AN EXPERIMENTAL RF SUBCARRIER SYSTEM TO PROVIDE A MASS COMMUNICATION SYSTEM FOR THE DEAF

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This presentation describes the history and development of the first radio station for the deaf in the world. An innovative communications tool called RTTY, or Radio Teletype, this system provides news, weather and general information to deaf people in the Philadelphia area via radio. At the end of the second year of operation, it is expected to reach approximately 750 households. Nicknamed "Printed Radio", the system operates from punched tapes of current news and information of interest to the deaf community. These tapes are created in a studio located in the Pennsylvania School for the Deaf, 7500 Germantown Ave., Philadelphia, Pa. 19119, and transmitted via standard telephone lines to radio station WRTI on the campus of Temple University, about five miles away. At the studio, the signal is monitored and rebroadcast to the transmitter site, a distance ten miles from the parent station. There, the five-level TTY code is superimposed over a high-frequency subcarrier and beamed out to the Delaware Valley. By means of a single station radio, the person is able to reconvert the subcarrier back to the original TTY code, thus allowing him to read the original message. The principal benefits of RTTY communications over the few telephone news centers scattered throughout the country are that an infinite number of persons can receive information simultaneously, and the individual does not need a telephone to receive the information, only a teletype machine and a special RF tuner. Broadcast information comes from three principal sources: twenty-four hour UPI services; deaf community news; and, programs generated by students and staff of the Pennsylvania School for the Deaf. The radio teletype service to the community has been melded into the English courses for deaf children. Time spent at work in the studio is evaluated and incorporated into the student's permanent records. During their time in the studio the students interpret, edit, rewrite and create the programs under the direction of two adults. Students learn responsibility by working against the clock, as the studio is committed to airing programs twice a day. The experimental radio TTY center is also a research facility, conducting experiments in electronic communications. Finally, this experimental radio station is but half of a much larger TTY study being conducted in Philadelphia, and funded by a private foundation.

The concept of radio teletype as a source of printed media is lost on most hearing persons. In an age where electronics provide virtually every creature-comfort, radio for the deaf is neither exciting nor particularly innovative. Our experience has been that even the media finds RTTY amusing. But for the 200,000 potential deaf "listeners" in the United States, radio teletype is a link to a future taken for granted by hearing persons.

On October 13, 1976, at 10:30 a.m., the world's first regularly scheduled radio program for the adult deaf was broadcast from a studio at the Pennsylvania School for the Deaf in Philadelphia. Heard by only ten people, this short, thirty minute program reflected the

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hopes, dreams and labors of many individuals over a period of many years. As far back as 1971, at the first TTY Convention held in Chicago, deaf and hearing professionals have reflected on the day when radio would be available to deaf citizens. Some of the earliest references to a radio-TTY concept were made by Bellefleur, (1) Marsters, (2) and Torr. (3) Each, working independently, foresaw the time when a carrier or subcarrier system would be used to broadcast the five-level teletype code to the homes of TTY users.

Radio-TTY is a logical outgrowth of the TTY system of communications between deaf persons. Appearing only twelve years after Weitbrecht's (1964) success in electro-acoustically coupling two TTY machines together over a standard telephone wire, radio TTY appears as a new point on a continuum of services that will someday electronically link the hearing person and the deaf person more completely, each using his own communication device. The sequence of historical developments leading to radio-TTY has been:

1. The creation of the electro-acoustic coupler (or modem), making possible TTY communication for deaf persons.
2. The establishment of Teletypwriters for the Deaf, Inc., and its subsequent national telephone directory. (4)
3. A voice link, via a special service provided by hearing persons, enabling the deaf person to use a third part to communicate with other hearing persons or agencies.
4. Direct contact, via TTY, with emergency services such as fire, police and ambulance.
5. Direct contact, via TTY, with government and other agencies (Internal Revenue Service, Conrail, etc.) enabling deaf persons, nationally, to feel less like second class citizens.
6. TTY catalog ordering through Sears and other stores in major cities in the United States.
7. And, finally, in October 1976, radio teletype communication to be followed in the distant future by captioned television and, ultimately, direct contact between the hearing and the deaf, via computer, in conjunction with the "talking typewriter".

The principal purpose of this presentation, however, is not the accomplishments of the past, or even the dreams of the future, but rather an explanation of the present. And the present is RTTY media communication.

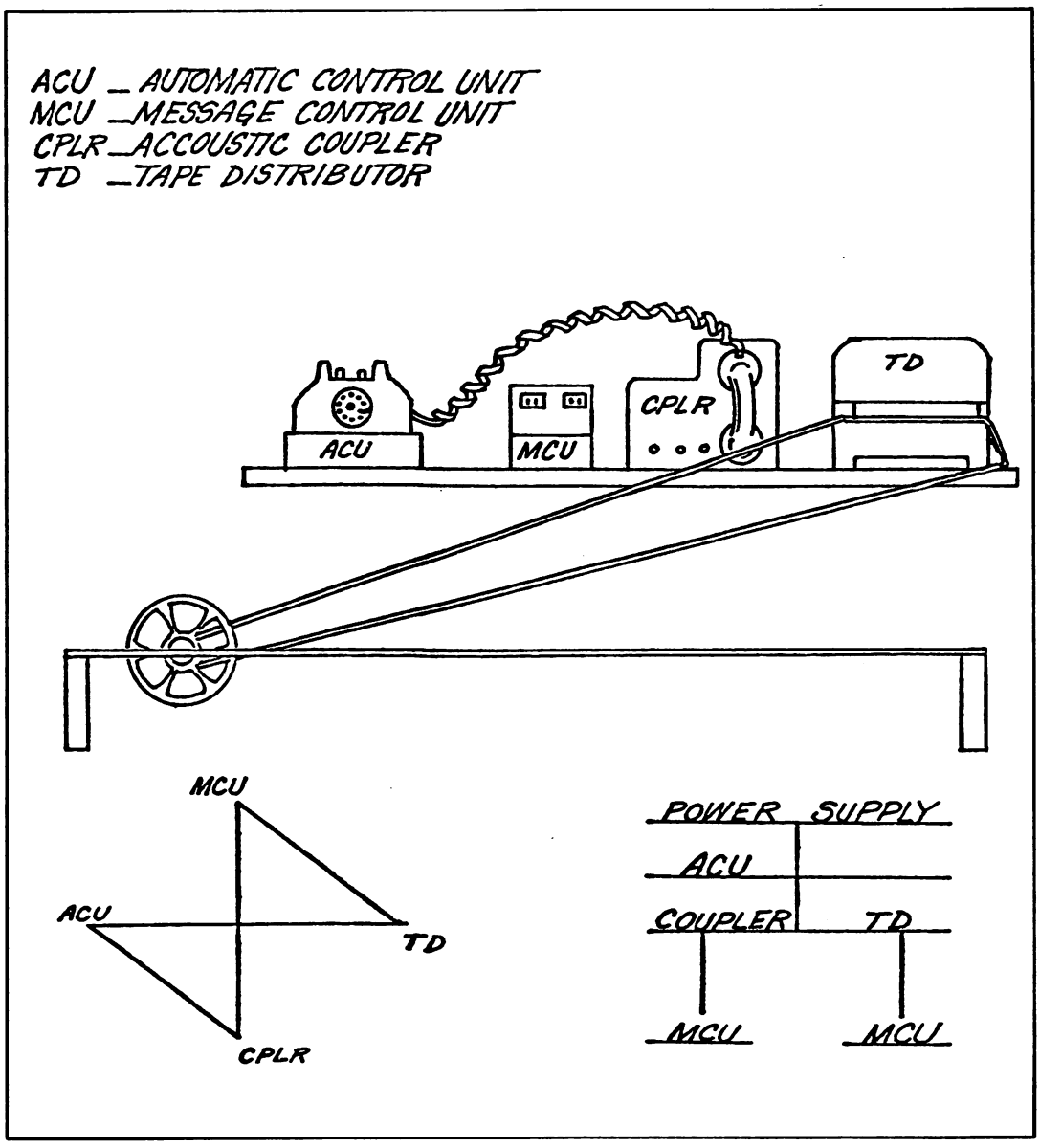
To best understand the RTTY concept, a comparison with phone-type news systems is helpful.

(FIGURE I)

In its simplest form, the phone-type news system consists of an electromechanical telephone answering machine and a tape distributor, or a cassette tape recorder. Both utilize a tape loop. The deaf person dials a designated telephone number and places his telephone handset in the coupler of his teletype machine. Assuming the line is free, the answering machine at the other end opens the circuit and the caller sees the prerecorded messages or announcements. This system is limited in the number of people it can serve each day. For example, if the message is ten minutes long, and assuming 100% efficiency, only six people per hour would have access to the news. A modification of the single unit phone-type news is a multi-telephone line unit that allows several callers to receive the same message simultaneously. The two major disadvantages of this system are: 1) the prohibitive cost of each additional telephone line, and, 2) the fact that many listeners will begin receiving the data in the middle of the tape. As you will see later, RTTY eliminates these problems.

Phone-TTY news service plays an important supportive role to RTTY, however. By making community news available by telephone, people have a backup source for news they may have missed on radio. It also allows the community a convenient means for submitting news by typing information to the News Center. At the end of the taped news is a thirty second pause, allowing a person to type a message of any length, which then can be used on the radio and telephone news services. A telephone news service can carry information

FIGURE I



Block Diagram of Phone-TTY System

prohibited by FCC rules, and thus circumvent the FCC. For example, mention can be made on radio that further details are available by calling the telephone news service. The two types of services, therefore, complement each other.

Radio-TTY has several advantages over a phone-TTY system. In a large metropolitan area, where greater numbers of deaf people can and need to be served, radio has the advantage of offering more information at prime times and serving more people than a phone teletype does. There is no need to wait in line to receive news and no feeling of frustration because the circuit is continually busy. Therefore, telephone news must be limited. The project's phone systems are set for ten minutes. This gives a reasonable coverage of the news, but keeps toll charges or message units within reason. With radio, however, a variety of programs is possible, over a longer period of time, with the only cost being the increased use of paper for hard copy machines, and the initial cost of the radio itself.

In the Philadelphia experiment, the deaf person turns on a pre-tuned subcarrier radio receiver at the appropriate time of the day or evening. These units are designed to receive broadcasts from both the main channel and the subcarrier. By means of a switch, the receiver can be shifted from the main channel, which broadcasts for hearing people, to the subcarrier, exclusively for the deaf. When the receiver is switched to the subcarrier, the TTY code is audible. By connecting the radio receiver to the modem of the teletype machine, the code is reconverted to word information and instantaneous reproduction of the PSD transmission is printed on the TTY of the individual.

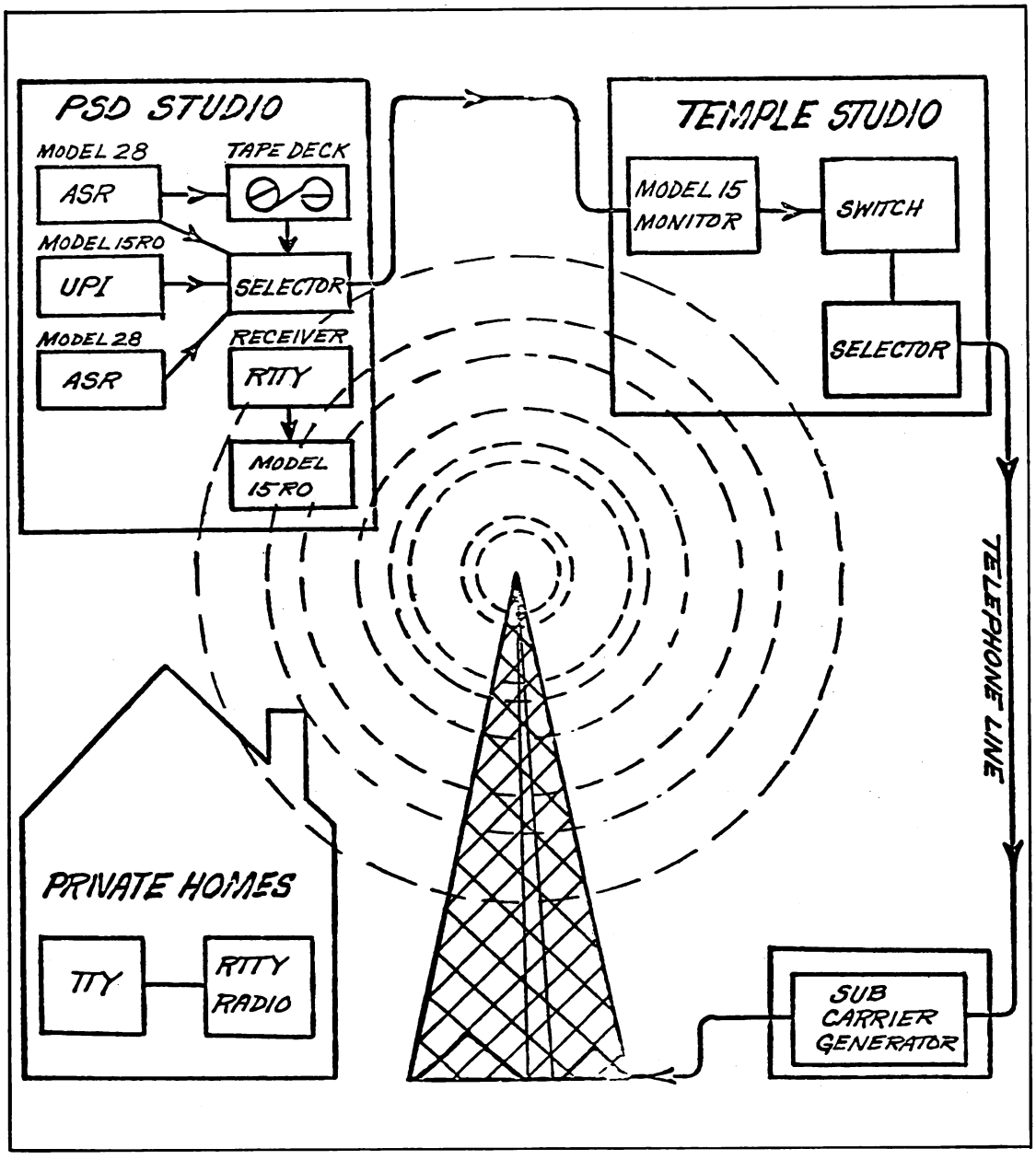
In this project the radio-teletype news differs from phone news in several ways. First, it is presented twice a day with two different programs; one hour in the morning and two in the evening. Each day, the staff of the station, consisting of three adults, plus student participants, review the information of community interest left by persons calling in on the phone news, along with print-outs from the United Press International machine. These are read by the students and the staff and a mock-up of the morning program begins to develop. In addition, events listed on a Community Calendar, maintained by the Center, are added to the program. These may reflect upcoming activities of any of the fifty-two organizations serving the deaf in our Delaware Valley. As a result of much trial and error, and numerous consumer surveys to determine the most popular kinds of features, evening programs offer a variety of topics that meet the needs and wants of the community.

Once a mock-up of the program is completed and is ready to be put on paper tape, a typist follows a special format that provides for consistency in spatial patterns and makes scanning and reading easier from one news item to another. The machine used for developing taped program material is an Automatic Send-Receive Teleprinter. At this point, the tape is run through a tape distributor which converts the five-level punched tape to audible tones, at a steady rate of 60 words per minute. By connecting a tape recorder to an acoustic coupler, both of which are joined to the output side of the ASR, the coded signals are transferred to the magnetic tape. The magnetic tape is then ready to use for actual broadcasting. A control panel in the News Center offers options for selecting the method by which programming will originate. Choices include originating material from one of two ASR's, using a paper tape; another is the magnetic tape, and finally, United Press International as it comes direct from the UPI wire. By selecting any one of these options at the press of a button, a variety of programming capabilities are possible. In addition, having both the punched and the more reliable magnetic tapes of the same program assures a backup system in the event of equipment failure.

(FIGURE II)

The procedure for sending broadcast material to the WRTI-FM transmitter involves transmitting the five-level baudot code of the TTY, on a dedicated voice-grade telephone

FIGURE II



Block diagram of Radio-TTY System

line, first to the Temple University studio. There the signal is picked up by a demodulator (or the receiving portion of an acoustic coupler) which activates a teleprinter. Up to this point, this is all that is needed for the monitoring procedure. However, during an actual broadcast, the audio signals are relayed on a 5KC radio grade telephone line to the radio transmitter, where the TTY code is superimposed on a 67 KHz subcarrier. In our case, this signal is piggy-backed on the 90.1 MHz main channel of station WRTI-FM, Temple University.

Signals are transmitted on five kilowatts of power and can be received up to fifty miles, with the outer limits requiring a directional antenna.

Before the Philadelphia Project commenced a year and a half ago, the number of teleprinters in the five county area, in and around Philadelphia, was roughly 350. One set of objectives of the Philadelphia Project has been to distribute an additional 600 teleprinters and 750 radio receivers, by June of 1978, to hearing impaired individuals and institutions serving the deaf.

At a time when mainstreaming is gathering momentum, the Pennsylvania School for the Deaf is able to serve not only its students, but also the greater Philadelphia area with a news service. The advantage of having a radio news service for the deaf in a school is that it is fundable, stable, service-oriented, and educational. Fundable because, now established, it has demonstrated the need for scheduled, community-oriented media for the deaf; stable because a salaried staff, as opposed to volunteers, is able to provide substance and continuity necessary for such a venture; service-oriented because of the contribution of students who develop an interest in media for the benefit of their communities; educational because of the increased awareness on the part of the deaf students in current events, consumer aids, health, legal rights information, and many other areas. As young adults pass through the educational experience of contributing to the News Service, they become dependent upon the need to have immediate news information and this, in itself, becomes vital to their way of living, as it has for the hearing population for over fifty years.

At the beginning of this paper we said that the concept of RTTY was lost on most hearing persons. To be perfectly honest, it is even lost on many deaf as well. For the hearing person it is because they can't see the distinction between RTTY and a daily newspaper. With the deaf it is simply a lack of exposure to a new system. Both groups often ask: "Why bother with a radio news service? Why not purchase a newspaper like anyone else?" Why does anyone listen to radio or TV news? Obviously, the newspaper does not offer a collection of deaf community calendar or social news items, nor does it specialize in news of specific interest to the deaf community, such as features on the life and work of outstanding deaf personalities or professional people. In addition, a collection of the best news of the day, from the local scene to the world arena, is presented to keep the community abreast of important events as well as to offer interesting stories that might never make the news or are easily missed when scanning the headlines. Our senior citizens, and others whose eyes are failing them, prefer reading their news on RTTY because of the larger print. Furthermore, the personalization of the teleprinter has the potential to provide a more meaningful news presentation because the motivation exists to read it. This we have observed by those who read our news, and many have become totally addicted to the service. No attempt is made to replace the newspaper, but rather to glean the important, the amusing, the informational news items. We have even been told that having the advanced copy from UPI makes it easier to lipread the TV news in the evening. It is important to remember that for some in the deaf community, the TTY service, be it radio or telephone, is the only reading accomplished from day to day.

Perhaps radio-TTY will be an interim step in the evolution of an effective mass communications system for the deaf in this country. However rudimentary our system may be, we have taken the first step to produce a service to

the deaf in the Philadelphia area, and have provided an example and, hopefully, a promise of things to come. Already, people around the country are learning of our experimental program and are writing for technological and program data in an effort to duplicate such a system. Often we are asked to describe the future of mass media service for the deaf, especially in light of television captioning systems. We do not know, for example, to what extent TV captioning will replace RTTY, or whether it ever completely will: as captioning exists today, there seems to be a place for both "captioned radio" and captioned television. And perhaps in the future, the technology of RTT will be used as a TV captioning technique. We know, for example, many television stations have audio subcarrier capability and it is certainly in the realm of possibility, therefore, that television stations could broadcast this radio subcarrier information directly to the television screen via a modified receiver. It is also possible, using the same system, that a remote studio such as the Philadelphia Center could produce its daily news in code, sending it to the television station in much the same manner it transmits to the FM station now, and through a process of closed captioning of the subcarrier, could produce on the viewers screen, a continuing news broadcast unrelated to the programming format of the station. There is no doubt that remote studios could receive news broadcasts of local community interest, transmitted to them over long distances by telephone line, and beamed back to them by microwaving processes or rebroadcast techniques.

When one considers the number of hours it will take to caption any television program, and the number of dollars it will cost, it is quite certain that, in the future, alternative systems will have to be reviewed. We firmly believe that RTTY is one of these alternative systems. In the optimism over television captioning, we have lost sight of the economies of deafness. It is unlikely that major producers will expend much time, money or effort to program for a small minority group. Even with the power of federal legislation, it is to be expected that their efforts will be minimal. When this time occurs, the search for alternative systems will begin. In the meantime, there are needs and challenges to be met. The process of news service production may become more sophisticated as electronic memory banks or electronic TTY's take over the storage of material, but the consumer will still be receiving the same product — up to the moment news via radio — a service the hearing community has taken for granted for over half a century, but has been denied to the deaf.

(1) Bellefleur, Philip A. Proposal to Social Administrative Services, 3/72, Washington, D.D. "To establish and Study a Model Telecommunications Network for the Deaf", Philadelphia, Pa.

(2) Marsters, James. *First National Conference of Agents of Teletypewriters for the Deaf, Inc., Appendix D,* 11/71, Washington, D.C.

(3) Torr, Donald. *First National Conference of Agents of Teletypewriters for the Deaf, Inc.,* Appendix G, 11/71, Washington, D.C.

(4) Weitbrecht, Robert. *Teletypewriters for the Deaf Dictionary, "History",* p. IX, Teletypewriters for the Deaf, Inc., Washington, D.C.