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FINAL REPORT

VIDEO DISTRIBUTION SYSTEM COST MODEL

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by

I. Gershkoff
J. Kent Haspert
B. Morgenstern

ARINC Research Corporation
a *Subsidiary of Aeronautical Radio, Inc.*
2551 Riva Road
Annapolis, Maryland 21401

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ABSTRACT

This report describes a cost model that can be used to systematically identify the costs of procuring and operating satellite-linked communications systems. The user defines a network configuration by specifying the location of each participating site, the interconnection requirements, and the transmission paths available for the uplink (studio to satellite), downlink (satellite to audience), and voice talkback (between audience and studio) segments of the network. The model uses this information to calculate the least expensive signal distribution path for each participating site. Cost estimates are broken down by capital, installation, lease, and operations and maintenance. The design of the model permits flexibility in specifying network and cost structure.

ARINC Research Corporation performed the work for the National Aeronautics and Space Administration (NASA) under Contract NAS5-25401; the Public Service Satellite Consortium served as a major subcontractor.

SUMMARY

As part of its pioneering work in applying advanced communications technology to the improvement of public services' productivity, the National Aeronautics and Space Administration (NASA) has demonstrated the feasibility of using satellite-linked video communications systems. This report is concerned with ARINC Research Corporation's development of a model that can systematically identify the costs of procuring and operating such systems.

First, we accomplished a quick-look evaluation of the cost of a one-way-video, two-way-voice distribution system to serve federal office buildings in 14 cities. The analytical procedures used in preparing this initial report then were used in addressing the major task: developing a model for analyzing the costs of the options available for transmitting a video signal via satellite and selecting the preferred options. The costs were grouped into four categories, each of which can be analyzed independently of the others:

- Uplink: The cost of producing the video signal and transmitting it to the satellite
- Downlink: The cost of receiving the satellite signal and distributing it to the local audiences
- Voice Talkback: The cost of a voice link from the audience to the program originators
- Administrative: The costs associated with planning, management, and other overhead activities

Each of these costs may be further divided into recurring and nonrecurring elements.

The model's user must define the network configuration by specifying the location of each participating site, the interconnection requirements, and the transmission paths available for the uplink, downlink, and voice talkback segments of the network. The model uses this information to calculate the least expensive path for each participating site.

In the uplink cost category, five options were used in the model; they involved combinations of transmitting-earth-terminal costs, studio costs, and terrestrial-link costs.

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In the downlink cost category, up to 37 options were available; they involved combinations of costs for a receiving earth terminal, a terrestrial link, a local distribution medium, and end user equipment. The network itself might own the earth terminal or simply be linked to a shared terminal. Local distribution might be accomplished by video lines, microwave links, cable TV (CATV), or Instructional Television Fixed Service (ITFS) lines. Voice talkback might be accomplished through direct dial, WATS, or private line. Direct dial was modeled as a straight hourly rate, private line as a fixed monthly charge dependent on distance, and WATS as having both fixed and hourly components.

Administrative costs are not used as parameters for the model; they are merely inserted into the data base to be read directly as part of the output.

The model was used to analyze eight cases. All were hypothetical or proposed nonprofit public service applications of differing complexities. Five represented individual networks, and three involved several networks sharing transmission equipment. The cases are briefly characterized as follows:

1. Federal Cities Network - 14 major U.S. Government offices distributed throughout the continental United States. Programming originates from Washington, D.C.
2. Appalachian Educational Satellite Project (AESP) - 45 small cities and towns located in or near the Appalachian Mountains, from New York to Alabama. Many of the receiving sites are small colleges. Programming originates from Lexington, Kentucky.
3. Washington-Alaska-Montana-Idaho (WAMI) - 15 sites in northwest United States and Alaska. The WAMI network is used for medical education. Programming originates from Seattle, Washington.
4. "East" Case - a combination of the following networks:
 - a. The Federal Cities Network
 - b. 70 AESP sites (an expansion of case 2)
 - c. 10 Veterans Administration (VA) hospitals
5. "West" Case - a combination of the following networks:
 - a. The Federal Cities Network
 - b. The WAMI Network
 - c. 32 VA hospitals
 - d. 10 Denver Research Institute sites
 - e. 5 Project Interchange sites
 - f. 27 California Education sites
 - g. 3 California Conferencing sites

6. Standard Metropolitan Statistical Areas (SMSA) Cases - a series of cases involving progressively higher numbers of downlink cities. Programming originates from Washington, D.C. The following networks were analyzed:
 - a. 10 Federal Regional Headquarters
 - b. (a) plus 12 additional cities to include the top 20 SMSAs
 - c. (b) plus 42 additional SMSAs at or near state capitals
 - d. (c) plus 14 additional state capitals that are not SMSAs
7. Federal Regional Programming - a network where each of the 10 federal regional offices independently produces a small amount of programming each week. The receiving sites are the same 78 cities as in case 6d.
8. Cost Allocation Case - a network of the 10 federal regional offices and the top 20 SMSAs (similar to 6b). Eight of the 10 federal offices are also SMSAs. The overall cost is allocated to the two organizations on the basis of various network parameters.

The results of exercising the model for these cases are summarized in Table S-1. Annual operating costs for each network depended primarily on hours of utilization. Some economy of scale could be observed since average cost per uplink hour tended to be lower for the larger networks. Benefits from sharing facilities were a function of the level of shared investment. The East case, which had few common facilities among its three member organizations, showed much lower savings attributable to sharing than did the West case, which had a relatively large number of shared facilities. The cost allocation case quantifies possible savings from sharing facilities. By consolidating facilities in the eight cities that receive programming from both organizations, the number of required sites can be cut significantly. As a result, an equivalent level of service can be provided at lower cost than either organization acting alone could achieve.

Table S-1. SUMMARY OF TEST RUN RESULTS

Case	Number of Organizations	Number of Sites	Uplink Hours	Total Annualized Cost (\$ Thousands)	Average Cost per Uplink Hour per Site (Dollars)
Federal Cities	1	15	1,612	932*	38.53
Appalachian Educational Satellite Project (AESP)	1	45	1,040	891*	19.02
Washington-Alaska-Montana-Idaho (WAMI)	1	15	1,664	1,120*	44.87
"East" Case	3	95	3,932	2,040**	5.46
"West" Case	7	86	6,812	3,638**	6.21
SMSA Cases					
a.	1	10	1,300	481†	37.00
b.	1	22	1,300	517†	18.08
c.	1	64	1,300	689†	8.28
d.	1	78	1,300	763†	7.52
Full Duplex Federal Regions	1	78	1,300	813†	8.02
Cost Allocation Case					
Overall	2	22	2,340	952†	18.49
Federal Regions	1	10	1,300	332†	25.54
Top 20 SMSAs	1	20	1,040	620†	29.81

*Based on 5-year amortization at 10 percent rate.

**Based on 8-year amortization at 10 percent rate.

†Based on 8-year amortization at 12 percent rate.

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CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND

NASA has been a pioneer in the development of communications technology to improve the productivity of public services. Experiments conducted on the ATS-1, -3, -6, and CTS demonstrated that communications satellites have the technical capability to improve access to vital public services.

Public service agencies that participated in the NASA experiments now are in the process of changing over to the use of commercial facilities. An essential element in making this transition a success is demonstrating to the agencies and to other potential users that cost savings and improved service can be achieved by increased use of these communications techniques. The key lies in establishing appropriate shared-use networks. To this end, under Contract NAS5-25401, ARINC Research Corporation and its subcontractor, the Public Service Satellite Consortium, undertook the development and trial application of a computer model that would facilitate the design and costing of shared video distribution systems that would use common carrier facilities and serve the needs of various combinations of public service users. The work and results are described in this report.

The most difficult phase in the creation of a shared-used public service communications network will be the start-up phase. Once a backbone of users is established, it will be comparatively easy to expand the network. ARINC Research has found in studies of other industries that usually a small percentage of the users (e.g., 10 percent) generate a substantial amount of the total traffic (e.g., 90 percent). In the public service community, a similar phenomenon can be expected. Large urban institutions would make or break the cost-effectiveness of a public service network, even though the greatest benefits in terms of improved access and cost containment could accrue to smaller institutions located outside the major cities. Therefore, one must examine a base of users having complementary requirements in cities where established carriers can provide the desired services at a savings. The model described herein can remove many of the existing uncertainties regarding costs, preferred services, and locations associated with establishing the initial system users and suppliers.

There are several issues to be considered in establishing a shared-use network for one-way video. A number of earth stations that are interconnected by Western Union's WESTAR satellite or RCA's SATCOM have already been

installed or are about to be installed. The systems include 150 Public Broadcasting Service (PBS) stations, 190 National Public Radio (NPR) stations, and more than 400 cable TV (CATV) earth stations. Holiday Inns, Inc. is planning to install a large number of earth stations to provide closed-circuit television to some of its 1,500 outlets. Public service might be able to use these networks to establish a shared-use system for one-way video on an incremental cost basis. Feedback or a return communications path could be provided by a separate voice/data network or by Wide Area Telephone Service (WATS), if necessary.

Unfortunately, in many cases there is no existing local loop that could connect the earth station to institutions that are of interest to potential public service users. Before our work started, the Public Service Satellite Consortium (PSSC) evaluated the recurring and nonrecurring costs of providing end-to-end closed circuit TV service to interested public service users in 14 U.S. cities* served by PBS earth stations. Ten of these cities already have one or more Instructional Television Fixed Service (ITFS) or CATV systems. However, in only three of these 10 cities is the PBS earth station interconnected to an existing local loop. The cost of installing this interconnection (about \$25,000) would exceed the cost of a new receive-only earth station (which could view either WESTAR or SATCOM) if this new station were installed at the head-end facility of a CATV or ITFS system. Although all PBS earth stations have a redundant receiver that may be used on a preemptive basis at the discretion of the licensee, a new receive chain (at a cost of about \$10,000) might be required to provide regular nonbroadcast service once a certain volume is reached. Six of the 14 PBS installations have a "terrestrial tail" between the earth station and the studio. Additional channels (at a cost of \$15,000 per channel) might have to be installed on these microwave relays once the volume of nonbroadcast service became appreciable.

Thus, while existing earth stations might provide an excellent starting point for a shared-use, one-way video network, in many cities the lack of channel capacity or of an interconnected local loop might necessitate new capital investment to provide end-to-end transmission service. The decision on whether to augment existing facilities or construct new facilities will depend critically on the access arrangements that can be negotiated with owners of existing earth stations and local loops.

These considerations led to the work reported herein: the development of a model that could consider numerous options for the uplink (studio to satellite), downlink (satellite to audience), and talkback (between audience and studio) segments of a video distribution system and selection of the optimum ones for each of the cities in the network.

*Atlanta, Boston, Chicago, Cleveland, Dallas, Denver, Kansas City, Mo., Los Angeles, New York, Philadelphia, San Diego, San Francisco, Seattle, and Washington, D.C.

1.2 PROJECT OVERVIEW

The project outputs are (1) a model that can be used to define preferred configurations and to evaluate shared public service video communications systems and (2) the results of several trial applications of this model.

The initial phase of the project involved a 21-day effort to make a quick-look evaluation of the cost of a one-way video, two-way voice communications system serving federal office buildings in 14 major cities and to submit a report on the results. The analytical procedures developed in this work were later used as a guide for model formulation. The model was developed and was applied to five test cases. As a result, several additional refinements to the model were identified that would increase its capability and ease of use. The model was enhanced and tested against a new set of test cases.

Throughout the project there was a continuing effort to develop and refine a data base of applicable communications tariffs and hardware costs. The two prime activities -- the development of the video distribution systems cost model and the analysis of specific public service satellite communications scenarios -- were performed in parallel. The specific configuration requirements of the individual scenarios served to guide the features that were incorporated into the model. The model was used to develop insight into the types of economies that could be achieved through shared public service video distribution systems.

The Public Service Satellite Consortium (PSSC) provided many of the inputs to the data base and commented on and reviewed other aspects of the project.

1.3 REPORT ORGANIZATION

This report consists of this introductory chapter and three chapters that provide a model overview, the results of the cases analyzed, and concluding comments on the utility of the model in evaluating the benefits of sharing. There are six appendixes:

- Appendix A - Data Assumptions. The justification for some of the cost assumptions used in the uplink and downlink segments are presented.
- Appendix B - Model Formulation. Detailed documentation of the model is presented, including a description of the calculations and definitions of variables.
- Appendix C - Sample Outputs. The input data and output reports for a selected model run are shown.
- Appendix D - Program Listings. The main FORTRAN program and sub-routines used are listed.

- Appendix E - Model Installation. The procedures required to install the model on a minicomputer are explained.
- Appendix F - Operational Costs and Management Considerations. The feasibility of offering access to the model to a large community of users is assessed and presented in terms of the costs required to support the model.

CHAPTER TWO

MODEL OVERVIEW

A common requirement in business, government, and education is establishing efficient communications among individuals scattered over a wide geographic area. Face-to-face meetings are the most effective way to accomplish this, but the high cost of travel, room, and board often make them an unattractive alternative.

With the advent of satellite communications, it became more economically feasible to use video transmission to conduct meetings. In an education or presentation environment, where a single person presents the bulk of the material, a one-way video channel may be particularly effective. Interaction between the lecturer and the audience can be accomplished by either a conventional voice line or a second video channel. Economic feasibility of a video meeting depends on the number of participating sites, system utilization, individual equipment lease charges, and other lesser factors.

To analyze the complex trade-offs that can be involved, a model has been developed that permits rapid cost analysis of alternative transmission options in networks using video transmission. In a typical case, a small number of uplink sites originate video programs and transmit them via satellite to geographically diverse audience sites. Each receiver must have its own earth terminal or a link to a shared terminal. A terrestrial voice circuit may be required to enable each receiving site to talk back to the transmitting site. Figure 2-1 illustrates this typical video distribution system.

The cost model provides an estimate of capital and operating costs for video communications via satellite from signal generation to reception. At each stage of signal transmission there may be several options concerning the type of equipment or common carrier to use. The model can analyze these options and choose the most cost-effective "path." By performing a comparison between a baseline and a scenario case, the model can show the results of a single change in network parameters.

The model can also be used to highlight the cost benefits of sharing facilities. Two or more organizations that individually cannot use a facility effectively might find that sharing the facility would be mutually beneficial. Multiple organizations sharing earth terminals or recording studios, for example, provide substantial cost benefits to the users. The

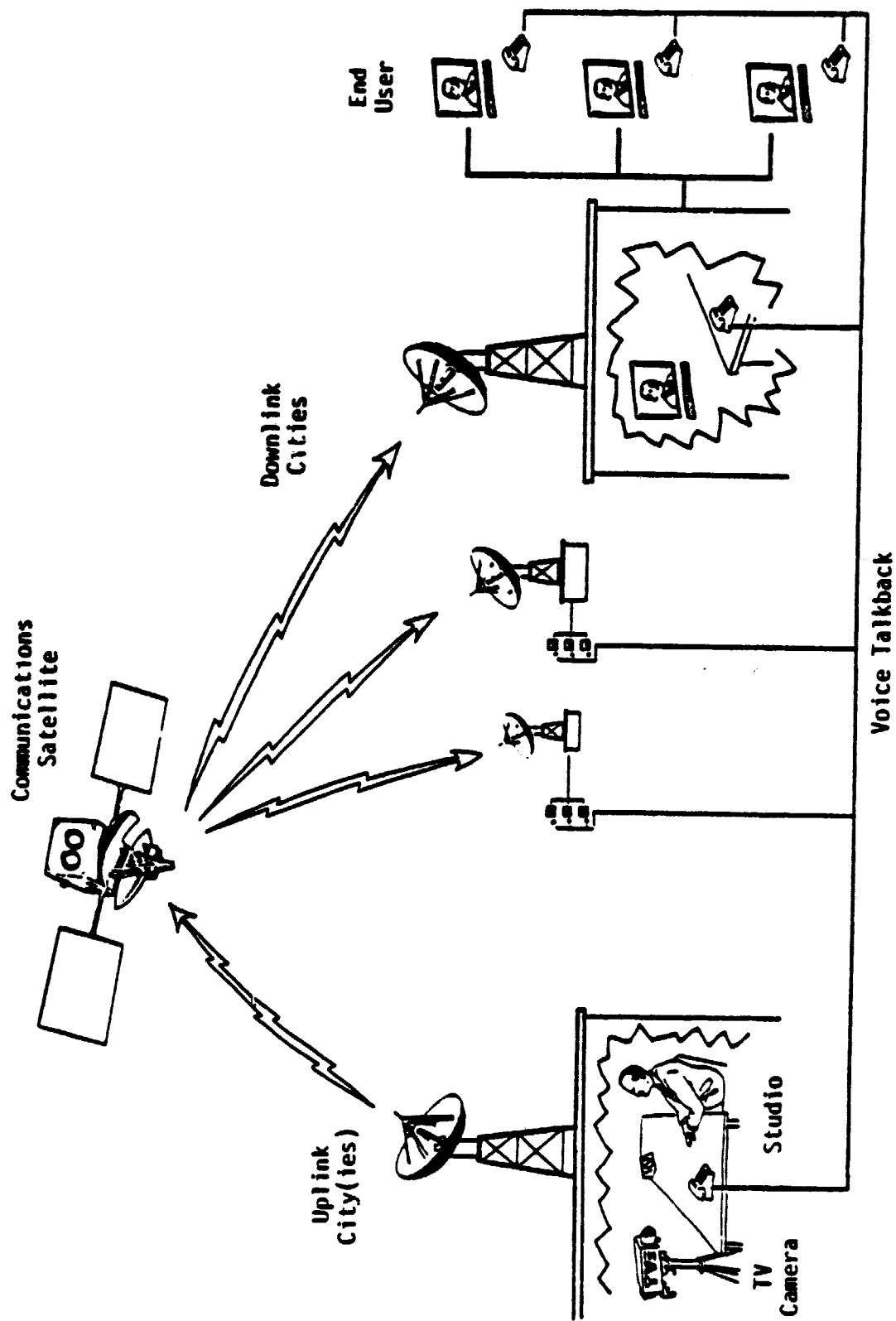


Figure 2-1. TYPICAL VIDEO DISTRIBUTION SYSTEM

savings limit would be reached when the shared facility became fully used. The model allows the user to establish his own cost allocation methodology by specifying the member organizations that will share the cost and applying weighting factors to the various cost items (e.g., peak versus off-peak usage) that affect each organization's share.

2.1 OVERALL MODEL STRUCTURE

The Video Distribution System Cost Model is designed primarily to analyze the economic options in transmitting a video signal, but may be applied to nonvideo systems as well. The cost structure is divided into four segments that can be analyzed independently of each other:

1. Uplink. The cost of producing the video signal and transmitting it through the satellite system. This includes costs of studio space and equipment, camera crews, and satellite transponder lease, and the cost of any terrestrial links from the studio to the uplink earth station.
2. Downlink and Local Distribution. The cost of receiving and decoding the satellite signal and distributing it to the local audience. This includes costs of receiving earth terminals, local distribution, and monitors. Distribution can be accomplished through a tie-in to a local CATV or Instructional Television Fixed Service (ITFS) system by a terrestrial video line or by microwave link.
3. Voice Talkback. The cost of the optional voice link from the audience to the originators of the programming. Depending on utilization and distance, voice talkback can be accomplished via direct dial, private line, or WATS.
4. Administrative. The management and overhead cost of the network as a whole. It includes items such as planning studies, management salaries, building space, and any other costs not directly attributable to the uplink, downlink, or voice talkback segments.

The costs for each of the segments are further divided into capital, installation, lease, and operations and maintenance (O&M) categories. Capital and installation costs are one-time charges for facilities necessary to bring the system into operation; lease and O&M costs are recurring. Capital and lease costs are for equipment; installation and O&M costs are for services. The capital and installation costs may be amortized as an ongoing expense over a period depending on interest rate and equipment life.

For each of the major cost segments other than "Administrative," the model user must specify a set of available options, or "paths," that define the various means of sending the information through that particular link of the system. The model will calculate the cost of each feasible option

and choose the least expensive, option for each city under consideration. Because of variations in hourly utilization, distances between cities, and other factors, the optional path will not necessarily be the same in each city.

Three types of input data are required from the model user:

1. Cost Element Data. These consist of the capital, installation, lease, and O&M costs of each cost element (piece of equipment or nonhardware cost unit) used in the analysis. A single cost element may consist of many individual items, as long as they are always considered together.
2. Path Data. A path consists of one or more cost elements and represents a method of transmitting the signal through one of the model segments. In the uplink segment, for example, a typical set of path data might consist of studio rental, a video link between the studio and the earth terminal, and the transponder lease.
3. City Data. For each audience site in the network, the user must specify location, utilization, local distribution requirements, voice talkback requirements, and which of the defined paths are feasible.

Figure 2-2 shows how the three types of data interact to generate the least-cost path. Costs are summed over all cost elements associated with each path and then modified by any variables (e.g., hourly utilization of the system) that are dependent on the city under consideration. This enables the calculation of costs of all feasible paths for the given city, from which the least-cost path is selected.

The following four sections address the model formulation in terms of the four cost categories: uplink, downlink, voice talkback, and administration. The last section examines the model's special features. A more detailed description of the model's logic and parameters can be found in Appendix B. A detailed description of how to use the model is presented in the *User's Guide to the Video Distribution System Cost Model*, published as ARINC Research Publication 1358-01-TR-2234, dated July 1980.

2.2 UPLINK FORMULATION

Uplink costs in the model are those involving production and transmission of the video signal to the satellite.

Figure 2-3 shows a representative set of uplink paths. Each box represents a cost element; any combination of elements connected by a link denotes an acceptable path. All paths will incur costs for satellite usage (transponder lease) and a television studio to produce the video signal. If an existing uplink earth terminal is to be used, a

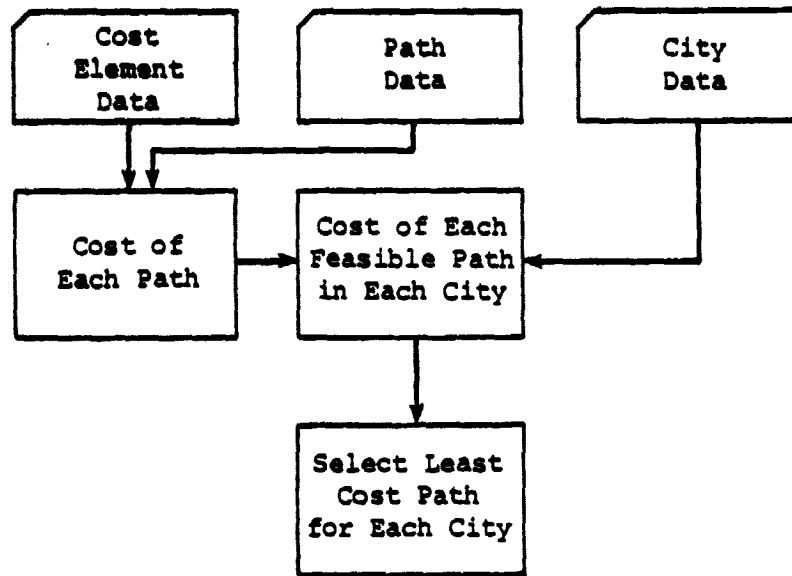


Figure 2-2. INFORMATION FLOW DIAGRAM

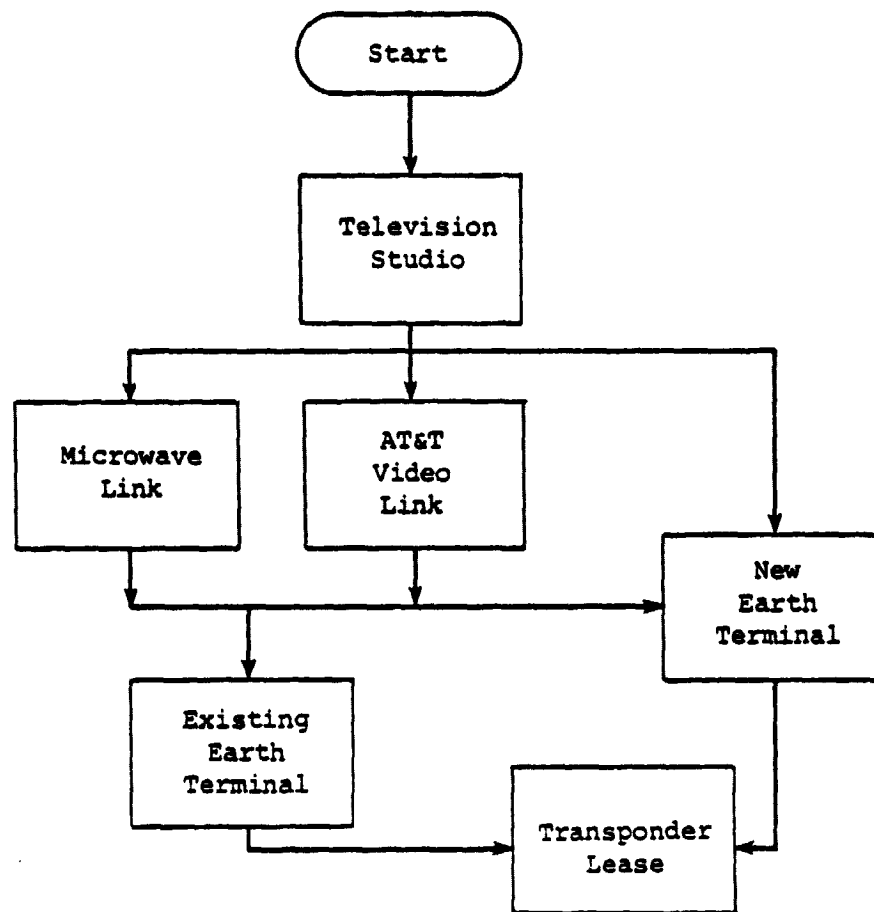


Figure 2-3. UPLINK PATHS

terrestrial video circuit or microwave link will be required to carry the signal from its point of origination to the uplink earth terminal. In some locations, a new earth terminal will be required; if it is colocated with the studio, a terrestrial video link between the two will not be necessary. These possibilities generate the five possible paths shown in the diagram:

- Microwave link to existing earth terminal
- AT&T video link to existing earth terminal
- Microwave link to new earth terminal
- AT&T video link to new earth terminal
- New earth terminal colocated with studio

Not all of the five paths are necessarily feasible for every uplink city. For example, if there is no existing earth terminal in a given city, then a new facility must be built, and the first two paths will not be feasible.

2.3 DOWNLINK FORMULATION

Downlink costs in the model are those associated with receiving the satellite video signal and distributing it to the audience.

Figure 2-4 shows the 37 possible downlink paths. Other paths might be possible, but those considered here were thought to be typical of most applications. The seeming complexity of the diagram is misleading, since the 37 paths simply represent various combinations of a receiving earth terminal, a terrestrial link, a local distribution medium, and end user equipment.

As in the uplink segment, each receiving site must have its own earth terminal or link to an existing one. In the diagram, options are displayed for a link to a CATV earth station, a PBS earth station, or a common carrier satellite station. If there was only one end audience in a particular city, it was considered practical to link it directly to the earth station via 1-hop or 2-hop microwave. For multiple users, the signal could be locally distributed via CATV or an ITFS transmission system. If either of these methods were used, it might be necessary to establish a microwave or video link between the earth terminal and the local transmission system.

The private earth terminal could also be colocated with one of the audience sites. If there is only one audience organization associated with a particular downlink city, there will be no need for a local transmission system as well. With multiple receiving organizations, it will be necessary to establish a local distribution system through a CATV or ITFS network. In cases where the receiver must also be used as a transmitter, either for a two-way video communications or for one-way transmission at a different hour of the day, a single two-way earth terminal could suffice

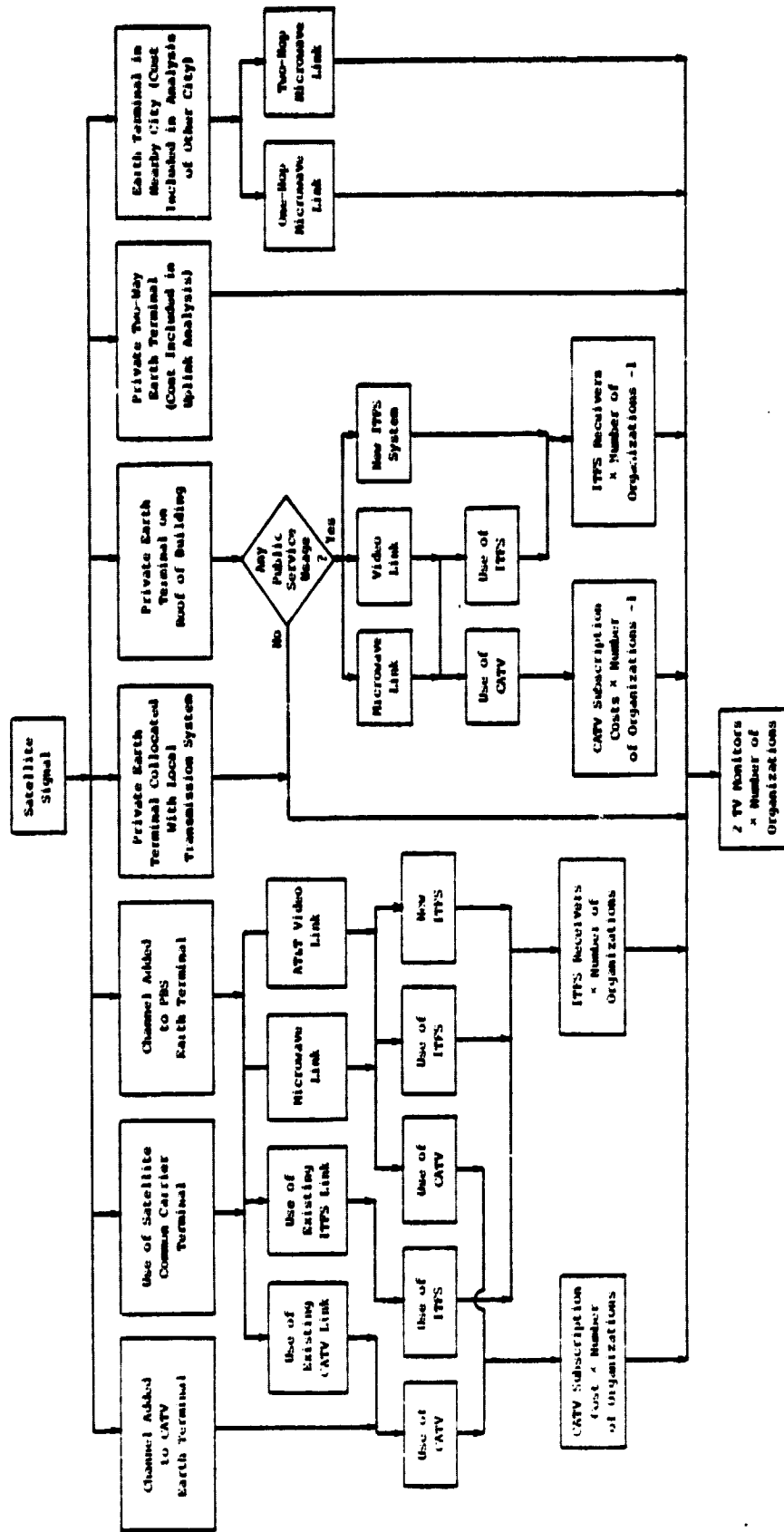


Figure 2-4. LOCAL DISTRIBUTION OPTIONS

for the downlink. A final alternative is to receive the signal by using an earth terminal in a nearby city and then running a one- or two-hop microwave link between the earth terminal and the viewing site.

2.4 VOICE TALKBACK FORMULATION

In some applications it is necessary that the audience of the video programming communicate with the originators to comment or ask questions. This communication, whether occurring during or after the presentation, would be by common-carrier voice circuits external to the satellite system.

There are three telephone options available for such voice talkback: Direct Distance Dialing (DDD), measured WATS, and private line. The most cost-effective approach depends on the distance between the two cities and the number of monthly hours of talkback required. DDD costs are modeled at a fixed rate of \$0.55 per minute regardless of distance, which corresponds approximately to the cost of a one-minute personal coast-to-coast long distance call during business hours. Rates are slightly lower for shorter distances or for additional minutes. Therefore, the 55 cents may be considered a worst case. The principal advantage of DDD is that there is no minimum charge. Private line charges, on the other hand, are based solely on mileage and are not dependent on utilization. Charges per month are set by interstate tariff at \$190.40 plus \$0.40 per mile. WATS charges fall between those of DDD and private line and have fixed (per month or mile) and variable (per hour) components. The average fixed monthly charge is approximately \$60.00; the average hourly charge is approximately \$18.00.

On the basis of this schedule of costs, DDD will be the preferred alternative for low-utilization circuits and private line for high-utilization circuits, regardless of distance. WATS will be preferred when utilization is sufficient to take advantage of the lower hourly tariffs and the two cities are so far apart that the private line charge would be prohibitive. Figure 2-5 shows the cost trade-offs associated with the three alternatives for Washington-to-Chicago communications.

2.5 ADMINISTRATIVE COSTS

Administrative costs accrue in addition to the direct costs of a video satellite system. They include costs for planning studies and legal procedures involved in establishing the network, and general management costs not attributable to the uplink, downlink, or voice talkback segments. Administrative costs are not expected to vary according to network configuration, utilization, or any other factor. The data are inputted by the user and read out directly in the output; the model performs no calculations with these figures.

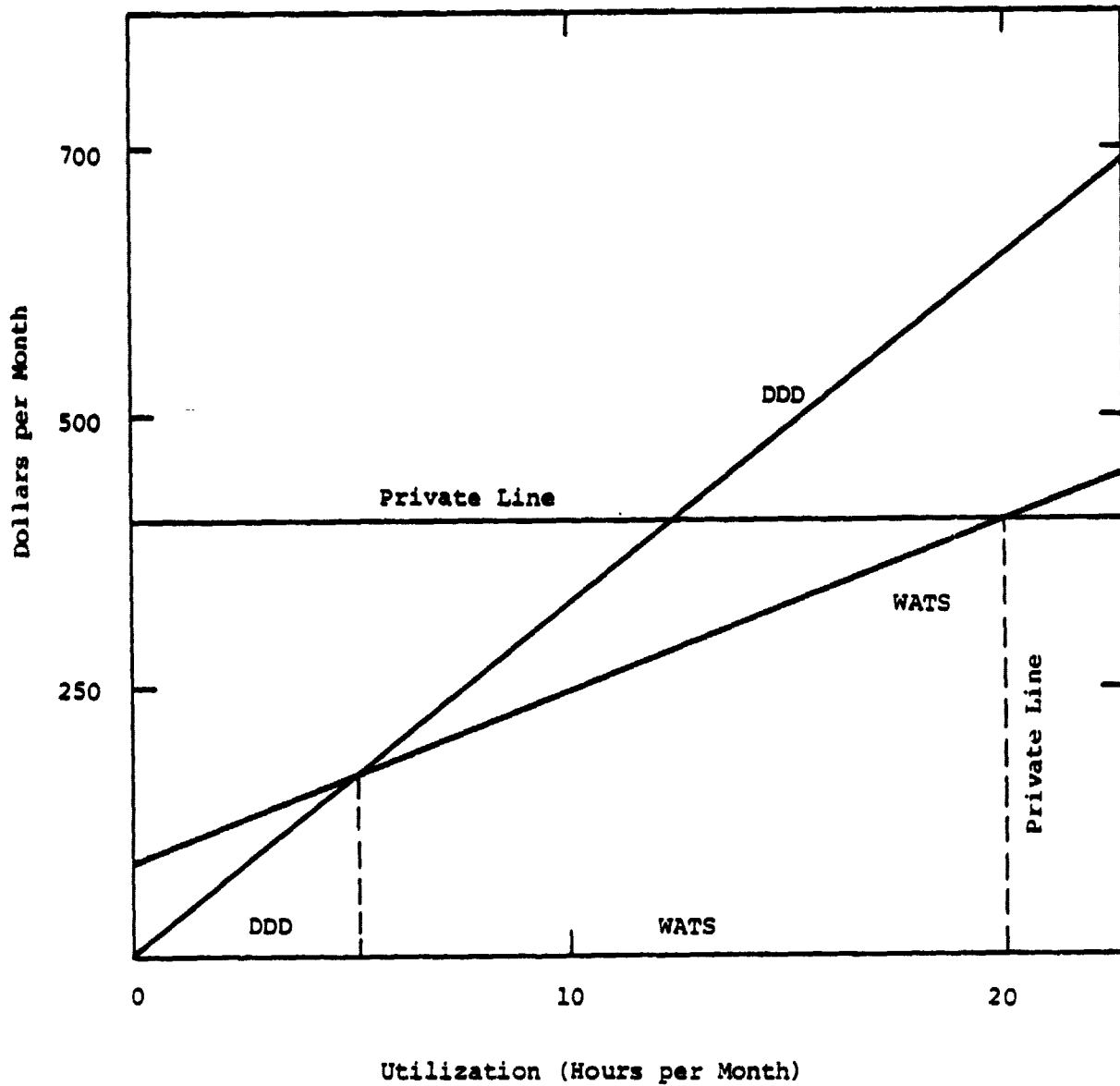


Figure 2-5. COMPARISON OF WATS, DDD, AND PRIVATE LINE (WASHINGTON TO CHICAGO)

2.6 OTHER SPECIAL FEATURES

2.6.1 Interactive Scenario Builder

The interactive scenario builder is used to establish the user's network configuration and associated cost elements. The scenario builder accepts as input either a system-created scenario file that contains

typical network costs (see Appendix A) or a scenario created by the user during a previous computer session.

Use of the system-created scenario file allows the user to provide minimum input. The only required data are the list of uplink and downlink network cities and their location in latitude/longitude or Bell System V and H coordinates, hours of satellite utilization by city, number of receiving organizations per city, terrestrial microwave or video link requirements, and voice talkback connectivity and utilization requirements.

Use of a previously created scenario allows the user to examine the sensitivity of the network configuration costs to changes in the number of uplink and downlink cities and in various cost allocation methodologies.

Other features of the scenario builder include automatic prompting for user input, simple procedures for implementing minor network changes, and sufficient generality so that nonvideo network distribution problems can be worked.

2.6.2 Transponder Channels

In the uplink segment, the user can assign a transponder channel number to each uplink site. The numbers have no significance except to indicate that cities assigned the same channel number are sharing a particular frequency. Fixed costs and minimum operating costs associated with using a transponder channel are assigned only to the first city associated with each unique channel number. If no channel assignment is made by the user, the model will assume that all programming is done on a single transponder frequency. The model is not currently equipped to schedule the time slots on the transponder; the user must do this. However, it is a simple process and can be done manually for all but the most complex cases.

2.6.3 Hierarchical Levels

In the downlink segment, the user can assign a single-digit hierarchical number to each downlink city. This number indicates the city's position in the overall organizational structure of the network. If the assigned level is two or less, talkback costs will be calculated from the given city to each uplink city; if three or greater, the city is assumed to talk back to the nearest level two city, which serves as a central relay point to the uplink city.

2.6.4 Earth Terminal Data Base

An earth terminal data base is available for determining the possibility of sharing an existing site. The data base is a subset of the data stored by the Federal Communications Commission (FCC) and consists of call sign, licensee, city, state, latitude/longitude, type of service, antenna size, and licensed points of communication (satellites). Unlicensed stations

and stations whose applications are pending are not included. The data base indicates all satellites to which the earth terminal is licensed to point, but does not indicate which satellite the earth terminal is currently pointing to. A sample record is illustrated in Figure 2-6. A utility exists to access this data base and provide appropriate data to the user.

2.6.5 Model Output

The major output of the model is a tabulation of costs for the least expensive system, broken out for the uplink, downlink, voice talkback, and administrative segments. Costs are further subdivided by capital, installation, lease, and O&M. Other reports show costs for the uplink, downlink, and voice talkback segments in greater detail. Output from a sample run is shown in Appendix C.

<u>Fields Included</u>	<u>Example</u>
• Call Sign	KB20
• Licensee	Teleprompter
• City	Anaheim
• State	CA
• Service	DFS-FES-D-TR*
• Latitude	37-37-02
• Longitude	121-49-51
• Antenna Size	4.5 Meter
• Licensed Points of Communication	KS20, KS21**

*Domestic Fixed Satellite - Fixed Earth Station - Developmental-Transmit/Receive.

**WESTAR I, WESTAR II.

Figure 2-6. SAMPLE EARTH TERMINAL RECORD

CHAPTER THREE

CASES ANALYZED

The model was exercised to analyze the eight cases described in this chapter. Most of them represent individual networks; three involve several networks sharing satellite transponder channels. The cases analyzed, varying widely in complexity, are characterized as follows:

1. Federal Cities - 14 major U.S. Government Offices distributed throughout the continental United States. Programming originates from Washington, D.C.
2. Appalachian Educational Satellite Project (AESP) - 45 small cities and towns located in or near the Appalachian Mountains from New York to Alabama. Many of the receiving sites are small colleges. Programming originates from Lexington, Kentucky.
3. Washington - Alaska - Montana - Idaho (WAMI) - 15 sites in the northwest continental United States and Alaska. The WAMI network is used for medical education. Programming originates from Seattle, Washington.
4. "East" Case - A combination of the following networks:
 - a. The Federal Cities network
 - b. 70 AESP sites (an expansion of case 2)
 - c. 10 Veterans Administration (VA) hospitals
5. "West" Case - A combination of the following networks:
 - a. The Federal Cities network
 - b. The WAMI network
 - c. 32 VA hospitals
 - d. 10 Denver Research Institute sites
 - e. 5 Project Interchange sites
 - f. 27 California Education sites
 - g. 3 California Conferencing sites

6. Standard Metropolitan Statistical Areas (SMSA) Cases - A series of cases involving progressively higher numbers of downlink cities. Programming originates from Washington, D.C. The following networks were analyzed:
 - a. 10 Federal Regional Headquarters
 - b. a plus 12 additional cities including the top 20 SMSAs
 - c. b plus 42 additional SMSAs at or near state capitals
 - d. c plus 14 additional state capitals that are not SMSAs
7. Federal Regional Programming - A network where each of the 10 Federal regional offices independently produces a small amount of programming each week. The receiving sites are the same 78 cities as in case 6d.
8. Cost Allocation Case - A network of the 10 federal regional offices and the top 20 SMSAs (similar to 6b). For this case, the computed overall cost is allocated to the two organizations on the basis of various network parameters.

These cases are intended to illustrate the capabilities of the model over a variety of video network problems. In most applications of this model it is expected that several runs will be required to refine cost and other parameters and to calculate the sensitivity to various cost components. The cases described in this chapter were developed and run at different times. As new and better information became available, the model's cost assumptions were updated; consequently, results from two different cases may not be directly comparable.

3.1 FEDERAL CITIES NETWORK

The Federal Cities network is a hypothetical one-way-video, two-way-voice communications system linking seven federal organizations in Washington with regional offices in federal office buildings in 14 major cities. The utilization requirements of each organization are shown in Table 3-1. The Bureau of Alcohol, Tobacco, and Firearms requires only occasional and minimal channel utilization for its needs, so its utilization is modeled as 0. Nevertheless, facilities must be made available for these occasional broadcasts.

Washington is the only uplink city; however, a separate studio and video link is required for each department. These are necessary to originate the programming and transmit it to a single uplink facility located in the Washington area. Transmission to the uplink terminal could be accomplished by either a leased video line or a microwave link. Principally because of the lower operating costs, microwave links were found to be less expensive than AT&T video lines.

Table 3-1. SYSTEM UTILIZATION				
Department	Agency	Cities	Utilization	Comments
Treasury	IRS	12	5 hrs/wk	Training for examiners
	BATF	9	0 hrs/wk	Bureau of Alcohol, Tobacco, and Firearms
HEW	Secretary	8	2 hrs/wk	Office of the Secretary
	SSA	9	5 hrs/wk	Social Security Administration
DOL	ETA	9	3 hrs/wk	Employment Training Administration
DOI	Secretary	4	2 hrs/wk	Office of the Secretary
U.S. House		10	32 hrs/mo	Congressmen discussions with constituents
U.S. Senate		8	20 hrs/mo	Senate discussions with constituents
DOC	Secretary	6	2 hrs/wk	Office of the Secretary

On the downlink side, options depended on the facilities available in each city. CATV earth terminals that might be used were available in Atlanta, New York, and Seattle. Existing ITFS systems could be used for local distribution in Atlanta, Chicago, Los Angeles, New York, and San Francisco. All cities have a PBS earth station that could be wired into a local distribution system. Alternatively, all cities could construct their own receive-only earth terminals and install them close enough to each federal building that it would be necessary only to run a short coaxial line directly to the viewing room. Because of the relatively low cost of an earth station and because there was only one site in each city (since all agency offices are selected to be colocated), the private earth terminal option was found to be the most cost-effective for all cities. Different options might be preferred if it were necessary to distribute the video signal to more than a single site in each of the cities.

In the voice talkback segment, only the WATS and private-line alternatives were considered. Monthly utilization of the talkback circuits ranged from 29 hours in Denver to 134 hours in Dallas. (Even the 29 hours is far beyond the maximum cost-effective level of DDD.) Private line was the preferred medium for all cities except Denver, where a combination of low utilization and high mileage to Washington made WATS the cheaper alternative.

Table 3-2 summarizes the preferred configuration and the model's cost output for this network. The capital expenditures are concentrated in the purchase of the microwave equipment to carry the video signal to the uplink terminal and the receive-only earth stations to be used in each downlink

Table 3-2. FEDERAL CITIES NETWORK

Available Option					
City	Uplink	Downlink	Voice Talkback		
Atlanta, GA	--	Private Earth Terminal	Private Line		
Boston, MA	--	Private Earth Terminal	Private Line		
Chicago, IL	--	Private Earth Terminal	Private Line		
Cleveland, OH	--	Private Earth Terminal	Private Line		
Dallas, TX	--	Private Earth Terminal	Private Line		
Denver, CO	--	Private Earth Terminal	WATS		
Fort Worth, TX	--	Private Earth Terminal	Private Line		
Houston, TX	--	Private Earth Terminal	Private Line		
Kansas City, MO	--	Private Earth Terminal	Private Line		
Los Angeles, CA	--	Private Earth Terminal	Private Line		
New York, NY	--	Private Earth Terminal	Private Line		
San Diego, CA	--	Private Earth Terminal	Private Line		
San Francisco, CA	--	Private Earth Terminal	Private Line		
Seattle, WA	--	Private Earth Terminal	Private Line		
Washington, DC	Private Earth Terminal, studio, microwave links	--	--		
Cost Summary					
Model Segment	Capital Expenditures	Planning and Installation	Annual Lease	Annual O&M&A	Annualized Cost
Uplink	420,000	70,000	198,787	28,000	356,048
Downlink	350,000	0*	0	224,000	316,328
Voice Talkback	28,000	1,429	113,070	0	120,833
Administrative	0	160,100	0	96,500	138,734
Totals	798,000	231,529	311,857	348,500	931,943
Total Annualized Cost	210,510**	61,077**	311,857	348,500	931,944
*Installation costs included in capital expenditures for downlink segment.					
**Effective yearly costs for 5-year, 10.00 percent amortization.					

city. Satellite usage and voice lines account for most of the lease costs. The bulk of O&M expenses are for the operation of the downlink earth terminals.

3.2 APPALACHIAN EDUCATIONAL SATELLITE PROJECT (AESP)

AESP is a network of about 45, mostly small, cities and towns in or near the Appalachian Mountains between New York and Alabama. Each downlink organization, many of which are small colleges, receives community service programming originating in Lexington, Kentucky. In some cities, programming is locally distributed through a CATV outlet.

Each city in the network was assigned to one of three "levels" depending on its role in the network hierarchical structure. Level 1 denoted an uplink site. Levels 2 and 3 were assigned on the basis of the city's role in the voice talkback subsystem: level-2 cities were equipped to call Lexington directly, while level-3 cities could talk only to the nearest level-2 city. In an actual programming environment, the level-2 cities would receive questions or comments from viewers in the level-3 cities, screen them, and relay them to Lexington, possibly adding a few comments of their own. An algorithm was programmed into the model to search through the level-2 cities to find the closest one to a given level-3 city. Only Lexington was assigned level 1; 22 cities were assigned to level 2 and 22 to level 3.

In the uplink segment, a new transmitting earth terminal was required because there was no common-carrier earth terminal with which to link. No microwave or video link was necessary since it was assumed that the transmitter would be colocated with the studio. Thus, there was only one option available.

In the downlink segment, all cities have the same system utilization, so the cost of a given path would be the same in each city in which it was feasible -- if it was the most economical in one city, it would be the most economical in all cities. A city that was within 20 miles of another network-city was permitted to establish a single microwave link to that city*. If the distance was 20-100 miles, a two-hop microwave link was permitted. However, the two-hop microwave option turned out to be the most expensive and even the one-hop microwave proved to be more expensive than a private earth terminal. Therefore, a private terminal was the preferred option for all downlink segments except Lexington's. In the case of Lexington, from which the programming originates, there was no need for any downlink equipment, since the audience is local.

Because of high utilization (87 hours per month)** and low distances between cities, private line was more cost-effective for talkback than WATS in every case. DDD was not examined because at \$33.00 per hour it would certainly have been considerably more expensive than either WATS or private line.

The preferred configuration of the AESP network and the results of exercising the model for this case are shown in Table 3-3. The annualized cost of about \$900,000 is divided approximately equally between one-time capital, leases, and operations expenses. A five-year, 10-percent amortization rate was used to annualize the capital expenses and planning and installation charges.

*Although one-hop microwave is often feasible at a distance of 50 miles or more, 20 miles was felt to be a conservative bound; i.e., if the distance is less than 20 miles, a one-hop microwave can always be built, whereas at 20-50 miles, it depends on the terrain.

**This was an early estimate of AESP talkback that was later revised.

Table 3-3. APPALACHIAN EDUCATIONAL SATELLITE PROJECT

Available Option			
City	Uplink	Downlink	Voice Talkback
Guntersville, AL*	--	Private Earth Terminal	Private Line
Rainsville, AL*	--	Private Earth Terminal	Private Line
Gadsden, AL	--	Private Earth Terminal	Private Line
Huntsville, AL	--	Private Earth Terminal	Private Line
Clayton, GA*	--	Private Earth Terminal	Private Line
Rome, GA*	--	Private Earth Terminal	Private Line
Gainesville, GA	--	Private Earth Terminal	Private Line
Hazard, KY	--	Private Earth Terminal	Private Line
Lexington, KY	Private Earth Terminal colocated with studio	Monitors Only	None
Morehead, KY	--	Private Earth Terminal	Private Line
Somerset, KY	--	Private Earth Terminal	Private Line
Hagerstown, MD*	--	Private Earth Terminal	Private Line
Cumberland, MD	--	Private Earth Terminal	Private Line
McHenry, MD	--	Private Earth Terminal	Private Line
Booneville, MS*	--	Private Earth Terminal	Private Line
Tupelo, MS	--	Private Earth Terminal	Private Line
Scooba, MS	--	Private Earth Terminal	Private Line
Alfred, NY*	--	Private Earth Terminal	Private Line
Fredonia, NY	--	Private Earth Terminal	Private Line
Olean, NY	--	Private Earth Terminal	Private Line
Boone, NC*	--	Private Earth Terminal	Private Line
Marion, NC*	--	Private Earth Terminal	Private Line
Morganton, NC*	--	Private Earth Terminal	Private Line
Sylva, NC	--	Private Earth Terminal	Private Line
Athens, OH	--	Private Earth Terminal	Private Line
Ebensburg, PA*	--	Private Earth Terminal	Private Line
Edinboro, PA*	--	Private Earth Terminal	Private Line
Smethport, PA*	--	Private Earth Terminal	Private Line
Pittsburgh, PA	--	Private Earth Terminal	Private Line
Columbia, SC*	--	Private Earth Terminal	Private Line
Greenville, SC	--	Private Earth Terminal	Private Line

*Level 2 cities.

Table 3-3. (continued)

Available Option (continued)					
City	Uplink	Downlink	Voice Talkback		
Spartanburg, SC	--	Private Earth Terminal	Private Line		
Chattanooga, TN*	--	Private Earth Terminal	Private Line		
McMinnville, TN*	--	Private Earth Terminal	Private Line		
Johnson City, TN*	--	Private Earth Terminal	Private Line		
Tazewell, TN*	--	Private Earth Terminal	Private Line		
Cookeville, TN	--	Private Earth Terminal	Private Line		
LaFollette, TN	--	Private Earth Terminal	Private Line		
Stickleyville, VA*	--	Private Earth Terminal	Private Line		
Dublin, VA	--	Private Earth Terminal	Private Line		
Norton, VA	--	Private Earth Terminal	Private Line		
Petersburg, WV*	--	Private Earth Terminal	Private Line		
Wheeling, WV*	--	Private Earth Terminal	Private Line		
Romney, WV*	--	Private Earth Terminal	Private Line		
Bethany, WV	--	Private Earth Terminal	Private Line		
Cost Summary					
Model Segment	Capital Expenditures	Planning and Installation	Annual Lease	Annual O&M&A	Annualized Cost
Uplink	285,000	5,000	133,225	66,000	275,726
Downlink	705,000	0**	0	132,000	317,977
Voice Talkback	88,000	4,752	134,257	0	158,722
Administrative	0	160,100	0	96,500	138,734
Totals	1,078,000 ⁺	169,852 ⁺	267,482	294,500	891,159
Total Annualized Cost	284,373	44,806	267,482	294,500	891,161
*Level 2 cities.					
**Installation costs included in capital expenditures for downlink segment.					
⁺ Effective yearly costs for 5-year, 10.00 percent amortization.					

3.3 WASHINGTON-ALASKA-MONTANA-IDAHO (WAMI)

The WAMI network examined in this study is a medical-education network of 15 cities, 11 of which are in the northwestern United States and four in Alaska. The hub of the network is Seattle, where the programming originates from the medical school at the University of Washington, the only medical school in the four-state area.

Two types of programming are carried by WAMI. In the first, Seattle and Fairbanks or Seattle and Bozeman transmit medical-school programs full duplex on different channels for three hours per week; this programming is also received in Pullman. In the other, Seattle and Boise transmit clinical programs full duplex for 10 hours per week. This programming is received by clinics in all WAMI cities except Bozeman, Boise, and Pullman.

The uplink cities are, therefore, Seattle, Fairbanks, Bozeman, and Boise. During operations, Seattle and one of the other three cities will be transmitting video signals full duplex to the satellite. Each requires a two-way earth terminal and a television studio. The studio is assumed to be colocated with the earth terminal, therefore no microwave link or terrestrial video line should be needed. The other 11 cities require receiving capability only. It is also necessary that all cities be able to talk back to Seattle. Fairbanks, Bozeman, and Boise can accomplish this with no additional facilities because they are transmitting video to Seattle. The other cities will need WATS, private line, or DDD service to meet their talkback needs.

In the Federal Cities case, it was learned that for the given set of assumptions, the private earth terminal provides the least expensive downlink path. Consequently, this was the only downlink option specified for the 11 receive-only cities. Since each receiving site is a single clinic or university, it was assumed that there would be no need for local distribution of the signal.

The preferred configuration of this network and the results of exercising the model for this case are shown in Table 3-4. The detailed report for the uplink segment (not shown) indicates that neither the Seattle channel nor the Fairbanks-Bozeman-Boise channel was used enough to exceed the minimum charge for transponder leasing. Equipment and lease costs for the four uplink cities were identical, except for the allocation of satellite usage costs. On the downlink segment, each city showed the same costs for a receive-only earth terminal and two monitors. The four uplink cities already had the cost of their earth terminals allocated to the uplink side and therefore incurred costs only for the monitors. In the talkback segment, most cities were suited for private lines; only Bethel, Alaska was suited for WATS. Leases ranged from \$217 per month in Anacortes, Washington (68 miles from Seattle) to \$941 in Bethel (1,876 miles away).

3.4 "EAST" CASE

The "East" case is a hypothetical aggregation of several smaller networks. The purpose of analyzing such a configuration was to examine economies that would result from sharing facilities. The total system consists of the Federal Cities network, 10 VA hospital sites, and 70 AESP cities, 25 of which are planned additions to the AESP network. Johnson City, Tennessee, is the only city that is a member of more than one network.

Table J-4. WASHINGTON-ALASKA-MONTANA-IDAHO (WAMI) NETWORK

Available Option					
City	Uplink	Downlink	Voice Talkback		
Seattle, WA	Private Earth Terminal	Monitors Only	--		
Fairbanks, AK	Private Earth Terminal	Monitors Only	--		
Bozeman, MT	Private Earth Terminal	Monitors Only	--		
Boise, ID	Private Earth Terminal	Monitors Only	--		
Spokane, WA	--	Private Earth Terminal	Private Line		
Pullman, WA	--	Private Earth Terminal	Private Line		
Anchorage, AK	--	Private Earth Terminal	Private Line		
Billings, MT	--	Private Earth Terminal	Private Line		
Ketchikan, AK	--	Private Earth Terminal	Private Line		
Whitefish, MT	--	Private Earth Terminal	Private Line		
Anacortes, WA	--	Private Earth Terminal	Private Line		
Pocatello, ID	--	Private Earth Terminal	Private Line		
Bethel, AK	--	Private Earth Terminal	WATS		
Missoula, MT	--	Private Earth Terminal	Private Line		
Great Falls, MT	--	Private Earth Terminal	Private Line		
Cost Summary					
Model Segment	Capital Expenditures	Planning and Installation	Annual Lease	Annual O&M&A	Annualized Cost
Uplink	1,140,000	20,000	266,450	264,000	836,455
Downlink	180,000	0*	0	33,000	80,483
Voice Talkback	22,000	1,105	58,572	0	64,667
Administrative	0	160,100	0	96,500	138,734
Totals	1,342,000**	181,205**	325,022	393,500	1,120,339
Total Annualized Cost	354,016	47,801	325,022	393,500	1,120,339
*Installation costs included with capital expenditures for downlink segment.					
**Effectively yearly costs for 5-year, 10.00 percent amortization.					

The uplink options are the same as those of the previous cases. Each of the three uplink cities (Lexington, Philadelphia, Washington) bears the cost of satellite time and a transmitting earth terminal. Washington also requires seven studios and video lines because the programming on the Federal Cities network originates from seven locations. The model chose microwave over AT&T land lines for the video links.

Five paths are feasible in the downlink segment: (1) A private earth terminal colocated with monitors is available in all cities. (2) If a CATV earth terminal is located within 20 miles, the signal may be received and distributed through the cable systems. (The 20-mile figure is based

on estimated "range" of a CATV network beyond the earth terminal.) For this case, the only costs would be for equipment to receive the additional frequency at the earth terminal and feed it into the local distribution network, and for user subscription charges. (3) One-hop microwave from an existing terminal is a feasible option if the sites are less than 20 miles apart; (4) two-hop microwave is feasible if they are less than 100 miles apart. (5) If a downlink city is also an uplink city (Lexington, for example), the cost of the earth terminal has already been allocated in the uplink segment; therefore, earth terminal costs will not be counted in the downlink segment as well.

Since the cost of the five paths is not dependent on utilization, each path would cost the same in every city. As in the AESP case, the microwave options, because of their high capital costs, are more expensive than the private earth terminal option, which is available in every city. However, the CATV path is less expensive than the private earth terminal. The monitors-only option (Lexington) is the least expensive of all because no additional equipment is required. The least expensive available downlink option for each city is identified in Table 3-5.

In the talkback segment, DDD is the most cost-effective method for the low-utilization routes to Lexington and Philadelphia. WATS is better for some city pairs where utilization is three hours per month or more. For the 14 federal cities, utilizations range from 33 to 134 hours per month, which is sufficient to make private line the most attractive option in most cases.

The preferred configuration for this network and the models' costs output for it are shown in Table 3-5. The costs are not directly comparable to those obtained for the Federal Cities or AESP cases because cost estimates for most of the uplink and some downlink cost elements were updated; talkback hours were set at two hours per month except for the 14 federal cities; and the amortization rate was adjusted to be 8 years at 10 percent.

The principal economy gained by these three organizations' sharing facilities is in channel utilization. Alone, neither Washington nor Lexington met the 1800-hour minimum charge for a transponder channel, but together they did and saved about \$147,000 per year. Common facilities in Johnson City, Tennessee (the only downlink city in more than one of the three networks) would save about \$5,200; common talkback facilities would save the negligible amount of about \$72 per year.

The total network required a one-time investment of about \$5.1 million and incurred annual lease and maintenance costs of about \$1.1 million. Assuming an amortization rate of 10 percent for 8 years, annual expenses were about \$2.0 million. Only about 7 percent of this figure is saved as a result of sharing. In the next case to be discussed, the "West" Case, there is much more overlap between the subnetworks and consequently more significant savings.

Table 3-5. "EAST" CASE

Selected Options					
City	Uplink	Downlink	Voice Talkback		
Philadelphia, PA	Private Earth Terminal studio, microwave	--	--		
Washington, DC	Private Earth Terminal studio, microwave	--	--		
Lexington, KY	Private Earth Terminal studio, microwave	Monitors Only	--		
Atlanta, GA	--	Private Earth Terminal	Private Line		
Boston, MA	--	Private Earth Terminal	Private Line		
Chicago, IL	--	Private Earth Terminal	Private Line		
Cleveland, OH	--	Private Earth Terminal	Private Line		
Dallas, TX	--	Private Earth Terminal	Private Line		
Denver, CO	--	Private Earth Terminal	WATS		
Fort Worth, TX	--	Private Earth Terminal	Private Line		
Houston, TX	--	Private Earth Terminal	Private Line		
Kansas City, MO	--	Private Earth Terminal	Private Line		
Los Angeles, CA	--	Private Earth Terminal	Private Line		
New York, NY	--	Private Earth Terminal	Private Line		
San Diego, CA	--	Private Earth Terminal	Private Line		
San Francisco, CA	--	Private Earth Terminal	Private Line		
Seattle, WA	--	Private Earth Terminal	Private Line		
Group A (25)	--	Private Earth Terminal	DDD		
Group B (8)	--	Private Earth Terminal	DDD		
Group C (3)	--	Private Earth Terminal	DDD		
Group D (8)	--	Link to CATV	DDD		
Group E (9)	--	Link to CATV	DDD		
Group F (16)	--	Link to CATV	--		
Group G (9)	--	Link to CATV	--		
Cost Summary					
Model Segment	Capital Expenditures	Planning and Installation	Annual Lease	Annual O&M&A	Annualized Cost
Uplink	3,585,000	189,000	393,200	300,000	1,400,612
Downlink	915,000	109,200	7,920	129,300	329,347
Voice Talkback	136,000	1,479	158,118	0	183,887
Administrative	0	160,100	0	96,500	126,510
Totals	4,636,800	459,779	559,238	525,800	2,040,353
Total Annualized Cost	869,139*	86,183*	559,238	525,800	2,040,359
*Effective yearly costs for 8-year, 10.00 percent amortization.					

Table 3-5. (continued)

DEFINITION OF CITY GROUPS AND AVAILABLE OPTIONS		
<p>GROUP A: Private earth terminal downlink only</p> <p>Dublin, GA Fayetteville, NC Salisbury, NC Oteen, NC Altoona, PA Wilkes-Barre, PA Johnson City, TN Clarksburg, WV Guntersville, AL Rainsville, AL Clayton, GA Rome, GA Boone, NC Marion, NC Morganton, NC Ebensburg, PA Edinboro, PA Smethport, PA Tazewell, TN Petersburg, WV Stickleyville, VA Romney, WV Scooba, MS Alfred, NY Morehead, KY</p>	<p>GROUP B: (continued)</p> <p>Sylva, NC Athens, OH Pittsburgh, PA</p>	<p>GROUP F: Private earth terminal, CATV Link, or two-hop microwave; no talkback required</p> <p>Florence, AL Decatur, AL Birmingham, AL Chatsworth, GA Dalton, GA Barbourville, KY Crooksville, OH Elkins, WV Wytheville, VA Sparta, TN Crossville, TN Oak Ridge, TN New Albany, MS Anderson, SC N. Wilkesboro, NC Corinth, MS</p>
	<p>GROUP C: Private earth terminal or one- or two-hop microwave</p> <p>Olean, NY Dublin, VA Bethany, WV</p>	
	<p>GROUP B: Private earth terminal or two-hop microwave</p> <p>Hazard, KY Somerset, KY McHenry, MD Tupelo, MS Fredonia, NY</p>	<p>GROUP D: Private earth terminal or CATV Link</p> <p>Salem, VA Beckley, WV Hagerstown, MD Booneville, MS Chattanooga, TN McMinnville, TN Columbia, SC Wheeling, WV</p>
<p>GROUP E: Private earth terminal, CATV Link, or two-hop microwave</p> <p>Gadsden, AL Huntsville, AL Cumberland, MD Greenville, SC Spartanburg, SC Cookeville, TN LaFollette, TN Norton, VA Gainesville, GA</p>		

3.5 "WEST" CASE

The "West" case is a hypothetical aggregation of several smaller networks. It includes the Federal Cities network, the WAMI network, and 32 VA hospitals. Also included is the Denver Research Institute (DRI), a network of 10 sites in Colorado, Montana, and Utah. There are three California

networks included: Project Interchange (5 sites), Education (27 sites), and Conferencing (3 sites). There is considerable overlap among the various subnetworks, the 106 sites representing only 82 downlink cities.

Most of the same uplink and downlink options that were used in the East case were available in the West. The major difference is that the one-hop and two-hop microwave options were not considered because of their high cost, as demonstrated in Section 3.2. As in the East case, the cheapest downlink option was monitors only, but this is available only for those cities that are uplink cities also. Linking to a CATV system again was found to be cheaper than using a private earth terminal.

There are a total of nine uplink cities in the West network: Seattle, Fairbanks, Bozeman, and Boise are the uplinks for WAMI; Seattle is also the uplink for the VA cities; Washington is the hub of the Federal Cities network; Moffett Field, near San Francisco, is the uplink center for all three of the California networks. In the case of the California Conferencing, Sacramento and either Moffett Field or Los Angeles transmit full duplex video; finally, Denver is the uplink city for the DRI group. Transmissions for all six subnetworks can be accommodated on three satellite channels, assuming all of them operate during normal business hours.

Talkback requirements are two hours per month, except for the Federal Cities network, where lines must be open whenever transmission is in progress. No talkback is required for the California Conferencing, since all three sites are transmitting full duplex. The options in this segment are similar to those of the East case. DDD was the preferred alternative for three hours per month usage or less; the crossover point varied according to the distance between the two cities. Private line was the medium generally preferred for the 14 federal cities due to the high utilization of the lines.

The preferred configuration for this network and the model's cost output for it are shown in Table 3-6. The total network required capital and installation expenditures of \$9.2 million. Amortized annual expenses were \$3.6 million, of which \$0.9 million were for leases, \$1.0 million for operations and maintenance, and \$1.7 million for payment on capital equipment. The biggest cost component was \$7.8 million capital expenditures (1.4 million per year amortized) for uplink earth terminals, studios, and associated installation costs.

Savings resulting from sharing occur in all three major segments of the model. In the uplink, only three transponder frequencies are required to serve the member networks, instead of the nine frequencies that would be required without sharing. This reduction in the number of frequencies saves approximately \$940,000 annually. Sharing downlink equipment eliminates the need for 24 earth terminals and video links, which results in annual savings of approximately \$78,000. Common talkback facilities could save about \$7,600 per year; these savings would occur primarily on equipment expenditures.

Table J-6. "WEST" CASE

Selected Options					
City	Uplink	Downlink	Voice Talkback		
Seattle, WA	Private Earth Terminal; link required	Monitors Only	Private Line		
Fairbanks, AK	Private Earth Terminal; no link required	Monitors Only	--		
Bozeman, MT	Private Earth Terminal; no link required	Monitors Only	DDD		
Boise, ID	Private Earth Terminal; no link required	Monitors Only	DDD		
Moffett Field, CA	Private Earth Terminal; link required	--	--		
Sacramento, CA	Private Earth Terminal; link required	--	--		
Los Angeles, CA	Private Earth Terminal; link required	Monitors Only	Private Line		
Denver, CO	Private Earth Terminal; link required	Monitors Only	Private (to Seattle) WATS (to Washington)		
Washington, DC	Private Earth Terminal; link required	--	--		
11 Federal Cities	--	Private Earth Terminals	Private Line		
Grand Junction, CO	--	CATV Link	DDD		
Menlo Park, CA	--	Private Earth Terminals	DDD		
Group A (48)	--	Private Earth Terminals	DDD		
Group B (16)	--	CATV Link	DDD		
Cost Summary					
Model Segment	Capital Expenditures	Planning and Installation	Annual Lease	Annual O&M&A	Annualized Cost
Uplink	7,430,000	442,000	681,200	774,000	2,930,756
Downlink	867,300	121,700	3,780	154,200	343,360
Voice Talkback	180,000	2,036	202,888	0	237,007
Administrative	0	160,100	0	96,500	126,510
Totals	8,477,300	725,836	887,867	1,024,700	3,637,630
Total Annualized Cost	1,589,016*	136,053*	887,867	1,024,700	3,637,636
*Effective yearly costs for 8-year, 10.00 percent amortization.					

Table J-6. (continued)

DEFINITION OF CITY GROUPS			
GROUP A: Private downlink earth terminal			GROUP B: CATV Link
Pullman, WA	Fresno, CA	Laverne, CA	Spokane, WA
Anchorage, AK	Livermore, CA	La Mirada, CA	Billings, MT
Ketchikan, AK	Long Beach, CA	Newhall, CA	Anacortes, WA
Whitefish, MT	Martinez, CA	Pomona, CA	Pocatello, ID
Bethel, AK	Sepulveda, CA	Orange, CA	Missoula, MT
Phoenix, AZ	Portland, OR	Moraga, CA	Great Falls, MT
Tucson, AZ	Chico, CA	Redlands, CA	Albuquerque, NM
Sheridan, WY	Torrance, CA	San Raphael, CA	Prescott, AZ
Fort Lyon, CO	Angwin, CA	San Luis Obispo, CA	Cheyenne, WY
American Lake, WA	Arcata, CA	Stockton, CA	Salt Lake City, UT
Vancouver, WA	Azuza, CA	Thousand Oaks, CA	Palo Alto, CA
Walla Walla, WA	Belmont, CA	Whittier, CA	Reno, NV
Roseburg, OR	Dominiguez, CA	Vallejo, CA	Hayward, CA
White City, OR	Claremont, CA	Pueblo, CO	Turlock, CA
Fort Harrison, MT	Costa Mesa, CA	Logan, UT	Helena, MT
Miles City, MT	Irvine, CA	Moab, UT	Kalispell, MT

3.6 SMSA CASES

Several cases were developed on the basis of a network of Standard Metropolitan Statistical Areas (SMSAs). These represent urban areas within the United States. Cities chosen for this network fall into at least one of the following categories: (1) the top 20 SMSAs, (2) the largest city in each state, and (3) the state capitals. The purpose of those cases was to examine the incremental cost impact of adding additional cities to a network. Although increasing the size of the network must increase the total cost, there are economies of scale that will reduce the average cost of service provided.

Programming for this hypothetical network is produced and uplinked from Washington, D.C., five hours per day, five days per week, for a total of 1,300 hours per year. All transmissions are to take place during business hours; therefore, off-peak rates for satellite usage apply. Voice talkback is required for 2 minutes per hour of programming for each downlink city; this is equivalent to 3.6 hours per month.

Scenarios were run for four different downlink city groups. The first contained downlinks for the 10 regional federal offices. The second case contained the 10 regional office cities plus all other cities ranked in the top 20 SMSAs according to the 1970 census. Kansas City and Denver are Federal regional offices and were not included in the top 20 SMSAs; therefore, this second group contains 22 cities. The third case included

an additional 42 cities representing SMSAs at or near state capitals. The fourth and final case included 14 additional state capitals that were not considered SMSAs.

Four uplink transmission options were available from Washington. All included costs for a high-capability color video studio and the satellite transponder lease. An earth station with transmit capability was found to exist in the Washington area; the signal could be uplinked either from this earth station or from a new station built for this purpose. Because of space requirements, the earth terminal could not be colocated with the studio, and a microwave or terrestrial video link would be required to transmit the signal between the studio and the earth station. Thus, there are four possible paths: microwave or terrestrial link to a new or existing earth station.

In the downlink segment, all cities are assumed to be capable of constructing a receive-only earth station sufficiently close to the viewing area that no local distribution system is required. Washington is the only city allowed the "monitor only" option because it is assumed that the viewing area will be colocated with the studio, and therefore no interaction with the satellite will be necessary for this city. Other options depend on the availability of existing earth terminals to receive the satellite signal. A scan of the earth terminal data base showed that receive capability earth terminals exist within 15 miles for 69 of the 78 downlink cities considered. These cities would be permitted to receive the signal on the "borrowed" earth terminal and bring the signal to its audience via a microwave link. Sixty-one of those 69 cities have at least one cable TV earth station. For these cities it would be permissible to buy or rent capacity on the CATV earth station, or to receive the signal on a private terminal and use the CATV system to transmit the signal locally.

Since the available options or city parameters did not change among the four cases, an option preferred in one case for a particular city will be preferred in all cases for that city. Table 3-7 shows the available downlink options by city, the selected downlink option, and which of the four cases each city was included in. In all cases, talkback utilization was low enough to make direct dial the preferred talkback option, although 3.6 hours is fairly close to the point where WATS becomes feasible.

Table 3-8 (a-d) shows cost summaries for these four scenarios. Uplink costs are identical because the structure of that segment is unchanged. Downlink costs grow disproportionately from \$18,904 in annualized cost to \$209,499 while the number of cities expands from 10 to 78. However, many of the cities added for the larger scenario have no earth terminals to link to and thereby incur additional downlink costs. Because uplink costs are constant, overall annualized costs per city decrease significantly, from roughly \$44,000 in the federal regions scenario to \$9,800 in the full 78-city scenario. The incremental cost of adding a city, however, is only about \$3,300 per year.

Table 3-7. SMGA CASES

City/State	Private E-T	Micro-wave from E-T	Cable TV E-T	Monitors Only	Selected Path	a	b	c	d
Boston, MA	X	X	X		CATV link	X	X	X	X
New York, NY	X	X	X		CATV link	X	X	X	X
Philadelphia, PA	X	X	X		CATV link	X	X	X	X
Atlanta, GA	X	X	X		CATV link	X	X	X	X
Chicago, IL	X	X	X		CATV link	X	X	X	X
Dallas, TX	X	X	X		CATV link	X	X	X	X
Kansas City, MO	X	X	X		CATV link	X	X	X	X
Denver, CO	X	X	X		CATV link	X	X	X	X
San Francisco, CA	X	X	X		CATV link	X	X	X	X
Seattle, WA	X	X	X		CATV link	X	X	X	X
Los Angeles, CA	X	X	X		CATV link		X	X	X
Detroit, MI	X	X	X		CATV link		X	X	X
Pittsburgh, PA	X	X	X		CATV link		X	X	X
St. Louis, MO	X	X	X		CATV link		X	X	X
Baltimore, MD	X	X	X		CATV link		X	X	X
Cleveland, OH	X	X	X		CATV link		X	X	X
Houston, TX	X	X	X		CATV link		X	X	X
Newark, NJ	X	X	X		CATV link		X	X	X
Minneapolis, MN	X	X	X		CATV link		X	X	X
Orange County, CA	X	X	X		CATV link		X	X	X
Milwaukee, WI	X	X	X		CATV link		X	X	X
Washington, DC	X	X	X	X	Monitors		X	X	X
Tacoma, WA	X	X	X		CATV link			X	X
Salem, OR	X	X	X		CATV link			X	X
Sacramento, CA	X	X			Private E-T			X	X
Reno, NV	X	X			Private E-T			X	X
Boise, ID	X	X	X		CATV link			X	X
Great Falls, MT	X				Private E-T			X	X
Salt Lake City, UT	X	X	X		CATV link			X	X
Phoenix, AZ	X	X	X		CATV link			X	X
Albuquerque, NM	X	X	X		CATV link			X	X
Fargo, ND	X	X	X		CATV link			X	X
Sioux Falls, SD	X	X	X		CATV link			X	X
Lincoln, NE	X				Private E-T			X	X
Topeka, KS	X				Private E-T			X	X
Oklahoma City, OK	X	X	X		CATV link			X	X
Austin, TX	X	X	X		CATV link			X	X
Des Moines, IO	X	X	X		CATV link			X	X
Little Rock, AR	X	X	X		CATV link			X	X
Baton Rouge, LA	X	X	X		CATV link			X	X
Madison, WI	X	X	X		CATV link			X	X
Springfield, IL	X	X	X		CATV link			X	X
Jackson, MS	X	X	X		CATV link			X	X
Lansing, MI	X	X	X		CATV link			X	X
Indianapolis, IN	X	X	X		CATV link			X	X
Lexington, KY	X	X	X		CATV link			X	X
Nashville, TN	X	X	X		CATV link			X	X
Montgomery, AL	X	X	X		CATV link			X	X
Tallahassee, FL	X	X			Private E-T			X	X

(continued)

Table 3-7. (continued)									
City/State	Private E-T	Micro-wave from E-T	Cable TV E-T	Mon-itors Only	Selected Path	a	b	c	d
Columbus, OH	X	X	X		CATV link			X	X
Columbia, SC	X	X	X		CATV link			X	X
Raleigh, NC	X	X	X		CATV link			X	X
Richmond, VA	X	X	X		CATV link			X	X
Charleston, SC	X	X	X		CATV link			X	X
Wilmington, DE	X	X	X		CATV link			X	X
Harrisburg, PA	X	X	X		CATV link			X	X
Trenton, NJ	X	X			Private E-T			X	X
Albany, NY	X	X	X		CATV link			X	X
Hartford, CT	X	X	X		CATV link			X	X
Providence, RI	X	X			Private E-T			X	X
Manchester, NH	X	X	X		CATV link			X	X
Lewiston, ME	X	X	X		CATV link			X	X
Honolulu, HI	X				Private E-T			X	X
Bismarck, ND	X	X	X		CATV link			X	X
Olympia, WA	X	X	X		CATV link				X
Carson City, NV	X	X			Private E-T				X
Helena, MT	X				Private E-T				X
Santa Fe, NM	X	X	X		CATV link				X
Pierre, SD	X	X	X		CATV link				X
Frankfort, KY	X	X	X		CATV link				X
Dover, DE	X	X			Private E-T				X
Concord, NH	X	X	X		CATV link				X
Augusta, ME	X				Private E-T				X
Cheyenne, WY	X				Private E-T				X
Jefferson City, MO	X				Private E-T				X
Annapolis, MD	X	X	X		CATV link				X
Montpelier, VT	X	X			Private E-T				X
Juneau, AK	X	X	X		CATV link				X

3.7 FEDERAL REGIONAL PROGRAMMING

This case is similar to 6d except that the program production is done in 10 different cities instead of one. Each Federal regional office is assumed to broadcast 2.5 hours of programming per week; all 10 offices share the same transponder channel. The resulting 1,300 hours per year of channel utilization all occur during daylight (off peak) hours.

Available options for the uplink and downlink segments are the same as in the SMSA cases. For uplink, it is assumed that any city that has a transmit capability earth station within 15 miles may link to it. Five of the 10 cities have such a capability; the rest will be forced to incur costs for building their own transmitting earth stations.

Table 3-8(a). OVERALL COST SUMMARY -- SMSA CASE 1

FEDERAL REGIONAL OFFICES

OVERALL COST SUMMARY

	CAPITAL EXPENDITURES	PLANNING AND INSTALLATION	ANNUAL LEASE	ANNUAL O&M&A	ANNUALIZED COST
UPLINK	199400.	51000.	180000.	101000.	331406.
DOWNLINK	77000.	3000.	1800.	1000.	18904.
VOICE TALKBACK	145.	400.	13478.	0.	13588.
ADMINISTRATIVE	0.	160000.	0.	85000.	117208.
TOTALS	276545.	214400.	195278.	187000.	481107.
ANNUALIZED COST	55669.	43159.	195278.	187000.	481107.

EFFECTIVE YEARLY COSTS FOR 8 YEAR, 12.00 PERCENT AMORTIZATION --- \$ 481107.

Table 3-8(b). OVERALL COST SUMMARY -- SMSA CASE 2

FEDERAL REGIONAL OFFICES AND TOP 20 SMSA'S

OVERALL COST SUMMARY

	CAPITAL EXPENDITURES	PLANNING AND INSTALLATION	ANNUAL LEASE	ANNUAL O&M&A	ANNUALIZED COST
UPLINK	199400.	51000.	180000.	101000.	331406.
DOWNLINK	162700.	6300.	3780.	2200.	40000.
VOICE TALKBACK	305.	840.	28305.	0.	28535.
ADMINISTRATIVE	0.	160000.	0.	85000.	117208.
TOTALS	362405.	218140.	212085.	188200.	517150.
ANNUALIZED COST	72953.	43912.	212085.	188200.	517150.

EFFECTIVE YEARLY COSTS FOR 8 YEAR, 12.00 PERCENT AMORTIZATION --- \$ 517150.

Table 3-8(c). OVERALL COST SUMMARY -- SMSA CASE 3

FEDERAL REGIONAL OFFICES, TOP 20 SMSA'S, AND SMSA STATE CAPITALS

OVERALL COST SUMMARY

	CAPITAL EXPENDITURES	PLANNING AND INSTALLATION	ANNUAL LEASE	ANNUAL O&M&A	ANNUALIZED COST
UPLINK	199400.	51000.	180000.	101000.	331406.
DOWNLINK	551800.	72000.	9720.	19900.	155193.
VOICE TALKBACK	914.	2520.	84914.	0.	85605.
ADMINISTRATIVE	0.	160000.	0.	85000.	117208.
TOTALS	752114.	285520.	274634.	205900.	689413.
ANNUALIZED COST	151403.	57476.	274634.	205900.	689413.

EFFECTIVE YEARLY COSTS FOR 8 YEAR, 12.00 PERCENT AMORTIZATION --- \$ 689413.

Table J-8(d). OVERALL COST SUMMARY -- SMSA CASE 4

FEDERAL REGIONAL OFFICES, TOP 20 SMSA'S, AND STATE CAPITALS

OVERALL COST SUMMARY

	CAPITAL EXPENDITURES	PLANNING AND INSTALLATION	ANNUAL LEASE	ANNUAL O&M&A	ANNUALIZED COST
UPLINK	199400.	51000.	180000.	101000.	331406.
DOWNLINK	710700.	117500.	10980.	31800.	209499.
VOICE TALKBACK	1117.	3080.	103784.	0.	104629.
ADMINISTRATIVE	0.	160000.	0.	85000.	117208.
TOTALS	911217.	331580.	294764.	217800.	762742.
ANNUALIZED COST	183430.	66748.	294764.	217800.	762742.

EFFECTIVE YEARLY COSTS FOR 8 YEAR, 12.00 PERCENT AMORTIZATION --- \$ 762742.

Results for this case are shown in Tables 3-9 and 3-10. Table 3-9 shows the results for the uplink segment, and Table 3-10 may be compared with Table 3-8d, which shows the SMSA scenario for a single uplink city. Those uplink sites that cannot use an existing earth terminal must buy and maintain a new one. This results in an additional cost of about \$120,000 per year per earth terminal, or \$600,000 in all. In addition, a studio is required for each uplink site. It was assumed that the studios used would be less expensive than the full-capability studio assumed for the SMSA case. Even so, since 10 are required instead of 1, an additional \$200,000 in annualized cost is required. Downlink costs are somewhat lower because 10 of the cities will no longer require a receive capability. Overall, the cost impact of 10 regional broadcast centers is considerable, resulting in roughly a doubling in system cost.

3.8 COST ALLOCATION CASE

One scenario was developed primarily to test the model's cost allocation capability. This case is similar to Case 2 in Section 3.6. The network consists of a single uplink city (Washington) broadcasting to both a network of 10 Federal regional offices and a network of the top 20 SMSAs. Because eight of the 10 Federal regional offices are located in cities that are also in the top 20 SMSA's, there are only 22 cities in the combined network.

It was assumed that the Federal network would be on the air 5 hours per day, or 1,300 hours per year, during off-peak hours. The SMSA network would be on the air 4 hours per day, 1,040 hours per year, during peak hours.

Each of the uplink and downlink cities must be associated with the Federal network, the SMSA network, or both. For those cities that are associated with one network but not the other, the entire uplink or downlink cost attributable to that city is allocated to the proper organization. If the city is associated with both organizations, cost must be allocated. This was done by assigning weighting factors to the hours of utilization according to the ratio of peak to off-peak hourly costs. Thus, the SMSA network incurs most of the uplink costs, even though it uses fewer transponder hours, because it is running at peak times. Voice talkback is an unweighted allocation based on talkback hours, and administrative costs are allocated in the same fashion as the downlink costs.

Table 3-11 shows the results of this scenario. Because the SMSA network has more sites than the Federal network and since it must pay peak-hour surcharges in addition, it is allocated about 65 percent of the total network cost. The allocated Federal network cost of \$332,221 is lower than the \$481,107 cost estimated for the Federal network alone in Case 1 of the SMSA cases.

Table J-9. UPLINK COSTS BY CITY -- FEDERAL REGIONAL PROGRAMMING

FEDERAL REGIONAL PROGRAMMING					
UPLINK COSTS BY CITY					
CITY	CAPITAL	INSTALL	LEASE	OSM&A	ANNUALIZED
BOSTON	59400.	16000.	18000.	11700.	44878.
	PEAK HR	OFFPK HR	STUDIO	GRD LINK	
	0.	130.	1.	1.	
CITY	CAPITAL	INSTALL	LEASE	OSM&A	ANNUALIZED
NEW YORK	59400.	16000.	18000.	11700.	44878.
	PEAK HR	OFFPK HR	STUDIO	GRD LINK	
	0.	130.	1.	1.	
CITY	CAPITAL	INSTALL	LEASE	OSM&A	ANNUALIZED
PHILADELPHIA	262900.	46000.	18000.	106700.	186882.
	PEAK HR	OFFPK HR	STUDIO	GRD LINK	
	0.	130.	1.	1.	
CITY	CAPITAL	INSTALL	LEASE	OSM&A	ANNUALIZED
ATLANTA	59400.	16000.	18000.	11700.	44878.
	PEAK HR	OFFPK HR	STUDIO	GRD LINK	
	0.	130.	1.	1.	
CITY	CAPITAL	INSTALL	LEASE	OSM&A	ANNUALIZED
CHICAGO	262900.	46000.	18000.	106700.	186882.
	PEAK HR	OFFPK HR	STUDIO	GRD LINK	
	0.	130.	1.	1.	
CITY	CAPITAL	INSTALL	LEASE	OSM&A	ANNUALIZED
DALLAS	262900.	46000.	18000.	106700.	186882.
	PEAK HR	OFFPK HR	STUDIO	GRD LINK	
	0.	130.	1.	1.	
CITY	CAPITAL	INSTALL	LEASE	OSM&A	ANNUALIZED
KANSAS CITY	59400.	16000.	18000.	11700.	44878.
	PEAK HR	OFFPK HR	STUDIO	GRD LINK	
	0.	130.	1.	1.	
CITY	CAPITAL	INSTALL	LEASE	OSM&A	ANNUALIZED
DENVER	59400.	16000.	18000.	11700.	44878.
	PEAK HR	OFFPK HR	STUDIO	GRD LINK	
	0.	130.	1.	1.	
CITY	CAPITAL	INSTALL	LEASE	OSM&A	ANNUALIZED
SAN FRANCISCO	262900.	46000.	18000.	106700.	186882.
	PEAK HR	OFFPK HR	STUDIO	GRD LINK	
	0.	130.	1.	1.	
CITY	CAPITAL	INSTALL	LEASE	OSM&A	ANNUALIZED
SEATTLE	262900.	46000.	18000.	106700.	186882.
	PEAK HR	OFFPK HR	STUDIO	GRD LINK	
	0.	130.	1.	1.	
UPLINK TOTAL	1611500.	310000.	180000.	592000.	1158804.

Table 3-10. OVERALL COST SUMMARY -- FEDERAL REGIONAL PROGRAMMING

OVERALL COST SUMMARY

	CAPITAL EXPENDITURES	PLANNING AND INSTALLATION	ANNUAL LEASE	ANNUAL O&M&A	ANNUALIZED COST
UPLINK	1611500.	310000.	180000.	592000.	1158804.
DOWNLINK	650400.	114800.	9360.	31800.	195197.
VOICE TALKBACK	986.	2720.	50918.	0.	51664.
ADMINISTRATIVE	0.	160000.	0.	85000.	117208.
TOTALS	2262886.	587520.	240279.	708800.	1522873.
ANNUALIZED COST	455525.	118269.	240279.	708800.	1522873.

EFFECTIVE YEARLY COSTS FOR 8 YEAR, 12.00 PERCENT AMORTIZATION --- \$ 1522873.

Table J-11. NETWORK COST ALLOCATION -- COST ALLOCATION CASE

FEDERAL REGIONAL OFFICES, TOP 20 SMSA'S -- COST ALLOCATION CASE

NETWORK COST ALLOCATION

	CAPITAL	INSTALL	LEASE	O&M&A ANNUALIZED	
UPLINK					
1 FEDERAL OFFICES	143165.	36617.	162500.	72516.	271206.
2 SMSA'S	255635.	65383.	290160.	129484.	484266.
TOTAL	398800.	102000.	452660.	202000.	755472.
DOWNLINK					
1 FEDERAL OFFICES	50200.	1800.	1800.	1000.	13268.
2 SMSA'S	142400.	22200.	2880.	6500.	42514.
TOTAL	192600.	24000.	4680.	7500.	55782.
VOICE TALKBACK					
1 FEDERAL OFFICES	87.	240.	8611.	0.	8677.
2 SMSA'S	218.	600.	14976.	0.	15141.
TOTAL	305.	840.	23587.	0.	23818.
ADMINISTRATIVE					
1 FEDERAL OFFICES	0.	53333.	0.	28333.	39069.
2 SMSA'S	0.	106667.	0.	56667.	78139.
TOTAL	0.	160000.	0.	85000.	117208.
TOTAL NETWORK					
1 FEDERAL OFFICES	193452.	91990.	172911.	101849.	332221.
2 SMSA'S	398253.	194850.	308016.	192651.	620060.
TOTAL	591705.	286840.	480927.	294500.	952281.

FEDERAL REGIONAL PROGRAMMING

CHAPTER FOUR

CONCLUSIONS

NASA has demonstrated that access to vital public services can be improved by using communications satellites. There are plans to establish several public service networks for the purpose of securing large blocks of video transmission time and redistributing that time to qualified public service organizations. Depending on requirements, the participating organizations may find it cost-effective to buy the transmission equipment they need, rent or lease the equipment on a short-term basis, or enter into a sharing agreement with an existing equipment user. While the existing network of earth stations and other associated facilities might provide an excellent starting point for a shared-use video network, lack of channel capacity and lack of a local distribution system in many cities might require substantial new investment. The decision whether to upgrade existing facilities or to construct new facilities will depend critically on the access arrangements that can be negotiated with owners of existing earth stations and local loops.

The Video Distribution System Cost Model developed during this study is designed to analyze these kinds of issues. At each stage of signal propagation there may be several options concerning the type of equipment or common carrier to use. The model can analyze these options and choose the most cost-effective "path." The output of the model consists of an estimate of capital and operating costs for public service video communications via satellite from signal generation to reception. By comparing the results of a baseline and a scenario run, the effect of a single change in network parameters can be shown. This procedure can be used to calculate the incremental cost of an additional city in the network or an additional hour of channel utilization.

In addition, the model can highlight the cost benefits of sharing facilities. A group of organizations, none of whom may be able to afford a particular facility alone, may find that together they can use the facility effectively. The savings limit is reached when the shared facility becomes fully used. It must also be realized that the cost of establishing a communications link between the proposed shared facility and the additional site may exceed the cost of a new facility. For example, in many cases installing a new receive-only earth terminal was found to be less expensive than using a terrestrial line to an existing terminal. In the cases that were analyzed, the greatest benefit from sharing was found to be the savings

generated by efficient scheduling of transponder time. Sharing of downlink equipment showed substantial, although less significant, savings.

The purpose of this study was to demonstrate the capability of the model to help managers make better decisions concerning which of several available options might be best in a given situation. The eight cases analyzed were hypothetical networks chosen to demonstrate some of the analysis capabilities of the model.

The Video Distribution System Cost Model is a useful tool in the analysis of video satellite costs in public service networks. Through the sample cases run in this study, the model has begun to establish general criteria or "rule of thumb" guidelines on the basis of which new networks could be implemented cost-effectively. It has measured sensitivity of network costs to a number of key parameters. The model has been developed into a powerful user-oriented analysis tool that is applicable to a broad spectrum of network cost problems, and it can be used by video network managers in the analysis of transmission alternatives at all stages of signal propagation.

APPENDIX A

DATA ASSUMPTIONS

This appendix presents justification for some of the cost assumptions used in the uplink and downlink segments of the model. This effort was conducted in parallel with the running of the cases; consequently, the assumptions presented here were not used in every instance. In addition, such factors as bulk equipment prices and prior agreements between the vendors and a given network may result in a different cost from that presented. The purpose of the cases was not so much to calculate the cost of a network as to demonstrate the capability to do so under a range of cost assumptions. Thus the cost assumptions should be viewed as careful estimates.

These costs are included in the sample scenario, which is presented at the end of this appendix. The sample scenario is accessed by the user to form the basis for the user's unique application.

VIDEO STUDIO COSTS

Simple Studio

Capital

Cameras: 2 Cameras (modest quality)	\$16,000
Remote controls on cameras	3,000
Switching	3,000
Lighting	1,500
Microphones	} 1,500
Mixer	
Video monitors	2,000
Audio monitors	500
Echo suppressor	3,000
Synch generator	1,500

Room modifications	\$ 5,000	
Installation costs	<u>5,000</u>	
	Total Capital	\$42,000

Operating

"Production"	--	
Scheduling	5,000	
Maintenance	<u>4,200</u>	
	Recurring Costs	\$ 9,200

More Complex Studio (Not Full Production Quality)

Capital

Cameras	40,000	
Remote control	3,000	
Switching	6,000	
Lighting	3,000	
Microphones	} 5,000	
Mixer (audio)		
Synch generator	2,500	
Video monitors	2,000	
Large screen display	4,000	
Video cassette machine	4,000	
Audio monitors	1,500	
Echo suppressor	3,000	
Character generator capability	3,500	
Room modifications	7,500	
Installation costs	<u>7,500</u>	
	Total Capital	\$92,500

Operating

Production	} 25,000	
Writing		
Scheduling		
Maintenance 10 percent	<u>9,250</u>	
	Recurring Costs	\$34,250

Production Studio (Campus Production)

Capital

Cameras (3)	\$75,000	
Synch generator	3,000	
Switching	10,000	
Character generator	6,000	
Lighting	5,000	
Microphones, audio mixing	7,500	
Video nonitors	14,000	
1 inch helical record/playback/edit	50,000	
Audio monitors	1,500	
Room modifications	30,000	
Installation	<u>15,000</u>	
	Total Capital	\$217,000

Operating

Producer/Director	25,000	
Cameras (3)	45,000	
Maintenance (1)	17,500	
Coordinator	<u>11,000</u>	
	Recurring Costs	\$ 98,500

LINE OF SIGHT MICROWAVE LINK COSTS

Single Hop Link

Equipment is Housed in Existing Building

Tower stubs (2)	2,000
Transmit and receive electronics	21,000
Waveguide 250 feet	1,500
Antenna and feed (2)	1,000
Pressurizing system (2)	900
Miscellaneous	1,000

Installation	\$ 5,000
Licensing, frequency coordination	<u>1,000</u>
Total	\$33,400
Operations and maintenance (per year)	2,500

Double Hop Link

Tower stubs (3)	\$ 3,000
Transmit and receive electronics	36,000
Shelter (at midpoint)	5,000
Waveguide 500 feet	3,000
Antenna and feed (4)	2,000
Pressurizing system (3)	1,350
Miscellaneous	2,000
Installation	7,500
Licensing, frequency coordination	<u>2,000</u>
Total	\$61,850
Operations and maintenance (per year)	3,300

SATELLITE TRANSPONDER USAGE COSTS

The rates for transponder usage vary according to the length of the commitment, the particular carrier, and the time of day. In addition, whether the service is protected or can be preempted is a factor. A selection of the range of charges available is given below:

RCA Global (Customer Supplied Downlink)

<u>Occasional Service</u>	<u>Cannot Be Preempted</u>		<u>Can Be Preempted</u>	
	<u>Peak*</u>	<u>Off-Peak*</u>	<u>Anytime</u>	
	\$750/hr	\$650/hr	\$350/hr	
<u>Fixed Term</u>	<u>Protected</u>		<u>Unprotected</u>	
	<u>Peak</u>	<u>Off-Peak</u>	<u>Peak</u>	<u>Off-Peak</u>
5 hour/day	\$279/hr	\$125/hr	\$215/hr	\$100/hr
10 hour/day	\$266/hr	\$125/hr	\$203/hr	\$100/hr

*Peak Time: Monday through Friday 5:00 P.M. - 2:00 A.M. ET.

Off-Peak Time: Monday through Friday 2:00 A.M. - 5:00 P.M. ET.

Western Union (Customer Supplied Downlink)

<u>Occasional Service</u>	<u>Earlybird*</u>	<u>Daytime*</u>	<u>Primetime*</u>
	\$90/hr	\$200/hr	\$450/hr
Monthly Scheduled	\$90/hr	\$195/hr	\$425
Long-Term Scheduled		Anytime	
		\$300/hr	

Broker of Western Union Services

<u>Occasional Service</u>	<u>Earlybird</u>	<u>Daytime</u>	<u>Primetime</u>
	\$100/hr	\$170/hr	\$200/hr

FEES FOR USE OF EXISTING CATV AND ITFS SYSTEMS

There is not a uniform cost structure for the use of existing CATV and ITFS systems. Since ITFS is a wireless transmission system, the end-user charge for ITFS usage will probably be based on incremental administrative costs. Charges for CATV distribution are more likely to depend on channel capacity and local regulatory factors. In some cases, charges for CATV transmission will be nearly zero if the cable company can attract a number of new subscribers as a result of the additional programming. The following estimates for these systems are based on small samples and should be used with caution.

CATV

Hourly rate for video signal to be received at an existing CATV earth station and to be passed to an existing (unused) channel.

-- \$30/hour

ITFS

Hourly rate for video signal to be passed through an existing ITFS system.

-- \$10/hour

*Earlybird Time: Monday through Friday 2:00 A.M. - 12:00 P.M. ET.
Daytime: Monday through Friday 12:00 P.M. - 4:00 P.M. ET
Primetime: Monday through Friday 4:00 P.M. - 2:00 A.M. ET

EARTH STATION COSTS

Receive-Only Earth Station

4.5 meter antenna system	\$ 6,000	
GaAs FET low noise amplifier	3,000	
Downconverter/Demodulator	5,000	
Frequency coordination	1,200	
Installation*	<u>5,000</u>	
	Total	\$20,200
Operations and maintenance (per year)		1,500

Two-Way Earth Station

10 meter antenna system	\$50,000	
GaAs FET low noise amplifier	3,000	
HPA system	50,000	
Receive chain	7,500	
Transmit chain	13,000	
Baseband monitoring	5,000	
Test equipment	40,000	
Spares	20,000	
Shelter	15,000	
Site development	10,000	
Installation and engineering	<u>20,000</u>	
	Total	\$233,500
Maintenance and operations (per year) (2 people and parts)		95,000

PUBLIC TELEVISION FACILITIES COSTS

Public television stations are somewhat uneven both in the facilities they can make available and in the charges for these facilities. In addition, there is considerable variance in the additional connectivity to other viewing locations that the public television stations possess. Nevertheless, the PSSC has experience with a significant cross section of the total set of public television stations and the following is provided as typical information. The only way exact information can be provided about

*Assumes equipment colocated in existing buildings.

any particular location is to construct an extensive data base. (The PSSC is currently undertaking this task.)

Typical Charges:

- | | |
|---|-----------|
| 1. Receive signal from satellite and pass through to further interconnect | \$35/hour |
| 2. Receive signal from satellite and view at television station in conference-room type situation | \$50/hour |
| 3. Additional charges if further interconnect is station-owned ITFS system | \$ 5/hour |

AT&T VIDEO LINK

Local Video Link, Less Than 20 Miles

Lease:	\$1,000/month
Installation:	\$2,500

VOICE TALKBACK COSTS

Talkback Capital Costs

Cost of station set, black, no Touch-Tone	\$14.50
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Direct Dial Costs

Based on 1-minute daytime call over 1,500 miles distance	\$ 0.52 per minute
--	--------------------

WATS Costs

Based on interstate tariff "L"	
First ten hours (per month)	\$240.00
Each additional hour	\$ 18.00

Private Line Costs

Based on MPL tariff	
First two terminations	\$215.00 per month
Each additional termination	\$ 40.00
Mileage charge	\$ 0.52 per mile per month

ADMINISTRATIVE COSTS*

INSTALLATION AND PLANNING

Salaries	\$47,100
Travel & Expenses	29,000
Management	25,000
Overhead	<u>59,000</u>
TOTAL	\$160,100

OPERATIONS & MAINTENANCE (per year)

Salaries	\$33,900
Travel & Expenses	21,000
Overhead	<u>41,600</u>
TOTAL	\$96,500

*PSSC Estimates

SAMPLE SCENARIO

This section presents the sample scenario that may be accessed by the user when building his own scenario. The sample scenario contains a nominal set of costs and paths, all of which may be changed by the user. The information is presented in the same order in which it would be requested in the scenario builder.

TITLE - Sample Scenario Containing Nominal Costs

COST ALLOCATION - There are no member organizations and therefore no cost allocation.

UPLINK COST INDEXES - fixed, per peak hour, per off-peak hour, per studio, per ground link

UPLINK COST INDEX WEIGHTING FACTORS - There are no weighting factors since this applies only to cost allocation

UPLINK COST ELEMENTS:

DATA FOR COST ELEMENT SU -- SATELLITE USAGE

	FIXED	PER PEAK HR	PER OFFPK HR	PER STUDIO	PER GRD LINK
CAP	0.00	0.00	0.00	0.00	0.00
INS	0.00	0.00	0.00	0.00	0.00
LES	0.00	279.00	125.00	0.00	0.00
OMA	0.00	0.00	0.00	0.00	0.00
MINIMUM LEASE COST	=180000.00				

DATA FOR COST ELEMENT S3 -- CASE 3 STUDIO COSTS

	FIXED	PER PEAK HR	PER OFFPK HR	PER STUDIO	PER GRD LINK
CAP	0.00	0.00	0.00	172000.00	0.00
INS	0.00	0.00	0.00	45000.00	0.00
LES	0.00	0.00	0.00	0.00	0.00
OMA	0.00	0.00	0.00	98500.00	0.00
MINIMUM LEASE COST	= 0.00				

DATA FOR COST ELEMENT M1 -- 1-HOP MICROWV TO TOC*

	FIXED	PER PEAK HR	PER OFFPK HR	PER STUDIO	PER GRD LINK
CAP	0.00	0.00	0.00	0.00	27400.00
INS	0.00	0.00	0.00	0.00	6000.00
LES	0.00	0.00	0.00	0.00	0.00
OMA	0.00	0.00	0.00	0.00	2500.00
MINIMUM LEASE COST =		0.00			

DATA FOR COST ELEMENT VL -- AT&T VIDEO LK TO TOC

	FIXED	PER PEAK HR	PER OFFPK HR	PER STUDIO	PER GRD LINK
CAP	0.00	0.00	0.00	0.00	0.00
INS	0.00	0.00	0.00	0.00	2500.00
LES	0.00	0.00	0.00	0.00	12000.00
OMA	0.00	0.00	0.00	0.00	0.00
MINIMUM LEASE COST =		0.00			

DATA FOR COST ELEMENT T2 -- 2-WAY EARTH TERMINAL

	FIXED	PER PEAK HR	PER OFFPK HR	PER STUDIO	PER GRD LINK
CAP	203500.00	0.00	0.00	0.00	0.00
INS	30000.00	0.00	0.00	0.00	0.00
LES	0.00	0.00	0.00	0.00	0.00
OMA	95000.00	0.00	0.00	0.00	0.00
MINIMUM LEASE COST =		0.00			

DATA FOR COST ELEMENT S1 -- CASE 1 STUDIO COSTS

	FIXED	PER PEAK HR	PER OFFPK HR	PER STUDIO	PER GRD LINK
CAP	0.00	0.00	0.00	32000.00	0.00
INS	0.00	0.00	0.00	10000.00	0.00
LES	0.00	0.00	0.00	0.00	0.00
OMA	0.00	0.00	0.00	9200.00	0.00
MINIMUM LEASE COST =		0.00			

DATA FOR COST ELEMENT M2 -- 2-HOP MICROWV TO TOC

	FIXED	PER PEAK HR	PER OFFPK HR	PER STUDIO	PER GRD LINK
CAP	0.00	0.00	0.00	52350.00	0.00
INS	0.00	0.00	0.00	9500.00	0.00
LES	0.00	0.00	0.00	0.00	0.00
OMA	0.00	0.00	0.00	3300.00	0.00
MINIMUM LEASE COST =		0.00			

*Television Operations Center

UPLINK COST/PATH MATRIX:

	SU	S3	M1	VL	T2	S1	M2
MICROWAVE TO E-T	*	*	*				
VIDEO LINK TO E-T	*	*		*			
USE OWN E-T	*	*			*		
MICROWAVE TO OWN E-T	*	*	*		*		
VIDEO LK TO OWN E-T	*	*		*	*		

DOWNLINK COST INDEXES - fixed, per peak hour, per off-peak hour, organization.

DOWNLINK COST INDEX WEIGHTING FACTORS - There are no weighting factors since this applies only to cost allocation.

DOWNLINK COST ELEMENTS:

DATA FOR COST ELEMENT CH -- 3RD CHNL RCVR ON E-T

	FIXED	PER PEAK HR	PER OFFPK HR	PER ORGNZTN
CAP	5000.00	0.00	0.00	0.00
INS	0.00	0.00	0.00	0.00
LES	0.00	0.00	0.00	0.00
OMA	0.00	0.00	0.00	0.00
MINIMUM LEASE COST =		0.00		

DATA FOR COST ELEMENT CT -- RENT COM CARR E-T

	FIXED	PER PEAK HR	PER OFFPK HR	PER ORGNZTN
CAP	0.00	0.00	0.00	0.00
INS	0.00	0.00	0.00	0.00
LES	0.00	35.00	35.00	0.00
OMA	0.00	0.00	0.00	0.00
MINIMUM LEASE COST =		0.00		

DATA FOR COST ELEMENT FT -- PVT EARTH TERMINAL

	FIXED	PER PEAK HR	PER OFFPK HR	PER ORGNZTN
CAP	9000.00	0.00	0.00	5000.00
INS	6200.00	0.00	0.00	0.00
LES	0.00	0.00	0.00	0.00
OMA	1500.00	0.00	0.00	0.00
MINIMUM LEASE COST =		0.00		

DATA FOR COST ELEMENT M1 -- 1-HOP MICROWAVE LINK

	FIXED	PER PEAK HR	PER OFFPK HR	PER ORGNZTN
CAP	27400.00	0.00	0.00	0.00
INS	6000.00	0.00	0.00	0.00
LES	0.00	0.00	0.00	0.00
OMA	2500.00	0.00	0.00	0.00
MINIMUM LEASE COST =		0.00		

DATA FOR COST ELEMENT VL -- AT&T VIDEO LINK

	FIXED	PER PEAK HR	PER OFFPK HR	PER ORGNZTN
CAP	0.00	0.00	0.00	0.00
INS	2500.00	0.00	0.00	0.00
LES	12000.00	0.00	0.00	0.00
OMA	0.00	0.00	0.00	0.00
MINIMUM LEASE COST =		0.00		

DATA FOR COST ELEMENT CU -- USAGE OF CATV SYSTEM

	FIXED	PER PEAK HR	PER OFFPK HR	PER ORGNZTN
CAP	1700.00	0.00	0.00	0.00
INS	300.00	0.00	0.00	0.00
LES	0.00	0.00	0.00	0.00
OMA	0.00	0.00	0.00	0.00
MINIMUM LEASE COST =		0.00		

DATA FOR COST ELEMENT CC -- CATV SUBSCRIPTIONS

	FIXED	PER PEAK HR	PER OFFPK HR	PER ORGNZTN
CAP	0.00	0.00	0.00	0.00
INS	0.00	0.00	0.00	0.00
LES	0.00	0.00	0.00	180.00
OMA	0.00	0.00	0.00	0.00
MINIMUM LEASE COST =		0.00		

DATA FOR COST ELEMENT MT -- TV MONITORS

	FIXED	PER PEAK HR	PER OFFPK HR	PER ORGNZTN
CAP	0.00	0.00	0.00	1000.00
INS	0.00	0.00	0.00	0.00
LES	0.00	0.00	0.00	0.00
OMA	0.00	0.00	0.00	100.00
MINIMUM LEASE COST =		0.00		

DATA FOR COST ELEMENT M2 -- TWO-HOP MICROWAVE

	FIXED	PER PEAK HR	PER OFFPK HR	PER ORGNZTN
CAP	52350.00	0.00	0.00	0.00
INS	9500.00	0.00	0.00	0.00
LES	0.00	0.00	0.00	0.00
OMA	3300.00	0.00	0.00	0.00
MINIMUM LEASE COST =		0.00		

DATA FOR COST ELEMENT NC -- CATV COLOC WITH E-T

	FIXED	PER PEAK HR	PER OFFPK HR	PER ORGNZTN
CAP	0.00	0.00	0.00	0.00
INS	0.00	0.00	0.00	0.00
LES	-180.00	0.00	0.00	0.00
OMA	0.00	0.00	0.00	0.00
MINIMUM LEASE COST =	-10000.00			

DOWNLINK COST/PATH MATRIX:

	CH	CT	PT	M1	VL	CU	CC	MT	M2	NC
DIRECT LINK TO CATV	*					*	*	*		
OWN LINK TO CATV SYS				*	*	*	*	*		
PRIVATE EARTH TERM				*					*	
MICROWAVE TO USER				*	*				*	
2-HOP MCRWV TO USER				*					*	*
MONITOR ONLY									*	
RENTED E-T TO CATV				*		*	*	*		

UPLINK CITIES - There are no uplink cities.

DOWNLINK CITIES - There are no downlink cities.

AUXILIARY PARAMETERS - see below.

TALKBACK:	DDD	WATS	PVT
INSTALLATION	40.00	30.00	60.00
ZERO USAGE CHARGE/MO.	0.00	60.00	215.00
MILEAGE CHARGE			0.52
HOURLY CHARGE	31.20	18.00	
MAXIMUM CHARGE		1200.00	

AMORTIZATION:	
INTEREST RATE	12.00 PERCENT
EQUIPMENT LIFE	8.00 YEARS

GENERAL AND ADMINISTRATIVE:

CAP	0.00
INS	160000.00
LES	0.00
OMA	85000.00

TALKBACK CAPITAL EXPENDITURES:

14.50

APPENDIX B

MODEL FORMULATION

1. GENERAL STRUCTURE

The cost model consists of four basic parts: the input scenarios, the scenario builder, the cost algorithms, and the earth terminal data base and its corresponding utility (see Figure B-1).

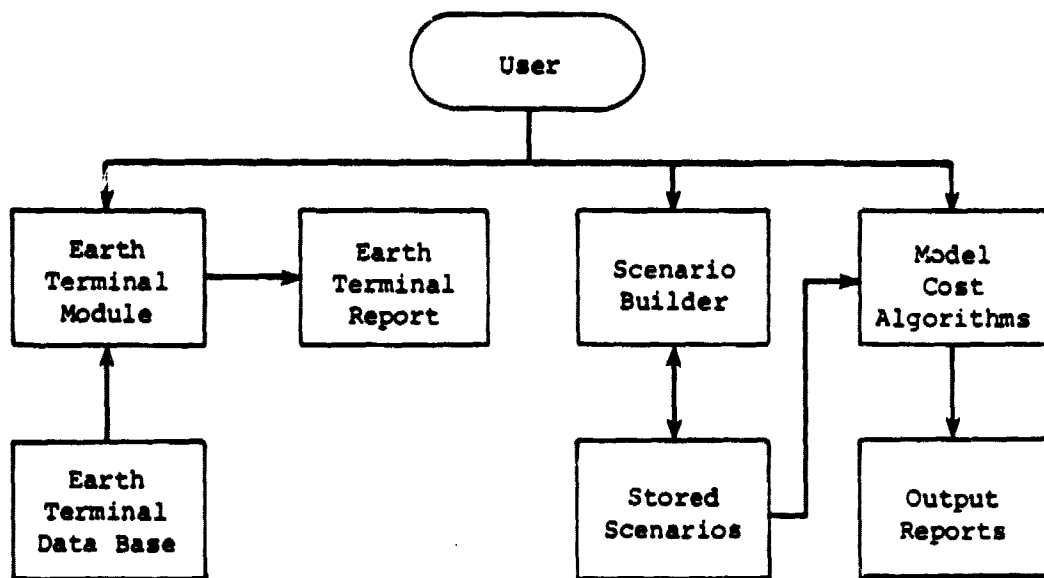


Figure B-1. MODEL ARCHITECTURE

The user establishes the network configuration with the aid of the scenario builder. The scenario builder accepts as input a scenario file that contains either system-supplied cost information (Appendix A) or some previously defined network scenario that requires modification. The

scenario builder allows the user to add, delete, and modify information interactively in the scenario. The output of the builder is a finished scenario tailored to the user's specifications.

The finished scenario serves as input to the model's cost algorithms (described in subsequent sections). In this module, the user inputs only the segments of the model of interest and the number and type of reports to be generated. Examples of the available reports appear in Appendix C.

The earth terminal module accesses the earth terminal data base. The user supplies a distance from his sites that is acceptable and the satellite that is desired. The module creates a list of earth stations that are within that given distance of the user's uplink and downlink cities and are licensed to point to the given satellite. It is up to the user to determine if the earth terminal can be shared. If so, the user specifies this condition during the scenario build.

Section 2 describes the software structure of the model, including a description of each of the programs used. Section 3 describes the variables and parameters used in the model. Section 4 presents the cost algorithms used in the uplink, downlink, and voice talkback segments of the model.

2. SOFTWARE STRUCTURE

The model is written in extended FORTRAN IV (Digital Equipment Corporation's FORTRAN IV-PLUS). It consists of three distinct modules: BUILD (scenario builder), MODEL (cost algorithms), and EARTH (earth terminal module).

This section describes each main program and subroutine and specifies the calling program, the subroutines called, and the arguments passed. A number of the subroutines are general utility subroutines and are called by all three modules. The section is organized as follows: BUILD, MODEL, and EARTH main program and subroutines, followed by the general utility subroutines.

BUILD - SCENARIO BUILDER

BUILD Main program for the scenario builder. It initializes certain parameters, and calls in the necessary subroutines to read in the scenario file, edit the cost, path, city, and rate information, and saves the modified scenario data.

Calls: COST, PATH, CITY, RATE, READIN, RITOUT, YESNO.

COST Add to or modify data for the uplink or downlink cost elements. The user has the capability to define additional cost elements, add data for them, and include them in one or more paths. Cost element data consist of capital, installation, lease, and operations and maintenance costs for each cost element (piece of equipment or nonhardware cost unit) used in the analysis. The user also has the capability to set up a cost allocation methodology.

Called By: BUILD

Calls: GETTER, CODCHK, DISAPR, REPRTR, YESNO, UPDOWN, RDCOST, MATMOD

PATH Defines or modifies data for uplink or downlink paths. Paths are video signal transmission options. The user can add or delete paths, change the cost elements associated with any of the paths, or specify the cities for which a path is valid.

Called By: BUILD

Calls: YESNO, UPDOWN, CODCHK, GETTER, MATMOD, DISAPR, REPRTR

CITY Define or modify the characteristics of the cities that constitute the network under consideration. The user can add, modify, or delete cities from the network and associate paths with cities. City data include name (and member organization if applicable), state, location (latitude/longitude or Bell System V and H coordinates), channel number (for uplink cities), cost index values, and feasible paths.

Called By: BUILD

Calls: YESNO, UPDOWN, GETTER, CODCHK, CTYCHK, VANDH, MATMOD, DISAPR, REPRTR

RATE Add or modify telephone charges, interest rates, and general and administrative costs.

Called By: BUILD

Calls: YESNO, GETTER, CODCHK, RATECK, REPRTR

MODEL - COST ALGORITHMS

MODEL Main program for the cost algorithm model. It determines the portion(s) of the model that the user would like run, and the number and type of reports required, and it calls the appropriate subroutines to execute the cost algorithms.

Calls: MODUP MODDN, MODTK, READIN, GETTER, CODCHK, REPRTR

MODUP Executes the cost algorithms for the uplink segment of the
 model.
 Called By: MODEL
 Calls: REPRT, VANDH

MODDN Executes the cost algorithms for the downlink segment of the
 model.
 Called By: MODEL
 Calls: REPRT, VANDH

MODTK Executes the cost algorithms for the talkback segment of the
 model.
 Called By: MODEL

EARTH - EARTH TERMINAL MODULE

EARTH Main program for the earth terminal module. This program pro-
 vides a list of earth terminals that are within a given distance
 from each city in a given user scenario. The list may be
 limited to those earth stations that are licensed to point to
 a particular user-specified satellite. The earth terminal in-
 formation is obtained from an FCC-supplied data base.

 Calls: MOVREC, CODCHK, VANDH, READIN

MOVREC This subroutine sets up the array of selected earth terminals
 which will then be sorted and printed.

 Parameters: i - index into city array
 j - index into earth terminal array

 Called By: EARTH

GENERAL UTILITIES

READIN Reads the scenario data file into an unnamed common.
 Called By: BUILD, MODEL, EARTH

RITOUT Writes out the scenario data into a new file.
 Called By: BUILD

YESNO Determines if the responses to a question is "YES" or "NO" or in error and sets the appropriate flag.
 Called By: BUILD, COST, PATH, CITY, RATE

UPDOWN Determines if the response to a question is "UPLINK" or "DOWNLINK" or in error and sets the appropriate flag.
 Called By: COST, PATH, CITY

CODCHK Checks an input argument against a list of valid arguments.
 Parameters: NCHAR - number of characters in input argument
 INDATA - array containing input argument
 NCOMPR - number of possible values
 CMPARR - array containing list of possible values
 POSTN - position in the array where input argument matched a possible value
 Called By: COST, PATH, CITY, RATE, RDCOST, MATMOD, MODEL, EARTH

GETTER Retrieves the next argument on the command line.
 Called By: COST, PATH, CITY, RATE, RDCOST, MATMOD, MODEL
 Calls: CCOUNT

CCOUNT Counts characters in an input argument.
 Parameters: ARG - argument to be counted
 NCHAR - number of characters (computed)
 Called By: GETTER

DISAPR Deletes a cost element, path, or city from the scenario data.
 Parameters: Code - type of deletion
 Index - position in arrays to be deleted
 Called By: COST, PATH, RATE

RDCOST Reads in an input argument and tests for a cost element code.
 Called By: COST
 Calls: GETTER, CODCHK

RATECK Performs a range check of a data element.
 Parameters: LOW - lower limit
 UP - upper limit
 XDAT - data element
 Called By: RATE

CTYCHK Determines if a city exists and, if it does, returns the index
in the appropriate array.

Parameters: POS - position in city array
 ORG - member organization

Called By: CITY, MATMOD

VANDH Converts latitude/longitude to Bell System V and H coordinates
(provides a simpler means of estimating the distance between
two cities).

Parameters: M - latitude
 N - longitude

Called By: CITY, MODUP, MODDN, EARTH

MATMOD Associates (disassociates) a path with a city or cost element.

Parameters: CODE - type of modify
 ONOFF - direction (1 or 0)
 MODPOS - index of element being modified

Called By: COST, PATH, CITY

Calls: GETTER, CODCHK, REPRTR, CTYCHK

REPRTR Prepares reports on scenario data -- cost elements, cost element/
path matrix, paths, path/city matrix, cities and cost index
values, uplink/downlink talkback matrix, member organizations,
and rates.

Parameters: REPTYP - report type
 POS - index into arrays

Called By: COST, PATH, CITY, RATE, MATMOD, MODEL, MODUP, MODDN

3. PARAMETER AND VARIABLE DEFINITIONS

This section describes the parameters and variables contained in the unnamed common, which is used in both the scenario builder and the cost algorithms modules. All arrays are shown dimensioned and, where applicable, the sizing parameter is specified. These parameters are also included in this description, and their nominal values are presented.

AMORT	Amortization factor.
ANNL(NDPATH)	Annualized cost of each path for a given city.
AORGCS(NUMORG,5)	Administrative capital, installation, lease, OMA, and annualized cost per member organization.
ARG(80)	General array used to hold the argument being processed.

BADD	Statement label to go to after processing an error.
BLANK	Holds four blank characters for use in output reports.
CAPCST	Capital cost of least-cost path.
CILO(5,2)	Literals for 'CAPITAL', 'INSTALL', 'LEASE', 'O&M&A', 'ANNUALZD' - used in output records.
CONTCO	Code indicating the presence of an additional argument in the user's input buffer.
DCINDEX(NDINDEX,8)	8-character downlink cost index names.
DCITYH(NDCITY)	Downlink city location -- H Coordinate.
DCITYV(NDCITY)	Downlink city location -- V Coordinate.
DCOSTX(NDCITY,4)	Capital, installation, lease, and OMA cost for each downlink city.
DCSCOD(NDELEM,2)	2-character downlink cost element code.
DCSDAT(NDELEM,NDINDEX,4)	Capital, installation, lease, and OMA costs for a given downlink cost element and cost index.
DCSMIN(NDELEM)	Minimum lease cost for a given downlink cost element.
DCSNAM(NDELEM,20)	20-character downlink cost element name.
DCSPTH(NDELEM,NDPATH)	Matrix of cost elements for each downlink path.
DCTLVL(NDCITY)	Hierarchical level number for downlink city.
DCTNAM(NDCITY,16)	16-character downlink city name.
DCTORG(NDCITY)	Organization code for each downlink city.
DCTXVL(NDCITY,5)	Downlink city cost index values.
DDDCPH	Direct dial cost per hour.
DDDINS	Direct dial installation cost.
DDLES	Direct dial less cost per month.
DDXWHT(NDINDEX)	Weighting factors for each downlink cost index.
DISCNT	Discount rate for amortization.
DORGCS(NUMORG,5)	Downlink capital, installation, lease, OMA, annualized costs by member organization.
DPTHCY(NDPATH,NDCITY)	Array of feasible paths for a downlink city.
DPTHNM(NDPATH,20)	20-character downlink path name.
DPTIDX(NDPATH,NDINDEX,5)	Downlink capital, installation, lease, OMA, annualized costs for a given cost index and a given path.
DSTCOD(NDCITY,2)	2-character state code for downlink city.

EQPLIF	Number of years of equipment life (for amortizing capital expenditures).
GANDAD(4)	Capital, lease, installation, OMA general and administrative costs.
INDATA(80)	80-character input buffer for user responses.
INSCST	Installation cost of least-cost path.
LESCST	Lease cost of least-cost path.
MAXCS(2)	Maximum number of cost elements (overlay).
MAXCT(2)	Maximum number of cities (overlay).
MAXDCS	Maximum number of downlink cost elements (30).
MAXDCT	Maximum number of downlink cities (80).
MAXDPA	Maximum number of downlink paths (20).
MAXPA(2)	Maximum number of paths (overlay).
MAXUCS	Maximum number of uplink cost elements (15).
MAXUCT	Maximum number of uplink cities (10).
MAXUPA	Maximum number of uplink paths (10).
NCHAR	Number of characters in an argument.
NCITY(2)	Number of cities (overlay).
NDCITY	Number of downlink cities (80).
NDELEM	Number of downlink cost elements (30).
NDINDX	Number of downlink cost indexes (6).
NDPATH	Number of downlink paths (20).
NELEM(2)	Number of cost elements (overlay).
NINDX(2)	Number of cost indexes (overlay).
NPATH(2)	Number of paths (overlay).
NSTART	Pointer into input buffer.
NUCITY	Number of uplink cities (10).
NUELEM	Number of uplink cost elements (15).
NUINDX	Number of uplink cost indexes (6).
NUMORG	Number of member organizations (9).
NUPATH	Number of uplink paths (10).
NUPREF(NDCITY)	Preferred path for each city.
OMACST	OMA cost of least-cost path.
ORGNAM(NUMORG,20)	20-character member organization name.
PER	Literal 'PER'.

POSITN	General index pointer into an array
PVTFIX	Private line zero-mileage monthly charge.
PVTINS	Private line installation charge.
PVTLES	Private line monthly lease charge for a given city pair in talkback segment.
PVTMIL	Private line monthly lease charge per mile.
REPLST(20,2)	Literal numbering for output reports.
REPNUM(20)	On/off array for report requests.
RUNSEC(4)	On/off array for execution of the different segments of the model.
TALKBK(NDCITY,NUCITY)	Number of talkback hours for a given city pair.
TCOST(6,5)	Total cost array for a network.
TITLE(72)	72-character title for output reports.
TLKCAP	Added capital expenditures required for adding voice talkback.
TORGCS(NUMORG,5)	Talkback capital, installation, lease, OMA costs by member organization.
UCINDEX(NUINDEX,8)	8-character uplink cost index name.
UCITYH(NUCITY)	Uplink city location -- H coordinate.
UCITYV(NUCITY)	Uplink city location -- V coordinate.
UCOSTX(NUCITY,4)	Capital, installation, lease, OMA costs for each uplink city.
UCSCOD(NUELEM,2)	2-character uplink cost element code.
UCSDAT(NUELEM,NUINDEX,4)	Capital, installation, lease, OMA costs for a given uplink cost element and cost index.
UCSMIN(NUELEM)	Minimum lease cost for a given uplink cost element.
UCSNAM(NUELEM,20)	20-character uplink cost element name.
UCSPTH(NUELEM,NUPATH)	Matrix of cost elements for each uplink path.
UCTCHN(NUCITY)	Uplink city channel assigned.
UCTNAM(NUCITY,16)	16-character uplink city name.
UCTORG(NUCITY)	Organization code for each uplink city.
UCTXVL(NUCITY,5)	Uplink city cost index values.
UDXWHT(NUINDEX)	Weighting factor for each uplink cost index.
UORGCS(NUMORG,5)	Uplink capital, installation, lease, OMA, annualized by member organization.
UPORDN(2,2)	Literal -- 'UPLINK', 'DOWNLINK'.

UPPDWN	Flag indicating the response to an uplink/downlink question (1 - uplink, 2 - downlink).
UPTHCY (NUPATH,NUCITY)	Array of feasible paths for an uplink city.
UPTHNM (NUPATH,20)	20-character uplink path name.
UPTIDX (NUPATH,NUINDEX,5)	Uplink capital, installation, lease, OMA, annualized costs for a given cost index and a given path.
USTCOD (NUCITY,2)	2-character state code for an uplink city.
WATCPH	WATS charge per hour of utilization.
WATINS	WATS installation charge.
WATLES	WATS lease charge per month.
WATMAX	Maximum monthly charges for WATS.
WGTARR (NDCITY)	Weight factors for cost allocation.
XDATA (NDINDEX)	Temporary storage for cost index data.
XORGCS (NUMORG,5)	Total capital, installation, lease, OMA, annualized cost by member organization.
YESSNO	Flag indication the response to a yes/no question (1 - yes, 2 - no).

4. COST ALGORITHMS

This section presents the cost algorithms used in the uplink, downlink, and voice talkback segments of the model. Variable names mentioned were described in Section 3 of this appendix.

UPLINK SEGMENT

Calculations in the uplink segment are done one city at a time. For each city, the annualized cost of each path is calculated and stored temporarily. Data for the least expensive path are set aside, and the process is repeated for the other cities.

The calculations are shown diagrammatically in Figure B-2. The process consists of a number of matrix multiplications. Braces in the diagram indicate what each dimension of the matrix signifies. The C, I, L, and O indicate that calculations are done for Capital, Installation, Lease, and O&M&A costs. These component costs are ultimately annualized and the results compared to determine the best path. Once the best path is known, the model can extract the component capital, installation, lease, and O&M cost corresponding to that path for reporting purposes.

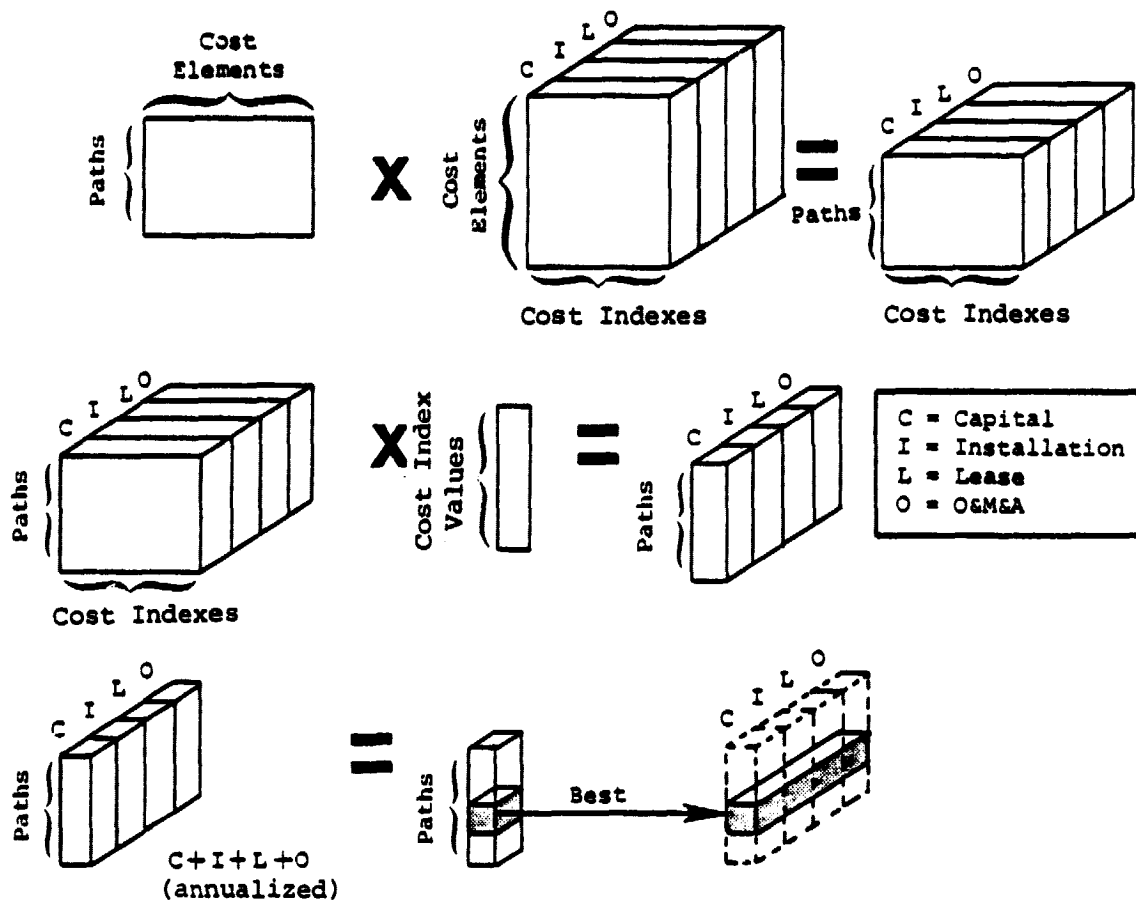


Figure B-2. MATRIX CALCULATIONS IN THE UPLINK AND DOWNLINK SEGMENTS

The first step in the computation process is to calculate the capital, installation, lease, and O&M cost of each path. That is,

$$UPTIDX(I,K,L) = \sum_{J=1}^{NUELEM} UCSPTH(J,I) \times UCSDAT(J,K,L)$$

where

I = path number

J = cost element subscript

K = cost index subscript

L = cost categories (1 = capital, 2 = installation, 3 = lease, 4 = OMA)

This calculation yields the cost by cost index (i.e., per hour or per organization) for each path, broken out by the four cost categories. The matrixes resulting from this calculation would apply to any of the cities.

The second step is to multiply the resulting matrix by the values of each of the cost indexes for the city under consideration. Thus,

$$\begin{bmatrix} \text{CAPCST} \\ \text{INSCST} \\ \text{LESCST} \\ \text{OMACST} \end{bmatrix} = \sum_{K=1}^{\text{NUINDEX}} \text{UCTXVL}(M,K) \times \begin{bmatrix} \text{UPTIDX}(I,K,1) \\ \text{UPTIDX}(I,K,2) \\ \text{UPTIDX}(I,K,3) \\ \text{UPTIDX}(I,K,4) \end{bmatrix}$$

where

I = path number

K = cost index subscript

M = city subscript

UCTXVL(M,K) = the value of the Kth cost index (e.g., hours, studios) for city M

The calculation of lease costs is somewhat more complicated because the user may specify a minimum lease charge to apply to any of the cost elements. If a minimum is specified, the program recalculates LESCSST to take this into account.

Finally, the capital and installation costs are amortized to an annual expenditure and added to the lease and O&M&A costs, yielding an annualized cost for each path:

$$\text{ANNL}(I) = (\text{CAPCST} + \text{INSCST})/\text{AMORT} + \text{LESCST} + \text{OMACST}$$

AMORT is the amortization factor, equal to $\sum_{i=1}^N \left(\frac{1}{1+R}\right)^i$. R is the interest

rate, and N the number of years of amortization. The resulting vector ANNL contains the annualized cost of each path in the given city. A simple comparison will determine the least expensive path.

DOWNLINK SEGMENT

The program logic of the downlink segment is identical to that of the uplink, except that the array names are different.

As in the uplink segment, calculation of the least-cost path is done in the following three steps:

1. Calculate Cost Parameters for Each Path

$$\text{DPTIDX}(I,K,L) = \sum_{J=1}^{\text{NDELEM}} \text{DCSPTH}(J,I) \times \text{DCSDAT}(J,K,L)$$

where

- I = path number
- J = cost element subscript
- K = cost index subscript
- L = cost categories

2. Calculate Cost of Each Path in Each City

$$\begin{bmatrix} \text{CAPCST} \\ \text{INSCST} \\ \text{LESCST} \\ \text{OMACST} \end{bmatrix} = \sum_{K=1}^{\text{NDINDX}} \text{DCTXVL}(M,D) \times \begin{bmatrix} \text{DPTIDX}(I,K,1) \\ \text{DPTIDX}(I,K,2) \\ \text{DPTIDX}(I,K,3) \\ \text{DPTIDX}(I,K,4) \end{bmatrix}$$

3. Calculate Annualized Cost by Path

$$\text{ANNL}(I) = (\text{CAPCST} + \text{INSCST})/\text{AMORT} + \text{LESCST} + \text{OMACST}$$

The ANNL array contains the annualized cost of each path for a given city. The entries of this array are compared to determine the least-cost path.

VOICE TALKBACK SEGMENT

When building the scenario, the user must specify for each downlink city the voice talkback requirements to each uplink city. Depending on the network requirements, the talkback can be either directly to the uplink city or to an intermediate "feeder" city. The hierarchical levels specified for the downlink segment are used. In this situation, if a given downlink city is of level 3, the voice communications link must go to the nearest level-2 city.

The talkback segment is similar to uplink and downlink in that there are cost elements and paths; however, the paths may not be altered by the user. Three possible paths are available: private line, WATS, and DDD. The most cost-effective option depends on monthly utilization and the distance between the two cities. Installation charges are amortized and added to the lease for the purpose of comparing monthly costs. However, even a \$100 installation charge amortizes to less than \$2 per month, and so these costs can be a negligible amount. Therefore, lease is the primary factor determining which option is selected.

APPENDIX C

SAMPLE OUTPUTS

This appendix presents the reports generated by the system cost model. The scenario illustrated here is the cost allocation case where the Federal regional offices and the top 20 SMSA cities share costs. The scenario is described in more detail in Chapter Three.

The appendix consists of 20 reports. The first 19 reports are the output from the cost model program. The last report is the output of the earth terminal utility. These reports are described by number and in the order in which they appear.

1. Auxiliary Parameters. Presents talkback parameters, amortization rates, and general administrative costs. This information is provided in the sample scenario and can be modified during the "rate" portion of the scenario builder.
2. Uplink Cost Element Data. Presents each of the uplink cost elements in the scenario, including the cost element name, its associated code, and the associated cost matrix broken down by capital, installation, lease, and OMA, and by each of the applicable cost indexes (such as fixed, per peak hour, per studio). This information is provided in the sample scenario and can be modified during the "cost" portion of the scenario builder.
3. Matrix of Cost Elements and Paths -- Uplink. Identifies the uplink cost elements associated with each uplink transmission path and presents them in matrix format. Cost elements are represented by their 2-character codes. This information is provided in the sample scenario and can be modified during the "cost" and "path" portions of the scenario builder.
4. Matrix of Paths and Cities -- Uplink. Identifies a matrix of uplink cities and paths. Uplink paths are represented by their path number. ORG represents the member organization number (if cost allocation has been selected). Cities will be listed once for each associated member organization. The information may be entered by the user in the "path" or "city" portion of the scenario builder, but this cannot be done until the city is defined.

5. Uplink Cost Index Values. Presents the cost index values associated with each uplink city. This corresponds to the number of peak hours, studios, etc., for a given city. The information may be entered during the "city" portion of the scenario builder.
6. Matrix of Talkback Requirements. Presents a matrix of talkback hours between downlink and uplink cities. Uplink city names are abbreviated to 3 characters, and the associated organization number is presented below. An entry exists for each uplink and downlink city by member organization. This information can be modified in the "city" portion of the scenario builder.
7. Sensitivity of Path Costs to Network Parameters -- Uplink. Combines the uplink cost element data with the matrix of uplink cost elements and paths (Report 3) to obtain the generalized cost of each uplink path. Annualized figures per path are also included.
8. Cost of Each Path -- Uplink. Presents, for each of the uplink cities, the total cost of each applicable path.
9. Uplink Costs by City. Presents, for each of the uplink cities, the total cost of the selected path. The report also includes the cost index values for each city and the aggregate cost for all uplink cities.
10. Downlink Cost Element Data. Downlink equivalent of report 2.
11. Matrix of Cost Elements and Paths -- Downlink. Downlink equivalent of report 3.
12. Matrix of Paths and Cities -- Downlink. Downlink equivalent of report 4.
13. Downlink Cost Index Values. Downlink equivalent of report 5.
14. Sensitivity of Path Costs to Network Parameters -- Downlink. Downlink equivalent of report 7.
15. Cost of Each Path -- Downlink. Downlink equivalent of report 8.
16. Downlink Costs by City. Downlink equivalent of report 9.
17. Talkback System Lease Costs. Presents one report per uplink city identifying the comparative costs of voice talkback using WATS, private line, and direct dial, and suggests the preferred medium in each case.
18. Network Cost Allocation. Presents total network costs by model segment (uplink, downlink, voice talkback, and administrative) and by member organization. (A discussion of cost allocation appears in the Cost Model User's Guide - ARINC Research Publication 1358-01-TR-2234).

19. Overall Cost Summary. Presents total network costs by model segment but does not indicate cost allocation.
20. Earth Terminal Report. Presents earth terminal information for those earth stations within a given distance from a scenario's uplink or downlink city and licensed to point to a given satellite. The following conventions are used in the report:

- a. Satellites are represented by the following identifiers:

KS20 - WESTAR I
KS21 - WESTAR II
KS22 - WESTAR III
KS26 - COMSTAR D-1
KS27 - COMSTAR D-2
KS28 - COMSTAR D-3
KS29 - COMSTAR D-4
KS30 - SATCOM I
KS31 - SATCOM II
KS32 - SATCOM III

ANIK1 - Canadian Telesat Satellites
ANIK2
ANIK3

MR1 - Marisat I
MR2 - Marisat II
MR3 - Marisat III

IN1 - Intelsat I
IN2 - Intelsat II
IN3 - Intelsat III
IN4 - Intelsat IV
IN4A - Intelsat IV-A
IN5 - Intelsat V

KS36 - SBS I
KS37 - SBS II
KS38 - SBS III

- b. Service is a combination of abbreviations that indicate the type of service, class of station, regulatory classification, and type of facility. The abbreviations have the following meanings:

Type of Service

DFS - Domestic fixed satellite
CS - Communications satellite
MMS - Maritime mobile-satellite
IP - International press service (IHF)
IFP - International fixed public (IHF)
IC - International control
X - Other

Class of Station

FES - Fixed earth station
SS - Space station
TFE - Temporary fixed earth station
PPT - Point-to-point telephone/telegraph (IHF)
TEL - Point-to-point telephone (IHF)
TGF - Point-to-point telegraph (IHF)

Regulatory Classification

C - Common carrier
P - Private
D - Developmental

Type of Earth Station Facility

TO - Transmit-only
RO - Receiver-only
TR - Transmit/receive

c. Size is the antenna size expressed in tenths of a meter.

FEDERAL REGIONAL OFFICES, TOP 20 SMSA'S -- COST ALLOCATION CASE

AUXILIARY PARAMETERS

TALKBACK:	DDD	WATS	PVT
INSTALLATION	40.00	30.00	60.00
ZERO USAGE CHARGE/MO.	0.00	60.00	215.00
MILEAGE CHARGE			0.52
HOURLY CHARGE	31.20	18.00	
MAXIMUM CHARGE		1200.00	

AMORTIZATION:

INTEREST RATE	12.00 PERCENT
EQUIPMENT LIFE	8.00 YEARS

GENERAL AND ADMINISTRATIVE:

CAP	0.00
INS	160000.00
LES	0.00
OMA	85000.00

TALKBACK CAPITAL EXPENDITURES:

14.50

FEDERAL REGIONAL OFFICES, TOP 20 SMSA'S -- COST ALLOCATION CASE

UPLINK COST ELEMENT DATA

DATA FOR COST ELEMENT SU -- SATELLITE USAGE

	FIXED	PER PEAK HR	PER OFFPK HR	PER STUDIO	PER GRD LINK
CAP	0.00	0.00	0.00	0.00	0.00
INS	0.00	0.00	0.00	0.00	0.00
LES	0.00	279.00	125.00	0.00	0.00
DMA	0.00	0.00	0.00	0.00	0.00
MINIMUM LEASE COST = 180000.00					

DATA FOR COST ELEMENT S3 -- CASE 3 STUDIO COSTS

	FIXED	PER PEAK HR	PER OFFPK HR	PER STUDIO	PER GRD LINK
CAP	0.00	0.00	0.00	17200.00	0.00
INS	0.00	0.00	0.00	45000.00	0.00
LES	0.00	0.00	0.00	0.00	0.00
DMA	0.00	0.00	0.00	98500.00	0.00
MINIMUM LEASE COST = 0.00					

DATA FOR COST ELEMENT M1 -- 1-HOP MICROWV TO TOC

	FIXED	PER PEAK HR	PER OFFPK HR	PER STUDIO	PER GRD LINK
CAP	0.00	0.00	0.00	0.00	27400.00
INS	0.00	0.00	0.00	0.00	6000.00
LES	0.00	0.00	0.00	0.00	0.00
DMA	0.00	0.00	0.00	0.00	2500.00
MINIMUM LEASE COST = 0.00					

DATA FOR COST ELEMENT VL -- AT&T VIDEO LK TO TOC

	FIXED	PER PEAK HR	PER OFFPK HR	PER STUDIO	PER GRD LINK
CAP	0.00	0.00	0.00	0.00	0.00
INS	0.00	0.00	0.00	0.00	2500.00
LES	0.00	0.00	0.00	0.00	12000.00
DMA	0.00	0.00	0.00	0.00	0.00
MINIMUM LEASE COST = 0.00					

(continued)

DATA FOR COST ELEMENT T2 -- 2-WAY EARTH TERMINAL

	FIXED	PER PEAK HR	PER OFFPK HR	PER STUDIO	PER GRD LINK
CAP	203500.0	0.00	0.00	0.00	0.00
INS	30000.00	0.00	0.00	0.00	0.00
LES	0.00	0.00	0.00	0.00	0.00
DMA	95000.00	0.00	0.00	0.00	0.00
MINIMUM LEASE COST =		0.00			

DATA FOR COST ELEMENT S1 -- CASE 1 STUDIO COSTS

	FIXED	PER PEAK HR	PER OFFPK HR	PER STUDIO	PER GRD LINK
CAP	0.00	0.00	0.00	32000.00	0.00
INS	0.00	0.00	0.00	10000.00	0.00
LES	0.00	0.00	0.00	0.00	0.00
DMA	0.00	0.00	0.00	9200.00	0.00
MINIMUM LEASE COST =		0.00			

DATA FOR COST ELEMENT M2 -- 2-HOP MICROWV TO TOC

	FIXED	PER PEAK HR	PER OFFPK HR	PER STUDIO	PER GRD LINK
CAP	0.00	0.00	0.00	52350.00	0.00
INS	0.00	0.00	0.00	9500.00	0.00
LES	0.00	0.00	0.00	0.00	0.00
DMA	0.00	0.00	0.00	3300.00	0.00
MINIMUM LEASE COST =		0.00			

REPORT 2 - (continued)

FEDERAL REGIONAL OFFICES, TOP 20 SMSA'S -- COST ALLOCATION CASE

MATRIX OF COST ELEMENTS AND PATHS-- UPLINK

	SU	S3	M1	VL	T2	S1	M2
MICROWAVE TO E-T	*	*	*				
VIDEO LINK TO E-T	*	*		*			
USE OWN E-T	*	*				*	
MICROWAVE TO OWN E-T	*	*	*			*	
VIDEO LK TO OWN E-T	*	*		*	*		

FEDERAL REGIONAL OFFICES, TOP 20 SMSA'S -- COST ALLOCATION CASE

MATRIX OF PATHS AND CITIES-- UPLINK

CITY	ORG	1	2	3	4	5
WASHINGTON	1	*	*		*	*
WASHINGTON	2	*	*		*	*

REPORT 4 - MATRIX OF PATHS AND CITIES -- UPLINK

FEDERAL REGIONAL OFFICES, TOP 20 SMSA'S -- COST ALLOCATION CASE
UPLINK COST INDEX VALUES

WASHINGTON	1				
PEAK HR		OFFPK HR	STUDIO	GRD LINK	
0.00		1300.00	1.00	1.00	
WASHINGTON	2				
PEAK HR		OFFPK HR	STUDIO	GRD LINK	
1040.00		0.00	1.00	1.00	

REPORT 5 - UPLINK COST INDEX VALUES

FEDERAL REGIONAL OFFICES, TOP 20 SMSA'S -- COST ALLOCATION CASE

MATRIX OF TALKBACK REQUIREMENTS

DOWNLINK CITY	ORG	WAS	WAS
		1	2
BOSTON	1	2.5	0.0
PHILADELPHIA	1	2.5	0.0
NEW YORK	1	2.5	0.0
ATLANTA	1	2.5	0.0
CHICAGO	1	2.5	0.0
DALLAS	1	2.5	0.0
KANSAS CITY	1	2.5	0.0
DENVER	1	2.5	0.0
SAN FRANCISCO	1	2.5	0.0
SEATTLE	1	2.5	0.0
LOS ANGELES	2	0.0	2.0
DETROIT	2	0.0	2.0
PITTSBURGH	2	0.0	2.0
ST. LOUIS	2	0.0	2.0
BALTIMORE	2	0.0	2.0
CLEVELAND	2	0.0	2.0
HOUSTON	2	0.0	2.0
NEWARK	2	0.0	2.0
MINNEAPOLIS	2	0.0	2.0
ORANGE COUNTY	2	0.0	2.0
MILWAUKEE	2	0.0	2.0
WASHINGTON	2	0.0	0.0
BOSTON	2	0.0	2.0
NEW YORK	2	0.0	2.0
PHILADELPHIA	2	0.0	2.0
ATLANTA	2	0.0	2.0
CHICAGO	2	0.0	2.0
DALLAS	2	0.0	2.0
SAN FRANCISCO	2	0.0	2.0
SEATTLE	2	0.0	2.0

FEDERAL REGIONAL OFFICES, TOP 20 SMSA'S -- COST ALLOCATION CASE

SENSITIVITY OF PATH COSTS TO NETWORK PARAMETERS-- UPLINK

PATH 1 -- MICROWAVE TO E-T

	FIXED	PER PEAK HR	PER OFFPK HR	PER STUDIO	PER GRD LINK
CAPITAL	0.	0.	0.	172000.	27400.
INSTALL	0.	0.	0.	45000.	6000.
LEASE	0.	279.	125.	0.	0.
O&M&A	0.	0.	0.	98500.	2500.
ANNUALZD	0.	279.	125.	142183.	9224.

PATH 2 -- VIDEO LINK TO E-T

	FIXED	PER PEAK HR	PER OFFPK HR	PER STUDIO	PER GRD LINK
CAPITAL	0.	0.	0.	172000.	0.
INSTALL	0.	0.	0.	45000.	2500.
LEASE	0.	279.	125.	0.	12000.
O&M&A	0.	0.	0.	98500.	0.
ANNUALZD	0.	279.	125.	142183.	12503.

PATH 3 -- USE OWN E-T

	FIXED	PER PEAK HR	PER OFFPK HR	PER STUDIO	PER GRD LINK
CAPITAL	203500.	0.	0.	172000.	0.
INSTALL	30000.	0.	0.	45000.	0.
LEASE	0.	279.	125.	0.	0.
O&M&A	95000.	0.	0.	98500.	0.
ANNUALZD	142004.	279.	125.	142183.	0.

PATH 4 -- MICROWAVE TO OWN E-T

	FIXED	PER PEAK HR	PER OFFPK HR	PER STUDIO	PER GRD LINK
CAPITAL	203500.	0.	0.	172000.	27400.
INSTALL	30000.	0.	0.	45000.	6000.
LEASE	0.	279.	125.	0.	0.
O&M&A	95000.	0.	0.	98500.	2500.
ANNUALZD	142004.	279.	125.	142183.	9224.

PATH 5 -- VIDEO LK TO OWN E-T

	FIXED	PER PEAK HR	PER OFFPK HR	PER STUDIO	PER GRD LINK
CAPITAL	203500.	0.	0.	172000.	0.
INSTALL	30000.	0.	0.	45000.	2500.
LEASE	0.	279.	125.	0.	12000.
O&M&A	95000.	0.	0.	98500.	0.
ANNUALZD	142004.	279.	125.	142183.	12503.

FEDERAL REGIONAL OFFICES, TOP 20 SMSA'S -- COST ALLOCATION CASE

COST OF EACH PATH-- UPLINK

CITY	PATH	CAPITAL	INSTALL	LEASE	O&M&A	ANNUALIZED
WASHINGTON	1	398800.	102000.	452660.	202000.	755472.
	2	344000.	95000.	476660.	197000.	762032.
	4	602300.	132000.	452660.	297000.	897477.
	5	547500.	125000.	476660.	292000.	904036.

REPORT 8 - COST OF EACH PATH -- UPLINK

FEDERAL REGIONAL OFFICES, TOP 20 SMSA'S -- COST ALLOCATION CASE

UPLINK COSTS BY CITY

CITY	CAPITAL	INSTALL	LEASE	O&M&A	ANNUALIZED
WASHINGTON	398800.	102000.	452660.	202000.	755472.
	PEAK HR	OFFPK HR	STUDIO	GRD LINK	
	1040.	1300.	2.	2.	
UPLINK TOTAL	398800.	102000.	452660.	202000.	755472.

REPORT 9 - UPLINK COSTS BY CITY

FEDERAL REGIONAL OFFICES, TOP 20 SMSA'S -- COST ALLOCATION CASE
 DOWNLINK COST ELEMENT DATA

DATA FOR COST ELEMENT CH -- 3RD CHNL RCVR ON E-T

	FIXED	PER PEAK HR	PER OFFPK HR	PER ORGNZTN
CAP	5000.00	0.00	0.00	0.00
INS	0.00	0.00	0.00	0.00
LES	0.00	0.00	0.00	0.00
(IMA	0.00	0.00	0.00	0.00
MINIMUM LEASE COST =		0.00		

DATA FOR COST ELEMENT CT -- RENT COM CARR L-T

	FIXED	PER PEAK HR	PER OFFPK HR	PER ORGNZTN
CAP	0.00	0.00	0.00	0.00
INS	0.00	0.00	0.00	0.00
LES	0.00	35.00	35.00	0.00
OMA	0.00	0.00	0.00	0.00
MINIMUM LEASE COST =		0.00		

DATA FOR COST ELEMENT PT -- PVT EARTH TERMINAL

	FIXED	PER PEAK HR	PER OFFPK HR	PER ORGNZTN
CAP	9000.00	0.00	0.00	5000.00
INS	6200.00	0.00	0.00	0.00
LES	0.00	0.00	0.00	0.00
OMA	1500.00	0.00	0.00	0.00
MINIMUM LEASE COST =		0.00		

DATA FOR COST ELEMENT M1 -- 1-HOP MICROWAVE LINK

	FIXED	PER PEAK HR	PER OFFPK HR	PER ORGNZTN
CAP	27400.00	0.00	0.00	0.00
INS	6000.00	0.00	0.00	0.00
LES	0.00	0.00	0.00	0.00
OMA	2500.00	0.00	0.00	0.00
MINIMUM LEASE COST =		0.00		

(continued)

DATA FOR COST ELEMENT VL -- AT&T VIDED LINK

	FIXED	PER PEAK HR	PER OFFPK HR	PER ORGNZTN
CAP	0.00	0.00	0.00	0.00
INS	2500.00	0.00	0.00	0.00
LES	12000.00	0.00	0.00	0.00
DMA	0.00	0.00	0.00	0.00
MINIMUM LEASE COST =		0.00		

DATA FOR COST ELEMENT CU -- USAGE OF CATV SYSTEM

	FIXED	PER PEAK HR	PER OFFPK HR	PER ORGNZTN
CAP	1700.00	0.00	0.00	0.00
INS	300.00	0.00	0.00	0.00
LES	0.00	0.00	0.00	0.00
DMA	0.00	0.00	0.00	0.00
MINIMUM LEASE COST =		0.00		

DATA FOR COST ELEMENT CC -- CATV SUBSCRIPTIONS

	FIXED	PER PEAK HR	PER OFFPK HR	PER ORGNZTN
CAP	0.00	0.00	0.00	0.00
INS	0.00	0.00	0.00	0.00
LES	0.00	0.00	0.00	180.00
DMA	0.00	0.00	0.00	0.00
MINIMUM LEASE COST =		0.00		

DATA FOR COST ELEMENT MT -- TV MONITORS

	FIXED	PER PEAK HR	PER OFFPK HR	PER ORGNZTN
CAP	0.00	0.00	0.00	1000.00
INS	0.00	0.00	0.00	0.00
LES	0.00	0.00	0.00	0.00
DMA	0.00	0.00	0.00	100.00
MINIMUM LEASE COST =		0.00		

DATA FOR COST ELEMENT M2 -- TWO-HOP MICROWAVE

	FIXED	PER PEAK HR	PER OFFPK HR	PER ORGNZTN
CAP	52350.00	0.00	0.00	0.00
INS	9500.00	0.00	0.00	0.00
LES	0.00	0.00	0.00	0.00
DMA	3300.00	0.00	0.00	0.00
MINIMUM LEASE COST =		0.00		

(continued)

REPORT 10 - (continued)

DATA FOR COST ELEMENT NC -- CATV COLOC WITH E-T

	FIXED	PER PEAK HR	PER OFFPK HR	PER ORGNZTN
CAP	0.00	0.00	0.00	0.00
INS	0.00	0.00	0.00	0.00
LES	-180.00	0.00	0.00	0.00
OMA	0.00	0.00	0.00	0.00
MINIMUM LEASE COST	=-10000.00			

REPORT 10 - (continued)

FEDERAL REGIONAL OFFICES, TOP 20 SMSA'S -- COST ALLOCATION CASE

MATRIX OF COST ELEMENTS AND PATHS--DOWNLINK

	CH	CT	PT	M1	VL	CU	CC	MT	M2	NC
DIRECT LINK TO CATV	*						*	*	*	
OWN LINK TO CATV SYS			*	*		*	*	*		
PRIVATE EARTH TERM			*						*	
MICROWAVE TO USER		*		*					*	
2-HOP MCRWV TO USER		*							*	*
MONITOR ONLY									*	
RENTED E-T TO CATV	*					*	*	*		

FEDERAL REGIONAL OFFICES, TOP 20 SMSA'S -- COST ALLOCATION CASE

MATRIX OF PATHS AND CITIES--DOWNLINK

CITY	ORG	1	2	3	4	5	6	7
BOSTON	1	*	*	*	*			*
PHILADELPHIA	1	*	*	*	*			*
NEW YORK	1	*	*	*	*			*
ATLANTA	1	*	*	*	*			*
CHICAGO	1	*	*	*	*			*
DALLAS	1	*	*	*	*			*
KANSAS CITY	1	*	*	*	*			*
DENVER	1	*	*	*	*			*
SAN FRANCISCO	1	*	*	*	*			*
SEATTLE	1	*	*	*	*			*
LOS ANGELES	2	*	*	*	*			*
DETROIT	2	*	*	*	*			*
PITTSBURGH	2	*	*	*	*			*
ST. LOUIS	2			*	*			
BALTIMORE	2	*	*	*	*			*
CLEVELAND	2	*	*	*	*			*
HOUSTON	2	*	*	*	*			*
NEWARK	2	*	*	*	*			*
MINNEAPOLIS	2	*	*	*	*			*
ORANGE COUNTY	2			*	*			
MILWAUKEE	2			*	*			
WASHINGTON	2	*	*	*	*		*	*
BOSTON	2	*	*	*	*			*
NEW YORK	2	*	*	*	*			*
PHILADELPHIA	2	*	*	*	*			*
ATLANTA	2	*	*	*	*			*
CHICAGO	2	*	*	*	*			*
DALLAS	2	*	*	*	*			*
SAN FRANCISCO	2	*	*	*	*			*
SEATTLE	2	*	*	*	*			*

REPORT 12 - MATRIX OF PATHS AND CITIES -- DOWNLINK

C-2

FEDERAL REGIONAL OFFICES, TOP 20 SMSA'S -- COST ALLOCATION CASE

DOWNLINK COST INDEX VALUES

BOSTON	1	PEAK HR 0.00	OFFPK HR 1300.00	ORGNZTN 1.00
PHILADELPHIA	1	PEAK HR 0.00	OFFPK HR 1300.00	ORGNZTN 1.00
NEW YORK	1	PEAK HR 0.00	OFFPK HR 1300.00	ORGNZTN 1.00
ATLANTA	1	PEAK HR 0.00	OFFPK HR 1300.00	ORGNZTN 1.00
CHICAGO	1	PEAK HR 0.00	OFFPK HR 1300.00	ORGNZTN 1.00
DALLAS	1	PEAK HR 0.00	OFFPK HR 1300.00	ORGNZTN 1.00
KANSAS CITY	1	PEAK HR 0.00	OFFPK HR 1300.00	ORGNZTN 1.00
DENVER	1	PEAK HR 0.00	OFFPK HR 1300.00	ORGNZTN 1.00
SAN FRANCISCO	1	PEAK HR 0.00	OFFPK HR 1300.00	ORGNZTN 1.00
SEATTLE	1	PEAK HR 0.00	OFFPK HR 1300.00	ORGNZTN 1.00
LOS ANGELES	2	PEAK HR 1040.00	OFFPK HR 0.00	ORGNZTN 1.00
DETROIT	2	PEAK HR 1040.00	OFFPK HR 0.00	ORGNZTN 1.00
PITTSBURGH	2	PEAK HR 1040.00	OFFPK HR 0.00	ORGNZTN 1.00
ST. LOUIS	2	PEAK HR 1040.00	OFFPK HR 0.00	ORGNZTN 1.00

(continued)

REPORT 13 - DOWNLINK COST INDEX VALUES

BALTIMORE	2		
PEAK HR		OFFPK HR	ORGNZTN
1040.00		0.00	1.00
CLEVELAND	2		
PEAK HR		OFFPK HR	ORGNZTN
1040.00		0.00	1.00
HOUSTON	2		
PEAK HR		OFFPK HR	ORGNZTN
1040.00		0.00	1.00
NEWARK	2		
PEAK HR		OFFPK HR	ORGNZTN
1040.00		0.00	1.00
MINNEAPOLIS	2		
PEAK HR		OFFPK HR	ORGNZTN
1040.00		0.00	1.00
ORANGE COUNTY	2		
PEAK HR		OFFPK HR	ORGNZTN
1040.00		0.00	1.00
MILWAUKEE	2		
PEAK HR		OFFPK HR	ORGNZTN
1040.00		0.00	1.00
WASHINGTON	2		
PEAK HR		OFFPK HR	ORGNZTN
1040.00		0.00	1.00
BOSTON	2		
PEAK HR		OFFPK HR	ORGNZTN
1040.00		0.00	1.00
NEW YORK	2		
PEAK HR		OFFPK HR	ORGNZTN
1040.00		0.00	1.00
PHILADELPHIA	2		
PEAK HR		OFFPK HR	ORGNZTN
1040.00		0.00	1.00
ATLANTA	2		
PEAK HR		OFFPK HR	ORGNZTN
1040.00		0.00	1.00
CHICAGO	2		
PEAK HR		OFFPK HR	ORGNZTN
1040.00		0.00	1.00
DALLAS	2		
PEAK HR		OFFPK HR	ORGNZTN
1040.00		0.00	1.00
SAN FRANCISCO	2		
PEAK HR		OFFPK HR	ORGNZTN
1040.00		0.00	1.00
SEATTLE	2		
PEAK HR		OFFPK HR	ORGNZTN
1040.00		0.00	1.00

REPORT 13 - (continued)

FEDERAL REGIONAL OFFICES, TOP 20 SMSA'S -- COST ALLOCATION CASE

SENSITIVITY OF PATH COSTS TO NETWORK PARAMETERS--DOWNLINK

PATH 1 -- DIRECT LINK TO CATV

	FIXED	PER PEAK HR	PER OFFPK HR	PER ORGNZTN
CAPITAL	6700.	0.	0.	1000.
INSTALL	300.	0.	0.	0.
LEASE	0.	0.	0.	180.
O&M&A	0.	0.	0.	100.
ANNUALZD	1409.	0.	0.	481.

PATH 2 -- OWN LINK TO CATV SYS

	FIXED	PER PEAK HR	PER OFFPK HR	PER ORGNZTN
CAPITAL	38100.	0.	0.	6000.
INSTALL	12500.	0.	0.	0.
LEASE	0.	0.	0.	180.
O&M&A	4000.	0.	0.	100.
ANNUALZD	14186.	0.	0.	1488.

PATH 3 -- PRIVATE EARTH TERM

	FIXED	PER PEAK HR	PER OFFPK HR	PER ORGNZTN
CAPITAL	9000.	0.	0.	6000.
INSTALL	6200.	0.	0.	0.
LEASE	0.	0.	0.	0.
O&M&A	1500.	0.	0.	100.
ANNUALZD	4560.	0.	0.	1308.

PATH 4 -- MICROWAVE TO USER

	FIXED	PER PEAK HR	PER OFFPK HR	PER ORGNZTN
CAPITAL	27400.	0.	0.	1000.
INSTALL	6000.	0.	0.	0.
LEASE	0.	35.	35.	0.
O&M&A	2500.	0.	0.	100.
ANNUALZD	9224.	35.	35.	301.

PATH 5 -- 2-HOP MCRWV TO USER

	FIXED	PER PEAK HR	PER OFFPK HR	PER ORGNZTN
CAPITAL	52350.	0.	0.	1000.
INSTALL	9500.	0.	0.	0.
LEASE	0.	35.	35.	0.
O&M&A	3300.	0.	0.	100.
ANNUALZD	15751.	35.	35.	301.

(continued)

PATH 6 -- MONITOR ONLY

	FIXED	PER PEAK HR	PER OFFPK HR	PER ORGNZTN
CAPITAL	0.	0.	0.	1000.
INSTALL	0.	0.	0.	0.
LEASE	0.	0.	0.	0.
OSM&A	0.	0.	0.	100.
ANNUALZD	0.	0.	0.	301.

PATH 7 -- RENTED E-T TO CATV

	FIXED	PER PEAK HR	PER OFFPK HR	PER ORGNZTN
CAPITAL	1700.	0.	0.	1000.
INSTALL	300.	0.	0.	0.
LEASE	0.	35.	35.	180.
OSM&A	0.	0.	0.	100.
ANNUALZD	403.	35.	35.	481.

FEDERAL REGIONAL OFFICES, TOP 20 SMSA'S -- COST ALLOCATION CASE

COST OF EACH PATH--DOWNLINK

CITY	PATH	CAPITAL	INSTALL	LEASE	O&M&A	ANNUALIZED
BOSTON	1	8700.	300.	360.	200.	2372.
	2	50100.	12500.	360.	4200.	17162.
	3	21000.	6200.	0.	1700.	7175.
	4	29400.	6000.	81900.	2700.	91726.
	5	54350.	9500.	81900.	3500.	98253.
	6	3700.	300.	82260.	200.	83265.
	7	3700.	300.	82260.	200.	83265.
PHILADELPHIA	1	8700.	300.	360.	200.	2372.
	2	50100.	12500.	360.	4200.	17162.
	3	21000.	6200.	0.	1700.	7175.
	4	29400.	6000.	81900.	2700.	91726.
	5	54350.	9500.	81900.	3500.	98253.
	6	3700.	300.	82260.	200.	83265.
	7	3700.	300.	82260.	200.	83265.
NEW YORK	1	8700.	300.	360.	200.	2372.
	2	50100.	12500.	360.	4200.	17162.
	3	21000.	6200.	0.	1700.	7175.
	4	29400.	6000.	81900.	2700.	91726.
	5	54350.	9500.	81900.	3500.	98253.
	6	3700.	300.	82260.	200.	83265.
	7	3700.	300.	82260.	200.	83265.
ATLANTA	1	8700.	300.	360.	200.	2372.
	2	50100.	12500.	360.	4200.	17162.
	3	21000.	6200.	0.	1700.	7175.
	4	29400.	6000.	81900.	2700.	91726.
	5	54350.	9500.	81900.	3500.	98253.
	6	3700.	300.	82260.	200.	83265.
	7	3700.	300.	82260.	200.	83265.
CHICAGO	1	8700.	300.	360.	200.	2372.
	2	50100.	12500.	360.	4200.	17162.
	3	21000.	6200.	0.	1700.	7175.
	4	29400.	6000.	81900.	2700.	91726.
	5	54350.	9500.	81900.	3500.	98253.
	6	3700.	300.	82260.	200.	83265.
	7	3700.	300.	82260.	200.	83265.
DALLAS	1	8700.	300.	360.	200.	2372.
	2	50100.	12500.	360.	4200.	17162.
	3	21000.	6200.	0.	1700.	7175.
	4	29400.	6000.	81900.	2700.	91726.
	5	54350.	9500.	81900.	3500.	98253.
	6	3700.	300.	82260.	200.	83265.
	7	3700.	300.	82260.	200.	83265.
KANSAS CITY	1	7700.	300.	180.	100.	1890.
	2	44100.	12500.	180.	4100.	15674.
	3	15000.	6200.	0.	1600.	5868.
	4	28400.	6000.	45500.	2600.	55025.
	5	53350.	9500.	45500.	3400.	61552.
	6	2700.	300.	45680.	100.	46384.
	7	2700.	300.	45680.	100.	46384.
DENVER	1	7700.	300.	180.	100.	1890.
	2	44100.	12500.	180.	4100.	15674.
	3	15000.	6200.	0.	1600.	5868.
	4	28400.	6000.	45500.	2600.	55025.
	5	53350.	9500.	45500.	3400.	61552.
	6	2700.	300.	45680.	100.	46384.
	7	2700.	300.	45680.	100.	46384.

(continued)

REPORT 15 - COST OF EACH PATH -- DOWNLINK

SAN FRANCISCO	1	8700.	300.	360.	200.	2372.
	2	50100.	12500.	360.	4200.	17162.
	3	21000.	6200.	0.	1700.	7175.
	4	29400.	6000.	81900.	2700.	91726.
	7	3700.	300.	82260.	200.	83265.
SEATTLE	1	8700.	300.	360.	200.	2372.
	2	50100.	12500.	360.	4200.	17162.
	3	21000.	6200.	0.	1700.	7175.
	4	29400.	6000.	81900.	2700.	91726.
	7	3700.	300.	82260.	200.	83265.
LOS ANGELES	1	7700.	300.	180.	100.	1890.
	2	44100.	12500.	180.	4100.	15674.
	3	15000.	6200.	0.	1600.	5868.
	4	28400.	6000.	36400.	2600.	45925.
	7	2700.	300.	36580.	100.	37284.
DETROIT	1	7700.	300.	180.	100.	1890.
	2	44100.	12500.	180.	4100.	15674.
	3	15000.	6200.	0.	1600.	5868.
	4	28400.	6000.	36400.	2600.	45925.
	7	2700.	300.	36580.	100.	37284.
PITTSBURGH	1	7700.	300.	180.	100.	1890.
	2	44100.	12500.	180.	4100.	15674.
	3	15000.	6200.	0.	1600.	5868.
	4	28400.	6000.	36400.	2600.	45925.
	7	2700.	300.	36580.	100.	37284.
ST. LOUIS	3	15000.	6200.	0.	1600.	5868.
	4	28400.	6000.	36400.	2600.	45925.
BALTIMORE	1	7700.	300.	180.	100.	1890.
	2	44100.	12500.	180.	4100.	15674.
	3	15000.	6200.	0.	1600.	5868.
	4	28400.	6000.	36400.	2600.	45925.
	7	2700.	300.	36580.	100.	37284.
CLEVELAND	1	7700.	300.	180.	100.	1890.
	2	44100.	12500.	180.	4100.	15674.
	3	15000.	6200.	0.	1600.	5868.
	4	28400.	6000.	36400.	2600.	45925.
	7	2700.	300.	36580.	100.	37284.
HOUSTON	1	7700.	300.	180.	100.	1890.
	2	44100.	12500.	180.	4100.	15674.
	3	15000.	6200.	0.	1600.	5868.
	4	28400.	6000.	36400.	2600.	45925.
	7	2700.	300.	36580.	100.	37284.
NEWARK	1	7700.	300.	180.	100.	1890.
	2	44100.	12500.	180.	4100.	15674.
	3	15000.	6200.	0.	1600.	5868.
	4	28400.	6000.	36400.	2600.	45925.
	7	2700.	300.	36580.	100.	37284.
MINNEAPOLIS	1	7700.	300.	180.	100.	1890.
	2	44100.	12500.	180.	4100.	15674.
	3	15000.	6200.	0.	1600.	5868.
	4	28400.	6000.	36400.	2600.	45925.
	7	2700.	300.	36580.	100.	37284.

(continued)

REPORT 15 - (continued)

ORANGE COUNTY	3	15000.	6200.	0.	1600.	5868.
	4	28400.	6000.	36400.	2600.	45925.
MILWAUKEE	3	15000.	6200.	0.	1600.	5868.
	4	28400.	6000.	36400.	2600.	45925.
WASHINGTON	1	7700.	300.	180.	100.	1890.
	2	44100.	12500.	180.	4100.	15674.
	3	15000.	6200.	0.	1600.	5868.
	4	28400.	6000.	36400.	2600.	45925.
	6	1000.	0.	0.	100.	301.
	7	2700.	300.	36580.	100.	37284.

REPORT 15 - (continued)

FEDERAL REGIONAL OFFICES, TOP 20 SMSA'S -- COST ALLOCATION CASE

DOWNLINK COSTS BY CITY

CITY	CAPITAL	INSTALL	LEASE	O&M&A	ANNUALIZED
BOSTON	8700.	300.	360.	200.	2372.
	PEAK HR	OFFPK HR	ORGNZTN		
	1040.	1300.	2.		
CITY	CAPITAL	INSTALL	LEASE	O&M&A	ANNUALIZED
PHILADELPHIA	8700.	300.	360.	200.	2372.
	PEAK HR	OFFPK HR	ORGNZTN		
	1040.	1300.	2.		
CITY	CAPITAL	INSTALL	LEASE	O&M&A	ANNUALIZED
NEW YORK	8700.	300.	360.	200.	2372.
	PEAK HR	OFFPK HR	ORGNZTN		
	1040.	1300.	2.		
CITY	CAPITAL	INSTALL	LEASE	O&M&A	ANNUALIZED
ATLANTA	8700.	300.	360.	200.	2372.
	PEAK HR	OFFPK HR	ORGNZTN		
	1040.	1300.	2.		
CITY	CAPITAL	INSTALL	LEASE	O&M&A	ANNUALIZED
CHICAGO	8700.	300.	360.	200.	2372.
	PEAK HR	OFFPK HR	ORGNZTN		
	1040.	1300.	2.		
CITY	CAPITAL	INSTALL	LEASE	O&M&A	ANNUALIZED
DALLAS	8700.	300.	360.	200.	2372.
	PEAK HR	OFFPK HR	ORGNZTN		
	1040.	1300.	2.		
CITY	CAPITAL	INSTALL	LEASE	O&M&A	ANNUALIZED
KANSAS CITY	7700.	300.	180.	100.	1890.
	PEAK HR	OFFPK HR	ORGNZTN		
	0.	1300.	1.		

(continued)

REPORT 16 - DOWNLINK COSTS BY CITY

CITY	CAPITAL	INSTALL	LEASE	O&M&A	ANNUALIZED
DENVER	7700.	300.	180.	100.	1890.
	PEAK HR	OFFPK HR	ORGNZTN		
	0.	1300.	1.		
CITY	CAPITAL	INSTALL	LEASE	O&M&A	ANNUALIZED
SAN FRANCISCO	8700.	300.	360.	200.	2372.
	PEAK HR	OFFPK HR	ORGNZTN		
	1040.	1300.	2.		
CITY	CAPITAL	INSTALL	LEASE	O&M&A	ANNUALIZED
SEATTLE	8700.	300.	360.	200.	2372.
	PEAK HR	OFFPK HR	ORGNZTN		
	1040.	1300.	2.		
CITY	CAPITAL	INSTALL	LEASE	O&M&A	ANNUALIZED
LOS ANGELES	7700.	300.	180.	100.	1890.
	PEAK HR	OFFPK HR	ORGNZTN		
	1040.	0.	1.		
CITY	CAPITAL	INSTALL	LEASE	O&M'A	ANNUALIZED
DETROIT	7700.	300.	180.	100.	1890.
	PEAK HR	OFFPK HR	ORGNZTN		
	1040.	0.	1.		
CITY	CAPITAL	INSTALL	LEASE	O&M&A	ANNUALIZED
PITTSBURGH	7700.	300.	180.	100.	1890.
	PEAK HR	OFFPK HR	ORGNZTN		
	1040.	0.	1.		
CITY	CAPITAL	INSTALL	LEASE	O&M&A	ANNUALIZED
ST. LOUIS	15000.	6200.	0.	1600.	5868.
	PEAK HR	OFFPK HR	ORGNZTN		
	1040.	0.	1.		
CITY	CAPITAL	INSTALL	LEASE	O&M&A	ANNUALIZED
BALTIMORE	7700.	300.	180.	100.	1890.
	PEAK HR	OFFPK HR	ORGNZTN		
	1040.	0.	1.		

(continued)

REPORT 16 (continued)

CITY	CAPITAL	INSTALL	LEASE	O&M&A	ANNUALIZED
CLEVELAND	7700.	300.	180.	100.	1890.
	PEAK HR	OFFPK HR	ORGNZTN		
	1040.	0.	1.		
CITY	CAPITAL	INSTALL	LEASE	O&M&A	ANNUALIZED
HOUSTON	7700.	300.	180.	100.	1890.
	PEAK HR	OFFPK HR	ORGNZTN		
	1040.	0.	1.		
CITY	CAPITAL	INSTALL	LEASE	O&M&A	ANNUALIZED
NEWARK	7700.	300.	180.	100.	1890.
	PEAK HR	OFFPK HR	ORGNZTN		
	1040.	0.	1.		
CITY	CAPITAL	INSTALL	LEASE	O&M&A	ANNUALIZED
MINNEAPOLIS	7700.	300.	180.	100.	1890.
	PEAK HR	OFFPK HR	ORGNZTN		
	1040.	0.	1.		
CITY	CAPITAL	INSTALL	LEASE	O&M&A	ANNUALIZED
ORANGE COUNTY	15000.	6200.	0.	1600.	5868.
	PEAK HR	OFFPK HR	ORGNZTN		
	1040.	0.	1.		
CITY	CAPITAL	INSTALL	LEASE	O&M&A	ANNUALIZED
MILWAUKEE	15000.	6200.	0.	1600.	5868.
	PEAK HR	OFFPK HR	ORGNZTN		
	1040.	0.	1.		
CITY	CAPITAL	INSTALL	LEASE	O&M&A	ANNUALIZED
WASHINGTON	1000.	0.	0.	100.	301.
	PEAK HR	OFFPK HR	ORGNZTN		
	1040.	0.	1.		
DOWNLINK TOTAL	192600.	24000.	4680.	7500.	55782.

REPORT 16 (continued)

FEDERAL REGIONAL OFFICES, TOP 20 SMSA'S -- COST ALLOCATION CASE

TALKBACK SYSTEM LEASE COSTS
TO WASHINGTON

CITY	LEVEL	HOURS UTIL.	WATS DIST	COSTS INSTALL	LEASE	PRIVATE LINE INSTALL	LEASE	DIRECT DIAL INSTALL	DIAL LEASE	BEST
BOSTON	2	5.	394.	30.	141.	60.	420.	40.	140.	DDD
PHILADELPHIA	2	5.	123.	30.	141.	60.	279.	40.	140.	DDD
NEW YORK	2	5.	202.	30.	141.	60.	320.	40.	140.	DDD
ATLANTA	2	5.	541.	30.	141.	60.	497.	40.	140.	DDD
CHICAGO	2	5.	594.	30.	141.	60.	524.	40.	140.	DDD
DALLAS	2	5.	1182.	30.	141.	60.	830.	40.	140.	DDD
KANSAS CITY	2	2.	941.	30.	105.	60.	704.	40.	78.	DDD
DENVER	2	2.	1488.	30.	105.	60.	989.	40.	78.	DDD
SAN FRANCISCO	2	5.	2434.	30.	141.	60.	1481.	40.	140.	DDD
SEATTLE	2	5.	2321.	30.	141.	60.	1422.	40.	140.	DDD
LOS ANGELES	2	2.	2293.	30.	96.	60.	1407.	40.	62.	DDD
DETROIT	2	2.	395.	30.	96.	60.	420.	40.	62.	DDD
PITTSBURGH	2	2.	190.	30.	96.	60.	314.	40.	62.	DDD
ST. LOUIS	2	2.	708.	30.	96.	60.	583.	40.	62.	DDD
BALTIMORE	2	2.	35.	30.	96.	60.	233.	40.	62.	DDD
CLEVELAND	2	2.	304.	30.	96.	60.	373.	40.	62.	DDD
HOUSTON	2	2.	1217.	30.	96.	60.	848.	40.	62.	DDD
NEWARK	2	2.	197.	30.	96.	60.	318.	40.	62.	DDD
MINNEAPOLIS	2	2.	923.	30.	96.	60.	695.	40.	62.	DDD
ORANGE COUNTY	2	2.	2281.	30.	96.	60.	1401.	40.	62.	DDD
MILWAUKEE	2	2.	635.	30.	96.	60.	545.	40.	62.	DDD

REPORT 17 - TALKBACK SYSTEM LEASE COSTS

FEDERAL REGIONAL OFFICES, TOP 20 SMSA'S -- COST ALLOCATION CASE

NETWORK COST ALLOCATION

	CAPITAL	INSTALL	LEASE	SMSA ANNUALIZED	
UPLINK					
1 FEDERAL OFFICES	143165.	36617.	162500.	72516.	271206.
2 SMSA'S	255635.	65383.	290160.	129484.	484266.
TOTAL	398800.	102000.	452660.	202000.	755472.
DOWNLINK					
1 FEDERAL OFFICES	50200.	1800.	1800.	1000.	13268.
2 SMSA'S	142400.	22200.	2880.	6500.	42514.
TOTAL	192600.	24000.	4680.	7500.	55782.
VOICE TALKBACK					
1 FEDERAL OFFICES	87.	240.	8611.	0.	8677.
2 SMSA'S	218.	600.	14976.	0.	15141.
TOTAL	305.	840.	23587.	0.	23818.
ADMINISTRATIVE					
1 FEDERAL OFFICES	0.	53333.	0.	28333.	39069.
2 SMSA'S	0.	106667.	0.	56667.	78139.
TOTAL	0.	160000.	0.	85000.	117208.
TOTAL NETWORK					
1 FEDERAL OFFICES	193452.	91990.	172911.	101849.	332221.
2 SMSA'S	398253.	194850.	308016.	192651.	620060.
TOTAL	591705.	286840.	480927.	294500.	952281.

REPORT 18 - NETWORK COST ALLOCATION

FEDERAL REGIONAL OFFICES, TOP 20 SMSA'S -- COST ALLOCATION CASE

OVERALL COST SUMMARY

	CAPITAL EXPENDITURES	PLANNING AND INSTALLATION	ANNUAL LEASE	ANNUAL O&M&A	ANNUALIZED COST
UPLINK	398800.	102000.	452660.	202000.	755472.
DOWNLINK	192600.	24000.	4680.	7500.	55782.
VOICE TALKBACK	305.	840.	23587.	0.	23818.
ADMINISTRATIVE	0.	160000.	0.	85000.	117208.
TOTALS	591705.	286840.	480927.	294500.	952281.
ANNUALIZED COST	119112.	57742.	480927.	294500.	952281.

EFFECTIVE YEARLY COSTS FOR 8 YEAR, 12.00 PERCENT AMORTIZATION --- \$ 952281.

REPORT 19 - OVERALL COST SUMMARY

FEDERAL REGIONAL OFFICES AND TOP 20 SMSA'S

UPLINK CITIES--EARTH STATIONS WITHIN 15 MILES AND LICENSED TO POINT TO KS30

CALL SIGN	LICENSEE	CITY	STATE	SERVICE	SIZE
***** WASHINGTON					
WM43	NATIONAL CABLE SATELLITE CORP.	BREN MAR	VA	DFSFESPTR	0100
WE74	AMERICAN SATELLITE CORPORATION	GREENBELT	MD	DFSFESCTR	0100

DOWNLINK CITIES--EARTH STATIONS WITHIN 15 MILES AND LICENSED TO POINT TO KS30

CALL SIGN	LICENSEE	CITY	STATE	SERVICE	SIZE
***** BOSTON MA					
WU57	WARNER CABLE CORP.	SALEM	MA	DFSFESPRO	0050
WT25	NEW BOSTON TELEVISION, INC.	BOSTON	MA	DFSFESPRO	0100
WQ70	WARNER CABLE CORP.	MEDFORD	MA	DFSFESPRO	0050
WH23	THE CHRISTIAN BROADCASTING NETWORK,	BOSTON	MA	DFSFESPTR	0100
***** PHILADELPHIA PA					
WX82	SOUTHEASTERN CABLEVISION, CO.	ASTON TOWNSHIP	PA	DFSFESPRO	0050
WT28	AMERICAN CABLEVISION OF PENNSYLVANI	CHESTER	PA	DFSFESPRO	0050
WS30	CITY LINE ASSOCIATES	PHILADELPHIA	PA	DFSFESPRO	0050
WQ72	WPHL-TV, INC.	PHILADELPHIA	PA	DFSFESPRO	0045
WQ58	GLOUSTER COUNTY CATV ASSOCIATES	WOODBURY	NJ	DFSFESPRO	0045
WQ47	TELECABLE OF SPRINGFIELD, INC.	FLOURTOWN	PA	DFSFESPRO	0045
WP58	COMCAST CORPORATION	WILLOW GROVE	PA	DFSFESPRO	0050
WK51	CPI SATELLITE TELECOMMUNICATIONS, I	UPPER DARBY	PA	DFSFESCRO	0060
WK37	ULTRACOM OF DELAWARE VALLEY, INC.	MARPLE TOWNSHIP	PA	DFSFESPRO	0043
WJ94	CABLE SYSTEMS, INC.	AUDUBON	NJ	DFSFESPRO	0050
WJ81	BLUE RIDGE CABLE TELEVISION, INC.	STROUDSBURG	PA	DFSFESPRO	0045
WJ65	MAPLE SHADE CABLE CO., INC.	MAPLE SHADE	NJ	DFSFESPRO	0050
WE22	RADIO BROADCASTING COMPANY	PHILADELPHIA	PA	DFSFESCRO	0050

(continued)

REPORT 20 - EARTH TERMINAL REPORT

***** NEW YORK NY

WZ21	CABLEVISION OF BAYONNE	BAYONNE	NJ	DFSFESPRO	0045
WU34	CABLESYSTEMS OF NEW JERSEY	BERGENFIELD	NJ	DFSFESPRO	0045
WS24	SUBURBAN CABLEVISION	EAST ORANGE	NJ	DFSFESPRO	0050
WL57	TELEPROMPTER CORP.	MANHATTAN	NY	DFSFESPRO	0045

***** ATLANTA GA

WU75	STORER BROADCASTING COMPANY	ATLANTA	GA	IFSFESPRO	0050
WR87	CLAYTON COUNTY CABLE COMMUNICATIONS	CLAYTON	GA	DFSFESPRO	0050
WR77	WOMETCO CABLE TV OF GEORGIA, INC.	MAPLETON	GA	DFSFESPRO	0050
WM48	CABLE HOLDINGS OF GEORGIA, INC. DBA	SHYRNA	GA	DFSFESPRO	0050
WL91	COX CABLE COMMUNICATIONS, INC.	ATLANTA	GA	DFSFESPRO	0050
WK35	DEKALB CABLEVISION CORP.	DECATUR	GA	DFSFESPRO	0050
WH25	THE CHRISTIAN BROADCASTING NETWORK,	ATLANTA	GA	DFSFESPRO	0100
WG73	UNITED CABLEVISION CORP	CHAMBLEE	GA	DFSFESPRO	0500
WD34	RCA AMERICAN COMMUNICATIONS, INC.	ATLANTA	GA	DFSFESCTR	0100

***** CHICAGO IL

WX83	CABLEVISION OF CHICAGO	FOREST PARK	IL	DFSFESPRO	0045
WQ40	WGN CONTINENTAL BROADCASTING CO.	CHICAGO	IL	DFSFESPRO	0100
WL95	TELEPROMPTER CORP.	CHICAGO	IL	DFSFESPRO	0045

***** DALLAS TX

KZ24	SILVER SCREEN, INC.	DALLAS	TX	DFSFESPRO	0045
KX69	SAMMONS COMMUNICATIONS, INC.	DUNCANVILLE	TX	DFSFESPRO	0050
KW98	VIDEO INTERNATIONAL PRODUCTIONS, IN	DALLAS	TX	DFSFESPRO	0050
KU37	STORER CABLE TV OF TEXAS, INC.	GARLAND	TX	DFSFESPRO	0050
KT49	SAMMONS COMMUNICATIONS, INC.	UNIVERSITY PARK	TX	DFSFESPRO	0043
KR56	CABLESYSTEMS OF ADDISON, INC.	ADDISON	TX	DFSFESPRO	0050
KR52	STORER CABLE TV OF TEXAS INC.	GRAND PRAIRIE	TX	DFSFESPRO	0050
KQ84	THE CHRISTIAN BROADCASTING NETWORK,	DALLAS	TX	DFSFESPRO	0100

(continued)

***** KANSAS CITY MO

KZ43	HI-NET COMMUNICATIONS, INC.	KANSAS CITY TOWE	KS	DFSFESPRO	0050
KZ32	AMERICAN CABLEVISION OF KANSAS CITY	KANSAS CITY	MO	DFSFESPRO	0050
KZ31	AMERICAN CABLEVISION OF KANSAS CITY,	KANSAS CITY	MO	DFSFESPRO	0050
KZ20	AMERICAN CABLEVISION OF KANSAS CITY	KANSAS CITY	MO	DFSFESPRO	0050
KY55	HI-NET COMMUNICATIONS, INC.	KANSAS CITY-NE	MO	DFSFESPRO	0050
KY54	HI-NET COMMUNICATIONS, INC.	MISSION	KS	DFSFESPRO	0050
KL20	SIX STAR CABLEVISION MANAGEMENT COR	KANSAS CITY	KS	DFSFESPRO	0045
KJ25	JACKSON COUNTY CABLE SYSTEMS	INDEPENDENCE	MO	DFSFESPRO	0060
KG63	CLAY-PLATTE HOME THEATRE, INC.	PARKVILLE	MO	DFSFESPRO	0050
KF30	TRANSPONDER CORPORATION	KANSAS CITY	KS	DFSFESCTR	0100

***** DENVER CO

KZ42	HI-NET COMMUNICATIONS, INC.	DENVER COLORADO	CO	DFSFESPRO	0046
KV31	JAC COMMUNICATIONS ASSOCIATES	DENVER	CO	DFSFESPRO	0050
KU50	UNITED CABLE TELEVISION CORP. DBA M	DENVER	CO	DFSFESPRO	0061
KT43	PUBLIC SERVICE SATELLITE CONSORTIUM	MORRISON	CO	DFSFESPTR	0110
KP77	TRINITY BROADCASTING OF DENVER, INC	DENVER	CO	DFSFESPRO	0050
KJ99	COMMUNITY TCI OF COLORADO, INC.	LAKEWOOD	CO	DFSFESPRO	0050
KG75	AMERICAN TELEVISION AND COMMUNICATI	ENGLEWOOD	CO	DFSFESPRO	0050

***** SAN FRANCISCO CA

KX30	HI-NET COMMUNICATIONS, INC.	SAN FRANCISCO-WH	CA	DFSFESPRO	0046
KX29	HI-NET COMMUNICATIONS, INC.	OAKLAND-METRO AI	CA	DFSFESPRO	0046
KK86	ATHENA CABLEVISION CORP.	RICHMOND	CA	DFSFESPRO	0050
KH91	WESTERN TV CABLE	S. SAN FRANCISCO	CA	DFSFESPRO	0045

***** SEATTLE WA

KY50	HI-NET COMMUNICATIONS, INC.	SEATTLE BOEING F	WA	DFSFESPRO	0046
KY49	HI-NET COMMUNICATIONS, INC.	SEATTLE-TACOMA A	WA	DFSFESPRO	0046
KX73	OLYMPIC TV CABLE, INC.	PORT ORCHARD	WA	DFSFESPRO	0050
KW96	TELE-VUE SYSTEMS, INC. DBA VIACOM	SEATTLE	WA	DFSFESPRO	0050
KP40	TRINITY BROADCASTING OF SEATTLE, IN	SEATTLE	WA	DFSFESPRO	0050
KM61	NATION WIDE CABLEVISION, INC.	BREMERTON	WA	DFSFESPRO	0050

(continued)

***** LOS ANGELES CA

KZ48	HI-NET COMMUNICATIONS, INC.	LOS ANGELES-AIRP	CA	DFSFESPRO	0050
KU38	R F W SATELLITE SERVICES	HOLLYWOOD	CA	DFSFESPTR	0100
KR65	SIX STAR CABLEVISION MANAGEMENT COR	INGLEWOOD	CA	DFSFESPRO	0045
KR53	KTS CORP. DBA KINNELOA TELEVISION S	PASADENA	CA	DFSFESPRO	0045
KR30	SAMMONS COMMUNICATIONS, INC.	GLENDALE	CA	DFSFESPRO	0043
KQ77	THE CHRISTIAN BROADCASTING NETWORK,	LOS ANGELES	CA	DFSFESPRO	0100
KL76	DOUGLAS TELEVISION COMPANY, INC.	PAYSON	AZ	DFSFESPRO	0050
KL47	KING VIDEOCABLE COMPANY	LOS ANGELES	CA	DFSFESPRO	0050
KJ86	SPANISH INTERNATIONAL COMMUNICATION	HOLLYWOOD	CA	DFSFESPTR	0100
KG94	THETA CABLE OF CALIFORNIA	SANTA MONICA	CA	DFSFESPRO	0045
KG72	RCA AMERICAN COMMUNICATIONS, INC.	PASADENA	CA	DFSFESCTR	0100

***** DETROIT MI

WX85	COX CABLE COMMUNICATIONS, INC.	ST. CLAIR SHORES	MI	DFSFESPRO	0050
WX69	RCA AMERICOM	SOUTHFIELD	MI	DFSFESDRO	0070
WX56	THE CHRISTIAN BROADCASTING NETWORK,	DETROIT	MI	DFSFESPRO	0050
WV80	CONTINENTAL CABLEVISION OF MACOMB	ROSEVILLE	MI	DFSFESPRO	0050
WV61	HI-NET COMMUNICATIONS, INC.	LIVONIA	MI	DFSFESPRO	0050
WV60	HI-NET COMMUNICATIONS, INC.	WARREN	MI	DFSFESPRO	0050
WH30	GREATER STAR LINK CORP.	DETROIT	MI	DFSFESCTR	0100

***** PITTSBURGH PA

WZ61	WESTINGHOUSE BROADCASTING CO.	ALLISON PARK	PA	DFSFESCTR	0100
WX84	AMERICAN CABLEVISION OF MONROEVILLE	MONROEVILLE	PA	DFSFESPRO	0050
WV73	ANTHONY MANCINI	PITTSBURGH	PA	DFSFESPRO	0046
WV70	ANGELO VALENT CABLE TV	OAKDALE	PA	DFSFESPRO	0050
WS31	CENTRE VIDEO INC.	PENN HILLS TWP	PA	DFSFESPRO	0050
WR27	WESTERN PENNSYLVANIA CHRISTIAN BROA	WALL BOROUGH	PA	DFSFESPRO	0060
WGB7	BAISLEY TV & CABLE CO., INC.	CANONSBURG	PA	DFSFESPRO	0045

(continued)

***** ST. LOUIS - MO

KZ26	HORIZON COMMUNICATIONS CORP. OF	HAZELWOOD	MO	DFSFESPRO	0050
KY76	HI-NET COMMUNICATIONS, INC.	CLAYTON	MO	DFSFESPRO	0050
KYS2	HI-NET COMMUNICATIONS, INC.	ST. LOUIS-NO.	MO	DFSFESPRO	0050
KV60	EVANS BROADCASTING CORP.	SHREWSBURY	MO	DFSFESPRO	0050
KU94	THE CHRISTIAN BROADCASTING NETWORK,	ST. LOUIS	MO	DFSFESPRO	0050
KJ37	CINEMA 8 PRODUCTIONS INC.	ST LOUIS	MO	DFSFESPRO	0045

***** BALTIMORE MD

WK31	HOWARD CABLE TELEVISION ASSOCIATES,	ELLCOTT CITY	MD	DFSFESPRO	0050
WJ49	CALVERT TELECOMMUNICATIONS CORP.	CANTONSVILLE	MD	DFSFESPRO	0050
WH37	GENESEE PROPERTIES	ANNA ARUNDEL	MD	DFSFESPRO	0045

***** CLEVELAND OH

WT44	STORER BROADCASTING CO.	PARMA	OH	DFSFESPRO	0050
WP65	COX CABLE COMMUNICATIONS, INC.	PARMA	OH	DFSFESPRO	0050
WG76	TELERAMA, INC.	BEACHWOOD	OH	DFSFESPRO	0600

***** HOUSTON TX

WE79	GULF COAST-BELLAIR CABLE TELEVISIO	BELLAIRE	TX	DFSFESPRO	0060
KV48	WESTLAND CATV, LTD.	HOUSTON	TX	DFSFESPRO	0070
KR51	VIDEO VISTA	NORTH HOUSTON	TX	DFSFESPRO	0046
KR40	VIDEO VISTA	WEST HOUSTON	TX	DFSFESPRO	0046
KJ32	MULTIPOINT-TEXAS COMPANY	HOUSTON	TX	DFSFESPRO	0045

***** NEWARK NJ

WZ21	CABLEVISION OF BAYONNE	BAYONNE	NJ	DFSFESPRO	0045
WS24	SUBURBAN CABLEVISION	EAST ORANGE	NJ	DFSFESPRO	0050

***** MINNEAPOLIS MN

KX31	HI-NET COMMUNICATIONS, INC.	BLOOMINGTON CENT	MN	DFSFESPRO	0046
KU45	UNITED TELEVISION, INC.	EDINA	MN	DFSFESPRO	0050
KT98	NORTHERN CABLEVISION, INC.	ST. LOUIS PARK	MN	DFSFESPRO	0050
KN70	NORTHERN CABLEVISION, INC.	BLOOMINGTON	MN	DFSFESPRO	0050
KK64	FIRST TELEVISION CORP.	FRIDLEY	MN	DFSFESCRO	0050

(continued)

REPORT 20 - (continued)

***** ORANGE COUNTY CA

KZ44 HI-NET COMMUNICATIONS, INC. LONG BEACH CA DFSFESPRO 0050

***** MILWAUKEE WI

WX98 HI-NET COMMUNICATIONS, INC. MILWAUKEE-WEST WI DFSFESPRO 0046

WX74 HI-NET COMMUNICATIONS, INC. MILWAUKEE-N.E. WI DFSFESPRO 0046

WT41 WITI-TV, INC. BROWN DEER VILLA WI DFSFESPRO 0050

KX28 HI-NET COMMUNICATIONS, INC. MILWAUKEE-SO AIR WI DFSFESPRO 0046

***** WASHINGTON DC

WU31 MARQUEE TELEVISION NETWORK, INC. BETHESDA MD DFSFESPRO 0050

WM43 NATIONAL CABLE SATELLITE CORP. BREN MAR VA DFSFESPTR 0100

WH49 ARLINGTON TELECOMMUNICATIONS CORP. ARLINGTON VA DFSFESPRO 0045

WE87 RCA AMERICAN COMMUNICATIONS, INC. SUITLAND MD DFSFESCRO 0110

WE74 AMERICAN SATELLITE CORPORATION GREENBELT MD DFSFESCTR 0100

APPENDIX D

PROGRAM LISTINGS

This appendix presents the program listings for the Video Distribution System Cost Model. The programs are presented in four sections. The first three sections include the principal programs associated with each of the three modules -- BUILD, MODEL, and EARTH. The last section includes the general utility subroutines used by all three modules.

SECTION 1. BUILD MODULE

Section 1 includes listings for the common area description, the main program for the BUILD module, and the following subroutines:

**COST
PATH
CITY
RATE**

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THIS IS THE COMMON AREA 'INCLUDED' IN THE SCENARIO BUILDER AND MODEL PROGRAMS. THE FILE NAME IS 'COMBLK'.

```
INTEGER*2 NULEM,NDELEM,NUINDX,NDINDX,NUCITY,NUCITY,NUPATH,NDPATH
COMMON NULEM,NDELEM,NUINDX,NDINDX,NUCITY,NUCITY,NUPATH,NDPATH
INTEGER*2 NELEM(2),NINDX(2),NCITY(2),NPATH(2)
EQUIVALENCE (NULEM,NELEM(1)), (NUINDX,NINDX(1))
EQUIVALENCE (NUCITY,NCITY(1)), (NUPATH,NPATH(1))
INTEGER*2 NUMORG,MAXUCS,MAXDCS,MAXUPA,MAXDPA,MAXUCT,MAXDCT,BADD
COMMON NUMORG,MAXUCS,MAXDCS,MAXUPA,MAXDPA,MAXUCT,MAXDCT,BADD
INTEGER*2 MAXCS(2),MAXPA(2),MAXCT(2)
EQUIVALENCE (MAXUCS,MAXCS(1)), (MAXUPA,MAXPA(1)), (MAXUCT,MAXCT(1))
INTEGER*2 UCITYV(10),UCITYH(10),DCITYV(80),DCITYH(80)
COMMON UCITYV, UCITYH, DCITYV, DCITYH
INTEGER*2 NCHAR,NSTART,CONTC,YESNO,UPDOWN,POSITN
COMMON NCHAR,NSTART,CONTC,YESNO,UPDOWN,POSITN
REAL*4 DDDCPH,DDDINS,DDLES,EQPLIF,PVTLES,PVTFIX,PVTINS,PVTMIL
COMMON DDDCPH,DDDINS,DDLES,EQPLIF,PVTLES,PVTFIX,PVTINS,PVTMIL
REAL*4 DISCNT,TLKCAP,WATINS,WATLES,WATCPH,WATMAX
COMMON DISCNT,TLKCAP,WATINS,WATLES,WATCPH,WATMAX
REAL*4 UCSDAT(15,6,4),DCSDAT(30,6,4),GANDAD(4)
COMMON UCSDAT, DCSDAT, GANDAD
REAL*4 UCSMIN(15),DCSMIN(30),UCTXVL(10,5),DCTXVL(80,5)
COMMON UCSMIN, DCSMIN, UCTXVL, DCTXVL
REAL*4 UDXWHT(6),DDXWHT(6),TALKBK(80,10),XDATA(6)
COMMON UDXWHT, DDXWHT, TALKBK, XDATA
LOGICAL*1 UCSCOD(15,2),DCSCOD(30,2),UCSNAM(15,20),DCSNAM(30,20)
COMMON UCSCOD, DCSCOD, UCSNAM, DCSNAM
LOGICAL*1 UCSPTH(15,10),DCSPTH(30,20),UPTHCY(10,10),DPTHCY(20,80)
COMMON UCSPTH, DCSPTH, UPTHCY, DPTHCY
LOGICAL*1 UCTNAM(10,16),DCTNAM(80,16),USTCOD(10,2),DSTCOD(80,2)
COMMON UCTNAM, DCTNAM, USTCOD, DSTCOD
LOGICAL*1 INDATA(80),ORGNAM(9,20),UCINDX(6,8),DCINDX(6,8)
COMMON INDATA, ORGNAM, UCINDX, DCINDX
LOGICAL*1 UPTHNM(10,20),DPTHNM(20,20),ARG(80)
COMMON UPTHNM, DPTHNM, ARG
LOGICAL*1 UCTORG(10),DCTORG(80),UCTCHN(10),DCTLVL(80)
COMMON UCTORG, DCTORG, UCTCHN, DCTLVL
LOGICAL*1 TITLE(72)
COMMON TITLE
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OF POOR QUALITY

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C      THIS IS THE MAIN PROGRAM FOR THE MODEL
C
C      SUBROUTINE CALLS: READIN, COST, PATH, CITY, RATE, YESNO, RITOUT
C
C      VARIABLES
C
C      MAXUCS - MAXIMUM NUMBER OF UPLINK COST INDEXES
C      MAXDCS - DOWNLINK
C
C      MAXUPA - MAXIMUM NUMBER OF UPLINK PATHS
C      MAXDPA - DOWNLINK
C
C      MAXUCT - MAXIMUM NUMBER OF UPLINK CITIES
C      MAXDCT - DOWNLINK
C
C      UCINDX - THE 'FIXED' UPLINK COST INDEX
C      DCINDX - DOWNLINK
C
0001      INCLUDE 'SYO:COMBLK.FTN/NOLIST'
0039      DATA MAXUCS /15/, MAXDCS /30/, MAXUPA /10/, MAXDPA /20/
0040      DATA MAXUCT /10/, MAXDCT /80/
0041      DATA UCINDX /'F',5*' ','I',5*' ','X',5*' ','E',5*' ','D',23*' '//
0042      DATA DCINDX /'F',5*' ','I',5*' ','X',5*' ','E',5*' ','D',23*' '//
C
C      OPEN AND READ USER-SELECTED SCENARIO FILE
C
0043      CALL READIN
0044      WRITE (1,*) 'SCENARIO TITLE IS...'
0045      WRITE (1,10) (TITLE(I),I=1,72)
0046      10  FORMAT ('0',72A1/)
0047      20  WRITE (1,*) 'DO YOU WANT TO ENTER A NEW TITLE?'
0048      CALL YESNO
C
C      YES NO ERR
0049      GO TO (30, 50, 20) YESNO
0050      30  WRITE (1,*) 'ENTER NEW SCENARIO TITLE'
0051      READ (1,40) (TITLE(I),I=1,72)
0052      40  FORMAT (72A1)
C
C      CALL SUBROUTINES TO EDIT COST, PATH, CITY, AND RATE INFORMATION
C
0053      50  CALL COST
0054      CALL PATH
0055      CALL CITY
0056      CALL RATE
C
0057      100 WRITE (1,*) 'DO YOU HAVE ANY MORE MODIFICATIONS TO MAKE TO THE SCEN
          2ARIO?'
0058      CALL YESNO
C
C      YES NO ERR
0059      GO TO ( 50, 300, 100) YESNO
C
C      SAVE MODIFICATIONS IN A NEW SCENARIO FILE
C
0060      500 CALL RITOUT
0061      STOP
0062      END

```

0001 SUBROUTINE COST

```
C
C
C COST MODULE
C THE COST MODULE IS USED TO ADD TO OR MODIFY DATA FOR THE
C UPLINK OR DOWNLINK COST ELEMENTS. THE USER HAS THE CAPABILITY
C TO DEFINE ADDITIONAL COST ELEMENTS, ADD DATA FOR THEM, AND
C INCLUDE THEM IN ONE OR MORE PATHS. COST ELEMENT DATA CONSISTS
C OF CAPITAL, INSTALLATION, LEASE, AND OPERATIONS AND MAINTENANCE
C COSTS FOR EACH COST ELEMENT (PIECE OF EQUIPMENT OR NON-HARDWARE
C COST UNIT) USED IN THE ANALYSIS. A SINGLE COST ELEMENT MAY CONSIST OF
C MANY INDIVIDUAL ITEMS AS LONG AS THEY ARE ALWAYS CONSIDERED TOGETHER.
C THE USER ALSO HAS THE CAPABILITY TO SET UP A COST ALLOCATION
C METHODOLOGY.
C
C ARRAY VARIABLES
C
C UCSCOD - 2 CHARACTER UPLINK COST ELEMENT CODE
C DCSCOD - DOWNLINK
C
C UCSNAM - 20 CHARACTER UPLINK COST ELEMENT NAME
C DCNAM - DOWNLINK
C
C UCSDAT - CAPITAL, INSTALLATION, LEASE, AND OMA COSTS FOR EACH UPLINK
C COST ELEMENT AND COST INDEX
C DCSDAT - DOWNLINK
C
C UCSMIN - MINIMUM LEASE CHARGE FOR EACH UPLINK COST ELEMENT
C DCSMIN - DOWNLINK
C
C UCSPTH - MATRIX OF COST ELEMENTS FOR EACH UPLINK PATH
C DCSPTH - DOWNLINK
C
C ORGNAM - 20 CHAR NAMES OF MEMBER ORGANIZATIONS FOR ALLOCATING COSTS
C
C UCINDX - 8 CHARACTER COST INDEX NAMES FOR UPLINK
C DCINDX - DOWNLINK
C
C UDXWHT - WEIGHTING FACTORS FOR COST ALLOCATION OF UPLINK COSTS
C DDXWHT - DOWNLINK
C
C CSTCMD - ARRAY OF COMMANDS FOR USE IN THE COST MODULE
C
C CSMCHD - ARRAY OF SUBCOMMANDS USED IN THE COST MODULE
C
C SCALAR VARIABLES
C NUELEM - NUMBER OF UPLINK COST ELEMENTS
C NDELEM - DOWNLINK
C
C NUINDX - NUMBER OF UPLINK COST INDEXES
C NDINDX - DOWNLINK
C
C UPPDWN - FLAG SET TO SPECIFY UPLINK OR DOWNLINK PROCESSING
C
C XDAT, XDATA - VARIABLES USED TO READ USER RESPONSE INTO
C
```

```
C
C SUBROUTINE CALLS: BETTER, CODCHK, DISAPR, REPRTR
C YESNO, UPDOWN, RDCOST, MATMOD
C
C THIS ROUTINE CALLED BY: BUILD
C
0002 INCLUDE 'SYO:COMBLK.FTN/NOLIST'
C
C LOCAL VARIABLES
C
0040 LOGICAL*1 MODFLG,CSTCHD(5,3),CBMCHD(9,3)
0041 REAL*4 PER,INPUTZ
0042 DATA PER //PER //
0043 DATA CSTCHD /'E','A','M','D','L',
2 'X','D','O','E','I',
3 'I','D','D','L','S'/
0044 DATA CBMCHD /'C','I','L','O','C','N','A','R','E',
2 'A','N','E','M','O','A','D','E','X',
3 'P','S','S','A','D','M','D','M','I'/
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C ASK FOR COST INFORMATION
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
0045 10 WRITE (1,*) 'DO YOU HAVE COST INFORMATION TO ENTER?'
0046 CALL YESNO
C YES NO ERR
0047 GO TO(50,950,10), YESNO
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C COST INFORMATION PROCESSING
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
0048 50 WRITE ( 1,* ) 'DO YOU WANT TO CHANGE YOUR COST ALLOCATION?'
0049 CALL YESNO
C YES NO ERR
0050 GO TO (70,97,50), YESNO
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C COST ALLOCATION PROCESSING
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
0051 70 NUMORD = 0
0052 75 WRITE ( 1,* ) 'ENTER LIST OF MEMBERS TO SHARE COSTS - 1 TO END'
0053 78 READ (1,101?) (INDATA(I), I=1,80)
0054 80 CALL BETTER
0055 IF ( ARG (1) .NE. '1' ) GO TO 85
0056 IF (NUMORD.EQ.0) WRITE(1,*) 'WARNING: NO ORGANIZATIONS SPECIFIED.'
0057 IF (NUMORD.EQ.0) WRITE(1,*) 'COST ALLOCATION IGNORED.'
0058 GO TO 97
```



```

0059 85 IF (NCHAR.EQ.0) GO TO 88
0060 IF (NUMORG.EQ.10) GO TO 95
0061 NUMORG = NUMORG + 1
0062 DO 84 J=1,20
0063 84 ORGNAM(NUMORG,J) = ARG(J)
0064 88 IF ( CONTCO .EQ. 0 ) GO TO 75
0065 IF ( CONTCO .NE. 0 ) GO TO 80
C
C TOO MANY MEMBERS
C
0066 95 WRITE (1,*) 'ONLY 9 ORGANIZATIONS CAN BE SPECIFIED'
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C ASK FOR UPLINK OR DOWNLINK PROCESSING
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
0067 97 WRITE(1,*) 'DO YOU WANT TO EDIT UPLINK OR DOWNLINK COST DATA?'
0068 WRITE(1,*) '(UP OR DOWN)'
0069 CALL UPDOWN
0070 IF (UPPDWN.EQ.3) GO TO 97
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C MODIFY COST INDEXES
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
0071 100 WRITE ( 1,* ) 'DO YOU WANT TO MODIFY COST INDEXES?'
0072 CALL YESNO
C
C YES NO ERR
0073 GO TO (120,280,100), YESNO
0074 120 NINDX(UPPDWN) = 1
0075 122 WRITE (1,*) 'ENTER NEW LIST OF COST INDEX NAMES'
0076 125 READ (1,1010) (INDATA(I),I=1,80)
0077 130 CALL GETTER
0078 IF ( ARG(1) .EQ. '1' ) GO TO 150
0079 IF (NCHAR.EQ.0) GO TO 138
0080 IF (NINDX(UPPDWN).EQ.6) GO TO 145
0081 NINDX(UPPDWN) = NINDX(UPPDWN) + 1
0082 DO 133 J=1,8
0083 IF (UPPDWN.EQ.1) UCINDX(NUINDX,J) = ARG(J)
0084 IF (UPPDWN.EQ.2) DCINDX(NDINDX,J) = ARG(J)
0085 133 CONTINUE
0086 138 IF ( CONTCO .EQ. 0 ) GO TO 122
0087 IF ( CONTCO .NE. 0 ) GO TO 130
C
C TOO MANY INDEXED INPUT
C
0088 145 WRITE (1,*) 'ONLY 6 COST INDEXES CAN BE SPECIFIED'
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C ENTER COST INDEX WEIGHTING FACTORS
C

```

```
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
0089 150 IF (NUMORG.EQ.0) GO TO 280
0090 WRITE (1,*) 'ENTER WEIGHTING FACTORS FOR COST INDEXES'
0091 ASSIGN 150 TO BADD
0092 GO TO (152,160),UPPDWN
0093 152 WRITE (1,1200) ((UCINDX(I,J),J=1,8),I=1,NUINDX)
0094 READ (1,*,ERR=170) (XDATA(I),I=1,NUINDX)
0095 DO 155 I=1,NUINDX
0096 155 UDXWHT(I) = XDATA(I)
0097 GO TO 280
0098 160 WRITE (1,1200) ((DCINDX(I,J),J=1,8),I=1,NDINDX)
0099 READ (1,*,ERR=170) (XDATA(I),I=1,NDINDX)
0100 DO 165 I=1,NDINDX
0101 165 DDXWHT(I) = XDATA(I)
0102 GO TO 280
C
C ERROR IN READ
C
0103 170 WRITE(1,*)'ERROR IN READING NUMERICAL DATA--PLEASE RE-ENTER'
0104 GO TO BADD
C
C
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C COST COMMAND PROCESSING
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C
C
0105 280 WRITE ( 1,* ) 'ENTER COST COMMAND'
0106 READ (1,1010) (INDATA(I),I=1,80)
0107 CALL GETTER
0108 CALL CODCHK (3,ARG,5,CSTCMD,POSITN)
C
C EXI ADD DEL MOD LIS
0109 IF ( POSITN .NE. 0 ) GO TO (900,400,500,705,800), POSITN
0110 WRITE (1,*) 'INVALID COST COMMAND'
0111 WRITE(1,*)'VALID COMMANDS ARE: EXI,ADD,DEL,MOD,LIS'
0112 GO TO 280
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C ADD COST ELEMENT
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
0113 400 WRITE ( 1,* ) 'ENTER NEW COST ELEMENT CODE - 2 CHARACTERS'
0114 ASSIGN 400 TO BADD
0115 CALL RDCOST
```

COST.FTN /TR:BLOCKS/WR

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0116         IF (NCHAR.EQ.1.AND.ARG(1).EQ.'1') GO TO 280
0117         IF ( POSITN .EQ. 0 ) GO TO 410
0118 405      WRITE (1,*) 'COST ELEMENT CODE ALREADY EXISTS'
0119         WRITE (1,*) 'USE A DIFFERENT CODE'
0120         GO TO BADD

C
C ERROR -- TOO MANY COST ELEMENTS
C
0121 410     IF (NELEM(UPPDWN) .LT. MAXCS(UPPDWN)) GO TO 415
0122         WRITE (1,*) 'ONLY ',MAXCS(UPPDWN),' COST ELEMENTS CAN BE SPECIFIED'
0123         GO TO 280

C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C ADD NEW ELEMENT CODE TO ARRAY
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
0124 415     NELEM(UPPDWN) = NELEM(UPPDWN) + 1
0125         NCSTEL=NELEM(UPPDWN)
0126         IF (NCSTEL .EQ. MAXCS(UPPDWN))
2          WRITE(1,*) 'THIS IS THE LAST COST ELEMENT WHICH MAY BE ADDED'
0127 416     DO 417 I=1,2
0128         IF (UPPDWN.EQ.1) UCSCOD(NCSTEL,I)=ARG(I)
0129         IF (UPPDWN.EQ.2) DCSCOD(NCSTEL,I)=ARG(I)
0130 417     CONTINUE
0131         IF ( MODFLG .EQ. 1 ) GO TO 523

C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C ADD COST ELEMENT NAME
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
0132 420     WRITE ( 1,* ) 'ENTER NEW COST ELEMENT NAME'
0133         ASSIGN 420 TO BADD
0134         READ (1,1010) (INDATA(I),I=1,20)
0135         CALL GETTER
0136         IF (UPPDWN.EQ.1) CALL CODCHK (20,ARG,MAXUCS,UCSNAM,POSITN)
0137         IF (UPPDWN.EQ.2) CALL CODCHK (20,ARG,MAXDCS,DCSNAM,POSITN )
0138         IF ( POSITN .EQ. 0 ) GO TO 430
0139 425     WRITE (1,*) 'COST ELEMENT NAME ALREADY EXISTS'
0140         WRITE (1,*) 'USE A DIFFERENT NAME'
0141         GO TO BADD

C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C MOVE NEW NAME TO ITS ARRAY
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
0142 430     DO 429 J=1,20
0143         IF (UPPDWN.EQ.1) UCSNAM(NCSTEL,J) = ARG(J)
0144         IF (UPPDWN.EQ.2) DCSNAM(NCSTEL,J) = ARG(J)
0145 429     CONTINUE
0146         IF ( MODFLG .EQ. 1 ) GO TO 523

```

```
C
C
CCCCCCCCCCCCCCCCCCCC
C
C ENTER COSTS FOR EACH COST INDEX - CAP, INS, LES, OMA
C
CCCCCCCCCCCCCCCCCCCC
C
C
0147      WRITE ( 1,* ) 'COST INDEXES ARE:'
0148      IF (UPPDWN.EQ.1) WRITE (1,1200) ((UCINDX(I,J), J=1,8),I=1,NUINDX)
0149      IF (UPPDWN.EQ.2) WRITE (1,1200) ((DCINDX(I,J), J=1,8),I=1,NDINDX)
0150  432  WRITE ( 1,* ) 'ENTER CAPITAL COST (ENTER A VALUE FOR EACH COST IND
2EX)'
0151      ASSIGN 432 TO BADD
0152      READ (1,*,ERR=170) (XDATA(I),I=1,NINDX(UPPDWN))
0153      DO 434 J=1,NINDX(UPPDWN)
0154      IF (UPPDWN.EQ.1) UCSDAT(NCSTEL,J,1) = XDATA(J)
0155      IF (UPPDWN.EQ.2) DCSDAT(NCSTEL,J,1) = XDATA(J)
0156  434  CONTINUE
C
C
CCCCCCCCCCCCCCCCCCCC
C
C ENTER INSTALLATION COSTS
C
CCCCCCCCCCCCCCCCCCCC
C
C
0157  440  WRITE ( 1,* ) 'ENTER INSTALLATION COSTS'
0158      ASSIGN 440 TO BADD
0159      READ (1,*,ERR=170) (XDATA(I),I=1,NINDX(UPPDWN))
0160      DO 443 J=1,NINDX(UPPDWN)
0161      IF (UPPDWN.EQ.1) UCSDAT(NCSTEL,J,2) = XDATA(J)
0162      IF (UPPDWN.EQ.2) DCSDAT(NCSTEL,J,2) = XDATA(J)
0163  443  CONTINUE
C
C
CCCCCCCCCCCCCCCCCCCC
C
C ENTER LEASE COSTS
C
CCCCCCCCCCCCCCCCCCCC
C
C
0164  450  WRITE ( 1,* ) 'ENTER LEASE COSTS'
0165      ASSIGN 450 TO BADD
0166      READ (1,*,ERR=170) (XDATA(I),I=1,NINDX(UPPDWN))
0167      DO 455 J=1,NINDX(UPPDWN)
0168      IF (UPPDWN.EQ.1) UCSDAT(NCSTEL,J,3) = XDATA(J)
0169      IF (UPPDWN.EQ.2) DCSDAT(NCSTEL,J,3) = XDATA(J)
0170  455  CONTINUE
C
C
CCCCCCCCCCCCCCCCCCCC
C
C ENTER OMA COSTS
```

```
C
CCCCCCCCCCCCCCCC
C
C
0171 465 WRITE (1,*) 'ENTER OPERATIONS AND MAINTENANCE COSTS'
0172      ASSIGN 465 TO BADD
0173      READ (1,*,ERR=170) (XDATA(I),I=1,NINDX(UPPDWN))
0174      DO 470 J=1,NINDX(UPPDWN)
0175      IF (UPPDWN.EQ.1) UCSDAT(NCSTEL,J,4) = XDATA(J)
0176      IF (UPPDWN.EQ.2) DCSDAT(NCSTEL,J,4) = XDATA(J)
0177 470 CONTINUE
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C ENTER MINIMUM LEASE COST, IF APPLICABLE
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
0178 471 WRITE (1,*) 'ENTER MINIMUM LEASE COST (IF APPLICABLE, OTHERWISE 0)'
0179      ASSIGN 471 TO BADD
0180      READ (1,*,ERR=170) XDATA(1)
0181      IF (UPPDWN.EQ.1) UCSMIN(NCSTEL) = XDATA(1)
0182      IF (UPPDWN.EQ.2) DCSDMIN(NCSTEL) = XDATA(1)
0183      DO 475 I=1,NPATH(UPPDWN)
0184      IF (UPPDWN.EQ.1) UCSPTH(NCSTEL,I) = 0
0185      IF (UPPDWN.EQ.2) DCSPTH(NCSTEL,I) = 0
0186 475 CONTINUE
C
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C ENTER PATH INFORMATION
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C
0187 480 WRITE (1,*) 'ENTER PATH NAMES TO WHICH THIS COST ELEMENT IS TO B
      2E ADDED'
0188      J = UPPDWN + 2
0189      CALL MATMOD(J,1,NCSTEL)
0190      IF (MODFLG .EQ. 1) GO TO 523
0191      GO TO 280
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C MODIFY COST ELEMENT
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
0192 500 WRITE (1,*) 'ENTER COST ELEMENT CODE TO BE MODIFIED'
0193      CALL RDCOST
0194      IF (POSITN .NE. 0) GO TO 510
0195      WRITE (1,*) 'COST ELEMENT CODE DOES NOT EXIST'
0196      GO TO 280
```

```
C
CCCCCCCCCCCCCCCCCCCC
C
C   ENTER MODIFIED CODE
C
CCCCCCCCCCCCCCCCCCCC
C
0197 510  WRITE ( 1,* ) 'COST ELEMENT TO BE MODIFIED IS:'
0198      IF (UPPDWN.EQ.1) WRITE(1,1020)
          2  (UCSCOD(POSITN,J),J=1,2),(UCSNAM(POSITN,J),J=1,20)
0199      IF (UPPDWN.EQ.2) WRITE(1,1020)
          2  (DCSCOD(POSITN,J),J=1,2),(DCSNAM(POSITN,J),J=1,20)
C
0200 520  NCSTEL=POSITN
0201 523  WRITE ( 1,* ) 'ENTER COST MODIFY SUBCOMMAND'
0202      MODFLG = 0
0203      READ (1,1010) (INDATA(I),I=1,80)
0204      CALL GETTER
0205      CALL CODCHK (3,ARG,9,CSMCMD,POSITN )
0206      IF ( POSITN .NE. 0 ) GO TO 530
0207      WRITE (1,*) 'INVALID SUBCOMMAND.'
0208      WRITE ( 1,1270)((CSMCMD(I,J),J=1,3),I=1,9)
0209      GO TO 523
C
C   BRANCH TO MODIFY COST SUBCOMMAND
C
C           CAP INS LES DMA COD NAM ADD REM EXI
0210 530  GO TO (540,540,540,540,620,640,660,680,280),POSITN
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C   MODIFY CAPITAL, INSTALL, LEASE, OR O+M COSTS
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C
0211 540  GO TO (541,561),UPPDWN
0212 541  WRITE (1,1210) (INDATA(J),J=1,3),(UCSCOD(NCSTEL,J),J=1,2),
          2  (UCSNAM(NCSTEL,J),J=1,20)
0213      IF (NUINDX.GE.2) WRITE(1,1220) (PER, J=2,NUINDX)
0214      WRITE (1,1230) ((UCINDX(I,J),J=1,8),I=1,NUINDX)
0215      WRITE (1,1240) (UCSDAT(NCSTEL,J,POSITN),J=1,NUINDX)
0216      WRITE (1,1280)
0217 545  WRITE (1,*) 'ENTER CHANGE -N,VALUE OR 0,0 TO END'
0218      ASSIGN 545 TO BADD
0219 550  READ (1,*,ERR=170) K,INPUT2
0220      IF (K.LE.0) WRITE(1,1240) (UCSDAT(NCSTEL,J,POSITN),J=1,NUINDX)
0221      IF (K.LE.0) GO TO 523
0222      IF (K.LE.NUINDX) GO TO 560
0223      WRITE (1,1250) K
0224      GO TO 545
0225 560  UCSDAT(NCSTEL,K,POSITN) = INPUT2
0226      GO TO 545
C
C   DOWNLINK MODIFY
C
```

```
0227 561 WRITE (1,1210) (INDATA(J),J=1,3),(DCSCOD(NCSTEL,J),J=1,2),  
2 (DCSNAM(NCSTEL,J),J=1,20)  
0228 IF (NDINDX.GE.2) WRITE(1,1220) (PER, J=2,N'INDX)  
0229 WRITE (1,1230) ((DCINDX(I,J),J=1,8),I=1,NDINDX)  
0230 WRITE (1,1240) (DCSDAT(NCSTEL,J,POSITN),J=1,NDINDX)  
0231 WRITE(1,1280)  
0232 565 WRITE (1,*) 'ENTER CHANGE - N,VALUE OR 0,0 TO END'  
0233 ASSIGN 565 TO BADD  
0234 570 READ (1,*,ERR=170) K,INPUT2  
0235 IF (K.LE.0) WRITE(1,1240) (DCSDAT(NCSTEL,J,POSITN),J=1,NDINDX)  
0236 IF (K.LE.0) GO TO 523  
0237 IF (K.LE.NDINDX) GO TO 580  
0238 WRITE (1,1250) K  
0239 GO TO 565  
0240 580 DCSDAT(NCSTEL,K,POSITN) = INPUT2  
0241 GO TO 565  
  
C  
C  
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC  
C  
C MODIFY COST ELEMENT CODE  
C  
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC  
C  
C  
0242 620 WRITE ( 1,* ) 'ENTER NEW COST ELEMENT CODE'  
0243 ASSIGN 620 TO BADD  
0244 CALL RDCOST  
0245 IF (POSITN.NE.0) GO TO 405  
0246 MODFLG=1  
0247 GO TO 416  
  
C  
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC  
C  
C MODIFY COST ELEMENT NAME  
C  
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC  
C  
0248 640 WRITE ( 1,* ) 'ENTER COST ELEMENT NAME (20 CHARACTERS MAXIMUM)'  
0249 ASSIGN 640 TO BADD  
0250 READ (1,1010) (INDATA(I),I=1,80)  
0251 CALL GETTER  
0252 IF (UPPDWN.EQ.1) CALL CODCHK (20,ARG,MAXUCS,UCSNAM,POSITN)  
0253 IF (UPPDWN.EQ.2) CALL CODCHK (20,ARG,MAXDCS,DCSNAM,POSITN)  
0254 IF (POSITN.NE.0) GO TO 425  
0255 MODFLG=1  
0256 GO TO 430  
  
C  
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC  
C  
C ADD A COST ELEMENT TO A PATH  
C  
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC  
C  
0257 660 MODFLG=1  
0258 GO TO 480
```

```

C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C REMOVE A COST ELEMENT FROM A PATH
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
0259 680 WRITE ( 1,* ) 'ENTER PATH NAMES FROM WHICH THIS COST ELEMENT IS TO
      2 BE REMOVED'
0260      J = UPFDWN + 2
0261      CALL MATMOD(J,0,NCSTEL)
0262      GO TO 523
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C DELETE COMMAND
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
0263 705 WRITE ( 1,* ) 'ENTER COST ELEMENT CODE TO BE DELETED'
0264      CALL RDCOST
0265      IF ( ARG(1) .EQ. ';' ) GO TO 280
0266      IF ( POSITN .EQ. 0 ) GO TO 710
0267 706 IF ( UPFDWN .EQ. 1 ) WRITE(1,1260)(UCSNAM(POSITN,I),I=1,20)
0268      IF ( UPFDWN .EQ. 2 ) WRITE(1,1260)(DCSNAM(POSITN,I),I=1,20)
0269      CALL YESNO
C
C YES NO ERR
C
0270      GO TO (708, 280, 706) YESSNO
0271 708 CALL DISAPR (UPFDWN, POSITN)
0272      IF(NELEM(UPFDWN) .GT. 0 ) GO TO 280
0273      WRITE(1,*) '***** WARNING *****'
0274      WRITE(1,*) ' ALL COST ELEMENTS HAVE BEEN DELETED'
0275      WRITE(1,*) ' IN THIS SEGMENT'
0276      WRITE(1,*) 'THE MODEL WILL NOT WORK UNLESS AN ELEMENT IS ADDED'
0277      WRITE(1,*) '*****'
0278      GO TO 280
C
C ERROR IN COST CODE
C
0279 710 WRITE ( 1,* ) 'COST ELEMENT CODE DOES NOT EXIST'
0280      GO TO 280
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C LIST COST ELEMENT INFORMATION
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
0281 800 WRITE ( 1,* ) 'ENTER LIST SPECIFICATION'
0282      N=0
0283      READ ( 1,1010 ) (INDATA(I),I=1,80)

```



```
0284 803 CALL GETTER
0285 IF (NCHAR.EQ.0) GO TO 804
0286 IF( ARG(1) .EQ. 'A' .AND. ARG(2) .EQ. 'L' .AND. ARG(3) .EQ. 'L')
* GO TO 820
0287 IF( ARG(1) .EQ. 'P' .AND. ARG(2) .EQ. 'A' .AND. ARG(3) .EQ. 'T')
2 GO TO 840
0288 IF( ARG(1) .EQ. 'C' .AND. ARG(2) .EQ. 'O' .AND. ARG(3) .EQ. 'S')
2 GO TO 860
0289 IF (ARG(1).EQ.';') GO TO 280
0290 IF (UPPDWN.EQ.1) CALL CODCHK (2,ARG,MAXUCS,UCSCOD,POSITN )
0291 IF (UPPDWN.EQ.2) CALL CODCHK (2,ARG,MAXDCS,DCSCOD,POSITN)
0292 IF ( POSITN .EQ. 0 ) GO TO 810
0293 CALL REPRTR (1,POSITN)
0294 804 IF (CONTCO.EQ.0) GO TO 800
0295 IF (CONTCO.NE.0) GO TO 803
C
C ERROR - INVALID RESPONSE OR CODE DOESN'T EXIST
C
0296 810 WRITE (1,*) 'INVALID LIST OPTION'
0297 WRITE(1,*) 'LIST OPTIONS ARE: ALL, COST, PATH, A COST ELEMENT CODE,
2 OR ;'
GO TO 800
0298
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C PRINT PATH MATRIX AND COST INFORMATION
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
0299 820 DO 830 I = 1,NELEM(UPPDWN)
0300 CALL REPRTR (1,I)
0301 830 CONTINUE
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C PRINT PATH MATRIX ONLY
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
0302 840 CALL REPRTR (2,1)
0303 GO TO 280
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C PRINT COST ELEMENT CODES AND NAMES
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
0304 860 CALL REPRTR(9,1)
0305 GO TO 280
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C EXIT COMMAND
C
```

```
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC  
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC  
C  
0306 900 IF (UPPDWN.EQ.2) GO TO 950  
0307 WRITE (1,*) 'DO YOU WANT TO MODIFY DOWNLINK COST DATA?'  
0308 CALL YESNO  
C YES NO ERR  
0309 GO TO (910,950,900), YESSNO  
0310 910 UPPDWN = 2  
0311 GO TO 100  
0312 950 RETURN  
C  
C  
0313 1010 FORMAT ( 80A1)  
0314 1020 FORMAT (1H ,2A1,' -- ',20A1,/) )  
0315 1200 FORMAT (1X,6(8A1,2X))  
0316 1210 FORMAT(1H0,3A1,' COSTS FOR ',2A1,' -- ',20A1)  
0317 1220 FORMAT(1H ,19X,5(7X,A4))  
0318 1230 FORMAT(1H ,8X,6(3X,8A1))  
0319 1240 FORMAT(1H ,6X,6F11.2)  
0320 1250 FORMAT(1H0,'SPECIFIED SUBSCRIPT TOO LARGE:', I10)  
0321 1260 FORMAT(1X,'COST ELEMENT TO DELETE IS ',20A1,' Y OR N')  
0322 1270 FORMAT(1X,'VALID COMMANDS: ', 9(1X,3A1))  
0323 1280 FORMAT(1X,'N= 1 2 3 4  
2 5 6')  
0324 END
```

PATH.FTN /TR:BLOCKS/WR

```

0001      SUBROUTINE PATH
C
C
C          PATH MODULE
C
C THE PATH MODULE DEFINES OR MODIFIES DATA FOR UPLINK OR DOWNLINK
C PATHS.  PATHS ARE OPTIONS FOR TRANSMITTING THE VIDEO SIGNAL
C THROUGH A PARTICULAR SEGMENT OF THE MODEL.  THE USER CAN ADD OR
C DELETE PATHS, CHANGE THE COST ELEMENTS ASSOCIATED WITH ANY OF THE
C PATHS OR SPECIFY THE CITIES FOR WHICH A PATH IS VALID.
C
C ARRAY VARIABLES
C
C UPTHCY - ARRAY OF UPLINK CITIES FOR WHICH A PATH IS FEASIBLE
C DPTHCY -          DOWNLINK
C
C UPTHNM - 20 CHARACTER ARRAY OF UPLINK PATH NAMES
C DPTHNM -          DOWNLINK
C
C UPTIDX - CAPITAL, INSTALLATION, LEASE, OMA, ANNUALIZED COST FOR A
C          GIVEN COST INDEX AND PATH - UPLINK
C DPTIDX -          DOWNLINK
C
C SCALAR VARIABLES
C
C NUPATH - NUMBER OF UPLINK PATHS
C
C NDPATH - NUMBER OF DOWNLINK PATHS
C
C MAXUPA - MAXIMUM NUMBER OF UPLINK PATHS
C
C MAXDPA - MAXIMUM NUMBER OF DOWNLINK PATHS
C
C SUBROUTIN CALLS:  GETTER, YESNO, CODCHK, DISAPR,
C                  REPRTR, UPDOWN, MATMOD
C
C CALLED BY:  BUILD
C
0002      INCLUDE 'SYO:COMBLK.FTN/NOLIST'
C
C LOCAL VARIABLES
C
0040      INTEGER*2 CURENT,ORG
0041      LOGICAL*1 PTHLST(4,2), PTHCMD(8,5), PTHCMD(5,3)
0042      DATA PTHCMD /'E','A','M','D','L',
2             'X','D','O','E','I',
3             'I','D','D','L','S'/
0043      DATA PTHLST /'C','C','P',,/,
2             'O','I','A',,/,
0044      DATA PTHCMD /'A','D','N','A','D','N','N','E',
2             'D','E','E','D','E','E','E','X',
3             'D','L','W','D','L','W','W','I',
4             'C','C','C','C','L','C','N','T',
5             'O','O','O','I','I','I','A',,/'
C
C ASK IF THE USER WANTS TO ENTER PATH DATA
C

```

```
0045 3000 WRITE (1,*) 'DO YOU HAVE PATH INFORMATION TO ENTER?'
0046      CALL YESNO
      C      YES NO ERR
0047      GO TO (3010,3720,3000), YESSNO
      C
0048 3010 WRITE ( 1,* ) 'UPLINK OR DOWNLINK?'
0049      CALL UPDOWN
0050      IF(UPPDWN .EQ. 3) GO TO 3010
      C
      C PATH COMMAND PROCESSING
      C
0051 3015 WRITE ( 1,* ) 'ENTER PATH COMMAND'
0052      READ ( 1,4910 ) (INDATA(I),I=1,80)
0053      CALL CODCHK (3,INDATA,5,PTHCMD,POSITN)
0054      IF ( POSITN .EQ. 0 ) GO TO 3020
      C
      C BRANCH ON PATH COMMAND
      C
      C      EXIT ADD MOD DEL LIST
0055      GO TO ( 3700,3100,3300, 3500, 3600), POSITN
      C
      C NO SUCH COMMAND
      C
0056 3020 WRITE (1,*) 'INVALID PATH COMMAND'
0057      WRITE ( 1,* ) 'VALID COMMANDS: EXIT,ADD,MOD,DEL,LIST'
0058      GO TO 3015
      C
      CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
      CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
      C
      C ADD COMMAND
      C
      CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
      CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
      C
      C CHECK FOR TOO MANY PATHS
      C
0059 3100 IF (NPATH(UPPDWN) .LT. MAXPA(UPPDWN)) GO TO 3110
0060 3105 WRITE (1,*) 'ONLY ',MAXPA(UPPDWN),' PATHS CAN BE SPECIFIED'
0061      GO TO 3015
      C
      CCCCCCCCCCCCCCCCCCCCC
      C
      C REQUEST PATH NAME
      C
      CCCCCCCCCCCCCCCCCCCCC
      C
0062 3110 WRITE ( 1,* ) 'ENTER NEW PATH NAME'
0063      ASSIGN 3110 TO BADD
0064      READ ( 1,4910 ) ( INDATA(I),I=1,80)
0065      IF (ARG(1).EQ.'') GO TO 3015
0066      CALL GETTER
0067      IF (UPPDWN.EQ.1) CALL CODCHK (16,ARG,MAXUPA,UPTHNM,POSITN)
0068      IF (UPPDWN.EQ.2) CALL CODCHK (16,ARG,MAXDPA,DPTHNM,POSITN)
0069      IF ( POSITN .EQ. 0 ) GO TO 3120
      C
```

PATH.FTN /TR:2LOCKS/WR

```

C DUPLICATE PATH NAME
C
0070 3115 WRITE (1,*) 'PATH NAME ALREADY EXISTS'
0071        WRITE (1,*) 'ENTER A DIFFERENT NAME'
0072        GO TO 3ADD
C
C MOVE NAME TO NEW ARRAY
C
0073 3120 NPATH(UFPDWN) = NPATH(UFPDWN) + 1
0074        DO 3125 I=1,20
0075            IF (UFPDWN.EQ.1) UPTHNM(NUPATH,I) = ARG(I)
0076            IF (UFPDWN.EQ.2) DPTHNM(NDPATH,I) = ARG(I)
0077 3125 CONTINUE
C
C
C ADD LIST OF COST ELEMENTS WHICH COMPRISE THIS PATH
C
0080 3130 WRITE (1,*) 'ENTER LIST OF COST ELEMENT CODES FOR THIS PATH'
0081        CALL MATMOD(UFPDWN,1,NPATH(UFPDWN))
C
C REQUEST CITY NAMES FOR WHICH THIS PATH IS FEASIBLE
C
0082 3145 WRITE (1,*) 'ENTER LIST OF CITY NAMES (/ORG) FOR WHICH THIS PATH
          *IS FEASIBLE'
0083        J = 6 + UFPDWN
0084        CALL MATMOD(J,1,NPATH(UFPDWN))
0085        GO TO 3015
C
C
C MODIFY COMMAND
C
0086 3300 WRITE (1,*) 'ENTER PATH NAME YOU WANT TO MODIFY'
0087        READ (1,4910) (INDATA(I),I=1,80)
0088        CALL GETTER
0089        IF (UFPDWN.EQ.1) CALL CODCHK (NCHAR,ARG,MAXUPA,UPTHNM,POSITN)
0090        IF (UFPDWN.EQ.2) CALL CODCHK (NCHAR,ARG,MAXDPA,DPTHNM,POSITN)
0091        IF (POSITN.EQ.0) GO TO 3310
0092        IF (POSITN.EQ. -1 .AND. UFPDWN.EQ. 1) CALL CODCHK(20,ARG,MAXUPA,
          UPTHNM,POSITN)
0093        IF (POSITN.EQ. -1 .AND. UFPDWN.EQ. 2) CALL CODCHK(20,ARG,MAXDPA,
          DPTHNM,POSITN)
0094        IF (POSITN.EQ. -1) GO TO 3315
0095        IF (POSITN.EQ. 0) GO TO 3310
0096        CURENT = POSITN
0097        GO TO 3320
C
C ERROR - PATH DOES NOT EXIST
C

```

```

0096 3310 WRITE (1,*) 'PATH DOES NOT EXIST'
0097      GO TO 3015
0098 3315 WRITE (1,*) 'SPECIFIED PATH NOT UNIQUE - ENTER MORE INFORMATION'
0099      GO TO 3300
      C
      CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
      C
      C BRANCH TO MODIFY SUBCOMMAND
      C
      CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
      C
0100 3320 WRITE ( 1,* ) 'ENTER PATH MODIFY SUBCOMMAND'
0101      READ ( 1,4910 ) (INDATA(I),I=1,80)
0102      CALL GETTER
0103      CALL CODCHK (5,ARG, 8,PTMCHD,POSITN )
0104      IF ( POSITN .EQ. 0 ) GO TO 3335
      C
      C          ADCO,DLCO,NWCO,ADCY,DLCY,NWCY,NWNH,EXIT
0105      GO TO (3340,3360,3380,3400,3420,3440,3460,3015),POSITN
      C
      C NO SUCH COMMAND
      C
0106 3335 WRITE (1,*) 'INVALID SUBCOMMAND. VALID SUBCOMMANDS ARE...'
0107      WRITE ( 1,4920)((PTMCHD(I,J),J=1,5),I=1,8)
0108      GO TO 3320
      C
      CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
      C
      C ADD A COST ELEMENT TO PATH
      C
      CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
      C
0109 3340 WRITE ( 1,* ) 'ENTER LIST OF COST ELEMENT CODES TO ADD TO PATH'
0110      CALL MATMOD(UPPDWN,1,CURRENT)
0111      GO TO 3320
      C
      CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
      C
      C DELETE A COST ELEMENT FROM PATH
      C
      CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
      C
0112 3360 WRITE (1,*) 'ENTER LIST OF COST ELEMENT CODES TO DELETE FROM PATH'
0113      CALL MATMOD(UPPDWN,0,CURRENT)
0114      GO TO 3320
      C
      CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
      C
      C REPLACE COST ELEMENTS FOR PATH
      C
      CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
      C
0115 3380 DO 3390 I=1,NELEM(UPPDWN)
0116      IF (UPPDWN.EQ.1) UCSPTH(I,CURRENT) = 0
0117      IF (UPPDWN.EQ.2) DCSPTH(I,CURRENT) = 0
0118 3390 CONTINUE
  
```

```

0119                WRITE ( 1,* ) 'ENTER NEW LIST OF COST ELEMENT CODES FOR PATH'
0120                CALL MATMOD(UPPDWN,1,CURRENT)
0121                GO TO 3320
                  C
                  CCCCCCCCCCCCCCCCCCCCCC
                  C
                  C ADD A CITY TO PATH
                  C
                  CCCCCCCCCCCCCCCCCCCCCC
                  C
0122                3400 WRITE(1,*)'ENTER LIST OF CITY NAMES (/ORG) TO ADD THIS PATH TO '
0123                                J = 6 + UPPDWN
0124                CALL MATMOD (J,1,CURRENT)
0125                GO TO 3320
                  C
                  CCCCCCCCCCCCCCCCCCCCCC
                  C
                  C DELETE A CITY FROM PATH
                  C
                  CCCCCCCCCCCCCCCCCCCCCC
                  C
0126                3420 WRITE(1,*)'ENTER LIST OF CITY NAMES (/ORG) TO DELETE FROM THIS PAT
                                     2H'
0127                                J = 6 + UPPDWN
0128                CALL MATMOD (J,0,CURRENT)
0129                GO TO 3320
                  C
                  CCCCCCCCCCCCCCCCCCCCCC
                  C
                  C REPLACE CITIES FOR PATH
                  C
                  CCCCCCCCCCCCCCCCCCCCCC
                  C
0130                3440 DO 3450 J=1,NCITY(UPPDWN)
0131                                IF (UPPDWN.EQ.1) UPTHCY(CURRENT,J) = 0
0132                                IF (UPPDWN.EQ.2) DPTHCY(CURRENT,J) = 0
0133                3450 CONTINUE
0134                WRITE ( 1,* ) 'ENTER NEW LIST OF CITIES (/ORG) FOR THIS PATH'
0135                                J = 6 + UPPDWN
0136                CALL MATMOD (J,1,CURRENT)
0137                GO TO 3320
                  C
                  CCCCCCCCCCCCCCCCCCCCCC
                  C
                  C REPLACE PATH NAME
                  C
                  CCCCCCCCCCCCCCCCCCCCCC
                  C
                  C
0138                3460 WRITE ( 1,* ) 'ENTER THE NEW NAME FOR PATH'
0139                                ASSIGN 3460 TO BADD
0140                READ ( 1,4910) (INDATA(I),I=1,80)
0141                CALL GETTER
0142                                IF (UPPDWN.EQ.1) CALL CODCHK (20,ARG,MAXUPA,UPTHNM,POSITN)
0143                                IF (UPPDWN.EQ.2) CALL CODCHK (20,ARG,MAXDPA,DPTHNM,POSITN)
0144                                IF ( POSITN .NE. 0 ) GO TO 3115

```

```
0145 DO 3465 I = 1,20
0146 IF (UPPDWN.EQ.1) UPTHNM ( CURENT,I) = ARG (I)
0147 IF (UPPDWN.EQ.2) DPTHNM ( CURENT,I) = ARG (I)
0148 3465 CONTINUE
0149 GO TO 3320
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C DELETE A PATH FROM SCENARIO
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
E
0150 3000 WRITE ( 1,* )'ENTER PATH NAME TO DELETE FROM SCENARIO'
0151 READ ( 1,4910 ) (INDATA(I),I=1,80)
0152 CALL GETTER
0153 IF (ARG(1).EQ.'') GO TO 3015
0154 IF (UPPDWN.EQ.1) CALL CODCHK(NCHAR,ARG,MAXUPA,UPTHNM,POSITN )
0155 IF (UPPDWN.EQ.2) CALL CODCHK(NCHAR,ARG,MAXDPA,DPTHNM,POSITN )
0156 IF(POSITN .EQ. -1 .AND. UPPDWN .EQ. 1)CALL CODCHK(20,ARG,MAXUPA,
2UPTHNM,POSITN)
0157 IF(POSITN .EQ. -1 .AND. UPPDWN .EQ. 2)CALL CODCHK(20,ARG,MAXDPA,
2DPTHNM,POSITN)
0158 IF(POSITN .EQ. -1) GO TO 3515
0159 IF(POSITN .EQ. 0 ) GO TO 3310
0160 J = 2 + UPPDWN
0161 CALL DISAPR (J,POSITN )
0162 IF(NPATH(UPPDWN) .GT. 0) GO TO 3015
0163 WRITE(1,*)'***** WARNING *****'
0164 WRITE(1,*)' ALL PATHS DELETED FROM THIS SECTOR'
0165 WRITE(1,*)'MODEL WILL NOT WORK UNLESS A PATH IS ADDED'
0166 WRITE(1,*)'*****'
0167 GO TO 3015
0168 3515 WRITE (1,*) 'SPECIFIED PATH NOT UNIQUE - ENTER MORE INFORMATION'
0169 GO TO 3500
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C LIST PATH INFORMATION
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
0170 3600 WRITE ( 1,* )'ENTER LIST SPECIFICATION '
0171 READ ( 1, 4910 ) ( INDATA(I),I=1,80)
0172 CALL GETTER
0173 CALL CODCHK (2,ARG,4,PTHLST,POSITN )
0174 IF ( POSITN .EQ. 0 ) GO TO 3610
C
C COST CITY PATH ;
0175 GO TO ( 3620, 3630,3640,3015) POSITN
C
C NO SUCH COMMAND
C
```



```
0176 3610 WRITE (1,*) 'INVALID LIST OPTION'  
0177 WRITE (1,*) 'VALID COMMANDS: COST, CITY, PATH'  
0178 GO TO 3600  
C  
CCCCCCCCCCCCCCCCCCCCCCCCCCCC  
C  
C PRINT PATH/COST MATRIX  
C  
CCCCCCCCCCCCCCCCCCCCCCCCCCCC  
C  
0179 3620 CALL REPRTR (2,1)  
0180 GO TO 3015  
C  
CCCCCCCCCCCCCCCCCCCCCCCCCCCC  
C  
C PRINT PATH/CITY MATRIX  
C  
CCCCCCCCCCCCCCCCCCCCCCCCCCCC  
C  
0181 3630 CALL REPRTR (4,1)  
0182 GO TO 3015  
C  
CCCCCCCCCCCCCCCCCCCCCCCCCCCC  
C  
C PRINT PATH NAMES AND NUMBER  
C  
CCCCCCCCCCCCCCCCCCCCCCCCCCCC  
C  
0183 3640 CALL REPRTR (3,1)  
0184 GO TO 3015  
C  
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC  
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC  
C  
C EXIT FROM PATH MODULE  
C  
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC  
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC  
C  
0185 3700 IF (UPPDWN.EQ.2) GO TO 3720  
0186 WRITE (1,*) 'DO YOU WANT TO MODIFY DOWNLINK PATH DATA?'  
0187 CALL YESNO  
0188 GO TO (3710,3720,3700), YESNO  
0189 3710 UPPDWN = 2  
0190 GO TO 3015  
0191 3720 RETURN  
0192 4910 FORMAT (80A1)  
0193 4920 FORMAT(1X,'COMMANDS: ',8(1X,5A1))  
0194 END
```

```
0001      C              CITY MODULE
          C      SUBROUTINE CITY
          C
          C THE CITY MODULE IS USED TO DEFINE OR MODIFY THE CHARACTERISTICS
          C OF THE CITIES WHICH COMPRISE THE NETWORK UNDER CONSIDERATION.
          C THE USER CAN ADD, MODIFY OR DELETE CITIES FROM THE NETWORK
          C AND ASSOCIATE PATHS WITH CITIES. CITY DATA INCLUDES NAME (AND
          C MEMBER ORGANIZATION IF APPLICABLE), STATE, LOCATION (LATITUDE/
          C LONGITUDE OR BELL SYSTEM V AND H COORDINATES), CHANNEL NUMBER
          C (FOR UPLINK CITIES), HIERARCHICAL LEVEL (FOR DOWNLINK CITIES),
          C COST INDEX VALUES, AND FEASIBLE PATHS.
          C
          C ARRAY VARIABLES
          C
          C UCTXVL - VALUES ASSOCIATED WITH UPLINK COST INDEXES
          C DCTXVL - DOWNLINK
          C
          C UCTNAM - ARRAY OF UPLINK CITY NAMES - 16 CHARACTERS EACH
          C DCTNAM - DOWNLINK
          C
          C USTCOD - ARRAY OF 2 CHARACTER STATE CODES CORRESPONDING TO UPLINK
          C CITIES
          C DSTCOD - DOWNLINK
          C
          C UCITYV - VERTICAL COORDINATES FOR UPLINK CITIES
          C DCITYV - DOWNLINK
          C
          C UCITYH - HORIZONTAL COORDINATES FOR UPLINK CITIES
          C DCITYH - DOWNLINK
          C
          C DCTLVL - THE HEIRARCHICAL LEVEL OF EACH DOWNLINK CITY
          C
          C UCTCHN - THE CHANNEL ASSIGNED TO EACH UPLINK CITY
          C
          C TALKBK - THE HOURS OF TALKBACK NEEDED FROM EACH DOWNLINK CITY
          C TO THE ORIGINATING CITY
          C
          C SCALAR VARIABLES
          C
          C NUCITY - NUMBER OF UPLINK CITIES
          C
          C NDCITY - NUMBER OF DOWNLINK CITIES
          C
          C LATLON - FLAG TO TELL THE PROGRAM WHEN V AND H COORDINATES ARE
          C INPUT IN TERMS OF LATITUDE AND LONGITUDE
          C
          C SUBROUTINE CALLS: GETTER, YESNO, CODCHK, DISAPR, REPRTR,
          C UPDOWN, MATMOD, CTYCHK, VANDH
          C
          C CALLED BY: BUILD
          C
0002      C      INCLUDE 'SYO:COMBLK.FTN/NOLIST'
          C
          C LOCAL VARIABLES
          C
```

```

0040            LOGICAL*1 MODFLG,BYPASS,CTYCMD(6,3),CTLSTS(8,4),MODSUB(10,4),
                  2            BLANK
0041            INTEGER*2 ORGNUM,CURRENT,LAT,LON
0042            REAL*4 UD
0043            DATA CTYCMD/'A','O','M','D','L','E',
                  *            'D','U','O','E','I','X',
                  *            'D','E','D','L','S','I'//
0044            DATA CTLSTS/'I','P','P','T','O','A','C','I',
                  *            'N','A','N','A','R','L','I',
                  *            'D','T','A','L','G','L','T',
                  *            'E','H','M','K','S','Y'//
0045            DATA MODSUB /'U','C','C','I','A','D','C','C','T','E',
                  2            'A','H','H','N','D','E','H','H','A','X',
                  3            'N','A','L','D','D','L','G','G','L','I',
                  4            'D','N','U','E','P','P','P','N','K','T'//
0046            DATA BLANK/' '//
                  C
0047            6000 WRITE ( 1,* )'DO YOU HAVE CITY INFORMATION TO ENTER?'
0048                    CALL YESNO
                  C            YES    NO    ERR
0049            GO TO ( 6010, 6980, 6000 ) YESNO
0050            6010 WRITE ( 1,* )'UPLINK OR DOWNLINK?'
0051                    CALL UPDOWN
0052                    IF ( UPPDOWN .EQ. 3 ) GO TO 6010
                  C
                  CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
                  CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
                  C
                  C    CITY PROCESSING
                  C
                  CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
                  CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
                  C
0053            6015 WRITE ( 1,* )'ENTER CITY COMMAND'
0054                    READ ( 1,7990 ) (INDATA(I),I=1,80)
0055                    CALL GETTER
0056                    BYPASS = 0
0057                    CALL CODCHK ( 3,ARG, 6, CTYCMD,POSITN )
0058                    IF ( POSITN .EQ. 0 ) GO TO 6020
                  C
                  C BRANCH ON UPLINK CITY COMMAND
                  C
                  C            ADD    OVER    MOD    DEL    LIST    EXIT
0059            GO TO (6100, 6050, 6300, 6700, 6800, 6900 ) POSITN
                  C
                  C ERROR IN RESPONSE
                  C
0060            6020 WRITE (1,*) 'INVALID CITY COMMAND'
0061                    WRITE (1,*) 'VALID COMMANDS ARE: ADD,OVER,MOD,DEL,LIST,EXIT'
0062                    GO TO 6015
                  C
                  CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
                  CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
                  C
                  C ADD OR OVERLAY COMMANDS
                  C

```

```
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
CCCCCCCCCCCCCCCC
C
C OVERLAY CITIES
C
CCCCCCCCCCCCCCCC
C
0063 6050 BYPASS = 1
0064 IF ( NUMORG .GT. 0 ) GO TO 6100
C
C NO COST ALLOCATION - INVALID COMMAND IN THIS CASE
C
0065 WRITE (1,*)'INVALID COMMAND UNLESS COST ALLOCATION IS USED'
0066 BYPASS = 0
0067 GO TO 6015
0068 6100 WRITE ( 1,*)'ENTER CITY NAME (/ORG)'
0069 ASSIGN 6100 TO BADD
0070 READ ( 1,7990) (INDATA(I),I=1,80)
0071 MODFLG = 0
0072 CALL GETTER
0073 IF(ARG(1) .EQ. ';') GO TO 6015
0074 CALL CTYCHK ( POSITN,ORGNUM )
C
C POSITN < 0 - ERROR - START OVER
C
C POSITN = 0 AND ORGNUM = 0 - ERROR UNLESS NO COST ALLOCATION - NO CITY
C MATCH AND NO ORGANIZAION MATCH
C
C POSITN > 0 AND ORGNUM = 0 - CITY MATCH AND ORG MATCH
C THIS SITUATION IS ONLY VALID FOR
C MODIFY OR DELETE
C
C POSITN > 0 AND ORGNUM > 0 - EXISTING CITY AND NEW ORGANIZATION
C VALID FOR OVERLAY ONLY
C
C POSITN = 0 AND ORGNUM > 0 - NEW CITY AND NEW ORGANIZATION
C VALID FOR ADD ONLY
C
C ERROR - RETURNED NEGATIVE POSITN
C
0075 IF ( POSITN .LT. 0 ) GO TO BADD
C
C ADD WITH NO COST ALLOCATION
C
0076 IF ( NUMORG .EQ. 0 .AND.
2 POSITN .EQ. 0 .AND.
3 ORGNUM .EQ. 0 ) GO TO 6103
C
C NOT VALID FOR ADD OR OVERLAY
C
C
0077 IF ( POSITN .GT. 0 .AND. ORGNUM .EQ. 0 ) GO TO 6322
C
C OVERLAY
```

CITY.FTN

/TR:BLOCKS/WR

```

C
0070      IF ( BYPASS .EQ. 1 .AND.
           2      POSITN .GT. 0 .AND.
           3      ORGNUM .GT. 0 ) GO TO 6102
C
C      ADD
C
0077      IF ( BYPASS .NE. 1 .AND.
           2      POSITN .EQ. 0 .AND.
           3      ORGNUM .GT. 0 .AND.
           4      NUMORG .GT. 0 ) GO TO 6102
C
0080      IF ( POSITN .EQ. 0 ) GO TO 6315
0081      IF(POSITN .GT. 0) GO TO 6322
C
C
C
0082      6101 WRITE (1,*) 'INVALID RESPONSE - PLEASE RE-ENTER'
0083      GO TO 6015
C
0084      6102 IF ( NCITY(UFPDWN) .LT. MAXCT(UFPDWN)) GO TO 6103
0085      WRITE (1,*) 'ONLY ',MAXCT(UFPDWN),' CITIES CAN BE SPECIFIED'
0086      GO TO 6015
C
0087      6103 NCITY(UFPDWN) = NCITY(UFPDWN) + 1
0088      UD = 'DOWN'
0089      IF ( UFPDWN .EQ. 1 ) UD = 'UP'
0090      IF ( NCITY(UFPDWN) .EQ. MAXCT(UFPDWN)) WRITE (1,7992) UD
0091      7992 FORMAT (1X,'THIS IS THE LAST CITY YOU MAY ADD TO ',A4,'LINK')
0092      IF ( UFPDWN .EQ. 1 ) GO TO 6104
0093      CURENT = NCITY(UFPDWN)
0094      IF(NUMORG .GT. 0 ) DCTORG(CURENT) = ORGNUM
0095      GO TO 6105
0096      6104 CURENT = NCITY(UFPDWN)
0097      IF ( NUMORG .GT. 0 ) DCTORG(CURENT) = ORGNUM
0098      6105 DO 6106 I=1,NCHAR
0099      IF ( UFPDWN .EQ. 1 ) DCTNAM(CURENT,I) = ARG(I)
0100      IF ( UFPDWN .EQ. 2 ) DCTNAM(CURENT,I) = ARG(I)
0101      6106 CONTINUE
0102      IF ( NCHAR .GE. 16 ) GO TO 6110
0103      NCHAR = NCHAR + 1
0104      DO 6107 I=NCHAR,16
0105      IF ( UFPDWN .EQ. 1 ) DCTNAM(CURENT,I) = BLANK
0106      IF ( UFPDWN .EQ. 2 ) DCTNAM(CURENT,I) = BLANK
0107      CONTINUE
0108      6107
0109      6110 IF ( BYPASS .EQ. 1 ) GO TO 6175
C
C      CCCCCCCCCCCCCCCC
C
C      ADD STATE CODE
C
C      CCCCCCCCCCCCCCCC
C
0109      6113 WRITE ( 1,*) 'ENTER THE 2 CHARACTER STATE CODE FOR THIS CITY'
0110      READ ( 1,7990) (INDATA(I),I=1,2)

```

```

0110          DO 6120 I=1,2
0111             IF (UPPDWN.EQ.1) USTCOD(CURRENT,I)=INDATA(I)
0112             IF (UPPDWN.EQ.2) DSTCOD(CURRENT,I)=INDATA(I)
0113          6120  CONTINUE
              C
              CCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
              C
              C ENTER V AND H COORDINATES
              C
              CCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
              C
0114          6130  WRITE (1,*) 'ENTER V COORDINATE OR LATITUDE (-DDMM) FOR THIS CITY'
0115             ASSIGN 6130 TO BADD
0116             READ ( 1,*,ERR=7000) LON
0117             IF ( LON .LT. 0 ) GO TO 6135
0118             IF ( LON .GT. 15000 ) GO TO 7100
0119             IF (UPPDWN.EQ.1) UCITYV(CURRENT)=LON
0120             IF (UPPDWN.EQ.2) DCITYV(CURRENT)=LON
0121             GO TO 6160
              C
              C V COORDINATE INPUT AS LATITUDE
              C
0122          6135  LAT = LON
0123             LATLON = 1
              C
              C ENTER H COORDINATE AS LONGITUDE
              C
0124          6145  WRITE ( 1,* ) 'ENTER THE POSITIVE LONGITUDE (DDMM) FOR THIS CITY'
0125             ASSIGN 6145 TO BADD
0126             READ ( 1,*,ERR=7000) LON
0127             IF ( LON .LT. 0 ) GO TO 7100
0128             CALL VANDH(LAT,LON)
0129             IF ( UPPDWN .EQ. 2 ) GO TO 6150
0130             UCITYV(CURRENT) = LAT
0131             UCITYH(CURRENT) = LON
0132             GO TO 6155
0133          6150  DCITYV(CURRENT) = LAT
0134             DCITYH(CURRENT) = LON
0135          6155  IF ( MODFLG .EQ. 1 ) GO TO 6525
0136             GO TO 6180
              C
              C ENTER HORIZONTAL COORDINATE
              C
0137          6160  WRITE ( 1,* ) 'ENTER HORIZONTAL COORDINATE FOR THIS CITY'
0138             ASSIGN 6160 TO BADD
0139             READ ( 1,*,ERR=7000) LON
0140             IF ( LON .GT. 15000 .OR. LON .LT. 0 ) GO TO 7100
0141             IF (UPPDWN.EQ.1) UCITYH(CURRENT)=LON
0142             IF (UPPDWN.EQ.2) DCITYH(CURRENT)=LON
0143          6170  IF ( MODFLG .EQ. 1 ) GO TO 6525
0144             GO TO 6180
              C
              CCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
              C
              C OVERLAY COMMAND WITH EXISTING CITY
              C
  
```

```
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C
C SET STATE, V AND H, AND ORGANIZATION FROM PREVIOUS CITY DEFINITION
C
0145 6175 IF ( UPPDWN .EQ. 2 ) GO TO 6177
0146      UCTORG(CURRENT) = ORGNUM
0147      USTCOD(CURRENT,1) = USTCOD(POSITN,1)
0148      USTCOD(CURRENT,2) = USTCOD(POSITN,2)
0149      UCITYV(CURRENT) = UCITYV(POSITN)
0150      UCITYH(CURRENT) = UCITYH(POSITN)
0151      GO TO 6180
0152 6177 DCTORG(CURRENT) = ORGNUM
0153      DSTCOD(CURRENT,1) = DSTCOD(POSITN,1)
0154      DSTCOD(CURRENT,2) = DSTCOD(POSITN,2)
0155      DCITYV(CURRENT) = DCITYV(POSITN)
0156      DCITYH(CURRENT) = DCITYH(POSITN)
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C ENTER CHANNEL NUMBER
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
0157 6180 IF ( UPPDWN .EQ. 2 ) GO TO 6185
0158      WRITE ( 1,* )'ENTER CHANNEL NUMBER FOR THIS UPLINK CITY'
0159      ASSIGN 6180 TO BADD
0160      READ ( 1,* ,ERR=7000) LON
0161      IF ( LON .GT. 999 .OR. LON .LT. 0 ) GO TO 7100
0162      UCTCHN(CURRENT) = LON
C
0163      IF ( MODFLG .EQ. 1 ) GO TO 6525
0164      GO TO 6195
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C ENTER HIERARCHICAL LEVEL
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
0165 6185 WRITE ( 1,* )'ENTER HIERARCHICAL LEVEL NUMBER FOR THIS CITY'
0166      ASSIGN 6185 TO BADD
0167      READ ( 1,* ,ERR=7000) LON
0168      IF ( LON .LT. 2 .OR. LON .GT. 100) GO TO 7100
0169      DCTLVL(CURRENT) = LON
0170      IF ( MODFLG .EQ. 1 ) GO TO 6525
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C ENTER VALUES FOR COST INDEXES
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
0171 6195 IF ( UPPDWN .EQ. 2 ) GO TO 6205
0172      IF(NUINDX .EQ. 1 ) GO TO 6213
0173      DO 6200 I=2,NUINDX
```

```

0174     6196   WRITE (1,*) 'ENTER THE VALUE FOR NUMBER OF...'
0175                 ASSIGN 6196 TO BADD
0176                 WRITE (1,6197) (UCINDX(I,J),J=1,5)
0177     6197     FORMAT (2X,8A1)
0178                 READ (1,*,ERR=7000) UCTXVL(CURRENT,I-1)
               C
0179     6200     CONTINUE
0180                 GO TO 6213
               C
0181     6205     IF (NDINDX .EQ. 1) GO TO 6213
0182                 DO 6212 I=2,NDINDX
0183     6206     WRITE (1,*) 'ENTER THE VALUE FOR NUMBER OF...'
0184                 ASSIGN 6206 TO BADD
0185                 WRITE (1,6197) (DCINDX(I,J),J=1,8)
0186                 READ (1,*,ERR=7000) DCTXVL(CURRENT,I-1)
0187                 6212     CONTINUE
               C
0188     6213     IF ( MODFLG .EQ. 1 ) GO TO 6525
               C
               CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
               C
               C ENTER LIST OF PATHS FEASIBLE FOR THIS CITY
               C
               CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
               C
0189     6215     WRITE ( 1,* ) 'ENTER LIST OF PATH NAMES FEASIBLE FOR THIS CITY'
0190                 J = UPPDWN +4
0191                 CALL MATMOD ( J,1, CURRENT)
0192                 IF ( MODFLG .EQ. 1 ) GO TO 6525
0193     6225     IF(UPPDWN .EQ. 1) GO TO 6015
               C
               CCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
               C
               C ENTER TALKBACK HOURS
               C
               CCCCCCCCCCCCCCCCCCCCCCCCCC
               C
0194                 DO 6240 I=1,NUCITY
0195     6235     WRITE (1,6236) (UCTNAM(I,J),J=1,16),UCTORG(I)
0196     6236     FORMAT (1X,'ENTER TALKBACK HOURS TO: ',16A1,'/',I1)
0197                 ASSIGN 6235 TO BADD
0198                 READ(1,*,ERR=7000)TALKBK(CURRENT,I)
0199     6240     CONTINUE
0200                 GO TO 6015
               C
               CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
               CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
               C
               C MODIFY PARAMETERS FOR CITY
               C
               CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
               CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
               C
0201     6300     WRITE ( 1,* ) 'ENTER NAME OF CITY (/ORG) TO MODIFY'
0202                 ASSIGN 6015 TO BADD
0203                 READ ( 1,7990) (INDATA(I),I=1,80)

```



```
0204      CALL GETTER
0205      IF ( ARG(1) .EQ. 'I' ) GO TO 6015
0206      CALL CTYCHK ( POSITN,ORGNUM )
0207      IF ( POSITN .GT. 0 .AND. ORGNUM .EQ. 0 ) GO TO 6325
0208      IF(POSITN .GT. 0 ) GO TO 6320
C
0209      IF ( POSITN .LT. 0 ) GO TO 6300
0210      6305 IF ( ORGNUM .GT. 0 ) GO TO 6320
C
C CHECK FOR EXISTANCE OF CITY/ORGANIZATION COMBINATION
C
C CITY DOES NOT EXIST
C
0211      6315 WRITE (1,*) 'CITY DOES NOT EXIST'
0212      GO TO 6015
C
C CITY/ORGANIZATION COMBO DOES NOT EXIST
C
0213      6320 WRITE (1,*) 'CITY/ORG COMBINATION DOES NOT EXIST'
0214      GO TO 6015
C
C
0215      6322 WRITE ( 1,*)'CITY AND ORG COMBINATION ALREADY EXIST'
0216      GO TO 6015
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C ENTER MODIFY SUBCOMMAND
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C
0217      6325 CURENT = POSITN
0218      6327 WRITE ( 1,* ) 'ENTER CITY MODIFY SUBCOMMAND'
0219      MODFLG = 0
0220      READ ( 1,7990) (INDATA(I),I=1,80)
0221      CALL GETTER
0222      CALL CODCHK ( 4,ARG,10,'ODSUB,POSITN)
0223      IF ( POSITN .EQ. 0 ) GO TO 6330
C
C BRANCH ON MODIFY SUBCOMMAND
C
0224      MODFLG=1
C
C VAND CHAN CHLV INDE ADDP DELP CHGP CHGN TALK EXIT
0225      GO TO ( 6130,6380,6390,6195,6215,6350,6600,6625,6630,6015) POSITN
C
C NO SUCH MODIFY COMMAND
C
0226      6330 WRITE (1,*) 'INVALID SUBCOMMAND'
0227      WRITE(1,*)'COMMANDS ARE: VAND,CHAN,CHLV,INDE,ADDP,DELP,CHGP,TALK,E
2XIT'
0228      GO TO 6327
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C CHANGE CHANNEL ASSIGNMENT
```

```

C
CCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
0229 6380 IF ( UPPDWN .NE. 2 ) GO TO 6180
0230      WRITE (1,*) 'THIS COMMAND VALID ONLY FOR UPLINK CITIES'
0231      GO TO 6327
C
CCCCCCCCCCCCCCCC
C
C CHANGE LEVEL
C
CCCCCCCCCCCCCCCC
C
0232 6390 IF ( UPPDWN .NE. 1 ) GO TO 6185
0233      WRITE (1,*) 'THIS COMMAND VALID ONLY FOR DOWNLINK CITIES'
0234      GO TO 6327
C
C
C FINISHED WITH MODIFY - RESET FLAG AND ASK FOR ANOTHER COMMAND
C
0235 6525 MODFLG=0
0236      GO TO 6327
C
CCCCCCCCCCCCCCCC
C
C DELETE A PATH
C
CCCCCCCCCCCCCCCC
C
0237 6550 WRITE ( 1,* ) 'ENTER LIST OF PATH NAMES TO DELETE FROM THIS CITY'
0238      J=UPPDWN + 4
0239      CALL MATHOD ( J,0,CURENT )
0240      GO TO 6327
C
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C CHANGE PATHS ( REPLACE PATHS )
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C
0241 6600 DO 6610 I = 1, NUPATH
0242 6610      UPTHCY ( I, CURENT ) = 0
0243      WRITE (1,*) 'ENTER A NEW LIST OF PATH NAMES FOR THIS CITY'
0244      J=UPPDWN + 4
0245      CALL MATHOD ( J,1,CURENT)
0246      MODFLG = 1
0247      GO TO 6327
C
CCCCCCCCCCCCCCCCCCCC
C
C CHANGE CITY NAME
C
CCCCCCCCCCCCCCCCCCCC
C

```

CITY.FTN /TR:BLOCKS/WR

```

0249 6625 WRITE ( 1,*)'ENTER NEW NAME FOR THIS CITY'
0250      ASSIGN 6625 TO BADD
0251      READ ( 1,7990)(INDATA(I),I=1,80)
0252      CALL GETTER
0253      IF ( UPPDWN .EQ. 1)CALL LODCHK(NCHAR,ARG,MAXUCT,UCTNAM,POSITN)
0254      IF(UPPDWN .EQ. 2 ) CALL CODCHK(NCHAR,ARG,MAXDCT,DCTNAM,POSITN)
0255      IF ( POSITN .GT.0) GO TO 6322
0256      IF ( UPPDWN .EQ. 2) GO TO 6628
0257      DO 6627 I=1,NCHAR
0258 6627 UCTNAM(CURRENT,I) = ARG(I)
0259      GO TO 6630
0260 6628 DO 6629 I=1,NCHAR
0261 6629 DCTNAM(CURRENT,I) = ARG(I)
0262 6630 IF ( NCHAR .GE. 16 ) GO TO 6640
0263      NCHAR=NCHAR+1
0264      DO 6640 I=NCHAR,16
0265          IF (UPPDWN.EQ.1) UCTNAM(CURRENT,I)=BLANK
0266          IF (UPPDWN.EQ.2) DCTNAM(CURRENT,I)=BLANK
0267 6640 CONTINUE
0268      GO TO 6327
    
```

```

C
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C CHANGE TALKBACK PARAMETERS
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
    
```

```

0269 6650 IF ( UPPDWN .EQ. 1 ) GO TO 6390
0270 6651 WRITE ( 1,*)'ENTER UPLINK CITY NAME (/ORG) '
0271      ASSIGN 6651 TO BADD
0272      READ ( 1,7990) (INDATA(I),I=1,80)
0273      CALL GETTER
0274      IF ( ARG(1) .EQ. 'I' ) GO TO 6327
    
```

```

C
C UPPDWN MUST BE 1 TO CHECK UPLINK CITIES
C
    
```

```

0275      UPPDWN = 1
0276      CALL CTYCHK(POSITN,ORGNUM)
0277      UPPDWN=2
0278      IF(POSITN .LT. 0 ) GO TO 6651
0279      IF (POSITN .EQ. 0 ) GO TO 6315
0280      IF ( POSITN .GT. 0 .AND. ORGNUM .EQ. 0 ) GO TO 6652
0281      GO TO 6320
0282 6652 TALKBK(POSITN,CURRENT) = 0
0283 6653 WRITE ( 1,*)'ENTER TALKBACK HOURS'
0284      ASSIGN 6653 TO BADD
0285      READ ( 1,*,ERR=7000) XLON
0286      IF(XLON .LT. 0 .OR. XLON .GT. 9999.9) GO TO 7100
0287      TALKBK(CURRENT,POSITN ) = XLON
0288      GO TO 6327
    
```

```

C
C NO SUCH CITY
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
    
```

```
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C DELETE A CITY FROM THE SCENARIO
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
0288 6700 WRITE ( 1,* ) 'ENTER CITY (/ORG) TO BE DELETED'
0289      ASSIGN 6700 TO BADD
0290      READ ( 1,7990) (INDATA(I),I=1,80)
0291      CALL GETTER
0292      IF(ARG(1) .EQ. '') GO TO 6015
0293      CALL CTYCHK ( POSITN,ORGNUM )
0294      IF ( POSITN .LT. 0 ) GO TO 6700
0295      IF ( POSITN .EQ. 0 .OR. ORGNUM .NE. 0 ) GO TO 6320
0296      IF ( POSITN .GT. 0 .AND. ORGNUM .EQ. 0 ) GO TO 6710
0297      IF(POSITN .GT. 0 ) GO TO 6700
0298      GO TO 6305
0299 6710 J=UPPDWN +4
0300      CALL DISAPR ( J,POSITN )
0301      IF (UPPDWN.EQ.1.AND.NUCITY.EQ.0.OR.UPPDWN.EQ.2.AND.NDCITY.EQ.0)
0302          2 GO TO 6806
0302          GO TO 6015
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C LIST INFORMATION PERTAINING TO CITY
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
0303 6800 IF (UPPDWN.EQ.1.AND.NUCITY.EQ.0.OR.UPPDWN.EQ.2.AND.NDCITY.EQ.0)
0304          2 GO TO 6806
0304      WRITE ( 1,* ) 'ENTER CITY LIST SPECIFICATION'
0305      READ ( 1,7990) (INDATA(I),I=1,80)
0306      CALL GETTER
0307      CALL CDBCHK(4,ARG,8,CTLSTS,POSITN)
0308      IF ( POSITN .EQ. 0 ) GO TO 6805
C
C
C INDE PATH PNAM TALK ORGS ALL CITY ;
0309      GO TO ( 6810, 6830, 6840, 6850, 6860, 6870, 6865, 6015) POSITN
C
C NO SUCH COMMAND
C
0310 6805 WRITE (1,*) 'INVALID LIST OPTION'
0311      WRITE(1,*) 'VALID COMMANDS: INDE, PATH, PNAM, TALK, ORGS, ALL, CITY
0312          2'
0312          GO TO 6800
C
0313 6806 WRITE (1,*) 'ALL CITIES HAVE BEEN DELETED'
0314      GO TO 6015
CCCCCCCC
C
C INDEXES
C
```

```
CCCCCCCCC
C
0315 6810 CALL REPRTR ( 5, 1 )
0316 GO TO 6015
C
CCCCCCC
C
C PATHS
C
CCCCCCC
C
0317 6830 CALL REPRTR ( 4, 1 )
0318 GO TO 6015
C
0319 6840 CALL REPRTR ( 3, 1 )
0320 GO TO 6015
C
CCCCCCCCCC
C
C TALKBACK
C
CCCCCCCCCC
C
0321 6850 CALL REPRTR ( 6, 1 )
0322 GO TO 6015
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C ORGANIZATION NAMES AND NUMBERS
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
0323 6860 CALL REPRTR ( 7, 1 )
0324 GO TO 6015
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C PRINT CITY NAMES, ORGANIZATIONS, AND STATES
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
0325 6865 CALL REPRTR ( 10, 1 )
0326 GO TO 6015
C
CCCCCCCCCCCCCCCCCCCC
C
C ALL OF THE ABOVE
C
CCCCCCCCCCCCCCCCCCCC
C
0327 6870 CALL REPRTR ( 5, 1 )
0328 CALL REPRTR ( 4, 1 )
0329 CALL REPRTR ( 6, 1 )
0330 CALL REPRTR ( 7, 1 )
0331 CALL REPRTR ( 10, 1 )
0332 GO TO 6015
```

```
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C EXIT FROM CITY
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
0333 6900 IF(UPPDWN .EQ. 2 ) GO TO 6980
0334 WRITE (1,*) 'DO YOU WANT TO MODIFY DOWNLINK CITY DATA?'
0335 CALL YESNO
C
C          YES  NO   ERR
0336 GO TO ( 6910, 6980, 6900) YESNO
0337 6910 UPPDWN = 2
0338 GO TO 6015
0339 6980 RETURN
0340 7000 WRITE (1,*) 'ERROR IN NUMERICAL READ -- PLEASE RETYPE'
0341 GO TO BADD
0342 7100 WRITE (1,*) 'SPECIFIED VALUE IS OUT OF RANGE:',LON
0343 GO TO BADD
0344 7990 FORMAT ( 80A1)
0345 7991 FORMAT(1X,'COMMANDS: ',12(1X,4A1))
0346 END
```

RATE.FTN /TR:BLOCKS/WR

0001 SUBROUTINE RATE

C

RATE MODULE

C

C

C THE RATE MODULE IS FOR THE PURPOSE OF ADDING OR MODIFYING
 C TELEPHONE CHARGES, INTEREST RATES, OR GENERAL AND ADMINISTRATIVE
 C COSTS. THE INTEREST AND GENERAL RATES PERTAIN TO THE NETWORK(S)
 C AS A WHOLE AND THUS ARE NOT DIVIDED BETWEEN UPLINK AND DOWNLINK.

C

C VARIABLES

C

C DDDCPH - DIRECT DIAL COST PER HOUR

C

C DDDINS - DIRECT DIAL INSTALLATION COST

C

C DDDLES - DIRECT DIAL LEASE COST PER MONTH

C

C DISCNT - DISCOUNT RATE FOR AMORTIZATION

C

C EQPLIF - NUMBER OF YEARS OF EQUIPMENT LIFE (FOR AMORTIZING
 C CAPITAL EXPENDITURES)

C

C GANDAD - ARRAY OF THE FOUR COSTS FOR GENERAL AND
 C ADMINISTRATIVE COSTS FOR CAPITAL, LEASE, INSTALLATION
 C AND OPERATIONS AND MAINTENANCE

C

C PVTLES - PRIVATE LINE MONTHLY LEASE CHARGE FOR A
 C GIVEN CITY PAIR IN TALKBACK SEGMENT

C

C PVTFIX - PRIVATE LINE ZERO MILEAGE MONTHLY CHARGE

C

C PVTINS - PRIVATE LINE INSTALLATION CHARGE

C

C PVTMIL - PRIVATE LINE MONTHLY LEASE CHARGE PER MILE

C

C TLKCAP - ADDED CAPITAL EXPENDITURES REQUIRED FOR ADDING VOICE
 C TALKBACK

C

C WATINS - WATS INSTALLATION CHARGE

C

C WATCHPH - WATS CHARGE PER HOUR OF UTILIZATION

C

C WATLES - WATS LEASE CHARGE PER MONTH

C

C WATMAX - MAXIMUM MONTHLY CHARGE FOR WATS

C

C SUBROUTINE CALLS: GETTER, CODCHK, YESNO, RATECK, REPRT

C

C CALLED BY: BUILD

C

0002 INCLUDE 'SY0:COMBLK.FTN/NOLIST'

C

C LOCAL VARIABLES

C

0040 LOGICAL*1 RATECD(8,4)

0041 INTEGER*2 XDAT

RATE.FTN

/TR:BLOCKS/WR

```

0042      DATA RATECD/'P','W','D','I','G','T','L','E',
          2          'R','A','D','N','A','A','I','X',
          3          'I','T','D','T','L','S','I',
          4          'U','S',' ',' ',' ','K','T','T'/
C
0043      8000 WRITE ( 1,* )'DO YOU HAVE RATE INFORMATION TO ENTER?'
0044      CALL YESNO
C
C          YES NO ERR
0045      GO TO ( 8010, 8800, 8000 ) YESNO
0046      8010 WRITE ( 1,* )'ENTER RATE COMMAND'
0047      READ ( 1,8990) (INDATA(I),I=1,80)
0048      CALL GETTER
0049      CALL CODCHK (4,ARG,8,RATECD,POSITN)
0050      IF ( POSITN .EQ. 0 ) GO TO 8015
C
C BRANCH ON RATE COMMAND
C
C          PRIV WATS DDD INT GA TALK LIST EXIT
0051      GO TO (8100,8200,8300,8400,8500,8600,8700,8800) POSITN
C
C INVALID COMMAND
C
0052      8015 WRITE (1,*) 'INVALID RATE COMMAND'
0053      WRITE(1,*)'VALID COMMANDS: PRIV,WATS,DDD,INT,GA,TALK,LIST,EXIT'
0054      GO TO 8010
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C MODIFY PRIVATE LINE COSTS
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
0055      8100 WRITE ( 1,* )'PRIVATE LINE CHARGES'
0056      WRITE ( 1,* )' INSTALLATION ZERO CHG/MO CHG/MILE/MO'
0057      WRITE ( 1,8991) PVTINS,PVTFIX,PVTMIL
0058      WRITE ( 1,* )'N=      1          2          3'
0059      8105 WRITE ( 1,* )'ENTER CHANGE : N,VALUE OR 0,0 TO END'
0060      ASSIGN 8105 TO BADD
0061      READ ( 1,* ,ERR=8115) XDAT, XDATA(2)
0062      IF ( XDAT .EQ. 0 .AND. XDATA(2) .EQ. 0 ) GO TO 8010
0063      CALL RATECK ( 1,3,XDAT )
0064      IF (POSITN .EQ. 0 ) GO TO 8105
C
C          INS FIX MIL
0065      GO TO ( 8120, 8140, 8160 ) XDAT
C
C ERROR IN RESPONSE
C
0066      8115 WRITE (1,*)'ERROR IN NUMERICAL READ - PLEASE RETYPE'
0067      GO TO BADD
0068      8120 PVTINS=XDATA(2)
0069      GO TO 8105
0070      8140 PVTFIX=XDATA(2)
0071      GO TO 8105
0072      8160 PVTMIL=XDATA(2)

```



```

0073      GO TO 8105
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C MODIFY WATS CHARGES
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
0074      8200 WRITE ( 1,* )'WATS CHARGES'
0075      WRITE ( 1,* )'  INSTALLATION  ZERO CHG/MO      CHG/HR      MAX CHG'
0076      WRITE ( 1,8992) WATINS,WATLES,WATCPH,WATMAX
0077      WRITE ( 1,* )'N=      1      2      3      4'
0078      8205 WRITE ( 1,* )'ENTER CHANGE:  N,VALUE  OR 0,0 TO END'
0079      ASSIGN 8205 TO BADD
0080      READ ( 1,* ,ERR=8115) XDAT, XDATA(2)
0081      IF ( XDAT .EQ. 0 .AND. XDATA(2) .EQ. 0 ) GO TO 8010
0082      CALL RATECK ( 1,4, XDAT )
0083      IF ( POSITN .EQ. 0 ) GO TO 8205
C
C      INS  LES  CPH  MAX
0084      GO TO( 8220, 8240, 8260, 8280 ) XDAT
C
0085      8220 WATINS=XDATA(2)
0086      GO TO 8205
0087      8240 WATLES=XDATA(2)
0088      GO TO 8205
0089      8260 WATCPH=XDATA(2)
0090      GO TO 8205
0091      8280 WATMAX=XDATA(2)
0092      GO TO 8205
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C MODIFY DIRECT DIAL CHARGES
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
0093      8300 WRITE ( 1,* )'DIRECT DIAL CHARGES'
0094      WRITE ( 1,* )'  INSTALLATION  PER MINUTE  ZERO CHG/MO'
0095      WRITE (1,8991) DDDINS, DDDCPM, DDDLES
0096      WRITE ( 1,* )'N=      1      2      3'
0097      8305 WRITE ( 1,* )'ENTER CHANGE:  N,VALUE  OR 0,0 TO END'
0098      ASSIGN 8305 TO BADD
0099      READ ( 1,* ,ERR=8115) XDAT, XDATA(2)
0100      IF ( XDAT .EQ. 0 .AND. XDATA(2) .EQ. 0 ) GO TO 8010
0101      CALL RATECK ( 1,3,XDAT)
0102      IF ( POSITN .EQ. 0 ) GO TO 8305
C
C      DDINS DDCPM DDLES
0103      GO TO ( 8320, 8340, 8360 ) XDAT
C
0104      8320 DDDINS=XDATA(2)
0105      GO TO 8305
0106      8340 DDDCPM=XDATA(2)
0107      GO TO 8305
0108      8360 DDDLES=XDATA(2)

```

```
0109 GO TO 8305
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C MODIFY INTEREST INFORMATION
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
0110 8400 WRITE ( 1,* )'INTEREST RATES'
0111 WRITE ( 1,* )' EQUIPMENT LIFE (YEARS) DISCOUNT (X)'
0112 WRITE ( 1,8993) EQPLIF,DISCNT
0113 WRITE ( 1,* )'N= 1 2'
0114 8405 WRITE ( 1,* )'ENTER CHANGE: N,VALUE OR 0,0 TO END'
0115 ASSIGN 8405 TO BADD
0116 READ ( 1,*,ERR=8115) XDAT, XDATA(2)
0117 IF ( XDAT .EQ. 0 .AND. XDATA(2) .EQ. 0 ) GO TO 8010
0118 CALL RATECK ( 1,2,XDAT )
0119 IF ( POSITN .EQ. 0 ) GO TO 8405
C
C EQUIP DISCNT
0120 GO TO ( 8420, 8430 ) XDAT
C
0121 8420 EQPLIF=XDATA(2)
0122 GO TO 8405
0123 8430 DISCNT=XDATA(2)
0124 GO TO 8405
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C MODIFY GENERAL AND ADMINISTRATIVE EXPENSES
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
0125 8500 WRITE ( 1,* )'GENERAL AND ADMINISTRATIVE EXPENSES'
0126 WRITE (1,*)' CAPITAL INSTALLATION LEASE OP AND MAIN
2T'
0127 WRITE ( 1,8992) (GANDAD(I),I=1,4)
0128 WRITE (1,*)'N= 1 2 3 4'
0129 8505 WRITE ( 1,* )'ENTER CHANGE: N,VALUE OR 0,0 TO END'
0130 ASSIGN 8505 TO BADD
0131 READ ( 1,*,ERR=8115) XDAT, XDATA(2)
0132 IF ( XDAT .EQ. 0 .AND. XDATA(2) .EQ. 0 ) GO TO 8010
0133 CALL RATECK ( 1,4,XDAT)
0134 IF ( POSITN .EQ. 0 ) GO TO BADD
C
0135 GANDAD(XDAT)=XDATA(2)
0136 GO TO 8505
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C MODIFY TALKBACK CAPITAL EXPENDITURES
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
0137 8600 WRITE ( 1,* )'TALKBACK CAPITAL COSTS'
0138 WRITE ( 1,8994) TLKCAF
```

```
0139 8605 WRITE ( 1,* )'ENTER NEW VALUE'  
0140      ASSIGN 8605 TO BADD  
0141      READ ( 1,*,ERR=8115)TLKCAP  
0142      GO TO 8010  
C  
C  
C LIST RATE INFORMATION  
C  
C  
0143 8700 CALL REPRTR ( 8)  
0144      GO TO 8010  
C  
C  
C EXIT FROM RATE  
C  
C  
0145 8800 RETURN  
0146 8990 FORMAT ( B0A1)  
0147 8991 FORMAT ( 2X,3(2X, F9.2, 3X ) )  
0148 8992 FORMAT ( 2X,4( 2X, F9.2, 3X ) )  
0149 8993 FORMAT ( 2X,2(6X, F9.2, 5X ) )  
0150 8994 FORMAT ( F9.2)  
0151      END
```

SECTION 2. MODEL MODULE

Section 2 includes listings for the extended common area description, the main program for the MODEL module, and the following subroutines:

MODUP
MODDN
MODTK

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0000

THIS IS THE EXTENSION TO THE COMMON AREA 'INCLUDED' IN THE MODEL PROGRAMS. THE FILE NAME IS 'MOBBLK'.

```
INTEGER*2 NUPREF(80)
COMMON NUPREF
REAL*4 UORGCS(9,5), DORGCS(9,5), TORGCS(9,5), AORGCS(9,5), XORGCS(9,5)
COMMON UORGCS, DORGCS, TORGCS, AORGCS, XORGCS
REAL*4 WGTARR(80)
COMMON WGTARR
REAL*4 UFTIDX(10,6,5), DFTIDX(20,6,5), UCOSTX(10,4), DCOSTX(80,4)
COMMON UFTIDX, DFTIDX, UCOSTX, DCOSTX
REAL*4 CAPCST, INSCST, LESCST, OMACST, AMORT
COMMON CAPCST, INSCST, LESCST, OMACST, AMORT
REAL*4 ANNL(80), TCOST(6,5)
COMMON ANNL, TCOST
REAL*4 CILO(5,2), PER, BLANK, UPORDN(2,2)
COMMON CILO, PER, BLANK, UPORDN
LOGICAL*1 RUNSEC(4), REPNUM(20), REPLST(20,2)
COMMON RUNSEC, REPNUM, REPLST
```

```

C
C      THIS IS THE MAIN PROGRAM FOR THE COST SECTION OF THE MODEL
C
C      SUBROUTINE CALLS: READIN, GETTER, REPRTR, CODCHK,
C                        MODUP, MODDN, MODTK
C
0001      INCLUDE 'DK2:COMBLK.FTN/NOLIST'
0039      INCLUDE 'DK2:MODBLK.FTN/NOLIST'
0056      LOGICAL*1 LBLANK
C
C      DATA INITIALIZATIONS
C
0057      DATA LBLANK // //
0058      DATA BPUT //PUT //, BWATS //WATS//, BDDD //DDD //
0059      DATA CILO //CAPI', 'INST', 'LEAS', 'O&M$', 'ANNU',
2         'TAL', 'ALL', 'E', 'A', 'ALZD'//
0060      DATA PER //PER //, BLANK // //
0061      DATA UPORDN // UP', 'DOWN', 'LINK', 'LINK'//
0062      DATA UCINDX //F',5* //, I',5* //, X',5* //, E',5* //, D',23* //
0063      DATA DCINDX //F',5* //, I',5* //, X',5* //, E',5* //, D',23* //
0064      DATA REPLST //1',2',3',4',5',6',7',8',9',10*'1', 'A',
2         9* //, '0', '1', '2', '3', '4', '5', '6', '7', '8', '9', 'L'//
0065      DATA REPNUM /20*0/
0066      DATA MAXUCS,MAXDCS,MAXUFA,MAXDFA,MAXUCT,MAXDCT /15,30,10,20,10,80/
0067      DATA UORGCS /45*0./, DORGCS /45*0./, TORGCS /45*0./, XORGCS/45*0./
0068      DATA WGTARR /80*0./
0069      DATA UPTIDX /300*0./, DPTIDX /600*0./
0070      DATA UCOSTX /40*0./, DCOSTX /320*0./, TCOST /30*0./
C
C      READ IN SCENARIO
C
0071      CALL READIN
C
C      NOW DETERMINE WHICH REPORTS ARE REQUESTED
C
0072      160 WRITE(1,*) 'INDICATE THE REPORT NUMBERS YOU WISH TO SEE'
0073      WRITE (1,*) 'ENTER THE NUMBERS (1-19) SEPARATED BY COMMAS AND'
0074      WRITE (1,*) 'TERMINATE WITH A ';' OR SIMPLY ENTER 'ALL' FOR ALL RE
2        2PORTS'
0075      READ(1,1000) (INDATA(I),I=1,80)
0076      170 CALL GETTER
0077      IF (ARG(1).EQ.';') GO TO 220
0078      IF (NCHAR.EQ.1) ARG(2) = LBLANK
0079      CALL CODCHK (2,ARG,20,REPLST,POSITN)
0080      IF (POSITN.LE.0) GO TO 190
0081      IF (POSITN.EQ.20) GO TO 200
0082      REPNUM(POSITN) = 1
0083      180 IF (CONTCO.EQ.0) GO TO 160
0084      IF (CONTCO.EQ.1) GO TO 170
C
C      ERROR--INVALID REPORT SPECIFIED
C
0085      190 WRITE (1,1001) ARG(1),ARG(2)
0086      GO TO 180
C
C      ALL REPORTS DESIRED

```

```

C
0087 200 DO 210 I=1,19
0088 210 REPNUM(I) = 1
C
C CALCULATE INTEREST RATE AMORTIZATION FACTOR
C
0089 220 NYEARS = IFIX(EQPLIF)
0090 AMORT = 0.
0091 DO 230 I=1,NYEARS
0092 230 AMORT = (AMORT + 1.)/(1. + DISCNT/100.)
C
C INTEREST RATE, EQUIP. LIFE, AND MISC. ASSUMPTIONS REPORT
C
0093 IF (REPNUM(1).EQ.0) GO TO 240
0094 WRITE (3,1002) (TITLE(I),I=1,72)
0095 CALL REPRTR (8,1)
C
C UPLINK SEGMENT
C
0096 240 UPFDWN = 1
0097 CALL MODUP
C
C DOWNLINK SEGMENT
C
0098 UPFDWN = 2
0099 CALL MODDN
C
C VOICE TALKBACK AND SUMMARY
C
0100 CALL MODTK
0101 STOP
C
C FORMAT STATEMENTS
C
0102 1000 FORMAT (80A1)
0103 1001 FORMAT (1H0,'INVALID REPORT NUMBER: ',2A1,/)
0104 1002 FORMAT (1H1,72A1)
0105 END
```

MODUP.FTN

/TR:BLOCKS/WR

```

0001      SUBROUTINE MODUP
          C
          C      THIS SUBROUTINE DOES THE CALCULATIONS FOR THE UPLINK SEGMENT
          C      OF THE MODEL.
          C
          C      SUBROUTINE CALLS: REPRTR, VANDM
          C
0002      INCLUDE 'DK2:COMBLK.FTN/NOLIST'
0040      INCLUDE 'DK2:MODBLK.FTN/NOLIST'
          C
          C      COST ELEMENT DATA
          C
0057      IF (REPNUM(2).NE.1) GO TO 110
0058      WRITE (3,1001) (TITLE(I),I=1,72)
0059      WRITE(3,1002) UPORDN(1,1),UPORDN(1,2)
0060      DO 100 I=1,NUELEM
0061      CALL REPRTR (1,I)
0062      100 CONTINUE
          C
          C      PRINT COST/PATH MATRIX
          C
0063      110 IF (REPNUM(3) .EQ. 0) GO TO 112
0064      WRITE (3,1001) (TITLE(I),I=1,72)
0065      CALL REPRTR (2,1)
          C
          C      PATH/CITY MATRIX
          C
0066      112 IF (REPNUM(4) .EQ. 0) GO TO 114
0067      WRITE (3,1001) (TITLE(I),I=1,72)
0068      CALL REPRTR (4,1)
          C
          C      CITY COST INDEXES
          C
0069      114 IF (REPNUM(5) .EQ. 0) GO TO 116
0070      WRITE (3,1001) (TITLE(I),I=1,72)
0071      CALL REPRTR (5,1)
          C
          C      MATRIX OF TALKBACK REQUIREMENTS
          C
0072      116 IF (REPNUM(6) .EQ. 0) GO TO 118
0073      WRITE (3,1001) (TITLE(I),I=1,72)
0074      CALL REPRTR (6,1)
          C
          C      CALCULATE COSTS OF UPLINK PATHS, BY COST INDEX
          C
0075      118 DO 130 J=1,NUPATH
0076      DO 130 I=1,NUELEM
0077      DO 130 M=1,NUINDX
0078      DO 120 L=1,4
0079      N = UCSPTH(I,J)
0080      120 UPTIDX(J,M,L) = UPTIDX(J,M,L) + FLOAT(N)*UCSDAT(I,M,L)
0081      130 UPTIDX(J,M,5) = UPTIDX(J,M,5) + FLOAT(N)*
          2 ((UCSDAT(I,M,1)+UCSDAT(I,M,2))/AMORT+UCSDAT(I,M,3)+UCSDAT(I,M,4))
          C
          C      COST SENSITIVITY REPORT
          C

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MODUP.FTN

/TR:BLOCKS/WR

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0082      IF (REPNUM(7).NE.1) GO TO 160
0083      WRITE (3,1001) (TITLE(I),I=1,72)
0084      WRITE (3,1020) UPORDN(1,1),UPORDN(1,2)
0085      DO 150 I=1,NUPATH
0086      WRITE (3,1021) I, (UPTHNM(I,J),J=1,20)
0087      IF (NUINDX.GT.1) WRITE (3,1022) (PER,J=2,NUINDX)
0088      WRITE (3,1023) ((UCINDX(J,K),K=1,8),J=1,NUINDX)
0089      DO 140 J=1,5
0090      140  WRITE (3,1024) CILO(J,1),CILO(J,2),(UPTIDX(I,K,J),K=1,NUINDX)
0091      150  CONTINUE
C
C      IF COST ALLOCATION SPECIFIED, REMOVE MULTIPLE CITY LISTINGS
C
0092      160  IF (NUMORG.EQ.0) GO TO 250
0093      DO 240 K=1,NUCITY
0094      WGTARR(K) = UDXWHT(1)
0095      IF (NUINDX.EQ.1) GO TO 180
0096      DO 170 L=2,NUINDX
0097      170  WGTARR(K) = WGTARR(K) + UCTXVL(K,L-1)*UDXWHT(L)
0098      IF (WGTARR(K).LE.0.0) WGTARR(K) = 1.0
0099      180  IF (K.EQ.1) GO TO 240
0100      DO 230 I=1,K-1
0101      DO 190 J=1,16
0102      IF (UCTNAM(K,J).NE.UCTNAM(I,J)) GO TO 230
0103      190  CONTINUE
0104      DO 200 J=1,NUINDX-1
0105      200  UCTXVL(I,J) = UCTXVL(I,J) + UCTXVL(K,J)
0106      DO 210 J=1,NDCITY
0107      210  TALKBK(J,I) = TALKBK(J,I) + TALKBK(J,K)
0108      DO 220 J=1,NUPATH
0109      220  UPTHCY(I,J) = UPTHCY(I,J) .OR. UPTHCY(K,J)
0110      UCITYV(K) = -1
0111      GO TO 240
0112      230  CONTINUE
0113      240  CONTINUE
C
C      CALCULATE COSTS FOR UPLINK PATHS BY CITY, AND CHOOSE THE BEST
C      ONE. THEN ADD 'CHOSEN' PATH COSTS TO TOTALS FOR SUMMARY TABLE
C
0114      250  IF (REPNUM(8).EQ.0) GO TO 255
0115      WRITE (3,1001) (TITLE(I),I=1,72)
0116      WRITE (3,1034) UPORDN(1,1),UPORDN(1,2)
0117      255  DO 350 K=1,NUCITY
0118      INDIC = 0
0119      IF (UCITYV(K).EQ.-1) GO TO 350
0120      IF (UCITYV(K).LT.0) CALL VANDH(UCITYV(K),UCITYH(K))
0121      BOTTOM=1.E38
0122      DO 310 J=1,NUPATH
0123      IF (UPTHCY(J,K).EQ.0) GO TO 310
C      OMIT LEASE CALCULATIONS, BECAUSE OF THE MINIMUM VARIABLE
0124      CAPCST = UPTIDX(J,1,1)
0125      INSCST = UPTIDX(J,1,2)
0126      OHACST = UPTIDX(J,1,4)
0127      IF (NUINDX.EQ.1) GO TO 270
0128      DO 260 M=2,NUINDX
0129      CAPCST = CAPCST + UPTIDX(J,M,1)*UCTXVL(K,M-1)

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MODUP.FTN

/TR:BLOCKS/WR

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0130          INSCST = INSCST + UPTIDX(J,M,2)*UCTXVL(K,M-1)
0131    260    OMACST = OMACST + UPTIDX(J,M,4)*UCTXVL(K,M-1)
          C
          C    CALCULATE LEASE COSTS
          C
0132    270    LESCST = 0.
0133          DO 290 I=1,NUELEM
0134          TEMP=0.
0135          IF (UCSPTH(I,J).EQ.0) GO TO 290
0136          TEMP = TEMP + UCSDAT(I,1,3)
0137          IF (NUINDX.EQ.1) GO TO 290
0138          DO 280 M=2,NUINDX
0139    280    TEMP = TEMP + UCSDAT(I,M,3)*UCTXVL(K,M-1)
0140          IF (TEMP.LT.UCSMIN(I)) TEMP=UCSMIN(I)
0141          LESCST = LESCST +TEMP
0142    290    CONTINUE
0143          ANNL(J) = (CAPCST+INSCST)/AMORT + LESCST + OMACST
          C    COMPARE ANNUALIZED COST WITH BEST PREVIOUS PATH
0144          IF (REPNUM(8).NE.1) GO TO 300
0145          IF (INDIC.EQ.0) WRITE (3,1035) (UCTNAM(K,M),M=1,16),J,
          2          CAPCST,INSCST,LESCST,OMACST,ANNL(J)
0146          IF (INDIC.EQ.1) WRITE (3,1036) J,
          2          CAPCST,INSCST,LESCST,OMACST,ANNL(J)

0147    300    INDIC = 1
0148          IF (ANNL(J).GE.BOTTOM) GO TO 310
0149          NUPREF(K) = J
0150          BOTTOM = ANNL(J)
0151    310    CONTINUE
0152          N=NUPREF(K)
0153          DO 340 L=1,4
0154          UCOSTX(K,L) = UPTIDX(N,1,L)
0155          IF (NUINDX.EQ.1) GO TO 330
0156          DO 320 M=2,NUINDX
0157          UCOSTX(K,L) = UCOSTX(K,L) + UPTIDX(N,M,L)*UCTXVL(K,M-1)
0158    320    CONTINUE
0159    330    IF (L.NE.3) TCOST(1,L) = TCOST(1,L) + UCOSTX(K,L)
0160    340    CONTINUE
0161          UCOSTX(K,3)=BOTTOM-UCOSTX(K,4)-(UCOSTX(K,1)+UCOSTX(K,2))/AMORT
0162          TCOST(1,3) = TCOST(1,3) + UCOSTX(K,3)
0163          TCOST(1,5) = TCOST(1,5) + BOTTOM
0164    350    CONTINUE
          C
          C    DO COST ALLOCATION CALCULATIONS
          C
0165          IF (NUMORG.EQ.0) GO TO 410
0166          DO 400 I=1,NUCITY
0167          TOTWGT=0.
0168          DO 380 J=1,NUCITY
0169          DO 360 K=1,16
0170          IF(UCTNAM(I,K).NE.UCTNAM(J,K)) GO TO 380
0171    360    CONTINUE
0172          IF (USTCOD(I,1).NE.USTCOD(J,1).OR.
          2          USTCOD(I,2).NE.USTCOD(J,2)) GO TO 380
0173          TOTWGT = TOTWGT + WGTARR(J)
0174          IF (I.EQ.J) GO TO 380
0175          DO 370 L=1,4

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MODUP.FTN

/TR:BLOCKS/WR

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0176 370 UCOSTX(J,L) = UCOSTX(I,L)
0177 380 CONTINUE
0178      N = UCTORG(I)
0179      DO 390 L=1,4
0180 390 UORGCS(N,L) = UORGCS(N,L) + UCOSTX(I,L)*WGTARR(I)/TOTWGT
0181 400 CONTINUE
      C
      C UPLINK SUMMARY REPORT
      C
0182 410 IF (REPNUM(9).NE.1) RETURN
0183      WRITE (3,1001) (TITLE(I),I=1,72)
0184      WRITE (3,1010) UPORDN(1,1), UPORDN(1,2)
0185      DO 420 I=1,NUCITY
0186      IF (UCITYV(I).LT.0) GO TO 420
0187      WRITE (3,1011)
0188      YEARLY = (UCOSTX(I,1)+UCOSTX(I,2))/AMORT+UCOSTX(I,3)+UCOSTX(I,4)
0189      WRITE (3,1012) (UCTNAM(I,J),J=1,16),(UCOSTX(I,J),J=1,4),YEARLY
0190      IF (NUINDX.GT.1) WRITE (3,1013) ((UCINDX(K,J),J=1,8),K=2,NUINDX)
0191      IF (NUINDX.GT.1) WRITE (3,1014) (UCTXVL(I,J),J=1,NUINDX-1)
0192 420 CONTINUE
0193      WRITE (3,1015) (UPORDN(1,K),K=1,2), (TCOST(1,K),K=1,5)
0194      RETURN
      C
      C FORMAT STATEMENTS
      C
0195 1001 FORMAT (1H1,72A1)
0196 1002 FORMAT (1H0,17X,2A4,' COST ELEMENT DATA',//)
0197 1010 FORMAT (1H0,26X,2A4,' COSTS BY CITY')
0198 1011 FORMAT (1H0,3X,'CITY',15X,'CAPITAL',4X,'INSTALL',6X,'LEASE',6X,
2 'O&M&A',2X,'ANNUALIZED')
0199 1012 FORMAT (1H0,16A1,2X,5F11.0)
0200 1013 FORMAT (1H0,18X,5(3X,8A1))
0201 1014 FORMAT (1H0,18X,5F11.0/)
0202 1015 FORMAT (1H0,//3X,2A4,' TOTAL',2X,5F11.0)
0203 1020 FORMAT (1H0,11X,'SENSITIVITY OF PATH COSTS TO NETWORK PARAMETERS--',
2 2A4,//)
0204 1021 FORMAT (1H0,'PATH ',I2,' -- ',20A1)
0205 1022 FORMAT (1H0,20X,5(7X,A4))
0206 1023 FORMAT (1H ,11X,6(3X,8A1))
0207 1024 FORMAT (1H ,3X,2A4,6F11.0)
0208 1034 FORMAT (1H0,25X,'COST OF EACH PATH--',2A4,///,4X,'CITY',
2 10X,'PATH',5X,'CAPITAL',4X,'INSTALL',6X,'LEASE',6X,'O&M&A',
3 2X,'ANNUALIZED',/)
0209 1035 FORMAT (1H0,16A1,I4,F13.0,3F11.0,F12.0)
0210 1036 FORMAT (1H ,16X, I4,F13.0,3F11.0,F12.0)
0211      END

```

```

0001      SUBROUTINE MODDN
          C
          C THIS SUBROUTINE PERFORMS THE CALCULATIONS FOR THE DOWNLINK
          C SEGMENT OF THE MODEL
          C
          C SUBROUTINE CALLS: REPRTR, VANDH
          C
0002      INCLUDE 'DK2:CGMBLK.FTN/NOLIST'
0040      INCLUDE 'DK2:MODBLK.FTN/NOLIST'
          C
          C COST ELEMENT DATA
          C
0057      IF (REPNUM(10).NE.1) GO TO 200
0058      WRITE (3,1001) (TITLE(I),I=1,72)
0059      WRITE (3,1002) UPORDN(2,1),UPORDN(2,2)
0060      DO 100 I=1,NDELEM
0061      CALL REPRTR (1,I)
0062      100 CONTINUE
          C
          C PRINT COST/PATH MATRIX
          C
0063      200 IF (REPNUM(11) .EQ. 0) GO TO 225
0064      WRITE (3,1001) (TITLE(I),I=1,72)
0065      CALL REPRTR(2,1)
          C
          C PATH/CITY MATRIX
          C
0066      225 IF (REPNUM(12) .EQ. 0) GO TO 250
0067      WRITE (3,1001) (TITLE(I),I=1,72)
0068      CALL REPRTR(4,1)
          C
          C CITY COST INDEXES
          C
0069      250 IF (REPNUM(13) .EQ. 0) GO TO 275
0070      WRITE (3,1001) (TITLE(I),I=1,72)
0071      CALL REPRTR(5,1)
          C
          C CALCULATE COSTS OF DOWNLINK PATHS, BY COST INDEX
          C
0072      275 DO 400 J=1,NDPATH
0073      DO 400 I=1,NDELEM
0074      DO 400 M=1,NDINDX
0075      DO 300 L=1,4
0076      N = DCSPTH(I,J)
0077      300 DPTIDX(J,M,L) = DPTIDX(J,M,L) + FLOAT(N)*DCSDAT(I,M,L)
0078      400 DPTIDX(J,M,5) = DPTIDX(J,M,5) + FLOAT(N)*
          2 ((DCSDAT(I,M,1)+DCSDAT(I,M,2))/AMORT+DCSDAT(I,M,3)+DCSDAT(I,M,4))
          C
          C COST SENSITIVITY REPORT
          C
0079      IF (REPNUM(14).NE.1) GO TO 700
0080      WRITE (3,1001) (TITLE(I),I=1,72)
0081      WRITE (3,1020) UPORDN(2,1),UPORDN(2,2)
0082      DO 600 I=1,NDPATH
0083      WRITE (3,1021) J,(DPTHNM(I,J),J=1,20)
0084      IF (NDINDX.GT.1) WRITE (3,1022) (PER,J=2,NDINDX)

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MODDN.FTN

/TR:BLOCKS/WR

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0085      WRITE (3,1023) ((DCINDX(J,K),K=1,8),J=1,NDINDX)
0086      DO 500 J=1,5
0087  500    WRITE (3,1024) CILO(J,1), CILO(J,2), (DPTIDX(I,K,J),K=1,NDINDX)
0088  600    CONTINUE
      C
      C   IF COST ALLOCATION SPECIFIED, REMOVE MULTIPLE CITY LISTINGS
      C
0089  700    IF (NUMORG.EQ.0) GO TO 1600
0090      DO 1500 K=1,NUCITY
0091      WGTARR(K) = DDXWHT(1)
0092      IF (NDINDX.EQ.1) GO TO 900
0093      DO 800 L=2,NDINDX
0094  800    WGTARR(K) = WGTARR(K) + DCTXVL(K,L-1)*DDXWHT(L)
0095      IF (WGTARR(K).LE.0.0) WGTARR(K) = 1.0
0096  900    IF (K.EQ.1) GO TO 1500
0097      DO 1400 I=1,K-1
0098      DO 1000 J=1,16
0099      IF (DCTNAM(K,J).NE.DCTNAM(I,J)) GO TO 1400
0100  1000   CONTINUE
0101      DO 1100 J=1,NDINDX-1
0102  1100   DCTXVL(I,J) = DCTXVL(I,J) + DCTXVL(K,J)
0103      DO 1200 J=1,NUCITY
0104  1200   TALKBK(I,J) = TALKBK(I,J) + TALKBK(K,J)
0105      DO 1300 J=1,NDPATH
0106  1300   DPTHY(I,J) = DPTHY(I,J) .OR. DPTHY(K,J)
0107      DCITYV(K) = -1
0108      GO TO 1500
0109  1400   CONTINUE
0110  1500   CONTINUE
      C
      C   CALCULATE COSTS FOR DOWNLINK PATHS BY CITY, AND CHOOSE THE BEST
      C   ONE. THEN ADD 'CHOSEN' PATH COSTS TO TOTALS FOR SUMMARY TABLE
      C
0111  1600   IF (REFNUM(15).EQ.0) GO TO 1650
0112      WRITE (3,1001) (TITLE(I),I=1,72)
0113      WRITE (3,1034)UFORDN(2,1),UFORDN(2,2)
0114  1650   DO 2500 K=1,NUCITY
0115      INDIC = 0
0116      IF (DCITYV(K).EQ.-1) GO TO 2500
0117      IF (DCITYV(K).LT.0) CALL VANDH (DCITYV(K),DCITYH(K))
0118      BOTTOM=1.E38
0119      DO 2100 J=1,NDPATH
0120  2100   IF (DPTHY(J,K).EQ.0) GO TO 2100
      C   OMIT LEASE CALCULATIONS, BECAUSE OF THE MINIMUM VARIABLE
0121      CAPCST = DPTIDX(J,1,1)
0122      INSCST = DPTIDX(J,1,2)
0123      OMACST = DPTIDX(J,1,4)
0124      IF (NDINDX.EQ.1) GO TO 1800
0125      DO 1700 M=2,NDINDX
0126      CAPCST = CAPCST + DPTIDX(J,M,1)*DCTXVL(K,M-1)
0127      INSCST = INSCST + DPTIDX(J,M,2)*DCTXVL(K,M-1)
0128  1700   OMACST = OMACST + DPTIDX(J,M,4)*DCTXVL(K,M-1)
      C
      C   CALCULATE LEASE COSTS
      C
0129  1800   LESCST = 0.

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MODDN.FTN

/TR:BLOCKS/WR

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0130      DO 1900 I=1,NDELEM
0131          TEMP=0.
0132          IF (DCSPTH(I,J).EQ.0) GO TO 1900
0133          TEMP = TEMP + DCSDAT(I,1,3)
0134          IF (NDINDX.EQ.1) GO TO 1900
0135          DO 1850 M=2,NDINDX
0136      1850  TEMP = TEMP + DCSDAT(I,M,3)*DCTXVL(K,M-1)
0137          IF (TEMP.LT.DCSMIN(I)) TEMP=DCSMIN(I)
0138          LESCST = LESCST + TEMP
0139      1900  CONTINUE
0140          ANNL(J) = (CAPCST+INSCST)/AMORT + LESCST + OMACST
C      COMPARE ANNUALIZED COST WITH BEST PREVIOUS PATH
0141          IF (REFNUM(15).NE.1) GO TO 2000
0142          IF (INDIC.EQ.0) WRITE (3,1035) (DCTNAM(K,M),M=1,16),J,
2              CAPCST,INSCST,LESCST,OMACST,ANNL(J)
0143          IF (INDIC.EQ.1) WRITE (3,1036) J,
2              CAPCST,INSCST,LESCST,OMACST,ANNL(J)
0144      2000  INDIC = 1
0145          IF (ANNL(J).GE.BOTTOM) GO TO 2100
0146          NUPREF(K) = J
0147          BOTTOM = ANNL(J)
0148      2100  CONTINUE
0149          N=NUPREF(K)
0150          DO 2400 L=1,4
0151          DCOSTX(K,L) = DPTIDX(N,1,L)
0152          IF (NDINDX.EQ.1) GO TO 2300
0153          DO 2200 M=2,NDINDX
0154          DCOSTX(K,L) = DCOSTX(K,L) + DPTIDX(N,M,L)*DCTXVL(K,M-1)
0155      2200  CONTINUE
0156      2300  IF (L.NE.3) TCOST(2,L) = TCOST(2,L) + DCOSTX(K,L)
0157      2400  CONTINUE
0158          DCOSTX(K,3)=BOTTOM-DCOSTX(K,4)-(DCOSTX(K,1)+DCOSTX(K,2))/AMORT
0159          TCOST(2,3) = TCOST(2,3) + DCOSTX(K,3)
0160          TCOST(2,5) = TCOST(2,5) + BOTTOM
0161      2500  CONTINUE
C
C      DO COST ALLOCATION CALCULATIONS
C
0162          IF (NUMORG.EQ.0) GO TO 3100
0163          DO 3000 I=1,NDICITY
0164          TOTWGT=0.
0165          DO 2800 J=1,NDICITY
0166          DO 2600 K=1,16
0167          IF(DCTNAM(I,K).NE.DCTNAM(J,K)) GO TO 2800
0168      2600  CONTINUE
0169          IF (DSTCOD(I,1).NE.DSTCOD(J,1).OR.
2          DSTCOD(I,2).NE.DSTCOD(J,2)) GO TO 2800
0170          TOTWGT = TOTWGT + WGTARR(J)
0171          IF (I.EQ.J) GO TO 2800
0172          DO 2700 L=1,4
0173      2700  DCOSTX(J,L) = DCOSTX(I,L)
0174      2800  CONTINUE
0175          N = DCFORG(I)
0176          DO 2900 L=1,4
0177      2900  DORGCS(N,L) = DORGCS(N,L) + DCOSTX(I,L)*WGTARR(I)/TOTWGT
0178      3000  CONTINUE

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C
C   DOWNLINK SUMMARY REPORT
C
0179 3100 IF (REPNUM(16).NE.1) RETURN
0180       WRITE (3,1001) (TITLE(I),I=1,72)
0181       WRITE(3,1010) UPORDN(2,1), UPORDN(2,2)
0182       DO 3200 I=1,NDCITY
0183       IF (DCITYV(I).LT.0) GO TO 3200
0184       WRITE (3,1011)
0185       YEARLY = (DCOSTX(I,1)+DCOSTX(I,2))/AMORT+DCOSTX(I,3)+DCOSTX(I,4)
0186       WRITE(3,1012) (DCTNAM(I,J),J=1,16),(DCOSTX(I,J),J=1,4),YEARLY
0187       IF (NDINDX.GT.1) WRITE (3,1013) ((DCINDX(K,J),J=1,8),K=2,NDINDX)
0188       IF (NDINDX.GT.1) WRITE (3,1014) (DCTXVL(I,J),J=1,NDINDX-1)
0189 3200 CONTINUE
0190       WRITE(3,1015) (UPORDN(2,K),K=1,2), (TCOST(2,K),K=1,5)
0191       RETURN

C
C   FORMAT STATEMENTS
C
0192 1001 FORMAT (1H1,72A1)
0193 1002 FORMAT (1H0,17X,2A4,' COST ELEMENT DATA',//)
0194 1010 FORMAT(1H0,26X,2A4,' COSTS BY CITY')
0195 1011 FORMAT (1H0,3X,'CITY',15X,'CAPITAL',4X,'INSTALL',6X,'LEASE',6X,
2     'O&M&A',2X,'ANNUALIZED')
0196 1012 FORMAT(1H0,16A1,2X,5F11.0)
0197 1013 FORMAT (1H0,18X,5(3X,8A1))
0198 1014 FORMAT (1H0,18X,5F11.0/)
0199 1015 FORMAT(1H0,///X,2A4,' TOTAL',2X,5F11.0)
0200 1020 FORMAT(1H0,11X,'SENSITIVITY OF PATH COSTS TO NETWORK PARAMETERS--',
2     2A4,//)
0201 1021 FORMAT (1H0,'PATH ',I2,' -- ',20A1)
0202 1022 FORMAT (1H0,20X,5(7X,A4))
0203 1023 FORMAT (1H ,11X,6(3X,8A1))
0204 1024 FORMAT(1H ,3X,2A4,6F11.0)
0205 1034 FORMAT(1H0,25X,'COST OF EACH PATH--',2A4,///,4X,'CITY',
2     10X,'PATH',5X,'CAPITAL',4X,'INSTALL',6X,'LEASE',6X,'O&M&A',
3     2X,'ANNUALIZED',/)
0206 1035 FORMAT(1H0,16A1,I4,F13.0,3F11.0,F12.0)
0207 1036 FORMAT(1H ,16X, I4,F13.0,3F11.0,F12.0)
0208       END
  
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MODTK.FTN

/TR:BLOCKS/WR

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0001      SUBROUTINE MODTK
          C
          C THIS SUBROUTINE PERFORMS THE CALCULATION FOR THE TALKBACK SEGMENT
          C OF THE MODEL. IT ALSO PRODUCES THE GRAND SUMMARY REPORT.
          C
0002      INCLUDE 'DK2:COMBLK.FTN/NOLIST'
0040      INCLUDE 'DK2:MODBLK.FTN/NOLIST'
0057      REAL*4 BPVT,BWATS,BDDD
0058      DATA BPVT /'PUT '/, BWATS /'WATS'/, BDDD /'DDD '/
          C
          C PREPARE AND PRINT TABLE FOR VOICE TALKBACK SYSTEM COSTS
          C
0059      DO 1700 J=1,NUCITY
0060      IF (UCITYV(J).EQ.-1) GO TO 1700
          C
          C CHECK FOR NO TALKBACK REQUIREMENT AND SET V AND H COORDINATES
          C
0061      T = 0.
0062      DO 100 I=1,NDCITY
0063      T = T + TALKBK(I,J)
0064      100 CONTINUE
0065      IF (T.EQ.0.0) GO TO 1700
          C
          C REPEAT FOR EACH COMBINATION OF UPLINK AND DOWNLINK CITY
          C
0066      IF (REPNUM(17).EQ.0) GO TO 150
0067      WRITE (3,1001) (TITLE(K),K=1,72)
0068      WRITE (3,1015) (UCTNAM(J,N),N=1,16)
0069      150 DO 1600 I=1,NDCITY
0070      IF (DCITYV(I).EQ.-1) GO TO 1600
0071      TOTWGT = 0.
0072      IF (TALKBK(I,J).GT.0.AND.DCTLVL(I).EQ.3) GO TO 200
0073      IF (TALKBK(I,J))1600,1600,500
0074      200 DIST=1.E38
0075      DO 400 K=1,NDCITY
0076      IF (K.EQ.I) GO TO 400
0077      IF (DCTLVL(K)-2) 400,300,400
0078      300 X = DCITYV(K) - DCITYV(I)
0079      Y = DCITYH(K) - DCITYH(I)
0080      DIST=MIN1(DIST,SQRT((X**2+Y**2)/10.))
0081      400 CONTINUE
0082      GO TO 600
0083      500 X = UCITYV(J) - DCITYV(I)
0084      Y = UCITYH(J) - DCITYH(I)
0085      DIST = SQRT ((X**2+Y**2)/10.)
0086      600 HOURS = TALKBK(I,J)
0087      WLEASE=MIN1(WATLES+WATCPH*HOURS,WATMAX)
0088      PLEASE=PVTFIX+DIST*PVTMIL
0089      DDLEAS=DDDCPH*HOURS
0090      TCOST(3,1)=TCOST(3,1)+TLKCAP
0091      IF(WLEASE-PLEASE)700,800,800
0092      700 IF(WLEASE.GT.DDLEAS) GO TO 900
0093      TALK=BWATS
0094      INSCST = WATINS
0095      LESCST = WLEASE*12.
0096      GOTO 1000

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0097      800 IF(PLEASE.GT.DDLEAS) GO TO 900
0098          TALK=BPVT
0099          INSCST = PVTINS
0100          LESCST = PLEASE*12.
0101          GO TO 1000
0102      900 TALK=BDDD
0103          INSCST = DDDINS
0104          LESCST = DDLEAS*12.
0105      1000 TCOST(3,2) = TCOST(3,2) + INSCST
0106          TCOST(3,3) = TCOST(3,3) + LESCST
0107          TCOST(3,5) = TCOST(3,5) + TLKCAP/AMORT + INSCST/AMORT + LESCST
C
C      DO COST ALLOCATION CALCULATIONS, IF APPLICABLE
C
0108          IF (NUMORG.EQ.0) GO TO 1500
0109          DO 1200 L=1,NDCITY
0110          DO 1100 K=1,16
0111          IF(DCTNAM(I,K).NE.DCTNAM(L,K)) GO TO 1200
0112      1100 CONTINUE
0113          IF (DSTCOD(I,1).NE.DSTCOD(L,1).OR.
2          DSTCOD(I,2).NE.DSTCOD(L,2)) GO TO 1200
0114          TOTWGT = TOTWGT + WGTARR(L)
0115      1200 CONTINUE
0116          DO 1400 L=I,NDCITY
0117          DO 1300 K=1,16
0118          IF (DCTNAM(I,K).NE.DCTNAM(L,K)) GO TO 1400
0119      1300 CONTINUE
0120          IF (DSTCOD(I,1).NE.DSTCOD(L,1).OR.
2          DSTCOD(I,2).NE.DSTCOD(L,2)) GO TO 1400
0121          N = DCTORG(L)
0122          TORGCS(N,1) = TORGCS(N,1) + TLKCAP*WGTARR(L)/TOTWGT
0123          TORGCS(N,2) = TORGCS(N,2) + INSCST*WGTARR(L)/TOTWGT
0124          TORGCS(N,3) = TORGCS(N,3) + LESCST*WGTARR(L)/TOTWGT
0125          TORGCS(N,4) = 0.
0126      1400 CONTINUE
C
C      TALKBACK REPORT
C
0127      1500 IF (REPNUM(17).EQ.1) WRITE(3,1016)(DCTNAM(I,K),K=1,16),DCTLVL(I),
2          HOURS,DIST,WATINS,WLEASE,PVTINS,PLEASE,DDDINS,DDLEAS,TALK
0128      1600 CONTINUE
0129      1700 CONTINUE
C
C      ALLOCATE ADMINISTRATIVE COSTS
C
0130          IF (NUMORG.EQ.0) GO TO 3300
0131          TOTWGT=0.
0132          DO 1800 I=1,NDCITY
0133          TOTWGT=TOTWGT+WGTARR(I)
0134      1800 CONTINUE
0135          DO 2000 I=1,NDCITY
0136          N=DCTORG(I)
0137          DO 1900 L=1,4
0138          AORGCS(N,L) = AORGCS(N,L) + GANDAD(L)*WGTARR(I)/TOTWGT
0139      2000 CONTINUE
C

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MODTK.FTN

/TR:BLOCKS/WR

C COST ALLOCATION TABLE

```

C
0140 2100 IF (REFNUM(18).NE.1.OR.NUMORG.EQ.0) GO TO 3300
0141      WRITE (3,1001) (TITLE(I),I=1,72)
0142      WRITE (3,1025)
0143      WRITE (3,1026)
0144      DO 2200 I=1,25
0145 2200  ANNL(I) = 0.
0146      DO 2400 I=1,NUMORG
0147      UORGCS(I,5) = (UORGCS(I,1) + UORGCS(I,2))/AMORT + UORGCS(I,3)
                2      + UORGCS(I,4)
0148      DO 2300 J=1,4
0149 2300  ANNL(J) = ANNL(J) + UORGCS(I,J)
0150      ANNL(5) = ANNL(5) + UORGCS(I,5)
0151      WRITE (3,1027) I,(ORGNAM(I,J),J=1,20),(UORGCS(I,J),J=1,5)
0152 2400  CONTINUE
0153      WRITE (3,1028) (ANNL(J),J=1,5)
0154      WRITE (3,1029)
0155      DO 2600 I=1,NUMORG
0156      DORGCS(I,5) = (DORGCS(I,1)+DORGCS(I,2))/AMORT + DORGCS(I,3)
                2      + DORGCS(I,4)
0157      DO 2500 J=6,9
0158 2500  ANNL(J) = ANNL(J) + DORGCS(I,J-5)
0159      ANNL(10) = ANNL(10) + DORGCS(I,5)
0160      WRITE (3,1027) I,(ORGNAM(I,J),J=1,20),(DORGCS(I,J),J=1,5)
0161 2600  CONTINUE
0162      WRITE (3,1028) (ANNL(J),J=6,10)
0163      WRITE (3,1030)
0164      DO 2800 I=1,NUMORG
0165      TORGCS(I,5) = (TORGCS(I,1)+TORGCS(I,2))/AMORT + TORGCS(I,3)
                2      + TORGCS(I,4)
0166      DO 2700 J=11,14
0167 2700  ANNL(J) = ANNL(J) + TORGCS(I,J-10)
0168      ANNL(15) = ANNL(15) + TORGCS(I,5)
0169      WRITE (3,1027) I,(ORGNAM(I,J),J=1,20),(TORGCS(I,J),J=1,5)
0170 2800  CONTINUE
0171      WRITE (3,1028) (ANNL(J),J=11,15)
0172      WRITE (3,1032)
0173      DO 3000 I=1,NUMORG
0174      AORGCS(I,5) = (AORGCS(I,1)+AORGCS(I,2))/AMORT + AORGCS(I,3)
                2      + AORGCS(I,4)
0175      DO 2900 J=21,24
0176 2900  ANNL(J) = ANNL(J) + AORGCS(I,J-20)
0177      ANNL(25) = ANNL(25) + AORGCS(I,5)
0178      WRITE (3,1027) I,(ORGNAM(I,J),J=1,20),(AORGCS(I,J),J=1,5)
0179 3000  CONTINUE
0180      WRITE (3,1028) (ANNL(J),J=21,25)
0181      WRITE (3,1031)
0182      DO 3200 I=1,NUMORG
0183      DO 3100 J=1,5
0184      XORGCS(I,J) = UORGCS(I,J)+DORGCS(I,J)+TORGCS(I,J)+AORGCS(I,J)
0185      ANNL(J+15) = ANNL(J+15) + XORGCS(I,J)
0186 3100  CONTINUE
0187      WRITE (3,1027) I,(ORGNAM(I,J),J=1,20),(XORGCS(I,J),J=1,5)
0188 3200  CONTINUE
0189      WRITE (3,1028) (ANNL(J),J=16,20)

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MODTK.FTN /TR:BLOCKS/WR

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C
C   CALCULATE AND PRINT TOTAL COSTS FOR GRAND SUMMARY TABLE
C
0190 3300 DO 3500 K=1,5
0191      DO 3400 J=1,4
0192      TCOST(4,J) = GANDAD(J)
0193 3400 TCOST(5,K) = TCOST(5,K)+TCOST(J,K)
0194 3500 CONTINUE
0195      TCOST(4,5)=(TCOST(4,1)+TCOST(4,2))/AMORT + TCOST(4,3) + TCOST(4,4)
0196      TCOST(6,1)=TCOST(5,1)/AMORT
0197      TCOST(6,2)=TCOST(5,2)/AMORT
0198      TCOST(6,3)=TCOST(5,3)
0199      TCOST(6,4)=TCOST(5,4)
0200      TCOST(5,5)=(TCOST(5,1)+TCOST(5,2))/AMORT+TCOST(5,3)+TCOST(5,4)
0201      TCOST(6,5)=TCOST(6,1) + TCOST(6,2) + TCOST(6,3) + TCOST(6,4)
0202      IF (REPNUM(19).NE.1) RETURN
0203      WRITE (3,1001) (TITLE(I),I=1,72)
0204      WRITE(3,1004)
0205      WRITE(3,1005)((TCOST(I,J),J=1,5),I=1,6)
0206      NYEARS = IFIX(EQPLIF)
0207      WRITE(3,1006)NYEARS,DISCNT.TCOST(6,5)
0208      RETURN

```

```

C
C   FORMAT STATEMENTS
C
0209 1001 FORMAT (1H1,72A1)
0210 1004 FORMAT(1H0,////,30X,'OVERALL COST SUMMARY',////,20X,
2      'CAPITAL',3X,'PLANNING AND',7X,'ANNUAL',7X,'ANNUAL',
3      3X,'ANNUALIZED',/,17X,'EXPENDITURES',1X,'INSTALLATION',
4      7X,'LEASE',8X,'O&M&A',7X,'COST'//)
0211 1005 FORMAT(1H0,'UPLINK',9X,5F13.0/, 'ODOWNLINK',7X,5F13.0,
2/, 'OVOICE TALKBACK',1X,5F13.0/, 'OADMINISTRATIVE',1X,5F13.0,
3//,'O TOTALS',6X,5F13.0//,'OANNUALIZED COST',5F13.0)
0212 1006 FORMAT(////,1X,'EFFECTIVE YEARLY COSTS FOR ',I2,' YEAR, ',F5.2,
2' PERCENT AMORTIZATION --- $',F9.0)
0213 1015 FORMAT(1H0,27X,'TALKBACK SYSTEM LEASE COSTS',/,35X,'TO ',16A1,////
2      21X,'HOURS',8X,'WATS COSTS',4X,'PRIVATE LINE',3X,
3      'DIRECT DIAL',/,5X,'CITY',6X,'LEVEL',1X,'UTIL.',1X,'DIST',1X,
4      'INSTALL LEASE',2X,'INSTALL LEASE',2X,'INSTALL LEASE',2X,
5      'BEST'//)
0214 1016 FORMAT (1H0,16A1,I3,F5.0,F6.0,F8.0,F6.0,F9.0,F6.0,F9.0,F6.0,2X,A4)
0215 1025 FORMAT(1H0,28X,'NETWORK COST ALLOCATION',///,30X,'CAPITAL',4X,
2      'INSTALL',6X,'LEASE',6X,'O&M&A',1X,'ANNUALIZED')
0216 1026 FORMAT(1H0,/, ' UPLINK',//)
0217 1027 FORMAT (1H ,I3,1X,20A1,1X,5F11.0)
0218 1028 FORMAT(1H0,8X,'TOTAL',12X,5F11.0)
0219 1029 FORMAT(1H0,/, ' DOWNLINK',//)
0220 1030 FORMAT(1H0,/, ' VOICE TALKBACK'//)
0221 1031 FORMAT(1H0,/, ' TOTAL NETWORK'//)
0222 1032 FORMAT(1H0,/, ' ADMINISTRATIVE'//)
0223      END

```

SECTION 3. EARTH MODULE

Section 3 includes listings for the main program for the EARTH module and the following subroutines:

MOVREC

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EARTH STATION REPORT PROGRAM

C
C THIS PROGRAM PRODUCES A REPORT OF ALL EARTH STATIONS THAT ARE
C WITHIN A GIVEN DISTANCE FROM AN UPLINK OR DOWNLINK CITY THAT
C IS IN A USER'S SCENARIO. THE REPORT MAY BE LIMITED BY SPECIFYING
C A UNIQUE SATELLITE THAT THE EARTH TERMINAL MUST BE LICENSED TO
C POINT TO.

C
C SUBROUTINE CALLS: READIN, VANDH, MOVREC, CODCHK

0001 INCLUDE 'SYO:COMBLK.FTN/NOLIST'
0039 LOGICAL*1 PAD(12460)
0040 COMMON PAD

C
0041 LOGICAL*1 CALSIN(5),LICNSE(40),CITY(20),STATE(2),SERVIS(18)
0042 LOGICAL*1 BAND(4,2),SIZE(4)
0043 INTEGER*2 UPDOWN
0044 COMMON /ESTATN/ UPDOWN,CALSIN,LICNSE,CITY,STATE,SERVIS,BAND,SIZE

C
C LOCAL VARIABLES

0045 LOGICAL*1 SATLIT(5),AUTHCD,INCHAR(5)
0046 LOGICAL*1 SATCOD(25,5),HEADER(72),TMPARY(82),SAT(5,5)
0047 LOGICAL*1 NAMUCT(10,16),NAMDCT(80,16),CODUST(10,2),CODDST(80,2)
0048 INTEGER*2 BAD,LAT,LON,UCTARY(10),DCTARY(80),NUMCHR,NUMSAT
0049 INTEGER*2 POS,UCITYN,DCITYN,NUMREC,I,J,FIRST,LAST
0050 INTEGER*2 ORGNUM,VUCITY(10),HUCITY(10),VDCITY(80),HDCITY(80)
0051 REAL*4 DIST,DISTNC,DOWNUP(2),X,Y

C
C TO PROVIDE CONSISTENCY BETWEEN THE BUILD, MODEL, AND EARTH
C MODULES, THE SUBROUTINE READIN IS USED TO READ THE USER'S
C SCENARIO. SINCE THIS REQUIRES A LOT OF OVERHEAD IN TERMS OF
C DATA THAT IS NOT REQUIRED FOR THIS MODULE, THOSE VARIABLES
C THAT ARE NEEDED ARE SAVED IN LOCAL ARRAYS AND THE EARTH
C TERMINAL ARRAY IS OVERLAYED ON TOP OF THE COMMON. TO
C PROTECT AGAINST WRITING OVER OTHER VARIABLES, THE COMMON
C MUST BE 'PADDED' OUT TO ASSUME THE SIZE OF THE EARTH TERMINAL
C ARRAY. THE FORMULA FOR DOING THIS IS:

$$\text{SIZE OF PAD} = 78 + 82 * (\text{NUMBER OF RECORDS IN ARRAY} - 199)$$

0052 LOGICAL*1 BIGREC(350,82)
0053 EQUIVALENCE (BIGREC(1,1),NUELEM)

0054 DATA NUMSAT /25/
0055 DATA DOWNUP /'DOWN','UP'/

0056 DATA SATCOD /'K','K','K','K','K','K','K','K','K','K','K','A','A','A',
2 'M','M','M','I','I','I','I','I','I','I','K','K','K','S',
3 'S','S','S','S','S','S','S','S','S','S','N','N','N','R',
4 'R','R','N','N','N','N','N','N','N','S','S','S','2','2',
5 '2','2','2','2','2','3','3','3','I','I','I','1','2',
6 '3','1','2','3','4','4','5','3','3','3','0','1','2',
7 '6','7','8','9','0','1','2','K','K','K',,
8 ' ',' ',' ',' ',' ','A',,
9 ' ',' ',' ',' ',' ',' ',' ',' ',' ',' ','1','2','3',,
9 ' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' ',' '

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0098             IF (NAMDC(T(K,J).NE.NAMDC(T(I,J)) GO TO 120
0099   110         CONTINUE
0100             UDCITY(K)=-1
0101             GO TO 130
0102   120         CONTINUE
0103   130         CONTINUE
C
C   NOW, CLEAR OUT THE COMMON BY FILLING THE BIGREC ARRAY WITH BLANKS
C
0104   140         DO 160 I=1,350
0105             DO 150 J=1,82
0106                 BIGREC(I,J)=' '
0107   150         CONTINUE
0108   160         CONTINUE
C
0109   170         WRITE (1,*) 'ENTER THE MAXIMUM ACCEPTABLE DISTANCE (IN MILES)'
0110             WRITE (1,*) 'BETWEEN AN EARTH STATION AND A CITY'
0111             ASSIGN 170 TO BAD
0112             READ (1,*,ERR=9000) DISTNC
0113             IF (DISTNC.GT.0.AND.DISTNC.LE.50.) GO TO 200
C
C   DISTANCE OUT OF RANGE
C
0114             WRITE (1,*) 'DISTANCE MUST BE LESS THAN 50 MILES'
0115             GO TO 170
C
C   ENTER SATELLITE
C
0116   200         WRITE (1,*) 'ENTER THE SATELLITE OF INTEREST BY CALL NUMBER'
0117             READ (1,210) (SATLIT(I),I=1,5)
0118   210         FORMAT (5A1)
0119             IF (SATLIT(1).EQ.'A'.AND.SATLIT(2).EQ.'L'.AND.SATLIT(3).EQ.'L')
2             GO TO 400
0120             CALL CODCHK(5,SATLIT,NUMSAT,SATCOD,POS)
0121             IF (POS.NE.0) GO TO 500
0122             WRITE (1,220) (SATLIT(I),I=1,5)
0123   220         FORMAT (1X,'INVALID SATELLITE CALL NUMBER ',5A1//)
0124             WRITE (1,*) 'VALID SATELLITES ARE...'
0125             WRITE (1,230) ((SATCOD(I,J),J=1,5),I=1,25)
0126   230         FORMAT (/,1X,5A1,2X,'WESTAR I',//,
2             1X,5A1,2X,'WESTAR II',//,
3             1X,5A1,2X,'WESTAR III',//,
4             1X,5A1,2X,'COMSTAR D-1',//,
5             1X,5A1,2X,'COMSTAR D-2',//,
6             1X,5A1,2X,'COMSTAR D-3',//,
7             1X,5A1,2X,'COMSTAR D-4',//,
8             1X,5A1,2X,'SATCOM I',//,
9             1X,5A1,2X,'SATCOM II',//,
1            1X,5A1,2X,'SATCOM III',//,
1            1X,5A1,2X,'CANADIAN TELESAT SATELLITES',//,
2            1X,5A1,//,
3            1X,5A1,//,
4            1X,5A1,2X,'MARISAT I',//,
5            1X,5A1,2X,'MARISAT II',//,
6            1X,5A1,2X,'MARISAT III',//,
7            1X,5A1,2X,'INTELSAT I',//,

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```
      8      1X,5A1,2X,'INTELSAT II',//,
      9      1X,5A1,2X,'INTELSAT III',//,
      1      1X,5A1,2X,'INTELSAT IV',//,
      1      1X,5A1,2X,'INTELSAT IV-A',//,
      2      1X,5A1,2X,'INTELSAT V',//,
      3      1X,5A1,2X,'SBS I',//,
      4      1X,5A1,2X,'SBS II',//,
      5      1X,5A1,2X,'SBS III',//)

C
0127      GO TO 200

C
0128      400      BYPASS=1
0129      500      UPDOWN=0
0130      NUMREC=0

C
C      READ THE DATA BASE
C
0131      520      READ (2,530,ERR=9020,END=580) (CAL SIN(I), I=1,5), (LICNSE(I), I=1,40),
2          (CITY(I), I=1,20), (STATE(I), I=1,2), AUTHCD
0132      530      FORMAT (SA1,1X,40A1,1X,20A1,1X,2A1,4X,A1)
C
0133      READ(2,535,ERR=9020,END=580) (SERVIS(I), I=1,18), ((BAND(I,J), J=1,2),
2          I=1,4), (SIZE(I), I=1,4), LAT, LON, ((SAT(I,J), J=1,5), I=1,5)
0134      535      FORMAT (6X,18A1,4(2A1),4A1,14,2X,15,2X,5(SA1))

C
C      LOOK FOR SATELLITE
C
0135      IF (BYPASS.EQ.1) GO TO 536
0136      CALL CODCHK(5,SATLIT,5,SAT,POS)
0137      IF (POS.EQ.0) GO TO 520

C
C      CALCULATE V AND H COORDINATES
C
0138      536      LAT=-LAT
0139      CALL VANDH(LAT,LON)

C
C      CALCULATE DISTANCE FROM UPLINK CITIES
C
0140      542      UPDOWN=1
0141      IF (SERVIS(8).NE.'T') GO TO 557
0142      GO 545 I=1,UCITYN
0143      IF (UCITY(I).EQ.-1) GO TO 545
0144      X=UCITY(I)-LAT
0145      Y=UCITY(I)-LON
0146      DIST=(X**2+Y**2)/10.
0147      DIST=SQRT(DIST)
0148      IF (DIST.GT.DISTNC) GO TO 545
0149      IF (NUMREC.EQ.750) GO TO 570
0150      NUMREC=NUMREC+1
0151      CALL MOVREC(I,NUMREC)
0152      UCTARY(I)=UCTARY(I)+1
0153      545      CONTINUE

C
C      CALCULATE DISTANCE FROM DOWNLINK CITIES
C
0154      557      UPDOWN=2
```


/TR:BLOCKS/WR

```

0155      IF (SERVIS(8).NE.'R'.AND.SERVIS(9).NE.'R') GO TO 520
0156      DO 560 I=1,DCITYN
0157      IF (VDCITY(I).EQ.-1) GO TO 560
0158      X=VDCITY(I)-LAT
0159      Y=VDCITY(I)-LON
0160      DIST=(X**2+Y**2)/10.
0161      DIST=SQRT(DIST)
0162      IF (DIST.GT.DISTNC) GO TO 560
0163      IF (NUMREC.EQ.350) GO TO 570
0164      NUMREC=NUMREC+1
0165      CALL MOVREC(I,NUMREC)
0166      DCTARY(I)=DCTARY(I)+1
0167 560   CONTINUE
0168      GO TO 520
C
0169 570   WRITE (1,*) '***** OVER 350 EARTH STATIONS QUALIFY *****'
0170      WRITE (1,*) 'ONLY A PARTIAL REPORT WILL BE CREATED'
0171      WRITE (1,*) 'USE A SMALLER DISTANCE FOR A FULL REPORT'
C
C      CLOSE THE EARTH TERMINAL FILE AND SORT THE ARRAY
C
0172 580   CLOSE (UNIT=2)
0173      NLESS1=NUMREC-1
0174      DO 800 I=1,NLESS1
0175      IPLUS1=I+1
0176      DO 700 J=IPLUS1,NUMREC
0177      IF (BIGREC(J,1).GT.BIGREC(I,1)) GO TO 700
0178      IF (BIGREC(J,1).LT.BIGREC(I,1)) GO TO 600
0179      IF (BIGREC(J,2).GT.BIGREC(I,2)) GO TO 700
C
C      OTHERWISE SWAP
C
0180 600   DO 610 L=1,82
0181 610   TMPARY(L)=BIGREC(J,L)
0182      DO 620 L=1,82
0183 620   BIGREC(J,L)=BIGREC(I,L)
0184      DO 630 L=1,82
0185 630   BIGREC(I,L)=TMPARY(L)
C
0186 700   CONTINUE
0187 800   CONTINUE
C
C      PRINT THE REPORT
C
0188 4000  WRITE (3,4100)(HEADER(I),I=1,72)
0189 4100  FORMAT ('1',72A1/)
0190      IDIST=DISTNC
0191      WRITE (3,4600) DOWNUP(2),IDIST,(SATLIT(I),I=1,5)
0192 4600  FORMAT (//,1X,A4,'LINK CITIES--EARTH STATIONS WITHIN ',I3,
2        ' MILES AND LICENSED TO POINT TO ',5A1//)
C
0193      WRITE (3,4620)
0194 4620  FORMAT (1X,'CALL SIGN',11X,'LICENSEE',21X,'CITY',6X,'STATE',2X,
2        'SERVICE',3X,'SIZE')
C
0195      FIRST=1

```

```

0196      DO 4750 I=1,UCITYN
0197      IF (VUCITY(I).EQ.-1) GO TO 4750
0198      IF (UCTARY(I).EQ.0) GO TO 4740
0199      WRITE (3,4730) (NAMUCT(I,J),J=1,16),(CODUST(I,J),L=1,2)
0200      4730  FORMAT (/, '*****' ,16A1,2X,2A1/)
0201      LAST=FIRST+UCTARY(I)-1
0202      DO 4735 K=FIRST,LAST
0203      WRITE (3,4731) (BIGREC(K,L),L=3,82)
0204      4731  FORMAT (1X,80A1/)
0205      4735  CONTINUE
0206      FIRST=LAST+1
0207      GO TO 4750
0208      4740  WRITE (3,4745) (NAMUCT(I,L),L=1,16),(CODUST(I,L),L=1,2)
0209      4745  FORMAT (/,1X,'NO EARTH STATIONS NEAR ',16A1,2X,2A1)
0210      4750  CONTINUE
C
C      DOWNLINK PART OF REPORT
C
0211      5000  WRITE (3,4600) DOWNUP(1),IDIST,(SATLIT(I),I=1,5)
0212      WRITE (3,4620)
0213      DO 5750 I=1,DCITYN
0214      IF (VDCITY(I).EQ.-1) GO TO 5750
0215      IF (DCTARY(I).EQ.0) GO TO 5740
0216      WRITE (3,4730) (NAMDCT(I,J),J=1,16),(CODDST(I,J),J=1,2)
0217      LAST=FIRST+DCTARY(I)-1
0218      DO 5735 K=FIRST,LAST
0219      WRITE (3,4731) (BIGREC(K,L),L=3,82)
0220      5735  CONTINUE
0221      FIRST=LAST+1
0222      GO TO 5750
0223      5740  WRITE (3,4745) (NAMDCT(I,L),L=1,16),(CODDST(I,J),L=1,2)
0224      5750  CONTINUE
C
0225      GO TO 9900
C
0226      9000  WRITE (1,*) 'ERROR IN NUMERICAL READ - PLEASE REENTER'
0227      GO TO BAD
0228      9010  WRITE (1,*) 'ERROR OPENING EARTH TERMINAL FILE'
0229      GO TO 9900
0230      9020  WRITE (1,*) 'ERROR READIN EARTH TERMINAL FILE'
0231      9900  STOP
0232      END

```

MOVREC.FTN /TR:BLOCKS/WR

```
0001      SUBROUTINE MOVREC(I,J)
C
C THIS ROUTINE MOVES THE EARTH TERMINAL INFORMATION INTO AN ARRAY
C WHICH IS PRINTED IN THE PROGRAM EARTH.
C
C CALLED BY: EARTH
C
C BIGREC - AN ARRAY CONTAINING UPLINK OR DOWNLINK CODE, CITY INDEX,
C          AND A PRINT RECORD FOR EACH EARTH TERMINAL NEAR EACH
C          CITY
C
C I      - INDEX OF THE UPLINK OR DOWNLINK CITY
C
C J      - INDEX OF THE BIGREC
C
C UPDOWN - 1 = UPLINK, 2=DOWNLINK
C
0002      INCLUDE 'SY0:COMBLK.FTN/NOLIST'
C
0040      LOGICAL*1 PAD(12460)
0041      COMMON PAD
C
0042      LOGICAL*1 CALSIN(5),LICNSE(40),CITY(20),
2          STATE(2),BAND(4,2),SIZE(4),SERVIS(18)
0043      INTEGER*2 UPDOWN,I,J
C
0044      COMMON /ESTATN/ UPDOWN,CALSIN,LICNSE,CITY,STATE,SERVIS,BAND,SIZE
C
0045      LOGICAL*1 BIGREC(350,82)
0046      EQUIVALENCE (BIGREC(1,1),NUELEM)
C
0047      BIGREC(J,1)=UPDOWN
0048      BIGREC(J,2)=I
0049      DO 10 K=3,7
0050      10  BIGREC(J,K) = CALSIN(K-2)
0051          DO 20 K=9,43
0052      20  BIGREC(J,K) = LICNSE(K-8)
0053          DO 30 K=46,61
0054      30  BIGREC(J,K) = CITY(K-45)
0055          DO 40 K=64,65
0056      40  BIGREC(J,K) = STATE(K-63)
0057          DO 50 K=68,76
0058      50  BIGREC(J,K) = SERVIS(K-67)
0059          DO 60 K=79,82
0060      60  BIGREC(J,K) = SIZE(K-78)
C
0061      RETURN
0062      END
```

SECTION 4. GENERAL UTILITY SUBROUTINES

Section 4 includes listings for the general utility subroutines used by all of the modules.

READIN
RITOUT
YESNO
UPDOWN
CODCHK
GETTER
CCOUNT
DISAPR
RDCOST
RATECK
CTYCHK
VANDH
MATMOD
REPRTR

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C
0063 510 IF (NUINDX.GE.2)
      2 READ(2,5005,ERR=5030) ((UCINDX(I,J),J=1,8),I=2,NUINDX)
0064 5005 FORMAT (5(8A1,1X))
0065 IF (NUMORG.GT.0) READ(2,5006,ERR=5030) (UDXWHT(I),I=1,NUINDX)
0066 5006 FORMAT(6F7.3)
C
C UPLINK COST ELEMENT DATA
C
0067 JERROR=2
0068 DO 530 I = 1,NUELEM
0069 READ(2,5007,ERR=5030) (UCSCOD(I,J),J=1,2),(UCSNAM(I,J),J=1,20),
      2 UCSMIN(I),(UCSDAT(I,1,K),K=1,4)
0070 5007 FORMAT(2A1,1X,20A1,7X,5F10.3)
0071 IF (NUINDX.EQ.1) GO TO 540
0072 J = 0
0073 518 J = J + 2
0074 IF (J - NUINDX) 520,525,530
0075 520 JJ = J + 1
0076 READ(2,5008,ERR=5030)(UCSDAT(I,J,K),K=1,4),(UCSDAT(I,JJ,K),K=1,4)
0077 5008 FORMAT(8F10.3)
0078 GO TO 518
0079 525 READ(2,5008,ERR=5030) (UCSDAT(I,J,K),K=1,4)
0080 530 CONTINUE
C
C UPLINK PATH DATA
C
0081 JERROR=3
0082 DO 540 I=1,NUPATH
0083 READ(2,5009,ERR=5030)(UPTHNM(I,J),J=1,20),(UCSPTH(J,I),J=1,NUELEM)
0084 5009 FORMAT(20A1,5X,15I1)
0085 540 CONTINUE
C
C UPLINK CITY DATA
C
0086 JERROR=4
0087 IF (NUCITY.EQ.0) GO TO 555
0088 DO 550 I=1,NUCITY
0089 READ(2,5010,ERR=5030) (UCTNAM(I,J),J=1,16),(USTCOD(I,J),J=1,2),
      2 UCITYV(I),UCITYH(I),UCTCHN(I),UCTORG(I),(UPTHCY(J,I),J=1,NUPATH)
0090 5010 FORMAT(16A1,1X,2A1,2I6,2I2,5X,10I1)
0091 IF (NUINDX.GT.1) READ(2,5008,ERR=5030) (UCTXVL(I,J),J=1,NUINDX-1)
0092 550 CONTINUE
C
C DOWNLINK COST INDEX NAMES AND COST ALLOCATION WEIGHTS
C
0093 555 JERROR=5
0094 IF (NDINDX.GE.2)
      2 READ(2,5005,ERR=5030) ((DCINDX(I,J),J=1,8),I=2,NDINDX)
0095 IF (NUMORG.GT.0) READ(2,5006,ERR=5030) (DDXWHT(I),I=1,NDINDX)
C
C DOWNLINK COST ELEMENT DATA
C
0096 DO 630 I = 1,NDELEM
0097 READ(2,5007,ERR=5030) (DCSCOD(I,J),J=1,2),(DCSNAM(I,J),J=1,20),
      2 DCSMIN(I),(DCSDAT(I,1,K),K=1,4)

```

```

0098      IF (NDINDX.EQ.1) GO TO 640
0099      J = 0
0100  618  J = J + 2
0101      IF (J - NDINDX) 620,625,630
0102  620  JJ = J + 1
0103      READ(2,5008,ERR=5030)(DCSDAT(I,J,K),K=1,4),(DCSDAT(I,JJ,K),K=1,4)
0104      GO TO 618
0105  625  READ(2,5008,ERR=5030) (DCSDAT(I,J,K),K=1,4)
0106  630  CONTINUE
      C
      C   DOWNLINK PATH DATA
      C
0107      JERROR=6
0108      DO 640 I=1,NDPATH
0109      READ(2,5009,ERR=5030)(DPTHNM(I,J),J=1,20),(DCSPTH(J,I),J=1,NDELEM)
0110  640  CONTINUE
      C
      C   DOWNLINK CITY DATA
      C
0111      JERROR=7
0112      IF (NDCITY.EQ.0) GO TO 690
0113      DO 650 I=1,NDCITY
0114      READ(2,5010,ERR=5030) (DCTNAM(I,J),J=1,16),(DSTCOD(I,J),J=1,2),
      2 DCITYV(I),DCITYH(I),DCTLVL(I),DCTORG(I),(DPTHCY(J,I),J=1,NDPATH)
0115      IF (NDINDX.GT.1) READ(2,5008,ERR=5030) (DCTXVL(I,J),J=1,NDINDX-1)
0116  650  CONTINUE
      C
      C   TALKBACK INFORMATION
      C
0117      JERROR=8
0118      IF (NUCITY.EQ.0) GO TO 690
0119      DO 680 J=1,NUCITY
0120      L2 = 0
0121  660  L1 = L2 + 1
0122      L2 = L1 + 12
0123      IF(L1.GT.NDCITY) GO TO 680
0124      IF(L2.GT.NDCITY) L2=NDCITY
0125      READ(2,5011,ERR=5030) (TALKBK(I,J),I=L1,L2)
0126  5011  FORMAT (13F6.1)
0127      GO TO 660
0128      CONTINUE
0129  680  CLOSE (UNIT=2)
0130      RETURN
      C
      C   IF ERRORS OCCUR WHILE READING THE INPUT FILE
      C
0131  5020  WRITE(1,5025) (INNAME(I),I=1,16)
0132  5025  FORMAT(1H , 'ERROR IN OPENING FILE ',16A1)
0133      GO TO 5040
0134  5030  WRITE(1,5035)(PROBLM(I,JERROR),I=1,3)
0135  5035  FORMAT(1H , 'ERROR READING ',3A4, ' DATA')
0136  5040  WRITE (1,*) 'PROGRAM TERMINATED'
0137      CLOSE (UNIT=2)
0138      STOP
0139      END
  
```



```

0061      L1 = L2 + 1
0062      IF (L1.LE.NUMORG) GO TO 501
C
C      UPLINK COST INDEX NAMES AND COST ALLOCATION WEIGHTS
C
0063      510  IF (NUINDEX.GE.2)
           2  WRITE(2,5005,ERR=5030) ((UCINDEX(I,J),J=1,8),I=2,NUINDEX)
0064      5005  FORMAT(5(8A1,1X))
0065      5006  IF (NUMORG.GT.0) WRITE(2,5006,ERR=5030) (UDXWHT(I),I=1,NUINDEX)
0066      5006  FORMAT(6F7.3)
C
C      UPLINK COST ELEMENT DATA
C
0067      JERROR=2
0068      DO 530 I = 1,NUELEN
0069      WRITE(2,5007,ERR=5030) (UCSCOD(I,J),J=1,2),(UCSNAM(I,J),J=1,20),
           2  UCSMIN(I),(UCSDAT(I,1,K),K=1,4)
0070      5007  FORMAT(2A1,1X,20A1,7X,5F10.3)
0071      IF (NUINDEX.EQ.1) GO TO 540
0072      J = 0
0073      518  J = J + 2
0074      IF (J - NUINDEX) 520,525,530
0075      520  JJ = J + 1
0076      WRITE(2,5008,ERR=5030) (UCSDAT(I,J,K),K=1,4),(UCSDAT(I,JJ,K),
           2  K=1,4)
0077      5008  FORMAT(8F10.3)
0078      GO TO 518
0079      525  WRITE(2,5008,ERR=5030) (UCSDAT(I,J,K),K=1,4)
0080      530  CONTINUE
C
C      UPLINK PATH DATA
C
0081      JERROR=3
0082      DO 540 I=1,NUPATH
0083      WRITE(2,5009,ERR=5030) (UPTHNM(I,J),J=1,20),(UCSPTH(J,I),J=1,
           2  NUELEN)
0084      5009  FORMAT(20A1,5X,15I1)
0085      540  CONTINUE
C
C      UPLINK CITY DATA
C
0086      JERROR=4
0087      IF (NUCITY.EQ.0) GO TO 555
0088      DO 550 I=1,NUCITY
0089      WRITE(2,5010,ERR=5030) (UCTNAM(I,J),J=1,16),(USTCOD(I,J),J=1,2),
           2  UCITYV(I),UCITYH(I),UCTCHN(I),UCTORG(I),(UPTHCY(J,I),J=1,NUPATH)
0090      5010  FORMAT(16A1,1X,2A1,2I6,2I2,5X,10I1)
0091      IF (NUINDEX.GT.1) WRITE(2,5008,ERR=5030) (UCTXVL(I,J),J=1,NUINDEX-1)
0092      550  CONTINUE
C
C      DOWNLINK COST INDEX NAMES AND COST ALLOCATION WEIGHTS
C
0093      555  JERROR=5
0094      IF (NDINDEX.GE.2)
           2  WRITE(2,5005,ERR=5030) ((DCINDEX(I,J),J=1,8),I=2,NDINDEX)
0095      IF (NUMORG.GT.0) WRITE(2,5006,ERR=5030) (DDXWHT(I),I=1,NDINDEX)

```

```

C
C   DOWNLINK COST ELEMENT DATA
C
0096      DO 630 I = 1,NDELEM
0097      WRITE(2,5007,ERR=5030) (DCSCOD(I,J),J=1,2),(DCSNAM(I,J),J=1,20),
2         DCSMIN(I),(DCSDAT(I,1,K),K=1,4)
0098      IF (NDINDX.EQ.1) GO TO 640
0099      J = 0
0100      618  J = J + 2
0101      IF (J - NDINDX) 620,625,630
0102      620  JJ = J + 1
0103      WRITE(2,5008,ERR=5030) (DCSDAT(I,J,K),K=1,4),(DCSDAT(I,JJ,K),
2         K=1,4)
0104      GO TO 618
0105      625  WRITE(2,5008,ERR=5030) (DCSDAT(I,J,K),K=1,4)
0106      630  CONTINUE
C
C   DOWNLINK PATH DATA
C
0107      JERROR=6
0108      DO 640 I=1,NDPATH
0109      WRITE(2,5009,ERR=5030) (DPTHNM(I,J),J=1,20),(DCSPTH(J,I),J=1,
2         NDELEM)
0110      640  CONTINUE
C
C   DOWNLINK CITY DATA
C
0111      JERROR=7
0112      IF (NDCITY.EQ.0) GO TO 690
0113      DO 650 I=1,NDCITY
0114      WRITE(2,5010,ERR=5030) (DCTNAM(I,J),J=1,16),(DSTCOD(I,J),J=1,2),
2         DCITYV(I),DCITYH(I),DCTLVL(I),DCTORG(I),(DPTHCY(J,I),J=1,NDPATH)
0115      IF (NDINDX.GT.1) WRITE(2,5008,ERR=5030) (DCTXVL(I,J),J=1,NDINDX-1)
0116      650  CONTINUE
C
C   TALKBACK INFORMATION
C
0117      JERROR=8
0118      IF (NUCITY.EQ.0) GO TO 690
0119      DO 680 J=1,NUCITY
0120      L2 = 0
0121      660  L1 = L2 + 1
0122      L2 = L1 + 12
0123      IF(L1.GT.NDCITY) GO TO 680
0124      IF(L2.GT.NDCITY) L2=NDCITY
0125      WRITE(2,5011,ERR=5030) (TALKBK(I,J),I=L1,L2)
0126      5011  FORMAT (13F6.1)
0127      GO TO 660
0128      680  CONTINUE
0129      690  CLOSE (UNIT=2)
0130      RETURN
C
C   IF ERRORS OCCUR WHILE WRITING THE OUTPUT FILE
C
0131      5020  WRITE(1,5025) (INNAME(I),I=1,16)
0132      5025  FORMAT(1H,'ERROR OPENING FILE ',16A1)

```

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```
0133      GO TO 5040
0134      5030 WRITE(1,5035)(PROBLM(I,JERROR),I=1,3)
0135      5035 FORMAT(1H,'ERROR WRITING ',3A4,' DATA')
0136      5040 WRITE (1,X) 'BUILDER TERMINATED'
0137      CLOSE (UNIT=2)
0138      STOP
0139      END
```

```
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C                               SUBROUTINE YESNO
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C CALLED BY: BUILD, COST, PATH, CITY, RATE, MODEL
C
C
C YESNO DETERMINES IF THE RESPONSE TO A QUESTION IS 'YES' OR 'NO'
C OR IN ERROR AND SETS THE APPROPRIATE FLAG - ONLY THE FIRST
C CHARACTER OF THE RESPONSE IS CHECKED.
C
0001      SUBROUTINE YESNO
0002      INCLUDE 'BYO:COMBLK.FTN/NOLIST'
0040      YESSNO = 3
0041      READ(1,10,ERR=20) INDATA(1)
0042      10  FORMAT (A1)
0043      IF (INDATA(1).EQ.'Y') YESSNO = 1
0044      IF (INDATA(1).EQ.'N') YESSNO = 2
0045      20  IF (YESSNO.EQ.3) WRITE (1,*) 'ANSWER MUST BE 'YES' OR 'NO''
0046      RETURN
0047      END
```

```
C  
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC  
C  
C SUBROUTINE UPDOWN  
C  
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC  
C  
C CALLED BY: COST, PATH, CITY, RATE  
C  
C  
C UPDOWN DETERMINES IF THE RESPONSE TO A QUESTION IS 'UPLINK' OR  
C 'DOWNLINK' OR IN ERROR AND SETS THE APPROPRIATE FLAG - ONLY THE  
C FIRST CHARACTER OF THE RESPONSE IS CHECKED.  
C
```

```
0001 SUBROUTINE UPDOWN  
0002 INCLUDE 'SYO:COMBLK.FTN/NOLIST'  
0040 UPPDWN = 3  
0041 READ(1,10,ERR=20) INDATA(1)  
0042 FORMAT(A1)  
0043 10 IF (INDATA(1).EQ.'U') UPPDWN = 1  
0044 IF (INDATA(1).EQ.'D') UPPDWN = 2  
0045 20 IF (UPPDWN.EQ.3) WRITE (1,*) 'ANSWER MUST BE 'UP' OR 'DOWN''  
0046 RETURN  
0047 END
```

```
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C          SUBROUTINE CODCHK
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C  CALLED BY: COST, PATH, CITY, RATE, METHOD, RDCOST, MODEL, EARTH
C
C  CODCHK CHECKS AN INPUT ARGUMENT AGAINST A LIST OF VALID ARGUMENTS
0001  SUBROUTINE CODCHK(NCHAR,INDATA,NCOMPR,CHPARR,POSITN)
C
C  ARGUMENTS:
C    NCHAR = NUMBER OF CHARACTERS IN INPUT ARGUMENT
C    INDATA = ARRAY CONTAINING INPUT ARGUMENT
C    NCOMPR = NUMBER OF POSSIBLE VALUES
C    CHPARR = ARRAY CONTAINING LIST OF POSSIBLE VALUES
C    POSITN = POSITION IN THE ARRAY WHERE INPUT ARGUMENT MATCHED
C             A POSSIBLE VALUE.
0002  INTEGER*2 NCHAR,NCOMPR,POSITN,I,J,NMATCH
0003  LOGICAL*1 INDATA(1),CHPARR(NCOMPR,1)
C
0004  POSITN = 0
0005  NMATCH = 0
0006  DO 20 I=1,NCOMPR
0007     DO 10 J=1,NCHAR
0008        IF (INDATA(J).NE.CHPARR(I,J)) GO TO 20
0009  10    CONTINUE
0010     NMATCH = NMATCH + 1
0011     POSITN = I
0012  20    CONTINUE
C
C  USER'S RESPONSE CONTAINED TOO FEW CHARACTERS TO MAKE A UNIQUE MATCH
0013  IF (NMATCH.GT.1) POSITN = -1
0014  RETURN
0015  END
```

```
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C          SUBROUTINE GETTER
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C SUBROUTINE CALLS: CCOUNT
C CALLED BY: MAIN, COST, PATH, CITY, RATE, RDCOST, METHOD, MODEL
C THIS SUBROUTINE RETRIEVES THE NEXT ARGUMENT ON THE COMMAND LINE
C
0001      SUBROUTINE GETTER
0002      INCLUDE 'SYO:COMBLK.FTN/NDLIST'
0040      LOGICAL*1 BLANK, COMMA, SEMIC
0041      DATA BLANK /' ', COMMA /',', SEMIC /';'
0042      DATA NSTART /1/
C
C GET RID OF LEADING BLANKS IN INPUT ARGUMENT AND CLEAR ARG ARRAY
C
0043      NCHAR = 0
0044      CONTCD = 1
0045      DO 10 I = 1,80
0046          ARG(I) = BLANK
0047      10 CONTINUE
0048      DO 20 I=NSTART,80
0049          IF (INDATA(I).NE.BLANK) GO TO 30
0050          NSTART = NSTART+1
0051      20 CONTINUE
C
C CASE WHERE ENTIRE LINE IS EMPTY
C
0052      CONTCD = 0
0053      NSTART = 1
0054      RETURN
C
C CHECK EACH CHARACTER
C
0055      30 DO 50 I=NSTART,80
0056          IF (INDATA(I).NE.SEMIC) GO TO 50
C
C SEMICOLON ENCOUNTERED
C
0057      NCHAR = I - NSTART
0058      IF (NCHAR.NE.0) GO TO 40
C
C IF CHARACTER COUNT IS ZERO
C
0059      NCHAR = 1
0060      ARG(1) = SEMIC
0061      CONTCD = 0
0062      NSTART = 1
0063      RETURN
C
0064      40 NSTART = I
```

```
0065          GO TO 90
C
C   IF COMMA IS ENCOUNTERED
C
0066 50      IF (INDATA(I).NE.COMMA) GO TO 70
0067          NCHAR = I - NSTART
0068          NSTART = I + 1
0069          IF (NCHAR.EQ.0)
2          WRITE(1,*) 'NULL ARGUMENT SPECIFIED--IT WILL BE IGNORED.'
C
C   SCAN REMAINDER OF LINE TO SEE IF THIS IS THE LAST ARGUMENT
C
0070          DO 60 J = NSTART,80
0071          IF (INDATA(J).NE.BLANK) GO TO 90
0072 60      CONTINUE
0073          CONTCD = 0
0074          NSTART = 1
0075          GO TO 90
C
C   IF CHARACTER (OTHER THAN BLANK, COMMA, SEMICOLON) ENCOUNTERED
C
0076 70      NCHAR = NCHAR + 1
0077          ARG(NCHAR) = INDATA(I)
0078 80      CONTINUE
C
C   END OF INPUT LINE REACHED
C
0079          CONTCD = 0
0080          NSTART = 1
0081 90      CALL CCOUNT(ARG,NCHAR)
0082          RETURN
0083          END
```



```
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C                               SUBROUTINE CCOUNT
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C CALLED BY: GETTER
C
C THIS SUBROUTINE COUNTS CHARACTERS IN AN INPUT ARGUMENT UNTIL
C IT SEES A SEMICOLON OR COMMA. TRAILING BLANKS ARE IGNORED.
C
0001     SUBROUTINE CCOUNT (ARG,NCHAR)
0002     LOGICAL*1 ARG(1),COMMA,BLANK,SEMIC
0003     INTEGER*2 NCHAR
0004     DATA COMMA /',',/, SEMIC /';',/, BLANK /' '/

C
C ARGUMENTS:
C ARG = ARGUMENT TO BE COUNTED
C NCHAR = NUMBER OF CHARACTERS (COMPUTED)
C
0005     DO 20 I = 1,24
0006     IF (ARG(I).EQ.BLANK) GO TO 20
0007     IF (ARG(I).NE.SEMIC.AND.ARG(I).NE.COMMA) GO TO 10
0008     NCHAR = I - 1
0009     RETURN
0010     10 NCHAR = I
0011     20 CONTINUE
0012     RETURN
0013     END
```

```
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C                               SUBROUTINE DISAPR
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C CALLED BY: COST, PATH, CITY
C
C THIS SUBROUTINE DELETES A COST ELEMENT, PATH, OR CITY FROM THE
C DATA BASE. ARGUMENTS:
C
C CODE=CODE INDICATING TYPE OF DELETION
C     1=UPLINK COST ELEMENT           2=DOWNLINK COST ELEMENT
C     3=UPLINK PATH                   4=DOWNLINK PATH
C     5=UPLINK CITY                   6=DOWNLINK CITY
C INDEX=POSITION IN ARRAYS TO BE DELETED
C
0001 SUBROUTINE DISAPR(CODE,INDEX)
0002 INCLUDE 'SYO:COMBLK.FTM/NOLIST'
0040 INTEGER*2 CODE,INDEX
0041 LOGICAL*1 BLANK
0042 DATA BLANK /' '/
C
0043 GO TO (100,200,300,400,500,600), CODE
C
C UPLINK COST ELEMENT
C
0044 100 IF (INDEX.EQ.NUELEM) GO TO 190
0045     I1 = INDEX + 1
0046     DO 110 K=1,4
0047     DO 110 J=1,NUINDX
0048     DO 110 I=I1,NUELEM
0049 110 UCSDAT(I-1,J,K) = UCSDAT(I,J,K)
0050     DO 120 I=I1,NUELEM
0051 120 UCSDAT(I-1) = UCSDAT(I)
0052     DO 160 I = I1,NUELEM
0053     DO 130 J = 1,2
0054 130 UCSCOD(I-1,J) = UCSCOD(I,J)
0055     DO 140 J = 1,20
0056 140 UCSNAM(I-1,J) = UCSNAM(I,J)
0057     DO 150 J=1,NUPATH
0058 150 UCSPTH(I-1,J) = UCSPTH(I,J)
0059 160 CONTINUE
0060 190 UCSCOD(NUELEM,1) = BLANK
0061     UCSNAM(NUELEM,1) = BLANK
0062     NUELEM = NUELEM - 1
0063     RETURN
C
C DOWNLINK COST ELEMENT
C
0064 200 IF (INDEX.EQ.NDELEM) GO TO 290
0065     I1 = INDEX + 1
0066     DO 210 K=1,4
0067     DO 210 J=1,NDINDX
0068     DO 210 I=I1,NDELEM
```

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```

0069 210 DCSDAT(I-1,J,K) = DCSDAT(I,J,K)
0070      DO 220 I=I1,NDELEM
0071 220 DCSMIN(I-1) = DCSMIN(I)
0072      DO 260 I = I1,NDELEM
0073      DO 230 J = 1,2
0074 230 DCSCOD(I-1,J) = DCSCOD(I,J)
0075      DO 240 J = 1,20
0076 240 DCSNAM(I-1,J) = DCSNAM(I,J)
0077      DO 250 J=1,NDPATH
0078 250 DCSPTH(I-1,J) = DCSPTH(I,J)
0079 260 CONTINUE
0080 290 DCSCOD(NDELEM,1) = BLANK
0081      DCSNAM(NDELEM,1) = BLANK
0082      NDELEM = NDELEM - 1
0083      RETURN

```

C

C UPLINK PATH

C

```

0084 300 IF (INDEX.EQ.NUPATH) GO TO 390
0085      I1 = INDEX+1
0086      DO 360 I=I1,NUPATH
0087      DO 310 J=1,NUELEM
0088 310 UCSPTH(J,I-1) = UCSPTH(J,I)
0089      DO 320 J=1,NUCITY
0090 320 UPTHCY(I-1,J) = UPTHCY(I,J)
0091      DO 330 J=1,20
0092 330 UPTHNM(I-1,J) = UPTHNM(I,J)
0093 360 CONTINUE
0094 390 UPTHNM(NUPATH,1) = BLANK
0095      NUPATH = NUPATH-1
0096      RETURN

```

C

C DOWNLINK PATH

C

```

0097 400 IF (INDEX.EQ.NDPATH) GO TO 490
0098      I1 = INDEX+1
0099      DO 460 I=I1,NDPATH
0100      DO 410 J=1,NDELEM
0101 410 DCSPTH(J,I-1) = DCSPTH(J,I)
0102      DO 420 J=1,NDCITY
0103 420 DPTHCY(I-1,J) = DPTHCY(I,J)
0104      DO 430 J=1,20
0105 430 DPTHNM(I-1,J) = DPTHNM(I,J)
0106 460 CONTINUE
0107 490 DPTHNM(NDPATH,1) = BLANK
0108      NDPATH = NDPATH-1
0109      RETURN

```

C

C

C UPLINK CITY

C

```

0110 500 IF ( INDEX .EQ. NUCITY ) GO TO 590
0111      I1 = INDEX + 1
0112      DO 560 I = I1,NUCITY
0113      UCITYV(I-1) = UCITYV(I)

```

DISAPR.FTN

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```

0114          UCITYH(I-1) = UCITYH(I)
0115          UCTCHN(I-1) = UCTCHN(I)
0116          IF ( NUMORG .GT. 0 ) UCTORG(I-1) = UCTORG(I)
0117          DO 510 J=1,16
0118      510          UCTNAM(I-1,J) = UCTNAM(I,J)
0119          DO 520 J=1,NUINDX
0120      520          UCTXVL(I-1,J) = UCTXVL(I,J)
0121          DO 530 J=1,2
0122      530          USTCOD(I-1,J) = USTCOD(I,J)
0123          DO 540 J=1,NDCITY
0124      540          TALKBK(J,I-1) = TALKBK(J,I)
0125          DO 550 J=1,NUPATH
0126      550          UPTHCY(J,I-1) = UPTHCY(J,I)
0127      560          CONTINUE
0128      590          UCTNAM(NUCITY,1) = BLANK
0129          NUCITY = NUCITY-1
0130          RETURN

```

C

C

C DOWNLINK CITY

C

C

```

0131      600          IF ( INDEX .EQ. NDCITY ) GO TO 690
0132          I1 = INDEX + 1
0133          DO 660 I=I1,NDCITY
0134              DCITYV(I-1) = DCITYV(I)
0135              DCITYH(I-1) = DCITYH(I)
0136              DCTLVL(I-1) = DCTLVL(I)
0137              IF ( NUMORG .GT. 0 ) DCTORG(I-1) = DCTORG(I)
0138              DO 610 J=1,16
0139      610              DCTNAM(I-1,J) = DCTNAM(I,J)
0140              DO 620 J=1,NDINDX
0141      620              DCTXVL(I-1,J) = DCTXVL(I,J)
0142              DO 630 J=1,2
0143      630              DSTCOD(I-1,J) = DSTCOD(I,J)
0144              DO 640 J=1,NUCITY
0145      640              TALKBK(I-1,J) = TALKBK(I,J)
0146              DO 650 J=1,NDPATH
0147      650              DPTHCY(J,I-1) = DPTHCY(J,I)
0148      660          CONTINUE
0149      690          DCTNAM(NDCITY,1) = BLANK
0150          NDCITY = NDCITY-1
0151          RETURN
0152          END

```

RDCOST.FTN /TR:BLOCKS/WR

```

C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C                               SUBROUTINE RDCOST
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C SUBROUTINE CALLS: GETTER, CODCHK
C
C CALLED BY: COST
C
C THIS SUBROUTINE READS IN AN INPUT ARGUMENT AND TESTS FOR A COST
C ELEMENT CODE.
C

```

```

0001     SUBROUTINE RDCOST
0002     INCLUDE 'SY0:COMBLK.FTN/NOLIST'
C
0040     READ (1,1000) (INDATA(I),I=1,80)
0041     1000  FORMAT (80A1)
0042     CALL GETTER
0043     IF (UPPDWN.EQ.1) CALL CODCHK(2,ARG,MAXUCS,UCSCOD,POSITN)
0044     IF (UPPDWN.EQ.2) CALL CODCHK(2,ARG,MAXDCS,DCSCOD,POSITN)
0045     RETURN
0046     END

```



```
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C                               SUBROUTINE CTYCHK
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C CALLED BY: CITY, MATMOD
C
C THIS SUBROUTINE WILL DETERMINE IF A CITY/ORGANIZATION PAIR EXISTS
C AND IF SO, WILL RETURN THE INDEX TO THAT PAIR. ORGANIZATION WILL BE
C IGNORED IF COST ALLOCATION HAS NOT BEEN SELECTED.
C
0001 SUBROUTINE CTYCHK(POS,ORG)
0002 INCLUDE 'SY0:COMBLK.FTN/NOLIST'
0040 INTEGER*2 ORG,NMATCH,LIMIT,POS,POS2
C
0041 POS = 0
0042 ORG = 0
0043 POS2=0
0044 NMATCH = 0
0045 IF (NCHAR.EQ.1.OR.ARG(NCHAR-1).NE.'/') GO TO 100
0046 ORG = ARG(NCHAR)-48
0047 IF (ORG.LE.0.OR.ORG.GT.NUMORG) GO TO 1001
0048 NCHAR = NCHAR-2
0049 100 IF (ORG.EQ.0.AND.NUMORG.GT.0) GO TO 1000
0050 IF (UPPDWN.EQ.1) LIMIT=NUCITY
0051 IF (UPPDWN.EQ.2) LIMIT=NDCITY
0052 DO 130 I=1,LIMIT
0053     DO 110 J=1,NCHAR
0054         IF (UPPDWN.EQ.1.AND.ARG(J).NE.UCTNAM(I,J)).OR.
0055             2 UPPDWN.EQ.2.AND.ARG(J).NE.DCTNAM(I,J)) GO TO 130
C
C MATCH FOUND
C
0056 POS2 = I
0057 IF (ORG.EQ.UCTORG(I).AND.UPPDWN.EQ.1.OR.
0058     2 ORG.EQ.DCTORG(I).AND.UPPDWN.EQ.2) GO TO 120
0059 GO TO 130
0059 120 NMATCH=NMATCH + 1
0060 POS = I
0061 130 CONTINUE
C
0062 IF (NMATCH.GT.1) WRITE (1,*) 'SPECIFIED CITY NOT UNIQUE - ENTER MO
0063 2RE INFORMATION'
0064 IF (NMATCH.GT.1) POS=-1
0065 IF (NMATCH.EQ.1) ORG=0
0066 IF (NMATCH.EQ.0) POS=POS2
0067 RETURN
0067 1000 WRITE (1,*) 'AN ORGANIZATION CODE MUST BE SPECIFIED'
0068 GO TO 1002
0069 1001 WRITE (1,*) 'INVALID ORGANIZATION CODE'
0070 1002 POS=-2
0071 RETURN
0072 END
```

```
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C          SUBROUTINE VANDH
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C   CALLED BY: CITY, MODUP, MODDN, EARTH
C
C   THIS SUBROUTINE CONVERTS LATITUDE/LONGITUDE TO BELL SYSTEM U AND
C   H COORDINATES (PROVIDES A SIMPLER MEANS OF ESTABLISHING THE
C   DISTANCE BETWEEN TWO CITIES).
C
C   PARAMETERS: M - NEGATIVE OF THE LATITUDE IN DDMM FORMAT
C               N - LONGITUDE IN DDDMM FORMAT
C
0001   SUBROUTINE VANDH(M,N)
0002   INTEGER*4 I,J
C
C   COMPUTE 'A' WHICH IS THE LATITUDE IN RADIAN AND FRACTIONS OF A
C   RADIAN
C
0003   I=((-1)*M)/100
0004   J=(M+I*100)*(-1)
0005   A=FLOAT(I)/57.2958+FLOAT(J)/3437.75
C
C   COMPUTE 'B' WHICH IS THE LONGITUDE IN THE SAME UNITS
C
0006   I=N/100
0007   J=N-I*100
0008   B=FLOAT(I)/57.2958+FLOAT(J)/3437.75
C
C   THE FOLLOWING CALCULATIONS ARE A GEOMETRIC APPROXIMATION TO A
C   BELL SYSTEM PROPRIETARY ALGORITHM. A KNOWN POINT IN BOTH SYSTEMS
C   IS USED AS A REFERENCE (IN THIS CASE, NEW YORK CITY WHICH HAS
C   A U AND H OF 4995,1408). SPHERICAL TRIGONOMETRY IS USED TO
C   DETERMINE THE AZIMUTH AND DISTANCE TO THE UNKNOWN POINT.
C   AZIMUTH AND DISTANCE FORM A VECTOR USED TO COMPUTE THE U AND H
C   COORDINATE.
C
0009   ALPHA=0.62786*SIN(A)+0.757542*COS(A)*COS(1.29144-B)
0010   THETA=(SIN(A)-ALPHA*0.652786)/(0.757542*SQRT(1.-ALPHA*ALPHA))
0011   THETA=ACOS(THETA)
0012   IF(B.GT.1.29144)THETA=6.283185-THETA
0013   BETA=2.22013-THETA
0014   DIST=12510.25*ACOS(ALPHA)
0015   M=IFIX(4995.-DIST*SIN(BETA))
0016   N=IFIX(1408.-DIST*COS(BETA))
0017   RETURN
0018   END
```



```
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C
C          SUBROUTINE MATMOD
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C
C SUBROUTINE CALLS: GETTER, CODCHK, CTYCHK, REPRTR
C
C CALLED BY: COST, PATH, CITY
C
C THIS SUBROUTINE CHANGES THE MATRICES OF 1'S AND 0'S. IT READS A
C LIST OF COST ELEMENTS, PATHS, OR CITIES, AND MAKES APPROPRIATE
C CHANGES IN UCSPTH,DCSPTH,UPTMCHY, AND DPTHY. ARGUMENTS:
C
C CODE=TYPE OF CHANGE
C 1=READ UPLINK COST ELEMENTS, MODIFY COST ELEMENT/PATH MATRIX
C 2=READ DNLINK COST ELEMENTS, MODIFY COST ELEMENT/PATH MATRIX
C 3=READ UPLINK PATHS,          MODIFY COST ELEMENT/PATH MATRIX
C 4=READ DNLINK PATHS,          MODIFY COST ELEMENT/PATH MATRIX
C 5=READ UPLINK PATHS,          MODIFY PATH/CITY MATRIX
C 6=READ DNLINK PATHS,          MODIFY PATH/CITY MATRIX
C 7=READ UPLINK CITIES,         MODIFY PATH/CITY MATRIX
C 8=READ DNLINK CITIES,         MODIFY PATH/CITY MATRIX
C ONOFF=1 OR 0, DEPENDING ON WHETHER THE MATRIX IS TO BE SET ON OR OFF
C MODPOS=ELEMENT IN THE MATRIX WHICH IS NOT BEING READ IN
C
0001 SUBROUTINE MATMOD(CODE,ONOFF,MODPOS)
0002 INCLUDE 'SYO:COMBLK.FTN/NOLIST'
0040 INTEGER*2 MODPOS,CODE,ONOFF,POS,ORG
C
0041 GO TO (100,100,200,200,200,200,300,300), CODE
C
C COST ELEMENTS SPECIFIED
C
0042 100 WRITE (1,*) 'ENTER COST ELEMENT CODES, ALL, OR 1'
0043 READ(1,900) (INDATA(I),I=1,80)
0044 105 CALL GETTER
0045 IF (ARG(1).EQ.'1') RETURN
0046 IF (ARG(1).EQ.'A'.AND.ARG(2).EQ.'L'.AND.ARG(3).EQ.'L') GO TO 190
0047 IF (NCHAR.EQ.0) GO TO 170
0048 IF (CODE.EQ.1) CALL CODCHK(2,ARG,MAXUCS,UCSCOD,POSITN)
0049 IF (CODE.EQ.2) CALL CODCHK(2,ARG,MAXDCS,DCSCOD,POSITN)
0050 IF (POSITN.EQ.0) GO TO 180
0051 IF (CODE.EQ.1) UCSPTH(POSITN,MODPOS) = ONOFF
0052 IF (CODE.EQ.2) DCSPTH(POSITN,MODPOS) = ONOFF
0053 170 IF (CONTCU.EQ.0) GO TO 100
0054 IF (CONTCU.NE.0) GO TO 105
C
C IF ERRORS HAVE OCCURRED
C
0055 180 WRITE (1,*) 'INVALID COST ELEMENT CODE'
0056 WRITE (1,*) 'VALID COST ELEMENTS ARE...'
0057 CALL REPRTR(9,1)
0058 GO TO 100
C
```

/TR:BLOCKS/WR

```

0059 190 DO 195 I=1,NELEM(UPPDOWN)
0060     IF (CODE.EQ.1) UCSPTH(I,MODPOS)=ONOFF
0061     IF (CODE.EQ.2) DCSPTH(I,MODPOS)=ONOFF
0062 195 CONTINUE
0063     RETURN
      C
      C PATHS SPECIFIED
      C
0064 200 WRITE (1,*) 'ENTER PATH NAMES, ALL, OR I'
0065     READ(1,900) (INDATA(I),I=1,80)
0066 205 CALL GETTER
0067     IF (ARG(1).EQ.'I') RETURN
0068     IF (ARG(1).EQ.'A'.AND.ARG(2).EQ.'L'.AND.ARG(3).EQ.'L') GO TO 295
0069     IF (NCHAR.EQ.0) GO TO 270
0070     IF (UPPDWN.EQ.1) CALL CODCHK(NCHAR,ARG,MAXUPA,UPTHNM,POSITN)
0071     IF (UPPDWN.EQ.2) CALL CODCHK(NCHAR,ARG,MAXDPA,DPTHNM,POSITN)
0072     IF (POSITN.EQ.0) GO TO 280
0073     IF (POSITN.LT.0) GO TO 290
0074     IF (CODE.EQ.3) UCSPTH(MODPOS,POSITN) = ONOFF
0075     IF (CODE.EQ.4) DCSPTH(MODPOS,POSITN) = ONOFF
0076     IF (CODE.EQ.5) UPTHCY(POSITN,MODPOS) = ONOFF
0077     IF (CODE.EQ.6) DPTHCY(POSITN,MODPOS) = ONOFF
0078 270 IF (CONTCO.EQ.0) GO TO 200
0079     IF (CONTCO.NE.0) GO TO 205
      C
      C IF ERRORS HAVE OCCURRED
      C
0080 280 WRITE (1,*) 'PATH DOES NOT EXIST. VALID PATHS ARE...'
0081     CALL REPRTR(3,1)
0082     GO TO 200
0083 290 WRITE (1,*) 'SPECIFIED PATH NOT UNIQUE - ENTER MORE INFORMATION'
0084     GO TO 200
      C
0085 295 DO 297 I=1,NPATH(UPPDOWN)
0086     IF (CODE.EQ.3) UCSPTH(MODPOS,I)=ONOFF
0087     IF (CODE.EQ.4) DCSPTH(MODPOS,I)=ONOFF
0088     IF (CODE.EQ.5) UPTHCY(I,MODPOS)=ONOFF
0089     IF (CODE.EQ.6) DPTHCY(I,MODPOS)=ONOFF
0090 297 CONTINUE
0091     RETURN
      C
      C CITIES SPECIFIED
      C
0092 300 WRITE (1,*) 'ENTER CITY NAMES, ALL, OR I'
0093     READ(1,900) (INDATA(I),I=1,80)
0094 305 CALL GETTER
0095     IF (ARG(1).EQ.'I') RETURN
0096     IF (ARG(1).EQ.'A'.AND.ARG(2).EQ.'L'.AND.ARG(3).EQ.'L') GO TO 390
0097     IF (NCHAR.EQ.0) GO TO 370
0098     CALL CTYCHK(POSITN,ORG)
0099     IF (POSITN.EQ.0) GO TO 380
0100     IF (POSITN.LT.0) GO TO 370
0101     IF (NUMORG.GT.0.AND.ORG.NE.0) GO TO 380
0102     IF (CODE.EQ.7) UPTHCY(MODPOS,POSITN) = ONOFF
0103     IF (CODE.EQ.8) DPTHCY(MODPOS,POSITN) = ONOFF
0104 370 IF (CONTCO.EQ.0) GO TO 300
  
```

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```
0105      IF (CONTCO.NE.0) GO TO 305
          C
          C
          C      IF ERRORS HAVE OCCURRED
0106      380  WRITE (1,*) 'CITY DOES NOT EXIST'
0107          WRITE (1,*) 'VALID CITIES ARE...'
0108          CALL REPRTR(10,1)
0109          GO TO 300
          C
0110      390  DO 395 I=1,NCITY(UPPDWN)
0111          IF (CODE.EQ.7) UPTHCY(MODPOS,I)=ONOFF
0112          IF (CODE.EQ.8) DPTHCY(MODPOS,I)=ONOFF
0113      395  CONTINUE
0114          RETURN
          C
0115      900  FORMAT(80A1)
0116          END
```



```

0072 1900 FORMAT (1H0,20X,15(1X,2A1))
0073      DO 1600 J=1,NUPATH
0074      DO 1590 I=1,NUELEM
0075      OUTARR(I) = BLANK
0076      IF (UCSPTH(I,J).EQ.1) OUTARR(I) = STAR
0077 1590 CONTINUE
0078      WRITE (3,1910) (UPTHNM(J,K),K=1,20),(OUTARR(I),I=1,NUELEM)
0079 1910 FORMAT(1H0,20A1,15(1X,A2))
0080 1600 CONTINUE
0081      GO TO 99999
  
```

C
 C MATRIX OF DOWNLINK COST ELEMENTS ASSOCIATED WITH EACH PATH
 C

```

0082 2500 WRITE (3,1800) UPDOWN(2),LINK
0083      WRITE (3,1900) ((DCSCOD(I,J),J=1,2),I=1,NDELEM)
0084      DO 2600 J=1,NDPATH
0085      DO 2590 I=1,NDELEM
0086      OUTARR(I) = BLANK
0087      IF (DCSPTH(I,J).EQ.1) OUTARR(I) = STAR
0088 2590 CONTINUE
0089      WRITE (3,1910) (DPTHNM(J,K),K=1,20),(OUTARR(I),I=1,NDELEM)
0090 2600 CONTINUE
0091      GO TO 99999
  
```

C
 C LIST OF UPLINK PATH NUMBERS AND NAMES
 C

```

0092 3000 IF (UPPDWN.EQ.2) GO TO 3500
0093      WRITE (3,3010)
0094 3010 FORMAT(1H0,/, ' NO.',6X, ' PATH NAME'//)
0095      DO 3100 I=1,NUPATH
0096      WRITE (3,3090) I,(UPTHNM(I,J),J=1,20)
0097 3090 FORMAT(1H ,I3,5X,20A1)
0098 3100 CONTINUE
0099      GO TO 99999
  
```

C
 C MATRIX OF DOWNLINK PATH NUMBERS AND NAMES
 C

```

0100 3500 WRITE (3,3010)
0101      DO 3600 I=1,NDPATH
0102      WRITE (3,3090) I,(DPTHNM(I,J),J=1,20)
0103 3600 CONTINUE
0104      GO TO 99999
  
```

C
 C MATRIX OF UPLINK PATHS AND CITIES
 C

```

0105 4000 IF (NCITY(UPPDWN).EQ.0) GO TO 4600
0106      WRITE (3,4010) UPDOWN(UPPDWN),LINK
0107 4010 FORMAT (1H0,/,1H , 'MATRIX OF PATHS AND CITIES--',2A4)
0108      J1 = 1
0109      J2 = MIN(NPATH(UPPDWN),16)
0110      WRITE (3,4030) (J,J=J1,J2)
0111 4030 FORMAT(1H0, ' CITY',13X, 'ORG ',16I3/)
0112      IF (UPPDWN.EQ.2) GO TO 4500
0113      DO 4080 I=1,NUCITY
0114      IF (UCITYV(I).EQ.-1) GO TO 4080
0115      DO 4070 J=J1,J2
  
```

```

0116      OUTARR(J) = BLANK
0117      IF (UPTHCY(J,I).EQ.1) OUTARR(J) = STAR
0118 4070  CONTINUE
0119      IF (NUMORG.EQ.0)
0120      2 WRITE (3,4075) (UCTNAM(I,J),J=1,16), (OUTARR(J-J1+1),J=J1,J2)
0121 4075  FORMAT('0',16A1,7X,16(1X,A2))
0122      IF (NUMORG.GT.0) WRITE (3,4076) (UCTNAM(I,J),J=1,16),UCTORG(I),
0123      2 (OUTARR(J-J1+1),J=J1,J2)
0124 4076  FORMAT('0',16A1,15,2X,16(1X,A2))
0123 4080  CONTINUE
0124      GO TO 99999
C
C   MATRIX OF DOWNLINK PATHS AND CITIES
C
0125 4500  DO 4580 I=1,NDCITY
0126      IF (DCITYV(I).EQ.-1) GO TO 4580
0127      DO 4570 J=J1,J2
0128      OUTARR(J) = BLANK
0129      IF (DPTHCY(J,I).EQ.1) OUTARR(J) = STAR
0130 4570  CONTINUE
0131      IF (NUMORG.EQ.0)
0132      2 WRITE (3,4075) (DCTNAM(I,J),J=1,16), (OUTARR(J-J1+1),J=J1,J2)
0133      IF (NUMORG.GT.0) WRITE (3,4076) (DCTNAM(I,J),J=1,16),DCTORG(I),
0134      2 (OUTARR(J-J1+1),J=J1,J2)
0133 4580  CONTINUE
0134      GO TO 99999
C
0135 4600  WRITE (3,*) 'THERE ARE NO CITIES IN THIS SEGMENT'
0136      GO TO 99999
C
C   C UPLINK CITIES AND ASSOCIATED COST INDEX VALUES
C
0137 5000  WRITE (3,5050) UPDOWN(UPPDWN), LINK
0138 5050  FORMAT ('0',24X,2A4,' COST INDEX VALUES',///)
0139      IF (UPPDWN.EQ.2) GO TO 5500
0140      DO 5275 I=1,NUCITY
0141      WRITE (3,5060) (UCTNAM(I,J),J=1,16),UCTORG(I)
0142 5060  FORMAT ('0',16A1,I3)
0143      WRITE (3,5075) ((UCINDX(K,J),J=1,8),K=2,NUINDX)
0144 5075  FORMAT (6X,5(1X,8A1))
0145      IF (UCITYV(I).EQ.-1) GO TO 5275
0146      WRITE (3,5100) (UCTXVL(I,J),J=1,NUINDX-1)
0147 5100  FORMAT (9X,F8.2,4(4X,F8.2))
0148 5275  CONTINUE
0149      GO TO 99999
C
C   C DOWNLINK CITIES AND ASSOCIATED COST INDEXES
C
0150 5500  DO 5800 I=1,NDCITY
0151      WRITE (3,5060) (DCTNAM(I,J),J=1,16),DCTORG(I)
0152      WRITE (3,5075) ((DCINDX(K,J),J=1,8),K=2,NDINDX)
0153      IF (DCITYV(I).EQ.-1) GO TO 5800
0154      WRITE (3,5100) ( DCTXVL(I,K),K=1,(NDINDX-1))

```

```
0155 5800 CONTINUE
0156      GO TO 99999
      C
      C
      C TALKBACK MATRIX BETWEEN UPLINK AND DOWNLINK CITIES
      C
      C
0157 6000 IF (NDCITY.EQ.0) GO TO 6600
0158      WRITE (3,6050) ((UCTNAM(I,J),J=1,3),I=1,NUCITY)
0159 6050 FORMAT(1H0,'MATRIX OF TALKBACK REQUIREMENTS',//,
2 ' DOWNLINK CITY  ORG  ',10(2X,3A1))
0160      WRITE (3,6100) (UCTORG(I),I=1,NUCITY)
0161 6100 FORMAT (21X,10I5,/)
0162      DO 6500 I=1,NDCITY
0163      WRITE (3,6150) (DCTNAM(I,J),J=1,16), DCTORG(I),
2 (TALNBK(I,J),J=1,NUCITY)
0164 6150 FORMAT (1H ,16A1,I2,3X,10(1X,F4.1),///)
0165 6500 CONTINUE
0166      GO TO 99999
      C
0167 6600 WRITE (3,*) 'THERE ARE NO DOWNLINK CITIES IN THIS SEGMENT'
0168      GO TO 99999
      C
      C
      C ORGANIZATION NAMES AND NUMBERS
      C
0169 7000 IF (NUMORG.EQ.0) GO TO 7200
0170      WRITE (3,7025)
0171 7025 FORMAT ('0','ORGANIZATION NAMES AND NUMBERS'//)
0172      DO 7100 I = 1,NUMORG
0173          WRITE (3,7050) (ORGNAM(I,J),J=1,20),I
0174 7050      FORMAT ( 1X, 20A1, 5X, I1)
0175 7100 CONTINUE
0176      GO TO 99999
      C
0177 7200 WRITE (3,*) 'THERE ARE NO ORGANIZATIONS IN THIS SCENARIO'
0178      GO TO 99999
      C
      C AUXILIARY PARAMETERS
      C
0179 8000 WRITE (3,8010) DDDINS, WATINS, PUTINS,
2 DDDLES, WATLES, PUTFIX,
3 PUTMIL,
4 DDDCPH, WATCPH,
5 WATMAX,
6 DISCNT,EQPLIF, (CTYPE(I), GANDAD(I), I=1,4),TLKCAP
0180 8010 FORMAT (1H0,/,17X,'AUXILIARY PARAMETERS',//,
2 ' TALKBACK:',24X,'DDD',8X,'WATS',8X,'PUT',/,
3 3X,'INSTALLATION', 13X,F10.2,2X,2F10.2/
4 3X,'ZERO UC GE CHARGE/MO.',4X,F10.2,F12.2,F10.2/
5 3X,'MILEAGE CHARGE', 33X, F10.2,/,
6 3X,'HOURLY CHARGE', 12X,F10.2,2X,F10.2/,
7 3X,'MAXIMUM CHARGE', 23X, F10.2,/,
8 ' AMORTIZATION:',/,/)
```

```
          9 3X,'INTEREST RATE',7X,F5.2,' PERCENT',//  
          A 3X,'EQUIPMENT LIFE',6X,F5.2,' YEARS',//,  
          B ' GENERAL AND ADMINISTRATIVE:',/, 4(3X,A4,5X,F12.2,/,),//,  
          C ' TALKBACK CAPITAL EXPENDITURES:',/,2X,F10.2, //)  
0181      GO TO 99999  
  
          C  
          C LIST COST ELEMENTS AND COST ELEMENT CODES  
          C  
0182      9000 WRITE (3,9050)  
0183      9050 FORMAT ('0','COST ELEMENT CODES AND NAMES'//)  
0184      IF (UPPDWN.EQ.2) GO TO 9300  
0185      DO 9200 I=1,NUELEM  
0186          WRITE (3,9100) (UCSCOD(I,J),J=1,2),(UCSNAM(I,J),J=1,20)  
0187      9100 FORMAT (1X,2A1,2X,20A1)  
0188      9200 CONTINUE  
0189      GO TO 99999  
0190      9300 DO 9400 I=1,NDELEM  
0191          WRITE (3,9100) (DCSCOD(I,J),J=1,2),(DCSNAM(I,J),J=1,20)  
0192      9400 CONTINUE  
0193      GO TO 99999  
  
          C  
          C LIST CITIES/ORG AND STATES  
          C  
0194      10000 WRITE (3,10001)  
0195      10001 FORMAT ('0','CITY',13X,'ORG',2X,'STATE'//)  
0196      IF (UPPDWN.EQ.2) GO TO 10300  
0197      DO 10200 I=1,NUCITY  
0198          WRITE (3,10100) (UCTNAM(I,J),J=1,16),UCTORG(I),  
              2 (USTCOD(I,J),J=1,2)  
0199      10100 FORMAT (1X,16A1,2X,I1,4X,2A1)  
0200      10200 CONTINUE  
0201      GO TO 99999  
0202      10300 DO 10400 I=1,NDCITY  
0203          WRITE (3,10100) (DCTNAM(I,J),J=1,16),DCTORG(I),  
              2 (DSTCOD(I,J),J=1,2)  
0204      10400 CONTINUE  
0205      99999 WRITE (3,*) ' '  
0206      RETURN  
0207      END
```


APPENDIX E

MODEL INSTALLATION

The Video Distribution System Cost Model has been developed for implementation on a Digital Equipment Corporation PDP-11. The programs are written in extended FORTRAN IV and consist of 3 distinct modules -- BUILD, MODEL, and EARTH. In addition, there are two data files -- the earth terminal data base and the sample scenario.

The model is installed under Digital Equipment Corporation's RSX-11M operating system. The programs have been compiled by using version 02-51C of FORTRAN IV-PLUS. Standard compiler switch settings may be used for all programs except EARTH and REPTR, which require larger buffers for continuation lines (switch - /CO:26.).

Both BUILD and MODEL are overlaid tasks because of large memory requirements. The ODL files are as follows:

BUILD.ODL

```
.ROOT BUILD-REPTR-SUBS-VANDH-* (READIN,COST,PATH,CITY,RATE,RITOUT)
SUBS: .FCTR YESNO-UPDOWN-CCOUNT-MATMOD-GETTER-CODCHK-CTYCHK-DISAPR-AØ
AØ: .FCTR RDCOST-RATECK
.END
```

MODEL.ODL

```
.ROOT MODEL-MODSUB-* (READIN,MODUP,MODDN,MODTK)
MODSUB: .FCTR YESNO-GETTER-CCOUNT-CODCHK-REPTR-VANDH
.END
```

The disk swapping occurs at natural breaks in the programs and is not very noticeable.

The task build command files are as follows (it is assumed that all files are located on the system disk - SYØ):

BUILD.CMD

```
BUILD/CP/FP=BUILD/MP
UNITS = 3
ACTFIL = 2
ASG = TI:1, SYØ:2, TI:3
//
```

MODEL.CMD

```
MODEL/CP/FP = MODEL/MP
UNITS = 3
ACTFIL = 2
ASG = TI:1, SYØ:2, TI:3
//
```

EARTH.CMD

```
EARTH/CP/FP = EARTH, READIN, MOVREC, VANDH, CODCHK
/
UNITS = 3
ACTFIL = 2
ASG = TI:1, SYØ:2, TI:3
//
```

The data files are named EARTH.DAT (earth terminal data base) and SAMPLE.DAT (sample scenario).

APPENDIX F

OPERATIONAL COSTS AND MANAGEMENT CONSIDERATIONS

This appendix identifies the tasks and costs associated with maintaining and operating the Video Distribution System Cost Model. Cost estimates are included where feasible; they are based on the development effort that produced the model and on experience with commercial time-sharing services.

1. INSTALLATION

To provide access to a large number of users, the model should be installed either on a commercial time-sharing service that has nationwide dial-up access or on a privately owned or government-owned computer with dial-up access and In-WATS capability (if traffic warrants).

The most cost-effective installation would be on a Digital Equipment Corporation (DEC) PDP-11 minicomputer because the installation procedures listed in Appendix E could be applied directly. This computer should have at least 128K bytes of memory, should be running a recent version of the RSX-11M operating system, and should be equipped with a FORTRAN IV-PLUS compiler. Installation, in this case, should require less than two man-days. Other DEC operating systems could be used but would require a different task build procedure. Other versions of FORTRAN may require changes in the source code.

If unavailable, dial-up access could be provided by a standard asynchronous interface with a low-speed (300-baud) originate/answer modem for manual connections or by an auto-answer modem for automatic pickup. Either option leases for less than \$50 per month. Nationwide toll-free access (In-WATS) can be provided on a metered rate (\$244.00 for the first 10 hours and \$18.31 for each additional hour) or on a full-business-day rate (240 hours for approximately \$1,500.00 per month). The breakpoint occurs around 80 hours. Projected line utilization should be the determining factor.

Installation on other computers or on a commercial time-sharing service could be a costly proposition. Compatibility with DEC FORTRAN should be the primary consideration. A minimum of two man-weeks should be allocated for conversion, assuming that the target system is well understood. If a commercial time-sharing service is the target system, a minimum of \$1,500 should be budgeted for the conversion. The advantage of converting the model to a

large computer is that larger scenarios could be developed (more cities, more paths, and more cost elements). In addition, most commercial time-sharing services offer nationwide dial-up access as part of their general services.

2. SOFTWARE MAINTENANCE

As with any user-oriented model, there will be requests for model enhancements. Approximately two man-weeks will be required for a FORTRAN programmer to become familiar enough with the model software to make any extensive changes. After that, modifications should require no more than a few hours to complete.

The sample data file includes all of the model's current cost assumptions, and it should be reviewed and updated at least twice a year. Four man-days per year should be allocated for this purpose. A new sample data file can be created by use of the scenario builder.

The earth terminal data file should be updated quarterly. A tape of the file must be acquired from the National Technical Information Service (NTIS). The tape must then be processed to strip out extraneous information, and it must be formatted into a form readable by the model. The format of the tape can be obtained from the Federal Communications Commission. This process is technically simple but will require three to four man-days to perform all the necessary coordination, processing, and validation.

Backup of the system should be performed on a periodic basis depending on model use. Backup procedures should not require more than two hours each time.

Commercial time-sharing charges for software maintenance will probably average about \$100 per month. In addition, if software and data files are kept on line, storage charges should run about \$500 per month. These charges are not necessarily applicable to a small minicomputer system.

3. HARDWARE MAINTENANCE

Hardware maintenance costs are not applicable to commercial time sharing because they are included in the normal charge algorithm. Maintenance costs on a minicomputer would vary depending on the hardware configuration, but they would probably run less than \$600 per month. However, unless the cost model were the only application using the computer, only a percentage of this cost would apply.

4. CUSTOMER SERVICE

The user's guide should answer most questions about the model, but it will not be of much help in answering application-dependent inquiries. Therefore, it would be most useful for the organization that maintains the

model to have staff available to assist in user applications or refer users to another organization. Service can be provided on a consulting basis (user charged by the hour) for complex questions or handled under an overhead account for simple questions. The amount of time required to perform this activity is proportional to the number of user requests for assistance, but it can be billed on a cost-reimbursement basis.

5. COSTS AND BILLING

There are three areas of costs: direct processing costs, indirect processing costs, and administrative costs. Direct processing cost reflect the costs of building scenarios, processing the earth terminal data base, executing the cost algorithms, and preparing the output reports. The indirect processing costs include the software maintenance activities of program changes, backup activities, and earth terminal file updates and the on-line costs that accumulate. The administrative costs reflect the manpower required to perform the software maintenance activities, the user interface, and the billing process, as well as overhead items such as telephone and equipment rentals.

Direct processing costs can be estimated as follows (commercial time sharing used as a basis for comparison):

- Build a large scenario file* \$35.00
- Modify an existing scenario \$ 5.00
- Execute cost model \$ 3.00
- Print all output reports \$ 3.00
- Process earth terminal data \$15.00

Indirect processing costs will probably run about \$100 per month. Billing will require approximately two man-days per month. An overhead service charge, based on estimated usage, should be computed to cover these indirect costs and all administrative costs.

6. SUMMARY AND RECOMMENDATIONS

The various costs and manpower requirements are summarized in Table F-1. The most cost-effective solution appears to be installation on a government-owned or privately owned PDP-11 minicomputer because the installation and recurring costs will be lower.

*Assumes a two-hour hookup to computer.

Table F-1. COST SUMMARY BY TASK

Task	Time and Dollar Expenditure	
	Commercial Time-Sharing Service	Government-owned or Privately owned PDP-11 Minicomputer
Installation		
Manpower	2 man-weeks	2 man-days
Computer Charges	\$1,500	\$0
Software Maintenance		
Familiarization	2 man-days*	2 man-weeks
Monthly Maintenance	3 man-days	3 man-days
Computer Charges	\$100	\$0
Monthly On-Line Storage Charges	\$500	\$0
Hardware Maintenance	\$0	0-\$600**
Customer Service		
Model Assistance	3 man-days per month (depends on model usage)	Same
Network Consulting	As required, directly billable	
Administration		
Billing	2 man-days per month	2 man-days per month
Nationwide Dial-up Access	\$0	\$244 for 10 hours and \$18.31 for each additional hour per month
<p>*Most of necessary familiarization is achieved as part of installation. **Depends on hardware configuration (only a percentage of total cost applicable to the model).</p>		