MARYLAND EMSCS

TECHNICAL NEWSLETTER

MARYLAND INSTITUTE FOR EMERGENCY MEDICAL SERVICES SYSTEMS

Fall 1980

ELECTRICAL NOISE IN AMBULANCES

A flashing light, rotating beacon, siren, or alternator/generator can produce electrical noise superimposed on the otherwise steady DC power furnished by the vehicle's battery.

This is the most common source of radio noise problems that the editor has found among the more than 350 Maryland ambulances equipped with our UHF radios. Ignition noise from spark plugs will be covered in a later issue.

Bonding of the chassis and body is important because these parts are commonly used as the ground path to the negative terminal of the battery. The better the ground path (the lower the resistance), the better the electrical system will work.

Ground loops occur, however, even with all-welded construction of body and chassis. Whenever noise-sensitive equipment, such as a radio, is grounded to the body or frame, noise from other electrical equipment can cause problems.

Figure A shows that, when a flasher turns on the rear light, electrical current flows through the light and then through the body or chassis to the negative terminal of the battery. Although the resistance (R) to the current is very low, the radio registers a "bump" in its negative path to the battery.

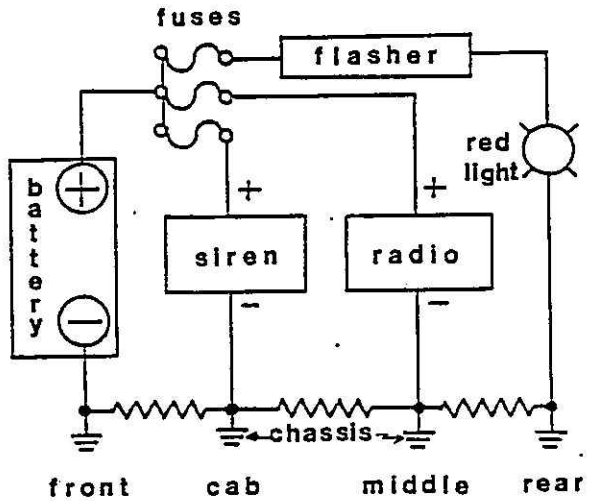

Figure A

If this "bump" is very small, the radio's operation may not be impaired. Large "bumps" are sometimes found even in new ambulances. "Bumps" in older ambulances are the rule rather than the exception, since body/chassis resistance tends to increase with age.

To avoid ground-loop noise, the negative power lead from the noise-sensitive equipment should be connected to the battery using insulated wire (Figure B), instead of grounding it to the chassis. This arrangement is recommended for all two-way radios and ECG monitor/defibrillator equipment. If the wire furnished with the

equipment must be extended to reach the battery, insulated wire as large or larger than the manufacturer's wire should be used for the connection.

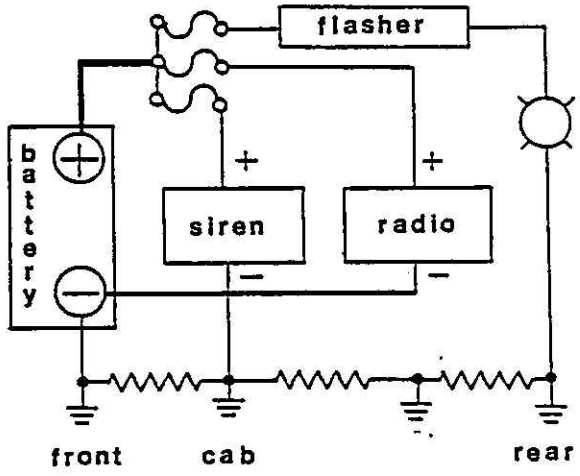

Figure B

A common feed wire to a fuse block can cause noise from one source to be coupled to another load (Figure B). Like a welded body or chassis, the heavy-guage (large diameter) line from the battery's positive terminal has a low DC resistance, but noise voltages can develop.

Patient-compartment power is often distributed with fuses or breakers housed in a box at the rear of the ambulance. This box is fed by a large common wire to the battery. To avoid ground loops, an insulated negative lead must also be run to the battery, as shown in Figure C, and a suitable filter should be connected as close as possible to the power distribution terminals.

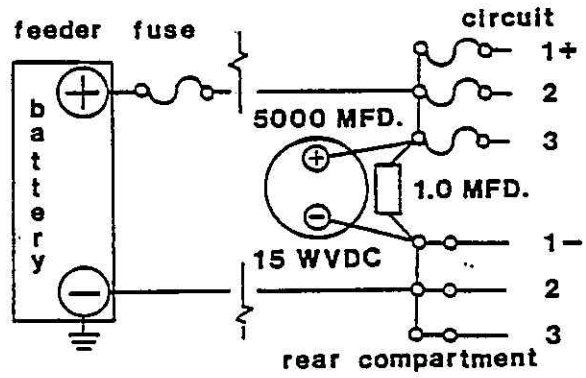

Figure C

Alternator noise is another common problem, especially in dual-battery systems that use a battery-selector switch.

As the name implies, an alternator generates an alternating current, which is then rectified and sent to the battery. The battery filters out most AC ripple that gets through the rectifier.

When the alternator is connected directly to the battery, as in Figure D, the alternator's ripple and noise are filtered by the battery before it can be picked up by the rest of the electrical equipment.

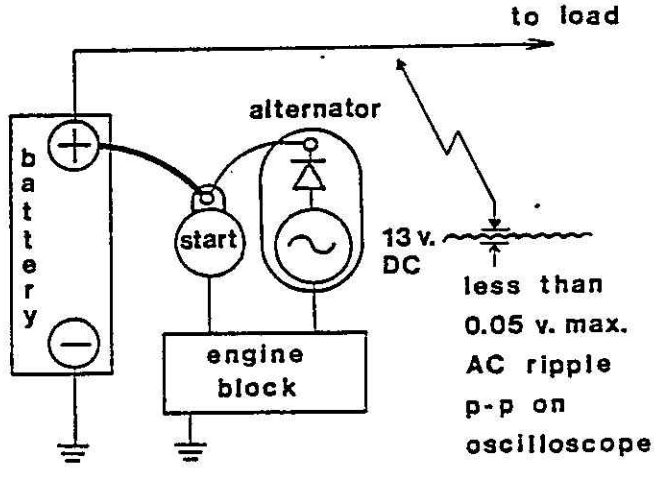

Figure D

Many dual-battery systems have a Cole-Hersee switch for selecting the battery to be used, as shown in Figure E.

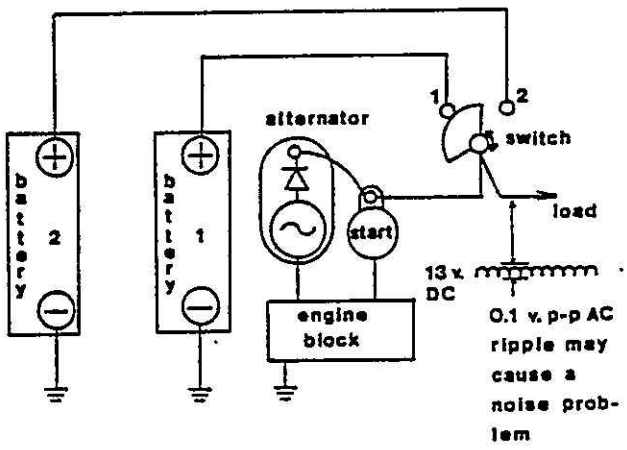

Figure E

In this configuration, the alternator is electrically closer to the load than to the filtering action of the batteries. Even when heavy cables are used between the batteries and the Cole-Hersee switch, the ripple and noise fed to the ambulance's electrical equipment are greater than they are when the alternator is connected directly to the battery.

A solution to this kind of noise problem is the power divider arrangement shown is Figure F.

The output of the alternator is connected to the center post of power divider, which feeds charging current to both batteries through heavy-duty diodes. It is important to make sure that the current rating of the divider's diodes are equal to, or greater than the maximum output current of the alternator. The diodes ensure that the battery with the lowest charge is recharged first to equal the other battery. Then, both batteries are charged to the maximum voltage set by the alternator's voltage regulator.

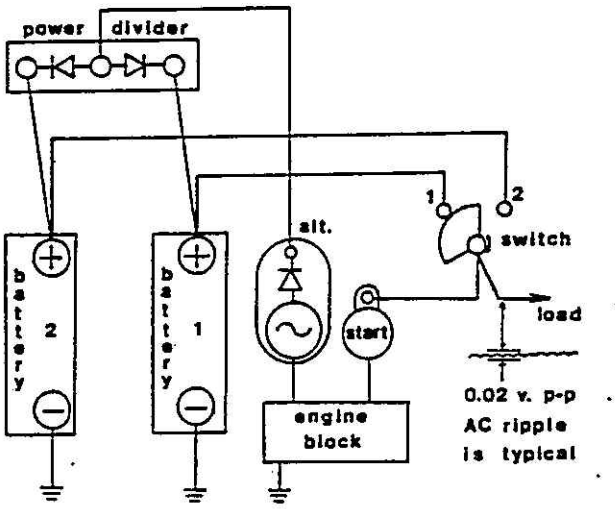

Figure F

Another advantage of the power divider is that the alternator is always connected to a battery. Thus, the alternator will not be damaged if the battery selector switch is changed while the engine is running.

The next issue of the Maryland EMSCS Technical Newsletter will discuss ignition spark noise, noise caused by alternator rectifiers, why an alternator can be bad and still charge a battery, and why an ambulance should be started and run on a single battery instead of both.

A more technical version of the above article is available upon request from:

Communications Development
Branch - MIEMSS
22 S. Greene Street
Baltimore, MD 21201

CB "HANDLE" CONTEST

MIEMSS recently acquired a "class D" Citizen's Band (CB) license as the first step toward participation in the National Emergency Aid Radio (NEAR) program sponsored by the U.S. Department of Transportation. The first MIEMSS fleet vehicle to get a CB radio will be that of MIEMSS' director, Dr. R Adams Cowley. He will be using channels 9 and 19.

The NEAR program will foster professionalsim, and use of common English, on CB channel 9. However, there is no way to stem the use of lingo on channel 19, which carries most of the routine traffic. As anyone who owns a CB radio knows, it is next to impossible to receive a civil reply to a request for assistance on channel 19 unless one speaks in the "good buddy" dialect. So, RA must now begin learning that dialect. As a first step, he will need an appropriate "handle" to respond to time and radio checks.

Suggestions are welcome. Please keep in mind that profanity is frowned upon by the FCC. The final selection will be made by Dr. Cowley, since he will be stuck with the handle.

First prize will be an autographed copy of the book, Shock Trauma. Second prize will be a shock trauma T-shirt..

Send your suggestions with your name and mailing address to:

Larry Mitchell
MIEMSS - Communications
22 South Greene Street
Baltimore, MD 21201

ALTERNATE ROUTING

Smoke signals are great for communicating through trees and can even be read from long distances in mountainous terrain. Unfortunately, a way has not been found to send ECG strips that way, nor can ETA's be sent in less time than it takes an ambulance to get where its going except with two-way radio.

Since radio signals are absorbed by trees and blocked by mountains, two-way communication between certain locations and the Central Alarm may be poor to non-existant. In many instances, however, an adjacent Central Alarm may be able to receive the signal "loud and clear" if its tone code is selected, or if the initial contact is made on the CALL-1 "open squelch" channel.

If CALL-1 is used, it is important to advise the Central Alarm operator that the call is coming on CALL-1. The dispatcher hears both CALL-1 and CALL-2 from the same base station and may try to answer on CALL-2. Once the initial contact is made, the adjacent Central Alarm can direct the call to one of its available MED channels and then patch the call back to the local Central Alarm via the EMSTEL network.

CALL-1 FOR EMRC

EMRC in Baltimore controls 33 radio base stations scattered throughout Region III. This busy center provides medical communications not only for the 150 ambulances in Region III but also for the ambulances that bring patients from other regions to

specialty-referral centers in Baltimore.

Initial contact with EMRC is made on CALL-1. No tone code is required. This contact must be brief, e.g. "EMRC, this is Baltimore County six."

When EMRC answers, "Baltimore County six, go ahead," brief remarks should be given about the nature of the communications and the ambulance's destination, e.g. "Cardiac consultation enroute to University Hospital." EMRC will then direct the call to an appropriate MED channel.

The CALL-1 channel is often busy, and the caller cannot hear the other ambulances that may be calling at the same time. Therefore, it is extremely important to keep the initial call brief, and to listen carefully for both the county and the unit number to make sure EMRC is not giving someone else the "go ahead." These measures will ensure the rapid transmission of messages. NEVER talk long on CALL-1. Just give the minimum information necessary to allow the EMRC operator to set up connections to the appropriate hospital and consultation center on a MED channel.

NEW BASE STATION AT CHESAPEAKE BEACH

Calvert County has a new base station in operation at Chesapeake Beach, thanks to the U.S. Navy for providing space for equipment and antenna at the Naval Research Laboratory. Supplementing coverage from the primary Calvert County base station near Prince Frederick, the new base station improves radio signals in the North Beach area.

The new site also provides good coverage to Anne Arundel County and the Fairhaven and Deale areas which, until now, had only marginal coverage from the EMRC base station at Crownsville. Region III ambulances close to the Naval Research Laboratory can ask the Calvert County Central Alarm to patch them back (via EMSTEL) to EMRC if normal communications direct to EMRC are not possible.

Early reports show noticeably improved coverage in northern Calvert County as a whole, including the North Beach bay-front area. Another new base station will be added to improve communications in hard-to-reach "over-the-cliff" areas bordering the bay in southern Calvert County as soon as site details are complete.

DECODERS IMPROVE COMMUNICATION

Interstate ambulance operations in western Maryland's Allegany, Garrett, and Washington counties are assisted by VHF base stations (155.280 and 155.340 MHz) in addition to the UHF base stations used by Maryland ambulances. Pennsylvania and West Virginia ambulances not yet equipped with UHF radios have VHF radios for contacting the Central Alarms in these western Maryland counties and, through the EMS Operating Consoles, for talking to the Maryland hospitals to which they are headed.

Interstate communications in western Maryland have now improved, thanks to digital tone decoders furnished by the West Virginia EMS and installed by MIEMSS. This is an inexpensive but important example of cross-border cooperation. The VHF stations originally installed in Maryland's

EMSCS for interstate communications were equipped with Continuous Tone-Coded Squelch (CTCS) tone detectors. The detectors permitted Pennsylvania and West Virginia ambulances, wanting to contact an EMSCS Central Alarm in Maryland, to transmit the prescribed CTCS tone to "open" the receiver at the Maryland base station. Unfortunately, economic considerations subsequently prevented many of the out-of-state ambulances from implementing the CTCS tone for Maryland access. The Central Alarms in Allegany, Garrett and Washington counties used to keep their VHF receivers "open" to hear any call to them. The increased use of these two VHF radio channels made "open squelch" an operational headache. With "open squelch," Central Alarm operators were bombarded with VHF traffic from hospital paging and other "traffic." As a result, their ears tuned out the VHF receivers. The operators literally would not hear a VHF call directed to them amid such "noise."

The Mid-Atlantic EMS Council's Communications Committee discussed the problem, made recommendations, and then gave responsibility for final resolution to representatives of Maryland, Pennsylvania and West Virginia EMS Communications.

As a result, the digital-tone detection equipment in the VHF radio receivers in Allegany, Garrett and Washington counties will allow the receivers to remain quiet unless an out-of-state ambulance, wanting to contact a Central Alarm in western Maryland, dials the required access code. The access code will pulse a digital command to "open" the receiver and let the Maryland operator hear the call. Thus, the operators will hear only the radio transmissions on the VHF channels that are directed to them.

BASE MON SWITCH LIGHT

At the Operating Console, Central Alarm operators can see their own transmitters "on the air" by the BASE MON light. Every Operating Console includes a separate set of radio receivers that listen to the base station's transmitting frequency. By depressing the BASE MON switch-light, operators can hear their own transmitted signal. They also can listen to another county's base station on that (selected) channel. This feature is useful for intercounty radio communication if, for example, phone lines fail on EMSTEL.

In addition, operators can tell at a glance if their CALL base station is repeating signals (on CALL-2, of course, since that is the only signal which can repeat). If RELAY ON is selected (or was selected and has not been cancelled), the BASE MON will light when the ambulance transmits. The BASE MON light shows the base transmitter "on" when the base station is receiving. If this mode of operation has not been selected by operating the green RELAY switch, and is not required, the Central Alarm operator should "knock down" the repeater by operating the green RELAY switch once, which will turn on that green switch-light lamp. The operator should then activate the switch again to turn the green lamp off. This will send a "relay off" command to the base station.

If a repeater is "up" and the operator is unable to "knock it down" from the Operating Console, SYSCOM should be notified. Either another county is repeating ambulance signals (and that county's CALL-2 base station is heard on the base monitor), or the CALL base

is repeating but will not respond to relay-off commands.

Note that the BASE MON light will light when another county within range transmits on the selected channel. This is normal.

COMMUNICATIONS TO EASTON MEMORIAL

The Talbot County Central Alarm, under the direction of Ed Mullikin, has control of EMS communications to Easton Memorial Hospital. As reported in the last issue of the Maryland EMSCS Technical Newsletter, the MIEMSS Communications Division has recently added new UHF base stations at Denton (Caroline County) and Centreville (Queen Anne's County). These stations are connected to the EMS Operating Console manned by Mr. Mullikin and his staff. Along with the original base station in Easton, the new stations will give the Talbot Central Alarm solid, three-county EMS radio coverage to support the expanding EMS programs in the mid-Eastern Shore.

NEW AUXILIARY BASE STATION

The Charles County Central Alarm now controls a new auxiliary base station at Governor Nice Bridge, as well as its original base station in LaPlata. The new base provides parallel channel capability, and improved radio signals to southern Charles County and to approaches to U.S. Route 301, which crosses into Virginia.

As soon as site-use arrangements are completed, the Communications Division will install another auxiliary base station at the Douglas Point Potomac Electric Power Company in western Charles County. This station will add channels and improve coverage in this heavily forested and hard-to-reach area. Except in winter, the otherwise beautiful forest umbrella soaks up the UHF radio signals and hides many of the roads in the area from aerial view.

PLEASE TELL US

The existing system for reporting troubles (actual outages) does not cover such problems as the location of "dead spots" in radio coverage, or minor communications difficulties. But these kinds of reports are important, too, as we try to improve the communications system.

So, please inform the Communications Division about the location of "dead spots," or about other problems in using the EMSCS by dropping a note to:

Larry Mitchell
MIEMSS - Communications
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Baltimore, MD 21201

MARYLAND EMSCS TECHNICAL NEWSLETTER

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MARYLAND INSTITUTE FOR EMERGENCY MEDICAL SERVICES

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Evaluation

June 1, 1978

MEMORANDUM

TO: Richard L. Neat, Director of Field Operations

FROM: Lawrance H. Mitchell, Chief, Communications Development Branch

SUBJECT: Technical Newsletter Number One

ITEM I - REGION III RADIOS NOW CONVERTED to operate on CALL-1, MED-2,3,4 and 8 (a selected number of radios in the City of Baltimore ONLY also have MED-7).

These Region III radios can communicate with Central Alarms outside Region III by calling them on CALL-1. The users of the Region III radios will do well to remember to remind the non-Region III station that they are on CALL-1: "HOWARD MEDIC 65, PRINCE GEORGE'S, CALL-1." Or, "CARROLL AMBULANCE 18, MONTGOMERY, CALL-1."

The Central Alarm responding on CALL-1 to these calls from Region III radios should remember two important details:

A. If you don't have anything else to match the MED-2,3,4 or 8, MED-8 is implemented in all counties.

B. The Region III radios do not have CTCS capability; therefore, you must disable your CTCS on your MED channel base station before asking the Region III radio to switch to MED-____.

ITEM II - ALL EMSCS RADIOS IN MARYLAND ARE DUPLEX and can receive at the same time they are transmitting. Therefore, the fact that the ambulance crew can "hear" the Central Alarm or hospital is no assurance that the ambulance radio is not transmitting.

In fact, we have handled a number of Trouble Reports that turned out to be that either the MDT switch on the Rear Control Head was operated (IN POSITION) or that the PTI switch on the Headset was depressed (operated) by something resting on it.

Of course, in radios other than Region III, this condition can last for only three (3) minutes or so, at which time the ambulance radio will sound a rather loud alarm tone and shut its transmitter off. The transmitter can be re-keyed ON by either removing the keying input for a moment or by turning the power

off and then back on. Please do not play this game: if the loud tone alarm sounds, check for the microphone and headset PTI switches and, especially, the Rear Control Head's MDT switch.

ITEM III - REGION III RADIOS HAVE 2300 HERTZ MDT SUBCARRIER but are being changed to the statewide 1400 hertz MDT SUBCARRIER STANDARD. A few Region III radios assigned to companies that regularly run to or need to send ECG strips to Region I, II, IV or V hospitals have already been converted.

Region III hospitals and the EMRC, meanwhile, are not affected: they automatically receive and decode (demodulate) either 2300 or 1400 hertz subcarriers.

ITEM IV - ALL MARYLAND EMSCS RADIOS can contact the EMRC in Baltimore (for checks enroute a Specialty Referral Center, for example). When in range of EMRC base stations, virtually anywhere in or near the City of Baltimore and Counties of Anne Arundel, Carroll, Baltimore, Harford or Howard, CALL EMRC ON CALL-1.

For best results when calling EMRC, turn off the CG button-switch on the front control head and also put the monitor switch on the side of the front microphone hanger in the MONITOR position.

ITEM V - BE ALERT TO ABNORMAL CONDITIONS as several Central Alarm operators have to catch problems early before they become real headaches. Wicomico County Central Alarm operators recently noticed a regular, repetitive breaking of squelch one evening and put 2 and 2 together that only one ambulance (from adjacent Somerset County) was on the road. They asked the ambulance crew to check their radio and, sure enough, the red transmit light on the front control head was flashing on and off all by itself.

Early pickup of this failure was fixed the next day and prevented an unidentified "interference generator" from wandering the highways causing lots of hard-to-find problems.

ITEM VI - DEFINING TROUBLES for Trouble Reports is another very BIG help to us in Communications Development Branch (CDB). With definite information, we can better send the right help to the right place.

A recent example showed an ambulance unable to transmit through unless the Central Alarm disabled the CTCS. Rather than report the first and obvious "ambo cannot transmit with CTCS," the Central Alarm called out another ambulance and discovered that they could not receive it either. Result? The Trouble Report was for possible failure of CTCS at the base station. The repairman was indeed sent there, found and fixed a serious problem in the base station receiver.

ITEM VII - IN A MARGINAL SIGNAL AREA, another wide-awake Central Alarm operator called an adjacent County's Central Alarm on EMSTEL and asked them if they could copy the ambulance. They could, established contact and patched the ambulance back to the other Central Alarm (via EMSTEL, of course) for an important consultation.

ITEM VIII - MSP HELICOPTER AIR BASES ARE NOW ON EMSTEL to speed up the dispatch and coordination functions that must occur between the helicopter and SYSCOM on every MEDEVAC mission.

While you may use any means you wish to summon a Maryland State Police helicopter for a MEDEVAC mission, you may find it quicker and easier to call SYSCOM (who must be involved anyway).

LHM:me

Attachment:

cc: Technical Mailing List Regions I, II, III, IV, V
Regional Coordinators Regions I, II, III, IV, V
EMRC
SYSCOM
George Atkinson, Chief, Communications Operations Branch