Growing APRS' Value within the Emergency First Responder Community

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Abstract

"Filling [the modern needs of the emergency management official] is within our capabilities as radio amateurs, but it may take us in new directions and into new partnerships. Let's be open to the possibilities, and alert to the opportunities." -- David Sumner, K1ZZ ARRL Chief Executive Officer, QST, September 2007

What role does APRS play in emergencies? What role ***could*** it play? The answers to these two questions will be explored more deeply in this concept paper – designed to engender both fresh thoughts and strategies in hopes of more closely connecting Amateur Radio and the needs of the official Emergency First Responders. The following topics will be covered (from left-to-right, top-to-bottom):

- APRS Situational Awareness
- The need for reliability
- Providing a fixed service
- EOC's Need for Data
- Setting "Reliability" Specs
- A deployable service, too?
- Existing APRS telemetry
- Building to the Specification
- Building trust, and expanding

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According to Bob Bruninga (WB4APR), the conceptualizer and visionary of what is today widely known as APRS, APRS is designed to be a real-time tactical and situational awareness communication system. In the Amateur's RF-world, APRS meets this need squarely. Amateur Radio operators within a situation-area can quickly and visually assess their environment and communicate on VHF. There is an HF component as well, however the throughput is limited due to bandwidth/speed limitations imposed by the FCC rules governing the Amateur service. An Internet data stream exists through a constellation of simple, yet effective, telnet forwarders. It is quite possible for those Amateur Radio operators that are outside of an incident area to become engaged and supportive in real-time.

With a few exceptions, this very robust and powerful system is a largely self-serving (to the Amateur Radio Service) tool. FCC rules restrict who may communicate via APRS to only licensed individuals. While there are Emergency First Responders (EFR's) that are licensed Amateurs, when they are deployed their job is less "amateur" and more "official", often with sworn duties to perform. Doing anything else could result in the loss of life.

The APRS data stream is a potentially rich source of information that could be better utilized to others' benefit. Likewise, EFR's are constantly seeking useful, authoritative and accurate information to support their activity during incidents.

The challenge is to find a way to connect the two in a way that assures Amateur Radio operations don't interfere, yet still provides data that EFR's and their commanders value –

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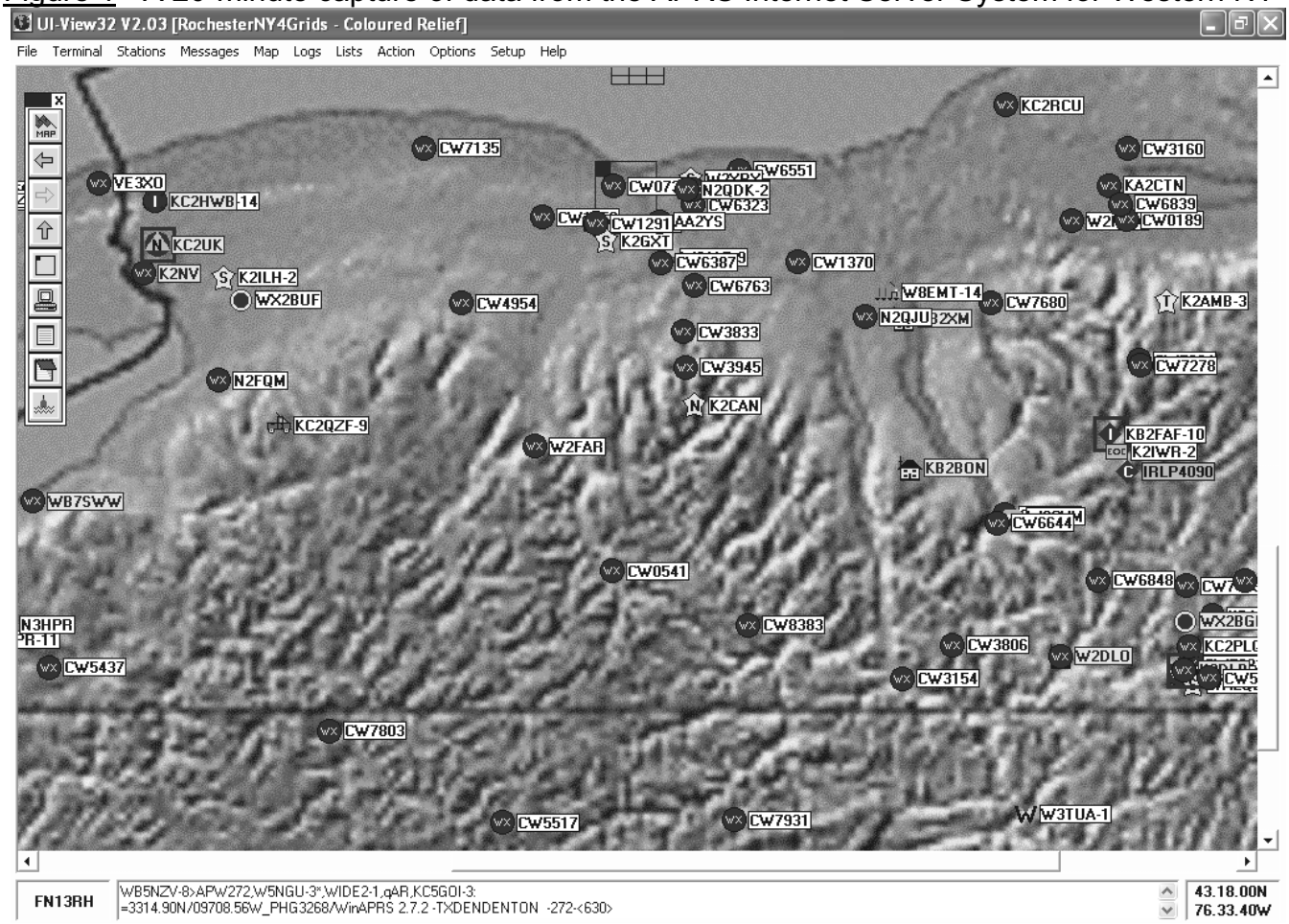
directly to the Emergency Operations Center (EOC) and possibly (some day) even imported into the systems used by EFR's (such as Automatic Vehicle Location and Computer Automated Dispatching systems) as a valued support service.

Mining for Blue Diamonds, er... Circles

An examination the APRS data stream reveals a “sea of blue” that is often the source of much on-line discussion amongst APRSers. From the standpoint of a casual user of RF-based APRS, those “blue circles” representing weather-telemetry stations can certainly fill a screen and “block the view” at some zoom-levels. Internet APRS users have it potentially “worse”, because the data stream includes weather stations from non-Amateur Internet-connected Citizens Weather stations. Is it possible that this annoyance to the rank-and-file APRS operator is potentially a “diamond in the rough” to Incident Commanders and EOC's?

Figure 1 - A 20-minute capture of data from the APRS Internet Server System for Western NY



Incident Commanders are often quite concerned with pre-arrival, incident and post-incident environmental conditions of all sorts (even beyond weather). Dispatched EFR's can arrive better prepared if they know what to expect upon arrival. EOC's can better manage deployed assets if they can monitor the environment in real time. Situational telemetry is obviously important to both EFR's and their command centers.

The low-hanging fruit is certainly weather data. It is also some of the potentially least accurate telemetry on the APRS network due to the fact that it's quality is limited by the skills and interest level of the private host. For instance, the accuracy of wind speed and direction is dependent on how much care the owner took in assuring that the anemometer is “in the clear” and that the station was calibrated to know where “North” actually is. However this weakness provides an interesting opportunity for ARES/RACES leadership and personnel.

Opportunity Knocks

ARES and RACES tends to take their roles to a higher level than the rank-and-file Amateur and non-Amateur citizenry does. By redirecting some of their focus to that of providing reliable and accurate incident telemetry, a new foundational connection to EFR's can be opened. The process of doing so can be remarkably straightforward.

Obviously, Incident Command Centers are more likely to request ARES/RACES support if they can count on a high-quality and meaningful effort. This is why these organizations hold training sessions and practice several times a year. Within the context of providing incident telemetry, this includes assuring that the instruments used must be (1) functional, (2) calibrated and (3) easily deployed.

The first challenge is to standardize on an industrial-quality weather station. In a related way, deploying them to the homes of ARES/RACES personnel (who would be tasked with keeping it maintained and calibrated) would send a strong message. This would provide a generally stable deployment of quality weather telemetry for a given area and an excellent start in gaining the confidence of the area EOC staff as they can come to rely on the data to be always present and accurate.

Next, consider having your ARES/RACES group assemble a constellation of field-deployable and securable[2] weather-telemetry stations! Doing so would allow Incident Commanders to engage Amateur Radio in a new way: providing more localized incident telemetry! The additional benefit is that it can be done from “outside of the yellow tape”. That is to say that ARES/RACES operations can be both deployed in real-time (rather than as an after thought) and can stay out of the way of the sworn officers while providing a valued service to them and their commander center.

It is quite possible that the purchase of field-deployable weather stations could be covered by a Department of Homeland Security grant! Check with your area law enforcement agencies to see if they would be willing to help you with the process.

What telemetry equipment to use?

At present, there is little (if any) standardization of weather stations within the APRS community. Easily a half-dozen or so different makes and models of equipment are supported, without much thought going into what is the most mechanically robust and metrically accurate device for the given task. Instead, it was “market forces” (e.g. -- largely the cost of purchasing a unit by a private individual) that drove APRS support. If ARES/RACES is going to provide incident telemetry, then it is time to assess the need and then find a weather station that will meet those needs. The “cheapest box” may not the best solution.

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2 It may need to be deployed and left unattended for some period of time. Thought should go into how to do this, safely.

"Start with the end in mind", and then "find the right tool for the job". By definition, field-deployed telemetry (in this case, weather) stations will be outside, in the natural environment. Start by determining the most extreme limits of things like temperature, rainfall, etc. These will be a good data points in determining the "worst cases" to engineer to. Then, take local ecology and likelyhood into consideration and account for it, too.

For instance, the extreme temperature limits[3] for North America are 134-degrees Fahrenheit (recorded in Death Valley, California in 1913) and -81-degrees Fahrenheit (recorded in Yukon, Canada in 1947). It is safe to say that a telemetry instrument that is engineered to function within these limits could be considered for deployment anywhere in North America. Finding electronic components that could survive (or engineering a "power budget friendly" temperature conditioning system for the equipment) is the challenge! This may be a specification or guideline forwarded by an international Emergency First Response authority (e.g. - DHS, NATO, etc?).

On the other hand, it may be doubtful that ARES/RACES personnel from Maryland, USA will be dispatched to Death Valley. As a result, regional EFR authorities may wish to create regional guidelines for field deployed equipment. In the case of Maryland, USA, the all-time temperature extremes are 109-degrees F[4] and -40-degrees F[5]. This range of temperatures is certainly more manageable, yet still not without challenge.

Temperature is only the easiest factor to consider. Humidity, moisture and condensation can come into play as well. In one wintertime icing event in Upstate New York – and to the lament of the local weather reporters – all weather stations were reporting no wind, yet simple observation showed that there was significant wind (and danger, due to the ice-loaded tree branches!). The anemometers were likewise frozen!

The first step involves setting standardized specifications for field-deployed telemetry devices. The second step is to determine which industrial-grade[6] telemetry devices could be used and what additional Amateur ingenuity would need to be applied to assure its full operation. This sets an an equipment standard (try to approve a *narrow* variety of makes/models and build from there). Be sure to involve interested ARES/RACES personnel, in conjunction with the regional APRS intelligencia. Remember that the idea is to get reliable telemetry to the EOC via either an APRS Internet-connected Igate or via RF directly. The third step is to make the equipment and methodologies replicable and trainable as ARES/RACES staff changes over time. Lastly, operationalize it all.

Of course, there are many more types of telemetry. As a future vision, this strategy can be applied to water level monitors, air opacity monitors and even radiation monitors.

In Conclusion

Think of how rewarding it can be if your local EOC could count on being able to bring up a simple APRS map of their region and count on knowing that the telemetry coming from

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3 http://www.geocities.com/donsutherland1/WorldTempRecords.html – referencing the "National Climactic Data Center"

4 http://www.infoplease.com/ipa/A0001416.html – referencing the National Climactic Data Center

5 http://www.infoplease.com/ipa/A0113527.html – referencing the National Climactic Data Center

6 Referring to mechanical robustness, since field-deployed units may encounter harsh conditions, both naturally and from accident and vandalism.

ARES/RACES weather stations was spot-on reliable. Imagine a haz-mat event in which Amateur field-deployed weather stations were sent out to the safe-periphery to save lives and property because the EOC could count on Amateurs both staying out of harms way and being able to properly setup and send critical data.

This discussion is intended to be used simply as a point of thought and inspiration. To date, a vast majority of Amateur emergency operations have been in providing voice-communication support to third-party organizations such as the Red Cross. Every once-in-a-while, a pioneering ARES/RACES responder will use APRS to track supply assets. These are certainly noble actions.

If ARES/RACES wishes to become more closely engaged with the official, sworn Emergency First Responder community, then telemetry is a good first service to consider providing. It simply needs to be planned for, and provided reliably – both in availability and accuracy.

Imagine a day when such Amateur telemetry is so dependable that Incident Commanders request that it be purposefully overlaid on the EOC's existing Automatic Vehicle Location or Computer Aided Dispatching system! That may be a future that is worth building toward as the success of any homeland security effort grows to rely on positive participation by the general citizenry.