



**fcfm**

FACULTAD DE CIENCIAS  
FÍSICAS Y MATEMÁTICAS  
UNIVERSIDAD DE CHILE



**SPEL**  
Space and Planetary  
Exploration Laboratory

# SUCHAI - first satellite built in Chile

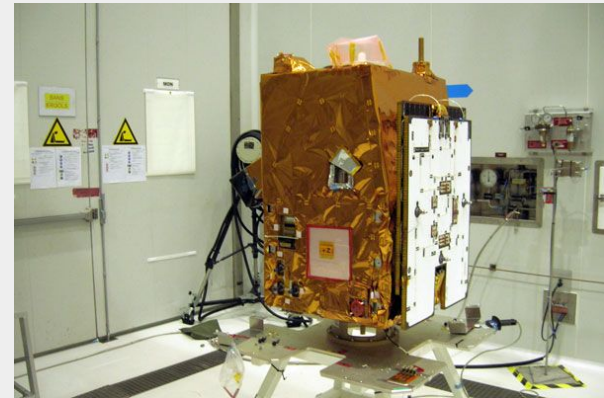
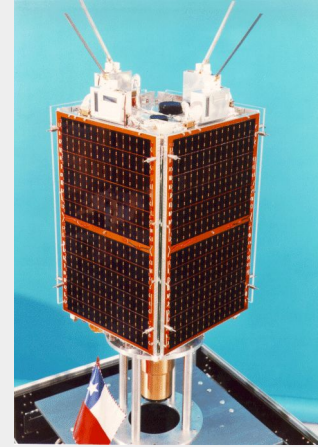
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**Project Engineer**  
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# Chilean satellites

- 2 successes: Fasat-B (Surrey) and Fasat-C (Astrium)
- 1 failure: Fasat-A (Surrey)



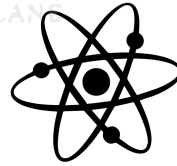
## Objectives

Last generation technology for the country



## Education

Development of human capital



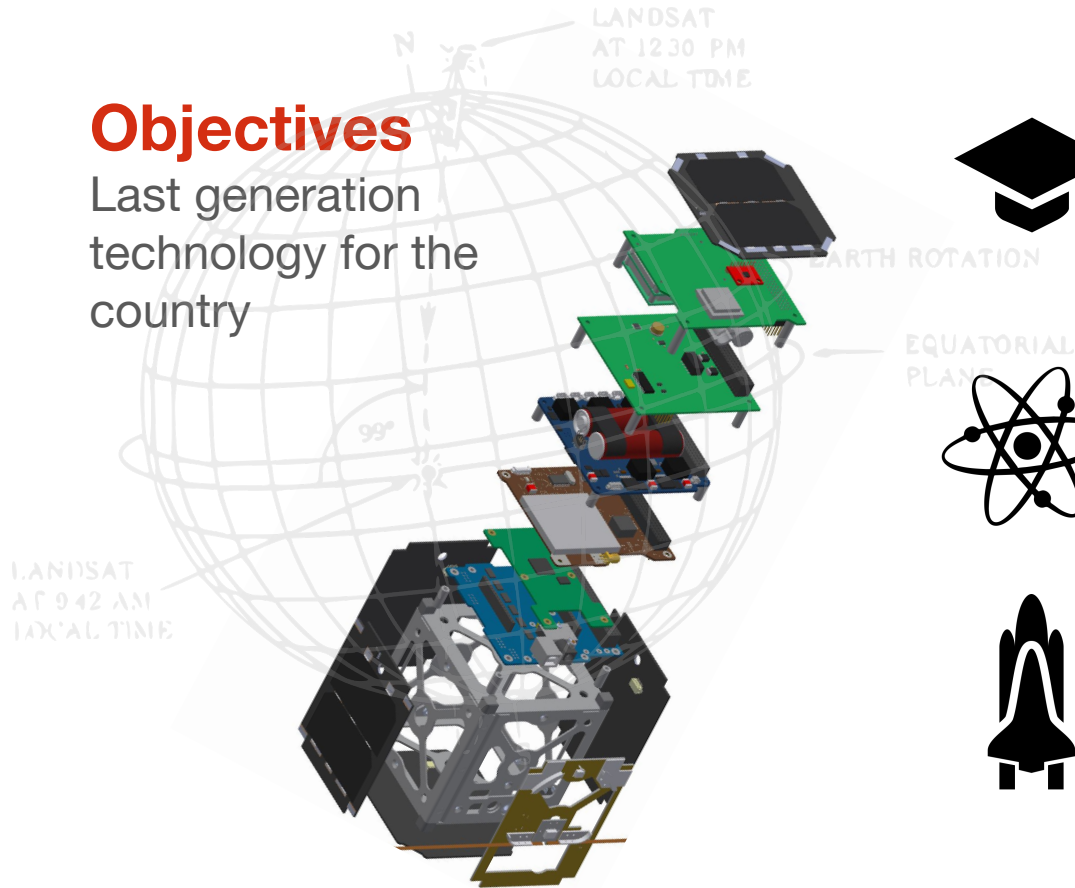
## Science

Scientific experiments in space environment



## Technology

Integration and development of space technology in Chile



# Mission success level

A big challenge with different levels of success



## 4. Photography

Take a picture of the Earth (and download it)

## 3. Scientific data

Successful payload operation

## 2. Telecommands

Reception and execution of remote order (from our GND STN)

## 1. Listen to the beacon

Correct system operation

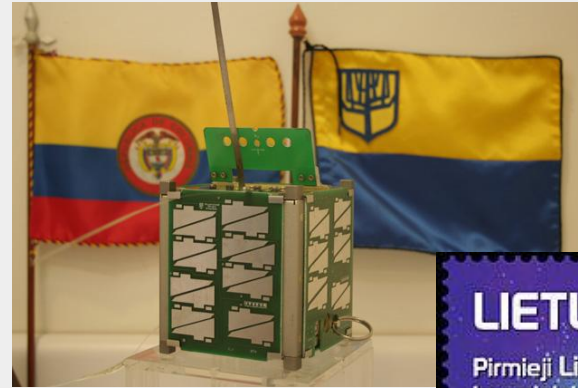
## 0. Put it into orbit

Successful launch

# What's going on the world...

- Cubesat has been the first artificial satellite of many countries
  - Colombia, Switzerland, Hungary, Poland, Romania, Austria, Ecuador, Estonia, Perú, Lithuania, Belgium, Finland, Ghana, Slovakia

(Source: project's web pages - wikipedia)



# Timeline

LANDSAT  
AT 12:30 PM  
LOCAL TIME



EARTH ROTATION

EQUATORIAL  
PLANE



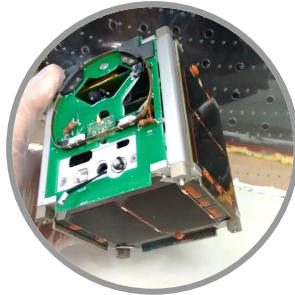
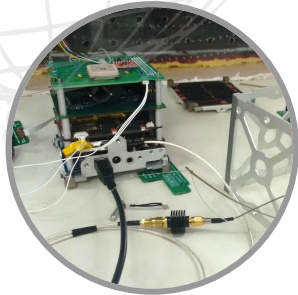
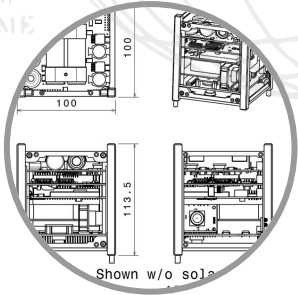
2009

2011

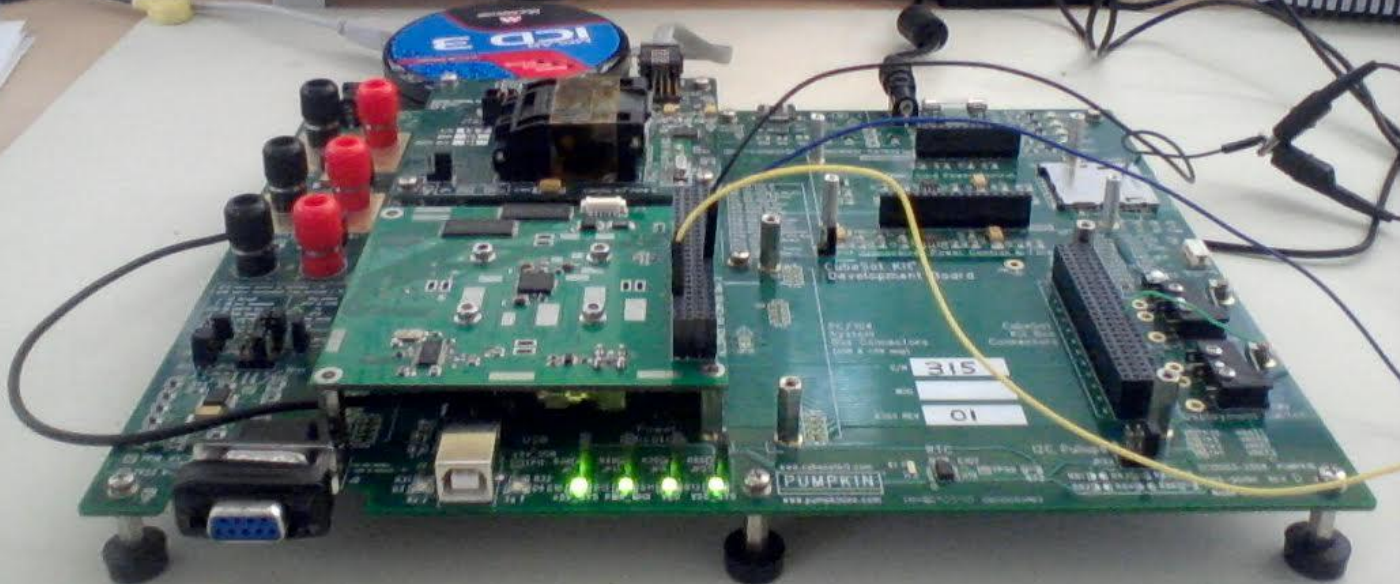
2013

2014

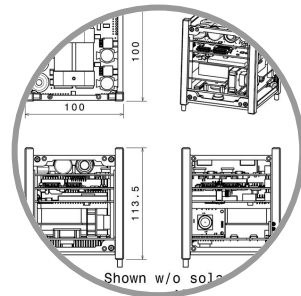
2016



# Beginning of the project

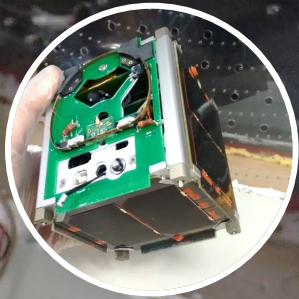


2010



Last 10%...

2014





# Final stages



2015



2016





TH ROTATION

EQUATORIAL PLANE

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LANDSAT  
AT 12:30 PM  
LOCAL TIME

SUCHAI 10:11:59 UTC

00suchai02111111101 0hz

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Take a picture of the Earth (and  
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SUCHAI Remote Ground Station

Archivo Herramientas Ayuda

Consola Telemandos Telemetría

	Time	Status	Payload	Frames	Lost frames	Payload status	Data length	Data
402	17-08-09 02:46:52	Finished	Status	2	0	Stop	1	0x0000,0x000...
403	17-08-01 14:20:10	Finished	Status	2	0	Stop	1	0x0000,0x000...
404	17-08-01 14:18:39	Finished	Status	2	0	Stop	1	0x0000,0x000...
405	17-08-01 14:18:13	Finished	Status	2	0	Stop	1	0x0000,0x000...
406	17-08-01 14:15:22	Broken	Gyroscope	28	3	Waiting down...	950	0xB389,0x45C...
407	17-08-01 14:14:46	Finished	Status	2	0	Stop	1	0x0000,0x000...
<b>408</b>	<b>17-07-12 19:29:40</b>	<b>Broken</b>	<b>Status</b>	<b>99</b>	<b>3</b>	<b>Waiting down...</b>	<b>9880</b>	<b>0xB0C5,0x45C...</b>
409	17-07-12 19:29:39	Finished	Status	2	0	Stop	1	0x0000,0x000...
410	17-07-12 19:29:39	Finished	Gyroscope	32	0	Waiting down...	950	0xB0CF,0x45C...

Fields	Time1	Time2	Time3	Time4
0	2017-07-03 11:03:05	2017-07-03 11:04:05	2017-07-03 11:05:05	2017-07-03 11:06:05
1	sta_RTC_isAlive	0x0001	0x0001	0x0001
2	sta_TRX_isAlive	0x0000	0x0000	0x0000
3	sta_EPS_isAlive	0x0000	0x0000	0x0000
4	sta_MemEEPROM_isAlive	0x0001	0x0001	0x0001
5	sta_MemSD_isAlive	0x0001	0x0001	0x0001
6	sta_AntSwitch_isOpen	0x0001	0x0001	0x0001
7	sta_fpl_index	0x0000	0x0000	0x0000
8	sta_ppc_opMode	0x0000	0x0000	0x0000
9	sta_ppc_lastResetSource	0x0006	0x0006	0x0006
10	sta_ppc_hoursAlive	0x00F8	0x00F8	0x00F8
11	sta_ppc_hoursWithoutReset	0x0084	0x0084	0x0084
12	sta_ppc_resetCounter	0x0010	0x0010	0x0010
13	sta_ppc_wdt	0x0001	0x0001	0x0001
14	sta_ppc_osc	0x0004	0x0004	0x0004
15	sta_ppc_MB_nOE_USB_NINT_stat	0x0000	0x0000	0x0000
16	sta_ppc_MB_nOE_MHX_stat	0x0001	0x0001	0x0001
17	sta_ppc_MB_nON_MHX_stat	0x0000	0x0000	0x0000
18		0x0000	0x0000	0x0000

DB Server: 192.168.11.154 Port: 27017 Reconnect Import CSV Delete

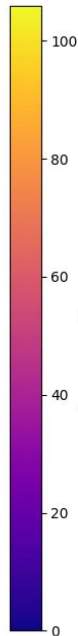
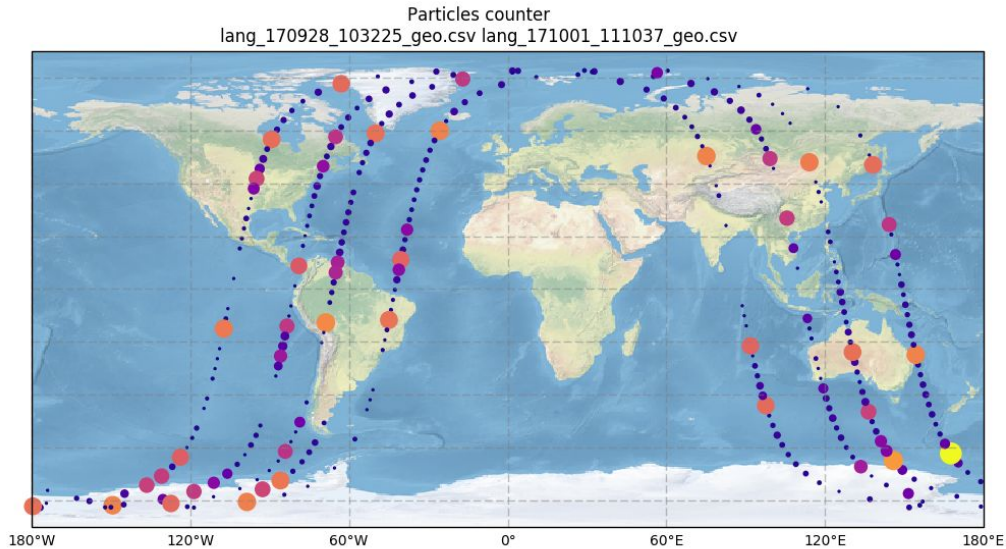
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Successful launch

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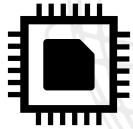
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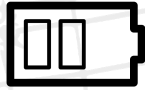
4. Photography  
Take a picture of the Earth  
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# SUCHAI 2 & 3

New generation of satellites for scientific purposes (2 x 3U Cubesats)



x2



x3



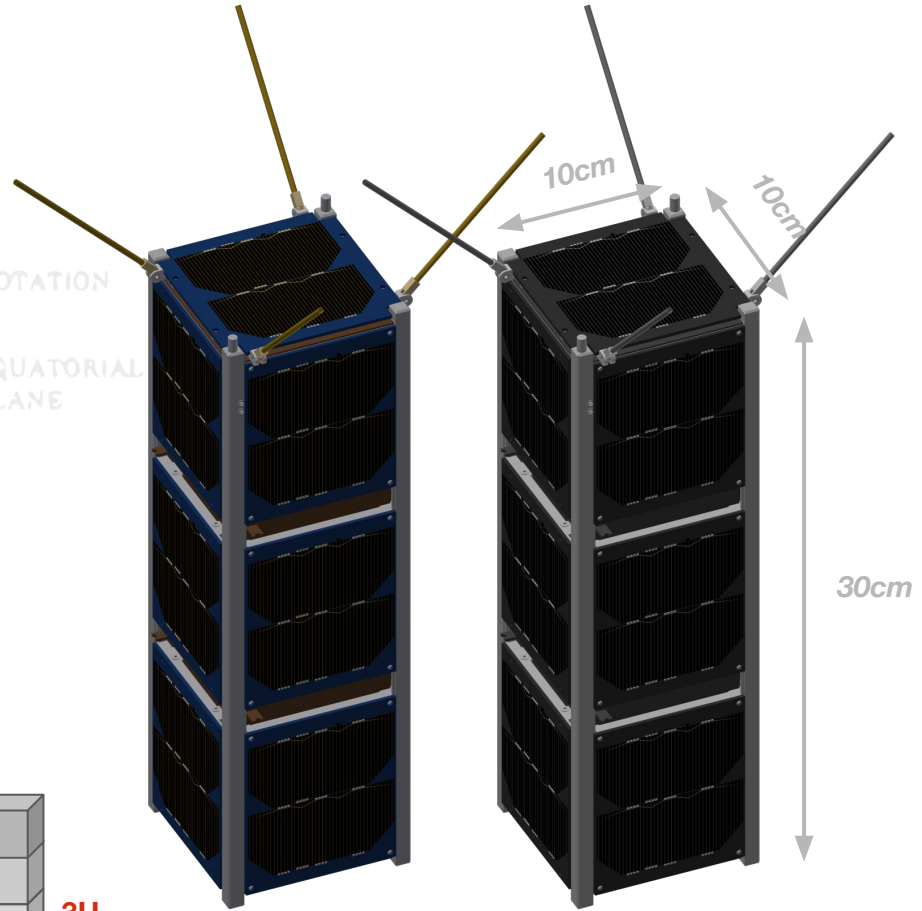
x3



1U



3U



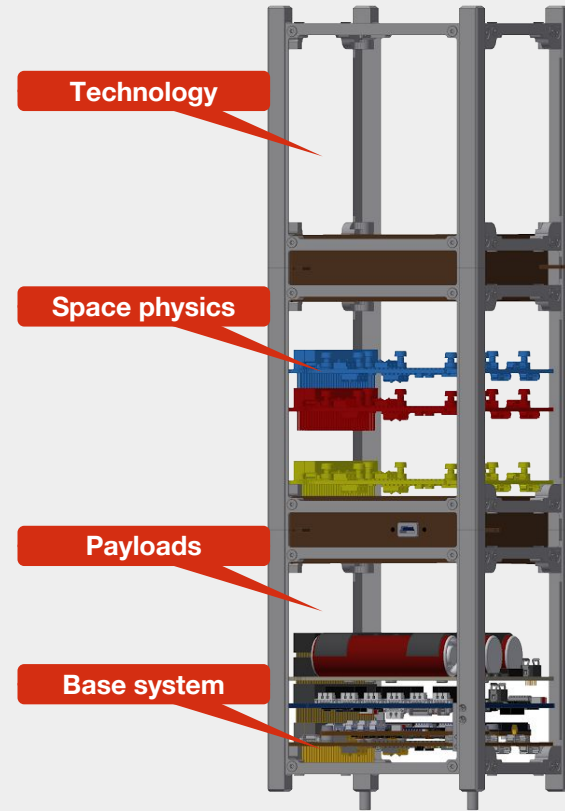
# Payloads

- **Space physics**

- Langmuir Probe
- Magnetometers
- Double band GPS
- Femto satellite networks
- Microgravity experiments

- **Technology**

- Flight software
- Failure forecast and detection
- Passive thermal systems
- Constellations
- 60 GHz communication (ISL)
- Positioning and star trackers
- Propulsion
- Deorbiting system







## What we learnt (not so technical)

- Cubesat democratized the access to space and we benefited from that
- Cooperation is key to success.
- To fail is part of the process and we need to learn to fail.
- There's no better way to train engineers than a hands on project
- A Cubesat is small, resource-limited platform but after all, is a KICK OFF for something bigger if there's a good continuation plan.
- We are conscious that space is a global resource therefore we have to be careful about using it.

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