

THE BIG ONE COMES TO SANTA CRUZ

Commentary on Ham Radio Operations

A Critique and Recommendations

Wayne Thalls, KB6KN

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ACKNOWLEDGEMENTS

Twenty-four hours after termination of the ARES operations, the first of a series of debriefing meetings was convened. Several local Radio Amateurs, who played key roles in the operation, were asked to participate. While this report primarily reflects my personal experiences, it also incorporates very important contributions from these people. The Santa Cruz Amateur Radio Emergency Service can certainly benefit from a review of the accomplishments and problems. This may have been the largest scale disaster related Amateur Radio operation, ever. Since we have what I believe to be a unique perspective, Amateurs throughout the nation can benefit by sharing our experiences. My critical comments are not directed toward individuals---rather they are intended to identify some real problems, and suggest solutions.

I wish to thank the following individuals who contributed invaluable observations and recommendations during debriefings, following the quake operations.

Don Cooper	KB6NMW
Sharon Cooper	N6TUZ
Leon Fletcher	N6HYK
Dave Taylor	K6GHA
Jack Sanders	WX6X
Rich Hanset	KI6EH
Art Lee	WF6P

ABOUT THE AUTHOR

In the early hours of October 18, Wayne Thalls, KB6KN, assumed responsibility as the Acting Emergency Coordinator for Santa Cruz. He continued in that capacity until cessation of operations on October 25. Thalls has been a licensed Radio Amateur since 1942. He also has held commercial radiotelephone and radiotelegraph licenses. His career included 13 years as a Communications Officer with the **Indiana State Police**. The last several years of that service entailed overall responsibility for the statewide communications operations of the agency.

He served concurrently as the Director of Communications for the Indiana Department of Civil Defense. President Eisenhower appointed him to the **National Defense Executive Reserve**, as a public safety communications specialist. After leaving the State of Indiana, Thalls spent ten years with RCA as a radio communications system-engineering manager, and as a marketing executive. Responsibilities there included, radio system design, product planning for mobile communication products, and the operation of RCA's Washington FCC liaison office. While working for RCA, Thalls was named by the FCC to a two-year stint as a consultant on land-mobile spectrum utilization.

Coming to California in 1969, Thalls joined the marketing department of **Plantronics** in Santa Cruz. Following nearly a decade with that company, he served as a marketing executive with several Silicon Valley electronics firms, until his 1988 retirement.

INTRODUCTION

The Quake of '89

To understand the situation we faced in Santa Cruz County it is necessary to put it in perspective.

The temblor was centered in Santa Cruz County, even though damage occurred in a much wider area. Of course, we did not know this immediately.

This was the third largest quake to hit the U.S. in this century. It was one hundred times stronger than the Armenian quake last year. Damages were greater than those sustained in Hurricane Hugo. This may well have been the greatest disaster to ever rely so heavily upon Ham radio.

In the very beginning we did not know where the quake was centered. We had no idea of the situation in surrounding counties. In other words, the counties were isolated from each other. As it turned out there was serious damage as far away as San Francisco and Oakland. All of the counties in the area were in a disaster mode, instantly and simultaneously. This was not an isolated predictable situation involving a definable area---unlike a forest fire, flood, hurricane, or plane crash.

Within 15 seconds Santa Cruz was virtually isolated from the rest of California. Roads were blocked and bridges damaged. Some of these conditions will continue for months, or even years.

Electrical power was instantly lost throughout the central coast area. Telephone service was disrupted over this same area. Many emergency generators did not function. Only three service stations in the Santa Cruz area were able to pump gasoline.

Santa Clara Valley commuters were isolated on the other side of the "hill". This included an appreciable number of our hams.

Hundreds of Santa Cruz County residents were instantly made homeless. Temporary shelter was critically needed.

Watsonville Community Hospital was damaged. It was necessary to evacuate part of the building. The other two county hospitals took some of these patients. Others were transferred to Ft. Ord, Monterey Community, Stanford Medical Center, and other facilities throughout the area. Amateur Radio, solely, had to meet the immediate communications needs for this activity.

As the evacuated patients were being transported to other area hospitals, quake victims were also arriving. For a time emergency surgery was being performed on the Watsonville hospital lawn, by generator powered lights. There were serious shortages of supplies and personnel almost immediately, at all hospitals. Ham radio also had to deal with this situation. At the same time we were summoning ambulances and helicopters from surrounding counties. Since many of the choppers could not communicate with the local hospitals, the Ham channels were used to coordinate operations.

Apparently many local residents, like out-of-towners, also believed this was the San Francisco earthquake. Many still do not appreciate the magnitude of what happened here. Apparently, if you don't see it then it doesn't exist.

Amateur Radio was the only link to much of our area for several hours.

The plans and equipment of many of the "professional" organizations did not function for quite some time. This added to an already tremendously confusing situation.

While much of what follows is of a critical nature, it is obvious that we did manage to cope with the situation. Even so, we could have done much better.

Personal Perspective

I met Rich Hanset, SCARES Emergency Coordinator, at the Santa Cruz County Governmental Center about thirty minutes after the October 17 quake. We opened the ARES/RACES communications center, which continued operations until October 23. I immediately assumed the net control operation. What followed is literally a blur. For the next seven hours I was on the air virtually non-stop. We were much too busy to keep logs, or record all communications. Messages were passed and acted upon instinctively. We provided the sole communications between County OES and many locations, including medical facilities, State OES, and local governments for a period of time when no other means existed.

Rich Hanset had to leave the next day on a crucial scheduled business trip. By mutual agreement, I assumed the Emergency Coordinator responsibility in the early morning hours of Wednesday October 18. I continued in this role until final cessation of operations at 2:00 PM on Wednesday October 25.

AN OVERVIEW

First, what went right.

Our linked repeaters system performed exactly as we had hoped it would. The coverage of the south county area was absolutely crucial in the entire event, from beginning to end.

The few (as a percentage of the estimated 500 Ham residents) Santa Cruz County hams that showed up did yeoman's service. Some who did not appear in the early hours after the quake did volunteer later, when the initial pressure was off.

SOME HUMAN INTEREST STORIES

One member of the local ARES group reported in from his hospital bed at Fort Ord, forty miles away, apologizing because he couldn't help.

Another member, who is legally blind, performed in an extremely professional manner on several shifts from the County Communications Center (County OES).

Two hams, each with severe hearing loss, worked multiple shifts at County Comm. One then went on to handle Health and Welfare traffic from home, while the other worked several shifts at Red Cross shelters.

A totally inexperienced ham, who doesn't even own Ham gear, operated from County Comm at a time when our ability to staff was severely limited.

A 14-year-old member of the Santa Cruz County Amateur Radio Club operated the Red Cross station on multiple shifts. She performed in a cool and efficient manner, which could put some of the OT's to shame.

At various times we were forced to utilize new and unlicensed operators at County Comm. Even though working under loose supervision of the "control op" these people played an essential role.

Many shifts at County Comm (the key activity) were manned totally by out-of-area hams. We were forced to shut down the County Comm activity at midnight on Thursday, for lack of personnel. It was reopened at 0700.

Several hams, acting independently, drove all night from places as far away as L.A., and then volunteered for service immediately upon their arrival.

One radio club member, who was at work as a manager at Pacific Telephone in Santa Cruz, used his two meter handheld to communicate with County Comm to expedite the installation of critically needed telephone lines between Watsonville and County OES and from Santa Cruz Red Cross to Watsonville area. Considerable bureaucratic delay was thus avoided.

The total number of out-of-the-area hams who came here to help is estimated at 370.

Major Problems

There was at no time ARES management in depth. The need for trained and committed AECs is strikingly apparent. A chart does not constitute an organization. When the real thing comes every AEC must be prepared to take charge of the operation---and perform any required management task. By Friday, having had no more than six hours sleep in total, I personally was close to exhaustion. No one can work at their peak level under those conditions.

Because of our heavy reliance upon "out-of-towners", there were often shifts when no local operators were on duty at the key locations. This certainly made it more difficult for the visitors who lacked local knowledge. Here again the availability of an AEC, for consultation, would be invaluable.

If the quake had occurred 24 hours later, both Rich Hanset, KI6EH and I would have been out of town.

There was, at all times, very limited resource management capability. Primarily this was due to the dearth of AEC's. This resulted in duplication of assignments, failure to recruit in a timely manner, and volunteers being turned away at times---while it was impossible to fill spots at other times.

Related to this was the problem of overly long shifts for personnel in hot spots. During peak traffic periods no one should have to work more than three hours at a time without a break. The positions are much too stressful, causing accuracy and efficiency to decrease greatly.

Generally no one should work more than eight hours, even during slack mid-watches; the job is too tiring to insure accuracy. On the other hand two people should not be assigned to positions that can be handled readily by one operator.

The ARES roster contains numerous people who will normally not be available in any major emergency. Specifically I refer to Firefighters and medical

personnel. This is not meant to imply that they are not needed in the organization. They can be utilized to great benefit in a planning and preparation role. They will often be available for assignment during lesser emergencies. They should not, however, be listed as unqualified resources. This becomes critical because people actually relying upon the published lists do not know the true status of any individual. Expanding the roster coding system can solve this.

We probably should also have a means of identifying the commuters who work "over the hill". In this event, those people were isolated from us for 24-48 hours, and thus were not available for duty.

The fractured Santa Cruz County ARES structure created inefficiency. While there are, theoretically, three separate ARES organizations, there was only one emergency. This emergency was a countywide operation, and therefore Santa Cruz ARES played the key role in operations and in staffing. The key activities were being directed from County Comm---and the key decisions were being made there. After the first day all resource assignments were made from County Comm, too.

At various times, stations in seven, or more, counties were inter-communicating. One of the participating stations could not act as Master Net Control. The organization and management of changing net structures could best be controlled by an organization outside the direct operations. Logically this could fall somewhere within the ARRL role, at the Section or Division level. Specifically this would apply to the inter-county liaison, state OES linking, and inter-county Red Cross activity. This is a problem unique to wide-area disasters.

Individual hams made too many operational decisions. This is always a problem---one which can't be prevented, but which must be addressed by the managers involved in an event. There was much duplication of capabilities, which resulted in less than optimum utilization of the available radio resources. For example it made no sense to have simultaneous UHF, HF, and VHF connections with State OES. Traffic did not warrant this, when communications were really being handled primarily by telephone. These multiple resources were there for backup only. Superfluous activity resulted there, and at other locations, because an operator was assigned at each radio---even though they really had no traffic. (Give a Ham a radio and he feels compelled to talk.) We had to deal with all this unnecessary communication, while handling disaster related traffic locally.

Often, individual hams, reporting to a location for the first time, established unnecessary links simply because they had extra equipment available. For example, shelters had no reason to communicate with any station other than the Red Cross Chapter House. Some operators, however, would also needlessly operate on the inter-county net---or even some adjacent county repeater.

Once more the lack of an NTS structure in the Monterey Bay area was apparent. It is absolutely essential to keep everything relating to Health and Welfare off the emergency nets. From the very beginning of operations, people were trying to enter H & W messages via our Tactical Net. If we had allowed this there would have been total chaos. Too many hams are unable to place H & W in the appropriate perspective in such a situation. There was, however, no one playing a coordination role elsewhere. This is a very serious problem. It was also apparent in the recent Hurricane Hugo disaster. In an effort to tie this all together Hank Bond, KG6EE was assigned to working this problem from his home QTH, on the day following the quake. We have identified only eight operators who handled traffic at any time via HF.

Packet could have played an extremely valuable role in handling tactical communications. It never did. Our current equipment installation is impractical---as both a Bulletin Board Station and a send-receive terminal. There are a number of reasons why this setup requires revamping.

We need terminal capability, not BBS, for emergency communications. While it is important that there be an operational BBS somewhere in our area during normal times, it can serve no useful disaster communications mission.

If for no other reason, the current equipment is much too complex to be practical. It should be possible for an inexperienced operator to sit down and use the equipment within 5 minutes, or less. We could not possibly have manned this position with experienced packet operators.

The current operating area can not accomodate an additional operator. A rearrangement is imperative. The room, the console, and the gear mounted in it are seriously deficient from a human factors standpoint. This is not a Ham shack. It is an emergency operations room.

We really need two Packet stations---in addition to the BBS.
One should be for incoming messages only.

The other should be for outgoing traffic only.

A separate computer for preparing files "off line" would be extremely valuable.

Portable packet terminals could have been used to great advantage for the Red Cross shelters and some of the other locations which handled a tremendous amount of logistical and administrative traffic. Speed, accuracy, and security would benefit. We should not rely on individual hams to provide this equipment. It should be dedicated and in the control of County OES or Red Cross and ARES.

After a few hours the KI6EH BBS was saturated with Health and Welfare message activity. The station could not possibly have also handled tactical traffic.

Many, many problems resulted when we had to rely almost entirely upon Ham volunteers with handheld radios. Permanently installed antennas and feed lines were needed at numerous locations for improved coverage. The ability to install temporary antennas at some of the locations would also be very beneficial. A quantity of simple, lightweight, inexpensive antennas, feed lines, and installation hardware should be stockpiled.

We need several VHF/UHF mobile units, with power sources, stockpiled for temporary installations. This would allow us to control the use of handhelds, in fixed locations. It would also permit us to use hams who did not have equipment available.

Now is the time to persuade the various agencies of the need to purchase some of this equipment, in their own interest. I am sure the administrators of all three area hospitals now agree that it was a good idea to install those 2 meter base stations.

We should have backup equipment available at County Comm. Luckily we did not suffer the failure of a single piece of gear. If one transceiver should fail, there could be considerable delay in finding someone to come forward with loaned equipment.

Our operations were severely hampered due to the lack of repeaters. Essentially our one repeater system handled all emergency traffic and most of the resource traffic. Most of the time this system was linked with the N6RZ 2 meter repeater in the San Lorenzo Valley, and the N6IYA UHF repeater. There were stations on the net in at least 4 counties. In this operation we needed to establish a totally separate Red Cross net. If a base station with antenna had been available at the Red Cross chapter house in Watsonville, I believe this net could have been established on a simplex frequency.

One inexperienced Ham made a very important observation regarding the shelter operations. She used an available telephone for forwarding information, rather than add to the traffic on the primary net. How many times could the Ham on duty have used the telephone? The shelter management personnel were frequently too busy to make a phone call, so they gave the information to the Ham communicator. Hams should understand that a 2-meter hand held is not the only resource he may use.

We should determine if it is practical to convert the old SCCARC repeater for portable operation. We should also explore the acquisition of a second portable repeater. A proposal by Leon Fletcher, N6HYK is directed toward this problem. He and his wife have pledged \$500 to be used toward purchase of the necessary equipment. The remainder of the funds is to be raised within the Ham community.

We were extremely fortunate that there were no failures of our repeater system. The two VHF repeaters, and the associated UHF link performed unbelievably well. This is amazing, because the transmitters were on the air virtually continuous duty for the first six or seven hours. I talked so much that the muscles in my throat were sore for days. Many Amateur repeaters, and commercial base stations, did fail. What would we have done if any part of our system had failed? The two key individuals, involved in maintenance of the equipment, were both out of town. We should have enough qualified people available at all times to assure rapid response to a failure. This is certainly not easy when relying upon volunteers.

Essential operational reference materials were not available to the County Comm operators. The same problem exists at Red Cross. This is all material which is of importance equal to the Ham gear. All reference materials must be updated and filed systematically, on a continuing basis.

The current "Blue Book" (SCARES Manual) contained the only ARES roster, which could be readily located. It was dated 1987.

Current Santa Cruz County Amateur Radio Club and San Lorenzo Valley club rosters.

Street maps for all areas of the county--preferably a Thomas Brothers atlas. The inability of most NCS operators to promptly give accurate and concise directions over the air created much additional traffic. The availability at key locations, including County Comm and Red Cross, of detailed verbal directions to various key locations would be very helpful.

All reference material should be organized in binders and kept permanently stored in the console. Since virtually no storage capability exists, it must be created.

Current area telephone directories

Some Operational Problems

1. The Net Control operator must be forceful and in command. No "Mr. Nice Guy." This is no time for routine Ham protocol. There must be structure. A good control operator can make order out of chaos.
2. Most hams do not understand the role of the individual agencies involved in an operation. Knowledgeable control ops will be invaluable. The presence of a qualified AEC, at all times, would alleviate this problem.
3. The center of the disaster activity must be in control. Too many individual hams were establishing links and nets. The outside, or third party control, mentioned previously could help here.
4. Most the communication in the Watsonville area involved the shelter operations. At some point we could have separated the two repeaters, for more efficient utilization. No one was available to evaluate the situation and make the appropriate decision. Again the need for ARES management.
5. No one has any business to be in the County Comm facility unless they are assigned there. It should not be used as a staging area, and certainly it should not be open for sightseeing--too much confusion results. A resource management capability would help, by directing people to their assignments over the air or by telephone.
6. We should not issue bulletins based upon hearsay. This applies to the situation analysis, road conditions, etc. The commercial broadcast stations are not necessarily a reliable source of information.
7. Accidental jamming occurred on several occasions. Base station microphones, such as those at County Comm are an invitation to trouble. The push-to-talk bar, and especially the lock button can be readily jammed by accidental pressure. The mikes must be mounted on the console and foot switches added. Prominent P-T-T indicator lights on the panel would also help. Indicators on the gear are of no help, since they are too small to be seen. Handheld microphones tend to get shoved around unless they are stored in a hanger.

Most of these occurrences were in the field, where cramped operating conditions probably resulted in the mike P-T-T switch being jammed on. This was a problem at the Red Cross in Santa Cruz, as well as other locations.

I am always amazed when someone comes on the air to tell everyone to check that their transmitter isn't keyed.

8. An inter-county net was essential from the beginning---especially for coordinating Red Cross efforts between counties. With several high level repeaters knocked out of service, or providing inadequate coverage, this net quickly migrated to the W6WSH repeater. Considerable difficulty was experienced, at times, in attempting to utilize the W6WSH repeater. Control ops/trustees of their club refused to relinquish the repeater to unlimited access for the disaster operations. They insisted, "this is a private repeater"

(and still do). This repeater is the "most powerful" in northern California. It penetrates all of the area impacted by this disaster. The 146.64/.04 channel pair is thus their private domain for much of northern California. No one else can ever utilize that frequency pair. What would we have done if the K6BJ repeater had failed---certainly not depend on W6WSH.

9. Most hams do not understand the use of tactical calls. Much, much valuable airtime was lost due to this failure. Too many people insisted on using calls and names, even when tactical calls were also used. Then of course, there were the long-winded operators who never use one word when three are possible. The net control operator must provide on-the-job training for these people.

10. A great deal of confusion occurred because multiple stations were using identical tactical calls.

"Net Control" should not be used as a tactical call. In our case County Comm was the Net Control Station. Everyone must be informed as to who is in control. At times we had "Net Control" in the SLV, in Monterey County, and in Santa Clara County all linked into one net. Complete tactical calls would prevent this confusion.

"County Comm" was also a confusing ID at times. We were communicating with County Comm's in Santa Clara County, San Francisco, Alameda County, and in Monterey County. Again this was via linked repeaters throughout the Bay area.

11. A direct inter-communication channel between our comm room and the OES operations manager would be very helpful. Unnecessary movement and lost time resulted from our present setup. An intercom of some sort could be used. It is important to understand that this cannot replace written messages. It should be used for only priority, urgent and immediate exchanges, and coordination.

It would be very helpful to have runners to handle messages within OES. This might be an activity where county clerical personnel could be pressed into service. This problem is common to the entire OES function, not just our activity.

12. The Santa Cruz Veterans Memorial Building initiated an unofficial activity. Hams were recruited directly for duty there. Fortunately there were few responders. In any event, valuable resources were recruited there, when they could have been utilized in the primary operation. At no time did this become a part of the county, or the Red Cross operations. There was on-the-air activity; however everything I heard was strictly informational bulletins, intended for general public dissemination---and which went no further. A friendly visit by an AEC might have been appropriate.

Communications Van

Because of the considerable amount of effort and money being expended in the development of a communications van, I feel compelled to comment on this subject.

I cannot identify any valid role such a vehicle could have played in this disaster. Yes, I am sure we would have sent it to some spot and had it on the air. It would simply have been another mobile unit, however. Certainly, there will be events where such a resource will be needed. Localized emergency situations would be an example. If it had become necessary to abandon the County

Building, the van would have been utilized. There was no need for multiple radios at any site, other than County Comm and Red Cross. The radio gear, which will be placed in this vehicle, could have been utilized at some of the temporary sites--if it could be readily removed from the vehicle. I urge that this be planned in the installation. Equipment installed in a console looks very nice, but is virtually impossible to remove or replace rapidly. It also is difficult to maintain or replace. Obviously, security must not be overlooked.

I saw no place for the use of ATV in this situation. If it had been available, I am sure someone would have tried to use it. This would only have placed a further strain on our limited resources.

I have previously discussed the Packet Radio needs. A packet system in the van would be in the same category as the mobile equipment. It certainly should not be a complex computer installation. SIMPLE IS SUPERIOR!

The plans for the van should be reviewed.

Changes to County Comm Facility

The following changes should be made to this facility. They are essential to more efficient operation. The design of Amateur Radio equipment imposes certain conditions, which influence the physical layout of operating facilities. The current County Comm installation is no exception.

Ham equipment is intended for "hands-on" operation. It is not easily remoted.

Multi-mode multi-channel operation requires ready access to several controls in addition to P-T-T and volume. Fortunately modern equipment is compact.

We hams like to show-off our equipment.

This is, of course, different from the objectives in designing "professional" operating facilities. There the primary purpose is to efficiently handle messages and manage resources. The electronics equipment is just a tool for accomplishing the mission.

These observations and suggestions are based upon my own personal experience in public-safety/emergency communications. Many of them can be easily, and inexpensively, implemented. These recommendations are intended to make our facility more "professional" through some human-engineering improvements. They will enhance the operating environment by:

Minimizing movement of people within the room.

Reducing distractions, both visible and audible.

Reducing the need for verbal communication among operators.

Reducing the need for others to visit the radio room. This will speed up the transfer of messages, and reduce distractions.

Simplify equipment operation, thus allowing operators to concentrate on message handling.

Make it easier for new people to quickly adapt to the equipment.