# 2016

**AIS Saves Lives!**

**By**

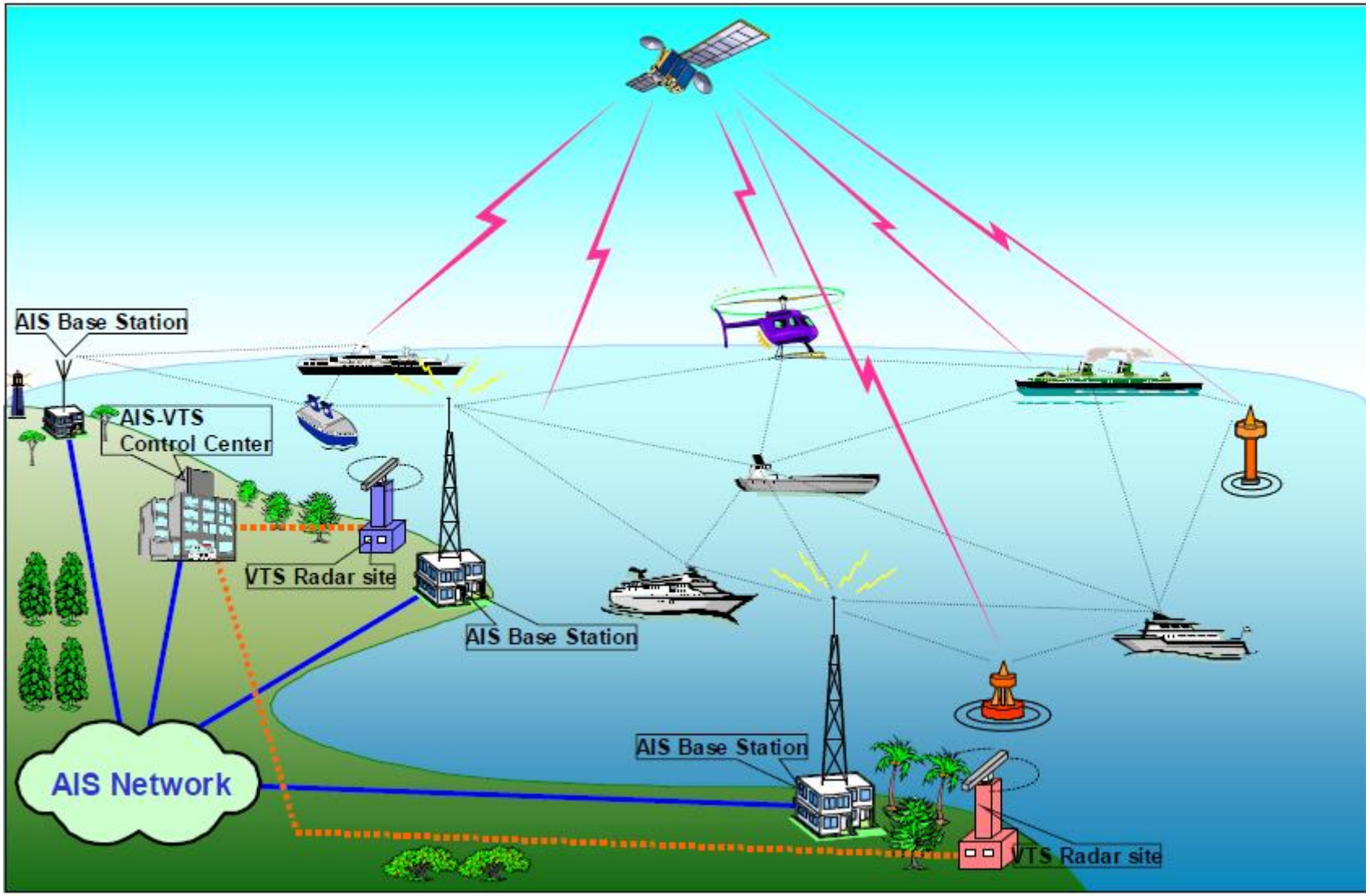
**Julie VK3FOWL and Joe VK3YSP**

# SARTS MEETING SEPTEMBER 2015

Jeff 9V1AS, Secretary SARTS

Will Ellison, SOLIS Marine Consultants

# AUTOMATIC IDENTIFICATION SYSTEM



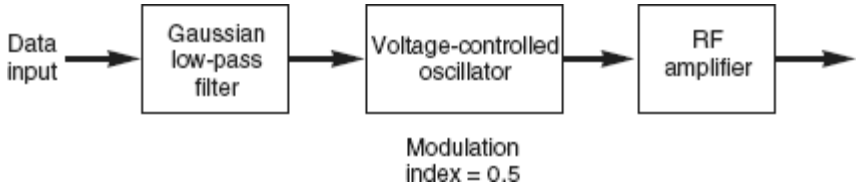
# SHIPBOARD AIS TRANSPONDERS

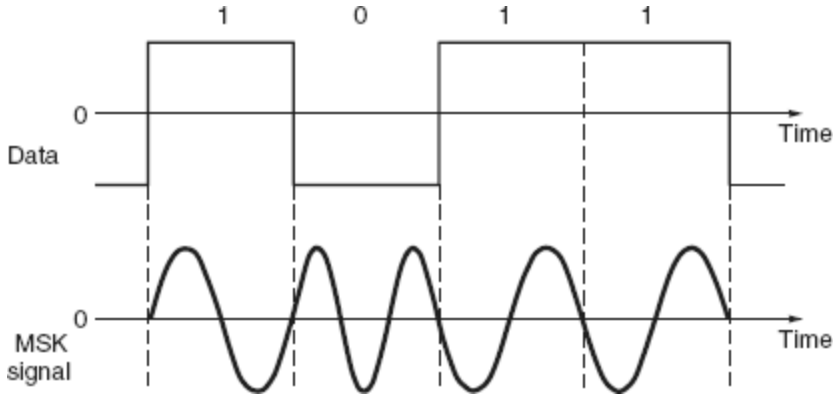
**CLASS A**

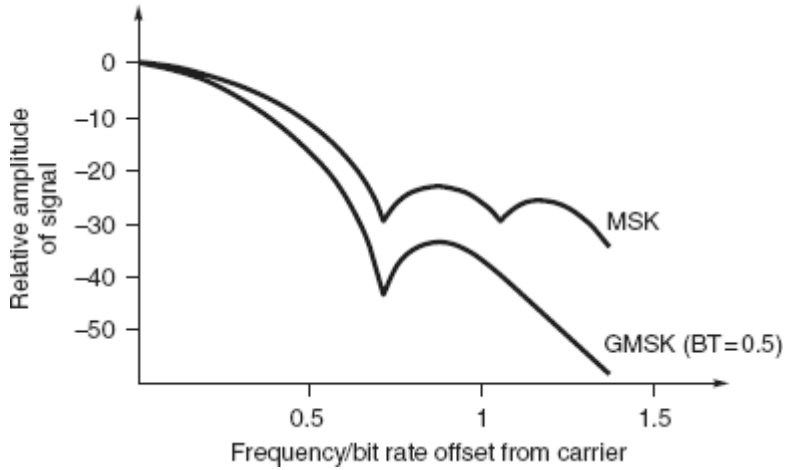
**CLASS B**

# AIS FORMAT

- AIS Frequency: A=161.975MHz, B=162.025MHz.
- Mode: FM. Bit Rate: 9600bps
- Modulation: Gaussian Minimum Shift Keying (GMSK)

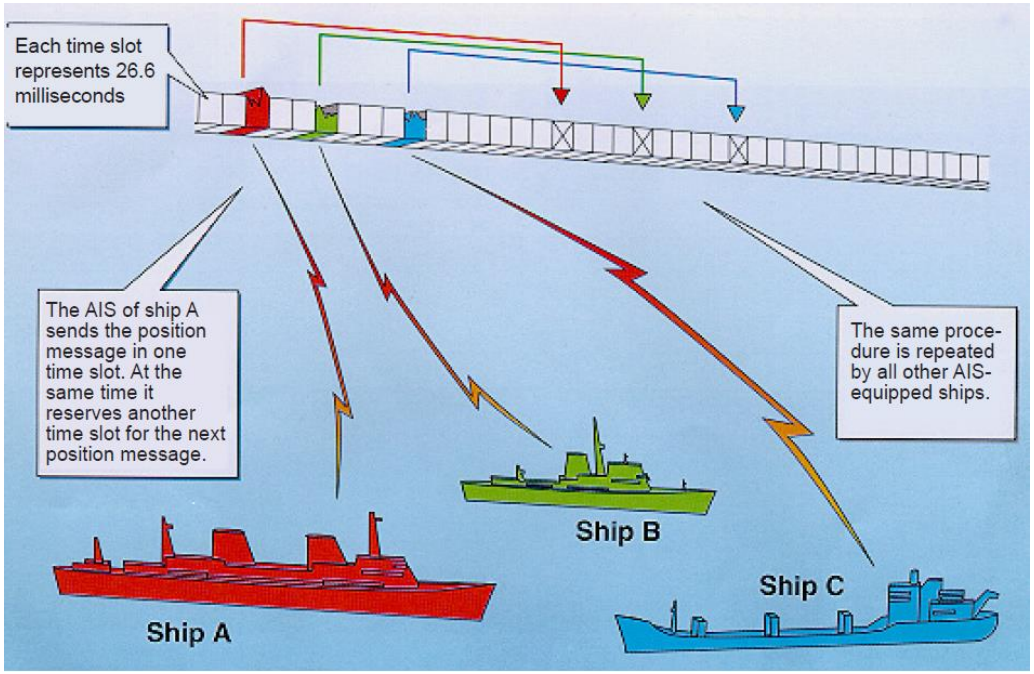


# AIS LINK LAYER

- Self Organized Time Division Multiple Access ITU-R M.1371-5
- 2 VHF channels. 2250 time slots per minute. GPS synchronised.
- Messages are alternated on AIS channel A/B
- Frame format tolerates < 120NM propagation delay



# AIS MESSAGES

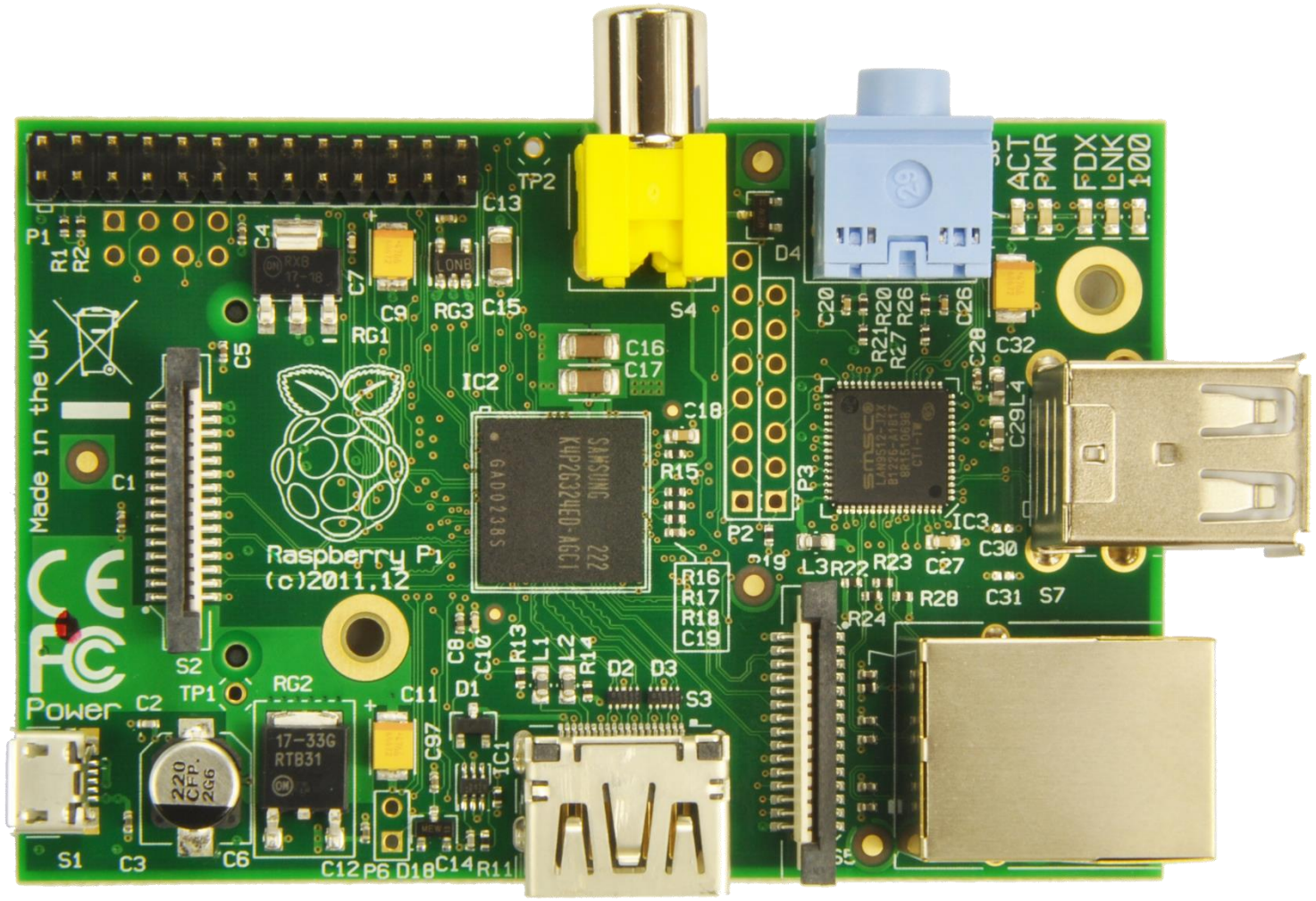
Sync (24 bits), Start (0x7E),Data (168 bits), CRC16, Stop (0x7E), Buffer (24bits)

!AIVDM,1,1,,A,14eG;o@034o8sd<L9i:a;WF>062D,0*7D

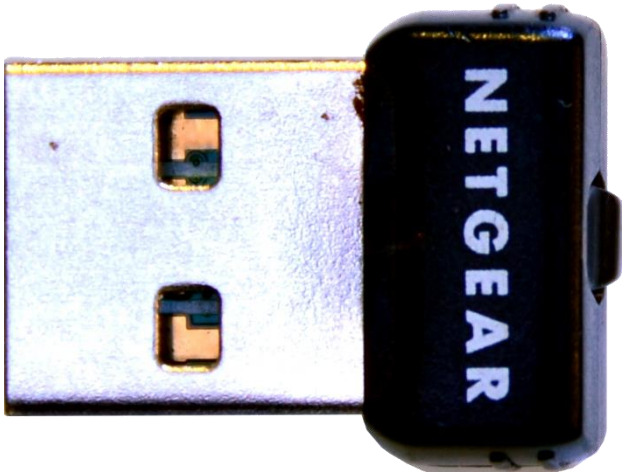
| | |
|---|---|
| !AIVDM | The NMEA message type |
| 1 | Number of Sentences |
| 1 | Sentence Number |
| | Sequential Message ID (Blank) |
| A | The AIS Channel (A or B) |
| 14eG;... | The Encoded AIS Data |
| 0* | End of Data |
| 7D | NMEA Checksum |

# RTL DONGLE (1PPM TCXO)

# RASPBERRY PI MODEL B, VER 1, 2 OR 3



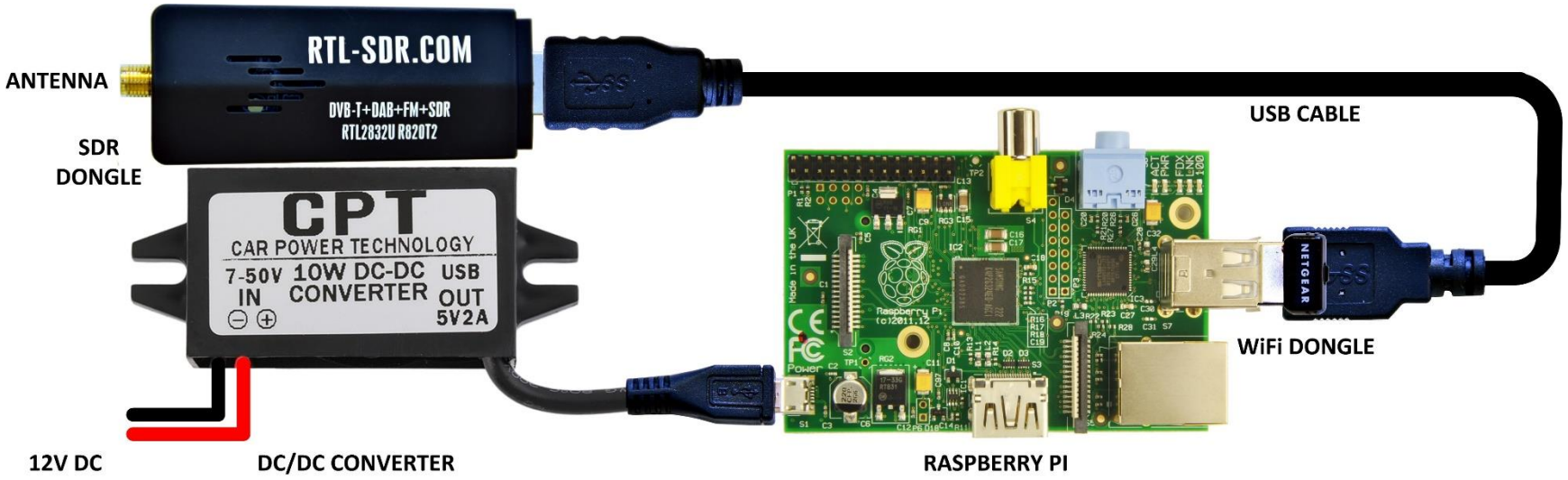
# USB WIFI DONGLE



# MICRO USB DC/DC CONVERTER

# USB EXTENSION CABLE

# AIS RECEIVER PICTORIAL SCHEMATIC



# CALIBRATING THE RTL DONGLE PART 1

**kal -s GSM900**

Found 1 device(s):

0: Generic RTL2832U OEM

Using device 0: Generic RTL2832U OEM

Found Rafael Micro R820T tuner

Exact sample rate is: 270833.002142 Hz

kal: Scanning for GSM-900 base stations.

GSM-900:

chan: 8 (936.6MHz + 2.289kHz) power: 40324.67

chan: 12 (937.4MHz + 1.677kHz) power: 48893.99

**chan: 15 (938.0MHz + 2.250kHz) power: 68151.80**

chan: 77 (950.4MHz + 1.764kHz) power: 51462.37

# CALIBRATING THE RTL DONGLE PART 2

**kal -c 15**
Found 1 device(s):
  0:  Generic RTL2832U OEM
Using device 0: Generic RTL2832U OEM
Found Rafael Micro R820T tuner
Exact sample rate is: 270833.002142 Hz
kal: Calculating clock frequency offset.
Using GSM-900 channel 15 (938.0MHz)
average [min, max] (range, stddev)
+ 2.243kHz [2218, 2267] (50, 13.075513)
overruns: 0
not found: 0
average absolute error: **-2**.391 ppm

# RPI TERMINAL PROFILE

**/home/pi/.bash_profile**

```
echo "Starting AIS Receiver in 10 seconds. CTRL-C to exit"
sleep 10
setterm -blank 0 -powerdown 0
sudo killall -w rtl_ais
sudo killall -w aisdispatcher
/usr/bin/aisdispatcher -u -G -h 127.0.0.1 -p 10110 -H 54.225.113.225:5322 &
/usr/bin/rtl_ais -p -2 &
```

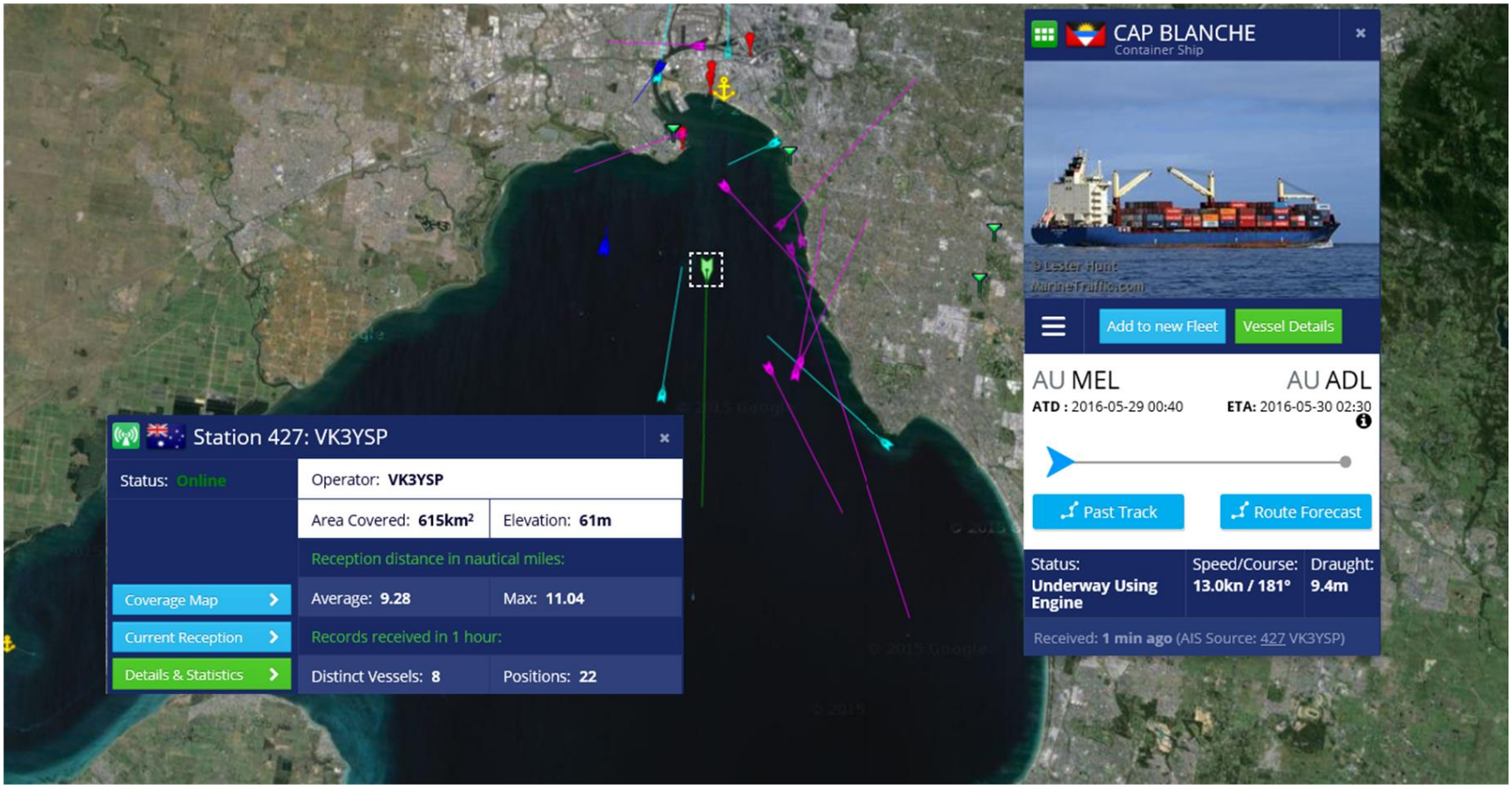
# RTL AIS STARTUP

**/usr/bin/rtl_ais -p -2 &**
**Edge tuning disabled.**
**DC filter enabled.**
**RTL AGC enabled.**
**Internal AIS decoder enabled.**
**Buffer size: 163.84 mS**
**Downsample factor: 64**
**Low Pass: 25000 Hz**
**Output: 48000Hz**
**Found 1 device(s):**
**0:  Generic, RTL2832U, SN: 77771111153705700**
**Using device 0: Generic RTL2832U**
**Found Rafael Micro R820T tuner**
**Log NMEA sentences to console ON**
**AIS data will be sent to 127.0.0.1 port 10110**
**Tuner gain set to automatic.**
**RTL AGC mode ON**
**Tuner error set to -2ppm.**
**Tuned to 162000000 Hz.**
**Sampling at 1600000 S/s.**

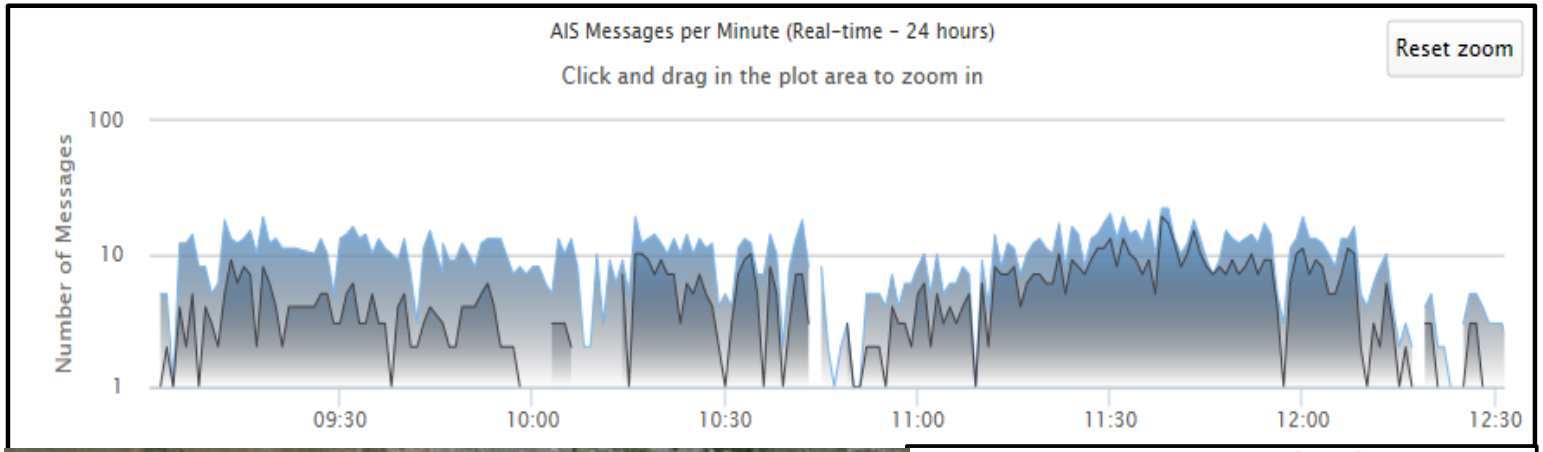
**!AIVDM,1,1,,A,17PF4v3000:GFjabEL2c7aw408ct,0*77**
**!AIVDM,1,1,,B,17OetM0000:GFs=bG;VrUjun00RF,0*6F**

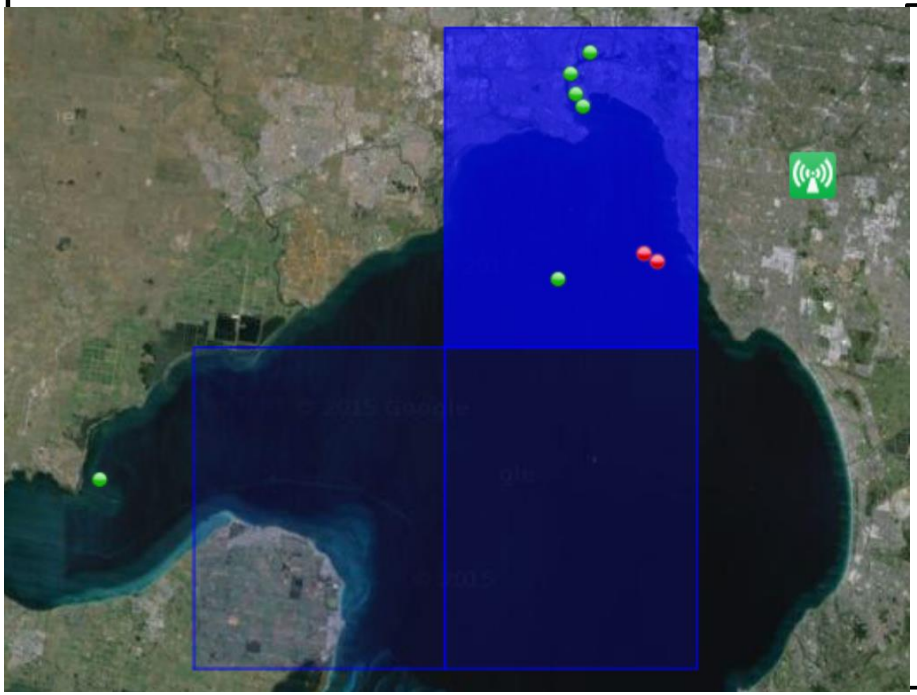
# AIS RECEIVER ASSEMBLY

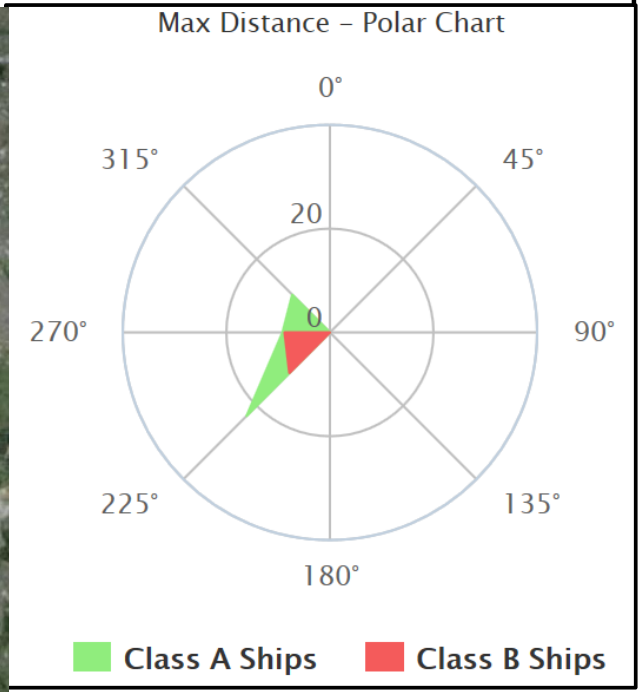
# AIS MAP DISPLAY



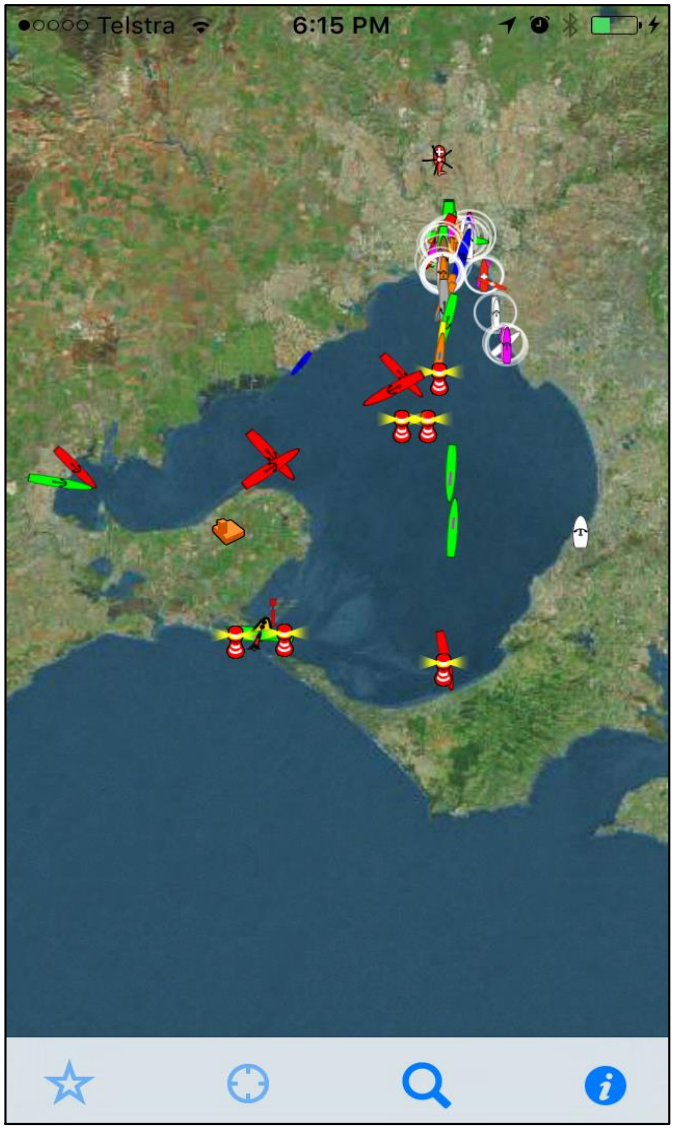
# AIS RECEIVING STATISTICS





# AIS MOBILE APP



# SOURCES/LINKS

The following sources are acknowledged:

- http://www.sarcnet.org/projects/project_ais.html
- https://en.wikipedia.org/wiki/Automatic_Identification_System
- http://www.embedded.com/print/4017656
- http://catb.org/gpsd/AIVDM.html
- http://www.itu.int/dms_pubrec/itu-r/rec/m/R-REC-M.1371-5-201402-I!!PDF-E.pdf

The following AIS service providers are acknowledged:

- Pocketmariner: http://pocketmariner.com/ais-ship-tracking/cover-your-area/
- AISHub: http://www.aishub.net/ais-tracking-join-us.php
- Marinetraffic: https://www.marinetraffic.com/en/users/register/1/12
- Shipfinder: http://www.shipfinder.com/Login/reg