A PROPOSED EQUIPMENT DEVELOPMENT PLAN FOR CLOSED CIRCUIT TELEVISION

AS IT RELATES TO THE EXISTING CURRICULUM

AT COLLEGE OF SOUTHERN UTAH

by

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Don L. Blanchard
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ABSTRACT

A Proposed Equipment Development Plan for Closed Circuit Television as it Relates to the Existing Curriculum at College of Southern Utah

by

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Utah State University, 1968

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Department: Speech

A study of closed circuit television systems was made which could be utilized to supplement conventional teaching methods at College of Southern Utah.

A basic, but complete studio installation for production work and radio-television classroom instruction in addition to four, individual, self-contained installations are recommended for regular classroom use. All equipment is to be compatible and provide for complete interchangeability of tapes within the system.

Present costs of distribution systems indicate that video tapes produced in the classroom, in the field, or in the studio and played back in the classroom would provide better utilization of available funds. It is recommended, however, that all future buildings be cabled with coaxial cable for closed circuit television distribution. This form would be less costly and more versatile than microwave distribution.

Included are recommendations of presently available, commercial equipment that satisfy the indicated needs.

(91 pages)
INTRODUCTION

History

College of Southern Utah had its beginning on March 11, 1897, as Branch Normal School under the administration of the University of Utah. For the first thirteen years B.N.S., as it was then known, was operated as a three year high school institution and in 1910 was authorized to grant the fourth year of high school training. During this period, B.N.S. began having difficulty in obtaining operating funds as it was the only high school in the state being operated on state funds. In an effort to provide for continuance of the school, local lawmakers presented a bill to the 1913 State Legislature requesting that the school administration be transferred to the Agricultural College at Logan (later Utah State University) and give the institution collegiate rank. The transfer was made that year changing the name to Branch Agricultural College with the collegiate courses beginning in 1916 and upper division courses being added in some areas in 1936. In 1948 the school gained four year status in elementary education, and in 1953 the name was again changed and became known as the College of Southern Utah.¹

The next significant change came in 1965, when the Utah State Legislature granted independent status to C.S.U. creating a four year liberal arts college.

During its early years B.N.S. and B.A.C. had rather sporadic growth which began to level off after the war in 1945. Since gaining four year status in 1941, with the exception of the Korean War, the school had an average increase in enrollment of 12.8 per cent per year to the present time. The enrollment for the past year (1966-1967) was 1,951 with an expected fall enrollment for the following year 1,864. The previous fall enrollment was 1,676.2

A number of factors, most of which are related to this growth, fostered an interest at C.S.U. in the feasibility of using closed circuit television to supplement the conventional classroom methods. Most pronounced of these interests are those in the fields of Education, English (Speech), Mathematics, and Biological Science.

Need and justification for such facilities is a recognized fact as indicated in a study by Dr. Morris A. Shirts, Dean of the College of Education.

The number of Student Teaching Stations available to CSU students in the immediate area is becoming limited. The Iron County schools are becoming saturated now as reflected by a growing resistance to changes we make in our program and an increasing difficulty in placing all student teachers in desirable locations. Other than in the St. George and Beaver areas, distances to other public schools are too great for our students to commute daily. We have been sending them to Kanab, Delta, Richfield, Mesquite, and Las Vegas where they have had to establish residence which has been an additional financial burden to the students as well as a conflicting interest to their dormitory space and other academic commitments on the college campus.

The number of student teaching stations is further reduced since we also use the public schools for a pre-student teaching observation/participation experience which has proved to be one of the strong attributes of our program. If we could reduce these, we could increase the number of student teaching stations. We hesitate to do this as it would weaken what is now a high

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quality program. Such a solution would be but a temporary one anyway as increasing enrollments will soon eliminate this alternative as a solution. We have but two alternatives: (1) Limit enrollment, (2) Find some way to extend the number of student teaching stations available. We prefer not to limit the enrollment as a solution.

The technical problems of recording classroom experiences have for the most part been solved. The equipment is available and is of such technical quality that it can be used in the classroom. Several schools have conclusively demonstrated its feasibility. It is possible to record a good teacher at work and replay the video-tape recording for study by prospective teachers. This technique could reduce the amount of pre-student teaching classroom time needed. It is also possible to record a student teacher at work and replay the video-recording for evaluation which could reduce the length of the student teaching experience. Both of these applications might, in effect, make more student teaching stations available.

In another study, conducted by Earl Phillips for the Department of Biological Sciences, the major interest was expressed as a real need for CCTV in providing a wide range of readily available audio-visual media that would enhance the present classroom instruction.

The English department (including the area of speech) has for several years requested television facilities for use in activity type classes as well as to fill an acute need in the area of radio-television training classes. It has gone to the extent of using simulated equipment in an effort to give the students some experience in its use.

Members of the mathematics department have contacted the radio-television committee on several occasions in an effort to obtain and utilize ETV facilities to alleviate a growing condition of teacher overload due to large class numbers. They feel that television teaching could be effective in handling multiple sections of these large classes.

Other expressed interests are on a more limited need basis such as the need for equipment to train electronics students in the technical aspects of television production equipment. All areas of instruction have expressed a desire to utilize ETV in the presentation of audio-visual aids in a more effective and convenient manner.

Recognition of these needs became apparent to the Utah State Legislature, and in 1965 a sum of $50,000 was appropriated to the college for use in educational television. The appropriation was perhaps a little premature in that adequate studies had not been conducted to determine the immediate needs of the school in view of equipment or facilities required. This, however, was soon recognized as an asset in that closed circuit television equipment within the next year and one half took two major declines in cost with major increases in development so that four to five times as much equipment is now available with the same investment.
Purpose of the Study

With expressed needs for educational television facilities and with funds available, a Radio-Television Committee was established at C.S.U. and a concentrated effort to establish CCTV facilities was begun. A number of major questions were immediately encountered by the committee. Most important of these were: (1) What type of system or combination of systems could best serve the interests of the school as a whole? (2) Which of the many commercially available systems would best fulfill the needs of the various departments of the school? (3) Where should these facilities be located for the most effective and convenient use? (4) By what means could the faculty be trained in the use of the media?

The necessity of finding the answers to these questions was apparent, and the committee felt it advantageous to seek the answers within the capabilities of our own staff rather than bring in outside help who would not be familiar with the internal structure of the college and its needs. It was suggested that the author seek the answers to the first and second questions because of his background both in electronics and educational television.

In reference to the third question, the Radio-Television Committee felt it best to leave those decisions to the various departments that would be concerned.

The answer to the fourth question was also to be resolved and will be explained in more detail later in this study.

In summary, the purpose of this study was to: (1) Determine the best system or systems in terms of use, quality, and cost, to be recommended to
the individual departments and the school as a whole, and (2) determine which equipment would be best suited for each departmental system.
Scope and Limitations

In early analysis of the problem an attempt to study the entire program of equipment, facilities, and curriculum use was considered. It was felt, however, that the scope of the total problem was too wide-spread to give adequate consideration to each of the areas concerned and that the curricular use of the equipment could best be determined by the individual departments involved.

The author, having taught electronics at C.S.U. for the past three years, had a particular interest in the technical aspects of the anticipated equipment installation. It was thus decided to limit the scope of the study to the present and immediate future needs with respect to equipment only. Suggested location of these facilities on the C.S.U. campus is not included in this study, because it is felt that this could be best achieved through a separate study.

The study is further limited by the amount of available funds for use in the CCTV installation. This study will attempt to confine immediate recommendations to the presently available $50,000 budget with future recommendations on a priority basis to be obtained as additional funds become available.

Lack of adequate travel funds has also restricted visits to current CCTV installations primarily to those in the state of Utah. Copies of many studies done in all parts of the country, however, were obtained in an effort to gain greater insight into what is being done in all phases of CCTV.
Definition of Terms

To clarify the meanings of certain terms used in the study, the following list of terms and their associated meanings have been incorporated as a part of the study. The definitions, in part, are taken from Robert M. Diamond, *A Guide to Instructional Television.*

**AUDIO CONSOLE**—An audio amplifier used to switch and control the audio levels that are either broadcast or supplied to the video tape recorder. These are used primarily in studio operations and are not necessary for individual camera recorder operations where a single microphone will usually suffice.

**CABLE**—A coaxial cable consists of a center conductor encased in a shielded braid and is used to provide low losses in the transmission of television or radio signals by direct wire.

**CAMERA MONITOR**—A video monitor that is electrically connected to an individual camera so that the camera image may be monitored in the control room. An individual camera monitor may also be connected directly to the camera for use by the person operating the camera.

**CHANNEL**—An assigned operating frequency for an individual television signal in both open circuit and closed circuit television.

**CLOSED CIRCUIT TELEVISION (CCTV)**—The use of television, transmitted from cameras to monitors over cable, or by microwave, thus permitting private reception of the program by the receivers connected to the circuit.

**CONTROL ROOM**—A room adjacent to the studio which houses such equipment as the video tape recorder, switcher/fader, multiplexer and film chain.

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It is here that the director can coordinate all of the resources that are used in producing a program.

**DEFINITION**— The sharpness or detail of a reproduced image. (See Resolution)

**DISTRIBUTION SYSTEMS**— Different methods of conveying the televised signals from the point of origin to a receiver. This is usually accomplished through the use of cable or microwave. V.H.F. channels are seldom used because of their extensive use by the commercial stations which generally make them too crowded to squeeze educational channels in. Recent frequency allocations by the F.C.C. have opened a section in the 2500 MHz area for closed circuit television distribution.

**EDUCATIONAL TELEVISION**— A broad term usually applied to the use of television in presenting programs of educational nature in or out of the classroom and may even be present on a commercial channel.

**EIA (Retma) STANDARDS**— A set of performance standards which form the basis for commercial broadcast equipment—both transmission and reception. The Electronic Industry Association (EIA) was responsible for initiating the standards.

**LINE AMPLIFIER**— An amplifier used to boost the strength of the televised signals to offset the losses encountered in long lengths of coaxial cable.

**MONITOR**— Normally implying a video monitor. These are for the purpose of viewing the televised signal in a classroom, the control room, or the studio itself. When used in classrooms, the audio is usually incorporated into the set and it is sometimes referred to as a receiver.

**MULTIPLEXER**— A system of mirrors or prisms that are arranged in a manner that a single television camera can pick up the images projected from several projectors.
OPEN CIRCUIT TELEVISION- More commonly referred to as broadcast television which requires no closed loops for distribution. Open circuit television may incorporate both ultra high frequency and very high frequency.

PATCH PANEL- A termination point for cables which allows "patching" or interconnection of various pieces of equipment and sources at a common and convenient place.

PORTABLE UNIT- A small, compact, and highly portable closed circuit television system, most often comprising a camera, video tape recorder, and monitor.

SIGNAL MULTIPLEXING- Placing of more than one set of televised signals on a single cable or transmitted signal. This provides for more economical use of distribution systems.

SINGLE ROOM TELEVISION- A teacher-controlled, self-contained television system, basically containing one or two cameras and associated monitors are adequate for the classroom, and may or may not utilize a video tape recorder.

STUDIO- A room designed for use in producing programs in a professional manner, utilizing sets, props, stage type lighting, and production crews.

SWITCHER/FADER- A device used to switch or fade from one camera to another. Some switchers are not capable of providing the fading function, and either function must employ a synchronization generator to provide the proper interlace of the incoming signals.

SYNC GENERATOR- A device used to provide timing pulses used in coordinating all of the incoming and outgoing signals, which prevents momentary loss of the picture when switching from one source to another.
TELECTERN- A lectern employing the use of a television camera as an integral part of the lectern. It is used in viewing objects, pictures, transparencies, and etc. Some newer models provide video switching capabilities at the tellectern allowing the lecturer to control cameras, slides, and films.

TRANSLATOR- An electronic device that receives a television signal on one frequency and re-transmits it on another frequency. They are used to extend the distribution of the signal into areas that are not covered by the primary signal.

TWENTY-FIVE HUNDRED MEGA-HERTZ- (2500 MHz)- A recent allocation by the Federal Communications Commission in the Super High Frequencies for distribution of television signals on a local basis.

ULTRA HIGH FREQUENCY (UHF)- Frequencies from 300 to 3000 MHz and include the television channels from 14 through 83.

VERY HIGH FREQUENCY (VHF)- Frequencies from 30 to 300 MHz and include channels 2 through 13.

VIDEO TAPE RECORDER (VTR)- An instrument capable of recording on magnetic tape both the video and audio presentation and will allow immediate and repeated playback. Recent developments in VTR's are providing color recording on an educational level.

VIDICON CAMERA- The more popular type of camera for educational use in that it is harder to damage than the image orthicon and is less expensive to operate. Their greatest disadvantage is the demand for greater light intensity. The camera takes its name from the vidicon pick-up tube that it employs.

ZOOM LENS- A variable focal-length lens which through a simple lens adjustment will give the effect of moving the camera closer or farther away from the object focused on.
Administrative Considerations in
Closed Circuit Applications

Contained in this section are a number of concepts taken from other studies that will be helpful to administrators in better understanding some of the background and reasoning that is behind the use of ETV for classroom instruction.

One of the important factors in establishing ETV facilities in a school is determination of needs and intended uses of the equipment. Application of these two points as they pertain to C.S.U. will be discussed later; however, as they presently apply to other schools will be helpful in pinpointing more precisely the aims and goals that should be kept in mind at C.S.U.

Related Broadcast Services

The establishment of a campus FM broadcast station in 1966 has paved the way for an expanded program to include educational television in the ensuing years. The administrative and student experience from this operation has been invaluable in providing both programming and technical background that will aid in the establishment of ETV facilities. This procedure is recommended by many authorities in the subject, among whom are Mr. Richard H. Bell, formerly Director of Radio and Television at the University of Colorado in Boulder.

In regard to supporting activities, I believe that a "wired wireless" campus radio station (under academic control) is essential as a radio laboratory, and that closed-circuit television studios must be established. If the institution has any service responsibility to the community, then I would recommend that these be a broadcast FM station, rather than closed-circuit.
For analysis of student work, audio tape recorders and video tape recorders are essential. If TV broadcast is not contemplated, helical-scan VTR's are satisfactory.

Planning for Future Growth

Early attempts to visualize the use and probable expansion of ETV is most often lacking, and one of the major problems encountered is inadequate planning for future growth. Cost is usually the prominent factor which limits proper installation of an adequate ETV system. There is usually an attempt to "get by" for the least possible cost and a maximum of usable equipment. In contrast, it is often best to purchase smaller quantities of greater quality equipment. Difficulties arising in this area are primarily due to the lack of experienced technical personnel in making recommendations and in writing specifications. An effort to eliminate or at least reduce this problem was undertaken in a 1966 meeting of the Western Radio and Television Association where a number of guidelines were resolved for use in administrative planning. This lack of looking toward future expansion was also expressed in this study.

It was also pointed out that when it involves television, educators are often tempted to be only concerned with immediate goals and do not plan their television systems to be upgraded. It was the unanimous decision to recommend that educators purchase equipment better than their immediate needs might indicate wherever possible.6

Financial planning is only the first of the ETV hurdles. An ETV system will not run itself and will be only as good as those using the system make


it. Only where teachers and administrators are willing to sacrifice both time and effort will the establishment and operation of such a program be successful. This is especially true in the first critical test of its performance. Enthusiasm along with innovative spirit will do much to overcome many of the problems that will be encountered, even to the extent of insufficient funds. A number of very successful operations have been established with seemingly impossible budgets.

Through proper planning and scheduling procedures, many hidden savings can be realized that are normally overlooked because of traditional practices. For example, a properly designed ETV system can easily replace several methods of audio-visual presentation, accomplishing the same task with more versatility. At times it will also provide for presentations not possible through any other medium. Other assets of ETV are expressed in William Spahr's report of the Great Falls, Montana, Closed-Circuit Television system.

Another advantage which comes as a by-product of a school closed-circuit system is that of being able to use the distribution system for other audio-visual messages. 16 mm films, slide sequences, film strip presentations, 8 mm single concept films, and audio tape recordings could all be processed through such a distribution system. Teachers would no longer have to battle uncooperative 16 mm projectors, nor would they find it necessary to darken their rooms for films. Not only would this mean that the inventory of such apparatus as motion picture screens, tape-recorders and projectors would be reduced, but upkeep on audio-visual materials and machinery would drop sharply. Damaged film and jammed projectors as a result of careless handling could virtually cease to exist as distribution would come from one central source where trained personnel would operate the equipment. Along this same line, mention should also be made of the fact that a completely automated system would not necessarily require highly skilled operators. In fact, students could be trained to manage the equipment very easily. 7

Another of the important assets of television is the readily available resources from other institutions.

The continued growth of instructional television all over the country is making it mutually advantageous for institutions to pool their resources. The recent foundation of the National Instructional Television Library (now known as "National Center for School and College Television at Bloomington, Indiana), an organization which lists and expedites the sharing of recorded telecourses on a rental basis, is a step in this direction.³

Plans are now underway to obtain the sources of these tapes and distribute lists to the various departments so that they may begin to make plans now to incorporate these resources into their instruction as soon as possible. In addition to educational outlets there are numerous sources of educational materials that are excellent, but are not necessarily academic in nature.

Although many commercial programs are not produced with the student in mind, there are definitely many offerings that have educational value. Many public affairs programs, documentaries, historical plays or movies, and fine arts programs could profitably be used as enrichment material in the classroom providing physical facilities and copyright laws permitted educators to record them and use them at convenient times. Along this same line of reasoning, the possibility of videotaping and replaying special cultural and public affairs programs from local ETV stations must also be considered as a means of enriching the school curriculum offering.⁹

Production and utilization of programs from within the school is also an excellent source of material. These may vary from short supporting concepts to major productions that might even be shared with other schools.

As educational television has evolved, there has developed a specialized kind of TV production intended to be used in classroom situations as an integral part of the overall instructional program. In some instances instructional television becomes or might constitute the total instructional offering in a given subject area. These "instructional television" programs are


⁹Ibid.
typically produced by educators and are designed to harmonize with established curriculum outlines and learning principles. There have come to be a variety of types and formats for these ITV programs. As indicated, some programs constitute the total teaching offering, while other programs are intended to be sources of enrichment material for the classroom teacher to integrate into her coverage of various topics. Some are designed to be supplementary programs wherein a TV teacher works as a team partner with the classroom teacher to the end that competent specialized instruction might be provided in all phases of the curriculum offering. And finally, some productions are supplementary in that they support the classroom teacher's presentation.10

Most schools also have some aspect of their location that is unique and would lend itself very readily to some rather distinctive productions. Examples of these might be geological locations, industrial manufacturing, historical areas, and etc.

Fear of using television by the faculty has been a problem in every institution when starting an ETV program. It is also realized here that if television is not properly presented and adequate training is not incorporated prior to its use that many teachers will have some bad experience with it and refuse to have any more to do with the medium. In one study that was done in Chicago City Junior College, the following was found to work satisfactorily in creating confidence in their teachers.

The teacher's first step is to familiarize himself with the TV medium. To help him do this, we introduced several years ago what has been proved to be an invaluable part of our preparation process. As has already been indicated, each prospective teacher is invited to prepare a five- or six-minute videotaped presentation of any topic he feels he presents especially well. A few minutes after completing this sample lesson—often his television debut—the teacher sits in a conference room, along with members of the TV college staff, to watch a playback. The staff members help him evaluate his performance realistically. For the first time he sees himself as his students see him—with every mannerism of speech, gesture, and body movement

painfully apparent. Most teachers regard this—in retrospect, of course—as the most salutary, even though momentarily shattering, experience of the preparation period. Subsequent trial presentations generally show marked improvement.

In short, before he makes his actual open-circuit debut, the prospective television teacher has had the experience of several trial lessons under studio conditions. He winds up his preparation with a full 45-minute "dress rehearsal" to acquaint himself with the problems of coverage and pacing. 11

Television Teaching

They also found that some teachers could not adapt to television teaching. It should be pointed out that the instruction at Chicago City Junior College is done as actual television teaching and is not used as supplementary in-classroom aids. Their report shows in nearly every phase of their television instruction that TV-in-class is producing as good or better results than conventional methods and that, depending on the exposure to it, many students preferred TV classes.

Thus, the preferences of graduates who had taken fewer than two courses inclined toward conventional classroom instruction. Those of graduates with more than the equivalent of a year's work inclined toward TV.

Most found TV instruction slightly more demanding than conventional instruction. Most stated that they learned as much via TV as they did in Chicago City Junior College classrooms and earned about the same grades. (Those indicating that they had gone on to a university or another school after leaving TV college reported that the grades they made in their advanced courses were the same as their TV grades.) And as might be expected, a majority indicated that they considered televised instruction better organized and more efficiently presented than classroom instruction—an opinion which attests to the virtue of making television teaching a full-time job. 12


12 Ibid, p. 18.
From indications of the C.S.U. faculty there is only one area of instruction that is desirous of using television for the purpose of total television teaching. This is the mathematics department, and their hopes are to utilize this method in relieving teacher work loads through the use of videotaped lectures.

As previously mentioned, many of the faculty do not know the potentials of ETV, indicating an even greater need for the initial installation to be well planned and capable of expansion. The uses of ETV are limited only to the individual imagination. College of Southern Utah may wish to expand in the future to areas of total television teaching. Some advantages of such a program are summarized in the Chicago City Junior College study.

Uses of TV-in-class bring a number of advantages to the Chicago City Junior College campuses. First of all, the TV College permits the skillful teacher to reach many more students than he could under usual circumstances. Second, TV-in-class enables the less developed campuses of the Chicago City Junior College to schedule offerings in areas in which they lack faculty. Third, TV-in-class is an improvement in many respects over the large lecture section that is a fixture on many campuses. Every student "sees" the demonstration or the exhibit, since every student has a front seat. Finally, TV-in-class is an effective way of relieving the overflow of students. Without it many of our students could not take certain courses, or would be forced to delay taking them.13

The fact that many teachers are not aware of its many uses reemphasizes the need to plan for complete ETV flexibility from its onset, encouraging teachers to "broaden their presentations," rather than waiting for each teacher to see specific needs later as he gains more experience.

Lack of experience with the television medium by most faculty will be detrimental to the program, but the facts indicate that television is definitely advantageous when properly used and could easily enhance the subject area.

Undoubtedly, television has a place in the instructional program of the school. What this place will ultimately be is now being determined as school staffs increase their experience with the medium... Through the use of visuals and other techniques unique to television, classroom television provides experiences for Washington County pupils that could not be achieved in any other way.14

Although this study is directed to equipment, brief mention is made here of space requirements. This should be most helpful in planning for future construction. One of the major problems in providing for facilities is that of obtaining adequate space. Usually the determining factor is presently available facilities at the institution. These are usually lacking in both size and convenience. If installation is to be planned in a future structure, the following guideline would be useful in the initial planning stages. Strong consideration might also be given to the numerous advantages of providing adjacent radio facilities.

A total of 2,100 square feet have been allocated in the specifications for radio facilities in the Fine Arts Center as follows: 400 square feet for control rooms for two anticipated studios, Studio A (1200 square feet), Studio B (200 square feet), Record Library and audition room (250 square feet), and Radio Equipment and Storage (100 square feet). (p. 42)

The planning specifications for the Fine Arts Center also include an allocation of 4,300 square feet for an educational television facility. A total of 400 square feet is allocated to control room facilities. (p. 49) Specifications for studio space indicate a total of 2,000 square feet to be used either as one large studio or two smaller studios. (p. 50) An announcer's booth has been allocated 100 square feet with another 600 square feet given for the storage of equipment. (p. 51) Two dressing rooms of 200 square feet each have been prescribed for a total of 400 square feet. (p. 51) An additional 800 square feet have been prescribed for a TV scene shop and for storage of scenery and properties. (p. 52)15

Future planning should also provide for adequate office space adjacent to both facilities. The number of offices would naturally be determined by the staff requirements and organizational structure. The following should provide for a rough guideline in respect to office requirements.

Office space has been specified for the broadcast education program as follows: Radio and Television Director's Office, Radio-TV Office for Booking and General Services and Office for Radio and Television Staff. The office of the Director of Radio and Television is described as follows: "150 square feet, related to TV-Radio studio, and Control areas, to provide space for desk, conference table and chair, seven chairs, and filing cabinets." (p. 41)

The following specifications are given for Radio-TV Booking and General Services Office: "120 square feet, related to Radio-TV Director's Office, space to be used for schedule log of radio-television channels, equipment use, studio reservations, and programming schedule. Facility to be used for stenographic and reception area. (p. 42)"

An effort to save money by reducing space requirements in both of these areas would be one of the first deterrents to future growth and flexibility.

In conclusion, it is pointed out that when an administration is planning for a closed-circuit television installation, a number of factors must be considered, among which are related services, future plans, the type of teaching to be done, space requirements, and location.

\[17\text{ Ibid, pages cited.}\]
METHODS AND PROCEDURES

Design of the Study

In limiting the study to equipment only, the design of the study was greatly simplified. The first step was to obtain literature and as much information as possible on similar studies or installations. This, however, proved to be rather difficult since there were relatively few studies that have been published and are readily available. The studies that were obtained proved to be very useful. Many valuable points of information were obtained from a number of related studies that were not directly related to equipment. Those that are considered beneficial to this study are contained in the following section.

The second step was to determine the needs of the college. This was accomplished by contacting the heads of each department of instruction and through both questionnaire and discussion determining the needs of that department.

The next step was to review the programs of other institutions similar to College of Southern Utah. This, it was felt, would be advantageous in determining the possible problems that might be encountered in the installation at C.S.U. It had been hoped that visits to other institutions could be made, but budget limitations restricted the visits to the immediate vicinity of Utah.
Criteria for Evaluation of the Study

In a study of this nature there is not a single answer as to what is best. A number of variables could easily change needs or availability of equipment. A number of plausible avenues will be explored with the final criteria being based on the following aspects: (1) present needs and intended uses of the facilities, (2) available budget, (3) quality and compatibility of the equipment to a total system, and (4) the availability of both equipment and service to that equipment.

Concerning the needs and uses of ETV facilities at College of Southern Utah, it is difficult to establish firm needs and intended uses because of lack of experience with the medium by most of those who will be involved with its use. The criteria used in this study are based both upon expressed needs by the individual departments and the author's judgment concerning these needs as expressed in interviews with department members. The reason for this approach is to obtain maximum utilization of the facilities. Many of the departments want the facilities at their immediate disposal, but have given little thought to or planning for its effective use. It is believed that the sharing of facilities wherever possible, even though it will require advance scheduling, will result in a more satisfactory operation from the standpoint of cost, space, utilization, and maintenance. After more experience is gained by all concerned, those departments needing additional facilities can then make requests based on their specific needs.

Recommendations and specifications for equipment will be written in so far as possible within the framework of the present ETV budget with recommendations for future expansion as additional funds become available.
Compatibility of equipment in most applications is essential, and even though a small self-contained ETV system is individually satisfactory, it can be the source of real difficulties when it is necessary to couple it into a different system for purposes of duplication or distribution. To permit maximum flexibility of the system, complete compatibility of the entire system will be suggested unless prohibited by cost, size, or quality.

A final consideration is given to availability and particularly to repair service. Suppliers should be able to supply all equipment within a reasonable length of time following notification of bid acceptance. Failure to do so should warrant either penalty or disqualification of the bid. Equipment failures are not only costly, but often crucial in both presentations and productions. The need to maintain equipment in proper operating condition reflects back to the supplier in terms of guaranteed replacement parts that are readily available to the user. Even the best equipment is useless when a single, but vital part is needed. Manufacturers and suppliers should be required to provide written guarantees relating to their equipment service policies.
Survey of Present Needs at C.S.U.

Determining the needs of each department of instruction proved to be more difficult than was anticipated. It was found in contacting department heads concerning their needs that most of them had never worked with ETV, and some were not even remotely aware of its capabilities and uses. Further discussion disclosed, however, that in nearly all departments someone within the department had been acquainted with ETV at some former school and had expressed desires of supplementing their classroom instruction with television. At this point of the study, the author prepared a simplified questionnaire (see Appendix A) covering the possible projected needs of each department. This was then personally delivered to each department head or, in some instances, a representative was appointed by the department head who was more familiar with the departmental needs in ETV. Terminology was explained by this investigator. The meanings of each question were then discussed as were the needs of that department. This was done in an effort to determine the actual needs of the department and to what extent the equipment would be used. This, it was felt, would guard against equipment being requested by a department and then not being utilized effectively. In so far as possible, the questionnaires were completed in the presence of the author, insuring greater reliability.

One oversight in the questionnaire, detected later in the study, was remedied by subsequent discussions with each department head. This was in obtaining an average enrollment for the classes intending to be taught with ETV facilities, which was necessary in determining the number and size of classroom monitors required. Further discussion concerning the results of this survey will be treated in more depth later in the study.
It should be kept in mind that recommendations were to be made on the basis of the discussions with the representative departments as to their need and intended use as well as information obtained from the survey.

In conducting the survey with members of the C.S.U. faculty, one inherent problem was discovered which amounted to a misunderstanding of the uses of educational television. All who were not familiar with the medium were at first very opposed to its installation and use on the campus. This stemmed from the fact that their only concept of its use was to tape recorded lectures for playback to multiple sections of large classes and in obtaining recorded lectures from other institutions. Some were opposed because they did not understand how feedback and direct contact with the student is achieved at other institutions using these methods. Most, however, feared television as a threat to their security as teachers. Members of the Radio-Television Committee attempted to broaden their understanding of instructional television by informing them of the possibilities of applying instructional television to their areas. Members of the Education Department have undertaken as a project a series of instructional demonstrations in the classroom use of television to be presented to the faculty. It was hoped that these presentations would not only dissolve these fears, but give instructors in all areas an insight to the many possibilities that instructional television holds for the person who is willing to put forth a little extra effort and time.
Survey of Existing Programs and Studies

Copies of nearly all reports that were obtained concerning closed-circuit television were lacking in the type of information that was needed for this study. The intent of the study was to find the trends in closed-circuit television installations regarding types of systems and equipment and to seek out those problems that other institutions had experienced in their installations. Nearly all reference to equipment was in terms of block diagrams or sketches illustrating the use being made of the equipment and little mention, if any, of specific equipment. Some equipment manufacturers were able to supply source materials along the equipment lines, but these were directed to the lay person rather than being of a technical nature and were naturally slanted toward their particular equipment. One published study by the Western Radio and Television Association, an unpublished report by Boyd Humphreys, Chief Engineer of Radio-Telvision at Utah State University, a survey report from Brigham Young University, and a number of related articles from Electronics magazines provide the source of most material for this section. Additional information was obtained through visits to the presently active schools of higher education in the state, these being Brigham Young University, University of Utah, and Utah State University. Information obtained from these studies and through these visits will in some instances provide the basis for recommendations in this study.

Administrations should consider, when planning for ETV installations, that operation costs continue each year and budgets must be provided for that purpose. Information relating to cost factors is contained in a 1967 B.Y.U. study, which consisted of a questionnaire sent to seventy-eight
colleges and universities in the intermountain west concerning present installations and future plans for closed-circuit. Forty-four of the institutions replied, but only fourteen were operating CCTV systems, with nine institutions planning installations in the immediate future. It is noteworthy that of the existing operations 18 per cent were operating with a budget of less than $10,000, 27 per cent have budgets of between $10,000 and $25,000, and additional 27 per cent operate between $25,000 and $50,000, and the remaining 27 per cent had budgets of between $50,000 and $100,000. It should be kept in mind that these were operating budgets and did not include initial installation costs.

Regarding production costs, it was found that a 50 minute tele-lecture involved less than $50 at 18 per cent of the institutions, between $50 and $75 at 10 per cent, between $75 and $100 at 36 per cent, and the remaining 36 per cent indicated a cost of over $150 per tele-lecture. These costs are underwritten by the CCTV budget for 50 per cent of the productions, mostly underwritten by the CCTV budget for an additional 42 per cent, and totally underwritten by the departments using the service only 8 per cent of the time. Distribution cost percentages parallel very closely those indicated for production.

Of the distribution systems in use, cable represents 76 per cent, microwave 12 per cent, instructional television fixed service (2500 Mc) 6 per cent, and VTR on location also 6 per cent. It was also interesting to note that all institutions planning new installations intend to use cable distribution.1

Discussions with ETV personnel at each of the three previously mentioned schools indicated that establishment of a central distribution center would be advantageous in the early installation of a system and could provide a basis for future expansion later. This would not only provide a source for distribution of audio-visual materials but a facility for the production of programs and lectures. In most cases the equipment could be functioning in dual capacity, providing better utilization and greater flexibility. Distribution of such materials, on the other hand, is costly. At the present time, there are three main types of distribution being utilized in ETV. These are, (1) open broadcasts, (2) closed-circuit cable systems, and (3) micro-wave distribution. Open broadcast distribution is achieved through regular station broadcasting (educational stations operating on an assigned channel 2-13 and in some cases in the UHF band). These assignments are usually limited to fairly populous areas and are costly both to establish and maintain. Distribution is open to public viewing and is restricted to a single channel with additional channels not likely to be granted.

The need for multi-channel ETV distribution systems is clearly indicated in situations where television is used as a regular adjunct to classroom instruction. While the FCC has honored requests for second ETV channels in several cities, it has recently indicated that it will not continue to do so in the future when the primary use of the proposed station will be the extension of in-school instructional program services. A CCTV center serving a single school could broadcast many programs simultaneously—the only limitation being the nature of the technical installation made. Even a single coaxial cable system could transmit 5 to 6 simultaneous signals.

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The system is not without its disadvantages.

Closed-circuit cable systems have the capability for multi-channel distribution and are being used successfully in many areas of the country. These systems, however, generally tend to be very expensive to operate because of the high cost of leasing the cable facilities when large geographic areas and numbers of schools must be covered.  

The third and most recent distribution system was authorized by the Federal Communications Commission in 1963 and consists of 31 channels organized into seven groups of four alternately spaced six Mc. channels and one group of three channels.

On September 9, 1963, the Commission (FCC) decided on the 2.5 GHz frequencies. It specified a maximum power of 10 watts per channel, with additional power to be authorized only on proof of need. By February of 1966 there had been so many applications for the 31 channels that the Commission proposed new rules to limit the number of channels for a single license to four.

This service is known as Instructional Television Fixed Service (ITFS). One characteristic of this service may be both an advantage and disadvantage at the same time.

In fact, line-of-sight seems to be the secret of 2.5 GHz TV Transmission. If the transmitter antenna does not have line-of-sight to schools even a few blocks away, it is not likely the signal will be received there unless a receiving antenna tower is erected.

During a visit to the University of Utah it was strongly advised to look into the possibility of this 2500 Mc. distribution for the C.S.U. installation providing for four channel assignments with a single license

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4 Browne, p. 12.
6 Sitts, p. 51.
which would be more than adequate for the present school size. This appeared to be a solution to the problem that would be encountered in laying cable for the long, narrow campus. Further study into the matter, however, revealed that costs of using this type of service at least at the present was completely prohibitive. Cost of establishing just a single channel for distribution would consume the entire budget and leave nothing for studio equipment and operation. A typical operation would cost approximately $75,000. (See Appendix B for a complete breakdown of ITFS costs) The 2500 Mc. services must also be licensed by the Federal Communications Commission providing further burden to the school. In comparison, the cost of cabling the six most used classroom buildings at the present time would be approximately $2040. The major costs would be coaxial cable at $1040 (8000 feet at 13 cents per foot) and installation at approximately $1000. This comparison includes cabling to the building only, since the buildings would have to be cabled using either method of distribution. Where great distances (line of sight) are to be covered, the cost of cabling would more than offset the cost of the 2500 Mc. service, with local coverage being most economically achieved through the use of cable. This was also verified in correspondence with Stephen J. Anderson, Assistant Director of CCTV at Brigham Young University (see Appendix C).

General recommendations of all technically qualified persons regarding VTR's was to purchase models using 1 inch tape and utilizing helical scan heads. It was also a suggestion to require EIA standards for all equipment unless cost prohibited such action. It is felt that this is justifiable from a standpoint of quality and interchangeability with other systems, not only within the school, but at other institutions. Present indications are that this will become the standard at nearly all schools. EIA is already
the standard for the broadcasting industry and, even though a 2-inch tape has been the standard for broadcasting, many stations are now capable of using the 1-inch tape. The use of \(\frac{1}{2}\)-inch tape, at least under present engineering standards, is incapable of satisfactory broadcast results.
RESULTS AND ANALYSIS OF DATA

Survey indications revealed that all departments desired the availability of television facilities for implementation into their instructional programs. The fact that television is relatively new to most concerned, combined with the fact that its installation on the campus is imminent, is probably the reason for the numerous responses to ETV facility needs. (See Table 1 on page 33)

All departments concerned expressed desires for having single-room television, indicating that they wanted control of the equipment.

Video tape recorders are desired by each individual department. This approach would reduce immediate pressure to provide for distribution facilities, but be rather costly.

With respect to central distribution, nearly all areas indicated a desire to move in this direction, but at a future date. As indicated in the survey, a central distribution system alone would not satisfy any departments total needs, and only two indicated that they could utilize a system of this type immediately. Each department did, however, indicate an immediate need for studio type facilities to use in producing materials for classroom presentation.

Expressed needs for a telectern could probably be handled in the studio with the possible exception of the biological science department.

All areas plan to utilize programs from channel 7 (KUED Salt Lake City). Microscope facilities can be obtained with the use of an overhead camera on a telectern stand and is desired only by the Biological Sciences.
## Table 1. Summary of CCTV Needs at C.S.U.

<table>
<thead>
<tr>
<th>Department</th>
<th>Single Room Television</th>
<th>Video Tape Recorder</th>
<th>Central Distribution Center Only</th>
<th>Central Dist.</th>
<th>Telecine</th>
<th>Studio Facilities</th>
<th>Utilize Channel 7</th>
<th>Microscope</th>
<th>Portable Units Needed</th>
<th>Days per Week</th>
<th>Average Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biological Science</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>5</td>
<td>15-35</td>
</tr>
<tr>
<td>Social Science</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>4</td>
<td>15-25</td>
</tr>
<tr>
<td>Business</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>4</td>
<td>15-25</td>
</tr>
<tr>
<td>Education</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>5</td>
<td>10-30</td>
</tr>
<tr>
<td>English &amp; Speech</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>4</td>
<td>10-20</td>
</tr>
<tr>
<td>Physical Science</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>5</td>
<td>20-40</td>
</tr>
<tr>
<td>Physical Education</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>5</td>
<td>15-20</td>
</tr>
<tr>
<td>Humanities &amp; Arts</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>5</td>
<td>10-35</td>
</tr>
<tr>
<td>Technical Education</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>5</td>
<td>10-20</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td><strong>9</strong></td>
<td><strong>9</strong></td>
<td><strong>4</strong></td>
<td><strong>0</strong></td>
<td><strong>5</strong></td>
<td><strong>9</strong></td>
<td><strong>9</strong></td>
<td><strong>1</strong></td>
<td><strong>9</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Indications of probable usage of ETV facilities is on the average of four to five days per week. This again is probably an over-estimate in most departments.

Average class size ranges from 10 to 40 students. Larger classes are held on the campus, but use of television under present circumstances probably would not be an advantage in these classes because they are entirely lecture in nature.
Obtaining an accurate indication of current needs at C.S.U. was impossible through questionnaire alone. In judgment of this writer the departments' expressed needs appeared to be greater than the actual needs. This is particularly true in cases where little or no thought had been given to television until information was requested in the survey. Some departments, however, already have plans formulated for using the facilities as soon as they become available. The greatest needs appear to be in the areas of education, speech, biological sciences, and physical science. These were the departments that have done previous planning into the use of television.

In so far as possible, the author attempted to evaluate those needs and where feasible recommends the sharing of some facilities in an effort to obtain greater utilization. Grouping was done by geographical location.

The expressed needs in biological science are for a classroom installation consisting of a VTR, overhead camera, and monitors. Similar needs were expressed by the science department. Needs of both social science, business, technical education, and humanities and arts are at present limited and similar in nature. The needs of English and speech are for complete facilities.

It is felt that sharing of a single facility through scheduling could insure greater utilization and would adequately serve the present needs of both the science and biology departments. A joint facility consisting of a VTR and monitors could be scheduled to satisfy the needs of social science and business. A similar arrangement would satisfy the needs of the humanities and arts department and technical education. It is felt that the needs
of the English and speech departments could best be served through scheduling of the studio facility. The need in the physical education department is primarily for a small, portable unit that can be utilized in video-taping of ball games and sports activities. A camera with monitors and zoom lens is also needed. The education department has unique needs of its own and during the course of this study purchased a separate system which is in operation at this time. At least part of the system was purchased based on the specifications of this report to insure some measure of compatibility between systems.

One additional camera, compatible with all departmental systems, is suggested and should be made available upon request to individual departments having occasional need for a separate camera. This would reduce inventory and still insure availability of a complete system when the need should arise.

A single 23 inch monitor is considered adequate to serve from 25 to 30 students; however, the use of two monitors of this size at each installation is suggested even in smaller classes. This tends to eliminate "grouping" and provides a more balanced atmosphere.

The best receivers in financial terms are usually the 23 inch sets. These models are produced by industry in great quantity and are more subject to discount prices.¹

¹Design for ETV, p. 37.
SUMMARY AND RECOMMENDATIONS INCLUDING
SPECIFICATIONS FOR EQUIPMENT

Summary and Recommendations

By way of summary, the following points have been established in this study and are presented here in the form of a review.

1. There are definite needs for the establishment of a closed-circuit educational television at College of Southern Utah.

2. The need for a studio operation to be incorporated into the closed-circuit system is indicated by all departments at the school.

3. Individual ETV systems are currently needed by the various departments for in-classroom-use. Sharing of these facilities for the present could represent the best, most efficient utilization.

4. Present costs of distribution systems is high and use of tapes produced by the departments individually or at the studio and played on VTR's in the classroom would presently be less expensive than either cable or transmitted signal distribution.

5. Cable distribution is the most economical, convenient form of distribution for the campus and all future buildings should be cabled during construction with present buildings being cabled as the need arises and funds to do so become available.

The following recommendations are based on the findings of the survey and the author's estimation of needs at the college. It appears that current needs are for studio facilities and several individual ETV classroom facilities.
Based on past experience and recommendations of qualified persons in the area of ETV in Utah, the following equipment is recommended as minimum in quantity and quality for a studio operation. In the judgment of the author, lower quality would result in poorer production quality and limit future expansion of the system. It has also been suggested that the studio equipment be bid as a package to insure compatibility, completeness of order, and a more favorable price consideration.

**Recommended Studio Equipment**

- 2 Compact solid state viewfinder type cameras, employing vidicon type pickup tubes
- 2 Camera tripods
- 2 Camera dollies
- 2 Camera cradle heads
- 1 Film camera chain
- 6 Video monitors
- 1 16mm film projector
- 1 Video patch panel
- 6 Video patch plugs
- 6 Video patch cords
- 1 Video distribution amplifier
- 2 Video studio monitors
- 1 Compact solid state camera employing vidicon type pickup tube for overhead pickup
- 2 Lavalier microphones
- 1 Desk microphone
- 1 Set interphone equipment
1- Video switching equipment
2- Variacs for film chain control
1- Audio console
1- Turntable equalizer pre-amp
1- Synchronizing generator
1- Waveform monitor
1- Video tape recorder
1- Processing amplifier
1- Camera control console
1- Slide and film multiplexer
1- Audio tape recorder
3- Single earphone sets
3- Speaker baffles
1- Microphone
3- Speakers
1- Slide projector
1- Turntable
1- Pickup arm
1- Stereo pickup cartridge
1- Audio amplifier

Individual Classroom

Needs in the departmental areas of instruction are different from those of a studio. The individual classroom needs can be met with more compact and less costly equipment.

The following installation is recommended for individual instructional television facilities at College of Southern Utah with placement of equipment
to be made as indicated in the estimation of needs. Compatibility of this
equipment to studio equipment is desirable.

**Recommended Equipment for Departmental Installations**

4- Video tape recorders

2- Cameras with viewfinders

1- Camera for overhead pickup use

3- Zoom lens for above cameras

1- 1000 feet foll RG-59 coaxial cable for interconnection of VTR's, cameras, and monitors

1- Set of connectors necessary for interconnection of all equipment

2- Microphones

8- 23 inch monitors
Recommended Studio Facilities

- Telectern
- Overhead Camera
- Microphone Inputs
- Monitor
- Cameras
- Monitor
- Power, Sync, and Etc.
- Video
- Audio
- Monitors
- Tape
- Turntable
- VTR
- VTR
- Slide
- Multiplexer
- Film
Recommended Departmental Facilities

One unit for Departments of Physical Science and Biological Science.

One unit for Departments of Business and Social Science. Addition of overhead camera to be made later.

One unit for Departments of Humanities and Arts and Technical Education. Overhead camera to be added later.

One VTR, two monitors, and one camera with viewfinder for Physical Education Department.
Specifications

The following specifications for the above recommended equipment are written with the intent of providing College of Southern Utah with a closed-circuit television system that is as modern and up-to-date as the current state of the art permits. They are written with quality and compatibility in mind, providing the school with as trouble-free and convenient a system as possible. It will function compatibly with equipment being utilized by nearly all other institutions in the intermountain area, which will provide for greater flexibility and future use. A similar installation being made at Utah State University provides the source for most of the specifications included here.²

It is intended that these specifications serve as a guide for equipment needs only and that additional information needed in providing for complete bid invitations be included prior to submitting bid invitations to vendors.

It is suggested that "The final responsibility of selecting any piece of electronic equipment should be made by or at least shared with a qualified technical person."³

General Specifications

"Two copies of instruction manuals (including circuit and connection diagrams) shall be provided for each piece of equipment, a replacement parts price catalogue, and any other information necessary for proper operation and maintenance of the system. The instruction books shall include:

a. Installation instructions
b. List of parts and their replacement parts numbers

c. Routine maintenance procedures
d. Indicated test equipment necessary for proper operation and maintenance of the system

A full set of interconnection drawings shall be furnished to include video and remote control connections. The drawings that would normally be used by installation personnel are satisfactory to meet the requirements of this specification.

The equipment supplied shall be designed so that the system can be expanded as desired at a later date with a minimum of obsolescence. This may involve the addition of additional console desks, monitors, remote controls or cameras.

The successful bidder shall provide on a no cost basis technical information to update and modernize the equipment supplied by him as the state of the art dictates.

The successful bidder shall warrant all material and workmanship furnished by him to be free from defects for a period of one year after delivery with the exception of tubes or transistors, for which their standard warranty shall apply. Any materials or workmanship found defective within one year from delivery shall be promptly replaced without cost to College of Southern Utah.

The supplier shall maintain a replacement parts inventory for the normal life of the equipment and in no case less than 10 years. The location of the suppliers parts warehouse and provisions for handling emergency orders shall be included to aid in determining spare parts accessibility.

The supplier shall include all male and female connectors as required on each piece of equipment, a complete set of operating tubes, and transistors, all necessary cables, wiring, blank panels and miscellaneous hardware for a complete system. Supplier shall be responsible for visiting site to determine requirements."4

Studio Equipment

The system described by these specifications shall be a complete and professional quality system capable of producing standard EIA television signals for either broadcast or closed-circuit use. The facilities are to include live studio cameras, film and slide capabilities, a video tape recorder, overhead camera, audio equipment, and video monitoring equipment.

4Humphreys, op. cit.
Vidicon Cameras

General Specifications

1.1 "The basic vidicon studio camera system shall consist of the following:
   a. Transistorized camera with integral 8" viewfinder.
   b. 1" separate mesh vidicon, type 8507 or equivalent, factory installed in the camera.
   c. High quality coated optics zoom lens with 10:1 focal length ratio.
   d. Processor unit consisting of plug-in modules which shall occupy no more than one-half of the space in a 5 1/4" high rack-mounting fram assembly.
   e. Remote control panel which shall provide operational control of the camera from a remote position.
   f. 50' of premium quality neoprene-jacketed camera cable which shall be interchangeable with the camera cable commonly employed in 3" image orthicon and 4 1/2" image orthicon camera systems.

1.2 The studio camera and associated processor unit shall be completely transistorized with the exception of the high voltage rectifier and regulator in the viewfinder.

1.3 Plug-in modular construction shall be employed throughout the camera system, and it shall be possible to interchange modules between cameras of the same type.

1.4 The studio camera chain shall produce stable high quality pictures suitable for television tape recording or broadcast transmission. At least two source-terminated 75 ohm video outputs shall be provided which are in full conformance with EIA/CCIR Standards. Each output shall have switch selectable composite/non-composite capability.

1.5 The video outputs specified in paragraph 1.4 shall be achieved when the camera chain is being driven from an external source of standard EIA/CCIR sync and blanking pulses. This shall produce timing compatibility between the camera covered by these specifications and other studio camera chains of previous design.

1.6 The basic camera shall include a high quality 10:1 (15-150mm) zoom lens with motor-driven zoom and iris functions. The zoom controls shall be built into the camera handle and accessible to the cameraman without moving his hand from the handle.

1.7 Zoom lens focus shall be controlled by a large handwheel located in the customary position on the right side of the camera.
1.8 The studio camera shall include an integral mechanical lens cap which can be controlled from the camera or the remote control position. The lens cap shall, when actuated by the local or remote control switch, prevent any light from being transmitted through the camera lens to the vidicon faceplate. The camera lens shall be automatically "capped" when the camera is turned off.

1.9 The viewfinder shall include a "precision focus" circuit to facilitate the proper setting of the optical and electrical focus controls. The "precision focus" circuit shall be actuated by touching a bar located on the camera handle within the normal reach of an operator's hand.

1.10 The camera lens shall operate through an 80° vertical tilt angle and a 360° horizontal pan angle without the need for an external cradle head or friction head. The viewfinder kinescope screen shall remain fixed in a vertical plane irrespective of the tilt angle of the camera lens. A camera whose viewfinder moves up and down with the camera lens, or which requires an external cradle or friction head, shall not be considered as meeting the intent of these specifications.

1.11 The camera operating controls shall be available on the rear of the camera and also on the remote control panel which may be rack or console mounted. The camera control delegation switch shall be on the rear of the camera.

1.12 The camera shall provide for unrestricted access to the internal modules and components by means of a hinged top cover. A module extender shall be provided to permit full access to both sides of the module while the camera is in operation.

1.13 The rack-mounting processor unit shall utilize plug-in construction. A module extender shall make it possible for components to be accessible for maintenance while the camera chain is in operation.

1.14 The camera shall include jacks and level controls for a 2-circuit transistorized intercom.

Camera Specifications - Electrical

2.1 Video Outputs - at least two 75 ohm source terminated video outputs shall be provided. The video outputs shall be in full conformance with EIA Standard RS-170 or CCIR Standards, and may be composite or noncomposite.

2.2 Video Output Level - With the camera viewing a normal scene with incident illumination of 125-foot candles, the video outputs shall be adjustable to 0.7 volt peak-to-peak non-composite or 1.0 volt peak-to-peak composite.

2.3 Horizontal Resolution - The television camera shall be capable of 850 lines horizontal resolution in the center of the picture and 600 lines
in each corner when viewing a standard EIA resolution chart with a 50mm f/1.5 lens.

2.4 Detail Response - The detail response of the camera, measured with a 50mm f/1.5 lens under normal operating conditions, shall be not less than:

<table>
<thead>
<tr>
<th>TV Lines</th>
<th>Relative Response (Center of Raster)</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>95%</td>
</tr>
<tr>
<td>200</td>
<td>83%</td>
</tr>
<tr>
<td>300</td>
<td>65%</td>
</tr>
<tr>
<td>400</td>
<td>45%</td>
</tr>
<tr>
<td>500</td>
<td>31%</td>
</tr>
<tr>
<td>600</td>
<td>22%</td>
</tr>
<tr>
<td>700</td>
<td>15%</td>
</tr>
</tbody>
</table>

2.5 Gamma Correction - It shall be possible to select a gamma correction ratio of 1.0 or 0.7.

2.6 Aperture Correction - A delay line type phaseless aperture correction circuit shall be provided to enhance black-to-white transitions. The amount of aperture correction shall be adjustable from 0-12 db, and the frequency of maximum aperture boost shall be switchable to either 4MC or 8MC. (Approximate peak frequencies)

2.7 Gray Scale - The camera shall reproduce 10 shades of gray from a standard EIA gray scale chart.

2.8 Signal-to-Noise Ratio - The ratio of peak-to-peak video signal to RMS noise without aperture correction shall be at least 40 db when measured with the camera viewing a standard test chart with 50 foot lambert high-light brightness and using an f/1.5 lens.

2.9 Vidicon focus current shall be regulated to within 1% over the specified temperature and line voltage range.

2.10 Raster Distortion - The sum of all deflection waveform non-linearities plus geometric distortions due to the deflection components shall not cause any point on the raster to be displaced from its true position by more than 2% of picture height.

2.11 Scanning Standards - The television camera shall operate at the standard EIA scanning rate of 525 lines, 60 fields interlaced 2:1, or the CCIR Scanning rate of 625 lines, 50 fields interlaced 2:1.

2.12 Vidicon Beam Alignment - Electro-magnetic beam alignment shall be provided.

2.13 High Peaking - An adjustable high peaking circuit shall be provided to compensate for high frequency losses due to vidicon target and load capacitance.
2.14 Automatic Light Compensation - A dynamic automatic target control circuit shall compensate for a 2,000 to 1 change in scene brightness with less than a 50% change in peak video level. The automatic target control shall respond only to changes in average scene illumination, and shall cover the normal target voltage operating range of the vidicon tube.

2.15 Vidicon Protection Circuit - The vidicon protection circuit shall be entirely automatic so that in the event of vertical and/or horizontal deflection failure, the vidicon beam cannot damage the photosensitive vidicon target surface. This protection circuit shall be solid state.

2.16 Power Requirements - The television camera shall provide specified performance when operated from a power source of 115/230 volts ± 10%, 47-63 cycles. Power consumption shall not exceed 80 watts.

2.17 High Voltage Power Supply - The camera high voltage supply shall be a DC to DC convertor which shall be synchronously driven to operate at a half-horizontal line frequency rate. Zener diode regulators shall be included for maximum stability, and the output voltages shall contain no 60 cycle or 120 cycle hum components.

Viewfinder Specifications - Electrical

3.1 Kinescope - The viewfinder shall utilize an 8" kinescope with bonded faceplate. The kinescope shall produce a highlight intensity of 150 foot-lamberts with no blooming or smearing.

3.2 Horizontal Resolution - The viewfinder shall be capable of 650 lines horizontal resolution.

3.3 The viewfinder kinescope shall have minimum accelerating potential of 12 KV, regulated to within 1%.

3.4 Deflection Linearity - The viewfinder kinescope shall have a deflection linearity of 2%.

3.5 The viewfinder shall include a "precision focus" circuit which can be actuated by touching a bar on the camera handle. This circuit shall not affect the program video outputs.

Mechanical Specifications

4.1 The viewfinder operating controls shall include brightness and contrast.

4.2 The camera operating controls shall include:

*Beam
*Target-Auto/Manual
*Electrical Focus
*Pedestal
*Video Gain
*Lens Cap
*Iris
*Zoom
*Precision Focus
*Lens Focus
*Vidicon Focus
*Delegation Switch

* Available on remote control panel
4.3 The camera shall provide specified performance with up to 1,000 feet of camera cable.

4.4 An integral pan and tilt mechanism shall allow the camera lens to pan through 360° and tilt through an 80° arc. No external cradle head or friction head shall be required.

4.5 The camera shall provide specified performance under the following ambient conditions:

- Temperature: -20°C to 50°C
- Humidity: Up to 95% R.H.
- Altitude: Sea level to 40,000 feet

4.6 The camera shall not exceed:

- Height: 10"
- Weight: 50 lb.
- Width: 12"
- Length: 23"

The processor unit shall not exceed:

- Height: 5 1/4
- Weight: 35 lb.
- Width: 19"
- Length: 16"

Each vidicon camera chain shall also include the following items:

1. Processor and necessary mounting hardware in a 19" equipment rack. (Mounting hardware shall be included with the two vidicon chains to mount the two processors side by side in a 19" rack.)

2. A remote control panel for each camera chain. (NOTE) Remote control cable is not required. Rack mounting adaptors for RCP will not be required since RCP will probably be desk top mounted, all mating connectors for cameras, processors, and RCP shall be included.

3. Each camera chain shall include 50' of standard camera cable, including male and female connectors of the appropriate type to match camera and processor. If a right angle camera cable connector is required on the processor end to stay within a standard rack, this shall be included.

4. Appropriate camera or processor circuitry to enable compatible timing between these cameras and other standard TV studio signals.

**Camera Tripods**

These tripods shall be constructed of aluminum castings and heavy wall tubular steel.
The legs shall be adjustable in length to provide a tripod height of 33" to 55". The legs shall slide in nylon bushings.

A positive locking, hand operated worm gear, elevator drive shall provide an increase above tripod height to an additional 18".

The foot plates shall be rubber faced and self leveling by means of a ball and socket joint.

The tripod shall fold to a compact size for transportation or storage.

Weight shall be minimum.

The tripod shall be designed to mount the cameras as specified in A-1 above, and come complete with all necessary hardware to do so.

The tripod shall be designed to mount on the dollies as specified in A-3 below and come complete with all necessary hardware to do so.

Rated load capability shall be at least 75 lbs.

Camera Dollies

These dollies shall be designed to mount the above mentioned camera tripods.

A sliding clamp shall fasten the tripod foot plate to castor units.

The dolly shall be equipped with oversize neoprene castors of 8" diameter.

The castors shall be provided with adjustable cable guards in addition to brakes and swivel locks.

The dolly load capacity shall be at least 500 pounds.

Height shall be 10" and weight shall be minimum.

The dolly shall fold into a compact package for storage or carrying.

Construction shall be of aluminum and steel.

Camera Cradle Heads

Specifications are listed for these two items should the bidders system require it. Should systems not require it, it should be omitted in bidding.

The camera cradle head shall accommodate all standard monochrome television cameras.
The cradle head shall rock around a constant center of gravity, assuring balance at any tilt angle.

The cradle shall track on phenolic covered ball bearings.

Tilt angles shall be at least $30^\circ$ up and $38^\circ$ down.

Panning action shall be supported by ball bearings. Pan and tilt action shall have lock brakes and also controllable drag.

The top mounting plate shall be adjustable fore and aft to compensate for differences in camera and lens balances, without loosening camera hold down screw. The top mounting plate shall feature a centrally located hold down screw for fastening camera.

A cradle mounted wrench or knob shall be provided to adjust cradle head balance and operate the hold down screw.

The cradle head shall employ an adjustable handle (both in length and position) to facilitate operation of camera on cradle head by cameraman.

The cradle head shall be fastened by a standard tripod by a threaded retaining ring.

Construction shall be of durable aluminum casting and steel.

The cradle head shall be furnished with an operating manual and parts list.

**Cameras with Viewfinders**

This camera shall be solid state with the exception of the vidicon which shall be a 1" type.

Definition shall be at least 500 lines, picture center.

Scanning shall be random interlace, 525 lines per frame, 30 frames per second.

Camera shall feature an automatic light compensator to limit excursions video output with extreme variations in light level.

Camera shall include a viewfinder to facilitate use by cameraman.

Camera shall feature a mechanical focus control on the rear to focus vidicon tube.

Screwdriver controls shall be provided for beam, focus and target.

Camera shall have tapped holes in base for mounting on tripod.

Video output shall be 1.4 volts P-P.
Camera shall be designed to mount standard "C" mount lenses.

Film Camera Chain

Input Power: The input power shall be 115 volts AC, nominal, 47 to 63 cycles, single phase. Power consumption shall be a minimum.

Scanning Rate: 525 lines, 60 fields.

System Electronics: The camera system shall be completely solid state throughout. A complete technical and parts manual shall be furnished.

System Video Responses: Flat within 1 db to 10 mc.

Horizontal Resolution: The camera shall be capable of resolving at least 700 lines in the picture center and at least 550 lines in the corners (all at the same control settings).

Output Signal(s), Composite Video: 1 volt, peak to peak composite, unbalanced 75 ohms, sync negative, source terminated, or .7 volt non-composite, sync level being adjustable from maximum to zero.

Input Signal(s): The camera system shall be capable of being driven by an external standard EIA synchronizing generator, providing standard 2:1 interlace. Since the output of the camera, composite or non-composite, may be made to drive the camera with the appropriate pulses, sync and blanking, etc., so that no delays or shift is discernable in the switching process. The number of input signals shall be a minimum.

Vidicon and Transistors: The camera shall employ a vidicon, transistors and diodes that are of U.S. manufacture, and are easily obtainable.

Controls: All commonly-used controls shall be accessible for adjustment on the outside of the camera without removing the camera cover. An easily removable control panel, containing the most often used operating controls shall be included that can be removed from the camera and located some distance away from the camera if desirable. The following controls should be available on the outside of the camera whether on the removable control panel or camera proper: Beam, target, pedestal, focus, sensitivity, power switch, fuse and power indicating lamp, power connector, and automatic target switch, and manual focus. A remote control panel, separate from above, shall be furnished with the film camera.

Aperture Correction: Phaseless, adjustable, aperture correction shall be provided within the camera. Adjustment shall be 0 to 12db. Peak aperture frequency shall be 5.5 mc.

Gamma Correction: It is desirable to have an adjustable gamma correction provision within the camera. Selection shall be 1.0 to .7 for positive film and 1.0 to 1.4 for negative film.
Gray Scale: The camera shall reproduce 10 full shades of grey from a standard test chart (Gamma ratio 1:0).

Signal to Noise Ratio: Signal to noise ratio shall be at least 38 to 1, peak to peak signal to RMS noise.

High Peaking: The camera shall employ an adjustable high peaking control for optimum compensation.

Sweep Linearity: Sweep linearity shall be within 2 per cent of picture height at any point on raster.

Automatic Light Compensation: The camera shall employ automatic light compensation, or target control with a range of no less than 2,000 to 1 with less than a 50 per cent change in resultant video level. This feature can be switched out of the circuit, allowing manual control of target if desirable.

Environmental: Camera operation shall be satisfactory and within specifications for operation in temperatures from 0°C to +50°C.

Mechanical: The camera case shall be of rugged construction and as dust and moisture proof as possible. Three mounting holes (1/4-20 thread) in the camera base shall allow for variations in lens weights. Camera shall have an easily removable cover or be able to be opened easily for maintenance or inspection. Electronic circuits shall be mounted on easily removable or extendable circuit boards with accessible test points. Camera size and weight shall be a minimum.

Mechanical focus of the vidicon shall be accomplished by an external thumbwheel or focus knob. An optional remote controlled focus motor shall be available. Camera circuitry and cabling shall be designed to accommodate this optional item. The lens shall be attached by insertion into a standard "C" mount ring. (1 inch-32 thread)

Tubes, Transistors, and Connectors: The camera shall come complete with vidicon, all transistors, and all mating plugs.

A module extender shall be provided to enable circuit boards to be examined or serviced.

Switches shall be incorporated on the camera to enable horizontal sweep reversal and video polarity reversal.

This camera shall come equipped with a 25mm, 1" or other suitable lens with a speed of at least f/1.5.

This lens shall be compatible with the multiplexer system, as described elsewhere in these specifications.

Video Monitors

The following specifications shall cover three (3) dual television monitors to be rack mounted in a standard 19" equipment rack.
Size: The dual monitors shall each contain two independent monitors with screen of not less than 8" in size. The assembly shall be designed to mount in a standard 19" equipment rack and occupy not more than 10 1/2" of rack height.

Input Power: The input power shall be 117/234 volts, 50/60 cycles, with a three wire AC cord of at least 6' in length. All performance specifications shall be met while line voltage varies from 105 to 130 volts AC at any rate.

Video Input: A minimum video input (sync negative) of .25 volts, peak to peak, shall produce full contrast on the kinescope screen (approximately 50 volts at kinescope grid). Two UHF type connectors shall provide loop through high impedance bridging video input connections with an internal 75 ohm termination selected by a switch.

Video Response: The frequency response of the video system shall be uniform within 1 db to 10 MC and differential gain shall be less than 5% at full contrast.

Linearity: Kinescope linearity shall be within 2% of picture height at any point.

Sync Input: Each monitor shall have two UHF type connectors to provide high impedance loop through provisions for external synchronization with an external-internal sync switch provided.

Voltage Regulation and Adjustment: Each monitor shall have high and low voltage regulation and the low voltage shall be adjustable by means of a conveniently located control.

Controls: Each monitor shall provide the following easily accessible operating and adjustment controls: brightness, on-off switch, horizontal hold, vertical linearity, vertical hold, contrast, DC restoration switch, focus, vertical feedback, horizontal drive, horizontal frequency, horizontal width, line and high voltage fuses.

Size Reduction: Each monitor shall have provisions for size reduction by means of taps of the horizontal output transformer to provide reduced scanning features.

Circuitry: Solid state rectifiers shall be employed for low voltage rectification.

These monitors shall be Conrac type CNB8/2R, RCA PX-8N Dual or equivalent.

16mm Film Projector

This projector shall be designed to be used with the film camera described above and the multiplexer also described in these specifications.
Amplifier Frequency Responses: 80 to 8,000 cycles within ±1.5db.
Amplifier Signal to noise ratio:
- Optical - 60 db below rated output
- Magnetic - 40 db below rated output
Wow and Flutter: Less than 0.25%
Tube Compliment: 3-12AX7, 3-6AQ5, 2-6x4
Motors (2): Universal (blower) and synchronous (drive)
Exciter Lamp: Prefocused, 6 volt, 1 ampere
Photo cell: Germanium diode

Change over from optical to magnetic sound reproduction shall be accomplished by push button control.

Remote control of projector operating controls shall be possible. A complete remote control panel for controlling two film projectors and one slide projector shall be included. This projector shall be a Bell & Howell type 614 CVBM or equivalent.

Audio Patch Panel and Patch Cords

This audio jack panel shall be designed to mount in a 19" equipment rack. The jack panel shall be no more than 2 1/8" high.

It shall contain 24 pair of jacks and shall provide a means for labeling each pair of jacks.

Each jack shall be designed so that it may be wired for normal closed circuit usage providing continuous paths through the jacks, until a patch cord is inserted to make the external connection.

This patch panel shall be an RCA type MI-11645, trim type 96-02 or equivalent.

Five audio patch cords shall be supplied to use with the above described panel.

They shall be at least two feet long and be of the twin variety to be compatible with the above patch panel and other equipment on campus.

These patch cords shall be RCA Type MI-4652, TRIMM type 840-2X-PP or equivalent.

Video Patch Panel

This patch panel shall be designed to mount in a standard 19" equipment rack, being no more than 3 1/2" in height, and 8 1/2" in depth.

It shall provide 15 pairs of jacks.
The rear of each jack shall be fitted with a female UHF connector so that video cables may be directly attached by means of their male UHF cable connector.

There shall be no soldered connections to work loose.

Each individual jack shall be mounted on a bakelite panel which provides the rear support of the patch panel.

Identification of each circuit shall be accomplished by means of a small cord which can be inserted above the top row of jacks and below the bottom row of jacks in a cord holder or slide.

This video jack panel shall be an RCA type MI-26219 or equivalent providing compatibility with presently installed equipment on campus.

**Video Patch Plugs**

These patch plugs shall be designed to be used with the video patch panel described above.

The patch plugs shall be designed to be inserted vertically in the patch panel connecting the top and bottom jack in a particular pair.

Each patch plug shall feature two built-in pin jacks, for ground and video tests, without interrupting the video path.

These patch plugs shall be RCA type MI-26820 or equivalent.

**Video Patch Cords**

These patch cords shall be designed to be used with the video patch panel described above.

The patch cords shall be designed to connect jack circuits in the patch panel other than vertical pairs.

Each patch cord end shall feature two built-in pin jacks, for ground and video tests, without interrupting the video path.

These patch plugs shall be RCA type MI-26818 or equivalent.

**Video Distribution Amplifier**

This video distribution amplifier shall be completely solid state and be self contained, requiring no other power source other than 110 volt power.

This distribution amplifier shall be designed to mount in a 19" equipment rack and all required mounting hardware required to do so shall be supplied.
Video input level: 0.5-1.0 volt peak to peak

Input impedance: At least 7,000 ohms bridging with loop through provisions.

Gain: Adjustable, -2db to +8db.

Outputs: At least 3, isolated, 1 volt peak to peak.

Sync input: Nominal 4 volts, negative to bridging loop through input. Sync output adjustable from 0 to .4 volt, peak to peak.

Sync drop provision: Provision shall be made for sync drop by means of an internal relay controllable through a control connector.

Control adjustments: Video gain sync gain, high frequency peaking.

Power input: 115/230 volts, 110%, 50-60 cycle.

Size and weight: Minimum.

Isolation between outputs: At least 45db at 3.58 mc.

Frequency response: Uniform to 10mc ± 1db.

Low frequency tilt: Less than 1% square wave.

Differential gain: Less than 1%, 10-90% APL.

Differential Phase: Less than 1°, 10-90% APL.

Internal noise & hum: At least 50db below 1 volt, peak to peak.

This distribution amplifier shall be suitable for color systems.

Mounting and size compatibility shall be provided between this unit and other pieces of equipment in this bid which may be rack mounted, such as switching equipment, etc.

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**Video Studio Monitor**

Size: The monitor shall contain a screen of not less than 23" in size. The monitor shall have a sturdy metal case.

Input power: The input power shall be 117/234 volts, 50/60 cycles, with a three wire AC cord of at least 6' in length. All performance specifications shall be met while line voltage varies from 105 to 130 volts AC at any rate.

Video input: A minimum video input (sync negative) of .25 volts, peak to peak, shall produce full contrast on the kinescope screen.
(approximately 50 volts at kinescope grid). Two UHF type connectors shall provide loop through high impedance bridging video input connections with an interval 75 ohm termination selected by a switch.

Video response: The frequency response of the video system shall be uniform within 1dB to 10MC and differential gain shall be less than 5% at full contrast.

Linearity: Kinescope linearity shall be within 2% of picture height at any point.

Voltage regulation and adjustment: The monitor shall have high and low voltage regulation and the low voltage shall be adjustable by means of a conveniently located control.

Controls: The monitor shall provide the following easily accessible operating and adjustment controls: brightness, on-off switch, horizontal hold, vertical linearity, vertical hold, contrast, focus, vertical feedback, horizontal drive, horizontal frequency, horizontal width, line and high voltage fuses.

Circuitry: Solid state rectifiers shall be employed for low voltage rectification.

This monitor shall be Conrac type EMA23/C. RCA PX-23C or equivalent.

Lavalier Microphones

These microphones shall be designed to wear around the neck and shall be as small and as light as possible.

It shall be non-directional and shall have as broad a frequency response as possible.

Output impedance shall be 30-250 ohms.

Output level (1000 cps) effective (10 dy nex/cm²)

Shall be at least -60 dbm (150 ohms)

Hum pickup (0.001 gauss, 60 cps) shall be -120 dbm max.

Mounting: Lavalier and tie clip holder shall be supplied.

Finish: Dull non-glare finish.

The microphones shall come equipped with a 2 conductor shielded flexible cable of at least 30 feet length.

The microphones shall feature an easily field replaceable cartridge.
The microphones shall be RCA type BK-12A or equivalent.

Desk Microphone

This microphone shall be designed to mount on a desk top by means of a swivel desk stand. This desk stand shall be furnished with the microphone.

The microphone shall be of the pressure type and have the following characteristics:

Effective output level at 1,000 cycles: -52 dbm (10 dynes/cm²).

Frequency response: As broad as possible.

Output impedance: 250 ohms.

Hum pickup: (0.001 gauss, 60 cps) shall be -102 dbm max.

Size and weight: Minimum

Finish: Dull non-glare finish.

The microphone shall come equipped with a 2 conductor, shielded flexible cable of at least 30 ft.

Directional characteristics shall be semi directional when mounted horizontally and non-directional when mounted vertically.

The microphone shall be an RCA type BK-1A or equivalent.

Interphone Equipment

The Interphone System shall include the following items:

2 - Retardation coils, if required for system. RCA Type MI-11737 or equivalent.

2 - Interphone connection units. These units shall be designed to be mounted beneath the desk top to facilitate insertion of earphones. The unit shall be compatible with the earphones described elsewhere in the specifications and the camera system described. The interphone connection units shall be transistorized and shall come complete with mating plugs and connectors. It shall be an RCA Type MI-11784-A or equivalent.

Video Switching System

The switching system shall accommodate 8 composite-noncomposite video inputs.

The switchers shall consist of two 8 input busses, A & B with a fader and lap dissolve amplifier.
A. These specifications call for rack mounted video switching modules, lap dissolve amplifier and their associated mounting hardware, terminating plugs, and power connectors.

College of Southern Utah shall design and fabricate control cables, and mounting hardware for fader assembly and switcher button assembly.

The video switching system characteristics, differential gain and phase, frequency response, etc., shall be suitable for NTSC color operation.

System frequency response shall be 1 db to 8 mc. Low frequency tilt shall be less than 1% for a 60 cycle 50% square wave. Differential gain shall be less than 1%, 10% to 90% APL. Differential phase shall be less than 1%, 10% to 90% APL.

Provision for future expansion and improvement

The system shall be designed so that additional inputs can be added to the composite-noncomposite fader busses, or additional busses be added across the incoming video lines without major modifications to the switcher assembly or assemblies.

Technical description and specifications

The video switching system shall be entirely solid state employing American made transistors and parts.

Power input shall be 110 V. AC 60 cycle. The power supply for the solid state electronics shall be self-contained and require no separate source of power, other than 24 volts DC for relay activation. The system shall be adequately fused and shall consume a minimum of power. All mating power, control, video input and pulse input connectors shall be included.

The switching system shall be designed to be mounted in a standard 19" equipment rack.

The rack mounted switching modules and lap dissolve amplifier shall be capable of being operated remotely from the console by means of a remote switcher panel and multiconductor cable.

The switching modules or busses shall utilize reed relays to switch the video signals. Each relay shall be isolated from its incoming video line by at least one transistor or stage of amplification to eliminate line disturbances. The reed relay operating voltage shall be 24 volts D.C. These reed relays shall exhibit a minimum activation and release time. The input impedance of the switching modules or busses shall be high enough to permit at least 6 modules to bridge a single line without impedance difficulties or performance degradation. Each module or buss shall have loop through capability and connections.

The gain of the composite, non-composite busses shall be unity with provision for minor adjustment in gain.
The frequency response of the non-composite busses shall be at least $\pm .5\,\text{db}$, 60 cps to 8 mc.

Tilt shall be less than 1% with a 60 cps square wave.

Signal to noise ratio shall be at least 60db.

The lap dissolve amplifier shall operate on 110 V AC and require no other voltages than DC control voltages generated within the amplifier, fed out to the fader assembly and back for A-B mixer operation. The amplifier shall have two bridging video inputs to accept signals from the A and B mixer busses. Video input levels shall be 1 volt p-p. The amplifier shall have unity gain into one to two 75 ohm source terminated outputs.

The amplifier frequency response shall be at least $\pm .5\,\text{db}$ to 8 mc. Differential gain shall be less than 1.0% at 3.58 mc, 10% to 90% APL. Input and output isolation shall be at least 40db from 60 cps to 8 mc. Low frequency tilt shall be minimum.

Complete information shall be furnished as to type of fader assembly required for correct operation. This should include resistances of the fader pots and other necessary circuit details.

All modules or assemblies of the switching system shall be easily removable for inspection or maintenance.

All gain controls for video and SYNC, as well as all other normally used controls, shall be readily accessible from the front panel.

Front panel test points shall also be available for test purposes.

Transistors, connectors, cables and hardware

The successful bidder shall include all male and female connectors as required on each piece of equipment, a complete set of transistors (in place), all necessary coax cables to tie all busses as shown in the accompanying diagram, and all necessary termination plugs to terminate the 8 video input lines. All rack mounting shelves, module adaptors, fastening hardware or other materials necessary to mount the specified equipment in a 19" rack shall be included. The number of mounting shelves shall be correlated with that necessary for the video distribution amplifier specified elsewhere in this bid.

This switcher system shall contain the following basic components:

A. Switcher modules for A & B busses, 8 inputs.

B. Lap dissolve amplifier.

C. Fader assembly with pots, and switch contacts for tally, etc.

D. Connecting cables and terminations for the switching modules. (Note - connecting cables from the fader and mechanical switcher are not required since they will be fabricated by College of Southern Utah)
E. 2 x 8 mechanically interlocked push button switches. These shall feature rear illumination and contacts for tally, audio switching, and video switching.

F. Rack mounting frames for above.

Variacs

These variacs shall be designed to mount in the console desk as described above.

They will be used to control the lamp voltages on the 16 mm film projector and the 35 mm slide projector as described above.

They shall have the appropriate current carrying capacity to permit full lamp brilliance without over-heating of the variacs.

Screw terminals shall be provided on the variacs to allow a connection for remote cables to projectors.

These variacs shall be RCA type MI-26646 or equivalent.

Audio Console

The audio console covered by these specifications shall be designed so that it can be partially mounted in a 19" equipment rack. The major portion of the console shall be desk-top mounted with the rear portion extending into a single 19" standard equipment rack.

The console shall have a large easily readable VU meter.

The console shall be completely solid state employing easily obtainable transistors.

Input to the mixers shall be by means of push buttons. The console shall be capable of remote control by providing source switching by self contained relays.

The console shall have a built-in intercom system for communicating with several stations.

The console electrical characteristics shall be as follows:

Mixers -- 4 mono

Inputs -- Low level (microphones -- 6
          High level -- 14 (7 to each of 2 mixers)

Outputs -- Program -- 1
          Audition -- 1
          Monitor speaker relays -- 2
Source Impedances -- Microphones -- 37.5/150/600
Turntables/tape/remote -- -10 dbm

Maximum gain -- 105 db

Frequency response -- 1.5 db 30-15,000 cps

Distortion -- Program Channel -- less than .5% 50-15,000 cps
less than .75% 30 cps
Monitor amplifier -- less than 1% 50-15,000 cps

Signal to noise ratio -- 68 db

Dimensions -- 19 1/2" wide, 12 1/2" high, 24" deep

The console shall contain all necessary power supplies, preamplifiers, program amplifiers, monitor amplifiers, cue amplifiers, console housing, high level isolation unit, etc. to provide a complete audio console system.

This audio console shall be an RCA type BC-9A or equivalent.

Turntable Equalizer Pre-amps

This equalizer pre-amp shall be designed to operate with the above described turntable and pickup.

It shall be completely solid state and shall be physically small as possible.

Input power shall be 110 volts AC, 60 cycle.

It shall be designed to meet NAB/R1AA equalizing curves.

A convenient terminal board shall be mounted on the equalizer pre-amp, for input and output connections.

The controls shall be located on the unit which shall extend through the table top. A three position filter switch, providing normal equalization, high frequency de-emphasis and high frequency cut-off. The second switch shall select either of two tone arm inputs to the pre-amp.

A variable gain control shall be available to adjust gain.

Output impedance shall be 150 ohms and 600 ohms.

Frequency response shall be ± .5 db 20 to 20,000 cps in the flat position.

Hum and noise shall be -78 db (30 to 15,000 cps).

Input impedance shall be 24,000 ohms shunted by approximately 100 pf.

Output level shall be -20 VU (average record).
Distortion at -20 dbm output level shall be less than 1 per cent inter-modulation, 40/4000 cps and less than .25 per cent harmonic from 30 to 15,000 cps.

These equalizer pre-amps shall be RCA type BA-26B, MI-11436-B or equivalent.

**ADDITIONAL EQUIPMENT**

The following pieces of equipment shall be bid for on an individual basis since many are single source items from various manufacturers.

**Synchronizing Generator**

The synchronizing generator shall be utilized to provide EIA synchronizing pulses for a monochrome television system. The synchronizing generator shall meet performance specifications in accordance with EIA standards, RS-170.

The generator shall be completely solid state and be physically as small as possible and consume a minimum of power.

**Technical Description:**

Input power: The input power requirements shall be 110 volts AC, 60 cycle, single phase.

Power supply: The generator shall have a self contained, well regulated power supply to minimize effect of line voltage variations.

Operating temperature range: The generator shall be capable of operating within EIA specifications within the nominal temperature range of 15°C to 55°C.

Frequency control: Provision shall be made by means of a front panel switch to control the frequency of the master oscillator in any one of the following modes, 60 cycle line lock, crystal control, free running, and external control.

Output signals: Four output pulse signals shall be available, composite sync, mixed blanking, horizontal drive, and vertical drive. These signals shall be available at four UHF (SO-239) type receptacles, as well as at four test points on the front panel for monitoring purposes. Output voltage for each output shall be 4.0 volts nominal into a 75 ohm resistive termination. The rise and decay times of all pulse outputs shall be within EIA specifications.

Circuitry and components: All transistors shall be silicon. All components shall be of American manufacture and conservatively rated for long term performance. Circuitry shall be easily accessible for service while in operation.
Operating stability: Lock in range shall be at least $\pm 4\%$ and hold in range shall be at least $\pm 4\%$.

Normal operation: The generator shall be furnished to operate on commercial 525 line standards, but shall be capable of operating on other military and industrial standards with factory modifications.

Front panel controls: Front panel controls shall consist of power switch, power indicating lamp, operating mode switch, master oscillator frequency adjustment, and other controls necessary to adjust the generator for correct timing and pulse widths. Front panel test points shall also be available for ease of adjustment.

Mounting: The synchronizing generator shall be capable of being mounted in a standard 19" equipment rack with furnished mounting hardware.

This generator shall be a GRASS VALLEY, type 750-1 or equivalent.

Wave Form Monitor

The television waveform monitor covered by these specifications shall be designed to mount in a standard 19" equipment rack. The height shall be 5 1/4" and the depth shall be 20".

It shall be designed for 525 line, 30 frame television standards.

It shall be air cooled (convection) and contain a minimum number of transistors and tubes.

The electrical characteristics shall be as follows: Two unbalanced coaxial inputs, (video), shall be available for 75 ohm terminated input or bridging input. Four video response characteristics shall be available, selectable by a switch, high pass, low pass, IEEE, and flat. Frequency response in the flat position shall be $\pm 3\%$ to 8 Mc. Low frequency tilt shall be less than 1% on 60 cps window. Differential gain and multiburst axis shift shall be 1% or less. Switchable DC restoration shall be available. Restoration shall be keyed back porch type or Sync tip with minor modification. Gain stability shall be $+1\%$ over rated line voltage and ambient temperature ranges. 0° C to +50° C. The waveform monitor shall contain two calibrated sweep rates, 0.250H/cm and 0.125H/cm. A magnifier for all sweep rates shall be available to provide X5 and X25 expansion. The waveform monitor shall be capable of being used with color cameras YRGB and RBG displays. A variable line selector shall permit detailed study of any portion of any desired line(s), including VIT signals. A video output amplifier shall supply video and a brightening pulse to the associated picture monitor, intensifying the same line, or lines, displayed on the instrument when using the line selector. A field selector switch shall be provided to display one or two fields.Triggering shall be on composite video signals. Internal: 200 mv to 1 volt or more, pk-to-pk.
External: 250 mv to 1 volt or more, pk-to-pk. A built in calibrator shall be included that furnishes two calibrated voltages, 0.714 v and 1.00 v on the 1 volt full-scale range of the vertical gain switch. This internal calibration signal shall have an amplitude stability of 1% over ambient temperature range and line voltage range. A coaxial connector shall be provided to provide an input for an external calibration signal if desired. The waveform monitor shall contain a regulated power supply and shall operate on 115 volts or 230 volts, 60 cycle. The waveform monitor shall contain a 5" flat faced, rectangular crt, operating at 5.5 kv accelerating potential. The calibrated viewing area shall be 6 X 10 cm. Scale illumination shall be provided by variable edge lighting.

THE ABOVE DESCRIBED WAVEFORM MONITOR SHALL BE A TEKTRONIX TYPE RM 529 OR EQUIVALENT.

Video Tape Recorder

The television tape recorder covered by these specifications shall be completely broadcast compatible and within the U.S.A. FCC standards of Good Engineering Practice, 111, A, 3687a(8).

The video tape recorder shall come complete with an electronic editor, and slow motion provision which shall allow variable speed from half speed to stop. It shall be capable of 5 hours of recording time.

Specifications:

Controls: Record, playback, fast forward, fast rewind, stop, video level, audio levels.

Tape counter: Provides reference for locating any desired segment on tape.

Dimensions: Length, 29 7/8"; depth, 17 3/8"; height, 14 5/8". Weight, 100 lb.

Power: 400 watts.

Voltage: 105/130 volts without adjustment. 200/250 volts after change of a single transformer tap.

Tape speed: 3.7" per second.

Maximum playback time: Up to five hours.

Maximum reel size: 12 1/2" (10 1/2", 8", and 6" reels available)

Rewind time: 80 seconds for full 8" reel.

Still frame: Dependent on tape used.
Video

Frequency response: $\pm 3$db, 10 cycles to 3 megacycles.

Signal-to-Noise ratio: 40 db or better on interchanged tapes, peak-to-peak video to RMS noise.

Input: 75 ohms unbalanced, terminated internally. Composite signal, sync negative. Either standard EIA or industrial sync, interlaced or non-interlaced may be used. Any number of scanning lines at 60 fields/second can be accommodated. Video input in adjustable. Minimum input level is 0.5 volts of peak-to-peak composite video.

Output: 75 ohms unbalanced, 1 volt $\pm 10\%$ peak-to-peak composite.


Audio

Frequency response: $\pm 3$ db from 50 cps to 9 Kc.

Signal-to-Noise ratio: 45 cb below 3% distortion level at 400 cps.

Inputs: (2) 600 ohms unbalanced line at -10 dbm minimum. Terminated internally. Microphone inputs, nominal 1/2 millivolt across 50,000 ohms (typical high impedance microphone).

Output: 600 ohms, balanced or unbalanced, at +8 dbm nominal, +16 dbm maximum.

Recording medium: 2" wide Ampex Video Tape, Series 145.

This recorder shall include a metal take-up reel, four matching audio plugs, a spare set of recording heads, and a complete technical instruction manual for the recorder as well as the electronic editor.

This recorder shall be an AMPEX VR-660B or equivalent.

Processing Amplifier

This processing amplifier shall be an accessory to the above described video tape recorder.

It shall accept the video output of the tape recorder, process the video signal, cleaning up the synchronizing pulse.

The processor shall have a built-in distribution amplifier providing at least three isolated video outputs.
The processor shall be mounted inside of the video tape recorder without major modifications and shall obtain all necessary power from within the recorder.

The processor shall not degrade the video output characteristics of the video tape recorder.

This unit shall be a plug-in unit and be designed to be installed as a field installation.

**Video Recording Tape**

The six rolls of video tape shall be designed specifically for helical scan recording with the above described tape recorder.

The tape shall be pre-burnished to eliminate tape break in and allow extended stop motion.

The tape length shall be 1200' per reel providing 64 minutes of recording time on the above specified recorder.

The reels shall be 8" in diameter and feature metal flanges.

**Specifications:**

- **Video signal-to-noise ratio:** 42 db minimum
- **Video frequency response:** 3.5 MHz
- **Audio signal-to-noise ratio:** 46 db minimum
- **Audio frequency response:** 12 KHz
- **Stop-motion operation:** 5 minutes minimum
- **Base film:** 1.0 mil polyester
- **Tape width:** 2.000 +0, -0.004.
- **Reel:** Precision aluminum
- **Box:** Rub supported Book Box
- **Operating environment:**
  - **Temperature:** +30°F to 110°F
  - **Humidity:** 25% RH to 95% RH
- **Erasure with 1000 Oersted field:** Better than 60 db.

This tape shall be Ampex type 142-96TCIC or equivalent.
Camera Control Console

The control console shall consist of 3 desk sections, each capable of mounting standard 19" rack equipment.

The three section console shall have a writing desk across the full length and shall be at least 18" deep from the front of the console.

The three sections of the console with the addition of the writing desk shall be designed to be bolted together to form one complete unit.

The overall height of the console shall be minimum.

21" of rack mounting space will be needed above the writing desk top.

The writing desk top shall be designed to be securely fastened to the console sections.

The console desk shall consist of the following EMCOR parts or equivalents:

3 - FR-24A frames.
1 - OPT-30W-22 one piece writing top.
3 - PN-17PA perforated top closure panels for FR-24A frames.
3 - PN-43 plain rear closure panels for FR-24A frames.
3 - PN-15 plain front closure panels for FR-24A frames.

All assembly hardware for the above console shall be included.

Slide and Film Multiplexer

This multiplexer shall be designed to accept three inputs, 1-35mm slide projector and 2-16mm film projectors.

Mounting provisions shall be provided to mount a 35mm slide projector as bid in these specifications and a film camera as bid.

The multiplexer shall utilize high quality prisms for the multiplex operation instead of hinged mirrors to allow superimpositions of slide over film.

A high quality field lens shall also be furnished if required by the system.

The multiplexer shall be designed for control and camera cable access for these units mounted on it.
The multiplexer shall come complete with mounting instructions for commonly used projectors and film cameras.

The multiplexer shall be constructed to minimize entry of dust, dirt, and extraneous light.

The weight shall be minimum.

The multiplexer shall be constructed of rigid material to minimize mechanical movement of the multiplexer proper.

The multiplexer shall be designed with mounting holes to allow mounting on floor or pedestal.

This shall be an RCA Type TP-11C, D, or equivalent.

(Alternate for Above Item)

Used slide and film multiplexer.

This item shall be a used multiplexer with the same characteristics as the one described above.

The multiplexer shall be in excellent condition and shall be complete with all parts, i.e. prism, field lens, light hood, etc.

This used multiplexer shall be an RCA, type TP, 11C, D, or equivalent.

Audio Tape Recorder

Power input: The tape recorder shall operate from a standard 110 volt, 60 cycle power source.

Operating speed: The tape recorder shall be a dual speed recorder, capable of operation at either 3 3/4 IPS or 7 1/2 IPS. This speed selection shall be accomplished by operation of a single lever or switch located on the front panel.

Mounting: The tape recorder shall be capable of being mounted directly in a standard 19" equipment rack.

Tape reel capacity: The tape recorder shall be capable of utilizing tape reels of at least 7" in diameter.

Remote control: The tape recorder shall be capable of optional remote control operation. A receptacle located on the rear of the recorder shall accommodate the remote control wiring.

Audio inputs: The tape recorder shall have two separate inputs, microphone and line.
Audio output: A balanced 600 ohm output shall be provided with a level of approximately +4dbm at 0 VU.

Front panel controls: All important and commonly used controls such as input level, bias, output level, record, playback, rewind, and record equalization controls shall be easily accessible from the front.

VU Meter: A large easily readable VU meter shall be located on the front panel for level monitoring.

Recording and Cueing Operations: The recording operation shall be a one hand operation. However, provision shall be made to prevent accidental erasure during a playback operation. Means shall be provided to lift tape from heads during rewind operations. Tape in the vicinity of the heads shall be easily accessible to facilitate tape editing.

Frequency response: The frequency response of the tape recorder shall be within ± 2db from 40 to 12,000 cps at 7 1/2" per second.

Signal to noise: The tape recorder shall have a signal to noise ratio of at least 60 db.

Flutter and wow: The tape recorder flutter and wow shall not exceed .18% rms at 7 1/2 IPS.

Stereo operation: The tape recorder shall be equipped for monaural, full track operation. If at a later date stereo operation should be desired, the tape recorder shall be capable of being converted by the addition of electronics and additional recording, playback heads. This conversion shall not increase the size of the recorder.

Start stop and rewind controls: The start, stop, and rewind controls shall be push buttons, operating solenoid relays.

Size and weight: The size and weight of the tape recorder shall be a minimum.

This recorder shall be an AMPEX PR-10 or equivalent. (96001-090), Unmounted.

Single Earphone Headsets

These headsets shall be designed to be compatible with the camera and interphone equipment specified above.

The headsets shall be designed for rugged use with a minimum of exposed wires at the headset proper.

These headsets shall be RCA type MI-11743, WESTERN ELECTRIC type 53AW without plugs or equivalent.
Speaker Baffles

These baffles shall be designed to be wall mounted and shall accommodate speakers of 12" in diameter.

They shall be of hardwood construction and shall feature an attractive grill facing.

These baffles shall be an ARGOS, Type PE-12 or equivalent.

Microphone

This microphone shall be designed to use for studio talk back purposes.

It shall have a push-to-talk switch which is line shorting and also designed to actuate a relay.

It shall have attached a flexarm of at least 16" in length with a mounting flange attached at the end.

Microphone and control cable shall extend at least 4 feet from mounting flange.

This microphone shall be a TURNER Type SR-58 5D or equivalent.

Speakers

These speakers shall be high quality units designed to mount in the above described baffles, (12") Impedance shall be 8 ohms.

The speakers shall have as wide a frequency response as possible.

The speakers shall be QUAM, type 12C10PAX or equivalent.

Slide Projector

This new slide projector shall be designed to mount on and operate on the multiplexer bid on above.

It shall have a slide capacity of at least 36 slides in two drums, right and left.

Slide sequence shall be controllable from a local or remote position.

Remote and local functions shall include lamp on and off, slide advance, slide reverse, and right or left hold.

Slide change shall be accomplished by means of a momentary contact push button switch located at both positions, remote and local.

Slide change, alternating from one drum to the other, shall be instantaneous, eliminating fades to black during change.
Provision shall be made to control the projection lamp with a remotely located variac described elsewhere in these specifications.

The projector shall have a built-in spare lamp to provide instant changeover should the main lamp fail.

This projector shall be designed for TV use -- either color or monochrome.

A remote control panel shall be furnished with the projector which shall permit all remote functions of the projector.

This projector shall include a high-quality projection lens such as a 7 1/2" or 9" variety to make it compatible with the above bid multiplexer and film camera.

Remote control cable is not requested in this bid.

This new slide projector shall be a new RCA TP-7A or equivalent.

Alternate for Above Slide Projector

This shall be a used slide projector with the same characteristics as the one described above.

The slide projector shall be in excellent condition and shall be complete with all parts, i.e. remote control panel, control box, lens, etc.

This used slide projector shall be an RCA type TP or equivalent.

Turntables

These turntables shall be designed for heavy-duty commercial broadcast use.

These turntables shall be capable of operating at 33 1/3 rpm, 45 epm, and 78 rpm, selectable by a front mounted gear shift lever. A neutral position shall free the turntable for easy cueing. On-off operation shall be accomplished by a long-life silent-operating switch. A 25,000 hour high brightness pilot light shall indicate when the unit is on.

The turntable shall utilize only 3 rotating parts, and shall have a heavy-duty synchronous Bodin motor with vertical ball thrust bearing.

The turntable shall be in an off-center position to allow mounting space for the pickup arm and rest. The turntable shall come up to full speed in 1/16 revolution at 33 1/3 rpm.

These turntables shall be QRK Model 12/C or equivalent.
Pickup Arms

These pickup arms shall be designed to mount on the above described turntables. They shall be complete with stereo wiring connections and arm rests.

The cartridge shell shall accept all standard stereophonic or monophonic cartridges. Tracking error shall be under 1°.

Construction shall be of tubular aluminum die-casting cartridge shell. Horizontal movement shall be achieved by ball-bearing action. Resonance shall be below 12 cycles.

Vertical height shall be adjustable to permit setting tone arm parallel to record surface.

Adjustable dynamic balance shall be provided to balance arms with any cartridge.

The arms shall track at one gram or less.

Complete mounting instructions shall be provided with each pickup arm. These arms shall be REK-O-KUT type S-320 or equivalent.

Stereo Pickup Cartridges

These cartridges shall be designed to mount in the above described arms. They shall have 4 output terminals, and come with 3 terminal adaptors. Channel separation shall be over 20 db.

Frequency response shall be 20 to 20,000 cps.

Output voltage shall be 4 mv per channel at 1000 cps.

Recommended load impedance shall be 47,000 ohms.

Compliance shall be 9.0 x 10^-6 cent. per dyne, vertical and lateral.

Tracking force shall be 2 grams optimum (2 1/2 maximum).

Inductance shall be 420 millihenrys; D.C. resistance shall be 280 ohms.

These cartridges shall include a 0.0007 stereo stylus.

These cartridge and stylus assemblies shall be SHURE, type M7/N21D or equivalent.
Audio Amplifier

This audio amplifier shall be completely solid state, shall have a small size and consume a minimum of power.

Power input shall be 110 V AC 60 cycles.

Power output shall be 8 to 10 watts RMS at 1000 cps.

Hum and noise shall be at least -55db below rated output for microphone input and at least -70 db below rated output for the program channel.

Input and output connections shall be by means of a terminal strip on the rear of the amplifier.

Distortion shall be less than 1 per cent from 50 to 15,000 cycles at 1 watt, and less than 2 per cent from 50 to 15,000 cycles at rated output.

Controls shall be power off-on switch, tone control, program gain, and microphone gain.

Input connections and transformer shall be provided for high and low impedance mike inputs, high impedance and balance line input.

This amplifier shall be an RCA type SA-115, MI-38480, McMartin LT-80 or equivalent.

DEPARTMENTAL EQUIPMENT

Video Tape Recorder

These video recorders shall be a helical scan variety utilizing 1" wide tape. Tapes made on this recorder shall be capable of being played on other Ampex video tape recorders such as VR-6000, VR-7000, VR-5000, and VR-7800.

This recorder shall come in a portable carrying case weighting approximately 65 pounds.

This recorder shall be an Ampex Type VR-5000 or equivalent.

Cameras with Viewfinders

These cameras shall be solid state with the exception of the vidicon which shall be a 1" type.

Definition shall be at least 500 lines, picture center.

Scanning shall be random interlace, 525 lines per frame, 30 frames per second.
Camera shall feature an automatic light compensator to limit excursions video output with extreme variations in light level.

Camera shall include a viewfinder to facilitate use by cameramen.

Camera shall feature a mechanical focus control on the rear to focus vidicon tube.

Screwdriver controls shall be provided for beam, focus and target.

Video output shall be 1.4 volts P-P.

Camera shall be designed to mount standard "C" mount lenses.

Overhead Camera

This camera shall employ all specifications as listed for the above cameras with exception of the viewfinder.

Power input shall be 117 volts (nominal) 60 Hz.

Power consumption shall be a minimum.

Camera shall be a Concord type TCM-20 or equivalent.

Zoom Lens

These lenses shall feature a "C" mount fixture. Zoom range shall be 15mm to 150mm. Speed shall be F2.8. Zoom action shall be accomplished by means of a hand crank on the barrel.

These lenses shall be Angenieux type 10 x 15 or equivalent.

Microphone

These microphones shall be low impedance lavelier type with approximately 25-30' of cable.

The microphone shall come with a neck strap and compatible connector to mate with the audio mixer.

Monitor

These monitors shall be an all band receiver which shall be convertible by means of a switch to accommodate a loop through video feed. It shall feature a 23" picture tube.

It shall be an RCA type JH216B or equivalent."^5

[^5]: Ibid.
LITERATURE CITED

Brigham Young University, Department of Communications. 1966. Survey on CCTV. Provo, Utah. p. 1-3.


APPENDIX A

College of Southern Utah Closed Circuit Television Survey
DEPARTMENT _____________________________________________________________

LOCATION ON CAMPUS ____________________________________________________

COMPLETED BY _____________________________ TITLE _________________________

1. WHY DO YOU FEEL THERE IS A NEED FOR CLOSED CIRCUIT TELEVISION IN
   YOUR AREA? ____________________________________________________________

2. FOR WHAT PURPOSES DO YOU INTEND TO USE THE FACILITIES?_____________
   _______________________________________________________________________

3. IS YOUR NEED FOR A SINGLE ROOM TELEVISION SYSTEM? YES( ) NO( )

4. IS THERE NEED FOR A VIDEO TAPE RECORDER? YES( ) NO( )

5. WILL MONITORS FROM A CENTRAL DISTRIBUTION CENTER
   BE NEEDED? (NECESSARY FOR FILM AND SLIDE USE) YES( ) NO( )

6. WOULD THESE MONITORS ALONE SATISFY THE NEEDS OF
   YOUR DEPARTMENT? YES( ) NO( )

7. IS THERE NEED FOR A TELECTERN? YES( ) NO( )

8. ARE STUDIO FACILITIES FOR PRODUCTION WORK NEEDED? YES( ) NO( )

9. DO YOU PLAN TO MAKE USE OF THE EDUCATIONAL CHANNEL
   SEVEN FROM THE UNIVERSITY OF UTAH IN YOUR CLASSES? YES( ) NO( )

10. IS THERE A NEED FOR MICROSCOPE FACILITIES? YES( ) NO( )

11. WILL PORTABLE UNITS BE NEEDED IN THE DEPARTMENT? YES( ) NO( )

12. HOW MUCH DEMAND FOR A PORTABLE UNIT WOULD THERE BE? ___________ DAYS PER WEEK
APPENDIX B

2500 MHz ETV Systems Costs
2500-MHz ETV Systems Cost

<table>
<thead>
<tr>
<th>Transmitting</th>
<th>Transmitters</th>
<th>$10,000-$12,000</th>
<th>Each Channel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ant System</td>
<td>1,000-15,000</td>
<td></td>
<td>Depending on Tower Height, Number of Channels, Length of Wave-guide or Coax, Type of Antenna</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Receiving</th>
<th>2500 MHz Conv, Ant, Tower</th>
<th>$1,100-$1,500</th>
<th>Depending upon Height of Tower and Size of Dish</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distribution System</td>
<td>300-1,000</td>
<td></td>
<td>Depending upon number of outlets</td>
</tr>
<tr>
<td>Receivers, Stands</td>
<td>150-300</td>
<td></td>
<td>Each</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Repeaters</th>
<th>Transmitters</th>
<th>$8,000-$10,000</th>
<th>Per Channel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receiving Equipment</td>
<td>1,000-2,000</td>
<td></td>
<td>Depending upon number of channels</td>
</tr>
<tr>
<td>Ant System</td>
<td>1,000-10,000</td>
<td></td>
<td>Depending upon Tower Height, Number of Channels, Type of Antenna</td>
</tr>
</tbody>
</table>

Other Costs not Included

- Production/Origination Equipment
- Test Equipment, Spares
- Engineering Design, Specifications
- Legal Fees
- Building, Construction Permits
- Land, Buildings, Modifications, Power Wiring

Maintenance Costs

- 5% - 10% of Total System Cost per year

A system now in operation with two channels to 60 schools cost $125,000 not including production equipment, school distribution systems, or receivers.

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APPENDIX C

Letter from Stephen J. Anderson (BYU)
January 6, 1967

Mr. Don L. Blanchard
Department of Electronics
College of Southern Utah
Cedar, Utah

Dear Don:

Since our conversation of December 8, I have had the chance to discuss your project with some of my associates, and also with one or two 2500 megacycle manufacturers. I did not identify the College of Southern Utah specifically in any of these discussions, but I wanted to find out what decision these people would make with regard to a choice between 2500 megacycle and cable. I talked to Bob Snider from Jerrold Corporation, a manufacturer of 2500 megacycles; and if my memory serves me well, with a representative from Electronic Sales Corporation in Salt Lake, among others. After discussing with them a situation with them similar to yours, I asked each a question, "If you are making a decision, would you choose cable or 2500 megacycle?" Almost universally the answer was cable, and the reasons most often given were that cable was less expensive and it will provide better and more complete service.

I don't want to give the impression that I am any type of an authority in this field. I merely thought you might appreciate my passing on this information. We certainly wish you the best of success in your endeavors. If any time we can be of assistance, we hope you will get in touch.

I would like to extend to you and your associates and students an invitation to visit our facilities any time. If you will give us a couple of days advance notice, I will be prepared to have someone show you around.

Sincerely,

[Signature]

Stephen J. Anderson
Assistant Director
VITA

Don Lee Blanchard

Candidate for the Degree of

Master of Science

Thesis: A Proposed Equipment Development Plan for Closed Circuit Television as it Relates to the Existing Curriculum at College of Southern Utah.

Major Field: Speech

Biographical Information:


Education: Attended elementary school in Chester and St. Anthony, Idaho; graduated from South Fremont High School in 1957; attended Ricks College 1957-58 and 1961; received Junior College Diploma from Ricks College in 1962 with a major in Electronics; attended Brigham Young University in 1962; received a Bachelor of Science degree from Utah State University in 1964 with a major in Industrial Arts Education and a minor in Speech; completed requirements for the Master of Science degree in Speech, specializing in radio and television, at Utah State University in 1968.

Professional Experience: 1964 to present, instructor, Electronic Technology and Industrial Arts Education, College of Southern Utah; 1962-64, announcer, Radio Station KVNU; 1962, electronic maintenance, Utah State University.