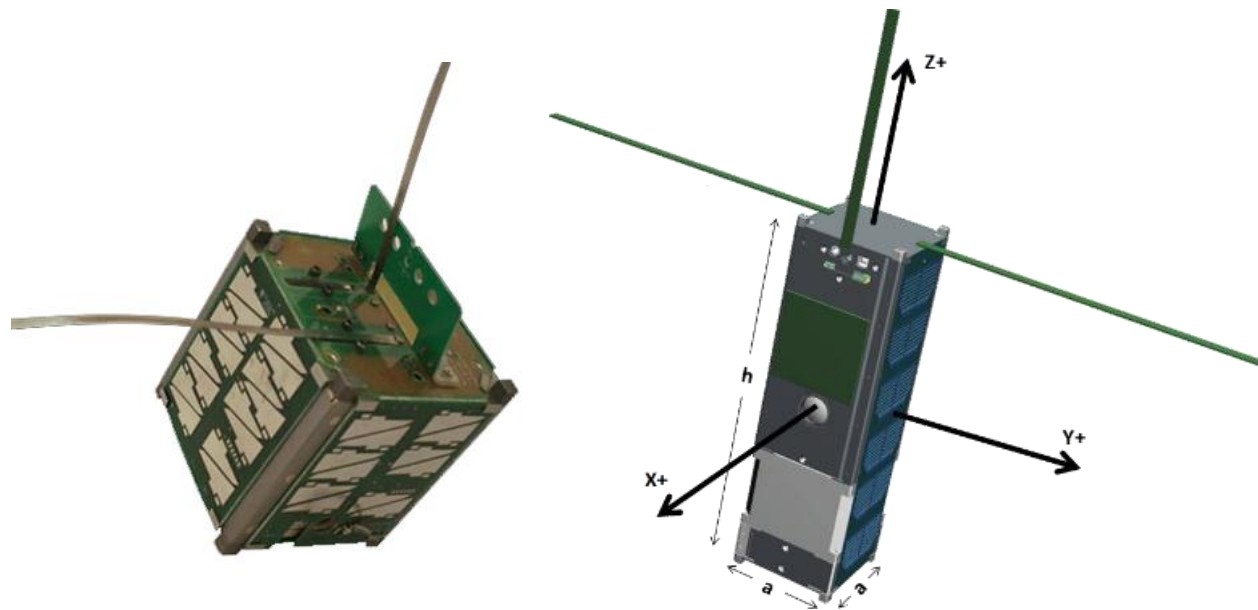


Development of the Satellite Mission Libertad-2: A Project for Empowering the Science and Technology in Colombia



Presented by:

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Electronic Engineer, Researcher and Science Communicator

Astronomical Observatory Department

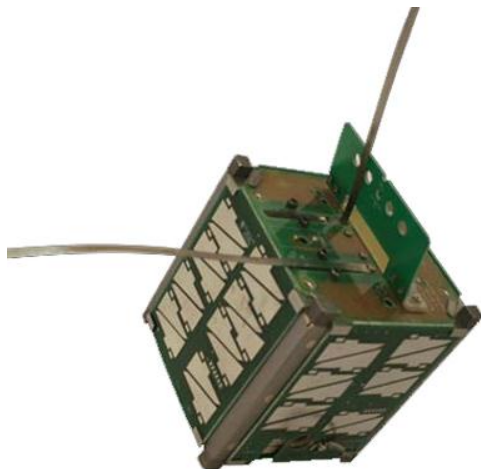
sergioa.sanchez@correo.usa.edu.co



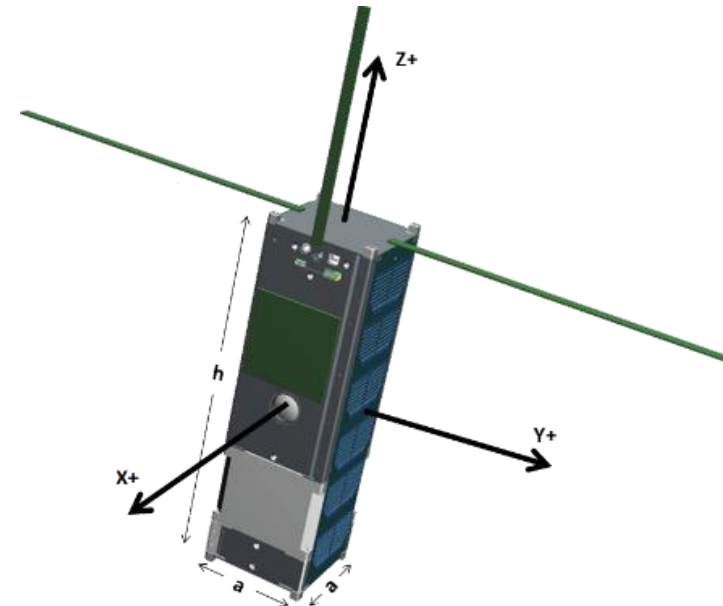
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Introduction

- Sergio Arboleda University is the first institution that launched a CubeSat satellite in Latin America in 2007 (and the number 37 in the World). That project was called Libertad 1.
- The first mission was developed by professors and students from the School of Exact Sciences and Engineering with the support of the Colombian Air Force and Calpoly University.
- Currently, we are working in the development of a second satellite which will be a 3U-size CubeSat and will carry a camera for Earth-observing purposes.



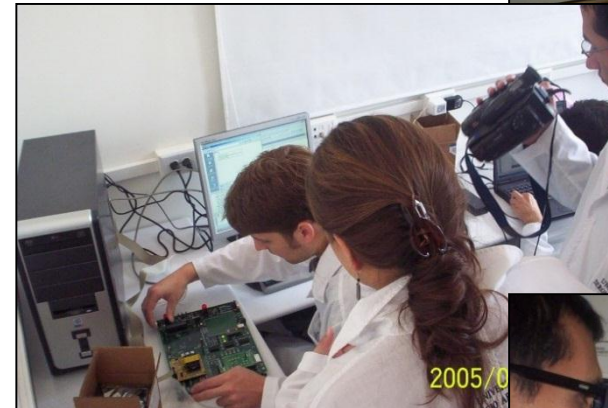
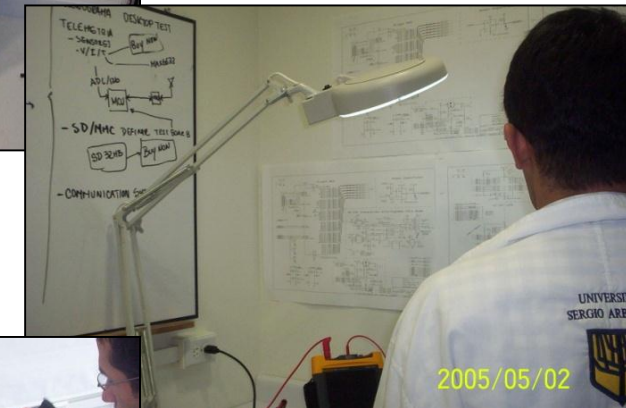
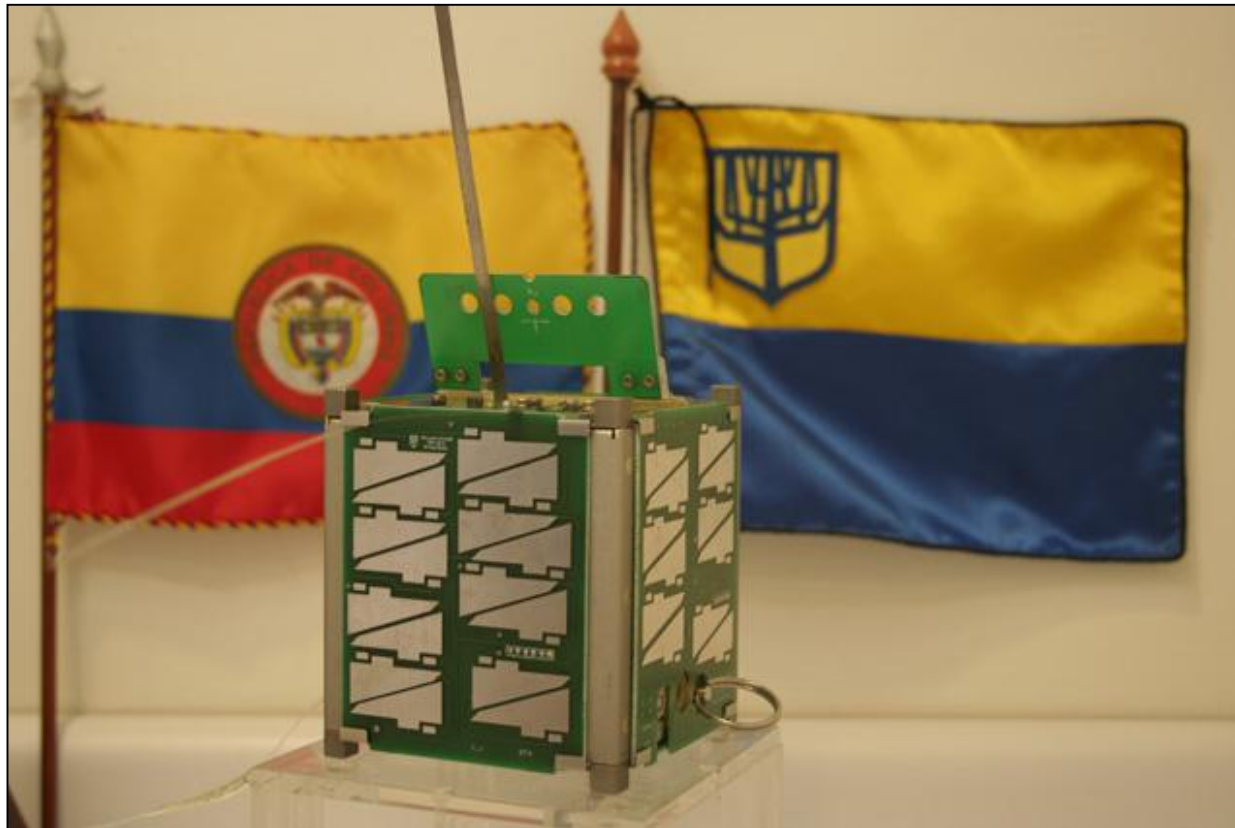
Libertad 1 (Launched: 2007)



Libertad 2 (3D model)

Libertad – 1

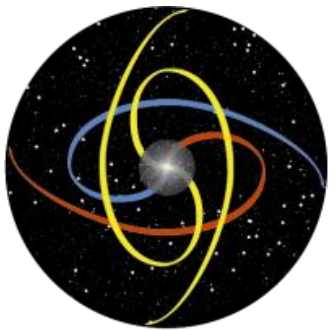
The first mission was launched on April 17th of 2007 after a 3-year project in Bogotá, Colombia.



Libertad – 1

Main Objectives:

- To demonstrate the capacity of Colombia in the development of an aerospace project.
- To receive telemetry data from the satellite to a ground station installed in the University's facilities.
- To start a Colombian commission in space affairs.



**COMISIÓN
COLOMBIANA
DEL ESPACIO**





Electrical Power Supply



Communications Board



Transmission Board

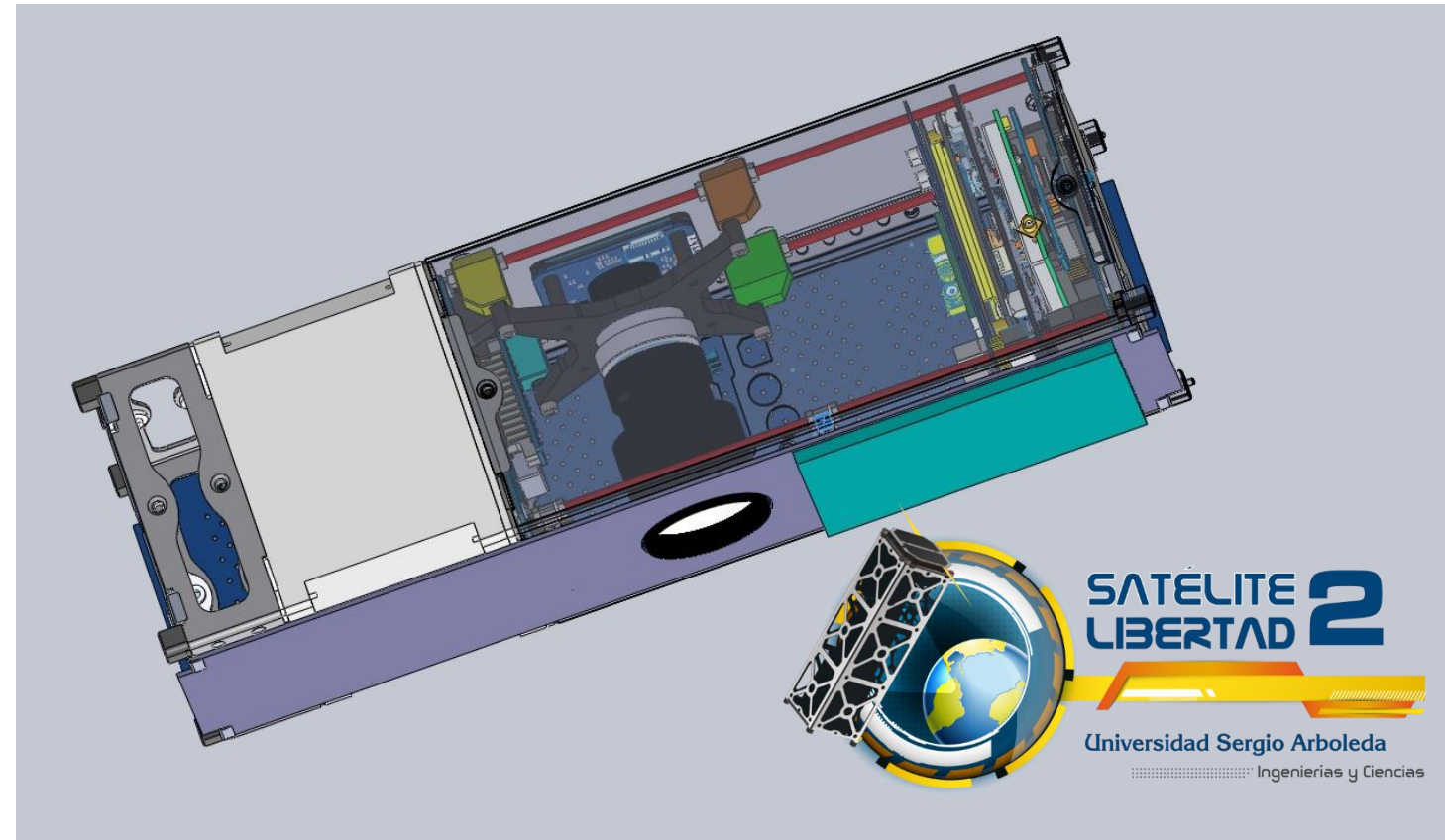
Project Libertad 2

Vision:

To promote a solid space program in Colombia where students and young professional can get immersed during the development of the whole mission.

Objective: To launch a nano-satellite into space with a optical camera which will be used to capture and send images of the Colombian soil.

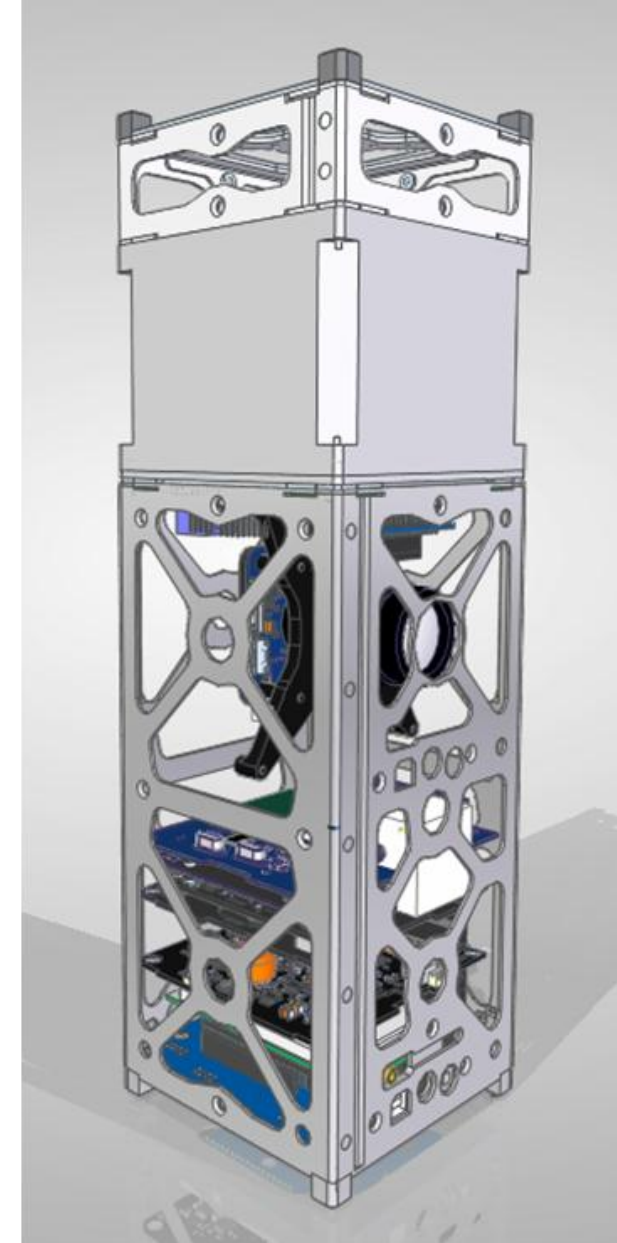
- ✓ **Classification:** Nano-Satellite
- ✓ **Weight:** 4 kg
- ✓ **Standard:** CubeSat
- ✓ **Payload:** Optical Camera
- ✓ **Orbit:** LEO
- ✓ **Average Height:** 500 km – 600 km



Mission Libertad 2

The subsystems considered for the satellite are shown below:

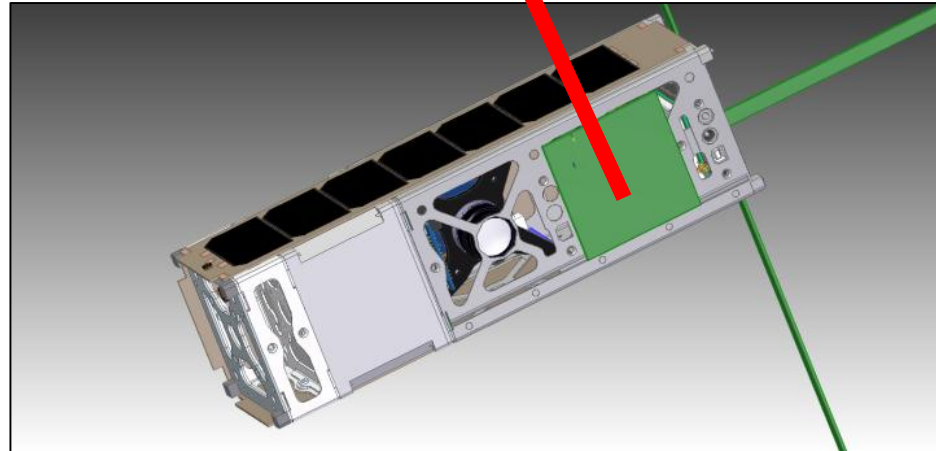
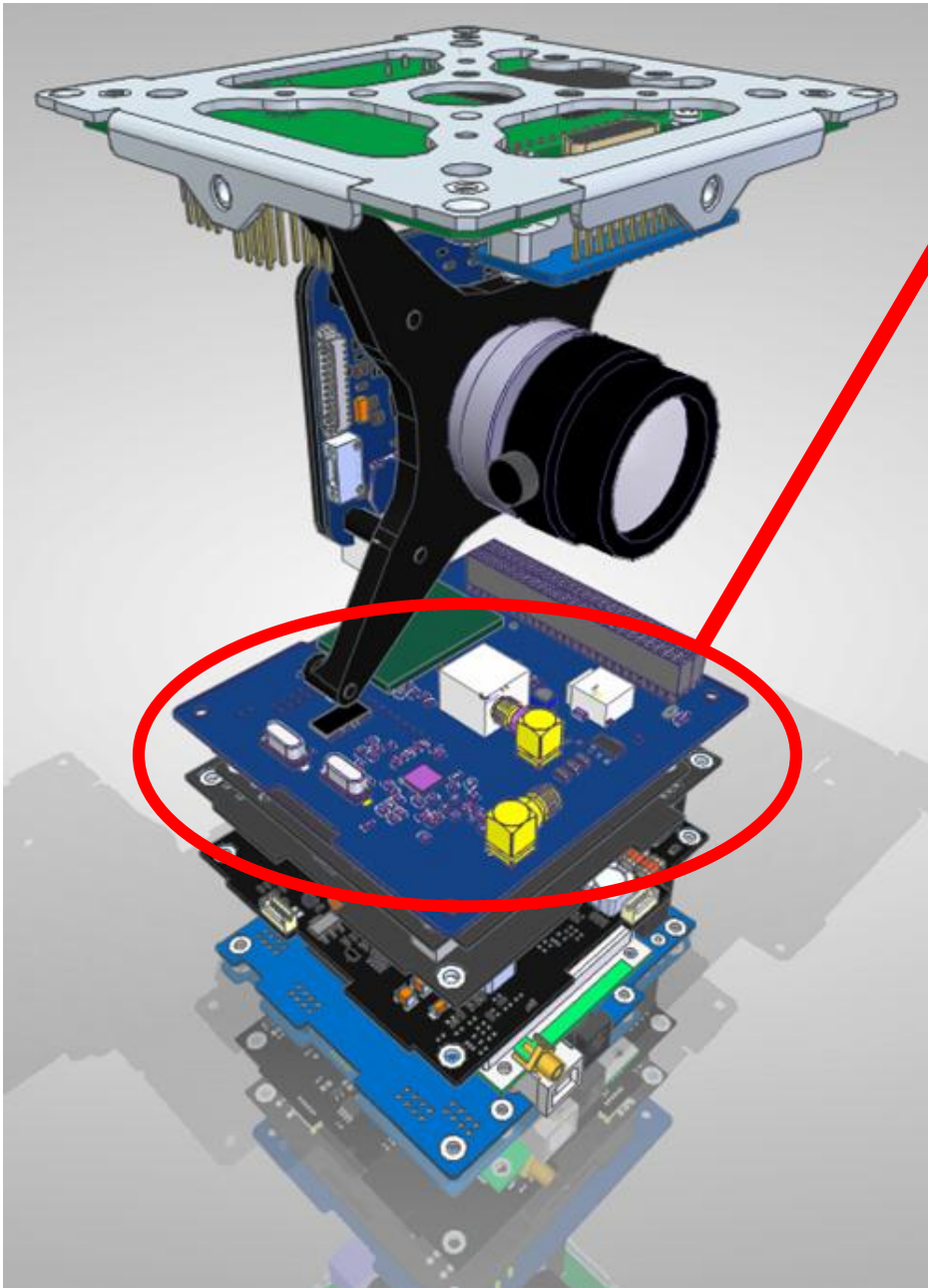
- Command and Data Handling (CDH)
- Electrical Power System (EPS)
- Communications (COMM)
- Ground Station (GS)
- *Attitude and Determination Control System (ADCS)*
- Payload (PYL) – Camera
- *Structure (MS)*
- *Thermal Control System (TCS)*



C&DH (On-Board Computer)



Communications



Frequencies:

Uplink: VHF 145,825 MHZ
Downlink: UHF 437,405 MHZ
S-band: 2,11 GHz



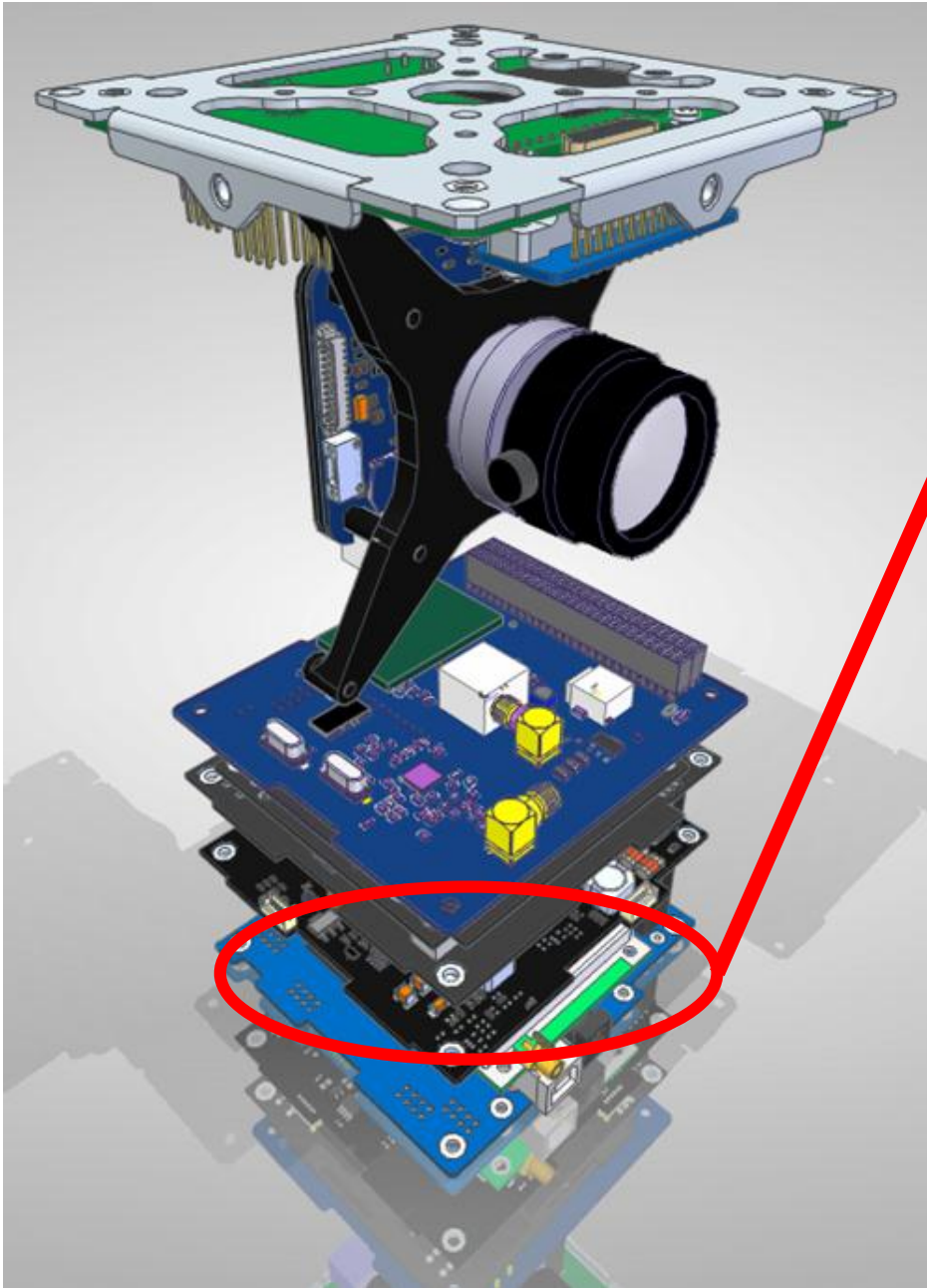


ADCS
(Attitude Determination
and Control System)

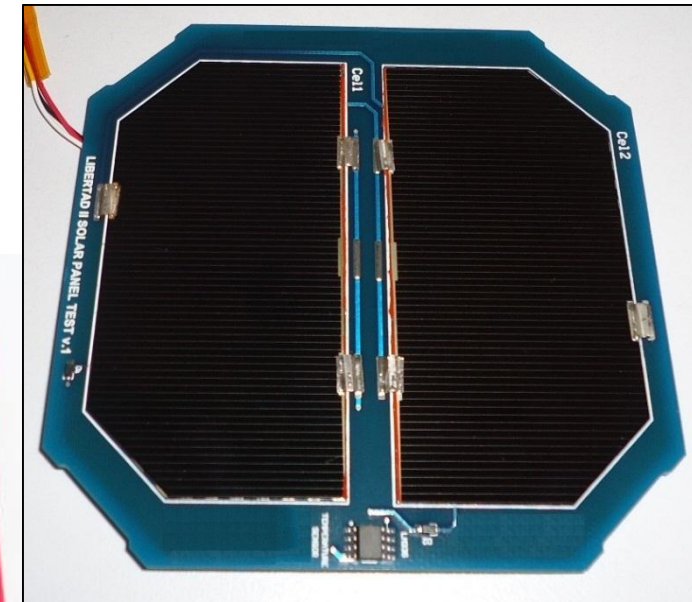


Reaction Wheels System of 3 axis

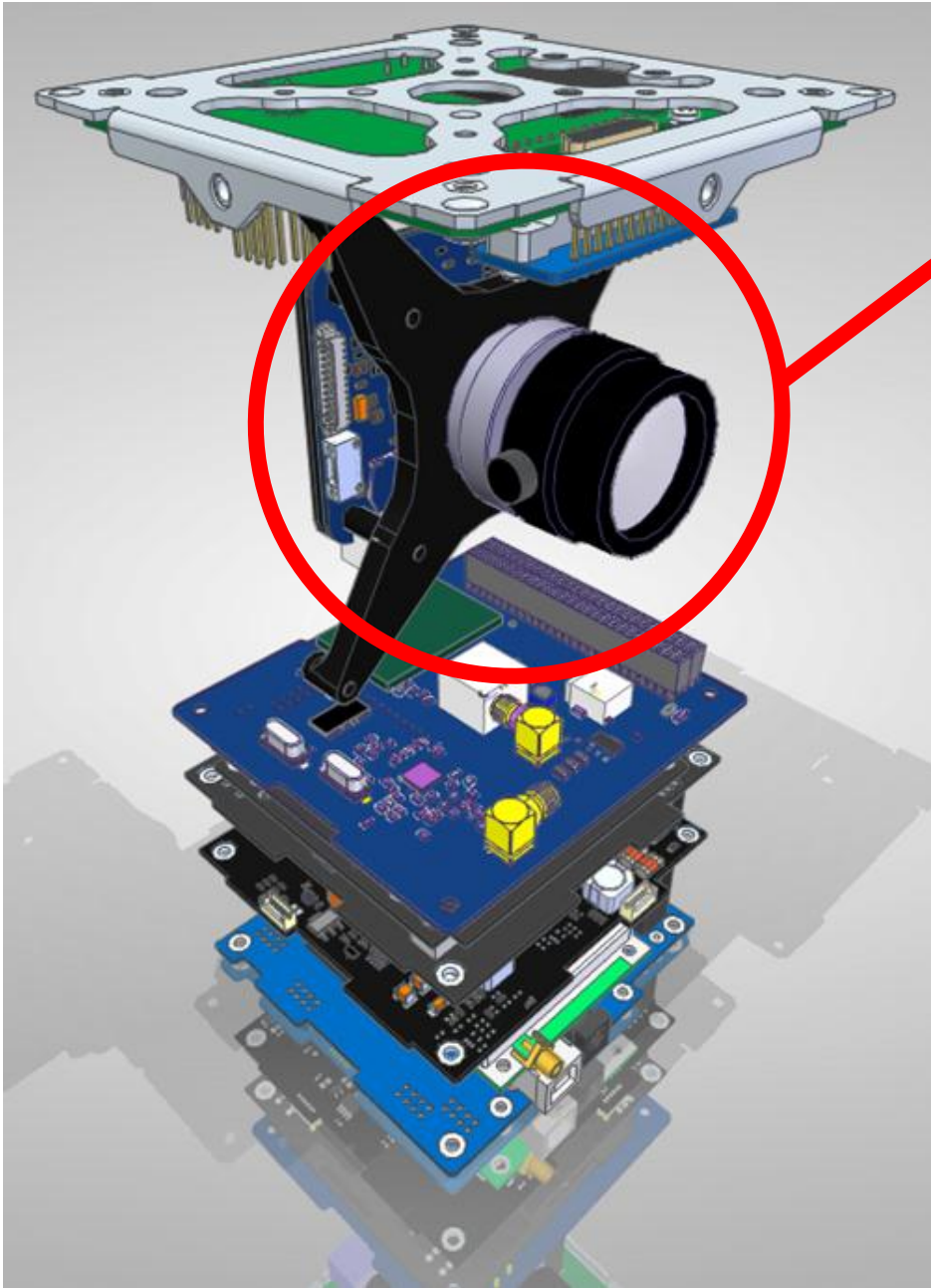
EPS (Electrical Power System)



EPS Board



Solar Panel



**Camera
(Payload- experiment)**

Optical Camera

80GSD = 80 Ground Sample Distance



Bogota from the ISS

Important Results

Papers written by members of the mission and published in journals:

Ítem	Título	Revista	Autor	ISSN
1	Evaluation of Techniques for Power Regulation on Nanosatellites	Esa Sp - Cd-Rom	Jesus Gonzalez Llorente, Ronald Hurtado, Sergio Sanchez Sanjuan, Eduardo Ortiz	1609-042X
2	Estimación de la cantidad de potencia suministrada por las celdas fotovoltaicas de un cubesat	Tecnura. Fondo Editorial Universidad Distrital Francisco Jose De Caldas	Jesus David Gonzalez Llorente, Gustavo Puerto Leguizamon	0123-921X
3	IDENTIFICATION OF DESIGN CONSIDERATIONS FOR SMALL SATELLITE REMOTE SENSING SYSTEMS IN LOW EARTH ORBIT	Journal Of Aerospace Technology And Management (JTAM)	FREDDY ALEXANDER DIAZ GONZALEZ, JUAN SEBASTIAN TRIANA CORREA, SEBASTIAN BAUTISTA VELASQUEZ,	2175-9146
4	Power Consumption Based on a Four Reaction Wheels in a Pyramidal Configuration	Advances In The Astronautical Sciences	Ronald Hurtado Velasco, Jesús González Llorente, Yesid Villota Narváez	0065-3438
5	Design of a Nanosatellite Ground Monitoring and Control Software - a Case Study	Journal Of Aerospace Technology And Management (JTAM)	FREDDY ALEXANDER DIAZ GONZALEZ	2175-9146
6	Comparison of the Incident Solar Energy and Battery Storage in a 3U CubeSat Satellite for Different Orientation Scenarios	Journal Of Aerospace Technology And Management (JTAM)	Sanchez-Sanjuan, S., Gonzalez-Llorente, J., & Hurtado-Velasco, R.	2175-9146
7	Simulation of the magnetic field generated by square shape Helmholtz coils	Applied Mathematical Modelling	Ronald Hurtado-Velasco, Jesus Gonzalez-Llorente	0307-904X
8	Quality Evaluation Of Chromatic Interpolation Algorithms For Image Acquisition System	Journal Of Aerospace Technology And Management (JTAM)	Diana Carolina Morón Hernández, Freddy Alexander Díaz González, Juan Sebastian Triana Correa, Pablo Roberto Pinzón Cabrera	2175-9146

Important Results

Books written by members of the mission:

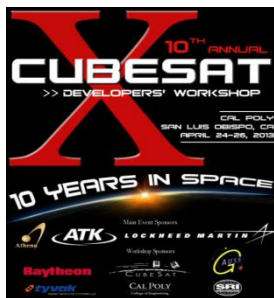
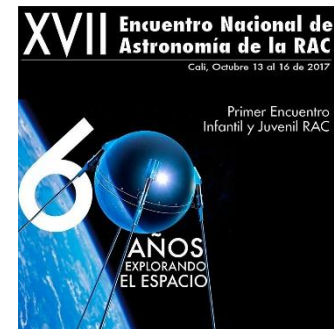
ítem	Título	Autores	ISBN
1	Software de monitoreo y control para la estación terrena de un nanosatélite introducción al diseño	FREDDY ALEXANDER DIAZ GONZALEZ; Camargo Villamil, Diana Catalina; Pinzón Cabrera, Diana Carolina	978-958-8866-18-5
2	Aproximación a los sistemas de percepción remota en satélites pequeños	FREDDY ALEXANDER DIAZ GONZALEZ, SHIRLEY VIVIANA QUINTERO TORRES, JUAN SEBASTIAN TRIANA CORREA, DIANA CAROLINA MORON HERNANDEZ	978-958-8866-19-2
3	Obtención de energía solar y su uso eficiente en la orientación de pequeños satélites	Jesús González Llorente, Ronald Hurtado Velasco, Sergio Sánchez Sanjuán, David Rodríguez Duarte, Andrés Rambal Vecino	978-958-8866-94-9 (rústica), 978-958-8866-93-2 (.pdf)

Other results:

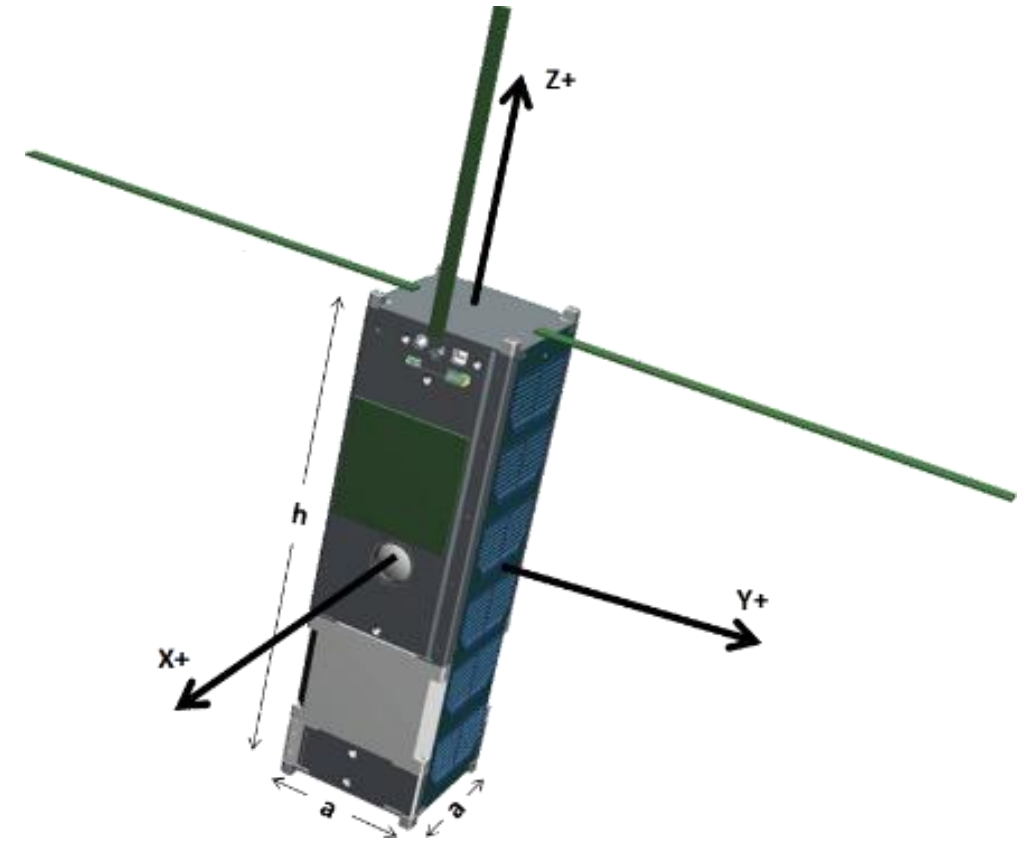
Type	Quantity	Country
Proceedings	14	<ul style="list-style-type: none"> • Panama • United States • Mexico • Italy • Brazil • The Netherlands • Canada

Type	Quantity	Comments
Thesis	21	<ul style="list-style-type: none"> • Electrical Power Supply • On-Board Computer • Communications • ADCS
Researchers	16	<ul style="list-style-type: none"> • Supported by Colciencias

Our Commitment

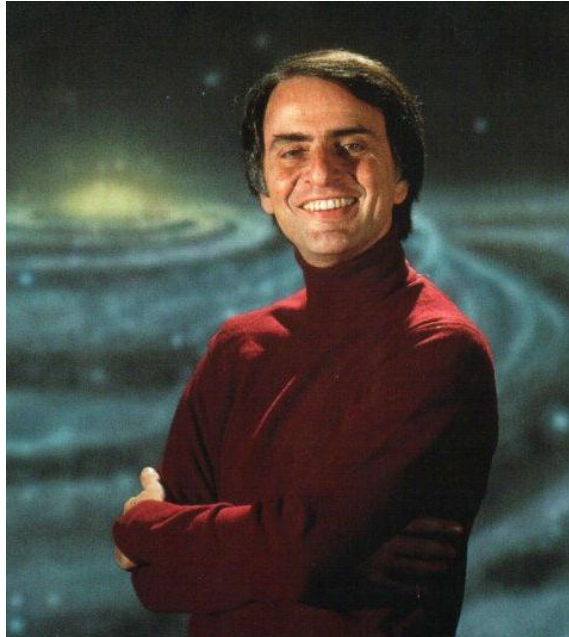


Our Commitment



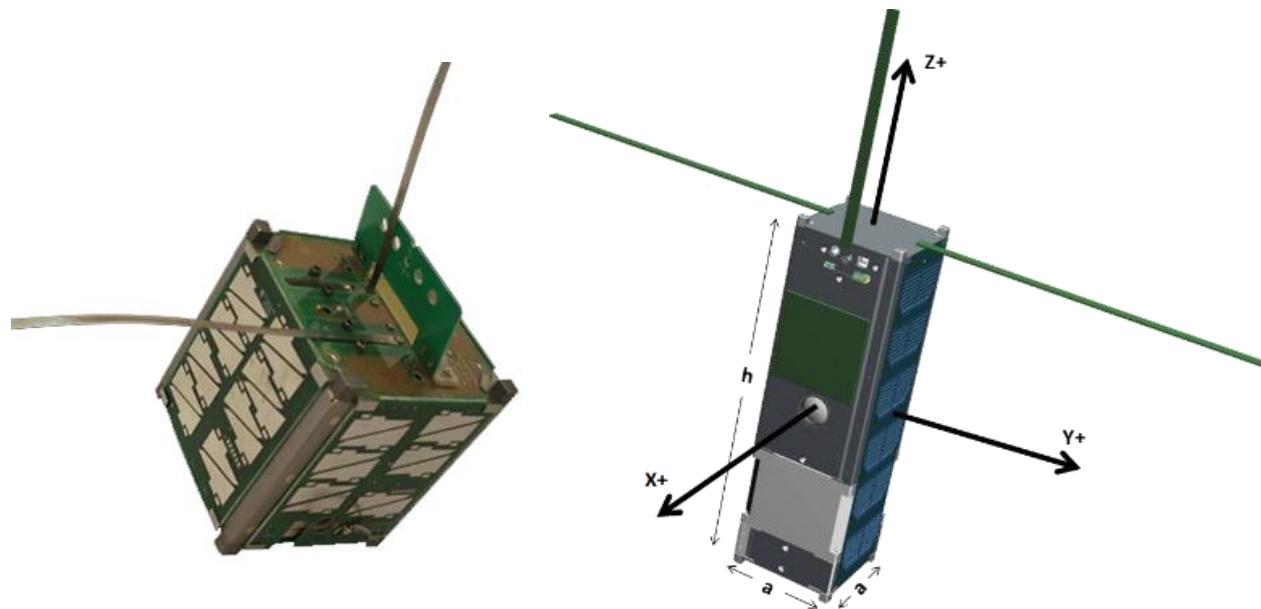
*If we can dream it,
we can do it.*

Science is not perfect. It's often misused; it's only a tool, but it's the best tool we have. Self-correcting, ever-changing, applicable to everything; with this tool, we vanquish the impossible.



Carl Sagan

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