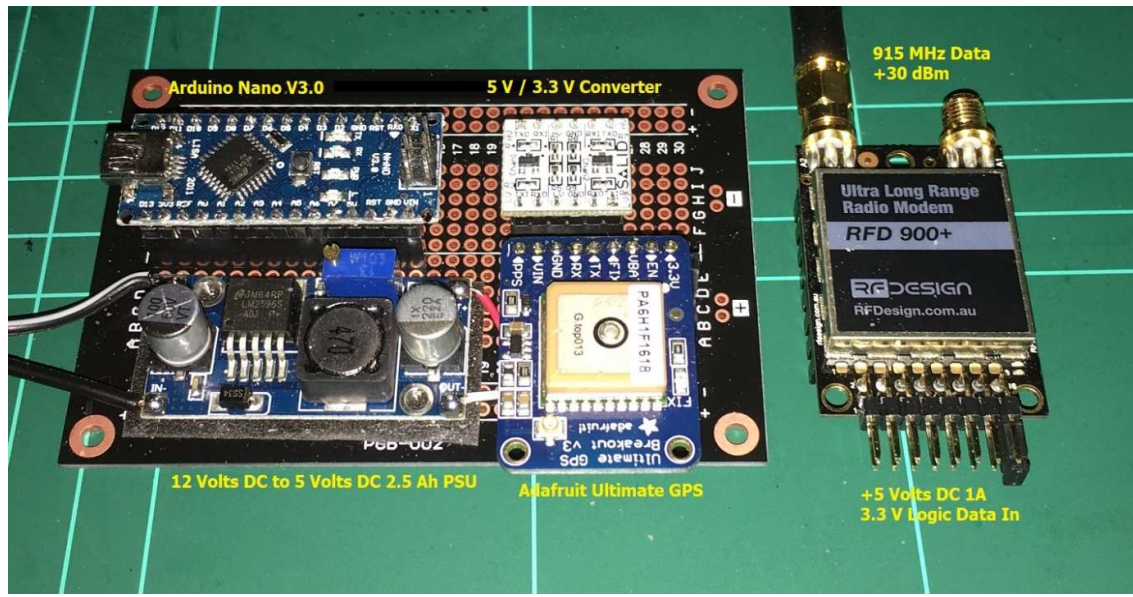


A 915 MHz GPS location based Transmission System designed by Andrew Rich June 2018



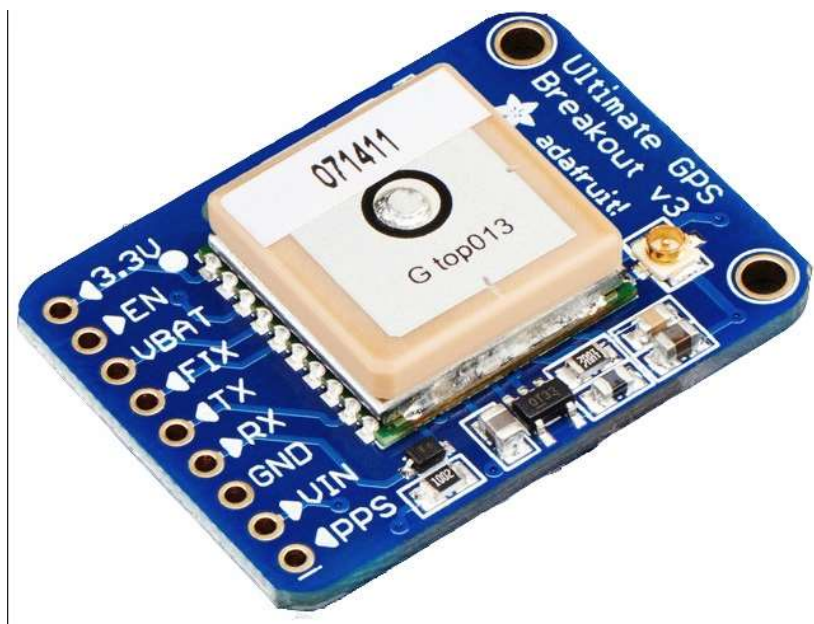
The purpose of this document is to outline the inner workings of a 915 MHz GPS based tracking system.

The system consists of the airborne unit (AU) and the Ground Unit (GU)

The intention is to feed either raw NMEA data from a GPS from an aircraft to the ground or

Parse the GPS data using an Arduino Nano controller before sending data to the GU.

The GPS chosen was an Adafruit Ultimate GPS.



As the GPS is going into a box, an external antenna solution is needed



The GPS runs on 3 – 5 Volts and can update at 10 Hz if required.

The output from the GPS is NMEA data at 9600 baud 3.3 Volt Logic

The RF Modem selected was the RF Design RFD900+ 1W 915 MHz Freq Hopping Spread Spectrum

RFD900+ Modem



RFD900+ Radio Modem 1W (30 km range)

The RFD900+ takes in 3.3 v logic and runs from 5 volts at a maximum of 1 AH.

The RFD900+ employs spread spectrum modulation up to a power of +30 dBm

The GPS, Arduino Nano and RFD900+ can all be configured / programmed.

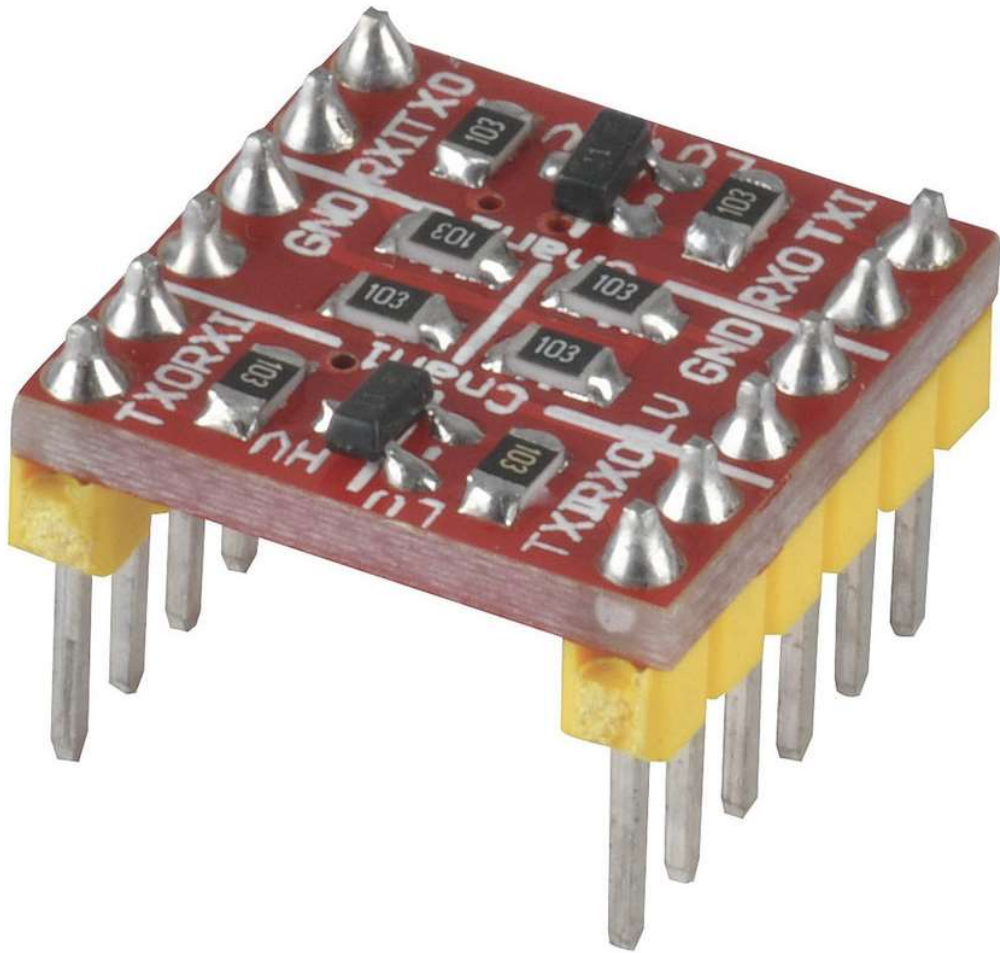
A 12 volts to 5 volt PSU module was used to supply 5 volts up to 2.5 Ah.



The Arduino runs from the input voltage (12 Volts) VIN

The Ultimate GPS runs from the 5 volts from the PSU and consumes 20 mAH

Because the RFD900+ modem wants 3.3 volts logic, a 5volt 3.3 v logic converter is used.



The PSU can handle 4.5 – 35 v in and outputs 4 – 34 V DC out. (Adj to 5 volts)

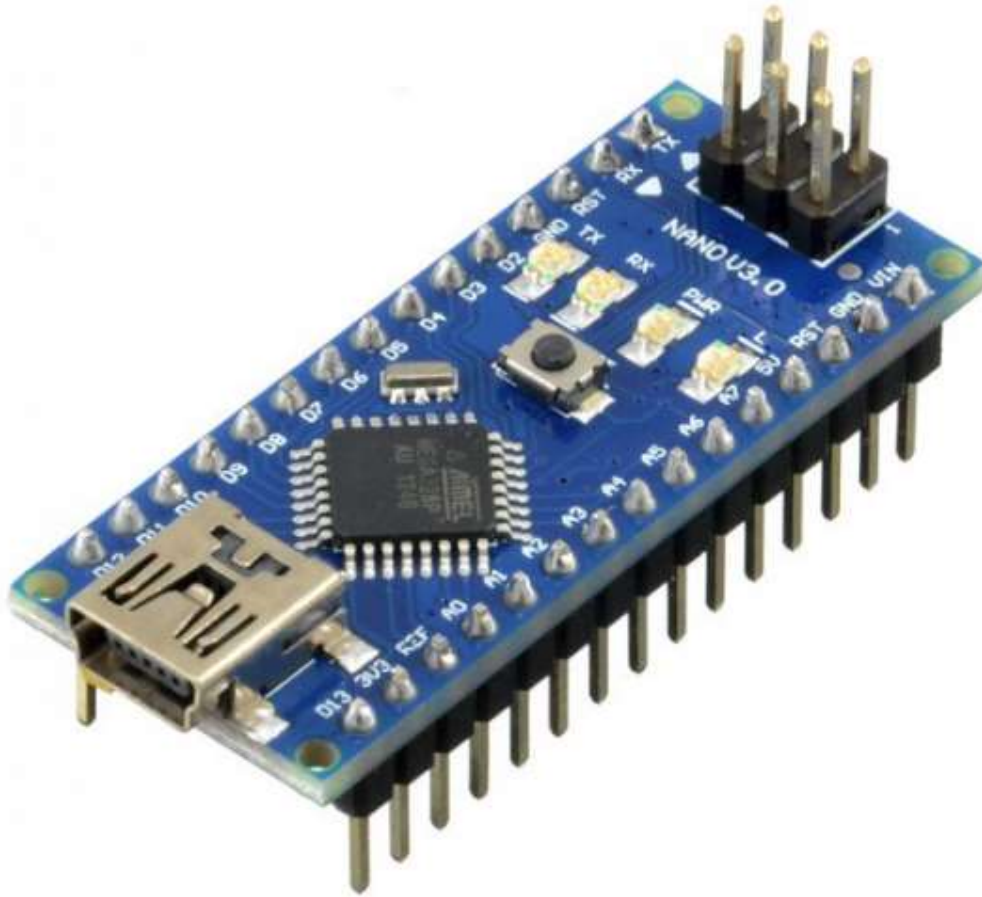
The RFD900+ modems are configured to run at 9600 baud using the RFD tools.

A supplied FTDI USB to pin header cable is used to program the radios.

The radios can handle from 902 – 928 MHz

Either raw 3.3 volt NMEA data can be fed to the radio modem or parsed packets from the Arduino.

An Arduino Nano is used



Without the Arduino there is no way to preformat or add identifying information to the payload.

The Arduino can pass commands to the GPS to turn on and off NMEA sentences and rates. Etc

The claimed range of the system is 30 km (un tested)

The Arduino is programmed using the standard Arduino IDE.

Using existing GPS libraries, certain NMEA values can be extracted and used to for a custom payload.

An example might be "VH-ABC,-27.2343,S,153.1234,E,<heading>,<speed> etc"

The ground system would then place the data into a MySQL table and a simple perl code called to form kml to be displayed live on google earth.

At the GU Ground Unit, the RFD900+ must have the same settings and use the FTDI cable to receive data. A perl script would be used to insert the data into a MySQL table.

The FTDI cable often shows up at /dev/ttyUSBx

A crontab job could be called to destroy older targets.

/etc/crontab

A hand drawn connection diagram of the AU Airborne unit follows.

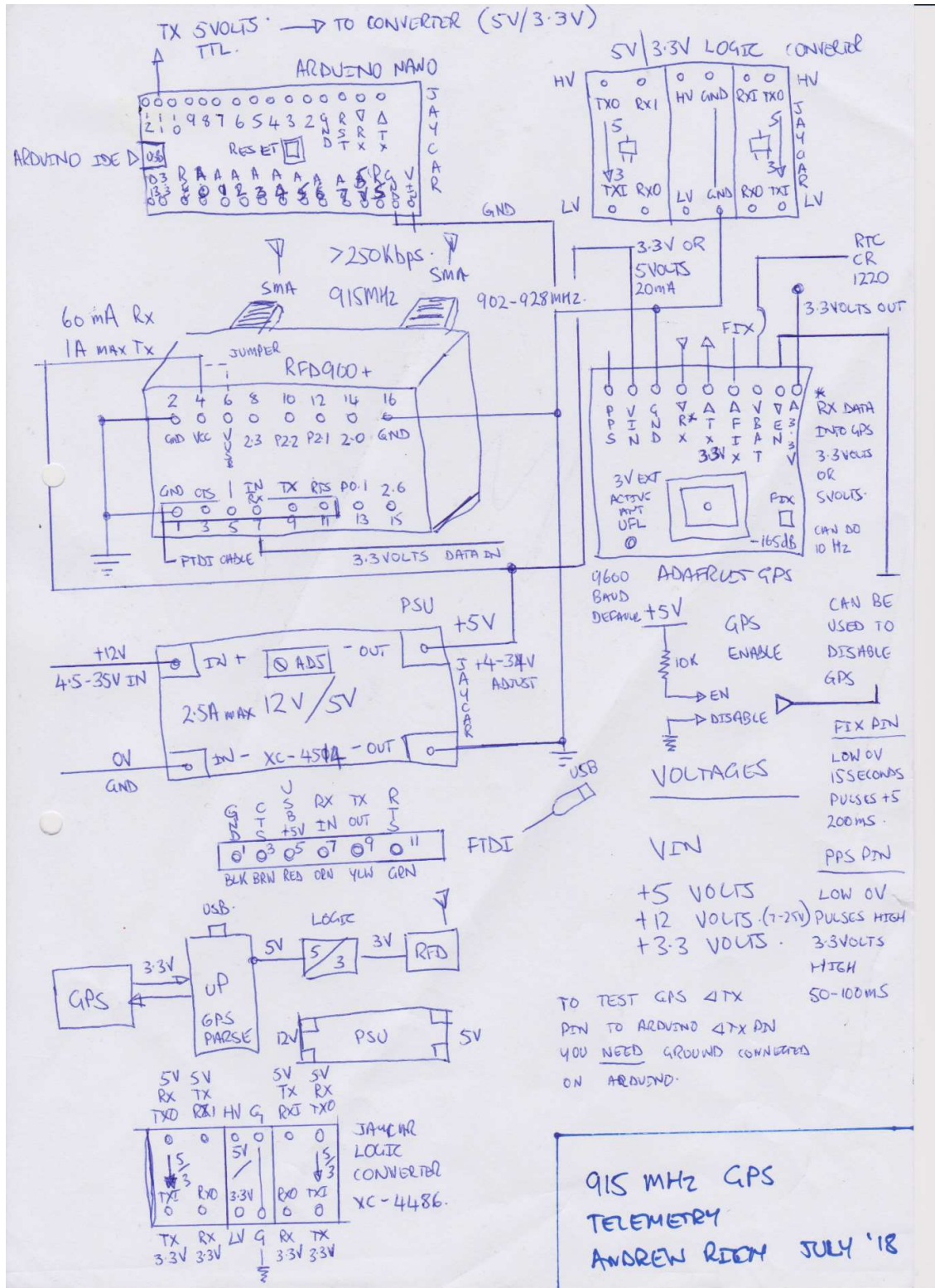


Figure 1 – The interconnections and components of the AU (Airborne Unit)

Further work has now to be done to lock down a packet format to be sent over air.

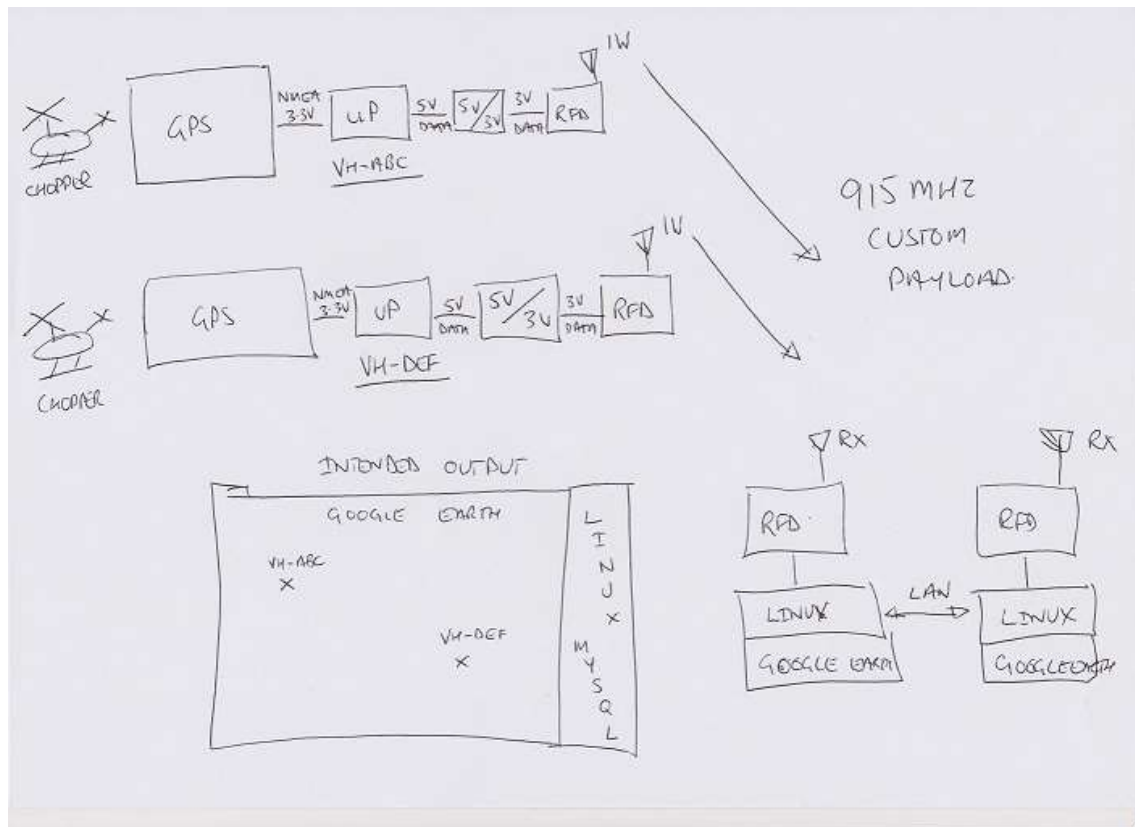
Each AU (Airborne Unit) would need to be programmed with a specific ID to be displayed on google earth. It is suggested this might line up with the aircraft registration mark.

In google earth a "network link" is created to resample the MySQL data (location and ID) and displayed on the map

Only one AU (Airborne unit) could carry a unique ID, whilst many GU (Ground Units) could receive targets in range of the receiver at once.

The system could be networked to display targets out of range of receiving stations

A systematic display of the entire system is shown below.



LED Indicators

It is suggested that the TX have



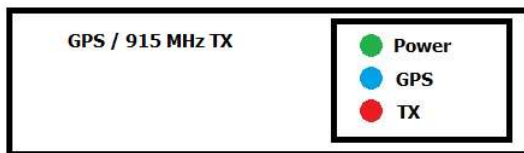
Power – LED 3mm Green

Transmit – LED 3mm Red

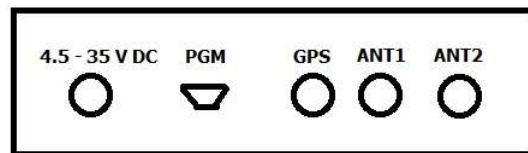
GPS – LED 3mm Blue (flash / lock / data)

Panels

The front and rear panels might look like this



Front Panel



Rear Panel

Andrew Rich

vk4tec@tech-software.net

0419 738 223