# Missouri Section ARES®
## Emergency Operations Plan
## Digital Addendum

## Objectives

- To provide an advanced high speed digital packet network for emergency service communications
- To training required
- To use standard hardware, firmware, and software (Airmail) configuration
- To be easy to set up and expand
- To be upgradeable for future technologies
- To be able to be built with available "off the shelf" equipment

## Purpose

To provide guidelines and suggestions for amateur radio operators, using digital communications, to assist with emergency and normal communications links to served agencies and affiliated organizations including, but not limited to State of Missouri Emergency Management Agency (SEMA), American Red Cross, Salvation Army, National Weather Service, other public service and disaster relief organizations, and affected areas of the Missouri section during ARES® activation.

## Background

Contrary to the thinking of some amateur radio operators, radio frequency digital communications has not been replaced by the Internet, but remains an important part of emergency communications. Internet messages and information sharing play a significant role for ARES®. However, when the electrical power or telephone lines are down, amateur radio traffic can still get through to its destination.

During disasters, the American Red Cross National Headquarters Disaster Operations Center (DOC) in Fairfax County Virginia relies on reports from field offices. This information is often obtained from HF voice communications and placed on either packet or Internet for relay to the DOC.

Missouri ARES® is dedicated to the use of many forms of communications to transmit messages during times of disaster and/or emergencies. Digital communications has the ability of providing messages to a destination, without errors, minimizing public disclosure of sensitive information, and in a written format. The Missouri State Emergency Management Agency (SEMA) has requested that Missouri ARES® provide digital communications coverage throughout all areas of the state. To this end, Missouri ARES® is deploying the Missouri Emergency Packet Network (MEPN – http://www.ares-mo.org/mepn.asp). The MEPN, when deployed, will be an interconnected set of packet nodes operating on VHF frequencies at 1200 baud and interconnected by VHF-LO (6 meter) nodes at 9600 baud across the state.

# Concept of Operations

In order to accomplish our objectives we need to have redundancy and utilize <u>all</u> available communications modes, and planned redundancy.

Ideally, each Missouri ARES® group will have two OES (Official Emergency Stations) with VHF, UHF and HF digital capabilities, the ability to function as a VHF-HF gateway, and packet-to-Internet gateway using the Telpac software.  Internet wireless access points (WAPs) using any of the IEEE 802.11 protocols on 2.4 GHz may be used, if available (yes, we're moving into the 21$^{st}$ century!).  Some of the frequencies utilized in the 2.4GHz 802.11 hardware are in the amateur spectrum.  Operations on those frequencies can fall under part 97 of the FCC regulations.

# Winlink 2000

In order to comply with the ARRL encouragement for ARES® to deploy the Winlink 2000 system, Missouri ARES® shall make use of this system as an additional emergency communication capability. Information regarding the recommendation of the ARRL is located here…
http://www.arrl.org/announce/reports-2004/july/arescom.html as well as in the board minutes of the July 2004 meeting (http://www.arrl.org/announce/board-0407/).  Local ARES® groups are encouraged to install and maintain Telpac nodes in their areas as outlined below.  ARES® groups are also encouraged to utilize the Paclink and Airmail software packages to access the Winlink 2000 system via HF, VHF and UHF (where available).  Deployment of ARES®/EMCOMM PMBO's in the Missouri Section shall be coordinated through the Section Emergency Coordinator (SEC) in cooperation with the Winlink Development team to ensure appropriate distribution of Winlink PMBO assets in the Missouri Section. The SEC shall also coordinate PMBO assets located near Missouri state borders with adjoining states/section SEC's.

# VHF/UHF Network

The primary VHF 1200bps user frequencies are already set in many areas of the state.  While it is not our intention to dictate how you run your network, it is suggested that there be a common local access frequency for ease of use statewide. Some portions of the state may elect to operate on existing packet networks on different frequencies.  A link into the ARES® network is sufficient to accomplish the mission. The suggested 2m frequency for ARES® is 145.070.

AX.25 protocol with compression is the preferred VHF/UHF mode, and client software of your choice that meets your needs.  A program, such as WinPack, is recommended along with AGW Packet Engine or Packet Engine Pro.  Airmail can be used to access the Winlink system via VHF/UHF and HF as well. All of these programs are available on the Internet.  Links are provided on the Missouri Section ARES® website at www.ares-mo.org/links.asp.

# High Frequency Network

High frequency (HF) digital modes supplement the VHF/UHF networks that may not always be operating. Pactor is the preferred mode for HF digital operations due to its ability to get through interference.  Pactor II and III have a much higher throughput and are highly encouraged where possible. The HF frequencies used are dependent on the time of day, and a table of these is located in the appendix.  Both HF and VHF digital can use the same software client, Airmail.

# Gateway

Gateways allow the exchange of email messages between packet and the Internet.  Telpac is the software package selected to perform this task, and it works with either full-time or dial-up Internet connections. This software is easily installed and configured.  It can use the computer sound card as a software TNC, which allows nearly any modern computer to perform the gateway function if the primary and secondary digital stations lose Internet connectivity.  Links are available at the website above.

# 900 MHz and 2.4 GHz

IEEE 802.11 series of protocols may be used to transmit data to and from the Winlink 2000 system or between local users.  When used with Airmail and Telpac, it provides additional capability and functionality.  This could also be used to quickly establish a field Telpac station that could be used by outlying stations to access via regular packet radio.  Only open, public, wireless access points should be used, as opposed to those intended for private operation.  Public use access points can often be found at public libraries and colleges, coffee houses and other locations.  These access points should be located and confirmed before you need them.  Some access points are listed on these sites – www.jwire.com and www.wifi411.com.  Please note: The ARRL recommends avoiding channel one due to its proximity to the AO-40 satellite downlink frequency.

# Local Operation

- During activation, packet users that are not involved in the incident should refrain from using the primary frequency, 145.070 MHz, or whatever the primary frequency is for the affected area. Similarly, stations are expected to halt all traffic that is not related to the ARES® operation.

- Official Emergency Station (digital)
    o Each ARES® district in Missouri should have at least one primary and one secondary Official Emergency Station (OES), with digital capability. Preferably one per county.
    o These stations should be geographically separated, but located where they are usable throughout the area.
    o These stations should ideally be equipped for HF and VHF/UHF digital operations and have backup power available during an extended power failure.
    o Internet connection is required for Telpac operation, but this need not be a full-time Internet connection; a dial-up connection is acceptable.

- First suggested priority is to prepare portable packet kits that can be deployed most anywhere on short notice.  These kits must include enough gear to communicate via 1200 baud VHF packet at a minimum.  Also included should be a computer (ideally a laptop) with at least Airmail loaded to provide connectivity to the Winlink system.  Ideally these kits would also include UHF capability and 9600 baud capability as well.  Outlying areas where VHF and UHF assets are non-existent or are hard to reach may want to include HF capability with Pactor for longer range connections.

- Second suggested priority is to install or pre-deploy multi-mode TNC's and radio equipment at the city and county EOC's and other key public safety and disaster relief organizations such as hospitals, Red Cross EOC's.

- Simple VHF/UHF TNC's such as the Kantronics KPC-3 (Version 5.2 and above) or the KPC-9612 can be centrally located within a county or district for portable use, multiple installations (Telpac nodes) are suggested for better access.

- Connection priorities
  - Determine if the served agencies have Internet access.
  - ARES® digital stations should always try to connect to the stations which are running Telpac.  Stations running Telpac send messages immediately to the Winlink 2000 server over the Internet.  This reduces the traffic volume on the served organization (city/county EOC's TNC), and reduces the congestion when each TNC tries to send a message to any of the primary served agencies.
  - If Telpac (or Internet) is unavailable in your county, messages should be sent to a digital station in a neighboring county via VHF/UHF or HF.
  - If the local ARES® Telpac gateway stations are not available, and the served agency is not directly reachable, connect to the next station in line for further forwarding.  The "next station in line" is defined as any station capable of forwarding the message towards its final destination.  Any station running the Airmail client can accept messages, which are temporarily stored in the "TRANSIT" box, until forwarded to the next station.  The stations used for such forwarding should be determined in advance. Do not waste your time and tie up the system trying to force forward a message through multiple nodes to any station.  Simply get the message to the next station in line and let the system work as it was designed.   One useful feature for finding the best route is the position reports and requests, which can be mapped.  This is similar to APRS.

- Simplex operation
  - Simplex operation (without nodes) should be practiced whenever possible to gain experience, due to the possibility those remote nodes may be off the air during activations. Stations should experiment operating in the simplex mode to find what works best at the local and county wide levels.  Be sure to include 6 and 10 meters in your testing.
  - Airmail can be used for direct message transfer between two stations, when both are running Airmail.  When used in this mode, the "post to" address must be that of the destination station, and not the default of WL2K.

# Frequencies and Modes

Suggested frequencies for simplex operation on multiple bands are listed in the Missouri ARES® Interoperability Plan.  Listed below are known frequencies that are not included in the Interoperability document and that are specific to Missouri ARES®.  NTS Digital info can be found here…
http://home.earthlink.net/~bscottmd/n_t_s_d.htm

| Net Designation | Frequency (in MHz) | Mode | Speed | Usage |
|---|---|---|---|---|
| MESN | 3.963 | LSB | Voice | Evening and night usage as propagation warrants |
| MESN | 7.263 | LSB | Voice | Daytime usage as propagation warrants |
| Telpac Node | 145.070 | FM | 1200 | Connect to K0SI-10 in Central Missouri / Columbia area (EM38ux) |
| Telpac Node | 145.070 | FM | 1200 | Connect to WB0HSI-1 in the O'fallon area (EM48rs) |
| Telpac Node | 145.090 | FM | 1200 | Connect to KC0CZI-5 in Central Missouri / Jeff City area (EM38vn) |
| Telpac Node | 145.090 | FM | 1200 | Connect to W0OEM-10 in the Kansas City area (EM28sw) |
| Telpac Node | 145.090 | FM | 1200 | Connect to KB0EMB in the Independence area (EM29td) |
| Telpac Node | 145.090 | FM | 1200 | Connect to KB0RPJ in the Trenton area (EN30eb) |
| Telpac Node | 145.090 | FM | 1200 | Connect to KC0LNU-14 in the Peculiar area (EM28rq) |
| Telpac Node | 145.090 | FM | 1200 | Connect to KG0CX in the Blue Springs area (EM29ua) |
| Telpac Node | 147.495 | FM | 1200 | Connect to KB5WBH in the Monette, AR area – near the bootheel (EM45tv) |

An up-to-date listing of Telpac nodes can be found at http://www.winlink.org/status/TelpacEx.aspx

## SUGGESTED TNC PARAMETERS

Standardized parameters make a tremendous difference in the throughput of the network.  These suggested VHF/UHF parameters are for smoother 1200bps AX.25 packet operations.

SSID for Telpac nodes should be -10 so as to standardize with other Telpac nodes across Missouri and the rest of the country.  (not required, but strongly suggested)

**Normal Users TNC Parameters**
Frack 4
ID E 45 Minutes
BE E 0 Minutes (no beacons please)
Numnodes 0
MaxFrame 2
MAXUSERS 10
Paclen 125
Persist 63ms*
Response 2
Retries 10
Slottime 10ms* (adjust to 30 when used with TCP/IP systems)
TXDelay 35 (adjusted based on your transmitter)
Unproto Airmail Station via (node you hit normally)
Users 10
* Check your TNC manual to determine the timing rate used.

**Node TNC Parameters**
Beacon E 89 Minutes
Digipeat On
Frack 4
Heard List 25
Link Retries 10
MAXFrame 2
No Activity Timeout 600 seconds
Node Broadcast 30 Minutes
Obsolescence Count Initial Value 5
Obsolesence Count Minimal Value 3
PPersist 63
Minimum Quality for Auto update 63
Radio Channel Quality (HDLC) 192
RS232 Port Quality 255
Response 2
TXDelay 35

*While there have been many changes made, this document would not be possible without the original from Harris County ARES® and Nelson Livingston, AE5NL, along with significant input from Dale Huffington, AEØS, Missouri Section Traffic Manager.*

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