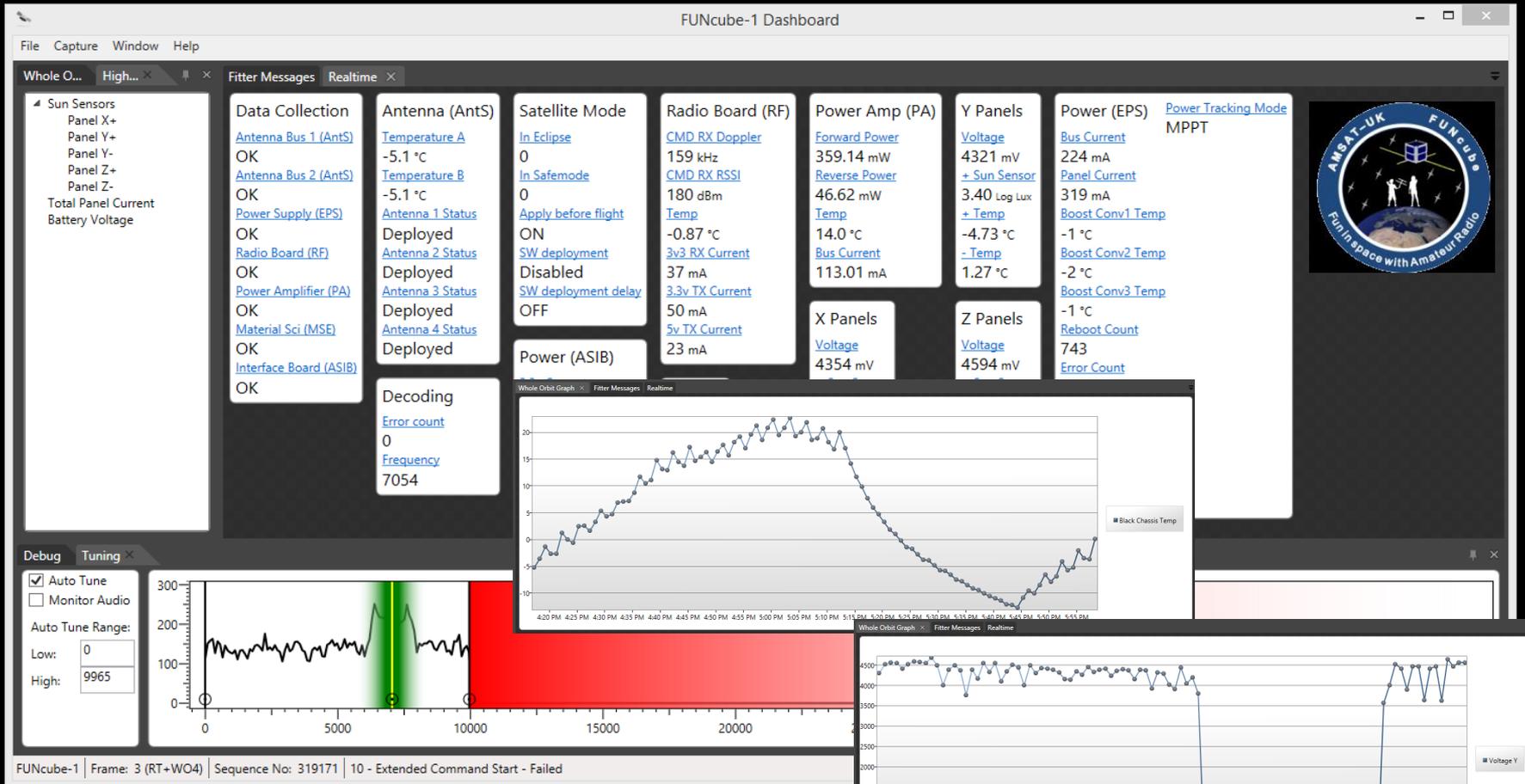


# FUNcube-1 (AO-73)

## 2 Meter Satellite Telemetry



David Haworth  
www.stargazing.net/david

# CubeSat: Small Standard Size Satellites

- Standard sizes
  - 1U: 10 cm cube, mass <1.33 kilograms
  - 2U: 2x1U
  - 3U: 3x1U
- Common deployment system
  - Poly-PicoSatellite Orbital Deployer (P-POD)

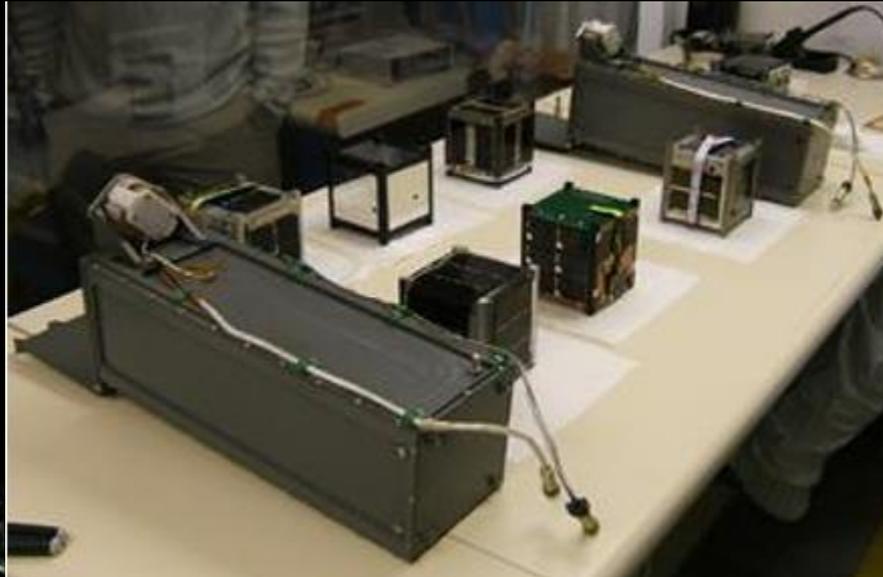


Image Credit: CubeSat Design Specification Rev. 13

# FUNcube-1 Satellite

👁️ AMSAT-UK

👁️ <http://amsat-uk.org/>



**AMSAT-UK**

*Radio Amateur Satellites*

👁️ FUNcube

👁️ <http://funcube.org.uk/>

👁️ FUNcube Warehouse

👁️ <http://warehouse.funcube.org.uk/>



👁️ AMSAT-NL

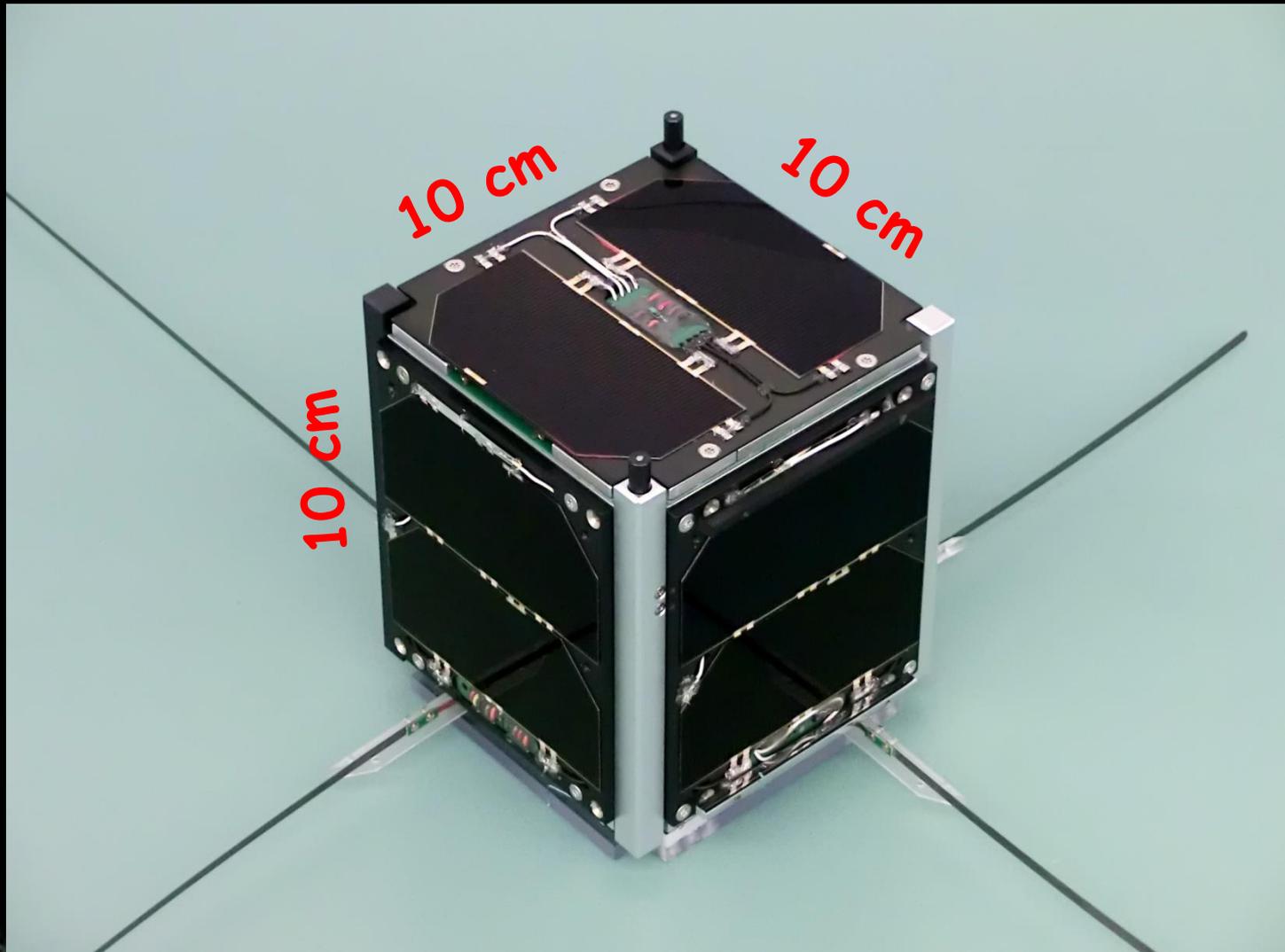
👁️ <http://amsat-nl.org/>



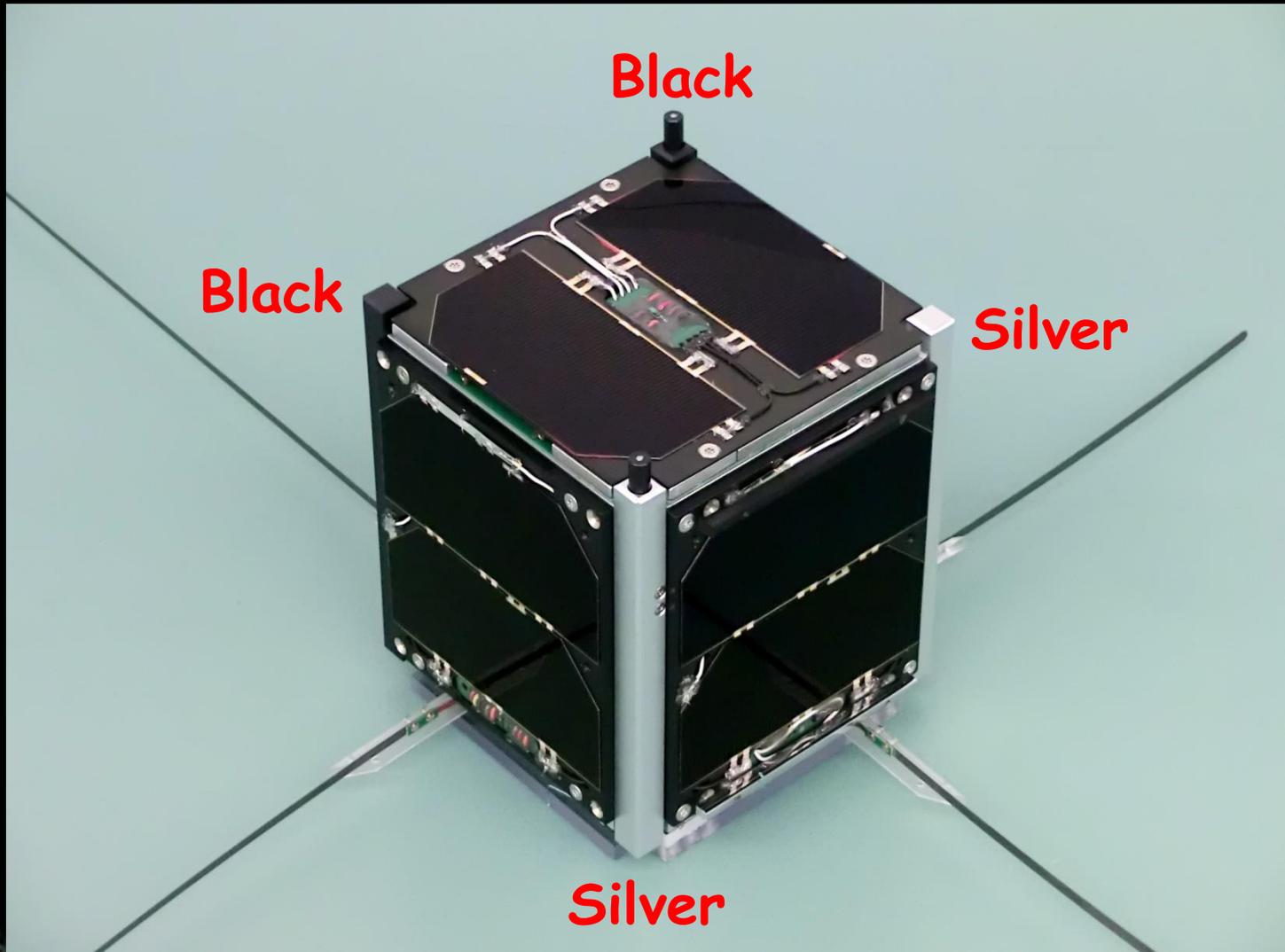
**AMSAT-NL**

*Radio Amateur Satellites*

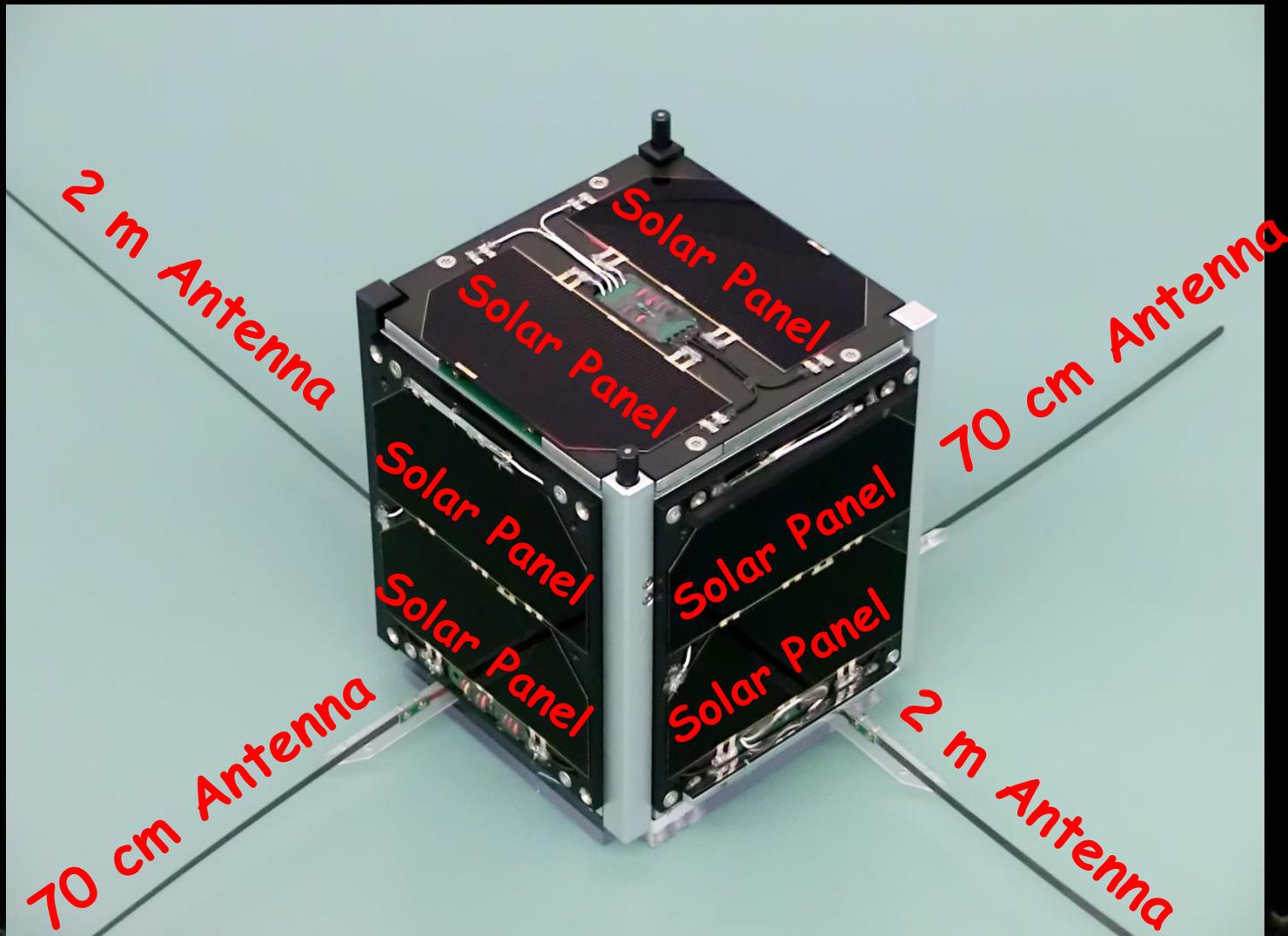
# 1U CubSat: FUNcube-1, AO-73



# 1U CubSat: FUNcube-1, AO-73



# 1U CubSat: FUNcube-1, AO-73



# FUNcube-1, AO-73

Launch Date: November 2013, Mission Goal 1 Year



<b>Mission type</b>	Amateur Radio
<b>Operator</b>	<a href="#">AMSAT-NL</a>
<b>COSPAR ID</b>	2013-066AE
<b>SATCAT №</b>	39444
<b>Website</b>	<a href="http://funcube.org.uk">funcube.org.uk</a> 
<b>Spacecraft properties</b>	
<b>Bus</b>	1U CubeSat <sup>[1]</sup>
<b>Manufacturer</b>	ISIS-BV, AMSAT-NL, AMSAT-UK
<b>Launch mass</b>	0.98 kilograms (2.2 lb)
<b>Power</b>	2.2 watts
<b>Start of mission</b>	
<b>Launch date</b>	21 November 2013
<b>Rocket</b>	<a href="#">dnep</a>
<b>Launch site</b>	Yasny Launch Base
<b>Contractor</b>	ISL
<b>Orbital parameters</b>	
<b>Reference system</b>	<a href="#">Geocentric</a>
<b>Regime</b>	<a href="#">Low Earth</a>

# FUNcube-1 Telemetry (TLM)

2 Modes: High Power M-F Mornings, Low Power Other Times

- ☉ In sunlight full power 300 mW TLM
  - ☉ TLM down link freq 145.935 MHz +/- Doppler
  - ☉ Monday - Friday mornings Europe time
  - ☉ Transponder off

Satellite Status  
Mode switching: Auto  
Transponder state: Off

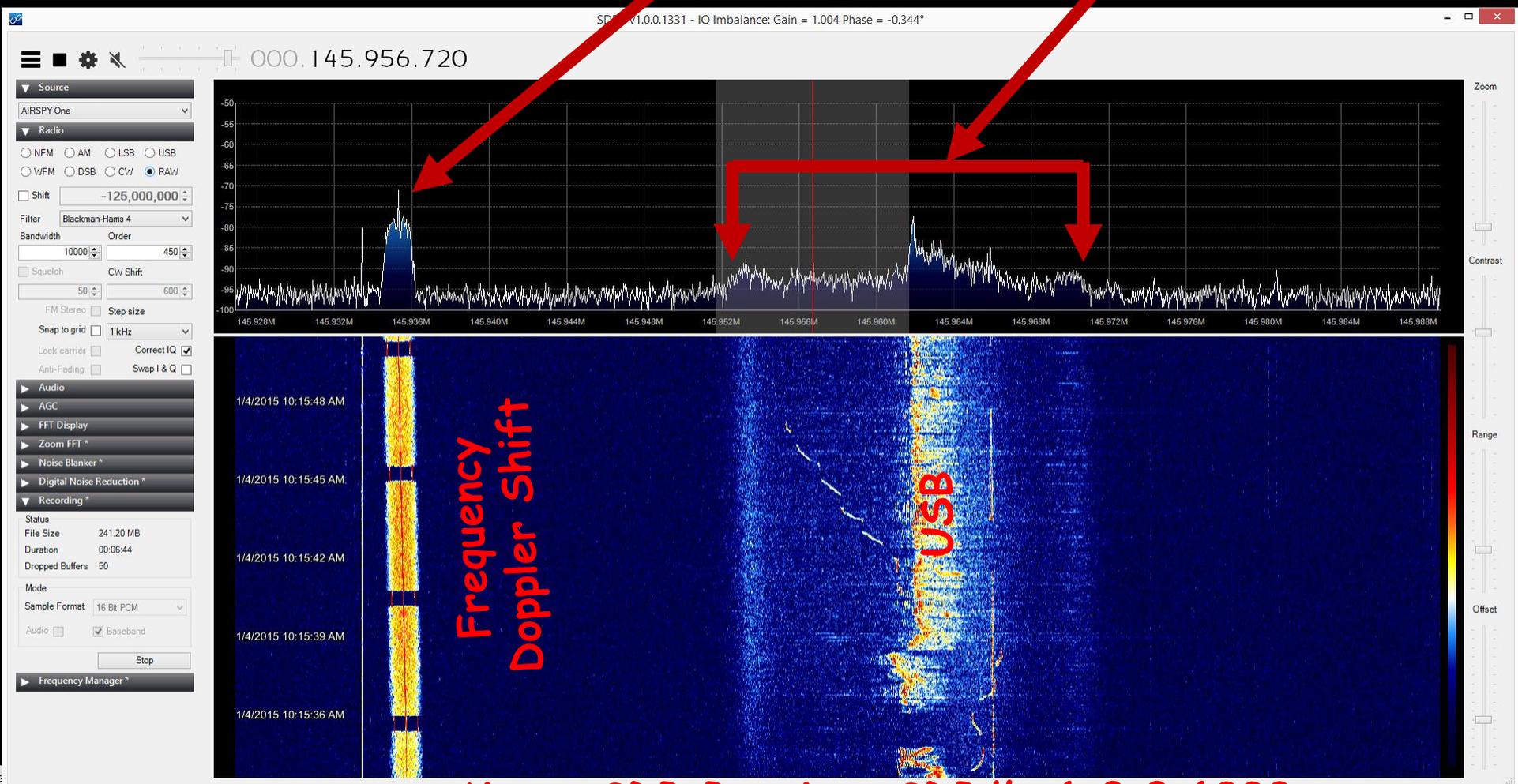
- ☉ In eclipse low power 30 mW TLM plus
  - ☉ Transponder evenings & weekends
    - ☉ Surface to satellite to surface communications
    - ☉ Uplink 435.150 - 435.130 MHz CW & LSB (Inverting)
    - ☉ Downlink 145.950 - 145.970 MHz CW & USB

Satellite Status  
Mode switching: Manual  
Transponder state: On

# FUNcube-1 Telemetry (TLM)

## Low power TLM beacon with transponder

Satellite Status  
Mode switching: Manual  
Transponder state: On



Airspy SDR Receiver SDR# v1.0.0.1332

# FUNcube-1, AO-73 Position

<http://warehouse.funcube.org.uk/satmap.html?satelliteId=2>

## Current Satellite Position



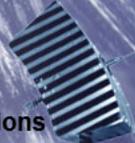
# FUNcube-1, AO-73 Position

<http://www.amsat.org/amsat-new/tools/predict/index.php>



## AMSAT™

AMSAT Online Satellite Pass Predictions



10605 Concord St, #304  
Kensington, MD 20895  
1-888-322-6728

### AMSAT Online Satellite Pass Predictions - AO-73

[View the current location of AO-73](#)

Date (UTC)	AOS (UTC)	Duration	AOS Azimuth	Maximum Elevation	Max El Azimuth	LOS Azimuth	LOS (UTC)
08 Feb 15	03:58:46	00:11:07	116	14	55	5	04:09:53
08 Feb 15	05:33:17	00:13:36	169	75	240	346	05:46:53
08 Feb 15	07:12:19	00:09:43	229	8	270	321	07:22:02
08 Feb 15	17:20:18	00:11:16	28	17	90	153	17:31:34
08 Feb 15	18:56:16	00:12:39	7	46	276	210	19:08:55
08 Feb 15	20:34:01	00:07:44	345	5	319	270	20:41:45
09 Feb 15	04:18:34	00:12:06	128	21	68	0	04:30:40
09 Feb 15	05:53:57	00:13:32	181	46	271	342	06:07:29
09 Feb 15	07:34:31	00:07:04	247	3	273	311	07:41:35
09 Feb 15	17:40:34	00:12:11	23	27	82	166	17:52:45

**Your results are shown above**  
Use the form below to request more pass predictions

Show Predictions for:  for Next  Passes

Calculate Latitude and Longitude from Gridsquare:

Or

Enter Decimal Latitude:\*

Enter Decimal Longitude:\*

Elevation (Metres):

Save my location for later use



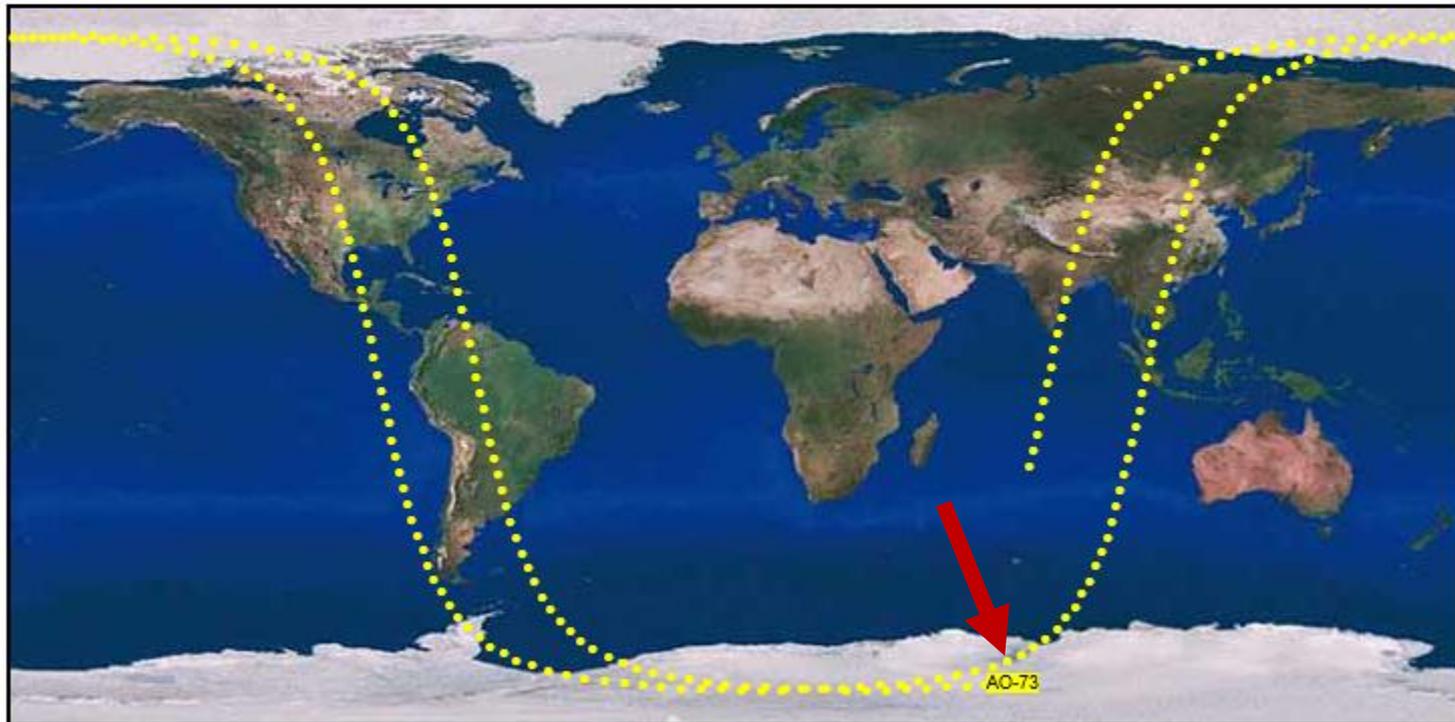
10605 Concord St, #304  
Kensington, MD 20895  
1-888-322-6728

## Satellite Tracking for AO-73

### Current Position of AO-73

Sun, 08 Feb 2015 01:46:43 GMT (17:46:43 local time)

Current Location: 70E 81S



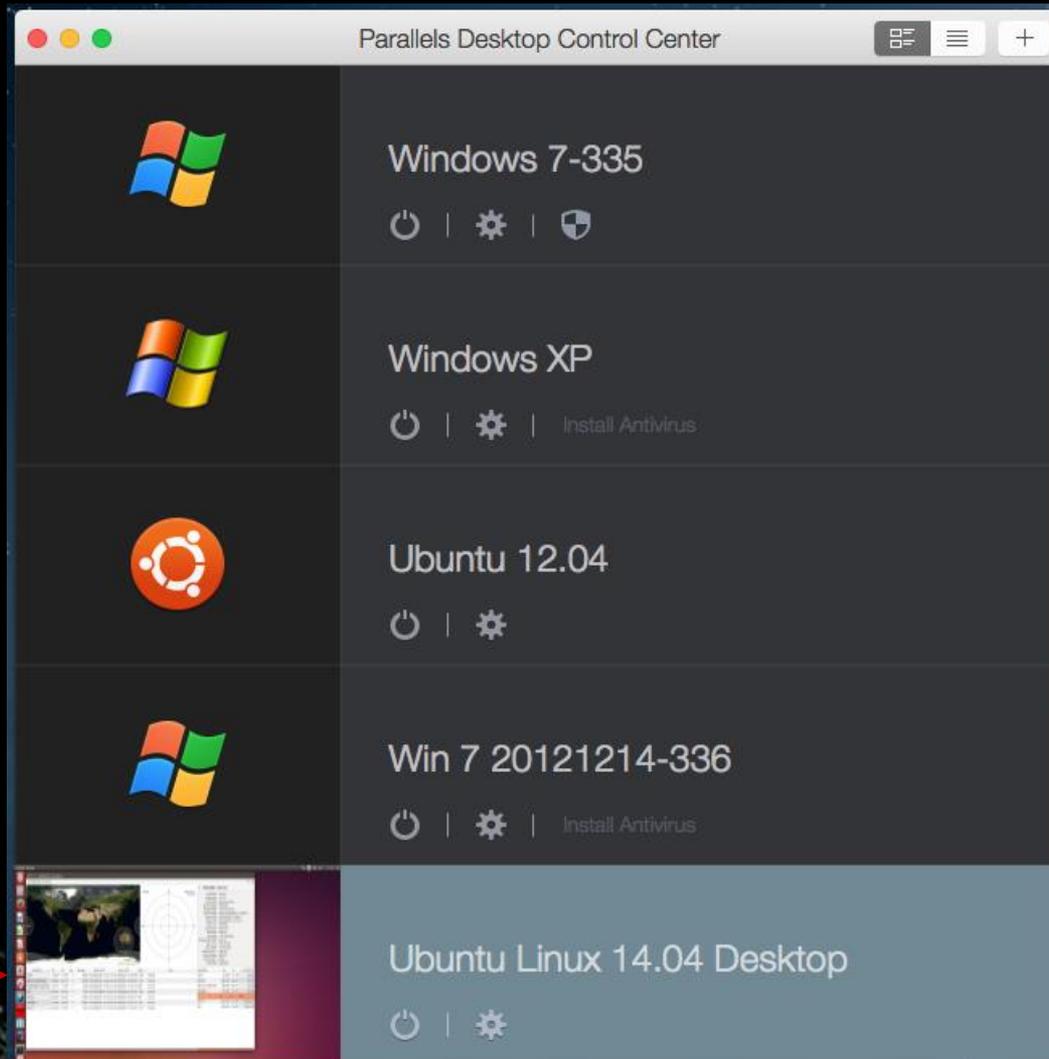
Select a Different Satellite:  ▼

*Note: Position is approximate and depends on your computer's performance.*



# Gpredict on MacBook Pro

Ubuntu Linux 14.04 on Parallels Desktop 10





# Gpredict on MacBook Pro

## Ubuntu 14.04 Software Center Easy Install

The screenshot shows the Ubuntu Software Center interface. At the top, there are navigation buttons for 'All Software', 'Installed', 'History', and 'Progress'. The main content area displays the details for 'GNOME Predict', a satellite tracker. It shows a globe icon, the name 'GNOME Predict', the category 'Satellite tracker', and a rating of 5 stars (8 ratings). A green checkmark indicates it is 'Installed on 2014-12-27'. A 'Remove' button is visible. Below this, a description states: 'Gpredict is a real time satellite tracking program for GNOME, based on the tracking engine of John Magliacane's excellent satellite tracker Predict.' It then lists features: tracking an infinite number of satellites, displaying data in various formats, multi-module support, ground station management, pass prediction, real-time simulation, Doppler tuning, and antenna rotator control. A version number 'gpredict 1.3-2ubuntu2' is shown at the bottom. An inset window titled 'About GPREDICT' is overlaid on the right, showing the application's logo, version 'GPREDICT 1.3', copyright information for Alexandru Csete OZ9AEC, and a link to the project website: <http://gpredict.oz9aec.net/>. The 'About' window also has 'Credits', 'License', and 'Close' buttons.

**GNOME Predict**  
Satellite tracker  
★★★★★ (8 ratings)

✓ Installed on 2014-12-27 Remove

Gpredict is a real time satellite tracking program for GNOME, based on the tracking engine of John Magliacane's excellent satellite tracker Predict.

Gpredict includes the following features:

- Tracking an infinite number of satellites limited only by the physical memory and processing power of the computer.
- Display the tracking data in lists, maps, polar plots or any combination of these.
- You can have many modules open at the same time, either in a notebook or in their own windows. The module can also run in full-screen mode.
- You can use many ground stations. Ground station coordinates can be entered manually or you can get some approximate values from a list with more than 2000 predefined locations worldwide.
- Predict upcoming passes for satellites, including passes where a satellite may be visible and communication windows open.
- Very detailed information about both the real time data and the predicted passes.
- Gpredict can run in real-time, simulated real-time (fast forward and backward), and manual time control.
- Doppler tuning of radios via Hamlib rigctld.
- Antenna rotator control via Hamlib rotctld.

Version gpredict 1.3-2ubuntu2

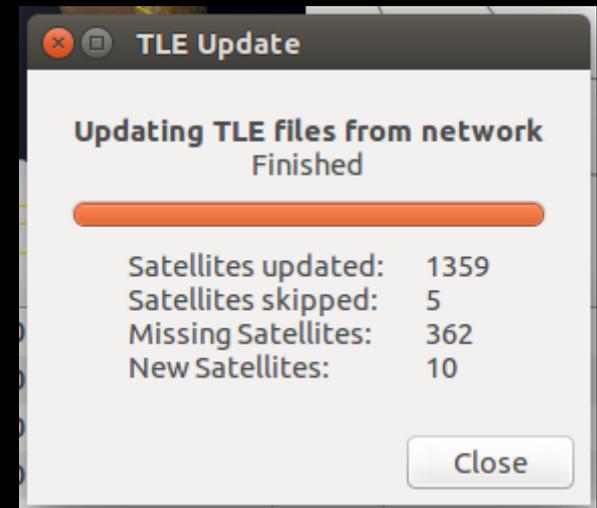
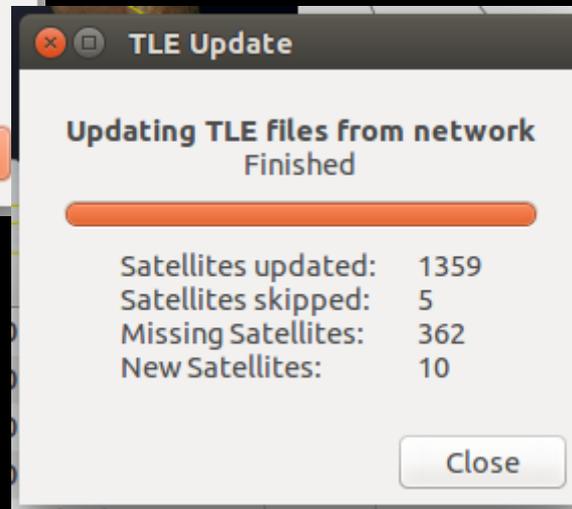
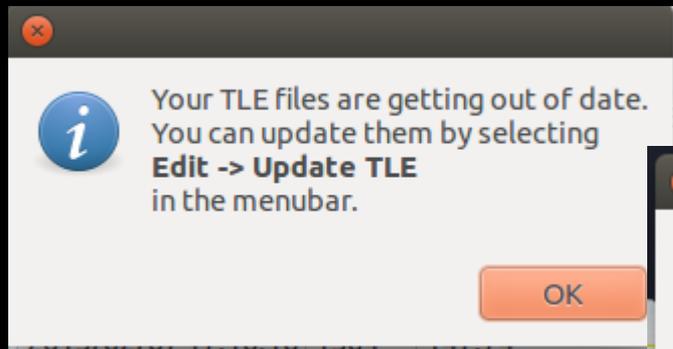
**About GPREDICT**

  
**GPREDICT 1.3**  
Copyright (C) 2001-2011 Alexandru Csete OZ9AEC  
Gpredict is available free of charge from:  
<http://gpredict.oz9aec.net/>  
Credits License Close



# Gpredict Keplerian Elements

Elements define the satellite orbit





# Gpredict Custom Layout

## Main window has 5 panels

Ubuntu Linux 14.04 Desktop

GNOME Predict

GPREDICT: Amateur

2015/02/07 18:42:12

Camas - Camas, WA, USA

Next: UO-11 in 05:05

**FUNCUBE-1 (AO-73)**

- Azimuth : 287.60°
- Elevation : 78.13°
- Direction : Approaching
- Slant Range : 630 km
- Range Rate : -0.123 km/sec
- Next Event : LOS: 2015/02/07 18:48:34
- Next AOS : 2015/02/07 20:12:56
- Next LOS : 2015/02/07 18:48:34
- SSP Loc. : CN85BX
- Footprint : 5402 km
- Altitude : 618 km
- Velocity : 7.565 km/sec
- Doppler@100M : 41 Hz
- Sig. Loss : 128.39 dB
- Sig. Delay : 2.10 msec
- Mean Anom. : 211.90°
- Orbit Phase : 297.99°
- Orbit Num. : 6426
- Visibility : Daylight

Satellite	Az	El	Dir	Range	Next AOS	Next LOS	Dop	Loss
AO-7	106.17°	-45.97°	↑	11043	2015/02/07 19:08:05	2015/02/07 19:18:56	1194	153.26
DELFI-C3 (DO-64)	177.25°	-82.54°	↓	13227	2015/02/07 19:27:48	2015/02/07 19:38:04	-287	154.83
FUNCUBE-1 (AO-73)	287.60°	78.13°	↑	630	2015/02/07 20:12:56	2015/02/07 18:48:34	41	128.39
ISS	224.77°	-50.06°	↑	10282	2015/02/08 01:33:29	2015/02/08 01:42:56	69	152.64
NO-44	301.64°	-81.18°	↑	13400	2015/02/07 19:21:42	2015/02/07 19:37:21	301	154.94
UKUBE-1	189.09°	-81.67°	↓	13240	2015/02/07 19:28:17	2015/02/07 19:40:15	-339	154.84
UO-11	11.12°	-14.64°	↑	4937	2015/02/07 18:47:17	2015/02/07 18:59:33	2215	146.27

**Gpredict Radio Control: Amateur**

**Downlink**

145.936.100 Hz

Doppler: 60 Hz LO: 0 MHz

**Radio: 145.936.172 Hz**

Target: FUNCUBE-1 (AO-73)

Az: 287.60° Range: 630 km  
El: 78.13° Rate: -0.123 km/s

**Uplink**

145.890.000 Hz

Doppler: -60 Hz LO: 0 MHz

**Radio: 145.889.928 Hz**

Settings

1. Device: IC-9100

2. Device: None

Cycle: 1000 msec

**LOS in 06:21**

Satellite	Az	El	▲ AOS/LOS
UO-11	11.12°	-14.64°	05:04
FUNCUBE-1 (AO-73)	287.60°	78.13°	06:21
AO-7	106.17°	-45.97°	25:52
NO-44	301.64°	-81.18°	39:28
DELFI-C3 (DO-64)	177.25°	-82.54°	45:35
UKUBE-1	189.09°	-81.67°	46:04
ISS	224.77°	-50.06°	06:51:16

**Floating Window**

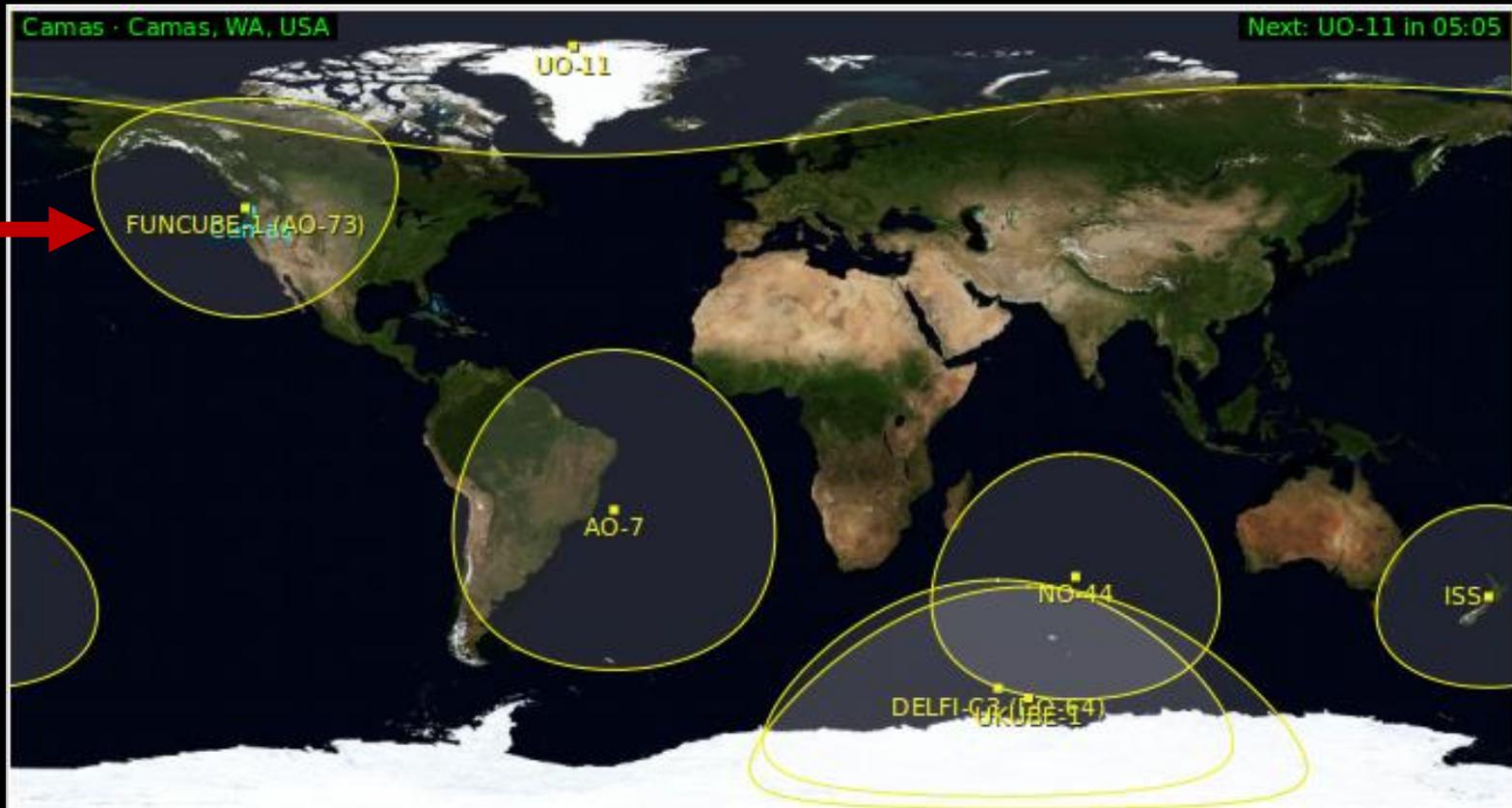
**Main Window**

CDROM



# Gpredict Satellites Footprints

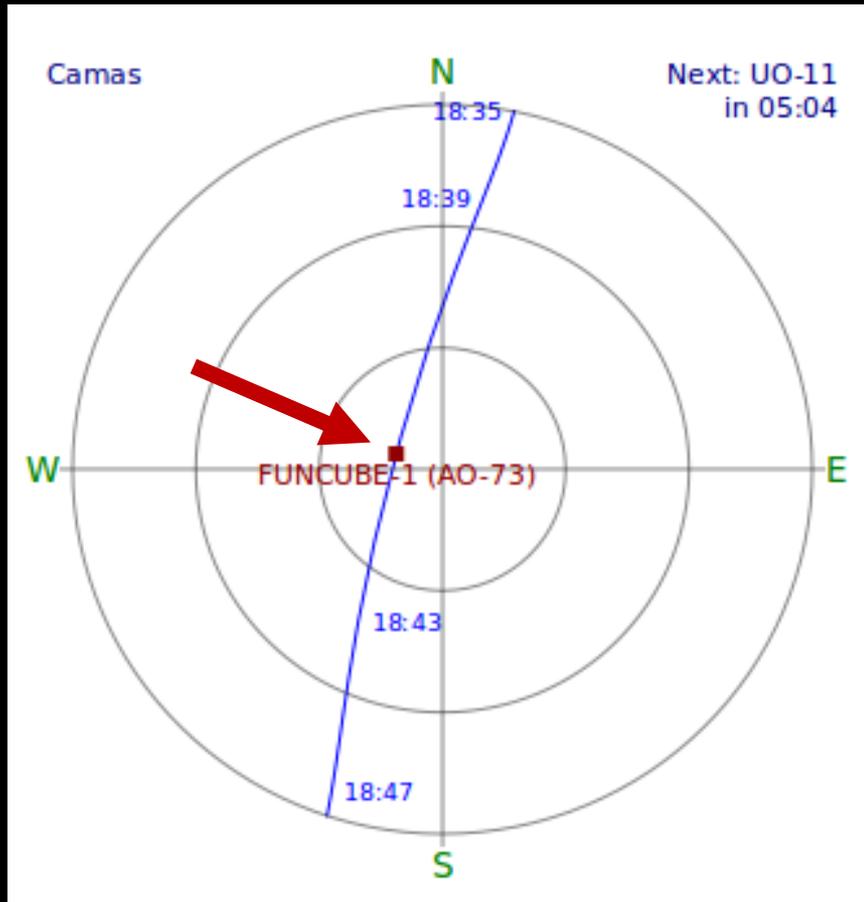
Can the satellite & you see each other





# Gpredict Satellite Location in Sky

Altitude-Azimuth Position for pointing the antenna



Azimuth : 287.60°  
Elevation : 78.13°  
Direction : Approaching  
Slant Range : 630 km  
Range Rate : -0.123 km/sec  
Next Event : LOS: 2015/02/07 18:48:34  
Next AOS : 2015/02/07 20:12:56  
Next LOS : 2015/02/07 18:48:34  
SSP Loc. : CN85BX  
Footprint : 5402 km  
Altitude : 618 km  
Velocity : 7.565 km/sec  
Doppler@100M : 41 Hz  
Sig. Loss : 128.39 dB  
Sig. Delay : 2.10 msec  
Mean Anom. : 211.90°  
Orbit Phase : 297.99°  
Orbit Num. : 6426  
Visibility : Daylight



# Gpredict Satellite Prediction

Acquisition of signal (AOS) & Lost of signal (LOS)



Satellite	Az	El	▲ AOS/LOS
UO-11	11.12°	-14.64°	05:04
FUNCUBE-1 (AO-73)	287.60°	78.13°	06:21
AO-7	106.17°	-45.97°	25:52
NO-44	301.64°	-81.18°	39:28
DELFI-C3 (DO-64)	177.25°	-82.54°	45:35
UKUBE-1	189.09°	-81.67°	46:04
ISS	224.77°	-50.06°	06:51:16



# Gpredict

## List of satellites on 2 meters band

Satellite	▲	Az	El	Dir	Range	Next AOS	Next LOS	Dop	Loss
AO-7		106.17°	-45.97°	↑	11043	2015/02/07 19:08:05	2015/02/07 19:18:56	1194	153.26
DELFI-C3 (DO-64)		177.25°	-82.54°	↓	13227	2015/02/07 19:27:48	2015/02/07 19:38:04	-287	154.83
FUNCUBE-1 (AO-73)		287.60°	78.13°	↑	630	2015/02/07 20:12:56	2015/02/07 18:48:34	41	128.39
ISS		224.77°	-50.06°	↑	10282	2015/02/08 01:33:29	2015/02/08 01:42:56	69	152.64
NO-44		301.64°	-81.18°	↑	13400	2015/02/07 19:21:42	2015/02/07 19:37:21	301	154.94
UKUBE-1		189.09°	-81.67°	↓	13240	2015/02/07 19:28:17	2015/02/07 19:40:15	-339	154.84
UO-11		11.12°	-14.64°	↑	4937	2015/02/07 18:47:17	2015/02/07 18:59:33	2215	146.27

# 2 Meters 144-148 MHz Band Plan

144.00-144.05	EME (CW)
144.05-144.10	General CW and weak signals
144.10-144.20	EME and weak-signal SSB
144.200	National calling frequency
144.200-144.275	General SSB operation
144.275-144.300	Propagation beacons
144.30-144.50	New OSCAR subband
144.50-144.60	Linear translator inputs
144.60-144.90	FM repeater inputs
144.90-145.10	Weak signal and FM simplex (145.01,03,05,07,09 are widely used for packet)
145.10-145.20	Linear translator outputs
145.20-145.50	FM repeater outputs
145.50-145.80	Miscellaneous and experimental modes
145.80-146.00	OSCAR subband
146.01-146.37	Repeater inputs
146.40-146.58	Simplex
146.52	National Simplex Calling Frequency
146.61-146.97	Repeater outputs
147.00-147.39	Repeater outputs
147.42-147.57	Simplex
147.60-147.99	Repeater inputs

Satellites



# 2 Meters 145.8-146.0 MHz Satellites

January 2015

## 145.800-146.000 MHz

Frequency MHz +/- Doppler	Satellite	Notes	Observations
145.825	<a href="#">Navy-OSCAR 44, NO-44, PCsat</a>	FM FSK, AX.25, 1k2 and 9k6 in Sun only	
145.825	<a href="#">ISS</a>	FM FSK, AX.25 packet	
145.825	<a href="#">UoSAT OSCAR, UO-11</a>	FM 1k2 AFSK ASCII	
145.870	<a href="#">DELFI-OSCAR 64, DO-64, DELFI-C3</a>	CW and 1k2 BPSK AX.25	
145.915	<a href="#">FUNcube-2, UKube-1</a>	30mW or 300 mW Telemetry Beacon 1200 bps BPSK, same as FUNcube-1 AO-73	
145.935	<a href="#">FUNcube-1, AO-73</a>	30mW or 300 mW Telemetry Beacon 1200 bps BPSK	<a href="#">20150104</a> <a href="#">1809UT</a>
145.925 - 145.975	<a href="#">AMSAT OSCAR 7, AO-7</a>	Mode U/V (B) Linear Transponder (Inverting) alternates with Mode A USB and CW when in the Sun	
145.950 - 145.970	<a href="#">FUNcube-1, AO-73</a>	Transponder Downlink USB and CW	<a href="#">20150104</a> <a href="#">1809UT</a>
145.9775	<a href="#">AMSAT OSCAR 7, AO-7</a>	CW Beacon when in the Sun	



# Gpredict Doppler Shift

+ Frequency Coming, - Frequency Going

The image displays three overlapping screenshots of the Gpredict Radio Control: Amateur software interface, illustrating the Doppler shift and radio frequency changes over time. Red arrows point from the text above to the Doppler and Radio frequency values in the screenshots.

**Screenshot 1 (Top Left):** Shows a Downlink frequency of 145.936.100 Hz and a Radio frequency of 145.939.480 Hz. The Doppler shift is 3380 Hz. The target is FUNCUBE-1 (AO-73). The status is "LOS in 12:34".

**Screenshot 2 (Middle):** Shows a Downlink frequency of 145.936.100 Hz and a Radio frequency of 145.936.172 Hz. The Doppler shift is 60 Hz. The target is FUNCUBE-1 (AO-73). The status is "LOS in 06:21".

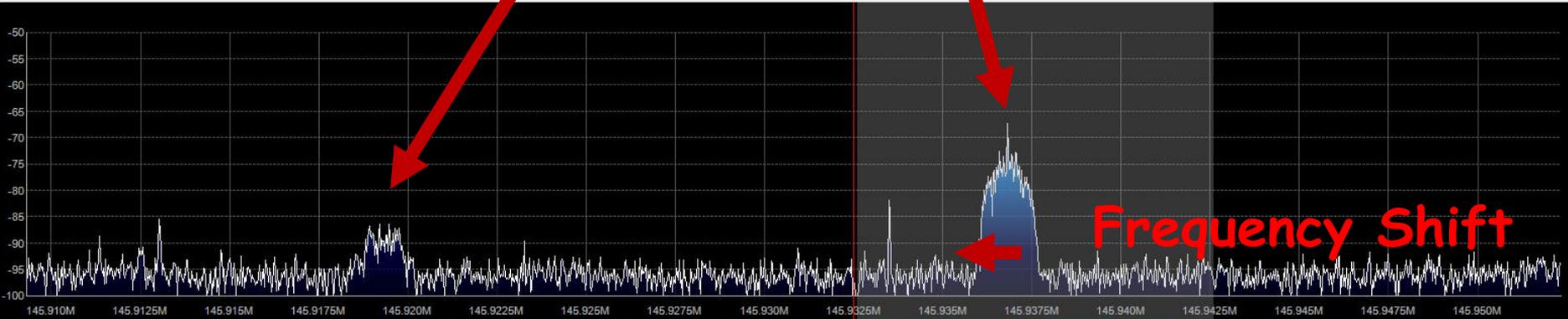
**Screenshot 3 (Bottom Right):** Shows a Downlink frequency of 145.936.100 Hz and a Radio frequency of 145.932.701 Hz. The Doppler shift is -3399 Hz. The target is FUNCUBE-1 (AO-73). The status is "LOS in 00:01".



# Frequency Doppler Shift

UKcube-1 TLM, FUNcube-1 TLM

000.145.932.506



1/13/2015 9:05:53 PM

1/13/2015 9:05:50 PM

1/13/2015 9:05:47 PM

1/13/2015 9:05:44 PM

1/13/2015 9:05:40 PM

1/13/2015 9:05:37 PM

Time

Frequency

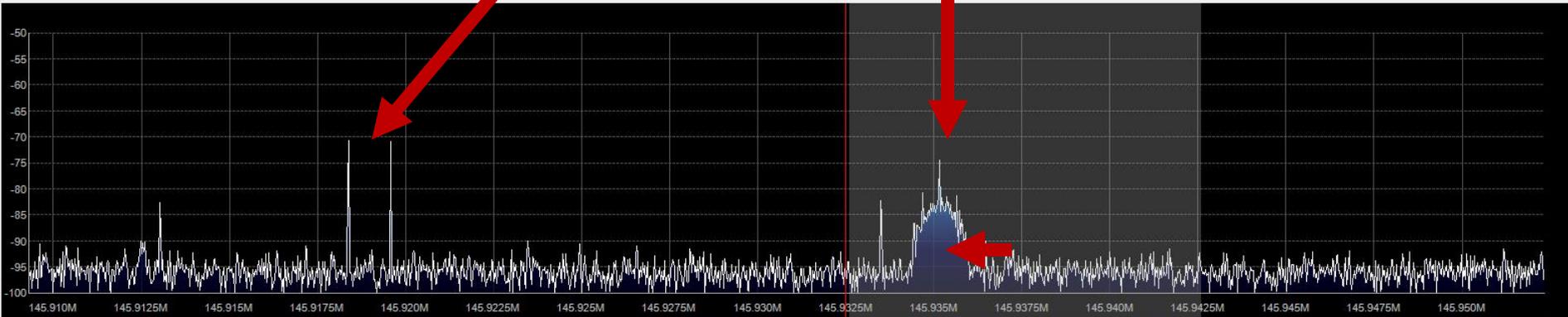
Airspy SDR Receiver  
SDR# v1.0.0.1332



# Frequency Doppler Shift

UKcube-1 TLM, FUNcube-1 TLM

000.145.932.506



1/13/2015 9:06:55 PM

1/13/2015 9:06:52 PM

1/13/2015 9:06:49 PM

1/13/2015 9:06:46 PM

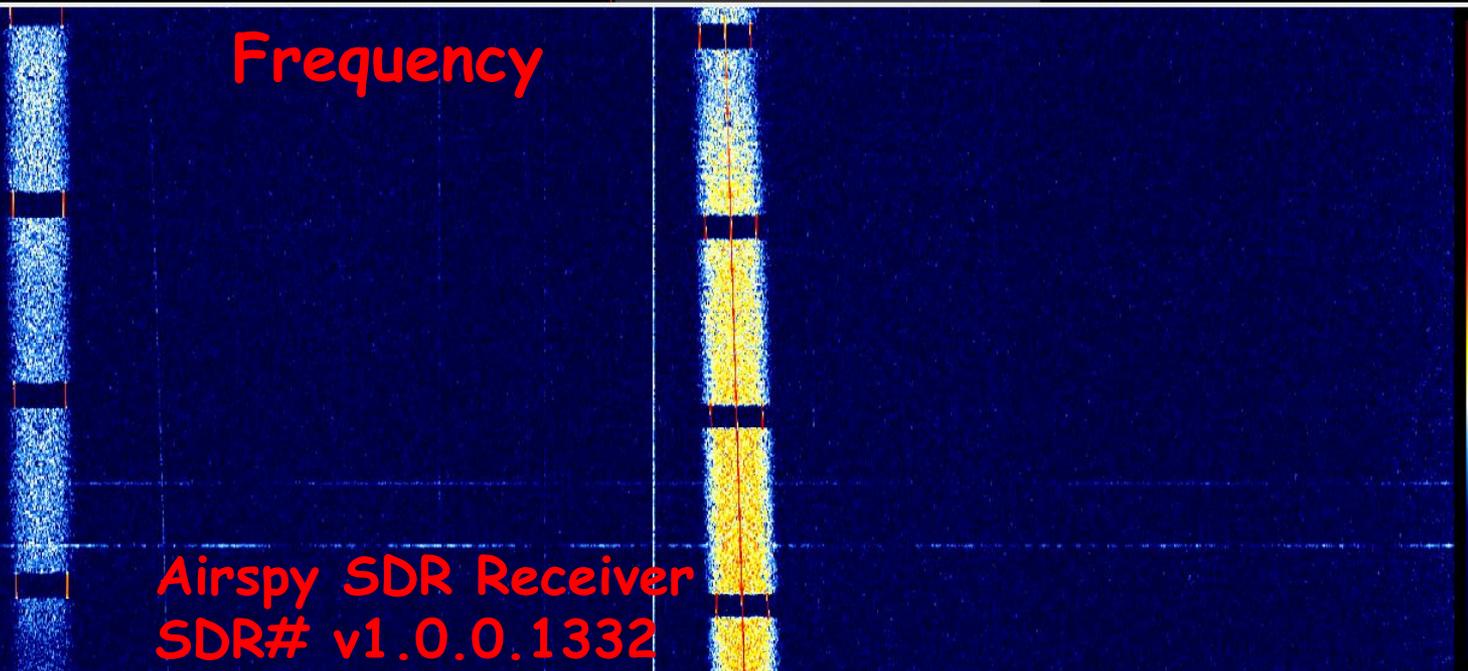
1/13/2015 9:06:43 PM

1/13/2015 9:06:40 PM

Time

Frequency

Airspy SDR Receiver  
SDR# v1.0.0.1332





# Saturday 2015-2-7 Passes

Camas WA, USA

Upcoming passes for FUNCUBE-1 (AO-73)

AOS	LOS	Duration	Max El	AOS Az	LOS Az
2015/02/07 17:00:11	2015/02/07 17:10:14	00:10:03	10.46°	34.99°	138.87°
2015/02/07 18:35:39	2015/02/07 18:48:34	00:12:54	77.20°	11.16°	198.18°
2015/02/07 20:12:56	2015/02/07 20:22:27	00:09:30	9.41°	351.10°	255.42°
2015/02/08 03:58:45	2015/02/08 04:09:52	00:11:06	14.23°	115.73°	4.71°
2015/02/08 05:33:16	2015/02/08 05:46:52	00:13:36	76.21°	169.41°	346.14°
2015/02/08 07:12:17	2015/02/08 07:22:01	00:09:43	8.19°	228.45°	321.22°

3 in Morning

3 in Evening



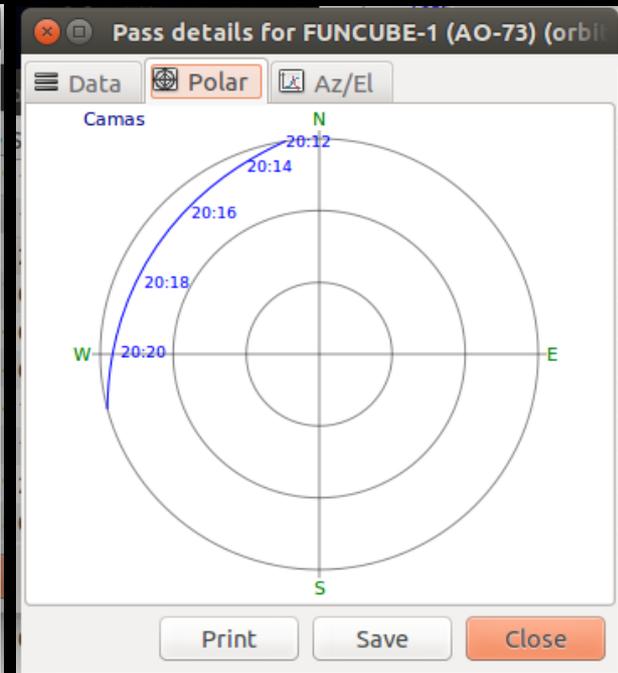
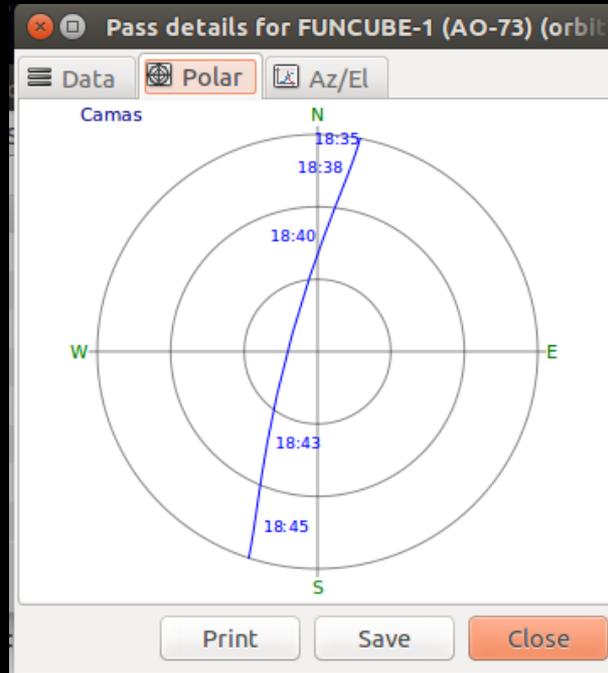
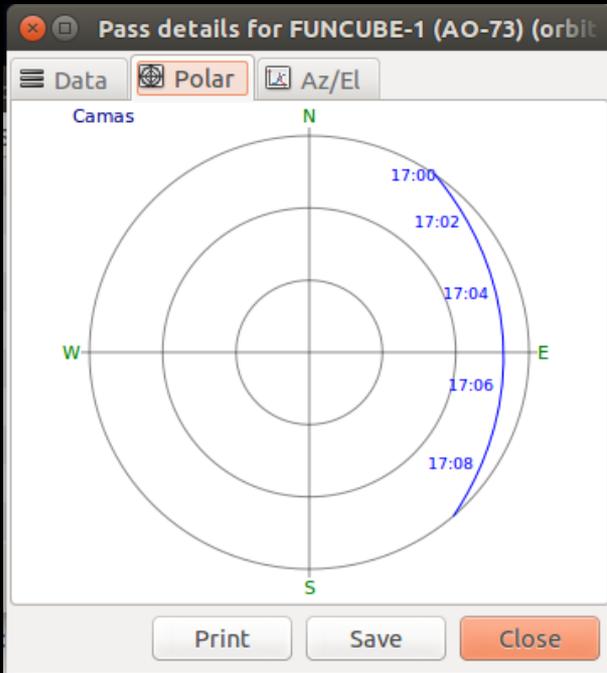
# Saturday Morning 2015-2-7 Passes

Camas WA, USA

2 Frames

46 Frames

3 Frames



AOS	LOS	Duration	Max El	AOS Az	LOS Az
2015/02/07 17:00:11	2015/02/07 17:10:14	00:10:03	10.46°	34.99°	138.87°
2015/02/07 18:35:39	2015/02/07 18:48:34	00:12:54	77.20°	11.16°	198.18°
2015/02/07 20:12:56	2015/02/07 20:22:27	00:09:30	9.41°	351.10°	255.42°



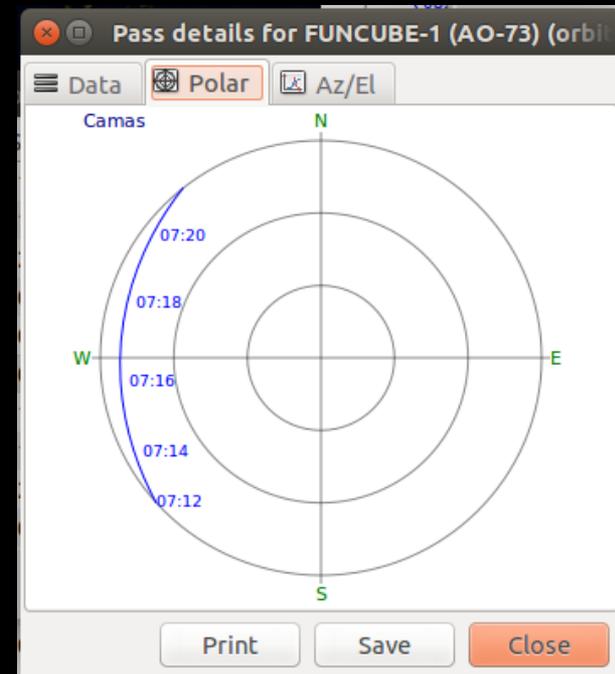
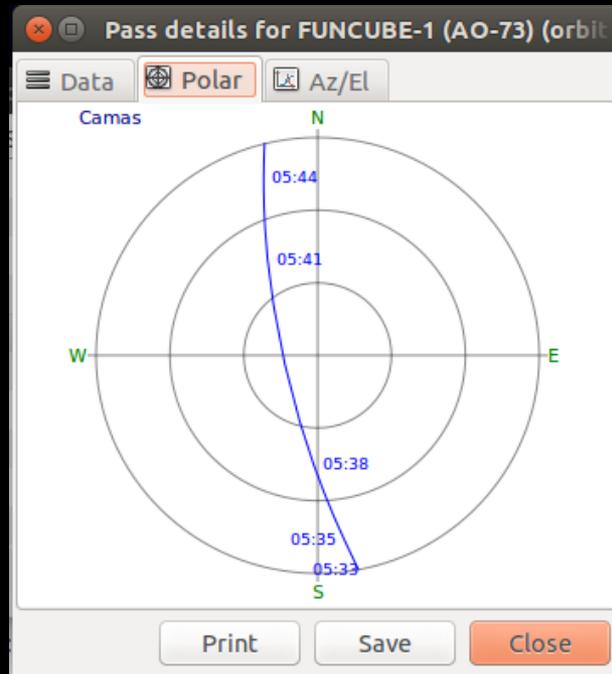
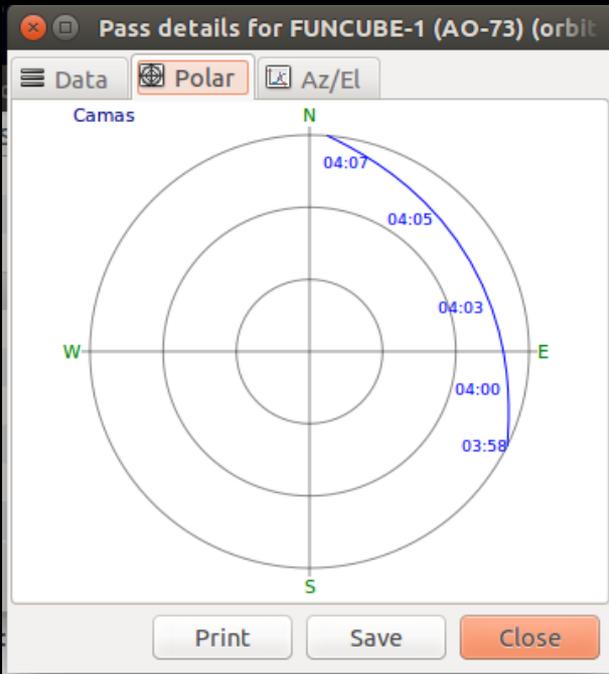
# Saturday Evening 2015-2-7 Passes

Camas WA, USA

0 Frames

74 Frames

3 Frames



AOS	LOS	Duration	Max El	AOS Az	LOS Az
2015/02/08 03:58:45	2015/02/08 04:09:52	00:11:06	14.23°	115.73°	4.71°
2015/02/08 05:33:16	2015/02/08 05:46:52	00:13:36	76.21°	169.41°	346.14°
2015/02/08 07:12:17	2015/02/08 07:22:01	00:09:43	8.19°	228.45°	321.22°



# Low Pass in the East at 30 mW

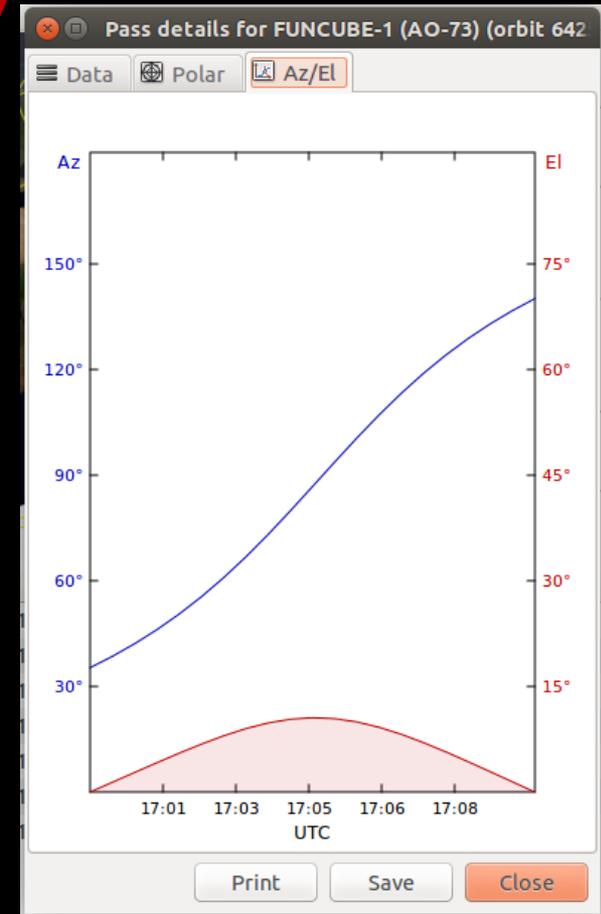
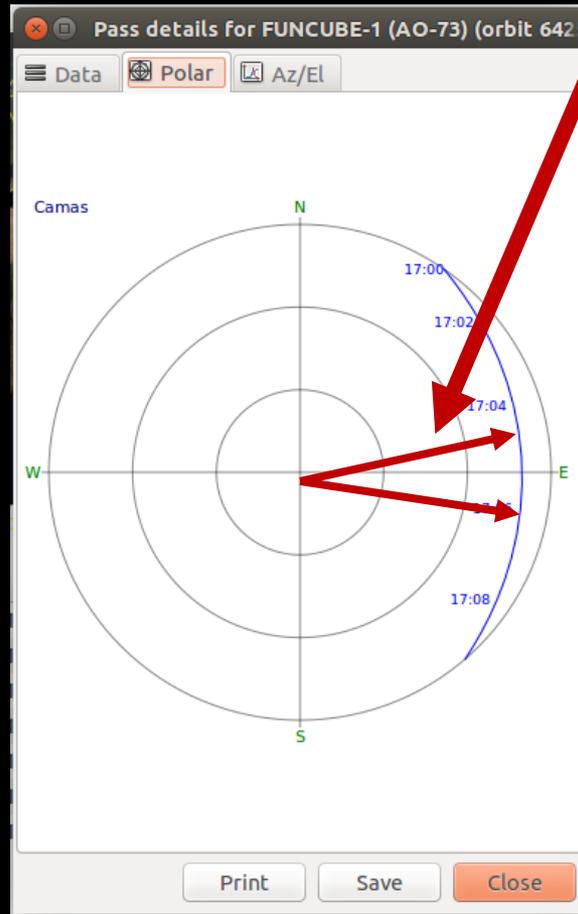
2 frames with 2 receivers 2 antennas

Pass details for FUNCUBE-1 (AO-73) (orbit 642)

Data Polar Az/El

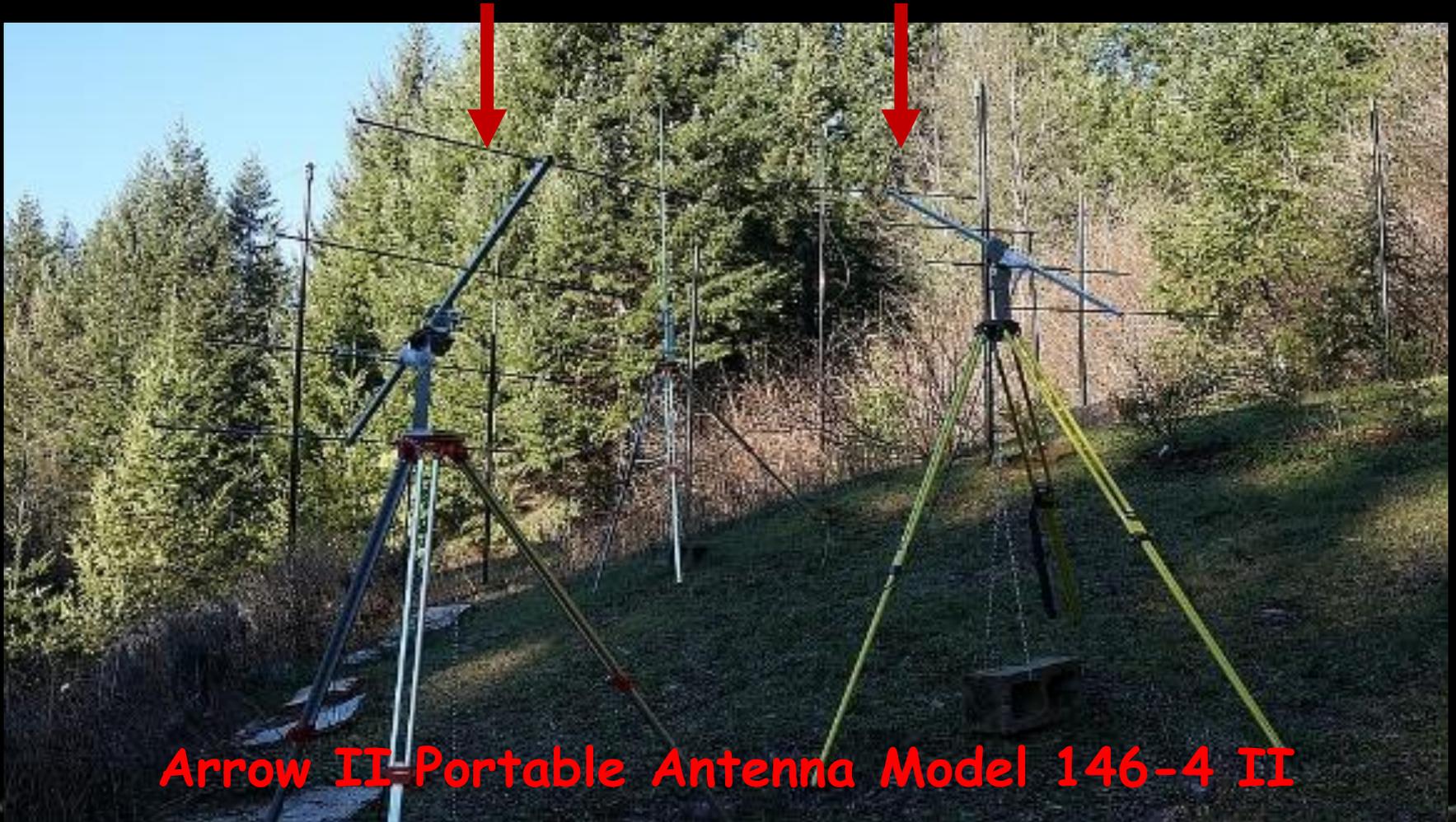
Time	Az	El	Range	Footp
2015/02/07 17:00:11	34.99°	0.00°	2913	5466
2015/02/07 17:00:42	38.18°	1.37°	2760	5459
2015/02/07 17:01:12	41.72°	2.75°	2615	5452
2015/02/07 17:01:42	45.67°	4.12°	2479	5445
2015/02/07 17:02:12	50.06°	5.46°	2353	5438
2015/02/07 17:02:42	54.93°	6.74°	2240	5431
2015/02/07 17:03:12	60.29°	7.91°	2142	5424
2015/02/07 17:03:42	66.14°	8.92°	2060	5418
2015/02/07 17:04:13	72.44°	9.72°	1998	5411
2015/02/07 17:04:43	79.09°	10.25°	1958	5404
2015/02/07 17:05:13	85.96°	10.46°	1940	5398
2015/02/07 17:05:43	92.87°	10.33°	1945	5391
2015/02/07 17:06:13	99.66°	9.87°	1973	5385
2015/02/07 17:06:43	106.16°	9.12°	2023	5378
2015/02/07 17:07:14	112.26°	8.12°	2095	5372
2015/02/07 17:07:44	117.88°	6.95°	2184	5366
2015/02/07 17:08:14	123.00°	5.65°	2290	5361
2015/02/07 17:08:44	127.63°	4.27°	2410	5355
2015/02/07 17:09:14	131.79°	2.86°	2542	5350
2015/02/07 17:09:44	135.52°	1.43°	2684	5344
2015/02/07 17:10:14	138.87°	0.00°	2835	5339

Print Save Close



# Two 4 Element Yagi Antennas

East at 30° alt & west at 30° alt



Arrow II-Portable Antenna Model 146-4 II



# High Pass at 30 mW

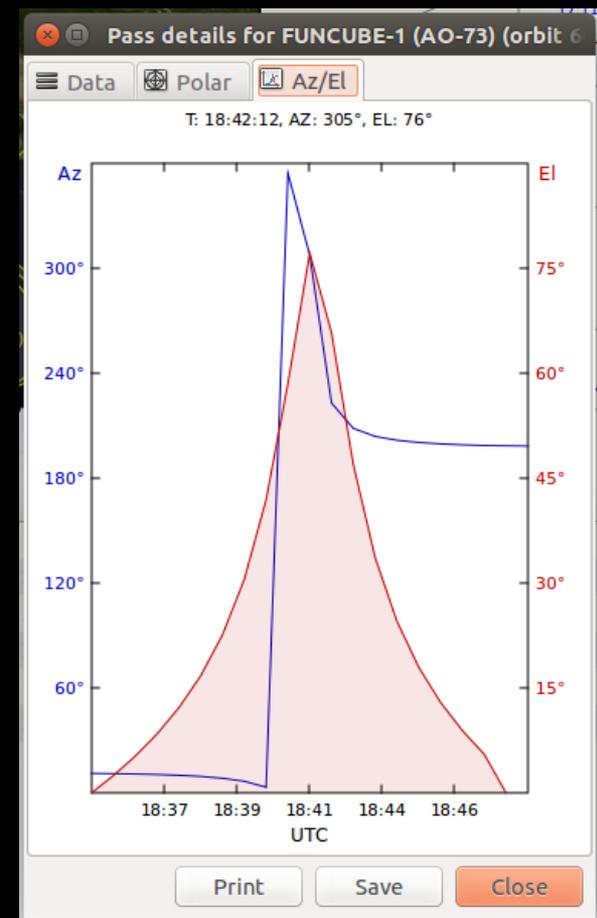
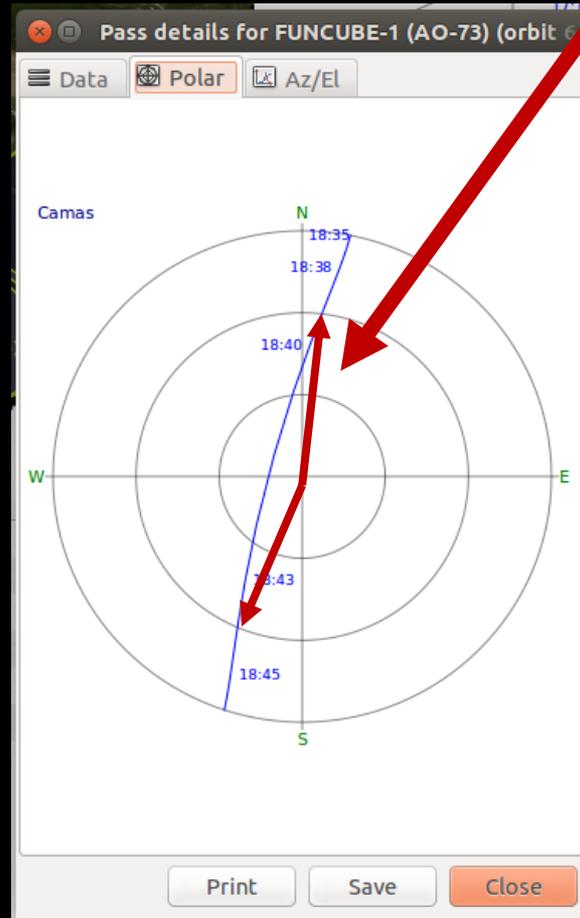
46 frames with 2 receivers 2 antennas

Pass details for FUNCUBE-1 (AO-73) (orbit 6)

Data Polar Az/El

Time	Az	El	Range	Footp
2015/02/07 18:35:39	11.16°	-0.00°	2928	5491
2015/02/07 18:36:18	11.03°	2.48°	2659	5482
2015/02/07 18:36:56	10.82°	5.26°	2390	5474
2015/02/07 18:37:35	10.52°	8.43°	2123	5465
2015/02/07 18:38:14	10.08°	12.17°	1858	5456
2015/02/07 18:38:53	9.42°	16.74°	1597	5447
2015/02/07 18:39:31	8.40°	22.60°	1343	5438
2015/02/07 18:40:10	6.66°	30.53°	1102	5430
2015/02/07 18:40:49	3.27°	41.91°	885	5421
2015/02/07 18:41:28	354.42°	58.53°	715	5412
2015/02/07 18:42:06	307.53°	77.18°	<b>632</b>	5403
2015/02/07 18:42:45	223.01°	65.80°	669	5395
2015/02/07 18:43:24	208.49°	46.94°	810	5387
2015/02/07 18:44:03	203.88°	33.65°	1012	5379
2015/02/07 18:44:41	201.69°	24.53°	1246	5371
2015/02/07 18:45:20	200.43°	17.96°	1496	5363
2015/02/07 18:45:59	199.63°	12.94°	1756	5356
2015/02/07 18:46:38	199.08°	8.90°	2020	5349
2015/02/07 18:47:16	198.69°	5.52°	2288	5342
2015/02/07 18:47:55	198.40°	2.60°	2558	5336

Print Save Close



# Upload Ranking of 830 Submitters

We should like to thank all the groups and individuals who have uploaded data to the FUncube data warehouse.

The following list gives the site names of those who have uploaded the most data frames:

Key: **Within 1 week**, **within 2 weeks**, greater than 2 weeks

Site Id	Count	Position
g0mjw	291648	1
OM3BC	249343	2
KC0BMF	196223	3
HB9MFL	174654	4
VK5HI	173182	5
SV2CPH	14812	142
w5sxd	14615	143
AD7MQ	14305	144
WA9ONY	14230	145
JA1GDE	14145	146
M0GBZ	13964	147
KB5WIA	13856	148
NC7V	13350	149

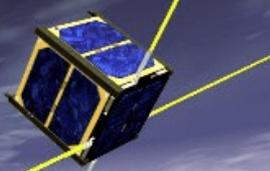
Started Jan. 2015

# Real Time Data

4 data providers for Seq. No.: 319,173

## FUNcube

UK Amateur Radio Educational Satellite



[ Register ]

**FUNcube-1 Flight Model**    FC1 Engineering model    UKube FC2 Payload

### Navigation

- [Real Time Data](#)
- [High Resolution Data](#)
- [Whole Orbit Data](#)
- [Fitter Messages](#)
- [Amateur Radio Info](#)
- [Satellite Position](#)
- [Upload Ranking](#)
- [About](#)

### Real Time Data

This page shows the latest value of all the housekeeping parameters in the spacecraft. The data has been collected by one or more of the ground stations who are submitting this data from all around the world.

To download a .csv file which contains Realtime data, please click [here](#). This data is generated every hour, on the hour and contains the preceding 250 minutes of information

The date/time in the csv file is 'SatelliteTime' It is based on the number for sequences / frames it has transmitted since spacecraft initialisation after separation (2013-11-21 07:38:16). This time will drift as it is based on the MCU clock which is not temperature controlled. In the future we may be able to give realtime if we can model the drift...

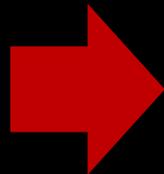
### Data Providers

- wa6fwf
- NH6Y
- Kc7ces
- WA9ONY

### Warehouse Info

Seq. No.: 319173  
Packets: 1861411 (476.5MB)

EPS	ASIB	RF	PA	ANTS	SW
<b>Electrical Power Subsystem</b>					
Satellite Latitude: 37.1 N, Longitude: 140.5 W					
Uploaded at: 2015-02-05 19:40:30 UTC, MinMax from: 2015-02-04 20:53:41 UTC					
Name		Value	Min.	Max.	
Solar Panel Voltage X		4583 mV	0	5288	



# NH6Y 4,147.4 km Distance from WA9ONY

NH6Y



THOMAS K WORTHINGTON  
1035 NAALAE RD  
KULA, HI 96790  
USA

Email: Use mouse to view..

Ham Member Lookups: 19997

Label



Biography

Detail

Logbook 9

Log a NEW contact with NH6Y...

Lookups 19997 (28890)

QRZ Record# 1786998

QRZ Admin NH6Y

Date Joined 2009-01-28 22:59:17

Last Update 2014-12-10 21:19:41

Class E

Effective 2011-08-12

Latitude 20.756000 (20° 45' 21" N)

Longitude -156.342000 (156° 20' 31" W)

Grid Square BL10ts

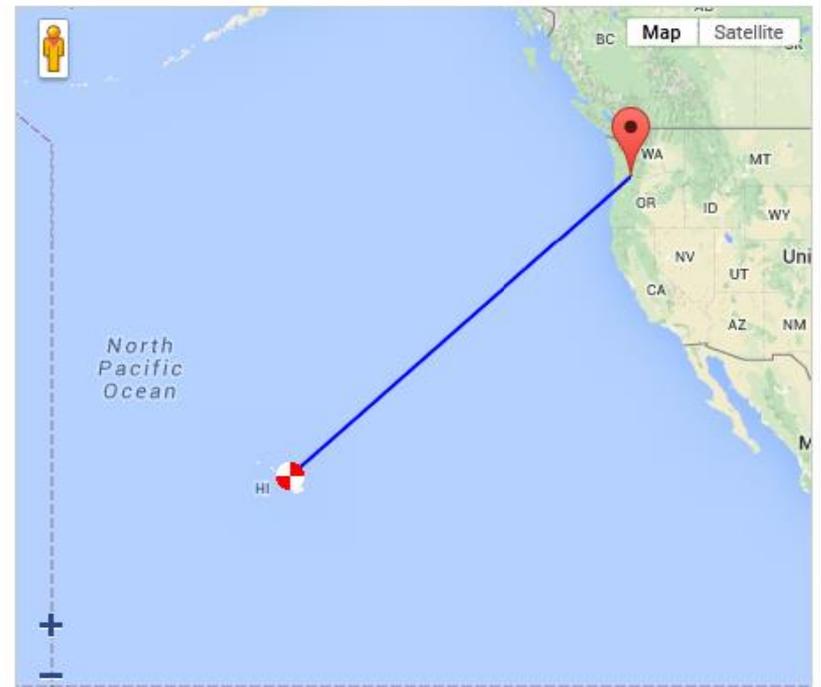
Geo Source User supplied

US State Hawaii

US County Maui

Bearing 239.6° WSW (from WA9ONY)

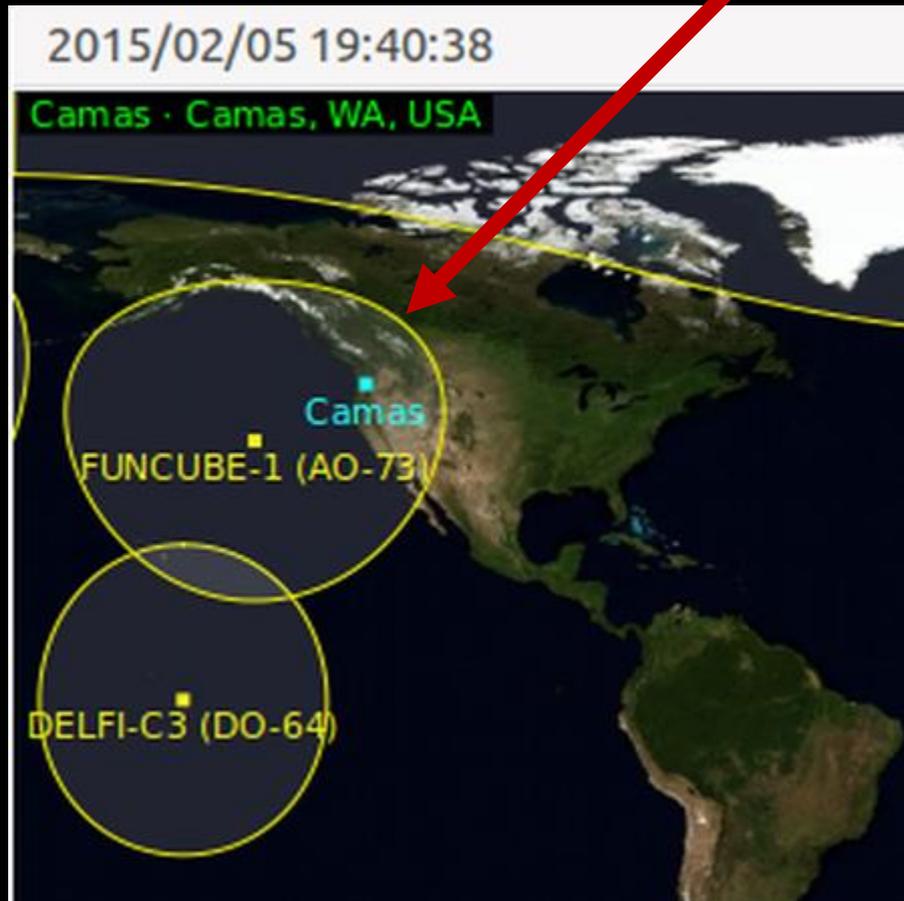
Distance 2577.1 mi (4147.4 km)





# FUNcube-1 Footprint

Both WA9ONY & NH6Y see FUNcube-1 TLM at the same time

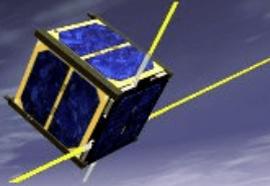


# Real Time Data

WA9ONY only data provider for Seq. No.: 319,454

## FUNcube

UK Amateur Radio Educational Satellite



[ Register ]

**FUNcube-1 Flight Model**    FC1 Engineering model    UKube FC2 Payload

### Navigation

- [Real Time Data](#)
- [High Resolution Data](#)
- [Whole Orbit Data](#)
- [Fitter Messages](#)
- [Amateur Radio Info](#)
- [Satellite Position](#)
- [Upload Ranking](#)
- [About](#)

### Real Time Data

This page shows the latest value of all the housekeeping parameters in the spacecraft. The data has been collected by one or more of the ground stations who are submitting this data from all around the world.

To download a .csv file which contains Realtime data, please click [here](#). This data is generated every hour, on the hour and contains the preceding 250 minutes of information

The date/time in the csv file is 'SatelliteTime' It is based on the number for sequences / frames it has transmitted since spacecraft initialisation after separation (2013-11-21 07:38:16). This time will drift as it is based on the MCU clock which is not temperature controlled. In the future we may be able to give realtime if we can model the drift...

### Data Providers

WA9ONY

### Warehouse Info

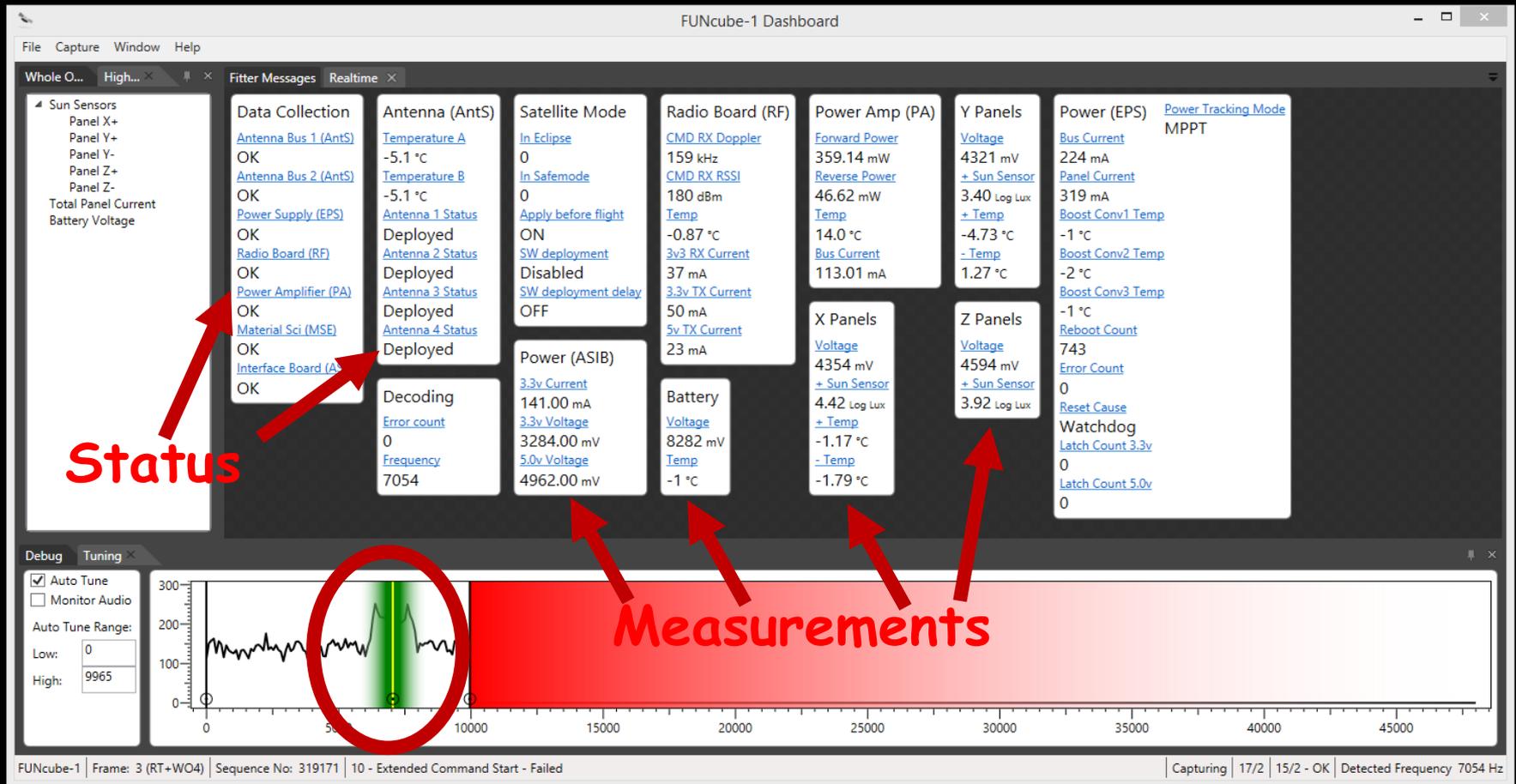
Seq. No.: 319454  
Packets: 1863161 (477.0MB)

### Satellite Status

Name	Value	Min.	Max.
Solar Panel Voltage X	0 mV	0	5288

# 58 Telemetry Channels

FUNcube-1 Dashboard decodes the TLM BPSK with FEC



# 58 Telemetry Channels

- Real-time measurements every five seconds
- High resolution data
  - Satellite stores last 60 real-time measurements
- Whole orbit data
  - Satellite stores 104 measurements
  - One measurement per minute

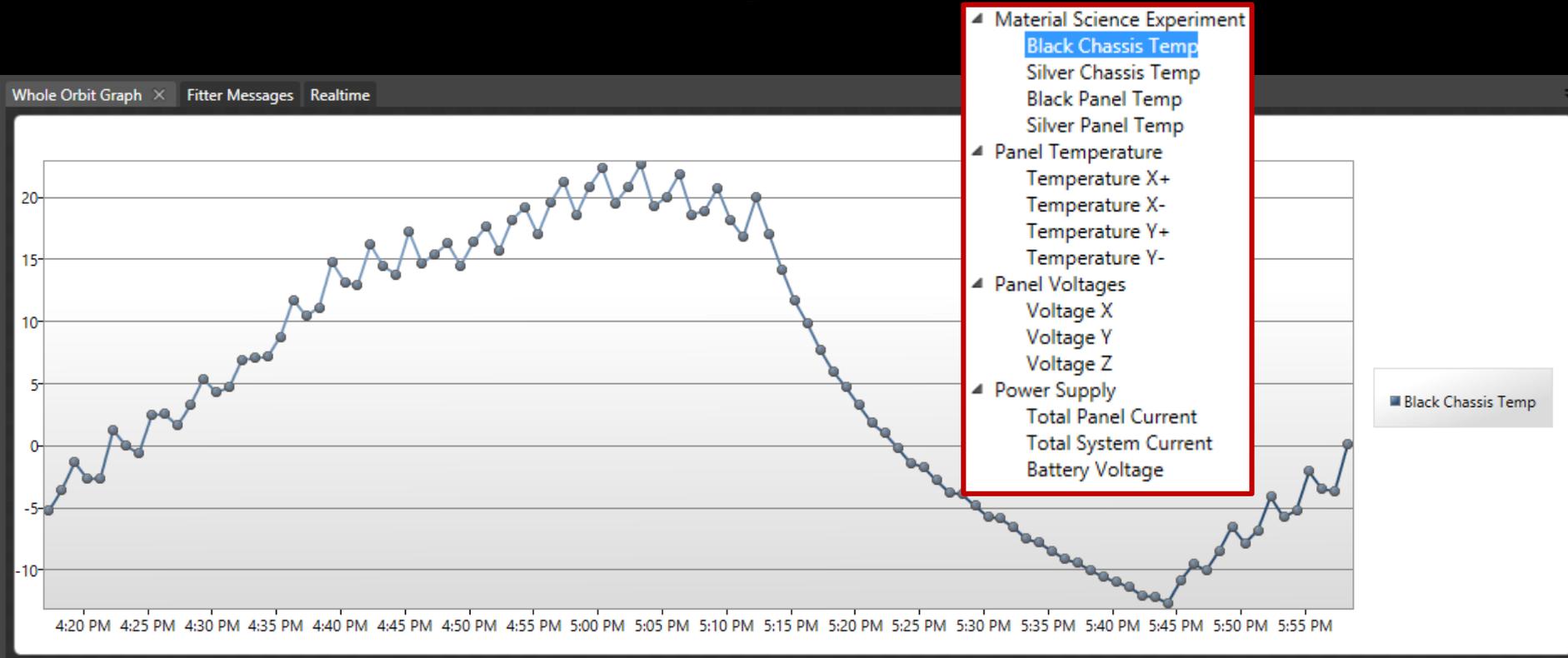
# Telemetry Transmission Organization

2 minutes for sequence, 5 seconds per frame

- Sequence is composed of 24 frames
- Frame is composed of 256 bits of data after decode
  - Frame always contains real-time data
- Sequence structure
  - 12 whole orbit frames WO1 to WO12
  - 1 high resolution frame HR1
  - 3 Fitter messages FM1 to FM3
  - 1 high resolution frame HR2
  - 3 Fitter messages FM4 to FM6
  - 1 high resolution frame HR3
  - 3 Fitter messages FM7 to FM9

# 14 Whole Orbit Data Sets

104 Measurements During 1 Orbit, 1 Minute Intervals

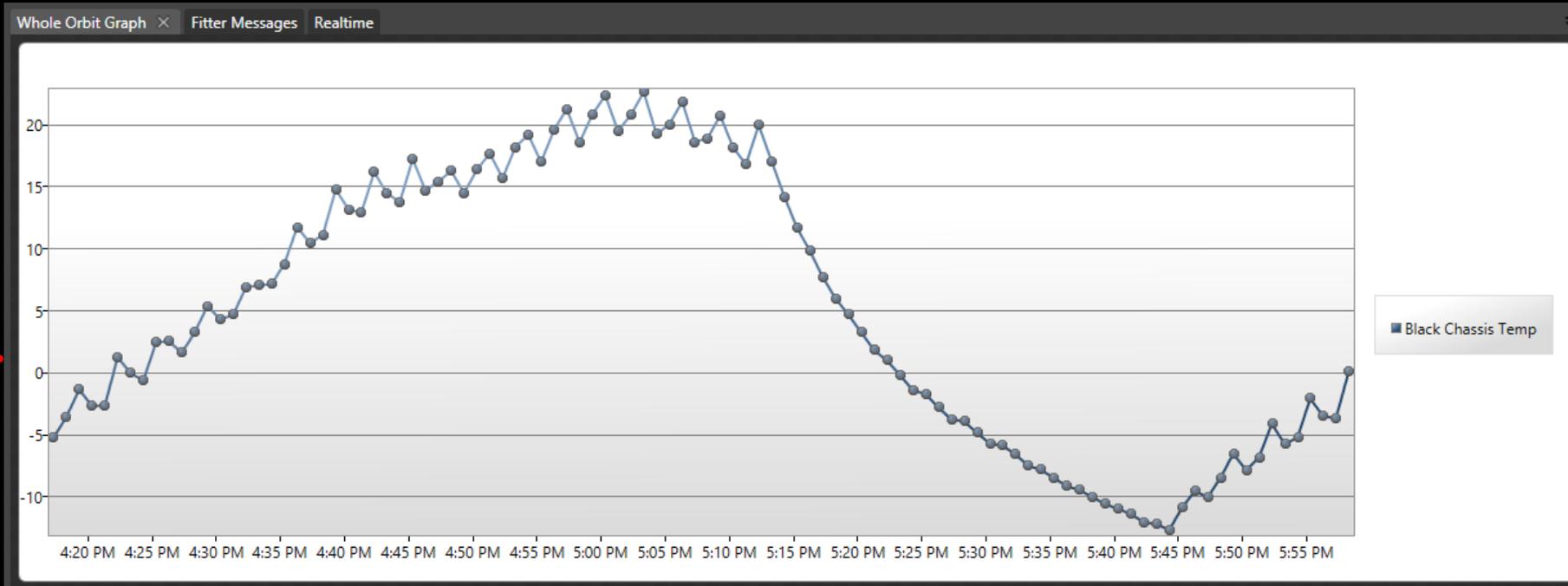


Satellite Saves 1 Orbit of Data Onboard

# Black Chassis Temp Whole Orbit Graph

Measurements During 1 Orbit, 1 Minute Intervals

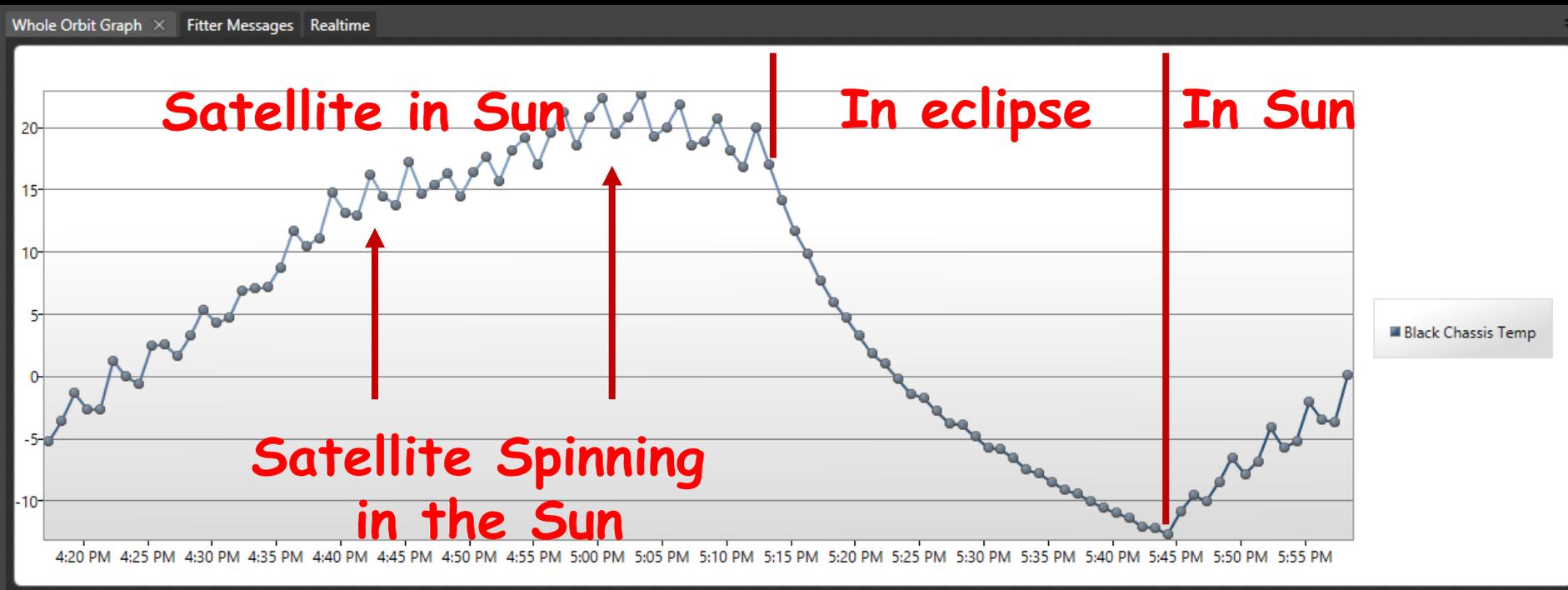
Temperature



Time

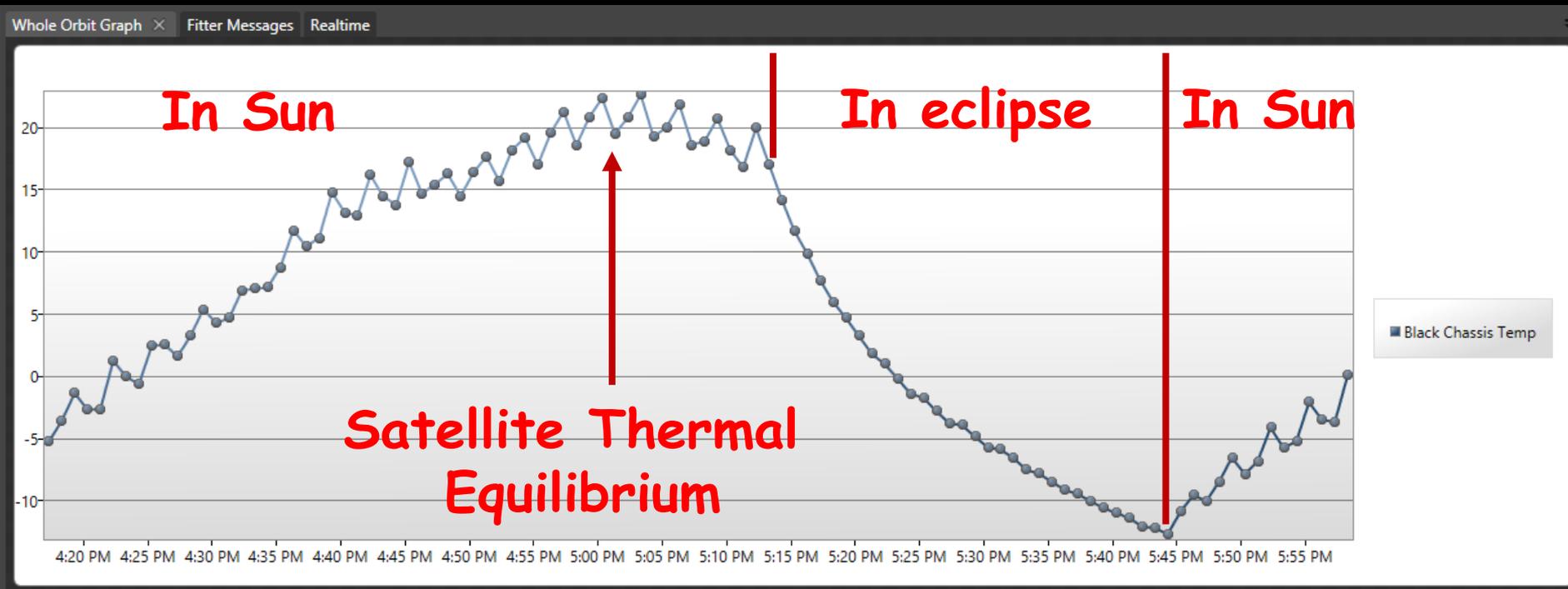
# Black Chassis Temp

## Whole Orbit Graph



# Black Chassis Temp

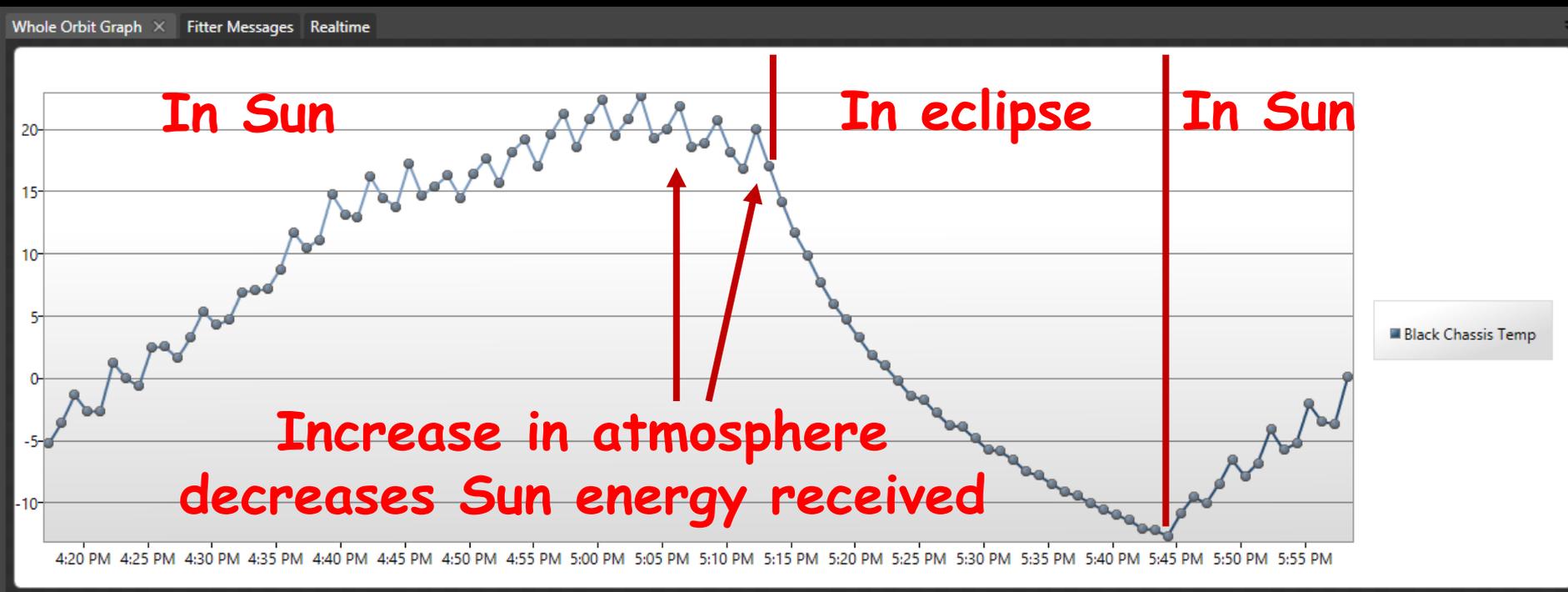
## Whole Orbit Graph



**Sun Energy Received Equals Energy Radiated into Space**

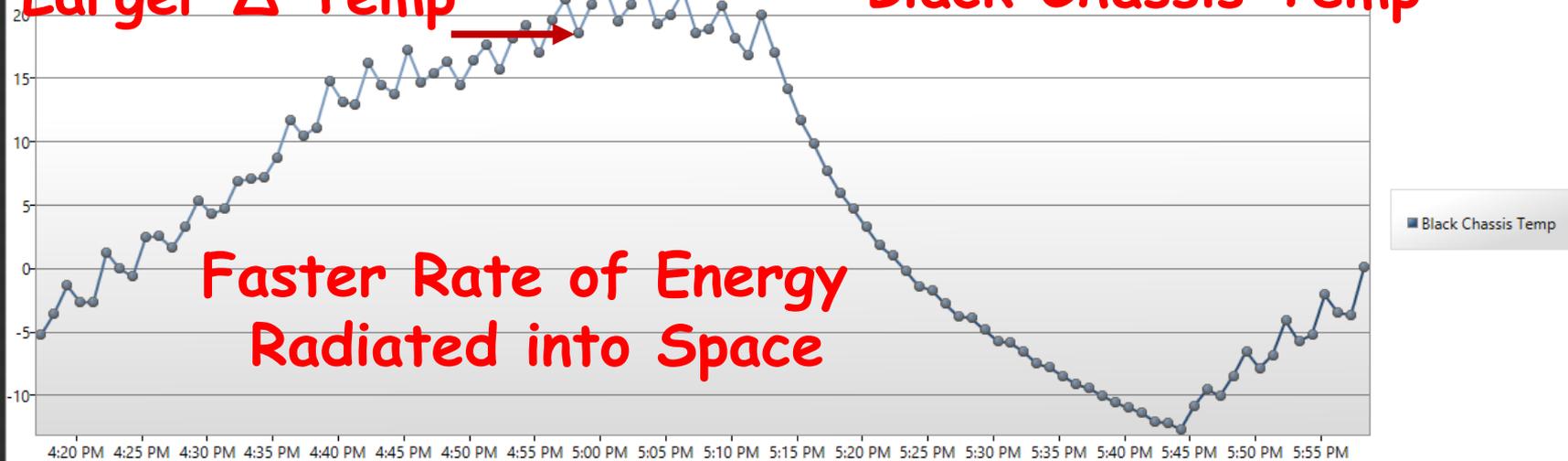
# Black Chassis Temp

## Whole Orbit Graph

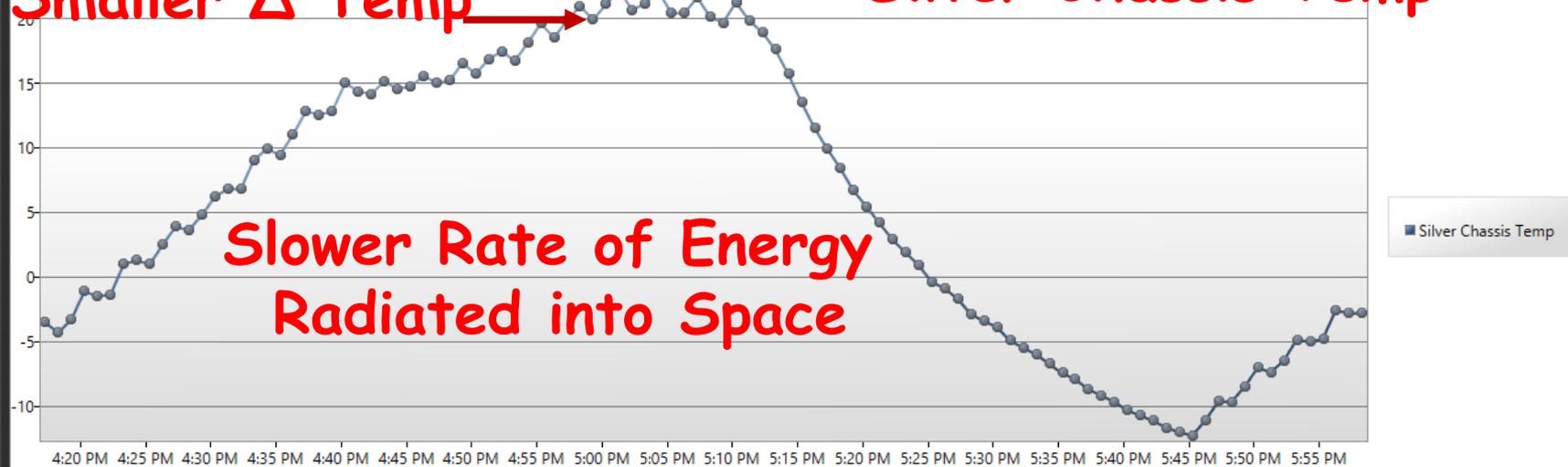


Temperature

Larger  $\Delta$  Temp  $\longrightarrow$  Black Chassis Temp

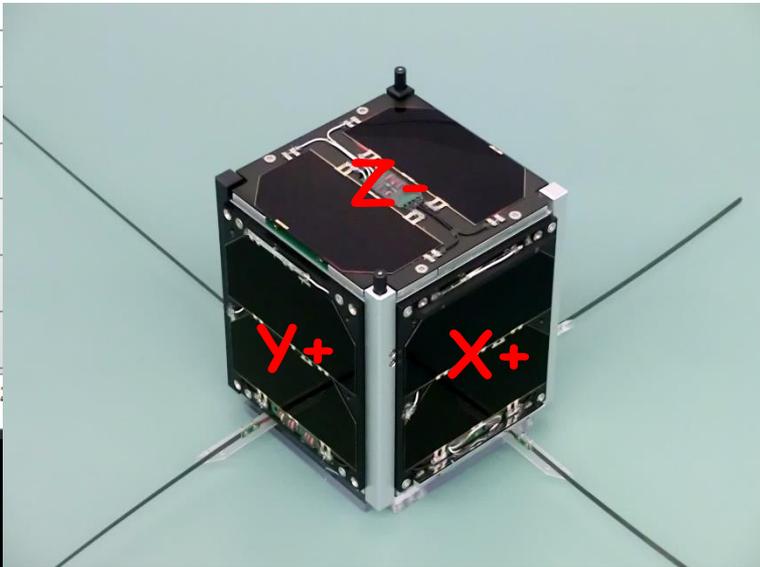
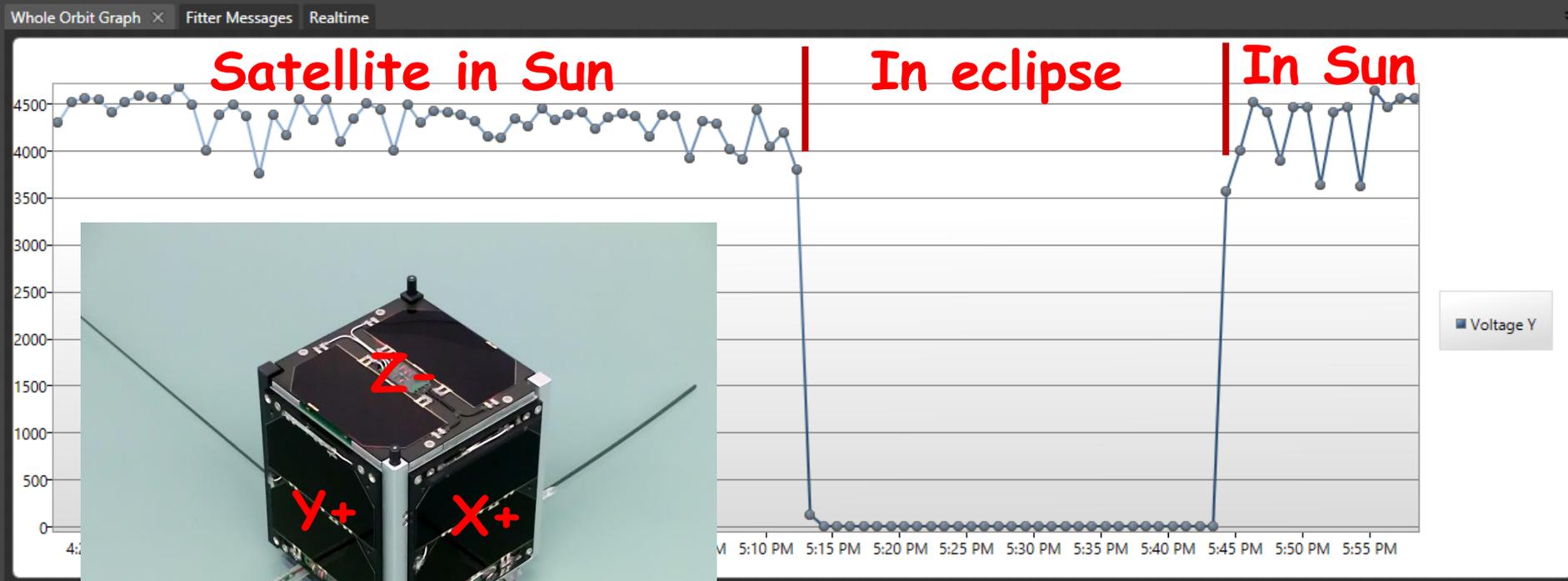


Smaller  $\Delta$  Temp  $\longrightarrow$  Silver Chassis Temp



# Solar Panel Voltage Y

## Whole Orbit Graph



# Fitter Messages (FM)

9 FM 200 characters each transmitted by the satellite

Receive Time	Sequence	Packet	Message
2/5/2015 6:02:01 PM	319123	FM9	2 d * V E & & " & e395m 94e73e 94e73e 94e73e 94e73e 94e73e072c541c 94e73e 94e73e 94e73e 94e73e 94e73e072c541c 94e73e 94e73e 94e73e
2/5/2015 6:01:49 PM	319123	FM7	For details of the education resources check <a href="http://www.funcube.org.uk/education-outreach">www.funcube.org.uk/education-outreach</a> .
2/5/2015 6:01:38 PM	319123	FM6	Hello world, this is 5JW from Central Walker primary in Newcastle upon Tyne, UK
2/5/2015 6:01:32 PM	319123	FM5	The 73 on 73 Award is organised by by Paul N8HM see <a href="http://amwat-uk.org/2014/08/18/73-on-73-award-announcement">http://amwat-uk.org/2014/08/18/73-on-73-award-announcement</a>
2/5/2015 6:01:26 PM	319123	FM4	If you can read this you are receiving FUNCube fine. Please register with the FUNCube data warehouse at <a href="http://api.funcube.org.uk/">http://api.funcube.org.uk/</a>
2/5/2015 6:01:15 PM	319123	FM3	AMSAT-UK Colloquium 24-26 July 2015, Guildford, UK
2/5/2015 6:01:09 PM	319123	FM2	Call all schools - if you would like a Fitter message uploaded please email <a href="mailto:operations@funcube.org.uk">operations@funcube.org.uk</a>
2/5/2015 6:01:03 PM	319123	FM1	The main FUNCube tech team is: Dave G4DPZ, David G0MRF, Duncan M6UCK, Gerard Aalbers, Graham G3VZV, Jason G7OCD, Jim G3WGM, Howard G6LVB, Phil M6IPX, Wouter PA3WEG & Wouter Jan PE4WJ
2/5/2015 6:00:01 PM	319122	FM9	z 2 d * V E & & " & e395m 94e73e 94e73e 94e73e 94e73e 94e73e072c541c 94e73e 94e73e 94e73e 94e73e 94e73e072c541c 94e73e 94e73e 94e73e
2/5/2015 5:59:55 PM	319122	FM8	More information about this spacecraft, orbital details, etc an the telemetry decoder and dashboard can be downloaded from <a href="http://www.funcube.org.uk">http://www.funcube.org.uk</a>
2/5/2015 5:59:49 PM	319122	FM7	For details of the education resources check <a href="http://www.funcube.org.uk/education-outreach">www.funcube.org.uk/education-outreach</a> .
2/5/2015 5:59:38 PM	319122	FM6	Hello world, this is 5JW from Central Walker primary in Newcastle upon Tyne, UK
2/5/2015 5:59:26 PM	319122	FM4	If you can read this you are receiving FUNCube fine. Please register with the FUNCube data warehouse at <a href="http://api.funcube.org.uk/">http://api.funcube.org.uk/</a>
2/5/2015 5:59:15 PM	319122	FM3	AMSAT-UK Colloquium 24-26 July 2015, Guildford, UK
2/5/2015 5:59:09 PM	319122	FM2	Call all schools - if you would like a Fitter message uploaded please email <a href="mailto:operations@funcube.org.uk">operations@funcube.org.uk</a>
2/5/2015 5:59:03 PM	319122	FM1	The main FUNCube tech team is: Dave G4DPZ, David G0MRF, Duncan M6UCK, Gerard Aalbers, Graham G3VZV, Jason G7OCD, Jim G3WGM, Howard G6LVB, Phil M6IPX, Wouter PA3WEG & Wouter Jan PE4WJ

**Send school messages to [operations@funcube.org.uk](mailto:operations@funcube.org.uk)**

# WA9ONY Receiving Equipment

SDR with a 4 element Yagi antenna

- Receiver: Airspy software defined radio (SDR)
- Preamp: Mini-Circuits ZFL-500LN+ Amplifier 24 db.
- Filters: after the preamp
  - Mini-Circuits VHF-145+ 140 to 1150 MHz high pass filter.
  - Mini-Circuits BLP-200 190 MHz low pass filter.
- Antenna: 4 elements Yagi Arrow II Portable Antenna Model 146-4 II.

# WA90NY Receiving Software

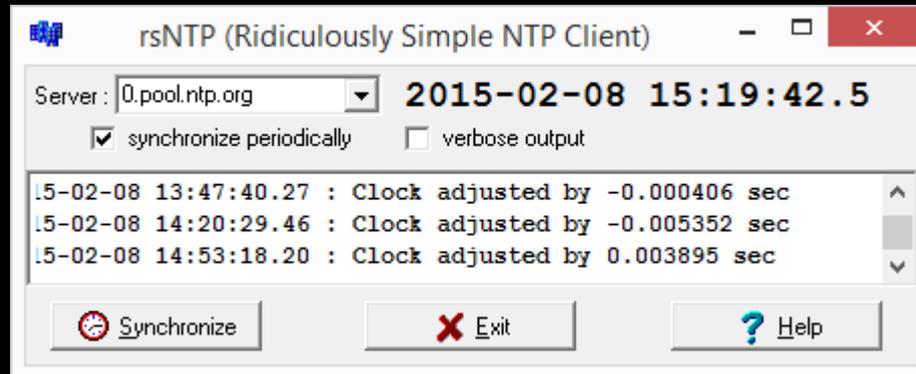
i7 core laptop with Windows 8.1

- SDR# V1.0.0.1332
- Behringer XENYX 302 USB audio mixer to USB
  - Audio line input
- FUNcube Telemetry Dashboard v848

# WA90NY Software

i7 core laptop with Windows 8.1

- 🌀 Ridiculously Simple NTP Client by Wolfgang "Wolf" DL4YHF for time keeping



- 🌀 Python 2.7.6 and Python Imaging Library (PIL V1.1.7) script taking screen captures every one second.

# www.stargazing.net/david/satellites/2meters.html

http://www.stargazing.net/david/satellites/2meters.html NH6Y - Callsign Lookup by QR... Real Time Data ISS and Satellites on 2 Meters

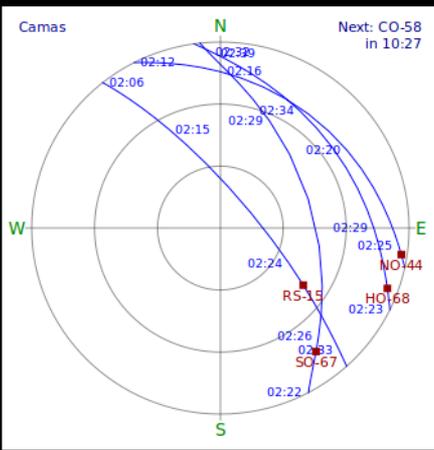
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Norton Safe Search THIS PAGE IS SAFE ACCESS VAULT SHARE VIA FACEBOOK

Observational Astronomy WildTangent Games ...

<<PREVIOUS - HOME - CONTENTS - NEXT>>  
SATELLITES INDEX - 

## ISS & Satellites on 2 Meters



**Summary**

Listening to the [International Space Station \(ISS\)](#) and [satellites](#) in [orbit](#) with a focus on [radio signals](#) in the [amateur radio 2 meter](#) band comprising frequencies from 144.000 MHz to 148.000 MHz.

The satellite radio signals are classified into two groups: voice and data transmissions.

**2 Meters Band Satellite Plan**

**ARRL Band Plan**

- 144.300-144.500 OSCAR (satellite)
- 145.800-146.000 OSCAR (satellite)