CHAPTER IV

A SYSTEM APPROACH TO DEVELOPING AND ASSESSING RURAL BROADBAND COMMUNICATIONS

The preceding chapters have examined the potential of broadband communications for responding to rural needs and contributing to the goals of rural development. However, realization of this potential depends upon demonstration that rural applications are economically viable. In this Chapter, a system approach to developing economically viable systems is described and two case studies illustrating some of the concepts involved in approach are presented. Technological, regulatory and economic factors as possible constraints to wider application of broadband communications are then examined and it is shown that, for rural areas, the immediate primary constraint has been economic. This finding is used in discussing the need for rural demonstrations of broadband systems and an approach to implementation of such a demonstration program is described. The approach taken in this Chapter is then compared to other alternatives as suggested in recent legislative initiatives and other studies. From that follows a discussion of policy alternatives. The Chapter closes with a three-step approach to future assistance which might be provided by the Office of Technology Assessment for consideration by the Senate Committee on Agriculture and Forestry.

What is Meant By A System Approach

As used here, a broadband communications system indicates specific characteristics. With regard to service, the term “system” implies that all persons in the community served by the system can hook up to it and that community institutions will also have access to the system. Thus, the system

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will provide an array of services. In addition to conventional news and entertainment such services would include several public services and/or commercial uses as described in Chapter II. By comparison, prior applications (see Chapter II) have provided one service -- say, a health service -- to one type of organization (such as hospitals and clinics) or to a subpopulation of individuals (the sick or elderly). In the context of the system concept, such an application would be a component or subsystem. Several such subsystems combine to form a total broadband system.

Still on the topic of service, there is an important implication of the system concept. This is that the system derives from and is based upon community needs rather than the interests of a single business or group of experimenters. The particular services to be provided may be health, education, entertainment, meter reading, burglar and fire alarms, commodity prices or others, depending upon the needs of the people and the capability of the community to provide these services in other ways.

The system approach implies a positive cost-benefit ratio and that other alternatives than broadband have been evaluated to determine whether the same service might be provided through some other method at lower cost. Thus, it might be cheaper to bus people to hospitals or hire more paramedics than to use telemedicine. In making such an analysis, however, the total service to be provided by the telecommunications system must also be considered. Provision of several services will reduce the cost of any single service because all will use the same physical plant.

Thus, an important reason for the system approach to rural telecommunications is economic. Besides the economies of scale achieved when a number of services are provided, there is also benefit to the individual. School systems, hospitals and community agencies might afford to pay respectable sums for use of the system because of savings made in reduced salaries, transportation costs and physical plant. This institutional support can be used to offset some of the cost of providing network TV via cable to the individual subscriber.

The system approach has technical implications as well. Combinations of technology, such as both cable and translators, may be required to meet the needs of the community economically. Thus, cable can be provided where there is adequate density and several cable systems might be linked by microwave relays to connect related institutions within a county. Translators can provide service to households in the most rural areas. (Regulatory constraints to this approach will be discussed later). The important point is the intent to provide broadband to everyone rather than siphoning off households in the most dense, and thereby profitable, areas and leaving outlying rural households with no access at all.

Service, economic and technological aspects will be dealt with in more detail later. The purpose here has been to introduce the philosophical concepts underlying the system approach.

Case Studies

The project which most clearly illustrates the system approach is being undertaken in Trempealeau County, Wisconsin. However, some other projects, such as the three National Science Foundation Phase II projects in Spartanburg, North Carolina; Reading, Pennsylvania; and Rockford, Illinois show some

characteristics of this approach. The Trempealeau County and Spartanburg projects are described below. Besides illustrating what is meant by a system approach, these projects also indicate some of the regulatory, institutional and financial constraints to broadband applications. The description of both projects follows a common framework:

- demographic and socioeconomic characteristics of the area served by the broadband system;
- motivating forces behind the project;
- system description;
- financial considerations; Federal involvement;
- status of the system; and
- summary and significant findings.

Trempealeau County, Wisconsin Project

Trempealeau County, Wisconsin is a predominantly rural area with a population of 23,172 persons. Those younger than 20 years of age, or over 65, make up about 39 percent of the population and this percentage is close to the Wisconsin average. However, the over 65 age group is about 16 percent of the county population, which exceeds the statewide averages by about 5 percent (1-5).[1]

Examination of migration patterns reveals greatly decreased migration out of the county from 1960 to 1970, as compared to the previous decade. While county population as a whole appears close to stabilization, there has

* References are numbered consecutively in the order of their first appearance in the text. The first number is the reference. The number after the dash is the page number on that reference.

been within county movement from rural farm to rural non-farm households. The percentage of the population in incorporated areas in 1970 accounted for 47 percent of the population compared to 33 percent in 1940 and 21 percent in 1900 (l-6). Persons classified as rural non-farm in 1970 accounted for about 64 percent of the population, with rural farm making up the difference (l-83).

County median income was $7,391. A large percentage of people depend upon public assistance (13 percent of families) or social security (29 percent) . In 1970, 14 percent of families in Trempealeau County had incomes below the poverty level (l-7).

Of the total population, 8,233 or 36 percent were in the labor force. Agriculture and manufacturing predominate as sources of employment. Agriculture employs 26 percent of the work force and manufacturing employs 22 percent (l-7).

There are several important implications to be drawn from the above capsule summary of Trempealeau County characteristics. First, the relatively high percentages of elderly and nonworking residents means that a significant percentage of the population is home during the day and could use broadband services during this time (l-9). Presently, 93 percent of households have television sets (l-9). Television usage figures in hours per day are high compared to the national average despite good reception on only two channels in most areas (1-13). Surveys indicate an interest in more choice of programs as well as in local programming (1-14). Besides entertainment, the characteristics of the area suggest a potential for health, education and other services described in Chapter 11 of this report.

On the other hand, income for many residents is low. Consequently, little is available for discretionary spending. Thus, any broadband telecommunications services based on subscriber fees or fees otherwise charged to the consumer must be very desirable if they are to be purchased. In addition, the low density of the area makes it unattractive to broadband entrepreneurs. A cable system serving the county, including all towns, would have less than 10 subscribers per mile of line (2-15). Cable operators generally consider 30-40 households/mile a minimum (3-4).

Thus, while it appears that broadband communications could fill a need in Trempealeau County, it also appears unlikely that a conventional system will fill that need. Given the situation, the project underway in Trempealeau is of special interest.

Trempealeau County proposes to provide itself with broadband communications by paralleling the approach which brought electricity and telephone service to rural areas. There are many unique features of this project and they are indicated in the following discussion.

Role of Trempealeau County cooperatives. The motivating force behind the Trempealeau County project stems from several cooperatives. Because of the importance of cooperatives in many rural areas and because of their potential for bringing broadband communications to other areas, the following discussion briefly outlines the historical development of cooperatives, their role in bringing electricity and telephone service to rural areas and the current activity of cooperatives in the Trempealeau County project.

The formation of cooperatives stems from the Capper-Volstead Act of 1922 which allowed farmers, ranchers, dairymen and others engaged in agricultural activities to form associations for the purposes of marketing their products (4). The intent of the legislation was to permit agricultural workers to reduce competition among themselves and enable cooperative members to realize the benefits which could accrue from processing, handling and marketing their goods themselves.

Since the 1922 Act, cooperatives have become a way of life in many rural areas and supply an array of services from insurance to schooling for their members. Of notable significance to this assessment is the role played by cooperatives in bringing electricity to the countryside. In the 1930's, realizing that the utility companies saw no economic reason to bring electricity and telephone service to rural America, rural residents organized their own electric cooperatives. Aided by the Rural Electrification Act of 1934 which made long-term, low-interest loans available, the electric cooperatives were extremely successful in bringing telephone and electric service to sparsely populated areas (5-13).

The situation today with regard to cable television in rural areas is not dissimilar from the problem of getting telephone service and electricity to the same areas a generation ago. As noted previously, low rural population densities are not economically attractive to the private cable operator. Cooperatives, on the other hand, exist for the benefit of their membership and are not constrained by considerations of profit as is private industry.

In addition, as noted by Steven Rivkin writing in Rural Electrification Magazine (May 1974, pg. 13):

> "Rural cooperatives have special practical qualifications for entering the field of broadband communications that go far beyond a perception of historical nuances. First there are the vital intangible ingredients to success of motivation -- the commitment born of past struggles to put technology to work for their members -- and the principles of area coverage that makes special sense when success of a high-capacity communications system is so dependent on opening access to all members of community. Moreover, there also may be available physical facilities (i.e., utility poles, whose cost is normally a significant factor in stringing cable), services (such as billing and accounting) and organizational mechanisms (such as an existing cooperative itself)."

In Trempealeau County, cooperatives are numerous and active. Initial interest in the broadband communications project was sparked by Gordon Meistad, Manager of Trempealeau Electric Cooperative, who became interested in the potential of cable for rural areas. He decided that rural residents would have to become actively involved if that potential was to be realized. As stated by Mr. Meistad (Rural Electrification Magazine, May 1974, pg. *16):*

> "'I'm not interested in cable to get a few commercial channels. If that's all we were working for I wouldn't waste my time,' Meistad says, 'but we're planning on building a total communications system to serve the future communications needs of every resident of the county. The real goal of the communications co-op is to upgrade the quality of life for our rural members.'"
>
> "Meistad firmly believes that cable communications offers more for rural people than for city dwellers. 'It can, if developed to its full potential, revitalize rural life and keep young people in the area with jobs and every social, cultural and economic advantage. It's going to take hard work and we'll have to do the -job ourselves but we did it once with electricity. We should be able to do it again with cable.'"

Others grew enthusiastic about the project. William Urban, Superintendent of Trempealeau Valley School Cooperative, sees two-way cable as a way to improve the quality of primary and secondary education and to save both teacher costs and student time. Interconnection of schools

would permit special teachers at individual schools to make their services available to all without the need to bus children between schools. Cable would also permit bringing education to the handicapped, the elderly and any other citizen who wished to increase his education.

The project obtained the support of the Trempealeau County Association of Cooperatives and its president, Gerhard Nilsestuen.

The outcome is the Western Wisconsin Communications Cooperative. WWCC is a consortium of 23 Trempealeau County cooperatives and seven schools (2-14). One school in Jackson County is also involved (6-3).

A county-wide, multi-service broadband communications system. As indicated in the quotes from Mr. Meistad and Mr. Rivkin, the Western Wisconsin Communications Cooperative proposes to provide a broadband communications network accessible to all 9,500 households in the county (2-14). This in itself is unusual and a dramatic departure from the economics governing most private cable operators. Densities of some areas in Trempealeau County are at least as low as 3.5 households/cable mile (2-15), far below commonly accepted figures for a profitable cable operation. Nevertheless, provision of service to all members **is** a tenet of cooperatives.

The question is how such a system can be economically viable. Indeed, an early feasibility study for Trempealeau Electric Cooperative (l-46) showed that provision of cable service to Trempealeau County residents would be marginal at best. What substantially altered the outlook was the active involvement of local institutions in the use and support of the system, a development which reflected the principle of the system approach earlier described.

The key institution to be involved in the early phase of the project is the schools. Linking of Trempealeau County schools will form the backbone of the initial system. The higher fees charged the schools will reflect institutional (as compared to individual) use and the contemplated savings to be achieved by the county as a whole in education. The institutional rates will permit lower individual subscriber costs than would be possible if individuals alone were supporting the system.

System description. The proposed system will combine cable and microwave technology (6-1; 7-l). The system will be installed in three phases at an estimated total cost of 5.5 to 6 million dollars (8-3).

In Phase I, the schools and homes in the larger communities will be interconnected. Figure I on the following page shows major towns involved in Phase I. The eight schools are located in Arcadia, Blair, Elevastrum, Galesville, Independence, Osseo and Whitehall in Trempealeau County and in Taylor in Jackson County (6-3). (One Jackson County school is included because cooperative and educational system boundaries are not always congruent with county boundaries.) Three private parochial schools may also be included. The schools and nearby homes will be cabled and there will be three microwave receivers to interconnect the cable systems and pick up channels from distant cities. In the initial phase, 64 miles of transmission cables and 43 miles of distribution wires will be installed. The system will be available to about 2300 private residences and 230 commercial and educational organizations (9-lff.).

The Phase I system will use 6 channels directly, be immediately expandable to 8 channels and be sufficiently flexible that additional channels can be made operational (7-l). Initially, only the schools will have two-way capability.

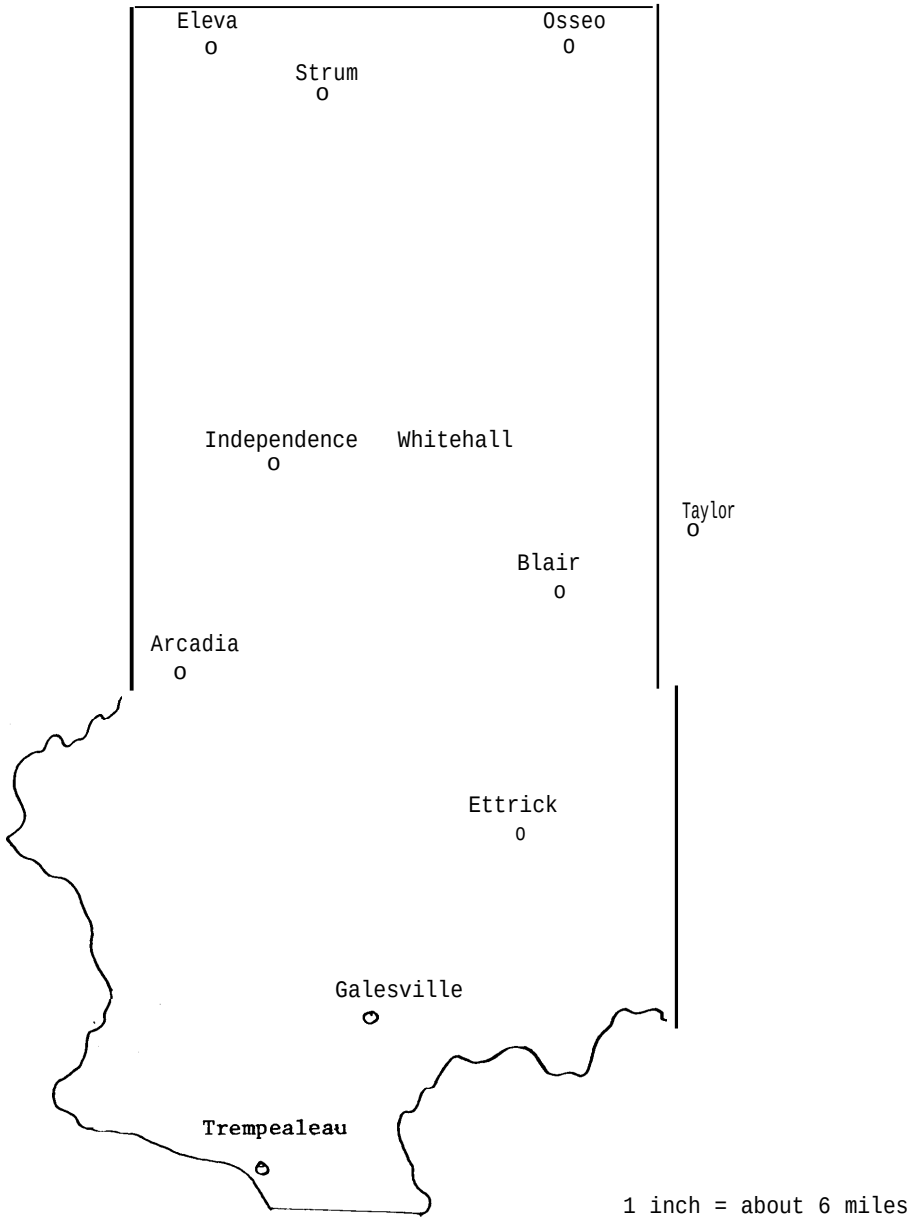

Figure 1. Location of communities in Phase I (based on map in 6-2).

Phases II and III will expand the system to the less densely populated areas so that the facility becomes available to every resident and business. The smaller villages will be connected in Phase II. The most isolated farms will be connected in Phase III.

Initially, the system will provide individual subscribers with network TV and the educational and single independent channel permitted by the FCC. [A waiver will be sought to permit bringing in two independents (10).] Subsequently, however, the possibility of additional services such as fire and burglar alarms, will be explored (10,11). The Cooperative is also eager to provide service to institutional users other than the schools. Preliminary conversations indicate an interest by the banks. At present there are 11 independent banks with 42 branches. There appears to be interest in use of a central computer by the banks and even in the possibility of using the proposed system to eliminate the need for checks (11).

Financial considerations; Federal involvement. The consulting engineering firm of Ralph Evans and Associates retained by the Western Wisconsin Communications Cooperative (WWCC) estimated the Phase I cost of the system at $1,245,000 (7-10). In seeking outside financial assistance, the Cooperative explored the possibility of a Rural Electrification Administration (REA) loan. When receipt of an REA loan appeared unlikely, WWCC applied in January 1974 for a Community Facility loan from the Farmers Home Administration (FmHA) under the Rural Development Act of 1972. In two subsequent letters (12, 13) the FmHA identified approximately 20 conditions which must be met. After WWCC agreed to meet these conditions, the Wisconsin FmHA State Director approved a $1,238,000 loan on August 28, 1974 and obligated funds for it.

This loan is unique in that it is the only Community Facilities loan granted under Title I of the Rural Development Act of 1972 for the purpose of establishing a broadband communications system. FmHA has approved a direct loan with a 15 year repayment period at 5% interest with repayment of principal deferred for 2 years (14). Of the conditions imposed by FmHA, one posed a particular problem and is illustrative of some of the difficulties faced by projects such as this one. FmHA required that long-term contracts between the eight schools and WWCC be established. However, the schools are prohibited from participating in any agreement longer than 3 years without voter approval. Such approval for a 10 year contract has been agreed to by the voters. In addition, a bill pending before the Wisconsin legislature will permit schools to make such contractual arrangements (11).

WWCC is concerned that private operators might skim off the more profitable densely populated areas of the county. The difficulty which WWCC experienced in promoting and financing their own system has stimulated another bill now pending before the Wisconsin State Assembly. This bill would allow intercommunity cable districts to organize and float municipal bond issues to raise funds for intercommunity cable systems (2). Arguments advanced in favor of the bill are that it will protect rural areas from lack of cable service, prevent formation of “pockets” of sparsely populated areas lacking broadband services and promote cable system compatibility (10). The bill has been defeated once but is expected to come up again.

In the Trempealeau County system, financial support and loan repayment will come from installation fees, membership fees and user charges. A small amount of revenue from advertising is also anticipated. Individual subscribers will be charged a $20 installation fee, $5 for membership in the cooperative and about $7/month for access to the system. The eight school districts will each pay a $1,000 installation fee and $9,000/year for two-way use of the system (9-lff.).

Although the user charge to the schools may seem high, the potential savings of the school system may be even higher. The broadband system will permit the connected schools to share teachers. Students in special programs will no longer have to be bused between schools. In-service teacher training can also be done on the cable system.

Later the banks are likely candidates for use of the system. A channel could be bought by several banks and used for in-service training, computer access, etc. $7,000 has been cited as a reasonable figure for rental of a channel per bank for one year (11).

Status of the system. As previously indicated, the Community Facilities loan from FmHA was approved August 28, 1974. However, construction of the system has not yet begun because of the need for a long term contract commitment between the schools and WWCC. Although voter approval of this commitment was obtained, state level action was also necessary. Thus, progress has been delayed pending action by the Wisconsin State Assembly on a bill approving entry into long term contracts by the schools. The bill will probably come to a vote early in calendar year 1976 (15).

In addition, FmHA imposed a condition that WWCC obtain signed membership pledges from 1008 households as evidence that the system will be used and bring in revenue in its first year (13). Early indications of subscriber interest suggest little difficulty in meeting this requirement.

The engineering consulting firm of Ralph Evans and Associates has prepared the specifications for bid for a turnkey contract. The specifications will be released as soon as there is state level approval for the school system contracts.

If the Wisconsin State Assembly acts favorably early in *1976*, Phase I construction can possibly be completed by late fall. If the Assembly does not act until later in the year, a problem arises because of the increased costs of installing the *system* under the climatic conditions which prevail in Wisconsin during the winter. Possibly, Phase I will be delayed until 1977. If the Assembly disapproves the bill, the entire situation must be re-examined.

Once implementation of Phase I is begun, about four years will be required before the detailed benefits of the Phase I system to the schools can be known. The first year will be devoted to construction and interconnection of the schools. During the first and second years, the schools will be developing their approach to using the system. The third year will be experimental and in the fourth year, the school system should be fully operational. These plans are reflected in the projected school user charges. The schools will not be charged for system use until the third year and then at a 50 percent rate (i.e., $4500 per year). Full charges will go into effect in the fourth year (14).

During the four year period described above, other activities can proceed in parallel. Thus, Phase II implementation, provision of additional services to individual subscribers beyond network and ETV, and involvement of other institutions such as the banks can be initiated. It is important to note that long time periods will be required to install, develop, and evaluate the innovative broadband uses such as contemplated in Trempealeau County. Thus, data on the value of systems such as the one proposed for Trempealeau County will not be available for a considerable number of years, even if work begins now.

Summary and significant findings from the Trempealeau County case study. The following summary discussion of the Trempealeau County project highlights the most significant points of this case study as they bear upon the future of rural broadband systems generally.

- the primary motivational force for the Trempealeau County project lies in the cooperatives, -- nonprofit organizations oriented to benefits for all members;

- within Trempealeau County cooperatives, a few key individuals have played significant roles in attempting to make an idea a reality;

- the underlying philosophy of the cooperative movement in rural areas led naturally to the concept of an areawide service which would serve all members even if their geographic location rated them poorly in the equation of cable system economics. This philosophic viewpoint was augmented by the vision of a few key persons concerning the full potential of cable in rural areas. At the same time, these key persons foresaw the consequences of granting

cable franchises for the most densely populated and profitable areas alone. Such franchises would mean that the most isolated residents would be left out of the cable system;

- feasibility study showed that provision of standard cable service in terms of improved network TV and ETV would not be economically viable -- a not surprising result given the low population density of Trempealeau County;

- the key motivating persons foresaw more than a standard cable system. Involvement of an institution, the schools, had many advantages. It was hypothesized that educational costs could be reduced while the quality of education was increased. Another significant benefit was lower individual subscriber fees than would be possible without institutional involvement. These economic benefits could be augmented by potentially higher quality education for all residents of the county;

- a Community Facilities loan under Title I of the Rural Development Act of 1972 was obtained. This is a unique loan-- the only one granted under Title I for a broadband system. Trempealeau County was fortunate in the timing of its application, which occurred shortly after Title I funds became available. Recently set priorities for the granting of such loans (16) plus the increasing competition for them indicates that this source of funding for broadband systems is unlikely to be available in the future. Indeed, correspondence to OTA from the FmHA Administrator states that "we do not anticipate this type

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of loan (i. e., for broadband systems) becoming a significant part of our community facilities loan program" (17);

- although FmHA provided assistance to Trempealeau County in the form of a loan, FmHA assistance did not extend to helping develop the rationale or justification for the system, nor did FmHA act as coordinator with other appropriate Federal agencies, such as the FCC. Trempealeau authorities were, and are, on their own in devising, and organizing their system. If the latter had not been possessed of a high degree of initiative and perseverance, it is not likely that they would have progressed as far as they have;

- Trempealeau authorities do not have a clear idea of concrete plans for service to be provided beyond community access to network and educational TV programs and use of the system by school districts. Some assistance, Federal or otherwise, probably will be necessary if the community is to realize such potential benefits as using the system for commodity and cattle market information; hospital and medical services; and fire and burglar detection. Revenue from these additional services might be essential to the economic viability of the expanded system now contemplated by local authorities;

- in Trempealeau, and elsewhere, state laws can constitute a major barrier to the development of community-based rural systems. The lack of authority for Trempealeau County school districts to enter into long term contracts has delayed implementation of the system;

- the tendency of cable entrepreneurs to buy up cable franchises in the most densely populated areas can isolate less densely populated areas from receiving service because the most economically attractive areas have been removed from the system;

- the desire to build an area-wide system is frustrated by the fact that townships cannot grant cable franchises. Thus, those interested in implementing an area-wide system are forced into the position of acquiring franchises from municipalities with hopes that intervening townships will join the system but with no guarantee that they will do so.

To summarize, the Trempealeau County project is a unique effort. It is an attempt to provide broadband telecommunications services by following the tradition of providing electricity and telephone service to rural areas through the use of cooperatives. The success or failure of the project will have significant implications for similar endeavors by other rural communities. It should be noted that other projects of this type are not likely to come to fruition under current conditions because of constraints on funds and the lack of a Federal program supporting demonstrations with objectives similar to those guiding the Trempealeau project.

Spartanburg, South Carolina Project

Unlike Trempealeau County, the Spartanburg, South Carolina project is taking place in a small city and contiguous parts of Spartanburg County rather than in a rural area. However, there are two reasons for including Spartanburg as one of the two case studies of this Chapter. First, the Trempealeau County project was initiated by cooperatives. For comparison, it is

useful to examine an example in which the Federal government has taken the initiative with the involvement of a consultant and private industry. Second, while Spartanburg is not rural, the services being investigated are applicable to rural areas. Aspects of the detailed cost analyses which are part of the Spartanburg project, such as transportation and telecommunications tradeoffs, will be suggestive of the results that might be obtained in rural areas.

The city of Spartanburg had a 1970 population of 44,546 persons. It has its own radio and television stations, newspaper, Spartanburg Technical College and other institutions. The black Community accounts for 33 percent of Spartanburg's population (18-11-1).

The table on the following page illustrates the demographic characteristics of the city and county of Spartanburg compared to South Carolina, the South Atlantic States and the U.S. as a whole. Of particular note in the table are the reduced educational and income levels in Spartanburg compared to the U.S. as a whole. There is also a larger proportion of families below the low-income line defined by the Bureau of the Census. Per capita expenditures for local government services are about half those for the U.S. average and are lower in the city than in the county. The reduced staff and budget in the city reflect the responsibility of the county for many public services, including education and health for both city and county residents (18-11-3). The lack of responsibility of the city for social services may be contrasted with the fact that only the city can grant cable franchises (19).

- National Science Foundation (NSF) - this agency is funding the project as part of a comprehensive telecommunications research program;

- The Rand Corporation - Rand is the contractor for the experimental studies in Spartanburg;

- TeleCable Corporation of Norfolk, Virginia - TeleCable is the owner/operator of the Spartanburg system, one of fifteen cable systems owned by TeleCable;

- Jerrold Corporation - Jerrold installed the cable system under a turnkey contract;

- state and local organizations - these are involved in the services the system provides.

Each of the above groups is motivated to participate in the project for different reasons. Thus, the state and local organizations are interested in the services which the system can provide while the Jerrold Corporation has used Spartanburg as a test-bed for its second generation of two-way equipment, especially its unified amplifiers (19).

One of the factors leading to the initiation of this project involving NSF, Rand and Telecable was the reassessment by the Federal Communications Commission (FCC) of its position on two-way cable systems. In 1972 the FCC ruled that all cable systems in the 100 largest markets must have two-way capability by March 1977. However, such factors as less-than-expected profitability of cable systems and inadequate evidence on the actual value of return signals has led to postponement of the rule. Three National Science

Foundation-projects, of which Spartanburg is one, are expected to provide data to the FCC and others on the value of two-way cable systems (18-1-1; 21-1).

As a cable operator, TeleCable is interested in the revenue potential of new services via two-way cable as well as the final outcome of the FCC decision. TeleCable worked extensively with Rand in developing Rand's proposal to NSF. As stated by Mr. Rex Bradley, President of TeleCable corporation in a letter to Dr. Leland Johnson of the Rand Corporation (18-VII-18): "We feel the social service delivery projects selected by Dr. William Lucas and his staff are meaningful experiments which will serve well in determining the future usefulness of broadband communications over cable television facilities for the delivery of social services." It might be noted that this is not the first time TeleCable has been involved in social services. For example, at their Overland Park, Kansas installation, cable was used for in-home education of two severely handicapped teenagers (21-2).

System description. The Spartanburg cable system is a high quality state-of-the-art two-way system which has been relatively free of many of the technical problems encountered by other systems. It provides twenty-seven forward or "downstream" and four return or "upstream" video channels. Twelve of the forward channels are used for major broadcast stations, locally originated programs and automated programming, leaving fifteen downstream channels available for other purposes. Three of the return channels are available for experimental use (21-2ff.).

The system provides extensive coverage. As of late 1974, of 10,000 city dwellings, 8000 were within access of the cable, as were 6000 in the county. Of the total with access, half, or 7000, had subscribed (21-2). Plans for expansion will provide access to an additional 6000 homes in the city and county (18-11-8).

Description of experiments. Actual needs of the area which might be supplied by cable were established through meetings held with more than 60 agency departments and offices at local, district and state levels (18-11-6). Persons interviewed were encouraged to define their problems and then consider how telecommunications might help, rather than being presented with the technology and asked to suggest ways to use it. There is some suggestion that these *two* contrasting approaches produce different results (21-3) and that where the technology is sufficiently flexible, as in Spartanburg, more meaningful needs assessments can be obtained by concentrating on needs rather than technology (19). Six months were spent in a careful needs analysis (21-3). Three basic groups of experiments were identified in the areas of:

- adult education;
- training of day care workers; and
- communications between social service agencies.

The education experiment attacks one of the major social service needs in Spartanburg and South Carolina. South Carolina is 49th in the United States in median years of education (10.5 years), and 62% of its adults have not finished high school (18-111-2). According to the Rand proposal "in the areas accessible to the Spartanburg cable system alone, there are approximately 20,000 adults without a high school education; 10,000 of these Spartanburg residents don't have an eighth grade education" (18-111-2).

Despite past efforts to upgrade the educational level of area residents by Spartanburg public schools and Spartanburg Technical College, much remains to be done. Current programs reach only a small proportion of those who could profit from them: in South Carolina, such programs have enrolled 1% of adults lacking basic (less than high school) education

and about 2% of those lacking a high school education (18-111-3). Of those enrolled, only a small proportion complete the programs (18-111-3). Significant reasons for dropout are difficulty arranging transportation and difficulty meeting child care needs and related family responsibilities (18-III-3). These difficulties are equally or more applicable to residents of rural areas, indicating the applicability of Spartanburg project to rural as well as more urbanized areas.

Broadband communications, by bringing education to those needing it, rather than requiring them to go to the source of education, might circumvent the barriers cited (see Chapter II for further discussion rural needs in education) . What remains to be demonstrated in the Spartanburg experiment is that quality education can be achieved through the use of broadband communications.

The purpose of the project will assess telecommunications as a method for providing second level basic adult education (grades 6-8) and high school equivalency education (18-111-1). The following three techniques will be tested: traditional classroom; one-way television; and two-way television using pushbuttons alone or pushbuttons with return voice for student response (18-I-2; 19-4ff .).

Measures of effectiveness of the three methods are directed at asessing both benefit and cost. Tests of educational progress such as the TABE (Test of Adult Basic Education) and GED (General Educational Development) will be used to measure student learning (18-III-17ff.). In addition, **updated** measures of student progress will be available throughout the telecommunications experiments (19). With regard to cost, careful records of the cost to maintain, operate , and administer the broadband system will be kept in

these and other experiments (19). Specific costs associated with the educational program which will be measured include direct instructional costs and student travel costs (18-111-18). Perhaps the hardest to obtain -- yet the most significant -- measure of the benefit of this program is its value to students who are reached by this system who wouldn't be reached otherwise (18-111-18). The latter are those students who couldn't partake of the benefits of adult education if obtaining it requires going to a classroom. While student questionnaires will enable an estimate to be made of the proportion of these students and their response to the program (18-111-18), it is unfortunate that a better means of determining this value is not available.

The second experimental application in the Spartanburg project is use of broadband telecommunications to train day care personnel. As stated by William Lucas of the Rand Corporation (21-6):

> "The need for quality day care has grown substantially in recent years as the number of women in the work force has grown. Child care in centers has grown more sophisticated as more positions are filled by well-trained personnel, but in-home and family care is a continuing problem. In these situations, the child either remains at home or is kept in the home of the caregiver, typically a neighbor or relative who is often a mother with children of her own. All too often this caregiver sees herself as little more than a babysitter. Even if she would like training, it is difficult to acquire because she is tied to her home. In the day, she must usually care for several children by herself, in the evenings and on weekends she must tend her own family. Of course, some caregivers are so motivated they attend occasional training workshops despite the inconvenience, but for the general population of this type of caregiver, effective training needs to reach into the home."

Despite recognition of the need for training of day care personnel (19-IV-8), the above quotation indicates the reasons such training is difficult to implement. Some of these reasons are identical to those

which make adult education difficult to provide -- the necessity to go-to a training center, which is prevented by conflicting demands on the trainees time. As in adult education, broadband is a potential way to resolve such problems in both rural and urban areas.

The day care training experiment uses a workshop approach with training workshops conducted in the cable studio and in homes and day care facilities in the field. According to the project prospectus, "participants in homes and centers will be seen as they ask questions, show techniques and exchange experiences with the professional leading the workshop. The multipoint distribution capacity of the system will be used to send the workshop and the associated dialogues [between the professional leading the workshop who may be located at the cable studio or one of the home or day care facility sites and day care workers at other locations] live over a closed channel to members of the day care community throughout the system" (18-IV-1).

Day care training by three different methods will be compared. For one group, five television cameras will be rotated among the studio and homes or facilities so each has a chance to actively participate. By switching the cameras on and off at the various locations, caregivers at sites with cameras can see and hear each other. A second group of caregivers will be able to watch the program but these people will not be able to actively participate because they will have no return equipment and thus cannot be heard or seen. A third group will receive the materials used in the workshop but will not have access to the cable system.

Videotapes of the workshop sessions will be saved, permitting changes in caregiver skills to be later identified and analyzed (19).

Cost-benefit analysis comparing one and two-way cable with actual visits to the home or facility to provide training sessions also will be conducted. Elements of this analysis will include cost of developing the materials, travel to homes, the wages and salaries of visiting training personnel, costs associated with use of the cable system, and the number of caregivers reached (18-IV-36ff.).

The third set of experiments in the Spartanburg project involves use of cable to facilitate inter-agency communications. One such application is reduction of the time and costs associated with the processing of applicants for federal assistance programs which require processing by more than one local agency. The specific program which is the subject of this experiment is the Work Incentive or "WIN" program which is administered by the U.S. Department of Labor and Health, Education and Welfare (18-V-7). Screening and approval for this program involves two agencies and several client visits. The associated problems of setting appointments, arranging and paying for client travel, and inter-agency interactions means that approval of the application requires considerable time -- an average of 77 days in Spartanburg on the basis of a small sample (21-9). In this experiment, cable will permit interviewing of the client and processing of papers by both agencies with the client remaining in one location (21-9).

Elements to be evaluated include the time necessary to complete the application process, with and without the cable system, and associated costs (which will take account of the travel costs for the client, work time lost, and child care costs) (18-TV-4). Another measure is the reduction in the backlog of cases which the cable system may permit (18-V-16).

Financial considerations; Federal involvement. The commitment of the National Science Foundation to the three experiments in this project totals $1,106,566, over a three-year period. The dollar value of TeleCable's and Spartanburg Technical College's contribution in terms of system or personnel costs is not known.

Previous sections have described some of the specific analyses of costs and benefits which will be undertaken in connection with the three sets of experiments in adult education, day care training and interagency communications. In a more general view, there are basically three types of costs on which data are needed in order to establish the potential for cable communications in providing social services. These are (19):

- the additional cost of two-way cable;
- the cost of the services themselves using the cable system; and
- transportation/telecommunications cost trade-offs.

The proposal for this study submitted to NSF by the Rand Corporation confined itself to providing data on the second of these categories of cost. This is not surprising, given the difficulty of quantifying the marginal costs of two-way cable and the tradeoffs between costs of transportation and telecommunications. Nevertheless, on their own initiative, project personnel will attempt to provide data on these more difficult costs. Despite the difficulty, other investigators should be encouraged to provide similar data.

The interagency communications experiment will provide data on two of these cost categories: services costs and the tradeoffs between transportation and telecommunications. The day care experiment will be used to estimate the marginal cost of two-way cable. The education experiment is difficult to evaluate in terms of any of the above three categories of costs because the bulk of the population served will be those who wouldn't have been reached otherwise.

Another important consideration is the potential economic viability of the system after NSF support is discontinued. NSF has indicated that economic viability and consideration of ways to continue the services beyond the period of NSF support was one of the criteria in the selection of contractors for this study (22). In addition, interviews with key project personnel (19, 20, 23, 24) suggest that the long-term viability of the system for providing public services is of considerable personal concern. Funding for related projects is being sought, notably from HEW. Hopefully, the experiments will also demonstrate the value of the services provided -- and the cost savings achievable -- to state and local authorities. Local support of the system on the basis of demonstrated cost-benefit might then be negotiated. Such an outcome, involving as it would, the provision of these innovative services on a self-sustaining basis in a privately owned system, would be both significant and important as a precedent within the industry.

Status of the system. The Spartanburg project started in September 1975 and is scheduled for completion in December 31, 1977. "The adult education and day care experiments are well underway. Substantive reports on various parts of the project will be prepared as data are available. For example, a report on the social benefits of broadband telecommunications for the

training of day care operators should be ready in the fall of 1976. Significant data on transportation/telecommunications tradeoffs derived from the interagency experiments should be available in early 1977.

Summary and significant findings from the Spartanburg Case Study. This section draws together some of the points already made and summarizes additional ones to highlight the relevance of the Spartanburg project to the potential for broadband communications systems in rural areas.

- While Spartanburg is not a rural area, the project has the potential for demonstrating the cost-effectiveness of cable for providing a combination of several public service uses. If so, the data may suggest that such services could be economically feasible in rural areas as well;

- Despite the involvement of a private cable operator in Spartanburg, many problems block the entry of the private entrepreneur into similar enterprises. The difficulty of interacting with a multitude of state, regional and local agencies to put together the necessary combination of public service uses, each of which, taken by itself, might not warrant the costs involved in installing a two-way system is significant. There is a need to demonstrate that a potential market exists. The Spartanburg project is a step in that direction. In addition, the possibility of encouraging the development of a new kind of entrepreneur who is a "broker" for combining telecommunications services should be considered;

- an important prelude to putting together a successful combination of public services is a careful analysis of community needs and the matching of those needs with the capabilities and costs of cable;

- the Spartanburg project so far has generated a list of some 40 additional applications which could be served by the broadband system;

. better methods for quantifying benefits are needed. An example is determining the benefits of making adult education available to those who won't or can't come to a specific classroom but who can partake of such opportunity "on the cable";

- unionization (or lack of it) has a significant effect on system costs. In Spartanburg, studio costs are about $25/hour for most programs and only one operator is required. In unionized New York City, the same program would require 3-5 people at much greater cost;

- as in Trempealeau County, success of the Spartanburg project depends on the personal commitment and vision of a few personnel, among whom are the Rand Corporation Project Leader and Site Manager, the Dean of Continuing Education at Spartanburg Technical College and Telecable employees.

Constraints To Wider Application Of Broadband Communications In Rural Areas

In preceding sections of this Chapter, the system approach was defined, and the Trempealeau County project, which most clearly illustrates the system approach in a rural setting, was described. The experiments supported by the National Science Foundation in Spartanburg, South Carolina, were discussed to illustrate other uses of broadband communications to meet public service needs. The latter experiments will also provide needed data on transportation/telecommunications tradeoffs and the costs and benefits of providing public services by broadband or alternate methods.

The following discussion addresses factors which constrain more widespread use of broadband communications to meet rural needs. This discussion begins by identifying those technologies which were included in the study as having potential for meeting rural needs beyond supplying news and entertainment. The degree to which technology is a constraint is then considered. Thereafter, regulations and economics as they apply to the technologies and act as constraints to wider use of broadband communications in rural areas are discussed.

Technology

As requested by Senator Talmadge of the Committee on Agriculture and Forestry, this study was concerned with the potential application of broadband communications to rural areas. “Broadband” communications refers to transmission of many television voice and/or data signals through a single system. The transmission may be through the atmosphere or through wires or fibers. There is no clear point of separation between broadband and narrowband.

For the purposes of this study, the term "broadband" indicates a communications system employing one or more of the following technologies:

- coaxial cable — "hardwired" - a solid substance (wires or
- fiber optics — glass fibers is used for transmission

- translators — transmissions are broadcast -- a solid
- microwave — medium is not used
- satellite

In general, broadband as used in this report implies two-way interaction with video as well as voice and/or data in at least one direction. It will be noted that of the above listed technologies, coaxial cable and fiber optics can accommodate transmissions to and from individual users whereas translators, microwave and satellite are generally used to transmit signals in one direction only; namely, to the user. Because of the potential value of low-cost translators in rural areas, an additional technology, the telephone, was included because it can be employed to provide return audio signals as a response to audiovisual signals sent to users by means of the translator.

It is important to note the technologies excluded from this preliminary assessment. Conventional telephone service except as previously noted was not included. [1] Broadcast over the airwaves from a single station, whether

[1] It should be noted that there are many potential uses for conventional two-way telephone to provide public services in rural areas. However, the requesting committee expressed its interest in broadband communications, and for this reason conventional telephone was not given major attention in this preliminary study. Applications solely based on conventional two-way telephone were considered outside the scope of this preliminary study.

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audiovisual or audio only, was not included. Thus, network or independent television stations broadcasting on a single frequency, and radio stations, whether fixed or mobile, commercial, military or citizen's band,[1] were not included. However, some consideration has been given (later in this Chapter) to the implications for the telephone and broadcast television industries of increased usage of broadband telecommunications.

A more detailed description of the technologies is presented in Appendix D. Technical characteristics of the technologies and costs associated with their use are included as well.

For purposes here, of this discussion, it is sufficient to note that there are a variety of technologies available which can be combined in various ways to meet rural needs. For example, cable can be used where it is economically feasible. Where density is very low there are two options. The uneconomic areas can be subsidized by the denser areas. This is the essence of the cooperative approach which is dedicated to providing full service to all members. Alternately, low cost translators can be used to provide service to less dense areas with response capability provided by telephone. However, the latter service will be inferior to cable because video return by telephone is not within the state-of-the-art and response is thus limited to voice or pushbuttons. Microwave or satellite can be used to link several rural systems with distribution to individual users accomplished by cable or translator. (It will be recalled that the Trempealeau County system will use a combination of microwave and cable.) Fiber optics is a new

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[1] Citizen's band radio has been in extensive use in rural areas for a number of years and its obvious advantages of flexibility and low cost could continue to make it a valuable supplement even after a broadband system was established.

technology which, while still experimental, is developing rapidly. Its value lies in its potential lower cost than cable, as well as its vastly increased channel capacity. A fiber optic cable of the same diameter as a coaxial cable could carry one million times more information.

In general, it can be said that technology is not presently a limiting factor in bringing broadband communications to rural areas. In the future, if several two-way public services cannot be time-shared and must be transmitted simultaneously, along with a number of conventional television channels, then channel capacity of conventional cable would become limiting. Meanwhile, existing technology is adequate to test the feasibility and value of public service and/or commercial use of broadband communications in rural areas. If success in initial demonstrations generates demand beyond present day technology, then fiber optics at that time may well be available to meet additional demands for channel capacity.

Since technology is not limiting, reasons for the failure of broadband communications to penetrate farther into rural areas must be sought elsewhere -- in regulatory or economic constraints. These are explored further below.

Regulation

The following treatment of major regulatory issues affecting the future of rural broadband systems treats the two main technologies for local distribution of broadband service to rural areas: cable and translators. In addition, because of recent strides in the development of fiber optics, some indication will be given of the consequences for rural systems of the alternative ways in which future regulatory decisions concerning fiber optics may be handled.

In discussing these three technologies, first the regulatory constraints will be outlined and then their implications for rural systems described. At the end of the section will be a brief overview of the principal issues.

Cable. Cable regulations vary with the location of the cable service in relation to the top 100 television markets in the nation.[1] However, because some rural areas fall within television range of stations in these markets, the full range of FCC regulations -- those concerning the "top 100" as well as those pertaining to remote rural areas -- must be considered.

At the present time, FCC rules, based upon the Cable Television Report and Order of *1972*, provide that cable systems in the top 100 markets may import a limited number of distant signals (usually two or three) and must provide:

- transmission of local broadcast stations;
- a channel for local educational programming, free for at least 5 years;
- a channel for use by local government, free for at least 5 years;
- a free channel for use by the public on a first-come, first-served basis;

1 Market rank of major television cities is determined from the number of prime time viewers and ranges from the first market (with the largest number of viewers) to the 100th. Those falling outside the top 100 are not ranked.

- at least one channel for local programming if there are more than 3500 subscribers;

- channels which may be leased for other services.

The 1972 FCC rules also required that cable systems in major markets must provide at least 20 channels by 1 March 1977 and that for each channel carrying a broadcast signal, at least one channel must be available for nonbroadcast use (27-16; 28-74; 29-6). Another rule promulgated in 1972, but without a specific date for compliance, was that cable systems must be able to accommodate return signals from the subscriber to the control center. Concerning the latter rule, in addition to the absence of an effective date of implementation, it is significant to note that neither video nor voice return capability are required, although both are well within the state-of-the-art. Instead all that is required is a simple response capability as can be accomplished by pushbutton.[1]

Concerning the above rules, the requirement for existing systems to meet 20-channel capability has been indefinitely postponed because of adverse economic conditions facing the cable industry (27-16). In addition, the requirement that cable systems with more than 3500 subscribers must originate programming was stayed by the FCC during litigation.[2]

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[1] It should also be noted that cable systems existing prior to March 1, 1972 are "grandfathered" and need only continue the service they offered at that date (27-15). Thus, they are exempt from the public access and other dedicated channel requirements of the 1972 rules.

[2] U.S. vs. Midwest Video Corp., 406 U.S. 649 (1972). Although the Supreme Court upheld the rule, the stay was never vacated so the rule is not in effect (32-9).

As indicated, the above rules described pertain to cable operators within the top 100 markets. Outside these areas, the FCC rules on channel access for public, educational and government use do not apply.

There are three important implications of these rules for rural cable applications as discussed in this report:

- First, without encouragement from the FCC to provide return capability on cable systems, it is not surprising that most do not provide such capability.[1] The reasons advanced against two-way are lack of demonstrated need and the uncertain prospects for marketing such a capability for the benefit of the cable operator and/or the community. On the other hand, without an existing technical capability for two-way service, it is impossible to explore its value and its potential for economic viability. The result is a self-perpetuating circular situation.

- Second, the FCC requirement that channels for educational, government and public use be provided free of charge makes sense only where such services cannot be used to generate revenue. Applied in a blanket fashion to all systems, it could bar the development of the rural systems contemplated in this report. As will be recalled from the earlier discussion, the feasibility of area-coverage rural systems will depend upon the revenues to be received from the use

[1] It should be noted that systems for major market areas now being installed by some major multi-system operators do provide for conversions to two-way. Anticipated conversion costs are about $500 per mile (compared to basic installation costs of $4300/mile).

of excess channel capacity for public service and commercial uses. Had Trempealeau County, for example, been located within a top 100 market area (and subject to FCC requirement for such markets), it is entirely possible that the project would not have been attempted. Without revenue from the school systems (and citizens might well have objected to paying for channels that were meant to be free of charge), low population density and other unfavorable characteristics would have made the system economically unattractive. In this connection, it should be emphasized that payment for such institutional use of channels should not necessarily represent a net increased burden for the residents involved. As in the case of Trempealeau County, savings from the use of the broadband system may offset the costs. As a further comment on the difference between the concept underlying the FCC "free of charge" rule and that of the full-service rural systems discussed in this report, it should be noted that the FCC concept implies the use of broadband as a supplement to education while the usage contemplated here is an integral element of the basic delivery system for educational services.

- Third, the current debate over possible relaxation of cable regulations has focused on such issues as the number of distant signals which the cable operator may import (presently three in markets 1-50, two in market 51-100 and one outside the top 100 markets) and on the pro's and con's of restriction of cablecasting of sports events and movies (31-160).

This is a debate between the broadcasters and current cable operators over the areas in which they presently are in conflict: entertainment and sports events. If the potential for full-service rural broadband systems is not considered in this debate, it is possible that the dispute may be resolved solely on merits of the cases as viewed from the urban perspective -- when in fact, those also affected by the outcome will be rural residents.

This is not the only example of the problems that might persist if the interests of rural systems are not taken into account. On the one hand, the FCC does not restrict nonentertainment uses of cable (which could have the effect of permitting the development of the broadband systems discussed in this report). But on the other hand, FCC regulations on the importation of distant signals are most restrictive outside the top 100 markets (27-55), which could have the unintended effect of frustrating the development of the very systems that could provide the nonentertainment services that FCC has decided not to constrain. This is because a full range of news and entertainment is necessary to capture subscriber interest. In other words, rural systems cannot be solely supported by public service and commercial use of which charges are levied. Full subscriber support is also necessary.

Expansion of cable into the rural public service market has not been directly restricted by FCC regulations. More important are: 1) the indirect impact of regulations which have not been enforced (20-channel capacity and response capability); and, 2) regulations which have been designed primarily with the broadcaster in mind.

With regard to the first, requirements for response capability and 20-channel capacity were not enforced because the cable industry was competing with broadcast under adverse economic circumstances created in part by other FCC regulations designed to protect broadcasters (restriction on distant signal importation, limitation of cablecasting of sports and movies, etc.). Although the impact has yet to be felt, failure to enforce the 20-channel capacity and response capability requirements has led to the installation of reduced capacity cable systems which ultimately will restrict cable operators from providing exactly those multi-channel services which cable can uniquely provide.

With regard to the second point, cable has been treated as ancillary to broadcasting. As described in a recent House Subcommittee on Communications staff report:

> ..."it means that cable has no charter of its own -- that is is largely regulated as an appendage to conventional broadcasting. But cable television has distinct characteristics, and merits the opportunity to develop on the basis of those differences" (27-29).

Translators.[1] A number of regulations presently Constrain the use of translators as a supplementary means of servicing remote households in an area-coverage broadband system. In most instances cited below, these restrictions could have the practical effect of preventing a broadband system from integrating translators into their operation.

- Translators are restricted to rebroadcasting signals from licensed broadcast stations with station approval for such

[1] Translators are defined as broadcast stations ".. .operated for the purpose of retransmitting the signals of a television broadcast station, another television broadcast translator station, or a television translator relay station by means of direct frequency conversion and amplification of the incoming signals. .." (Federal Communications Commission Rules and Regulations 74701).

rebroadcast. Thus, an owner of a translator cannot originate programs. This restriction also applies to advertising, reducing the potential of this form of financial support. More particularly, UHF translators are permitted 30 seconds per hour of still picture and recorded audio advertising. No advertising or other local origination is permitted on VHF translators. These restrictions may be contrasted to cable alone, where station approval for program transmission is not required and where local origination of programs is encouraged.

- importation of distant signals by microwave, whether land or satellite based, is barred for translator stations (26). Thus, the distance over which signals can be imported is limited to the number of "hops" which can be made by translators before the signal degrades (a few hops at 50-80 miles per hop) (3-5). Not only is distance limited but the cost of distant signal importation is increased compared to the cost if distant signals were obtained from land-based microwave relays or satellites. Such restrictions do not apply to cable systems. [1,2]

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1 It should also be noted that Nevada Radio-Television, Inc. has had permission since December 1972 to use 7 and 13 gigahertz, subject to several conditions, for a television relay and translator network. The original reference is the FCC Memorandum Opinion and Order No. FCC-72-lll0. The current reference is Nevada Radio-Television, Inc. 38 FCC 2nd 55525RR 2nd 1197.

- Regulations prohibit scrambling of translator signals (26-318). Thus, because these signals are broadcast over the air; they can be picked up by any television set. This may be contrasted to cable service where a fee can be charged for installation of the cable and subsequent use of it. Because of the difficulty of charging for translator use, entrepreneurs do not find installation and operation of translator stations economically attractive. Instead translator stations are usually operated by broadcasters wishing to reach locations outside their signal range, government entities or nonprofit community organizations (3-5).

As is apparent from the above, translator stations are operated primarily as extenders of broadcast systems, permitting wider signal coverage, rather than as a technology with potential in its own right. Exclusion of local origination and an inability to charge for service is likely to lead to continuation of this situation.

In urban areas, where broadcast stations are located, there are strong arguments for restricting translators, the most cogent being protection of broadcasters. On the other hand, it must be noted that the 1952 FCC frequency allocation plan, deriving its justification from the Communications Act of 1934 which called for "a fair, efficient and equitable distribution" of communications service in the United States, envisaged 2,000 television stations (27-l). In fact, today, there are less than 900 television broadcasters. Those who are underserved by this scarcity of broadcast stations are the inhabitants of rural areas (27-l).

Fiber Optics. As discussed earlier in this Chapter and more fully in Appendix D, the availability of fiber optic technology could be of great importance to the development of rural broadband systems. Not only would this technology vastly increase the number of channels that could be carried on a given line, but it also holds the promise of being cheaper than coaxial cable, which might have the effect of opening up those rural areas that have too low a density to justify the expense of conventional cable.

Here, as in connection with the above discussion of the dispute between broadcasters and cable operators, the concern is that jurisdiction over the uses of this technology might be decided without taking into account the interests of rural broadband systems. As an example, the decision might be framed largely in terms of the uses of fiber optics for long-distance transmission, with an appropriate institution assigned on this basis to have exclusive jurisdiction over its use. In turn, this could have the practical, if inadvertent, result of denying its use for short distances in low-density rural areas. .

Alternatively, this jurisdictional dispute could come down to a competition between the telephone and urban cable operators -- with the same end result for rural broadband systems. Competition between these two is not an immediate problem because of the dissimilar capabilities of telephone and cable television systems. If, however, optical technology provides the telephone company with broadband capabilities and the cable companies begin to offer two-way services such competition may occur.

Already there are indications that the leaders in the cable television industry will probably propose that there be two distinct services and two cables brought into each household. One service, provided by the telephone utilities, would be a switched service with a universal two-way voice and data capability. The other, operated by the cable industry, would be a distribution only, non-switched service having the specific function of carrying program material from a central point to the home.

If this were to occur, once again rural interests could be left out. Present cable operators, interested largely in expanding their market for entertainment and similar services -- which only entails one-way transmission -- understandably might be willing to retain this jurisdiction in return for assigning two-way systems to the telephone companies. Left out would be the interests of potential rural broadband system operators, who conceivably could have their right to two-way capability almost inadvertently traded away.

Discussion

Broadcast television has not developed to the extent anticipated because the economic base to support a broadcast station is larger than was expected when the regulations were formulated. As a result, rural areas are underserved with conventional television. Cable operators, who could remedy this deficiency, are restricted by regulations on the number of distant signals they can import in order to protect the few broadcasters that are located in rural areas. Translators, which could increase the coverage of independent broadcasters, are sometimes not used because the independent broadcaster may then be considered a network and the costs and benefits of possible unionization must be weighed against the benefits accruing from increased coverage.

The FCC has attempted to foster development of the unique potential of cable (especially two-way cable) by imposing a requirement for free channels for educational, governmental and public access use for systems in major market areas. Local authorities frequently levy similar requirements in granting franchises. However, these attempts to encourage development of unique services may have discouraged rather than encouraged the development of cable. This is because cable operators tend to think of public services as services to be provided without charge rather than as sources of revenue. As a result, cable operators have not contributed to the development and spread of public (or commercial) services via cable.

Because cable operators generally believe that economic viability lies in conventional television programs, they have competed with broadcasters rather than emphasized the development of unique services. If it can be shown that meeting public and commercial needs can generate revenue, attitudes might change and the result could be the development of a new type of cable entrepreneur, one who might “broker” a total system consisting of a combination of services.

As for the impact on cable of possible future legislation, one further area of current debate requires comment. At issue is whether cable should be treated as a common carrier, as telephones are. The underlying concept, as articulated in the Whitehead Report and elsewhere, is separation of the medium -- the cable distribution system -- from the message -- the program or information content. The cable operator would be similar to a telephone company, a common carrier, in that he would provide a communications system but would be barred from influencing the use made of his system. Separate entities, such as the networks, private broadcasters or other groups desiring to provide special services would rent or buy channels from the cable operator.

Regulation of cable as a common carrier could constrain the system concept as described in this report. This is because this concept assumes a combination of services and accessibility to the system by all residents (those living in relatively unpopulated regions as well as those living in more densely populated rural towns). Economic viability is based on averaging of costs across all residents so each pays the same and on the potential reduction of costs to each individual subscriber because of higher fees for institutional use which help to support the total system. If the cable operator is restricted to distribution and excluded from content, his motivation to participate in developing a viable combination of services which will support an area-wide cable plant in a low density area will be greatly reduced.

As an overall comment on regulatory constraints upon the development of broadband systems, it has been shown that these constraints, present and likely in the future, seem to represent errors of omission rather than commission. To the degree that the interests of rural broadband systems are not brought to the attention of policy-makers, it is likely that important issues will continue to be resolved as if only urban interests were involved. In the latter instance, decisions might be made which could have the practical effect of foreclosing the development of rural broadband systems before the latter even have a fair test.

Economic Constraints

A prima facie case can be made that the principal constraint on the deployment of rural broadband systems has been economic viability.[1] The

[1] It should be noted that in the long run it will be necessary to look beyond economic constraints. To the extent that neighboring rural communities, for whatever reason, refuse to work together or share

common facilities such as broadband systems, economic unfeasibility might be said to be grounded in social factors. A similar caveat applies when jurisdictional disputes among state and local government and community groups hamper such common enterprises as these systems -- except that in this instance the cause for non-adoption might be labelled as political. While either or both of these factors could have significant influence upon the ultimate degree to which broadband systems are adopted, they are not immediately relevant to the task at hand -- which is attempting to understand why rural areas which otherwise might be willing and able to support such systems have been unable to develop them.

necessary technology has long been available, present regulations are not totally restrictive, but Trempealeau County remains the only rural area in the United States where an area-coverage system is being seriously attempted.

Data are inadequate to judge whether the belief that such systems are not economically viable is valid -- or whether this belief is simply "conventional wisdom." What does seem clear is that conventional cable systems, limited to news and entertainment and having as their sole source of revenue the fees of individual subscribers, are not economic in low-density rural areas. To the extent that potential entrepreneurs and system operators continue to think strictly in terms of the traditional uses of broadband, then their negative opinion -- or, "conventional wisdom" -- will continue to be self-fulfilling in nature.

Hard data on the economic feasibility of area-wide multiservice systems must be gathered before this predominant opinion of investors and operators can be altered. Later in this Chapter an approach will be outlined by which such data can be gathered. First, however, it is necessary to describe the economic constraints to the development of rural systems as they exist and are perceived today. There are two aspects of the problem: capital for system construction and, capital for operating and maintenance costs.

Construction. Installation of a broadband communications system, regardless of the technology used, is capital-intensive and requires a large front-end investment. The costs of laying cable, providing hardware at the head-end, erecting antennas and installing translators, or constructing an earth station, are sizable. These costs can be reduced somewhat in rural areas; for example cable undergrounding will

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be cheaper in rural areas than in high density urban areas or may not be required. But even under the best conditions a large investment will always be required.

Unfortunately, sources of funds are extremely limited. Private entrepreneurs will not put up the necessary capital or use their conventional loan sources for rural systems because such systems are believed to be uneconomic. Two government sources which have been used to support installation of rural systems were found, but, for the reasons outlined below, neither is likely to be of significant assistance in the future.

The first of these is USDA Farmer's Home Administration Community Facilities loans under Title I of the Rural Development Act of 1972. One such loan has been made to a cooperative, the Western Wisconsin Communications Cooperative (WWCC), to fund the first phase of a county-wide cable and microwave system. As has been described, WWCC was fortunate in the timing of their loan application, having submitted it just after the Act was passed. Today, there is more competition for these funds. A successful applicant would have to justify a telecommunications system in terms of recently issued loan priorities, which are (in descending order): 1) public safety facilities; 2) health care facilities; 3) public service facilities; 4) recreation facilities; 5) new hospitals or expansion of existing hospitals; and 6) other (33).

Given the present uncertainty as to the value of broadband communications to rural areas, it is unlikely that such an application could successfully compete today for funds. The validity of such an interpretation is shown by a statement from the FmHA Administrator in correspondence to OTA: "we

do not anticipate this type of loan becoming a significant part of our community facilities loan program" (17). In sum, this potential source of capital for construction of new systems is probably now a dry well in the shifting sands of uncertainty surrounding rural broadband communications. In fact, it seems unlikely that additional funding will be forthcoming for Phases II and III in Trempealeau County, which must be completed if anything concrete is to be known about the overall value of a community-based, area-coverage system.

The second government source of funds for capital construction of rural telecommunications systems is the Business and Industrial (B and 1) Division, also under the Farmer's Home Administration of the USDA. Unlike Community Facilities which grants direct loans, the B and I Division guarantees loans from other lenders, such as banks. Whereas Communit$_y$ Facilities can help a cooperative or other non-profit community organization, B and I is a useful guarantor of loans for the private entrepreneur. One B and I guarantee for a telecommunications system was found. This guarantee was approved on behalf of Windsor CableVision, which is installing a cable system in parts of the contiguous counties of Windsor, Williamson and Plymouth, North Carolina. Although the system will initially provide commercial and educational television, the system operator, Bermey Stevens, envisions far more. Under the right circumstances, this system could evolve in the Trempealeau County direction -- but through the efforts of private industry, rather than through the non-profit cooperative mechanism. It remains to be seen whether circumstances will facilitate such evolution. The outcome will depend greatly on the ability of this one person to accomplish what no other private operator has achieved and to devise, assemble, and sell a combination of non-entertainment services that can be of economic value to his community and still pay for themselves. Before

leaving this section, however, it should be noted that the B and I Division of USDA could guarantee funds for other telecommunications operators. Whether rural-based operators will take advantage of the opportunity in order to support systems which go beyond conventional television service may be unlikely in view of the prevailing opinion in the industry about the economics of these systems and such services.

Operations and Maintenance. Assuming that a broadband system exists in a community, its economic viability will depend upon revenues in excess of costs. Costs include retirement of capital debt, salaries and overhead associated with operating the system, and maintenance requirements.

Until now, revenue to cover these costs has depended almost entirely on fees from individual subscribers whether directly or indirectly collected. (An example of an indirect collection method is the use of special community tax districts to pay for translator service.) The service in return for subscriber fees generally has been limited to network or educational television, possibly supplemented by channels dedicated to special use (e.g., public and government access) if required by FCC rules. Fees are typically in the order of $5/month. Under these conditions, the number of subscribers per unit area will determine the economic viability of the system.

This economic picture, however, can change radically if revenue can be derived from public or commercial services. The concept is best illustrated by the proposed Trempealeau County project in which the schools will each pay $9000/year to use the system. The benefit for the schools is expected to be more effective use of teachers and reduced transportation costs. The broadband system will be used to link teachers and students across schools

for special classes, which will eliminate the extensive shuttling of students from school to school which now takes place.

It is this aspect, of providing a cost-effective alternative to manpower intensive and transportation intensive solutions to rural problems, which has not been adequately explored. In fact, it is ironic that the FCC requires free cable channels for government, educational and public access use, in major market areas. If these were used effectively (they are not), the community might well be willing to pay for value received.

Discussion. If the costs and revenues of a rural broadband system depend solely upon conventional television programs in sparsely populated rural regions, then a cautious stand toward economic viability is justified. What remains to be tested is the value of broadband communications as a substitute for manpower, transportation or other alternatives in providing health, education, governmental and commercial services to rural areas. A fair test must include revenues to the system based upon the value of these services, in which case the fees to be charged might nearly equal the next most costly alternative. If broadband communications then can provide a benefit equal to or greater than that provided by alternatives, broadband would be the technique of choice for providing the service. In turn, the fees paid by institutions or the community might allow the fees charged to the individual subscriber for news and entertainment services to be lowered and thus affordable by most residents. Inquiries conducted in the course of this study indicate that this test has not yet been made.

Summary Of Findings

In preceding sections of the Chapter, a broadband communications system was defined, two illustrative case studies were described, and constraints

to system applications in rural areas were identified. Findings are briefly summarized below.

A rural broadband system is a community-wide communications network, available to all residents and many institutions. The system may be used to meet health, education and other social service needs, facilitate government and administrative transactions, and serve commercial enterprises as well as provide network TV and entertainment. The particular services are derived from an assessment of community needs in which it is determined whether broadband is the most cost-effective method for filling those needs. Significant fees are charged for public service and institutional use of the system. These fees are justified by savings made elsewhere (e.g., the salary costs of hiring more teachers.) Institutional and public service support of the system reduces installation and subscriber costs for individual users. The combination of services leads to economic viability.

The Trempealeau County project most closely illustrates what is meant by the system approach. A county-wide cable and microwave system available to all residents is planned. An institution, the schools, will use the system in hopes of improving the quality of education and saving dollars associated with teacher salaries and transportation of pupils between schools. While an early feasibility study showed that a conventional individual subscriber supported cable system would not be economically feasible, the combination of individual subscribers and institutional use is expected to result in economic viability. It should be noted that each school will be charged a significant fee -- *$1000* for installation and *$9000* per year for two-way use -- compared to a *$20* installation fee and *$5* yearly user charge for individual subscribers.

The Spartanburg, South Carolina experiment illustrates multiservice use of a broadband system. Three experiments are being conducted with Spartanburg's two-way cable system. These are in adult education, training of day care personnel and streamlining the processing of applicants for multi-agency programs. The costs and benefits of two-way broadband vs. one-way broadband, vs. meeting these needs by more conventional means are being compared. Although Spartanburg is an urban rather than a rural community, these same services are needed in rural settings. National Science Foundation support for the project will end when the experiments are over in about three years. However, the potential is there for evolution into a system demonstration. If broadband proves to be a cost-effective method for providing these services, they could be continued by other funding mechanisms.

Given the high potential of broadband to meet rural needs, it is noteworthy that there have been so few applications providing services other than conventional television. Technology is not limiting. FCC regulations do provide some constraint. For example, relaxation of restrictions on translators, so that they could rebroadcast signals received from ground or satellite-based microwave relays, would encourage wider use of this technology. For cable alone, regulations restrict cable transmission of commercial television but do not inhibit use of cable for public services or institutional use.

The primary constraint on wider use of broadband in rural areas is economic. However, it is unclear whether this constraint is actual or perceived. While the low density of rural populations makes use of broadband to provide conventional television economically less attractive than in urban areas, the same low density could well favor it for public service

and institutional use. However, lack of knowledge on how to put together an effective combination of services, inadequate data on their value which makes it difficult to determine an appropriate charge for such uses, and inadequate sources of capital have inhibited rural applications.

The Need For System Demonstrations

Tests of the system approach to broadband communications have not been made in rural areas. What are now needed are demonstrations to see whether this approach works. As has been pointed out (34-II-46):

> "the argument developed in much of the literature -- that as systems become profitable they will naturally develop public service programs -- simply has not held true. Many profitable systems have never instituted such programs. Other systems that have penetrations well above the expected profit-generating point of 40 percent, discontinued their programs (e.g., Wilmington, Delaware at over 60 percent, Santa Rosa at over 80 percent). It is clear that if natural experimentation in social and/or public service delivery is to develop -- even in a technologically limited mode -- it will have to be developed by agencies other than cable systems."

> "...the development is not likely to come from those municipalities where cable exists. In general, they are not large enough to have the research or technical capabilities necessary to establish a comprehensive delivery system."

The system concept as developed in this report does not assume that the public service aspects of broadband commmunications are economically unsound and therefore require subsidy by more profitable entertainment programs. Instead, the opposite hypothesis has been advanced. Public and commercial services figure prominently in the economic base for the system. However, as pointed out in the above quotation, broadband systems providing public services as well as conventional television have not spontaneously evolved.

In view of past experience, they are not likely to evolve without Federally assisted demonstration programs.

On the other hand, a massive government program to support rural broadband systems seems premature. Not enough is known about the detailed nature, feasibility, and value of such systems to enable their widespread deployment by means of routine and standard operating programs. Demonstration programs are a necessary intermediate step.

Before describing an approach to implementing system demonstrations, it is important to clarify what is meant by a demonstration and distinguish it from an experiment.[1] An "experiment" implies careful selection of variables, a rigorous evaluation protocol and a limited span of time over which the experiment will operate. An experiment is generally superimposed on a community. It is not intended to be self-supporting and generally is heavily or entirely supported by Federal funds. Public service applications of telecommunications have largely been experiments, not demonstrations. The objective has usually been to determine whether it is possible to use broadband to provide the service in question. There has been relatively little emphasis on evaluating how effective broadband is compared to other methods or whether it is less costly. When the experiment is over and Federal funds are withdrawn, the community usually (but not always) cannot, or does not provide funds to continue the service.

1 Definitions of "experiment" and "demonstration" vary among researchers in different fields. It is recognized that these terms as used in this report may be used differently by others.

In contrast, the intent of a "demonstration", as used here, is to test whether entertainment, public service and commercial uses of broadband communications can be combined so as to produce a system which is economically viable and which meets the needs of a whole community rather than one or a few subpopulations within it. The particular services must be tailored to the specific and individual needs of each community because different services will have different cost effectiveness ratios depending on the demographic, socioeconomic and institutional characteristics of the community.

Associated with the concept of a demonstration as used in this Chapter, is the consequence that a certain amount of experimental rigor may be forfeited. For example, the ideal community for a demonstration is one which has indicated a strong desire for the service as shown by its assembling knowledgeable personnel, developing a preliminary system concept and perhaps investigating some of the economics of the situation. However, the community may not be the one which an experimenter would select after careful consideration of all communities in which the experiment might ble conducted. Nevertheless, the success of a demonstration (as contrasted with an experiment) is more likely to be related to a widespread community desire for the service than to experimental needs.

It is important to distinguish this report's use of the term "demonstration" from another use sometimes made of it. Thus, demonstration sometimes refers to construction of hardware to see if it will work or could be used in a particular application. There have been many such demonstrations in the field of broadband communications. However, under the definitions used here, these would be hardware experiments, not demonstrations.

It should not be assumed that a finding of this study is that there is no further need for experimentation. However, such organizations as the National Science Foundation and the Department of Health, Education and Welfare are fulfilling this need. The need for demonstrations and the means to bring them about has been less adequately explored and hence are the subject of most of the rest of this Chapter.

An Approach To Implementation Of System Demonstrations

As to what broadband services may be included in systems demonstration any or all of those discussed in Chapter II might be candidates. In addition, consideration might be given to comparison studies of transportation demonstrations such as the Rural Bus Program in rural counties with similar characteristics to those which are the sites for broadband communications demonstrations.[1]

Turning to the specifics of designing system demonstrations, there are financial, technical and institutional aspects which will vary with the characteristics of the rural areas in which the demonstration is to take place. A preliminary framework has been developed based upon the three types of rural counties described in Chapter 111.[2] In brief, it will be recalled that these are:

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1 The importance of these comparisons lies in the fact that there are substantial funds for transportation demonstrations in rural communities. Rural communities may become prematurely committed to transportation options (such as shuttling students back and forth among schools for special classes) when communications options might be more cost-effective.

2 As stated in Chapter III, the individual county has been used as the unit of analysis because most statistics have been gathered on this basis. In practice, a rural broadband system could take in the area of all or parts of several counties, which could also mean that more than one category of county might be included in a single system. Especially

if these systems are to be underwritten in part by public service users, such as schools, it is more likely that the boundaries of the broadband system will be coterminous with the geographical boundaries of these administrative districts, which in recent years have increasingly become regional rather than following county lines. This does not invalidate the general point that has been made concerning the necessity for matching a system to the characteristics of the individual rural area being considered.

- Turnaround Acceleration -- counties which are usually adjacent to metro counties, have accounted for 62% of the net migration gained by rural areas in the 1970's and are characterized by growth in the service sector of the economy.

- Turnaround Reversal -- counties which are usually not adjacent to metro areas, have not grown as rapidly as Turnaround Acceleration counties (but whose growth in the 1960's and 1970's is significant because it followed decades of declining population) and are characterized by growth in the manufacturing sector of the economy.

- Declining -- counties which account for 25% of all rural counties and are generally not adjacent to metro counties, are still showing net outmigration and in which employment opportunities in service or manufacturing have not kept pace with losses in agricultural or mining jobs. Elderly and young people typically account for a disproportionately high percentage of the population.

As indicated in Chapter II, revenue sources to support broadband communications are likely to also vary with the individual community. In general it can be said that:

- for the rapidly growing, service-oriented Turnaround Acceleration counties, business and commercial services are a potential source of revenue. Some of these counties are also characterized by a high proportion of couples of child-bearing age, whereas others contain a significant proportion of relatively well-off retirees. Regardless of which (or both) of these populations are predominant,

the educational attainment and relative well-being of these populations are likely to result in a demand for public services (in such areas as education and health) together with a possible willingness to pay for those public services that could be supplied by broadband.

- for the less rapidly growing Turnaround Reversal counties, characterized by growth in manufacturing jobs, business and commercial uses of telecommunications are less likely to be an important source of system revenue. In these counties, as in the instance of Trempealeau County, non-subscriber revenue is likely to depend upon fees paid by the local governments for use of the system for health, education and similar public service purposes.

- in Declining counties, the economic base is likely to be too depressed to enable paying for the incremental improvements broadband might bring to health, education, and other public services. In these counties, dependent on outside governmental assistance for the upgrading of public services, selection of broadband as a way to provide these services is more dependent on Federal decision as to the cost-effectiveness of this approach than in the other two types of counties.

Assuming that a decision might be made to provide Federal assistance for these demonstrations, the following basic steps would need to be taken:

1. designation of a Federal agency (or agencies) to administer the program, collect data and evaluate results;

2. provision of a funding mechanism(s);

3. dissemination of the system demonstration concept and identification of potential demonstration sites.

Responsible Agencies

In considering agencies that might be assigned responsibilities for system demonstrations, the need for an effective planning organization at the local level should not be overlooked. In some areas, such as Trempealeau County, cooperatives may be so pervasive that they can unite most of the population and the local government in the organizational effort necessary to plan for and implement a broadband system. In others, something akin to the multi-county planning districts being established in several states might provide technical assistance and direction. [1]

At the Federal level, it is clear that a great deal of attention will have to be given to devising an effective means of direction and coordination. Listing only a few of the possible institutional mechanisms, an inter-agency task force could be appointed to oversee federal participation in demonstrations. Or, a policy board comprised of representatives from executive agencies and rural and industry interest groups could be designated to design and supervise demonstrations in accordance with broad legislative guidelines.

1 Although the **concept** of multi-county development districts in rural areas is still relatively new, in some states they could be of direct assistance to rural communities wishing to consider broadband systems to meet public service needs. In South Dakota, for example, one planning district indicated that it intended to look into alternative ways of supplying county services in rural and sparsely settled areas. In other states, these districts have provided technical assistance and consultation in such areas as communications, law enforcement and school district reorganization. For additional details see The Role of Multi-county Development Districts in Rural Areas (U.S. Department of Agriculture, August 1975, Washington, D.C.).

It is beyond the purview of this study to examine fully these and other alternatives. The approach taken here is to outline one simplified alternative in which oversight is provided by existing Congressional committees (possibly with the assistance of OTA, as described in the final section of this Chapter).

Many agencies have been involved in telecommunications research, including NASA and HEW. However, there are three, for the reasons described below, that might be initially considered for major roles in the demonstration phase. These are: 1) the National Science Foundation (NSF); 2) the Department of Commerce; and 3) the Department of Agriculture.

In recent years, the National Science Foundation has taken the lead in "systematic experimentation" (34-11-50) with its Phase I design and Phase II implementation studies of public services and broadband communications. Although these projects are not necessarily rural, conduct of system demonstrations could be a natural follow-on to these efforts. An appropriately staffed project office within NSF might be established to head up the coordination, data collection, and evaluation of the overall federal program. Additionally, because of its specific experience in the Spartanburg project and other experimental efforts with public service applications, NSF might also be responsible for one of the three major elements to be included in system demonstrations (public service applications; the other two are business and commercial use, and impact on rural life).

Dissemination of "how to" information and collection of data on business and commercial applications might be undertaken by the Department of Commerce. In this connection, it should be noted that the Economic Development Administration, within the Department of Commerce, recently funded a study to help "in determining

national policy regarding the future course of telecommunications research and development as related to rural economic development" (35-l).

The Department of Agriculture is presently a source of loans and loan guarantees (under the Rural Development Act of 1972) for broadband projects as well as being an authoritative source of detailed knowledge on rural development in general and potential demonstration sites in particular. A significant part of this project must be evaluation of the impact of expanded telecommunications services on rural growth and on the distinctive characteristics of life (both positive and negative) in rural areas. The Economic Research Service, which was a major source of information for Chapter III, might be considered for involvement in the project.

In addition, as described later, the Department of Agriculture, through its Extension Service, might play a significant role in introducing the system demonstration concept to potential rural sites.

Funding Mechanisms

There are two aspects of funding which must be considered: 1) capital for broadband equipment plant; and 2) operations and maintenance resources which are needed for identifying demonstration sites; developing software and materials for public service, commercial and other system demonstration uses; operating and maintaining the system; and conducting evaluations.

For capital construction of telecommunications plant, an existing source of funds is Community Facilities loans under Title I of the Rural Development Act of 1972.[1] As discussed earlier in the Chapter, one such

[1] Steven R. Rivkin, formerly counsel to the Sloan Commission on Cable Communications, has suggested that Rural Electrification Administration (REA) funds might also be used for these purposes. IN Rivkin's view, a 1962 change to the REA act might be construed as providing sufficient authority to this agency to grant loans to support rural cable service (5-12).

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loan has been approved for installation of a cable/microwave system in Trempealeau County, Wisconsin. However, as has also been pointed out, loans for telecommunications systems are not expected to become a significant part of the Community Facilities loan program. Congressional action will therefore be required if further assistance to broadband systems through this program is to be possible. In this connection, it should be noted that broadband systems providing public services might qualify under the top three of the six recently issued priorities for Community Facility loans as follows:

1. public safety facilities (if the system demonstration includes fire and burglar alarm or law enforcement administration);

2. health care facilities (if the system demonstration includes health provision); and

3. public service facilities (if the system demonstration provides or extends the services normally provided in courthouses or community buildings).

Under the above priorities, the broadband equipment might become the "facility" in lieu of a conventional building, ambulance or piece of firefighting equipment. Because a properly designed system would provide many different services rather than one, it could compete for funds under several different categories of priorities rather than one and thus might compete effectively with more conventional "community facilities" for loans.

The second category of funds required is for operations and maintenance of system demonstrations, which has been broadly defined to include site selection, technical assistance in setting up public service programs and evaluation of results, as well as system operation and maintenance. These funds should be provided under the aegis of the lead agency conducting the system demonstrations -- the National Science Foundation. There are two types of mechanisms to be considered: outright grants and loans.

In favor of outright grants, it can be argued that the system demonstration concept is novel and unproved. Therefore, it is unlikely that there will be applicants for loans, either direct loans or more especially loan guarantees. In addition, the program might be considered to be in the national interest and to ensure that it takes place, grants are both justified and necessary. In any event, even if grants should be decided upon, a system demonstration> if successful, should be transferred to a self-supporting basis. Concerning the desirability of loans instead, it is possible that these might induce a closer look at the economics of each candidate system demonstration site. One possibility which might be considered, if the loan approach is selected, is to use FmHA B and I Division loans for the business and commercial parts of each demonstration.

The above listing is intended only as a brief indication of the factors to be considered in deciding between loan and grant mechanisms. This decision, in any event, clearly would be of lesser priority than the basic issue as to whether the government should encourage and assist system demonstrations.

The level of resources required to fund both capital construction and operations and maintenance for system demonstrations is difficult to estimate.

Factors such as whether loans are direct or only guaranteed, whether an existing broadband plant might be used or whether one must be built, will produce large differences in program cost. However, in order to provide a rough indication as to possible costs, the following assumptions have been made:

- Assume that four system demonstrations will be funded -- two each in Turnaround-Acceleration and Turnaround-Reversal counties. (Initially, demonstrations might not be practical in Declining counties. The state of public services in these counties might be such as to require basic rehabilitation before broadband use could provide any measurable benefit. In any event, the funds and level of effort required would exceed the resources contemplated to be available for the kind of system demonstrations here discussed).

- Assume that four systems require funds for capital construction and that these will be direct loans. The estimated cost of the Trempealeau County system is 5.5 to 6 million dollars (8-3) and is taken as the estimate of the capital cost for each system. Thus, capital costs for four systems, not including debt service costs, may be estimated at $24 million.

- Assume that operations and maintenance costs will be covered by grants. The Spartanburg project will cost slightly more than $1 million over a period of three years or $300,000/year. However, Spartanburg is a phased demonstration. Had it not been

phased, costs could have been considerably higher. For these reasons, projected costs for each system demonstration have been doubled to roughly $600,000/year. Assume that each system demonstration will run for three years. Thus, for four demonstrations: 3 x 4 x $600,000 = $7,200,000.

- Assume that costs for preliminary studies to select system demonstration sites and plan all four demonstrations will total about $2 million.

- Thus, for a five-year program (two years for preparation plus three years for implementation and analysis), the following costs might be incurred:

Capital construction	$24 Million (loans)
Operations and Maintenance and Evaluation	$7.2 Million (grants)
Preparation	$2.0 Million (grants)
Per year grant costs:	$1.8 Million

For purposes of comparison, it is interesting to note that Federal expenditures for telecommunications research based on spending levels by major agencies over the past year is $12.6 million annually. This is shown in the table on the following page.

If system demonstration construction costs are funded through loans, it can be seen that the per year costs of the program ($1.8 million) are not greatly different in magnitude to that amount presently spent by each of the major Federal agencies in recent years.

TRENDS IN FEDERALLY CONTRACTED TELECOMMUNICATIONS RESEARCH*

(reproduced from Reference 35, pg. 76)

National Institute of Education	$ 5,000,000
Health Resources Administration	500,000
National Library of Medicine/Lister Hill	2,000,000
Department of Commerce/Office of Telecommunications	1,700,000
Housing and Urban Development	400,000
Federal Communications Commission	1,000,000
Office of Telecommunications Policy	1,000,000
National Science Foundation	1,000,000
Department of Defense	(not available)
TOTAL	$12,600,000

* These figures reflect approximate funding trends for yearly expenditures by these agencies over the past three years.

Identification Of Potential Sites And Dissemination Of The System Demonstration Concept

Only one criterion might be universally applied to all candidate rural areas which might wish to serve as a system demonstration site. That is, that there must be a high degree of community support for the system. Institutional and public service use of broadband is novel and unfamilar. Individuals within the community in question will have to work together, as they have in Trempealeau County, to define those collective needs which can be best met through broadband services. They will also have to be capable of recognizing the economic value of these services and support the system accordingly, (e.g., tax monies used to support schools

can also be used for educational services offered through broadband communications). Without such commitment, it is unlikely that a system demonstration will work.

A way to expose communities to the program is required. One mechanism is the trade press through magazines such as Rural Electrification. A more organized mechanism is use of rural extension agents, who form a wide network under the Department of Agriculture's Extension Service. These agents could play a key role in describing the program to communities and assisting in the identification of potential demonstration sites.

Types of Sites

Demonstrations should be conducted at more than one kind of site. As a conclusion to this section, note is made of two potential types of demonstration sites. One type illustrates cooperative ownership and two examples of potential sites are described. The other is that of the private operator and one example is provided. These examples have been included to provide specificity in what would otherwise be an abstract discussion rather than to suggest that these sites must be selected for system demonstrations.

The Trempealeau County project, investigation of which gave rise to development of the system demonstration concept, illustrates many facets of a system demonstration especially as it may be conducted under the aegis of a cooperative. Phases II and 111 of the Trempealeau project remain to be completed.

A second example of the cooperative type of demonstration is a project investigated by the Blue Ridge Electric Membership Corporation for Lenoir,

North Carolina. Blue Ridge Electric undertook a study of providing cable TV as a cooperative member service in 1973. A very careful feasibility study (36, 37) indicated that cable television costs compared to subscriber interest showed that the project was not justified. However, the project was oriented to conventional TV and it will be recalled that a similar study at an early stage in Trempealeau County also indicated that simply providing conventional TV was not economic in that county. The institutional involvement of the schools was required to move the Trempealeau project towards economic viability. So far, use of public services to support a system in Lenoir has not been investigated.

The efforts of Windsor Cablevision to bring cable to three rural towns (Windsor, Plymouth and Williamson) in three North Carolina counties, which has been briefly described elsewhere, illustrates a second type of demonstration project. This example differs in motivating force from Trempealeau (private operator rather than cooperative) and is a long way from being a system demonstration. However, the cable operator is interested in providing a system which is much more than a medium for conventional television. It will also be recalled that a Department of Agriculture B and I loan guarantee has been approved for this project.

Investigation Of The Impacts Of Widespread Implementation Of Telecommunications In Rural Areas

Changes brought to rural areas through broadband might be positive or negative, depending on the attitudes and preconceptions of an observer. Increased migration (<u>without</u> improved services from broadband) has already strained the resources of some rural communities. Whether broadband communications, if it exacerbates this trend, is an overall good is an area deserving considerable attention. Thus, definition of impact areas, and

development of a plan for evaluation of the potential positive and negative consequences of widespread rural telecommunications systems, should be an integral part of any system demonstration program. While detailed consideration of this topic is beyond the scope of this study, the following is a representative listing of the impact areas that are pertinent. It will be noted that some of these impacts, being national in scope, could be largely hypothetical unless broadband systems were deployed in large numbers.

Population balance

- change in the proportion of people living in metro and nonmetro areas.
- shift from current situation in which greatest nonmetro growth is occurring in counties adjacent to metro areas to one in which rapid growth occurs in more remote rural counties.
- change in distribution of age groups and socioeconomic characteristics in metro areas and in the three types of nonmetro areas (Turnaround Acceleration, Turnaround Reversal and Declining).

Economic

- change in number, type and level of employment opportunities in nonmetro as compared to metro areas.
- movement of corporation headquarters or branches to nonmetro areas -- effect on metro economic base.

- market aggregation based on criteria other than geographic location or transportation access -- for example, availability of broadband communications system.

Social

- quality of education in metro and nonmetro areas.
- quality of health in metro and nonmetro areas.
- overall quality of life in metro and nonmetro areas.

Institutional

- effect on network, commercial, public broadcast and educational TV.
- effect of a possible change from a single nationwide communications network based on the telephone to a two-tier broadband network -- a national network and a community-based local network.

Transportation - Telecommunications Tradeoffs

- impact on petroleum usage.
- impact on automobile and other transportation industries.

Longer Term Impact Areas

- changes in work patterns (work at home will affect office building construction and commuting; teleconferencing will affect the convention hotel industry, etc.)

A Future Course Of Action If System Demonstrations Prove Successful

If system demonstrations prove the feasibility of community-wide broadband systems to meet a variety of rural needs and if it is judged that the positive and negative impacts of such systems are, on balance, favorable for national growth and development, then funding services for implementing such systems on a broad scale might be sought. One solution might be to establish a Federal program modelled on the Rural Electrification Administration which brought electricity and telephone to rural areas through low cost loans. However, in the case of rural telecommunications systems, a more flexible approach involving several different funding mechanisms might be considered (and evaluated further during the system demonstration phase).

The reason why a more flexible approach might be called for lies in the widely varying economic characteristics of rural America. Employing the Turnaround Acceleration, Turnaround Reversal and Declining county categories used earlier as a framework for analysis, it can be seen that these three classes of counties might require different funding mechanisms for system construction, as well as different levels of government involvement. This concept has been discussed previously and is diagramed in the table below:

County Type	Federal Financing Mechanism
Turnaround Acceleration	Guaranteed Loan
Turnaround Reversal	Direct Loan
Declining	Government Subsidy

Turnaround Acceleration counties have a well-developed economic base, opportunity for commercial and business uses of telecommunications, and expanding need for educational, health and other services. Of the three classes of counties, these should be the most attractive to private entrepreneurs. Guaranteed loans, such as those available from the Business and Industrial Division of USDA, could be an adequate funding mechanism to induce development of broadband systems if their potential is shown in a system demonstration program.

The less rapidly growing, manufacturing-oriented Turnaround Reversal counties could be less attractive to the private entrepreneur. Business and commercial uses of telecommunications are less likely in these remote counties. While the need for public services may be substantial, the problem of convincing the community of the value of meeting these needs via telecommunications is likely to be great. Capital will be harder to find, and thus direct loans such as those for Community Facilities under Title I of the Rural Development Act of 1972 could be needed to help fund these installations.

For Declining counties, system revenues might not be sufficient to pay back loans of either category. In these counties, improvement of public services might require outright grants or subsidies. These services cannot now be supported by the community and it is unlikely that broadband will be very much more cost-effective than conventional methods. However, telecommunications could permit upgrading service where other methods fail. For example, through broadband, the services of a doctor could be brought to Declining counties where inducements to physically bring him there have failed. In this way, the effectiveness of Federal funds spent in Declining areas could be increased via broadband.

Turning from financial to institutional mechanisms, a similar matrix can be constructed. As shown below, different types of owner/operators may be appropriate for, or attracted to, developing systems in the three types of counties.

County Type	System Owner/Operator
Turnaround Acceleration	Private Industry
Turnaround Reversal	Rural Cooperative
Declining	Private Industry/Local Government

Private industry, given a source of capital, should find Turnaround Acceleration counties an attractive market, provided there is community commitment to the system and services can be charged appropriately.

Turnaround Reversal counties, unlike Turnaround Acceleration counties, are typically remote from metro areas, and truly rural. Many such counties have active and vigorous rural cooperatives, oriented to non-profit membership service. As described elsewhere, rural cooperatives played a crucial role in bringing electricity to rural areas, a situation not without parallel to bringing broadband to the same communities.

For Declining counties, the de facto owner/operator of a system might be the Federal government. Although private industry or a local government may “own and operate” the system, in these counties sizable Federal support may be necessary.

The two tables already presented can be combined into a single table. The Trempealeau County project would be located on the second line of this table.

County Type	Federal Financing Mechanism	System Owner/Operator
Turnaround Acceleration	Guaranteed Loan	Private Industry
Turnaround Reversal	Direct Loan	Rural Cooperative
Declining	Government Subsidy	Private Industry/Local Government

Trempealeau County illustrates the use of a direct loan by a rural cooperative to facilitate installation of a broadband system. Unfortunately, Trempealeau County is a unique project and it is not likely that additional funds for broadband systems will be available under Title I of the 1972 Rural Development Act, absent Congressional action.

Trempealeau can be roughly categorized as a Turnaround Reversal county. For Turnaround Acceleration demonstrations, the B and I Division of USDA could be a source of funds. Specific Congressional direction might be required, however, to earmark some of these funds for systems demonstrations.

For Declining counties, no Federal funding mechanism is readily apparent. The criteria for USDA Community Facilities loans or Business and Industrial loan guarantees would exclude such counties. A new Federal mechanism might be required to support broadband systems installation in such areas.

Previous Legislative Initiatives And Findings From Other Studies

Rural applications of telecommunications have interested executive branch agencies and the Congress over the last several years. Treatment of the problem has ranged from recognition that market forces may not be sufficient to bring broadband communications to rural areas to suggestions

that resources should be made available to fund rural projects on a broad scale. The purpose of this section is to compare the system demonstration approach to other approaches which have been proposed. To set the framework for this comparison, salient characteristics of the system demonstration approach are summarized below:

- the approach is based on the finding that the benefits and costs of using broadband systems to meet rural public service needs and to provide commercial services have not been adequately explored.

- it is assumed that public service uses should "pay their full share" based on value received. The cost of providing these services by broadband may provide the same or greater value at roughly the same cost as by more conventional methods, or make possible services which would simply not exist otherwise -- for example, full medical services cannot be provided if no doctor will locate in the area.

- it is assumed that public services in rural areas, if paid for appropriate to value, will contribute to the economic feasibility of a broadband system. Fees for public services and for commercial use may make a broadband system economically viable when such a system would not be economically viable if income were based solely on subscriber fees for conventional network and educational television.

- it is assumed that a broadband system providing public and commercial services as well as the news and entertainment of conventional broadcast could economically serve all residents in a given community. However, the feasibility of this approach must first be demonstrated. Not enough is presently known about how to assemble such systems or about what kinds of services should be provided in areas of differing demographic and socioeconomic characteristics. In the absence of such knowledge, large scale Federal assistance programs making broadband services widely available might be premature: a large number of systems could be implemented which may not be economically viable whereas, with more knowledge of likely costs and revenues, such systems could be established on a sounder footing.

- it is assumed that if the feasibility of broadband systems which bring public and commercial services as well as news and entertainment to rural areas is demonstrated, different funding mechanisms might be used to bring these systems to rural areas on a broad scale. Depending on the characteristics of the rural community (e.g., Turnaround Acceleration, Turnaround Reversal or Declining) the appropriate Federal funding mechanism could vary from loan through guaranteed loan to outright grant or subsidy.

Several recent studies and legislative initiatives are summarized below. The intent is to indicate the different types of approaches for bringing broadband communications to rural areas, so that these may be compared to the system demonstration concept. Thus, illustration of similarities and differences rather than comprehensiveness is the objective here.

Whitehead Report (28)

One of many recommendations for developing a national policy for broadband communications contained in the Whitehead Report was that broadband communications should be made available to rural residents and the poor. To prevent the possible tendency of cable operators to limit their services to affluent areas, the report suggests that franchising authorities require that service be extended to all parts of a franchise area.

The Whitehead Report notes that a number of services such as vocational training and public health information could be provided by cable and suggests that the Department of Health, Education and Welfare investigate the feasibility and cost of using cable for these purposes. Commercial uses of cable were not considered in the Whitehead Report nor is there exploration of the relationships between public services, commercial uses and conventional programming. The primary interest seems to be on parity of programming and other information services with those available in more urbanized areas. The report notes that “free market incentives of cable operators may not be adequate to meet certain national policy objectives, such as the widespread availability of information” (28-46).

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Significantly, the Whitehead Report was concerned with outlining a national broadband policv for the long-range future. rather than with the problems of rural areas which might be met by broadband communications today. Thus, it is not surprising that the Report does not consider the lack of present-day broadband services in rural areas a major problem. Instead, the Report suggests that the situation should be monitored by the Secretary of Housing and Urban Development and the Secretary of Agriculture. Then, if the problem becomes significant in the future, "the Government should take affirmative action to assure a basic level of broadband communications service for residents of outlying rural areas" (28-46).

Finally, the Whitehead Report indicated a need for demonstration programs and suggested that different services be aggregated and the costs shared. Further detail was not provided. The Report stated (38-59):

> "...there is a chicken and egg problem hampering the development of many valuable services that might be commercially viable. The demand for these services depends heavily on their availability, yet few potential suppliers are willing to accept the risk of developing new services without significant evidence of a market demand for them. Similarly, while each new cable service would require relatively expensive special facilities if offered alone, these services can be aggregated and the requisite facilities can be combined so that these costs can be shared, but no one has emerged to lead and coordinate such a joint effort."

S. 1219, H.R. 5319 and H.R. 244 (38, 39, 40)

These bills, introduced in 1972, 1973 and 1975, respectively, exemplify the idea of making low interest loans available for the development of rural cable systems. S. 1219 was introduced by Senators Ted Stevens and Mike Gravel and proposed federal low-cost, long-term loans for low density areas. Co-ops would also be authorized by such loans. H.R. 5319 was a similar bill. More recently (14 January 1975), Representative Downing introduced H.R. 244,

Like H.R. 5319, H.R. 244 provided for 35-year, four percent loans to "eligible cable television systems" (40-2), which were defined as those which "can reasonably be expected to pass less than a system average of sixty potential consumers per linear mile during the first five years of its operation" (40-2).

Cable Television: Promise Vs. Regulatory Performance

This report was prepared by the staff of the Subcommittee on Communications of the House Committee on Interstate and Foreign Commerce and was published in January 1976. It contains an analysis of the problem of providing broadcast and cable services to rural areas (27-55ff.). The study notes that present broadcast service in low density areas is inadequate compared to that in more densely populated areas and that the threat of cable to local broadcasters in low density markets has not been proved (27-55, 56). Like the bills above, the report suggests low cost loans (and technical assistance). However, citing the Denver Research Institute study (3), the report notes that cable cannot economically serve very low density areas and therefore includes translators as well as cable in the loan program. The enabling legislation would be called the Rural Telecommunications Act and it is proposed that the Office of Telecommunications in the Department of Health, Education and Welfare administer the program.

Long-term, low cost loans have also been proposed by others, notably Rivkin (5-3) and the Cablecommunications Resource Center (35-95). The last study is discussed in more detail later.

Comment

Unlike the Whitehead Report, the bills and the study described on the preceding pages assume that broadband communications should be brought to rural areas today. They suggest that the problem can be solved in a manner paralleling the Rural Electrification Act of 1934 which enabled the spread of electricity and telephone service to rural areas. However, the parallel between these two situations may not be as exact as it appears. For cable, content is all important whereas the consumer supplies the uses for electricity or the content carried by telephones. In other words, is it simply the risks associated with bringing broadband services to rural areas which have prevented the entry of private entrepreneurs into the rural market? Or, as suggested in this study, is it their failure to understand the necessity for themselves becoming directly involved in arranging for content to be provided by these systems (i.e., the full range of services necessary to make rural systems economically practical)? In sum, simply helping an operator to secure funding for a system might not be enough to enable the system to have a fair chance of success.

Regardless of the answer to the last question, it should be noted that the emphasis in these bills and the Subcommittee study is on increasing the parity between rural areas with regard to network and public broadcasting, rather than on bringing public services to rural areas. Thus, even if these similar bills were implemented and broadband systems were successfully brought to some rural areas (inclusion of translators would increase the likelihood of success), it is doubtful whether public services would be provided automatically without a specific program to accomplish this objective. As was noted previously (see preceding section on system implementation),

provision of public services does not tend to occur as cable systems become profitable.

H.R. 4564, S. 1257 and H.R. 9630 (41, 42, 43)

The titles and dates of introduction of these bills are:

- H.R. 4564 - Telecommunications Facilities and Demonstration Act of 1975 introduced March 10, 1975 by Mr. Staggers.

- S. 1257 - Telecommunications Facilities and Demonstration Act of 1975 introduced March 20, 1975 by Senator Magnuson.

- H.R. 9630 - Educational Broadcasting Facilities and Telecommunications Demonstration Act of 1976 introduced January 21, 1976.

The first two bills are identical and the third elaborates on them. The bills are of interest because they propose:

> "To extend the Educational Broadcasting and Facilities Program and to provide authority for the support of demonstrations in telecommunications technologies for the distribution of health, education, and public or social service information and for other purposes" (43-l).

In supporting the need for demonstrations and specifically identifying public service applications, these bills relate directly to the findings of this report. Referring to the most recent bill, H.R. *9630, $1* million would be authorized for the remainder of FY 76 and $250 thousand for the transition quarter ending September 30, 1976 to "demonstrate innovative methods or techniques for utilizing nonbroadcast telecommunications equipment or facilities" (43-7) for "transmission, distribution and delivery of health, education, and public or social service information" (43-6). The bill permits diverse "nonbroadcast" technologies (such as satellite, cable and fiber optics) and is clearly oriented to serviec demonstrations rather than hardware construction (44-8). The Committee Report on the bill

states that "the demonstration program is intended to respond to local and community initiatives in generating proposals" (44-8). The responsible agency would be Health, Education and Welfare.

It should be noted, however, that these bills are not restricted to rural areas. In fact, because the funds would be used for demonstrations on existing systems, the sites for such projects would most likely be urban areas. In addition, these bills are not system-oriented in that they apply only to the public service aspect of telecommunications systems.

Telecommunications Technology Act of 1975 (H.R. 9289) (45)

This bill was introduced by Harley Staggers, Chairman of the House Interstate and Foreign Commerce Committee. Like the preceding bills, it was not specifically directed to rural areas, and it authorized demonstrations. However, unlike the others, this bill did not limit demonstrations to health, education and social service information but is broader in scope. The bill cites the need to evaluate both feasibility and value of new telecommunications technology. A specific agency is designated, the Department of Commerce, and it is suggested that a Bureau of Telecommunications be established to conduct demonstration projects or support such projects conducted by other agencies (35-71ff.).

One of the interesting aspects of the bill is its list of impediments to full use of telecommunications technology. As abbreviated in Ref. 35, pg. 73, these include:

- "lack of adequate information about or understanding of telecommunications technology among a significant number of those in a position to hasten, deter, or regulate its progress;

- lack of sufficiently detailed social, economic, and technical information to enable sound selection from among the many choices and options offered by telecommunications technology;

- lack of national goals, priorities, policies, and plans specific to telecommunications;

- lack of sufficient engineering and commercial standardization for telecommunications; and

- lack of sufficient capital to finance production of telecommunications technology products and services which have not yet been demonstrated to be marketable."

Report titled: A Preliminary Review of Current Practices and Trends In Rural Telecommunications Development And Recommendations For Future Development

This recent report was prepared by the Booker T. Washington Foundation/ Cablecommunications Resource Center (CRC) for the Department of Commerce. To our knowledge, it is the only recent detailed study of the potential for, and problems associated with, bringing telecommunications to rural areas.

Some of the findings of the CRC study parallel those of this study.

The first five are as follows (35-90ff.):

> "1. There has been a significant number of projects designed to test the applicability of telecommunications technology to various aspects of community development. The majority of these demonstrations have centered on the delivery of health and educational services. While most of these experiments can be termed "successful" in improving the ability of telecommunications technology to deliver those services effectively, few, if any, of the projects have focused specifically on their application to rural areas of the country. It is generally acknowledged that the delivery of community development services to rural areas poses particular sets of problems that have not been addressed by most telecommunications demonstration projects.
>
> 2. Several service areas falling under the general categories of social services (i.e., employment, economic/financial, political, etc.) and entertainment/recreation/cultural services have not been the subjects of significant demonstration programs in spite of: a) their recognized role in determining the quality of rural living conditions; b) the unique ability of telecommunications technologies to serve these areas; and c) the understood potential of these services (particularly entertainment) to play an important part in improved community economic development.
>
> 3. Most demonstrations have been carefully structured to prove the capability of telecommunications hardware. The extremely important area of cost benefits resulting from hardware installation and software program implementation has been largely unexplored on any substantive level. The economic analysis section of this study defined a major problem blocking the further development of effective cost benefit analysis as being the lack of social accounting system or measurement indicators incorporating quality of life factors.
>
> 4. *The* development and implementation of telecommunications technologies for overall community development as it applies to rural areas must be considered and evaluated on regional bases if the effect of these programs is to be maximized. Programs developed and coordinated on a regional level ultimately can have more impact both economically and socially for regional consideration and will impart economies of scale to major demonstration programs which, in turn, will work to defray the capital costs of both hardware and software.

5. A significant number of demonstration programs to date have neglected the importance of software programming. It is essential to conduct research and demonstrations that specifically address software production based on articulated needs, systematized needs assessments, impact measurement, and evaluation of the development process. The production of effective software is vital to any meaningful assessment of telecommunications to meet rural economic development needs, both technologically and economically."

However, the findings of this OTA staff study differ from those articulated in the Cablecommunications Resource Center (CRC) report in several ways. Noteworthy among these are:

- the CRC Report recommends establishing low interest loans for building rural telecommunications systems (35-95). As discussed earlier, a large-scale low interest loan program seems premature at the present time. Instead, the present state of knowledge suggests the need for an intermediate step -- system demonstrations.

- the CRC Report supports low interest loans but does not consider other mechanisms. By contrast, this study has proposed that if system demonstrations show the feasibility and value of rural telecommunications systems, then different funding mechanisms may be appropriate depending upon the economic characteristics of each rural area. A useful gross classification which may indicate which funding mechanism might be appropriate is that of Turnaround Acceleration, Turnaround Reversal and Declining counties. Loan guarantees, low-cost loans or outright grants might be used to fund telecommunications systems depending on the economic strength of the community.

- the concept of public services "paying their own way" and making possible reduced costs for individual subscribers receives considerable attention in this study but not in the CRC report.

- commercial users of rural telecommunications systems (e.g., banks) are considered important sources of revenue in this report.

In summary, if the CRC report and this study are compared, it might be said that this study both goes beyond, as well as steps backward, from the CRC report. The system approach builds upon the kind of findings presented in the CRC report. The need for an interim system demonstration phase before funds are made available for widespread implementation of rural telecommunications, on the other hand, might be interpreted as a step backwards from the conclusions reached by CRC.

Summary

A number of bills and studies have been discussed. These may be divided into three groups depending on their treatment of the problem of bringing broadband communications to rural areas.

The Whitehead Report exemplifies the class of national cable policy studies. Within this class of studies, rural cable is treated more as a monitoring problem than as a problem requiring action. Thus, it is not surprising that no specific course of action is outlined nor is a funding mechanism proposed for bringing cable to rural areas.

The second group of bills and studies includes S. 1219, H.R. 5319, H.R. 244 (38, 39, 40), the Interstate and Foreign Commerce Subcommittee report on cable (27) and the Booker T. Washington/Cablecommunications Resource Center report on rural telecommunications (35). This group suggests that telecommunications should be brought to rural areas now and suggests low-cost long-term loans as the funding mechanism. The implication is that the major constraint on rural telecommunications is lack of risk capital.

The third group of bills includes H.R. 4564, S. 1257 and H.R. 9630 (41, 42, 43, 44). This group specifically addresses the problem of providing new services, such as public service applications, via telecommunications and proposes demonstration programs which would enable evaluation of such services. Unlike the second group, these bills are not directed at rural areas and probably projects would not take place in rural areas. This is because the funds, when specified, are to be used for studying methods for bringing in the service. Existing systems would be used in the demonstrations and those with significant capacity -- as for two-way use -- are located in metro areas.

This report combines and extends the concepts in all these groups of bills and studies. It proposes a limited demonstration program, specifically for rural areas, aimed at investigating the feasibility and value of combinations of public services, commercial uses and entertainment. The concept of area-wide coverage and accessibility to the system by residents of the most remote areas, as well as in the most densely populated *areas within* a community, is emphasized. The program might be administered

by NSF in conjunction with the Departments of Commerce and Agriculture. If the feasibility and value of the system concept were then demonstrated, different funding mechanisms might be matched to the economic characteristics of different rural communities.

Policy Alternatives For Applications Of Broadband Telecommunications To Rural Areas

Three policy alternatives are presented in the following discussion. The pros and cons of each of these alternatives are briefly considered. These policy alternatives are:

- continue the status quo;
- fund a limited number of system demonstrations projects; and
- create a Federal mechanism to facilitate wide dissemination of broadband services in rural areas.

Continue Status Quo

The term "status quo" does not imply that Federal programs are presently having no effect upon the development of rural broadband systems; rather, it refers to the continuance of a particular set of Federal policies that have not had the effect of promoting their widespread deployment at this time. On the one hand, the Federal government has funded research into the uses of broadband in both urban and rural areas. On the other, with the exception of the isolated instance in which the Farmers Home Administration granted a loan to Trempealeau County, no Federal program presently exists which can be of direct assistance in helping rural areas to translate these potential broadband uses into actual system applications.

"Status quo" as a Federal policy alternative is therefore defined as continued Federal support for research into the general uses of broadband communications, but relatively little emphasis on programs designed to assist in their actual deployment in rural systems. The key issue to be addressed in considering this policy alternative is whether it is desirable or necessary that the Federal government make an increased effort to encourage and assist such deployment.

Pro. If telecommunications represents 'the wave of the future' and if it is likely, as some contend, to transform the way in which we live and work, then it is reasonable to assume that it will someday come to rural America, first to those rural areas adjacent to metropolitan areas and, subsequently, through the use of fiber optics or similar cost-cutting breakthroughs, to more remote rural areas. In other words, under these assumptions, telecommunications will eventually come to rural areas without specific Federal assistance.

In the meantime, Federal programs are already in existence that might provide more data on the value of new broadband services. The NSF Phase 11 experiments, in particular, could demonstrate the general value of these services and may also interest system operators in the revenue-generating potential of public service applications -- provided that communities also perceive their value and are willing to expend funds for their use of the system. Continuation of the "status quo" might also prevent rushing into widespread rural applications of broadband communications before their value -- and economic feasibility -- are demonstrated.

Con. To the extent that the pace and nature of rural development remain a primary concern of the Federal government, it would seem inconsistent that the introduction of broadband systems be left to proceed on a "catch-as-catch-can" basis. While the value and feasibility of many broadband services have yet to be conclusively demonstrated, their potential in contributing to the objectives of rural development, as outlined in Chapter III, would seem too great for their implementation to be ignored. Although the introduction of broadband systems into rural areas eventually might occur unassisted, it could well bypass those rural areas most in need of the benefits the systems could bring and, to the extent that introduction is delayed longer than need be, unnecessarily prolong their lack of access. At minimum, it would seem consistent with other Federal efforts in the area of rural development that this possible instrument of change be given a fair opportunity to prove itself in actual system applications.

As to the need for assistance if such systems are to be deployed in any significant number, there does not seem much question. At best, the novelty and untested economics of the services to be provided, including their unknown costs and benefits as compared to alternative ways of providing the same services, are likely to make financing difficult for even the most carefully planned systems. If the multitude of tasks involved in surveying community needs, designing revenue-producing broadband programs to service these needs, securing community and local government support, estimating hardware needs and costs, and so on are added to these unknowns, then the practical barriers for most potential system operators are likely to be insurmountable.

Additionally, to the extent that the interests and needs of rural systems are not of major concern when decisions are made at the Federal level concerning communications policy, then the future development of such systems could be effectively foreclosed. To give only a few examples, on the assumption that cable systems are not feasible in very low density areas, a decision could be made to promote translator coverage of rural America, with cable being limited to more densely populated rural towns. This "skimming of the cream" by conventional cable systems and the relegation of rural areas unprofitable for cable-like, two-way systems to coverage by translators, could prematurely eliminate one of the main bases of support for full-service, area-coverage systems. Alternatively, with the advent of fiber optics, a decision might be made to assign their exclusive use to a national communications network without taking into consideration their possible use in individual rural-based systems.

Fund A Limited Number of System Demonstration Projects

This alternative has been thoroughly discussed in previous sections of this Chapter. It has been suggested that a minimum of two demonstration projects for each of two of the three types of rural counties (Turnaround Acceleration, Turnaround Reversal) be initiated.

Pro. Current data are inadequate to evaluate the utility of broadband communications to rural areas. It is likely that the cost-effectiveness of broadband will vary with the characteristics of rural communities receiving the services. However, hard data on this point do not exist.

Simply making channels available for public service and institutional use of broadband communications will not guarantee that effective use will be made of them. The message rather than the medium is the economic

commodity in a broadband system. A system demonstration program will help develop hard data on the uses to which these systems can be put.

It appears that some types of broadband services in rural areas could be attractive to potential operators. However, the components of an effective systems package are not known.

Cable operators to date have seen little profit in channels dedicated to public service and institutional use. If system demonstrations show the economic value of such channels and indicate the fair price for these uses, these attitudes might change. Additionally, a new class of broadband operators, capable of putting together packages of services, could develop. However, such development requires time -- and demonstration.

This practical emphasis upon real-world applications could have a beneficial effect upon the rest of the Federal Government's considerable investment in broadband research. Experiments could be designed with their eventual application in actual demonstrations in mind, and in turn the results of demonstrations could be used in determining the further need for experimentation.

A system demonstration program will enable the Federal Government to evaluate whether broadband services to rural areas are economically feasible -- before large sums of money are committed to such efforts.

Con. System demonstrations could be opposed on the grounds that the consequences of providing health, education, and other services "by remote control" are not sufficiently understood. This is an important issue and will be taken up in connection with the next policy alternative . For now, it is sufficient to note that the system demonstrations here contemplated would be fixed both in time and number. If these innovative services prove

to be detrimental, it will be a relatively simple matter to terminate them.

It also can be argued that demonstrations should not proceed until there has been settlement of the broader issue of Federal policy toward cable television generally. Even though the special requirements and functions of rural systems seem not to have entered into the present debate over FCC regulations, a decision at this time to authorize demonstrations could be criticized as a "backdoor" attempt to skirt the issue in favor of the interests of these systems.

A system demonstration program might take as long as five years. If system demonstrations are not really needed, services to the rural populations not served by the demonstrations will have been unnecessarily delayed.

Create A Federal Mechanism To Facilitate Wide Dissemination Of Broadband Services in Rural Areas

The legislative approach most often suggested (e.g., see references 5 and 27) consists of low-cost, long-term loans paralleling those made available under the Rural Electrification Act of 1934. It is argued that the hesitancy of private industry to enter the rural market with broadband communications today is similar to the hesitancy of private industry forty years ago to enter the rural market with telephones and electric service. Thus, the mechanism which was effective then (largely because of the rural cooperatives) should be effective now.

Pro. Implementation of broadband communications in rural areas could begin as soon as legislation for an appropriate Federal mechanism was passed by the Congress.

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If the parallel between broadband services and electricity/telephone service is valid, further delay is unnecessary.

The Rural Electrification Act of 1934 created a relatively inexpensive Federal program. Government expense consists of debt service on the loans plus the cost of administering the program.

Con. The parallel with the Rural Electrification Act of 1934 may not be valid. Effective use of broadband communications for education, health, and commercial use requires development of program content and/or computer software. Simply helping an operator to secure funding for a system might not be enough to enable the system to have a fair chance of success.

Without specific encouragement to the contrary, the probable use of new systems is likely to be limited to conventional news and entertainment television. Development of unique services specifically tailored to rural needs would probably not occur because they would have no demonstrated value and thus significant fees for these services could not be justified. Without the economic base such services could provide, higher fees would have to be charged individual subscribers to support the system, thus restricting access to the more affluent members of the community. The result might be a system providing limited service to a limited number of viewers.

A fundamental objection that could be raised to this policy alternative as well as to any effort to promote the innovative public service use of broadband, is that fascination with gadgetry and a desire to seem up to date might lead communities to an uncritical acceptance of “standard” broadband solutions to the problems of improving education and health care. Even though these broadband services might have been tested in

demonstrations they still could turn out to be inappropriate when applied against the needs of the full range of all rural areas. If precautions are not taken to avoid the latter contingency and if the quality of educational and health care deteriorates, the rural area in question still might remain locked into delivery mechanisms in which all but the consumers had a vested and continuing interest.

Future OTA Role

As stated in the Preface, the object of this staff study was to provide a basis upon which the Technology Assessment Board might decide what contribution, if any, OTA might make in assisting the Senate Committee on Agriculture and Forestry to evaluate the feasibility and value of rural broadband communications.

In the course of the staff study, the subject of rural broadband communications was found to be relatively unexplored. In particular, no analyses were found which considered the utility of broadband in relation to the fundamental factors underlying the sudden reversal of growth trends in rural America depicted in most recent Census statistics. Therefore, in order to gain some clear understanding of what OTA might do in connection with the subject, it first was necessary to originate a conceptual means of relating broadband to the forces underlying this change. Subsequently, it was necessary to consider how and whether such systems could actually be deployed and their value assessed.

Because of these somewhat unique circumstances, this study does not constitute a simple reply to Senator Talmadge's query as to how OTA can be of assistance. Instead, what is reflected in this staff study is a possible course of action the Senate Agriculture Committee might

weigh. OTA's future role and the specific form its assistance might take, therefore, will depend upon the Committee's judgment as to which of the courses of action spelled out herein, if any, it might wish to explore further.

With these qualifications in mind, the following is a three-part approach to OTA's participation that the Senate Committee might consider:

First as an adjunct to hearings the Committee might wish to conduct, OTA could help the Committee to assemble a panel(s) to examine and verify or refute the findings described in this report. Topics to be covered could include:

- the present and probable future trends in rural growth;
- the impact of broadband communications on probable growth trends;
- constraints to wider application of broadband communications in rural areas;
- the need for system demonstration and the number and type of system demonstrations which should be conducted, including criteria for site selection;
- consideration of the possible need for, and best form of, Federal involvement in rural broadband applications in the system demonstration phase as well as in subsequent programs; and

- consideration of the possible role of OTA in helping the Committee to assess and monitor the programs suggested above.

Second, OTA might begin a continuing assessment program to help the committee monitor: 1) telecommunications experiments in or applicable to rural areas; and, 2) the progress of the Trempealeau County project and any system demonstrations undertaken. With regard to the second task, a critical feature would be assessing the impact of telecommunications on the characteristics of life in rural areas affected. (Assessing whether these impacts might be desirable is outside the scope of OTA activities. The purpose of this monitoring effort would be to provide the committee with data from which a judgment could be made.)

Third, on an as-needed basis, small assessments involving either panels or other mechanisms could be conducted to integrate the data of the monitoring efforts with other data, including the preliminary findings of this study.

Because any system demonstration will require several years, what is proposed here is a long-term relatively low-cost activity. An estimated level of effort and cost is as follows:

● *1/2* manyear/year of senior staff	=$17,000
● 1/2 manyear/year of support staff	= 9,000
● 1/3 manyear/year of secretarial support	= 5,000
● average yearly cost of panels, small contracts, etc.	= 30,000
● contingencies including staff travel	= 4,000
	$65,000/year

It is anticipated that OTA's participation in the project would be reviewed by the Technology Assessment Board at least biyearly. At these times, both the progress and the adequacy of OTA's effort would be subjects of evaluation.

CHAPTER IV

References

1. Carroll, R. L. and Larson, T. L., Feasibility Study Report on a County-wide Cable Television Service for Trempealeau County, Wisconsin: (Arcadia, Wisconsin: prepared for the Trempealeau Electric Cooperative), 23 July 1973.

2. Hey, Tom, "Rural Communications Co-op: Of the People," Rural Electrification Magazine, May 1974.

3. Bortz, P., Spongberg, R. and Venditti, F., Broadband Communications in Rural Areas: final report to the Executive Office of the President, Office of Telecommunications Policy. (Denver: Denver Research Institute), November 1973.

4. Wisconsin Cooperative, Government Summit Conference, 19-20 March 1975.

5. Rivkin, Steven R., "ANew Role for Cooperatives? Bringing Broadband Communications to the Countyside," Rural Electrification Magazine, May 1974.

6. Sinder, Brian, "Educational Applications of Two-way Interactive Cable Communications in the WWCC Service Area:" prepared for Western Wisconsin Communications Cooperative and the Eight Participating School Districts, December 1974.

7. Ralph E. Evans Associates, "Budgetary Estimate: Western Wisconsin Communications Cooperative," Trempealeau County Interactive CATV System, Phase I, May 1974.

8. Western Wisconsin Communications Cooperative, Supplement to preapplication for Federal assistance, FHA Form #AD621, 23 January 1974.

9. U.S. Congress, House, Committee on Agriculture, Briefing Statement on Western Wisconsin Cable TV System, Trempealeau County, Wisconsin, Community Facility Loan.

10. Meistad, Gordon, Stevens Point, Wisconsin, personal interview on 10 December 1975.

11. Kirkman, Dennis, Nilsestuen, Gerhard and Urban, Bill, Trempealeau, Wisconsin, personal interview on 11 December 1975.

12. Capps, Willis W., State Director, Farmers Home Administration, Wisconsin, Letter to Gerhard Nilsestuen, President, regarding the Western Wisconsin Communications Cooperative Application for a Farmers Home Administration Community Facilities Loan, 7 June 1974.

13. Capps, Willis W., State Director, Farmers Home Administration, Wisconsin, Letter to Gerhard Nilsestuen, President, regarding the Western Wisconsin Communications Cooperative, 22 July 1974.

14. Hurdin, Sam and Schneider, Robert, Stevens Point Wisconsin, personal interview on 10 December 1975.

15. Guthrie, Paul, Madison, Wisconsin, personal interview on 12 December 1975.

16. FmHA AN No. 18(442), Priorities for Funding Community Facility Loan Applications.

17. Elliott, Frank B., Administrator, Farmers Home Administration, Letter to William Mills, Office of Technology Assessment, 23 December 1975.

18. The Rand Corporation, "Using Cable Television for Public Services in Spartanburg:" Response to NSF 74-8, Phase II, submitted to the National Science Foundation in response to NSF 74-8, Phase II, January 1975.

19. Lucas, William, personal interview in Spartanburg, South Carolina, 3-4 February 1976.

20. Heatherly, Jocelle, personal interview in Spartanburg, South Carolina on 4 February 1976.

21. Lucas, W. A., "Two-way Cable Communications and the Spartanburg Experiments," The Rand Corporation Paper Series, August 1975.

22. Schinn, Allen and Brownstein, Charles, personal interviews on 28 December 1975.

23. Bazemore, Judith, personal interview at Spartanburg, South Carolina, 3-4 February 1976.

24. Herring, Gordon, personal interview at Spartanburg, South Carolina, 3-4 February 1976.

25. Nicholson, V., "Rural Extension Techniques And Systems," NCTA 74-105.

26. FCC Rules and Regulations.

27. U.S. Congress, House, Committee on Interstate and Foreign Commerce, Subcommittee on Communications, Cable Television: Promise versus Regulatory Constraint, U.S. Government Printing Office, January 1976.

28. Cabinet Committee on Cable Communications, Cable, A Report To The President, U.S. Government Printing Office, 1974.

29. Baer, W. S., Cable Television: A Handbook For Decisionmaking, (The Rand Corporation, RS-1133-NSF), February 1973.

30. Hallowell, M. L., cd., Cable Handbook 1975-1976, (Washington D.C.: Communications Press, Inc.), 1975.

31. Cohen, R. E., "Regulatory Report/Broadcast, Cable Industries Face Off on Cable Reform Plan," National Journal, 7 February 1976.

32. Cable Television Information Center, The Uses of Cable Communications, Washington, D.C., 1973.

33. Farmers Home Administration, Office of the Administrator, Priorities for Funding Community Facility Loan Applications, 4 November 1975.

34. Kay, Peg, Social Services and Cable TV: draft report for the National Science Foundation, obtained December 1975.

35. Booker T. Washington Foundation/Cablecommunications Resource Center, A Preliminary Review of Current Practices One Trends in Rural Telecommunications Development And Recommendations For Future Development: prepared for the Economic Development Administration, Office of Economic Research, U.S. Department of Commerce, August 1975.

36. Rhodes, Maurice, Letter and materials to Gretchen Kolsrud, Office of Technology Assessment describing the Blue Ridge Electric Membership Corporation's feasibility Study of a Cable TV system, 3 February 1976.

37. Letter to Ronald Knouse, Blue Ridge Electric Membership Corporation, describing the Consideration of the Cable Television Information Center on the proposed Blue Ridge System, 15 August 1973.

38. U.S. Congress, Senate, S. 1219.

39. U.S. Congress, House, H.R. 5319.

40. U.S. Congress, House, H.R. 244, 14 January 1975.

41. U.S. Congress, House, H.R. 4564, 10 March 1975.

42. U.S. Congress, Senate, S. 1257, 20 March 1975.

43. U.S. Congress, House, H.R. 9630, 21 January 1976.

44. U.S. Congress, House, Committee on Interstate and Foreign Commerce, Educational Broadcasting Facilities and Telecommunications Demonstration Act of 1976: Committee Report 94-772.

45. U.S. Congress, House, H.R. 9289.