

**October 17, 1989 Earthquake
AMATEUR RADIO OPERATIONS**

A Review and Recommendations
For the Amateur Radio Emergency Service

Submitted to the Santa Cruz County
Office of Emergency Services

by
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Santa Cruz ARES
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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 experience. 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 these debriefings.

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. His career included 13 years as a Communications Officer with the Indiana State Police. Duties included 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. During this period of time he was appointed by the President to the National Defense Executive Reserve, as a public safety communications specialist. After leaving the State of Indiana, he spent ten years with RCA as a radio communications system-engineering manager and marketing executive. Responsibilities there included, radio system design, product planning, 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 an industry consultant on land-mobile spectrum utilization. Coming to California in 1969, he joined the marketing department of Plantronics in Santa Cruz. Following nearly a decade with that company, he worked as a marketing executive for several Silicon Valley telecommunications and electronics firms, until his 1988 retirement.

BACKGROUND

THE AMATEUR RADIO EMERGENCY SERVICE

Amateur Radio, or Ham radio, has existed as a hobby since the early part of this century. Since at least 1913, Hams have provided auxiliary communications during disasters. Often they are the only link with disaster areas. The 1985 Mexico City earthquake is an example. For several days during Hurricane Hugo, Amateur Radio provided the only link with several of the ravaged Caribbean Islands.

The Rules and Regulations of the Federal Communications Commission have established the Amateur Radio Service as a "voluntary non-commercial communications service, particularly with respect to providing emergency communications". The FCC, upon passing examinations covering technical knowledge and familiarity with the Rules and Regulations, licenses U. S. Amateur operators. The allocation of radio frequencies to the Amateur Radio Service is based upon international treaties. Amateur Radio, in some form, exists in virtually every country.

EMERGENCY PREPAREDNESS

Many U. S. Ham operators prepare themselves for disaster service by affiliating with the Amateur Radio Emergency Service (ARES). The American Radio Relay League (ARRL), the national association of Hams, established the ARES in 1935.

ARES members have voluntarily registered their capabilities and equipment for emergency communications. These groups of trained operators are ready to serve the public when disaster strikes, and normal communications can not cope. Locally the Santa Cruz County Amateur Radio Club sponsors the ARES group. Every licensed amateur is eligible to join ARES, whether a club member or not.

It is important to note that the ARES is a totally volunteer organization. There are no paid staff members, at any level, on the local or national level. This group was probably unique, among all organizations involved in this disaster.

ARES does not declare emergencies, but rather responds to the call for assistance from those agencies, which have that responsibility. A primary purpose of the ARES organization is to develop plans, train participating Amateurs, and maintain ongoing liaison with the groups to be served. The amateur resources complement existing governmental and disaster agency communications. ARES is prepared to provide communications where no established links exist, or to supplement existing systems when they become disabled or overloaded. Services provided by the Amateurs may include:

1. Communication between Santa Cruz County and other governmental agencies within the county.
2. Communication between Santa Cruz County and the State of California Office of Emergency Services.
3. Communications between Santa Cruz County and other counties throughout California---but particularly adjacent counties.
4. Communications between Santa Cruz County and disaster relief agencies, including the American Red Cross and Salvation Army.
5. Primary and initial disaster communications for the American Red Cross. This includes links with the ARC Western Region, and with Red Cross operations in adjacent counties.
6. Initial disaster communications between the American Red Cross chapter house and emergency shelters.
7. Auxiliary disaster communications for the three Santa Cruz County hospitals.

8. Additional communications links as required.
9. Handling of Health and Welfare inquiries for the general public throughout the US

THE SITUATION

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

This was the third largest quake to hit the U.S. in this century. Stronger than the Armenian quake last year. Damages were greater than those sustained in any previous disaster in U. S. history---including Hurricane Hugo. This may well have been the greatest disaster to ever rely so heavily on 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, except for amateur radio. 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.

Electrical power was instantly lost throughout the central coast area. Telephone service was disrupted over this same area. Many emergency generators did not function. Many commercial and governmental radio systems were off the air. Many amateur radio installations were also damaged.

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

Amateur radio was the only link to many areas for several hours.

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 realize we could have done much better. Efforts are underway to strengthen our organization, as a result.

AMATEUR RADIO RESOURCES IN THE COUNTY

SANTA CRUZ COUNTY OES

The focal point for ARES operations is the Amateur Radio facility located in the OES area at the County Governmental Center. The County has provided a well-equipped installation with High Frequency (HF), VHF (Very High Frequency) and UHF (Ultra High Frequency) radios. Provision has been made for voice communication in the local area, with surrounding counties, and more distant locations such as State OES in Sacramento. Digital communications, via radio, connects with a nationwide network.

HOSPITAL COMMUNICATIONS

Two-meter (VHF) Amateur Radio stations have been purchased and installed by each of the three hospitals in the county. These facilities provide backup communications between the hospitals, Red Cross, and other emergency groups. In the aftermath of the quake the Amateur Radio resource was required immediately, when the telephone systems did not function. The Hospital Emergency Radio Network did not function either.

THE AMERICAN RED CROSS

The Red Cross Chapter House in Santa Cruz has been equipped with 2-meter radio equipment for several years. Their installation also includes a Packet Radio station. Installation of 2-meter radios is planned for the coming year, at the Watsonville Chapter House. Just this year, the Red Cross installed an emergency generator capable of supplying all requirements of their Santa Cruz building.

THE AMATEUR RADIO REPEATER NETWORK

Repeater stations are used to rebroadcast transmissions from low power portable and mobile radios,

providing them with extended range. Several VHF repeaters provide the backbone of the Amateur Radio emergency communications capability in this county. The Santa Cruz County Amateur Radio Club owns and maintains two interconnected repeaters, which cover most of the county. One is located in De Laveaga Park in Santa Cruz, while the other is located on the fire station tower at Watsonville Airport. Both stations have emergency power sources. The two repeaters are interconnected by an UHF radio link. This means that stations operating on either repeater may talk with those operating through the other. The system allows mobile, portable, and fixed stations to intercommunicate throughout the central and south county areas.

Another VHF repeater located in the San Lorenzo Valley augments the coverage of these repeaters. The San Lorenzo Valley Radio Club operates this system. A privately owned amateur UHF repeater located in the mountains above the San Lorenzo Valley is also available for use during emergencies.

Following the quake, all of these repeaters were linked together into a common network. Anything transmitted on any one of the facilities was heard through all the others. This was especially valuable since most of the participating amateur operators were using low powered handheld portable radio transceivers.

OCTOBER 17, 1989 QUAKE OPERATIONS

LOCATIONS UTILIZING PERMANENTLY INSTALLED AMATEUR RADIO

The following locations, all equipped with permanently installed amateur stations, were staffed immediately following the earthquake.

- County Communications - OES
- American Red Cross, Santa Cruz
- Dominican Hospital, Santa Cruz
- AMI Community Hospital, Santa Cruz
- Watsonville Community Hospital
- California Department of Forestry and Fire Protection, Felton

TEMPORARY LOCATIONS UTILIZING AMATEUR RADIO

These locations were provided with Amateur Radio communications, utilizing equipment provided by the volunteers themselves.

- Santa Cruz City OES
- Watsonville City OES
- Boulder Creek Fire Department
- Ben Lomand Fire Department
- Watsonville Red Cross Chapter House
- CDF, Corralitos
- CDF, Base Camp/Henry Cowell Park
- CDF, Staging Area/Seven Day Adventist Campground

Temporary Shelters

- Corralitos Community Center
- Watsonville High School

Red Cross Emergency Shelters

- New Brighton Middle School, Capitola
- Civic Auditorium, Santa Cruz
- Messiah Lutheran Church, Santa Cruz
- Portuguese Hall, Santa Cruz
- St. Michael's Church, Boulder Creek
- C. T. English School, Loma Prieta
- National Guard Armory, Watsonville
- Veterans Hall, Watsonville

Ramsey Park, Watsonville
Santa Cruz County Fairgrounds, Watsonville

WIDE-AREA COMMUNICATIONS ESTABLISHED

Radio circuits to points outside the county were maintained throughout the days following the quake. County Comm was almost immediately in contact with all the adjacent county OES facilities, via Amateur Radio. Communication was established within the first hour to State OES in Sacramento and their Region II office in Pleasanton. Even after reestablishment of telephone circuits, the radio links remained as a backup.

Among the locations tied into this wide-area network were:

- California State OES, Sacramento
- California State OES Region II, Pleasant Hill
- Monterey County OES, Salinas
- Santa Clara OES, San Jose
- American Red Cross Western Region Headquarters, Burlingame
- American Red Cross, San Jose
- American Red Cross, Monterey
- American Red Cross, Salinas
- American Red Cross, Carmel
- American Red Cross, Los Gatos

HEALTH AND WELFARE COMMUNICATIONS

When any disaster strikes, normal communications facilities can quickly become saturated by calls into the affected area from concerned relatives and friends. When the telephone system fails, there is much frustration. Traditionally Amateur Radio has been utilized to handle inquiry messages and answers from disaster areas. This, of course, diverts many of these queries from the public-safety agencies, hospitals, and the Red Cross.

This disaster was no exception. Within the hour inquiries were being directed to Santa Cruz County from the entire country. Many of these were forwarded via the Packet Radio facility located in County Comm. From this computerized Bulletin Board System, Amateurs throughout the Monterey Bay area were extracting the messages and delivering them by telephone. This was all taking place without intervention by personnel occupied with the disaster-related operations. Over the first four days perhaps 2,000 Health and Welfare queries were processed by this system. At the same time other amateur operators, operating from their home stations, were handling messages directly from other areas via HF radio.

THE VOLUNTEERS

The 1989 earthquake has forced us to rethink some of our previous assumptions. With an estimated 600 licensed Radio Amateurs in Santa Cruz County, there have usually been an adequate number of local volunteers to cope with previous disaster situations. The core group---ARES members---was expected to be available to play key roles.

Because the entire county was a disaster area the Ham residents, like everyone else, were personally impacted. Many of the Hams, who are commuters across Highway 17, were stranded and not available to help us for at least two days. Because of the enormity of the situation many locations needed our services. The nature of the event required that these services be provided for an extended period of time.

Amateur Radio operations were maintained for eight days following the quake. The County Comm facility was in operation until 2400 October 22. Red Cross operations continued until October 25. At the peak, we were staffing 25 locations simultaneously. Many were in operation on a 24-hour a day basis. We found ourselves very much dependent upon volunteers from other areas. Fortunately, the surrounding counties were not as heavily impacted, as was Santa Cruz County. That, coupled with their relatively large population of Ham operators, enabled us to draw heavily on outside volunteers. Of the 370 volunteers utilized in our operations, most were from outside Santa Cruz County. They came from all parts of California, and some from other states. Santa Clara and Monterey Counties provided most of the

volunteers.

The Santa Cruz County Amateur Radio Club has recognized each of these volunteers by presenting them with a unique Certificate of Appreciation. This is the only compensation they can receive---other than the satisfaction of knowing they helped their neighbors.

PERSONAL PERSPECTIVE

Within one minute following the temblor, Hams providing damage reports from throughout the county activated the network. The writer met Rich Hanset, SCARES Emergency Coordinator, at the Santa Cruz County Governmental Center about thirty minutes after the quake. We opened the ARES/RACES communications center, which continued operations until October 23. I assumed the Net Control operation. What followed is literally a blur. For the next several hours, I was on the air virtually non-stop. I talked so much that the muscles in my throat were sore for several days. We were much too busy to keep logs, or even to record all communications. Messages were passed and acted upon instinctively.

Rich Hanset, the Santa Cruz Emergency Coordinator, heads a local new start-up electronics firm. He was scheduled to leave the next day on a business trip crucial to the company. 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.

COMMUNICATIONS HANDLED BY HAMS - SOME HIGHLIGHTS

We initially provided sole communications between County OES and numerous locations, including medical facilities, State OES, and local governments. We sent an amateur operator to radio station KSCO, to expedite activation of the Emergency Broadcast System.

Watsonville Community Hospital was damaged. We assigned an operator to activate the Amateur Radio station at that facility. By the time he reached the hospital, the decision had been made to evacuate part of the building. Ambulances were requested. We also summoned ambulances and helicopters from surrounding counties. Since many of the choppers could not communicate directly with the local hospitals, the Ham channels were used to coordinate their operations.

Dominican and Community/Santa Cruz hospitals took some of the patients. Others were transferred to Ft. Ord, Monterey Community, Stanford Medical Center, and other facilities throughout the area. Amateur Radio, solely, provided the immediate communications needs for this crisis. The inter-county Amateur Radio links were invaluable. As the evacuated patients were being transported to local hospitals, quake victims were also arriving. For a time emergency surgery was being performed on the Watsonville hospital lawn, by generator powered lights. This generator had been picked up, and transported to the hospital, by one of our amateur operators.

Serious shortages of supplies and personnel developed almost immediately, at all hospitals. Our ability to communicate directly with amateur stations at Red Cross facilities and hospitals in surrounding counties allowed us to deal promptly with this situation. One Amateur, aided by his wife, transported medical supplies from the Watsonville Airport to the Red Cross, in his Ham Radio equipped van.

Direct HF radio communication was established with agencies providing relief supplies from outside. This included, for example, Disaster Relief International (DRI) in Santa Barbara which airlifted medical supplies into Watsonville.

Numerous medical emergencies were reported directly via Amateur Radio during the evening hours of October 17. Soon after the Ham network was activated we received a call for an ambulance for a heart attack victim. One of the firefighters responding to the call is also an Amateur Radio operator. He reported back to us via Ham Radio after the victim was successfully resuscitated.

Amateur operators throughout the county reported gas leaks, and broken sewer and water lines. These reports continued during the first two days. They also provided numerous reports of road and bridge

damage.

Some Hams helped in routing leaders and search dogs to collapsed buildings.

Structural engineers were transported by military aircraft to the Watsonville Airport. Amateur Radio was used extensively in coordinating this operation.

Amateur Radio operators, with portable radio equipment, accompanied structural engineers, as they began their inspections in downtown Santa Cruz.

From the early evening hours of October 17, a major part of the Amateur Radio operations involved support communications for establishing, staffing and provisioning the Red Cross Emergency Shelters. The Red Cross Amateur Radio facility in Santa Cruz was staffed continuously from 1800 October 17 until 1400 October 25. The emergency shelter stations were staffed between 0700 and 2300 daily, as they were opened.

The Salvation Army in Monterey sent their mobile canteen to Watsonville. Direct communication was available, because the person in charge of the unit was also a Ham.

A church affiliated disaster relief group from Alabama included an Amateur, who established communications with us while the caravan was still enroute to Watsonville.

One local Radio Amateur, who was at work as a Pacific Telephone manager in Santa Cruz, used his portable Ham Radio to communicate directly with County Comm. We were able to expedite the installation of critically needed direct telephone lines between Watsonville and County OES and to Red Cross. Bureaucratic delay was bypassed.

AN OVERVIEW

First, what went right.

Our linked repeaters system performed exactly as we had planned. The coverage of the south county area was particularly crucial in the entire event, from beginning to end. We experienced no equipment failures. This is amazing, because the transmitters were on the air virtually non-stop the first five or six hours. Many amateur repeaters, and commercial base stations, did fail.

PROBLEMS

1. Our operations were severely hampered for lack of additional repeaters. It would have been impractical to utilize one of the "high-level" mountain top repeaters, because they cover several counties. Essentially our one repeater system handled all emergency traffic for the entire county. Most of the time our system was linked with the 2 meter and UHF repeaters in the San Lorenzo Valley. At any given time, there were stations on this net in at least 4 counties. We needed a totally separate Red Cross net. If a base station with antenna had been available at the Red Cross chapter house in Watsonville, this net could probably have been established on a simplex frequency for most of the county. This would have greatly relieved the overloaded tactical net facilities.
2. From a personnel standpoint, our greatest problem was an inadequate command structure. An expanded cadre of qualified managers must be developed. Most of our Assistant Emergency Coordinators were not prepared to assume responsibility for an activity of this magnitude. We must reevaluate our selection criteria for these positions, and develop appropriate training for these people. This is made more difficult because volunteers fill all positions.

3. The ARES roster lists people who will not normally be available in a major emergency--- such as firefighters and medical personnel. They can be utilized to great benefit in a planning and preparation role, and may be available for assignment during lesser emergencies. We can solve this by modifying the roster coding system.

We also need a method for identifying the commuters who work "over the hill". In this situation those people were isolated from us for 24-48 hours, and thus were not available for immediate duty.

4. Most Hams do not understand the missions of the agencies involved in an operation. Knowledgeable control ops are invaluable. The presence of a qualified AEC, at all times, will solve this problem.

5. No one has any business 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.

6. A direct inter-communication facility 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 can not replace written messages. It should be used for only priority exchanges, and coordination.

It would be very helpful to have runners available 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.

7. Accidental on the air jamming occurred on several occasions. Desk microphones, such as those at County Comm, are especially accident-prone. 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 panels, and foot switches added. Prominent transmit indicator lights on the panel would also help. Indicators on the gear are too small to be seen.

Most of these occurrences were in the field, where cramped operating conditions probably resulted in the mike P-T-T switch being jammed on. Handheld microphones tend to get shoved around unless they are stored in a hanger. This was a potential problem at the Santa Cruz Red Cross station, as well as temporary locations. Velcro strips can be used as a temporary solution.

It is amazing how someone will always come on the air to ask everyone to check if their transmitter is keyed.

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

9. Packet Radio (digital communications) might have played an extremely valuable role in handling tactical communications. It never did. Our current equipment can not function as both a Bulletin Board Station and a send-receive terminal. There are a number of reasons why this setup requires modification.

A. We need terminal capability, in addition to a BBS, for emergency communications. It is very important that there be an operational BBS in our area during normal times, however, it cannot be used for handling tactical communications.

B. The current equipment is too complex to be practical for terminal operation. 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, at all times, with experienced packet operators.

- C. The radio room will not accommodate an additional operator. Space rearrangement is imperative.
- D. We really need two Packet stations---in addition to the BBS.
 - 1. One should be for incoming messages only
 - 2. The other should be for outgoing traffic only.
 - 3. A separate computer for preparing files "off line" would be extremely valuable. This could be any PC, not necessarily one dedicated to this installation. In fact messages could be prepared off-line by anyone---not necessarily an Amateur.
 - 4. 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.
 - 5. Portable packet terminals could have been used to great advantage. This would have greatly improved operations at 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 be dependent upon individual Hams to provide this equipment. It should be dedicated and under the control of County OES or Red Cross, and ARES.

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

We needed several VHF/UHF mobile units, with power sources, stockpiled for the temporary installations. This would allow us to avoid reliance upon handhelds, in fixed locations. It would also permit us to use Hams who do not have their own equipment available.

11. We need backup equipment for 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 provide loaned equipment.

there 12. Coordination with the EOC's in the principal cities of the county was hampered since there are no agreements for use of ARES during emergencies. Temporary resources were established in Santa Cruz and Watsonville, after several hours. There was never a link established with Scotts Valley. These cities should install Amateur Radio equipment at their designated EOC locations.

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

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

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

C. 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.

D. 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.

E. Current area telephone directories

CHANGES TO COUNTY COMM FACILITY

The design of Amateur Radio equipment imposes certain limitations which influence the physical layout of operating facilities. The current County Comm installation is no exception.

1. Ham equipment is intended for "hands-on" operation. It is not easily removed.
2. Multi-mode multi-channel operation requires ready access to several controls in addition to P-T-T and volume. Fortunately modern equipment is compact.
3. We Hams like to show-off our equipment.

This is, of course, different from the objective 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 recommendations are intended to make our facility more "professional" through some human-engineering improvements. The following changes should be made to this facility. They are essential to more efficient operation. Most can be accomplished without great expense. The operating environment will be enhanced by:

1. Minimizing movement of people within the room.
2. Reducing distractions, both visible and audible.
3. Reducing the need for verbal communication among operators.
4. Reducing the need for others to visit the radio room. This will speed up the transfer of messages, and reduce distractions.
5. Simplifying equipment operation, thus allowing operators to concentrate on message handling.
6. Making it easier for new people to quickly adapt to the equipment.

SPECIFIC RECOMMENDATIONS

1. It is currently impossible for people to pass behind an operating position without disrupting the operators. The console should be moved closer to the rear wall. This may make it a little more difficult for someone performing occasional work inside the console---but more operator working space is absolutely essential. The three desks should be removed from the room, as well. Installation of a counter under the window would provide needed work space.
2. The packet system TNC's and radios should be placed on wall mounted shelves. The equipment and associated cabling should be made more secure. The packet operating position should be located as far away from the voice operating positions as possible. Even if packet operation had been possible, there is currently insufficient space to accommodate an operator.
3. The printer should be installed in an acoustic cover. Printer noise will seriously interfere with voice operations.
4. The cramped quarters require that non-essential personnel be kept out of the room. A split (dutch) door should be installed in the room entry. The upper half can, be left open for personal contact. Equip the

lower half with a narrow counter.

5. Install a digital clock at each operating position. The single analog clock installed on the side wall is almost impossible to use.

6. Wall mount a status board at the end of the console,. A chalkless board with permanent columns and lines would be excellent.

7. Mount, on the wall behind the console, a large scale detailed county map with a metal backing to allow the use of magnetic markers.

8. Console changes.

A. All microphones should be boom mounted. The microphones use space which is needed by the operator. This will also give hands-free capability, which is essential to efficient operation. Foot switches must also be installed.

B. Modify one, and preferably two, of the operating positions to permit one operator to use multiple radios. This will require bringing receiver audio and microphone lines to those positions. Separate speakers for each channel are preferable. A switching/bridging arrangement will be needed to allow a single microphone to be used with multiple radios. This will permit an operator to handle more than one function, on slower shifts---or in lesser emergencies. This should not be a major project.

C. Plate glass should be installed on all work surfaces of the console. Essential operational reference materials---Rosters, Maps, Call Lists, Frequencies, Etc.---can be stored under the glass.

Everything
ways of

The lack of work surface is the most serious deficiency of the present console. Everything possible must be done to keep the work surfaces clear. We should explore increasing the work surface area. This is really a desk---not radio equipment.

D. The multi-mode radios are too complex for the uninitiated. Since we can not change that, we should develop some very simple step by step instructions to be mounted adjacent to the radios---under the glass mentioned above is an ideal spot.

E. All console controls should be simplified and clearly labeled.

F. The present uncertain physical mounting of the telephone on the console must be corrected. It is extremely difficult to dial with a single hand. It is virtually impossible to use the phone from a seated position. There should be an extension, located away from the console.

G. Storage space for forms and supplies is sorely needed at each operating position. Pigeon holes in the console, and drawers under the writing surfaces are needed. If necessary, equipment changes should be made to satisfy this requirement. There must also be some basic supplies kept there at all times. At the very beginning of our operation it was necessary to search for forms, paper, pencils, staples, and such.

caps)

H. I could have operated infinitely more efficiently, if a communications typewriter (all had been available at the operating position. I can type as I listen, and even as I talk. Others can learn this skill. Typewritten messages are certainly more legible. A convertible typewriter well in the console surface would allow for removing the typewriter when it was not needed.

9. An emergency light should be installed in the radio room. Finding ourselves in virtual total

darkness when the emergency power failed was, to say the least, frustrating. This was also a potentially dangerous situation.

10. Acquire, and install at the repeater location, a professional logging recorder which can be activated remotely. Such a recorder is voice activated and capable of operating up to 24 hours on a single reel of tape. This would provide us with an invaluable record of our operations. It could also be a very useful educational tool at other times.

COMMUNICATIONS VAN

If it had become necessary to abandon the County Building, we certainly could have used the van, now being assembled. Otherwise, I can not identify an application where the vehicle could have been used in this disaster. There was no need for multiple radios at any site, other than County Comm and Red Cross. Certainly, there will be events where such a resource will be needed. On the other hand, the radio gear which will be placed in this vehicle could really have been utilized at some of the temporary sites. This, only if it could be readily removed from the vehicle. This should be planned in the installation. Equipment installed in a console looks very nice, but is virtually impossible to remove or replace rapidly. Obviously, security must not be overlooked.

I saw no application for ATV (Amateur Television), in this situation. If it had been available, I am sure someone would have tried to use it. This could only have placed a further strain on our limited personnel resources.

A packet radio station would be in the same category as the mobile equipment. It should be readily removable. It certainly should not be a complex computer installation. Operation should not require a computer expert. **SIMPLE IS SUPERIOR!**

The plans for the van should be reviewed, in light of our experience.

ONGOING STUDIES

We learned many things from our communications experience, following the quake. One of the most important lessons---even though we don't yet fully understand it---was that we were heavily dependent upon outsiders to help us in our own disaster operations. If damage in Santa Clara and Monterey Counties had equaled our own, the problem would have been even more critical.

Some Hams may think there is no room for the uninitiated to contribute when disaster comes. There is an apparent misconception that emergencies can and should be handled only by those who think and plan for them in advance---ARES. In fact, the ARES people are just the core group of pre-trained regulars during disasters. Just as in wartime, it is really the "volunteers" who make the operations succeed.

In a series of post-disaster meetings, with some key participants in the local Ham radio operations, we have concluded these perplexing questions must be answered.

1. What could be done to better inform and prepare the "average" Ham? Most Hams certainly are never going to affiliate with ARES or RACES.
2. How could we help Hams to be better prepared to cope with the personal challenges faced when they are victims of a major disaster?
3. How could we make emergency training more effective among those committed to serving in emergencies.
4. Why were we so heavily dependent upon Hams from surrounding areas?
5. Why were some Hams available, and some were not?

6. Why were some of those supposedly in a "state-of-readiness" unavailable?
7. What have other emergency services done to prepare their volunteers? What was their experience during this disaster?
8. Some of the least prepared, were among the best performers during our operations. These included brand new Hams, and many who never had been exposed to any kind of emergency operation. What is the explanation?
9. What is needed to better prepare the AEC's---the command structure of the ARES group?

Obviously these are not easily answered questions. They are not areas that any of us are really qualified to explore. For this reason we approached the University of California at Santa Cruz, and discussed our concerns. The Department of Sociology expressed great interest in doing a study for us. A graduate student has been assigned to the project. Essentially, the project will be based upon interviews. Obviously, only those who agree to be interviewed will be involved.

A complete report will be published upon conclusion of the study. The information should be of value to all ARES groups, for future planning.

GLOSSARY

The following are some commonly used terms.

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AEC Assistant Emergency Coordinator. Working under the Emergency Coordinator, AEC's are responsible for specific areas of emergency communication preparedness and operations.

Amateur Radio Operator A person holding a license issued by the Federal Communications Commission. Dependent upon class of license issued, may use specific Amateur Radio frequency bands for non-commercial purposes.

APCO Associated Public Safety Officers, Inc.

ARC American Red Cross

ARES Amateur Radio Emergency Service. The emergency communications organization sponsored by the ARRL. Dedicated to providing public service communications on a voluntary basis, in times of disaster.

ARRL American Radio Relay League. The national organization for Hams.

ATV Amateur Television. FCC rules permit television operation in particular frequency bands. Lightweight portable equipment is popular.

Autopatch Equipment which allows an Amateur Radio station to communicate via the telephone system. Connects transmitter and receiver of a fixed station to a telephone line and provides the necessary controls for both the telephone system and the radio equipment. Often used for reporting emergency situations to 911.

Base Station An Amateur Radio station installed at a fixed location.

CDF California Department of Forestry and Fire Protection

Channel The transmit and receive frequencies which are used together.

CHP California Highway Patrol

Coverage The area over which a radio transmitter can be heard.

DEC District Emergency Coordinator. Coordinates and supervises the emergency communication groups within an ARRL District (for example Santa Cruz County).

Distress Calls Normally applies to requests for emergency assistance from ships or aircraft.

EC Emergency Coordinator. Appointed to administer and coordinate local emergency communication preparedness and operations.

FEMA Federal Emergency Management Agency

Ham Commonly used term meaning Amateur Radio operator.

Handheld Small portable transceiver capable of being hand held. Is often the only VHF or UHF radio owned by Hams.

Health and Welfare Traffic Messages relating to the Health and Welfare of private citizens.

Input In a Repeater station refers to the receiver frequency.

NCS Net Control Station. Directs and coordinates all stations participating in any net operation, emergency or routine.

NTS National Traffic System. The ARRL sponsored network which is organized to handle Health and Welfare communications during emergency situations. Normally handles message movement over large distances.

OES Office of Emergency Services. That organization at the state, county, or local government level charged with responsibility for planning, preparation, and disaster operations.

Omnidirectional Refers to a non-directional antenna.

Output The transmit frequency of a repeater station.

Packet Radio A system which uses computer terminals transmitting via Amateur Radio stations. Provides fast reliable record communications.

Point-to-Point Communications Communication between fixed locations.

Public Safety Agency Governmental agencies charged with protecting lives and property. For example Police, Fire and Highway Patrol.

Public Service Non-profit. For the benefit of the general population.

RACES Radio Amateur Civil Emergency Service. An FCC established service, managed by state and local governments to provide disaster management or civil defense communications. In Santa Cruz County ARES members are also enrolled in the RACES.

Relay Station A station which serves as an intermediate receiving and transmitting location. Passes messages between stations which can not communicate directly.

Repeater A station which receives transmissions from a mobile, portable, or fixed station and re-broadcasts them, for extended range. Usually located in a relatively high location.

Resource Net The network operations involving the coordination of personnel and equipment for an Amateur Radio Emergency Service activity.

SEC Section Emergency Coordinator. Coordinates emergency activities within an ARRL Section. Works with local ARES groups through the DEC.

Served Agency Any governmental agency or relief organization with which local ARES groups have a working relationship.

SET Simulated Emergency Test. A drill.

Simplex Operation Refers to radio operations where both transmitter and receiver operate on the same frequency.

SKYWARN A system which becomes operational during specific emergency weather conditions such as hurricanes, tornados, floods and blizzards. Provides weather information to the National Weather Service and disseminates NWS advisories to local authorities.

Tactical Net A radio net organized for the purpose of handling the operational communications associated

with an emergency situation.

Third-Party Traffic Messages originated by, or addressed to, someone other than the originating amateur station.

2 Meters An FCC assigned Amateur Radio band covering 144-148 MHz. Most popular band for mobile and portable operation. Repeater stations are operated nationwide.

911 Emergency Service A system which provides fast easy access, via telephone, for citizens in need of emergency help such as police, fire, or medical emergencies.