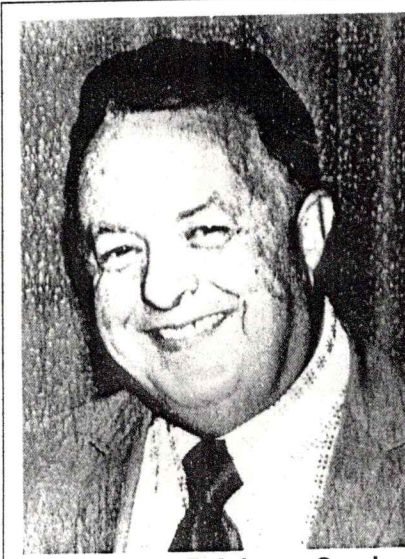




The Maryland Emergency Medical Services Communications System



Richard L. Neat



R Adams Cowley

The Emergency Medical Services Act of 1973 identified 15 key components of EMS systems that are considered essential for effective delivery of pre-hospital patient care. One of these components is communications. The Maryland Institute for Emergency Medical Services Systems (MIEMSS) has implemented a statewide emergency medical communications system that provides two-way radio communication between an ambulance and any or all hospitals within Maryland via dedicated EMS channels. In fact, through a complex network of base stations, microwave links, and dedicated leased lines, ambulance and rescue crews can consult with any or all Maryland EMS providers, including 45 hospital emergency departments, 14 specialty referral centers, nine areawide trauma centers, and four Medevac heliports. Each component of the Maryland EMS commu-

nications network also interfaces with the public-switched telephone network both as a backup for dedicated channels and as a means of conserving radio channel time. This capability allows telemetric consultations via a public telephone if one is available at the scene. Thus, Maryland's EMS communications network allows qualified ambulance personnel to render high-quality prehospital care under a physician's direction.

Ambulance crews, regardless of their level of training, need to communicate with medical control. Since the functional requirements of basic life support (BLS) and advanced life support (ALS) communications differ significantly, it is useful to review the general types of EMS communications models from this perspective.

EMS Communications Models. A BLS system requires only voice communication, primarily for advance notifi-

cation to a local emergency department, so that medical personnel can be prepared to care for the patient immediately upon arrival. This advance notice may include patient vital signs and an estimated time of arrival at the receiving hospital. For such information, a lead time of five to 10 minutes usually is adequate. Basic life support communication is generally established when the patient is en route to the hospital. Many BLS communications systems can use "off-the-shelf" equipment in a hospital-based configuration (*Figure 1*) to serve these relatively short-range and short-duration radio needs. In such an arrangement hospital emergency department personnel control EMS communications. Links with other emergency services such as police, fire, or rescue dispatchers are through dedicated "hot lines."

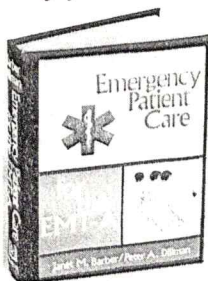
In contrast, ALS systems place more stringent requirements upon both ambulance-to-hospital and interhospital communications links. Each emergency incident is likely to require contact with and coordination of several EMS providers. A typical emergency might involve the ambulance or rescue squad, a local hospital, a specialty referral center, a Medevac helicopter, and landing site safety personnel. ALS systems must provide for both voice and telemetric consultation between ambulance personnel and specialty referral or area-wide trauma centers regarding life-threatening situations. At the same time, the emergency medical personnel at a separate receiving hospital must be informed of the patient's condition, pre-hospital care administered, and the medical decisions of the specialty center. In addition, special arrangements such as dispatch of a Medevac helicop-

- Richard L. Neat, Director of Communications; R Adams Cowley, MD, Professor of Thoracic Surgery and Director, Maryland Institute for Emergency Medical Services Systems, Baltimore, Maryland

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ter and/or fire and rescue equipment may need to be made.

The public-switched telephone network (PSTN) or "standard" telephone service and two-way radio are the primary means of establishing contact between any fixed point and a randomly located ambulance. In the dial interconnect model (Figure 1) these components are linked semiautomatically by a radio-telephone interconnect. Communication between fixed locations may be established by dedicated leased-lines or microwave channels. In ALS systems both the hospital-based and the dial interconnect alternatives have significant disadvantages since they place an undue communications operations burden on prehospital and hospital personnel whose main function is patient care. In matrix systems, an EMS operator, located at a "central alarm" or emergency operations center, contacts and coordinates the needed resources, leaving ambulance personnel and physicians free to tend to patient care.

Emergencies do not always occur in good radio locations, so the ALS communications system must be designed to maximize geographic coverage and, at the same time, minimize the burden of carrying excessive radio equipment. Since there is a direct relationship between the weight of a portable radio and its transmitting power, the design of an ALS communications system

should consider the trade-off of portable power output versus the density of the base station network. A hospital-based system with a limited number of base stations may not provide the full geographic coverage needed for ALS service. Repeaters located in mobile emergency vehicles can be used to relay signals to and from portables, thereby reducing the requirement for multiple base stations while permitting the ambulance crew member to use a low-power, lightweight hand-held radio at the patient's side.

Maryland EMS Region III and the EMRC.

The state of Maryland is comprised of five EMS regions. Region III includes Baltimore City and Anne Arundel, Baltimore, Carroll, Harford, and Howard counties. Approximately one-half of the state's population resides in this region; more than half of Maryland's hospital emergency departments and nearly all of its specialty referral centers are located in Region III.

The EMS communications system for Region III was developed by a private, nonprofit corporation, Emergency Medical Services Development, Inc., with the aid of a federal demonstration grant. The system was designed by the Atlantic Research Corporation as a matrix network, based on high-powered (20-watt) portable operation. Portable equipment and EMS control consoles (except for the 50 x 20 matrix switch

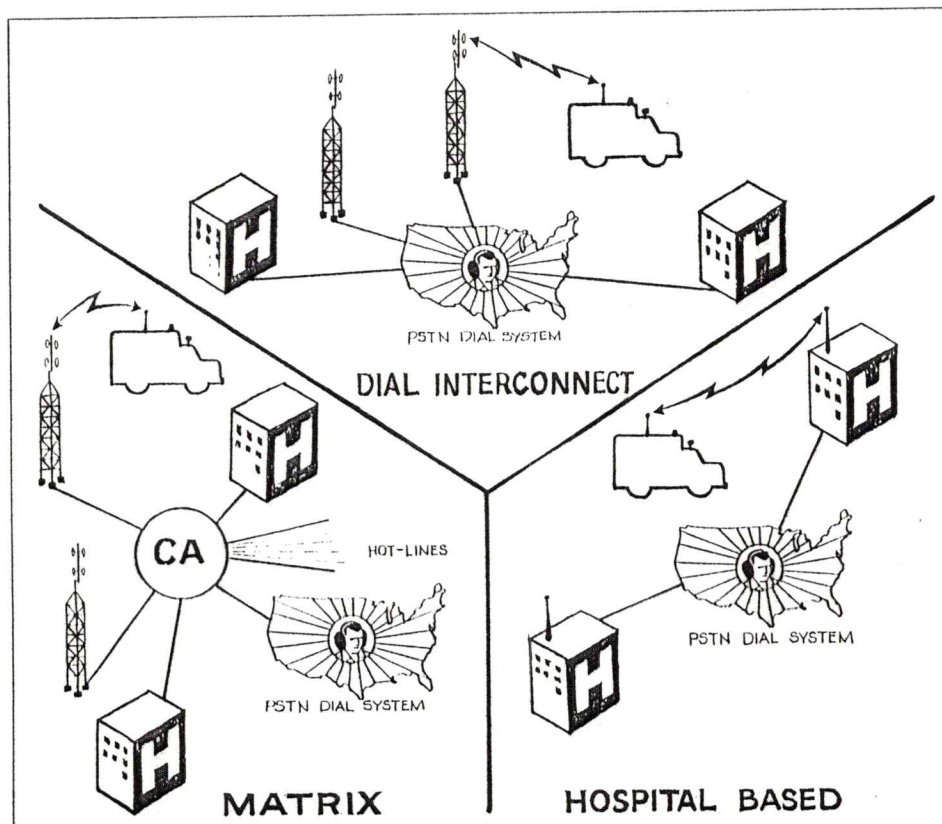


Figure 1: EMS communications models.

console provided by the Chesapeake and Potomac Telephone Company) were supplied by Pioneer Medical Systems. Each EMS vehicle in the region is equipped with a portable two-way radio that operates either on the vehicle's power or a self-contained battery. Once at the emergency scene, the attendant may use the portable at the patient's side.

Base stations in Region III are 250-watt UHF units manufactured by the General Electric Company. Eleven multitransmitter base station sites (30 base stations), located strategically within the region, transmit directly to the portable units (Figure 2). Base stations throughout the state can be connected, through a 20-trunk by 50-station telephone company terminal, to any of the region's emergency departments, specialty referral or areawide trauma centers, or to any other Maryland EMS resource via inter-regional dedicated telephone "tie lines"—EMSTEL.

A state-operated communications center, the Emergency Medical Resource Center (EMRC), is the hub of EMS communications in Region III, serving in the same capacity for EMS as the individual county central alarms, but on a larger regional scale. It is op-

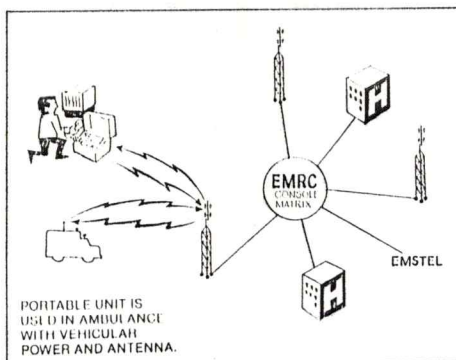


Figure 2: Region III, direct base to portable configuration.

erated around-the-clock by MIEMSS employees who must be certified emergency medical technicians at the time of their appointment. Two wall-sized maps at EMRC display the current status of the 24 Region III emergency departments, and indicate dispatch of ambulances in all jurisdictions. These maps are remote-controlled, respectively, by emergency departments and by the ambulance dispatch centers in Baltimore City and the surrounding counties. The hospital status lights are green (ready to receive patients), red (no cardiac beds available), and yellow (general emergency department overload). These indicators are used by the EMRC opera-

tor to advise responding ambulances of the need to reroute patients. The ambulance-dispatch map warns the operator of potential EMS calls, making possible more effective use of available channels.

Approximately 100 calls per day are for cardiac consultation. The EMRC simultaneously relays ECG telemetry and voice transmission from cardiac rescue technicians to one of three cardiac consultation centers and to the hospital that will receive the cardiac patient. Each cardiac consultation center is on-line for an eight-hour shift to provide 24-hour consultation coverage for the entire region. The receiving hospital plays a passive role, receiving telemetry strips and voice transmissions between the cardiac rescue technician and the consulting physician. The receiving hospital does not interrupt the dialogue, but records all prehospital events so medical personnel can be prepared to receive the patient.

SYSKOM, Medevac, and the Specialty Referral System. SYSKOM, the Systems Communications Center, also is manned by MIEMSS employees with the same qualifications required of EMRC operators. SYSKOM is the statewide coordination center for all EMS regions, Maryland State Police Med-

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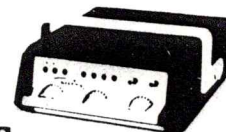


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evac helicopters, specialty referral centers, the areawide trauma centers, and the MIEMSS Shock Trauma Center. All Medevac helicopters are equipped with EMS radios for contact with SYSCOM and any EMS providers in Maryland. In addition, SYSCOM uses an avionics channel 123.05 MHz (UNICOM), to coordinate Medevac helicopter missions undertaken by the U.S. Park Service, Army, or Coast Guard. An omnidirectional radio beacon marks the SYSCOM location to aid Medevac navigation.

SYSCOM operators keep a record of the availability of beds at the various specialty referral and areawide trauma

centers and initiate flyby procedures in the event of a patient overload or a disaster. Thus, field emergency personnel do not have to search for an available source of appropriate emergency care.

EMS Regions I, II, IV, & V. In planning the EMS communications systems for the other four regions in Maryland, compatibility with the Region III system, which was already under construction, was a major consideration. The new portion of the system, also the matrix type, was designed by Spectra Associates, Inc., to use vehicular repeaters which rebroadcast signals to and from small, hand-held portable radios (Figure 3). These repeaters lessened the

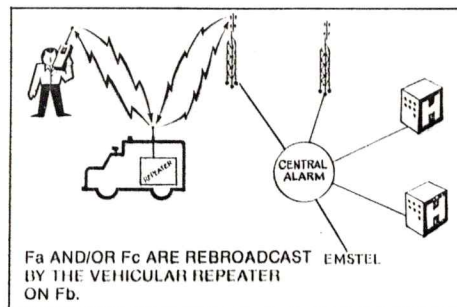


Figure 3: Regions I, II, and V vehicular repeater system.

multiple-site requirement for base stations, and reduced the weight of the patient-side radios.

The system for Regions I, II, IV, and V was built by the General Electric Co., using ComCenter EMS consoles and General Electric two-way radios. Channel assignments, tone, coding, and operating characteristics of the radio and control equipment were arranged to allow ambulances from any jurisdiction to access any EMS communications center, including the ones in Region III.

Interconnections between ambulance personnel and EMS providers outside Region III are made through each county's central alarm or emergency operations center. County employees not only operate their own fire board, sheriff's office, and other radio systems, they also control their "cell" of the EMS communications system through a state-owned EMS console. These consoles include the matrix circuitry necessary for interfacing radio communications, interhospital communications, and telephone circuits—both dedicated (EMSTEL and hot lines) and PSTN—to set up multiparty conferences. Each hospital emergency department console also directly controls a back-up base station at the hospital. This emergency transmitter capability converts the system from a matrix model to a hospital-based configuration in case of major matrix system failures.

Leased Circuits Versus Microwave. The annual cost of leased circuits in the Maryland EMS communications system is about \$230,000. This cost has remained relatively stable for several years despite inflation, rate increases, the rapid growth of the specialty referral system, and the addition of several "fill-in" base stations. Cost containment has been achieved by replacing several long, multichannel leased-lines with microwave terminals.

At the present time, the Maryland EMS communications system uses eight microwave links. Most of them are in Region III, where circuit density is high

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due to the multiple base station requirement of direct transmission to portable radios. Another reason for the high circuit density in Region III is that a majority of the hospitals in Maryland are located in the Baltimore metropolitan area. The microwave network in the region has reduced leased-line costs by approximately \$50,000 per year at 1978 rates. This savings has allowed the addition of leased-lines for three new emergency departments, six neonatal intensive care centers, two eye trauma centers, four heliports, and 13 new base stations without raising circuit costs significantly above the 1977 level.

Three of the eight microwave links in Maryland operate mountaintop base stations in Garrett, Allegheny, and Frederick counties, where telephone lines are not available. Amortization of the cost of these three links will take about 10 years, based on three circuits per link. Future plans call for installing three microwave links between Region III and the Eastern Shore (Region IV) to replace the less reliable leased circuits that now cross the Chesapeake Bay.

Goals for the Future. The Maryland EMS communications system has functioned very well since an initial

bout with the inevitable growing pains of almost all systems of such magnitude. The decision to use vehicular repeaters outside Region III made it necessary to train ambulance personnel to operate the new equipment. The ambulance radio was no longer a simple device. Crew members needed a good general understanding of the total system in order to avoid interference with fixed-site repeaters caused when several vehicular repeaters were operating in close proximity or when improper tone codes were selected for the vehicular repeater. However, the advantage of having medical consultation available at patient-side from a small portable radio has more than compensated for the hours spent in operator training.

As the number of vehicular repeater/portable units increases, the prospects for converting from a vehicular repeater system to a direct base to low-power portable system becomes increasingly attractive. A typical vehicular repeater/portable package sells for \$8,000 to \$15,000 depending on manufacturer and available features. To achieve coverage comparable to that of a vehicular repeater system using a direct-to-portable concept will generally require a far greater number of base station sites.

Considering that a portable alone could be purchased for approximately \$1,000, there is a potential for over \$2,000,000 in savings when mobile system replacement becomes necessary in a system of more than 300 ambulances. This savings could be applied to expanding the base station network as vehicular repeaters gradually are replaced by low-power portables. The resulting simplification of the system would probably improve overall operation, reduce maintenance costs, and decrease the need for training ambulance radio operators.

Our goal is to provide our prehospital personnel with the lightest, yet most reliable, communications tools available—without requiring a "Bachelor of Radio Operations" degree.

BIBLIOGRAPHY

1. Cowley, R.A., Cooper, A.B., III, Towson, D.E., et al. A Statewide Communications System to Support a Regional Program for Emergency Health Care Delivery in Maryland. Baltimore: Center for the Study of Trauma, January 1973.
2. Cowley, R.A. A total emergency medical system for the state of Maryland. *Md. State Med. J.* July 1975.
3. Garrett, C.W. MIEMSS, part 2: The Maryland emergency medical services communications system. *Md. State Med. J.* June 1978.

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