(b) To demonstrate the viability, ease of use, and effectiveness of personal-computer-based educational broadcasting, especially for mathematics and science instruction;

(c) To foster awareness and understanding of the merits of digital-based computer educational broadcasting as a tool for distributing both course instruction and materials.

ii. Objectives and the Statute Purpose - The stated purpose, *"To provide assistance.....for projects that strengthen and expand computer-based education in public and private elementary and secondary schools,"* could not have a more perfect embodiment than a project of the type proposed here. The computer will be used in originating materials for the course, originating the course broadcasts, presentation of the course broadcasts, dissemination of materials for use on other computers, interactive on- and off-line individual study, and a multitude of other innovative ways that we can only speculate about at present. The entire process will automatically instill a level of comfort and familiarity with computer techniques in both teachers and students which would be difficult or impossible to attain otherwise.

(2) Meeting the Needs Recognized in the Statute

i. The Needs Addressed by the Project -

The value of the computer as an individual learning tool has long been recognized. Its value as a classroom presentation medium is just now **beginning** to be recognized. There are **fundamental** changes occurring today in the communications industry that are nothing short of revolutionary in how they will affect the value of the computer as a distance learning tool and as a general channel of educational and other services. It is the transition to **digital** communications media. The reasons are varied and and are beyond the scope of this proposal. However, it is definite and inevitable, one example being High Definition Television which will be at least partially (if not totally) digital.

This fundamental revolution is going on virtually unnoticed by the educational community and the public in general. **The primary need addressed by this project is to perform an actual demonstration showing a few of the educational capabilities of a digital medium so that the educational community can become aware of the vast potential of computers through digital broadcast media.**

Much of what technology is available in the classroom today is simply not used due to lack of teacher training or lack of relevant software and courseware. **Classroom computers should have at least some modes of operation that are at least as easy to use as a television set or a VCR!**

ii. How the Needs were Identified - Reports such as The Governors' 1991 Report on Education, A Time for Results - Task Force on Technology, and the National School Boards' Association, A National Imperative: Education for the 21st Century, make clear the concerns of many educators regarding the need to introduce new methodologies and technologies into education. Conversations with numerous state and federal officials reiterated support of technological applications in the classroom to broaden access to educational resources.

It had been observed in the United States that there is a great interest in satellite distance learning for students in remote locations and for teacher training in large metropolitan areas (e.g., Los Angeles County). However, satellite transponder time is expensive. Many underdeveloped countries (e.g., China, India, Indonesia, Brazil) are using very expensive satellite equipment to offer educational courses not otherwise possible. Numerous attempts have been made to use expensive video compression equipment for distance learning over wire-line circuits as well as satellites.

The need for the proposed demonstration project was seen by the authors during almost two years of developing and promoting this concept. We have observed that those who are familiar with the technology understand what we are trying to do and are enthusiastic about its potential. On the other hand, those who are not familiar with this technology don't have the foggiest idea what we are talking about. It simply can not be adequately explained. It has to be seen.

iii. How the Need is to be Met -

Most of the components of what we are proposing to demonstrate are already commercially available. By using these components and developing only the minimally required increment, we can produce a demonstration which may of historic significance. The demonstration will consists of a few remote classroom lecturers (plus associated down-loaded off-line learning aids) using materials

generated by the instructor both off-line and in real-time and using other commercially available imagery and courseware.

The classroom receiver will be a computer with it's output connected to other monitors, a TV projector, or an LCD overhead projector computer display. The transmission capacity required for this will be substantially less than 1 % of a normal satellite transponder. Actual classes will be conducted in Math and Science. Evaluations will be made as to ease of use and educational effectiveness of the medium.

iv. **Public Benefit from Meeting the Need** - The public benefits to be derived from meeting the need for improved access to instructional and informational materials are legion. With Gutenburg's fifteenth century invention, costs fell and the dissemination of ideas exploded. Learning was available to a vastly expanded audience. Similarly today, although technology cannot replace the human resource of the teacher in the classroom, it can greatly extend and expand the teacher's inventory of educational materials and effectiveness with students. The demonstration of the feasibility of using digital-based computer communications in education and the lower costs associated with such a system will be the most persuasive argument for funding the proposed project.

(3) **Plan of Operation**

i. **Proposed Project Design** - The project will be coordinated by FEAT with specific tasks allocated to the other participants. Technical tasks involve principally the construction of specialized digital equipment for transmitting and receiving mathematics and science courses and the supporting operating system software. These will be performed by ACE and CSI. UALR will select and evaluate the instructional course material for the classroom demonstrations, and will contribute to the development of an evaluation module to assess the results.

Specialized hardware: The computer plug-in boards for data compression-decompression and interfacing to the transmission channel will be designed and manufactured by CSI.

Operating Software: The software necessary to operate the purchased and specialized hardware and to provide user-friendly instructor control will be developed by ACE.

Course Software Selection: Assisted by ACE, UALR will recommend the software for the classroom demonstrations. The software will include mathematics and science course materials suitable for demonstrations in the selected schools.

Equipment Assembly and Service Trials: Equipment will be tested by ACE and CSI. Field trials involving satellite transmissions will be conducted prior to the demonstrations in schools.

Analytical Methodology: UALR will prepare an assessment module for evaluating the classroom demonstrations. The methodology will include both quantitative and qualitative approaches. The mastery of the operating instructions and assimilation of course material will be measured through performance times and achievement tests.

Quantitative Analysis: The instruments measuring performance times and achievement will be administered during the classroom demonstrations and the results analyzed by UALR.

Qualitative Analysis: Issues raised by the quantitative analysis will be explored by UALR in focus groups and interviews as a follow up to the classroom demonstrations. Teachers involved in the demonstrations will meet with partners and project advisors.

Report on the Evaluations: The effectiveness of the project will be analyzed by all of the partners and advisors. The report will contain sections on technical analysis of the hardware and the utility of the technology in the classroom. Specifically, the major focus will be the results of the demonstration with Chapter 1 school students and their teachers.

The top level PERT schedule for the project is shown in Figure ??? and the corresponding Gantt (task time-line) chart is shown in Figure ???. Each box shows the earliest start date and the calendar days duration of the task.

Rough Draft

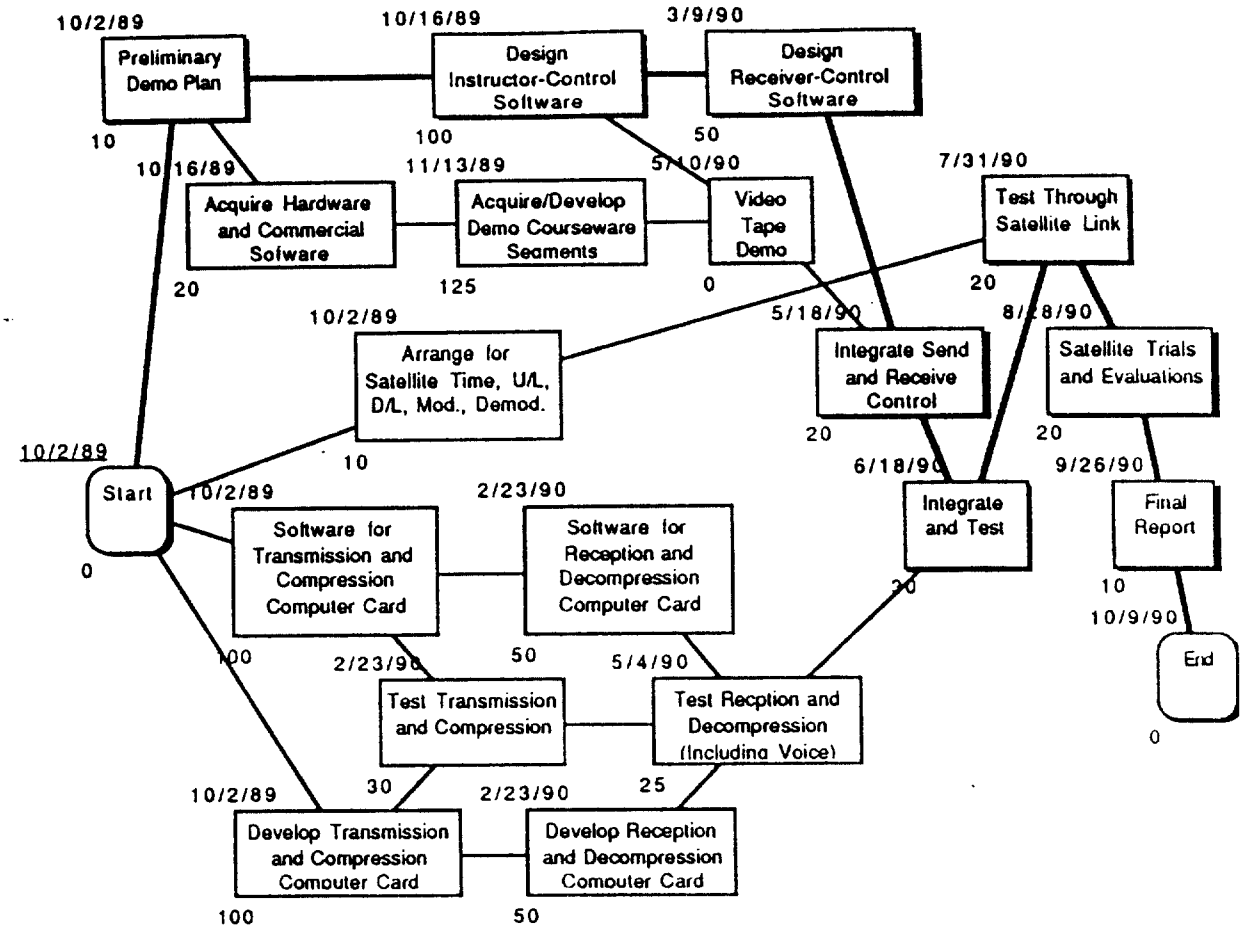


Figure 2-3 Work Activity Task (PERT) Flow Chart

ii. Management and Administration - FEAT will be responsible for the administration of the project including management, liaison, direction of the work tasks, reporting and evaluation. All administrative practices undertaken by FEAT on its own behalf and in behalf of the partners will conform to the cost principles and administrative provisions in the 34 CFR, Parts 74 and 75, Education Department General Administrative Regulations (EDGAR). Auditing of expenditures will be performed by Peat Marwick Main and Co., the largest international accounting firm (see Appendix J). Legal counsel to assure compliance with the government regulations and cost principles will be provided by Michael Brustein, Esquire, of Brustein and Manasevit, P.C., Washington, D.C. FEAT will provide regular quarterly reports to the USDE detailing progress toward task completion and outlining work expected to be performed during the next quarter.

Rough Draft

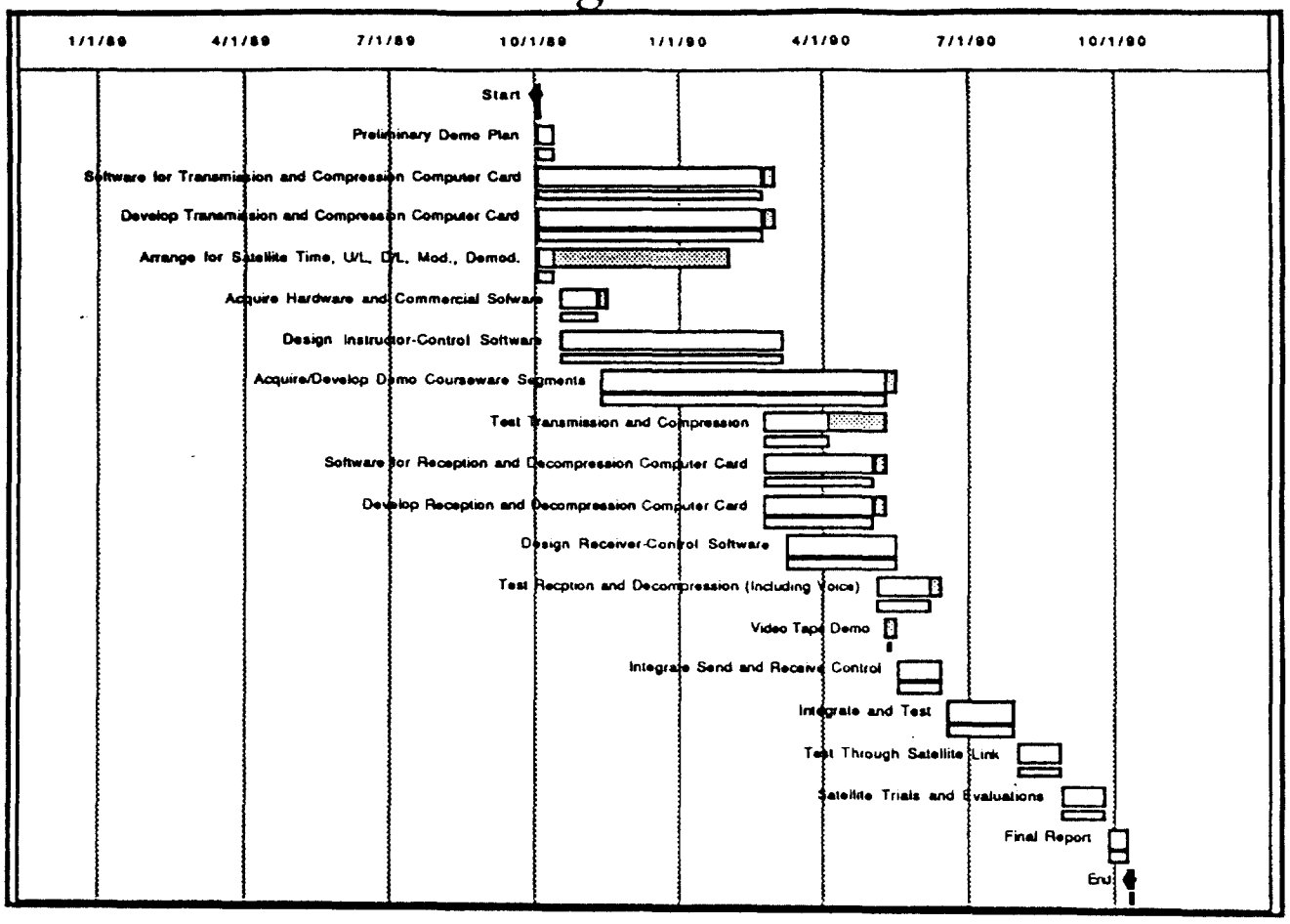


Figure 2-3 Work Activity Task (Gantt) Time Chart

iii. The Project Objectives Related to the Program Purposes - Clearly, the major focus of the program is **to extend to educationally deprived students improved access to educational resources** and benefits, and **leave a legacy of innovative educational techniques.**

iv. Resources, Personnel, and Planning - The plan of work has been developed adequately to accomplish the project's objectives and sufficient resources have been allocated to perform the work tasks.

Provisions have been made for liaison and cooperation within the participants, and extensive use of advisors is planned. This should insure adequate public involvement and awareness of the project,

contribute an invaluable additional resource of personnel to the project, improve planning, and guarantee a full, independent assessment of the project's benefits.

v. **Selection Plan** - Insofar as it is necessary to acquire services and materials outside of the project, FEAT and other participants will employ personnel and purchase supplies without discrimination on the basis of race, sex, handicap, or age. This is consistent with the personnel policies of the educational institutions who are participants in this application and of FEAT which has a non-discriminatory clause in its "Personnel Policies and Procedures".

(4) Quality of Key Personnel

(A) Key Personnel

Dr. G. Gordon Apple - Manufacturer's Task Manager. Dr. Apple (President of ACE) received his BSEE degree from the University of Arkansas in 1966 and an MSEE and PhD from Purdue University in 1967 and 1970 respectively. He has over 20 years experience in digital communications beginning with a NASA research contract for implementation of a transform coding digital filter. He then worked at Bell Telephone Laboratories on digital interframe coding techniques for PicturePhone® transmission. At North Electric he headed up a group which developed transmission and synchronization systems for a new digital telephone switching system. He then was Director of Engineering for Automation Products Company. While at TRW, Dr. Apple was involved in many digital communication system projects including several satellites and modem and data compression systems. He served as system engineer on the Space Shuttle's primary communications system. He was then principal investigator and project manager for a contract with CBS Television for data compression for High Definition Television transmission via Direct Broadcast Satellites. He also served as assistant Program Manager for VHSIC-implementation of ground terminals for the MILSTAR satellite system. Dr. Apple has several patents in the fields of error correction coding, digital transmission, synchronization, and video data compression. He also has various publications and has made many presentations (including internationally) on these subjects. Dr. Apple is a Senior Member of IEEE, a member of Sigma Xi (research society), other honor societies, and the Society of Motion Picture and Television Engineers.

Mr. Donald K. Dement - Manufacturer's Technical Director. Mr. Dement is founder and president of Novacom, Inc., a consulting company which provides specialized planning, marketing, and design studies in direct broadcast satellite systems, technology, and applications, and chairman of Advanced Communications Engineering, Inc. He has over 30 years of practical experience in planning

and management of engineering development in communications systems and technology. Presently, he directs a project team that is designing and developing an aeronautical satellite system. Mr. Dement has a long work history in the public sector, and many years of project management and contract administration. As NASA Headquarters' Director of Communications Programs, he planned the nation's new research and development efforts in satellite communications, specifically in applications of direct broadcast satellites and video compression. As Headquarters' Manager, Advanced Communications Research, he led NASA's advanced communications research program for five years. Additional work experience includes successfully managing a 600-person team as a Defense Department program manager to develop a major information processing system with a project budget of over $ 125,000,000. He is a member of many professional associations, a Senior Member of IEEE, and an associate fellow of AIAA. Among other awards and honors, he is a recipient of the Air Force Meritorious Civilian Service Medal.

Dr. Robert H. Bradley - Principle Classroom Demonstration Evaluator - Dr. Bradley received his AB from Notre Dame (1968) and PhD in Educational Psychology from the University of North Carolina, Chapel Hill (1974). Since 1982 he has been Professor and Director of the Center for Research on Teaching and Learning at the University of Arkansas at Little Rock. Also, he serves as adjunct Associate Professor of Pediatrics at the University of Arkansas for Medical Sciences (1979-present). He has been a consultant with the Parent Education Project, Kentucky State University since 1985. He was a member of the Review Committee, Office of Special Programs, USDE from 1982 - 1987. In 1983 he was a member of the Review Committee on Research Priorities, National Institute of Handicapped Research, and a Test Reviewer, Buros Ninth Mental Measurements Yearbook. Between 1979 and 1984 he was a member of the Research Advisory Group, College of Nursing, University of Maryland. He has received many research grants from various federal agencies and has published widely in scholarly journals. He will be assisted by two additional members of the College of Education (25%, 25%).

Mr. Bill M. Williamson - User Network Design Task Manager - Mr. Williamson has more than 25 years experience in assisting industry and government, educational institutions and economic development organizations in areas of marketing, market research, strategic planning and project management. He received his BSBA degree from the University of Southern Louisiana (1956) and his MS degree in Economics from Louisiana State University (1964). His career encompasses service as market analyst and sales forecaster with Ethyl Corporation, Senior Research Specialist with the University of Arkansas system's Industrial Research and Extension Center and Senior Management Consultant with the U. S. Department of Commerce's Mid-America Trade Adjustment Assistance Center, currently operated by St. Louis University. As advisor to the State of Arkansas' Industrial Development Commission, he authored the concept and provided implementation planning for that

state's currently operating Motion Picture Industry Development Program. Mr. Williamson has authored more than 50 industry location analyses, resource development research reports, business feasibility studies and development concepts, including an advanced educational development concept for the Fulbright Institute for International Relations.

Mr. Joseph F. Glass, Jr. - User Network Design Analyst - Mr. Glass attended the Naval Academy in Annapolis, Maryland and received his BA in Radio, Television and Film Production from San Francisco State University. Since 1985 he has been a consultant in private practice advising clients in video and broadcasting. From 1979 - 1985 he was employed by the Arkansas Industrial Development Commission as founding Director of Arkansas' Office of Motion Picture Development. He has extensive experience in stage, motion picture and video productions. From 1965 - 1969 he was employed by IBM specializing in applications and marketing of new equipment.

Mr. Bobby P. Kerr - Chapter 1 School Selection Coordinator - Mr. Kerr Coordinates the Chapter 1 Office for the Arkansas State Department of Education. He received his BS from Middle Tennessee State College (1961) and his MA in Education Administration and Supervision from Memphis State University (1969). From 1966 - 1970 he was Title I, ESEA Director for the West Memphis School District. From 1970 - 1986 he was Supervisor for Title I/Chapter 1, of the Federal Programs Division of the Arkansas State Department of Education. Since 1986 he has been Chapter 1 Coordinator for the Department. He has received several federal grants for improving methods of evaluation under Chapter 1 programs. He has served on the Advisory Council for Technical Assistance Centers since 1978. He will be assisted by Virginia Clark and Patsy Hammond of the ASDE staff, and the teachers and administrative personnel of the demonstration schools (25%, 25%).

(B) Allocation of Personnel Resources

(********** TBS **********)

The key responsibilities in the project are allocated so as to maximize the efficiency with which tasks are completed. Key personnel include the following:

Project Director - 100% - The project director will be responsible for administration, liaison with the USDE and among the partners, assurances and compliances with federal and departmental regulations including liaison with the fiscal agent, and insuring the cooperation and contributions of the advisory groups. The project director will have responsibilities in all tasks and will assure that schedules are adhered to.

Technical Advisors - 25%, 25%, 25%, 25% - There are four technical advisors assisting in the assembly, testing and evaluation of the hardware. They will provide assurance that technical tasks are followed by the manufacturer, that equipment is evaluated prior to the demonstration, and will verify that the equipment operates according to the specifications for the project.

Manufacturer's Technical Director - 100% - The manufacturer of the digital equipment used for the demonstrations will provide a project leader who will be responsible for completing production tasks on schedule and according to specifications. He will be the liaison with the other partners. Sixteen technicians and professional engineers (100%) will be supervised.

User Network Design Task Manager - 100% - The user network design task manager will be responsible for managing all surveys, assessments, and data gathering subtasks, and directing the design of the educational network. He will be aided by an Assistant Investigator (100%) who will contribute to developing and reviewing alternative designs for the network and by UALR and UM-CIL.

Classroom Demonstration Evaluators - 25%, 25%, 25% - The classroom demonstration evaluators will be directed by a Principal Evaluator who guide the development of the quantitative and qualitative methodologies used to evaluate receptivity of the Chapter 1 Schools students and teachers to the digital technology in the demonstrations. The evaluators will also review the teacher training instructions for clarity and content, and will assist in the selection of demonstration Chapter 1 schools.

(D) Non-Discrimination

The members of the project pledge themselves to abide by the regulations of the U.S.D.E. governing non-discrimination in employment and purchasing. As additional evidence of our commitment to non-discrimination, one of the organizations participating in this proposal (CSI) is a minority owned firm which was included due to a previous working relationship and the firm's unique technical expertise.

(5) Budget and Cost Effectiveness

i. Adequacy of the budget - The funds needed for the project are allocated among the stated tasks as follows:

Rough Draft

BUDGET

	Start	Latest Finish	Cost	Days
Start	10/2/89	10/2/89	$0.00	0
Preliminary Demo Plan	10/2/89	10/13/89	5000	10
Acquire Hardware and Commercial Sofware	10/16/89	11/10/89	25000	20
Software for Transmission and Compression Computer Card	10/2/89	3/1/90	20000	100
Develop Transmission and Compression Computer Card	10/2/89	3/1/90	20000	100
Arrange for Satellite Time, U/L, D/L, Mod., Demod.	10/2/89	2/1/90	5000	10
Test Transmission and Compression	2/23/90	5/10/90	5000	30
Design Instructor-Control Software	10/16/89	3/8/90	40000	100
Acquire/Develop Demo Courseware Segments	11/13/89	5/10/90	30000	125
Software for Reception and Decompression Computer Card	2/23/90	5/10/90	10000	50
Develop Reception and Decompression Computer Card	2/23/90	5/10/90	10000	50
Test Recption and Decompression (Including Voice)5/4/90		6/15/90	5000	25
Video Tape Demo	5/11/90	5/17/90	5000	5
Design Receiver-Control Software	3/9/90	5/17/90	20000	50
Integrate Send and Receive Control	5/18/90	6/15/90	5000	20
Integrate and Test	6/18/90	7/30/90	10000	30
Test Through Satellite Link	7/31/90	8/27/90	10000	20
Satellite Trials and Evaluations	8/28/90	9/25/90	10000	20
Final Report	9/26/90	10/9/90	5000	10
End	10/9/90	10/9/90	0	0
Total Direct			$240,000.00	
Overhead	25.00%		$60,000.00	
Total			$300,000.00	

ii. Reasonableness of the Costs - The above costs were developed from estimates of time and expenses required for completion of the tasks. Labor costs were derived from current salaries or estimates based on comparable wage rates. The overhead rate used for the cost estimates is 25 % of total costs and is considered conservative.

(6) Evaluation Plan

(********** TBS **********)

i. Appropriateness - The objective has been established for each task. Personnel, financial, and time resources are allocated to meeting objectives. A quarterly progress report will document resources expended, and describe accomplishments. This method is the most reasonable means of continually assessing project progress and demonstrating accountability. In addition, the EAB will review the project as it develops. Specific task products and milestones are scheduled. Their

completion on schedule establishes a scale of progress which will be documented in quarterly reports to the USDE. (See task flow chart above in section 2.(3)i, Plan of Operation).

ii. Objectivity and Generation of Quantifiable Data - The Assessment and Evaluation task, discussed in the Plan of Operation, will generate quantifiable data. For example, the classroom test demonstration will measure for both students and teachers the appropriateness of the technology in a practical setting. Primarily, this will involve measuring their receptivity to the technology and its applications. These will be quantitatively evaluated through assimilation of instructions and performance times and the results of brief achievement tests.

The tests will involve both classes of Chapter 1 students who are traditionally underserved and classes of non-Chapter 1 students who have benefitted from adequate educational resources. Qualitative research, including focus groups and individual interviews, will be conducted as a follow up and complement to the quantitative methods to reveal issues either not apparent from test results or unexplained by the quantified data. The instruments and methodology will be developed by UALR as a major component of the Assessment and Evaluation Task.

(7) **Adequacy of Resources**

Facilities - The tasks to be performed under this project are allocated to agencies, institutions or companies which have or can make available the space, personnel, materials and supplies, and other resources necessary to undertake their responsibilities. The cooperation of schools, in which the demonstration of the equipment and software will be conducted, will be obtained through the Arkansas State Department of Education. Satellite demonstration time has been previously pledged by GE.

Equipment - The equipment to be obtained through construction by ACE and CSI and purchase by FEAT include specialized software developed to complete the broadcast link and provide an operating system for the hardware, the personal computers (MAC IIcx) used in the demonstration schools, and related peripheral hardware. The developed software should not be confused with the "off-the-shelf" mathematics and science software which will be purchased for the demonstration.

Supplies - All supplies are incidental to the operations of the various offices where the FEAT staffs are working. No specialized supplies are required.

Rough Draft

3. Meeting Program Priorities

The FEAT project offers a major new opportunity to develop a network of users who will enjoy expanded access to existing **mathematics and science programming** as a result of introducing advanced digital satellite technology to schools on a national basis. This type of technology, involving computer and television applications, is readily adaptable to the types of programming appropriate to these instructional areas.

A major aim of FEAT is to demonstrate a new communications technology which can demonstrably and dramatically reduce costs and make available educational resources to areas with high concentrations of **Chapter 1 students**. The hardware is very flexible. It can be used with existing microcomputer hardware likely to be found in schools along with the broad range of existing software packages available in the marketplace.

Although the immediate purpose of the proposed project is to demonstrate new technology in selected schools, it is recognized that the proposed system is applicable to **all educational users**. These will not be limited to public and private primary and secondary schools, but will include educational agencies, industry, government, teacher training institutes, life-long education programs, libraries, conference and learning centers, vocational-technical schools, hospitals, and institutions of higher education. Individuals and families will ultimately participate through learning libraries and the direct reception of educational courses and materials.

The major element of the user population who will benefit most from implementation of this project are **those traditionally excluded from careers in science and mathematics** because of inaccessibility and disadvantaged backgrounds. Educational resources made available for the training of these groups will be expanded through a reduction in costs afforded by new technology and the eventual creation of a user network which will enrich programming, coordinate scheduling, and attract additional financial resources.

4. Conclusion

It is difficult at best to introduce new technologies and unique ideas - no matter how innovative and efficient they may prove to be. This must be done if educational resources are to be distributed uniformly with the greatest benefits.

Digital-based communications can and will deliver educational programming more efficiently than current alternatives. New communications hardware using this technology will permit the transmission of many times the programming now available through analog delivery equipment. So great is the level of advance that only two television channels could carry the educational broadcast burden for a national system. Two channels today, using hardware currently in place, would carry only two television programs or courses - far fewer than the tremendous array which would be potentially available on one channel using digital transmission and computer technology.

An actual demonstration program, such as that proposed here, is crucial for the evaluation and promotion of innovative uses of computer technology in the classroom. The proposed program could prove to be one of the best investments ever made in the future of technology in education.

Rough Draft

Appendix A Technical Aspects of the Project

The means of presenting visual materials in classrooms and business is rapidly undergoing a revolution of its own. It began with developing vu-graphs for an overhead projector by drawing and typing them on a personal computer. Then they are printed on paper (for transfer to acetate), or in some processes, printed directly to a transparency sheet.

Only recently has it been realized that the "printed medium" stage is not necessary except for handouts and that images can be output directly from the personal computer to a TV monitor for small groups or to a TV projector for larger audiences. The latest trend is to use a liquid crystal plate placed directly on an overhead projector. This results in a crisp, bright image with similar quality to that of a printed transparency and can easily be viewed from anywhere in a lecture hall. Numerous software packages now are readily available (e.g., Microsoft PowerPoint, Cricket Presents) for generating vu-graph images and then automatically sequencing them on the computer screen for the actual presentation.

Sophisticated animation programs (e.g., MacroMind's Director, Apple's Hypercard, Silicon Beach's Supercard, Telerobotic's Course Builder) also are economically available. They include a multitude of special effects which keep the presentation visually stimulating and highly effective.

Another recent trend is the use of personal computers for the capture, storage and manipulation of a vast amount of external imagery. This has been made possible by the increasing availability of inexpensive RAM memory chips, large capacity discs, graphics processor chips, image scanners, TV frame grabbers, and generally more powerful personal computers. Recent advances have also been announced for recordable CDs (Compact Discs) and DAT (Digital Audio Tape), both of which provide a quantum leap in available computer storage capacity at a fraction of the previous cost. It should be noted that, in a broadcast system, most of these items are only necessary at the program source. The service recipient requires only a relatively inexpensive personal computer, some of which are now in the $500-$1000 range with prices continually declining.

Sketch pads are also being used by instructors as an electronic blackboard and for pointing to or annotating items on the screen showing Vu-graphs.

High quality voice transmission will be provided by using 64 kb/s digital encoding. While this is the same bit rate used for the past 30 years by telephone digital carrier systems, the quality will be vastly superior to today's telephone channels and will sound completely natural. This system will use ADPCM (Adaptive Differential PCM) encoding (7 kHz bandwidth) instead of the older PCM (Pulse Code Modulation) encoding (≈ 3 kHz bandwidth) still used by the telephone system.

An illustration of this type of system is shown in Figure 4-1. Once prepared on the computer, the course could be presented entirely in real-time or by playback of a recording on CD, DAT, or F1-format VCR tape (standard tape, used today for digital high-quality music recording).

The simple addition of an inexpensive printer at the receiver will allow simultaneous transmission of printed materials for use by the class or the classroom teacher (or assistant). It should also be noted that only a single computer is necessary (although more might be desirable for other uses described below). The reconstructed signal can be distributed throughout the school to TV monitors or use other display methods described previously.

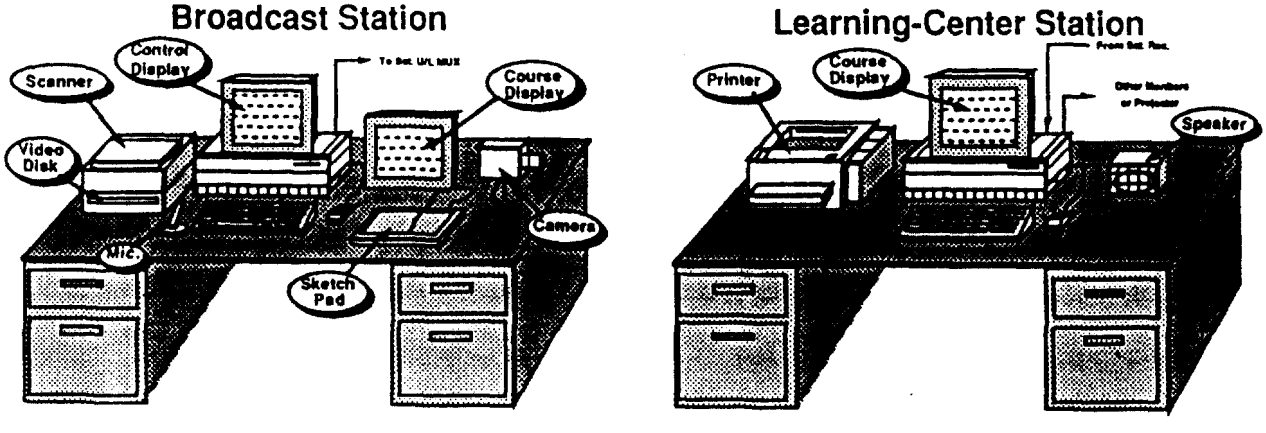


Figure 4-1 Computer Course System

Because the receiving terminal inherently uses a personal computer, it is easy to see that a vast number of additional teacher aids and learning aids can also be transmitted. For example, examinations can be downloaded to the computer and still allow the local teacher to select questions or customize the exam. Grading can also be highly automated and impartial. Programmed learning can

be provided for off-line remedial or advanced study. This is where additional computers would be useful. (They are not required to be connected to this system. Floppy disks will be adequate.)

The nominal basic bit rate for the computer course service has been selected to be a generous 256 kb/s with the capability of additional dynamically-assigned burst transmission when needed. This will ultimately allow **over 100 computer courses** to be simultaneously transmitted in one satellite channel if no other (e.g., TV) services are transmitted.

There is a great need for digital transmission capability, even in mainly analog systems. For example, the Los Angeles school system has announced its intent to initiate satellite services within the LA system. Officials there have indicated that they would like to use Scientific Atlanta's B-MAC analog encoding system simply because of the inclusion of a relatively low-rate data capability.

The MAC transmission systems (e.g., C-MAC, B-MAC, D2-MAC) were originally developed for commercial DBS transmission. They all use analog time-compressed component-video transmission which results in slightly improved video quality but increases the transmission bandwidth. Therefore, they still require an entire satellite transponder (channel) for each televised course. The only advantage of the MAC systems (over today's NTSC) in this application is the possibility of including some digital transmission capability which can be used for transmitting printed information.

Training and Installation

Anytime new technology is introduced into a non-technical environment, the questions of training and ease-of-use must be addressed. If a technology is not easy to use and provides only marginal benefit, it will simply be discarded and ignored. In the earlier decades of computer technology, a vast amount of training was necessary because humans had to change their mode of operation to conform to that of the computer. In the last few years that has radically changed. The introduction of personal computers into the mass non-technical market required that the human interface be given highest priority. Indeed, today's market will rapidly reject any software or system which is not "user-friendly."

For basic computer courses reception, the user will not require any special training. One page of instructions will suffice. Computer literacy is not required. Many of the supplementary services will also require no special training because the computer will prompt the user to perform certain actions such as inserting or removing a floppy disc or making sure that the printer is turned on and has paper.

Some of the more advanced features (e.g., customizing downloaded exams) will require more interaction between the local teacher (or assistant) and the computer. However, the user-friendly graphics interface of today's Macintosh and Amiga computers (and later, IBM with Microsoft's OS-2 Presentation Manager) allows people with no previous computer experience to accomplish what is needed with little or no special training. The computer prompts the user for the necessary actions.

The remaining training consideration is that of the computer course originating instructor. Part of the proposed software task is to generate a user-friendly interface for the originating instructor. Once the instructor has generated (or scanned) a set of presentation charts, the presentation will be no more complicated than using an overhead projector and a blackboard in a classroom. The only difference is that the instructor will be sitting down at a desk rather than standing in front of a class. Impromptu changes or additions (e.g., response to called-in questions) can be accommodated by real-time use of the scanner, sketch pad, and/or TV frame grabber (a device which freezes a TV image by digitizing it and storing it in computer memory). Training time for using this system is expected to be about one hour and requires no prior computer experience.

Most presentation materials are expected to be generated directly on the computer rather than being scanned. (The latter would still be used for pictures or previously generated materials.) In this case, familiarity with some of the available software packages is desirable. This can be done off-line and most of it can be done by teaching assistants, if available. Use of more sophisticated presentation software (e.g., animation) is at the discretion of the instructor and can be done by a trained assistant.

The Computer Course Software development consists mainly of generating the necessary control software to allow commercially available software to operate in a sequential or selective manner under the control of the Computer Course instructor. It also provides for the proper timing and sequencing of file transfers from the source computer to the destination computer and management and disposal of

files in the destination computer. It is, in effect, the computer transmission operating system. The software task finishes with a computer-to-computer demonstration which uses the computer serial ports for direct communication and allows evaluation of the Computer Course concept.

After integration of hardware and software, a demonstration through an actual satellite link (K_u-band) is planned. Both the University of Hawaii and GE Americom have volunteered to provide satellite time for system tests and for the demonstration.

CONFIDENTIAL

2/23/89 Contains letter from W.D. Mills to Gov Bush

Digital DBS, Education and HDTV

(Direct Broadcast Satellites; High Definition TV)

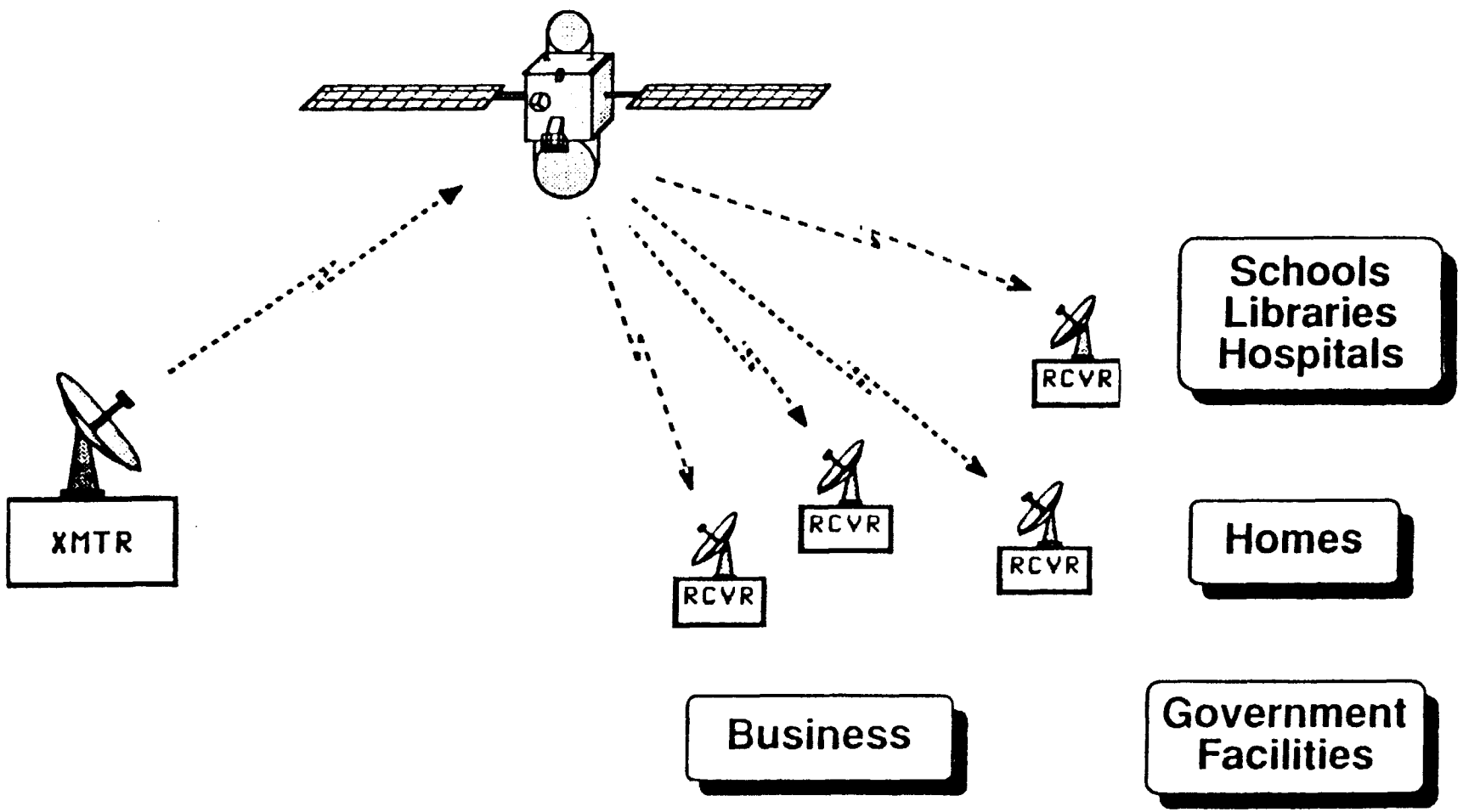
Presentation to:

President George Bush

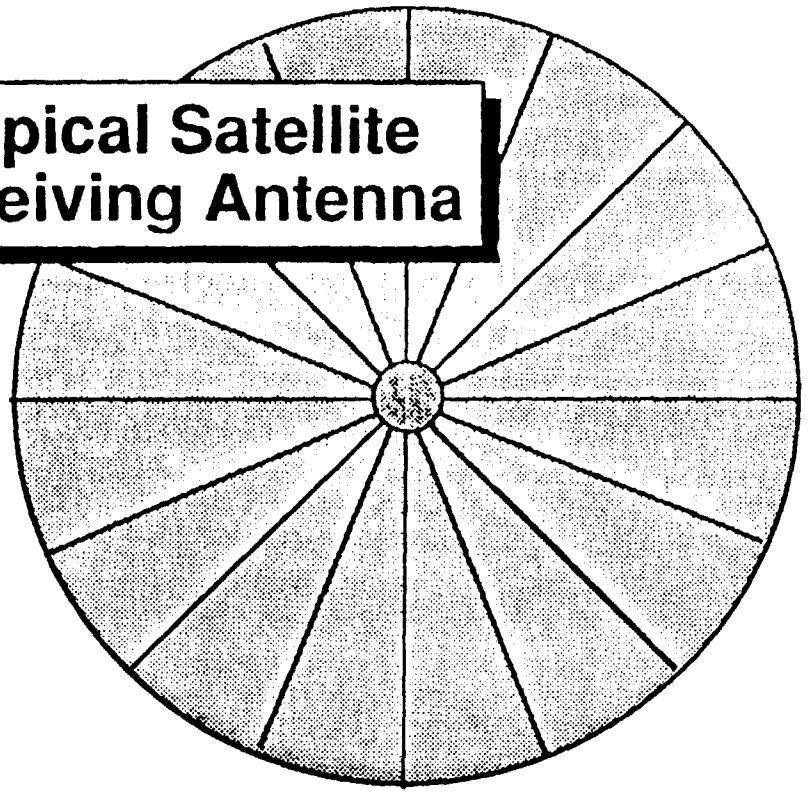
June 23, 1989

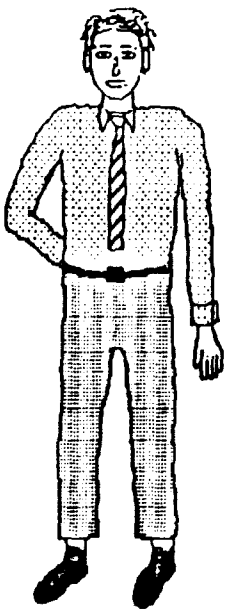
Advanced Communications Engineering, Inc.

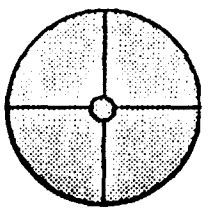
Digital DBS


XMTR
RCVR
RCVR
RCVR
RCVR
Schools
Libraries
Hospitals
Homes
Business
Government
Facilities

Antenna Size Comparison







DBS
Antenna

8' diameter. Requires pedestal, concrete pad, local zoning approval, and (sometimes) a fence.

2' diameter. No pedestal or pad, local zoning preempted by FCC, installed by owner.

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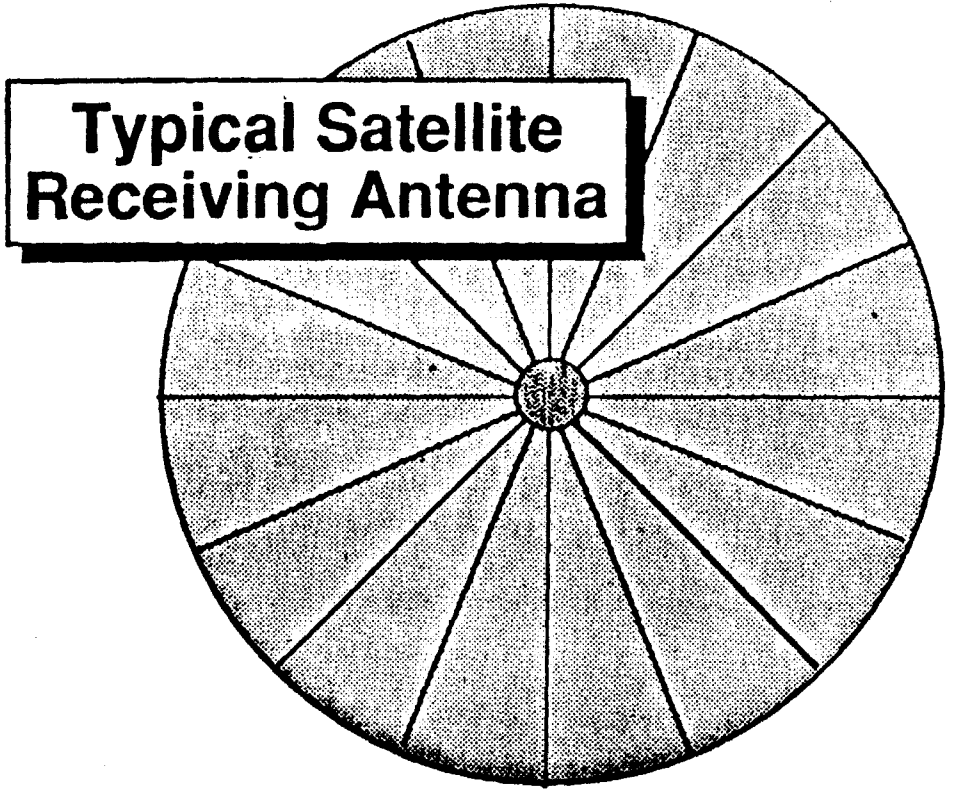
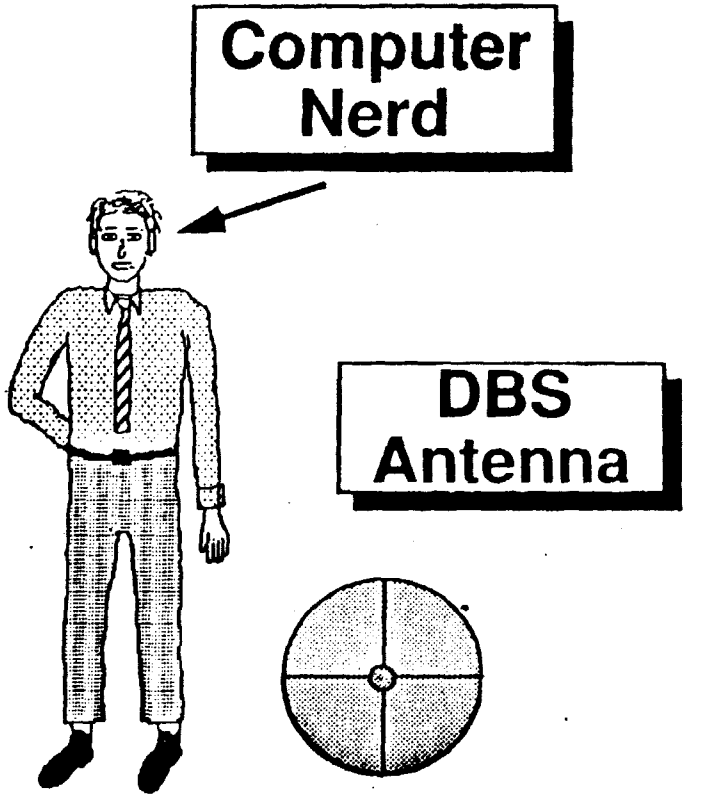
Aunt Emma Size Comparison





80' diameter. Requires pedestal, really hip pad, local yocal approval, hernia insurance, and (sometimes) a fence and guard dogs.

2" length. No pedestal or pad, doesn't attract UFOs, can be installed by an idiot.

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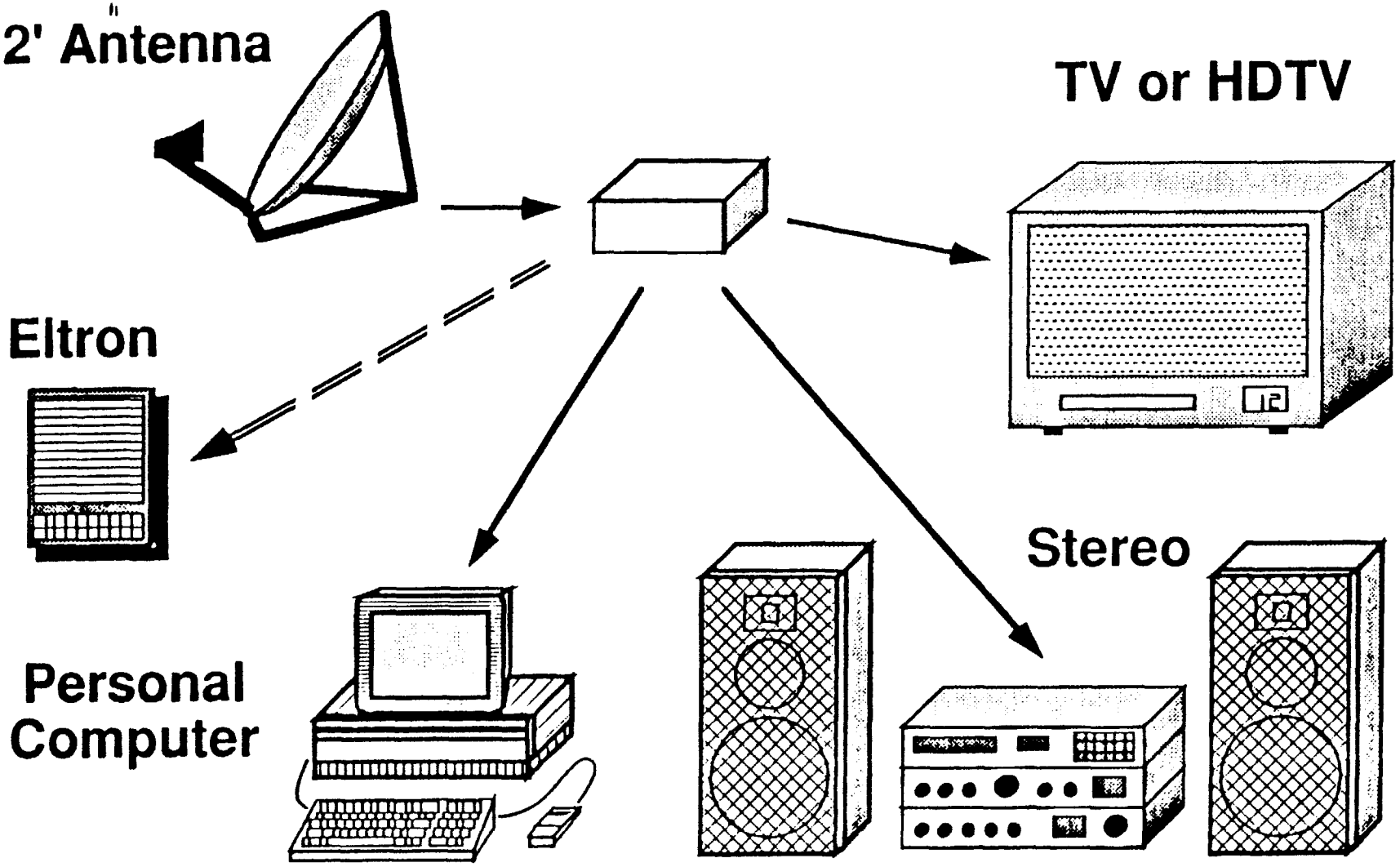
Receivers



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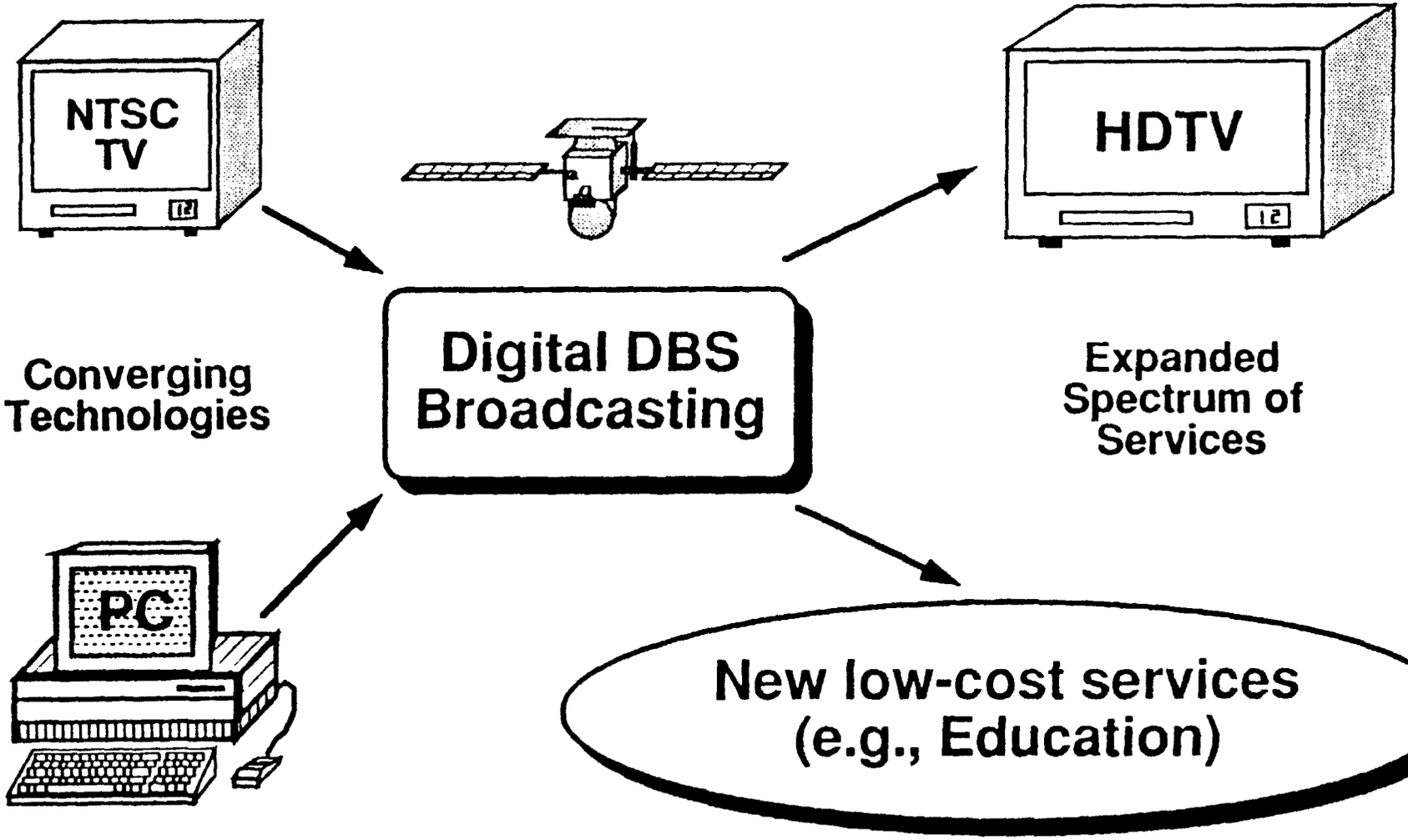
Converging Technologies: Expanded Services



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