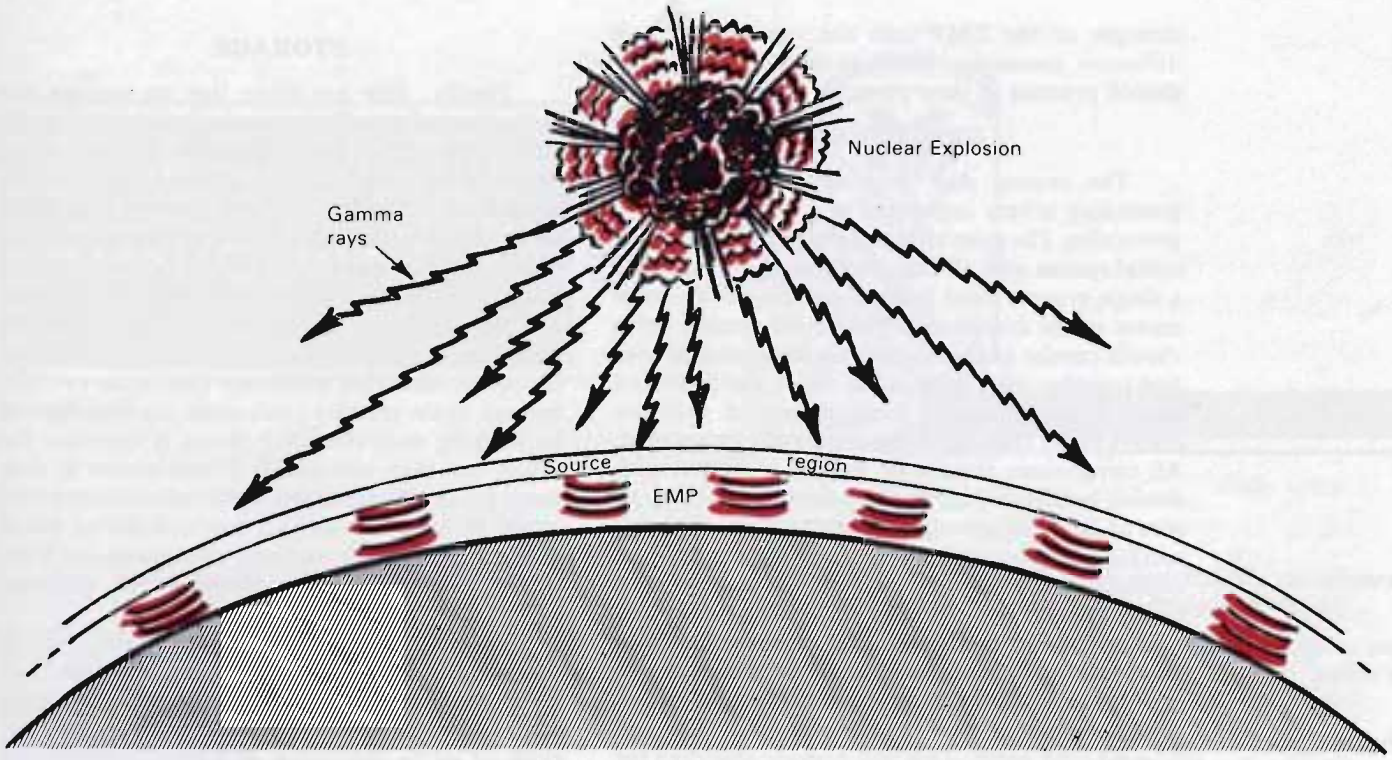

Field expedient Nuclear Electromagnetic Pulse (NEMP) protection for commanders

by Maj. Larry H. Will

The use of nuclear weapons on the battlefield is always a distinct possibility. Aside from blast and thermal effects, high altitude nuclear explosions radiate a radio signal called the electromagnetic pulse or EMP which is of severe intensity and which can propagate over thousands of kilometers. This EMP signal damages electrical and electronic equipment in much the same way that lightning does. But, there are four planning steps a commander can use to minimize the effects of EMP. They are siting, grounding, maintenance and storage.

The Department of Defense has, for several years, been involved in EMP hardening of military and selected civilian communications facilities to improve reliability. During a nuclear event, the intense release of radioactive particles and rays through electron recombination[1] generates a very strong, very short duration radio "signal." This signal is 10 to 100 times more powerful than the more familiar radio static generated by ordinary lightning. Since it is a radio signal in the true sense, it can be picked up by antennas, telephone lines, electrical power cables, data circuits and even metal cabinets and buildings. If no special precautions are taken, the EMP will enter into sensitive electrical and electronic equipment, damaging diodes, transistors and integrated circuits; altering digital data states; tripping circuit breakers and fuses; and burning wiring insulation. In order to maintain communications in the tactical environment, field expedient EMP protection is required. A good side effect will be improved resistance to lightning induced damage.

SITING

The first step in tactical EMP protection is equipment and facilities siting. Where possible, electronics facilities should be in enclosed metal buildings or CONEX containers or be located underground. Shielding, either by the earth or by a closed metal structure, greatly reduces the strength of the EMP and minimizes damage to equipment. Bury all electrical and electronic interconnecting cables as deeply as possible between various vans, semipermanent facilities, and external circuits such as overhead telephone wires and antenna masts. Even a short run underground, say from the base of an antenna mast to a van, will help reduce the

strength of the EMP into the van. As with all defensive measures, EMP protection upgrading should proceed as time permits.

GROUNDING

The second step is grounding. Equipment grounding is very important in dealing with EMP protection. The most effective grounding system is a radial system with all vans and shelters returning to a single ground point located approximately in the center of the compound. The actual ground point should consist of three to six separate ground rods tied together with large cable. Since the EMP is a short duration signal, multiple ground rods are always better than one in carrying away the current. All connections should be welded or bolted with double lockwashers to insure a firm connection. Be sure all lightning arresters are properly installed and working. Replace any suspect components. Special consideration should be given to the underground tactical operations center (TOC), when employed.

A counterpoise consisting of several copper wires laid out in the form of a grid and connected at each crossover and tied to the main ground system should be placed over the underground TOC and covered with earth. This will provide shielding for the equipment in the TOC. The entranceway, if time permits, should be lined with sheet metal to form a tube approximately six feet long. This tube or short tunnel acts as an electrical waveguide beyond cutoff[2] and prevents the EMP from entering the TOC through the doorway. This, coupled with the counterpoise will greatly improve the survivability of electronic equipment in the TOC.

All vans and shelters should have the shelter grounds firmly connected to the main ground system. The same is true for equipment located in metal buildings. The building shell and frame should also be grounded. If available, all interfacility wiring should be run in conduit. This is especially true for any unshielded telephone and data cables. The intent of this grounding is to insure that the EMP signal is dissipated in the earth and not in the sensitive input circuits of electronic equipment.

MAINTENANCE

Next, the commander should review maintenance procedures. All signal and electrical cables should be inspected particularly as to the integrity of the shield. The shield not only prevents hum and noise, but if intact, keeps the EMP on the outside of the cable away from the signal circuits. If the shield is broken, it becomes an antenna rather than a ground coupling the EMP directly into low level receiver, telephone or data circuits. In this condition, a broken shield is worse than no shield at all. If facilities are in place for long periods, have connections taken apart, inspected for corrosion, cleaned and reinstalled. Insure that all modification work orders regarding EMP protection are installed. More and more electronic equipment is being modified for improved EMP protection.

STORAGE

Finally, here are some tips on storage and utilization of standby equipment. Store all spare telephones, radios, data equipment, generators and switchboards with ALL cables disconnected. Remember that the EMP will damage equipment with the power OFF. If possible, store equipment in closed shelters, vans, or CONEX containers. Any backup equipment, which must be ready for rapid use, should be in place where needed with all interconnecting cables ready but disconnected from the equipment. This will insure that in the event of damage to the primary equipment, the standby will be working once the EMP threat is over and the cables are then connected. If equipment is shut down for any reason, say a strict radio silence which would be lifted at a known time and during which no net monitoring is required, all antenna and RWI cables should be disconnected to improve survivability.

Training on the modern battlefield assumes operation in a nuclear environment. The effects of EMP can damage friendly electronic equipment from enemy or friendly nuclear events that occur close or up to thousands of kilometers from the FEBA. As a commander, you can improve your communications survivability on the nuclear battlefield by careful siting, grounding, maintenance and storage of electrical and electronic equipment. By following these simple procedures and improving your EMP defense as time permits, you stand a greater chance of winning on the battlefield. As a side benefit, the survivability of your equipment from lightning induced damage is also greatly improved.

END NOTES

1. Capt. Robert C. Raiford, "EMP," THE ARMY COMMUNICATOR, Vol 4, No. 2 and Vol 4, No. 3, p. 6.

2. "Nuclear Electromagnetic Pulse (NEMP) Protection," *TM 5-855-5,* HQ, DA, 15 Feb 74, chapter 7.

FURTHER READING

Beck, G. and D. Clark. "Electromagnetic Pulse Protection for WHDH/WCOZ" Defense Civil Preparedness Agency, DOD, July 1977.

Fisher, Dr. C. R. and Dr. D. B. Nelson. "EMP and The Radio Amateur" *QST* Sept. 1975, pp 40-43.

"The Electromagnetic Pulse (EMP)" Defense Nuclear Agency, date not listed.

King, Capt. Michael A. and Paul B. Cleming. "An Overview of the Effects of Nuclear Weapons on Communications Capabilities" *Signal Magazine,* January 1980, pp 59-66.

Maj. Will is a reserve officer assigned as a MOBDES instructor at Ft. Gordon, GA. As a civilian, he is Assistant Director of Engineering for New Jersey Public Television.