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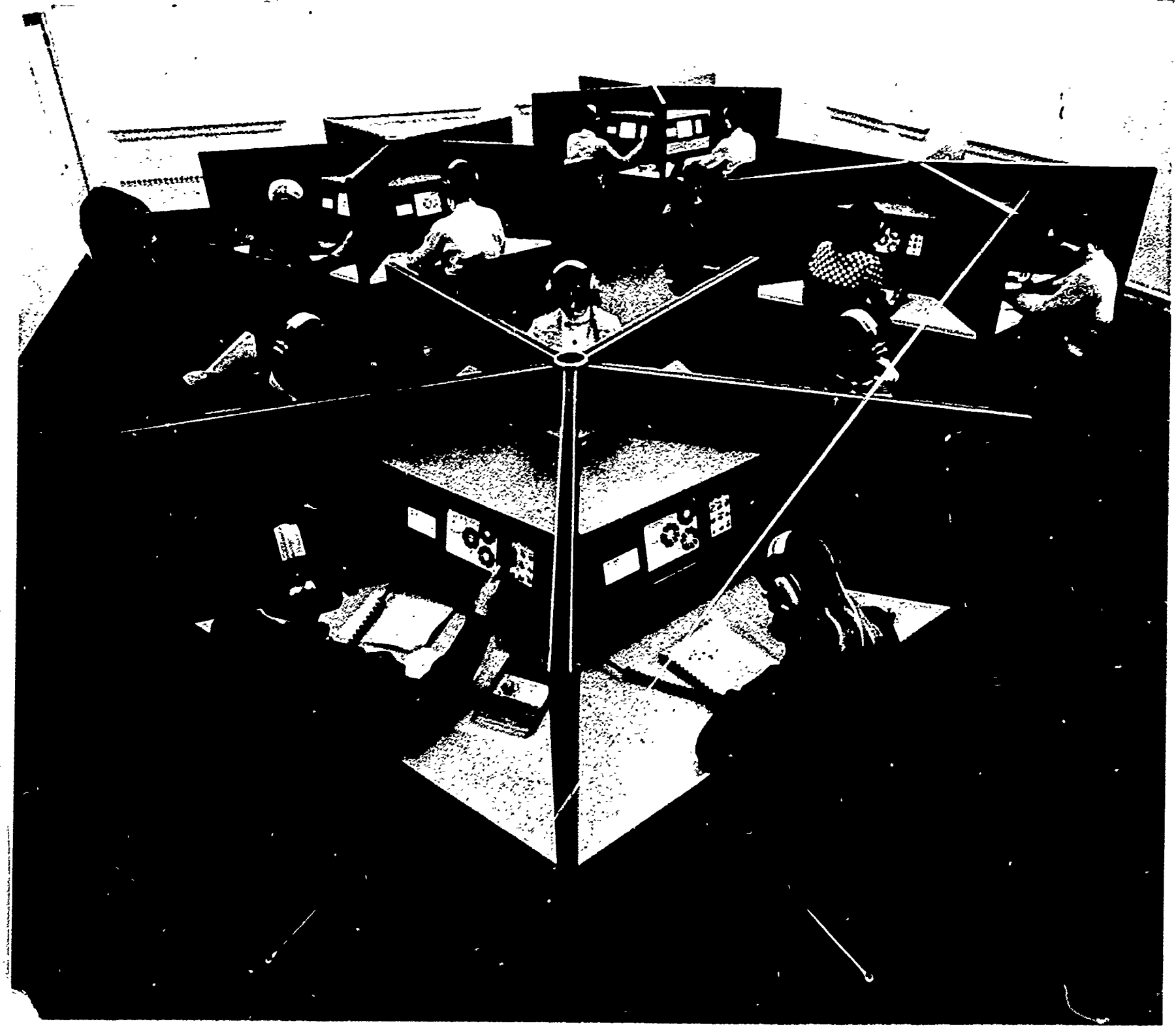
The specifications, planning, and initial development phases of the Random Access Center at the Oak Park and River Forest High School in Oak Park, Illinois, are described with particular attention to the ways that the five functional specifications and the five-part program rationale were implemented in the system design. Specifications, set out by a faculty committee prior to the contracting of the project, require instantaneous random access to both audio and visual materials, full user control over the selection and use of materials, remote access on the widest possible scale, and a single central storage and control facility. The goals of the program include enrichment of the program of studies; greater individualization of instruction in the curriculum; better integration of the instructional program around the focal point of the library; improvement of library services through the convenience and flexibility of an automated retrieval system; and finally, the elimination of the mechanical problems which inhibit student and teacher in their use of audio and visual materials. (MT)

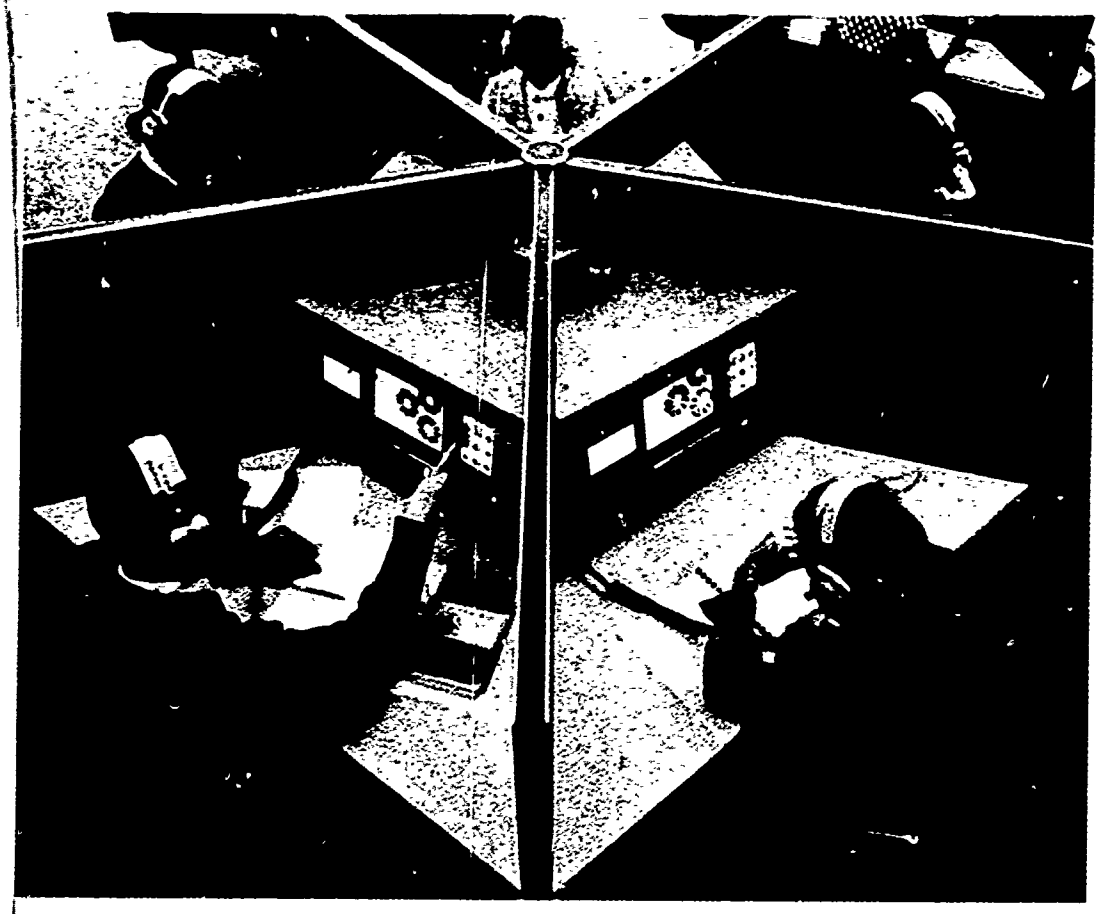


REPORT II

OAK PARK AND RIVER FOREST HIGH SCHOOL RANDOM ACCESS INFORMATION CENTER

A PACE PROGRAM

OAK PARK, ILLINOIS SEPTEMBER, 1968



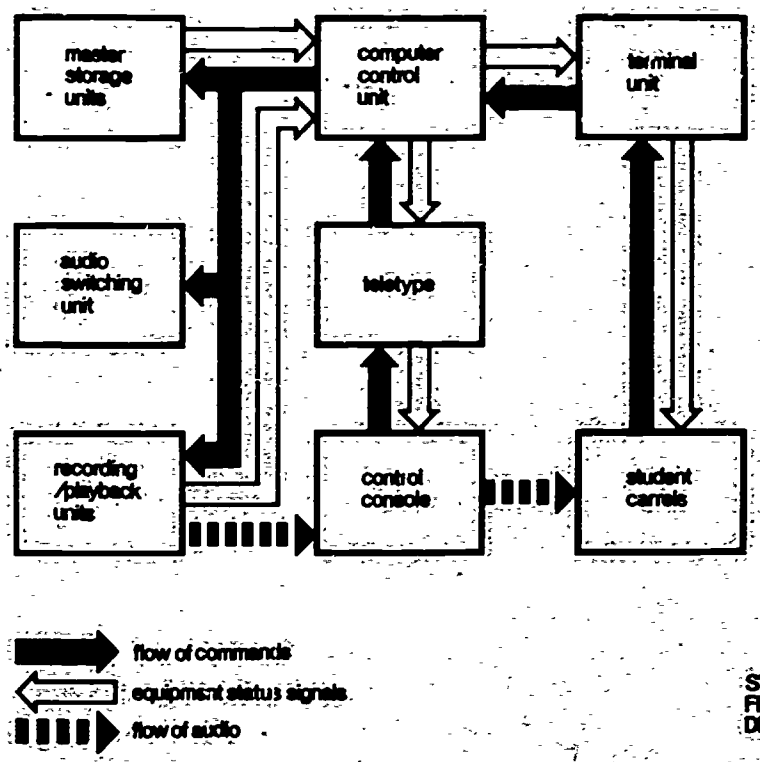
Title III of the Elementary and Secondary Education Act of 1965 was enacted to encourage innovations and to demonstrate exemplary programs of innovation in educational practice. Under a three-year grant commencing November 1, 1966, $1,486,200 was assigned to the Oak Park and River Forest High School to support the development of a retrieval system capable of providing random access to audio and visual instructional materials. The plan for this development program had been devised several months prior to the awarding of the grant by a faculty study committee.

Organized by the superintendent and chaired by the head of library services and a coordinator, this committee was particularly concerned with the creative application of technology to two major problem areas. An embarrassment of riches is the first of these problems. The information explosion and advances in the communication and publishing industries have generated an almost overwhelming array of materials significant to teaching and learning. Yet, under existing procedures it is not possible to utilize these materials adequately. New technologies to provide for use and storage are needed. The second problem area is also one of need and opportunity. Through changes in school operations and curricula, a major attempt is being made to increase the individualization of instruction. Pertinent to this effort is the need to make the full range of instructional materials available to students individually as well as in groups. Again, standard technology imposes basic limitations on the possibility of achieving this degree of pupil service.

In seeking constructive solutions to all or part of these two problems, the faculty study committee defined a new type of retrieval system which would provide instant, individual and remote access to audio and visual instructional materials. Essentially five functional specifications were insisted upon. Together they required the ability to devise a new technology for educational retrieval systems by calling for a level of service not available in standard systems. The five specifications were defined as: 1) Random access to stored materials must be provided. That is, each request for materials must be honored when made and instantly. Materials in the system must never be "not available now" or "now in process." 2) Access must be provided for both audio and visual materials. 3) The individual user must have full control over the selection and use of the instructional materials. 4) Remote access to the materials in the system must be supplied on the widest possible scale. Individual carrels, conference rooms, classrooms, other schools and private residences must be potential receiver points. 5) The efficiencies of a single, central storage and control facility must be provided.

Having reached the discipline of these specifications, the study committee then invited leading electronics and communications firms to consider the plan and translate the requirements into machine reality. Several of these firms submitted contract proposals for the plan. From among these proposals, that of the Ampex Corporation was selected as most nearly meeting the listed specifications and offering the greatest promise for future expansion and improvement.

The cooperative efforts of the faculty committee and Ampex produced a project development plan consisting of three stages. The first stage would include the engineering and installation of a random access retrieval system for audio materials in individual carrels. The second stage would include an expansion of the audio system and the introduction of video service. The third stage would provide random access to video materials, extend the automatic retrieval service to classrooms and offer broadcast services to neighboring schools. The audio system of stage one was placed in service for students on May 6, 1968.



SYSTEM FLOW DIAGRAM

Before considering the machinery of the first stage and progress toward the more advanced equipment, it is important to identify the rationale for this project. As it is being developed in the context of the Oak Park and River Forest High School program of studies, the retrieval system is based on a five-part rationale. Heading this list is the intention of enriching and supplementing the program of studies. All programs prepared for use in the system are designed for this purpose. In all curriculum areas and in differing applications, these programs support and extend the work which teachers and students must do together. Reference, remedial and makeup assistance are parts of this rationale. So too are accelerating, tutorial and drill programs. By enriching and supplementing classroom work in these ways, the retrieval system makes possible a more effective utilization of the time and talents of both students and teachers. Rather than becoming less important, the personal exchanges among students and teachers are made more productive.

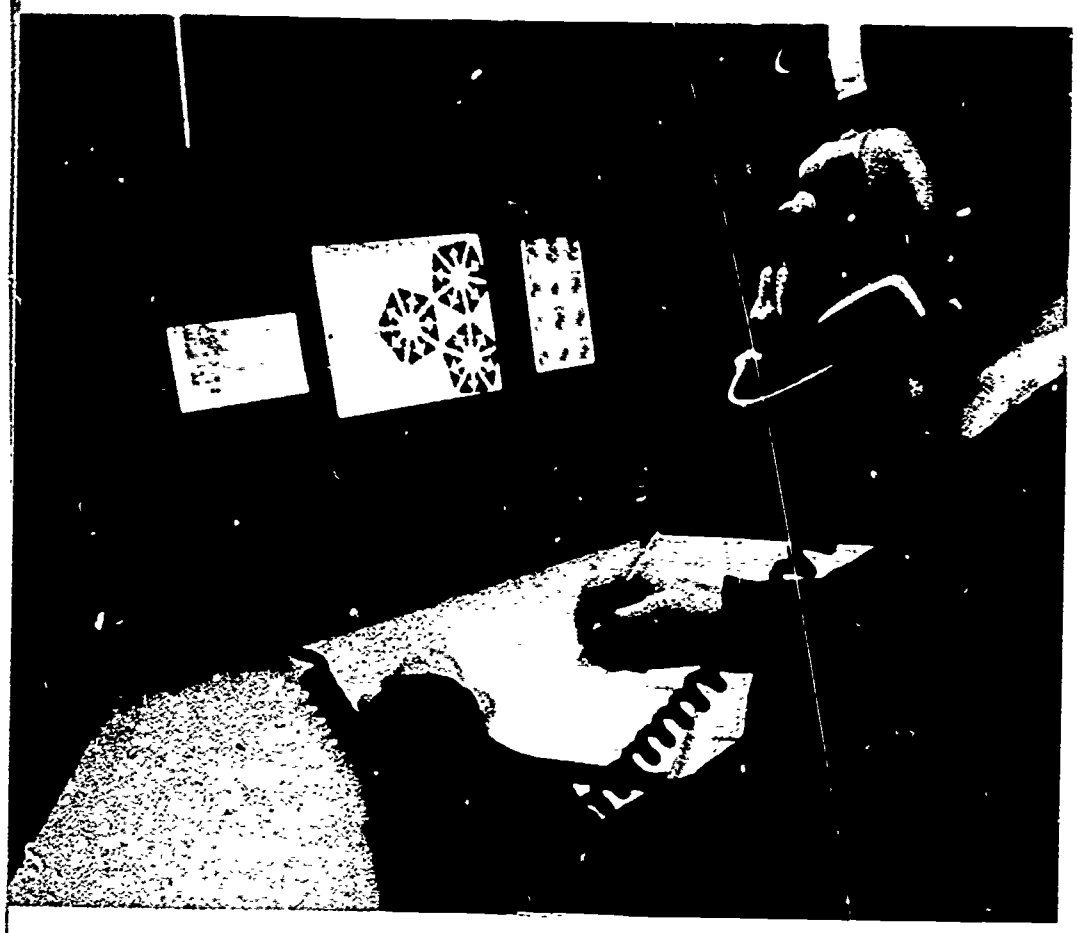
The related goals of a greater individualization of instruction and independent study are the second part of the system rationale. The choices available to the student are increased in quantity and kind. Additional and specialized study areas are supplied to him. Audio and visual materials are made at least as accessible as print material. Specific instructional units prepared by his teachers for his learning problems are placed at the student's fingertips at the convenience of his schedule.

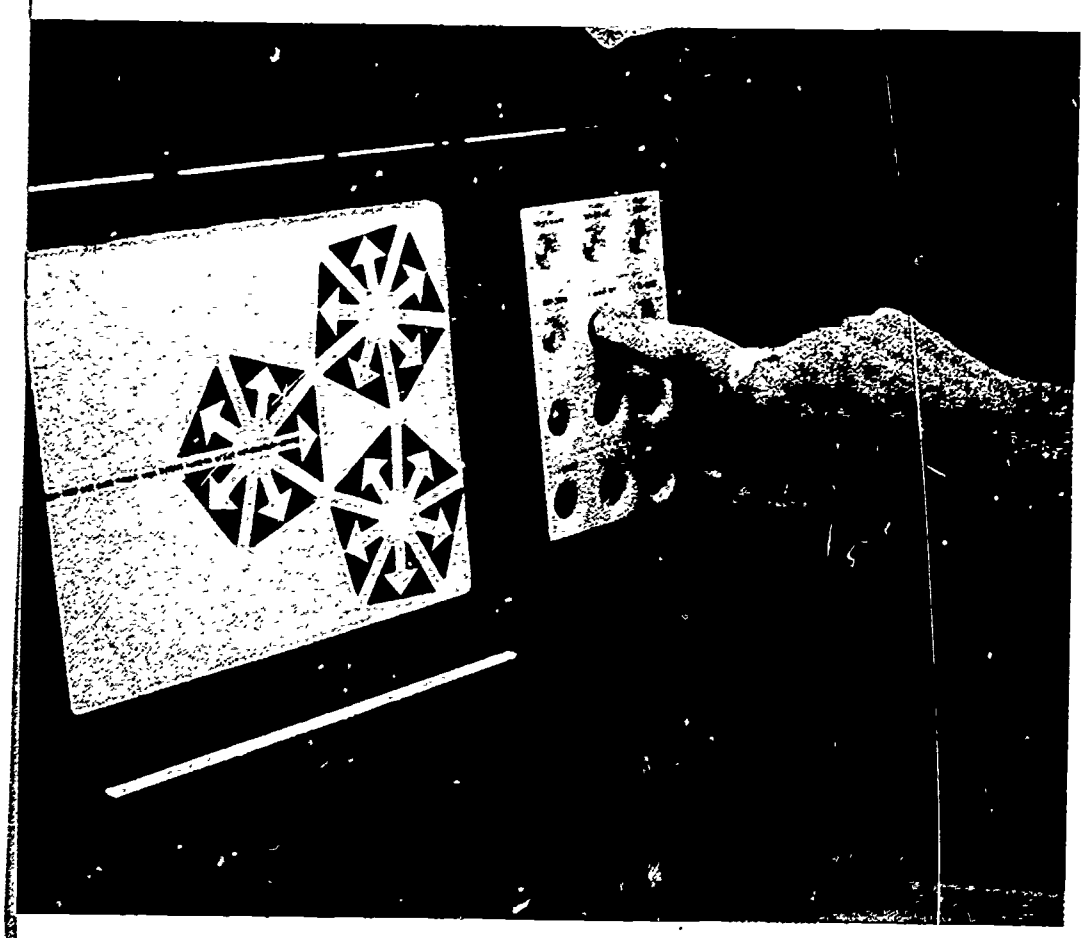
The user exercises full control over the rate, repetition and sequence of program units. Learning resources not otherwise accessible are made subject to the student's command. The talents of more teachers can be used to serve the learning needs of each student. Through choice, diversity and responsibility, the individuality and independence of students can be served and strengthened.

A more effective integration of the programs of the school can also be accomplished with a comprehensive random access retrieval system. The work of librarians, teachers and students is made more interdependent. The library support for classroom programs is made more direct and basic because of the nature of the instructional aids employed in the retrieval system. Department curricula can be related more closely to one another through the medium of the library if a full range of library services is supplied. The expertise of individual faculty members can be utilized in a number of related areas of study within the practical limits of school schedules. The library can truly become the focal point of the school's entire program of instruction if a total information and communication system is established.

The fourth rationale for the retrieval system insists the new technologies of information handling and communication are now essential tools for a full program of library services. The days of the library as a book and pamphlet center passed some time ago. Today the library must serve listening and viewing as well as reading. The sights and sounds of human interchange are today as basic as the printed words. If the sights and sounds are to be handled effectively and efficiently by libraries, appropriate listening and viewing facilities must be designed and established. Automated electronic and mechanical retrieval systems can provide an unmatched convenience and flexibility in access to audio and visual materials.

Fifth, the mechanical problems which limit the use of audio and visual materials by teachers and students must be reduced or eliminated. Teacher time and energy are now wasted in undesirable machine tending. Student access to these materials is frustrated by awkward, primitive or prohibitive equipment and procedures. A central, automated distribution system with true random access capabilities is a desirable solution for the removal of these barriers.

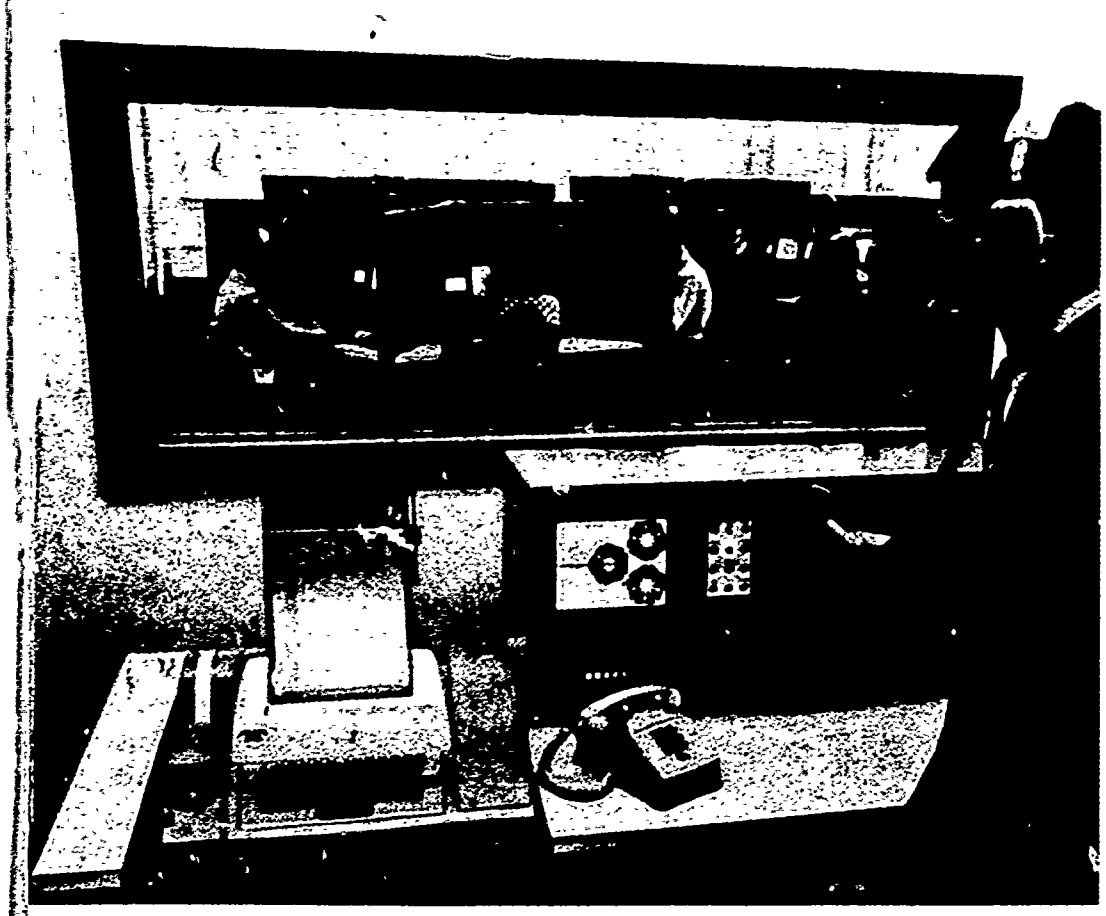




The audio system of stage one does provide random access to instructional materials. From each of the student receiver points, all programs in the system can be secured automatically and instantly. Each student request is honored as made and when made. There are three major components to stage one of the retrieval system: a storage bank for program materials, a computer control unit and 25 student study stations or carrels. From each of the 25 receiver points, instant access is provided at all times to any one of the programs in the storage bank.

The carrels for this system have been designed to give the student maximum convenience and control over his study situation. Wide enough to accommodate two people at one time, the carrel working surface has ample space to hold notebooks, reference items, supporting objects or utensils. The pentagonal-cluster form and large dividers secure semi-private conditions for the student. In addition to the control panel with which the student directs the program material, each carrel is equipped with a connector for a second headset, an electrical outlet and a program output for the student's own tape recorder in case he wishes to copy any of the program material. Each headset unit has a volume control and a microphone attached to it. Space for the video monitors of stage two is provided in each carrel.

To select the program he wishes to hear, the student uses a unique solid-state, touch-sensing keyboard with 12 control keys. These keys send control signals to the computer control unit when touched. This standard digital computer directs storage and playback equipment to supply the student's request. The computer also directs the lighting of the appropriate key to report to the student the mode of operation of the retrieval equipment serving his carrel. With the carrel keyboard the student can select any program in the storage bank, choose the moment at which the program begins playing, stop and restart the program at any point and as frequently as he might wish, recue the program to its starting point or dismiss the selected program. The student can also use the keyboard to permit him to record his own voice in conjunction with a program and to play his own recording alone or in concert with a system program. In addition an intercom key enables the student to establish two-way communication with the control room and secure assistance by remote control. The keyboard involves no moving parts, and the computer



can only accept signals from the keyboard which are made in proper sequence.

When the student makes a program request through the keyboard, the computer connects the master copy of the requested program to the high-speed recording device which serves the student's carrel. At a speed of 120 inches per second, a copy of the requested program is made. When the copying has been completed, the student is advised via the keyboard that the playback machine is waiting for his command to begin. The time required to make the program available to the student is 30 seconds.

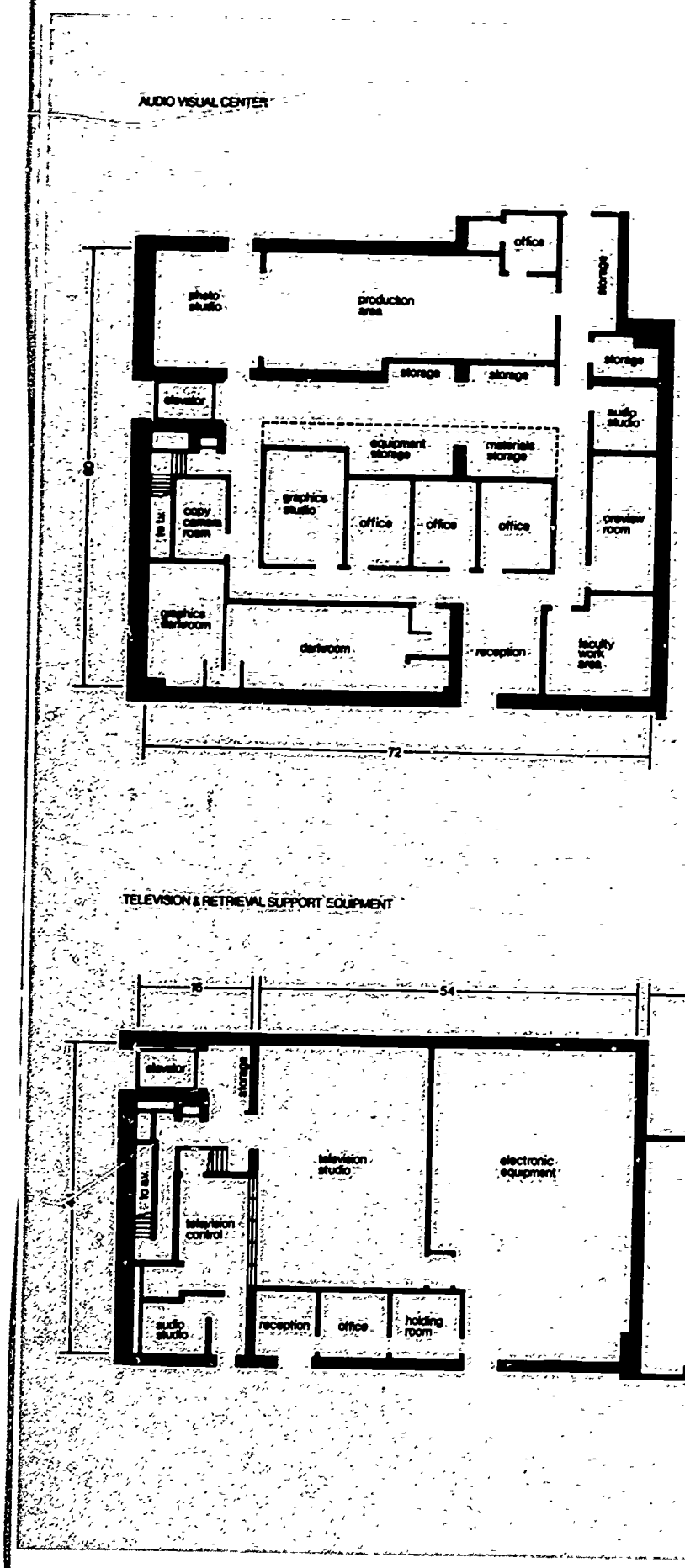
Master programs in the system are stored on 1-inch audio tape in 32 parallel tracks. There are seven program storage units in the stage-one facility, each housing 32 programs, giving the system a present capacity for storing 224 programs at any one time. The tape for each of these seven units is an endless loop housed in a closed bin. Reels are not used for storing and moving this tape. Each tape loop consists of 250 feet of tape in a single continuous piece. When a program request is made from a carrel, the computer selects the correct program track in the correct storage unit. This master program is then connected to the high-speed tape recorder which serves the carrel from which the request has come.

There are 25 of these high-speed tape recorders in the system, one for each of the student carrels. These units do the rapid copying of the master programs and are the playback and recording units for the carrels. The completed program copy is played for the user at a speed of three inches per second, the same speed used when the student records his own voice in conjunction with a system program. These two-track machines use 1/2-inch audio tape also in endless loops housed in closed bins.

From the system control console the operation of the entire retrieval system can be monitored. An intercom system connects each carrel with this unit, enabling the supervisor to provide full assistance for any carrel from the console. By remote control, each carrel can be inspected by the supervisor. The current state of operation for each carrel can be determined, and the control of any unit switched to the master control panel by this same procedure. The computer teletype located on the console logs each program request with the carrel number. Intercom requests are also logged by the teletype, and the teletype bell is used as a call signal for the supervisor. Through the use of a test program which cycles all program sources against all student positions, the teletype can also log out any defective operating paths. With nearly 6,000 such paths now in the system, this function is of obvious importance.

Without the high-speed duplicating process and the computer control, this retrieval system would be just another version of existing remote access systems. It would then be necessary to schedule the program materials and require the students to conform to the schedule, or require all program users to be bound by the directions of the student who happens to be the first to call for a program. With its new process and sophisticated control, this retrieval system provides the first true random access to instructional materials. Each user exercises his individual control over the program material of his choice, and all programs are available to all receiver points at any time.

A feature of the retrieval system which goes beyond the original project definition of stage one is an automatic telephone access capability. Because of the nature of the control equipment in the system, it is possible for any Touch-Tone telephone to be a receiver point for the audio programs in the storage units. No special equipment is required for the standard Touch-Tone telephone, nor are special tariffs imposed on the user. A device called



a Data-Phone date set must be installed in the high school to provide this access, however.

The Data-Phone provides the interface between the Touch-Tone telephone and the computer. The telephone number of the computer is touch-dialed, the computer signals the person making the call that the connection has been made, and the caller then uses the buttons of the telephone to tell the computer which program is required. After a delay of approximately 30 seconds, the desired program is played for the caller.

The retrieval system is being developed in the context of the school's program of library services. The evolution of these services in response to ever-changing needs helped generate the ideas for the concept of the retrieval system. Specifically, the steadily expanding use of audio-visual services within the library program and the development of subject-area resource centers helped to shape the retrieval system plan. In fact, the new technologies and arts of information and communication are basic to the plans for the current expansion of the library.

The new library complex now under construction will consist of several rooms each designed to serve particular functions. Subject-area resource centers, conference rooms, library classrooms, a professional library, special service areas and areas for the carrels of the retrieval system are being provided. Approximately 30,000 square feet will be utilized on two floors. Easy, internal access from one area to another and from one floor to the other is included in the plans.

The control and storage facilities for the retrieval system will be adjacent to the upper floor of the library. An audio recording studio, a television studio and control room, an electronic equipment room for the storage and control devices, and a maintenance area will be in this center. Immediately below the retrieval center and adjacent to the lower floor of the library will be the audio-visual service center. Spaces for the design, production, preview, storage and distribution of audio and visual materials are being provided in this center. The retrieval and audio-visual centers are to be internally connected by a freight elevator, a dumb waiter and a stairway.

The final engineering and the installation of the equipment for the second stage are now

in process. This portion of the project is to be completed during the 1968-69 academic year and consists of four steps. The telephone access will be refined and its service made standard. An improved and expanded audio recording facility will be completed. The initial video service will be added to the retrieval system. An additional fifty student carrels will be installed.

To begin the video service five relatively standard sources will be employed. Three film chains equipped with multiplexers capable of handling slides and motion pictures will be used along with a video tape recorder and a studio camera input. These five sources will be fully integrated into the retrieval system, functioning automatically under the control of the computer. The student will thus gain access to video programs with their own incorporated audio signals and video materials which function in coordination with audio signals stored in the equipment of stage one. This video service will be first supplied to five of the original student carrels.

The design of the fifty additional carrels to be added during stage two and the services which they will provide will be nearly identical to those of the initial 25 carrels. All carrels will be served from a single, central storage and control facility making all system programs available to each carrel. Each carrel will have an intercom connection with this central facility and access to assistance by remote control.

Stage three of the project will be concentrated on the installation of random access video service. This stage will also include providing classroom and conference room receiver points for the retrieval system. These units will enable teachers to use audio and visual materials in the classroom with maximum efficiency and impact. The right material will be available at the right time. A control keyboard and a large video monitor will be the basic components for each classroom receiver point. It will also be in the third stage that the retrieval system will be made a broadcast system capable of sending program material to other schools. Depending on the type of receiver points established, neighboring schools will be able automatically to utilize materials housed in the retrieval system without taking them out of circulation. These services will be available to both public and private schools involving grades K through 16.

When the first stage of the retrieval system began operating in May, 1968, a library of over 700 programs which had been prepared expressly for the system was ready for use. The production of these programs had been accomplished by eighteen members of the Oak Park and River Forest High School faculty during a two-year period. Workshops in the summers of 1966 and 1967 and released-time provisions during the 1966-67 and 1967-68 academic years provided the time necessary for such production efforts. The audio-visual staff of the high school, including a designer added for the project, have created and produced the visual materials which these programs employ. This local production is continuing, and the production staff and facilities are being expanded. At the same time efforts are being made to increase the involvement of educational publishers in the remote-access field. System conferences are being held and cooperative projects devised. Because of the increasing activity in this new technology, it is reasonable to assume the publishers will extend their activities to include these systems.

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