3990 Virginia Avenue
Shoreview, MN 55126
ewestgard@att.net
612-308-5321  8/2/13 1.2
http://www.14567.org

Applications and Infrastructure for Marathon Support

Erik Westgard, NY9D

**Abstract:** The technology for emergency communications is now overwhelmingly digital.  FCC Part 97 does not specify a voice-only or secondary role for Amateur Radio operators.  In our two decades of volunteer service to the Medtronic Twin Cities Marathon Medical Team, we have found the more we deliver data and applications, (see Figure 1), the more we are brought into critical roles in emergency leadership and planning.    Here are some ideas and best practices we have found to be helpful:

1.  The value of data.  In many public service communications roles, you collect information.  Our on-course radio operators (more than 100) report back to three Net Control stations by race bib number observations of runners seen dropping out of the race, and entering aid stations or busses.  This data is time stamped, and is of interest to the relatives and friends of runners, who start asking us in our Family Medical Tent about participants who do not finish on schedule.  They are happy when we can give them location information, such as the fact that their family member was last seen getting off a race bus a few minutes ago.  (Figure 3).  This capability can be adapted to other types of events- such as "missing persons" at a tornado or an earthquake.

2.  Database applications.  In our data trailers we use a very up to date "LAMP Stack" software platform– Linux, Apache, MySQL (+postgres) and PHP.   We wrote a Linux version of the existing ARES Data program, (Trivnetdb), and added a web front end to the command line interface.  The system can handle TCP/IP users of any kind and still supports AX.25. While we preload our system with a spreadsheet containing 15,000+ participant names and bib numbers, you can also set up free form databases at will.  We notice a lot of the existing packages for amateur use, such as WinLink 2000 and D-RATS, do not have a database.

3.  Event Tracking.  In recent discussions with Dr. Anthony Luke, who has developed a commercial cloud and mobile device medical software package for marathons called irunsafe.com, we decided we both have the concept of an "event"- when a runner has something non-routine happen to them, like entering or leaving a medical tent.   It needs to be easy to enter or query events- a button on a web page or mobile app is ideal.

4.  Medical tent operations.  Several years ago we started an admissions and discharge desk to formally track patients entering and leaving our large medical tent using iPads.  We were also asked to track transports from the race course to area hospitals.   This proved highly popular with the all-volunteer medical staff.  Importantly, we, using Part 97 frequencies, track only the locations of runners- any medical condition conversations are via secure means.   We were asked last year to investigate the possibility of sending an SMS text message to the emergency contact number of any seriously injured runners to ask them to call the Medical Director.

5. Medical Records.  Our doctors have created a basic paper medical chart for runners.   It is also helpful to have medical history ahead of diagnosis or treatment, so they know if someone has allergies or pre-existing conditions.    Various attempts have been tried to get runners to enter this information ahead of time, and the irunsafe.com program is the latest version of this.  There is strong interest from our doctors in using a commercial handheld device for entering treatment information and in developing an online patient record.  This is another function of irunsafe.com, which does not require any Part 97 support from us.  Modern medical practice is moving to the use of electronic systems, such as Electronic Medical Records, but these require strong security measures, and we feel are under non disaster conditions outside of Part 97.  We have never been asked to transmit patient specific medical data on our frequencies by a healthcare or EMS professional.   For 2013, there is a request for us to lead the development of an integrated system, and we are working to craft an "unclassified" mode on the commercial package or an interface that keeps our volunteers out of the medical data, but still allows the tracking of location oriented runner events across both user communities-hams and doctors.

6. Infrastructure and scale.   With 40 FM voice repeaters in the race area, scaling voice operations has never been an issue.  But if you have many operators generating event reports, and a dozen laptops and iPads running updates and queries across two cities, you need speed and redundancy for data.  We long ago exceeded the capacity of available AX.25 packet equipment to handle our web traffic.  Training operators on a command line syntax is time consuming, so we use standard web browsers, no special laptop software and a radio button on a simple web site.   For more than five years we and the Marine Corps Marathon have used the Icom D-Star 10 watt DD mode products with excellent results.    We use five rooftop "repeater" ID-RP1D/ID-RP2D nodes (they are simplex for high speed data), and can envision this being able to support very large or multiple simultaneous public service events, as we have 48 laptops available,  pre-positioned in sets of eight across several area clubs.  We also use a Linux computer with DNAT and IPTables on the back end of our DD Mode repeaters which allows any to any support on ID-1s.  The ID-1s talk to the repeater and Linux system and can in turn then talk to each other, as we control the IP addressing.  This allows our databases to be remote from the repeater sites.

7. Packet and OLSR.  The use of slower data radios (i.e. 1.2kbps-56kbps packet) is often discussed as a lower cost alternative to D-Star but does not meet our needs.   We support multiple laptops on a single ID-1, (such as in a command truck), and think the 90 kilobits and 100ms round trip delay we get with our Icom DD mode equipment is the minimum needed for web browsers, to avoid a one second default timeout.   We are also working with wireless mesh equipment (Ubiquiti 5Ghz gear with OLSR software).  This has been promising in tests, but we have seen weather related fade on longer paths unless those are carefully engineered.

8. Tablets and PDAs.  Once the move is made to TCP/IP the whole range of modern devices are available for use.  In the sprawling finish line area, we have installed stock 802.11N wireless access points that can reach our system.  These RF links allow non-licensed persons to be used for queries and data entry.  This is important for scale and redundancy.

9. Ham dispatchers, NIMS and ICS.  We brought in the idea of using NIMS/ICS to the event some years back.  This dovetailed nicely with parallel efforts by our Fire Department partners.  We have promoted the idea that during normal operations, we support our volunteer race officials and medical team to manage our routine medical care (such as aid stations and

calling 911 if we need an ambulance on the course) but that in a declared emergency the designated (usually Fire Department / EMS leader) would take over, and leave us in place under their direction.   We put some hams on the Marathon rented UHF radio medical channels to answer and log calls, and coordinate mostly volunteer medical resources.  Rented radios are ideal, as they can be handed to anyone.  We get gentle reminders we are too chatty on these channels (following the spirit of Part 97) but the volunteer/professional teamwork is truly remarkable.

10. IP Phones.  When using community volunteers heavily, such as nurses, they are used to a normal telephone, and rather than try to adapt operations to radios we string Ethernet cable (or use Wi-Fi) and put in Asterisk based IP phone systems.  These scale nicely and save time and confusion.

11. No "Go-Kits."  Nothing screams out "hobbyist" more than arriving at your event with a push cart full of obsolete or home-made electronics equipment.   At a Marathon, there are elaborate planning spreadsheets listing every piece of gear and there are site use permits to consider.  So we pre-plan our equipment deployments, and rely on shared infrastructure, standards and teamwork.  There is a tendency for low budget/"science project" techniques to fail on race day, so the use of commercial grade technology for us is mandatory.    In the light of the events of Boston, we have been asked again and again if our equipment is reliable and we will be there for the event when they need us.   We have a lot of credibility in this space, and the key to that is redundancy (three and five way sparing), practice and pre-planning.   In Minnesota, we have four separate teams of operators that have experience with major marathons.

12. Video feeds.  A few years ago in response to a request, we set up some IP cameras.  The request was not repeated until 2013, when cameras were again deemed important for looking for suspicious persons or packages.   These are ideal over 802.11 or mesh links.

13. Command trucks.  We employ several government or tribal command and communications trucks.  These are ideal for remote net controls.  We have asked that all the ones in our area install ID-1s, to be compatible with our backbone data and voice network.  We put in radios or program radios in these to be compatible with the rented UHF event radios that we answer for event medical and or security nets.

14. Shadow operators.  We don't use shadows.  Our event, medical and Fire/EMS leaders call in to our Net Control stations on the rented radios, and senior leadership occasionally drops into the control center.

15. Retired functionality.  Years ago, runners too tired to continue or lightly injured could be transported back to the finish line by a fleet of vans dispatched by our team.  APRS® units were added to each van for vehicle location.  There is a trend to use scheduled pickup busses, and we did as well, as there were also issues with the mobility of the vans due to traffic and road closures.  Our event leaders have not asked for vehicle location services.

In conclusion, one of the things we worry about is as the state of the radio art evolves, if we don't keep up we could find our role marginalized.  If we lead with advanced technology, it also makes our volunteer work far more interesting and gives us a sense of real impact and accomplishment.
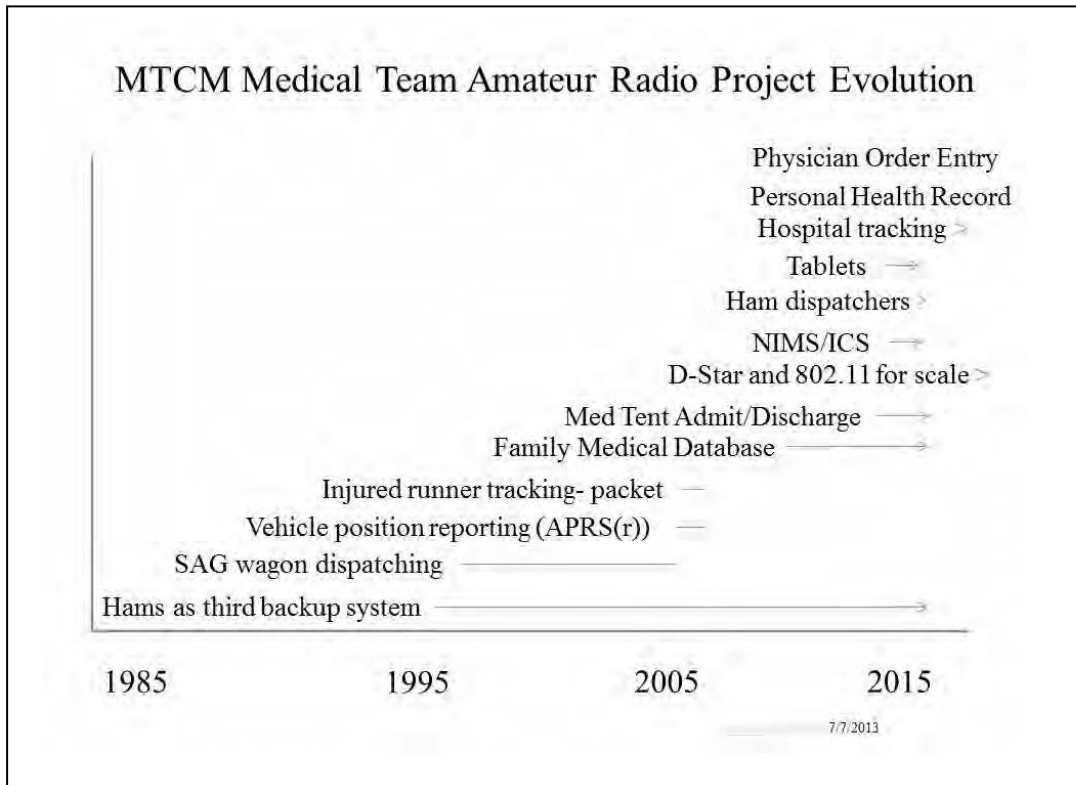
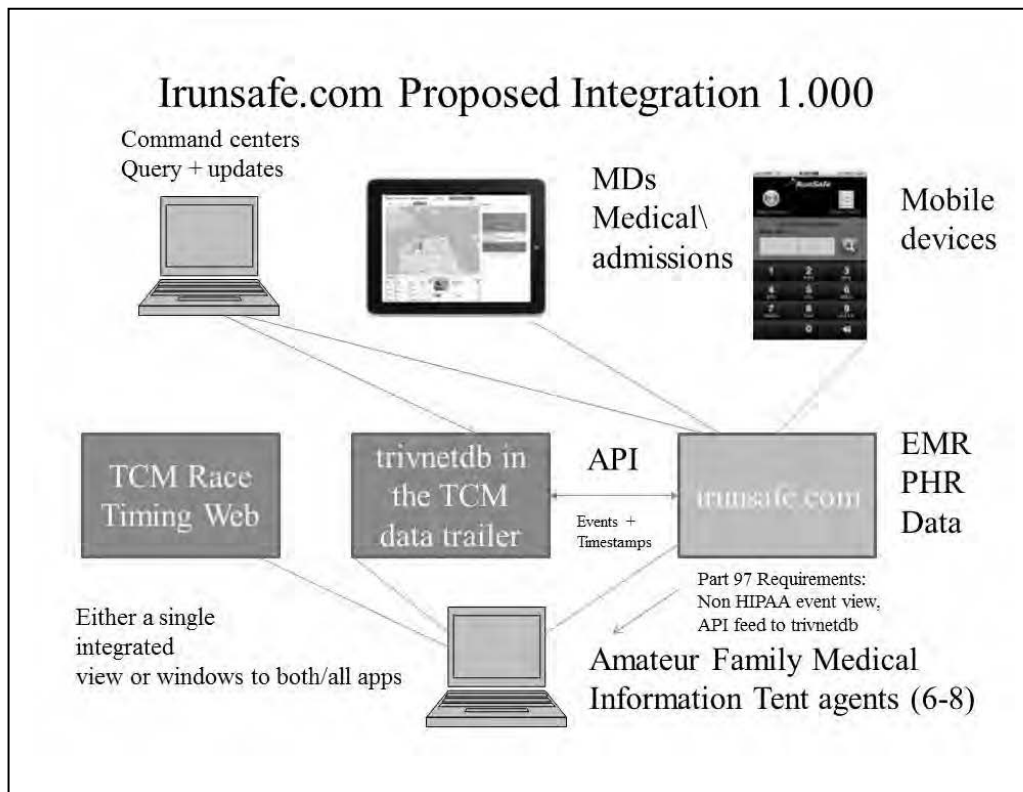**Figure 1- Some of the projects developed jointly with the Medtronic Twin Cities Marathon Medical Team**



**Figure 2. Integrating a commercial Marathon medical website/package with our system.**

News for 2010- iPads for check in – hospital tent
New for 2011 – IP Phones
New for 2012- Mobile devices

Family Medical Information

**Figure 3 – iPads are used at check in and we have a large number of stations ready for family medical queries from the public.**

Erik Westgard, NY9D has served as the volunteer medical communications coordinator for the Medtronic Twin Cites Marathon for more than ten years. He performs a similar role at the Red White and Boom Half Marathon and was an advisor to the Minneapolis Marathon.  He is employed in telecommunications and is on the adjunct MBA faculty at Metropolitan State University.