HF COMMS IN THE AUSTRALIAN OUTBACK

IPS WORKSHOP

03 December 2015

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OBJECTIVE

- To provide communications (including safety) using HF SSB amateur radio, for two vehicles during an eight week journey through remote NSW, South Australia, Northern Territory and Western Australia

THE CHALLENGE

To maintain adequate communications despite the ever-changing ionosphere

THE TOOLS

- Use of pre-determined frequencies within various amateur bands
- Test the frequency using Codan's "Beacon Call"
- Use APRS to indicate 10 MHz behaviour and the location of the mobile stations
- Up to date knowledge of ionosphere - IPS

The NSW vehicle

The NSW vehicle

The QLD vehicle

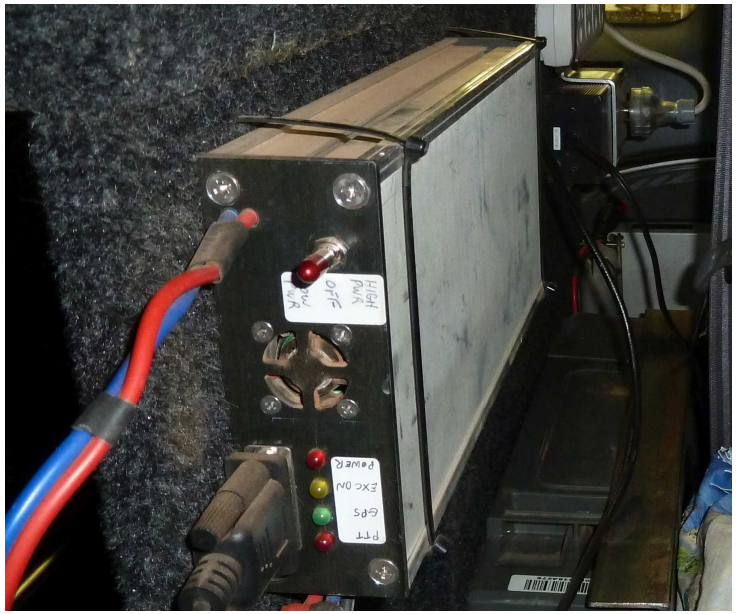
Both vehicles

Mobile radio equipment (QLD Vehicle)

- Codan 9323 for voice comms (100w PEP)
- Codan 9350 Auto-tuning Antenna

APRS radio equipment (QLD Vehicle)

- Home-made APRS FSK transmitter 100 W
- APRS antenna is a 1500mm long home-made helical antenna tuned to 10147.6 kHz, with a base loading coil.



Mobile radio equipment (NSW Vehicle)

- Codan 9323 for voice comms (100w PEP)
- Codan 9350 Auto-tuning Antenna

APRS radio equipment (NSW Vehicle)

- Codan 8525 for APRS (100w PEP), also capable of CW, modified for Morse
- Codan 3040 Auto-tuning Antenna

APRS GPS position encoder "Byonics TinyTrak3+"

- Transmits position, altitude, speed, heading, and timestamp

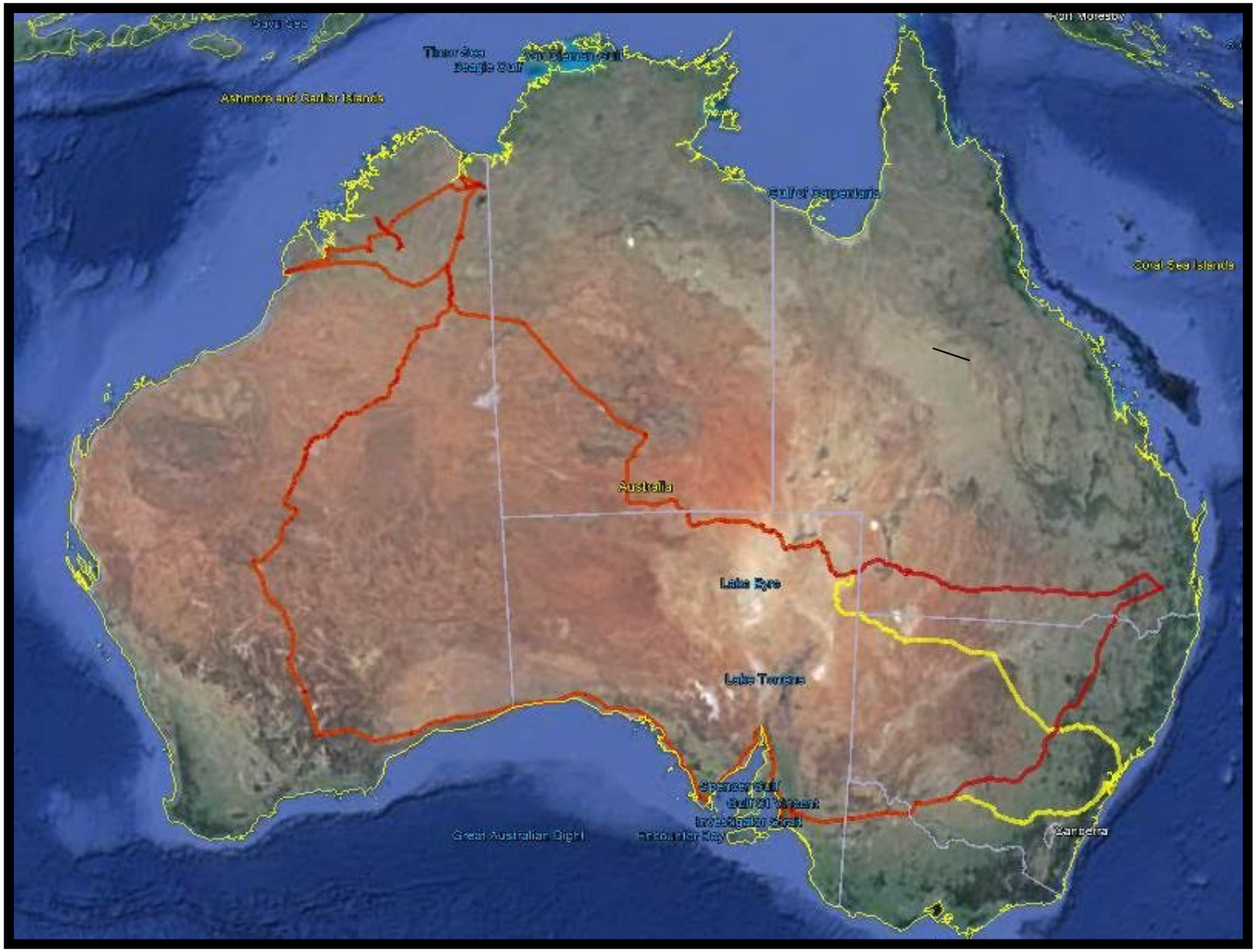
Fixed station equipment

- Codan 8528 (100w PEP)
- Kenwood TS440
- Yaesu FT-897D

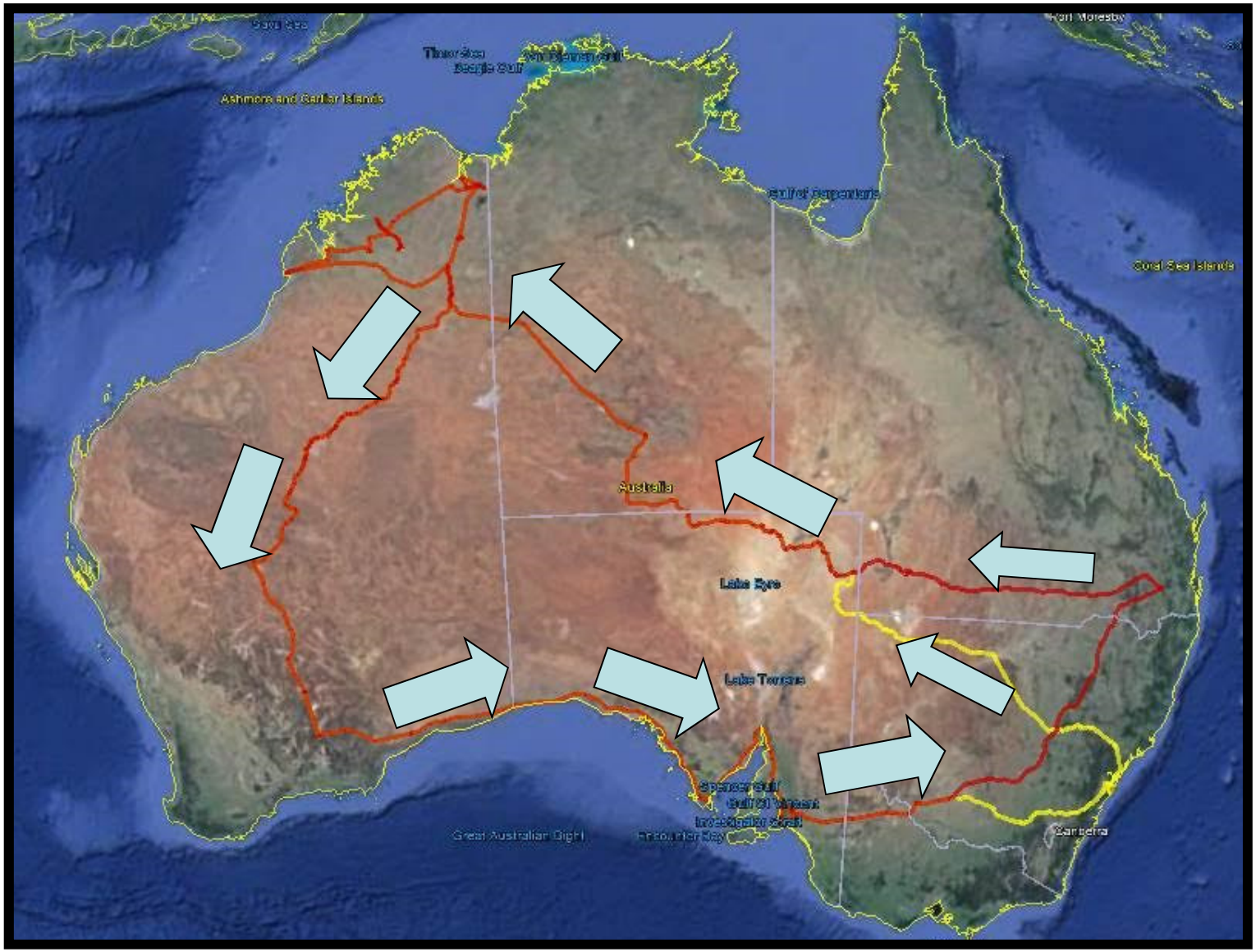
- Codan 9350 Auto-tuning Antenna
- Travelling wave dipole (Moonraker)
- Long Wire antenna

- Fixed stations located in Sydney & Crookwell

The Route


Ashmore and Cartier Islands
Gulf of Carpentaria
Coral Sea Islands
Australia
Lake Eyre
Lake Torrens
Great Australian Bight
Canberra

The Route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Codan Beacon Call

Using a "**beacon call**" establishes whether or not the chosen frequency is going to give you good communications.

The beacon call you send instructs the called station to transmit four beeps.

The quality of the received beeps indicates the quality of the selected frequency.

Automatic Packet Reporting System (**APRS**)

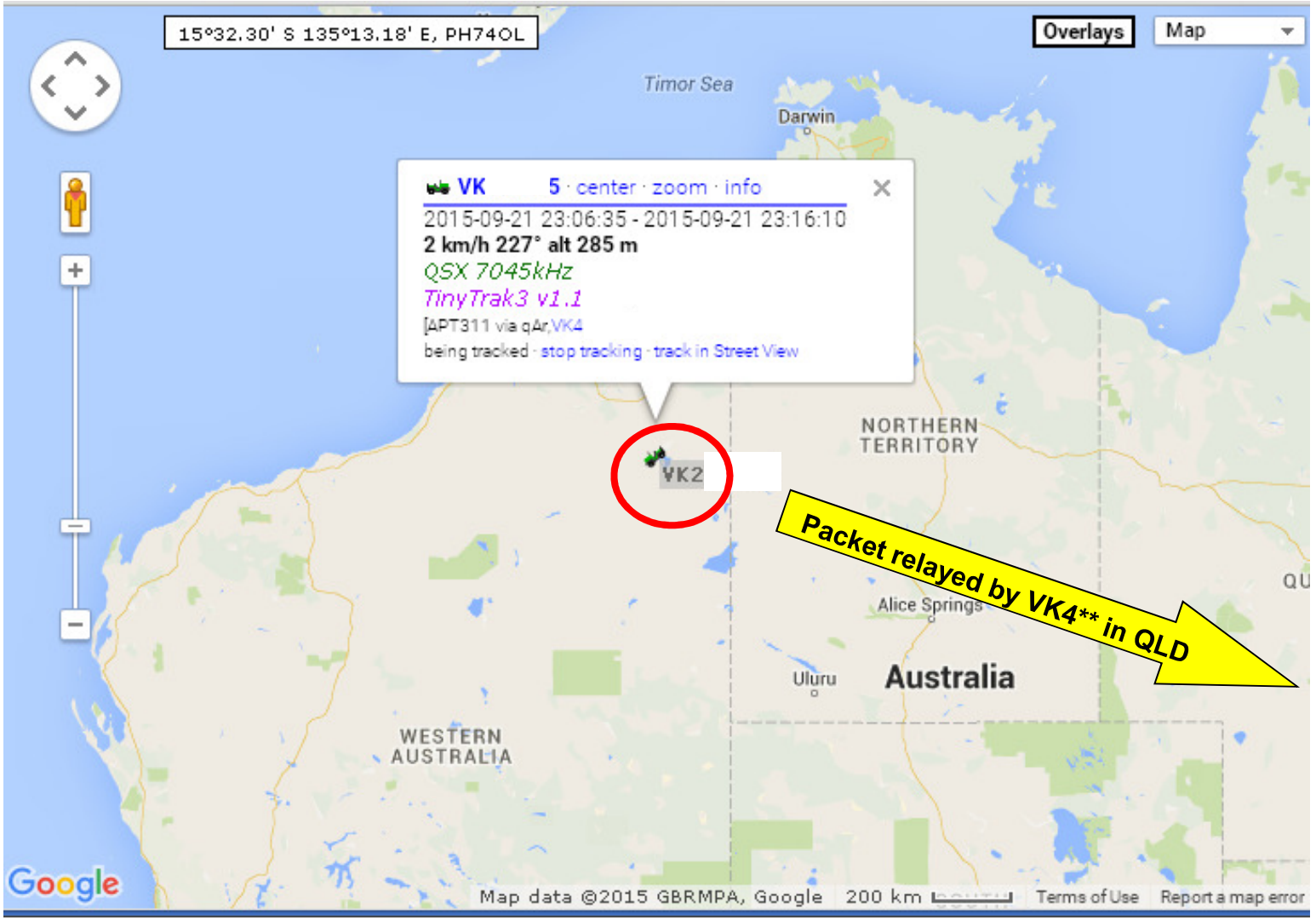
- An amateur-radio based system for real time tactical digital communication of information of immediate value in the local area.

- In addition, all such data are ingested into the APRS Internet System (APRS-IS) and distributed globally for immediate access.

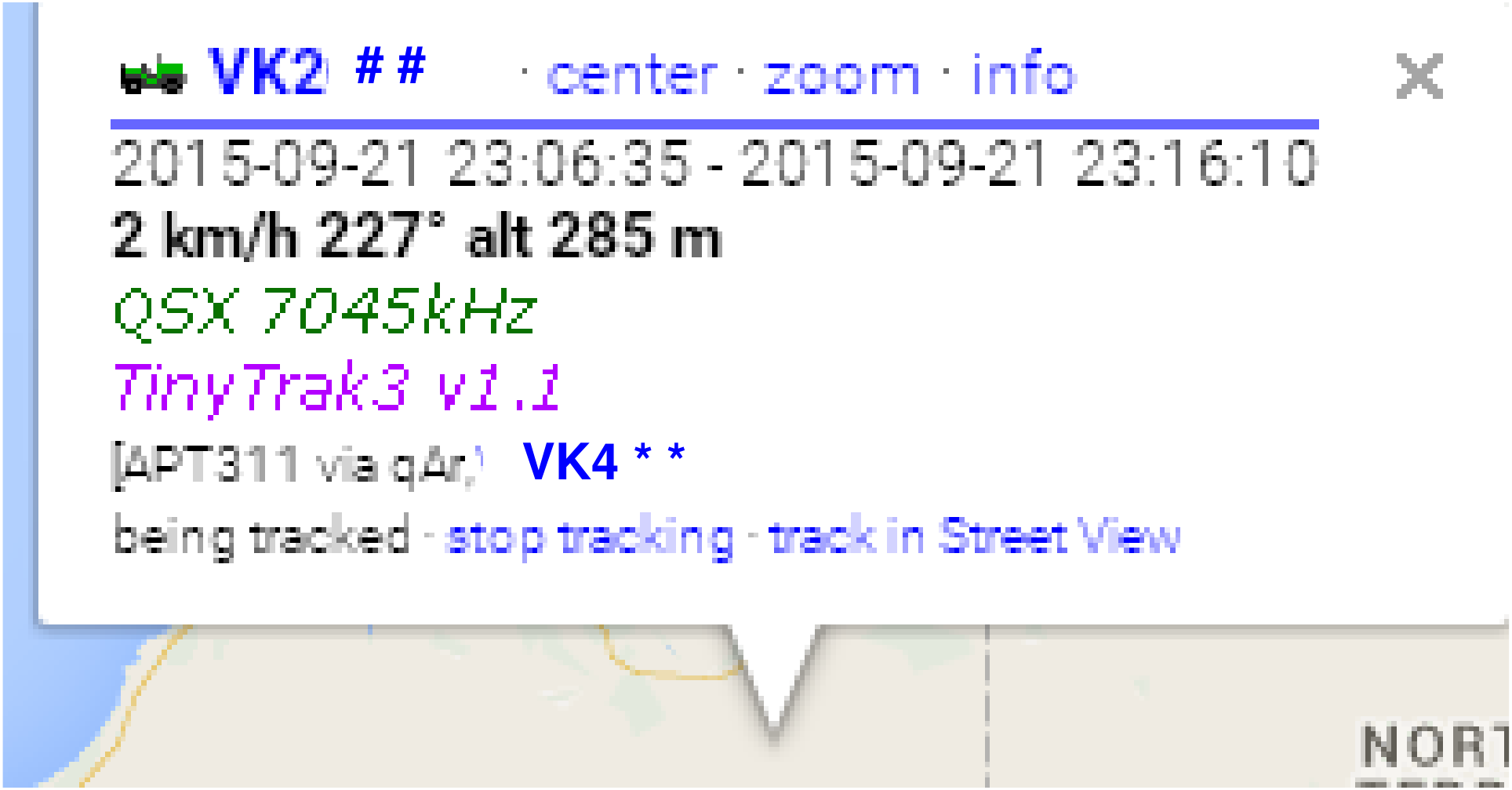
APRS

- Both vehicles had APRS and GPS equipment feeding a separate dedicated transmitter (10 MHz) and separate dedicated whip antenna
- APRS packets are automatically sent at regular intervals or when change of direction occurs
- These packets are received and sent to the internet by various amateur radio operators
- APRS data appears at an internet site almost instantly

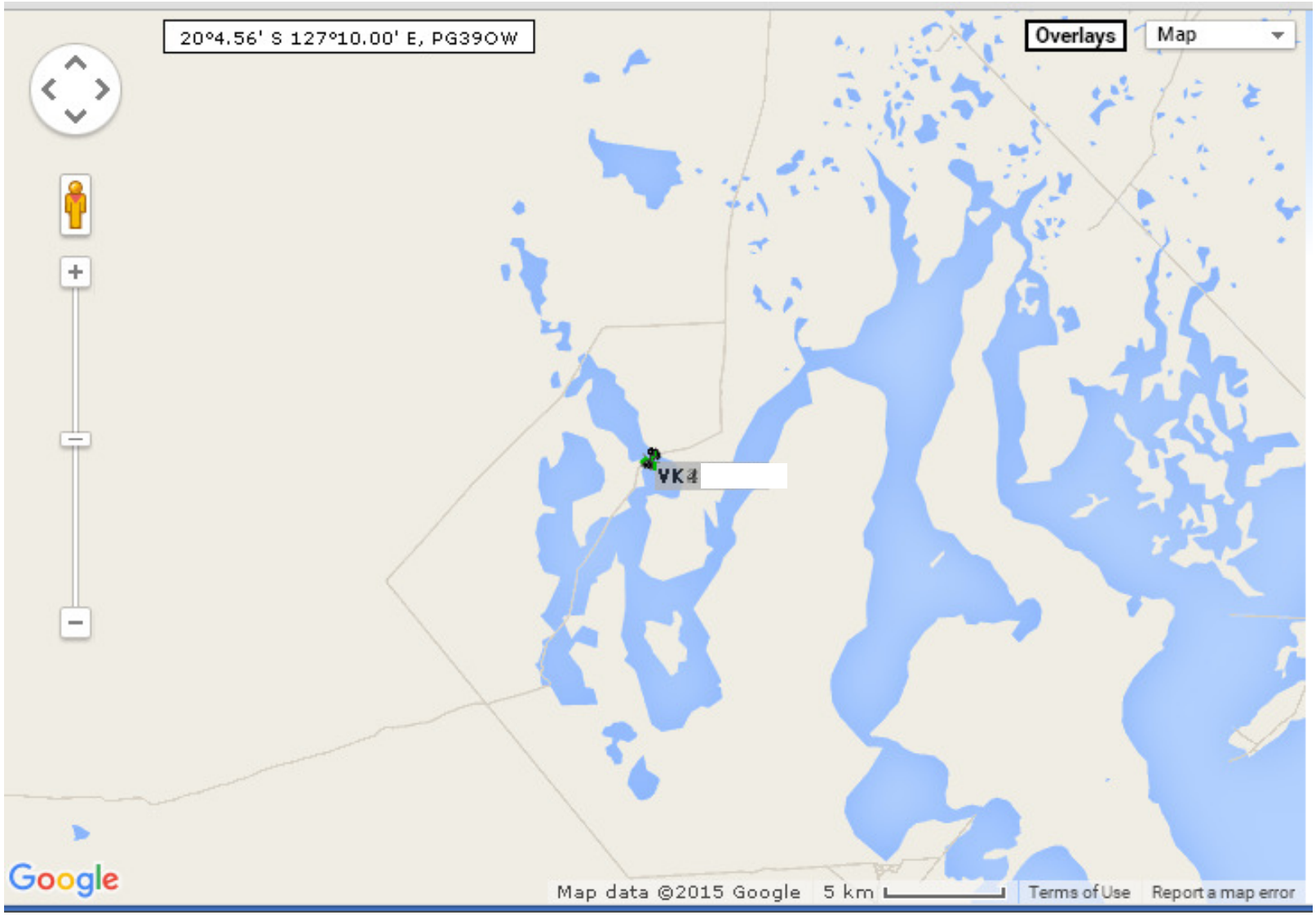
Typical APRS image



APRS data


VK2 # #
· center · zoom · info
2015-09-21 23:06:35 - 2015-09-21 23:16:10
2 km/h 227° alt 285 m
QSX 7045kHz
TinyTrak3 v1.1
[APT311 via qAr,] VK4 * *
being tracked - stop tracking - track in Street View
NORT

APRS image


20°4.56' S 127°10.00' E, PG39OW
Overlays
Map
VK4
Google
Map data ©2015 Google
5 km
Terms of Use
Report a map error

APRS image with terrain overlay

Ionospheric conditions

- **http://www.ips.gov.au/HF_Systems/1/2**
- **HF Conditions (at 21-09-2015)**
- Current foF2 Plots
- HF Communications Warning
- Ionospheric Summary and Forecast
- Maximum Usable Frequency (MUF) Report

Ionospheric Summary and Forecast

Date	T index
21 Sep	12

Observed Australian Regional MUFs

- Northern Australian Region:
- Depressed by 35% during local day.
- Depressed by 25% during local night.
- Depressed by 30% after local dawn.
- Southern Australian Region:
- Depressed by 40% during local day.
- Depressed by 45% during local night.

HF Communications Warning

SUBJ: IPS HF RADIO COMMUNICATIONS WARNING 15/57
ISSUED AT 2301UT/21 SEPTEMBER 2015
BY THE AUSTRALIAN SPACE FORECAST CENTRE.
Degraded HF conditions are continuing due to low levels of solar
ionising radiation and sustained mildly elevated geomagnetic activity. These conditions are expected to continue for the next few days.

DEGRADED HF PROPAGATION CONDITIONS EXPECTED FROM 22-24 SEPTEMBER 2015

Ionospheric Forecast

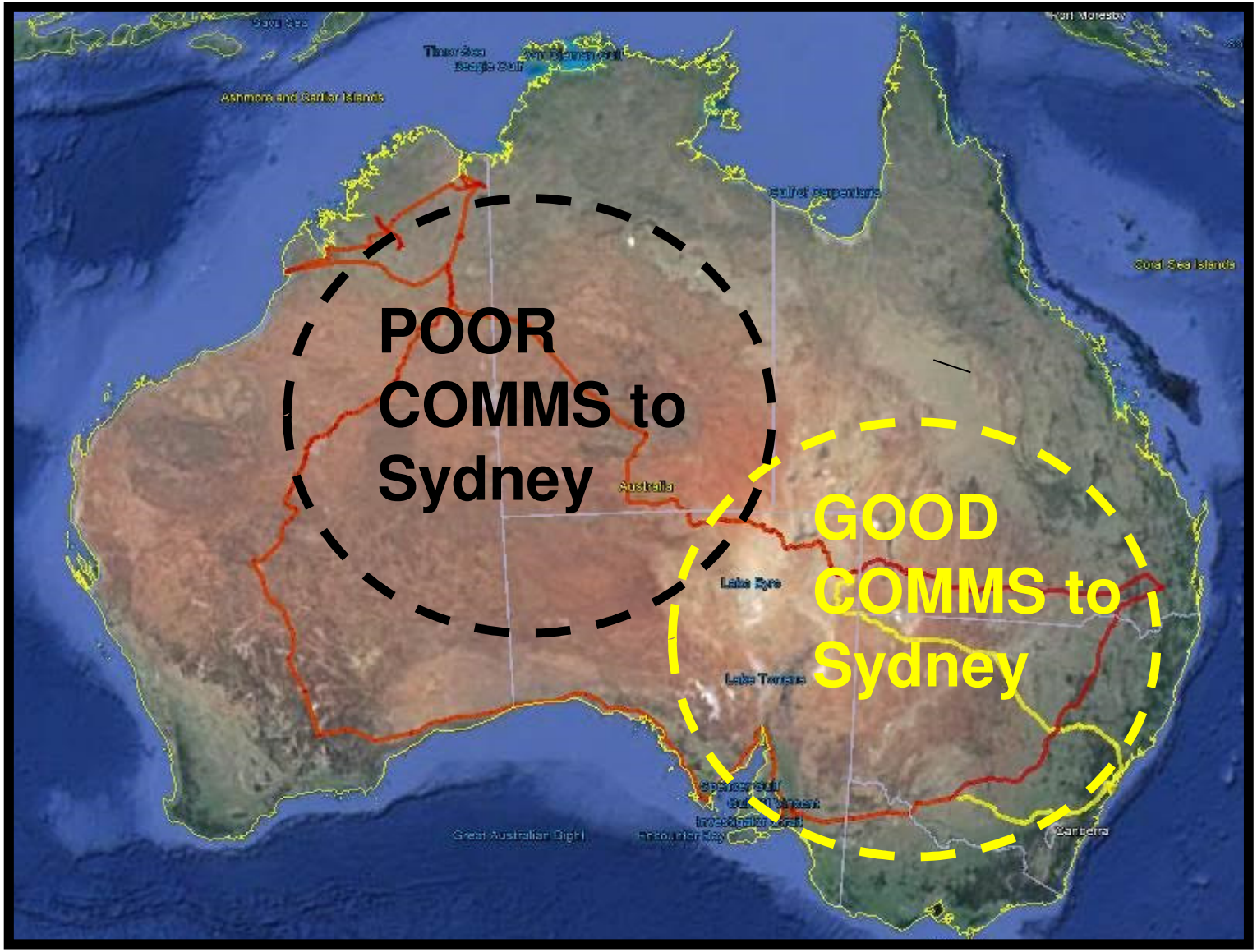
last updated 21 Sep 2015 23:31 UT

- **Date T index MUFs**
- 22 Sep 20 20 to 30% below predicted monthly values
- 23 Sep 20 20 to 30% below predicted monthly values
- 24 Sep 30 20 to 30% below predicted monthly values

• MUF Report

- Brisbane : depressed by -30%
- Canberra : depressed by -19%
- Cocos Is : depressed by -37%
- Darwin : no vertical MUF data.

Results


POOR
COMMS to
Sydney
GOOD
COMMS to
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Gulf of Carpentaria
Coral Sea Islands
Australia
Lake Eyre
Lake Torrens
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Canberra

CONCLUSION

- The remote stations could often copy the fixed stations, but not the other way around. We concluded this was because of high local noise levels in suburban Sydney.

- There are many variables to consider
  - *The behaviour of the IONOSPHERE*
  - *Antenna radiation pattern of FIXED stations*
  - *Man-made noise level at FIXED stations*
  - *Transmitter power and receiver performance*

- The use of BEACON CALL and interpretation of APRS packets enabled us to select optimum frequencies with some success