





- Near Space: RS41 -



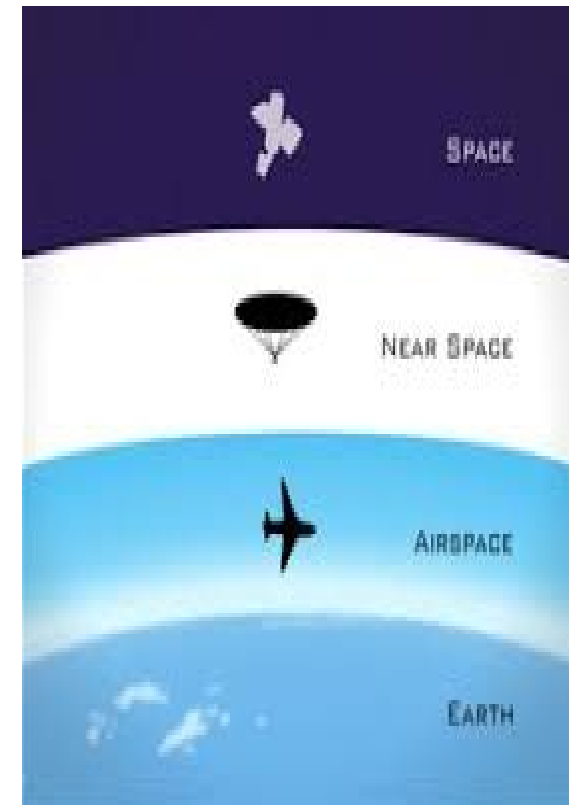
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PY2UEP

2nd Workshop on Radio Amateur's Satellites
Centro de Cultura Max Feffer – Pardinho – SP

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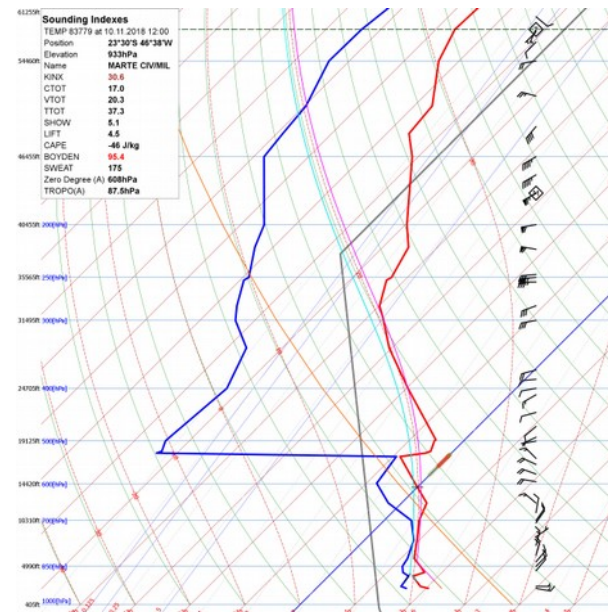
Near Space:

- From ~18km (Armstrong) to 100km (Karman)
- NSS: NS Stations (IARU):
 - Stations temporarily (minutes, hours) located in NS;
 - Observing band plan, can transmit on any frequency;
 - For longer missions (days): crossing international and regional boundaries, extra care must be observed in the harmonization of different allocations.



Meteorological Radiosonde

- PTU, wind speed and direction;
- Numerical modeling;
- Weather forecast;
- Balloons → ~@25km (NSS)
 - RS92GP (VAISALA)
 - Dedicated hardware: mods are too difficult;
 - QRG: ~403MHz not in the amateur band;
 - Band QSY: not possible!



Radiosonde RS41

- Question: is it an “ordinary” sonde as RS92?
- PTU, wind speed and direction;
- 403 MHz band;
- Hardware:
- “off the shelf”
- Community firmware enables:
 - Radio amateur 70cm band access;
 - New modes: RTTY, CW, APRS;
- Answer: definitively no! :-))))))



life.augmented

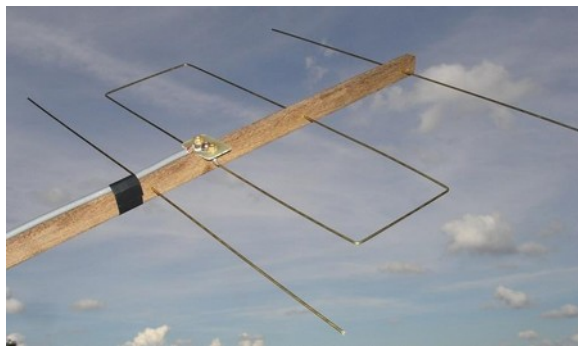


42 BR Meteo Sounding Stations

<u>Alta Floresta (MT) → RS-41</u>	Fernando de Noronha (PE)	Porto Velho (RO)
Belém (PA)	Florianópolis (SC)	Recife (PE)
Belo Horizonte [Confins] (MG)	Fortaleza (CE)	Rio Branco (AC)
Boa Vista (RR)	Foz do Iguaçu (PR)	Salvador (BA)
Bom Jesus da Lapa (BA)	Galeão (RJ)	Santa Maria (RS)
Brasília (DF)	Ilha da Trindade (ES)	Santarém (PA)
Campo de Marte (SP)	<u>Londrina (PR) → RS-41</u>	São Gabriel da Cachoeira (AM)
Campo Grande (MS)	Macapá (AP)	São Luís (MA)
Caravelas (BA)	Manaus (AM)	Tabatinga (AM)
Carolina (MA)	Manicoré (AM)	Tiririca (PA)
Corumbá (MS)	Natal (RN)	<u>Uberlândia (MG) → RS-41</u>
Cruzeiro do Sul (AC)	Petrolina (PE)	Uruguaiana (RS)
Cuiabá (MT)	Porto Alegre (RS)	Vilhena (RO)
Curitiba (PR)		<u>Vitória (ES) → RS-41</u>

Source: <http://www.inmet.gov.br>





“RS” Hunting

- Trajectory prediction: up to 6 days in advance;
- Real-time tracking at least 2km msl (remote);
 - Ideal: track down to the ground;
- At ground:
 - Small directional antenna;
 - HT's, PPE's;
 - A lot of common sense;
- At Landing place:
 - Power off and sensors protection;



First Steps After Recovery

- Careful transportation (temperature sensor is very fragile)
- Reprogramming and set parameters: callsign, tx frequency, modes, timings, messages contents, etc.
- QRG setting: UHF band plan!



- Re-use in your application!

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COM12 - PuTTY
BUTTON on/off - use button to turn off
LEDS on/off - use LEDs
POWER n - rf power n = 1 to 7 (7 is max.)
APRSFRQ n - n = aprs frequency in kHz
RTTYFRQ n - n = rtty frequency in kHz
APRSCALL string - aprs callsign (up to 6 characters)
RTTYCALL string - rtty callsign (up to 15 characters)
CWIDMESS string - cw message (up to 25 characters)
RTTY on/off - send rtty message
HOLDOFF n - n = time between two rtty messages in seconds
BAUD n - n = rtty baudrate
DBITS n - n = rtty databits (7 or 8)
SBITS n - n = rtty stop bits (1 or 2)
SHIFT n - n = 1,2,3,4 1=270, 2=540, 3=810, 4=1080 Hz
TEMP (or TEMPERATURE) on/off - send temperature in rtty messages
ALT (or ALTITUDE) on/off - send altitude in rtty & aprs messages
SPEED on/off - send speed in rtty messages
COURSE on/off - send course in rtty messages
UBAT on/off - send battery voltage in rtty messages
USYS on/off - send system voltage in rtty messages
SAT (or SATELLITES) on/off - send heard satellites in rtty messages
APRS on/off - send aprs messages
SPEEDCOURSE on/off - send speed and course in aprs messages
SYMBOL string - symbol from aprs symbol table (2 characters)
SSID n - aprs ssid n = 1 to 15
TXD n - Tx delay n = 10 to 500 ms
MICE on/off - send coded aprs messages in mic-e format
TEL (or TELEMETRY) on/off - send telemetry data in aprs messages
APRS EVERY n - time between aprs messages is n x holdoff
TAIL EVERY n - time between tail text is n x aprs time
TTEXT string - tail text (up to 100 characters)
APRS_UBAT on/off - send battery voltage in aprs ttext
WWL on/off - send wlocator messages
LWWL on/off - send long (10 char.) wlocator messages
CWID on/off - send cwid messages
CWID EVERY n - time between cw messages is n x holdoff
CW_SPEED n - cw speed in wpm
IGATE on/off - monitoring aprs message via UART
NMEA on/off - send NMEA GPGLA message via UART
DISP - show parameters
SERCOM n - speed of serial communication port (n = 300 to 115200)
CUT n - cut off altitude in meter (n = 3000 to 50000)
DEF - set default values
SAVE - save parameters to flash
cmd>
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RS41 Xprmts

- TX'ing in ham band:
 - Radio amateur HAB;
 - “Weather beacons”;
 - Promoting STEM;
 - Schools projects;
 - Very cheap telemetry for aeromodels, rockets;
 - A precursor of micro-satellite projects;
- Mandatory: licensed radio amateur directly involved to the activity;



Brainstorm: RS41 Sat

- Size: 2U Cubesat;
- Updated (modified) RS41 radiosonde;
- “Off the shelf” hardware;
- Add-on: powertrain (solar panels, regulators, batteries) plus additional sensors;
- Several protocols already available:
 - CW, RTTY, APRS, Horus;
 - New ones to be developed;
- Short lifetime orbit;



Projeto Ícaro



- Next December, 1st: launching planned!!!
- Payload: just an RS41: RTTY, CW, APRS;
- Height: at least 30km (low climb rate);
- QTH: Bauru;
- Electronic QSL on RX reporting;



PY2OAL - Luciano

- Tep Man, RS Hunter;



By Léo, PU2MCS

PY2OAL - Luciano

- 30/10/2018: First RS41 rescued in Brazil!!!;



By Luciano, PY2OAL

PY2OAL – Luciano's friends

- 03/11/2018: 3rd rescue...



By Feres, PU5TRP

References:

1. PY2GN's WEBSDR
2. RS41HUP (Ham Use Project)
3. RS41HUP - Project Horus Fork
4. OM3BC - Recycling of Vaisala RS-41
5. HappySat Website: Vaisala RS-41 Modification
6. FreeDV + Horus Binary
7. Radiossondas by PY4ZBZ





Obrigado!

Danke!

73 de PY2UEP

