the remote base:

an alternative to repeaters

Recommended reading for those wishing to relieve congestion on the vhf bands — a definitive description of the difference between remote-base and repeater stations

We feel that the case for remote base stations, as opposed to repeaters, is a very strong one for those interested in the advancement of vhf/uhf amateur communications. In this article we discuss the remote base-station concept with emphasis on its advantages over repeaters in today's crowded vhf/uhf spectrum.

Appreciable differences exist in the technical details between remote bases and repeaters. The former require a far more flexible command and control system than for repeaters, but they are potentially capable of performing many more functions. Furthermore, the remote base is designed and built with the systems approach in mind and with an eye toward modernization and expansion, whereas repeaters tend to be limited to one or two functions and are generally designed as "common-carrier" machines.

background

Radio amateurs have explored the characteristics of frequency-modulated communications systems since the 1930s, when Edwin H. Armstrong demonstrated the feasibility of this mode of transmission.[1] Initially failing to win acceptance on the hf bands because of the superiority of ssb in spectrum conservation and weak-signal

By Gordon Schlesinger, WA6LBV, and William F. Kelsey, WA6FVC. Mr. Schlesinger's address is 5364 Saxon Street, San Diego, California 92115; Mr. Kelsey at 13086 Melrose Avenue, Chino, California 91710.

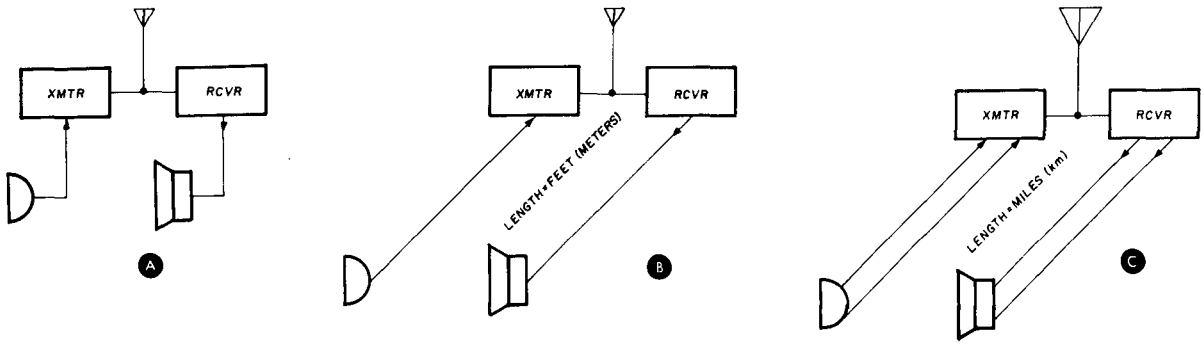


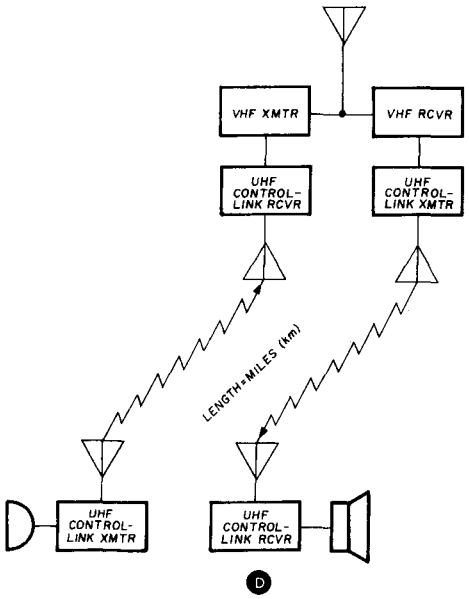
fig. 1. Evolution of a vhf remote-base station. A typical locally controlled amateur station is depicted in A. "Extended" local control is shown in B in which the microphone, speaker and control lines are routed from the operating position to equipment located elsewhere on the premises. A wire-line-controlled remote base is shown in C (transmitter and receiver are located at an elevated site to increase operating range). A radio-controlled remote base station, D, is the same as in C except that the wire link is replaced with a pair of uhf radio channels.

reception, fm entered into general amateur use on the vhf bands in the late 1950s.

Amateurs associated with the commercial* two-way radio business (land mobile service) purchased obsolete police and taxicab radios, retuned them to operate on adjacent amateur vhf bands, and began to experiment with the new mode. Having radios that generally offered one, or at most two, crystal-controlled transmitting and receiving frequencies (or channels), local fm groups quickly adopted standardized channels on which all radios would be operated. In the uncrowded vhf bands of those golden days, these few fm channels were placed well away from existing a-m and CW activity, and the new fm operators were generally ignored. With pretuned radios transmitting and receiving on the same frequency and with effective squelch circuits silencing receiver noise between transmissions, a natural party-line type of operation ensued. Thus the very first amateur fm operations were of a simplex nature – direct, point-to-point transmissions on a single frequency.

In southern California, the first simplex channels were established on 146.760 and 146.940 MHz. Since an a-m repeater (K6MYK) had been in operation at this time, fm operators saw no need for duplication. Instead they concentrated on extending the range of their simplex stations. In the mid 1960s several groups of fm operators established remotely controlled 2-meter fm transmitters on several southern California mountains. These transmitters were operated by radio-control links on the 450-MHz amateur band. Soon thereafter 2-meter fm receivers, tuned to the transmitting frequency, were added to the remotely controlled installations. These early groups of fm experimenters had established base stations (*i.e.*, stations designed to be operated at fixed

*The term "commercial radio" applies to a radio originally designed and manufactured for operation in the commercial two-way Land Mobile Radio Service and adapted to amateur use.



locations), which were on mountains to increase range. They were remotely controlled and were operated by uhf radio links. These were among the first remotely controlled base stations, or remote bases, as they are more commonly known.

Early remote bases in southern California included those of W6YY, WB6SLR, WB6CZW, WB6LXD, and WB6QEN. From this beginning the number of southern California remote bases has increased to over 100 at present, with a smaller number in northern California, Nevada, and Arizona. Remote bases have been established in other parts of the country though nowhere in the numbers found in California.

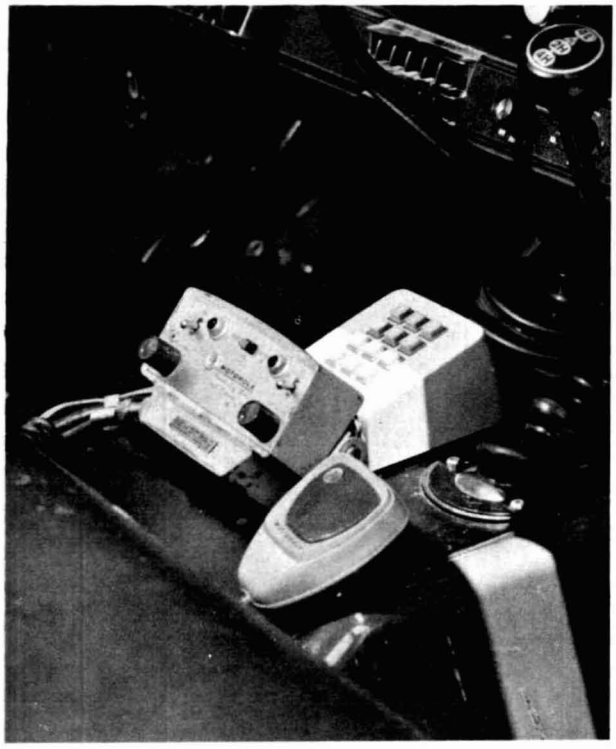
the remote-base concept

While both remote bases and vhf fm repeaters operate from elevated locations, it should be clearly understood that a remote base is *not* a repeater station. Major differences exist between them in construction, operation, and licensing; these differences are discussed later in greater detail. Most important, however, is the difference in intent of the two stations. Repeaters exist primarily to extend the intracommunity range of user mobile and hand-held portable stations, most operators

of which are *not* owners or control operators of the repeater. Remote bases, on the other hand, are extensions of the personal stations of their owners and are operated generally only by control operators.

Fig. 1 presents the evolution of the remote base concept. A typical amateur station is depicted in **fig. 1A**; for the sake of discussion let's assume that it's an fm base station. The owner/control operator talks on the local microphone, listens on the local speaker, and manually turns the transmitter on and off. All controls are at arms' length. This has been the typical style of amateur operation on all bands since the inception of ham radio.

Let's now assume, for reasons of space limitations, that it is inconvenient for the amateur to keep his fm base equipment at his operating position. Since fm stations are operated on crystal-controlled, fixed-tuned



Several radios may be installed at the remote base and operated through one uhf control station, which avoids duplication of radios between home and car or between several cooperating amateurs.

channels, it's not necessary to have direct physical access to the transmitter and receiver for tuning purposes. Therefore the amateur may elect to place his base equipment in his basement, attic, or garage, and extend the microphone, speaker, and push-to-talk lines back into his operating position (**fig. 1B**). Many commercial fm base stations include provisions for doing just this. The amateur is now operating his base station remotely by wire line, although for licensing purposes the station is still under direct control as long as it is entirely contained within the amateur's fixed station license location.

In **fig. 1C** we extend the operating range of the fm base station by relocating it to a higher elevation. It might be situated at a friend's house on a hill, on a mountain top commercial two-way radio site, or on top of a tall building – all depending on the local geography. The station is still controlled and operated by wire line, but in this case the length of the control line is measured in miles (km) rather than in feet (m). (The technical details of the control system depend on the characteristics of the wire-line pair, its length, and whether or not it is leased from the telephone company). This installation is now a remotely-controlled base station, or remote base, and it must be licensed as a remotely-controlled station. Few, if any, southern California remote bases are wire-line controlled, but the idea has merit for other areas of the country where distances and topography permit.

Now, let's assume that no wire lines can be run to the proposed remote base-station location because of expense, distance, or inaccessibility. It then becomes necessary to control and operate the remote base by radio (**fig. 1D**). FCC rules, (*Part 97.109a*), require that radio remote-control links operate on frequencies above 220 MHz. While some remote bases operate with 220-MHz radio links and a few others use the amateur microwave bands, the vast majority of remote base operators have elected to control and operate their stations through radio links on the 420-450 MHz amateur band. The reason for this is the availability of high-quality, surplus, commercial fm equipment designed to operate in the 450-470 MHz land mobile service band, or the 406-420 MHz government service band. The former set of radios can be easily retuned to operate in the 440-450-MHz segment of the amateur 3/4-meter band, while the latter set converts easily to the 420-430-MHz segment.

Note from **fig. 1D** that the control link must be bidirectional. Speech and control information is sent from the local uhf control-link transmitter to the remote base uhf control-link receiver. The information is demodulated and used to operate the vhf fm transmitter. Signals received by the remote base vhf receiver are used to modulate the remote uhf control-link transmitter and are then recovered by the local control-link uhf receiver. The entire control link could be operated on a single uhf channel but this is technically cumbersome. It has become customary to use separate channels for the uhf uplink and downlink. Spacing between the two control-link channels is typically on the order of 5 MHz, a separation sufficient to allow *all* uhf receivers to function properly while their associated transmitters are operating. Thus full two-way duplex operation of the control link is permitted; the control operator can simultaneously transmit signals to, and receive signals from, the remote-base station.

The locally-controlled fm base station in **fig. 1A** has now grown to become the radio-controlled remote base station in **fig. 1D**. Fundamentally, however, the only significant change between the two stations has been the replacement of three pairs of wires by one pair of 450-MHz radio links: the pair connecting the micro-

phone to the transmitter, the pair between the receiver and its speaker, and the push-to-talk line pair.

remote-base advantages

To this point we've discussed the concept of the radio-controlled remote-base station operating on fm simplex channels. While many southern California remote bases have been established to do just this, the description above is actually a restricted view of the capabilities of remote bases. In point of fact, the existence of the basic radio link and control equipment, together with the physical location of the remotely controlled station, represent a resource that can be developed: radios of any type of emission on any amateur band, from 1800 kHz to 10 GHz or higher can be operated remotely. The remote base, for example, allows operation of high-power transmitters, such as on the 50-MHz band, in areas where TVI is a problem. It allows operation on any amateur band where antennas can't be erected at the control operator's location. It affords improved operation on the hf bands where space for efficient antenna systems may be more easily available at the remote-base site.

A remote base offers the opportunity for a group of amateurs to relocate all their radios at one central point while achieving antenna space advantages on hf and height advantages on vhf/uhf. This relocation includes not only home-station radios but mobiles as well. All may be replaced with one uhf radio per location, thereby saving on duplication of radios among several home station and mobile installations.

Those remote-base stations that operate on the fm simplex channels promote spectrum conservation in several ways. With their extended local operating range, they provide interference-free regional-area communications. This can relieve congestion on the hf phone bands by shifting local-area communications to vhf. Because remote bases operate as simplex stations, each occupies only one vhf channel at a time (*i.e.*, 146.940 MHz) rather than two required by a repeater (*i.e.*, 146.340 and 146.940 MHz). Additionally, by the nature of the remote-base design, a control operator always monitors the channel of operation with a mountaintop receiver before transmitting. Thus activity on the operating channel over the entire remote base transmitting range can be easily detected and inadvertent interference avoided. The same is true for repeaters only when a separate receiver and auxiliary link system is used to monitor the output frequency from the repeater site.

Finally, a remote base usually represents the desire of a group of active vhf/uhf amateurs to build a communications system. In deciding to build a remote base, the constructing group does not require the use of the limited set of 2-meter repeater channels. This translates to spectrum conservation. In the southern California area it would be impossible to fit more than the one-hundred remote-base groups into individual 2-meter repeater pairs, even when using 15-kHz channel spacing and all the simplex channels. While it's true that each remote base requires a pair of dedicated channels, these channels are in the spacious 440-450 MHz region. On a narrow-band deviation (±5 kHz) basis, this region of the spectrum contains a potential 200 pairs of channels, with another 200 pairs in reserve between 420 and 430 MHz.

constructing a remote base

Occasionally an individual will undertake the entire job of designing, building, and installing a remote base. He will then either operate it as his own station, or may invite his friends to use the remote base as co-control operators. More often, in southern California, at least, a group of individuals will be formed to build and operate the remote base, thereby sharing the financial and technical responsibilities. The following comments, although addressed primarily to the group-ownership case, apply as well to single-owner bases.

administrative and technical responsibility. A remote base is a communications system that contains separate but intercommunicating radios. The cost and effort to build and operate a remote base is greater than that required to operate a home station, so careful attention should be given to financial and technical responsibilities. One member of the group should be responsible for handling and reporting finances. Provisions should be made for one owner selling his equity in the remote base in the event he must move out of the area. Provisions also should be made for including new members or owners. Lack of adequate preparation in this area has been an historical source of conflict in many remote base groups.

One individual should be responsible for obtaining the site for the remote base, which should be the first task undertaken and completed. When the site involves rental of space at a commercial two-way radio installation, it has been found best to have a single individual from the group maintain relations with the site owner. One individual will have to arrange for licensing the remote base, whether it is in his name or in that of a club station. Additional non-technical duties that may need to be delegated include a) obtaining supplementary permits (for example, from the Forest Service, Bureau of Land Management, local governmental authority) to operate the station, b) maintaining memberships in regional amateur radio associations, and c) providing for fulfillment of public-service commitments.

Technical responsibilities in establishing a remote base should be divided into design, construction, and installation and maintenance areas. A single individual should have overall responsibility for the design of the entire system, although he may wish to delegate specific design projects to others. Particular attention should be given to interfacing between the various subsystems, such as audio and control signal levels between rf hardware and the control system.

Once original equipment designs are complete, construction of individual components can be delegated to group members. Emphasis should be placed on building for reliability, both in selection of components and in construction practices. One or two individuals should assume the responsibility of tuning the rf hardware, integrating the amateur-constructed subsystems

into the final assembly, and performing on-the-ground checkout.

Maintenance. When installation of the remote base is completed, the maintenance team assumes responsibility for continued operation. These people should be equipped with the specialized test equipment (wattmeters, signal generators, frequency and deviation meters) for servicing fm communications systems. Inevitably there will be an initial period of system debugging as various design and subsystem deficiencies become apparent. Frequent trips to repair and service the remote will later taper off to occasional visits for scheduled maintenance. At this point the design team will probably begin work on improved subsystems to be retrofitted into the existing remote base, or perhaps better quality rf hardware will be acquired and put into service. Few remote bases are ever truly "completed."

Rf hardware. The remote base typically will consist of commercially manufactured rf hardware and amateur-built control systems. Antennas may be either commercially manufactured or home built. In the selection of transmitter and receiver strips, southern California remote-base groups invariably use late-model commercial equipment. All or partially solid-state equipment is preferred for greater reliability, although high-quality all-tube equipment has performed well at some installations for many years. Receivers should have good sensitivity (fet preamps may be added) as well as excellent rf selectivity and cross-modulation rejection; many busy commercial radio sites contain very heavy rf fields. Vhf receivers and transmitters should be capable

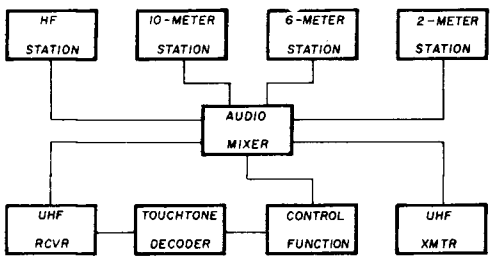


fig. 2. Block diagram of a typical remote-base station. Control signals from the uhf receiver are decoded in the Touch-Tone decoder, processed in the control-function circuits, and used to operate hf or vhf base station. Speech information is routed to the selected base station through the audio mixer.

of operation on several different channels, so that the remote base may be switched to operate on whatever channel the control operator wishes to use. The vhf transmitters should be capable of moderate power output (30 - 100 watts), and should be free from spurious output. A remote base operating from an elevated location with a few hundred milliwatts of spurious output will certainly make its presence known.

Commercially manufactured resonant cavities are often used ahead of the entire vhf portion of the remote base to provide additional rf selectivity. The uhf remote base control-link radio should be the best that can be purchased, since it will be the limiting factor in using remote base from distant locations. Matching commercially manufactured 110-Vac power supplies for fm installations are preferred to home-built supplies since they provide the exact voltages required, have provisions for properly interconnecting the transmitter and receiver to other equipment, and are usually rated for continuous-duty operation under severe environmental conditions.

Antennas. Antennas and transmission lines for the remote base should be selected with regard to survival under severe weather conditions. Antenna gain, easily obtainable at vhf and uhf is an additional factor to be considered. Remember, however, that many "gain" antennae have major radiation lobes directed at the horizon; for a mountaintop installation it may be preferable to select antennas that radiate their major lobes below the horizon. Transmission lines should exhibit the lowest loss possible; weak received signals and expensively generated vhf and uhf power can be lost in inferior coax. If available, commercially manufactured Foamflex should be used.

Control systems. Control systems are the heart of a remote base; they are always amateur constructed. In southern California they vary in complexity from simple audio-tone decoders that drive rotary stepping switches to sophisticated multilevel digital logic circuitry. These advanced systems allow any piece of rf hardware in the remote base to be interconnected with one or more of the remaining pieces in various combinations. Control systems reflect individual needs and capabilities; space prohibits giving specific examples.

A control system performs several functions in addition to enabling transmitters to be turned on and off. In general, the control system must provide for:

1. Authentication and decoding of the received control signals.
2. Selection and activation of the required transmitters and receivers.
3. Selection of specific frequencies to be used within each transmitter and receiver.
4. Processing and conditioning of audio.
5. Automatic indentification of active transmitters.
6. Automatic timing of transmission length to provide ultimate shutdown protection should the control link fail.

Typically, remote bases are controlled by specific audio tones sent along with speech on the uhf uplink channel. The use of *Touch-Tone** audio encoders for this purpose has become relatively standard. The control link usually also contains a subaudible continuous tone squelch signal (*Private Line, Channel Guard*, etc.) as a verification device. Audio-tone decoders, logic circuits, and audio processors are matters of personal preference and design, although some circuits have been published. Timers and IDers are well documented in amateur literature.

**Touch-Tone* is a trademark of American Telephone and Telegraph.

packaging. It is considered good construction practice to build all control circuits, timers, audio processors, and identifiers on standard-size edge-connector cards for insertion into a card rack. Interconnections to the individual pieces of rf hardware from the control system are made from the contacts at the rear of the card rack. Provisions should be included in any control system for expansion; the use of individual cards for specific circuits facilitates this goal.

New designs for amateur-built components should be breadboarded and thoroughly tested on the bench before being constructed in final form. In testing, provisions should be made for checkout of the new designs under conditions of continuous duty in temperature and humidity extremes. **Fig. 2** shows a typical remote base station.

One other design feature should be included in any remote base: "series audio." This is illustrated in **fig. 3.** In a series-audio system, the remote-base vhf receiver runs continuously, even when the control operator transmits; his speech is sent from his 450-MHz control transmitter to the 450-MHz remote base receiver and is then transmitted by the remote base vhf transmitter. The vhf receiver remains on, and although not connected to an antenna during this time, still receives a signal from the vhf transmitter operating nearby. This signal is retransmitted back to the control operator over the 450-MHz downlink. The control operator can listen to his voice as it is being transmitted on vhf by the remote base and can verify that the vhf transmitter in the remote base is being properly modulated. The speech from the control operator follows a path from the control-station microphone back to the control-station loudspeaker, with the remote base vhf transmitter and receiver in "series" with the duplex control link.

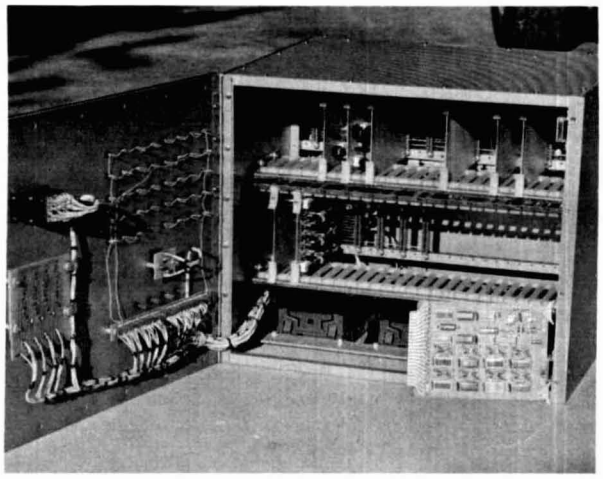
operating a remote base

What can be done with a remote base is limited only by the imagination and ingenuity of its owners. First and foremost, however, southern California remote bases operate on the area's simplex channels: many can be heard on 146.940 and 146.760 MHz. This is the historical rationale for the establishment of a remote base; and in fulfilling this function, remote bases have helped to remind fm operators — in a time of rapidly expanding numbers of repeaters — that much good work can be accomplished on a point-to-point simplex basis. Occasionally a remote base will be used to transmit bulletins of interest to the regional fm community on 146.940 MHz (a channel that every fm operator can monitor). With their height advantage, many southern California remote bases can be heard from Santa Barbara to the Mexican border; they provide an invaluable resource for tying together an entire region by radio.

Because of the large number of remote bases in southern California, an agreement has been reached that use of the 146.460-MHz simplex channel will be limited to an "intercom" channel among remote bases. This allows two or more remote bases to avoid monopolizing 146.760 or 146.940 MHz, which would prevent mobiles and home-base stations from using these channels. This arrangement has worked well in practice. A number of remote bases also have provisions for operating on 52.525 MHz and 29.600 MHz, the National simplex frequencies for these bands.

While it's possible to equip a remote base to transmit on a repeater input channel and listen to the corresponding repeater output channel, such practice is not often done. An exception would be where the repeater to be contacted is so far from a majority of the remote bases' control operators that they couldn't transmit on vhf directly into the repeater from their locations.

Several remote bases have been equipped with hf ssb



Control system for the remote-base station of WA6ZOI. Card-rack construction is featured. A typical edge-connector card, containing one circuit element, is shown in the lower-right corner.

transceivers. Notable was the former WA6ZRB remote base, which contained provisions for transmitting on 40 meters including remote tuning of the transceiver vfo. The remote was often used by control operators to check into the WCARS net.

Many remote bases contain autopatches. The use of a remote base for this purpose is particularly fortuitous because it removes the autopatch operation from repeaters in the busy 2-meter band thus reducing congestion and increasing repeater availability for mobile users. Generally, because of nonavailability of telephone lines at the remote base site, a special pair of auxiliary link channels operating in the 420 - 430 MHz region are used to transmit control-link audio from the remote base site to a telephone ground station at a convenient location.

Many remote bases contain auxiliary uhf radios, which link to other remote bases in other areas. Often two or more remote base groups will enter into reciprocal operating agreements, so that by means of the radio links the members of one group, transmitting through their own remote, can control and operate the other remote bases. For example, the Gronk Radio Network can be activated so that stations in southern California can talk to and operate through remote bases in central and nothern California, and in Nevada and Arizona (and vice versa). This is an area where advanced fm operators

are awaiting FCC rules and regulations to catch up to the state of the art.

Several remote bases contain special functions, such as telemetry of prevailing environmental and equipment conditions at the remote base site, or television surveillance of the site.

Remote bases have participated in emergency activities. With their great range and ability to contact virtually any fm-equipped amateur through vhf simplex channels, they provide a natural focus for emergency and disaster operations. Of particular note is the participation of remote bases in the rescue effort after the San Fernando Valley earthquake of 1971.[2] The use of remote bases to relay traffic accidents and other emergencies to public service agencies is a common occurence.

licensing

Before adoption of Repeater Docket RM 18803, remote bases were routinely licensed by the FCC after the required showings had been submitted. The FCC, then as now, wanted to be convinced that the remotely controlled station would not be tampered with or operated by unauthorized people, and that provisions had been made for automatic shutdown of the transmitters should a failure of the control link occur. Remote-base licenses could be single "additional station" licenses, or primary-station licenses with authorization for remote control. Control operators required no special licenses but were listed as control points on the remote base license.

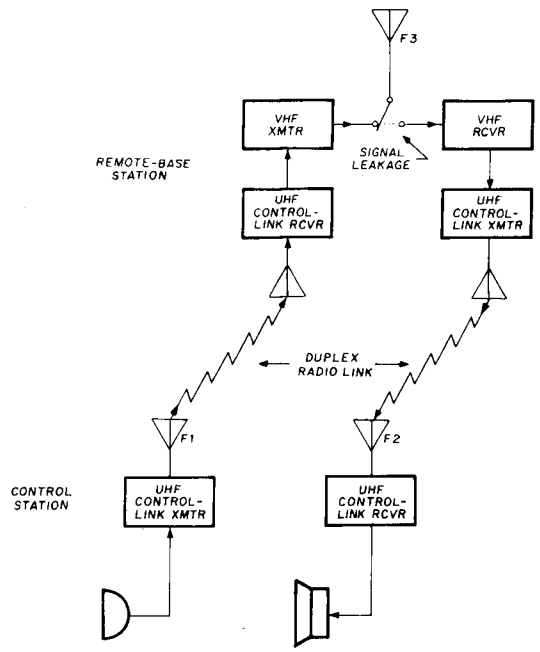


fig. 3. Remote-base station except for series-audio feature. All transmitters and receivers operate simultaneously. Speech information travels from the control-operator's microphone through the remote base station, then back to the control-station speaker.

Southern California remote-base operators became concerned with the status of licensing after the adoption of RM 18803. Apparently under the misapprehension that only a handful of remote base licenses would be requested, the FCC devoted its time to the increasing number of repeater applications. But along the way, they released a set of "interpretations" of the new Part 97 rules, which completely changed the nature of remote-base operation.

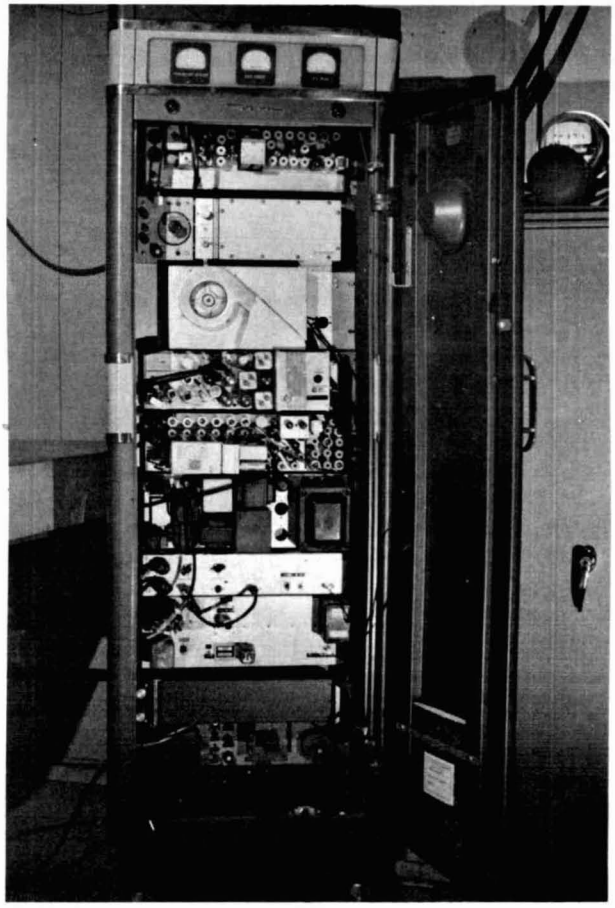
The interpretations included a requirement for a) the licensing as auxiliary-link stations of all uhf transmitters that carry speech to and from the remote base, b) the licensing as control stations of all uhf transmitters sending control information to the remote base, and c) the use of separate uhf frequencies for remote base speech and control uplink channels. A subsidiary effect of these interpretations was to declare as "illegal" the operation of the remote base from portable and mobile locations since, by definition, auxiliary links must operate between two fixed points. The FCC has since dropped the requirement that separate channels must be used for speech and control uplinks.

Nevertheless, remote-base operators are faced with a cumbersome and expensive licensing procedure and with operating restrictions more severe than those before RM 18803. The current licensing procedure, under which the FCC is processing and issuing remote base licenses, is as follows:

The mountaintop remote base must be licensed as a "secondary station" or "club station." This basic license covers the hf and vhf portion of the station; an "auxiliary link" license is required to cover the uhf down-link transmitter. Both privileges may be combined on a single station license for a single application fee. Each control operator must modify his primary station license to include both "control station" and "auxiliary link" privileges; this also can be accomplished with one application fee. The FCC has deleted the requirements for submitting many parts of the required showings, making them instead a required part of the station log.

During the ensuing years the FCC has come to better understand the remote base concept, and has shown increasing willingness to allow remote base (and also repeater) licensees more latitude in the operation of their stations. Docket 21033, which is based in part on a Rule Making petition by the authors of this article, if adopted, will grant essentially complete freedom to operate remote-base stations in the traditional ways described above. For example, Commission restrictions against operation of a remote base from portable and mobile control locations will be eliminated, licensing will be greatly simplified, and the distinction between the remotely controlled base station (with its associated control operators) and the true repeater will be clearly drawn. Southern California remote base operators are generally pleased with the contents of this Docket, and are looking forward to increased flexibility and freedom to innovate.

Remote bases are completely different in intent and operation from repeater stations. Repeaters are operated to extend the communications range for operators of specific mobile and hand-held portable stations interested in communications among themselves. Remote bases are operated as *extensions* of the owners' personal



View of the WA6ZOI remote-base station. Equipment includes a 50-MHz base station, 450-MHz receiver, power supplies and control system. The station is located on Johnstone Peak in southern California.

stations for purposes of communicating with *all* amateur stations. Almost all users of repeaters are *not* control operators, and the act of activating a repeater by transmitting on its input channel is *not* an act of controlling the repeater. Repeater control station operators are responsible for activating the station to repeat the transmissions of other amateurs and for suspending operations in the event that FCC rules are not complied with. By contrast, in southern California, every user of a remote base station has been a control operator. The remote base must be commanded by the control operator through the uhf radio link to operate for each transmission; it is not designed to *automatically* retransmit signals.

The comment has been made that, because the operation of a remote-base station involves speech transferred between hf-vhf and uhf frequencies, the remote base operates as a crossband repeater. From the discussion above it should be clear that the remote-base station does not fit the basic definitions of a repeater. The act of monitoring a vhf channel through the remote-base vhf receiver and uhf downlink channel is not an act of repeater usage. The system *could* be used as a crossband repeater if a) two nonremote base simplex stations were to transmit on a channel being monitored by a remote base, and b) each were to listen to the other through the remote base 450-MHz downlink instead of directly on the vhf channel. In practice this seldom happens; if it should happen it is the responsibility of the remote-base control operator to suspend operations on that vhf channel.

It is our feeling, which is shared by a majority of southern California remote base operators, that liberalization of the present FCC rules (and interpretations of these rules) is required. Ideally each remote base could be licensed as a remotely controlled station, with one license covering the entire mountaintop station including the uhf radio links. Each user would be required to be an authorized control-station operator, having control-station privileges added to his primary station license. There would be no limit to the number of control stations that could be *conveniently* licensed including other remote base stations operating as control stations (many remote bases have 15 control operators at present). The control-station license would confer the privileges of both controlling and operating the remote base and would be usable in portable and mobile operation in addition to its customary fixed-station use. Were these proposed changes to be adopted, remote-base operators would achieve more flexibility to innovate in the amateur vhf and uhf bands.

conclusion

For those vhf/uhf-oriented groups wishing to expand their interests from individual circuits and individual stations to building an entire communications system, the remote-base concept has several advantages. It offers the chance to experiment with systems engineering – to design and build a system constructed from individual pieces of equipment. The final system can reflect the designers' needs, wishes, and abilities, rather than the standardized requirements of the marketplace. The remote base offers reliable, interference-free local communications capability on the vhf bands, thus helping to relieve congestion on the crowded hf bands. It abolishes the need for duplication of radios between home and car, or duplication among several cooperating owners, and permits the establishment of high-power transmitters and large antennas at the remote-base site. It fosters spectrum conservation on popular bands by removing the requirement for dedicated repeater channels, substituting instead the need for a dedicated pair of channels in the far-less congested 420-450 MHz band. It promotes the use of simplex communications, thus reducing the load of busy repeaters.

Southern California amateurs developed the remote-base concept more than ten years ago. It has proved to be a useful adjunct to the amateur vhf community. We look forward to its adoption in other parts of the country.

references

1. Thomas McMullen, W1SL, *FM and Repeaters For the Radio Amateur*, ARRL, Newington, Connecticut, 1972, page 7.
2. "The Southern California Earthquake," *QST*, June, 1971, page 60.