Amateur Packet Radio and the Emergency Response

California Emergency Services Association Coastal Chapter

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1. Introduction
2. What is Packet Radio
3. The “Why’s” for Packet Radio
4. Introduction to Outpost
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6. Summary
What is Packet Radio?
What is Packet Radio?

... in a nutshell

• Amateur Packet Radio is one of many digital modes that Hams can use to build wireless computer networks

• Amateur Packet is built on the AX.25 protocol, a mature extension of the industry standard X.25. With this protocol, comes transparency, error correction, and automatic control

• Data transfer speeds range from 1200 baud up to 19.6K Baud (frequency dependent; higher speeds = wider bandwidth)

• Packet establishes a “private connection” between two stations while sharing a frequency with other stations

• Packet can use Bulletin Board Systems (BBSs) for dropping off and retrieve messages between users
What is Packet Radio?

What are the components?

- **Computer:** runs a “terminal emulation” program
- **TNC:** Terminal Node Controller; similar to a telephone modem; the interface between your radio and your computer
- **Radio:** and antenna; transmits the digital data sent to the TNC to another packet station
What is Packet Radio?

**What can we connect to?**

*Definition: BBS – Bulletin Board System*, a station that is configured as a “message drop” for connecting stations. May be stand-alone or networked to other BBSs or the Internet. Several free software-based BBS applications are available.

*Definition: PBBS – Personal Bulletin Board System*, a minimal station that is configured as a “message drop”. Usually implemented in hardware.

Home or EOC Packet Station
Why use Packet Radio?
Why use Packet Radio?

The case for Packet

1. Message Store and Forward

- BBSs allow messages to be stored, retrieved, or forwarded throughout the connected BBS network.
- The recipient does not need to be on line to get the message, meaning that messages can be retrieved at the recipient's convenience.
Why use Packet Radio?

The case for Packet

2. Communications Protocol

- Packet uses a protocol called AX.25. This is based on the ITU X.25 protocol for networked packet communications.
- AX.25 supports error correction and control that guarantees that all packets (and subsequently messages) are delivered correctly.
- TCP/IP is also used to support interlinking BBSs together.
Why use Packet Radio?

The case for Packet

3. Interoperability

- DHS suggested to the ARRL that the Amateur community should design and maintain a national digital network for emergency communication purposes.

- Winlink 2000 (WL2K) was adopted as that solution.

- WL2K provides radio packet users and internet 3rd party users with transparent email access.

Definition: **RMS – Radio Message Servers**, provides an RF gateway from packet users to the WL2K system.

Definition: **CMS – Common Message Servers**, coordinates message traffic between RMS stations and the internet.
Why use Packet Radio?

The case for Packet

4. Complex messaging

- Packet is ideal for passing lists of material, addresses, instructions, or complex words (i.e. pharmaceuticals or chemicals)
  - you do not want to mistake *Hydrogen Sulphide* (a gas) with *Hydrogen Sulfate* (an acid)

- Packet-based messaging ensures...
  1. the originator can verify the content before it is sent (more than likely typed it him/herself),
  2. reduces transcription errors between the sender and receiver, and
  3. keeps the voice channel clear for more critical traffic.
Why use Packet Radio?

The case for Packet

5. Reduces message handling

• Packet messaging can originate from the source using standard office applications (or other methods) and sent directly to the packet app or via *sneaker-net* to the radio room for loading and sending.

• Because packet is digital and relies on a computer, messages can also be printed directly to a printer (assuming the terminal program supports it, such as Outpost).
Why use Packet Radio?

The case for Packet

6. Supported by the Amateur Community

• Packet is supported by hams with the interest and intent of supporting a disaster response when commercial communications is overwhelmed or lost.

• During the recent Chino Hills Earthquake...
  • Magnitude 5.4 Earthquake
  • phones in the San Bernardino County Sheriff’s station worked only intermittently
  • telephone companies reported no physical damage to telecommunications facilities.
  • Sprint: “… reported an 800% increase over normal call volume in the half hour after the earthquake struck… the volume soared past predictions for emergencies.”
  • Verizon: “… about 40% more than the peak we expect during disasters.”

Source: Los Angeles Times article, “Post-quake callers overload phone systems”, 30-July-08
Why use Packet Radio?

The case for Packet

7. Packet aligns with how we work today

- Message complexity and timeliness of delivery drives how we use…
  - The telephone instead of email (during non-emergencies)
  - the radio instead of packet (during an emergency)

- We would use packet radio for the same reasons we would use internet email: message accuracy, delivery, privacy, and the ability to handle message complexity.

<table>
<thead>
<tr>
<th></th>
<th>Simple Messages</th>
<th>Complex Messages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mode</td>
<td>Voice</td>
<td>Packet</td>
</tr>
<tr>
<td>Messages</td>
<td>Short messages</td>
<td>Lists, instructions, details</td>
</tr>
<tr>
<td>Delivery</td>
<td>Immediate</td>
<td>Store &amp; forward; mail drop</td>
</tr>
<tr>
<td>Equipment</td>
<td>Radio</td>
<td>Radio + TNC + PC + SW + BBS</td>
</tr>
<tr>
<td>Complexity</td>
<td>Short learning curve</td>
<td>Many commands to learn (native Packet)</td>
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Introduction to Outpost
Introduction
Outpost Packet Message Manager

Mission
The Outpost Packet Message Manager program supports the Emergency Communications community with a contemporary amateur radio packet messaging client that allows users to focus on the message, and not on the medium.

Goal
Help local ARES/RACES teams get on the air with digital messaging using their existing hardware and BBS infrastructure.
Introduction

Outpost Packet Message Manager

What is Outpost?

• A Windows-based packet messaging client that hides the complexity of the packet world
• Helps automate all the features available with the packet message handling environment
• Manages all message-handling between you and the BBS
• Lets you read, delete, create, reply to, or forward messages back to the BBS
• Enables ARES / RACES teams to support the response efforts and requirements of our local served agencies by pass digital traffic
Introduction
Outpost Packet Message Manager

The California environment...

State OES...

Three state regions...

Counties...

Local Level towns and cities

- CBL
- CUP
- LGT
- MTV
- SJC

Op Area/SCC...

Op Area/SF

Op Area/Napa

Coastal Region

Inland Region

Southern Region

FEMA

CA State OES

State OES

Three state regions

Local Level towns and cities

CA State OES

Coastal Region

Inland Region

Southern Region

FEMA

State OES

Three state regions

Local Level towns and cities
A closer look
Outpost Packet Message Manager

Creating messages

- Familiar email-app look & feel
- Supports Private, NTS, and Bulletin messages
- Freeform formatting
- Delivery and read receipts
- Different ways for originating messages
A closer look
Outpost Packet Message Manager

Viewing messages

- Supports viewing, printing, deleting or saving a message to a local file
- Reply and Forward message formatting
### A closer look
*Outpost Packet Message Manager*

#### Aligning features to needs

<table>
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<tr>
<th><strong>Environment:</strong></th>
<th>Environments are different… how do we adapt our tools to our environment?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Policy:</strong></td>
<td>In a community of packet users, what policies do we adopt to ensure order, consistency, and efficiency in what we do?</td>
</tr>
<tr>
<td><strong>Mission:</strong></td>
<td>How do we support our served agencies in their efforts to minimize loss of life and property, and speed the recovery?</td>
</tr>
</tbody>
</table>
SCC’s Packet Infrastructure – today

Outpost Packet Message Manager
SCC’s Packet Infrastructure – proposed

Outpost Packet Message Manager

Link: 223.620 @ 9600 baud
Operating Policies

Outpost Packet Message Manager

Helps implement packet operating policies…

1. All stations will identify with a tactical call sign
2. All messages are sent as private messages
3. All messages are uniquely identified
4. All messages are as short as possible
5. All stations will poll the BBS periodically for traffic
6. All stations will poll for specific message types
7. All message traffic becomes part of the official event documentation package
Mission Support

Outpost Packet Message Manager

• Understanding the mission and purpose of the agencies we serve.

• Ensure our mission aligns with the needs of our served agencies.

• What our served agencies need from us…
  • Pass message traffic
  • Documentation
  • Audit trail
Mission Support: Pass message traffic

Outpost Packet Message Manager

**Requirement:** Originate messages based on the content and format specified by our served agencies.

- Direct entry
- Copy-and-paste from other apps
- Import text from a file
- On-line report builder
- NTS Message Maker

![New Packet Message interface](image)
How Outpost is being used
Deploying Outpost

Ardent Sentry 2007

• Three scenarios:
  1. a hurricane striking Rhode Island
  2. a land-based terrorist scenario in Alaska
  3. a 10-kiloton nuclear detonation in Indianapolis

• Rhode Island Chapter of the American Red Cross (ARC) was activated, opened shelters, all communications by Ham Radio

• The shelter on Island of Jamestown had to pass required ARC shelter reports hourly to the ARC EOC in Middletown, RI.

• RI ARES used Outpost’s custom (on-line) reports and Tactical Call capability.

Briefing to U.S. Forest Service and American Red Cross personnel on developments in a simulated hurricane, part of FEMA's "Ardent Sentry" exercise.
Deploying Outpost
Ardent Sentry 2007

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**RI Amateur Radio Emergency Service**
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**Daily Shelter Report (Hourly)**

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**DAILY SHELTER REPORT Part 2 :**

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**CONDITION OF SHELTER**

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**Safe**

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**Potential Problem:**

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If potential problem is transition to another shelter needed?
Describe the problem:

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HOW LONG CAN SHELTER SUSTAIN THE CURRENT LEVEL OF SERVICE?
HOURS:
DAYS:

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ADDRESS PROBLEM AREAS ONLY UNLESS (*):

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* Staffing:
* Food supply in days:
* Total meals served:
* Special dietary needs:
* Water supply in days:
* Communications Capability:
* Medical Staff:
1. Client injuries:
2. Medical Supplies:
3. Transportation to another facility:
Mental Health Staff:
1. Client special needs:
Deploying Outpost
Santa Clara County and PacForms

- Santa Clara County OES required a backup means to pass RIMS messages
- Packet Radio was the logical choice; Outpost was recommended
- County RACES also needed more standard means for soliciting and collecting information from the cities
- PacForms are web-based forms that can be deployed to the EOC staff for quick data entry
- PacForms can run stand-alone or directly pass a formatted message to Outpost
Deploying Outpost
Santa Clara County and PacForms

Available PacForms

• EOC Message Form
• “City Scan” – Flash Report
• Logistics Request Form
• Hospital Status Report Form, DOC-9
• Hospital-Bed Availability Status Report Form, DOC-9
• SEMS Situation Report
• SEMS Mission/Request Tasking Form
Deploying Outpost
Possibilities – Public Safety Health & Welfare

Situation

1. Many county public safety employees live outside the bay area

2. For those already here when a disaster strikes, putting their minds at ease that all is well at home removes a big distraction, thereby allowing them to focus on the stabilization and recovery task at hand.

3. During an infrastructure-impacting event, commercial communications will be overwhelmed if not down, and contact with home may be impossible for several hours or days.

Problem

1. How do bay-area public safety personnel know that everything is ok at home?
Deploying Outpost
Possibilities – Public Service Health & Welfare

One approach
1. Identify WL2K RMS stations that are outside of potential impact areas
2. After an event, Public Service family members send a formatted email to (for instance) kn6pe@winlink.org, stating that all is OK at home
3. Ham operators retrieve messages by radio from WL2K RMS stations
4. Messages are distributed as appropriate, replies can be sent
5. There are plenty of details to work out prior to deploying this solution
1. Packet Radio can fill a need for handling specific types of emergency messages.

2. New tools and applications (like Outpost and WL2K) are rekindling interest in packet because of its feature-set and ability to hide the complexity of the packet environment.

3. The Amateur Radio Community is interested in deploying Packet capability in support of their served agencies.

4. While Packet’s mission is not fully defined, I believe it has the potential for making a difference in the emergency response.
Thank you

Any Questions?