PACKET RADIO FOR EMERGENCY COMMUNICATIONS

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There is a need to redesign the techniques we use to handle emergency traffic. Many of us are combining processor controlled equipment and traffic handling techniques designed in the 1930's.

Traffic handling originated in radio, using CW, a continuance from the landline systems, I presume. This limits our copy to about 15 to 25 words per minute, depending upon the operator's ability. The reliability of this system is very good since a CW signal can punch its way through a lot of QRM and QRN. Accuracy, however, is limited to the accuracy of the sending operator and the receiving operator, both of whom are subject to fatique.

SSB or FM adds a new dimension, though, and we can talk about 150 to 200 words per minute. At these speeds, however, QRM is more of a problem. Also, we cannot pass traffic at that speed. Assuming we have to write the traffic on a message form, our speed decreases to about 25 words per minute, and we are really not much more ahead of the process than we were with CW. I remember copying MARS (Military Affiliate Radio System) traffic, and whenever possible, checking the addressee in the telephone book. It seemed more often than not that at least one digit was wrong.

RTTY automates what we were doing manually at speeds of 60 to 100 words per minute. Reliability is about the same as voice, and accuracy is slightly better. Maintaining good accuracy requires careful tuning, listening for a "hit", and human attention while typing. Generally I felt the accuracy of our MARS traffic left a lot to be desired.

The type of traffic influences both speed and accuracy. Ragchewing requires neither speed, accuracy, or hardcopy. "Traffic", such as health, welfare, or greeting messages is different. Any media or system we use has a maximum capacity. For instance, suppose we are passing messages using 100 words per minute RTTY, with no QRM, by continuously feeding paper tape to our TD (Transmitter Distributor). The system capacity would approach 100 words per minute in this case, and accuracy of the system would be very good. The dashed line (Figure 1) represents our system capacity. If we are using 60 words per minute RTTY, voice or CW, the dashed line would represent a different system capacity. Equally important though, is the type of traffic.

Normal day-to-day message traffic such as MARS, demands only a small percentage of system capacity. Even at peak periods such as holiday traffic, it can normally be handled during the alloted time for the traffic net. In Figure 1, traffic supplied equals traffic demanded, which is still below system capacity. System accuracy is fairly good since there is time for retransmission requests and no one is under any particular pressure,

Special events such as weather nets or public service events are difficult, as the traffic is not constant. System capacity is still constraining us, and the traffic demanded begins, reaches a peak, and tapers off, (Figure 2). In the case of a weather watch, t'here is a scramble to get the watchers in position. Traffic builds as the NWS (National Weather Service), EOC (Emergency Operating Center), or whomever we are assisting demands more information. Usually, just about the time information is most critical, such as when the storm is directly overhead, the system becomes overloaded, and traffic demands have exceeded capacity. What happens? Well, if the net control. can keep a cool head and the net is well disciplined, some of the more routine traffic becomes delayed. Accuracy decreases, however, and sorting priorities becomes a problem. Is the Mayor's "routine" acted upon before the NWS "priority"? In time the delayed traffic is transmitted, but some of it will disappear, because it is no longer timely. This is not to imply it wasn't important, it was important, but we missed our chance. Somehow we need a better way of conducting traffic nets.

Disaster nets have a terrible efficiency, (Figure 3). The traffic demands build to gargantuan proportions following tornado touchdowns, and other major events. We work our system to capacity, but it takes days and even weeks to chip away at the workload. Accuracy is horrible, and faith in the system and 'amateur radio suffers in the long run. I could justify this scenario in the 1930's, but what do we answer in the computer age?

The answer to this problem is to move that system capacity line up so high that we couldn't run into it if we tried and at the same time do error checking to insure 100% system accuracy. This is exactly what Packet Radio will do for us in the amateur community, and it will do this at a relatively low cost.

A Packet Radio station consists of your present rig (1930 vintage if you so desire, but preferably a modern FM transceiver), some kind of terminal or personal computer, and a TNC (terminal node controller), which does the packet formatting, error checking, and several other functions. Computers are becoming available for $100.00 and up, and TNCs, such as the one offered by the Tuscon Amateur Pack Radio group (TAPR), sell in the $200.00 range. So the cost to upgrade your station to Packet Radio is perhaps the cost of a two meter rig.

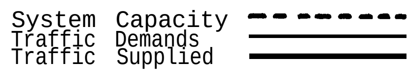
Packet Radio will do a number of things for us. It will change the system capacity line from 100 words per minute in our example (74 Baud) to 1200 Baud. On paper that's a sixteen fold increase. In reality, it will be less because of packet overhead, but the increase is still phenomenal. The accuracy is virtually 100%, because of error checking and system acknowledgements. Previously, the net controls could only talk to one station at a time. In Packet Radio, the 64 stations in each local area network (LAN) can send data to other stations simultaneously.

Computers don't have much effect on our present traffic systems, since human intervention is usually required to check status, stored messages, etc. In Packet Radio, we have many uses for the computer. We could store messages for a station not yet logged in. We could do inquiries, such as health and welfare traffic. This may best be done computer to computer, which is fairly easy to set up. We could tie our computer to others in the area over land line, or another frequency to handle incoming traffic. The possible uses for our home and club computers is seemingly endless.

Our traffic nets are usually single function; VHF for local, HF for large areas, etc. By using the gateway function, our LAN Packet System can access worldwide via satellite. This provides a means to get traffic in and out of the local system. Perhaps we need local stations to handle the LAN. The other four stations (or more) could link to other LAN's, gateways, computers, etc.

What could happen if the national emergency evacuation plan were implemented? Imagine moving 100,000 people in your community to an area 50 miles away. It is logical that amateur radio would be used to help coordinate this massive effort. How would we handle this? The logistics would involve massive vehicle movement, fuel, food, medical care, etc. Our present system would have little usefulness, but a Packet Radio system could easily accommodate this. If one LAN becomes overloaded, just initiate another. The gateways would also be heavily used and again, if a gateway becomes overloaded even at 19.4 K baud, another gateway would be initiated.

We are still using old technological equipment. Old technological traffic handling techniques are effective for day-to-day operation, but become overloaded at the first sign of large scale activity. We have the technology to correct the situation, but we need to act now to adapt Packet Radio technology and procedures to our traffic handling system.



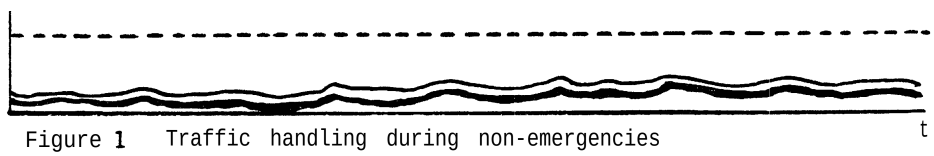


Figure 1 Traffic handling during non-emergencies

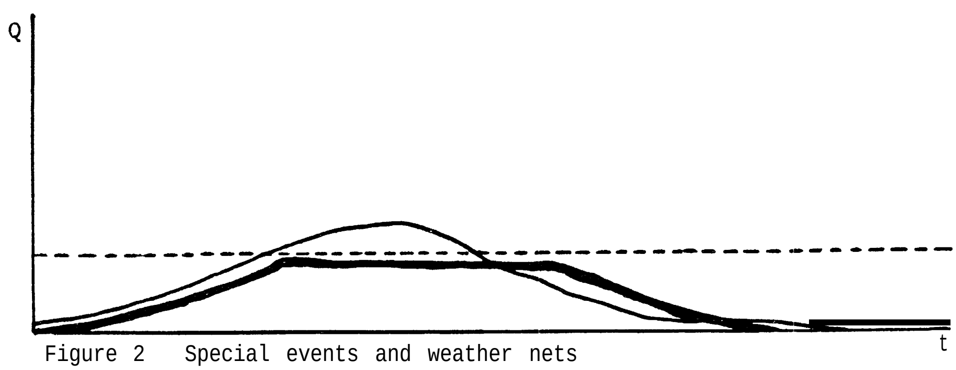


Figure 2 Special events and weather nets

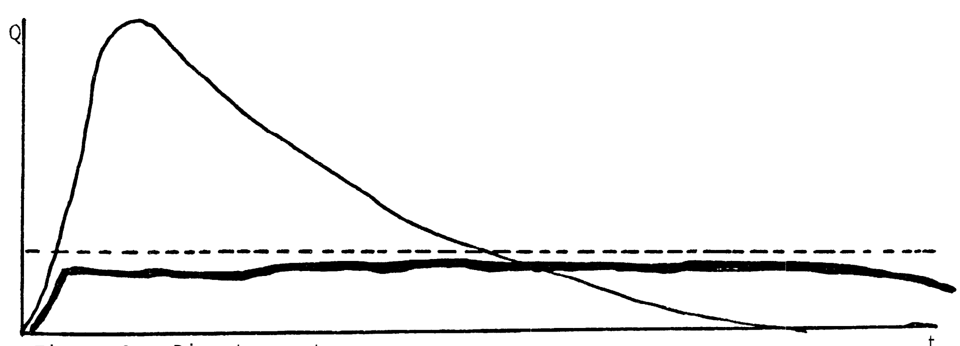


Figure 3 Disaster nets

Traffic Activity Chart