The NanosatC-Br Program

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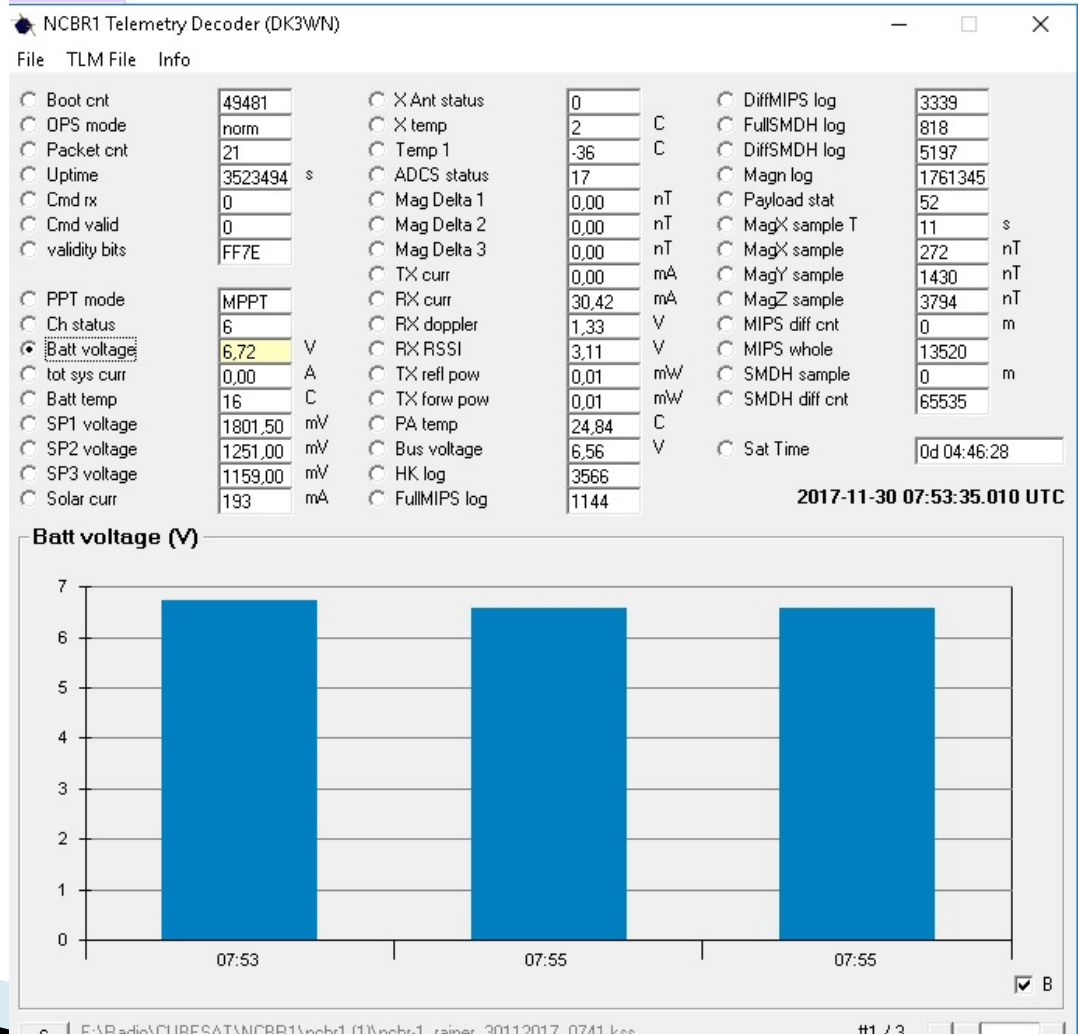
The NanosatC-Br1

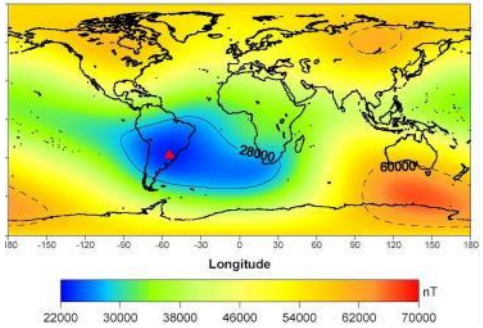
- Launch in 06/19/14
- Still working

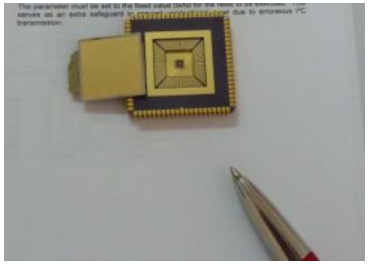


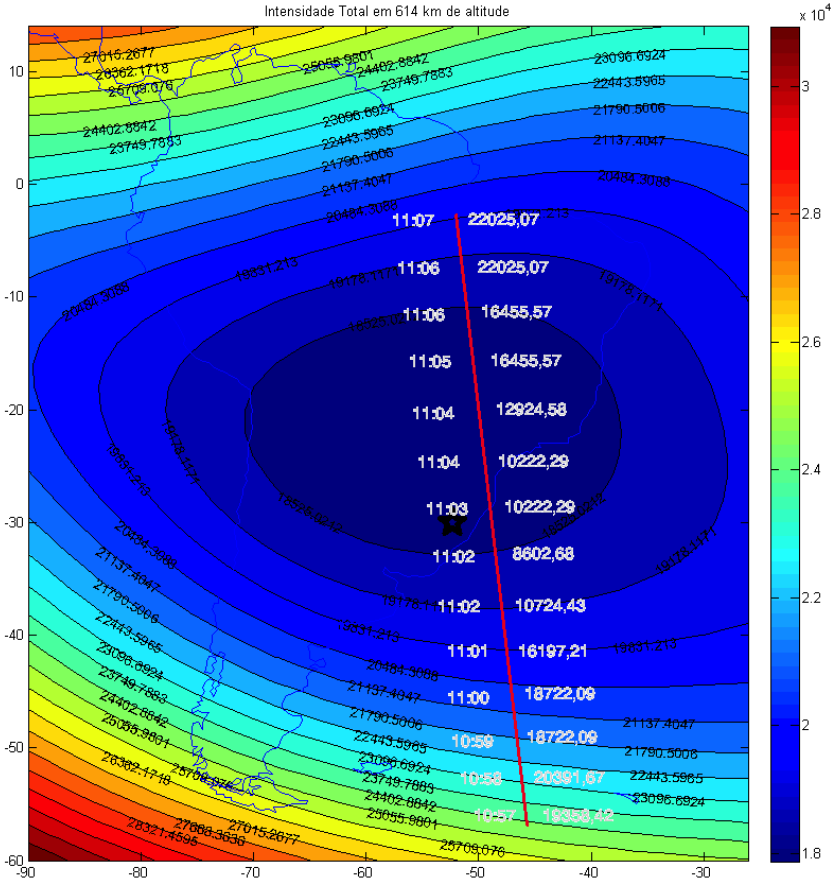
Development strategy

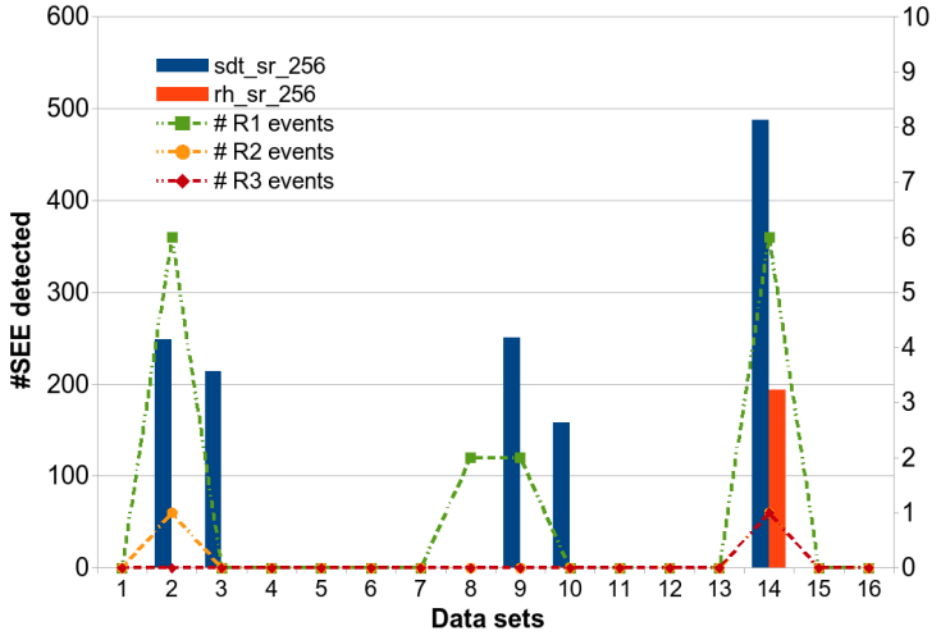
- Started with an undergraduate student and a research initiation schoolarship – Federal University of Santa Maria in 2008.
- In 2009 decision to launch it!
- To prove that cubesats can work
  - Purchase the subsystems from ISIS
  - Payload development, AIT, launch and operation
  - Two ground stations operated by students

Payloads


28000
60000
Longitude
nT
22000
30000
38000
46000
54000
62000
70000

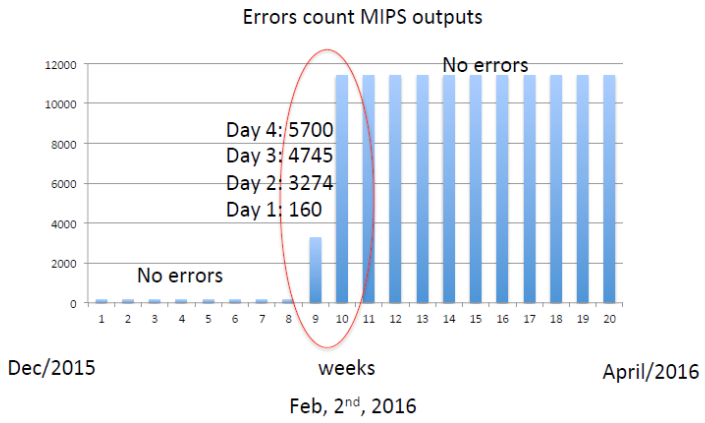



Intensidade Total em 614 km de altitude
x 10^4
11:07 22025,07
11:06 22025,07
11:06 16455,57
11:05 16455,57
11:04 12924,58
11:04 10222,29
11:03 10222,29
11:02 8602,68
11:02 10724,43
11:01 16197,21
11:00 18722,09
10:59 18722,09
10:58 20391,67

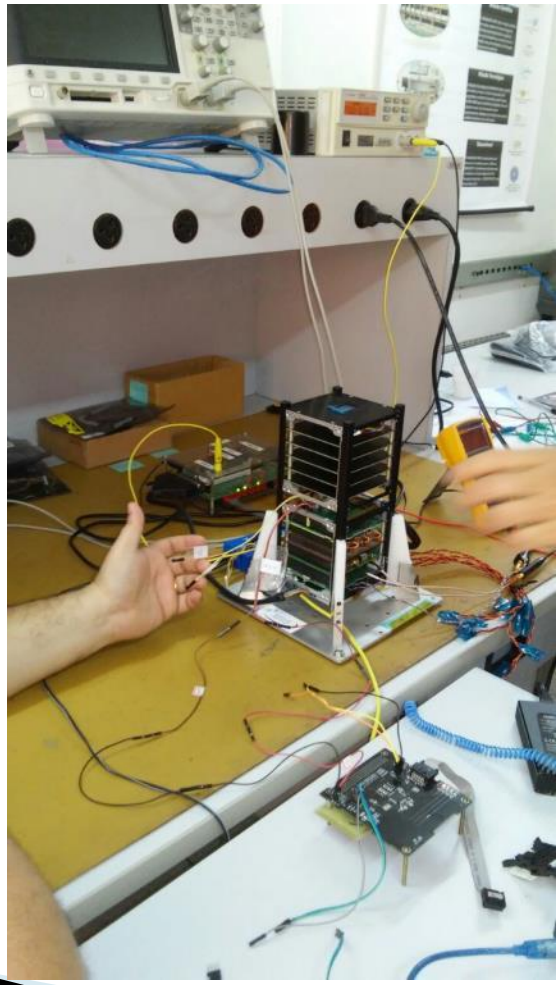

sdt_sr_256
rh_sr_256
R1 events
R2 events
R3 events
#SEE detected
Data sets

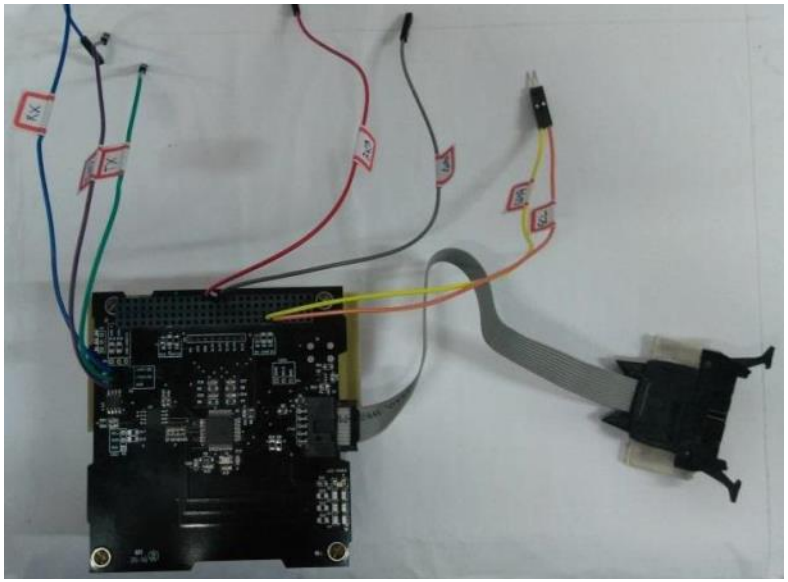
Payloads

Telemetry



NanosatC-Br2





Development strategy

- 6 payloads
- On board software
- Purchased 2U platform
- Increase the number of partners
- Launch by mid 2018

Third phase

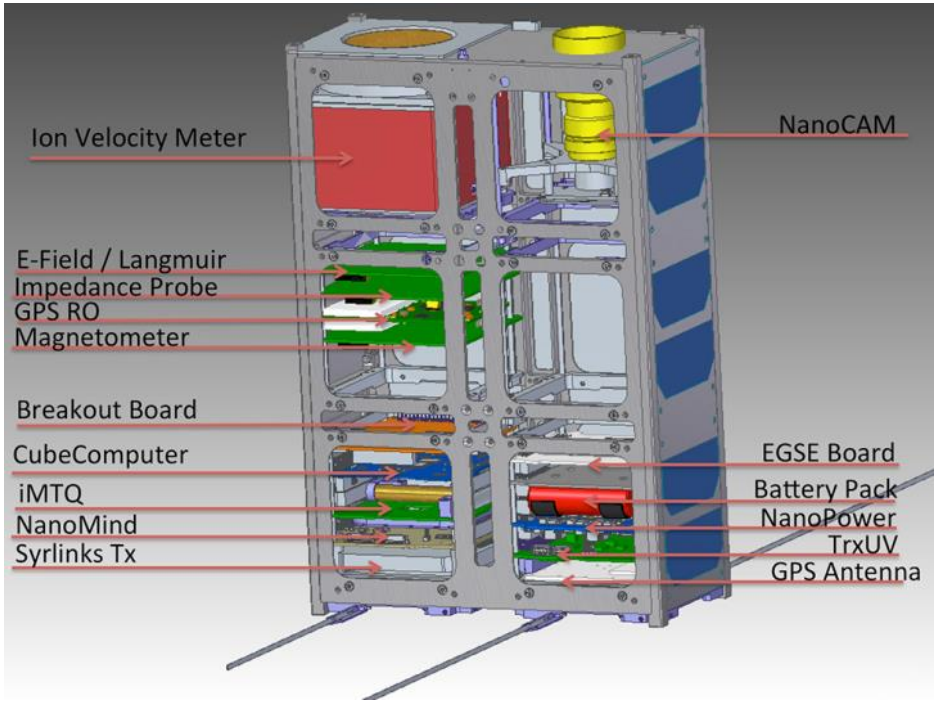
- To develop the platform subsystems
  - In partnership with brazilian industries
  - Not necessarily from the space sector
  - Funded through R&D State Funding Agency – FAPESP
    - Through the private sector – “prime contractor”
    - Mission is scientific – X ray measurements (INPE)

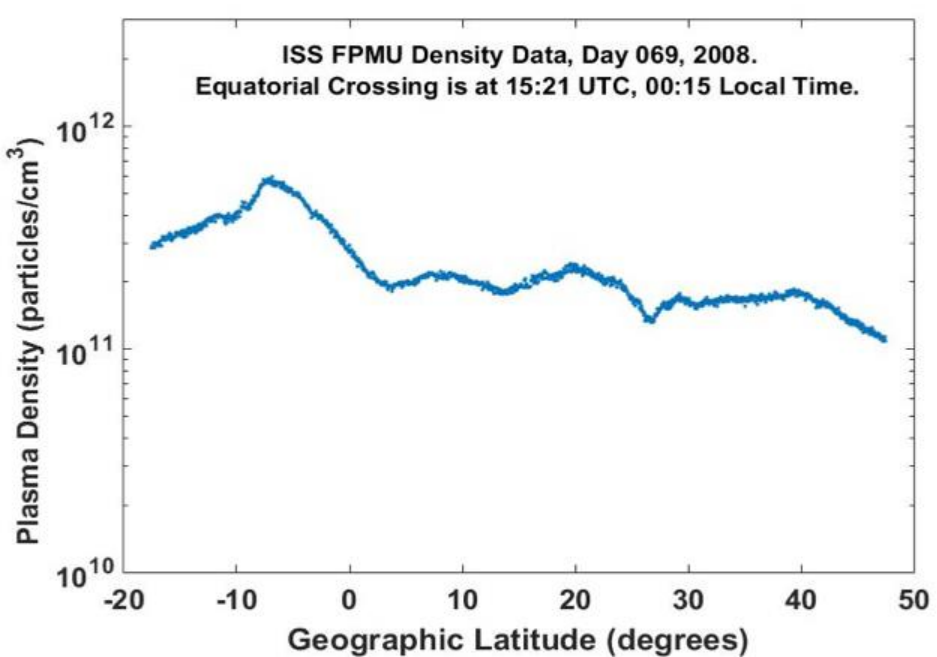
Third phase

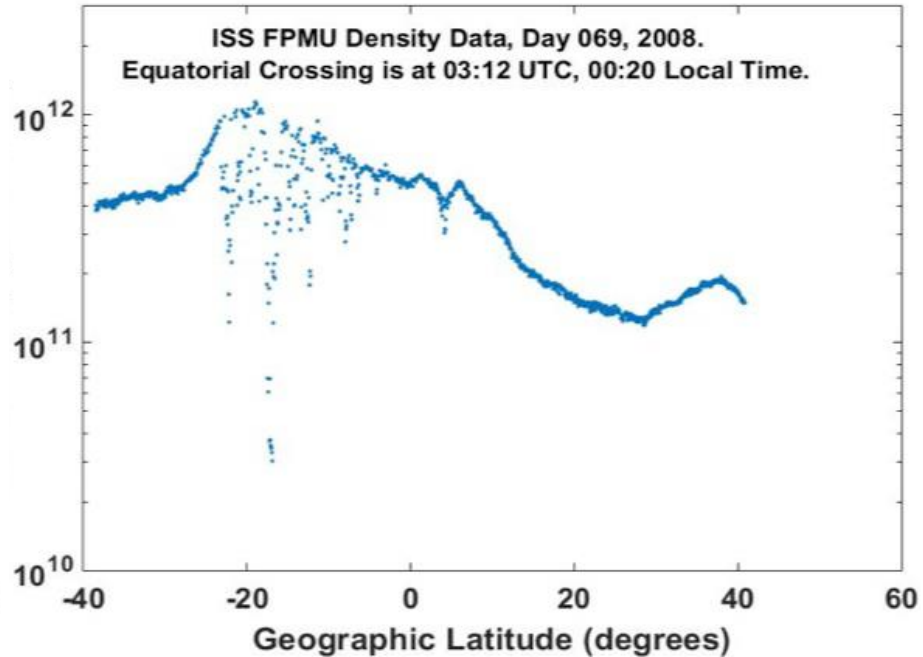
- New and more complex missions
- Up grade in reliability
- International cooperation
- Mission SPORT
  - Scintillation Prediction Observations Research Tasks
  - Ionospheric Science/Application Mission
  - 6U cubesat
  - Cooperation with NASA, Air Force Institute of Technology (Brasil) and american universities.

SPORT

- Measurements to uderstand the formation of ionospheric plasma bubbles
  - Signal interference in this region
  - GPS outage and precision.
  - Ecquatorial region.
- Work distribution
  - NASA and american universities – 5 payloads
  - ITA – 6U plataform
  - INPE – ground operation, AIT and data distribution


Ion Velocity Meter
NanoCAM
E-Field / Langmuir
Impedance Probe
GPS RO
Magnetometer
Breakout Board
CubeComputer
iMTQ
NanoMind
Syrlinks Tx
EGSE Board
Battery Pack
NanoPower
TrxUV
GPS Antenna


ISS FPMU Density Data, Day 069, 2008.
Equatorial Crossing is at 15:21 UTC, 00:15 Local Time.
Plasma Density (particles/cm3)
10^12
10^11
10^10
-20
-10
0
10
20
30
40
50
Geographic Latitude (degrees)


ISS FPMU Density Data, Day 069, 2008.
Equatorial Crossing is at 03:12 UTC, 00:20 Local Time.
10^12
10^11
10^10
-40
-20
0
20
40
60
Geographic Latitude (degrees)

Budget, partners and schedule

- Call for proposal at NASA
  - Winning among 70 proposals (3 selected)
  - Heliospheric Division
- Brazilian part granted by FAPESP – R&D Funding State Agency
  - Also very competitive and lenghty process
- Launch provided by NASA from the ISS
  - Launch scheduled for Oct. 19
  - Expected nominal life – 1 year
- NASA (Marshall and Goddard), ITA, INPE, Utah State University, University of Texas Dallas, Aerospace Corporation and University of Alabama Huntsville.

Other brazilian cubesat missions

- AESP-14 – launched from the ISS in Jan. 15
  - ITA
  - 1U
- SERPENS – 3U; launched from ISS in Sept. 15
  - University of Brasilia
- ITASAT – 6U; ITA; delivered to launch PSLV
- Others under development
  - CONASAT
  - SERPENS 2 and 3
  - Lightning detector – 3U
  - INPE Graduate School cubesat

Conclusions

- NanosatC-Br1 a pathfinder for cubesat missions in Brasil
- Change in perspective since then, even at INPE and AEB (Brazilian Space Agency)
- Seems to be consolidated in terms to explore the possibilities
- Highly motivational in general (young and not so young professionals and students)
- Budget feasibility

Next steps

- To organize it under a national program (?)
- Increase reliability; R&D work
- Private projects and applications
- Move from public to private.