Amateur Radio Emergency Network (AREN) for Central Virginia Hospitals

This ham radio based emergency network serves seventeen hospitals and the region's blood service. It covers a 10,000 square-mile (26,000 square-kilometer) area from just north of Richmond at Mechanicsville to the North Carolina border at Emporia (east) and South Boston (west). It's driven by three powerful repeaters, standard "radio rooms", and commercial-grade antennas at each hospital and the blood service. And it's all done with VHF for voice and UHF for packet!

Repeaters

May is beautiful in central Virginia and this "mass casualty" drill was taking place during one of those lovely spring days. We were participating in our first hospital drill using personal ham equipment to show the hospitals what we could do. They were impressed. We connected but propagation was lousy! We'd done an earlier communications test and knew that we'd have propagation problems since most of the hospitals are in tall building surrounded by even taller medical office buildings. We'd brought along a portable repeater for the downtown hospital. It was clear that that a full hospital network would need repeaters and external antennas for the hospital radios. What the drill taught us was that the medical traffic would be so intense that there would have to be repeaters dedicated to the hospitals.

The network consists of linked repeaters designed, built, and commissioned by Pacific Research (http://www.pacres.com/) to our specs. The first is in the north atop the main hospital at the Virginia Commonwealth University (VCU) Medical Center in Richmond. That hospital, and the Medical College of Virginia (MCV) that supports it, is the "Level One Trauma Center" for the area. It's the medical hub. Twenty-five miles (35km) south at a high elevation is the most powerful of the repeaters at Southside Regional Medical Center in Petersburg. It's the radio hub. Nearly 140 miles (225km) further south is the third repeater at Community Memorial Hospital in South Hill. (There's a fourth standby repeater just south of the James River in Richmond at Chippenham Medical Center.) The repeaters almost exactly follow the path of I-95 to I-85 south from Richmond.

(Picture of map.)

The repeaters are impressive. The antennas sit tall on top of high-rise hospitals and, for South Hill, on top of a water tower. They're all high gain commercial four-element folded dipoles, two for VHF and two for UHF. We've aimed their signal pattern to focus on the area served. To link the three repeaters together, there are highly-directional UHF multi-element Yagis pointed at each other. The repeaters are commercial Kenwood units with robust power supplies and battery backup.

Repeater power ranges from 50 to 180 watts. Since the Virginia Blood Service and about half the hospitals are in the extended Richmond metropolitan area, 50 watts is more than enough for that repeater. The repeaters further south have a longer reach so they have the highest power.

(Pictures of repeaters and antennas on top of hospitals.)

Hospital Radios

Our first drill within hospital command centers showed they are very different from government emergency command centers (EOCs). They're noisy, and internal hospital operations, not

communications, is the focus of the work. We could see that the radios had to be near, but outside, the command center. So “radio rooms” became the model.

(Pictures of radio rooms.)

Each hospital and the blood service has two Kenwood dual-band, packet-ready TM-D700 transceivers in its radio room. Each has two identical power supplies plugged into hospital emergency power. Each has a computer for packet. The radios are loaded with identical frequencies and alphanumeric names for each frequency. The packet messaging software is identical. Any ham trained by the joint ham-hospital team can walk into any hospital and get the radios going. Our training video and computer slide-show demonstrates to the hospital staff how to start and use the radios until the hams arrive. (It also states what the FCC defines as a true emergency so they stay out of trouble.)

We wanted the radio-room antennas high but most command centers are far from the best antenna locations, so we compromised. To minimize transmission line losses, we used high quality “bendable” hard line and placed the commercial-grade antennas at the highest point close to the radio rooms.

Packet is King

It came to us while preparing for a drill at the Richmond airport. The drill was to be of a plane crash with lots of casualties. We figured we could probably spell out “Ringer's lactate” alright, but it would be slow and we heard some other medical and casualty terms that were going to be a mess for us to get right. Then there were the names of the injured and the dead. Did we really want to send that out in plain voice?

Packet was the answer. The medical professional can walk up to the computer and type the message, and get it right. At the other end, a medical professional can read the message and not deal with ham-handed spelling.

Luke Bannister, AD4MG, modified a version of the JNOS packet software and built a message front-end that looks like the standard ICS message form and works like familiar e-mail. (There's more on the critical role of ICS in the next article.)

The Decision for VHF and UHF

It's the wee hours of a cold Sunday morning. The wet snow and sleet have frozen and there are massive power outages, telephone lines are coming down, and the hospitals are experiencing many casualties from traffic accidents. They need to communicate by ham radio but there are no hams at the hospitals. Since the FCC allows unlicensed people to use any radio they can find in a true life-or-death emergency, we needed radios the hospital staff can use until their ham volunteers arrive. We're careful to point out the trouble they'll be in if they can't justify their actions to the FCC, but we needed radios unlicensed staff can use in desperate times. VHF transceivers using standard repeater frequencies are simple to use.

Given the distance and the 10,000 square-mile area, VHF and UHF seems like the last choice we would make. However, packet means we have to use UHF; we need all the band-width we can get and HF doesn't cut it. Add to that, we know from our support during hurricane Floyd that we were going to need lots of hams to cover three-shifts over many days. There are lots of hams with Technician licenses. Even those of us with General and Extra licenses don't have much experience with HF,

especially in emergencies. It all pointed to VHF-UHF if we could find a way to go the distance. The linked-repeaters was the answer.

Getting the Hospital Support and the Funding

The network is run by an independent organization of hams, the not-for-profit Virginia RACES, Inc. It's organized somewhat differently from most ham groups and that was key to getting acceptance by the hospitals. That acceptance was key to the funding. It's taken nearly a half-million dollars to build the network. I'll tell you more about that in the next article.

Author

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