EMS to the Rescue

By Thomas A. Santogrossi

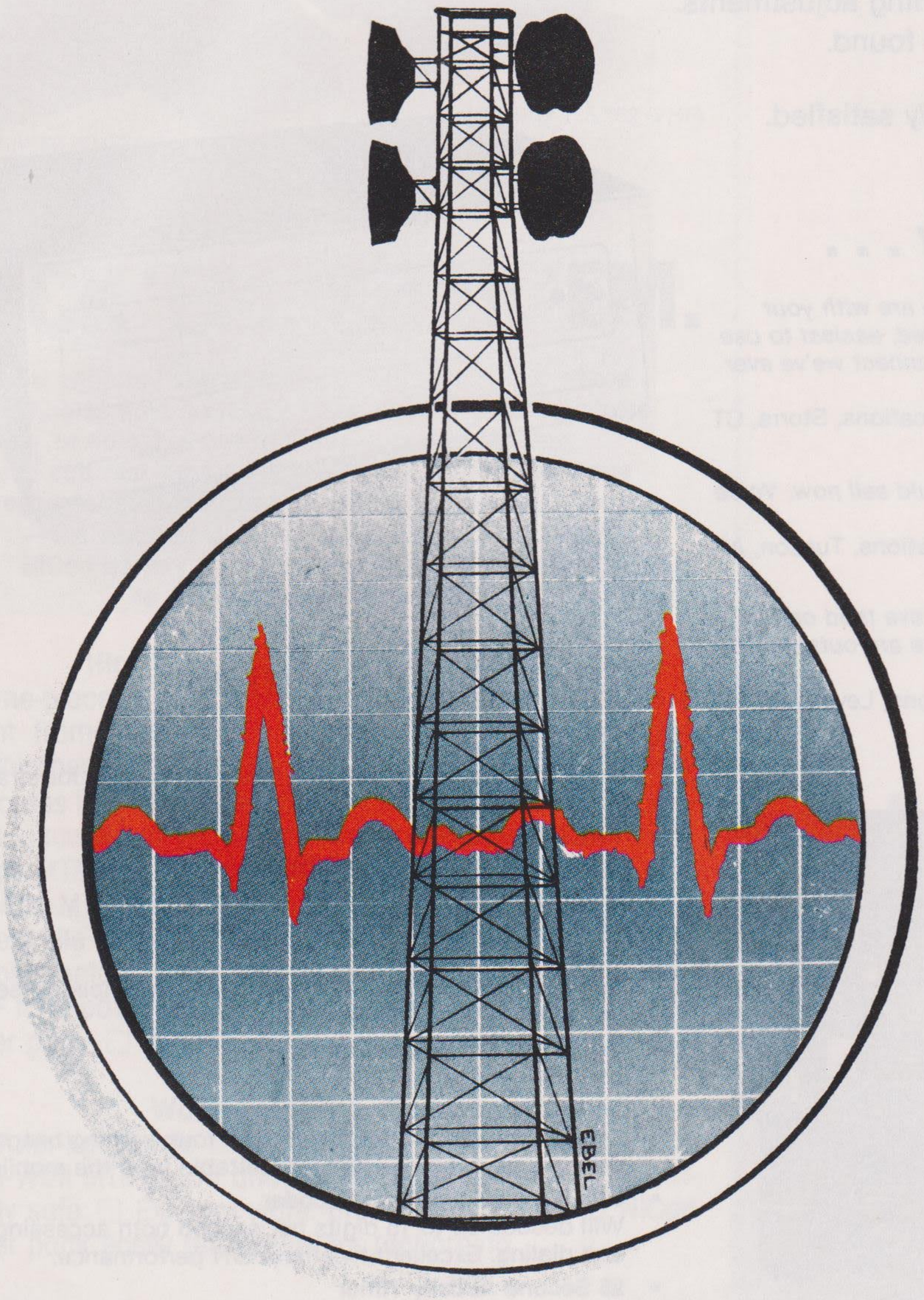
In any disaster or emergency situation involving serious injury, the difference between life and death can depend on how rapidly medical attention is received. The ideal situation would be to have a doctor at the scene of the accident. However, this would require a physician stationed on every street corner waiting for an accident to happen — a very expensive approach.

Acting as the doctor's hands in the field, the paramedics are in constant communications with the hospital, relaying valuable information concerning the injured victim. This data includes a verbal description of the victim's vital functions and condition, often including an electrocardiogram (ECG) transmission.

The doctor then informs the paramedic what treatment or drugs to administer in order to stabilize the patient for transport to the hospital. The communications can be maintained and the ECG transmission continued enroute to the hospital. Awaiting hospital personnel are prepared to handle the victim because they already know the condition and details of the injury.

After the paramedics deliver the patient to the hospital they are free to handle another case. The key to this type of service is communications.

The most common providers of paramedic services are the fire departments



Reliable communications equipment and systems allow paramedics to perform their life saving roles.

Figure 1. MED 1 - MED 10 Paramedic Radio Frequency Assignments.

	Transmit (MHz)	Receiver (MHz)
MED 1	468.000	463.000
2	468.025	463.025
3	468.050	463.050
4	468.075	463.075
5	468.100	463.100
6	468.125	463.125
7	468.150	463.150
8	468.175	463.175
9*	467.950	462.950
10*	467.975	462.975

* Frequencies normally assigned for coordination of MED 1-MED 8 channels.

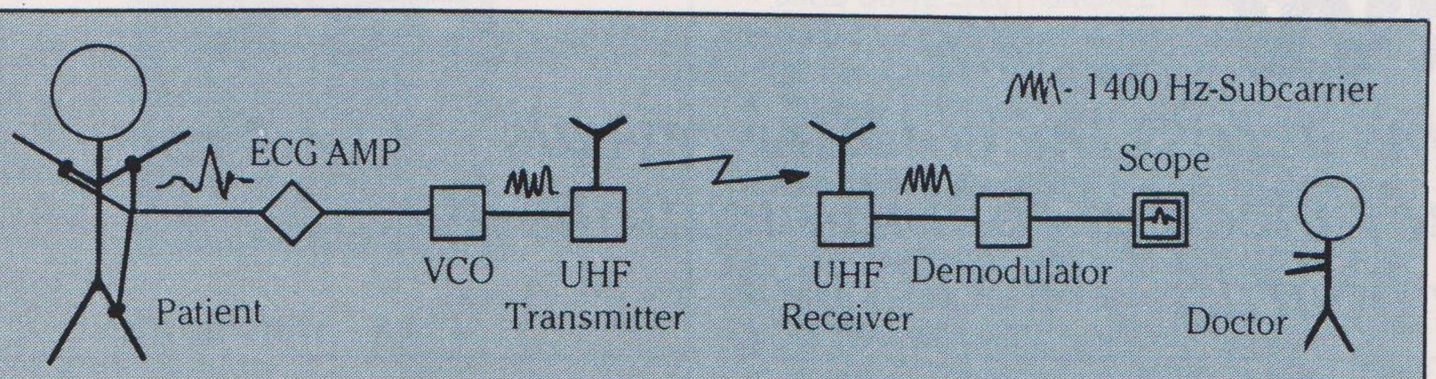


Figure 2. ECG Telemetry Transmission

ECG signals coming from the patient are not suitable for direct transmission so the system shown in figure 2 is employed. An amplifier having good common mode refjection ration and high input impedance drives a voltage controlled oscillator for FM subcarrier transmission. The national standard for this subcarrier is 1400 Hz center frequency with a deviation of 50 Hz per millivolt of signal from the patient. This 1400 Hz subcarrier is then fed to the modulation input of the transmitter and sent over the air.

The hospital receives and demodulates the ECG subcarrier and displays the patients ECG pattern on a scope or strip chart recorder. The doctor or paramedic liason nurse can then prescribe the necessary medication while viewing the incoming ECG.

because both paramedic and fire services require quick response to a large territory. Most EMS communications systems are set up on a county wide basis with users including hospitals, fire departments, and private ambulance services.

EMS equipment

Minimum paramedic equipment usually includes a base station and a medical communications console. The console contains; the remote controller, to control the base station; display oscilloscope and strip chart recorder, for viewing the ECG; and a cassette tape recorder, to document the two-way communications and the ECG transmission between the paramedic and the hospital.

The paramedic will normally use a full-duplex portable UHF-FM radio as the primary EMS communications equipment. This radio also contains the necessary circuitry to hook-up the patient and transmit the ECG. The radios should always be full-duplex as the ability to interrupt either party can be lifesaving in itself.

Although paramedic vehicles are usually dispatched with VHF radios, the paramedic portable will operate on the UHF frequencies that are exclusively reserved for doctor-talk and ECG telemetry (MED1-MED8). Two additional channels (MED9 and MED10) are used to coordinate channel assignments for the MED1-8 channels. (These frequencies are listed in Figure 1.)

In large metropolitan areas such as Los Angeles, computer-aided frequency coordination will also require DTMF signaling with ANI and 9 CTCSS encode and decode tones. DTMF signaling is also widely used in systems that interconnect with telephone company circuits.

Telemetry assurance

The average rescue squad makes between five and ten runs per day and due to the stress situations involved, the physical abuse to the equipment is tremendous. For this reason the radios are checked on a daily basis to assure proper operation of the ECG telemetry and transmission system. The means for testing the ECG signal path is built into the radio with a calibration signal being injected into the patient input of the radio. This signal, usually a one-millivolt square wave, is easily recognized by hospital personnel for quick verification of system performance.

An important feature of most EMS communications systems is the ability to utilize telephone circuits to back-up the UHF radio channels.

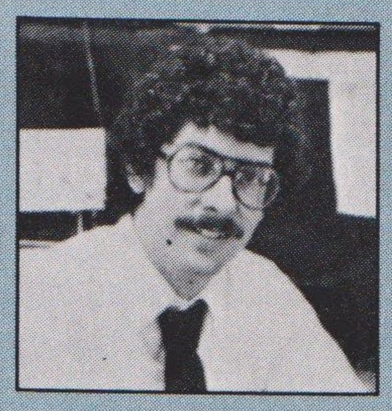
Each hospital generally has an unlisted emergency number to facilitate this type of communications. This phone line will be fed to the communications console to allow telemetry reception and display. When normal UHF communications are not possible, and a telephone is nearby, the paramedic can call the hospital emergency number and couple the paramedic radio to the phone line by using an acoustic coupler. Operation and capability then remain the same as UHF operation.

Summary

Emergency Medical Services have developed into a professional service to bring life saving benefits to the victims of accidents. The equipment and personnel must perform under adverse conditions and without fail.

The future of EMS must continue to bring experience and technology together to offer expanded service areas. This effort will depend on both the funding and communications networks available. □

About The Author



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Prior to joining Medical Communications and Instrumentation, Santogrossi was involved with cardiac pacemaker design and engineering.