GippsTech 2017

ARDF Telemetry

By

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SARC Search and Rescue Missions

SAR Operation

ARDF used in SAR Missions

Need to coordinate:

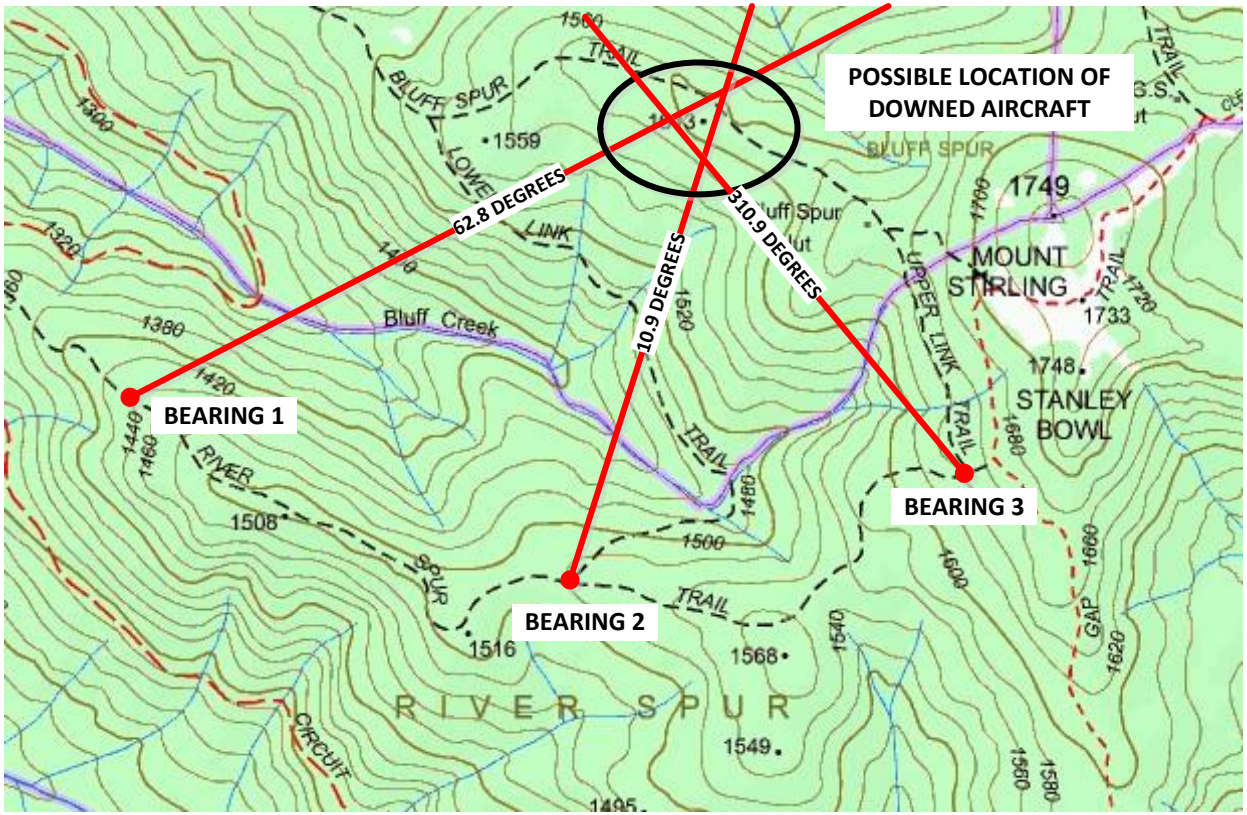
- Multiple ARDF beacons (i.e. “Downed Aircraft”)
  - Bionics Micro Fox
- Multiple ARDF Trackers
  - VK3YNG Sniffers + 3el Tape Yagi
- Multiple SAR teams with HF/VHF/UHF radios
- Base Camp SAR Command Centre
- Laminated Maps, Compasses, Rulers, Pens etc.

It is a bit like herding cats!

Could ARDF Telemetry help???

How would ARDF Telemetry work?

- Send ARDF fixes to base camp
- Plot bearing lines on a map



Information Required

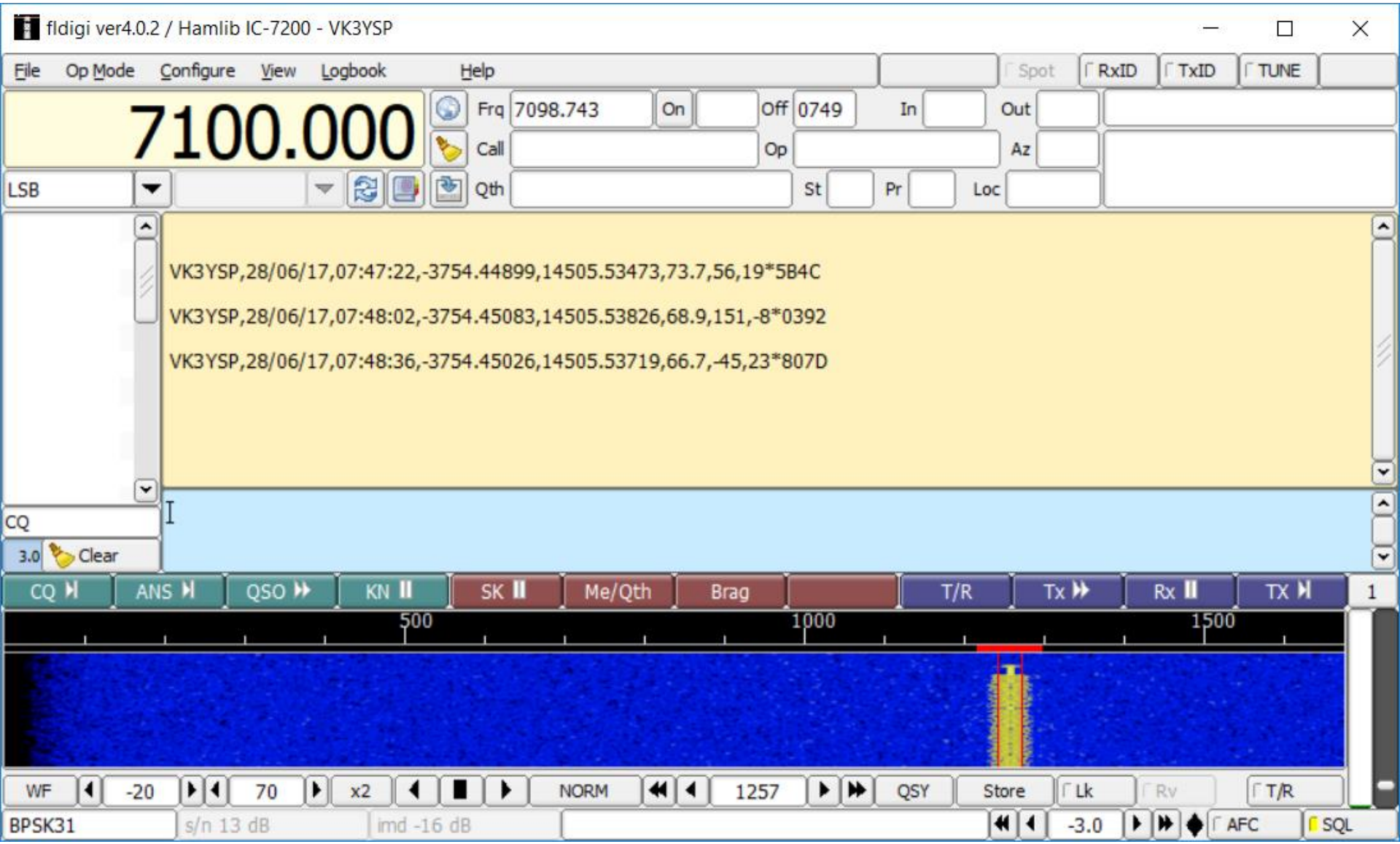
- Amateur radio call sign
- Date and Time of GPS fix
- Latitude, Longitude and Altitude of SAR Team
- Azimuth (Bearing) and Elevation to target
- CCITT CRC-16 Checksum
- Examples:

VK3YSP,28/06/17,07:47:22,-3754.44899,14505.53473,73.7,56,19*5B4C
VK3YSP,28/06/17,07:48:02,-3754.45083,14505.53826,68.9,151,-8*0392
VK3YSP,28/06/17,07:48:36,-3754.45026,14505.53719,66.7,-45,23*807D

Possible Telemetry Solutions

- Need Azimuth and Elevation of Tracker Yagi
  - Use our “Mini Satellite-Antenna Rotator” sensor
- Could use APRS Telemetry:
  - Use two commercial TNCs that support serial data
  - Expensive, requires a transceiver, low update rate
- Could use BPSK Telemetry:
  - Use our “HAB Payload” BPSK31 encoder
  - Use a Raspberry Pi 3 with FLDIGI decoder

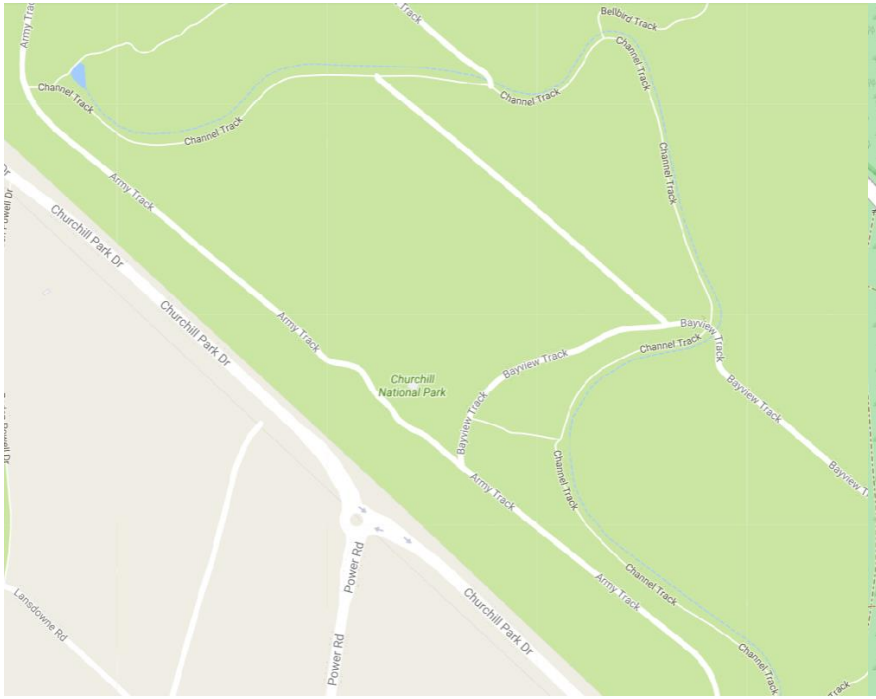
Using FLDIGI to Decode BPSK31



Possible Mapping Solutions

- Plot bearing lines using:
  - Google Maps + Google Maps API
    - Not open source
    - Registration Required
    - Commercial product
  - OpenStreetMap + OpenLayers
    - Open source
    - Better map detail in some cases

Google Maps vs OSM



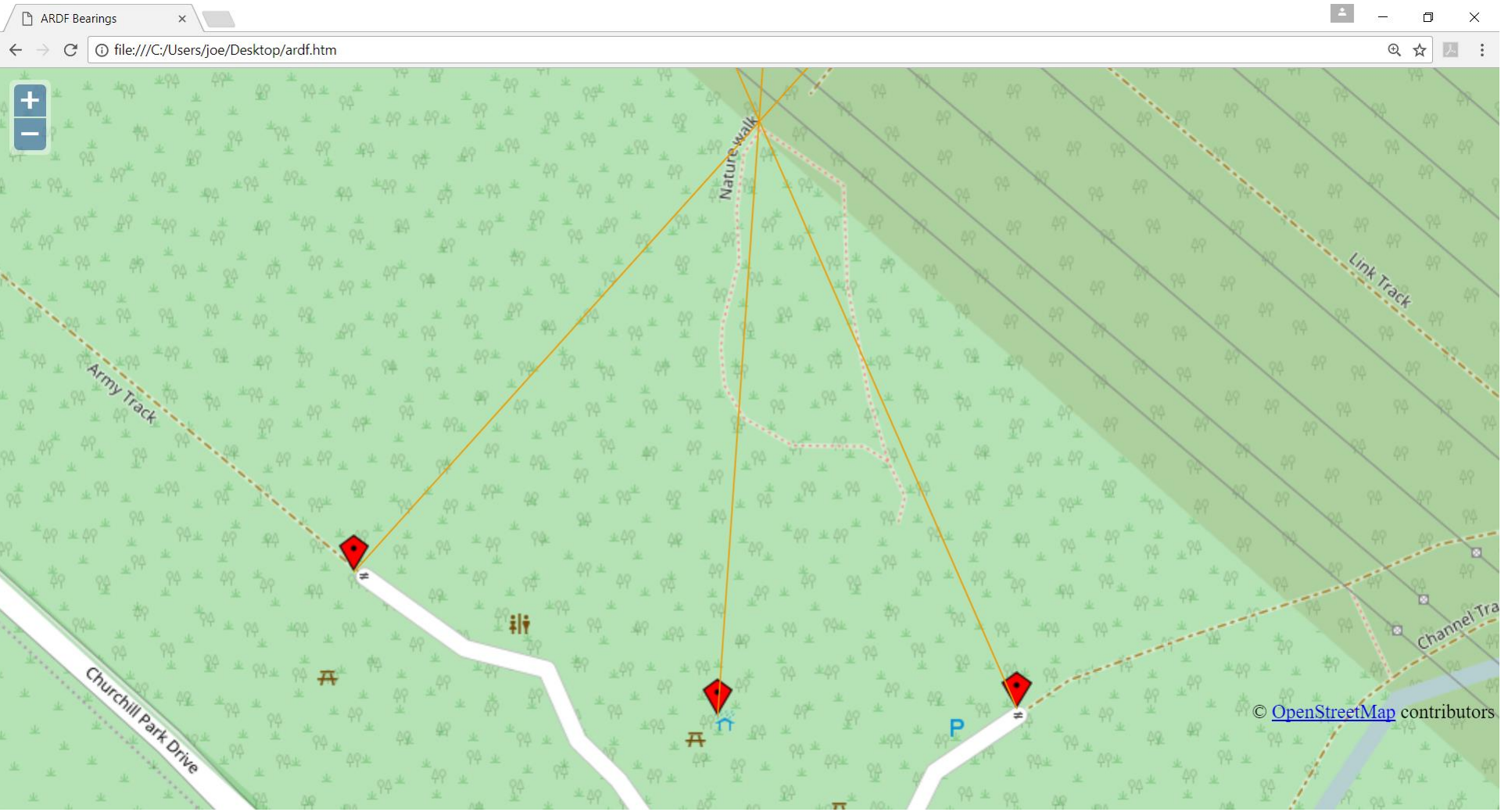
Google Maps

OpenStreetMap

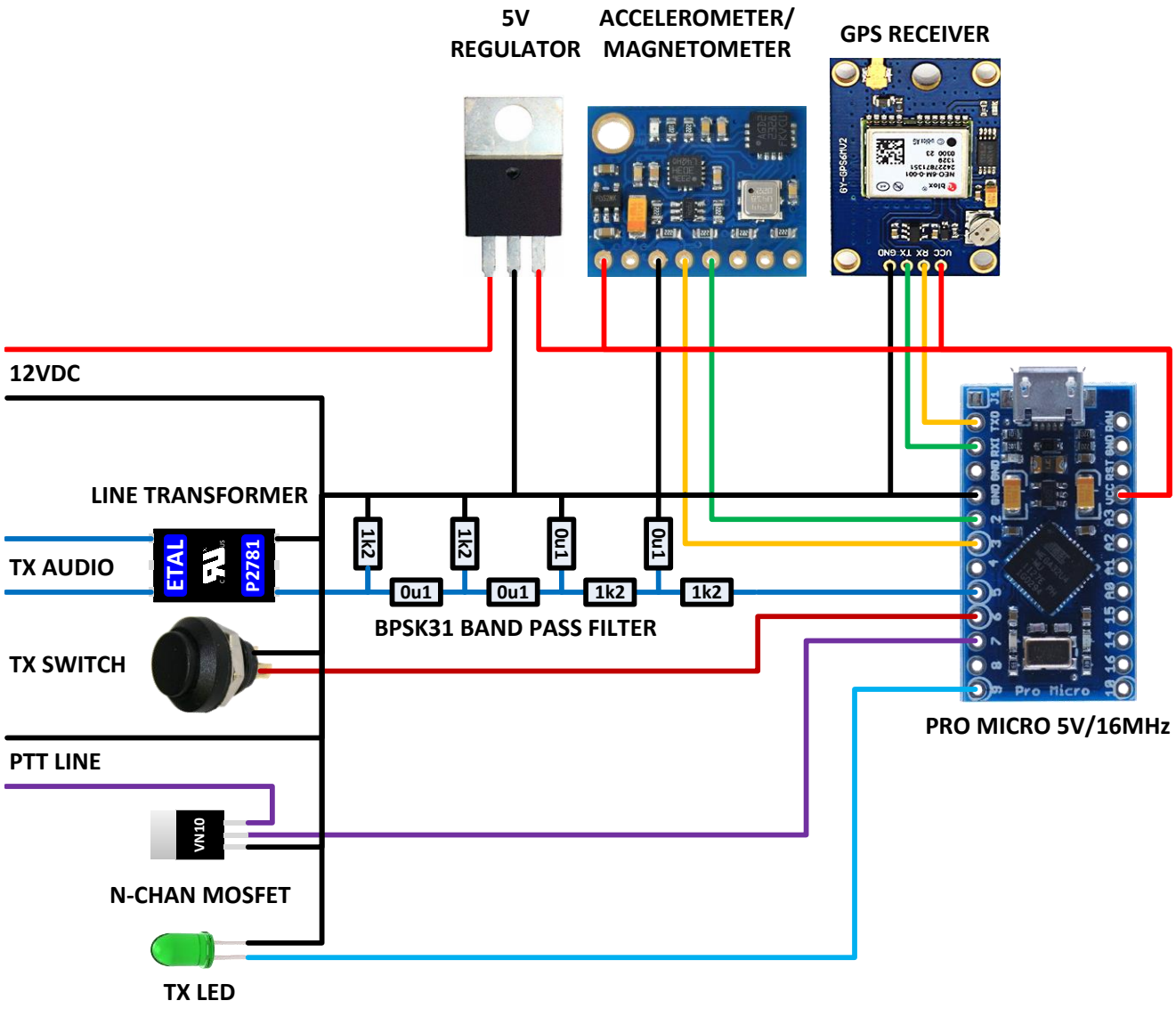
OpenLayers Java Script

```
<!DOCTYPE html>
<html>
  <head>
      <title>ARDF Bearings</title>
    <meta charset="utf-8" />
  </head>
  <body>
    <div id="map" style="top: 0; left: 0; bottom: 0; right: 0; position: fixed;"></div>
    <script src="http://www.openlayers.org/api/OpenLayers.js"></script>
    <script type="text/javascript">
        // Initialize map, projection, zoom and centre point
      var mapnik       = new OpenLayers.Layer.OSM(); // OpenStreetMap
      var fromProjection = new OpenLayers.Projection("EPSG:4326");   // Transform from WGS84 Projection
      var toProjection   = new OpenLayers.Projection("EPSG:900913"); // To Spherical Mercator Projection
      var zoom         = 16;
      var centre = new OpenLayers.LonLat(145.2514789795087, -37.94967535743975).transform( fromProjection, toProjection);
      var map = new OpenLayers.Map("map");
      map.addLayer(mapnik);
        // Add markers at the start of each line
      var markers = new OpenLayers.Layer.Markers( "Markers" );
      map.addLayer(markers);
      markers.addMarker(new OpenLayers.Marker(new OpenLayers.LonLat(145.25001449338987, -37.95097399227748).transform( fromProjection, toProjection)));
      markers.addMarker(new OpenLayers.Marker(new OpenLayers.LonLat(145.25134486906768, -37.951388535373304).transform( fromProjection, toProjection)));
      markers.addMarker(new OpenLayers.Marker(new OpenLayers.LonLat(145.2524391432882, -37.951367332396515).transform( fromProjection, toProjection)));
        // Add Vector
      var vector = new OpenLayers.Layer.Vector();
        // Add first bearing line
      var start_point1 = new OpenLayers.Geometry.Point(145.25001449338987, -37.95097399227748).transform( fromProjection, toProjection);
      var end_point1 = new OpenLayers.Geometry.Point(145.2530024742338, -37.948355548677064).transform( fromProjection, toProjection);
      var line1 = new OpenLayers.Feature.Vector(new OpenLayers.Geometry.LineString([start_point1, end_point1]));
      vector.addFeatures([line1]);
        // Add second bearing line
      start_point2 = new OpenLayers.Geometry.Point(145.25134486906768, -37.951388535373304).transform( fromProjection, toProjection);
      end_point2 = new OpenLayers.Geometry.Point(145.25165064088503, -37.94791560715396).transform( fromProjection, toProjection);
      var line2 = new OpenLayers.Feature.Vector(new OpenLayers.Geometry.LineString([start_point2, end_point2]));
      vector.addFeatures([line2]);
        // Add third bearing line
      var start_point3 = new OpenLayers.Geometry.Point(145.2524391432882, -37.951367332396515).transform( fromProjection, toProjection);
      var end_point3 = new OpenLayers.Geometry.Point(145.25064213029793, -37.94813557824445).transform( fromProjection, toProjection);
      var line3 = new OpenLayers.Feature.Vector(new OpenLayers.Geometry.LineString([start_point3, end_point3]));
      vector.addFeatures([line3]);
        // Draw map and layers
      map.addLayers([vector]);
      map.setCenter(new OpenLayers.LonLat(145.2514789795087, -37.94967535743975).transform( fromProjection, toProjection), zoom);
    </script>
  </body>
</html>
```

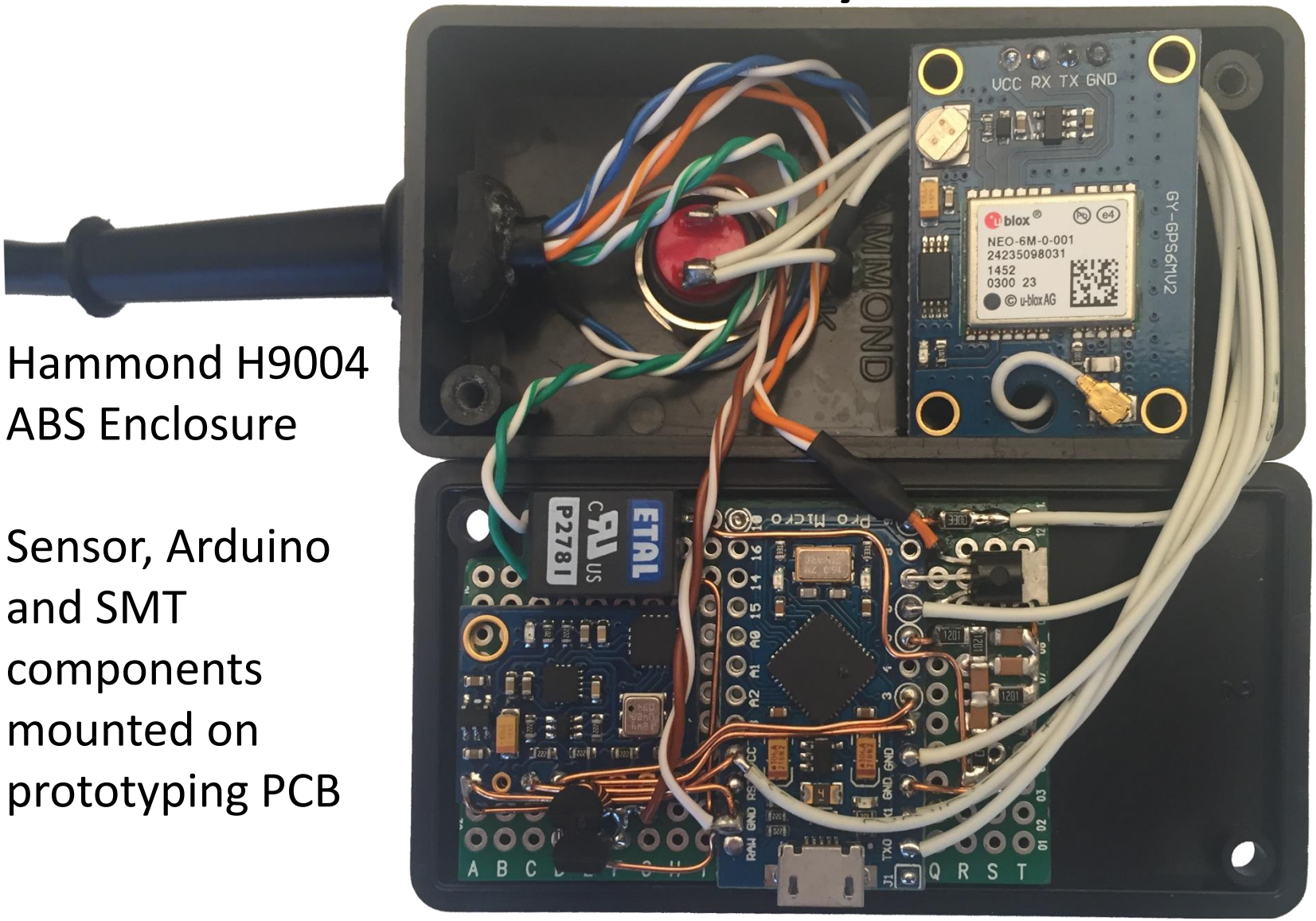
Mapping With OpenStreetMap



Pictorial Schematic Diagram



ARDF Telemetry Unit



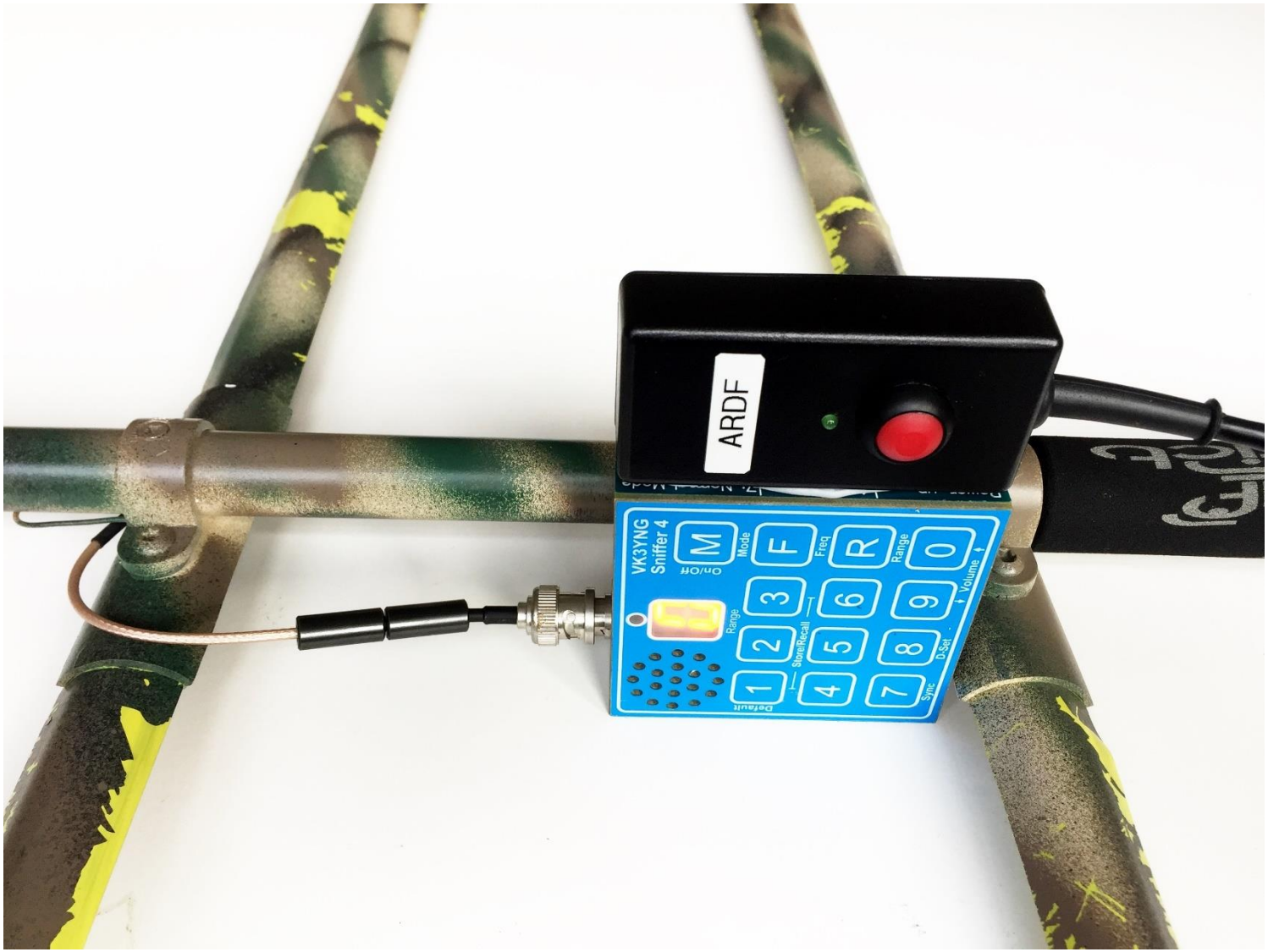
Hammond H9004 ABS Enclosure

Sensor, Arduino and SMT components mounted on prototyping PCB

ARDF Telemetry Unit Operation

- LED on for 5 seconds at power up
- LED displays the GPS 1-PPS signal when 3D-Fix is valid
- Press the button to transmit ARDF telemetry
- LED remains on while transmission is in progress

ARDF Telemetry Unit, Yagi and Sniffer



Links

- http://www.sarcnet.org/projects.html
- https://www.openstreetmap.org/about
- https://openlayers.org/
- http://www.foxhunt.com.au/
- https://sourceforge.net/projects/fldigi/