Digital Amateur Radio – Bridging the Gap

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Prologue…

In the last month's article we described the current status of emergency communications in the United Kingdom, with the emergency services sharing Airwave, a secure and resilient digital network. We also established that UK Cabinet Office recognises that amateur radio has a role to play in providing backup communications for organisations within the voluntary sector that fall outside of the Airwave scheme. This is especially important to those who rely heavily on mobile telephones and the internet – modes of communication that are susceptible to interruptions from flooding or power outages, and in extreme circumstances terrorist and cyber attacks.

It therefore shouldn't come as a surprise that our own Raynet Group has close connections with Yorkshire 4x4 Response, and our first question should be what type of backup communications do they require, and secondly what is the best means of providing it?

More than just Voice Communications…

> *"In this day and age, it isn't just voice communications that our User Services are requesting, but the ability to exchange all sorts of data – whether it is files, images or something we have not yet even thought of." – Cathy Clark, Chairman of Radio Amateurs Emergency Network* [1]

As the individual members of Yorkshire 4x4 Response are distributed over a county-wide area, they routinely make use of collaborative tools in their day-to-day operations. They use a web-based forum to provide the "social fabric", to disseminate information and to coordinate their activities in the "back office"; whilst Skype Messenger and SMS are used to coordinate their activities in the field. With such established protocols, it is difficult to see how amateur radio might be used, and simply offering handhelds as a backup solution isn't going to work as there is a requirement to send potentially sensitive information – something which cannot be done over publicly available channels and a more sophisticated solution is called for.

As the title of this article suggests, data communications may be able to provide an answer. However, before we delve into the technical details, let us look at what advice the current Raynet Data Procedure has to offer.[2] Reading through the document, it appears to be based upon the historical precedents that were employed by the Civil Defence, and appears to have been written with the anticipation that a member of the User Services would come knocking on the door of an amateur radio operator and ask them to send a telegram. It focuses upon data modes being used as a "wrapper", quoting historical message formats, and as such completely fails to unlock the potential that data modes have in providing tactical data, and worse still completely overlooks the issue of transferring computer files or providing high-speed network connectivity – clearly, a more up to date view is required.

An alternative view of what is required can be found in a recent paper presented to the 2012 American Radio Relay League (ARRL) and Tucson Amateur Packet Radio (TAPR) Digital Communications Conference, by Aleksandra Rohde (a former US Army Colonel and Lawyer responsible for leading the team that set up the "911 Emergency Network" in Iraq).[3]

She defines three key capabilities that were defined by the United States Department Homeland Security as being required to coordinate an effective response to an emergency:

- **Situational Awareness** – as the need to have the right information available at the right time in order to make the right decisions. This is particularly important during the early stages of a developing situation, when the least amount of information is available.[4]
- **Common Operating Picture** – as the tools with which to share this information with the various people involved with the operations, allowing them to coordinate their responses and share their resources effectively.
- **Enhancing Community Resilience** – as having the people embedded within the community who are able to deploy the tools effectively and autonomously in an emergency, and can integrate seamlessly and effectively into the operations.[5]

Although these requirements come from the United States, where the involvement of amateur radio in emergency planning is almost implicit, they are eminently applicable to the objectives of our own Raynet Group.

Automatic Reporting

The Automatic Packet Reporting System (APRS) is a system that was developed by Bob Bruninga, WB4APR, as a means of providing both the required **Situational Awareness** and **Common Operating Picture** using packet radio.

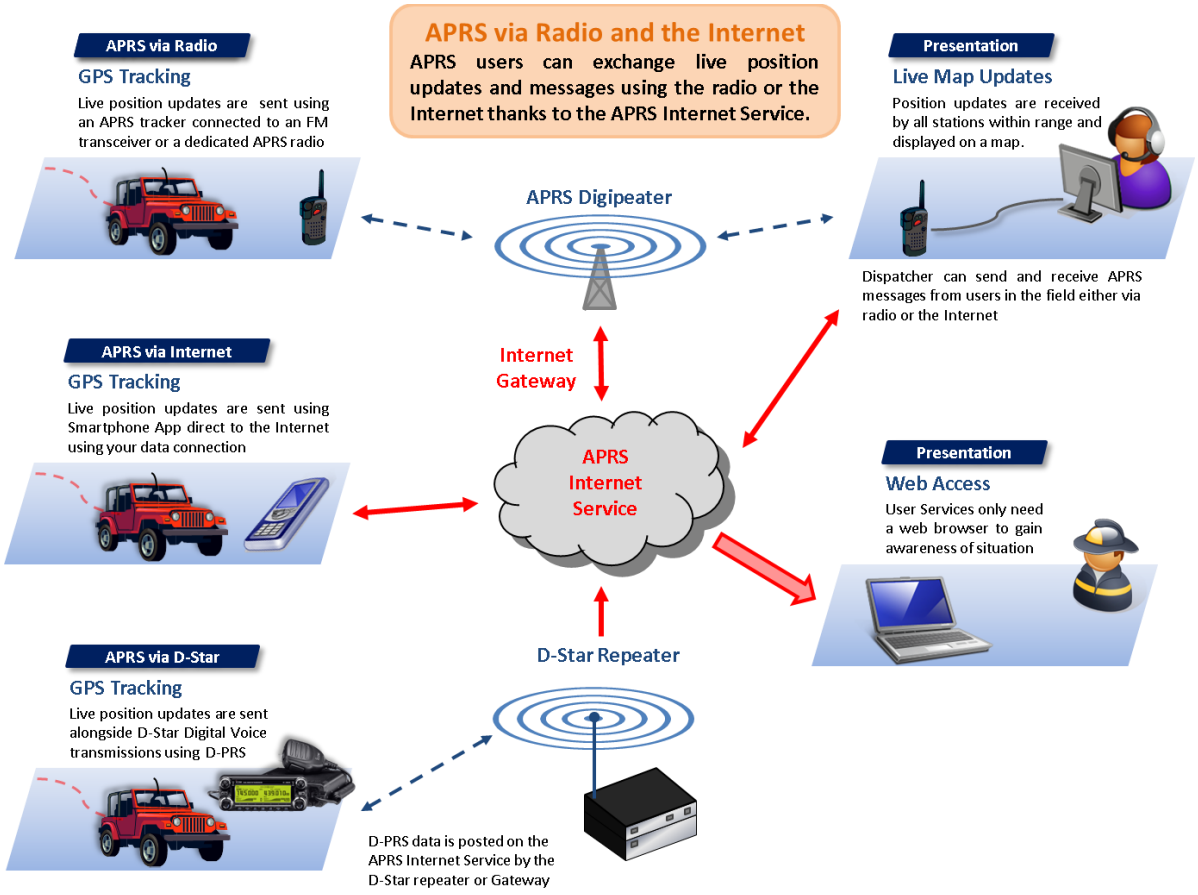
It is system for sharing tactical data (such as the real-time position of vehicles) and exchanging messages and bulletins, between multiple users spread over a wide area, using a combination of amateur radio and the Internet. Data is transmitted in short bursts, known as packets, which are sent without any form of acknowledgement to every other APRS station within range. These packets are automatically decoded by all the recipients within range, and are displayed as icons overlaid on a map on their computer screens – the picture building up as each of the transmissions are received from the various participants.

The strength of APRS in an emergency communications role is that it can operate without any fixed infrastructure, as it uses each of these recipients to build the network by using them to ***digi***tally re***peating*** (or digipeating) any message they receive, and ultimately to gate packets to the worldwide APRS Internet Service – this idea is a stark contrast to the modus operandi of formal networks, where individual messages to each of the recipients in turn and then waiting for a reply.

Whilst the first two requirements are eminently linked to a technical solution, the last requirement of **Enhancing Community Resilience** is the key to its success: Firstly, by providing trained operators who can use and support the network, this is achieved through the RCF Foundation Licence; and secondly, by raising the awareness of the unique services that amateur radio operators can provide (achieved through training exercises and community liaison). Although APRS has been around for nearly two decades, the ability to provide this type of data has only recently been added to Airwave handsets…

Whilst there are dedicated APRS radios and handhelds that have APRS functionality built in, these come at a premium cost. Probably the best place to start is to download an APRS "App" for your iOS or Android Smartphone; these use the phone's on-board GPS to track your position, and periodically upload it to the APRS Internet Service using your data connection. I am currently investigating methods of connecting a budget Android phone running ***APRSDroid*** [6] to a budget Baofeng handheld that has VOX, using nothing more than the phone's headphone socket and an audio cable…

Similarly, if you have a D-Star radio with a GPS (such as the IC-2820 mobile, the IC-E92D or ID-31E / 51E handhelds), then you can configure it to send APRS data alongside your Digital Voice transmissions. This data is automatically converted into APRS format and uploaded to the APRS Internet Service by the Repeater or Gateway – however, this conversion only works one-way!



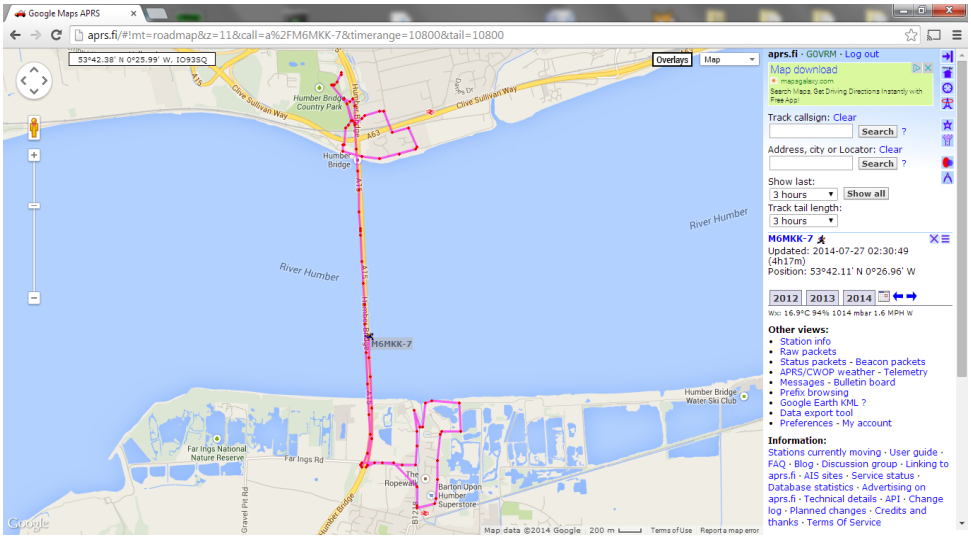
You can also download APRS programs for your PC or laptop. To try to build the required "critical mass" of users, I have written a user guide that describes the process of downloading ***APRSIS32*** [7] on your computer and setting it up to access the APRS Internet Service to view live data; this can be extended to support various devices such as GPS receivers and packet radio modems to build a full APRS station.

Accessing APRS data via the Web

Probably the best known APRS website is APRS.FI.[8] It was developed by Hessu Hannikainen OH7LZ and provides a means of accessing live APRS location data and presenting it using the familiar Google Maps Interface.

The site is hosted on dual-redundant servers which are located in commercial data centres in two separate cities in Finland; data is data collected from the worldwide APRS Information System and stored in duplicate copies of a database capable of holding a year's worth of data, the web server then presents this data, as objects, overlaid on the top of the map content provided by Google.

Users can customise their settings and store their favourite stations, map views and filters that show or hide specific callsigns or object types. Basic tools are also provided that allow the user to measure the distance and bearing between objects, and estimate the predicted radio coverage from data contained within the APRS packets.



The site also displays non-amateur radio data such as the location of ships, taken from their Automatic Information System (AIS) transponders, and the data collected from computerised weather stations. In fact **anyone**, whether they are licenced or not, can share their location via the APRS.FI website using a PC or GPS enabled smartphone, this is allowed because website data is not propagated back to the APRS network and therefore will never be transmitted by amateur radio.

This concludes this month's look at data communications and how APRS offers the ability for us to provide close support that integrates seamlessly into the operations of Yorkshire 4x4 Response and other User Services.

It's just that they don't know it yet – and yes we can send telegrams if anyone asks!

References

1 *Raynet Discussion Forum (Nov 2010). Topic: Transmission of data via RAYNET, started by Cathy Clark*
Available from < http://forum.raynet-uk.net/forum_posts.asp?TID=1153 >

2 *Raynet Data Procedure (2009). The Radio Amateur's Emergency Network*
Available from < http://www.raynet-uk.net/ep/Downloads/DATA%20PROCEDURE%20-%202009.pdf >

3 *ROHDE Aleks, W3JAG (2012). Digital Amateur Radio in Support of Situational Awareness, Common Operating Picture and Community Resilience for 21st Century Emergency Communications: Paper presented at the 31st ARRL and TAPR Digital Communications Conference 2012. pp.73-88.*
Available from < http://www.tapr.org/pdf/DCC2012-DigitalAmateurRadio-SituationalAwareness_W3JAG.pdf >

4 *US Department of Homeland Security (Jan 2008). National Response Framework. pp.32-33.*
Available from < www.fema.gov/pdf/emergency/nrf/nrf-core.pdf >

5 *US Department of Homeland Security (Feb 2010). Quadrennial Homeland Security Review Report. pp.31-32.*
Available from < http://www.dhs.gov/xlibrary/assets/qhsr_report.pdf >

6 *APRSdroid - APRS for Android*
Available from < https://aprsdroid.org/>

7 *APRS client for windows 32/64 and CE*
Available from <http://aprsisce.wikidot.com/>

8 *Google Maps APRS*
Available from < http://aprs.fi/ >