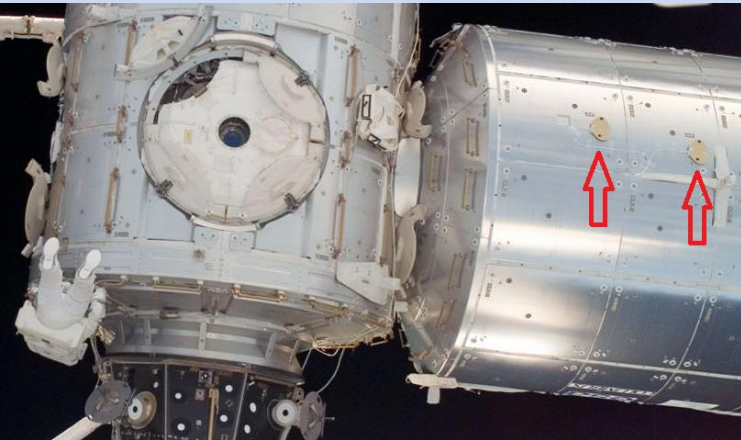


# ATV in Space



# Topics


 Current HamTV status on the ISS

– Ciaran M0XTD

 The HamTV transport stream

Merger system – Phil M0DNY

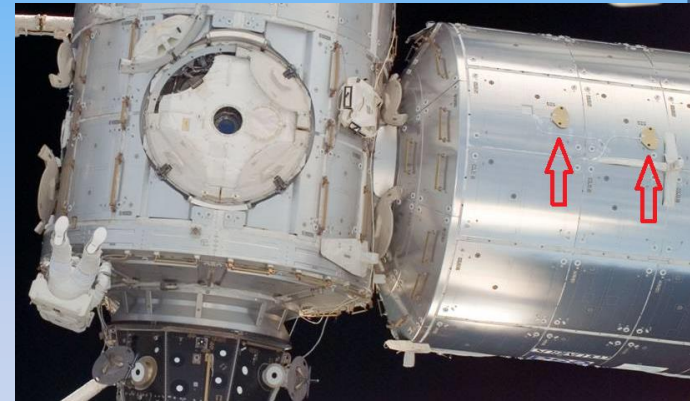
 Coffee Break

 Our Es'hail-2 opportunities

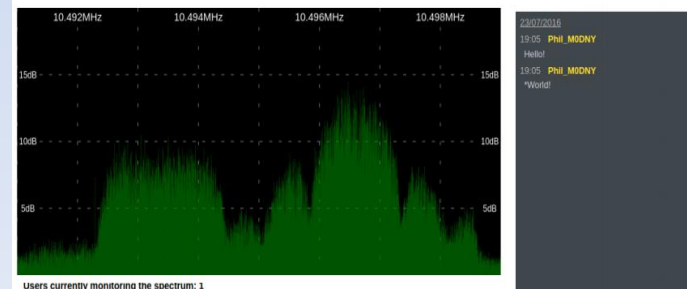
Overview – Graham G3VZV

Spectrum Monitor

– Dave G8GKQ



 Es'hailSat Spectrum Monitor



Q & A



# ARISS on-orbit capability update

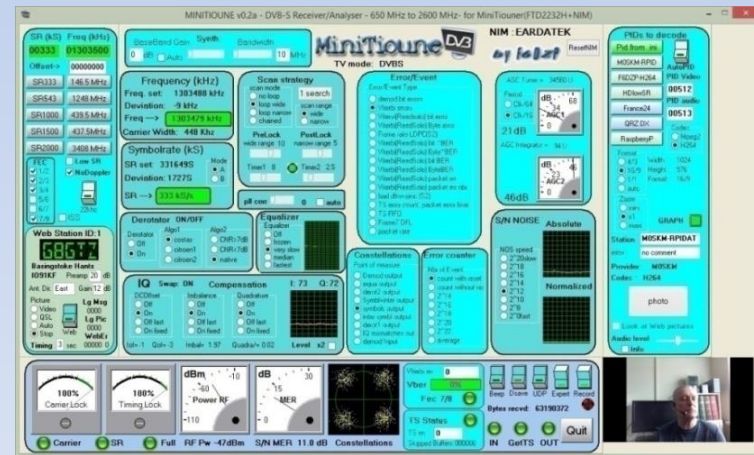
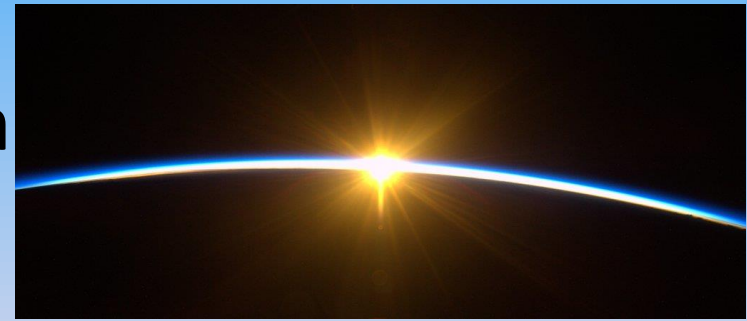
Ciaran Morgan, MØXTD

ARISS UK Team Leader



# ARISS

- BATC ARISS Live Stream
- BATC Interoperable Radio System
- BATC HamTV
- BATC MarconISSTa

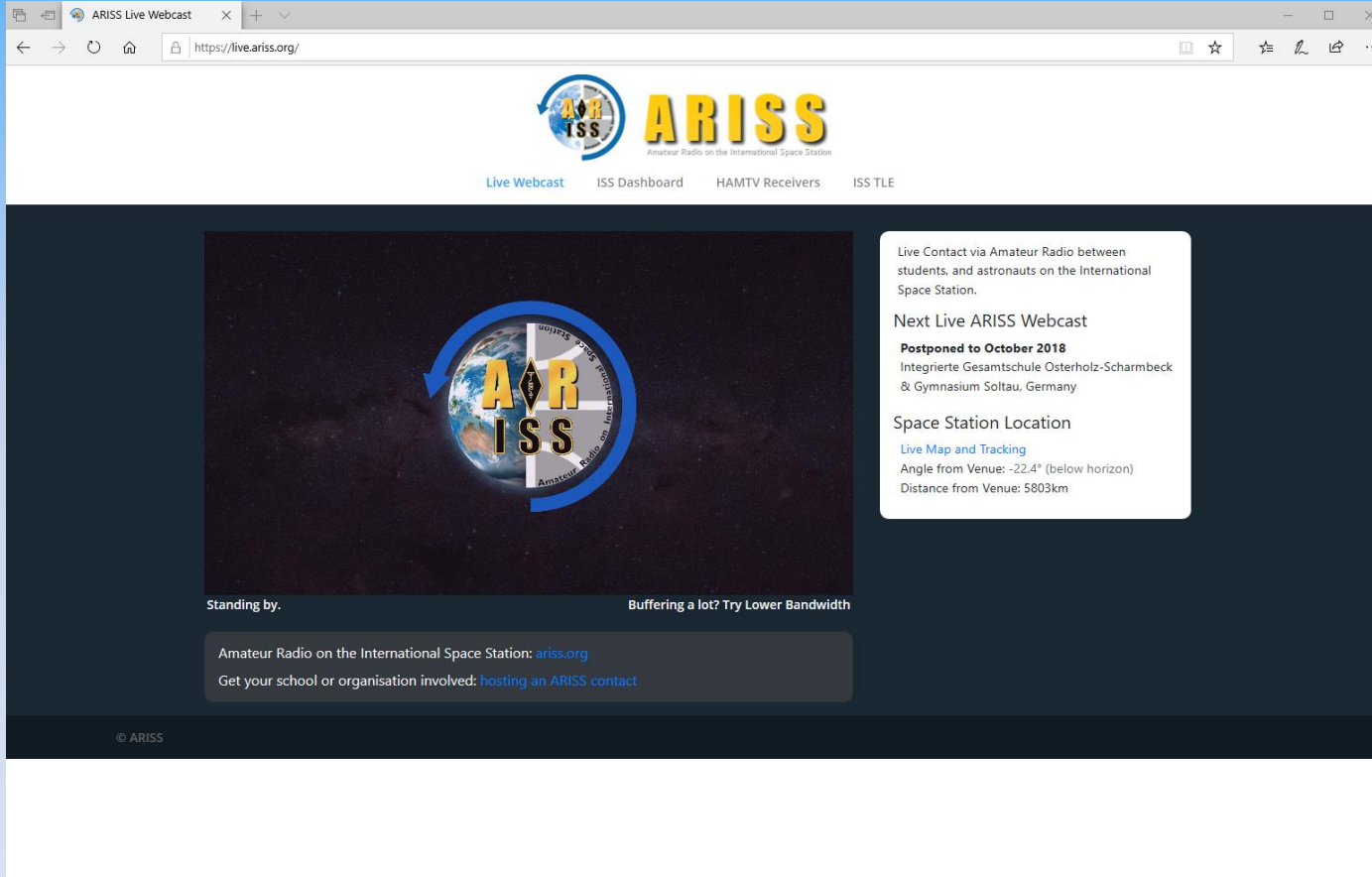


# But first.....

 A HUGE thank you to the BATC



# ARISS Live Stream....



The screenshot shows a web browser window with the address bar displaying <https://live.ariss.org/>. The website header features the ARISS logo (Amateur Radio on the International Space Station) and navigation links for Live Webcast, ISS Dashboard, HAMTV Receivers, and ISS TLE. The main content area is dark-themed and contains a large video player. The video player shows a circular ARISS logo with the text 'Amateur Radio on the International Space Station' around it, set against a background of Earth from space. Below the video player, the text 'Standing by.' is on the left and 'Buffering a lot? Try Lower Bandwidth' is on the right. A dark grey box below the video contains the text: 'Amateur Radio on the International Space Station: [ariss.org](https://ariss.org)' and 'Get your school or organisation involved: [hosting an ARISS contact](#)'. To the right of the video player is a white box with the following text: 'Live Contact via Amateur Radio between students, and astronauts on the International Space Station.', 'Next Live ARISS Webcast', 'Postponed to October 2018', 'Integrierte Gesamtschule Osterholz-Scharmbeck & Gymnasium Soltau, Germany', 'Space Station Location', 'Live Map and Tracking', 'Angle from Venue: -22.4° (below horizon)', and 'Distance from Venue: 5803km'. The footer of the page shows '© ARISS'.

# Interoperable Radio System

 Why is this relevant to HamTV?



# Interoperable Radio System



Multi-Voltage Power Supply with JVC-Kenwood  
D710GA on Mounting Bracket



# HamTV



Secure | <https://hamtv.batc.tv/liver>

**Live ISS HAMTV Video**  
Received by Amateur Radio

**BATC**







**HAMTV Receiver Stations**  
Goonhilly Dashboard & ISS Tracker

Station	Prime Receiver	Receiving Data	EL
GOONHILLY - Cornwall, UK	Prime Receiver	Receiving Data	EL: 10.0°
MODNY - Southampton, UK	Prime Receiver	Receiving Data	EL: 15.1°
FEDZP - Migné-Auxances, FR	Prime Receiver	Receiving Data	EL: 13.6°
PASWEG - Delft, NL	Prime Receiver	Receiving Data	EL: 27.1°
IK1SLD - Casale Monferrato, IT	Prime Receiver	Receiving Data	EL: 21.1°






HAMTV is live! Streaming provided by BATC






# HamTV Status...

-  Used successfully from Jan 2016 to early 2018
-  Currently not transmitting
-  Initial on-orbit investigations have taken place
-  So far, investigations have not revealed the cause of the problem
-  Only option is to down-mass the unit and carry out detailed analysis
-  But.....






# HamTV Status...

-  Have agreement from ESA to down-mass the HamTV transmitter unit
-  Down mass NET January 2019 via SpaceX
-  On-earth investigations to take place by developer, Kaiser Italia
-  To preserve flight certification, we have to be careful in what “fixes” are applied.
-  Reflight to ISS not expected until NET late 2019

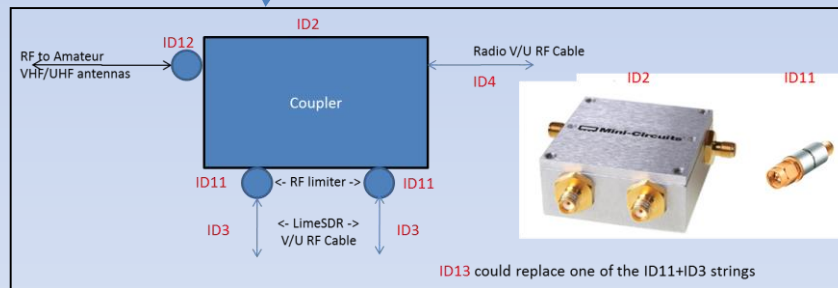
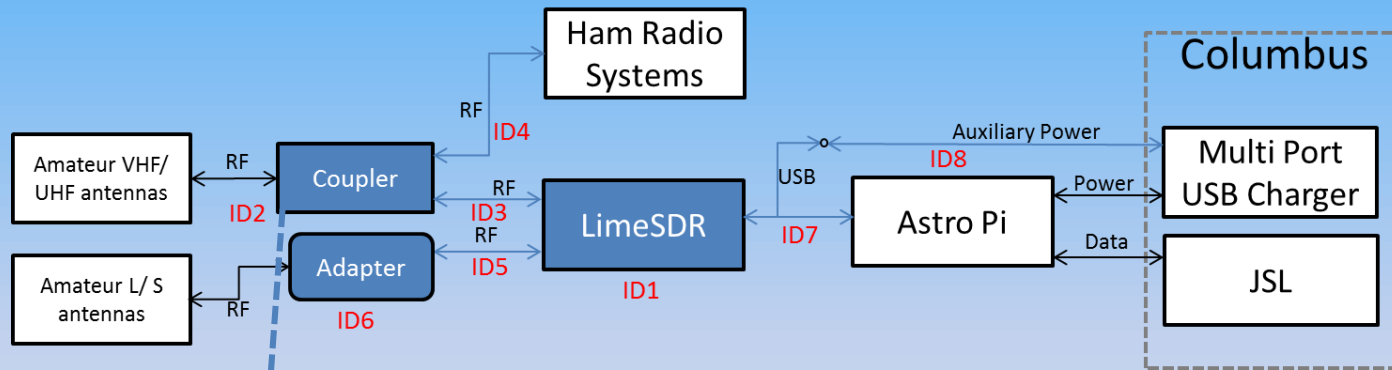
# HamTV Status...

-  Design started on HamTV2
-  Higher resolution, modular approach so repair by replacement of key parts can be carried out on orbit without need for down-massing
-  Will be a significant project

# MarconiSSta






-  Project developed by TU Berlin, supported by ESA
-  Based on a Lime Mini in Rx mode only
-  Connects to all ARISS antennas on COLUMBUS
-  Controlled by existing on-orbit Astro-Pi computer
-  Commissioned and returning data since August 2018

# MarconiSSta setup







ID	Item
1	LimeSDR (+ Housing)
2	RF Coupler
3	Cable LimeSDR to Coupler
4	Cable Ham Radio Systems to Coupler
5	Cable LimeSDR to adapter box/ cable
6	Adapter box/ cable to ISS ham L/S RF cable
7	Cable AstroPi to LimeSDR
8	Cable LimeSDR auxiliary power supply
9	Micro SD 32GB Card
10	SD Card Adapter
11	RF Limiter
12	Adapter N-type / SMA
13	50 Ohm dummy load
14	SMA Torque Wrench

# MarconISSta Primary Objectives

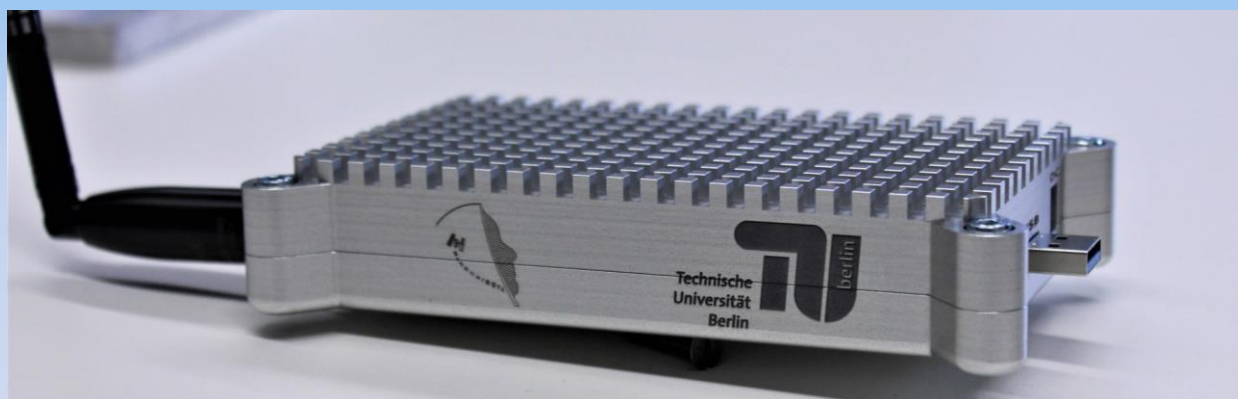
-  Analysis of spectrum use in UHF in the range 435-438 MHz
-  Analysis of spectrum use in VHF in the range 145.8-146 MHz
-  Analysis of spectrum use in L Band in the range 1260-1270 MHz
-  Analysis of spectrum use in S Band in the range 2400-2450 MHz
-  Detection of interferers using algorithms based on received signal strength, attitude information, frequency Doppler shift information and antenna gain pattern

# MarconISSta Secondary Objectives




-  Analysis of spectrum use in UHF in the ranges 400.15-420 MHz
-  Analysis of spectrum use in VHF in the ranges 150.05-174 MHz
-  Analysis of spectrum use in S Band in the range 2025-2120 MHz
-  Assessment of ARISS antenna radiation pattern



# MarconiSSta



# What happens at end of investigation?

-  TU Berlin/ESA will turn MarconiSSa hardware over to ARISS
-  Opportunity for ARISS to gain flight experience of SDR in space
-  Can we convert it to be a 'L' band uplink
  - Can the crew view the school they are making contact with?
  - Once HamTV is available, can ARISS implement an L/S band repeater
  - What other ideas are out there?

# How to follow MarconiSsta



[https://marconissta.com](https://marconissta.com/)  
/

# HamTV Technical Overview

- S- & L-band Antennas mounted to ESA Columbus Module – Launched 2008
- HamTV Transmitter built & certified for ARISS by Kayser Italia
- Transmitter upmassed to Columbus Module in 2013
- NTSC Composite & Audio Input
- DVB-S, 2.0MS/s, 2395MHz, 10W EIRP
  - MPEG-2 Video @ ~900kbps
  - MP2 Audio @ 256kbps
- S-Band patch antenna on Columbus Module exterior



# HamTV in Contacts

- Normally camera is disconnected, transmits a black screen with audio system hiss.
- Astronaut plugs in Camera for ARISS Contact passes
- Can give live demonstrations, and wave!



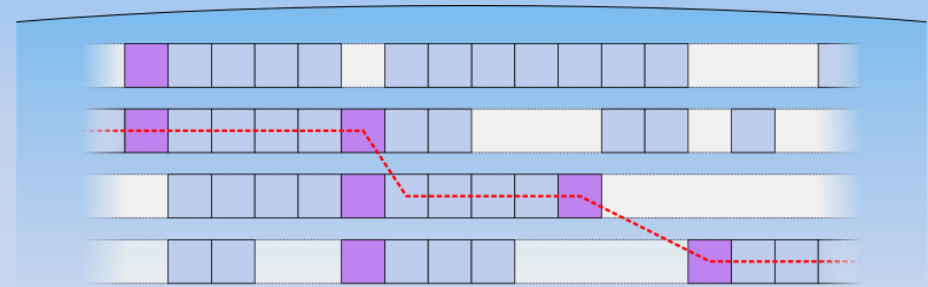
# Ground Station Co-operation

- Reception of moving station presents several challenges
  - Tracking Accuracy
  - Local Interference
  - Local obstructions
  - Space Station obstructions
- Multiple geographically-spaced ground stations
- One feed to School / Venue




# TS Merger System

- MPEG-TS is packetised
  - 188 Byte Packets
  - Some packets have PCR timestamp ( $\sim 1/50$ )
- PCR is used to synchronise ground station feeds
- 100ms delay to aggregate data from stations
- Most complete segment is copied to output buffer



# TS Merger Inputs & Outputs

- Input: MPEG-TS over UDP
  - live.ariss.org port 5678
- Output: MPEG-TS over TCP
  - live.ariss.org port 5679
- Public Webpage Viewer
  - <https://live.ariss.org/hamtv/>
  - HTML5 Live Stream
  - Live Ground Station Status



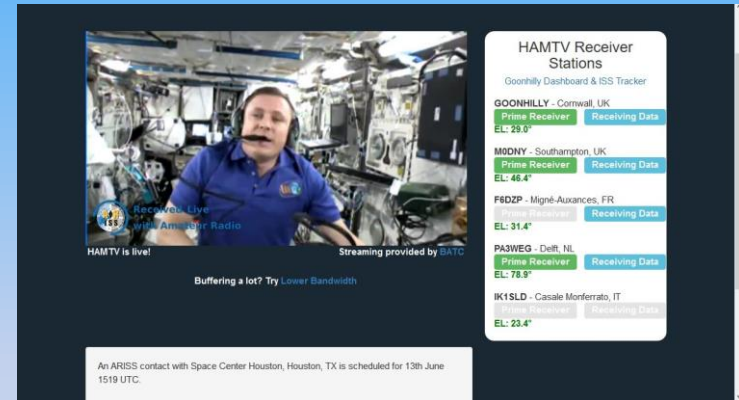
The screenshot shows the ARISS website interface. At the top, there is a navigation bar with the ARISS logo and the text "Amateur Radio on the International Space Station". Below the navigation bar, there are links for "Live Webcast", "ISS Dashboard", "HAMTV Receivers", and "ISS TLE". The main content area is divided into two sections. The left section is a video player area with a black background and a central ARISS logo. Above the video player, there is a text overlay: "This is the HAMTV video downlink only, [click here](#) for the Live Event Webcast." Below the video player, there are two status messages: "Standing by for HAMTV.." and "Buffering a lot? Try Lower Bandwidth". The right section is titled "HAMTV Receiver Stations" and lists several stations with their call signs, locations, and elevations. The stations listed are: GOONHILLY - Cornwall, UK (EL: -38.8°), PA3WEG - Delft, NL (EL: -40.2°), IK1SLD - Casale Monferrato, IT (EL: -44.0°), OK2UUJ - Olomouc, CZ (EL: -43.7°), SP3QFE - Kolo, PL (EL: -42.7°), F6DZP - Migné-Auxances, FR (EL: -41.5°), M0EYT - Dorset, UK (EL: -39.3°), and VK5EI - Adelaide, AUS (EL: -54.8°).

Call Sign	Location	Elevation (EL)
GOONHILLY	Cornwall, UK	-38.8°
PA3WEG	Delft, NL	-40.2°
IK1SLD	Casale Monferrato, IT	-44.0°
OK2UUJ	Olomouc, CZ	-43.7°
SP3QFE	Kolo, PL	-42.7°
F6DZP	Migné-Auxances, FR	-41.5°
M0EYT	Dorset, UK	-39.3°
VK5EI	Adelaide, AUS	-54.8°



# TS Merger in Contacts

- Developed during Tim Peake's Mission
- Used for as Backup & Primary
  - Thomas Pesquet
  - Paulo Nespoli
  - Jack Fischer

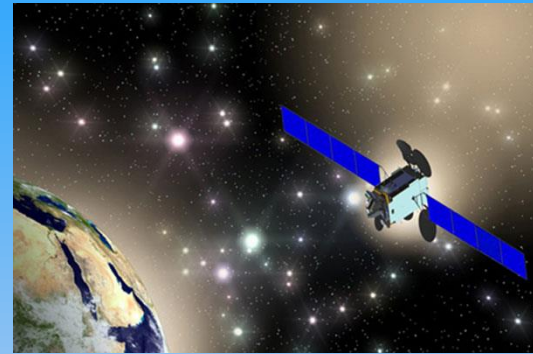










Any Questions?

[github.com/ariss-uk/tsmerge](https://github.com/ariss-uk/tsmerge)

# Es'hail -2



-  Launch arrangements
-  Coverage
-  Transponders
-  Proposed Bandplans
-  Do's and Don't's
-  Spectrum Monitor and Chat Room

# Es'hail -2

## Launch arrangements



**Date:** 4th Quarter

**Vehicle:** SpaceX Falcon 9 | Es'hail 2

**Mission:** A SpaceX Falcon 9 rocket will launch the Es'hail 2 communications satellite. Built by Mitsubishi Electric Corp. and owned by Qatar's national satellite communications company Es'hailSat, Es'hail 2 will provide television broadcasts, broadband connectivity and government services to Qatar and neighboring parts of the Middle East, North Africa and Europe. Es'hail 2 also carries the first amateur radio payload to fly in geostationary orbit.

**\*\*Delayed from August 2018\*\***

**Launch Site:** Cape Canaveral, Florida

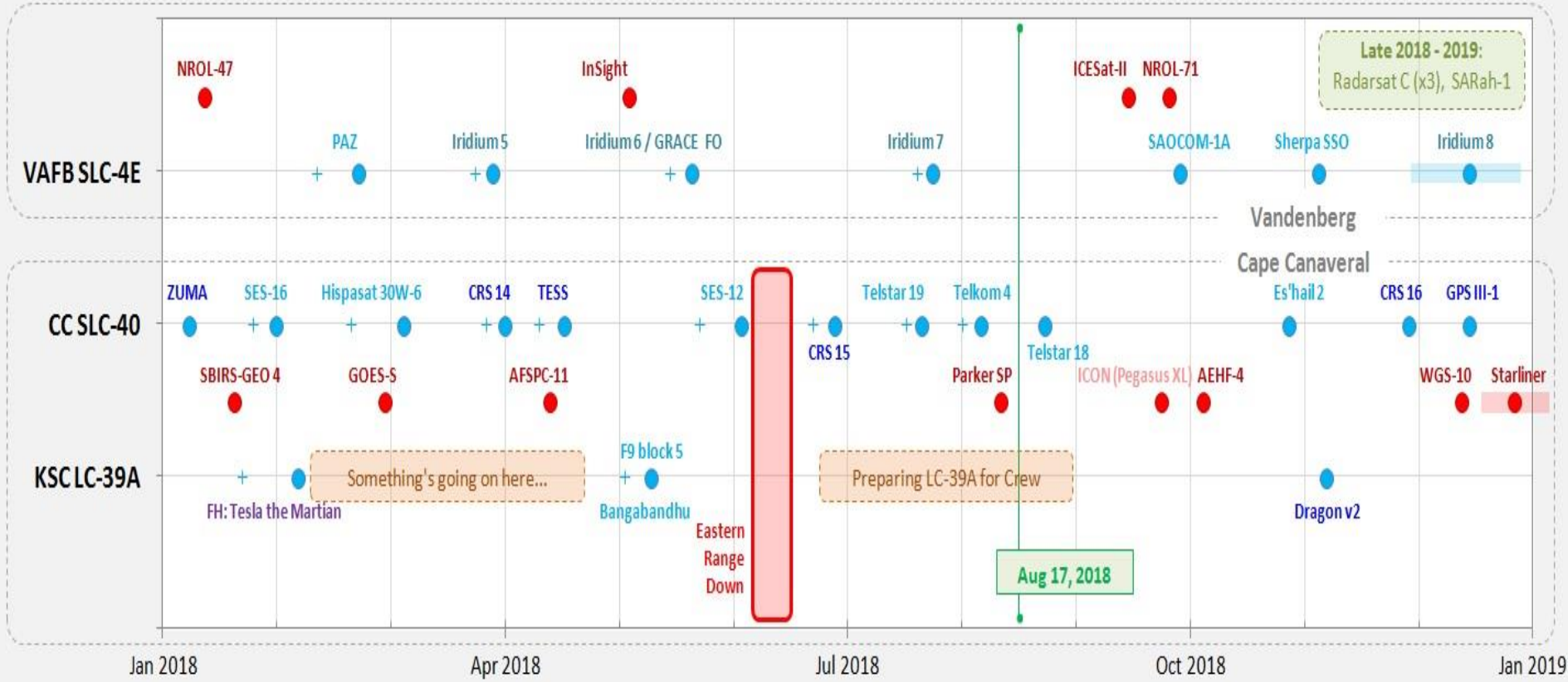
**Launch Window:** TBD

# Es'hail -2

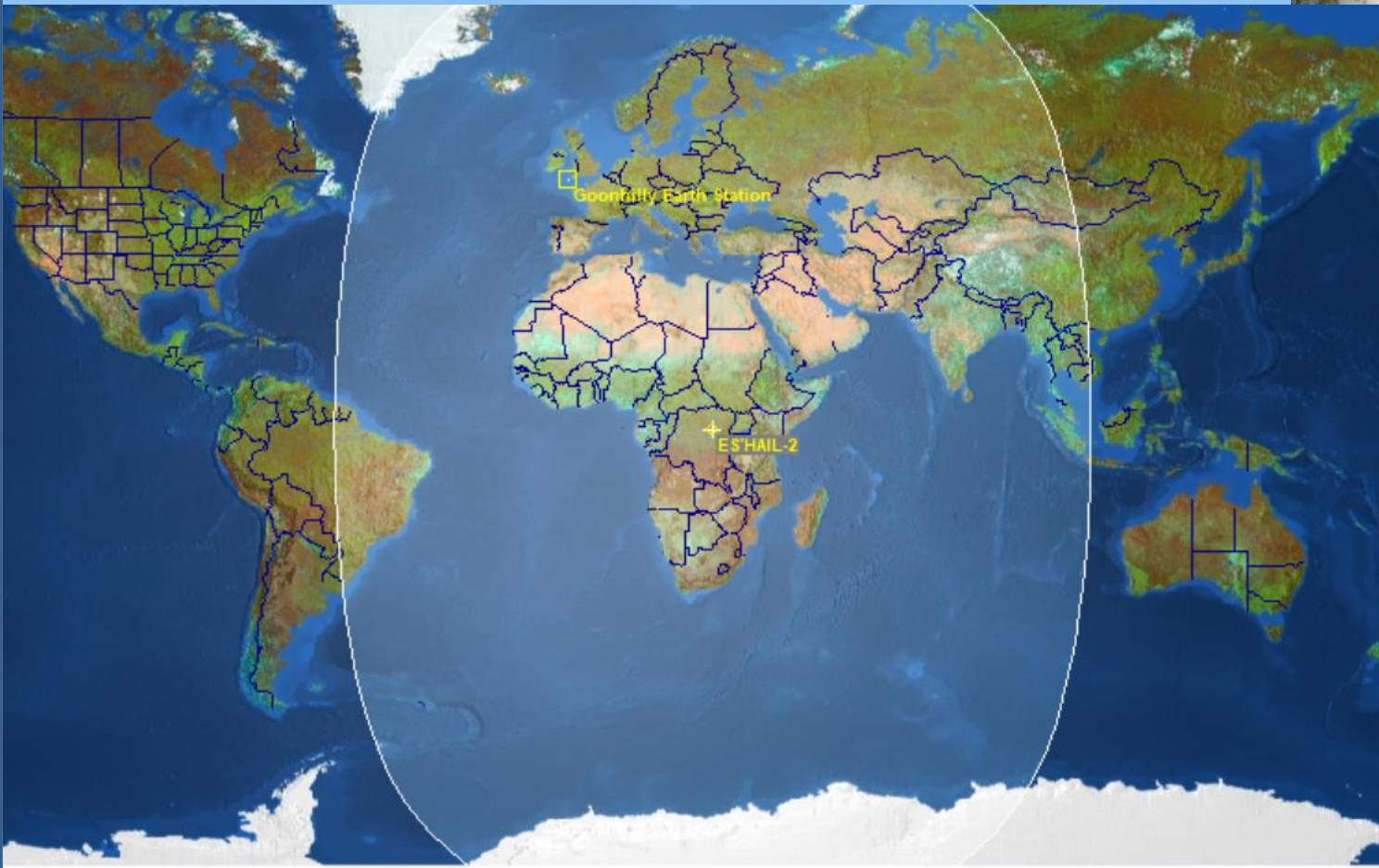
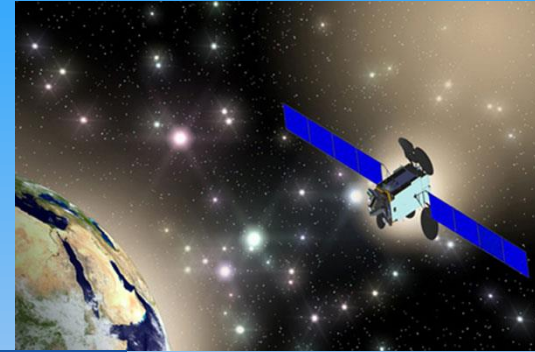
## Launch arrangements

### SpaceX "FPIP-chart" for 2018

Disclaimer: **1.** This chart is based on information from open sources only. Therefore, it has a lot of guesswork. **2.** Solid (official) launch info available is summarized in the first post ("SpaceX Manifest Updates...") **3.** The purpose of the chart is to visualize "launch density" and possible scheduling conflicts for Cape and Vandenberg.

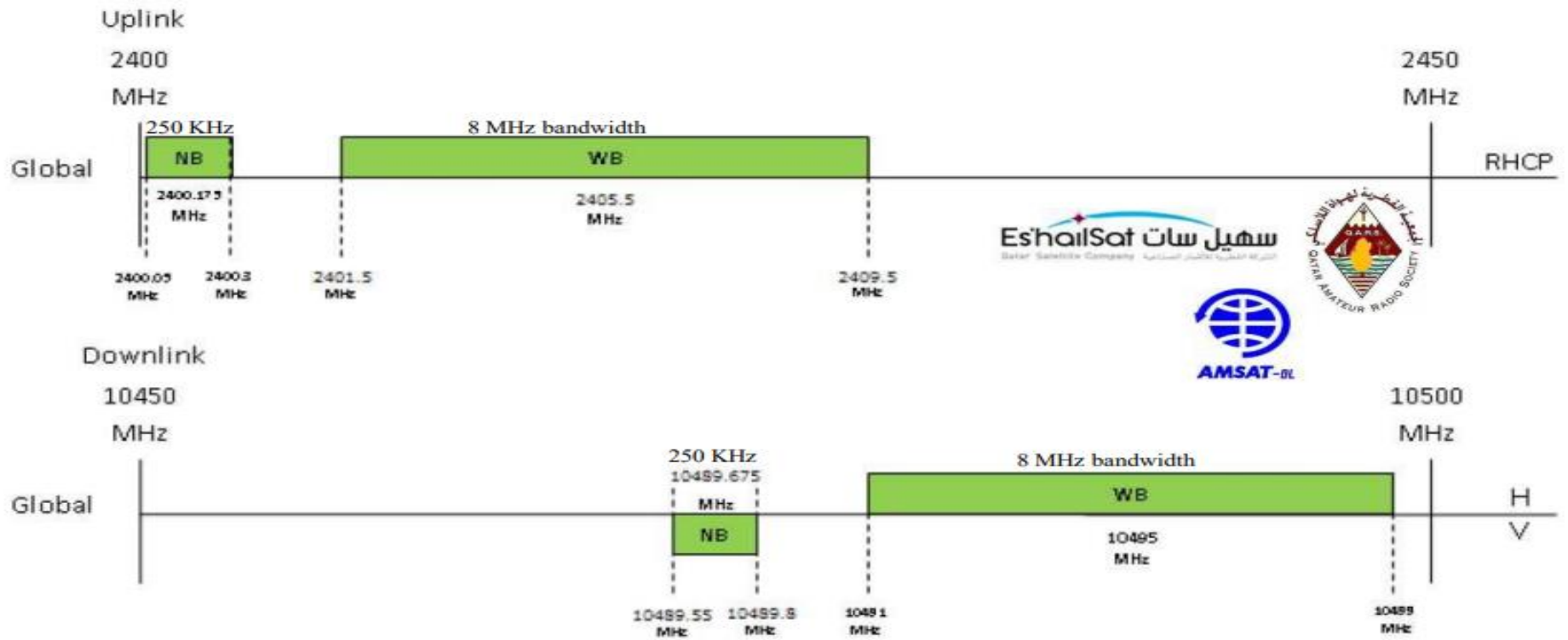
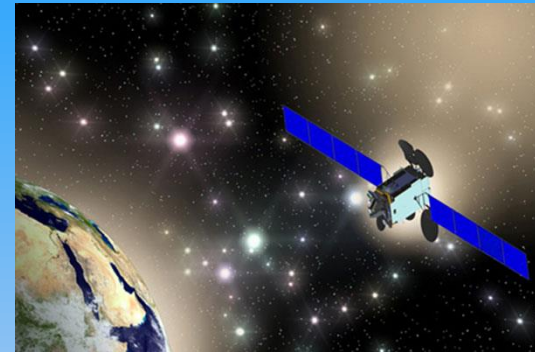


# Es'hail -2 Coverage



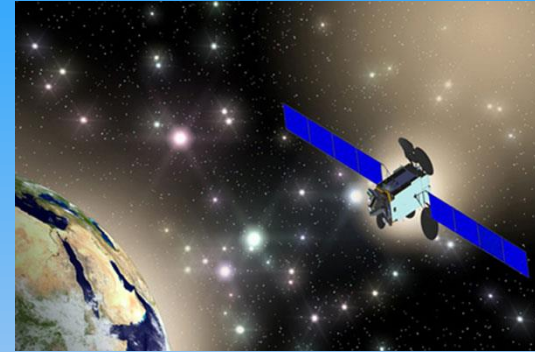
Down to  
0 degrees  
elevation

# Es'hail -2 Transponders



Xpdr No	U/L FREQUENCY (MHz)				D/L FREQUENCY (MHz)				LO (MHz)	BW (MHz)
	Pol	Begin	Center	End	Pol	Begin	Center	End		
NB	RHCP	2400.05	2400.175	2400.3	V	10489.55	10489.675	10489.8	8089.5	0.25
WB	RHCP	2401.5	2405.5	2409.5	H	10491	10495	10499	8089.5	8

# Es'hail -2 Preparations



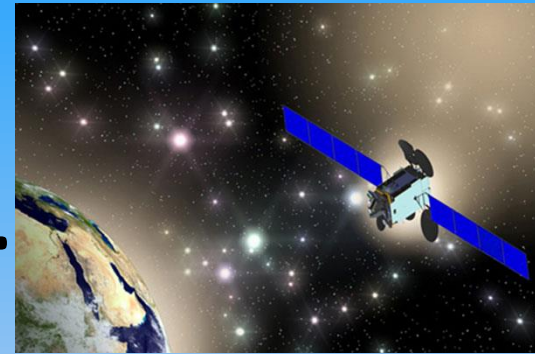
- Look for BADR-4
- Same location @ 26 East
- Lots of unencrypted DVB signals available
- 11996 MHz Horizontal has BBC News in Arabic (27500 kbps &  $\frac{3}{4}$  FEC)
- 45dBW eirp – >80 cm or 1 metre dish required





# Es'hail -2

## NB Proposed Bandplan .



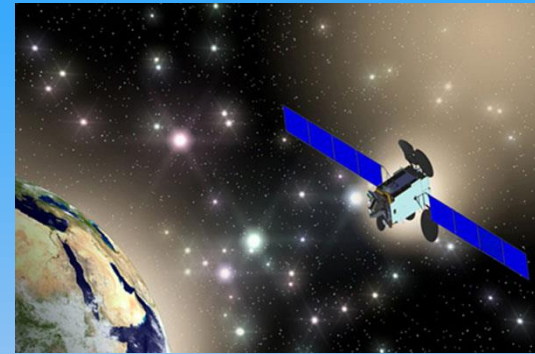
### Uplink





### Downlink

Uplink	Frequency	Downlink
	<b>10489.55 MHz</b>	<b>Lower beacon 400bps BPSK</b>
<b>2400.06 -2400.10 MHz</b>	10489.56 -10489.60 MHz	CW only
<b>2400.10 -2400.12 MHz</b>	10489.60 -10489.62 MHz	narrowband digimodes (500Hz max b/w)
<b>2400.12 -2400.14 MHz</b>	10489.62 -10489.64 MHz	digimodes (2700Hz max bandwidth)
<b>2400.14 -2400.19 MHz</b>	10489.64 - 10489.79 MHz	all modes (2700 Hz max bandwidth)
	<b>10489.80 MHz</b>	<b>Upper beacon 400 bps BPSK</b>

# Es'hail -2

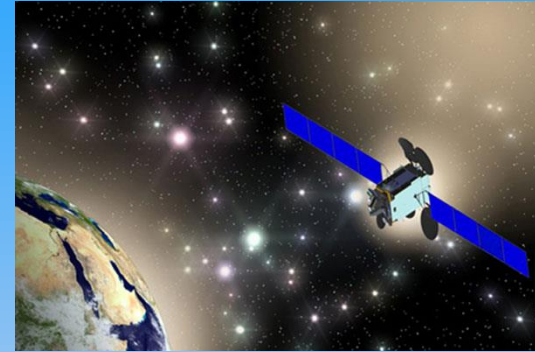
## Do's and Donts











-  Do respect this facility and other users
-  Do refrain from any activity that might cause offense
-  Don't operate outside the terms of your amateur radio licence.
-  Don't run too much uplink power – never stronger than the beacon

# Es'hail -2

## ATV Do's and Donts



-  Do keep overs short <10 mins
-  Do use the web monitor to verify your uplink power
-  Do use the chatroom before transmitting
-  Do use DVB-S2 if you can
-  Do experiment with higher order DVBS modes to conserve bandwidth
-  Don't show images or videos likely to cause offense
-  Don't show recordings of non amateur radio events
-  Don't transmit any copyright material