
Statewide Tele-Lecture Program
the teleconference
CONTINUING EDUCATION
FOR THE HEALTH
PROFESSIONAL
telelecture, students can talk to author
Tele-Lecture KCRCHE Net Ties Schools
COMMUNICATIONS NEWS / JANUARY, 1973
Bob Hope Lectures at Virginia College . . . by Phone from LA

The Portable Conference Telephone (PCT) allows voice communications among groups in widely separated locations. With extension microphones and with more power than its sister unit, the speakerphone, the PCT can be used for large classes or conferences.

Conferences And Classes Via PCT: If You Can't Come, Call

J. A. Alvarez, W. W. Grote, and C. E. Nahabedian

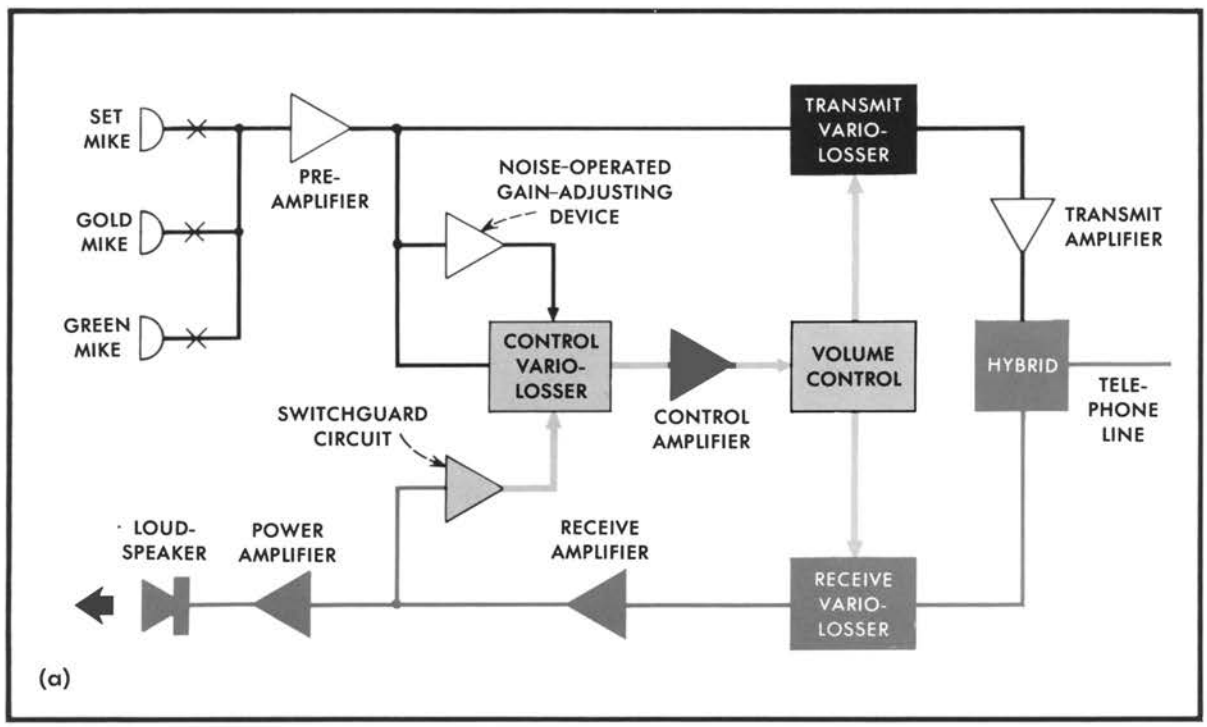
THE FEASIBILITY, as well as the value, of group discussions over long distance telephone lines has been demonstrated by the speakerphone. However, the speakerphone was designed to accommodate only a few people sitting several feet from the unit's microphone. There has been a need, therefore, for a more powerful version—specifically for conferences such as business meetings and educational seminars involving up to, say, 50 people. The Portable Conference Telephone (PCT), model 50A, was designed to meet this need.

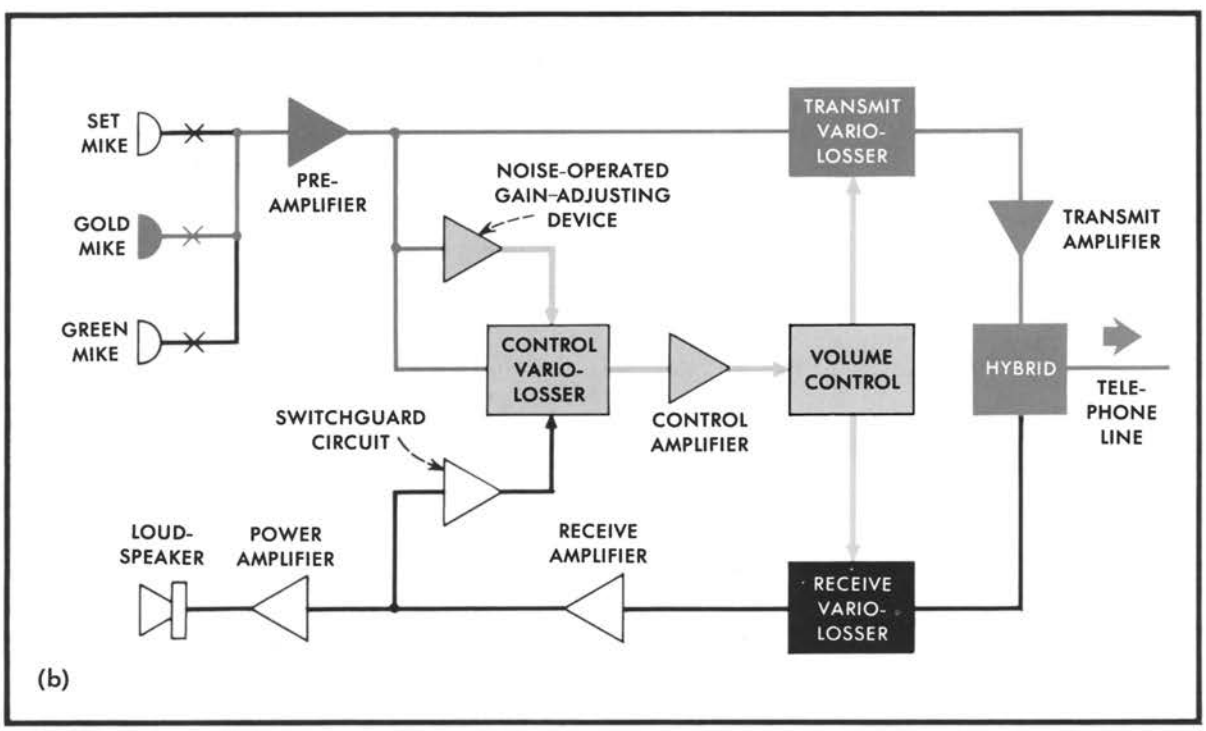
As a sister unit to the speakerphone, the PCT has other advantages beyond higher output power: it is portable, it has two extension microphones, and the customer himself can easily set it up wherever an ordinary ac power outlet and a telephone jack are available. (A higher powered "group" set, generally known as the tele-lecture—the KS-19134 Conference Set—has been available for some time, but it was designed for auditoriums holding groups of a hundred people or more. Although it offers some degree of portability, the tele-lecture set weighs 80 pounds and must be set up by a technician at each new location to prevent objectionable feedback effects.)

The PCT weighs only 21 pounds, about the weight of a portable typewriter, and fits in a single carrying case. Included are two extension microphones, cords, accessories, and a 73B control unit (recently redesigned from the 73A, an earlier version). The control unit contains a loudspeaker, a built-in microphone, electronic circuitry, a volume control (to adjust the received sound level), a cord receptacle for ac power, jacks for the extension microphones, and a plug for a TRIMLINE® handset (which may have either a rotary or TOUCH-TONE® dial). All three of the microphones can be used simultaneously in the 73B (only one microphone can be used at a time in the 73A). The 73B control unit can be used in place of a simple two-wire extension telephone, with a key telephone system, with a four-wire private network (the 73A unit must be modified to work with four-wire networks), and with an auditorium sound system. (While the 73A provides an audio output for sound systems in other rooms, the 73B, with an adjustment control and loudspeaker disconnect provisions, can be used in the same room with the sound system.)

Many businesses and educational institutions have already adopted the PCT. One example is a major computer manufacturer, which is using more than 40 PCTs scattered among its many locations throughout the country. Business and technical conference calls are regularly made, and even international conference calls are made between

The portable conference telephone has already gained wide acceptance among schools, medical institutions, and businesses. ("Tele-lecture" now covers PCTs as well as older, larger sets.)





When the PCT *is in the receive mode, upper diagram (a), incoming speech is tapped off by the switchguard circuit. The control variolosser and control amplifier then increase the loss in the transmit variolosser, almost cutting off the transmit path from the microphones. When the local user speaks, lower diagram (b), the control variolosser reduces the loss in the transmit variolosser and raises the loss in the receive variolosser, almost cutting off the signal to the loudspeaker.*

the company's headquarters and its offices in Europe. Another example is the University of West Virginia. The university sponsors evening courses that are held off campus with a PCT in each remote classroom to allow discussion with the lecturer on campus. The university also sponsors a private network covering 12 locations for weekly consultations with county boards of education. As part of the Northern West Virginia Learning Resources Laboratory, participants discuss and resolve joint problems and frequently hear lectures, sometimes taped, over the network. In still another application, the university's medical department has private-line telephone connections to over 50 hospitals and medical institutions scattered throughout the state, with a PCT at each location. Over 30 hours of classes in nursing and medical subjects, many for credit, are scheduled each week of the school term.

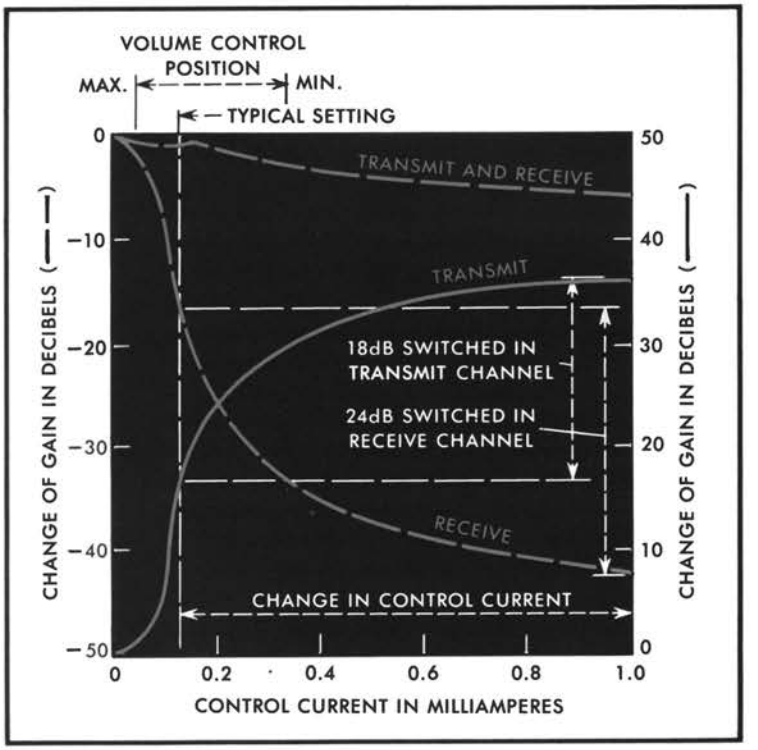
In developing the PCT to serve the size groups involved in such applications, we redesigned the speakerphone's audio circuitry and acoustic characteristics, retaining, however, its voice-switching circuitry, which automatically switches the unit between transmit and receive modes. The basic need was for 10 dB more output power from the loudspeaker so that it could be heard at the back of a large classroom. We could not have obtained the extra power by simply redesigning the amplifiers and using a loudspeaker capable of delivering more acoustic power. With no other changes, the greater audio output would have increased the chance for feedback from the loudspeaker to the microphone. Such feedback could have caused "singing"—a familiar problem in the design of audio systems. And, to achieve a compact unit, we had to place a microphone and the loudspeaker in the same package, only 12 inches apart (in the speakerphone, the microphone and loudspeaker are in different enclosures, typically more than 18 inches apart). With the microphone and the loudspeaker in the same package, feedback can result not only from sound transmitted through the air but also through the unit's chassis and cover.

Several steps were needed to overcome the feedback problem. First, we used a directional microphone (a "cardioid" type) to help reject sounds originating from the PCT loudspeaker, which is at the rear of the unit. To reduce mechanical feedback through the case, we mounted the microphone on a flexible support in the front cover.

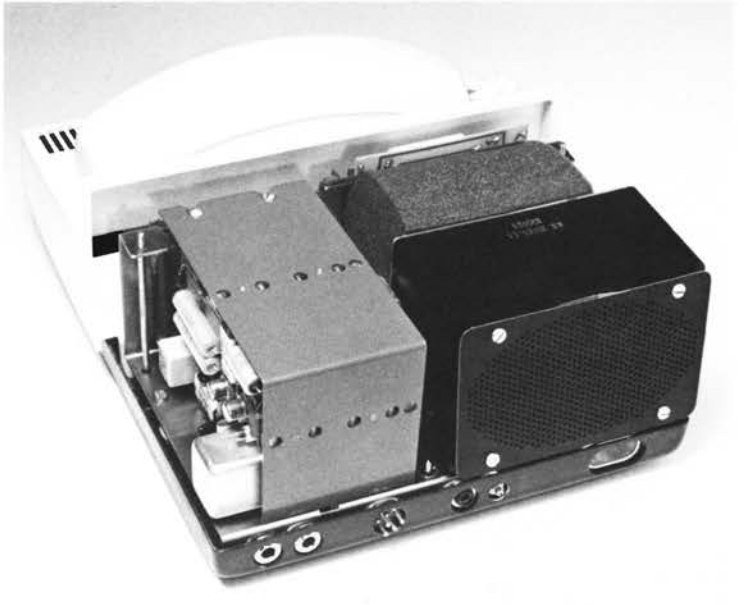
The loudspeaker and its acoustic enclosure were both specifically designed for the PCT. The combination assures a closely controlled, smooth frequency response with no significant spurious peaks in any portion of the useful frequency range (the peaks represent accentuations of certain frequencies). The presence of such peaks in many low-cost loudspeakers could lead to undesirable feedback effects. The smooth frequency response also helps suppress these feedback effects through the extension microphones, which normally are used several feet away from the loudspeaker.

To control feedback further, we used the voice-control circuits of the speakerphone (in fact, the same circuit boards). In the transmit mode, whenever the local user talks, the voice-control circuits automatically attenuate signals going to the loudspeaker, almost cutting off the loudspeaker. On the other hand, as soon as the distant user talks, a switchguard circuit senses the incoming speech and inserts loss in the transmit channel. This loss prevents the PCT from transmitting loudspeaker sounds back to the distant user. The automatic loss-control circuits, called the transmit variolosser (TVL) and receive variolosser (RVL), work together to insert and remove losses—when the TVL inserts loss, the RVL removes loss, and vice versa (see the illustration on page 102).

The polypropylene carrying case for the PCT, *molded as a single unit, has compartments for storing the extension microphones, telephone line cord, ac power line cord, and other accessories. The* PCT *has a microphone mounted in its right corner (the slots on the three surfaces contribute to the microphone's directional characteristics), and the volume control is in the front of the case (left). The* TRIMLINE® *handset, standard with the* PCT, *can have either a rotary or a* TOUCH-TONE® *dial.*



The PCT's *transmit and receive variolossers operate together—when one increases its loss, the other reduces its loss. The control current for each variolosser ranges between 1.0 milliampere and a lower current, determined by the setting of the volume control. In the receive mode, the current is set by the volume control. When the user speaks, the current increases, raising the loss in the receive channel and decreasing loss in the transmit channel.*



A 3 × 5 inch oval loudspeaker is mounted on the rear of the PCT *(right), with a polyurethane foam sound-absorbing pad behind it. Although the loudspeaker faces to the rear, its sound radiates in all directions. At the left are the amplifiers and voice-switching circuits. Included on the base, left to right, are jacks for the two extension microphones, a four-prong plug for the telephone line cord, a jack for an auxiliary* TOUCH-TONE® *dial (for access to special equipment, such as computer answer-back units, in rotary dial areas), a control for adjusting the sound in public-address applications, and a receptacle for the ac power cord.*

Another speakerphone circuit, called a NOGAD (noise-operated gain-adjusting device), monitors signals picked up by the microphone and responds only to steady or slowly varying signals (but not to speech). The NOGAD raises the operating threshold of the voice-switching control circuit just above the audio background noise, thus preventing switching until a rapidly varying signal such as speech is sensed by the control variolosser (CVL). The CVL compares the relative signal levels from the switchguard circuit (the incoming signal) and the microphone to determine when to switch between the transmit and receive modes. The higher threshold should not degrade transmission of the local user's speech, since speakers tend to raise their voices under noisy conditions.

The PCT is easy to use, since it plugs into jacks normally used for a simple two-wire extension telephone (in which the two wires handle signaling as well as transmit and receive). Although it has a four-conductor line cord, only two of the wires are used in a simple telephone application. If the unit is plugged into jacks for a key telephone set, then the two additional wires are used for control. The wires, for example, control ringing and lighting of the lamps on other key telephone sets having the same line to alert the other users that the PCT is in operation. However, if the PCT is to be used on a private-line, four-wire transmission system (one pair for transmit and the other for receive), then a craftsman can simply throw a switch under the control unit's rear cover to allow the PCT to use the second pair in the line cord for receiving rather than for control. (The addition of a few resistors, a cord change, and other minor changes were required to operate the 73A on a four-wire network.)

The most basic use of the PCT has been in point-to-point communications. The University of Illinois, for example, uses the PCT to bring educators from all over the country into the classroom. A professor at the University in Champaign uses the set to conduct seminars at the school's extensions in other parts of the state. In New York, the Boards of Cooperative Educational Services in Auburn, Cortland, and Ithaca have installed two private lines between each of their schools' PBXs. A classroom in one school is linked with a classroom in another, thereby sharing teachers among classes with too few students to justify separate courses. Handwriting is transmitted over a second channel via a telewriter system. Instructors change the hookup several times a day for different point-to-point connections.

Although the PCT was designed with such point-to-point use in mind, it has found many applica-

tions for multipoint conferencing. Some multipoint networks are set up as needed by a conference operator via direct distance dialing (DDD). Other networks, available to the customers around the clock, comprise permanent private lines that involve either two-wire or four-wire local arrangements with four-wire long distance networks.

The advantages of using DDD are low cost and flexibility in setting up the network. The disadvantages are that a certain amount of time and planning is required to set up the network for multipoint conferences. Regular telephone lines are tied up while the network is being set up, as well as during the session. Also, the transmission levels may differ appreciably from point to point because of the inherent statistical variations in transmission among connections in a DDD telephone network. The size of such a network will be limited to 12, 30, or 60 points depending on the types of conferencing and interconnecting facilities available. The Vanderbilt Medical School, for example, conducts a continuing education program via DDD with 37 hospitals located in southern Kentucky, northern Alabama, and eastern Tennessee. Usually 15 or 20 locations are dialed several times a week for classes in such complex subjects as dietetics, cardiovascular diseases, and pediatrics.

In cases where the PCT is to be used over long periods of time, such as a school semester, the two-wire and four-wire private lines have advantages. Both types minimize the set-up time required prior to each session and provide somewhat more uniform transmission than DDD conferencing among various locations. However, the two-wire arrangement is limited in size to about 15 locations, whereas a four-wire system can handle over 100 locations. Although this system is more expensive than the two-wire type, it is necessary to prevent feedback effects in the telephone network (singing through the repeaters, hybrids, and conference bridges) when large numbers of PCTs are in use.

Whether DDD or private-line networks are used depends upon cost, performance, and the type and amount of usage. The University of Minnesota uses DDD network conferencing and has reached 12,000 people during the year at a cost (including DDD and PCT charges) per student contact-hour of about 10 percent of the on-campus cost. The University of West Virginia's four-wire network mentioned previously shows how a frequently used private-line network could cost less per student contact-hour. With a conservative estimate of 40,000 student contact-hours per month, the cost—including the station sets and the interconnecting facilities covering more than 50 points—is less than three percent of the usual student contact-hour cost. And, in another application—the Kansas City Regional Council for Higher Education's four-wire network covering 18 universities and colleges — the program's coordinator says the amount of money saved has been "inestimable" because of the ability to bring prominent speakers thousands of miles into the classroom. These types of savings are also evident in an application at Bell Labs. High costs for travel are avoided by gathering participants, via PCT, for business meetings—in one recent session, over 200 college employment recruiters conferred from 13 Bell Labs locations.

The future for the PCT thus appears to be bright. During the past year, shipments have increased by about 40 percent. And since the unit lends itself to some unusual applications, it has received much press coverage. As potential customers become aware of the PCT's capabilities, we expect still more educational institutions and businesses to use the set.

Unusual Applications of the PCT

Although the Portable Conference Telephone has proven itself in strictly economic terms as an alternative to gathering large groups in one place, it also has produced some gratifying results in strictly human terms. This past year, for example, a home-bound graduate student at Cornell University was able to listen to lectures and participate in discussions via the PCT. Telephone jacks were installed in his classrooms and one PCT was moved from room to room while the student used a second unit. In a similar case, at West Sand Lake School, New York, the classrooms, library, and gymnasium are wired for telephone use. One girl, who is asthmatic and allergic to chalk dust, could not attend regular classes. The school placed a PCT in the classroom and provided her with an operator's headset at her home. Several times a day, she was called for classes and, as a result, missed very little class time. This school also uses the PCT in its library and classrooms so that the children can talk to some of the authors of their books. And on one occasion, the pupils gathered in the gymnasium for a "voice visit" with an astronaut. In another application, the University of Minnesota's Extension Service has equipped each county agent with a unit that he carries in his car. The agents go from town to town and set up evening classes based on lectures transmitted via DDD from the University. The classes cover general subjects for 4H clubs, veterinary medicine talks, and lectures on farming and landscaping.