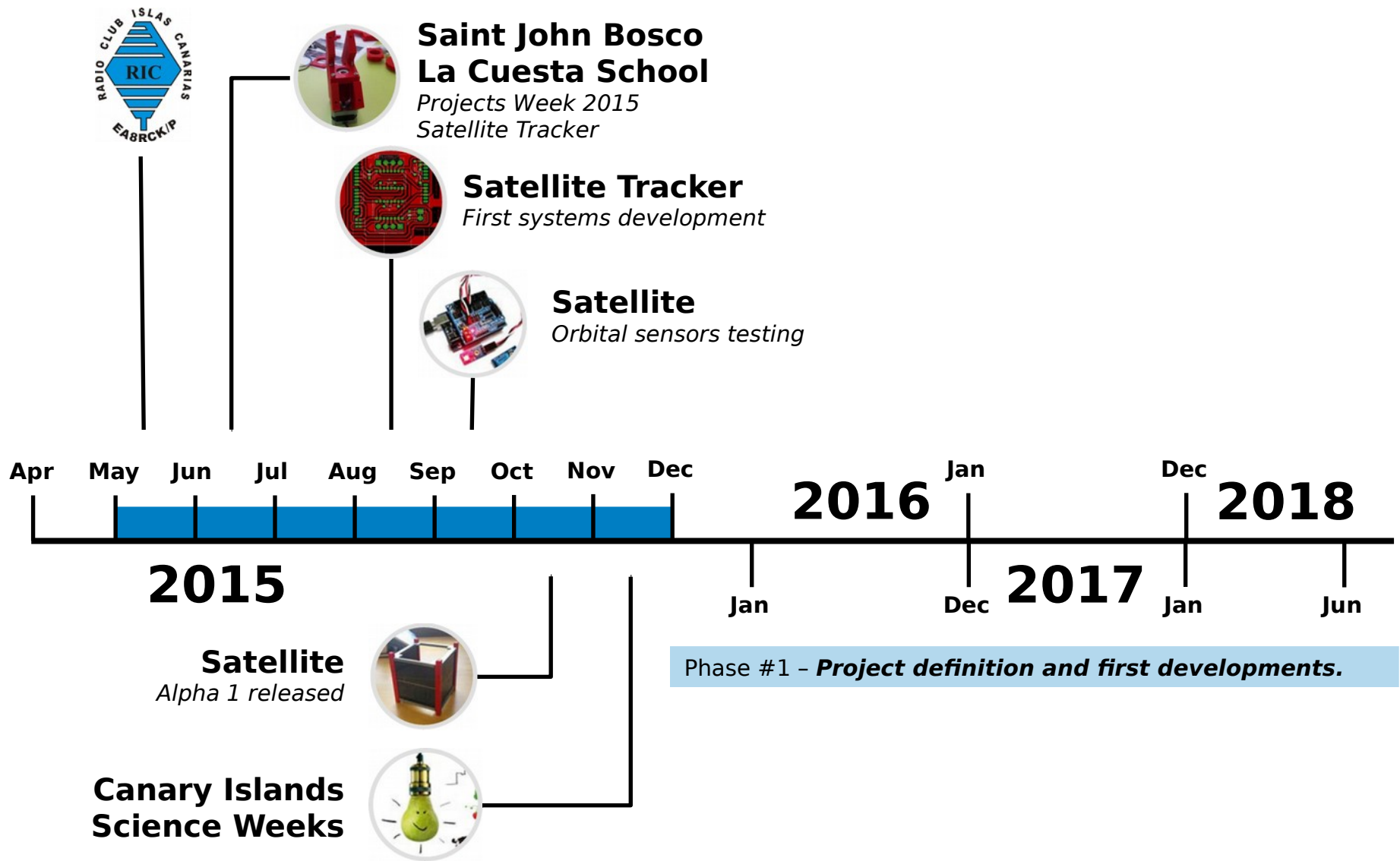
*Orbital sensors testing*



**salesianos**

COLEGIO SAN JUAN BOSCO LA CUESTA

# ROADMAP



**salesianos**

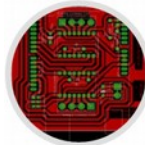
COLEGIO SAN JUAN BOSCO LA CUESTA

# ROADMAP



## Saint John Bosco La Cuesta School

*Projects Week 2015*  
*Satellite Tracker*



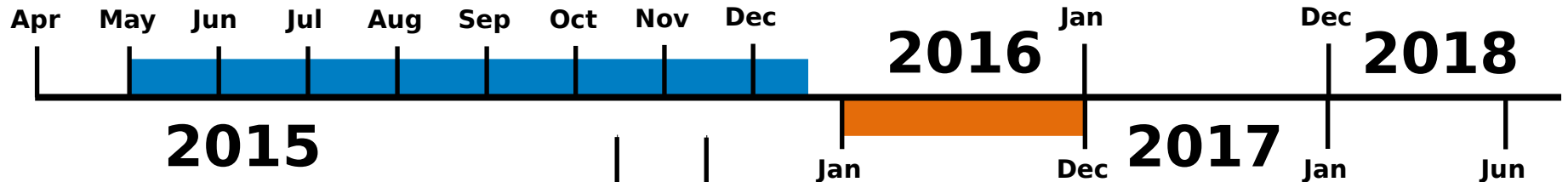
## Satellite Tracker

*First systems development*



## Satellite

*Orbital sensors testing*



## Satellite

*Alfa 1 release*



## Canary Islands Science Weeks



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

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



**salesianos**

COLEGIO SAN JUAN BOSCO LA CUESTA

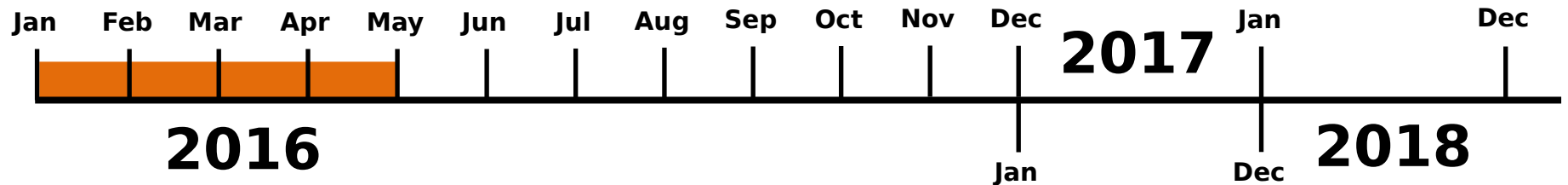
# 2016



# ROADMAP



**Research &  
Documentation**



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

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



**salesianos**

COLEGIO SAN JUAN BOSCO LA CUESTA

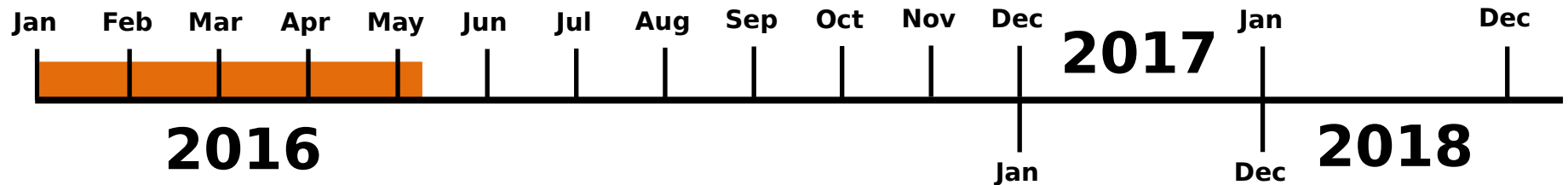
# ROADMAP



**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.***



**salesianos**

COLEGIO SAN JUAN BOSCO LA CUESTA

# ROADMAP

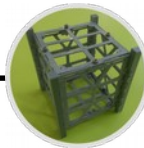


**Research &  
Documentation**



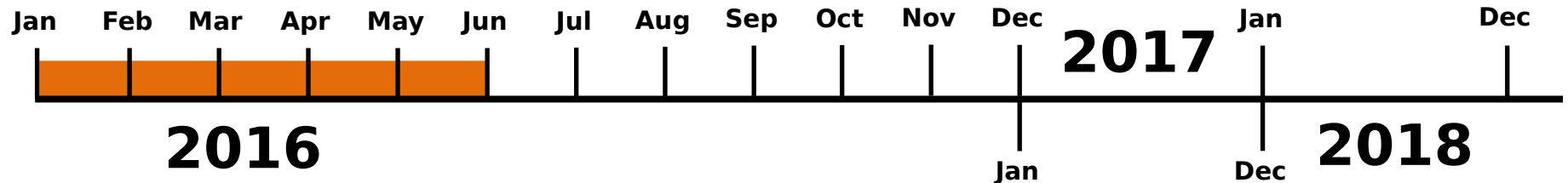
**III Science and Technology  
National Award**

*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.***



**salesianos**

COLEGIO SAN JUAN BOSCO LA CUESTA

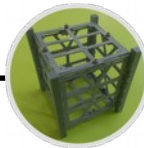
# ROADMAP



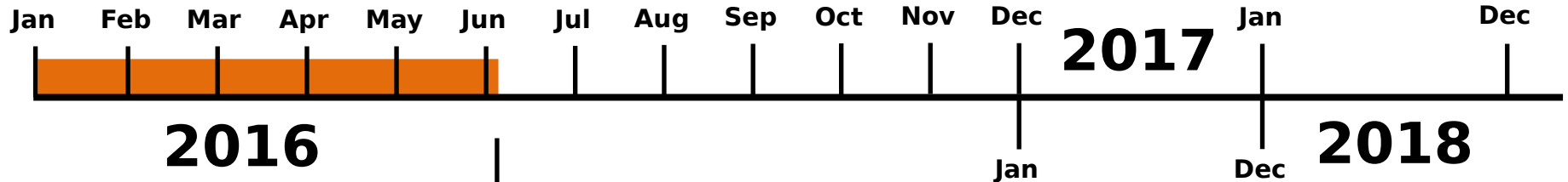
**Research &  
Documentation**



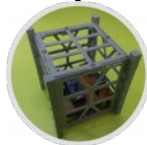
**III Science and Technology  
National Award**  
*St. Louis University Madrid*



**Structure & Electronics  
design**  
*3D printed prototype and shields*



**Saint John Bosco  
La Cuesta School**  
*Projects Week 2016  
Satellite Structure Test*



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

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



**salesianos**

COLEGIO SAN JUAN BOSCO LA CUESTA



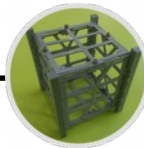
# ROADMAP



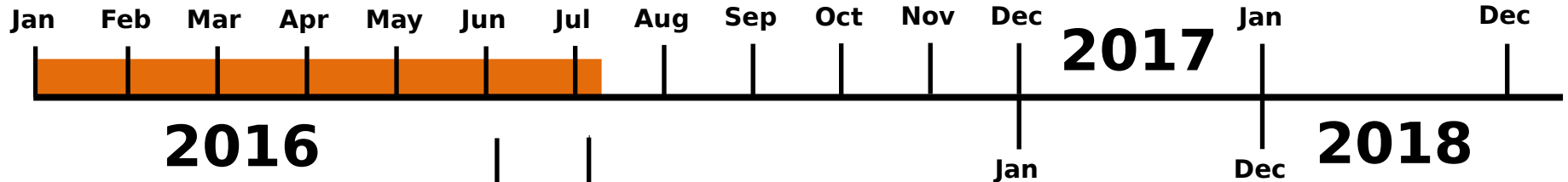
**Research &  
Documentation**



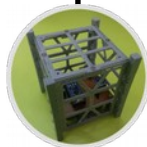
**III Science and Technology  
National Award**  
*St. Louis University Madrid*



**Structure & Electronics  
design**  
*3D printed prototype and shields*



**Saint John 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.**



**salesianos**

COLEGIO SAN JUAN BOSCO LA CUESTA

# ROADMAP

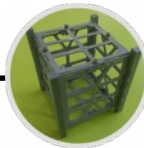


**Research &  
Documentation**



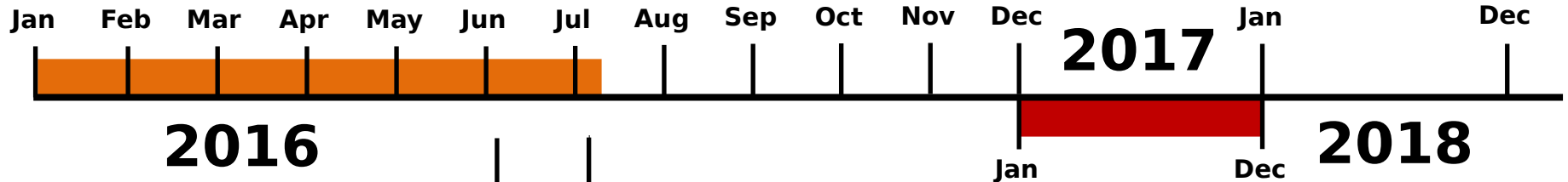
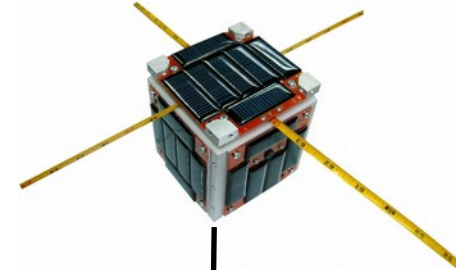
**III Science and Technology  
National Award**

*St. Louis University Madrid*



**Structure & Electronics  
design**

*3D printed prototype and shields*



**Saint John 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.**



**salesianos**

COLEGIO SAN JUAN BOSCO LA CUESTA

# ROADMAP

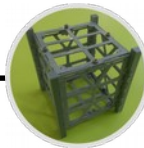


**Research &  
Documentation**



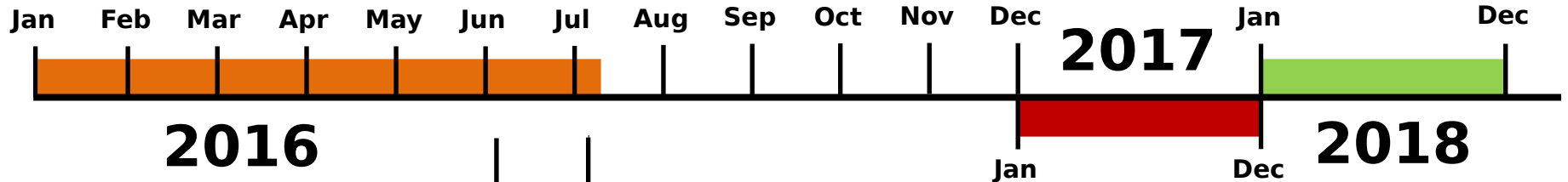
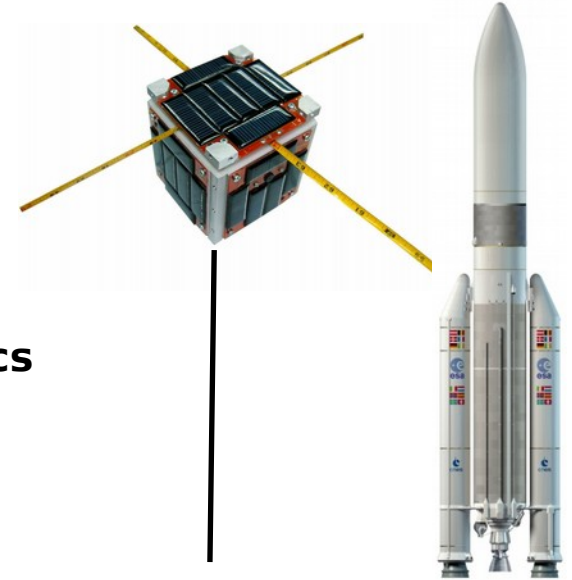
**III Science and Technology  
National Award**

*St. Louis University Madrid*



**Structure & Electronics  
design**

*3D printed prototype and shields*

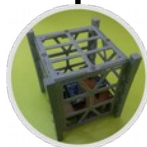


**Saint John Bosco  
La Cuesta School**

*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.**



**salesianos**

COLEGIO SAN JUAN BOSCO LA CUESTA

# INDEX

---

Problem

Solution

Project Philosophy

Team

Achievements

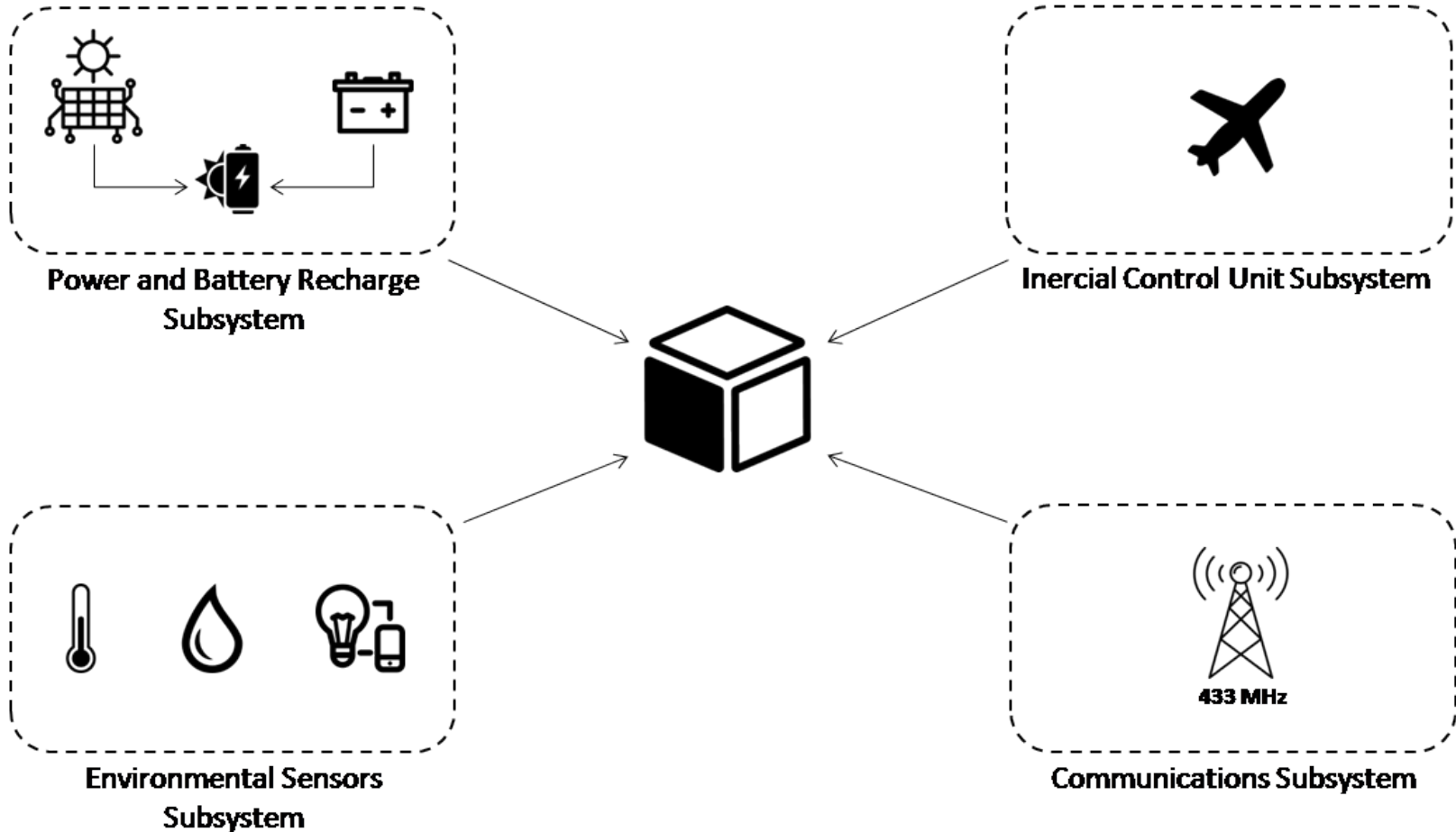
Tools

Roadmap

# Current I+D process



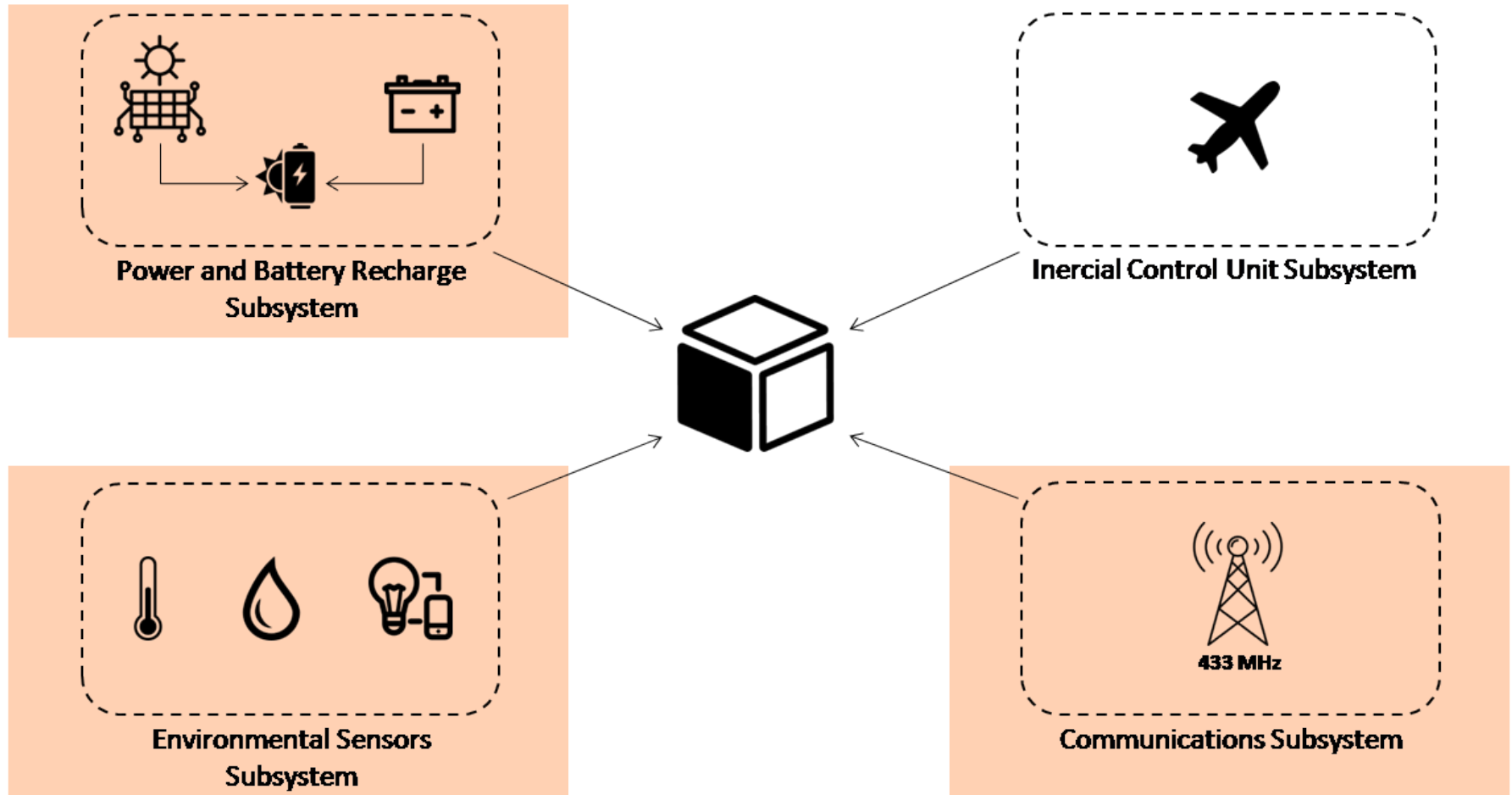
# CURRENT I+D PROCESS



**salesianos**

COLEGIO SAN JUAN BOSCO LA CUESTA

# CURRENT I+D PROCESS



**salesianos**

COLEGIO SAN JUAN BOSCO LA CUESTA



boscoverysat@gmail.com



@boscoverysat



boscoverysat



boscoverysat.github.com



BoscoverySAT



**salesianos**

COLEGIO SAN JUAN BOSCO LA CUESTA

---

# **Power and Battery Recharge Subsystem**



**salesianos**

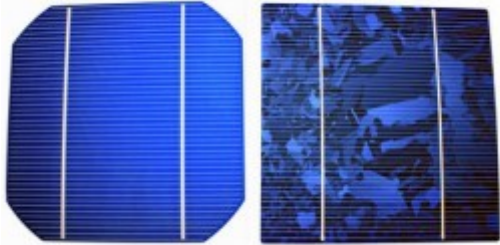
COLEGIO SAN JUAN BOSCO LA CUESTA



# POWER AND BATTERY RECHARGE SUBSYSTEM

---

## Facts



9,5 – 11 VDC/Side  
50 – 60mA/Side



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

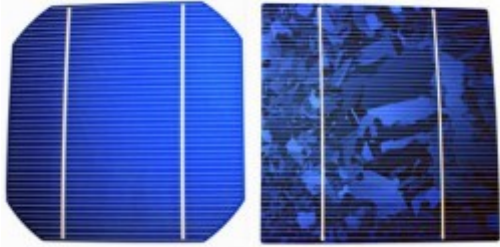


**salesianos**

COLEGIO SAN JUAN BOSCO LA CUESTA

# POWER AND BATTERY RECHARGE SUBSYSTEM

## Facts

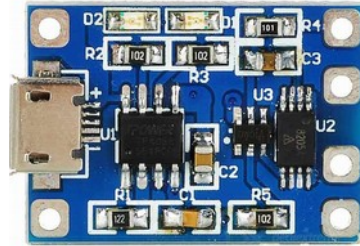


9,5 – 11 VDC/Side  
50 – 60mA/Side



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

## Fails

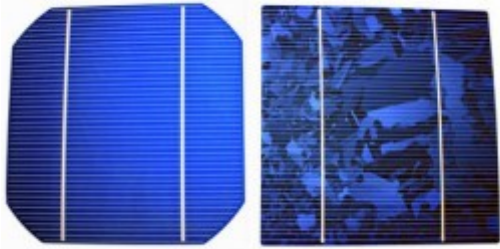


2 x TP4056  
4,1V @ 1A  
Battery Charger



# POWER AND BATTERY RECHARGE SUBSYSTEM

## Facts

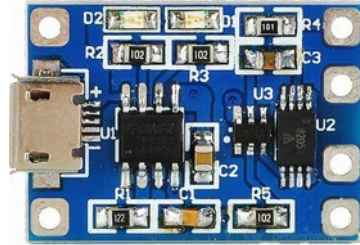


9,5 – 11 VDC/Side  
50 – 60mA/Side



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



---

# 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.



# 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





# 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.



**salesianos**

COLEGIO SAN JUAN BOSCO LA CUESTA

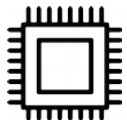
---

# 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.)

1.490 h

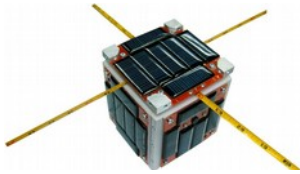


**salesianos**

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 €**



**salesianos**

COLEGIO SAN JUAN BOSCO LA CUESTA



# **A satellite with homespun electronics**

July 2016