MARS goes to the RACES

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In August 1984, The Federal Emergency Management Agency (FEMA) and the American Radio Relay League (ARRL) signed a Memorandum of Understanding (MOU) between their two organizations.[1] FEMA's director coordinates numerous local, state, and national civil emergency plans and agencies into one cohesive group. One of FEMA's missions is administering the Radio Amateur Civil Emergency Service (RACES).

The MOU has great significance for the Military Affiliate Radio Service (MARS). MARS participants know that their nets will continue to take an increasingly active part in disaster communications. Certainly, with the expertise in the field which is held by MARS members, participation in disaster drills under the auspices of RACES will continue to be of great value. Many MARS stations and net members are highly visible and active members of RACES. It is to MARS groups at the civilian level and at the military post level that this article on an emergency communications kit is directed.

The MARS System needs a Type Standard emergency fly-away kit for communications support of emergency personnel. MARS members are normally located in areas where floods, hurricanes, natural disasters, massive communications and power outages often occur. Most of these disasters have the potential to be immediately served by elements of FEMA.

MARS and other amateur radio operators of the ARRL have a *proven,* long-term track record of providing emergency communications support. Every amateur radio publication recounts numerous communications crises that have required amateur radio operators to step in and roll up their sleeves.[2] This support includes everything from providing a few operators on a weekend directing traffic at a foot race to training for the support of civil communications after nuclear war.

illustration by Mike Rodgers

Between those two extremes is the need for a common set of tools: an emergency radio kit.

Based upon the need for field emergency communications support, the authors developed and are recommending the following set of standards describing low-cost, state-of-the-art radio and data communications support to MARS and related organizations:

a. Personal communications of a non-classified nature between individuals on foot, in vehicles, or in a base station mode during an emergency, non-combat situation.

b. Long-haul communications using single-side band (SSB) voice radio, CW (morse code) and radio teletype (RTTY).

c. Satellite communications using data, voice and facsimile, at present, using Amateur space platforms, and, with a future capability for "store and dump" satellite message handling when the 1986 Amateur satellite system is launched.

d. Low cost for individual items and moderate cost for a complete, packaged installation.

e. Capability for point-to-point contacts, nets, Packet Message and mailbox functions, plus telephone health and welfare traffic patching.

During research for this article, one military organization that was contacted responded with the results of a "hot priority project" purchase of a similar fly-away communications kit. The project provided health and welfare communications to a localized potential emergency area. The area consisted of approximately 50 square miles, with rolling hills and a 2000 foot mountain in the middle. It was, essentially, the type of area that many of us in CONUS can see by looking out of our office windows.

The results of the purchase and fielding to that 50 square mile area proved true the old Army axiom "When you want something right away and really badly—you'll get it, *really bad!*. Design and purchase of a system was required in 30 days or less. The product, from a "do everything" contractor, was a customized, vendor specified (sole-source justified) system costing several hundred thousand dollars.

The package our collegues bought was either created by avaricious contractors or by personnel ignorant of how to field "quick and dirty" communications systems. The professional's answer had only a UHF repeater on the mountain and a supply of hand-held transceivers. The price tag? $2500 apiece for the hand-held transceivers plus $120,000 for a repeater transceiver system. The system was not successful in providing for the communications needs of the requestors.

Fortunately, most of us are not forced into reacting to such a quick fused requirement. Equally fortunate, MARS can purchase equipment using a variety of pocketbooks, including personal funds of the members, club funds, donations by military post Spouse's Clubs[3], and donations directly from commercial vendors.

Volunteers can buy any type equipment they want to buy, hook it up and operate it anytime, from any place, just as long as it is operated legally within the Amateur Radio Service and appropriate MARS directives.

With the foregoing experiences kept in mind, we searched for a system to be packed into a couple of footlockers and operated from a shipping pallet loaded on the back of a truck. We came up with a system that accomplishes all of the requirements that the military emergency team had originally asked the contractors to provide, plus the capability for more sophisticated communications than originally thought possible.

The system is the "Quick and Dirty Throw-away Radio System" or QUADTARS. QUADTARS is an inexpensive, non-secure, rapidly deployable, self-contained, miniaturized radio system suited for use by personnel assigned to MARS operations. QUADTARS is capable of local UHF FM communications, directly between hand-held transceivers, or by retransmission through a repeater. Also available is ACSCII and RTTY data simplex communications, inter-tie with a high frequency, SSB/CW transceiver, telephone patching in all modes, and relay through satellites presently in use by the Amateur Radio community.

Each of these capabilities is existent within certain discreet pieces of equipment presently on the market and in use by Amateur operators. What the QUADTARS concept does is draw all items together, hook them up and make them work. The individual items of equipment are inexpensive enough so that two or more of everything can be purchased, and breakage would not pose a personal disaster to the owner.

There are some obstacles to use. Agreements need to be reached on use of amateur radio frequencies in the satellite mode of operation by MARS operators who are either not licensed or whose class of license does not permit such operation. Ordinarily, use of the Third Party rule would permit non-licensed personnel to speak or send data. Third Party traffic transmission authority is not granted by all foreign nations, however.

Lack of Third Party authority would require a quickly negotiated agreement between the US State Department and the government of the country in which disaster relief was rendered. Such an agreement was provided to Amateur operators in Grenada during operation URGENT FURY.

The concept of QUADTARS is rapid and reliable emergency communications. That demands that users be knowledgeable of the communications systems which are discussed in this article. Amateur radio operators holding a Technician Class or higher license who have had some previous experience in field communications (ARRL "Field Day" contesting, for example) fit the profile, perfectly.

Setting up and operating QUADTARS should pose few problems to the average MARS volunteer; they are licensed amateur radio operators with expertise in message traffic handling and sophisticated equipment. Personnel who may have initial difficulties in operating QUADTARS would be the borrowed military manpower assigned to US Army MARS stations.

MARS station soldiers are generally familiar with only US Army equipment, and lack sophisticated communications skills. Due to the severe lack of adequate manning for MARS stations worldwide, it is a rare MARS station that has an "Old Timer MARS Operator" on board.

There are, of course, areas within the QUADTARS concept where the system users could fail to perform adequately. Those areas are common to many emergency communications support organizations and can be minimized by careful planning, practice, and frequent emergency action exercises.

What is QUADTARS and what does it do?

Advantages:

- It is micro-miniaturized (shirt pocket and briefcase size)
- It uses common batteries and/or solar cell recharging of common NiCads
- It uses commercial, off-the-shelf technology
- It is low-cost
- Original and replacement devices can be quickly procured
- It has multi-power source SSB/AM/FM/CW/FSK HF transceiver
- It is frequency agile
- It is repeater capable
- It features low output power on point-to-point, walkie-talkie comms (less likelihood of interference)

Disadvantages

- It is non-secure
- Some frequencies fall within common scanner receiver bandspread
- It is a Non-GSA Contract Schedule item
- It is Non-MILSPEC (not hardened, etc.)
- Some equipment of non-US manufacture (produced in Far East, assembled in USA)

QUADTARS kit hardware items

Repeater transceiver: Solar powered, using a 12-volt "Gel-cell" or NiCad battery pack for power during darkness. The repeater consists of a 15-watt transceiver, equipped with Digital Coded Squelch System. Approximate size is the same as an airline carry-on bag; it is built into a high-impact, waterproof camera case. The solar cell panel is approximately 12″x18″ and is integrated into the top panel of the case. The antenna is an aluminum pole structure which collapses into an 18″ length package. Approximate cost: $1400.

Back-up power generator: (10-amp, 13.8-volt or 500-watt, 120-volts AC), used to provide a "floating charge"

capability to two deep-cycle marine batteries (12-volt, 100-amp) wired into a 12-volt buss. The 12-volt buss provides plug capability for low voltage power of QUADTARS equipment. The generator itself is an ultra-quiet, lightweight, miniaturized 4-cycle Otto cycle generator using either 20-lb propane gas tanks, or gasoline. Weight is 25 lbs less the propane tank, and can be back-packed. Operates four hours on a tank of gasoline; 20 hours on a large tank of propane. Approximate cost: $400.

Personal transceiver: 100 mw/2 watt (operator switchable power output) hand-held with belt clip, lightweight headset with boom mike and earphone; rubber duck antenna, NiCad batteries; alligator clips to car battery, universal voltage (worldwide) wall socket power transformer plug, solar power cells, or replacement of NiCad pack with modular pack holding four AA type batteries. Hands-off headset has a user selected voice actuated mike capability. Approximate cost: $325.

Microcomputer data send and receive terminal: A micro-miniaturized portable computer using a Read Only Memory (ROM) cartridge containing an assembly language Radio teletype send/receive system. Output speed from 60 baud to 300 baud. The computer is directly connected to either the HF radio or telephone lines. An adaptor cable, terminated on one end with plugs fitting the hand-held transceiver's microphone and on the other end with a plug used by the microcomputer for telephone communications, connects the computer to the radio. The RTTY Terminal Unit (TU) is built in. Sending and receiving teletype includes the use of packet radio "message mailbox" capabilities. Approximate cost: $925.

Miniaturized base station: Continuous digital tuning HF transceiver, capable of SSB, AM, CW, FM, with RTTY/ASCII/ASCII Packet, AMTOR, transceiving capability when interfaced to the microcomputer terminal. Concurrently, the transceiver can be used in a stand-alone mode for long haul intercontinental communications, or with an inter-tie modem to cross connect the UHF hand-held transceivers and/or repeater transceiver into the HF transceiver, thus enabling long-haul HF transceiving using the individual hand-held UHF transceiver. This function includes telephone patching but requires HF radio operator intervention to effect the patch.

Automated log book function: Includes selection of volatile or non-volatile memory storage of frequencies, net information, logging of net members and standard or multiple use "book" formatted messages.

Two antennas are carried with QUADTARS, and are 100% backed up with spares: The UHF antenna used with the relay repeater is a vertically polarized, aluminum construction dipole. The support poles are friction fitting aluminum antenna tubing with adjustable clamps which attach the base pole to a metal stake driven into the ground. The HF antenna is a commercially manufactured wire dipole with an integral 50′ coaxial cable, balun and support wires. It covers 1.8 through 30 MZ with the QUADTARS antenna tuner. The HF antenna, of course, must be elevated above the ground at least 30 to 40 feet to be effective. Use of the pole and nylon rope components from either an OE-2354 or AN/RT-292 antenna system can support the HF antenna. Normally, the wire antenna would be strung between trees or buildings.

This generic prescription list recommends neither for nor against an individual trade name item. What the potential purchaser should maintain are the overall specifications contained in the QUADTARS concept. There are only one or two options which provide packet radio send and receive capability. However, there are several different miniaturized HF miniature transceiver models which could be selected for QUADTARS.

The only items which are standard brands in QUADTARS are the Army wooden footlockers and the plywood floored operating pallet. The rest of the equipment is not brand name dependent. The QUADTARS concept demands efficiency, portability, high technology, and reliability. Keeping those constraints in mind during production of a QUADTARS system will yield an emergency communications system that assembles easily and allows the volunteers to get down to the business of helping other people within minutes after arrival on the scene of disaster.

Endnotes

1. Williams, F. Dale, "FEMA Communications, from the Top Down", QST Magazine, November 1984, pg 60, 61.
2. Halprin, Robert J., "Public Service", a monthly column in QST Magazine.
3. An example of outstanding and continuing support by the local Officer Wives Club can be seen at MARS station AEMIUS, the HQ, USAREUR, Command MARS Station.

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