Radio Relay International

Training Manual

INDEX

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DISASTER COMMUNICATIONS PLANNING

The information contained in this book is designed for the radio amateur who is relatively new to the field of public service communications and traffic handling. This material was originally intended to be a guide to message traffic handling activities for members of the Michigan Net, QMN. However, as this document was developed, the author began to consider the importance of all radio amateurs having a basic understanding of the various common modes and methods used in public service communications activities. It seemed wise to expand the scope to include some general guidelines pertaining to common EMCOMM activities. You will find a variety of guidelines on such subjects as radiotelegraph and radiotelephone nets, Skywarn networks, emergency communications preparedness, and so forth. Be aware that this information is not, in and of itself, complete. It is intended to supplement the excellent information already available in other publications.

It is the author's recommendation that the newcomer to public service communications review additional training information provided by Radio Relay International such as the Field Manual (FM-001) as well as associated power point presentations and videos. Up-to-date information about RRI activities is available at the RRI Web Pages:

www.radio-relay.org
www.facebook.com/radiorelayinternational

Much of the information contained in this book may be of value to emergency planners, and others employed in the emergency management field. Please feel free to share this information with your local emergency management director, 911coordinator or others charged with the responsibility of emergency communications ("EMCOMM") planning.

What Would Happen?:

Let's imagine for a moment: A Category 4 hurricane is occurring on the United States Gulf Coast. Significant damage is anticipated and the storm is at its peak. What's happening to infrastructure in the area?

First, widespread disruptions are occurring in the Public Switched Telephone Networks. Provided local central offices ("CO") remain intact, there may be no service in many areas served by overhead cables. Many homes, businesses, and public buildings may have damaged drop pairs or may have no intact route to the CO. Those telephone circuits that are working may be unavailable due to the numerous calls to public safety agencies, relatives, hospitals, and various service agencies being routed through the switch. Long-distance services may be disrupted as well by excessive demands on circuit capacity. In short, reliable dial-tone telephone service is questionable or nonexistent.

Cellular telephones are not faring much better. Assuming mobile switching offices ("MSO") are intact (one office may serve several counties), a significant number of cell sites could be isolated by disruptions occurring within the Public Switched Telephone Network. Additional cell sites

may have damage to towers, antennas, or transmission lines. Because cell sites often use "float cells" (deep-cycle storage batteries) for emergency power, even more cell sites are being lost due to on-going power outages. As time goes on, this situation will become worse as more sites drop off-line as their float cells discharge.

Unfortunately, this is not the worst problem with the cellular mobile data networks. The capacity to process calls through these systems is limited. As numerous individuals try to use cell phones as a communications resource, they find only a "system busy signal". Repeated attempts to connect are necessary or the user must rely on text-messaging, if the network is operational.

Police and fire service radio systems are doing much better, but even these systems have limited capabilities. Only a certain volume of communications traffic can be handled over these systems at any time. Almost instantly, all available channels are packed with emergency and high-priority traffic. All unnecessary administrative messages are deferred, but even this is not always enough to restore efficiency to systems already at the breaking point.

As mutual aid is invoked and additional agencies from outside the area arrive, such as state police, nearby county sheriff agencies, Army National Guard personnel, and so forth, emergency response personnel quickly learn that many of these agencies have no effective way to communicate with each other! Even those agencies that can be linked via talk groups within the trunked radio systems are occasionally hampered by differing radio procedures and protocols, thereby "gumming-up" the communications situation even further.

Of course, other problems are arising for relief agencies. Numerous individuals are reporting to shelters. Everyone is anxious to let relatives know they are OK. Unfortunately, the limited phone service has created a need to dispatch welfare messages out of the area. In addition, these agencies need to communicate with key facilities outside the area, which may be located hundreds of miles away.

Some individuals try the Internet, but this too relies on the Public Switched Telephone Network. The Internet, like cellular mobile data networks, requires an extensive distributed network of switches, routers, fiber optic cables and central offices.

While some agencies have access to high frequency radio networks and satellite telephones, these facilities are also limited in both capacity and flexibility. Some NGO and relief agencies will have no access to these capabilities.

In short, all "heck" is breaking loose!

This is just the tip of the iceberg. Take a few moments and imagine a similar situation for yourself.

THE BASICS

Adequate pre-planning for an emergency requires a basic understanding of emergency and disaster communications theory. Only through an understanding of rather "predictable" events common to all disasters can we begin to plan, or implement, a framework through which preparedness can occur.

The Emergency Management Cycle:

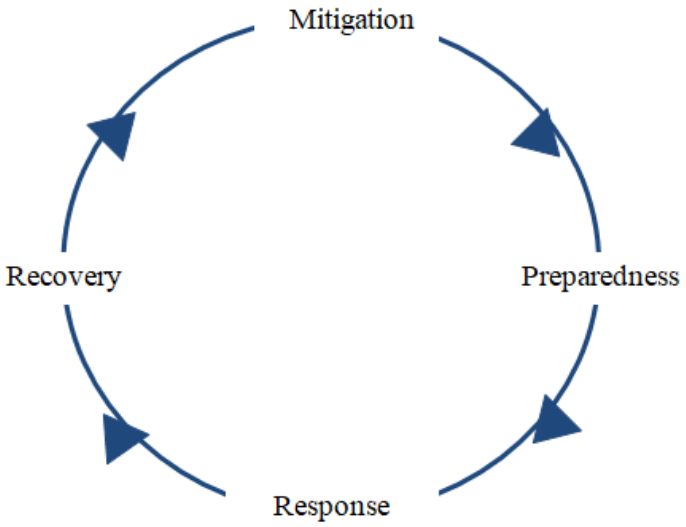


Fig. 1 The Emergency Management Cycle

The foundation of any effective Emergency Management Program is the "Emergency Management Cycle". This cycle can be broken down into four stages, which by nature segue into each other. The process begins with the first stage of Emergency Management called **Mitigation.** The process of Mitigation can best be described as "lessening the impact of disaster on the community, infrastructure and one's resources through design, engineering and construction." Some common examples of mitigation are flood control projects, tie-down regulations for mobile home parks, or the installation of "hurricane straps" on trusses during the construction of a new home.

Once mitigation steps have been taken, the cycle moves into the **Preparedness** phase. Common examples of preparedness include the training of emergency responders, stockpiling of disaster supplies, the development of an emergency plan and standard operating guidelines, institution of a set of on-going emergency drills and exercises, and so forth. These are steps, which lay the foundation for effective response to a disaster situation.

When a disaster occurs, the cycle enters the **Response** phase. During this phase, all available resources will be mobilized in response to the disaster situation, including law enforcement, fire

service, public health, sheltering, emergency public information, and so on. Ideally, the roles and responsibilities of each of these agencies will have been clearly defined in effective *Emergency Action Guidelines* ("EAG"). These guidelines will ensure that services are not duplicated and that each emergency response function is carried out in a coordinated and efficient manner.

As the disaster "winds-down," the **Recovery** phase begins. This might also be called the "rebuilding" stage. As life returns to normal, and the community begins to rebuild, it becomes necessary to consider methods which will lessen future impact when a similar disaster occurs at some future date. It is here that the Mitigation concept begins to blend with the Recovery stage. As public infrastructure and private property are rebuilt, mitigation steps are taken to ensure that the impact of future disasters is less severe. Therefore, it might be said that the entire process is a continuous cycle beginning, and ending, with Mitigation.

Hazard and Vulnerability Analysis:

Before one can put the Emergency Management Cycle to work, it is first necessary to perform a *Hazard and Vulnerability Analysis*. Through this process, disaster services organizations determine the frequency and occurrence of disasters within their area of jurisdiction. This process allows an organization to begin implementing effective and realistic mitigation and preparedness steps. In the case of an emergency communications organization, it is necessary to determine the potential vulnerabilities within available telecommunications systems.

Conducting a hazard analysis can be quite simple. Those disasters that present the greatest threat to the community in terms of risks to life, health and commercial communications infrastructure, as well as economic impact and frequency of occurrence should be planned for first as the Emergency Management Cycle is implemented. As time and resources allow, less significant disaster risks can be addressed. For example, one need not worry about earthquakes in Michigan's Upper Peninsula. On the other hand, if a major interstate highway and two rail lines pass through your community, a hazardous materials incident is likely.

An easy way to conduct a Hazard Analysis is to request a copy of the "**State Hazard and Vulnerability Analysis**" from your state emergency management agency. Many state EMAs issue a publication describing the frequency and occurrence of disasters based on historical data. Other sources of information may come from newspaper archives, county or city records or simple common sense.

Once a realistic understanding of the type and frequency of hazards for one's area has been developed, it is then necessary to examine carefully the vulnerabilities within one's telecommunications resources. The concept is to ask, for example, "What would happen to network A or resource B?" if a disaster occurred.

When applying vulnerability analysis to telecommunications systems, consider, for example:

- Widespread loss of AC power mains
- Lightning damage and power surges

- High wind and radial ice accumulation on towers
- Earthquake damage to telephone cables and related infrastructure
- Excessive demands on available circuit capacity
- Loss of key facilities (central office, mobile switching office, etc.)

An interesting way for an EMCOMM manager to approach the issue of vulnerability analysis is to conduct a "Table-Top" Emergency Exercise. Essentially, a tabletop exercise consists of presenting a scenario of a disaster to a group of participants and asking for their feedback on how they would respond. There is no time-line nor is there "formal" message input into the drill. The idea behind the exercise is to encourage responsible individuals to consider how they might respond to a given scenario. Open discussion should be encouraged, and the critique of the exercise should occur in real time, as the scenario evolves and ideas and solutions are presented. It is the role of the exercise coordinator to inject new problems as necessary to maintain the evolution and "flow" of the event. This insures that everyone in the room has an opportunity to discover what might go wrong with a given solution.

Emergency communications managers are encouraged to carry out occasional exercises of this type with their staff and network managers. For example, a scenario could be created describing a disaster, such as an F4 Tornado striking a 12-mile-long path through town. Problems would be injected into the exercise to see what solutions the participants might generate. Consider such dilemmas as loss of AC mains at communications sites, damage to a local telephone central office, or inadequate circuit capacity for large amounts of emergency traffic. Amateur radio EMCOMM organizations may want to consider such problems as loss of staff due to members being directly impacted by the disaster or the need to allocate volunteer resources in shifts. Other problems common to amateur radio organizations include loss of a local VHF repeater, the lack of individuals with magnetic-mount antennas and cigarette lighter plug adapters, loss of data radio nodes due to widespread power system disruptions, and so forth.

Such exercises should not only identify vulnerabilities, but also begin the process of determining what steps may be taken in advance to limit damage to systems or to protect an emergency communications program from disaster related problems.

The Emergency Management Cycle Applied to Telecommunications:

Mitigation

As stated earlier, *Mitigation* should be the first step in preparing for disaster. Generally, telecommunications mitigation consists of those steps taken to ensure that existing communications systems survive a disaster as nearly intact as possible. Some examples of mitigation steps as applied to communications systems include:

1. Installing, or retrofitting, communications systems using good engineering practice. In other words:
   - Proper bonding and grounding at communications sites.
   - Installation of surge suppression equipment on data circuits, phone lines, computers, etc.

- Installing redundant systems, back-up telephone service, and so forth.
- Ensuring that towers and antennas can withstand minimum ½-inch radial ice during high wind events to 70 MPH.
- Equipment inspection and maintenance policies.

2. Installing stand-by generators and/or battery backup systems for:
   - Repeaters
   - Remote receive sites
   - Base/dispatch Installations
   - Office PBX systems and necessary equipment/lighting
   - Computer systems
   - Emergency Operations Centers
   - Key stations

The competent communications manager takes a careful look at each telecommunications resource and asks: "What would happen to this system in the event of…." He then asks, "How can I prevent this from damaging my system?"

For example, a 911 Center or Emergency Operations Center ("EOC") should make sure that an alternate cable, traveling along a different route, is available to the telephone company central office. That way, if a contractor with a backhoe cuts the primary telephone cable servicing the Public Safety Answering Point (dispatch center), an alternate path can be quickly established using the secondary cable.

An amateur radio club may wish to install battery backup at its main repeater facility as well as its remote receive sites to ensure continuing service in the event of a widespread loss of electrical power. Likewise, the individual radio amateur may wish to install a standby generator at home to keep his equipment on-air in time of emergency. Solar panels and gel-cell batters may allow for continued operation when gasoline is in short supply.

Preparedness

Once everything has been done to ensure critical systems will survive a disaster as nearly intact as possible, the next step is **Preparedness**. During this phase of the emergency management cycle, we begin to develop the capabilities and secure the resources necessary to effectively respond to, and support a disaster operation. Generally, preparedness consists of:

1. Installing and maintaining survivable communications systems.
   - High Frequency Radio
   - VHF Simplex Systems
   - Satellite Telephone Systems
2. Testing redundant systems on a regular basis.
3. Preparing packages of up-to-date message forms and administrative materials for dispatch to EOCs, command posts, shelters, etc.
4. Providing drills and test alerts for key communications personnel
5. Instituting a program of regularly scheduled emergency exercises (e.g. orientation, drill,

tabletop, functional, full-scale, etc.)
6. Drafting and distributing an effective emergency plan.
7. Encouraging participation in traffic networks, weekly training nets, field days, etc.

Communications Systems:

Understanding the basic characteristics of various communications systems is critical to developing the resources and capabilities necessary to effectively *prepare* for a disaster situation. Generally, there are four basic characteristics, which must be carefully considered when examining a communications system for its suitability for an emergency management function. These characteristics are:

Survivability

It is important to remember that, once mitigation steps have been implemented, the first and foremost responsibility of any EMCOMM manager is to ensure that a survivable communications system is in place! The availability of a survivable communications system will not only allow one to coordinate the restoration of more flexible and "high-tech" systems, but will allow one to communicate the highest priority traffic when all else fails.

For example, public safety agencies should consider maintaining a basic operating VHF simplex or repeater system, even if upgrading to a new 800-MHz trunked network. Such systems can be tested periodically with volunteer police reserves or during community events such as parades, festivals, and so forth.

Radio amateurs should not overlook the importance of VHF simplex capability or traffic networks. Don't overlook high frequency capability, including radiotelephone, radiotelegraph and digital networks. Ensuring that operators are available to conduct operations using each of these modes is critical to maintaining survivable amateur radio communications. One might be surprised at how effective a radiotelegraph net can be in time of emergency!

Generally, survivability can be achieved in two ways; either through redundancy (as in the case of the telephone company), or via simplicity, decentralization and open architecture (as in the case of the Amateur Radio Service). In the latter case this usually means minimal reliance on complex infrastructure (as in the case of HF or VHF/UHF simplex radio).

Flexibility

Once one has ensured that reasonable access to a survivable network is in place, the next step is to look for back-up systems, which are flexible. These systems are often portable systems or systems with an "open architecture" which allow easy deployment and temporary configuration during emergency or unusual situations. Some examples of "flexible" systems include:

- VHF and UHF mobile two-way radio
- Cellular Mobile Telephones
- Mobile Data Radio systems (Amateur as well as MDTs)

- Hand-held and portable radios ("HTs", "man-pack" radios, etc.)
- HF portable and NVIS equipment

The point here is that *survivability and flexibility transcend circuit capacity*. In other words, the ability to process or handle a large volume of communications traffic is of little value if it can't be done from the needed location! Furthermore, large amounts of circuit capacity may be a disadvantage if the ability to process the information at an EOC or command post is limited, or if the ability to deliver the information is not available! This is a critical concern in any disaster response operation.

Circuit Capacity

Only after one has assured survivability *and* flexibility *should* one consider **Circuit Capacity**. Circuit capacity, or the amount of communications traffic which can be handled in a given time period, may be measured in a variety of ways such as:

- Calls in progress
- Baud Rate
- MBPS
- Words per Minute

It is very nice to send volumes of data from the field via a wireless data circuit, but this is often easier said than done. The necessary equipment may be vulnerable to rain, dust, weather, or cold, or it may be difficult to set up in the middle of a tent in freezing weather at a command post! EMCOMM managers also often fail to consider the fact that even if one can send 30 or 100 pages of text from point A to point B in seconds, it is often necessary for someone to process, read, discuss, deliver, and file a response to this communications traffic at an Emergency Operations Center or a similar facility.

Consider the following scenario: You've just set up a high-speed point-to-point circuit between the EOC (Emergency Operations Center) and an incident command post. You're now capable of transmitting hundreds of messages per minute over this circuit. Impressive! However, …

- How fast can the originator type?
- How fast can the recipient read messages?
- Does the recipient need to discuss the message with others?
- When delivering messages at either location, how long does it take to locate individuals on site, or worse, place telephone calls to people (assuming the system works or the individual is available to answer)?
- How does one effectively service back a message when information is undeliverable?
- Are runners available at the EOC or command post for quick delivery of messages?

Facilities with large circuit capacity are often most useful for the transmission of "reference" data, such as spreadsheets, financial reports, photographs, engineering drawings, detailed instructions, or similar information that does not require a reply. EMCOMM managers should be judicious in their use of high-capacity circuits for the transmission of tactical messages which may generate a large quantity of difficult to process replies or requests. Keep in mind the primary importance of survivability and flexibility in your emergency planning!

Security

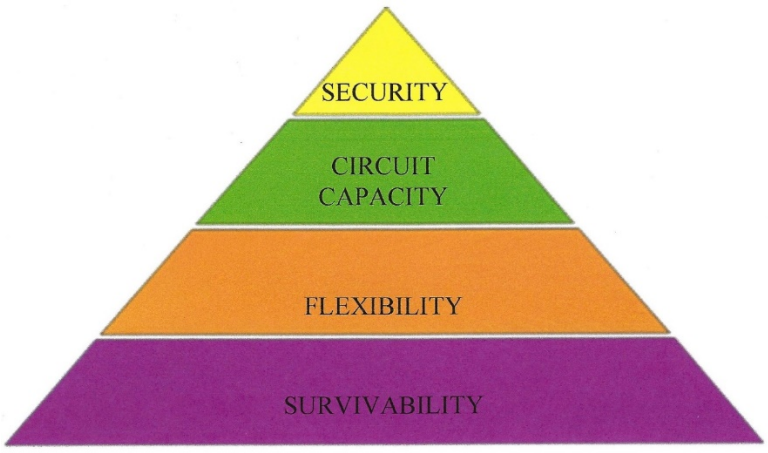
Last, and perhaps of least importance (except in wartime or in situations affecting national security) is **Security**. Some information is best kept confidential and hidden from such organizations as the electronic media or scanner listeners; for example, lists of fatalities, tenant lists from American Red Cross shelters, and so forth. Consider the following scenarios:

1. The local TV station overhears a VHF-FM radiotelephone transmission of a list of fatalities. They overhear the list and broadcast an inaccurate "body count" on the evening news. Later, the list turns out to be incorrect. Who receives the “black eye?”

3. A scanner listener overhears etiological data during a bio-terrorism event and misunderstands the information transmitted. Nonetheless, he starts a rumor mill which creates a panic.

Is it Unrealistic? Probably not. Is it unlikely? Perhaps. Security is critical in some cases, so do take some time to consider it. Data radio systems such as WL2K, the Radio Relay International Digital Traffic Network (DTN), VHF-SSB circuits and radiotelegraph circuits offer a reasonable amount of communications security for most situations, since the average media outlet or untrained individual cannot intercept the message traffic! It is strongly recommended that these capabilities be sought after in the amateur radio community for both these and other reasons!

Generally, the relationship between the characteristics of survivability, flexibility, circuit capacity and security may be viewed as a pyramid, at which the foundation is a survivable method of communications.



The Emergency Communications Pyramid

As an organization considers the types of functions it will carry out during a disaster situation, steps should be taken to ensure that a primary, secondary, and perhaps tertiary telecommunications resource is available for each function. The EMCOMM manager may wish to consult the jurisdiction’s emergency action guidelines, in order to identify those functions

typically carried out during a disaster operation. A properly prepared emergency plan will outline those functions common to all emergencies, as well as the steps necessary to respond to those emergencies presenting the greatest threat to the community. In many cases, such functions will be broken down by "agency" (e.g. "law enforcement," "fire service," "social services," etc.

Once one has identified the specific functions to be carried out, he can then assign communications resources to each function, with an eye toward the "Emergency Communications Pyramid."

Communications Emergency Preparedness:

One of the fundamental "truths" of the emergency management profession is the reality that **emergency managers do not manage emergencies, they manage resources!**

In general, the emergency management director or civil preparedness coordinator has little authority over a disaster operation. His or her job is to *coordinate* the response. This means:

1. Ensuring that agencies work together in a *coordinated response*
2. Ensuring that resources are not wasted through two or more agencies duplicating the same function
3. Ensuring that adequate resources are available to support each *emergency management function*, for example:
   - Law Enforcement
   - Fire Service
   - Mental Health
   - Shelter Operations
   - Public Health…and so forth
4. Acting as fiduciary; ensuring that funding limits (expense limits) are not exceeded during the operation
5. Acting as liaison between units of government (e.g. state, Federal, local).

These are just a few of the responsibilities typically associated with an emergency management director. However, the point is that any emergency manager coordinates response and brings resources to bear in support of a disaster operation. The same process applies to the EMCOMM manager. It is his job to deploy resources in such a way that they are used both efficiently and in a capacity in which they offer the best performance.

Once the EMCOMM manager has identified the emergency response functions which must be supported, he or she must carefully consider the most suitable telecommunications resource to be used in support of each emergency management function. For example:

- Cellular telephones
- Satellite telephones
- Police and fire service radio systems
- High frequency radio systems

- VHF and UHF radio systems
- Public Switched Telephone Network

The principle here is rather straightforward. Each potential disaster is carefully examined with respect to the types of emergency operations ("functions"), which must be carried out. Next, consideration is given to the type of communications systems or networks which are most likely to best support each function. Finally, a primary, secondary and tertiary resource is identified for each function based on survivability, flexibility, circuit capacity, and security.

For example, a VHF or UHF Repeater system would provide ideal support for coordinating the movements and deployment of American Red Cross emergency response vehicles ("ERVs"). A highly survivable alternate to such a system would be VHF simplex network controlled from a high-profile key station. Likewise, a data radio system such as WL2K or DTN may be ideal for originating health and welfare message traffic out of a disaster area. In addition, a highly survivable alternative to this system might be a HF radiotelegraph circuit staffed by competent operators.

Relative Merits of Various Modes:

Of fundamental importance to issues of planning and response is an understanding of the relative merits of each available telecommunications resource and its allocation for an emergency communications function. Some resources will simply do a job better than others. Some resources may be more survivable than others, or may be suitable only as a secondary or tertiary system.

EMCOMM managers are cautioned against making assumptions regarding the capabilities or usefulness of various communications modes or systems. For example, one relief agency manager severed her relationship with a local amateur radio organization stating, "we don't need amateur radio anymore because we just purchased 30 cellular telephones." Unfortunately, she failed to consider the issues of survivability and circuit capacity! When a disaster occurred some months later, she found that the cellular telephones were useless! Many cell towers had gone off-line due to power outages or damage to the public switched telephone networks. Those cells that were still functioning were quickly overloaded with calls (inadequate circuit capacity), as local citizens tried to rely on cellular phones for personal business.

Even knowledgeable radio amateurs make similar mistakes. During a recent disaster, a high frequency voice circuit failed between a state EOC and a distant command post, due to deteriorating propagation conditions. The lack of radiotelegraph capability at one end of the circuit resulted in lost communications, until such time a properly-trained radiotelegraph operator could be located. Once this was done, the circuit was quickly returned to reliable operation using "CW."

The following "relative merits" of some common telecommunications resources are broad generalizations. The author makes no claim for completeness. The idea is simply to show some of the advantages and disadvantages of these common resources, to get one started in the planning process. Remember that these "relative merits" are somewhat fluid, depending on the

size, duration and unique circumstances of each emergency. As you review each of the summaries, consider the suitability of each system for those emergency response functions outlined in your own jurisdiction's emergency response plan. Let's examine some of the relative merits of various common communications systems:

RESOURCE	SURVIVABILITY	ADVANTAGES	DISADVANTAGES
CELLULAR TELEPHONES	Moderate	• Convenient • Easy to understand and operate (anyone can use them) • May be used to call any working telephone in the world	• Limited Circuit Capacity (calls in progress) • Some sites use battery back-up with limited life-span. • With some exceptions, the system cannot prioritize message traffic to preserve circuit capacity • Reliant on distributed infrastructure (e.g. MSO, CO, fiber).
PAGERS	Fair to Good	• Convenient • Easy to use and understand • Alpha pagers provide written instructions and messages to personnel • Reasonably large circuit capacity	• Difficult to acknowledge receipt of a message • Difficult to determine if a message was received • System may be vulnerable to disaster, making coverage or access questionable • Less reliable than in the past • Uncommon resource today, except in some hospital operations.
VHF REPEATERS	Fair to Good	• Excellent for tactical communications • A single transmission can broadcast a bulletin to all personnel simultaneously • Predictable coverage area • Universal equipment and technical standards	• Significant technical failure will result in major disruption. • Vulnerable to jamming, intentional or otherwise • Limited Circuit Capacity • Backup power, refueling must be considered • VHF-FM may prove to be a slow mode for record message traffic transmission

RESOURCE	SURVIVABILITY	ADVANTAGES	DISADVANTAGES
VHF SIMPLEX	Excellent	• Good resource for command and control communications • Predictable coverage area (under certain conditions) • Less vulnerable to jamming	• Limited range • Mobile and Portable stations may not hear each other • Low Circuit Capacity • High-profile NCS required • Frequency coordination with other response groups needed.
HIGH FREQUENCY RADIOTELEPHONE	Good	• No infrastructure required • Good resource for medium- and long-haul circuits • May be used for coordination within a state or between states or regions	• Subject to interference, fading, solar anomalies • Low Circuit Capacity • Less accurate than CW for record message traffic applications
HIGH FREQUENCY RADIOTELEGRAPH	Excellent	• No infrastructure required • Excellent for point-to-point or medium/long haul circuits • Excellent for high-priority, low volume message traffic • More accurate than phone for message traffic applications • Security (media can't monitor) • May work well on lower power.	• Subject to interference, fading, and solar anomalies • Low Circuit Capacity • Smaller pool of experienced operators • Experienced operators are necessary to achieve the advantages listed in adjacent area. • Network subject to disruption by poor or inexperienced operators
DATA RADIO SYS.	Excellent	• Automatic error checking • Flexible Networking • Moderate Circuit Capacity • Security (media and public generally can't monitor)	• More equipment/ peripherals required. • Higher power consumption. • Automation may diffuse responsibility for message delivery • Fewer operators equipped for data modes. • Limited universality (multiple modes in field).

RESOURCE	SURVIVABILITY	ADVANTAGES	DISADVANTAGES
PUBLIC SWITCHED TELEPHONE NETWORKS	Excellent	• Easy to use and understand (everyone knows how the instrument works) • Worldwide access to millions of people • High Circuit Capacity • Compatible with computers, FAX machines, the Internet, etc. • Survivability achieved through redundancy	• Significant damage to Central Office can disrupt service over a wide area • Cables and wiring subject to damage • Circuit Capacity may be exceeded due to the large number of subscribers • Cannot prioritize traffic to preserve circuit capacity
SATELLITE TELEPHONE EQUIPMENT	Excellent	• Can be used to call any working telephone in the world • Operate independent of local infrastructure • Only minimal training required to operate	• Very expensive (per minute charges are quite high at the time of this writing) • May be impossible to use from indoors • Limited circuit capacity • Inability to prioritize message traffic

OK. You get the idea. There are many other resources which could be considered here, and, undoubtedly, there are many other advantages and disadvantages which could be listed. The goal is to simply show that each resource has advantages and disadvantages. Avoid the trap of "mode parochialism," and don't write off a communications resource just because it doesn't interest you or you feel it is too "old-fashioned" or too "high-tech". ***A diversity of resources is the key to an effective and survivable disaster communications program!*** Let's repeat that:

A diversity of resources is the key to an effective and survivable disaster communications program!

The Emergency Communications Plan:

Perhaps one of the most important, yet most often overlooked aspects of EMCOMM preparedness is the drafting of an emergency plan. The development of an effective emergency plan is critical to developing a successful emergency communications program. One word of caution:

The process of creating the plan is more important than the plan itself!

New emergency managers often make the mistake of attempting to draft an emergency plan on their own. When completed, the document may look nice, but those that will be expected to follow it will not because they've had no say in its creation! In other words, they are not "invested" in the process. As a result, the plan is left on the shelf, and no one reads it, or uses it when it is most needed.

The idea behind creating an emergency communications guidelines document is fundamentally simple; the roles and responsibilities of each emergency communications function should be clearly explained. Essentially, these roles and responsibilities should be consistent with the routine capabilities of the organization. For example, traffic networks and operators may be responsible for handling high-priority message traffic. Skywarn networks and observers may be responsible for reporting weather conditions. Technical staff members may be responsible for data networks and assisting with technical operations. Each EMCOMM function can be clearly explained in its own "functional annex" which provides the next level of detail. Everyone with the responsibility for supervising a particular "function" should be the one who drafts that particular functional annex. It is the role of the EMCOMM manager or communications officer to ensure that roles and responsibilities are not duplicated, and that each functional annex is complete.

So how does one goes about drafting an emergency communications plan for an Amateur Radio Service EMCOMM group, or similar organization? Let's examine a "step-by-step" approach suitable for this process:

1. The plan should define the overall mission of the organization.

   For example, an EMCOMM group might define its mission as that of "providing back-up emergency communications services to public safety, emergency management, the public and relief agencies, when required to do so in the absence of primary communications infrastructure." The plan should define those agencies with which it has agreements to serve, and clearly define what it can do for each agency. This should be done with a watchful eye toward potential over-commitment.

2. Identify those activities, which are common to all disaster operations.

   A few examples include:
   - Alert and notification – Explain how personnel are notified and activated.
   - Staging – Where do key personnel report? How about "rank and file" personnel?
   - Identify primary, secondary and tertiary common-denominator coordination frequencies.
   - Outline a basic response checklist for members.

3. A basic hazard and vulnerability analysis should be performed.

   As stated earlier, this process essentially asks; "What typed of disasters are most likely to affect one's area and how will they affect existing resources. The process of examining potential hazards and vulnerabilities can make for an interesting evening of

discussion and speculation over coffee, in advance of drafting the plan.

4. Key personnel should outline, in general terms, how they will most likely respond to a given emergency.

   For example, each potential emergency should be considered with an "eye" to what agencies and functions will require assistance. Be sure to ask the following questions:
   - What key facilities must be staffed?
     - County EOC
     - City EOCs
     - NWS Forecast Office, etc.
   - What specific EMCOMM functions might be carried out?
   - What equipment or special materials are needed for each type of response mission?
   - Are only specific individuals activated for an incident (e.g. to support a "search and rescue team," etc.)?
   - What special skills are required for each type of response mission?
   - What frequencies or networks are to be used (primary, secondary, tertiary)?

   This portion of the plan may be broken down by specific disaster such as "Tornado," "Flood," "Hazardous Materials Incident," and so forth. In each case, basic procedures common to the type of disaster should be clearly outlined.

5. Functional Annexes should be created within the plan to identify the roles and responsibilities of each team or EMCOMM function when it is activated.

   Perhaps there is one team whose primary mission is to support the American Red Cross. Perhaps another team's primary mission is as part of the SATERN (Salvation Army) program. Yet another role may include Skywarn spotter operations. One could go on with such questions as; "what is the role of the traffic system?" "What state nets do we maintain liaison with" and so forth. Consider carefully the relative merits of each available telecommunications resources for the various functions. This allows the developers of the plan to identify primary, secondary, and tertiary resources for each communications function.

6. The plan should include useful reference data, such as telephone numbers and other contact information for key personnel, served agencies, or special facilities.

   These data should be updated approximately every six months, to ensure that they are always useful in the event of an emergency. If the updating process is overlooked, you will be surprised at how quickly this information becomes obsolete! Additional useful information may include an outline of minimum training requirements, an organizational flow chart, and so forth.

7. The plan should be shared with those agencies with which the emergency communications program works.

This process creates a wonderful opportunity to "sell" your service and gain additional insight into what might be expected of your organization in time of emergency. Use this opportunity to take notes and learn more about the agencies with which you will be working. Likewise, be sure to share this information with your key personnel and modify the plan accordingly.

8. Share the plan with your members.

   Find a way to ensure that sufficient copies are available for each team member. While some will not read it, enough will gain an understanding of what is expected of them in an emergency to make the effort worthwhile. Remember that electronic copies may or may not be readily available in emergency situations.

Drills and Exercises:

An important part of preparing for a disaster is participation in regularly scheduled drills and exercises. It is wise to implement a cycle of drills and exercises of increasing complexity with an eye toward both training personnel as well as exposing faults within the emergency plan.

Generally, drills and exercises may be broken down into five categories: the *Orientation, Drill, Tabletop Exercise, Functional Exercise, and Full-Scale Exercise.*

Orientation

Orientations are typically conducted on a periodic basis throughout the year, for new personnel. The orientation familiarizes the individual with his/her roles and responsibilities within the emergency management organization. In addition to an overview of the management structure of the organization, the individual should receive information on any specific emergency response roles to which he may be assigned.

EMCOMM orientations should include an overview of such information as:

- Agencies served
- Alert and activation procedures
- Standard operating guidelines
- Roles and responsibilities
- Personal preparedness

Drills

Drills are conducted on a periodic basis to test a specific phase of emergency response. Contrary to popular belief, a drill is not an "exercise," but rather a specific task or procedure, which is practiced to ensure proficiency. Drills are perhaps the most important activity an emergency communications organization can conduct. The activity ensures that membership is familiar with those procedures which are common to all emergency communications activities. Some

examples of drills include:

Alert and Notification: This type of drill simulates an emergency call-up of personnel as defined in the emergency plan. Activation may be through a "telephone-tree," tone-encoder/decoder device, NOAA Weather Radio, text message, or similar alert mechanism. Individuals typically report into a directed net as prescribed in the organizations emergency plan.

Alert and notification drills are significant. They not only maintain awareness amongst EMCOMM members, but also reveal such problems as:

- Incorrect telephone numbers
- Deceased members
- Members who have relocated to other cities

Weekly Nets: Most EMCOMM organizations conduct a weekly net. Unfortunately, such nets often amount to little more than a series of check-ins, a few bulletins, and perhaps some discussion. Because such net sessions appear to provide little purpose, participation tends to be poor, and an excellent training opportunity can be lost.

An effective weekly net should be conducted with an emphasis on training. Some activities that may prove beneficial include:

- The transmission of radiogram and ICS-213 format message traffic
- The transmission of simulated weather data or other situation reports
- Drills utilizing proper prowords, prosigns and phonetic alphabet

For example, the transmission of radiogram format messages on a weekly net familiarizes members with the proper phonetic alphabet, proword usage, procedures for spelling difficult words or names and so forth. When conducting message handling drills, remember to instruct stations to utilize the phrase "test message" in advance of all simulated disaster traffic.

It is recommended that the net be controlled from a different communications facility each week. For example, the NCS may be at the county EOC one week, a local EOC the following week, and so on until all key stations have been tested, at which time the rotation begins again. This ensures that equipment problems are identified in advance of an emergency.

Response Drills: It is important for EMCOMM group members to obtain an understanding of the complexities involved in deploying to an unfamiliar location to provide emergency communications. A response drill simulates emergency deployment to a shelter, command post, public park or government building. Typically, the communications volunteer is provided with two or more radiogram format messages, and is instructed to drive to a specific location, set up a station, establish communications, and transmit the messages. At which time the messages are acknowledged, the drill is over, and the individual returns to the staging area or is excused from the drill. Response drills may be conducted in lieu of a monthly meeting. Arrangements are typically made in advance with a served agency for access to a suitable building, EOC, or a location indicated on a "shelter roster."

Similar drills may be conducted in which the member is asked to install a portable VHF or UHF

radio in an unfamiliar vehicle, such as a patrol car, relief agency truck, or similar mode of transportation, using a magnetic-mount antenna, 12 VDC adapter, and so on. Specialized capabilities may also be tested in this manner. For example, a NCERT (National Communications Emergency Response Team) group might be sent to a local park pavilion to set up a data terminal and transmit several radiogram messages to the EOC, or perhaps via a High Frequency radio station using voice, CW, WL2K or DTN.

The drills should be fun and interesting. An incentive may be provided in the form of a certificate or similar recognition for those successfully completing a series of drills.

Traffic Handling: EMCOMM members may take part in a drill at any time simply by checking into an RRI net. The procedures utilized on daily traffic nets are quite useful on any communications circuit. Traffic handling familiarizes the individual with net discipline, proper procedures, and efficient methods for conveying information.

Exercises

Tabletop Exercise: Unlike the orientation or drill, tabletop exercises are oriented more toward problem solving and discussion. During a tabletop exercise, key response personnel are presented with a hypothetical emergency. There is no message input, nor is there a timeline applied to the exercise. Individuals participating in the tabletop exercise simply attempt to deal with problems and determine the best solution as the "event" evolves. During a properly conducted tabletop exercise, the coordinator will inject new problems as necessary, to maintain the "natural" flow of the activity.

Tabletop exercises encourage participants to consider the "what ifs" associated with disaster preparedness and response.

Some tabletop exercises take place in an EOC setting, and will involve representatives from various agencies. However, individual organizations, such as an EMCOMM group, PSAP staff and similar groups can utilize this format on their own quite effectively. In some cases, a tabletop exercise may serve as the main subject of a monthly or bi-monthly meeting.

Functional Exercise: These exercises typically test the Emergency Action Guidelines or Incident Command System (NIMS). Unlike a full-scale exercise, there are no "troops" in the field. However, message flow to and from the field is simulated in real-time. The functional exercise is an excellent way of familiarizing new personnel assigned to an EOC or communications center with the stress of emergency response.

Most functional exercises are conducted as part of a larger emergency management activity. Their purpose is to test the level and quality of coordination between those individuals and/or agencies working together in a coordinated disaster response. Key amateur radio personnel are often present to offer potential solutions to any telecommunications problems that may arise during the exercise. However, rank and file members typically do not participate, nor are actual radio nets conducted.

Full-Scale Exercises: These exercises might be described as "everything but the disaster." When a full-scale exercise is conducted, personnel are deployed in the field, simulated victims may be present, shelters may be opened, the NIMS process is in place and the EOC is fully activated. Such exercises often rely on EMCOMM programs and other emergency communications systems for transmission of simulated emergency traffic in real time when telecommunications disruptions are simulated.

Many emergency management programs conduct exercises based on a cycle. Orientations and drills are conducted on a periodic or "as-needed" basis. Other exercises are often conducted annually, on a rotation basis. For example, a tabletop exercise may be conducted the first year, a functional exercise the second year, followed by a full-scale exercise the final year.

Disaster Response:

As stated earlier, the **response** phase begins when the emergency or disaster strikes. It is here that one finds out how effective the mitigation and preparedness steps have been during the weeks and months leading up to the "big one."

Message Prioritization

When disaster strikes, the EMCOMM manager becomes responsible for ensuring that the surviving communications systems operate at reasonable efficiency. This requires a basic understanding of what types of communications problems can be expected. In most cases, the over-riding problem will be a lack of capacity on available circuits.

Because circuit capacity (the maximum amount of communications traffic a system can handle at any one time) is typically a constant, it cannot be increased beyond the design parameters of the communications system. **The first step toward dealing with excessive demand on circuit capacity is to prioritize message traffic.** Many agencies do this intuitively. For example, when a police officer is in trouble, the dispatcher, as well as the other officers on the channel, will dispense with such relatively unimportant information as starting and stopping mileage, in-service reports, and so forth.

An important point for all emergency planners to remember is this:

Most communications facilities provided by telecommunications common carriers are not subject to message prioritization.

For example, unlike a public safety radio system or amateur radio network, cellular mobile data systems or public switched telephone networks do not distinguish between communications traffic of varying importance (with some exceptions). It is important to not rely extensively on any network which does not permit prioritization of communications traffic in time of emergency.

Many agencies have formalized the message prioritization process by creating a set of standardized criteria for determining the priority of messages. For example, Radio Relay International denotes formal message traffic in order of importance as 1) Emergency, 2) Priority, 3) Welfare and 4) Routine. Many military organizations follow a similar procedure with such precedence as 1) Flash, 2) Immediate, 3) Priority and 4) Routine.

Such message prioritization on circuits which handle formal record message traffic (radiograms, etc.) is a rather straightforward process; similar procedures could and should be implemented on all disaster communications circuits, regardless of their function. This includes both circuits carrying tactical communications, as well as those which may be carrying e-mail, text messages and so forth. Those individuals who will be serving in a communications capacity in time of emergency should be regularly drilled on these procedures.

Types of EMCOMM Traffic

Generally, the EMCOMM manager will be responsible for coordinating three types of disaster communications. These are:

1. Tactical Communications
2. Record Message Traffic (including Health & Welfare traffic)
3. Specialized Communications Modes

Tactical communications essentially instruct personnel on where to go and what to do. A common form of tactical communications is a radio-dispatched police call. For example:

> *"Unit 225, proceed to 22334 West Grand Blvd. Complainant reports her child was attacked by the neighbor's dog."*

An amateur radio example might be:

> *"ERV 221, return to the chapter to pick up additional coffee and blankets for the shelter at Harding Middle School."*

Generally, other than a notation in a radio log or computer database, this type of communications is not "written down" word for word. Most disaster communications are of this type, and most of it will be carried by VHF and UHF radiotelephone systems. However, the importance of keeping an accurate and up-to-date radio log summarizing content is not diminished simply because a circuit is carrying tactical communications.

Record Message Traffic: This is any form of communications which must be written down word-for-word and delivered to the addressee exactly as originated. Common examples of message traffic include radiograms, ICS-213 messages, MARS traffic, facsimile transmissions, and e-mail.

Standardized message formats, such as the radiogram format, should be used for any messages which must be passed or relayed through more than one network, or which must be delivered. Requests for supplies, damage assessment summaries, storm damage reports, and related traffic, is often best handled using a standard message form. Why?

- The addressee will require access to potentially critical information such as time of origin, place of origin, originator's name, title and so forth.
- If the message is undeliverable, a "service message" can be returned to the originating station requesting better address or advising him of the undeliverable status.
- The requirement for an authorizing signature on the message form limits the liability of the agency transmitting the message!
- The message is more likely to arrive intact at the receiving end. Accuracy may be critical when requesting medical supplies, food, personnel, or additional funds for a disaster operation.

Imagine yourself originating hundreds of messages on a communications circuit between several agencies. If a message becomes undeliverable, the receiving station need only refer to a message

serial number or date-time-group in his service message. Otherwise, someone on the sending end must look through hundreds of messages, read the content, and determine which message is being referred to!

Standardized message format is ideal for circuits using data, CW, or radiotelephone techniques. It is impractical for tactical communications intended to provide basic instructions directly to an individual, patrol car, or similar unit.

Today, some digital communications modes can automatically "date-time stamp" messages. However, communications personnel are cautioned to avoid relying on such a capability as a replacement for a standardized message format. Such automatic date-time stamping may not realistically reflect the time at which the message was drafted and presented for transmission. Likewise, such information may be lost when a message is transferred to another communications circuit or delivered to a third party. In addition, standard message formats provide more information than simply the date and time of origin.

Specialized Modes: These are modes which provide a unique and highly specialized function in time of emergency. Some examples of specialized modes include:

- Amateur Television (ATV)
- Automatic Packet (Position) Reporting Systems (APRS)
- Mesh Network applications and similar infrastructure solutions.

Consider the advantages of an ATV video link between an EOC and a hazardous materials ("Hazmat") Incident. Emergency planners could monitor the progress of response and recovery operations from an EOC while staying safely out of the way of hazmat technicians and fire officials!

Consider vehicle tracking. Imagine the advantages of installing many portable GPS receivers and APRS equipped transceivers in relief agency vehicles. If the served agency needs to know where a unit is, they need only look at a computer display located in the EOC or Command Post!

APRS technology has been applied to the practice of automating reports of weather conditions. Consider the potential of a group of dedicated radio amateurs deploying portable APRS weather stations in advance of a hurricane through which such information as precipitation, wind speed and direction, pressure, dew-point and temperature can be reported to the National Weather Service through a continuously updating process. Such data could also be of significant value for NWS or perhaps emergency management officials who require wind speed and direction data for plume-dispersion modeling during a hazmat incident.

Amateur radio is an excellent resource for these capabilities. EMCOMM organizations should be encouraged to develop these capabilities to offer the flexibility and creativity necessary to accomplish such unique communications tasks. Only the Amateur Radio Service offers the flexibility and open architecture needed to provide such services on an emergency basis.

Applications

As mentioned earlier, it is wise to use the best mode available for a specific purpose. For example, it would be unwise to transmit a list of names of shelter residents via a VHF-FM repeater link, when a telephone line and FAX machine is available! Likewise, it might be impractical to use a limited coverage VHF or UHF repeater to coordinate response between several counties.

To "start the ball rolling," we have created a list of applications for some common modes of communications in use by amateur radio organizations. While situations vary from place to place and situation to situation, the following generalizations have proven to be accurate, based on recent research into actual disaster situations:

VHF/UHF Repeaters

- Tactical communications
- Skywarn weather spotting networks
- Low volume record message traffic
- Note: UHF systems may offer better building penetration or superior performance in dense urban areas.

VHF/UHF Data Radio Systems

- Point-to-point circuits (between EOCs, command posts, shelters, etc.)
- Record message traffic handling (local nets)
- Local communications requiring a degree of security
- Bulletin dissemination
- Transmission of reference data, photographs, spreadsheets, etc.

Note: Do not rely on automated bulletin board systems for record message traffic delivery unless an individual is charged with the responsibility of clearing that BBS!

HF Radiotelephone (SSB) Nets:

- Medium and long-haul coordination
- Local NVIS communication when line of sight unavailable
- Record message traffic, research and general coordination
- An excellent common-denominator universally available

HF Radiotelegraph (CW) Nets:

- Record message traffic handling
- Medium to long-haul point-to-point circuits.
- Local NVIS communications when line of sight unavailable
- Standardized reporting of weather data
- Ideal mode during poor propagation conditions
- Supplemental communications circuits to expedite traffic routing

Of course, numerous other resources are available to many amateur radio groups. However, these fundamental modes should be a part of all EMCOMM programs.

At a minimum, at least three operators should be available who are skilled in network operations using the more advanced modes noted above. EMCOMM managers should sit down with their supervisory personnel to determine what types of skills are available within the amateur radio community and, if necessary, take steps to develop those skills which may be lacking.

Welfare Traffic:

Perhaps one of the most difficult problems confronting the EMCOMM manager is the issue of welfare traffic. Various agencies have adopted many methods for dealing with health and welfare messages and inquiries entering or leaving a disaster area. Some are better than others; perhaps the least effective being the “hot line” set up by some agencies, to field inquiries about the well-being of individuals affected by disaster. These “hot lines” present some potentially serious problems for the emergency manager. For example:

- If *national press coverage* is wide enough, so many inquiries may arrive on the hot-line number that the local telephone CO circuit capacity may be overloaded. This situation may result in disruption of calls to Public Safety Answering-Points (PSAPs) or long-distance communications entering or leaving the community. Always plan! The Telephone Company must install a “choke network” on such lines to shed calls and preserve circuit capacity for other users, when such a program is being implemented!

- Health and welfare tracking systems, which require an incoming message or phone call to achieve a response doubles the demand on critical communications circuit capacity! Remember! It is always “better to give than to receive!”

- Large disasters displace individuals. It is very difficult to locate the individual referred to in an inquiry, when homes are destroyed, various areas are inaccessible and local phone service is disrupted. Furthermore, inquiries may require personnel to travel or spend hours tracking down the disaster victim in question.

A better plan is to have a method through which welfare reports may be originated by disaster victims, for transmission to friends or relatives outside of the area. This may be done through the Radio Relay International manual-mode system, the Digital Traffic Net (DTN), WL2K, or a combination of thereof. For example, an NVIS high frequency traffic network can be established in a disaster area, which connects to a DTN gateway. The DTN gateway can then automatically route the traffic to its destination state or country. The delivery process then becomes manageable, because receipt and delivery of the welfare message traffic occurs simultaneously at multiple, distributed locations served by the network. This is a far superior method to informal procedures and so-called "nets" which tend to operate on 20 or 40-meters in an ad-hoc fashion, put most of the delivery load on a few people, and usually lack the ability to track or service an individual message.

It is strongly recommended that EMCOMM groups have access to a quantity of packets containing preformatted welfare-message forms, designed to facilitate the origination of large quantities of such traffic in "book" format. These packets may be provided to radio operators

dispatched to shelters, and public facilities. This greatly increases the efficiency of welfare message originations. However, remember to **never originate a welfare message without the express consent of the person whose signature appears on the message.**

Of course, the ability to originate disaster welfare messages requires that the EMCOMM group have access to many individuals skilled in the techniques of traffic handling and network operations. It is strongly recommended that each emergency communications organization have access to at least three individuals capable of operation on RRI circuits, using each of the following modes:

- RRI Radiotelegraph Nets
- RRI Radiotelephone Nets
- RRI Digital Traffic Network (DTN)

As alluded to earlier, it is much more efficient if welfare messages are originated in “book format,” regardless of the mode used. In other words, each message should have an identical text, preferably a coded text such as an "ARL Numbered Radiogram." When traffic is originated in book format, it is necessary to transmit the text only once (except on DTN), followed by the unique portions of the messages. This preserves valuable circuit capacity, since no part of the message is transmitted multiple times. Full details on how to “book” message traffic on manual mode nets is included in a later chapter.

One final note: Disaster welfare inquiries from the outside are “feel good” messages, that may not be deliverable, and they may “gum up the works” by taking valuable time and bandwidth. During wide-spread disasters it may be wise for the EMCOMM manager to request a “moratorium” on incoming disaster welfare inquiries during the first 24 to 48-hours of the operation. EMCOMM managers may request that Radio Relay International transmit a bulletin announcing this. This will ensure that communications circuits are available for high-priority traffic during the critical early stages of disaster response. Incoming messages may be “held” on a DTN hub station near the affected area, until such time as the operators within the area feel they can handle and deliver them.

Recovery:

As the disaster operation enters the Recovery Phase, primary communications infrastructure will be rebuilt quickly. Secondary systems will be shut down, and local EMCOMM organizations and traffic nets will have an opportunity to pick-up the routine business of day-to-day life. Mental health services, social service agencies, and various public and private organizations responsible for restoring infrastructure will be operating throughout this stage of the disaster, as it is often their role to promote the return to "normality."

The recovery stage is the ideal time for the EMCOMM manager to take a careful look at how the disaster affected various systems. With memories of the operation still fresh in everyone's mind, the opportunity arises to sit down and debrief those who were active in the response operations. Such a practice allows one to find out what worked and what didn't. Only by doing so, can one repair or rebuild communications systems to prevent a future recurrence of similar shortcomings or system failures. As systems are repaired or upgraded in response to lessons learned, mitigation steps can be implemented to improve the likelihood that they will survive future disasters intact.

It is at this stage that the emergency communications plan for the jurisdiction should be carefully examined. It is this document, which outlines the roles and responsibilities of each communications function. It should be remembered that the plan is of no value unless it is relevant. Relevancy can only be gained when the individuals involved in the actual communications response continually rewrite the plan, based on lessons learned from actual emergencies. Remember! *"A plan written in a vacuum will not be used!"*

Immediately after the disaster (or an exercise) is also a good time to look at training issues. Examine the level of personal preparedness within one's staff carefully. Seek ideas and recommendations for improved or additional training. Seek out key volunteers to develop the expertise and materials needed to better train rank-and-file members.

EMCOMM managers and others should plan on the following immediately after a disaster operation or emergency exercise:

- After-Action Reports submitted by participants should be reviewed. Major problems should be noted for future discussion or resolution.
- Once significant problems have been identified, the participants should be invited to a critique session. However, a few ground rules apply:
    - Individuals should not be singled-out or criticized!
    - Only constructive suggestions should be discussed.
- A final report should be written. Any problems should be honestly identified and solutions offered.
- Funding and/or staffing should be sought to correct these deficiencies while memories of the disaster are still fresh in everyone's mind.
- THE EMERGENCY PLAN AND STANDARD OPERATING GUIDELINES SHOULD BE REVIEWED AND MODIFIED AS NECESSARY.
- Training programs should be developed to address shortcomings in the skill set of rank-

and-file members.

Disaster brings opportunity. Use the opportunity of lessons learned to seek the community support necessary to improve and "grow" your program.

Skills and Equipment:

General Skills

Much of the information in this chapter is about overall planning, that is, the "big picture." However, no less important is the training and preparedness of the individual radio amateur. All emergency communicators should have certain basic skills, which will allow them to function at a basic level on a communications circuit. This should not be taken to mean they should be expert at a skill; however, they should be proficient to the point where they can function adequately during the stress of disaster operations. It is therefore recommended that all amateur radio volunteers have the following basic skills and training:

- Ability to properly use the ITU (ICAO) *Phonetic Alphabet* to spell names, words, and letter/figure groups
- Basic understanding of *general net procedures*
- The ability to draft a radiogram message and transmit it correctly using radiotelephone
- Basic Skywarn training (where appropriate)
- Hazardous materials awareness training
- Introductory NIMS training

Basic Equipment

While it is inappropriate to tell volunteers what they should own, all emergency communicators should be encouraged to procure certain basic equipment. Ideally, this equipment can be placed in a small brief case or bag to be kept available for use in time of emergency:

- Proper Identification
- VHF hand-held radio
- Cigarette Lighter Cord for above (negative ground)
- Mag-Mount antenna for above
- Spare Alkaline battery pack for above
- (qty 100) Disaster Welfare Message Forms
- (qty 100) Radiogram forms and "agency-specific" ICS-213 message forms
- 8 ½ by 11 pads of paper
- pens, pencils, etc.
- flashlight, personal needs (medications, etc.)
- Foul weather gear & sturdy shoes/boots and heavy clothing

For example, all too often an amateur radio volunteer will report to the scene of a disaster in a pair of tennis shoes or dress "wing-tips." Unfortunately, these types of shoes offer little protection against nails protruding from boards, jagged metal, and other hazards, all of which can quickly take a volunteer out of service. A pair of work boots or shoes could have prevented injury. Likewise, it is common for an responder to report to a disaster scene with just a handheld radio and single Ni-Cad pack. The result: the battery dies and contact is lost, or the HT is useless from inside a building! Spare charged (!!) batteries, and/or a pack that can use ordinary AA cells, could be an important addition to the "go kit."

The individual operating from home may wish to consider:

- Battery or generator back-up for essential equipment
- Renewable energy in the form of a 60 to 120-watt solar panel
- An inexpensive spare antenna, which, can be pressed into service if needed
- Appropriate message forms and operating aids
- Emergency lighting, flashlights, lanterns, etc.

EMCOMM coordinators should invest some time ensuring that members have the basic equipment and skills necessary to effectively respond to a disaster.

Available Skills:

As in the case of the professions, many communicators specialize in an area of technology or operating. For example, one volunteer may have an interest in data communications and computer networking, while another may be a "hot-shot" CW traffic op. Still another may be retired from the telephone company. In addition to each member developing the basic skills described above, each team member's specialized skills should be known to the EMCOMM managers. Generally, the following specialized skills should be sought for an effective EMCOMM program. Ideally, this would include:

- Access to three operators with reasonable experience on CW traffic nets
- Access to three operators with reasonable experience on SSB traffic nets
- Access to three operators with reasonable experience using various data modes, including WL2K and DTN
- Access to at least two individuals with a thorough knowledge of telecommunications networks and hardware
- Access to at least two people with a thorough knowledge of computer software troubleshooting and/or programming
- Access to at least one person with a thorough knowledge of two-way radio repair and/or component level troubleshooting.

While it may not be possible to locate these skills within a single group, it may be possible to develop specialized teams based on a regional model in conjunction with surrounding EMCOMM groups. Some specialties may require active recruitment, *before* the disaster strikes!

Keep in mind that not all tasks require an FCC Amateur Radio License. While helpful, a license may not be necessary for the individual charged with the responsibility of coordinating the installation and repair of telephone systems, the resident computer software and networking "expert," and so forth. Considerable reference material is available to provide training and guidance in those areas related to amateur radio operation. Remember; a good rule of thumb is:

Whenever possible, each key "skill-set" should be held by at least three people within your organization.

The reason for this "three-deep rule" is straightforward. A significant percentage of volunteer membership may be affected by a disaster (often up to 1/3 of members). A serious disaster operation may last days, requiring operators to perform duties in shifts. In addition, some individuals will not be able to take time off work, or they may hold key jobs essential to the restoration of critical infrastructure. These might include:

- broadcast engineers
- telephone company technicians
- two-way repair shop employees
- police officers
- firefighters
- medical personnel
- infrastructure repair specialists (power, roads, etc.)

One final word of caution: Dealing with volunteers is an art form. EMCOMM program managers are encouraged to try to use individuals in positions which are compatible with their interests and talents. It makes no sense to use a high-speed CW traffic operator as a message runner, nor does it make sense to try to make the local computer and digital radio "guru" into a SSB traffic handler! While such situations may, on occasion, be unavoidable, they should be the exception and not the rule.

Some specialties may require active recruitment, before the disaster strikes!

The Operator's "Image":

While perhaps a somewhat sensitive subject for some, one should not overlook the importance of how volunteers present themselves in the field. In addition to each operator understanding the limits of his or her authority, it is also important that members present themselves in a fashion that is "clean-cut" and professional. This means clean, properly fitting clothes, a shave (if necessary), and an overall presentable appearance. We've all seen the individual who arrives at the Emergency Operations Center or Command Post wearing a pair of running sweats and a shirt two sizes too small, both of which fail to cover an ample belly. Image is important. All that is necessary is a pair of clean blue jeans or casual trousers, a neat button-down, polo, or sport shirt, and a recent shower. Uniforms are unnecessary, as would be a suit and tie! EMCOMM program leadership should not ignore the fact that emergency operations require interaction with agencies, which place a premium on professional appearance, within the constraints of the disaster situation. Your personnel represent your organization and determine its image in the field.

Emergency Communications Facilities:

Many amateur radio organizations maintain a radio room or similar installation, at a local Emergency Operations Center or relief agency chapter. The question is often asked as to what equipment should be included, and what steps should be taken to prepare this facility for a disaster. While local circumstances may vary, as a rule, a well-equipped EOC should consist of the following equipment:

- A 144-MHz FM transceiver for local FM repeater or simplex operation

- A 440-MHz FM transceiver for point-to-point intercom circuits (i.e. to a command post, etc.) or a secondary disaster operation
- A 144-MHz transceiver, HF transceiver, terminal node controller, computer and printer for data radio operations
- A High Frequency transceiver, with associated antennas, capable of both SSB and radiotelegraph operation on 160, 80, 60, 40, 30 and 20 meters.
- Headphones for each operating position
- Radiotelegraph keys (one straight key, one semi-automatic key (bug), one electronic keyer/paddles)
- A typewriter (basic, electronic/no-frills) or computer terminal and word processing program at each operating location, for log-keeping, message transcription, etc.
- A complete set of all necessary message forms and radio logs
- A telephone and FAX machine

If the radio-room is located some distance from the EOC, it may be desirable to have a dedicated telephone line or data link between the two locations for transmission of messages to the "message router" (who is a person and not an electronic device). A "PX" line, or even two, army-type "field telephones" can often serve this function.

It is recommended that discrete radios be used for each operating position. This allows not only simultaneous use of each band, but prevents catastrophic loss of communications should a dual-purpose radio fail during an operation. Hence, use of a single dual-band radio for both 440-MHz and 144-MHz is not recommended. However, use of separate dual band radios at each operating position can be beneficial, since it provides redundancy for each band.

Another commonly asked question is "why do we need 440-MHz capability when almost everything we do is on two meters?" There are many situations where access to an alternate band can prove beneficial:

- A local disaster scene, such as a plane crash or hazmat incident, may be inundated by multiple agencies and jurisdictions, whose personnel are all using VHF and UHF radios within a confined area. "Intermod" problems may render 144 MHz useless at some locations, requiring access to an alternate band.
- It may be necessary to set-up an "intercom" circuit between an incident commander on-scene and the Emergency Operations Center or similar facility, or perhaps between two Emergency Operations Centers. This is often best done on an alternate band.
- Two meters may be needed for large-scale operations, such as a continuing Skywarn net, while selected personnel respond to a disaster scene. For example, it may be necessary to coordinate damage assessment during a severe weather situation while a spotter network is still in operation. Access to two bands allows two operations to be conducted simultaneously with minimal interference.
- 440-MHz offers superior "building penetration" as well as superior performance in dense urban areas.

Staffing the EOC

The critical stages of a disaster are typically the first 24 to 72 hours, depending on the size and type of emergency. As a rule, the EMCOMM manager should have access to enough individuals to staff the EOC radio room in shifts for a continuous operation. Any one shift should consist of at least one, preferably two, radio operators for each radio position in use along with a message clerk and runner (need not be a licensed operator) to process and deliver messages, answer telephones, and so forth.

Related EOC Equipment

While not particularly related to amateur radio, it is important that the EMCOMM manager have access to the equipment and skills necessary to implement some unique aspects of disaster communications response. For example:

- A relief agency may need to have a temporary EOC built and service centers wired (for phone service) to accommodate a national level operation.
- An incident commander may wish to have telephone service at his command post for e-mail, facsimile transmission, or basic telephone calls (he may need to coordinate with a railroad dispatcher, trainmaster, or a chemical manufacturer).
- Social service agencies may require telephone service or computer connections at a disaster application center.

The ability to provide a degree of expertise to perform field-expedient repairs to telephone systems or IT network configurations can be of great benefit to served agencies. As with any such relationship, the EMCOMM manager must maintain a balance between providing one or more field-expedient solution and accepting responsibility for work that can be provided by a professional organization. It is not the job of the Amateur Radio Service to replace union telecommunication employees or local vendors. However, implementing a low-risk, temporary solution to a telecommunications system may fall within the purview of the EMCOMM group and further enhance the quality of its community service.

Mutual Aid:

Amateur radio programs, like public safety departments, are encouraged to develop a mutual aid program with surrounding communities. This is of importance in those areas where the number of radio amateurs is somewhat limited. Mutual aid provides access to additional personnel, as well as a greater diversity of special skills needed for disaster response.

The drafting of mutual aid agreements should involve assistance from the local emergency management department or a similar official agency. For example, radio amateurs arriving from outside the area should not be turned back because their ID is not recognized at a roadblock.

An effective mutual aid program should encourage some consistency between the operating methods and procedures used in all involved counties or cities, so that a radio amateur from one area will feel comfortable with the operating procedures used when assisting a neighboring community. Therefore, universal methods, such as the radiogram format and/or ICS-213 format,

the standard phonetic alphabet, and plain-language tactical communications methods are of significant value.

In time of emergency, it is important to remember that volunteers arriving from outside the area may be unfamiliar with landmarks, street names, and other local peculiarities. Therefore, during a disaster operation, a staging location should be established for processing volunteers from outside the area, and an orientation session should be scheduled to brief mutual aid volunteers. Maps can be issued, lodging can be arranged, and operators can be brought "up-to-speed" on the status of the emergency. This can also provide an opportunity for emergency management or public safety officials to issue disaster site passes or similar temporary identification.

It may also be advisable to conduct a medical screening. There are considerable stresses associated with any disaster operation. Individuals with heart and other stress-related medical conditions should be excused from operations in the field or offered lower-stress administrative work or office-based assignments.

National Communications Emergency Response Teams:

Radio Relay International is developing "National Communications Emergency Response Teams (NCERT)" for rapid deployment to disaster areas. These teams of specialists can establish initial communications at EOCs, establish message centers in affected areas, or deploy specialized modes that may not be already available in a local EMCOMM group. NCERTs are equipped and trained to establish communications using WL2K, DTN, CW, voice and a variety of modes for local EMCOMM interface.

Similar specialized teams can be established at the local level. For example, during the July 1997 tornadoes in Detroit, Michigan, a team of three people built two temporary EOCs staffed for 50 operational positions, wired three service centers, and repaired numerous two-way radios, FAX machines and copiers. The job of the group was to aid, not run, the operation, so EMCOMM managers and others should not fear such assistance.

Conclusion:

This document was created to provide a "thumb-nail" sketch of some basic issues of emergency communications planning. The following chapters contained in this booklet are designed to help Radio Relay International volunteers develop the skills necessary to become familiar with RRI traffic nets, particularly those which rely on common-denominator modes, such as voice and radiotelegraph techniques. However, there is no true substitute for actual practice in daily traffic nets. The exact skills needed to handle routine traffic daily translate DIRECTLY to handling operational or welfare message traffic in time of emergency.

It is our hope that this book will expand the knowledge of many dedicated public service communicators.

AMATEUR RADIO PUBLIC SERVICE PROGRAMS

In the early days of amateur radio, public service communications were often spontaneous. Now and then, a few local radio amateurs would find themselves amidst a disaster, which had disabled commercial communications facilities, and simply step in to fill a need. However, over time it became apparent that much better service could be rendered to the community through organized emergency communications activities. As a result, today we find many amateur radio public service programs. Many radio amateurs and public safety officials are confused by the various terms and acronyms used to describe these programs. Perhaps the most often heard question is "What's the difference between ARES, RACES, NTS and RRI (Radio Relay International)? In this chapter, we will briefly discuss these common amateur radio emergency communications programs.

Now, when spontaneous amateur response does arise, it usually involves operators with significant practical experience with these organized groups.

Amateur Radio Emergency Service:

The *Amateur Radio Emergency Service* ("ARES")® is a program administered by the American Radio Relay League (ARRL), the "National Association for Amateur Radio." The ARRL may be viewed as an advocacy group for radio amateurs in the United States. Its administrative structure is broken down into Divisions, usually compromising several states within a region. For example, the Great Lakes Division consists of Michigan, Ohio, and Kentucky. Divisions are further subdivided into Sections. In most cases, the term "section" may be considered synonymous with the word "state." However, many heavily populated or geographically large states are broken down into two or more "sections" (e.g. North Florida, South Florida, Los Angeles, etc.), in order to ease administrative burden for league volunteers who must maintain contact with their field organization.

ARES programs at the ARRL section level are ultimately the responsibility of an elected Section Manager. Most Section Managers ("SM") delegate the administrative duties for ARES organization to an appointed *Section Emergency Coordinator* ("SEC"). The section emergency coordinator, with final approval of the section manager, appoints local *Emergency Coordinators* ("EC"), who are responsible for organizing radio amateurs to provide disaster and emergency communications services to public and private relief agencies, at the local level. An EC is typically appointed for each emergency management jurisdiction within a state or county.

In most instances ARES, there is one EC per county within a state. Occasionally, larger cities or metropolitan areas will also have their own emergency coordinator, due to the unique public service needs of these larger communities.

It is important for local public safety officials to remember that, while cooperation and coordination with local public safety agencies, such as emergency management, is critical to success, the SEC or local EC, these officials are ultimately ARRL volunteers. ARRL encourages the SECs and ECs to work with *all* erstwhile public and private relief agencies in

time of emergency. The successful ARES program will typically have working relationships with a diverse set of agencies, such as:

- State and local emergency management
- National Weather Service
- Salvation Army
- American Red Cross

National memorandums of agreement are maintained between the headquarters of the American Radio Relay League and a variety of agencies. Copies of these agreements are available from ARRL headquarters, upon request.

In addition, the ARRL writes a monthly column about Public Service in its national magazine "QST." Likewise, many ARRL SECs and other officials conduct regular training seminars about emergency communications planning and operations, as well as drills and exercises.

Radio Amateur Civil Emergency Service:

The *Radio Amateur Civil Emergency Service ("RACES")*, on the other hand, is a federal, state, and local government program designed to serve emergency management (formerly known as "Civil Defense). On a local level, the RACES program operates under the direct authority of a county or municipal emergency management director. This emergency management director has the authority to appoint a "*RACES Officer" ("RO")* or "*Communications Officer*," whose responsibilities include the organization of amateur radio operators as an emergency resource for civil preparedness work. In some areas, RACES groups may go by other names, including Disaster Communications Service (DCS) or Auxiliary Communications Service (ACS).

The authority to establish a RACES program is granted to federal, state, and local emergency management agencies under CFR 47, *Part 97, Subpart F* of the Rules and Regulations of the Federal Communications Commission (FCC) governing the Amateur Radio Service.

The origins of RACES date to World War Two when the Amateur Radio Service was closed for the duration of the war. As a result, many local government agencies lost the much-needed assistance of amateur radio, until which time a special "*War Emergency Radio Service*" could be created. This program operated in support of local civil defense efforts using FCC licensed amateur and commercial radio operators, providing much needed service to local government during the war years.

With the coming of civil defense programs during the cold war years of the 1950s, the FCC decided to ensure the future availability of the Amateur Radio Service for civil defense purposes in the event of a national emergency. This was done through the creation of the RACES program. This program organizes radio amateurs to assist with civil defense measures during a declared national emergency, even if such independent programs as the Amateur Radio Emergency Service are prohibited.

In the early days of civil defense (1950s and 1960s), RACES planning activities concentrated on

the cold war threat of nuclear and conventional warfare. As such, a local civil defense director was likely to use RACES for very specific functions. However, over time, local governments began to realize that the same planning concepts and material resources used for civil defense planning were also applicable to planning for, and responding to, natural and technological disasters (e.g. tornadoes, floods, chemical spills, etc.).

"Civil Defense" eventually evolved into what we know today as Comprehensive Emergency Management. The result is effective local civil preparedness programs that require close cooperation between a wide variety of public and private agencies. Today, a county emergency management director will ensure on-going coordination between a wide variety of agencies during **all** phases of the emergency management cycle. A few examples of agencies typically included in the emergency management process are:

- Law Enforcement
- Fire Service
- Public Health
- Department of Public Works
- Private Relief Agencies such as:
- American Red Cross
- Salvation Army
- Baptist Disaster Relief
- Conservation Departments
- Emergency Alert System (broadcast media)

The observant radio amateur will quickly note that many of the "independent" agencies, which are an integral part of the modern emergency management program, are those agencies traditionally served by ARES. As such, it can often be impractical to have two completely independent Amateur Radio (ARES and RACES) organizations serving clients who, by necessity, are working together. In some cases, the mere existence of two independent amateur radio organizations within this context has led to infighting, competition, and ultimately, a failure to deliver an effective service to the community.

Combined ARES and RACES Programs:

For an emergency management program to be truly effective, each disaster relief agency and governmental department must ensure that resources are not being duplicated. Furthermore, maximum efficiency is gained by ensuring that each specific emergency response function is carried out by the agency best equipped for that task. These same concepts apply to Amateur Radio. A single emergency communications program with a unified leadership and a larger membership "block" is typically more effective than several small "competing" organizations. Therefore, many (but not all) ARES and RACES programs choose to "combine" under a single leadership with a common membership body.

When ARES and RACES are combined, the Emergency Coordinator and RACES Officer are simply titles applied to the same person. ARES members hold identical positions in both organizations. Only the name on the "hat" is changed, depending on the specific emergency

communications task being conducted. This arrangement also ensures that all participating radio amateurs will be allowed to remain "on-air" for emergency response purposes should a national crisis arise.

A combined ARES and RACES program requires some cooperation and consensus at all levels. The ARRL SEC or Section Manager must make EC appointments carefully, and with the consent of the local emergency management director. Likewise, the local emergency management director must be willing to recognize the necessity of ARRL membership and the consent of the ARRL Section Manager as a prerequisite to appointment as EC (and RO). Fortunately, these are typically minor issues and as such, they seldom get in the way of an appointment. As a matter of fact, they often serve as the foundation for future cooperation.

There is one caution for combined ARES/RACES programs. Because RACES is designed to support emergency management, there exists a remote possibility that a conflict of interest may arise when personnel and resources are diverted from a local emergency management program to support another public or private relief agency. ARES leadership officials are cautioned to avoid over-commitment and are encouraged to educate local public safety and relief officials on role of Amateur Radio in support of multiple agencies.

Radio Relay International:

Radio Relay International (RRI) is an independent, non-governmental organization (NGO) active in public service and emergency communications. RRI is a registered California public benefit corporation recognized as a 501(c)(3) non-profit organization by the United States Internal Revenue Service. RRI was formed to ensure that a viable and effective national messaging layer with international connections was developed and maintained.

RRI might best be described as a system of layered communications networks, which systematically transfer messages between destinations throughout North America, Europe, Asia and Oceania. Methods are largely based on those of the ARRL's National Traffic System (NTS). Messages may be passed smoothly between RRI and NTS, as well as with a number of independent nets in existence.

Because many disasters cover more than one county or state, RRI networks provide the foundation for effective coordination between multiple EMCOMM organizations, over a large geographic area. RRI networks may serve as the foundation for such tasks as:

- Point-to-point communications circuits with a state EOC or headquarters
- Widespread reporting of weather conditions throughout a disaster area
- The filing of status reports with government agencies in the absence of regular telecommunications facilities
- The transmission of welfare traffic on behalf of disaster victims.

RRI is structured on the classical model of layered telecommunications networks, which provide for the exchange of both routine and emergency messages at several levels. These are:

Local Nets

Local RRI Nets typically cover a metropolitan area using a wide-coverage or linked repeater system. These nets provide access to the national messaging layer, for the origination and delivery of messages going to/from locations outside of the local net coverage. Some local nets meet daily, whereas others meet several days per week.

State Nets

State nets typically meet in the High Frequency portion of the radio spectrum. These nets provide for the exchange of messages throughout a state. Most meet once or twice per day.

Region Nets

Region nets facilitate the exchange of traffic within a region. Typically but not universally, the region corresponds to an FCC "Call Sign District." For example, the Eighth Region Net provides for the exchange of messages between Michigan, Ohio and West Virginia.

Area Nets

Area nets facilitate the exchange of message traffic within a broad portion of North America. There are three Area Nets covering the Eastern, Central, and Western areas of the United States. These nets are linked by special point-to-point circuits, called the "Inter-Area Traffic Network" (IATN), which provide for the exchange of messages between areas.

A more detailed explanation of how RRI functions is included in Chapter 3 of this Handbook.

RRI and Local EMCOMM:

There are several steps that the local EMCOMM manager should take to ensure that effective liaison with RRI takes place. These are:

- Ensure that all EMCOMM members are trained so that they can draft and transmit a basic radiogram message on blank paper.
- Maintain regular liaison between daily or weekly EMCOMM nets and the associated state RRI network to facilitate the origination and delivery of message traffic.
- Conduct regular training on basic net procedures. Each EMCOMM volunteer should be thoroughly familiar with the following:
  - ICAO ("ITU") Phonetic alphabet
  - Proper methods for reporting into and out of a circuit
  - Proper methods for spelling difficult names and words
  - Proper methods for transmitting groups of figures or mixed groups
  - Proper transmission of radiograms and ICS-213 messages.
- Each EMCOMM program should have access to at least two, preferably three, operators with the ability to handle radiogram messages using the following modes:
  - Radiotelephone

- Radiotelegraph
- Digital Traffic Network (DTN)
- WL2K

Emergency Operations Centers (“EOCs”) and similar installations should be equipped for access to RRI using each of the above modes.

It is important for the EMCOMM manager to remember that RRI is not based on any one mode of communications. For the national messaging layer to be an effective emergency communications resource, a diversity of modes should be available at both the local, as well as nationwide basis. Message formats used must be compatible between modes, since messages may change mode in transit.

Many new EMCOMM managers lack experience with traffic net operations. One source for RRI training is the RRI State Communications Manager (SCM). The SCM is appointed by the RRI Board of Directors to supervise the administration and development of RRI programs throughout a State. The SCM may be able to provide an EMCOMM manager with the names and addresses of experienced traffic operators, who would be willing to assist with the development of capabilities and skills needed to access the national messaging layer.

In more populated areas with larger EMCOMM programs, the local coordinator (SCM?) may wish to appoint an assistant to supervise RRI liaison and local traffic operations training. This will ensure that a specialist is always available to ensure that RRI access is available for the community.

One last word about RRI: one of the great advantages of RRI is the convenient training it provides the participant in basic net operations and circuit discipline. Any day of any week, a volunteer may check into an RRI net to become familiar with the proper use of phonetic alphabet, prowords and prosigns, spelling and transmission techniques, and so forth. The ready access to this training through regular RRI participation is far more accessible, effective (and easy) than any attempt to provide similar training in a meeting or classroom setting!

For a listing of RRI nets the reader is referred to the RRI Web Page at www.radio- relay.org.

What is NTS?

The "National Traffic System," or "NTS" applies to those traffic nets operating under the auspices of the American Radio Relay League (ARRL), the National Association for Amateur Radio. Most NTS nets are operated at the ARRL section (state) level, under the direction of the elected ARRL section manager or his appointee. Not all state or local nets are affiliated with the NTS. Some are affiliated with both Radio Relay International and the ARRL. Some are “independent nets.” Generally, the national messaging layer and the associated International Networks operated by RRI are "traffic neutral." In other words, RRI maintains liaison and provides messaging infrastructure for RRI nets, NTS nets, as well as cooperating independent nets, provided the traffic injected into the system meets the standards and formatting required by RRI (which are the same as for the NTS).

Why handle RRI Traffic?

In recent years, the communications capabilities of many local public safety and relief agencies have improved dramatically. Such resources as cellular mobile data networks and smart phones may have lulled many into a sense of complacency. For some years, the belief was that these modern resources had eliminated the need for amateur radio networks. However, recent experiences, including Hurricanes Harvey, Irma and Maria, have once again proven the value of traffic nets for both operational and welfare message traffic. These events have proven that the need for a robust and viable national messaging layer will continue well into the future.

RRI provides a highly survivable infrastructure that is quite impervious to natural or man-made disaster. As a matter of fact, no other radio service offers similar "one-stop shopping" for such a wide range of capabilities, ranging anywhere from highly survivable radiotelegraph circuits to the latest digital communications techniques. As an added "bonus," Amateur Radio throws in the trained personnel with a diverse set of skills ready to assist served agencies or the public at little or no cost!

Access to technology is only part of the picture, however. As high-tech capabilities become readily available to much of the public, mere possession of two-way radio capability is no longer sufficient to render the radio amateur of value to his community. **Today's radio amateur must be a skilled and experienced communicator, with substantial practical experience.** Participation in RRI nets ensures that one has the necessary skills to communicate accurately and effectively in time of emergency.

There is no substitute for training on emergency communications procedures. While daily participation in RRI, as mentioned, is an excellent starting place to learn communications skills, other subjects, which should be considered by the RRI volunteer, include:

- Personal Preparedness (What type of equipment, message forms, and data should I have ready?).
- Operator Roles and Responsibilities (What is expected of me and how do I interface with served agencies?)
- Can I deploy a low-power, portable station to the field and communicate with a traffic-quality signal?
- Do I have the tools and equipment needed to operate indefinitely using renewable energy resources?
- Can I maintain a radio log? Can I format a message without a message blank?
- Am I familiar with formatting traffic for the RRI Digital Traffic Network (DTN)?

The RRI volunteer is encouraged to remember that the primary role of Amateur Radio is **communications**. It is often tempting to engage in activities and training classes that might be better suited to relief workers and public safety personnel. There is certainly nothing wrong with this. However, such training should be secondary to fundamental training and **experience** related to emergency communications methods.

The variation in local conditions, from such factors as differing hazards, population levels, and

so forth, are such that it is outside of the scope of this book to provide detailed information on how to prepare for local events. However, there is no substitute for basic communications skills.

RADIO RELAY INTERNATIONAL MANUAL-MODE SYSTEM

Radio Relay International is a system of layered nets, which provide for the systematic exchange of record message traffic throughout the United States. Commonly referred to as the "national messaging layer," the RRI network covers most of North America with connections to Asia, Europe and Oceania. The system is designed in such a manner that no one station or operator is required to participate on a daily basis.

The foundation of the RRI network is the standard “radiogram” format. The radiogram format has origins in the Western Union and Postal Telegraph message formats of the late 19th century. Many concepts adopted for the transmission of record message traffic over 100 years ago are still applied today in a wide variety of communications systems, including military and maritime networks, RRI, and even the Internet! The standardized radiogram format offers a variety of advantages for certain applications:

- The standard format ensures that messages arrive at their destination accurately transcribed and intact, particularly when several relays are required during the transmission process.
- Standardized message format limits liability by providing a written record of messages handled. Furthermore, the requirement for a signature on the part of a competent authority during time of emergency further limits liability of radio amateurs providing disaster communications.
- The service data included in the message preamble allows a delivering station to not only easily identify the originator and his/her location, but also refer the originator to a message, which may be undeliverable or require clarification.
- The standardized preamble also contains key information of potential critical importance to the addressee, such as “place of origin” and date and time of origination.

The use of the radiogram format is of significant value for the transmission of high priority message traffic or welfare notifications during communications emergencies.

How the RRI Manual-Model Network Works:

As mentioned earlier, RRI consists of a system of layered radio networks, which meet according to a specific, sequential schedule. Traffic exchange between networks is provided by key stations, called “liaison stations.” These stations are responsible for transferring message traffic between nets (layers).

Local Nets

The most basic net is the local net. These nets typically operate using VHF-FM on wide coverage repeaters, or serve large metropolitan areas such as Detroit, Michigan or Dallas, Texas. Local nets often meet daily to ensure that reliable outlets always exist for routine message traffic. They serve as a final delivery point or an initial origination point for radiogram traffic. For the local nets to be effective, liaison must be maintained with the next highest echelon of RRI net called the State Net.

State (Section) Nets

State Nets are perhaps the most numerous and common of dedicated RRI networks. As the name implies, these nets typically cover a state or an ARRL Section (in the case of ARRL sponsored nets). For example, the Michigan Net (QMN) provides coverage for the exchange of message traffic throughout the State of Michigan.

Most state nets meet on 80 or 75-meters within the High Frequency portion of the RF spectrum. The most common modes are radiotelephone and radiotelegraph ("CW"). However, some sections are currently developing digital networks for the transmission of radiogram traffic at the section level.

When traffic is listed for a location outside the jurisdiction of the state net ("through traffic"), it is taken by an assigned liaison station to the next echelon of the RRI System: the Region Net.

Region Nets

The region net typically covers a single call sign district. For example, Michigan, Ohio, and West Virginia, all of which make up the Eighth Call District, fall within the jurisdiction of the Eighth Region Net (8RN). This net provides for the exchange of traffic between these three states. Because of its geographical size, the Seventh Call District is divided into two traffic regions (RN7 and the Twelfth Region TWN, with Nevada falling into RN6).

Region Nets usually operate as "closed" nets. Only assigned liaison stations representing state or area nets should report into a region net. Should a station check in while not representing a Section or Area Net, he may be excused politely by the net control station (NCS). An exception might be a station listing priority or emergency traffic, or stations functioning within a special routing set-up during disaster operations. Exceptions are also made for stations holding delayed traffic or those who cannot make a specific net schedule.

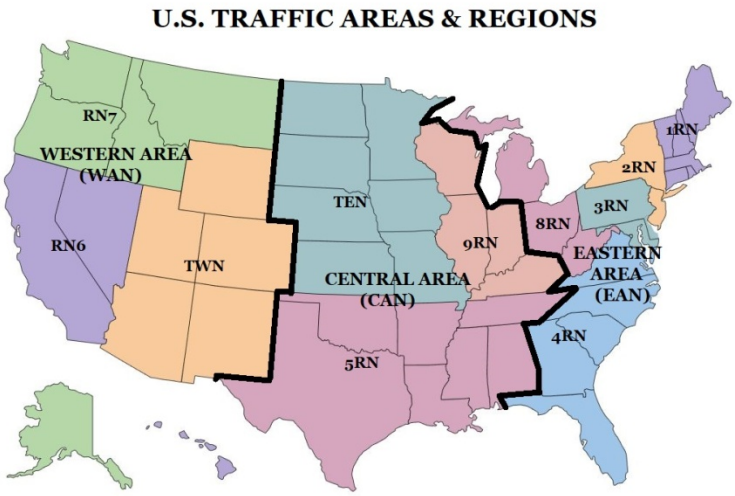
Should a "piece of traffic" (otherwise known as a radiogram) be destined for a location outside of the jurisdiction of the region net, it is transferred by an assigned liaison station to the *Area Net.*

Area Nets

Area nets cover a broad portion of North America. There are three region nets, covering the Eastern, Central, and Western Areas of the United States. These nets provide for the exchange of traffic between region nets within the area net's jurisdiction. For example, traffic for Florida which originates on a Michigan net would pass first to the Eighth Region Net (8RN), then to the Eastern Area Net (EAN), then to the Fourth Region Net (4RN), and finally to a Florida state net, where it could be picked up for delivery.

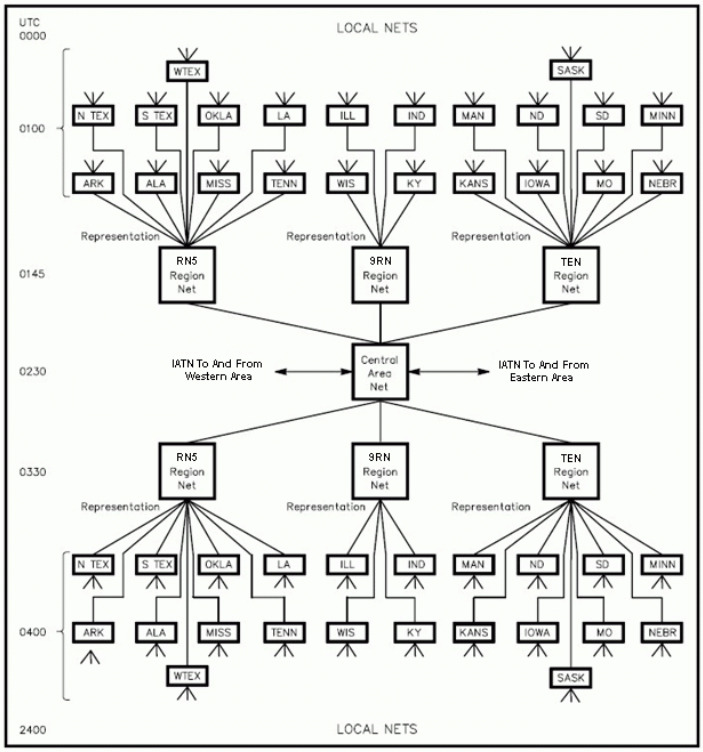
Traffic destined for a location outside of the area net's coverage is passed to its proper area net via special point-to-point communications circuits which operate on schedules, as part of the

Inter-Area Traffic Network.



Inter-Area Traffic Network (IATN)

The IATN is not a net, but rather a group of highly skilled operators with excellent stations, who meet on schedules to exchange traffic to be passed between area nets. These communications circuits are typically high-speed radiotelegraph circuits or digital circuits. For example, a message from Michigan to California, after passing through the section, region, and Eastern Area Net, would have to be transmitted to the Western Area Net via the IATN.



Message Routing Examples:

Message from Michigan to Florida:

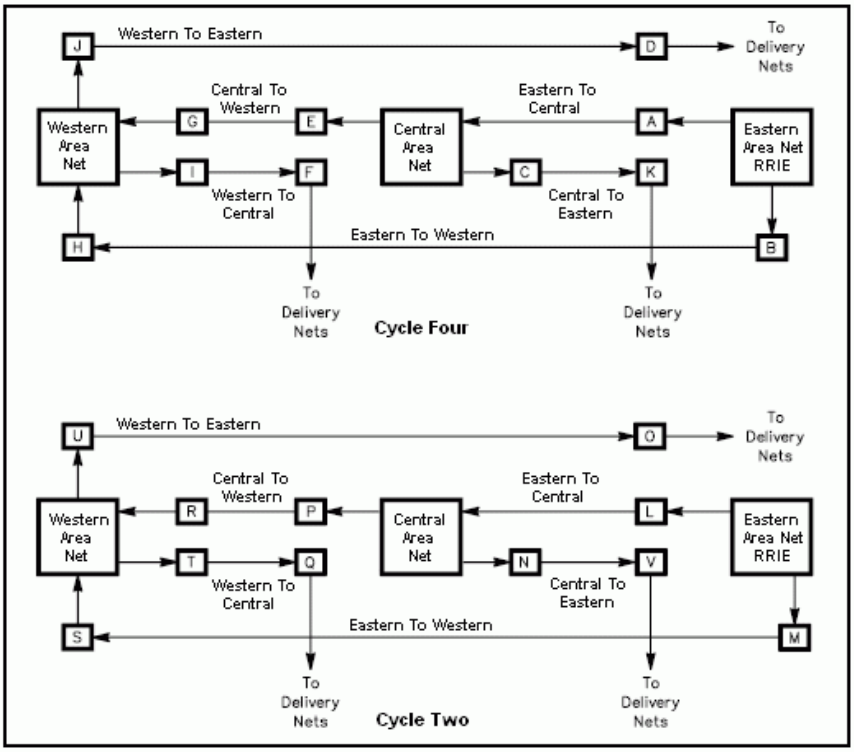
Michigan Net to **Eighth Region Net (8RN)** to **Eastern Area Net (EAN) to Fourth Region Net (4RN) to Florida Net**

Message going from Michigan to West Virginia:

Michigan Net to **8RN** to West Virginia Net

Message from Michigan to Los Angeles:

Michigan Net to **8RN** to **EAN** via **IATN** to **WAN** to **6RN** to California Net



Cycles of Operation:

There can be as many as four cycles of operation within the RRI System. Each cycle represents a complete exchange of traffic between all nets within the RRI system. Typically, only two cycles operate on a routine (daily) basis, these being cycles two and four. These cycles are often referred to as the "daytime" (cycle 2) and "nighttime" (cycle 4) cycles. The daytime cycle is typically built around radiotelephone nets, and the evening cycle, due to the increased traffic load, is typically built around radiotelegraph nets.

The cyclical concept is designed to allow for the smooth flow of traffic during periods of heavy usage, such as during communications emergencies. Cycles 1 and 3 may be added (activated) as necessary to facilitate the flow of additional traffic.

Within each cycle, a state net has some flexibility as to when it meets. However, in order for liaison station to meet their commitments, region and area nets will typically conform to the times assigned in their respective cycles. The RRI Cycles are as follows (all times local):

Cycle One		*Cycle Two*	
10:00 AM	Section	1:00 PM	Section
10:45 AM	Region	1:45 PM	Region
11:30 AM	Area	2:30 PM	Area
12:30 PM	Region	3:30 PM	Region

Cycle Three		*Cycle Four*	
4:00 PM	Section	7:00 PM	Section
4:45 PM	Region	7:45 PM	Region
5:30 PM	Area	8:30 PM	Area
6:30 PM	Region	9:30 PM	Region
		10:00 PM	Section

Operation in Disasters:

Contrary to a belief held by some radio amateurs, RRI does not exist as an alternate to the Public Switched Telephone Networks or the Internet. Rather, RRI provides a highly survivable communications network for use during communications emergencies that may require medium to long-haul communications capabilities. RRI networks also provide an easily accessed method through which an individual radio amateur can obtain practice and training on the use of standardized network communications procedures.

During normal times, deviation from the regular RRI routing system is considered detrimental to the overall "health" of the system, as it may deprive some nets of practices messages. However, during a communications emergency, it is not necessary to maintain the same flow of traffic throughout the system. For example, special routings, point-to-point circuits, and temporary high-capacity digital circuits can be set up to facilitate the flow of traffic between a disaster area/operation and key outside locations. For example, a point-to-point circuit may be set up between a state EOC and a disaster operation or command post for high priority messages, or IATN watch frequencies can be established to speed traffic flow.

Independent Traffic Nets:

Many independent traffic nets also provide public service communications using the standard radiogram format. These nets are not considered RRI nets; however, they rely on the standard radiogram format for the transmission of message traffic. Such nets as the "*Hit and Bounce Net*"

or "*ARTS*" cover wide portions of the country. In addition to providing additional traffic flow and outlets, liaison is often maintained with Radio Relay International. Many of these independent nets have been in operation for decades and continue to provide outstanding, efficient service. Others are long-standing social nets that also pass traffic.

Preparing for disaster operations:

RRI registered radio operators are encouraged to prepare for disaster in the following ways:

- Equip your station with emergency power, either generator or battery, which will allow you to operate a minimum of 24 hours at reasonable power levels.
- Prepare a package of radiogram forms and operating aids for use in time of emergency. Familiarize yourself with their use.
- Contact your local emergency management office, EMCOMM group and relief agencies. Familiarize them with your access to a communications network which can provide emergency communications throughout both your local area and the United States.
- Be sure to register with your local EMCOMM program. Inform your local EMCOMM group coordinator of your affiliation with RRI.
- Equip your station with email, which will allow you to deliver messages directly to a served agency in time of emergency. Be sure to telephone in association with deliveries to ensure someone is awaiting the arrival of important messages by email!
- Understand the use of proper radiogram format and associated skills such as the ability to print neatly or type, and know how to keep a radio log.
- Promote traffic handling amongst your local amateur radio community!

It is important to remember that many local EMCOMM volunteers have no idea how RRI operates. Many may consider RRI unnecessary to their local program. However, experience shows that RRI can play a critical role in time of emergency. When an emergency strikes, be sure to offer your services to the local EMCOMM program or your local served agencies.

UNDERSTANDING THE RADIOGRAM FORMAT

The radiogram format consists of four main parts, the preamble (contains the network management data), the addressee section, the **text**, and the **signature**. Each component plays an important role in the transmission of written message traffic:

The Preamble Components:

Message Number: The first component in the radiogram is the message number. This serial number is assigned by the originating station beginning with "1" at the beginning of the year. Some stations begin a new series of numbers each month when traffic volume warrants it.

The message number does not change as the message travels. It allows a delivering or relaying station to reference a message number, should a problem occur. Imagine yourself having originated hundreds of messages during a disaster operation and then having to read each one to find the right one, should a reply refer to a specific message's content! The assignment of a message number eliminates this problem. Avoid assignment of large or unwieldy numbers when originating traffic. Straightforward serial numbers enhance interoperability when messages must be transferred to manual-mode nets.

Precedence: The precedence of a message is assigned by the originating station and indicates the importance of the traffic to the party whose signature appears on the radiogram. There are four precedence definitions, which indicate the order in which traffic should be handled on the network. In order of importance they are:

1. EMERGENCY
2. Priority or P
3. Welfare or W
4. Routine or R

Specific definitions of each precedence appear in the operating aids associated with this book.

As a rule, emergency traffic should "get-off" the traffic system at the first access to public switched telephone systems or similar commercial/government service. Large volumes of priority traffic are often handled on special point-to-point circuits between official agencies in time of emergency.

Handling Instructions (HX): (Optional) Handling Instructions (HXA through HXG) provide guidance for the delivering station on how to handle the disposition of the radiogram. For example, the handling instruction "HXC" asks the delivering station to report the time and day of delivery to the originating station, generally by radiogram. Please see RRI Form 1720, also called the "Pink Card" ("RRI Traffic Operations Aid") for specific definitions of each handling instruction.

Station of Origin: This is the call sign of the first station to place the radiogram on the air. For example, if one radio amateur calls another radio amateur on the telephone and asks him to

originate a radiogram, the station of origin would be that of the station who first places the radiogram on-air. This policy ensures that service messages are routed via the network to a party who is both active and capable of operating on RRI networks.

Check ("Group Count"): These figures indicate the number of words or letter/figure groups in the text of the message (excluding address and signature). Each group, or word is counted as one group and mixed groups are counted as one word. For example:

Radio Relay International	3 groups
ARRL	1 group
K8QMN	1 group
313 477 3957	3 groups
R274/B/FRR	1 group

The text "WISHING YOU THE BEST IN YOUR NEW LOCATION" would have a group count ("check") of **8**.

When an ARL Numbered Radiogram message (preformatted text) is included in the text, the group count is preceded by the initials "ARL". (e.g. "ARL 5"). For example, the text "ARL FIFTY THANKSGIVING" would have a check of "ARL 3".

Place of Origin: The place of origin is the location of the individual or agency whose signature appears on the radiogram; it is not the location of the station of origin. For example, if a radio amateur in Ann Arbor, Michigan transmits a radiogram for a friend in Franklin, Tennessee, the place of origin would be "FRANKLIN TN", **not** Ann Arbor, Michigan.

Time of Origin: (Optional) This part of the preamble is the time the message is drafted and presented for transmission in Zulu time or UTC (GMT). Do not use local time on any RRI message traffic unless you are certain it will not leave the local net. Therefore, a rain gauge report to the National Weather Service filed at 6 PM EDT would have a time of origin at "2200Z."

Date of Origin: This is the date on which the message was drafted and presented for origination. Use only the standard three-letter month and day. For example, "MAY 13" or "DEC 24" is fine; 5/13 or 6/24 is **not**. Also, remember that a new radio day starts at 0001Z. Therefore, a message originated at 705 PM Eastern Standard Time on March 22, would have a date of March 23! In other words, "0005Z MAR 23"

The Addressee Section:

The address should be as complete as possible. Include the full name, address and up-to-date telephone number (with area code). Use the standard two-letter state abbreviations (e.g. California = "CA"). Originators should not use punctuation in the address. It is best to NOT us any punctuation, or at least keep in mind that punctuation may be "lost" in a future voice or CW transfer. Inclusion of an email address can also be beneficial. Email addresses should be spelled out, e.g. WB8SIW AT RADIO DASH RELAY DOT ORG.

The Text:

The second part of the Radiogram is the Text. Try to limit the text to 25 words or less for routine messages. A surprising amount of important information can be conveyed accurately, with the deletion of unnecessary words and phrases. However, read your message twice to make sure it makes sense! Do not include punctuation such as comma, period, parenthesis, etc. However, do use the "X" (pronounced Initial X-ray) to separate sentences. X is not required at the end; it is not a period. It is like the "STOP" used in old-time telegrams. The term "QUERY" can be used in place of the question mark. Served agency radiograms are NOT limited to 25 words, but brevity is strongly encouraged to enhance interoperability and reduce errors.

Numbered Radiogram Texts

The American Radio Relay League has developed a series of special "texts" or phrases, which are represented by codes called "ARL Numbers." These numbered radiogram texts speed up the transmission of radiograms. For example, the code ***ARL ONE*** means "*Everyone safe here. Please do not worry.*" Likewise, ***ARL FORTY SIX*** means "*Greetings on your birthday and best wishes for many more to come*." The idea behind Numbered Radiogram Texts is to preserve valuable circuit capacity for the most commonly sent messages, by limiting the amount of time it takes to transmit the text. A complete set of ARL numbered radiogram texts can be obtained from either the ARRL or RRI.

Here are some rules to follow with respect to using Numbered Radiogram Texts are:

- Include the letters "ARL" in front of the check ("group count") in the message preamble whenever using an ARL Numbered Radiogram Text. However, the check is still determined in the usual manner. For example, a message containing the text "ARL ONE" would have a check of "ARL 2." In other words, the originator is indicating that at least one ARL number is contained within the text of the message; however, there are still only two groups in the text!

- *Always* spell out the ARL numbers in the message text. In other words, "ARL FORTY SIX is acceptable, whereas "ARL 46" **is not!** The same rule applies when transmitting them via radiotelephone: for example, "ARL FORTY SIX" is transmitted as "ARL FORTY, I spell, Foxtrot, Oscar, Romeo, Tango, Yankee, Forty, SIX, I spell, Sierra, India, X-ray, Six." This prevents someone from copying, for example, "fifty" as "sixty," thereby significantly altering the meaning of the message.

- Two or more ARL Numbered Radiogram Texts may be included in the message. Some ARL texts have blanks that need to be filled in. Include this information immediately after its respective ARL Number. For example, consider this text containing two ARL Numbers:

"ARL FIFTY ONE OHIO STATE FAIR ARL FIFTY THREE PACKAGE 73"

This radiogram text contains two ARL Numbers and translates as "*Greetings by Amateur Radio. This message is sent as a free public service by ham radio operators at the Ohio State Fair. Am having a wonderful time. Received your package. It's appreciated; many thanks. 73.*" The check would be "ARL 11."

Always translate the ARL Numbered Radiogram Texts into plain text in advance of delivery. They are codes representing commonly used phrases. Pity the poor member of the public who is telephoned by an inexperienced traffic operator with the message "ARL Five." The addressee will have absolutely no idea what it means! Likewise, be sure to convert the "X" into a period in advance of delivery, particularly when delivering a message in writing.

The Signature:

The signature should be self-explanatory. It is the person on whose behalf the ham (whose callsign is in the preamble) originated the message. The originator and the signatory may or may not be the same person.

A couple of points are important. First, official messages during time of emergency should be signed by competent civil authority whenever possible. Second, feel free to include a telephone number, address, or e-mail address with the signature where appropriate. Third, a radiogram "signature" must be legible, unlike the one on a check or legal document!

SAMPLE RADIOGRAMS

RADIOGRAM

MSG. NO.	PRECEDENCE	HX	STATION OF ORIGIN	CHECK	PLACE OF ORIGIN	TIME (UTC)	DATE
213	P	C	K8QMN	12	DETROIT MI	Ø1Ø3Z	JUN 16

TO: LT FRANK J NAVIN
MICHIGAN STATE POLICE EMD
5512 CANAL ST
LANSING MI 48234
517 555 2323

MESSAGE:
TEMPORARY MORGUE ESTABLISHED AT CLEVELAND
INTERMEDIATE SCHOOL 13322 CONANT STREET
HAMTRAMCK 48212

FROM (SIGNATURE): DR MILLARD BASS
DETROIT MEDICAL EXAMINER

RECIVED FROM (CALL)	TIME	DATE	TRANSMITTED TO (CALL)	TIME	DATE
			WS8EOC	Ø107Z	JUN 16

Radiogram ICS-213 Message

Number	Precedence	HX	Station of Origin	Check	Place of Origin	Time of Origin	Date of Origin
32	P	C	W5WE	25	BRAZORIA TX	1232Z	AUG 25

To (Name):	Position (Title & Agency):
LT ROBERT STEVENS	ASST DIRECTOR STATE EMA

7021 FOURTH STREET

City, State, Zip:

AUSTIN TX 77055

Telephone and optional e-mail:

513-555-1212 ROBERT.STEVENS @ TEXAS.GOV

From (Name):	Position (Title & Agency):
MICHAEL R LORENZ	EM DIRECTOR
Subject:	**Agency Local Time (conversion from UTC):**
FLOODING	0732 CDT

ROAD CLOSURE FM385 AT FM1780 X EVACUATION IN PROGRESS AREA
BOUNDED BY FM235 AND PINELLAS HIGHWAY AND STEVENS RANCH ROAD
TO EAST BANK BRAZOS RIVER

Please be brief – Use only the period for punctuation – Assume message may be delivered in all capitals

Message Routing (Received from call sign / DTG):	Message Routing (Transmitted to call sign / DTG):
	WC5EOC 251241Z AUG 2017

info@radio-relay.org – www.radio-relay.org – Follow us on Twitter@RadioRelayIntl

RRI Form 1703 ICS
2017-5-1

Notice that the first example, a classic radiogram, is in all upper case and contains no conventional punctuation at all and yet is perfectly understandable. The second example, an ICS-213 message, has punctuation, which may or may not be preserved in that form throughout the relay chain. In this latter case, the operator may convert the period contained within the e-mail address to “dot” and the “@” to “at sign” during both transmission and transcription. Additionally, the “hyphens” in the telephone number are optional and would likely NOT be transmitted within the network. Instead, the phone number area code, prefix (exchange sequence) and suffix would be treated as three groups. It’s important to remember that in some environments, radiogram ICS213 forms may be populated by served agency functional representatives. Therefore, in such cases, one can expect a variety of approaches to populating the form, which will need to be managed.

As a rule, punctuation should be avoided whenever possible to speed the transmission process and to promote full interoperability. Remember; your radiogram or ICS213 message may be originated using a digital mode, but may be transferred to an amateur or public safety voice circuit to effect transfer to its final destination. **Always keep brevity and simplicity in mind when formatting record message traffic. Brief served agencies on the benefits of this approach.**

RADIOTELEPHONE NET PROCEDURES

Unlike radiotelegraph nets, the procedures used on radiotelephone nets vary tremendously depending on the nature of the net, its members, and the type of business in which it engages. Furthermore, the procedures used will differ depending on whether the net is primarily used for tactical functions (such as many local EMCOMM nets), traffic handling (such as many RRI nets), or severe weather spotting (such as many Skywarn nets).

The suggested guidelines presented here are general rules based on standard procedures for radiotelephone traffic nets. When checking into a phone net for the first time, one may need to modify his or her procedures slightly to "fit-in" with the local group. However, regardless of the informality of a net, one should remember that there is no place on any public service communications net for poor operating practices.

Circuit Discipline:

For any communications circuit to operate efficiently, it is necessary to maintain a measure of circuit discipline. This is the job of the Net Control Station (NCS). At all times, the NCS is the boss of the net. Her requests should be complied with immediately unless one has reason to believe they are incorrect or do not apply to the situation. One should not transmit unless invited to do so by the NCS. Of similar importance are the following rules applicable to all radiotelephone nets:

Net Guidelines

- Avoid unnecessary transmissions and phrases. Keep all transmissions short, succinct, and to the point.
- Always determine that the net frequency is unoccupied before transmitting.
- Be prepared to move to alternate frequencies to clear traffic, if so directed.
- Use the correct message format and procedures.
- Comply immediately with the instructions of NCS.
- Use the correct ITU (ICAO) phonetic alphabet.
- Never leave the circuit without first notifying NCS.
- Do not transmit without the permission of NCS.

Perhaps the most important rule is to *Listen*. It is often possible to learn everything you need to know about the status of a net or emergency operation simply by listening for a period of a few minutes. Do not simply jump into a net and waste valuable circuit capacity by requesting information. We've all heard it before: the Skywarn net is in progress, and two or three "lids" (slang for "poor operator") jump in and say: "Is there a weather watch?" Meanwhile, critical reports of observations are being delayed. Or worse: "Is this a traffic net? I'd like to report an accident on the 15 Freeway."

Again, the following procedures apply mainly to traffic nets; however, they are equally applicable to nets serving other functions, such as tactical or Skywarn operations, and so forth.

Checking into the Net:

Without Traffic

The proper procedure for checking into any radiotelephone net (without traffic) is as follows:

- Say "This is…"
- Unkey your mic for a moment to make sure you are not "doubling" with another station.
- Transmit your call sign clearly using phonetic alphabet.
- State "no traffic, *over*."

For example:

> "This is …. (unkey)…. Kilo Eight Quebec Mike November, no traffic, over."

With Traffic

The procedure for checking into a net with traffic is almost identical:

- Say "This is …"
- Unkey your mic.
- Transmit your call sign phonetically.
- List your traffic.
    - Quantity
    - Precedence
    - Destination
- Followed by the proword "*over*."

For example:

> "This is ... Kilo Eight Quebec, Mike, November, one Routine Detroit, two Priority Lansing, over."

When checking into the net, remember that most net control operators are keeping a hand-written radio log. Therefore, be sure to speak slowly and deliberately, allowing the NCS enough time to write down your call sign and traffic list! It is especially important that one give his call sign phonetically when first checking into the net.

Keep in mind that many linked repeater systems take a couple of seconds to activate after you key the mic. On such systems, it is better to take a breath before actually speaking.

When listing traffic for small towns, unusual destinations, or by call sign, you may wish to spell the location phonetically. For example:

- "One Routine Podunk, I spell, Papa, Oscar, Delta, Uniform, November, Kilo, Podunk, over."

- "One Priority Whiskey, Eight, Zulu, Zulu, over"

The net control operator will typically allow several stations to report into the net before acknowledging those stations checking in. This improves net efficiency by avoiding unnecessary "net calls". The NCS may acknowledge a group of check-ins in the following manner:

- "Roger WB8SIW, N8AHA, WI8K, NR8TU, no traffic; W8IHX 1 Routine Detroit, 2 Priority Pontiac; W5WE, 1 Routine Through. Out.

The Prowords:

Prowords, or "procedural words," are the equivalent of the "prosigns" used on radiotelegraph nets. Skillful use of prowords can significantly improve the efficiency of a radiotelephone net. All operators should be familiar with the proper use of the standard prowords. Some of these are:

- "Over" A reply is expected, "go ahead."
- "Out" No reply is expected. Do not respond (like "hanging up" the phone).
- "Roger" Received and Understood (NOT "Yes")
- "Affirmative" Yes
- "Negative" No
- "Clear" Same as "Out." No reply is expected.
- "Say Again" Repeat

Please take some time to familiarize yourself with the proper use of these prowords and phrases. Likewise, mentally review these basic check-in procedures several times using your own call sign and some "imaginary traffic." Be sure to use the proper prowords when doing so.

Signal Reports:

Unlike routine communications, there are several different phrases, which can be used to provide a signal report on a radiotelephone circuit. These are quite self-explanatory:

- "Good Readable"
- "Fair Readable"
- "Poor Readable"
- "Weak Unreadable."

Avoid unnecessary language by using these standardized phrases.

When establishing communications with another station, from whom you will be receiving traffic, be sure to provide him with a signal report. This will allow him to adjust his transmission speed and "spelling" procedures to suit your receiving situation. For example, let's say that WB8SIW has traffic for W8IHX. A proper exchange might be:

- "WB8SIW this is W8IHX over"
- "This is WB8SIW are you ready to copy, over?"
- "This is W8IHX fair readable, ready to copy over"

Receiving Traffic:

Establishing Communications

When two stations are directed to exchange message traffic, the station receiving the traffic always establishes communications with the station holding the traffic. This is especially important when two stations are sent off the net frequency to clear traffic. This procedure ensures that the receiving station has a clear frequency to work with. Once initial contact is made, the receiving station should provide the transmitting station with a suitable signal report.

While traffic is often exchanged on the net frequency, it is often preferable that net members be sent off frequency to improve net efficiency. The procedures for each situation are:

Exchanging traffic on net frequency - example

The Net Control Station will instruct two net participants to exchange a routine message:

- NCS: WB8SIW call N8AHA one Routine Ann Arbor, out.
- WB8SIW: This is WB8SIW fair readable ready to copy, over.
- N8AHA: This is N8AHA Message Number …

Please note the lack of unnecessary language. The operator at WB8SIW simply lets the operator at N8AHA know how well he is being heard, and that he is ready to copy the message. Also, note the use of the proword "out," which indicates the NCS has surrendered the frequency to WB8SIW and N8AHA. It will remain theirs until which time WB8SIW acknowledges receipt of the traffic and uses the proword "out," at which time it will revert to NCS.

Exchanging traffic off frequency – example

In this example, the NCS will send WB8SIW off frequency with N8AHA to receive one Routine message for Chelsea, Michigan.

- NCS: WB8SIW, call N8AHA 3932 MHz one Routine Chelsea, over.
- WB8SIW: WB8SIW, roger, out.
- N8AHA: N8AHA, roger, out.

An alternate procedure would be for WB8SIW and N8AHA to simply state their call signs, dispensing entirely with the prowords “roger, out.” This would serve as adequate acknowledgement of the instructions from NCS. Another alternate that is sometimes heard is WB8SIW, going.

WB8SIW and N8AHA will now move (QSY) to 3932 KHz. Remember, the station receiving the traffic, always calls the transmitting station. Therefore, WB8SIW will call N8AHA, provide a signal report, and state “ready to copy.” If conditions are difficult or interference is present, it may be necessary to first establish communications. For example:

- WB8SIW: N8AHA this is WB8SIW, over.
- N8AHA: This is N8AHA, how do you copy, over.
- WB8SIW: WB8SIW weak readable, ready to copy, over.

In this later example, N8AHA now knows that his signal is weak, but readable. He will take extra care to spell difficult words, perhaps repeat the occasional difficult phrase, or transmit more slowly.

Receiving the Radiogram:

The transmitting station will commence transmission of a radiogram with the phrase “message number” or “here is number” followed by the entire message ***preamble***. The message preamble consists of:

- Message Number
- Precedence
- Handling Instructions (optional)
- Station of Origin
- Check
- Place of Origin
- Time of Origin (optional)
- Date of Origin
- Address

These items will be transmitted slowly and concisely in the order in which they appear on the radiogram form. They should **not** be preceded with a “title phrase” such as “Place of Origin,”, “Check,” or “Station of Origin.”

Upon completing transmission of the preamble information, the transmitting station will say “break” and unkey his mic before continuing into the text. This provides the receiving station an opportunity to ask for any “fills” or confirmations on the preamble material. If, after a brief pause, the transmitting station hears no interruption, he should automatically continue with the transmission of the text. In other words, **if you copy the preamble correctly and require no fills, you simply keep quiet at the first break**. Your silence is your assent to the properly received information.

The transmitting station will then continue with the second part of the radiogram, the ***text***. A properly transmitted radiogram should be read at a speed at which the average operator can write comfortably. As you transmit the radiogram, imagine yourself writing it down. Upon completing transmission of the text, the transmitting station will again say the word "break," and listen for any "fill" requests. If he does not hear a fill request from the receiving station, he will conclude transmission of the radiogram with the ***signature***.

Upon completing transmission of the signature, the transmitting station will state:

- "**end, no more**" if he holds no other traffic or
- "**end, more**" if he holds additional traffic for the same receiving station.

If one has received the entire message correctly, it is necessary to acknowledge receipt of the traffic. This is done using the proword "**Roger**." For example:

- Say "Roger"
- Say the message number.
- Say your call sign.
- Say "Out" (no reply expected).

For example: "**Roger** number 221, WB8SIW out."

Note the use of the proword "out." No other communication is required between the two stations.

Requesting Fills:

Fills may be requested at three places during the transmission of a radiogram:

- At the first break following the address (preamble)
- At the second break following the text
- After the signature

All fill requests should be preceded by the phrase "Say Again." This phrase may be followed by:

- Word Before
- Word After
- From _____ to _____(insert appropriate words)
- All Before
- All After
- Group _____(insert group number)

For example: "***Say again*** word after Robert" or "***Say again*** group 15."

The station transmitting the radiogram should always reply to a fill-request by repeating the request, then providing the actual fill itself. For example, a typical exchange might be:

- "*Say again* word after Robert, over"
- "*I say again* word after Robert, Johnson, I spell, Juliet Oscar Hotel November Sierra Oscar November, Johnson, over"
- "Roger, over"

Up to three fill requests may be given at one time. For example:

"*Say again* word after Robert; *say again* word before Hickory; *say again* group 23, over"

If you have requested fills at the conclusion of the message (after transmission of the signature) and you have received all fills correctly with no further need for clarification, just use the standard acknowledgement of message receipt:

"Roger number _____ over" (or "out" if no more traffic is to be exchanged).

When Group Counts Do Not Agree:

Occasions will arise when the number of words, or groups, you count upon receiving a message will not agree with the number stated in the preamble. It therefore becomes necessary to resolve the inconsistency. The procedure is simple:

- Note the number of groups you copied in the message text.
- Say "Is the group count _____ (insert the number of groups you counted), over"

The transmitting station will then recount the groups and, if his count agrees with yours, he will confirm your count and you may change the message preamble to the corrected figures. For example:

- "Is the group count 15, over"
- "Affirmative, group count 15, over"
- "Roger message number 66, out."

If the transmitting station's count of the groups in the text is different, he should then say:

- "Negative, groups ___ ." (inserts the correct number)
- Transmit the first letter or figure of each group phonetically.
- The receiving station then "rogers" or requests an appropriate fill.

For example, consider the following example pertaining to the text "I hope you are having fun 73":

- "Is the group count six, over?"
- "Negative, group count seven, India, Hotel, Yankee, Alpha, Hotel, Foxtrot, 7, break, over."
- "Say again word after 'are' over."
- "I say again word after 'are', 'having', over."

- "Roger number 21, out."

Transmitting the Radiogram:

Transmission of the radiogram to another station is a straightforward process. However, it should be remembered that radiotelephone nets have quite limited circuit capacity. In other words, only a limited amount of traffic can be transmitted in a given time period using this. It is therefore necessary to eliminate all unnecessary language. For example, if a SSB traffic net is in session for an hour, and each station transmitting traffic were to repeat the phrase "place of origin is," it would be easy to consume such time as would be the equivalent to the transmission of several radiograms!

Spelling Difficult Names and Words:

The first step in learning to properly transmit a radiogram is to commit to memory the ITU Phonetic alphabet. Thorough knowledge of this phonetic system is the foundation to effective radiotelephone traffic handling (or any EMCOMM work). This alphabet is:

- A Alpha
- B Bravo
- C Charlie
- D Delta
- E Echo
- F Foxtrot
- G Gulf
- H Hotel
- I India
- J Juliet
- K Kilo
- L Lima
- M Mike
- N November
- O Oscar
- P Papa
- Q Quebec
- R Romeo
- S Sierra
- T Tango
- U Uniform
- V Victor
- W Whiskey
- X X-ray
- Y Yankee
- Z Zulu

An easy way to learn the ITU Phonetic Alphabet is to practice spelling the names of streets or

billboard advertisements as one travels to and from work using the standard procedures outlined below.

Spelling Difficult Words or Names:

In order to spell difficult names or words on a radiotelephone net, please follow this procedure:

- Pronounce the name or word.
- Say "**I Spell**."
- Spell the word phonetically using the ITU phonetic alphabet.
- Pronounce the name again (optional).
- Continue with the remainder of the message.

For example, let's say you are transmitting the name "Griffith":

"Griffith, I spell, Gulf, Romeo, India, Foxtrot, Foxtrot, India, Tango, Hotel, Griffith"

Do not rush through the process of spelling the name phonetically. Also, while it is possible to spell the name without a phonetic alphabet, particularly on a VHF-FM traffic net, we recommend the above procedure be used at all times, particularly for the training value.

Consider this: Say the letters "B, D, E, C, and G" quickly. You will note that they sound very much alike! Consider these similarities on a SSB traffic net under poor conditions! The value of a phonetic spelling method becomes obvious.

Transmitting Figures:

When transmitting telephone numbers, zip codes, or combinations of numbers, one should precede the group with the phrase "*figures*."

The procedure is:

- Say "**Figures**."
- Pronounce each number distinctly.
- Continue with the remainder of the radiogram.

Note: Do NOT "chunk" numbers. In other words, for the number 64, "six four" is correct, "sixty-four" is not! Also, please note that such phrases as "telephone" or "zip code" are not standard radiotelephone prowords. For example; the zip code "48867" would be transmitted as:

"**figures** four, eight, eight, six, seven."

However, "telephone figures" is sometimes used in the manner of a proword, to indicate that three number groups will follow (with pauses between).

Mixed Groups:

Whenever a radiogram contains a group of mixed numerals and letters, it is necessary to precede that group with the phrase "***I spell***." The term "mixed group" may also be used.

The procedure is:

Say "**I spell**" (or "**mixed group**").
Pronounce each letter or figure clearly, using the phonetic equivalent of each letter.
Continue with the remainder of the radiogram.

For example, the group "CH297" would be transmitted as:

"**I spell** Charlie, Hotel, Two, Niner, Seven"

The "I spell" procedure may be used for any mixed group including radio call signs!

ARL Numbers:

ARL Numbered Radiograms are preformatted texts designed to speed up the transmission of radiograms, which convey routinely-heard phrases or "common" texts. For example, "**ARL FIFTY**" means "Greetings by Amateur Radio." "**ARL SIXTY**" means "Wishing you the best of everything on ____ (insert the holiday here)."

The one basic rule is that ARL numbers are **always spelled out**! This prevents the translated product from arriving at the addressee's location with a totally different meaning than was originally intended by the originator! This rule is extremely important.

For example, the proper procedure for transmitting a text that includes "ARL SIXTY" would be:

"ARL Sixty, I spell Sierra, India, X-ray, Tango, Yankee, Christmas"

The delivering operator would translate this text before delivering the radiogram to the addressee. Therefore, instead of hearing "ARL Sixty," the addressee would receive the message as "Wishing you the best of everything on Christmas."

Please note that had the ARL number been expressed in numerals, it would have been transmitted as "ARL Figures Six, Zero," which would have been incorrect. The ARL Numbered Radiogram Texts are always spelled out!

Transmitting the Radiogram:

Now that you are familiar with the proper spelling and transmitting procedures, here are a few rules to keep in mind.

- **Do not** precede the preamble contents with titles such as "Station of Origin," "Check," or

"Place of Origin." The receiving station knows the format!

- **Do not** precede the address contents with such phrases as "Telephone," "Zip," or "Amateur Call."

- Some ops do use the introducer "telephone" so that the three groups (with pauses, can be transmitted under only one introducer.

- **Do not** use phrases such as "common spelling" or methods such as "last name Wells, as in 'Kitty Wells.'" Always spell the name using standard procedures.

- **Do** speak clearly, slowly and evenly!

- Upon completing the transmission of the address, insert a "Break" before the text. Wait a moment for the receiving station to request fills. If no request is heard, continue.

- Transmit the text slowly and clearly, spelling difficult words, names, or groups.

- Upon completion of the transmission of the text, again insert a "Break" and again listen for any fill requests.

- Transmit the signature followed by the phrase "end, no more" or "end, more."

- Use the correct prowords: over if you expect a reply, out, if your transaction is completed!

- Respond to all fill requests by repeating the fill request followed by the missing information: for example: "I say again, word after George, Wilson, I spell……."

Let's consider the following example of the procedure used to transmit a properly formatted radiogram:

221 R WB8SIW 21 ANN ARBOR MI JUL 14
EMMYLOU HARRIS
AMERICAN RED CROSS
225 PAKCARD RD
IONIA MI 48934
517-555-2121
BT
REQUEST COPY OF ARC FORM 3025 X MUST HAVE YOUR
REPORT BY 6TH OF MONTH X ARL SEVEN X BEST
REGARDS
BT
JIM ROGERS
STATE COMMUNICATIONS OFFICER

"Message number two two one, routine, Whiskey Bravo Eight Sierra India Whiskey, two one, Ann Arbor, Michigan, July, one four.

Emmylou, I spell Echo Mike Mike Yankee Lima Oscar Uniform, Harris, I spell Hotel Alpha Romeo Romeo Indie Sierra.

American Red Cross.

Figures two two five, Packard, I spell Papa Alpha Charlie Kilo Alpha Romeo Delta, Road.

Ionia, I spell india oscar november india alpha, Michigan. Figures four eight nine three four.

Figures five one seven, five five five, two one two one.

Break

Request copy of, initials Alpha Romeo Charlie, form, figures three zero two five. Initial X-ray. Must have your report by the, I spell, six, Tango, Hotel, of month. Initial X-ray. ARL Seven, I spell, Sierra Echo Victor Echo November, initial X-ray. Best regards.

Break

Jim Rogers I spell Romeo, Oscar, Golf, Echo, Romeo, Sierra, State Communications Officer.

End, no more, over.

Book Traffic:

On occasion, one is required to transmit a quantity of messages having an identical text to multiple addressees. In this case one should utilize "**book format**." In "book format" the common parts (those parts that are identical) are transmitted first, followed by those parts that differ. This procedure is practical only when significant portions of the message are identical, such as the text and preamble.

An example of traffic suitable for transmission as a book might be two greeting messages originated at a public demonstration of Amateur Radio during a fair or festival. For example, the format might be:

R W8JXN 12 JACKSON MI JUL 4
<BT> (break)
GREETINGS FROM THE JACKSON INDEPENDENCE
DAY FESTIVAL X HAPPY FOURTH
OF JULY

<BT>
LORI AND DAVID GRYWICZ
<BT>

221
ROBERT AND LOIS CLARK
225 HARDING BLVD
HOUSTON TX 77077
713 555 1879
<BT>

222
BILLY JOE SPEARS
16789 ROUND OAK
HOUSTON TX 77078
713 555 9888
<AR N> ("end…no more")

On other occasions, the preamble and addressee section would constitute the common parts, which are sent first, followed by multiple different text. The group count might differ, in which case check would be omitted from the transmission of the preamble. Each check would be inserted in the transmission of the "uncommon parts," following the message number.

When using radiotelephone procedures, this message would be transmitted exactly as written, including the proword "break" between each message component. This procedure will save not only time, but will lessen demand on the limited circuit capacity present on a traffic net.

Leaving the Net:

If you must leave the net for a short period of time, be sure to let NCS know you will be out of the net for approximately _____ minutes. If you wish to close permanently, simply call NCS at a convenient time and "request permission to close" or "request permission to secure."

Summary:

The best way to learn radiotelephone net procedures is through monitoring and participation in routine network activities. It is extremely difficult to to learn proper radiotelephone procedures in time of emergency. Inexperience combined with the stress of emergency operations not only introduces inefficiency in one's own operating practices, but also wastes the valuable time of seasoned operators. In the end, the result is significant disruption of critical net communications.

Imitation of good radiotelephone operating practices is an excellent learning tool. Readers are encouraged to monitor and imitate the operating practices of the better operators on those nets in your area. It is also possible, however to pick up bad habits. Using this chapter as a guide one should be able to identify those operators who understand and use proper procedures. The author has no doubt that you will want to be classified in the former group!

RADIOTELEGRAPH NET PROCEDURES

Radiotelegraph nets offer significant advantages over other modes for a variety of communications traffic handling functions. Some of the advantages of CW nets can be summarized as follows:

- CW nets are more accurate than radiotelephone nets for the transmission of record message traffic.
- A properly conducted CW net will typically clear two to three more messages per net time period than a similar radiotelephone nets.
- Lower transmitter power is required on CW circuits for the same level of readability (QRK).
- Significantly less bandwidth is required for CW transmissions, therefore permitting a larger number of stations to simultaneously exchange traffic off frequency with little interference from other operations.
- Mobile, portable, or stations with modest antennas and low power levels can reliably communicate on CW nets when conditions will not support SSB communications.

CW is also of significant advantage in significant disasters. As many learned during recent hurricane events, gasoline for generators was a scarce commodity. The use of CW allowed radio amateurs to operate indefinitely using simple equipment, solar panels and battery power.

This chapter is intended to familiarize the RRI operator with the procedures to be used on radiotelegraph nets. Prosigns are indicated by <>, for example <BT>. Most prosigns are a combination of regular Morse letters with no space in between then.

Checking Into the Net:

Checking into a CW Net is surprisingly easy! As a matter of fact, once you take the "plunge," you'll find out the water is quite warm. Follow these simple instructions and before you know it, you'll sound like an experienced traffic handler:

The NCS typically calls the net to order with a ***preamble*** stating the name of the net, the fact that the net is directed, and so forth. Immediately following the preamble, he will invite several specific stations (liaison stations) to check in first. This permits stations with high volumes of traffic to report in early to quickly conduct their business. This request to "answer in prearranged order," is called "**QNA**." For example, the typical order for QNA on the Michigan Net QMN (this varies from net-to-net) is as follows:

- QNA 8RN (Eighth Region Representative)
- QNA DTS (Digital Traffic Station)
- QNA MITN (Michigan Traffic Net Rep.)
- QNA SEMTN (Southeastern Michigan Traffic Net Rep.)
- QNA QNC Request for any net announcements.

Once the assigned liaison stations have reported in, the net will be opened to general check-ins

(**QNI**). The NCS will typically do this by transmitting a "net call." This "net call" consists of the net designator (an abbreviation for the net name) and the QN-signal "QNI." For example, the net designator for the Michigan Net is "QMN." The QN-signal "QNI" requests that stations report into the net.

Some examples of net-calls for the Michigan Net include:

- QMN QNI K
- MICHIGAN NET QNI K
- QMN K

Upon hearing any one of these net calls, a station may request an opportunity to be invited into the net, by sending any single letter of his/her choice (many choose the first letter of their call sign suffix). If the NCS repeats your letter, this is your invitation to "QNI."

For example:

- NCS: "QMN QNI K" (net call)
- QNI: "B" "C" "S" (several stations wishing to check-in)
- NCS: "B" (a single letter is repeated)
- QNI: "DE W8IHX QRU K" (the station whose letter was repeated checks in)
- NCS: "R W8IHX GE <AS>" (the check-in is acknowledged/told to standby)

When checking in without traffic, you should transmit the Q-signal "**QRU**" after your call. This notifies the NCS that you are holding no traffic for the net, but are available to accept traffic.

Typically, the NCS will hold your station for approximately ten minutes, in case someone checks in with traffic for your location. If no traffic is listed during this period, you may be excused from the net. When excusing you, the NCS will transmit your call sign suffix. You need respond with only a "dit" or a tap of your key. This lets the NCS know you are paying attention. He will then proceed to excuse you using the QN-signal "**QNX**." For example:

- NCS: "SIW"
- QNI: "dit"
- NCS: "73 ES QNX
- QNI: "73 DE WB8SIW <SK>"

Your first experiences on a CW net will likely consist of these two simple procedures. This will give you the opportunity to gain confidence, while listening to the net procedures for a period of time.

Checking In With Traffic:

Checking in with traffic is almost an identical procedure. However, instead of stating "QRU," one should transmit "QTC" followed by the destination and quantity of each message. There are two proper methods for doing this. For example:

- "DE W8IHX QTC DETROIT 1 MUSKEGON 2 K"
  or
- "DE W8IHX QTC 1 DETROIT 2 MUSKEGON K"

If one is listing priority or emergency traffic, such as during a disaster, the later method is preferred as it allows one to insert message precedence. For example:

- "DE W8IHX QTC 1 EMERGENCY LANSING 5 P ("priority") GRAND RAPIDS K"

A typical transaction might be:

- NCS: "QMN DE W8IHX K"
- QNI: "Z"
- NCS: "Z"
- QNI: "DE W8ZZ DETROIT 1 LANSING 2 K"
- NCS: "R W8ZZ GE (good evening) PSE <AS> (please standby).

Once you have successfully checked in to the net, you need wait only a short time before you are either excused or directed off frequency to exchange traffic with another net member.

There are three ways, in which one can be sent off frequency to exchange traffic. The following three examples will illustrate these procedures:

- When conditions are good and the NCS has reasonable assurance that two stations can hear each other, he will simply use the "QNY" signal. If both stations are presently on net frequency he will use the following procedure:

  "W8EGI & WB8SIW **QNY** DWN 3 DWN 3 NWS 1 K"

  (W8EGI and WB8SIW are sent down 3 KHz to exchange one routine message for the National Weather Service.)

- If conditions are poor and the NCS does *not* have reasonable assurance that two stations can hear each other, he will use the "QNV" signal. The procedure is:

  "W8EGI **QNV** WB8SIW DWN 3 DWN 3 NWS 1 AR"

  W8EGI would call WB8SIW on net frequency to see if they can communicate adequately. If so, they will QSY. If not, NCS must find a relay.

- If you were sent off frequency to exchange traffic with another station already engaged in a transaction off frequency, NCS would use the "QNQ" signal. This tells you who to call off frequency and when. For example:

  "W8EGI **QNQ** DWN 3 DWN 3 WB8SIW AFT W8RTN NWS 1 K"

W8EGI has just been told to QSY DWN 3 kHz and to call WB8SIW when he is done with W8RTN so they can exchange one NWS message.

Handling Traffic on Frequency:

In order to maintain net efficiency, as little traffic as possible should be transmitted on the net frequency. However, this may be necessary under poor conditions, or when NCS is the originator or recipient of traffic. For this situation we use the "QNK" signal, which means "transmit the messages specified to the station specified." For example:

- NCS: "W8ZZ QNK DETROIT 2 W8SCW K"
- W8SCW: "W8SCW QRK (1 to 5) QRV K" "Your readability is (1 to 5). Ready to copy."
- W8ZZ: "QSK HR NR …"

Returning to Net Frequency:

When returning to net frequency, wait a "lull" in activity and transmit your call sign suffix. If you are the proud owner of a "two by one" call sign, you may wish to include your call district number as well, to prevent being confused with a new check-in. The NCS will acknowledge your return by repeating your suffix. For example:

- QNI: "SIW"
- NCS: "SIW R"
- QNI: "IHX"
- NCS: "IHX R"

How to Transmit the Radiogram:

Radiotelegraph nets offer some distinct advantages, one of which is the accuracy and speed with which one can transmit a radiogram. Generally, the rules for transmitting a radiogram using CW are as follows:

- The receiving station always calls the station that will be transmitting the radiogram. This ensures that the receiving station has a clear frequency on which to operate.

- When conditions are questionable, the receiving station should give an indication of readability using the prosign "QRK". For example:
  "DE WB8SIW QRK 4 QRV K"
- This states that WB8SIW is copying the transmitting station quite well and is ready to copy.

- When transmitting the radiogram, notify the station of the CW mode you are using, such as a VOX system (semi-break-in), or "QSK" (full break-in). This will prevent futile attempts to "break" your transmission for "fills" when you are not operating "QSK."

- Never precede message content with titles such as “place of origin”, “date”, “to”, or “phone”. The receiving station is already familiar with the message structure, so these added words or phrases are simply time wasters!

- Separate the lines of the address with the American Morse comma, also known as the prosign “<AA>” (di-dah-di-dah). This prosign, the roots of which date back to the early days of telegraphy, tells the operator to “drop down one line,” much as a carriage return signal does on a teletype circuit. This rule also applies to signatures containing multiple lines.

- Be sure to us the prosign “<AR>” (end of message) at the conclusion of your transmission followed by the letter “N” if you are holding no more traffic for the particular station with whom you are in contact, or “B” if you have more messages for his location. If you have only one more radiogram, you may send “<AR> 1.

Perhaps the most important rule to follow when transmitting the radiogram is to transmit no faster than the speed at which the receiving station can copy. It is usually more efficient to transmit a radiogram at 10 words per minute once than to transmit a radiogram twice at 20 words per minute! If you are transmitting a radiogram to an operator of unknown ability, the rule of thumb is to transmit the message to him at the same speed at which he transmits to you. When acting as Net Control Station, remember that this same rule also applies when responding to new stations checking in to the net.

An example of a properly transmitted radiogram might be:

…QSK NR 221 R KC8ETY 24 DETROIT MI JUL 22

WILLIAM P RUTLEDGE <AA>
1118 WEST OLIVER ST < AA>
OWOSSO MI 48867 <AA>
517 723 4978

<BT> (dah-di-di-di-dah)

WISHING YOU THE BEST ON
YOUR MUCH DESERVED RETIREMENT FROM
THE DETROIT POLICE DEPARTMENT X
HOPE YOU ENJOY SMALL TOWN
LIFE X BEST REGARDS

<BT>

THE PURPLE GANG <AR> N

Book Traffic:

On occasion, one is required to transmit a quantity of messages having an identical text to multiple addressees. For example, during a disaster situation, it may become necessary to transmit a quantity of welfare messages on behalf of shelter residents advising relatives of their well being. In this case, one may wish to use a common "ARL Text", such as "ARL ONE," which means: "Everyone safe here. Please don't worry." This would allow one to save time and valuable circuit capacity by transmitting messages in "book format."

When transmitting in "book format," we transmits the common parts of the messages first, followed by the individual message serial numbers and those parts that are different. The easiest way to understand this is by viewing a typical example of "book traffic:"

W W8IHX ARL2 LANSING MI APR 4 <BT>

ARL ONE <BT>

23
JOHN GREBE <AA>
2234 MCKINLEY ST <AA>
UTICA NY 20225 <AA>
340 555-2211
<BT>
MOM AND DAD
<BT>

24
NANCI WILSON <AA>
225 MAIN STREET <AA>
HARTFORD CT 06121 <AA>
803 555 6788
<BT>
MARY JO AND LEN
<BT>

25
FLORENCE JOHNSON <AA>
17235 PLAINVIEW ST <AA>
DETROIT MI 48207 <AA>
313 555 8690
<BT>
LAWRENCE AND EMILY JONES

END BOOK <AR> N

Note that the entire preamble and text (except for the message number) is transmitted only once,

at the very beginning of the transmission. Only those portions unique to each message are transmitted separately, in this case, the message number, and its respective address and signature.

While this technique is often used at such events as amateur radio demonstrations, which originate large quantities of messages, the technique of transmitting book traffic may prove to be an extremely useful tool for the traffic handler during a communications emergency.

Requesting "Fills":

There will be occasions when the receiving operator misses a portion of the text or clarification is required on the message content. When this situation arises, the receiving operator must request "fills" or repeats on various portions of the message.

Group Count (check)

Upon receiving the message, the operator must count each word or group in the text and check his or her count against the check, or "group count," indicated in the message preamble. This process increases the likelihood that the complete message was received.

When the number of groups counted by the receiving operator do not match the "check" in the message preamble, the two numbers must be reconciled. This is done using the International Q-Signal "**QTB?**," meaning "Do you agree with my word count?" For example, let's say you are operating as W8IHX. Having just received a message from N8AHA, you note that the "check" in the preamble is 6. Yet you count only 5 groups in the text. You notify N8AHA that the two numbers do not reconcile. For example:

- W8IHX: QTB 5? (Is the group count 5?) (One sometimes hears **CK?)**
- N8AHA: QTB 5 K (I agree that the group count is 5).

In the above example, N8AHA counted the number of groups in the text and his count, as transmitting operator, agrees with yours. Sometimes the group count does not agree with the number or groups. This problem arises on occasion when an inexperienced operator originates a radiogram and does not understand the proper method for determining the group count, or "check," when originating the message. For example, the originator may have included the signature when determining the "check."

Let's assume that W8IHX copied the message incorrectly or perhaps that N8AHA made a mistake during transmission. W8IHX will again inquire as to the group count. N8AHA, as transmitting operator, will count the number of groups in the text, and will provide W8IHX with the first letter of each group in the text, for clarification.

For example:

- W8IHX: QTB 5? (Is the group count 5?)
- N8AHA: N 6 (Negative, group count 6) BT….G L O R X 7….BT….K
- W8IHX: QSL

In this case, W8IHX, the receiving operator, asked: "Is the group count 5?" N8AHA, the transmitting operator, said "No, the group count is 6." He then proceeded to transmit the first letter or number of each word or group in the text. This saves time by eliminating the need for an operator to repeat an entire text! In this case, the text represented by "G L O R X 7" was:

"GOOD LUCK ON RRI X 73."

W8IHX undoubtedly noticed that he missed the "X-ray" in the text, a common mistake on the part of traffic handlers. Therefore, all he needs to do is "QSL", or "Roger" the message.

Had the operator at W8IHX missed a word, such as "on" in the preceding text, he does not know what "o" represents. He would then ask for a "fill" or clarification on the missing word.

Fill Requests

"Fills" are requested on radiotelephone nets with the phrase "Say-Again." On CW nets, the "**?**", or "<**IMI**>," is used (di-di-dah-dah-di-dit). Just as in the case of phone nets, the following phrases may be used to request fills:

- <IMI> WB ___ (*phone equivalent:* "Say again word before _____")
- <IMI> WA ___ (*phone equivalent:* "Say again word after _____")
- <IMI> GROUP _____ (*phone equivalent:* "Say again group ")
- <IMI> FM ___ TO ___ (*phone equivalent:* "Say again from to _____")
- <IMI> BN ___ ES ___ (*phone equivalent:* "Say again between ____& ____")

As in the case of radiotelephone operation, when a "fill" is requested by the receiving operator, the request is repeated by the transmitting operator in order to prevent misunderstanding. For example:

- W8IHX: <IMI> WA "Luck" K
- N8AHA: <IMI> WA "Luck" "On" K
- W8IHX: QSL

Let's take a look at a radiogram transmitted along with some subsequent "fill" requests. In this case, N8AHA is the transmitting station, and W8IHX is receiving the radiogram:

N8AHA:

QSK…NR 221 R W8ZZ 7 HIGHLAND PARK MI DEC 1
JAMES H WATT <AA>
FEDERAL EMERGENCY MANAGEMENT AGENCY <AA>
1616 M STREET <AA>
WASHINGTON DC 20022 <AA> <BT>
GOOD LUCK ON RRI NETS X 73 <BT>
BILL <AR>K

- W8IHX: QTB 6?….K
- N8AHA: N….7….BT….G L O R N X 7….<BT>….K
- W8IHX: <IMI> WA LUCK….K
- N8AHA: <IMI> WA LUCK….ON….K
- W8IHX: QSL ….<AR>

In this case, W8IHX counted only 6 groups in the text. He asked the transmitting station, N8AHA, if his group count agreed. N8AHA said; "no" the group count is 7, as stated in the preamble. He then proceeded to transmit the first letter of each group in the text. W8IHX then located the missing word and transmitted a "fill" request using the word "luck" as a reference. The correction was transmitted and W8IHX acknowledged receipt of the message.

Being excused from net:

As mentioned previously, stations are typically excused from the net using the QN signal "QNX". The NCS will transmit your call sign suffix, to which you should respond with a simple "dit" or tap of the key; this will let him know you're paying attention. NCS will then send something like:

- "TNX 73 QNX"

You then sign out legally as illustrated by the following:

- "GE 73 DE W8IHX"

Other methods through which you may be excused are as follows:

- Nets with a large number of check ins may be excused using the signal "QNF" or "the Net is free."
  Example: "QMN QNF 73 DE W8IHX <SK>"
  (*translation*: "Michigan Net is Free 73 de W8IHX – close of work)

When time is short, and only a small number of stations need remain on frequency to conduct business, a group of stations may be excused at once. The NCS may use the procedure:

- "QMN QNC QNS QNX …..(list stations)…<AR>"
  (*translation*: "Michigan Net General Announcement, the following stations are excused…..")

CW Nets and Weather Reporting:

CW nets offer significant advantages for the reporting of weather information, such as rainfall, snow accumulations, wind speed and so forth. For example, reports of severe conditions or storm damage can be transmitted during periods of severe winter weather, flooding situations,

hurricanes or major blizzards. The use of standardized message format and procedures, combined with the efficiency and accuracy gained with CW, result in a system that can often "run circles" around some of the commonly heard phone nets providing similar services.

Other Resources:

All new CW operators should obtain a variety of operating aids, including a copy of *RRI Field Manual FM-001* and the *RRI Operating Aid 1720* (pink card). These resources will provide additional information covering operating procedures and the structure of the RRI manual mode and digital networks.

There are also extensive resources available via the Internet at the RRI Web Page:

www.radio-relay.org

SKYWARN NET OPERATIONS

While Radio Relay International does not normally conduct Skywarn Nets, this program is quite common throughout the United States and Canada. This information is provided to assist local EMCOMM groups with the organization and administration of these programs:

What is Skywarn?

Skywarn is a National Weather Service program, which employs trained spotters to identify those storm features and characteristics, which often precede tornado development or other significant severe weather events. The Skywarn program uses both volunteer organizations, such as Amateur Radio and Citizens Band groups, as well as professionals such as law enforcement officers and firefighters. However, the back bone of the Skywarn program is the radio amateur.

Amateur Radio operators are the ideal resource for an effective Skywarn program. The use of VHF and UHF repeaters can allow a single net to effectively cover a county warning area. The ability to "layer" networks using multiple repeaters and digital radio assets allow radio amateurs to effectively feed information from multiple counties to the National Weather Service through key stations (liaison stations). In addition, because Amateur Radio operators are not distracted" by primary responsibilities during severe weather situations, they are able to concentrate entirely on the job of "spotting," unlike police officers or firefighters who must conduct severe weather spotting as a secondary role.

The Amateur's Role:

The role of the radio amateur in the Skywarn program is to provide critical "ground-truth" information to the National Weather Service (NWS). This information may identify cloud features or weather events, which remain undetected by RADAR. Even sophisticated doppler weather RADAR does not detect tornadoes. While rotation and convergence may be visible within a mesocyclone as indicated on RADAR, meteorologists cannot always determine with certainty if this rotation has reached the surface as a tornado.

The job of the spotter is to provide information to the authorities as outlined in the EMCOMM organization's Standard Operating Guidelines (SOGs). In other words, most of information flow on a Skywarn net should be from the field to the NWS or emergency management agency. Periodic bulletins should be limited to those transmitted by the NCS advising net members of the status of storms in the area, anticipated storm tracks, and anticipated arrival times at various cities, towns, or landmarks throughout the warning area.

It is also important to understand that amateur radio organizations tend to provide information of higher reliability. The nature of EMCOMM organizations is such that reports submitted by trained radio amateurs tend to be subjected to a level of quality control unavailable in reports obtained through social media and similar public resources.

Training:

Annual Skywarn training should be provided for spotters by an instructor whose credentials are recognized by the local National Weather Service Office. While training varies from location to location based on local conditions, the typical Basic Skywarn Program should consist of the following subjects:

1. The basic thunderstorm cell – how it works.

2. An introduction to the concept of a spectrum of four basic thunderstorms types:
   - Single-cell Storm
   - Multi-cell Cluster Storm
   - Multi-cell Line Storm (Squall Line)
   - Super-cell Storms

3. The Super-Cell Storm.
   - Its environment
   - The location of major storm features
   - The dynamics of the Super-Cell Storm
   - The importance of the Rain-Free Base
   - The characteristics of the Tornadic Wall Cloud
   - The characteristics of Tornadoes and Funnel Clouds

4. The structure of the Squall Line (Multi-cell Line Storm) including:
   - The structure of the Squall Line
   - The dynamics of the Squall Line
   - Updraft/Downdraft Interface
   - Location of major storm features

5. Spotter Criteria (“what to report”)

6. Spotter’s “Quiz” – so students can test their knowledge.
   - Tornado look-alikes
   - Scud Cloud, Rain Shafts
   - Various storm features

Many NWS Offices also offer advanced spotter training programs. While not necessary to perform effectively as a spotter, attendance at such training programs should be encouraged, particularly for supervisory personnel. In general, advanced spotter training familiarizes the student with:

1. A detailed look at the environmental conditions in which each of the following types of storms occur:
   - Single Cell Storm
   - Multi-cell Cluster Storm
   - Multi-cell Line Storm

- Super-Cell Storm

2. The effects of Draft strength on Storm Severity.

3. The effects of Vertical Wind Shear on Storm longevity and organization.

4. A detailed look at each of the four major thunderstorm types including:
   - Storm structure
   - Environmental conditions
   - Spotting considerations
   - Hazard analysis

5. Super Cell Variations:
   - Review of the "classic" Super Cell
   - The Low-Precipitation Super Cell
   - The High-Precipitation Super Cell

6. Downdraft-related severe weather events
   - Downburst
   - Microburst
   - Macroburst

Much of the information in the succeeding sections of this document presumes the reader has attended at least one basic training class.

How Skywarn Nets Operate:

As mentioned earlier, it is the responsibility of the net manager to ensure that most of information flow is from the field to the NWS in the form of accurate, timely, and necessary severe weather reports. Generally, the following information is of importance to the NWS:

- Winds in excess of 50 MPH
- Hail in excess of ½ inch in diameter
- Wall Clouds
- Tornadoes
- Funnel Clouds
- Flash Flooding
- Rainfall in excess of 1 inch per hour.

In some cases, the NWS may set slightly different "thresholds" for such information as hail size or wind velocity, but these items listed above are excellent guidelines for any Skywarn net.

Some information, which is of little value and should therefore be discouraged (particularly when severe storms are imminent), may include:

- Rainfall arrival

- Moderately gusty winds
- Lightning
- Scud Clouds
- "SLCs" ("Scary looking clouds")

The "TEL" System:

Reports can be transmitted in a standard format such as the "TEL" system. This stands for:

Time at which the storm feature was observed
Effect which was observed
Location of the storm feature

Optional information includes the estimated direction and speed of movement. For example:

This is….W8IHX, at 535 PM a Wall Cloud at I-35 and 6th Street
This is….WB8SIW at 603 PM a Funnel Cloud at Congress and River moving northeast.

Skywarn spotters are encouraged to practice formatting reports in this fashion during drills and exercises.

Skywarn Numbers:

While the EC for a smaller community may know each volunteer and his capabilities personally, spotter programs in larger metropolitan areas may wish to issue a "spotter ID" number, for use by radio amateurs when checking-in to the net. This assures the NCS that the individual from whom he receives a report has had the minimum training necessary to ensure accuracy. This number may include an indication of whether the individual has had basic or advanced training.

False Reports:

The fact that a volunteer has attended training does not guarantee competency. It is therefore necessary for all net control operators to have a thorough understanding of storm structure and dynamics. This will allow them to "sift" through any false reports they may receive by comparing reports against their knowledge of where various storm features are most likely to occur. Ideally, net control operators and key personnel should have advanced training as well as extensive field experience.

Some typical situations, which may generate false reports, include:

The "Wall Cloud"

Research has shown that inexperienced spotters may confuse the Shelf Cloud, often located at the leading edge of the storm with the "Wall Cloud," which is an isolated lowering of the rain free base at the storm's rear flank. NCS operators should compare the location of those individuals reporting wall clouds against RADAR images showing the storms relative location.

If the wall cloud report is coming from the leading edge of the storm, it is quite likely false. Wall cloud reports from the southwest edge of a storm, particularly if located beneath a rain-free base, should be taken very seriously.

Remember the definition of a wall cloud: **An isolated lowering of the rain-free base typically one to three miles in diameter.**

One way to detect the differences between wall clouds and shelf clouds or other storm features is to be thoroughly familiar with the characteristics of each. For example:

Wall Cloud Characteristics

- Wall clouds typically occur at the Southwest edge of a storm beneath the Rain-free Base.
- Wall clouds slope upward away from the precipitation and suggest inflow.
- Tornadic wall clouds tend to rotate and often exhibit persistence more than 10 or more minutes.
- Airflow is typically into a wall cloud (inflow) when it is viewed from the east or southeast storm flank looking west.

Shelf Clouds Characteristics

- Shelf clouds typically occur near the leading edge of the storm or immediately adjacent to a precipitation area. Watch the East flank of the storm for a shelf cloud.
- Shelf clouds typically slope downward away from the precipitation area and suggest outflow.
- Shelf clouds may appear vaulted when viewed as they move overhead.
- Precipitation typically falls immediately behind an advancing shelf cloud.

Rain Shafts ("Virga")

Rain shafts are occasionally mistaken for funnel clouds or tornadoes. Rain shafts tend to be somewhat transparent in character. Unlike a tornado, they will not show evidence of inflow, rotation, or debris.

If a spotter reports a tornado under questionable circumstances, it may be wise for the net control operator to ask the following questions:

- Where within the storm is the feature located?
- Is rotation present?
- Is a debris cloud present?

Please look at the attached "flow chart" diagrams for use in determining the accuracy of funnel cloud and wall cloud reports.

Scud Clouds

Scud clouds, occasionally called "wind clouds," are pieces of detached cloud, which form when cool outflow air is injected into an area of warm moist air adjacent to a thunderstorm. Occasionally, when viewed from the correct angle, scud clouds may be mistaken for a significant storm feature such as a funnel cloud, tornado, or wall cloud. Again, it is important for the NCS to seek clarification when such reports are in doubt.

- Consider the location of the reported feature with respect to overall storm structure.
- Ask the reporting party key questions, which may help clarify his report.

Careful monitoring of reports by the net control operator will not only protect the reputation of the Skywarn group providing the service, but will prevent false warnings from being issued to the public. The purpose of the Skywarn program is to not only improve warning time, but also improve warning accuracy!

When should a net be called?:

A common question from many EMCOMM managers involves guidelines for calling a directed net for Skywarn events. As a rule, it is unwise to call a net too far in advance. There is no better way to discourage volunteers than to make them sit at spotter locations for a couple of hours awaiting storm arrival. A tornado watch or severe weather watch may be issued several hours in advance of storm arrival. Therefore, the following general rules are applicable to all Skywarn nets:

- It is suggested that guidance on when to activate be obtained from the meteorologist on-duty at your local NWS office.
- EOCs and key stations should be activated approximately one hour in advance of anticipated storm arrival.
- Spotters should be placed on active status approximately one half-hour before the storms reach the nearest point within the area of warning responsibility (County or City).

Standard operating guidelines may call for a net to be activated during the following conditions:

Tornado Watch
Tornado Warning
Severe Thunderstorm Warnings.

Depending on the guidance received from the National Weather Service, spotters may be activated for a **Severe Thunderstorm Watch** as well.

Whenever notice is given of an impending severe weather event, it is wise to arrange for staffing of key stations at such facilities as EOCs, the NWS office, or other served agencies.

Some National Weather Services offices transmit "**Severe Weather Outlook**" bulletins during the severe weather season either daily or when thunderstorms are forecast. These statements are typically issued in the morning, either around 6AM or around noon. These bulletins, often available over NOAA Weather Radio and the Internet, should provide excellent guidance for

supervisory personnel. When severe weather is anticipated in the area, it is advisable to notify key personnel so they will be ready to proceed to their posts should a tornado watch or severe thunderstorm watch be issued.

Net Logs and Forms:

NCS operators and key stations should maintain a log of all radio activity. This should include:

- The time at which each station reports into and out of the circuit
- The location of each spotter
- The time each effect is reported along with a description of that effect.

Special forms may be prepared on which significant reports can be transcribed in writing within an EOC to emergency management officials through a simple "fill-in-the-blanks" message format. Typical reports are simply "checked-off" and only the time, location, and call sign of the reporting station need be filled in.

It is important to remember that an accurate and neat radio log allows the EMCOMM group to assist a served agency when it becomes necessary to reconstruct a devastating severe weather event! Because of the speed at which severe weather may move through the area, it may be wise for NCS operators to develop the skills necessary to keep a log on a typewriter or computer.

Spotter Safety:

Spotters should select locations which provide access to a safe area, such as a nearby public building. Consider spotter locations near a fire station, school, business, or home. However, it is also important to remember that, to be effective, a spotter should have a clear view of the western sky and horizon. If a solid building is not available near a spotter location, then a plan of escape should be in place.

Spotter Equipment:

Generally, in addition to radio equipment, a spotter should have access to the following materials and equipment:

- Detailed map of the surrounding area
- Spotter ID, EMCOMM ID
- Amateur Radio License
- Rain gear
- Flashlight
- Field glasses (binoculars)

It is also wise for the spotter, or any active EMCOMM operator, to have access to a set of basic emergency equipment, such as spare battery packs, a portable VHF antenna, message forms, pens and pencils, and so forth. This equipment may be arranged in the form of a "go-kit" which can be kept in the car or carried to work and therefore available always should an emergency

arise.

Please take a moment or two to view the sample "Emergency Communications Check-List" included with this document.

Storm Damage Reports:

Spotter groups are encouraged to accumulate reports of significant storm related damage. Some examples of significant damage may include:

- Healthy trees or power lines blown down
- Damage to infrastructure
- Damage to substantial structures (homes, barns, etc.).
- Flooding
- Injuries or fatalities (do not refer to specific individuals).

These reports may be transmitted to the NWS within 24-hours after the event. However, it is important that the time at which the event occurred must not only be included with the report, but must be accurate within just a few minutes. These reports are critical to the storm verification process, which the NWS must conduct after a warning has been issued.

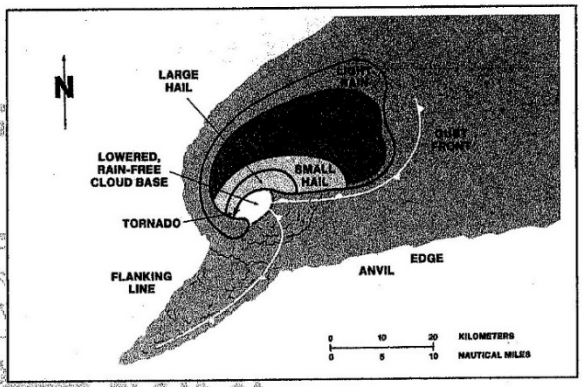
An excellent method for the transmission of storm damage reports is the radiogram format. This standardized format provides the NWS with much of the information they need when reviewing storm damage reports, such as place of origin, date and time of origin, the name of the reporting individual, and so forth.

THE SUPERCELL STORM

- Watch the **leading edge** of the storm for possible damaging straight line winds associated with the **Gust Front**
- Look for **a Shelf Cloud** located at the leading edge of the Storm. This cloud **is not** dangerous.
- Watch the **Rain Free Base**, typically located at the Southwest edge of the storm for a possible **Wall Cloud** or **Tornado.**
- Remember the characteristics of **a Tornadic Wall Cloud**:
  1. **Rotation**
  2. **Inflow**
  3. **Updraft**
  4. **Persistence**
- Do not confuse the Shelf Cloud located at the leading edge of the storm with the Wall Cloud which is typically located beneath the Rain Free Base.
- **Remember! Large Hail often falls close to the Wall Cloud or Tornado. When you are in large hail, you are near the most dangerous part of the storm!**

THE SUPERCELL STORM FROM A DISTANCE:

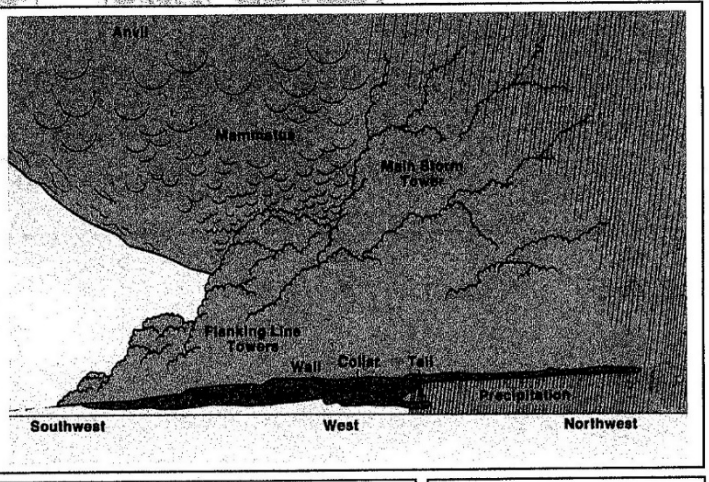
- Look for a well developed Anvil Cloud
- Watch for an over-shooting top (summit of Updraft)
- Main Storm Tower should be crisp and very well defined.
- Precipitation typically falls to the North and East of the Main Storm Tower (Updraft)



WHAT TO REPORT:

- **Tornado or Funnel Cloud**
- **Wall Cloud**
- **Hail in excess of ½ inch in diameter**
- **Damaging winds in excess of 50 MPH**
- **Flash Flooding**
- **Significant Storm Damage**

Use the **TEL** System:
Time of Observation
Effect or Storm Feature Observed
Location of Storm Feature



GUIDE FOR ESTIMATING WIND SPEEDS:

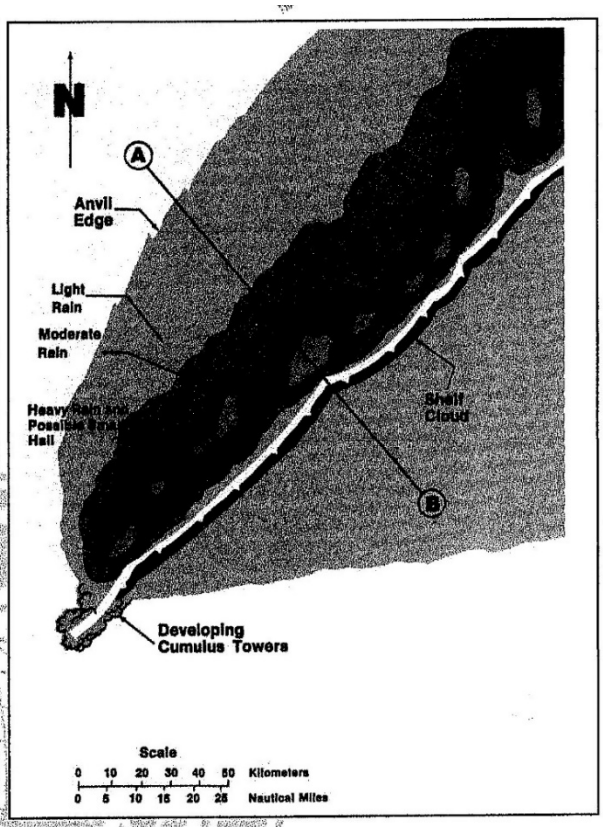
25 to 31 mph…Large Branches in motion whistling heard in telephone wires
32 to 38 mph…Whole trees in motion; inconvenience felt walking against the wind
39 to 54 mph…Twigs break off trees; wind generally impedes progress
55 to 72 mph…Damage to Chimneys and TV antennas, shallow-rooted trees pushed over.
73 to 112 mph…Peels surface off roofs; windows broken. Cars pushed off roads.
113 to 157 mph…Roofs torn off houses large trees uprooted mobile homes destroyed

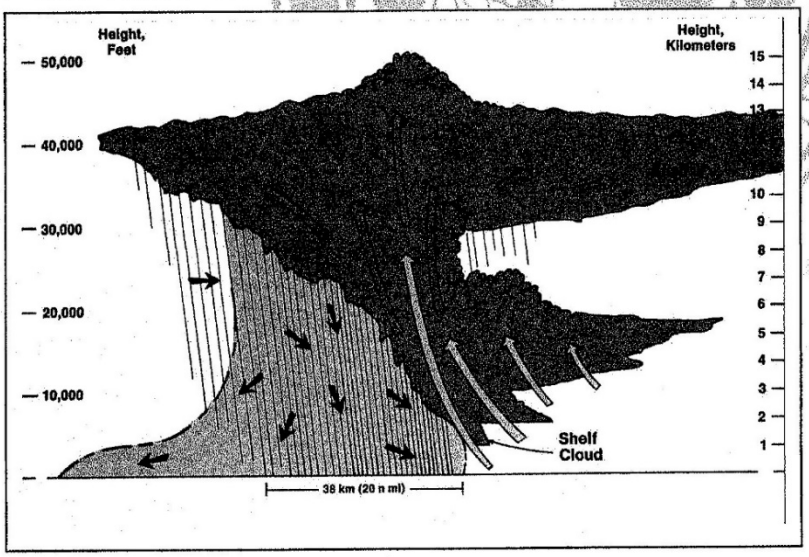
MICHIGAN NET 3663 KC QMN

QMN Form 9803 WB8SIW

SQUALL LINE THUNDERSTORMS

- The Updraft is typically located in a continuous curtain along the **leading edge** of the storm.
- Watch the leading edge of the storm for possible **damaging straight-line winds** or a **rare gust-front tornado.**
- Remember that it is **rare** for a tornado to occur at the leading edge of the storm. If one does occur it is likely to be weak and short-lived
- Occasionally, a **Roll Cloud** will form ahead of the Squall Line in association with the Gust Front. This long horizontal cloud is **NOT** a tornado!
- The strongest winds usually occur immediately after the Gust Front passes or just before rain and hail begin.
- Watch new cells forming at the **Southwest** edge of a Squall Line closely. They may be more severe!
- Watch areas near **a break** in the Squall Line closely. These cells may be more severe!
- **A Bow** in the Squall Line indicates a greater potential for damaging winds. Watch these areas carefully!





GUIDE FOR ESTIMATING HAIL SIZE

Pea Size	**¼ inch**
Marble Size	**½ inch**
Dime Size	**¾ inch**
Quarter Size	**1 inch**
Golfball Size	**1.75 inch**
Baseball Size	**2.75 inch**

NET GUIDELINES

- **Keep all transmissions short and succinct..Think before transmitting!**
- **Do not transmit without the permission of the NCS.**

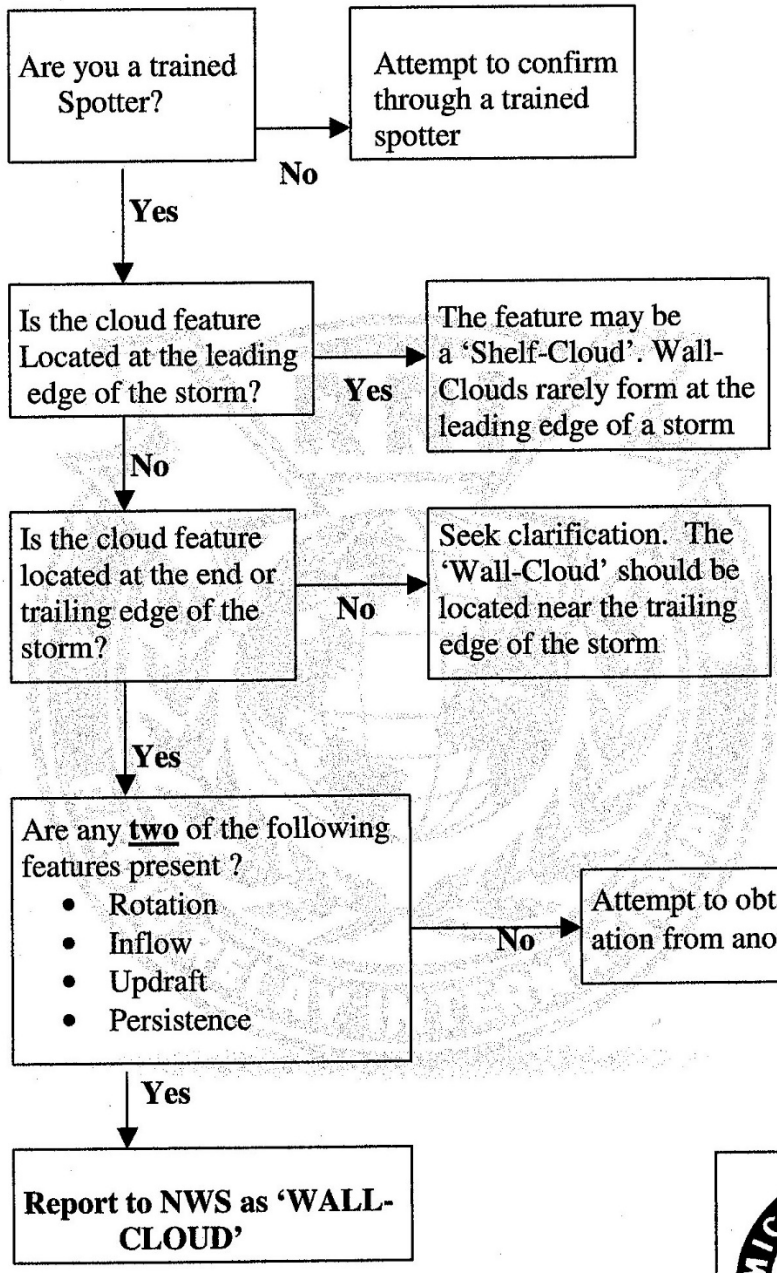
Tornado Safety

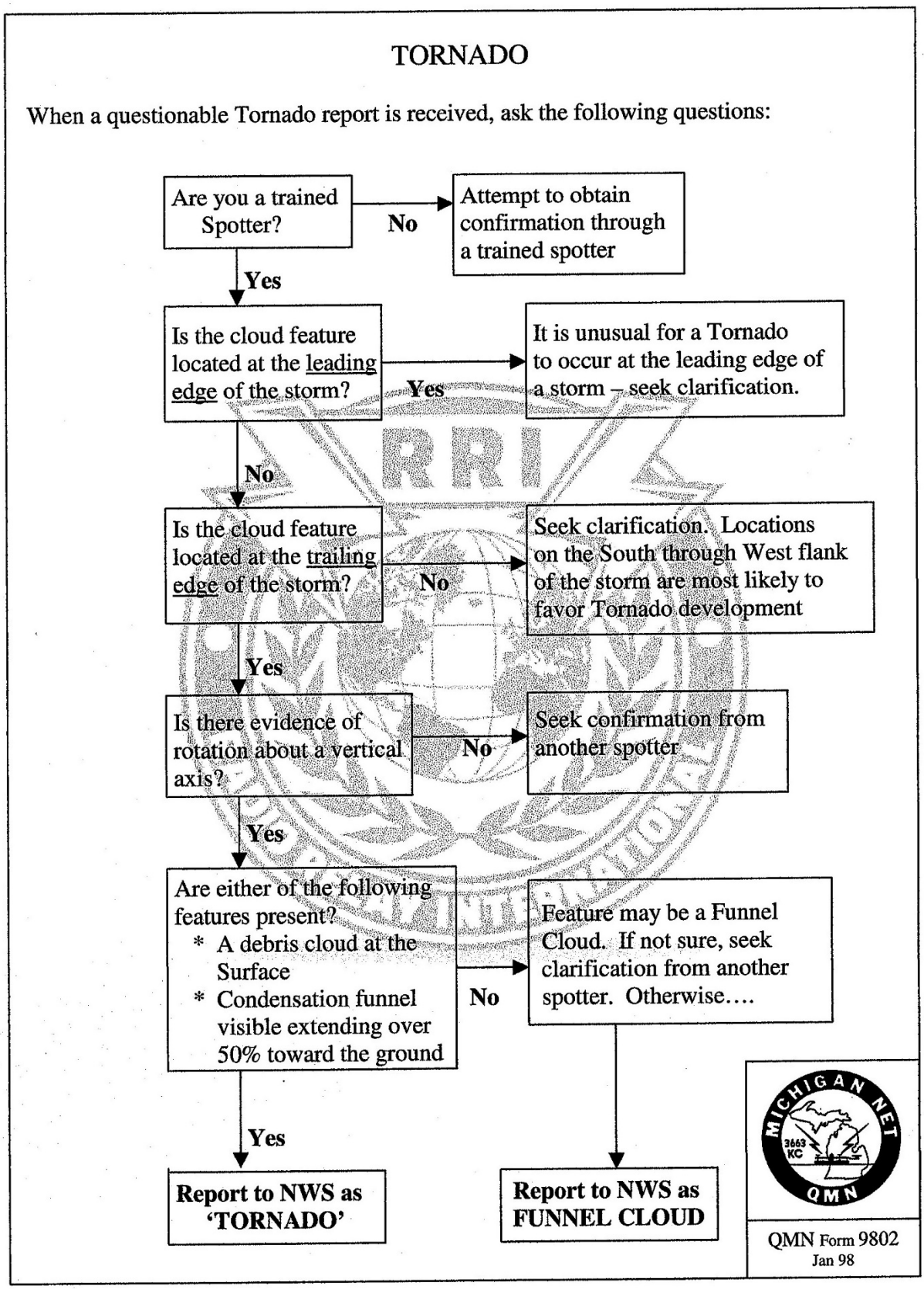
- In the home, go to the basement or a small interior room nearest the center of the lowest floor.
- If caught outside, seek shelter in the nearest ditch or ravine. Stay as low as possible.
- Do NOT stay in mobile homes or vehicles. Leave and take shelter elsewhere!
- Do NOT try to out-run a Tornado in your automobile. Seek Shelter instead!

MICHIGAN NET 3659 KC QMN

WALL CLOUD

When a questionable wall cloud report is received, ask the following questions:




TORNADO
When a questionable Tornado report is received, ask the following questions:
Are you a trained Spotter?
No
Attempt to obtain confirmation through a trained spotter
Yes
Is the cloud feature located at the leading edge of the storm?
Yes
It is unusual for a Tornado to occur at the leading edge of a storm – seek clarification.
No
Is the cloud feature located at the trailing edge of the storm?
No
Seek clarification. Locations on the South through West flank of the storm are most likely to favor Tornado development
Yes
Is there evidence of rotation about a vertical axis?
No
Seek confirmation from another spotter
Yes
Are either of the following features present?
* A debris cloud at the Surface
* Condensation funnel visible extending over 50% toward the ground
No
Feature may be a Funnel Cloud. If not sure, seek clarification from another spotter. Otherwise….
Yes
Report to NWS as 'TORNADO'
Report to NWS as FUNNEL CLOUD
MICHIGAN NET
3663 KC
QMN
QMN Form 9802
Jan 98

SKYWARN NET REPORT

Date: _____ From (call sign):_____

Time:_____

Effect:

☐ Winds in excess of 50 MPH – estimated speed _____

☐ Hail – estimated size _____

☐ Wall Cloud

Rotation
Inflow
Persistance
Updraft

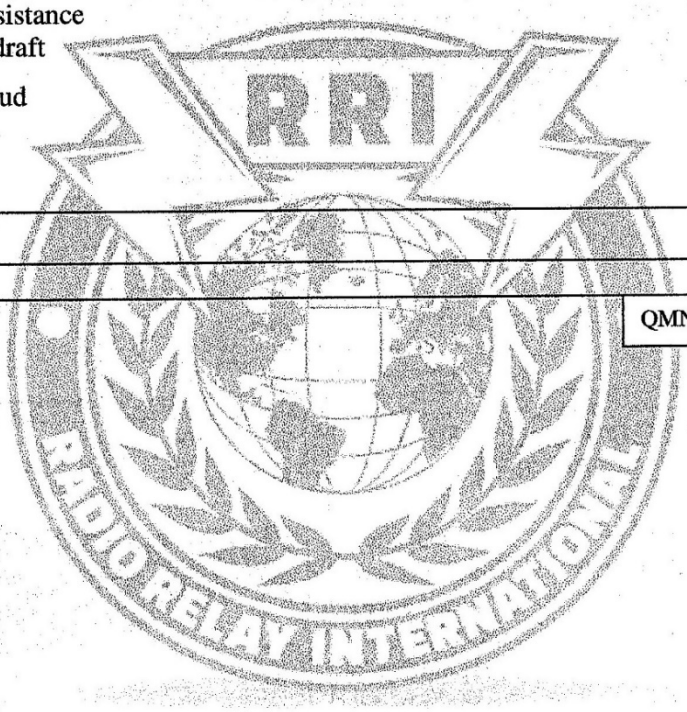
☐ Funnel Cloud

☐ Tornado

☐ Other: _____

Location: _____

QMN Form 9809



NET CONTROL OPERATOR GUIDELINES

The net control operator is the key to the efficiency of the net. His/her performance not only impacts the quality of the public service operations, but also determines the "image" the net presents to the potential member. Therefore, it is important that all net control operators strive to perform their duties in a careful and considerate manner. The following guidelines are written primarily for the CW traffic net. However, the same general rules apply to phone nets as well.

Preparation:

- Be prepared. Begin the net with the proper radio logs, message forms, pens, pencils, and operating aids (such as the "pink-card" – RRI Form 1702) on hand.

- If you use a typewriter or computer, make sure an adequate supply of paper and radio log forms are on hand, and the margins and tabs are set up for the radio logs and forms to be used.

- Ask a family member to answer telephone calls or, if home alone, you may want to mute the phone.

- Turn down the volume on scanners, secondary radios, and so forth.

- If conditions are poor, have available a set of headphones to aid the "copying" of weak signals.

Signal and Keying - Radiotelegraph:

- Make sure your antenna system allows you to radiate the best signal you can. While not everyone can have a "contest-quality" antenna system, it should be adequate to ensure that you can be heard even under marginal conditions.

- Net control operators should equip their stations for full break-in operation (QSK). If you are not used to this operating method, you may want to practice using it during routine contacts for a time before you use it as NCS.

- The quality of your "fist" represents not only you as an operator, but, when serving as NCS, the entire net membership. It is critical that you transmit the most readable code possible for the sake of both efficiency and "advertising." Listen to your fist with a critical ear and, if necessary use an electronic key or keyboard, which provides the most readable signal.

- Accuracy transcends speed! If you find yourself making errors, please slow down! You must be understood, in addition to being heard.

- Most nets do not require that the entire net operate at the speed of the slowest operator. However, any instructions or communications transmitted to an operator of unknown ability must be transmitted at the same speed he uses.

Signal and procedures – Radiotelephone:

- Net control operators on "phone" nets should speak clearly and concisely. Comments and instructions should be as brief as possible.

- The proper phonetic alphabet and prowords should be used at all times. This will prevent confusion, and set a proper example for less experienced members.

- Serving as NCS on a high frequency radiotelephone net typically requires a stronger signal for a given amount of readability than that required on a radiotelegraph net. This is due to the wider bandwidth and greater interference often present in the "phone" sub-bands.

- Serving as NCS on a VHF Net will typically require a stronger signal than the typical user. This is necessary for two reasons: to ensure that NCS may "overcome" malicious interference, and to ensure continuity of operations on an alternate repeater or via VHF simplex mode should the primary repeater fail.

- Operators should be careful with the use of audio processors. Some audio compression is useful; however, excessive compression may result in distortion, difficult copy, or interference to adjacent nets or contacts.

Calling the Net to Order (QND):

- Never leave a scheduled net unguarded. Call the net to order as close to the scheduled starting time as possible. If the scheduled net control operator for a session is not heard within 3 minutes, take over as NCS if possible (QNG). When propagation conditions are poor, you may want to check the alternate frequencies first before calling a net to order.

- Transmit the net preamble followed using "QNA" procedures. The use of this procedure allows the NCS to call for liaison stations ("reps") first, at the beginning of the net. This expedites the transmission and flow of traffic by ensuring that those stations representing other networks or served agencies are available immediately to expedite the flow of message traffic.

During the Net:

- As soon as a station reports into the net (QNI) with traffic for which an outlet is available, send them both off frequency to clear it. This should be done quickly to maximize critical network efficiency.

- Call for general check ins periodically throughout the remainder of the net using the "QNI" signal, periodically listing any traffic for which there is yet no outlet. For example, "net calls" for a radiotelegraph net might be:
    - "QMN DE W8IHX QNI K"
    - "MICHIGAN NET DE W8IHX QNI K"

- "QMN TFC DETROIT LANSING JACKSON QSP? QNI K"

- The key stations ("reps") may be excused (QNX) after ten minutes (but not sooner), if there is no traffic listed for their respective function.

- Regular check ins may be excused sooner at the discretion of the net control operator. However, those stations for which there is no business, should not be held longer than 10 minutes.

- Nets with many check ins may be excused using the signal "QNF," or the "net is free."

    - Example: "QMN QNF 73 DE W8IHX SK"

- When time is short, and only a small number of stations need remain on frequency to conduct business, a group of stations may be excused at once. Use the procedure:

    - "QMN QNC QNS QNX …..(list stations)…AR"
      or
    - "QMN QNC… the following stations are excused… <AA> _____AR"

How to send stations off-frequency:

There are several acceptable ways a net control operator may direct stations to move to a different frequency (QNY) to clear traffic. Please note that the radiotelephone examples are in parenthesis.

- When conditions are good and you have reasonable assurance that two stations can hear each other, simply use the "QNY" signal. If both stations are presently on net frequency use the following procedure:

    "WB8SIW ES W8EGI QNY DWN 3 DWN 3 NWS 1 K"
    ("WB8SIW call W8EGI down 3 khz one National Weather Service")

- If conditions are poor and you do not have reasonable assurance that two stations can hear each other, use the "QNV" signal. The procedure is:

    "WB8SIW QNV W8EGI DWN 3 DWN 3 NWS 1 AR"
    ("WB8SIW call W8EGI here, if OK move down 3 KHz one routine National Weather Service")

  WB8SIW would call W8EGI on net frequency to see if they can communicate adequately. If so, they will QSY. If not, you must find a station to relay.

- If you wish to send a station off frequency to exchange traffic with another station already engaged in a transaction off frequency, you would use the "QNQ" signal. This tells the station who to call off frequency and when. For example:

"W8EGI QNQ DWN 3 DWN 3 WB8SIW AFT W8RTN NWS 1 K"
("W8EGI move down 3 KHz call WB8SIW after W8RTN for one routine NWS")

W8EGI has just been told to QSY down 3 KHz and to call WB8SIW when he is done with W8RTN so they can exchange one NWS message.

Handling Traffic on Frequency:

- In order to maintain net efficiency, as little traffic as possible should be transmitted on the net frequency. However, this may be necessary under poor conditions or when NCS is the originator or recipient of traffic. For this situation we use the "QNK" signal. For example:

  "W8ZZ QNK DETROIT 2 W8SCW AR"
  ("W8SCW call W8ZZ two routine Detroit, out")

  W8SCW would immediately call W8ZZ, obtain a signal report, and then proceed to transmit the two messages for Detroit.

Net Announcements:

- Net announcements are typically listed by the originating stations as "QTC QNC"

- The point at which a QNC is transmitted during the net is at the discretion of the NCS. However, the timing should be chosen in such a way as to not delay the net nor keep members without business tied up unnecessarily.

- Always ask if any station needs "fills" immediately after the QNC is completed. It is appropriate for the station requesting fills to contact the originating station (with the QNC) directly without the permission of NCS at that point.

National Weather Service or other "Served Agency" Traffic:

- Because of the volume of traffic during emergency conditions, this traffic should be cleared as quickly as possible. The net control operator should be prepared to send stations off frequency quickly to meet with the representatives at served agencies.

- During emergency events, the origination of priority or emergency messages may occur. Be sure to begin handling these messages immediately before dispatching routine traffic to other side frequencies.

Radio Logs:

- All net control operators should develop the ability to maintain a radio log. Besides documenting the participation of individual net members for use in net reports, this

document serves two significant purposes:

- Develops the skill of record keeping which may be critical in time of emergency.
- Limits liability of net members should an inquiry occur after an emergency activation.

QMN Form 9805 Radio Log – Instructions for Use

- Record the date and type of net in the upper portion of the log.
- Note the time, call sign, and a summary of each net transaction on the radio log.
- When the net is completed, note the total number of check-ins (QNI), total traffic handled and the time the net was in session. This data can be referred to later when drafting your regular report to the Net Manager.

Note: Please see the attached examples of the log form.

IATN and Special Representatives:

Occasionally, a station with an unfamiliar call sign will report into net listing traffic for various destinations within the service area. If the station is not a regular net member and identifies himself as "IATN" or a representative of a similar "upper-echelon" net, his traffic should be cleared immediately. Solicit a volunteer to clear his file of messages for the net immediately. It is also helpful to excuse the IATN rep in advance of sending him off frequency.

Alternate Frequencies:

Many nets have alternate frequencies available for use. This can be especially useful during periods in which propagation conditions on High Frequency are anomalous, when the net must operate at unusual times (such as during emergencies), or when there is a CW or RTTY context going on that makes it difficult to find a clear frequency. High Frequency nets should publish these alternate frequencies in advance.

Typically, section level nets use the 40-meter frequency during the summer months or during the solar maximum, when conditions will not support communications on 80 meters. The 160-meter frequency is typically used during the late winter months or during the solar minimum, when evening conditions will not support local communications on 80 meters.

Net Control Stations are encouraged to equip their stations with effective antenna systems for the alternate frequencies.

It is recommended that the following procedures be followed when conditions warrant the possible use of an alternate frequency:

- In advance of the net, call two or more net regulars and establish communications. If

conditions are very poor, request that one remain on frequency for five minutes and transmit several bulletins that the net is meeting on _____ Khz.

- Be sure to avoid other nets, which may be operating on the same alternate frequencies. For example, Canadians are often using SSB on forty meters when CW nets are attempting to use a 7-MHz alternate frequency. Choose a frequency which will avoid interference to existing conversations or "contesting."

- Be careful not to send two stations off frequency atop another net, or within a "DX window."

- If you do not wish to move the entire net, you may want to send certain stations to an alternate band to clear traffic when necessary. This is determined based on experience with ongoing propagation conditions. For example, during the summer months, stations in Michigan's Upper Peninsula may have better luck exchanging traffic with Lower Peninsula stations on 40 meters.

Filing your report with the Net Manager:

Upon completion of the net, it is wise to draft your net report for transmission to the Net Manager. Try not to wait until the end of the month to file all your reports, as this makes it difficult for the Net Manager to consolidate his/her summary report for transmission to the RRI Statistician on time.

The net report should be drafted in radiogram format and may include the following items:

- The date on which you were NCS
- The stations who checked-in to the net (QNS) and their liaison functions
- The quantity of traffic, which was passed (not the quantity listed)
- The amount of time the net was in session (in minutes)
- Any short comments of importance to the manager ("poor conditions", "QRM," etc.).

Information includes identifying the liaison responsibility of each station may be optional. For example: "W8RTN/8RN" indicates that W8RTN served as liaison to the "Eighth Region Net" and "WB8SIW/NWS" indicates that WB8SIW served as liaison to the "National Weather Service." It is also possible to use abbreviated call signs when confusion on the part of the net manager receiving the radiogram is unlikely.

The following examples of properly drafted net reports should serve as a guideline for you to follow:

221 R W8IHX 26 WAYNE MI MAY 26 KB8HGM
<BT>
QMN/E MAY 26 X QNS
W8IHX/NCS W8RTN/8RN AA8PI/NWS WX8Y/MITN KB8ZYY/GLETN/NCN
N8TDE/SEMTN K8AI WB8R WD8KQC W8EGI

K8LJG K8SB KB8HGM W8WVU X
TFC 20 TIME 24 X
73
<BT>
JEFF

13 R W8ZZ 26 HIHLAND PARK MI MAY 27 W8YIQ
<BT>
QMN/L MAY 27Z X QNS
W8ZZ/NCS SIW TDE WX8Y ZYY
AI HGM EGI LJG RTN
SB WB8R WVU QHB X
TFC 5 TIME 22 X
73
<BT>
JIM

Note: Please observe the fact that this second radiogram, a report for the evening net manager, indicates that the net session occurred on May 27 UTC (zulu), not May 27 local time! Because the QMN Late net occurs at 10-PM local time, it is occurring on the next radio day! The date given must refer to Zulu time (UTC).

RADIO LOG			DATE		PAGE OF PAGES	
STATION/CALL SIGN:			MISSION/NET:			
FREQUENCY/MODE DESIGNATORS						
TIME	TO/FROM	MESSAGE/REMARKS				

RADIO LOG

DATE: 3 JUL ØØ

PAGE 1 OF 2 PAGES

STATION/CALL SIGN: WB8SIW

MISSION/NET: MICHIGAN NET (QMN) - EARLY

FREQUENCY/MODE DESIGNATORS: 7Ø68

TIME	TO/FROM	MESSAGE/REMARKS
2230	QMN	QMN QNC QND QNZ QNN WB8SIW QNA 8RN REP K
	W8RTN	QNI 8RN QTC NWS-1
2231	WX8Y	QNI MITN QTC NWS-1
	K8GA	QNI SEMTN QTC NWS-1
2233	K8SB	QNI QTC NWS-1
	AA8PI	QNI QTC NWS-1
	N9BDL	QNI QRU
2234	K8KV	QNI QTC NWS-1 W8FQT-1
	K8GA	K8KV QNY UP 3 W8FQT-1
2235	K8FE	QNI QRU
	N8TDE	QNI QTC NWS-1
	KI8C	QNI QTC NWS-1
2236	K8AE	QNI QTC NWS-1 W8FQT-1 WB8SIW-1
2237	K8MEG	QNI QRU
2238	W8RTN	QNK NWS-1 QNX
2240	WX8Y	QNK NWS-1 QNX
	KV/AE/GA	BACK
2242	K8GA	QNK NWS-1 QNX
2243	K8SB	QNK NWS-1 QNX
2244	AA8PI	QNK NWS-1 QNX
	N9BDL	QNX
	K8MEG	QNX

QMN Form 9805

DIGITAL TRAFFIC NETWORK

Radio Relay International operates a nationwide Digital Traffic Network (DTN) with International connections, utilizing automated PACTOR methods built on a BPQ-32 software platform. The DTN hybrid mesh network system automatically routes record message traffic to its destination as soon as it is injected into the network.

The following information originally appeared in the QNI Newsletter. Our thanks to Chuck Verdon (W5KAV) and Dave Struebel (WB2FTX) for their assistance with this portion of the Handbook.

The Digital Traffic Net is one arm of Radio Relay International. It operates in parallel and in concert with the RRI manual mode network layers. In the absence of emergencies or disasters, all parts of the RRI system are kept well-oiled and operational through daily exercise using routine messages. This allows operators to hone their skills and keep equipment in working order.

In the event of an emergency or disaster, both RRI manual mode nets and the DTN can move health and welfare messages or emergency messages within a state, region, area, or between areas using both traditional nets and digital means. DTN is capable of handling larger volumes of traffic than the traditional nets and can operate error-free, aside from errors present at input ("garbage in-garbage out").

Although many would-be participants are deterred by the high cost of a PACTOR III modem, many other options are available for those wishing to establish DTN capabilities. A PACTOR I modem such as a PK232 MBX, certain models of the Kantronics "KAM," or a sound-card device such as a "SignaLink USB" used with WINMOR software, can be used to connect to the DTN or Winlink2000 (WL2K) System. Many of these items can be purchased at swap meets for $50 or less. The needed cables can be built or found at swap-meets as well. The cost of used desktop or laptop computers may range from free from a friend, to a low-priced unit purchased used or from a discount retailer. Most of the needed software runs on Windows-95 or newer platforms.

Options are available for running a DTN station without infrastructure power, using batteries, a generator and/or a solar panel. If you have a car or truck, which is not running on vapors, you have fuel on hand for a generator.

DTN Area Digital Hubs:

DTN has a structure similar to traditional manual mode national messaging layer. The Area Digital Hubs correspond to the Western, Central and Eastern Area Nets. These hubs handle traffic in bulk between RRI Areas, throughout the United States (including Alaska and Hawaii) and Canada. Each area hub has at least one alternate station. Each of the Area hubs uses a store-and-forward node system, using Winlink Classic or BPQ-32 software, and running PACTOR I,

II or III modes. These hub stations scan multiple frequencies 24-hours per day, 7 days per week, stopping only to transfer traffic with another area hub or a region hub within their area. The operation, including traffic routing, is automatic and generally does not require any operator intervention.

All hubs also use the Winlink 2000 System to send and receive traffic in the form of radio-email. Radio-email can pass from radio to the Internet and vice versa via a gateway station. It may be in email format or it may carry formal radiograms. Small file attachments, consistent with amateur radio bandwidth limitations, may also be sent. HF PACTOR, VHF packet, and Telnet (conventional Internet all the way) may be used, with RMS Express, RMS Packet or Airmail software.

DTN Region Digital Hubs:

DTN region digital hubs use the same hardware, software, and mode selection methods as the area hubs, taking traffic for their region and sending out long-haul messages. Like the area hubs, the region hubs perpetually scan multiple frequencies, automatically routing the traffic and making the appropriate connections to further the messages on their way. Agencies served by RRI or local EMCOMM organizations that are equipped to use the Winlink 2000 System may also send and receive their traffic directly via the DTN, telnet or radio-email by connecting to any station designated as a DTN Target Station within their own region or area, unless there is a disaster or emergency, at which time they may connect to any available DTN target station.

Digital Traffic Stations:

Digital Traffic Stations (DTS) operate at the state or section level, either scanning as the hubs do, or by connecting once or twice a day to exchange traffic. Messages are automatically routed to them by the region hub. In the case of routine traffic, the DTS operator may deliver the traffic or may take it to state or local RRI nets for distribution.

As with the manual mode nets, long-haul traffic flows “up” from the local, state and region level to the area level. It then passes between the areas and back “down” to the region, state and local levels for delivery. Area hubs handle large volumes of traffic on PACTOR III. Region hubs serve to/from the DTS, who may be using PACTOR I, which, while nonetheless an effective mode, takes more time than the robust PACTOR III mode.

A major advantage of DTN is that traffic may be posted at any time of the day or night, independent of scheduled net times, and start moving immediately, subject only to the limitation of HF propagation conditions. The traffic is transferred automatically and very quickly to the region hub closest to its destination, where it waits for a DTS to pick it up.

WinLink2000 Target Stations:

The Winlink2000 System target stations are another line of defense for forwarding or relaying radio-email traffic if there is a total failure of the Internet. Also, the addition of the WL2K radio-email layer for DTN stations enables all EMCOMM and DTN stations to intercommunicate on a

common network when needed. For this reason, the RRI Methods and Practices Guidelines document has been revised to include WL2K system functions. This capability not only benefits the DTN, but also allows local EMCOMM organizations and served agencies to send and receive traffic in familiar email format, via amateur radio when the infrastructure is compromised.

Within this structure, different types of target stations have been defined from the state level up thought the area level. In the future, you will see a national database through which users can check to see which stations within their state, region or area are available for connections to target stations. This data base will be available both through the Internet and through digital connects over HF and VHF. Until then, the three area digital hubs serving RRIE, RRIC and RRIW are the points of contact as WL2K System target stations.

When no other route is open, state target stations will provide a WL2K System destination for communication with state leadership, connecting them with government and non-government agencies that may be responding to a disaster. Target stations are expected to be able to expedite time-sensitive traffic either on nets, via the WL2K System or via DTN. The target stations will also be the RRI Section Communications Manager's primary contact for out-going traffic in a disaster.

Target stations need to have the ability to connect to the Winink2000 System without infrastructure. This could be via HF PACTOR I, II or III, or VHF packet along with WINMOR software.

DTN Leadership:

As with the classical RRI manual mode net structure, the DTN leadership consists of three Area Digital Coordinators (ADCs) representing each of the RRI Areas (RRIW, RRIC, RRIE). These ADCs are part of the area staff, and function under the RRI Area Chairpersons. They are elected by the RRI area staff where they serve. The RRI Area Staff consists of net managers, voting members, and non-voting members as defined under the Constitution and By-Laws of Radio Relay International.

RRI Equipment Bank :

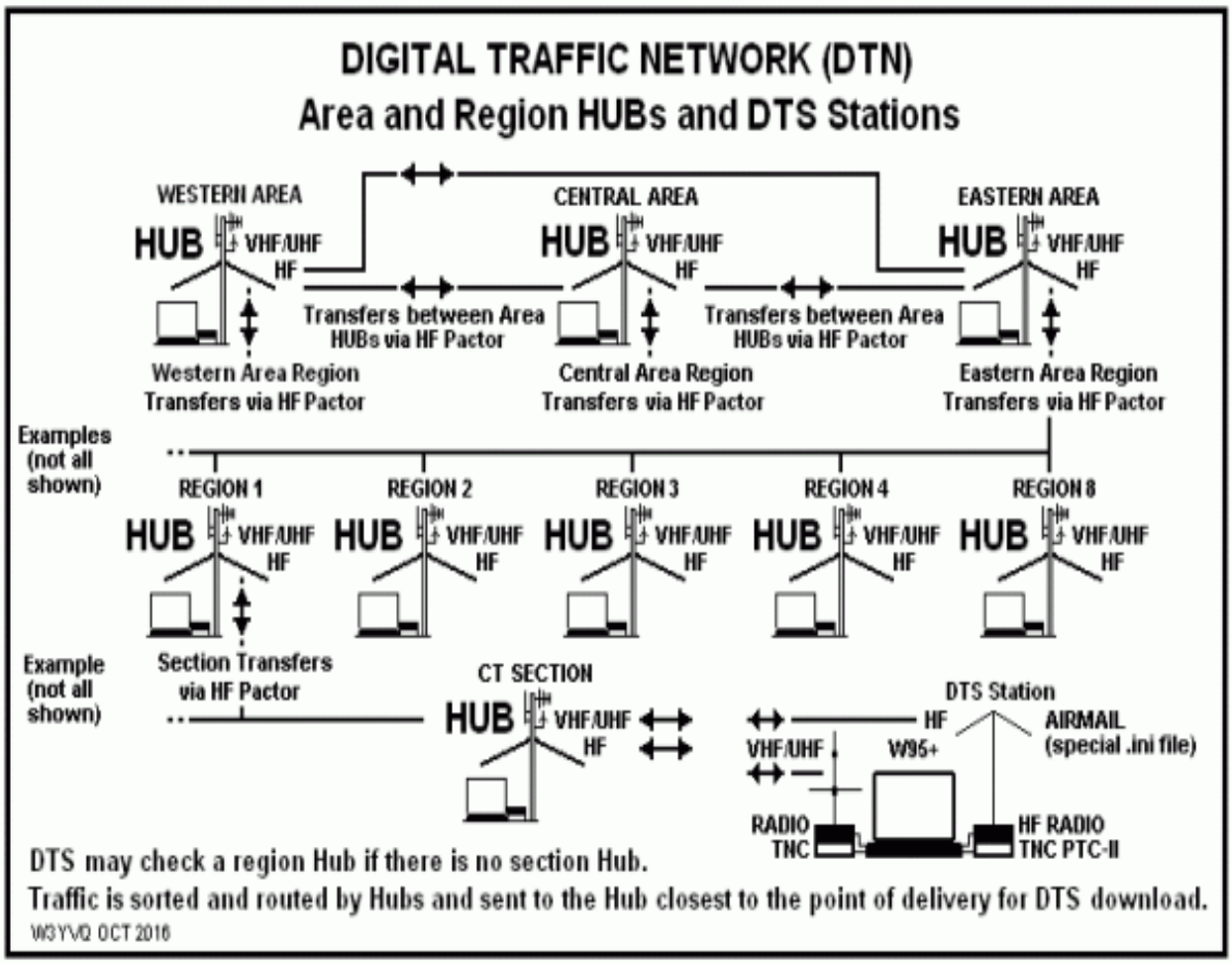
For operators who may be interested in getting started with digital traffic, the DTN operates an Equipment Bank. PACTOR I capable TNCs and packet TNCs are available for loan until the operator either resigns from DTN, or upgrades to using his own equipment. The Equipment Bank is always looking for donations of equipment or cash to further their program. All donations to RRI are tax deductible.

Get Involved:

Getting involved is easy! Any of the ADCs can put you in touch with a DTN station operator nearby who can help configure your system. Believe it or not, these so-called "Digital Sysops" do not have two heads and four arms! Yes! They may make your head spin around from time to time with all the information, but they are a friendly group always willing to help.

Radio amateurs who would like to get involved with the Digital Traffic Net should contact their ADC either by email, through the WinLink2000 System, or via radiogram.

Contact information for the current area digital coordinators is available on the RRI Web Page at: www.radio-relay.org



The Digital Traffic Station (DTS):

DTS is an RRI area appointment made by and reporting to the RRI Area Digital Coordinator (ADC). DTS appointments require that one register as an RRI Radio Operator. Monthly activity reports to the appropriate ADC are required, along with continued service in the DTS function. DTS operators are usually appointed at either a region or state level, although it could also be a local level assignment.

The function of the DTS is to check into (connect to) the "assigned" hub, download traffic for the assigned local or state, and take it to the region, section or local nets for further relay and ultimate delivery. Since the hub operates 24/7, the connection can be done at any time, at the

convenience of the DTS, although it makes the most sense to do it shortly before the scheduled nets.

When the DTS connects to their hub, traffic routed (by zip code) for their area of responsibility is automatically downloaded to their station. Likewise, any outgoing traffic they may have can be automatically uploaded to the hub in the same session. Depending on the traffic load, this could take up to several minutes to complete.

While the hubs use the higher speed PACTOR II and PACTOR III protocols to communicate among themselves, such speed is not necessary for a DTS, since they are only in contact with the hub for a short time. The older PACTOR I speed is suitable for a DTS. Fortunately, PACTOR I is very easy and inexpensive to operate.

Transceiver Requirements:

What else does a new DTS need? Although some of the hubs also have VHF packet capability, most of their activity is on HF, usually on 80 and 40 meters. That means you need an HF transceiver and antenna for 80 and 40 meters.

The transceiver doesn't have to be the latest and the greatest, but it should have a quick transmit/receive turnaround time (most modern rigs do) and preferably a digital frequency readout. Transceiver control by computer is handy, although not absolutely required. The primary requirement is frequency stability. An older rig that meets the rest of the above requirements, but takes time for the frequency drift to settle down, may still be used provided you turn it on and let it warm up before making your connection.

Controlling the Transceiver:

You need a cable to go from your modem to your rig. There are two ways of doing this. The preferred way is to use the accessory connection on your radio. The second method involves the use of the microphone and external speaker connections. The accessory route is preferred, because usually the audio levels on these ports are fixed. Also, such a connection avoids having to plug and unplug connections when you want to use your rig for other modes, such as SSB or CW.

There is very little standardization between modem and accessory port connections. Thus, you must specify a particular cable by the modem/rig combination. DTN personnel either have or can get copies of the operations manuals for most common transceivers and tell you what type of connector is needed. Some prefer to buy these cables already made. Assembly is especially difficult with the 13-pin DIN and 6-pin mini-DIN connectors found on most current radios. Ready-made cables are available from Buxcomm, which sells a vast selection of cables for different modem/transceiver combinations for about $22 plus shipping, or from MFJ, which does not have the same large selection.

The Modem:

The modem requires power, and fortunately that connection is one of the few that is standardized. The power connection is the DC coaxial type with a 5.5 mm OD, and a 2.1 mm ID, the center pin being positive (be careful about that, because the penalty for reversing the polarity is the destruction of the modem!). The nominal voltage is 13.8 V DC at about 750 ma, either from the supply in your shack (not recommended, since this might cause ground loop problems) or via a separate supply. "Wall wart" transformer supplies are ideal; just make sure you get one with the right voltage and sufficient current capacity. I recommend one with at least 1-amp capacity. Please check the output voltage. Some of these small units are unreliable and voltages may either exceed the maximum recommended or fall below the minimum.

The Antenna:

Any antennas that works for you on 80 and 40-meters is fine, although an NVIS configuration can be advantageous. As a DTS, you do not need an elaborate automatic antenna tuner, since you will be operating on one frequency at a time.

The Computer:

Lastly, you need a computer, which also doesn't have to be the latest and greatest. The primary software used by a DTS is Airmail 2000, which will run on any Windows computer from Windows 95 through Windows 10. Details and links for downloading the appropriate software and associated files can be provided by the area digital coordinator.

The PACTOR I modems are older designs with a physical serial port (often a female DB-25 or DB-9 serial connector). If your computer has an older serial ports with a male DB-9 connector, all you need is a cable to go from the modem to the serial port, male DB-25 on one end and female DB-9 on the other. But life is not always easy. Computers with serial ports are becoming harder to find. If all you have is a USB (Universal Serial Bus) port, you have two options. The best option, if you are using a desk-top computer, is to buy an add-on serial port board that fits into one of the PCI expansion slots. They come in single, dual, and multiple serial port varieties starting at about $15 to $25. Get at least a dual port card (you will see why later).

If you don't have available expansion slots or are using a laptop, you may only have a USB port available. In that case you need a USB-to-serial converter. These also come in single and multiple port configurations. Unfortunately, not all USB-to-serial converters are created equal. Some are up to the task at hand and some are not. Rather than guess, DTN experts often recommend the Keyspan HS-19. They install themselves with a simple executable program, so you don't have to search for the correct drivers. Amazon.com (and others) sells them.

Why the dual serial port card? The Airmail software can also control your radio, if the radio is so equipped. For this you most likely will need the second serial port, unless your radio can be controlled directly via a USB connection. Airmail has computer support for most of the recent rigs in the past 20-years. The advantage is that you will no longer have to manually set either the frequency or operating mode on the radio; Airmail will do it for you. For those of you without computer controlled radios, Airmail will tell you which "dial" frequency and what mode

(LSB/USB) to set manually on your radio.

Going Live:

Once you have everything together, one of the ADCs will walk/talk you through the hookup, installation and setup, either by telephone or via Skype. Skype is a free VoIP protocol that allows free Skype-to-Skype member video calls. We use it quite a bit within DTN for multi-station discussions and conferences.

If you sign up with Skype, send a connect request to whomever is going to do the walk/talk, so you are on their connection list. All of this will culminate in your first connection to your "assigned" Hub and instructions and practice on how to download and upload traffic. After that, you will be part of the expanding DTN network.

If you want additional details or help, please contact one of the three Area Digital Coordinators (ADC) listed on the RRI Web Page.

PERSONAL PREPAREDNESS

Much of this handbook has dealt with the "big-picture" of emergency planning and the development of important skills necessary for emergency and public service communications. In this section, we hope to introduce the reader to an equally important aspect of ECOM preparedness: essential equipment for the EMCOMM volunteer.

The "Go Kit":

While many individuals today possess wireless communications tools, few are prepared to extend the operation of such devices through alternate power supplies, battery packs, and so forth. For example, one may possess a hand-held satellite telephone, however, how does one use it from within a building? How does one charge the battery pack when AC Mains are not available? Amateur Radio Operators often know the answers to these questions whereas the public does not.

It is our recommendation that the newcomer to public service communications begin by creating a "go kit" containing basic emergency-communications items. Because many emergencies occur without prior warning, this basic kit should consist of items most useful to the majority of radio amateurs in a wide variety of emergency situations. Depending on one's primary responsibilities as well as local conditions, it is ultimately up to the individual to decide what items are most useful.

Because most local emergency response takes place on VHF ("two meter") frequencies, many operators will decide to build their go-kit around VHF equipment. Some typical contents of a basic go-kit are:

- 144-MHz handheld transceiver including:
  - Magnetic-mount antenna
  - Cigarette lighter plug
  - Spare alkaline battery packs
  - instruction card for above
- "Roll-up" J-Pole Emergency VHF Antenna (see last page)
- Quantity of radiogram blanks and blank pads of paper
- 100 copies of the Disaster Welfare Message Form
- Clipboard, pens, pencils
- Emergency telephone reference list
- Flashlight (with spare lamp and batteries)
- Emergency Services Identification
- Small bag of misc. RF adapters
- Medical Data sheet (in case you are injured)

These items can be kept in a small bag or briefcase, which can be kept in the back of one's vehicle or at one's office, for immediate use in time of emergency. This way, if an emergency occurs while one is at work, at the park, or on the golf course, it's a simple matter to proceed straight to one's assignment.

The reader will note that an "alkaline battery-pack" is recommended for the handheld radio. This recommendation is made for two reasons:

1. If you forget to charge a Ni-Cad pack it may be of no value when most needed.
2. Alkaline dry cell batteries (usually type "AA") are available everywhere.

All too often, volunteers report to an incident only to find their Ni-Cad or other rechargeable battery pack has discharged (typically about one percent per day) while sitting on the shelf. Worse, some show up without a spare battery pack of any kind.

Other items of critical importance is the "magnetic-mount" antenna and cigarette lighter plug. Many radio amateurs mistakenly assume that they will be most needed in their own vehicle. This is not always the case. Many situations require one to temporarily communicate from a public safety vehicle, American Red Cross ERV, or similar mode of transportation. While a handheld radio may be convenient to carry under such circumstances, the simple fact is that the small "rubber-duck" type antennas used with such equipment perform very poorly from inside a metal vehicle.

An additional useful item is the "roll-up" two-meter antenna J-pole antenna made from twin-lead. This antenna can be of critical importance should one have to communicate from shelter, command post, or similar temporary facility. As in the case of an automobile, attempting to communicate from inside a building with a "rubber-duck" antenna can be most inefficient. The roll-up two-meter antenna may be deployed near a window or hung from a nearby tree with a length of coax extending into the building where the radio is conveniently located.

Clothing:

One may also want to keep on hand a seasonally appropriate bag of clothing. When one is at the office in a suit and tie (or in some lines of work, in overalls) he may suddenly find himself dressed inappropriately for a disaster assignment. In any case, a change of clothing is helpful when you find yourself wet or muddy.

Many disaster sites present hazards such as nails protruding through boards, jagged metal, and uneven surfaces. The emergency responder may want to consider keeping the following items on hand for use in time of emergency:

Warm Weather

- Heavy steel toe shoes or work boots (prevent injury to feet)
- Pair of neat slacks or blue jeans made of a strong tear-resistant fabric
- Light jacket for day, heavier jacket for night
- Hat and sun-screen
- Tooth paste, tooth brush, hand towel and shaver
- Any required medications

Cold Weather

- Heavy Coat, insulated gloves, hat
- Warm, insulated boots (must keep your feet dry and warm!)
- Spare pair of socks
- Sweater
- Tooth paste, tooth brush, hand towel and shaver.
- Any required medications

Despite the fact that one may be responding to a disaster, it is important to remember that you still want to present a professional image. Clean, properly fitting clothes are all that is required. However, one may want to avoid such things as camouflage BDUs (khaki or solid color are OK, and have many pockets) or items that are excessively "military" in appearance.

Family Preparedness:

It is outside the scope of this Handbook to cover the details of family preparedness. However, plenty of excellent information is available through such organizations as:

- The American Red Cross
- The National Weather Service
- Federal Emergency Management Agency

It is important to insure that your family can be left alone (assuming they are not impacted directly by the disaster) for a time in the event of an emergency. Emergency responders should discuss personal and family preparedness issues with fellow family members, in order to make sure they are fully prepared to respond without your assistance to those hazards most likely to affect your area. For example, one's spouse and older children should know how to turn off important utilities (gas mains, AC-mains disconnect, etc). They should also know how to use emergency lighting, where supplies are located, and the like.

Emergency Checklists:

An emergency checklist can be of great assistance when responding to an emergency operation for which one has some warning. In some cases, operators may be assigned in shifts, allowing individuals to better prepare for the specific emergency communications needs of his assignment.

In this section, you will find a sample checklist designed by a radio amateur who is active in public service communications. It is important to remember that this checklist is unique to an individual or agency. The checklist you develop will depend on your specific skills, responsibilities, and the needs of your primary served agency. For example, the individual whose primary responsibility is to establish RRI liaison communications for the local EMCOMM group may have a greater emphasis on High Frequency radio equipment than the individual whose primary responsibility is reporting to a fully equipped EOC.

For those that are more involved in public service communications, the attached list should provide a wealth of ideas. Please feel free to borrow liberally from these ideas when setting-up your own emergency response checklist system.

SAMPLE EMERGENCY RESPONSE CHECK-LIST

VHF Radio Equipment:

___ Handheld radio(s)
___ Spare battery packs for above (rechargable)
___ Spare battery packs for above (Alkaline cells)
___ Battery charger(s)
___ Telescoping antenna for HT
___ Roll-up VHF antenna
___ Mag-mount antenna
___ 25 foot length of coax
___ Misc. RF Adapters

HF Radio Equipment:

___ Portable transceiver (Amateur)
___ Portable transceiver (MARS)
___ Transportable dipole antenna
___ Transportable random-wire antennas
___ Qty 1 500' role of nylon rope
___ Qty 2. 50' lengths of coax
___ Qty 2 SO-239 barrel adapters for above
___ Microphones for above
___ Radiotelegraph keys for above
___ DC power cables for both transceivers

Electrical Equipment:

___ Spare fuses
___ Cigarette-lighter cord
___ Deep-cycle battery
___ AC Power supply
___ Qty 2 Extension cords
___ Qty 2 power strips
___ 3.5 KW generator
___ 10 gallons gas
___ 2 qts 10W-30 oil

Writing Gear and Operating Aids:

___ Pens, pencils, erasers

___ Clipboard with small light
___ Net Directory
___ Telephone lists and data base information
___ Qty 100 Disaster Welfare Message Forms
___ RRI Form 1720 Amateur Message Form" Operating Aid
___ Message Forms
___ "Scratch Paper"
___ Computer, portable printer.
___ Wind-up clock

Miscellaneous:

___ Tool bag
___ Portable table(s)
___ Folding chair
___ Flashlight and spare batteries
___ First-Aid kit

Personal:

___ Identification
___ Medications
___ Eye Glasses
___ Aspirin
___ Sun Glasses
___ Field Glasses ("binoculars")
___ Shaving-cream, razor, toothbrush, comb
___ Rain gear
___ Jacket and hat
___ Steel-toe shoes
___ Change of clothes

TRAFFIC OPERATIONS AID

QN SIGNALS FOR CW NET USE

QNA*	Answer in prearranged order.
QNB*	Act as a relay Between ____ and ____.
QNC	All net stations Copy. I have a message to all net stations.
QND*	Net is Directed (controlled by a net control station).
QNE*	Entire net stand by.
QNF	Net is Free (not controlled).
QNG	Take over as net control station.
QNH	Your net frequency is High.
QNI	Net stations report In.* I am reporting into the net. (Follow with a list of traffic or QRU.)
QNJ	Can you copy me? Can you copy ____?
QNK*	Transmit messages for ____ to ____.
QNL	Your net frequency is Low.
QNM*	You are QRMing the net. Stand by.
QNN	Net control station is ____. What station has net control?
QNO	Station is leaving the net.
QNP	Unable to copy you. Unable to copy ____.
QNQ*	Move frequency to ____ and wait for ____ to finish handling traffic. Then send him traffic for ____.
QNR*	Answer ____ and Receive traffic.
QNS	Following stations are in the net.* (Follow with list.) Request list of stations in the net.
QNT	I request permission to leave the net for ____ minutes.
QNU*	The net has traffic for you. Stand by.
QNV*	Establish contact with ____ on this frequency. If successful, move to ____ and send him traffic for ____.
QNW	How do I route messages for ____?
QNX	You are excused from the net.* Request to be excused from the net.
QNY*	Shift to another frequency (or to ____ kHz) to clear traffic with ____
QNZ	Zero beat your signal with mine.

*** For use only by the Net Control Station.**

Notes on the Use of QN Signals

The QN signals listed above are special Q signals for use in amateur CW nets only. They are not for use in casual amateur conversation. Other meanings that may be used in other services do not apply. Do not use QN signals on phone nets. Say it with words. QN signals need not be followed by a question mark, even though the meaning may be interrogatory.

INTERNATIONAL Q SIGNALS

A "Q" signal followed by a ? asks a question. A "Q" signal without the ? answers the question in the affirmative unless otherwise indicated.

QRA	What is the name of your station?
QRG	What is my exact frequency?
QRH	Does my frequency vary?
QRI	How is my tone? (1-3)
QRK	What is my signal intelligibility? (1-5)
QRL	Are you busy?
QRM	Is my transmission being interfered with?
QRN	Are you troubled by static?
QRO	Shall I increase transmitter power?
QRP	Shall I decrease transmitter power?
QRQ	Shall I send faster?
QRS	Shall I send slower?
QRT	Shall I stop sending?
QRU	Have you anything for me? (Answer in negative.)
QRV	Are you ready?
QRW	Shall I tell ____ you're calling him?
QRX	When will you call again?
QRZ	Who is calling me?
QSA	What is my signal strength? (1-5)
QSB	Are my signals fading?
QSD	Is my keying defective?
QSG	Shall I send ____ messages at a time?
QSK	Can you work break-in?
QSL	Can you acknowledge receipt?
QSM	Shall I repeat the last message sent?
QSO	Can you communicate with ____ direct?
QSP	Will you relay to ____?
QSV	Shall I send a series of V's?
QSW	Will you transmit on ____?
QSX	Will you listen for ____ on ____?
QSY	Shall I change frequency?
QSZ	Shall I send each word/group more than once? (Answer, send twice or ____.)
QTA	Shall I cancel number ____?
QTB	Do you agree with my word count? (Answer negative.)
QTC	How many messages have you to send?
QTH	What is your location?
QTR	What is your time?
QTV	Shall I stand guard for you?
QTX	Will you keep your station open for further communication with me?
QUA	Have you news of ____?

OPERATIONAL, PROWORDS, PROSIGNS

VOICE	**CW**
YES, AFFIRMATIVE	**C**
NO, NEGATIVE	**N**
ROGER	**R**

(ROGER/R means all received and understood. It does not mean yes/affirmative.)

OVER	**K**
CLEAR	**CL**
CLEAR	**<SK>**
SEVENTY THREE	**73**

(Best regards - note meaning is plural.)

ARL (in Check)	**ARL** (in CK)
ARL (in Text)	**ARL** (in TXT)

(ARL + space precede Check figures if ARL Numbered Radiograms in text - voiced as letters "A R L", ARL on CW. ARL + space precede the Numbered Radiograms in the text as 1 group.)

NUMBER	**NR**

(begins message record copy until END)

BOOK OF # or BUK #	**BOOK OF # or BUK #**

(begins record copy of [# as spelled word] booked messages until END BOOK)

(use a slight pause)	**<AA>**

(<AA> marks end of address lines like a CR/LF)

OP NOTE	**OP NOTE**

(Introduces operator delivery or service note - generally not delivered to addressee.)

BREAK	**<BT>** or **=**

(Marks start and end of text and separates parts of booked messages. A listening pause follows a break at the start of the text and before NR when sending books. No listening pause before SIG.)

END +	**<AR> +**
[MORE, ONE MORE, NO MORE]	**[B, B1** (or **1), N** or **NM]**

(ends record copy of single messages + number of messages to follow)

END BOOK	**<AR> END BOOK <AR>**
+ [MORE, ONE MORE, NO MORE]	**+ [B, B1** (or **1), N** or **NM]**

(ends record copy of messages sent booked + number of messages to follow)

I SAY AGAIN	**?**
(FOR CLARITY)	(FOR CLARITY)

(Send "I SAY AGAIN, or "?" on CW, repeat previous group(s) for emphasis/clarity.

I SAY AGAIN	**?**
(FOR ERROR)	(FOR ERROR)

(Send "I SAY AGAIN, or "?" on CW, repeat last group sent correctly, and then continue.)

I SPELL	(none)

(Voice only ONE group then "I spell", and then spell the group with phonetics or letter spelling, then continue. Last and other proper names should be spelled phonetically.)

DTN BATCH FILE FORMAT: text files for posting Radiograms with the DTN via Radio-email or direct.

```
ST 21201@NTSMD < WA1QAA
P BALTIMORE 410 555

78 P WA1QAA 15 ELLICOTT CITY MD 1800 SEP 20
BACI EOC
BALTIMORE MD 21201
410 555 1212
BT
TWELVE SUPPORT TEAMS IN ROUTE
TO YOUR EOC X DO
YOU HAVE EMERGENCY POWER QUERY
BT
MIKE WA1QAA MDC SEC

/EX
(blank line if last message, or ST line of next message - no blank line allowed)
```

ST + space + [zip]@NTS[2 letter state] is key to routing. Use some kind of zip code even if a generic one close to the delivery point - Canadian zips must entered as 6 characters with no middle space. The call after "<" is the station of origin. The next line is the TOWN line showing the Precedence Flag, town, area code and exchange of the message's phone number. Batch Files must contain only messages of the same precedence status, a combination of the Precedence itself plus the presence or absence of the HXD handling instruction and Service status (SVC messages). Thus the possible flags are **S, D, SD, W, SW, WD, SWD, P, SP, PD, SPD.** No flag R is used for Routine messages. Thus the P flag matches the Radiogram Precedence here. The blank line before the PBL and after the signature is for readability. The Radiogram is entered as shown, framing the text with BTs on lines of their own. The /EX ends the message and must be followed by one more blank line if the last message, or immediately by the ST of an additional message, if any. Many Radiograms may be packed into one Batch File. Booking is not permitted. Filenames must be 8 x 3 (FAT) plain text files.

RADIO-EMAIL TYPES

TYPE 1:	Radio-email carrying active Radiograms. Subject line begun NTS for plain text, NTSD for Batch Files + service class, [destination], quantity and the request for confirmation of receipt: "pse HXC this email" .
TYPE 2:	Regular Radio-email with multiple network and/or internet addressees, binary attachments, email body text.
TYPE 3:	Radio-email sent to a single network client for delivery to a Radiogram type address entered with a PBL as the first lines of the body text, with an email-formatted body text message (a modern form of Radiogram).
TYPE 4:	Radio-email sent to a single client directly, peer-to-peer, for re-filing (or forwarding) onto the network or internet by a station with access.

FILL REQUESTS - VOICE

"[IN (part)] **WORD AFTER** (group(s))"
"[IN (part)] **WORD BEFORE** (group(s))"
"[IN (part)] **ALL AFTER** (group(s))"
"[IN (part)] **ALL BEFORE** (group(s))"
"[IN (part)] **BETWEEN** (group) **AND** (group)"
"part name"
"confirm (group(s)"

FILL REQUESTS - CW

"[IN (part)] **WA** (group(s))"
"[IN (part)] **WB** (group(s))"
"[IN (part)] **AA** (group(s))"
"[IN (part)] **AB** (group(s))"
"[IN (part)] **BN** (group) **ES** (group)"
"part name"
"CFM (group(s))"

(Respond only with group(s) requested or CONFIRM on voice, CFM on CW, as warranted. The "[IN (part)]" is used optionally to avoid ambiguity in defining the fill location.)

GENERAL NOTES: The objective in handling formal written Radiogram traffic is to pass an exact copy of the original message to the addressee in an efficient and timely fashion. Radio-email, added to the tool kit, allows real-time messaging everywhere, error corrected, with no intermediate relaying manpower needed.

TRAFFIC OPERATIONS AID

1. MESSAGE EXAMPLE

2.	1	R	HXG	W1NJM	8	NEWINGTON CT	1830	JUL	1
	a	b	c	d	e	f	g		h

3. DONALD SMITH
164 EAST SIXTH AVE
NORTH RIVER CITY MD 21201
410 555 1234
OP NOTE DELIVER WEEKDAY
BT

4. HAPPY BIRTHDAY X SEE YOU
SOON X LOVE
BT

5. DIANA
OP NOTE SERVICE TO STATION OF ORIGIN

1. CHARACTERS Use only capital letters, figures, slant bars (/).

2. PREAMBLE (Tracking information stays with message to delivery)

a. Number (begin with 1 each month or year - no leading zeros) SVC may be entered ahead of the number for Service messages.
b. Precedence (R, W, P, EMERGENCY). TEST + space may be used before Prec. in exercise traffic, as in: TEST P.
c. Handling Instructions (optional - see table for formatting)
d. Station of Origin (first amateur handler's call sign)
e. Check (number of words/groups in text only. ARL + space precede figures if ARL Numbered Radiograms in the text, as in: "ARL 8". Corrections are appended with "/".
f. Place of Origin (signer's location, not necessarily location of station of origin)
g. Time Filed (optional with originating station - if not UTC, add time zone letters and adjust Date as necessary.)
h. Date (MON, 3 letters, DT, no leading zeros - must agree with Time Filed) Time Filed, Date and Time are assumed UTC by default.

3. ADDRESS (complete with zip code, telephone #, email address, etc., may include an OP NOTE).

4. TEXT (typical limit, 25 groups, but may be expanded for emergencies) X as punctuation counts as a word - <BT> does not. A group is a series of characters with no spaces between them.

5. SIGNATURE: (person for whom message originated - may include a full address and OP NOTE).

RADIOGRAM HANDLING INSTRUCTIONS ("HX-CODES")

HXA__ (Followed by number.) Collect landline delivery authorized by addressee within ____ miles, (if no number in blank, authorization is unlimited). This means that the originating station has obtained authorization from the addressee, through the party originating the message, to call collect when delivering the message.

HXB__ (Followed by number.) Cancel message if not delivered within ____ hours of filing time; service message back to originating station. NOTE: filing time must be included in preamble.

HXC Report date and time of delivery of the message back to the originating station by service message.

HXD Report to originating station the identity of station from which received, plus date and time. Report identity of station to which relayed, plus date and time, or if delivered, report date and time and method of delivery (this information is sent by service message to the originating station).

HXE Delivering station get reply from addressee, originate message back. This reply is sent to the person from whom the original message was received, at the "place of origin", using a full address obtained from the addressee. If an address is not available, a reply can often be successfully routed back to the station of origin since a record is kept of originator's info.

HXF__ (Followed by a number.) Hold delivery until ____ (date). This blank contains the number of the day on which the message should be delivered (even if it is in the following month).

HXG Delivery by mail or landline toll call not required. If toll call or other expense involved, cancel message and send service message back to originating station.

Compliance with these instructions is mandatory. **MORE THAN ONE HX__ CODE MAY BE USED**. If more than one code is used, they may be combined provided no numbers are to be inserted; otherwise the HX should be repeated, thus: **HXCE, HXAC,** or **HXA50 HXC**

Ed. note: The numbers following eligible HX_ codes are expected. In this example the HXA in the first case has the range number intentionally omitted, thus the "C" may be appended. In the second case, where the optional 50 mile range is included, the figures force the separation of the full "HXC."

MESSAGE SENT ON VOICE

"**NUMBER** ONE ROUTINE HOTEL X-RAY GOLF WHISKEY ONE NOVEMBER JULIET MIKE EIGHT
NEWINGTON CONNECTICUT ONE EIGHT TREE ZERO JULY ONE
DONALD SMITH I spell SIERRA MIKE INDIA TANGO HOTEL
figures ONE SIX FOUR EAST SIXTH I spell S I X T H initials ALFA VICTOR ECHO
NORTH RIVER CITY MARYLAND figures TWO ONE TWO ZERO ONE
figures FOUR ONE ZERO FIFE FIFE FIFE ONE TWO TREE FOUR
OP NOTE DELIVER WEEKDAY
BREAK" // (mandatory listening pause)
"HAPPY BIRTHDAY initial X-RAY SEE YOU SOON initial X-RAY LOVE
BREAK
DIANA I spell DELTA INDIA ALFA NOVEMBER ALFA
OP NOTE SERVICE TO STATION OF ORIGIN
END NO MORE"
(NOTE: It is critically important to voice the message at a speed suitable for the receiving operator to copy accurately. Use no extraneous words. Do not voice the names of message parts.)

SENDING MESSAGES BOOKED

Unique text groups are each marked by "BLANK" to affirm Check, and the actual groups are sent later with the unique parts after a "BREAK" or <BT> on CW. Copy begins with "BOOK OF [quantity] and ends with "END BOOK", or <AR> END BOOK <AR> on CW. Common parts are sent first. Book parts are separated by "BREAK" or <BT> on CW, each unique message part beginning with "NUMBER" or NR on CW. Booked messages may be sent to multiple stations, polled ready to copy, and checking with each for copy when their unique parts are finished; or bulletins sent to multiple stations, polled ready to copy and then polled for acknowledgment at the end.

PHONETIC ALPHABET

A	ALFA	S	SIERRA
B	BRAVO	T	TANGO
C	CHARLIE	U	UNIFORM
D	DELTA	V	VICTOR
E	ECHO	W	WHISKEY
F	FOXTROT	X	X-RAY
G	GOLF	Y	YANKEE
H	HOTEL	Z	ZULU
I	INDIA	1	ONE
J	JULIET	2	TWO
K	KILO	3	THREE (TREE)
L	LIMA	4	FOUR
M	MIKE	5	FIVE (FIFE)
N	NOVEMBER	6	SIX
O	OSCAR	7	SEVEN
P	PAPA (PA-'PA)	8	EIGHT
Q	QUEBEC (KAY-'BEK)	9	NINE (NINER)
R	ROMEO	0	ZERO

RADIOGRAM PRECEDENCES

These precedences are not meant to prohibit handling lower level traffic until all higher levels are passed. Handle higher precedence traffic before lower as outlets are available.

EMERGENCY: (Spelled out on form.)* - Any message having life and death urgency to any person or group of persons, which is transmitted by Amateur Radio in the absence of regular commercial facilities. This includes official messages of welfare agencies during emergencies requesting supplies, materials or instructions vital to relief of stricken populace in emergency areas. During normal times, it will be very rare. On CW/RTTY, this designation will always be spelled out. If in doubt, do not use it.

PRIORITY (P): Use abbreviation P on CW/RTTY. This classification is for a) important messages having a specific time limit, b) official messages not covered in the emergency category, c) press dispatches and emergency related traffic not of the utmost urgency, d) notice of death or injury in a disaster area, personal or official.

WELFARE (W): This classification, abbreviated as W on CW/RTTY, refers to either an inquiry as to the health and welfare of an individual in the disaster area or an advisory from the disaster area that indicates all is well. Welfare traffic is handled only after all emergency and priority traffic is cleared. The Red Cross equivalent to an incoming Welfare message is DWI (Disaster Welfare Inquiry).

ROUTINE (R): Most traffic in normal times will bear this designation. In disaster situations, traffic labeled Routine (R on CW/RTTY) should be handled last, or not at all when circuits are busy with higher precedence traffic.

* **EMERGENCY:** Emergency is always spelled out in the preamble. Means other than Amateur Radio should be included in the delivery options. EMERGENCY messages have immediate urgency. They should take priority over any other activity and should be passed by the best means available with the cooperation of all stations.

FORMATTING

DASH	substitute for hyphen in text and zip codes
DOT	substitute for period in email addresses and URLs
R	substitute for decimal point in figure groups
X	substitute for period in text - except after last group

All other punctuation is entered as a spelled-out word.

EMAIL ADDRESS, URL

JOHN DOT SMITH ATSIGN DOMAIN DOT NET
HTTP COLON SLASH SLASH WWW DOT WORK DOT COM

INTRODUCERS - VOICING, USE ONLY ONE PER GROUP

Initial(s): "initial BRAVO", "initials JULIET ROMEO"
Figure(s): "figure FOUR", "figures ONE NINER"
Mixed Group: "mixed group BRAVO SLASH SIX"
Mixed Group Figure(s): "mixed group figures TWO TWO ZULU"
Amateur Call: "amateur call WHISKEY ONE NOVEMBER JULIET MIKE"
Telephone Figures: to introduce telephone figures if no zip code
NOTE: Introduced groups are voiced one character at a time, letters phonetically. Introducers are not voiced for Preamble groups.

MESSAGE SENT ON CW

NR 1 R HXG W1NJM 8 NEWINGTON CT 1830 JUL 1
DONALD SMITH <AA>
164 EAST SIXTH AVE <AA>
NORTH RIVER CITY MD 21201 <AA>
410 555 1234 <AA>
OP NOTE DELIVER WEEKDAY
BT // (mandatory listening pause)
HAPPY BIRTHDAY X SEE YOU
SOON X LOVE
BT
DIANA <AA>
OP NOTE SERVICE TO STATION OF ORIGIN
<AR> N

ARL NUMBERED RADIOGRAMS

Group One - For Possible "Relief Emergency" Use

ONE	Everyone safe here. Please don't worry.
TWO	Coming home as soon as possible.
THREE	Am in _____ hospital. Receiving excellent care and recovering fine.
FOUR	Only slight property damage here. Do not be concerned about disaster reports.
FIVE	Am moving to new location. Send no further mail or communication. Will inform you of new address when relocated.
SIX	Will contact you as soon as possible.
SEVEN	Please reply by Amateur Radio through the amateur delivering this message. This is a free public service.
EIGHT	Need additional _____ mobile or portable equipment for immediate emergency use.
NINE	Additional _____ radio operators needed to assist with emergency at this location.
TEN	Please contact _____. Advise to standby and provide further emergency information, instructions or assistance.
ELEVEN	Establish Amateur Radio emergency communications with _____ on _____ MHz.
TWELVE	Anxious to hear from you. No word in some time. Please contact me as soon as possible.
THIRTEEN	Medical emergency situation exists here.
FOURTEEN	Situation here becoming critical. Losses and damage from _____ increasing.
FIFTEEN	Please advise your condition and what help is needed.
SIXTEEN	Property damage very severe in this area.
SEVENTEEN	REACT communications services also available. Establish REACT communications with_____ on channel _____.
EIGHTEEN	Please contact me soon as possible at _____.
NINETEEN	Request health and welfare report on _____. (State name, address and telephone number.)
TWENTY	Temporarily stranded. Will need some assistance. Please contact me at _____.
TWENTY ONE	Search and Rescue assistance is needed by local authorities here. Advise availability.
TWENTY TWO	Need accurate information on the extent and type of conditions now existing at your location. Please furnish this information and reply without delay.
TWENTY THREE	Report at once accessibility and best way to reach your location.
TWENTY FOUR	Evacuation of residents from this area urgently needed. Advise plans for help.
TWENTY FIVE	Furnish as soon as possible the weather conditions at you location.
TWENTY SIX	Help and care for evacuation of sick and injured from this location needed at once.

Emergency / Priority messages originating from official sources must carry the signature of the originating official.

Group Two - Routine Messages

FORTY SIX	Greetings on your birthday and best wishes for many more to come..
FORTY SEVEN	Reference your message number _____ to _____ delivered on _____ at _____UTC.
FIFTY	Greetings by Amateur Radio.
FIFTY ONE	Greetings by Amateur Radio. This message is sent as a free public service by ham radio operators here at _____. Am having a wonderful time.
FIFTY TWO	Really enjoyed being with you. Looking forward to getting together again.
FIFTY THREE	Received your _____. It's appreciated; many thanks.
FIFTY FOUR	Many thanks for your good wishes.
FIFTY FIVE	Good news is always welcome. Very delighted to hear about yours.
FIFTY SIX	Congratulations on your _____, a most worthy and deserved achievement.
FIFTY SEVEN	Wish we could be together.
FIFTY EIGHT	Have a wonderful time. Let us know when you return.
FIFTY NINE	Congratulations on the new arrival. Hope mother and child are well.
SIXTY *	Wishing you the best of everything on _____.
SIXTY ONE	Wishing you a very merry Christmas and a happy New Year.

SIXTY TWO *	Greetings and best wishes to you for a pleasant _____ holiday season.
SIXTY THREE	Victory or defeat, our best wishes are with you. Hope you win.
SIXTY FOUR	Arrived safely at _____.
SIXTY FIVE	Arriving _____ on _____. Please arrange to meet me there.
SIXTY SIX	DX QSLs are on hand for you at _____ QSL Bureau. Send _____ self-addressed envelopes.
SIXTY SEVEN	Your message number _____ undeliverable because of _____. Please advise.
SIXTY EIGHT	Sorry to hear you are ill. Best wishes for a speedy recovery.
SIXTY NINE	Welcome to the _____. We are glad to have you with us and hope you will enjoy the fun and fellowship of the organization.

* Can be used for all holidays.

ARL NUMBERS SHOULD BE SPELLED OUT AT ALL TIMES.

Radio Relay International

Request for Official Traffic Station or Digital Traffic Station Appointment

The undersigned radio operator requests appointment as an Official Traffic Station (OTS) and/or Digital Traffic Station (DTS). OTS/DTS appointees are recognized for meeting the highest standards of professionalism, which includes outstanding operating skills, timely message relay and consistent, rapid delivery of all radiogram traffic. By accepting an appointment as an OTS, one agrees to abide by all standards and requirements associated with participation in Radio Relay International. Appointment as an OTS or DTS confers no special authority, but rather honors the commitment and professionalism of the appointee.

One may request one or more applicable OTS endorsements. By doing so, one asserts that he is knowledgeable and competent in the use of the applicable mode(s) or method(s) within a traffic-handling context. Please note that an OTS appointment requires the approval of a Net/Function Manager

Radiotelephone and Radiotelegraph endorsements confer the Official Traffic Station appointment. Digital endorsement confers the Digital Traffic Station appointment. Both appointments may be held concurrently.

(Please Print Neatly)

Name:_____ Call Sign:_____

Address:_____

City:_____ State:_____ Zip:_____

E-Mail:_____

Primary Net Affiliations: _____

_____

Endorsements Requested with Net/Function Manager Approval

____ Radiotelephone: _____Net Manager name and call sign

____ Radiotelegraph: _____ Net Manager name and call sign

____ Digital (DTN): _____ Area Digital Manager name and call sign

---

Mail form to:
Christopher R. Hanslits W4VX
102 Shagbark Circle
Simpsonville, SC. 29680

E-Mail: Submit scanned document in PDF format to:
w4vx@w4vx.org copy to james.wades@radio-relay.org

[RRI Form 1705]

Radio Relay International

Radio Operator Registration Form

Radio Relay International is a nonprofit, 501(c)(3) public service corporation dedicated to the development and maintenance of a high-grade, professional emergency communications and traffic network. RRI volunteer radio operators are encouraged to register in order to be placed on our mailing list. This will ensure that you receive each issue of "QNI-The Traffic Newsletter" (www.qni-newsletter.org), updated operations manuals, bulletins regarding operational matters and disaster exercises/operations.

(Please Print Neatly)

Name:_____ Call Sign:_____

Address:_____

City:_____State/Province:_____ Zip:_____

Country:_____E-Mail:_____

Primary Phone No._____ Secondary Phone No._____

Current Net Affliations:_____

_____

Primary HF Operating Modes: CW___ SSB ___ PACTOR ___ (indicate 1, 2, 3, 4)

Other HF Modes:_____

HF mobile capability: Yes: ____ No: ____ HF portable capability: Yes:____ No:____

ARES or other EMCOMM organization with which affiliated (if any):_____

RRI Interests: CW Nets:____ SSB Nets:___ Digital Traffic Net (DTN):___ Tropical Storm Net:____

VHF Local Nets:____ Local Emergency Management/EMCOMM:____ Other:____

Mail form to:
Radio Relay International, Inc.
PO Box 192
Buchanan, MI. 49107

E-Mail: info@radio-relay.org

RRI Form 1601
2017-5-1 T

Registration Year: **2018**

Traffic Net
Annual Registration Request
for the National Communication Plan

Print and mail completed form to:
Radio Relay International
P.O. Box 192
Buchanan, MI 49107
or email to:
info@radio-relay.org

Net Information

Formal Name	
Nickname or Callsign	
Type of Net	
Territory	
Sponsoring Org	
Webpage URL	

Contact Information

Net Manager	
Email or Packet	
Telephone	
Twitter	
Mailing Address	
Street	
City	
State/Province	
ZIP/Postal Code	
Country	
Emergency Contact	
Email or Packet	
Telephone	
Twitter	

Operations - Simplex

Primary Frequency	
Mode	
Callup (GMT/UTC)	
Callup (Daylight Saving)	
Secondary Frequency	
Mode	
Callup (GMT/UTC)	
Callup (Daylight Saving)	

Operations - Repeaters

Repeater System Name	
Callup (GMT/UTC)	
Callup (Daylight Saving)	
Primary Callsign	
Input Frequency +/-	
Tone	
Secondary Callsign	
Input Frequency +/-	
Tone	
Tertiary Callsign	
Input Frequency +/-	
Tone	

Notes

CERTIFICATION: I am authorized to request registration of this organization and certify it meets and agrees to abide by all applicable requirements in effect on this date. I acknowledge Radio Relay International has no obligation to accept this or any registration request.

Submitted by: Title	**Date:**
Approved by: Title	**Date:**

RRI Form 1750 8/17

RRI FORM 1750 FILING INSTRUCTIONS

NET INFORMATION	IMPORTANT: NETS MUST REGISTER ANNUALLY TO REMAIN IN GOOD STANDING!
Formal Name:	Enter the net's full name without abbreviations or contractions
Nickname or Callsign:	A commonly used nickname, if any; the cw callsign used in practice, if any
Type of Net:	Common description, usually included in the preamble e.g., traffic net, emergency net, training net, mobile net, special service net, etc.
Territory:	General description of the general operational reach of the net e.g., region, state, county, city
Sponsoring Organization:	If your net has a formal sponsor please identify it here e.g., "Philadelphia Amateur Radio Club."
Webpage URL:	identify the main URL for public information about this net e.g., website, Facebook, QRZ, etc.
CONTACT INFORMATION	Used for administrative and emergency purposes.
Net Manger:	Enter the full name of the net manager at the time of application.
Email or Packet:	preferred email address, packet mail address, or callsign if registered as DTN DTS
Telephone:	Supply the best number for urgent contact should need be.
Twitter:	(optional) Enter a Twitter handle associated with the net for publicity purposes.
Mailing Address:	Your standard postal address to receive formal notices and other information.
Emergency Contact:	This will be used if the net manager cannot be contacted. It must be independent of and redundant to the net manager. The information required is as detailed above.
OPERATIONS – SIMPLEX	This section is for all nets operating in simplex i.e., direct point-to-point communication circuits without benefit of an intermediate repeater system.
Primary Frequency:	Customary callup frequency. Please identify kHz or MHz.
Mode:	Operating mode used or digital waveform for data nets.
Callup:	Routine net callup time in GMT/UTC for Standard and Daylight Saving/Summer time seasons.
Secondary Frequency:	(Optional) seasonal or backup frequency, if used.
OPERATIONS–REPEATERS	This section is for all nets operating through an intermediate station or repeater regardless of band or mode including satellites, Internet tunnels, etc. The information required is as detailed above but specific details should be communicated in the "Notes" section.
NOTES	Please include additional, salient administrative information in this space. Use a separate piece of paper if required. Please detail technical operating information here if necessary.
CERTIFICATION	The request for registration must be submitted only by a duly authorized representative of the net however that may be decided. We use the direct synonym "organization" to emphasize the formal nature of registration and its obligations on the members and to remind applicants that a net is nothing less than an organization created for a specific purpose, whatever it may be.

INTERNATIONAL Q-SIGNALS

- Blank spaces in Q-Signals will be completed in the order in which they appear.
- The addition of a "?" converts the Q-Signal to an equivalent inquiry

QAP Listen for me on _____ kHz (MHz)
QAR You may cease listening on the watch frequency for ____ minutes.
QBM Here is the message sent by ____ at _____ hours.
QCB Delay is being caused by _____
1. Your transmitting out of turn
2. Your slowness in answering
3. Lack of your reply to my .

QCS My reception on _____ frequency has broken down.
QCX My full call sign is _____. ***Or:*** Use your full call sign until further notice.
QDE I have sent message ____to _____.
QDP I will accept control (responsibility) of _____ at _____ hours.
QIC Establish communications with _____ on _____ KHz (MHz).
QIF _____ is using _____ KHz (MHz)
QJA* Your _____is reversed
1. tape
2. mark and space

QJB* I will use _____.
1. radio
2. telegraph
3. teletypewriter
4. telephone
5. receiver
6. transmitter
7. reperforator

QJC* I will check my _____.
1. transmitter-distributor
2. auto-head
3. perforator
4. printer
5. printer-motor
6. keyboard
7. antenna system

QJD* You are transmitting _____.
1. in letters
2. in figures

QJE* Your frequency shift is _____.
1. too wide
2. too narrow
3. correct

QJF My signal as checked by monitor _____ is satisfactory .
1. locally
2. as radiated

QJH* Run .
1. your test tape
2. a test sentence

QJI* I am transmitting a continuous ____.
1. mark
2. space

QJK* I am receiving ____.
1. a continuous mark
2. a continuous space
3. a mark bias
4. a space bias

QLB I have monitored _____ station and report as follows.
QLH I will now key simultaneously on _____frequency and _____frequency.
QMH Shift to transmit and receive on _____ established within 5 minutes, revert to present frequency.
QRA The name of my station is _____.
QRB The approximate distance between our stations is _____ nautical miles.
QRR* I am ready for automatic operation.
QRS Send more slowly (or at _____ words per minute).
QRT Stop sending.
QRU I have nothing for your.
QRV I am ready to copy.
QRW Please inform _____ that I am calling on _____ kHz (MHz).
QRX I will call you again at _____ hours on _____ kHz (MHz).
QRY Your turn is number _____.
QRZ You are being called on _____ kHz (MHz).
QSA The strength of your signals (*or* those of _____) are _____.
1. Scarcely perceptible
2. Weak
3. Fairly good
4. Good
5. Very good

QSB Our signals are fading.
QSD Your keying is defective (*or* your signals are mutilated).
QSG Send _____ telegrams at a time.
QSM Repeat the last telegram (*or* message number) _____which you sent me.
QSN I did hear you on _____ kHz (MHz).
QSO I can communicate with _____ direct.
QSR Repeat your call on the calling frequency. I did not hear you.
QSS I will use the working frequency _____ kHz (MHz).
QSU Send or reply on this frequency (*or* on _____ kHz (MHz)).
QSV Send a series of V's.
QSW I am going to send on this frequency (*or* on ____ kHz (MHz)).
QSX I am standing watch (listening) on _____ kHz (MHz) (*or* for ____).
QSY Change to another frequency (or to _____ kHz (MHz)).
QSZ Send each word or group twice.
QTU My station is open from _____ to _____ hours.
QTV Stand guard for me on the frequency of _____ kHz (MHz).
QTX I will keep my station open for further communications with you.
QUA Here is the news of _____ (call sign).
QUC The number of the last message I received from you is _____.
QUF I have received the distress signal sent by _____ at _____ hours.

QUM Normal working may be resumed.

* For Radioteletype use.

Michigan Net QN-Signals for RRI Net Use:

QNA** Answer in prearranged order
QNB** Act as relay between _____ and _____.
QNC All net stations copy.
QND** Net is Directed.
QNE** Entire Net standby.
QNF** Net is Free (not controlled).
QNG Take over as Net Control Station.
QNH Your net frequency is high.
QNI Net Stations report in (I am reporting in; follow with QRU or traffic list).
QNJ Can you copy _____? (*or* can you copy me?).
QNK** Transmit messages for _____ to _____.
QNL Your net frequency is low.
QNM** Your are interfering with the net. Standby.
QNN Net control station is _____.
QNO Station is leaving the Net.
QNP Unable to copy you (*or* unable to copy _____).
QNQ** Move frequency to _____ and wait for _____ to finish handling traffic (with ____) then send him traffic for _____.
QNR Answer _____ and receive traffic.
QNS** The following stations are in the Net.
QNT I request permission to leave the Net for minutes.
QNU** The Net has traffic for you.
QNV** Establish contact with _____ on this frequency. If successful, move to _____ and send him traffic for _____.
QNW Route messages for _____ to _____.
QNX You are excused from the Net.
QNY** Shift to another frequency (or to ____) to clear traffic with ____.
QNZ Zero-beat your signal with mine.

** For use by the Net Control Station

RECOMMENDED STEPS FOR PROPER SEMIAUTOMATIC KEY ADJUSTMENT

The semiautomatic key, commonly known as the "Bug" has earned a poor reputation amongst the Amateur Radio community due to improper use. Unlike the electronic keyer, the bug must be set-up carefully and manipulated in a different manner in order to make good readable code. A slight investment in time at the outset of learning the proper use of a semiautomatic key will result in code that's a pleasure to hear on any communications circuit.

The following information was assembled not only from the author's personal experiences, but from a number of different resources including:

- The Department of Defense (US Army Signal Corps)
- Western Union Telegraph Company
- Grand Trunk Railroad

Please take advantage of this information before you start practicing with your speed-key. This will prevent the development of bad habits at the outset.

Steps for Speed-key Adjustment:

- Looking at the diagram below, identify the Lever Pivoting Screw (A). Set the vertical tension on the Arm such that it moves freely from side to side, but with minimum vertical motion.

- Locate the Right Trunnion Screw (D) – see inset drawing. Adjust it so that the end of the Reed (H) rests very gently against the Damper (G). The pressure against the Damper should be so light that it is not pushed away by the Reed.

- Next, adjust the Left Trunnion Screw (C) so there is approximately 0.011 inch of space between the Arm and the Screw when the Arm is at rest. While0.011 is recommended, up to 0.015 inch is acceptable. Use of a feeler gauge is recommended, these being readily available at most hardware outlets such as Sears.

- Now, with the Arm at rest, adjust the Dash Contact Adjusting Screw (B) so the spacing between the Arm and the Dash Contact is also approximately 0.011 inch.

- The Dit Contact Adjusting Screw (E) is adjusted by pressing on the Dit Paddle and holding it in this position until the vibrating Reed comes to rest. While continuing to hold the Dit Paddle, adjust the Dit Contact Adjusting Screw so that it makes light but solid contact with the Contact Spring (F) on the Reed (H).

- If a Simpson 260 or equivalent VOM is available, connect the meter across the key and set it to the R x 1 position. Depress the Dit Paddle. A mid-scale deflection (typically between the 10 and 15 ohm range) should indicate correct dit adjustment.

- The dit contact can be adjusted for various applications. Heavier dits can be useful for communications circuits operating at lower speeds (<15 wpm). Shorter dits are useful for high-speed radiotelegraph circuits or Morse circuits.

- Adjust the Dit Retractive Spring (I) and the Dash Tension Spring (J) for the minimum tension necessary to insure clean character formation.

- If using segmented weights, move only one weight at a time along the Reed to increase speed,

leaving the unused weights toward the rear of the Reed. Make sure the weights do not rub against the Damper.

USEFUL POINTERS ON THE CARE AND USE OF A SPEED-KEY

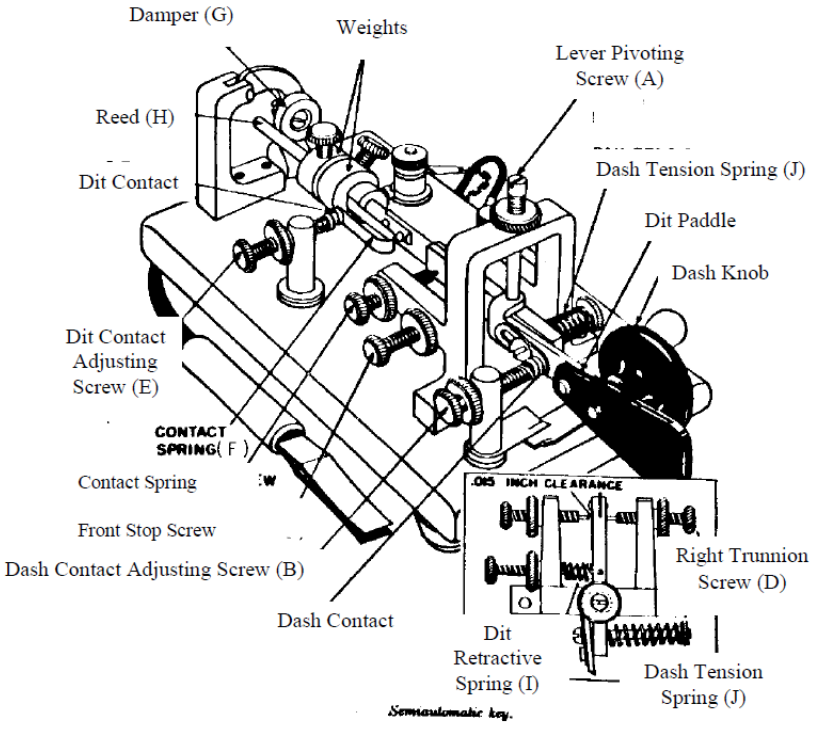
- When cleaning the contacts on a semiautomatic key, NEVER use sand paper or other highly abrasive substances. A piece of bond paper works quite well, as do burnishing tools used for relays and stepping switches.

- Once the "bug" is properly adjusted, practice sending names and telephone numbers at random out of the directory. Try varying the speed at which you are sending from column- to-column. After a few evenings of this, you will be an "expert" operator.

- Unlike the electronic keyer, the bug is manipulated mainly by rolling the wrist and forearm as opposed to moving the fingers. Make sure you have a reasonably flat surface on which you can rest your forearm, just as in the case of the standard key.

- Generally, the bug should stay in one place on the table without the use of nails, straps, glue, etc. While some movement is typical on smooth surfaces, heavy movement probably indicates excessive tension on the dot and dash lever springs. Save a horse! Set the tension to the minimum necessary. A mouse pad or non-skid shelf liner may help your but stay put.

Have fun, and enjoy the first time someone says; "You mean you're using a bug! Heck, I thought you were using a keyer!"



The Semiautomatic Key aka "bug"