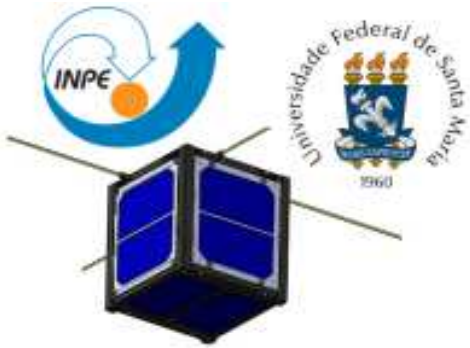
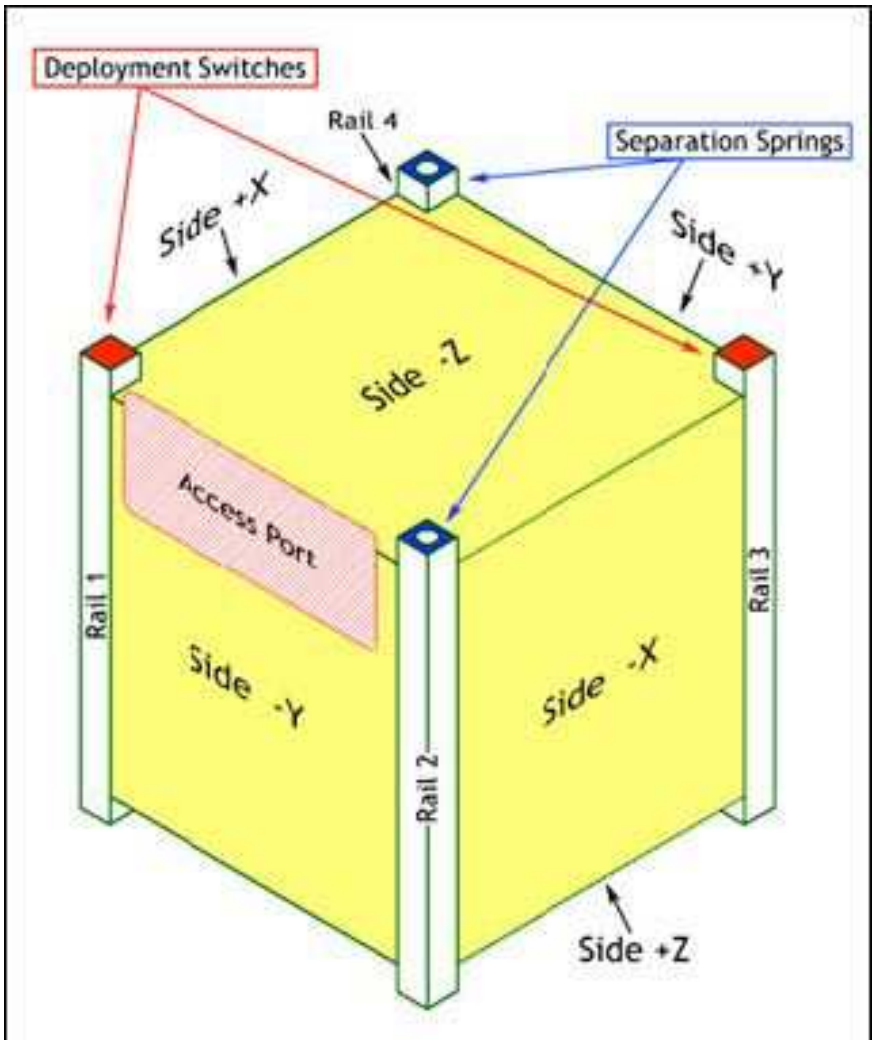


NANOSATC-BR1 E 2
INPE/CRS

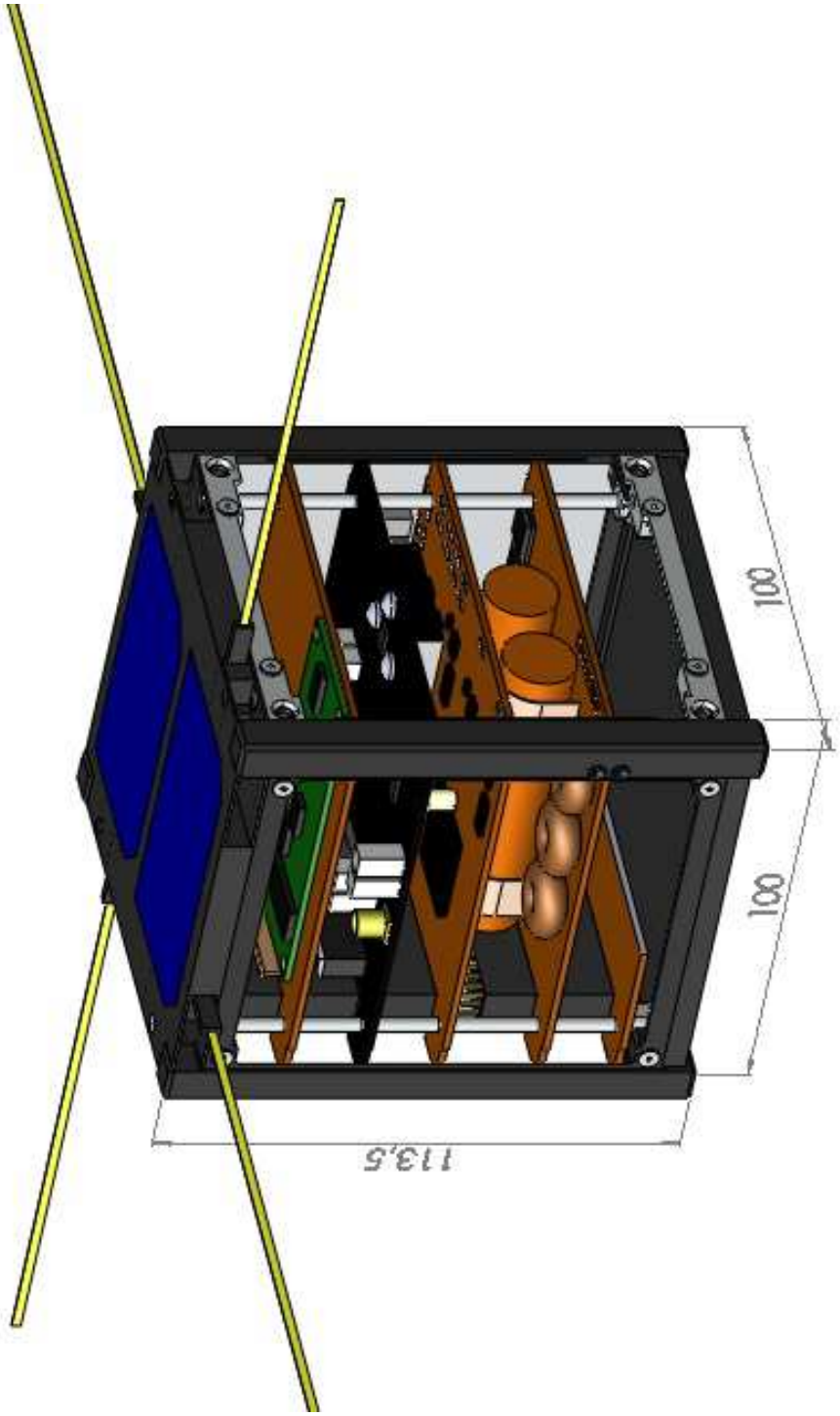
Otavio Durão – SJC - CPA

Nelson Jorge Schuch – CRS – Gerente do Programa

CUBESAT – PADRÃO DE ESPECIFICAÇÃO

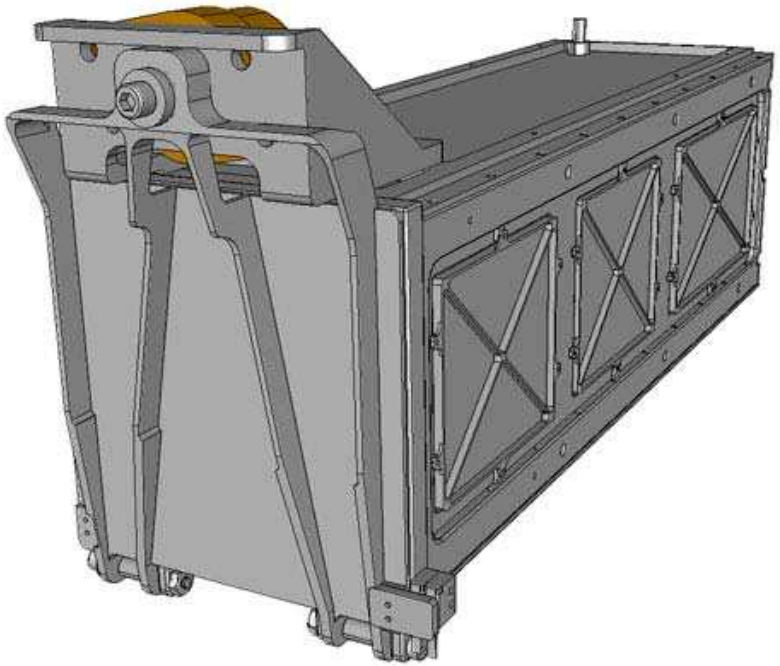


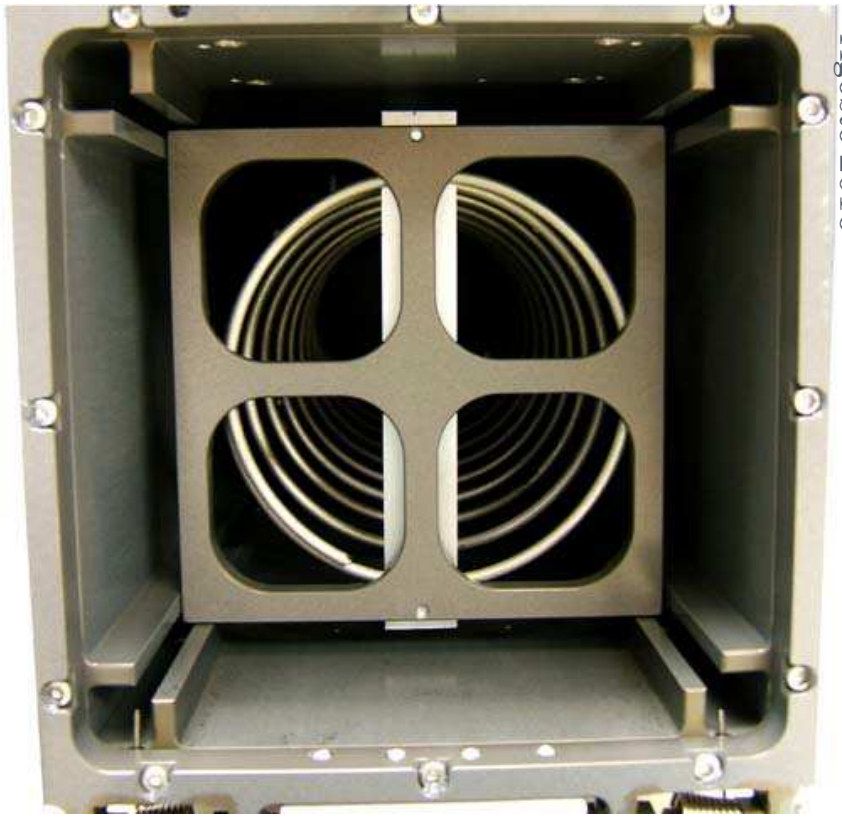
PADRÃO 1U



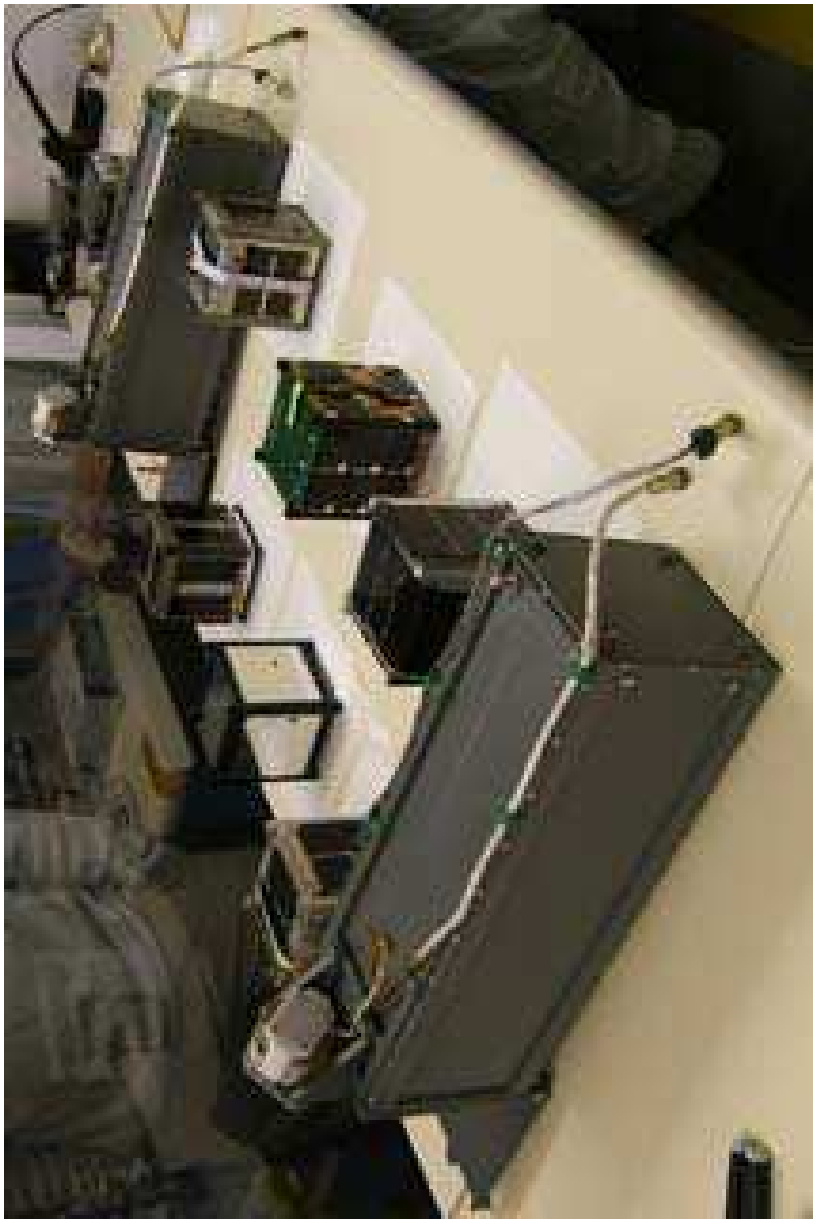
Interface com o lançador

- Padrão (P-POD MkIII ICD)
- POD – Picosatellite Orbit Deployer





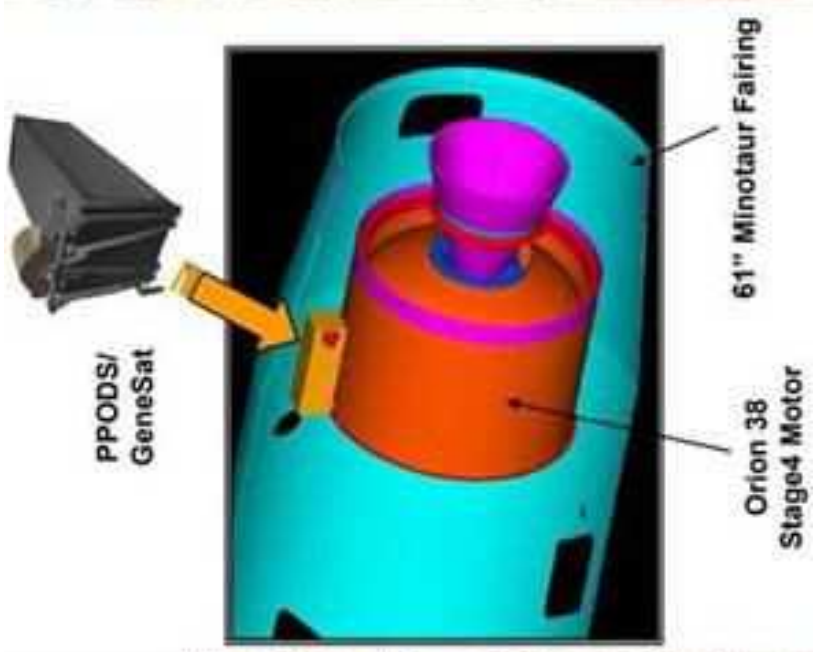
CUBESATS E P-POD´S

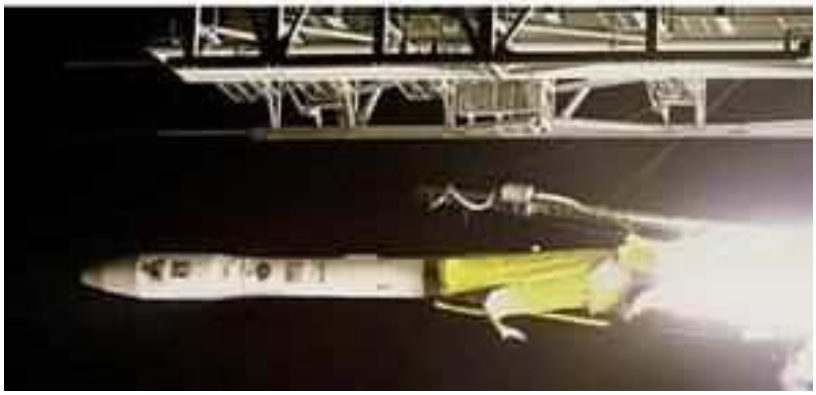


PSLV

MINOTAURO


P-POD mounted on Stage 4


61" Minotaur Fairing
PPODS/
GeneSat
Orion 38
Stage4 Motor



Lançamento pela ISS – Set.12

Potencial de uso

- nU´s mantendo padrão cubesat
- Câmeras
- Constelações e formação
- Testes de novas tecnologias
- Missões científicas
- Interplanetárias! (Lua e Marte)
- ITAR

SPACE NEWS
August 10, 2009

‹Small Satellites and Small Launcher

NRO Embraces Cubesats for Testing Advanced Technol

AMY KLAMPER, WASHINGTON

In an effort to reduce risk in developing operational spy satellites, the U.S. National Reconnaissance Office (NRO) has started a new program that will use tiny satellites, known as cubesats, as in-space test platforms for promising new technologies.

Last year, the spy satellite agency established a cubesat program office dedicated to small satellites weighing between 1 and 5 kilograms each. Located within the NRO's Advanced Systems and Technology division, the new Colony Program Office has 12 cubesats in production this year and plans to purchase between 20 and 50 additional cubesats at roughly $250,000 each over a two-year period beginning in 2010.

U.S. Air Force Maj. David "Dutch" Shultz, who heads the new Colony Program Office, told *Space News* Aug. 6 that the NRO sees the potential for cubesats to prove advanced technologies on orbit more quickly and affordably than on larger platforms. He also said the agency is making bulk purchases of the standardized satellite buses — which measure 10 centimeters on a side — and opening the buys to other government agencies, an acquisition approach that will save time and money in developing new technologies and mission capabilities for integration on a much larger scale.

MSU PHOTO BY ERIN RALEY

The U.S. National Reconnaissance Office has established a program to buy cubesats, like the one shown above, in large quantities to lower the cost of testing new technologies and components in space.

those things get built into big programs," Shultz said.

Last year House lawmakers issued a study, dubbed the "Report on Challenges and Recommendations for United States Overhead Architecture," which called on the Defense Department to conduct more research and development (R&D) on programs in advance of awarding

chairman of the House Intelligence subcommittee on technical and tactical intelligence and one of the report's principal authors, said in a July 14 interview. "You must have the R&D before you get to the manufacturing point."

In addition to R&D demonstrations, Shultz said the NRO cubesats could be used to validate new missions and capabilities.

sion," he said.

Among the technolog
ties targeted f early NRC
strations are hyperspectr
dardized attitude co
radio-frequency module
structureless antenna arr
NRO briefing documents.

Shultz said the agency
request for proposals for b
cubesats to be funded a
$250,000 each over a two
ginning in 2010, and that
is due out later this Augu
hopes other agencies will
bulk cubesat buy.

"It's an opportunity
any other agency, so that
ing of 50, other agencies
some of them," he said.
buy discounts and the cos
seventh satellite versus t
ing a single satellite tha
economies of scale."

The NRO anticipates
launch in 2010. Shultz
hopes to use NASA rocke
Poly Picosatellite Orbit
PODs), the standardized
tem for cubesats, as well
Department launchers.

"We are willing to le

NASA, Pentagon Team Up To Launch Dozens of Small Satellites

TURNER BRINTON, WASHINGTON

NASA's Ames Research Center, Mountain Vies, Calif., has begun construction of a new secondary payload adapter that could carry up to 24 very small satellites to orbit, an agency official said Aug. 6.

The new nanosatellite rideshare adapter could be ready for launch by this time next year and is being designed to be compatible with Orbital Sciences' Minotaur 1 rocket and Space Exploration Technologies' Falcon 1 and Falcon 1e rockets, John Hines, Ames' technical director for nanosatellite projects, said in an interview. The 13-centimeter-tall disk will serve as the connector between the upper stage of a rocket and its primary payloads of up to 450 kilograms. Ames is building the wafer, and the U.S. Defense Department's Operationally Responsive Space (ORS) Office has agreed to test it and launch the first one aboard a future launch that has not yet been decided, Hines said.

The adapter, nicknamed the wafer for its thin disc-like appearance, was conceived to further the progress that has been made in launching cubesats, which are simple, 10-centimeter cube-shaped satellites that weigh about 1 kilogram, Hines said. Standards for cubesats were developed by California Polytechnic University, San Luis Obispo, and Stanford University, and a number of rockets have been used to launch them since 2003. Canisters called Poly Picosatellite Orbital Deployers that attach to rocket bodies are used to carry three cubesats at once or one triple-sized cubesat.

The first version of the wafer will be reconfigurable to carry any combination of single or triple cubesats inside eight canisters, making for a maximum of 24 single satellites per launch. Once the wafer completes its demonstration, Ames intends to transfer the technology to industry for production, Hines said.

Among options being considered for future versions of the wafer are extending its height to accommodate even more small satellites, stacking multiple wafers on top of each other and modifying the wafer's configuration to host fewer, heavier satellites, Hines said.

The Ames project is one of several emerging technologies that could be a boon to small-satellite builders that have been hamstrung by the high cost of launch to space. United Launch Alliance of Denver is developing multiple options for adding secondary payloads to its Evolved Expendable Launch Vehicle (EELV) family of rockets.

United Launch Alliance is developing the Aft Bulkhead Carrier for a classified customer that will allow payloads up to 45 kilograms to be attached to an Atlas 5 or Delta 4 rocket's upper-stage booster, George Sowers, United Launch Alliance's vice president of business development and advanced programs, said in an interview. The apparatus will first be flown on an unspecified EELV launch in late 2010 and will eventually be available to other customers, Sowers said.

The company continues to make progress toward its 2008 mandate from the U.S. Air Force to use the EELV Secondary Payload Adapter (ESPA) ring on all launches for the service that have excess capacity by 2012, Sowers said. The ESPA ring, developed by the Air Force Research Laboratory and manufactured by CSA Engineering of Mountain View, Calif., fits between the primary payload and the rocket, and can carry up to six satellites, weighing up to 180 kilograms each.

The ESPA ring debuted in March 2007 aboard an Atlas 5 carrying four military microsatellites beneath the larger Orbital Express spacecraft. The ESPA ring got its second flight in June, this time serving as the core for NASA's Lunar Crater Observation and Sensing Satellite.

So far, only the final two launches of Defense Meteorological Satellite Program satellites, slated for 2011 and 2012, have been confirmed to use the ESPA ring. United Launch Alliance is working with the service to identify more possible candidates including the GPS 3 launches that will begin in 2014, Sowers said. The company believes at least half of future Air Force EELV launches will be good candidates to fly the ESPA ring.

NASA is also interested in flying the ESPA ring on future EELV missions and is considering it for the Landsat Data Continuity Mission launch in 2012, and the agency is also considering adding cubesat launchers to one or more of its five remaining Delta 2 launches, Sowers said. NASA spokeswoman Katherine Trinidad said Aug. 6 that the agency does not currently have any plans to add secondary payloads to its remaining Delta 2 launches.

CSA Engineering continues to develop secondary payload adapters, but sales so far have not met the company's expectations, ESPA ring program manager Joe Maly said in an Aug. 4 interview. The company has built and sold a total of five ESPA rings: three for Air Force launches, one for the Lunar Crater Observation and Sensing Satellite, and one that United Launch Alliance will use as a testbed at its Denver integration facilities.

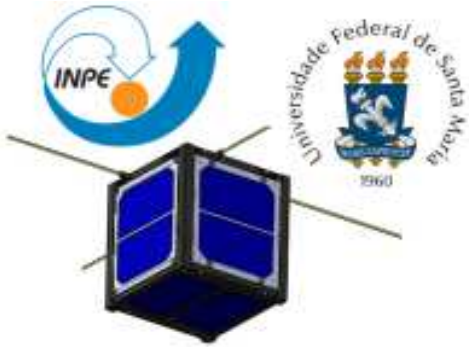
"Things have germinated more slowly that we had hoped for," Maly said.

CSA Engineering has branched out to make adapters for rockets other than EELVs, and it will soon deliver a two-payload Delta 2 adapter to an unspecified customer, Maly said. The company is also offering adapters for the Falcon 1e and Orbital's new Minotaur 4 rocket, but it has not sold any to date.

Comments: tbrinton@space.com

No Brasil - atualmente

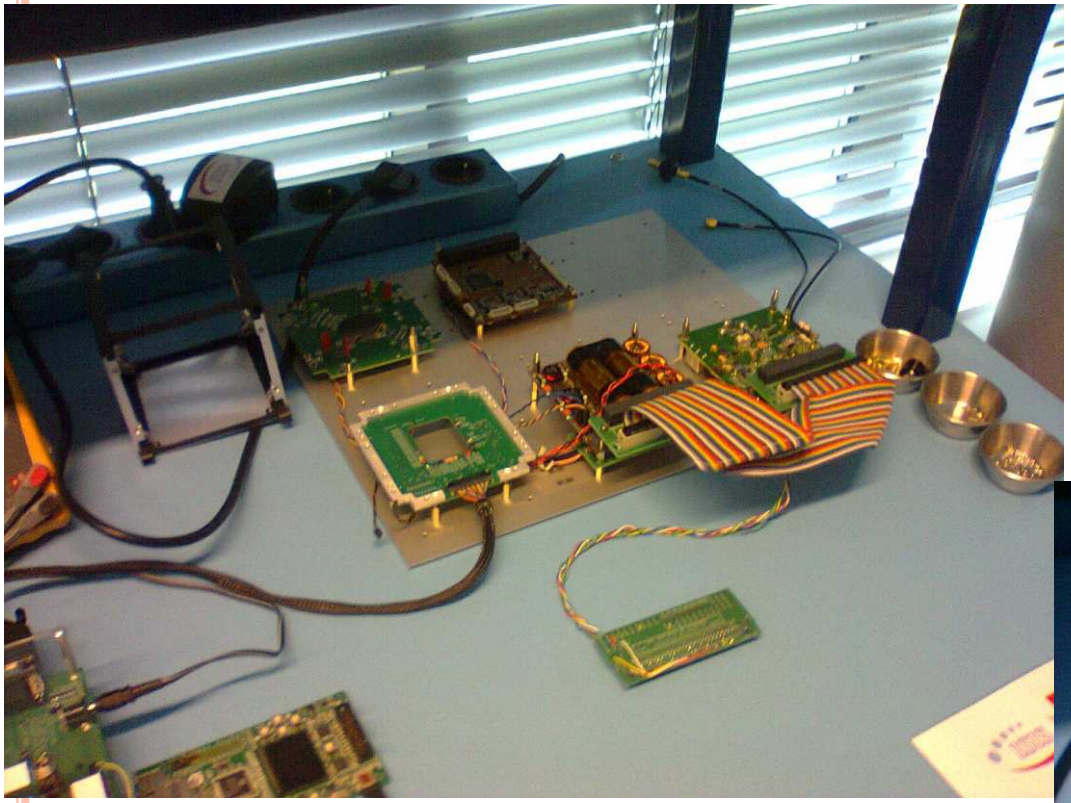
- Desenvolvimento de missão – carga útil, AIT, lançamento e operação
  - INPE/UFSM – NanosatC-Br1 (1U, lançamento 19 de Junho de 2014) e NanosatC-Br2 (2U, Q1 - 2017)
  - INPE/UFRN – Conasat (8U, missão SCD)
  - ITASAT – 6U
  - AESP-14 – ITA - lançado em 2015
  - SERPENS – Coordenação UnB – ISS; Agosto 2015
- Desenvolvimento de equipamentos e subsistemas da plataforma
  - ITA – AESP-14
  - IFF (QB50)
- Apoio da AEB

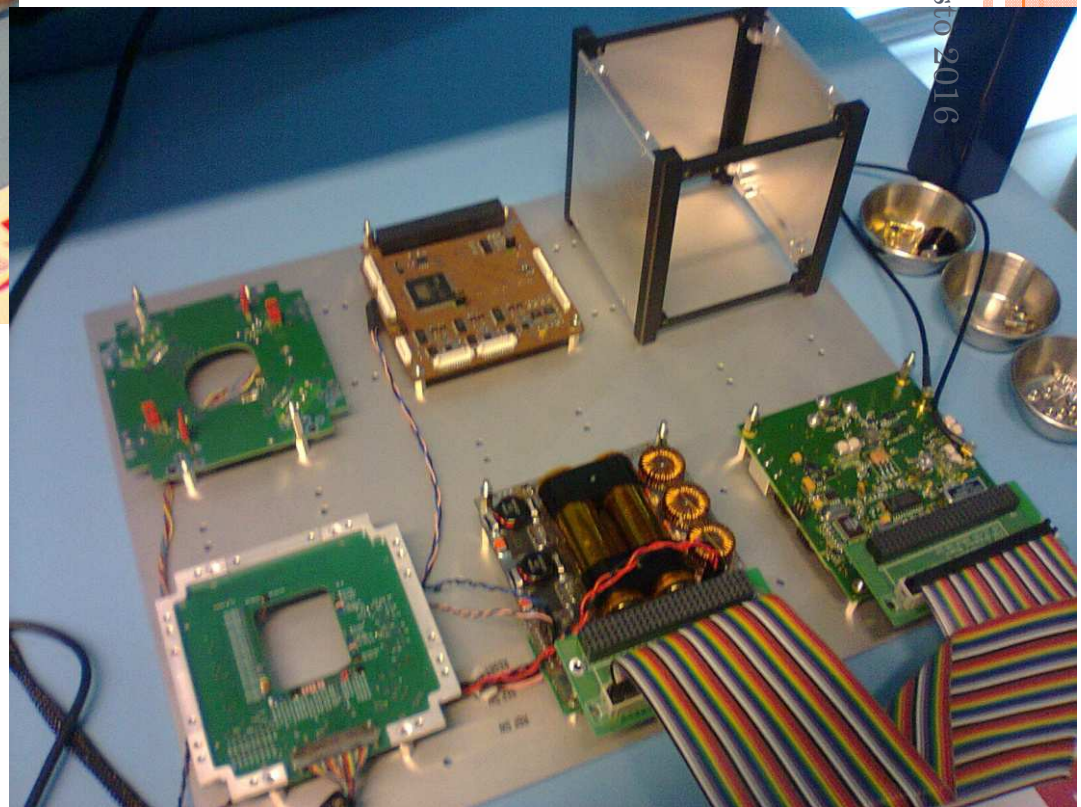


NANOSATC-BR1

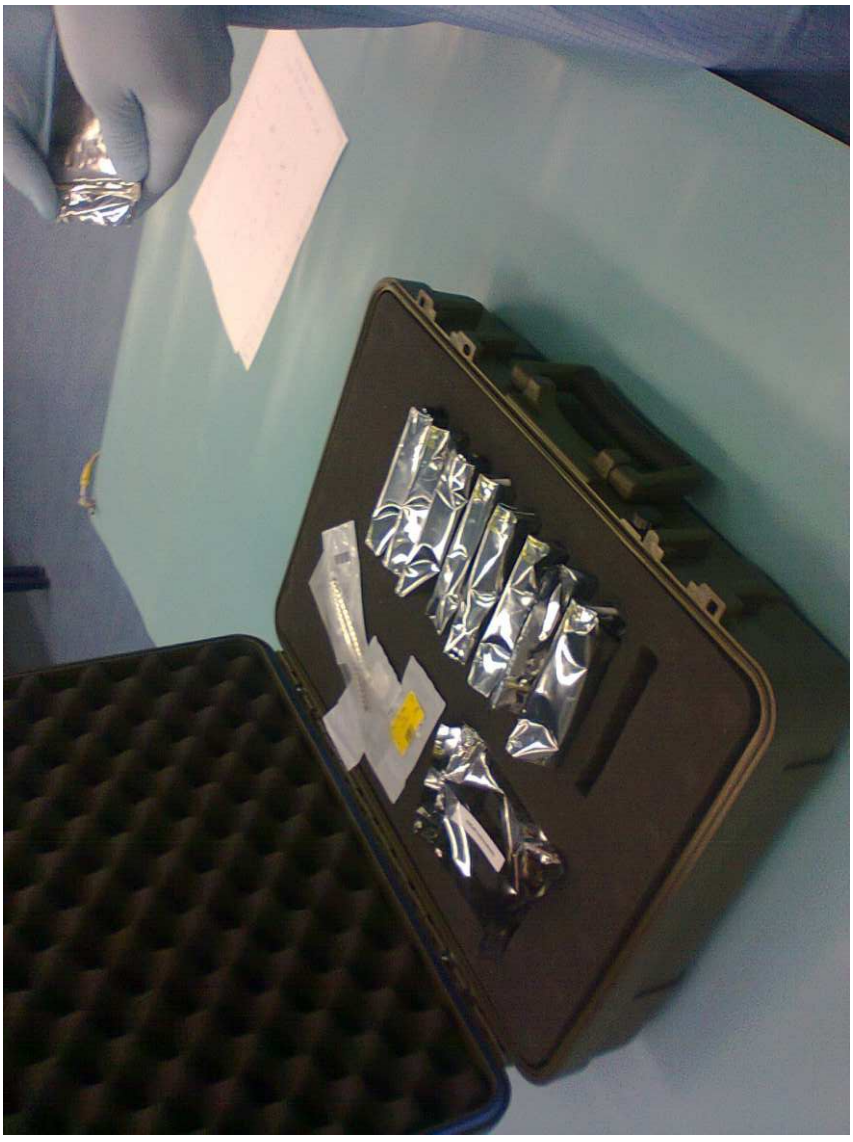
- Cooperação INPE/CRS e UFSM
- Objetivos
  - Missão científica – magnetômetro; medidas do campo magnético na AMAS
  - Missão tecnológica – testes de CI´s projetados no Brasil para uso espacial (resistentes à radiação – pioneiros)
    - FPGA com software tolerante a falha e driver on/off
  - Acadêmicos – formação de alunos de graduação
- Compra da plataforma e estação e desenvolvimento da carga útil, AIT e operação.

NanosatC-Br1 - plataforma



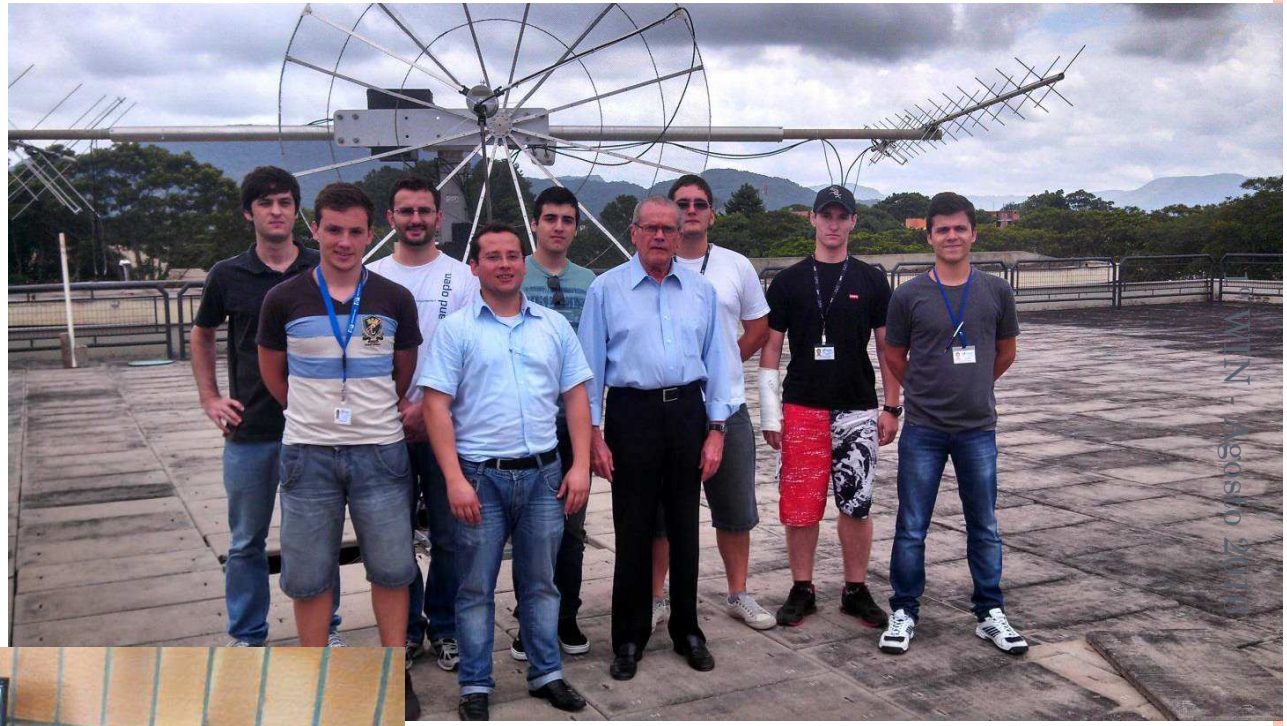


NANOSATC-BR1 - MV



NanosatC-Br1 – Estação terrena

- No CRS/SM

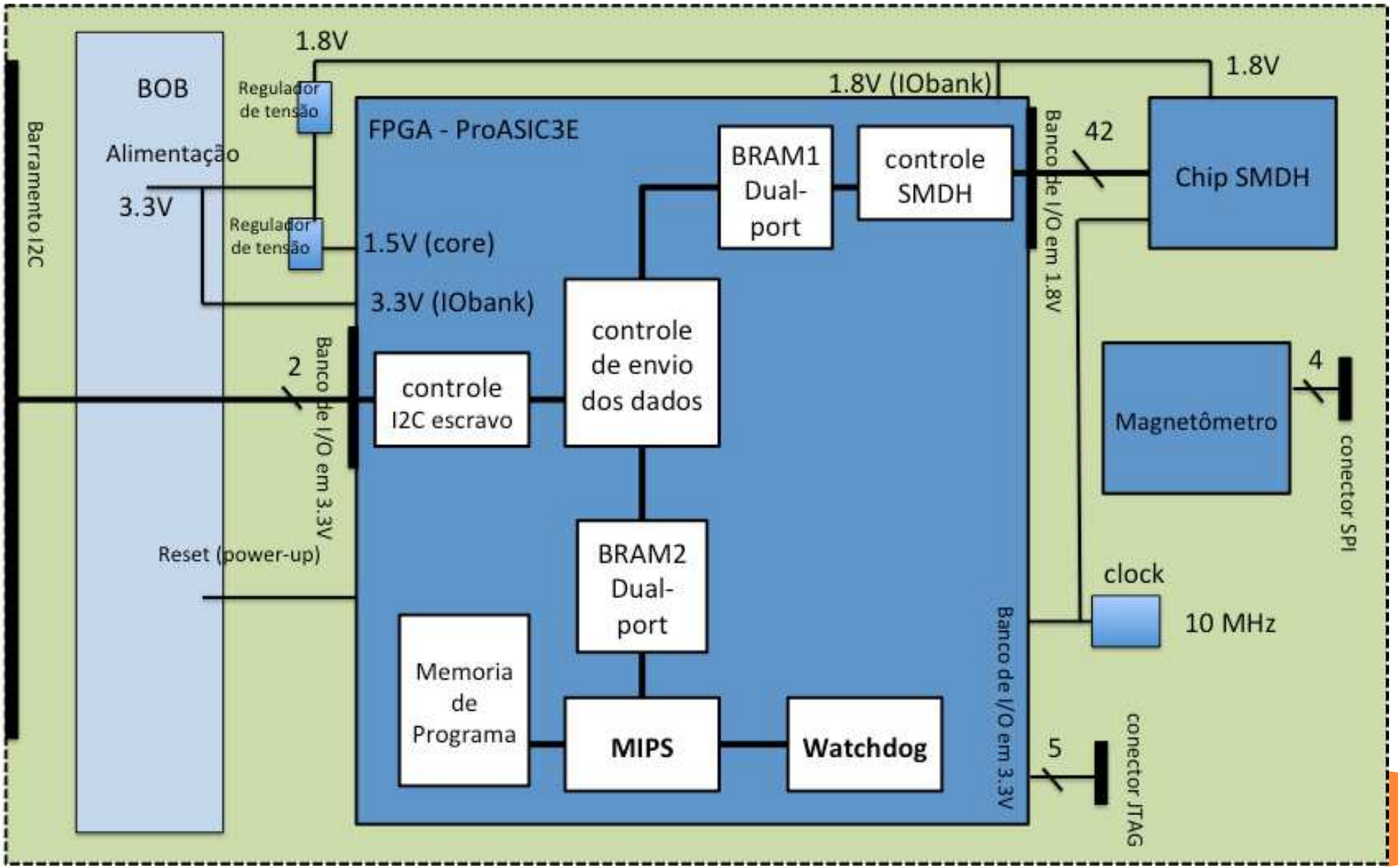


NanosatC-Br1 – Estação no ITA

NanosatC-Br1 – cargas úteis

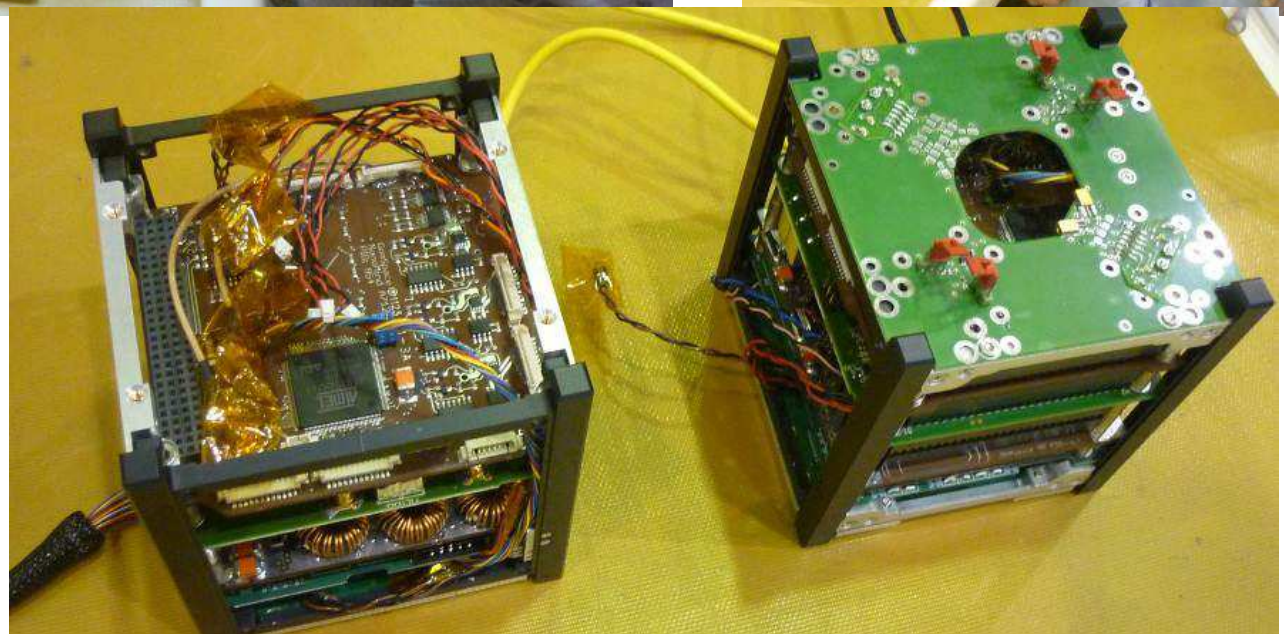
- Magnetômetro – XEN1210, XI 2x2x4 mm., 3 eixos + eletrônica
- Driver on/off
  - Projeto SMDH biblioteca in house
    - Projeto com proteção à radiação; pioneiro no país
  - Protótipo fabricado no exterior
  - Demanda do INPE/DEA/PMM
- FPGA
  - UFRGS – Lab. Informática
  - Resistência à radiação por software tolerante a falha; pioneiro no país; testado em solo no IEAv. para dose acumulada.
  - Componente industrial
  - Aplicação pioneira

Placa de carga útil do NanosatC-Br1

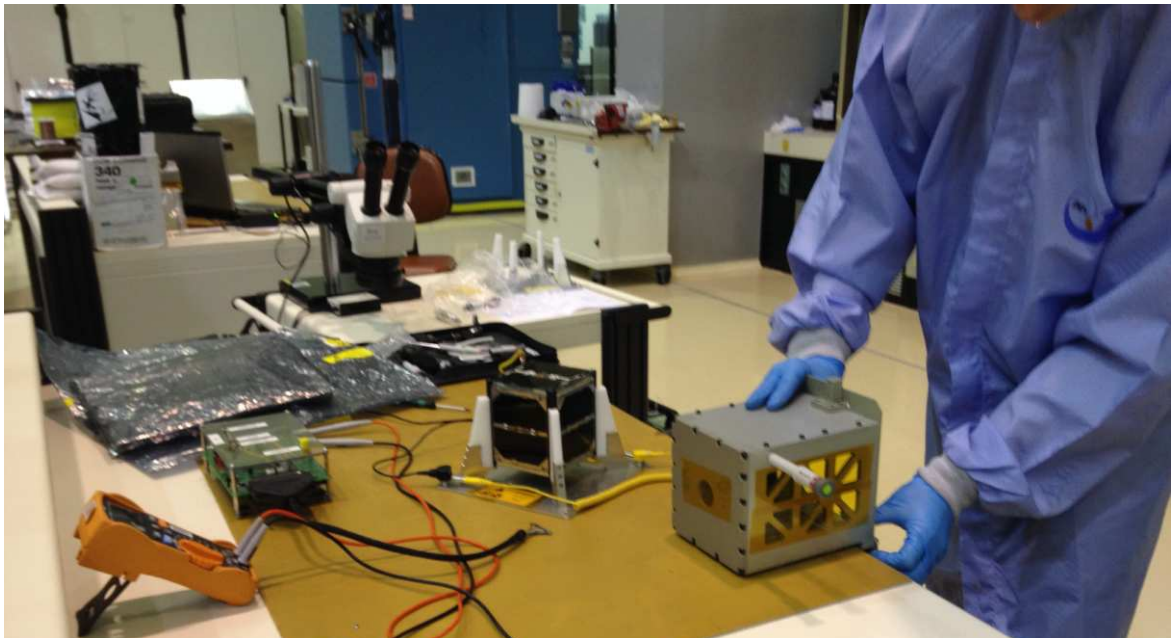



Actel
ProASIC 3E

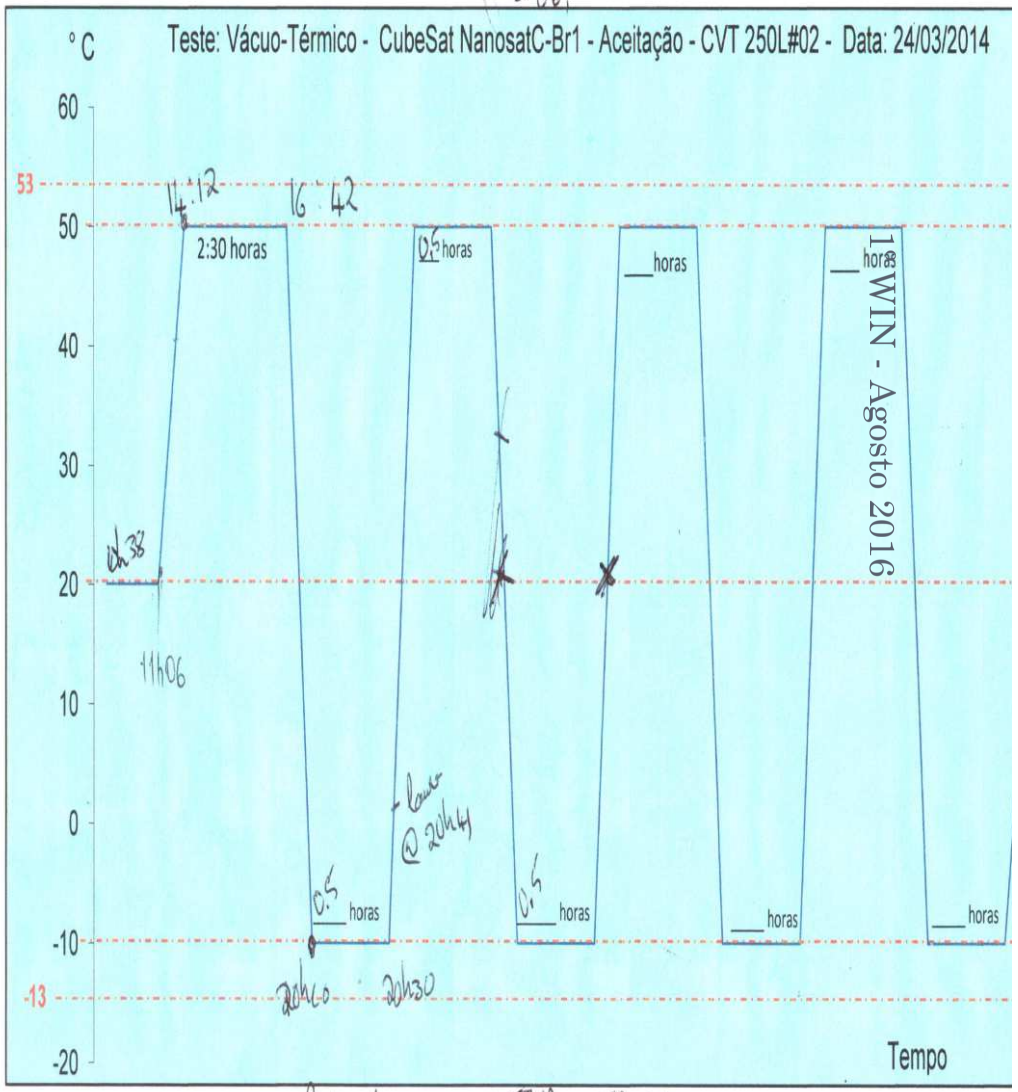
NanosatC-Br1 - Integração



Testes - vibração

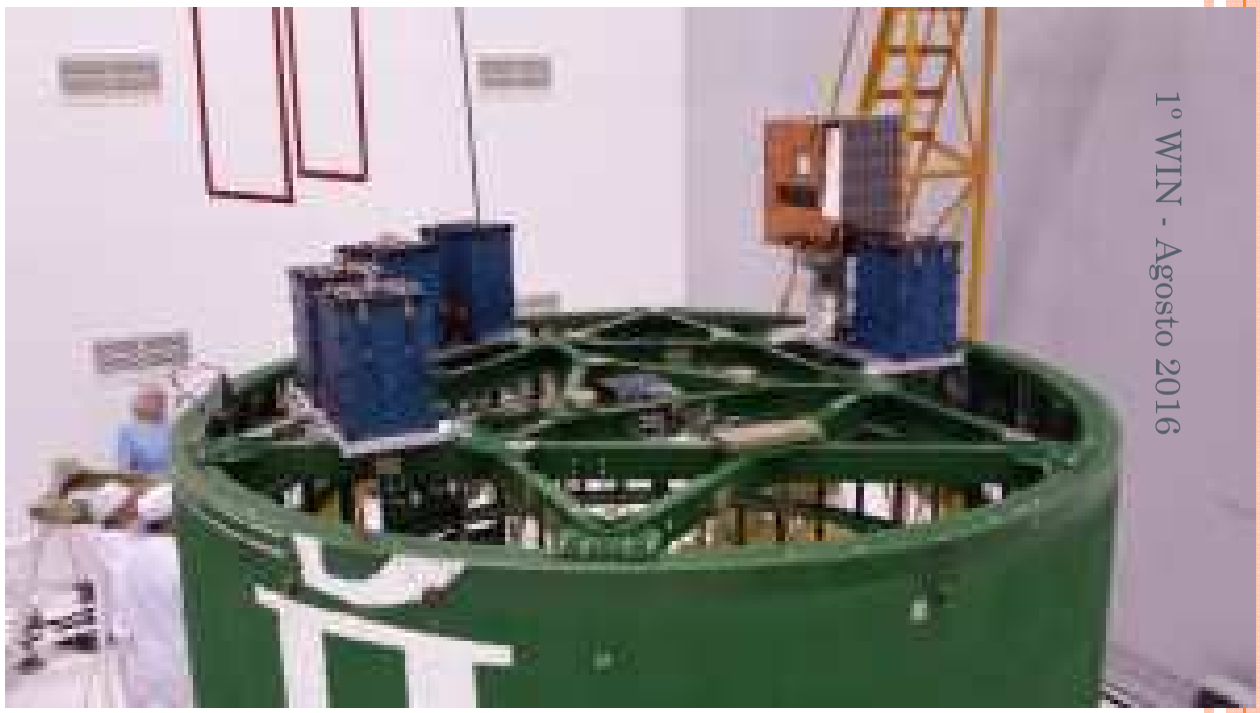


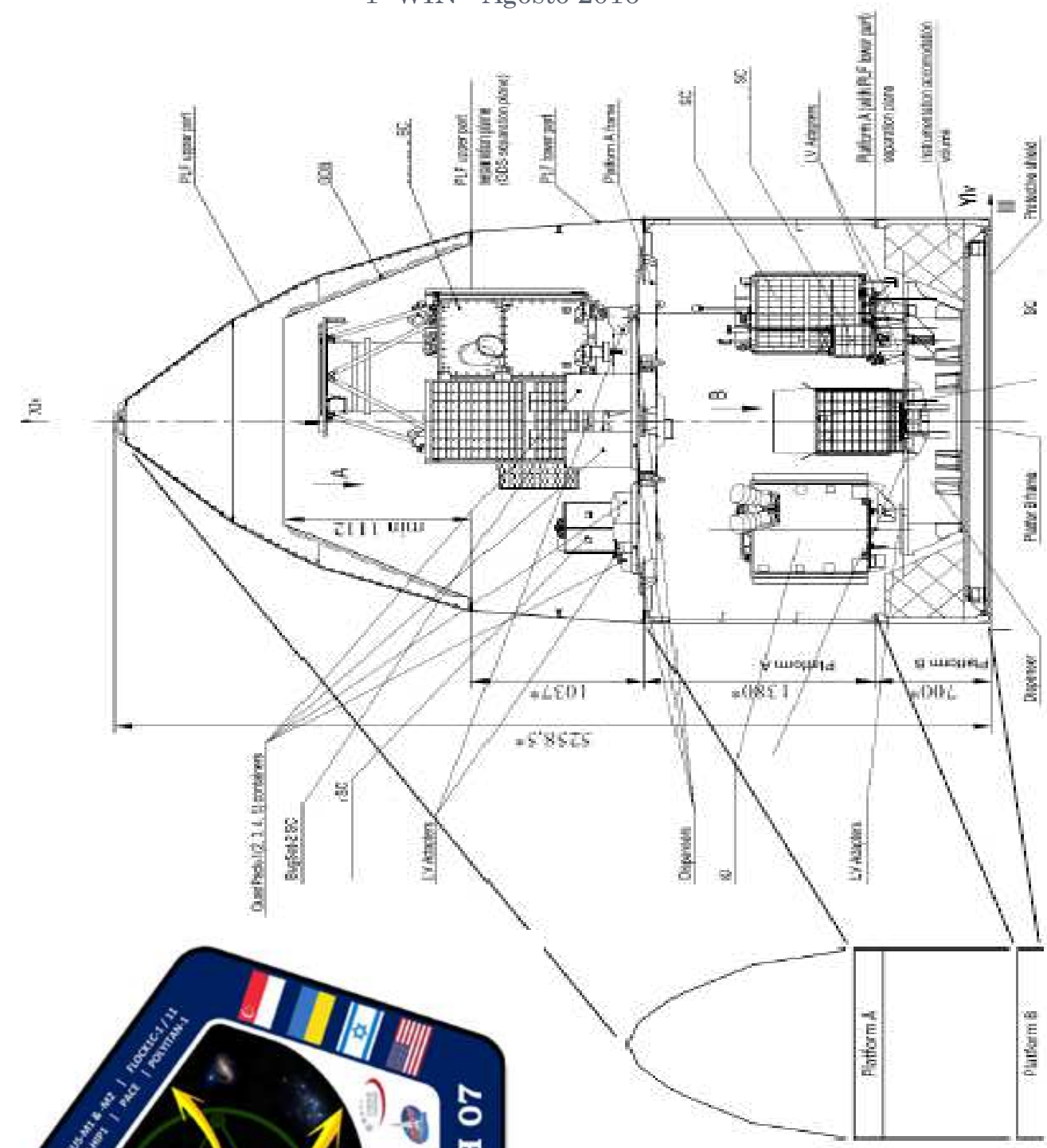
TESTES - TÉRMICOS



NanosatC-Br1 – Lançamento

NCBR1 – DNEPR, YASNY




PLF upper part
PLF lower part
Platform A frame
LV Adapters
Platform A (with PLF lower part) separation plane
Instrumentation accommodation volume
Protective shield
Platform A
Platform B
Deployer
Platform B
Platform A


ISILAUNCH 07

CERTIFICATE OF LAUNCH ACCOMPLISHMENT

DNEPR CLUSTER MISSION 2014

Настоящее информационное сообщение составлено на основании оперативного репортажа и свидетельствует о том, что космический аппарат NANOSATC-BR1 (Бразилия) с использованием пускового контейнера QuadPack, по заказу компании Innovative Space Logistics B.V., Нидерланды, был выведен на околоземную орбиту с Пусковой базы «Ясный» ракетой-носителем "Днепр"

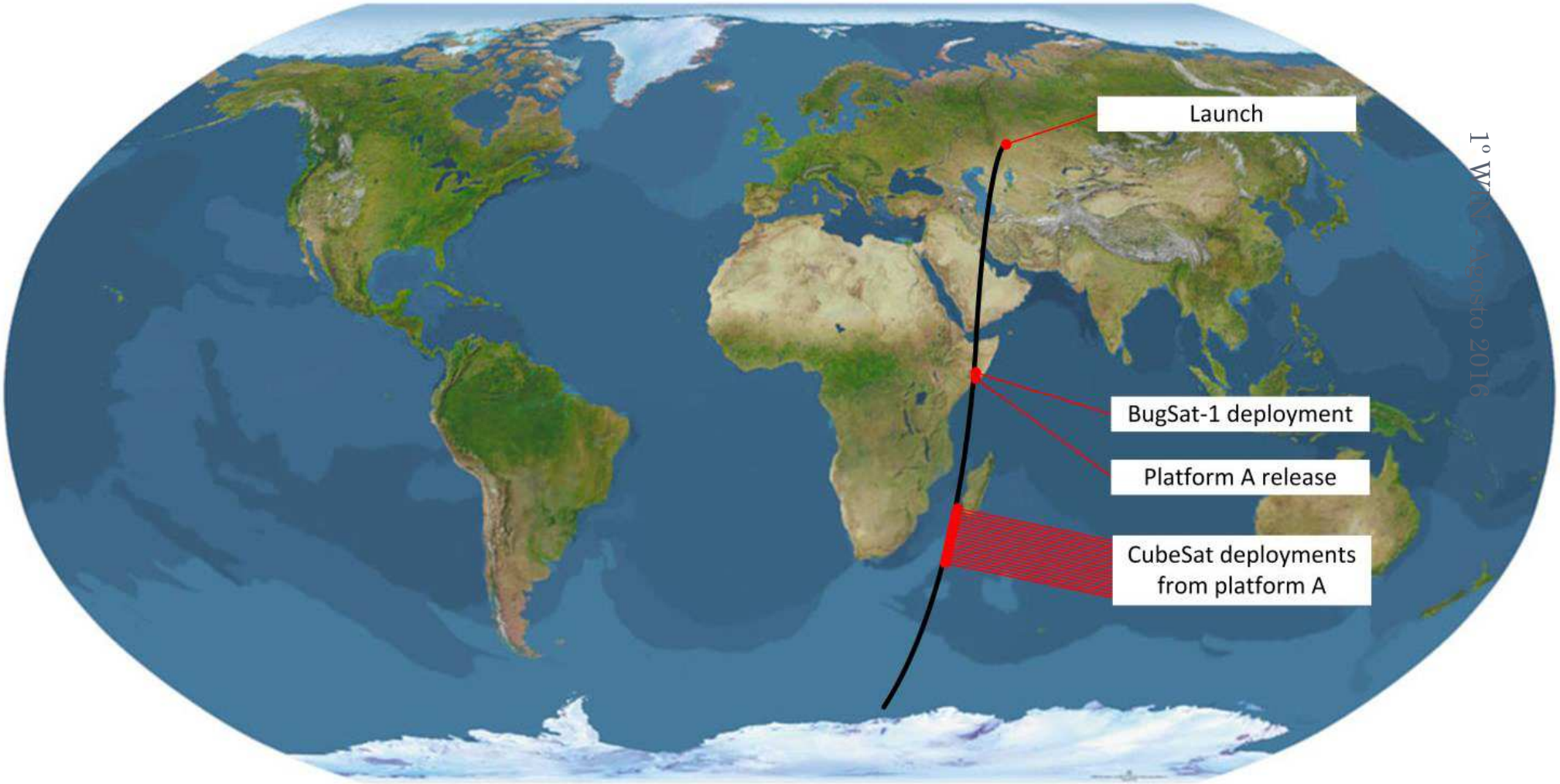
Based on real-time launch coverage data, this is to certify that SpaceCraft NANOSATC-BR1 (Brazil) with the use of QuadPack Deployer, by order of Innovative Space Logistics B.V., The Netherlands was injected into the near-earth orbit from Yasny Launch Base by DNEPR Launch Vehicle

Александр Серкин,
Генеральный директор МКК «Космотрас»

Alexander V. Serkin,
Director General, ISC Kosmotras

Дата/Date : 10 июня 2014 г./ 10 June 2014

NCBR1 – Operação



Estimados

Solicitei ao amigo Joe EI5EV (Irlanda) uma pequena gravação do BR-1. Passou por lá agora a pouco AOS 2222 LOS 2227 UTC.

Preparem a artilharia que lá vem ele....

73 de Paulo PV8DX
FJ92pt VUCC - SAT

Wow!

Maravilha.

73 de Paulo PV8DX
FJ92pt - VUCC SAT

Olá Dr. Durão,

Estamos atentos aos sinais do NanosatC-BR1 aqui no Brasil.

QB50P1 estava no mesmo cannister que nós e abaixo. Portanto sabemos que o Br-1 está em órbita

Sinais do NanosatC-BR1 recebidos na Europa!!! Parabéns à todo time!

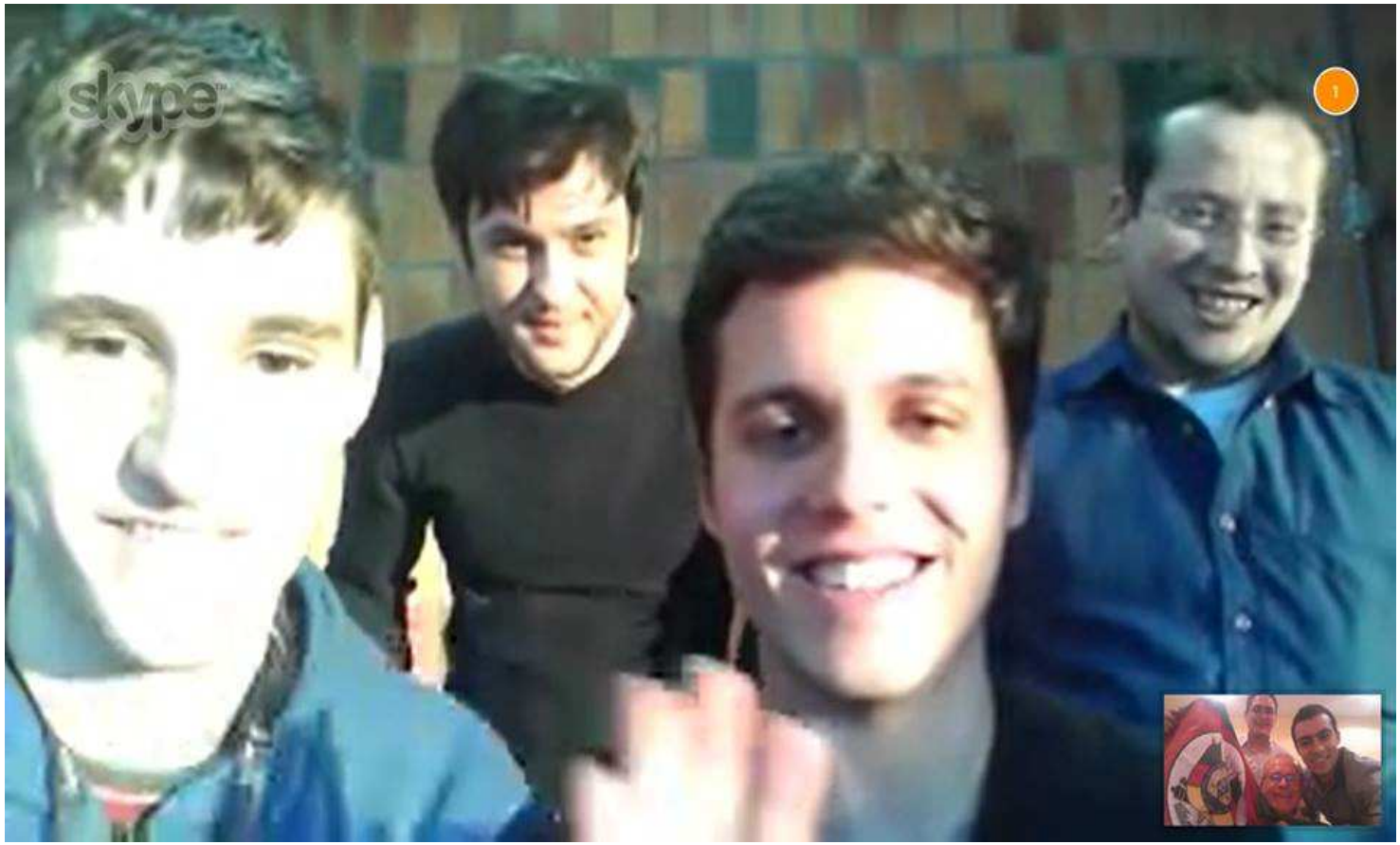
73

-- Edson PY2SDR Confirmado!!!

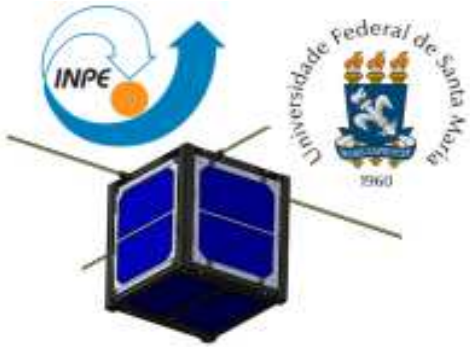
Dr, Durão,

Sinais recebidos em SP! Estou processando os sinais em CW e enviarei para o site. Gravei o arquivo de áudio. Se for de interesse, posso enviá-lo.

Primeira recepção em SM

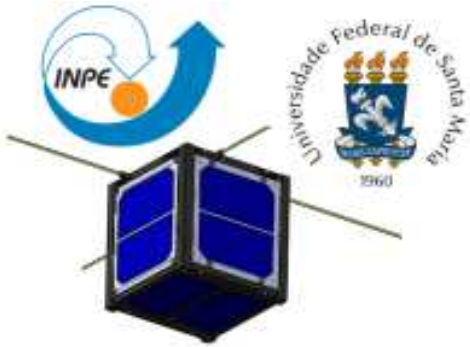


NCBR1 – Operação

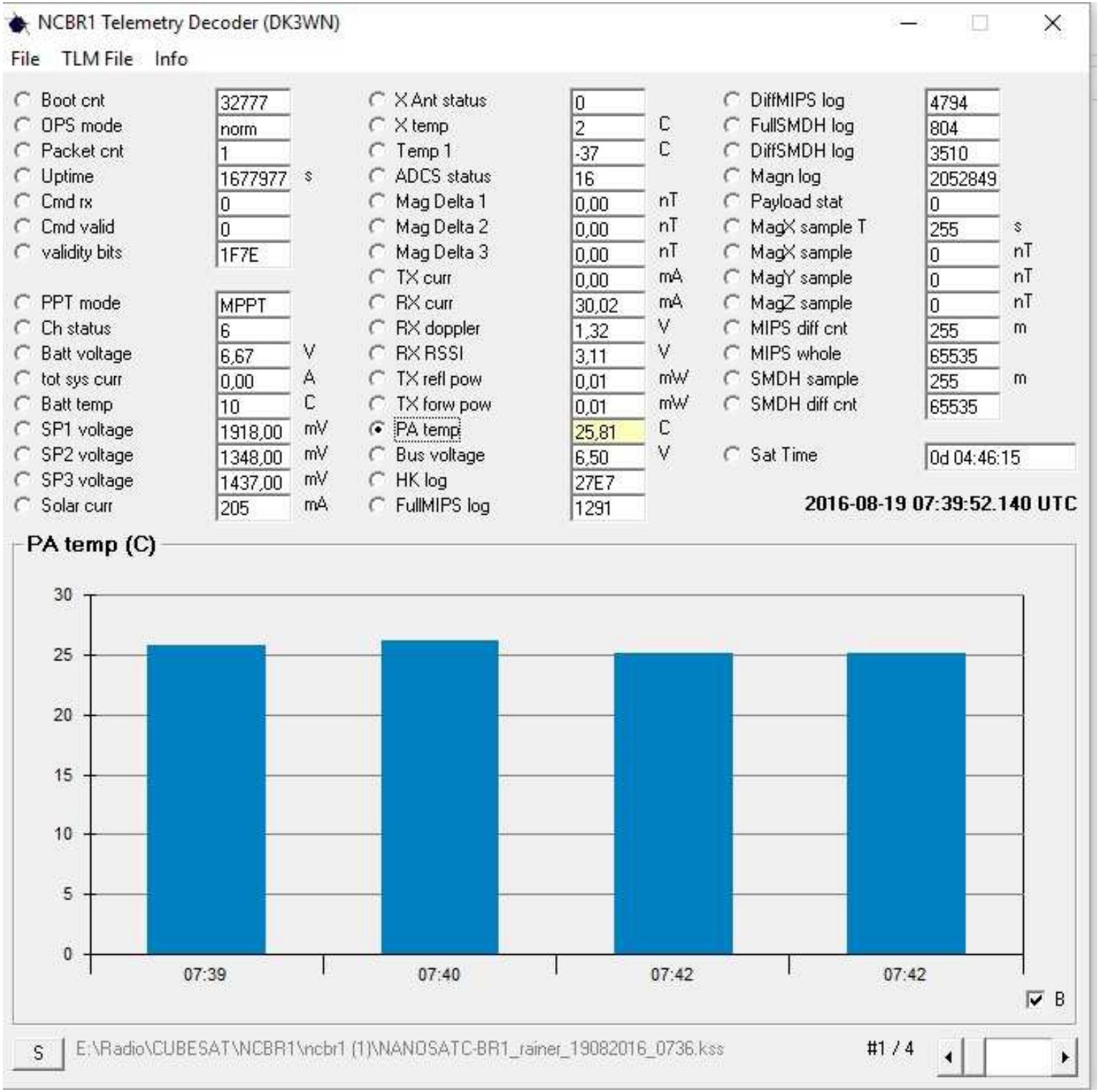


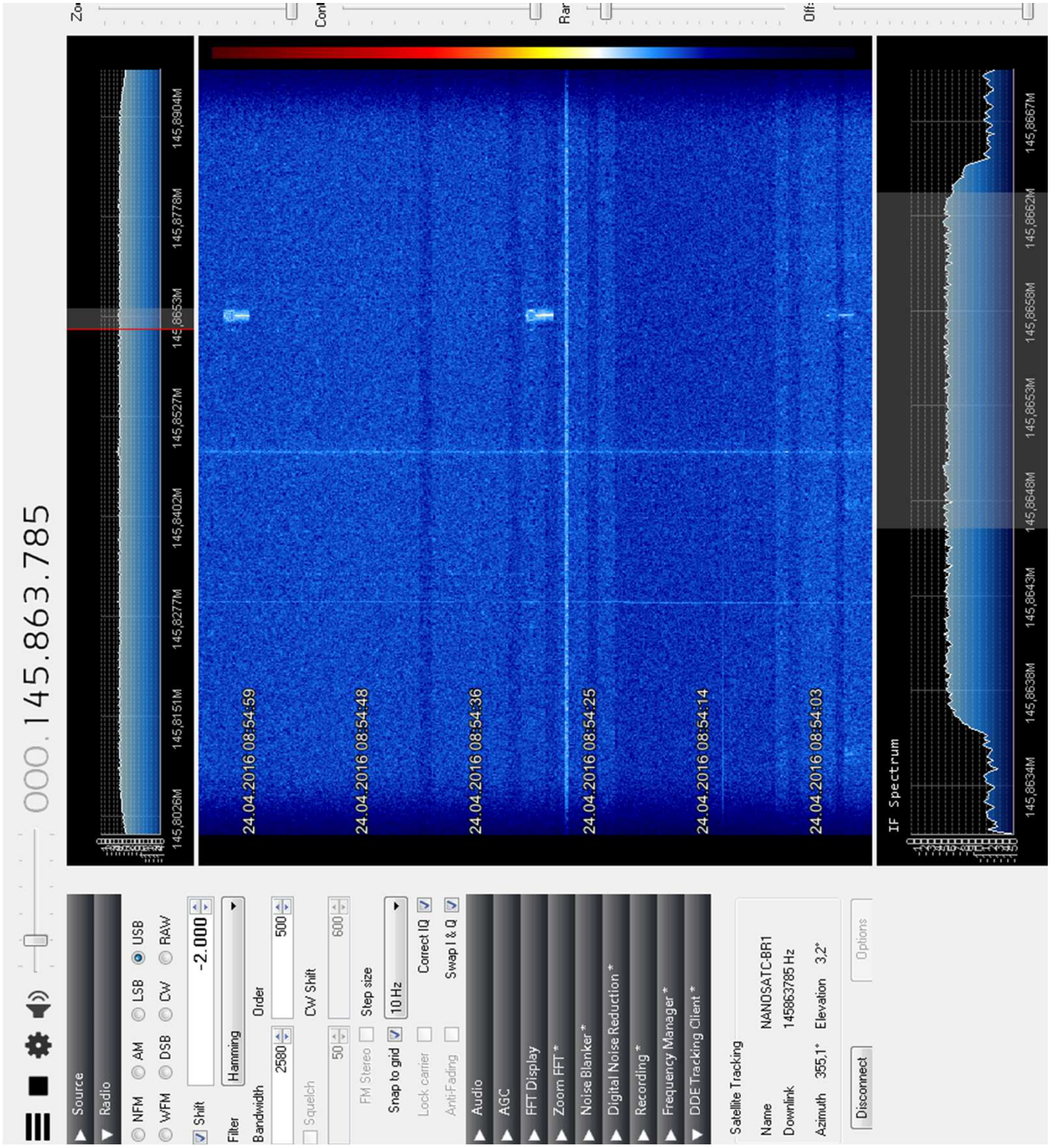
- Elementos orbitais da Plataforma A
- Lançado em modo de segurança
  - Transmissão em código Morse – beacon
- Variação de frequência do sinal devido ao efeito Dopler e à temperatura
- Envio de telecomandos
- Mudança para modo nominal
  - Transmissão digital em hexa
    - Beacon – 165 bytes
    - Arquivos de carga útil e parâmetros da plataforma
  - Decodificação para valores de engenharia

NCBR1 – Operação

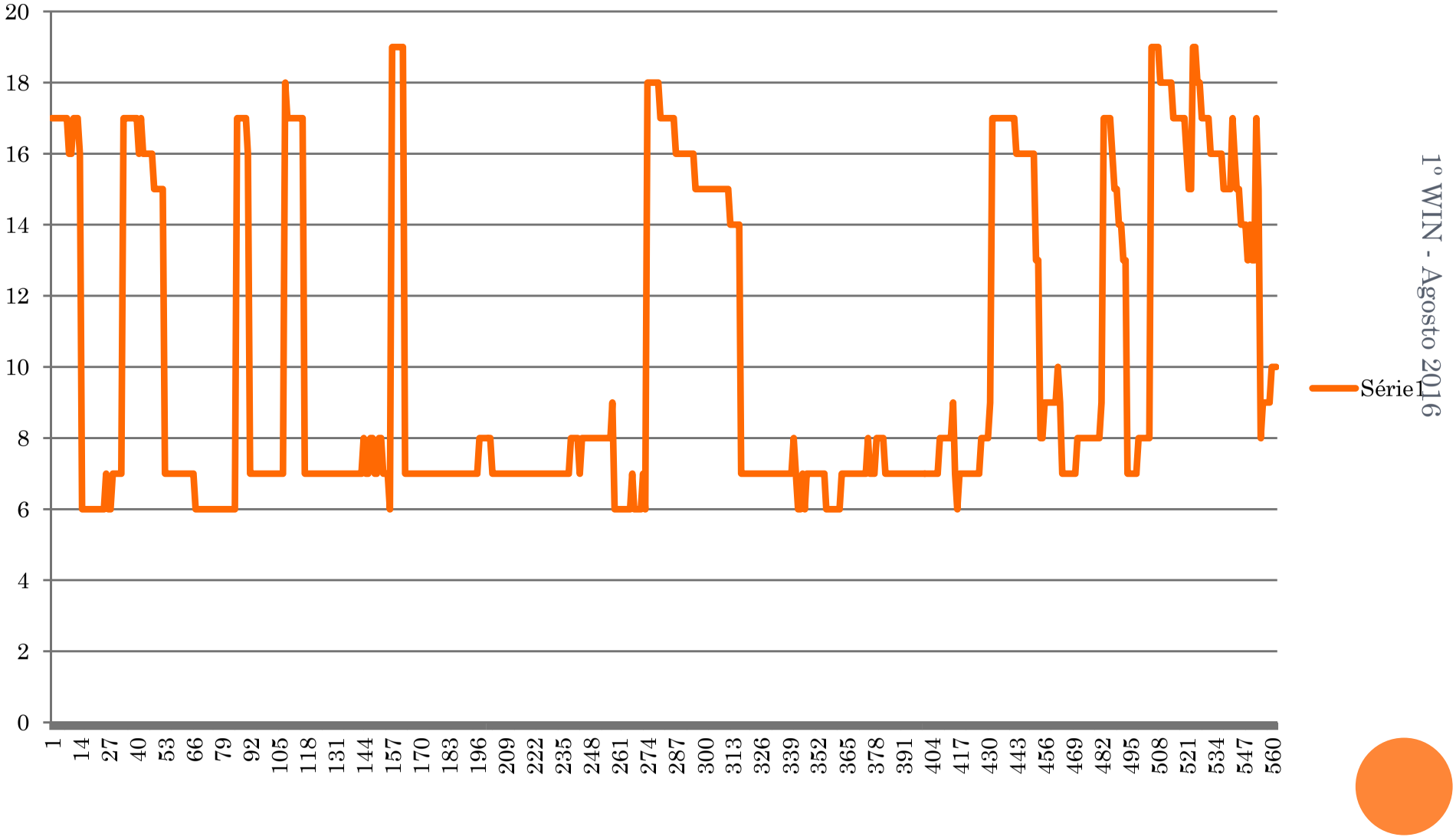


- Estação no CRS/UFSM (comando e telemetria) e ITA – UHF/VHF e banda S
- Ambas operacionais; por alunos
- Operação nominal, inclusive remotamente
- Banco de dados das cargas úteis e da plataforma enviados de SM e no ITA para o INPE SJC
- Acesso via internet através de cadastro e log in.
- Rastreio por radio amadores no Brasil e exterior

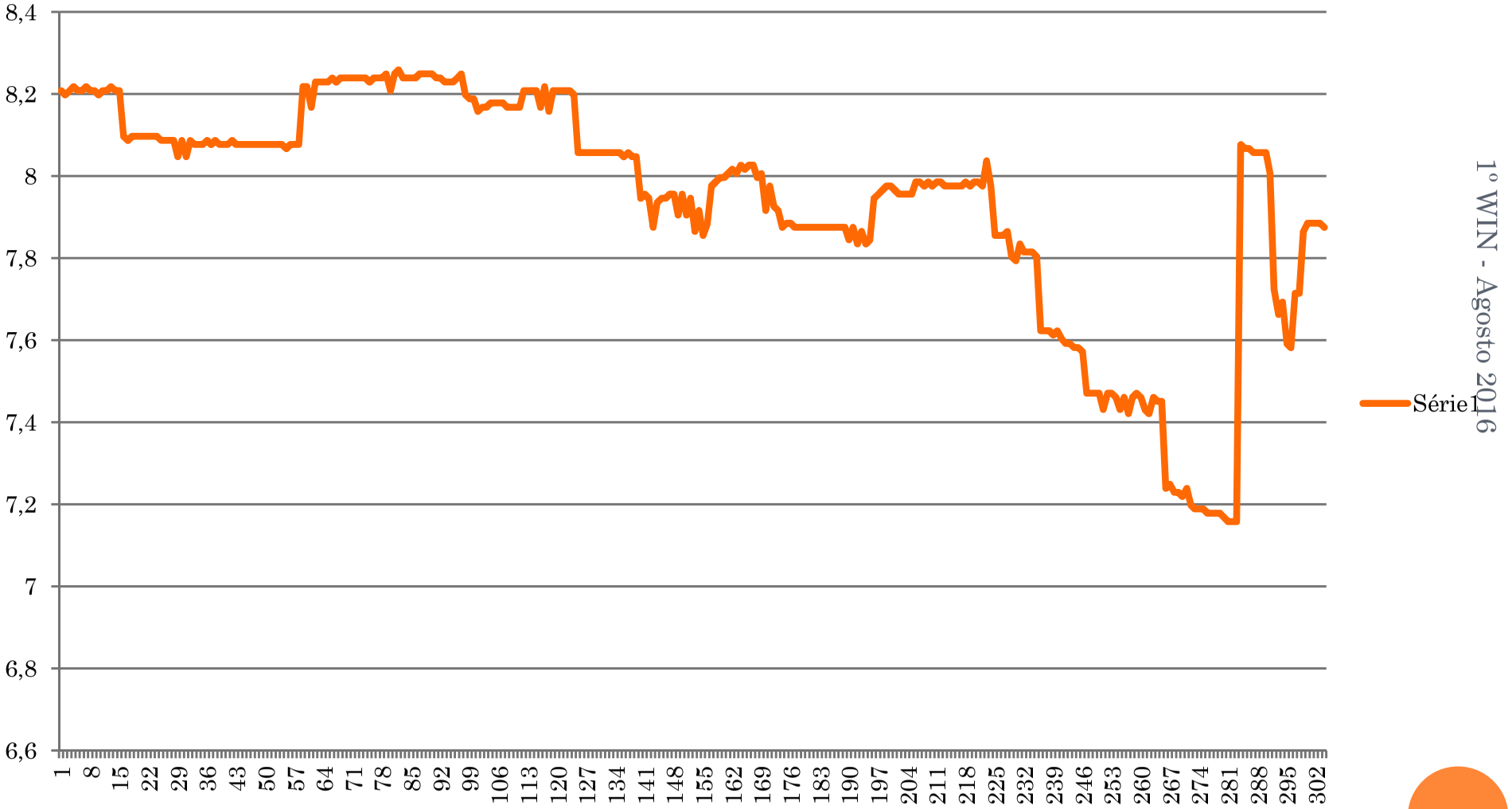

NCBR1 Telemetry Decoder (DK3WN)
File
TLM File
Info
Boot cnt 32777
OPS mode norm
Packet cnt 1
Uptime 1677977 s
Cmd rx 0
Cmd valid 0
validity bits 1F7E
PPT mode MPPT
Ch status 6
Batt voltage 6,67 V
tot sys curr 0,00 A
Batt temp 10 C
SP1 voltage 1918,00 mV
SP2 voltage 1348,00 mV
SP3 voltage 1437,00 mV
Solar curr 205 mA
X Ant status 0
X temp 2 C
Temp 1 -37 C
ADCS status 16
Mag Delta 1 0,00 nT
Mag Delta 2 0,00 nT
Mag Delta 3 0,00 nT
TX curr 0,00 mA
RX curr 30,02 mA
RX doppler 1,32 V
RX RSSI 3,11 V
TX refl pow 0,01 mW
TX forw pow 0,01 mW
PA temp 25,81 C
Bus voltage 6,50 V
HK log 27E7
FullMIPS log 1291
DiffMIPS log 4794
FullSMDH log 804
DiffSMDH log 3510
Magn log 2052849
Payload stat 0
MagX sample T 255 s
MagX sample 0 nT
MagY sample 0 nT
MagZ sample 0 nT
MIPS diff cnt 255 m
MIPS whole 65535
SMDH sample 255 m
SMDH diff cnt 65535
Sat Time 0d 04:46:15
2016-08-19 07:39:52.140 UTC
PA temp (C)
30
25
20
15
10
5
0
07:39
07:40
07:42
07:42
B
S
E:\Radio\CUBESAT\NCBR1\ncbr1 (1)\NANOSATC-BR1_rainer_19082016_0736.kss
#1 / 4


000.145.863.785
Source
Radio
NFM
AM
LSB
USB
WFM
DSB
CW
RAW
Shift
-2.000
Filter
Hamming
Bandwidth
Order
2580
500
Squelch
CW Shift
50
600
FM Stereo
Step size
Snap to grid
10 Hz
Lock carrier
Correct IQ
Anti-Fading
Swap I & Q
Audio
AGC
FFT Display
Zoom FFT *
Noise Blanker *
Digital Noise Reduction *
Recording *
Frequency Manager *
DDE Tracking Client *
Satellite Tracking
Name NANOSATC-BR1
Downlink 145863785 Hz
Azimuth 355,1° Elevation 3,2°
Disconnect
Options
145,8026M
145,8151M
145,8277M
145,8402M
145,8527M
145,8653M
145,8778M
145,8904M
24.04.2016 08:54:59
24.04.2016 08:54:48
24.04.2016 08:54:36
24.04.2016 08:54:25
24.04.2016 08:54:14
24.04.2016 08:54:03
IF Spectrum
145,8634M
145,8638M
145,8643M
145,8648M
145,8653M
145,8658M
145,8662M
145,8667M

Temperaturas

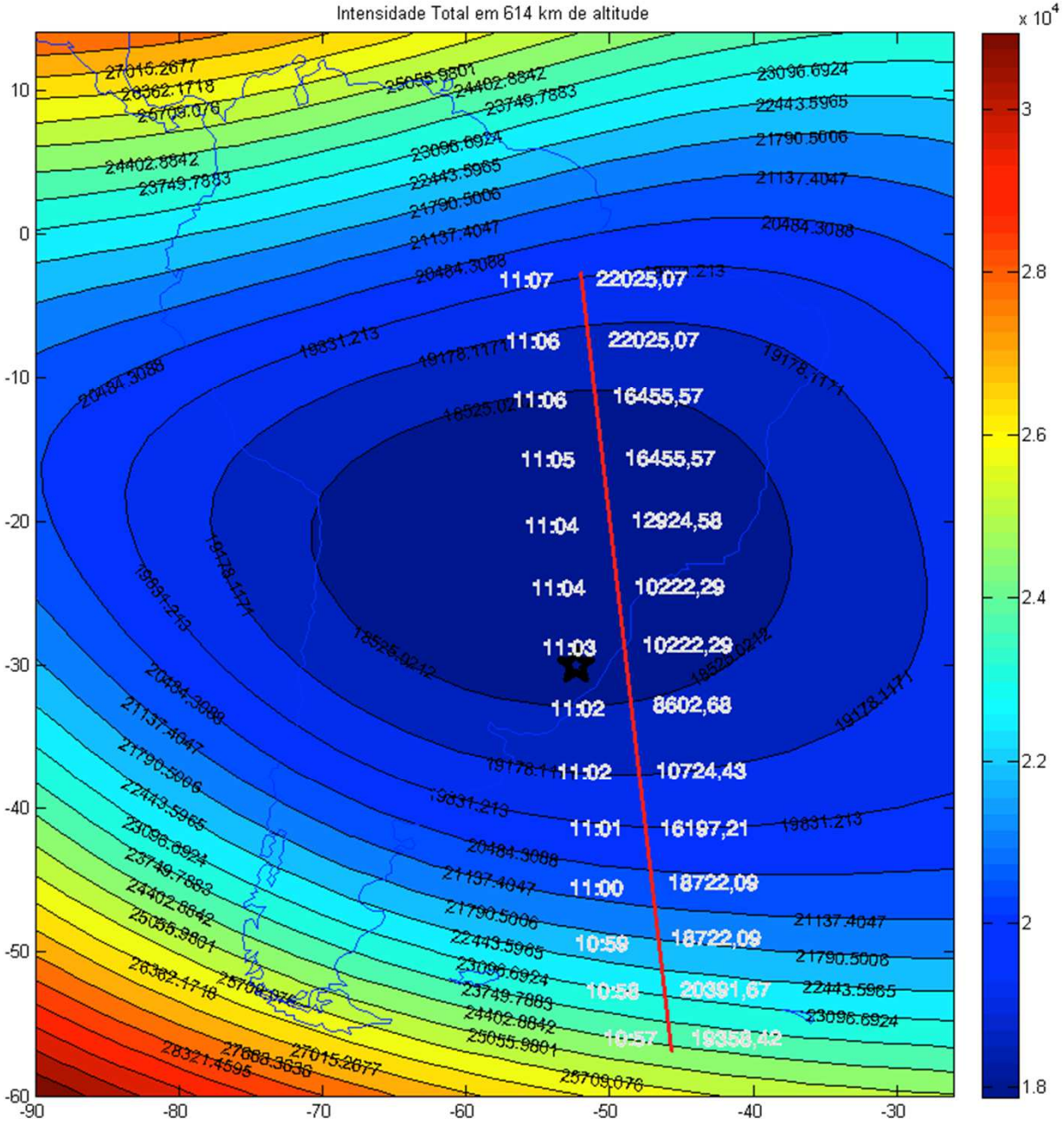


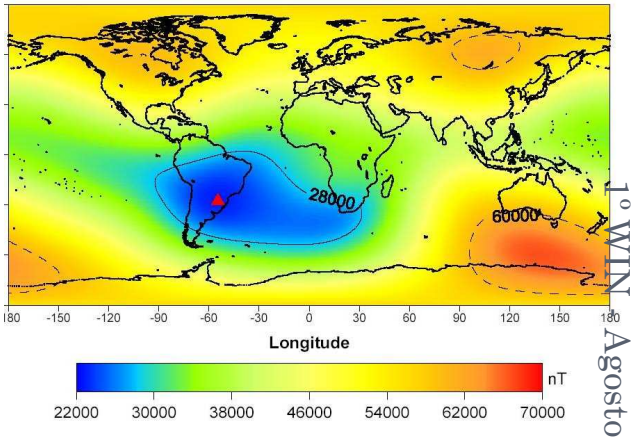
Baterias



1º WIN - Agosto 2016

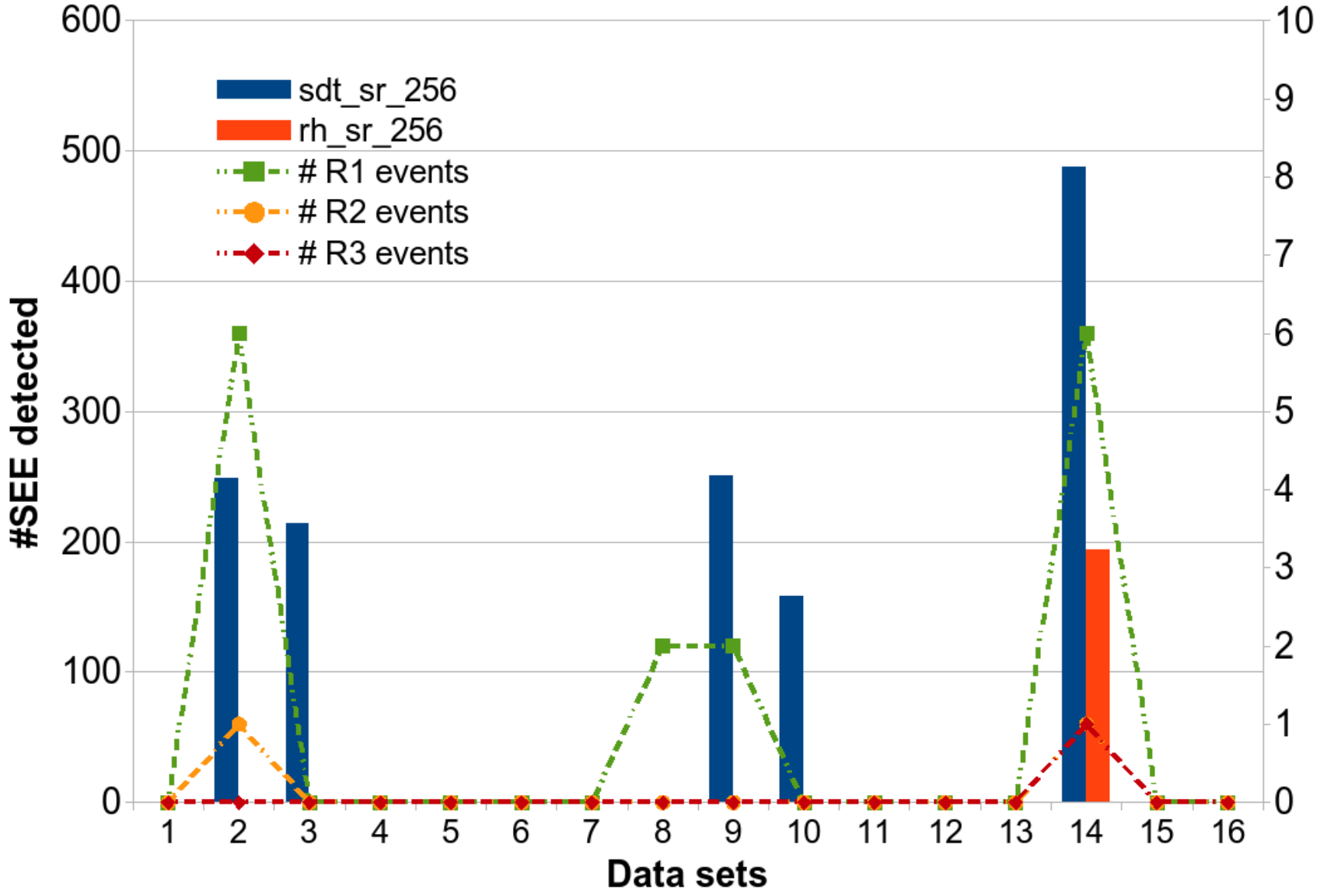
NCBR1 – Resultados científicos



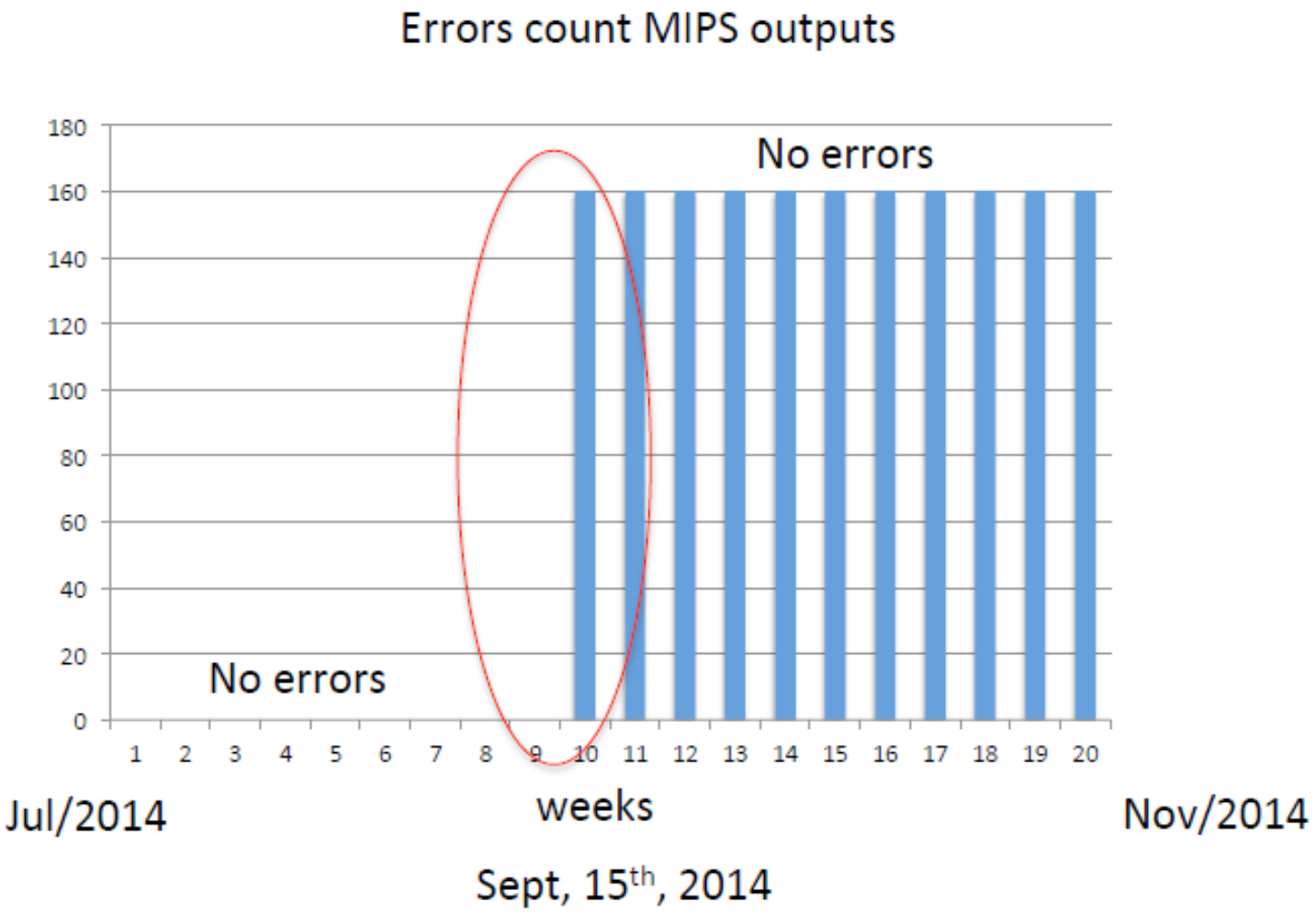


1º WIN Agosto 2016

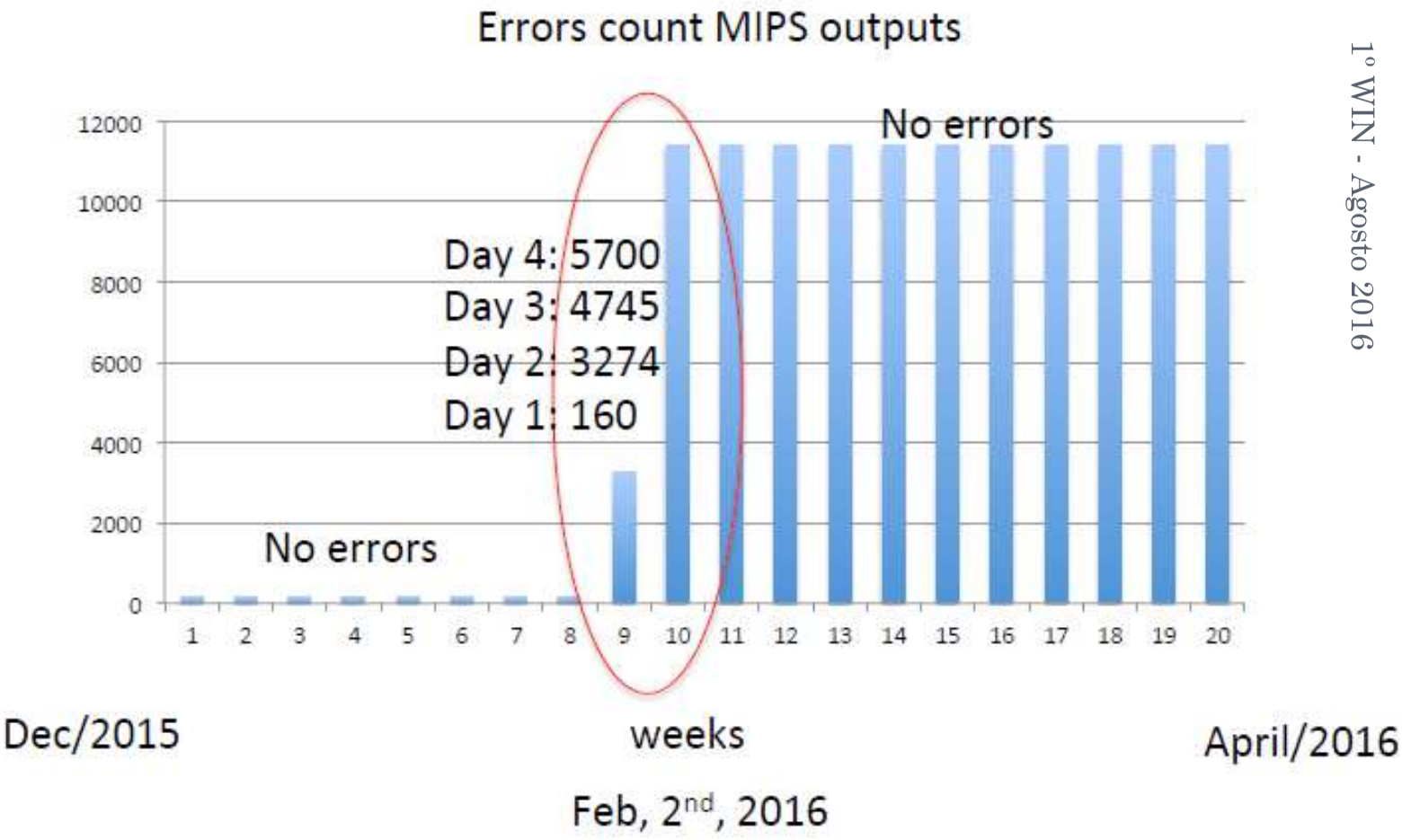
Resultados tecnológicos



Telemetry


Errors count MIPS outputs
180
160
140
120
100
80
60
40
20
0
No errors
No errors
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Jul/2014
weeks
Nov/2014
Sept, 15th, 2014

Telemetry

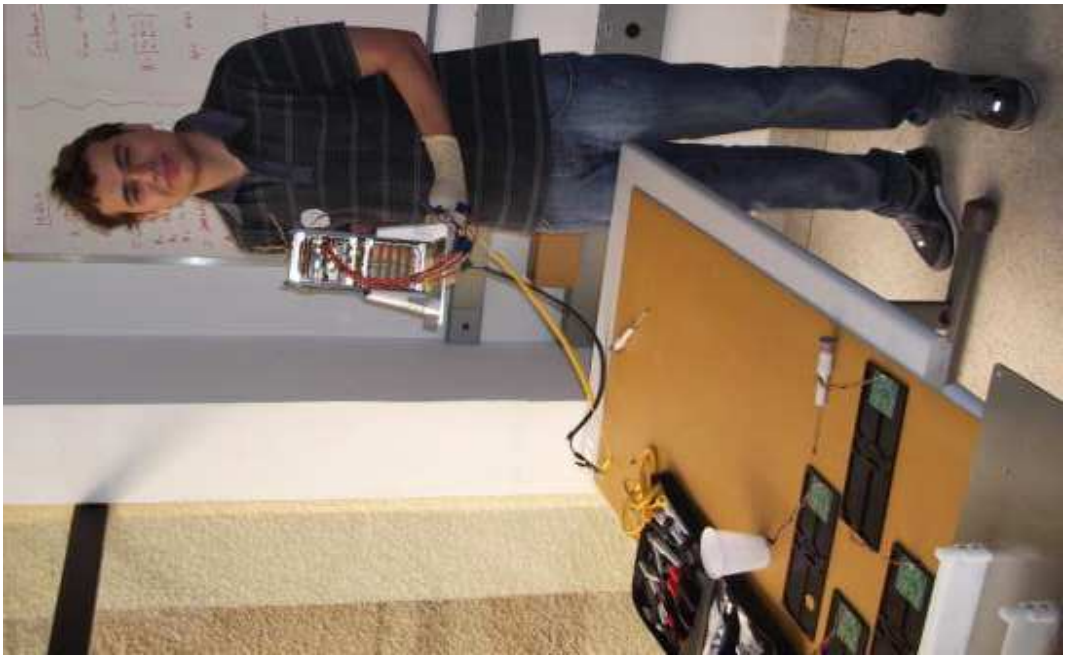

Errors count MIPS outputs
12000
10000
8000
6000
4000
2000
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
No errors
Day 4: 5700
Day 3: 4745
Day 2: 3274
Day 1: 160
No errors
Dec/2015
weeks
April/2016
Feb, 2nd, 2016

RESULTS - ACADEMIC

- Two students hired permanently by INPE as civil servants
- Four others in Ph.D. space engineering programs in INPE
- About 15 undergraduate students per year
- Other projects in other universities/institutions
- Engª Aeroespacial aprovada pelo MEC na UFSM – 1ª turma em 2016 (30 alunos em visita hoje ao INPE!)

NANOSATC-BR2

- – Lançamento previsto para Abril 2017
  - 2U
  - 6 experimentos
    - Sonda de Langmuir (INPE)
    - Subsistema de determinação de atitude com tripla redundância (UFMG/INPE/UFABC)
    - Placa v.2 do Br-1 – magnetômetro, FPGA e CI
    - Comunicação de dados – AMSAT-Br



NANOSATC-BR2

Cooperações

- ITASAT – 6U – lançamento em 2016
  - Câmera
  - GPS nacional (UFRN)
  - Transponder (INPE/CRN)
- CONASAT – 2U e 8U – INPE/CRN
  - Missão de coleta de dados.
  - Modelos de engenharia da plataforma no CRN
- NASA – Marshal Space Flight Center
  - Missão ionosférica (clima espacial)
  - Recursos NASA (Edital), INPE e FAPESP
  - 6U – plataforma recorrente do ITASAT (ITA)
  - NASA e universidades americanas – equipamentos de payload
  - INPE - sensores de solo e processamento e distribuição dos dados de cargas úteis (CEA/EMBRACE); AIT (LIT) e operação (CCS)