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Before the
Federal Communications Commission
Washington, D.C. 20554

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| In the Matter of | ) | |
| | ) | |
| The Bell Atlantic Telephone Companies | ) | Transmittal No. 741 |
| Tariff FCC No. 10 | ) | |
| | ) | |
| Video Dialtone Service | ) | |

## Affidavit of Dr. Charles L. Jackson

I, Charles L. Jackson, being duly sworn, depose and say:

1. My name is Charles L. Jackson. My business address is Strategic Policy Research, Inc., 7500 Old Georgetown Road, Bethesda, Maryland. I am a Principal at Strategic Policy Research, Inc. By training, I am an engineer. I received the B.A. degree in Applied Mathematics from Harvard University with honors. I received the M.S., E.E., and Ph.D. degrees in Electrical Engineering from the Massachusetts Institute of Technology. At MIT I was honored by promotion to faculty rank while still a graduate student and election to the scientific honor society, Sigma Xi. Early in my career, I worked as a digital designer and computer systems engineer. I have worked for over twenty years in the telecommunications field, including holding positions on the staffs of the Communications Subcommittee of the U. S. House of Representatives and the Federal Communications Commission. I have testified before the Commission, several state public utility commissions and Congressional committees on policy and technology issues in communications. I have served as chairman of the board of the annual Telecommunications Policy Research Conference. I currently serve on the Department of Commerce's Spectrum Planning and Policy Advisory Committee ("SPAC"). I have written and spoken extensively on communications policy issues. Attachment A is a full statement of my background and qualifications.

2. This affidavit is provided in support of Bell Atlantic's video dialtone ("VDT") tariff filing application for Dover Township, New Jersey. It contains my analysis of the functions of various subelements in the system hardware and software and identifies those subelements that are used exclusively for the provision of voice services, used exclusively for the provision of video services, and used jointly for the provision of both services. The purpose of this engineering analysis is to respond to observations made by commenters on the VDT tariff filing. In addition, I specifically respond to issues raised by NCTA and the Atlantic Cable Coalition.

3. My opinion in this matter is based upon my familiarity with modern electronic systems generally, meetings with engineers from BroadBand Technologies ("BBT"), a review of BBT documentation and training materials, meetings with Bell Atlantic engineers and cost analysts, and a review of the Bell Atlantic tariff and supporting materials.

4. The issue I address here is identification of the function of the various subassemblies that, when properly assembled, provide the hardware and software to be used by Bell Atlantic to deliver a variety of services in Dover Township, New Jersey. In particular, I identify whether equipment is used only in the provision of telephone service, only in the provision of video service, or jointly to provide both services. Such a categorization is an integral step in the cost allocation process.

5. The method I use for categorizing equipment by function is easily described using a familiar piece of electronic equipment — a personal computer. Personal computers, like most other electronic equipment, are composed of many hardware and software subsystems. Consider a person using a personal computer for two purposes — word processing and playing a game provided on CD-ROM — who wishes to identify how much of the computer investment is used for word processing, how much for the game, and how much is joint investment used for both applications.

6. In a modern personal computer, the natural subsystems or subdivisions are the smallest parts that are normally purchased as separate assemblies by end-users and retailers. Thus, the computer's system unit could be subdivided into the enclosure, power supply, cord, motherboard, hard-disk drive and various plug-in cards such as display adapters and modems. In contrast, the display which is normally purchased as a unit by consumers would not be subdivided into subassemblies for such an analysis.

7. For the hypothetical case at issue — dividing the investment in the computer among (1) word processing, (2) CD games, and (3) joint use — much of the analysis is quite easy. The printer and word processing software are only used for word processing. The CD-ROM drive and game software are only used for games. The keyboard, display and system software are used jointly for both applications. We could go on with this example, but this example illustrates the principles at work.

8. The hardware that Bell Atlantic plans to use in Dover can be divided into the three categories (1) telephony, (2) video and (3) joint use in essentially the same manner as described above for a PC. First I consider, what I regard as, the natural subdivisions of the equipment — the subassemblies as defined by BBT. (Note: Here I use the term "subassembly" to refer to the smallest or least aggregated hardware or software unit normally considered in field installation or repair.) After examining the function of each subassembly, I identify the category which properly describes the function of the equipment. For example, an enclosure that holds both video and voice hardware is joint-use equipment. A line card that is used only for voice-signals would be identified as telephone equipment. A fiber cable that carries only video signals and control signals associated with video signals would be identified as video equipment.

9. A quick note on terminology. I use the terms "voice" and "video" to denote the two disparate signal streams that flow over the VDT system and that will be used, in the short-run, for providing telephone and video transport service respectively. In the discussion that follows, I treat the capabilities for providing broadcast but nonvideo service capabilities (e.g., overlaid text

messages) as properly part of the video category because such services will be carried on the same high-speed digital pathways as the video signals. My shorthand terminology of voice and video could potentially mask an important reality. The "voice" service is a two-way, ISDN-like, digital service all the way to the Optical Network Unit near the home and could be extended to the home. The "video"service is best thought of as a very high-speed asymmetric data service with 18 megabits per second outbound to the consumer and low-speed data on the return channel. Thus, the video service could be used for high-speed access to the Internet, at rates ten to a hundred times faster than possible on an ISDN line and a thousand times faster than most households use today. But, I cannot really describe all the possibilities that flow from the VDT system's capabilities. Bits are bits and high-speed bit streams are the prestressed concrete, two-by-fours and 3/4" plywood of the information age. The services that can be constructed using the services of the Dover system can no more be foreseen than one can foresee what kind of buildings architects and engineers will construct with modern materials. I cannot overemphasize how important it is to consider the broad range of services that can be provided in the future using the capabilities of the Dover system if one wants to understand the benefits of investing in this technology.

10. Experience with real-world designs teaches that they can frequently be decomposed into basic support modules (e.g., enclosures, cooling fans, lightning protection) that are shared across all uses of the equipment and specialized modules (in the PC case, CD-ROM drives, for example) that can be identified with a specific application of the equipment. Such a decomposition of the equipment is natural and is frequently seen in practice. It simplifies engineering, production and repair and may facilitate better matching of investment to specific market needs.

11. Figure 1 below shows the architecture of the Dover system.

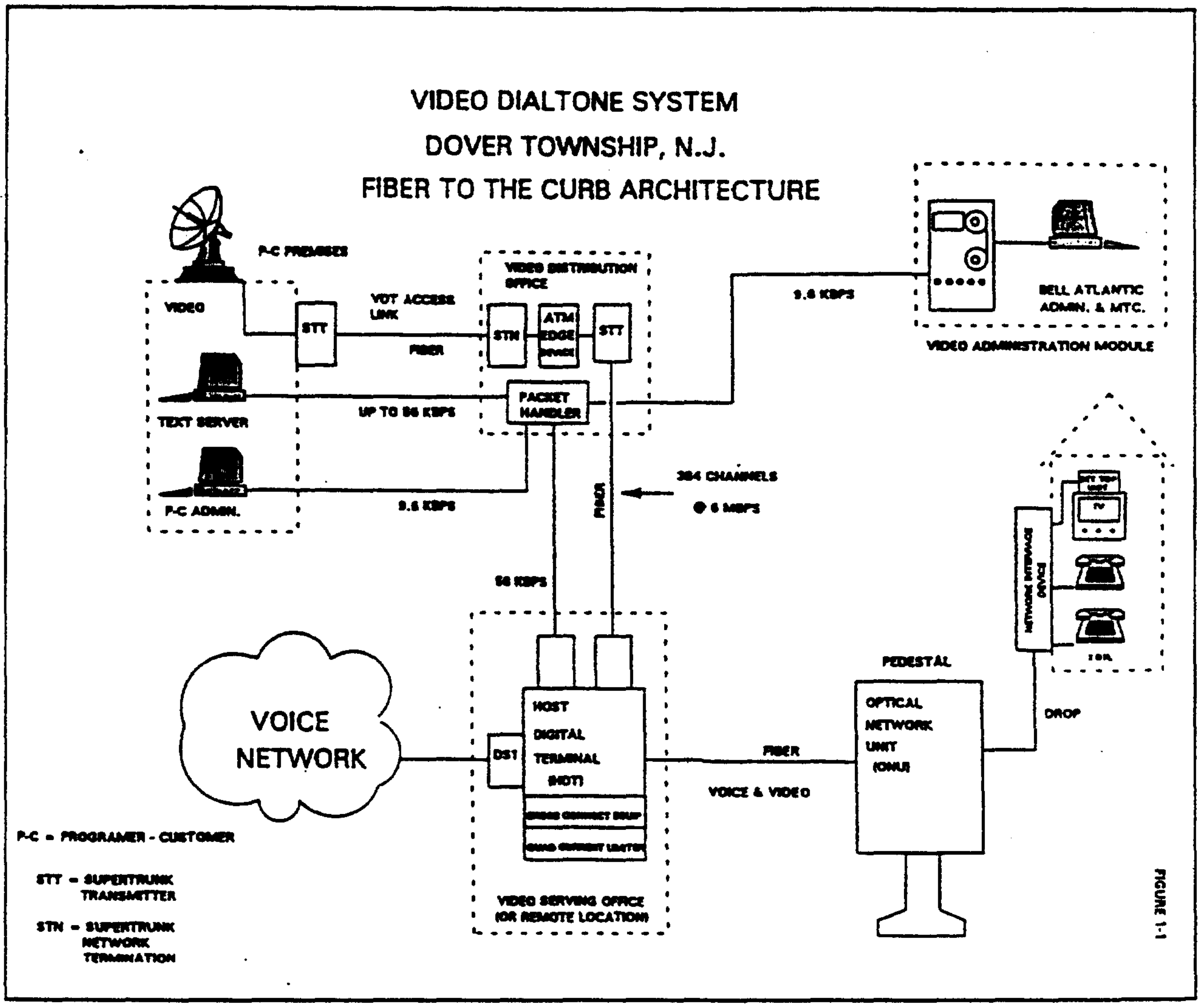


**Figure 1 Video Dialtone System Architecture**

Examining this system architecture diagram allows one to easily identify substantial portions of the system that are devoted to either voice or video alone.

12. Figure 2 below shows those portions of the network that can easily be seen to be used only for video services.

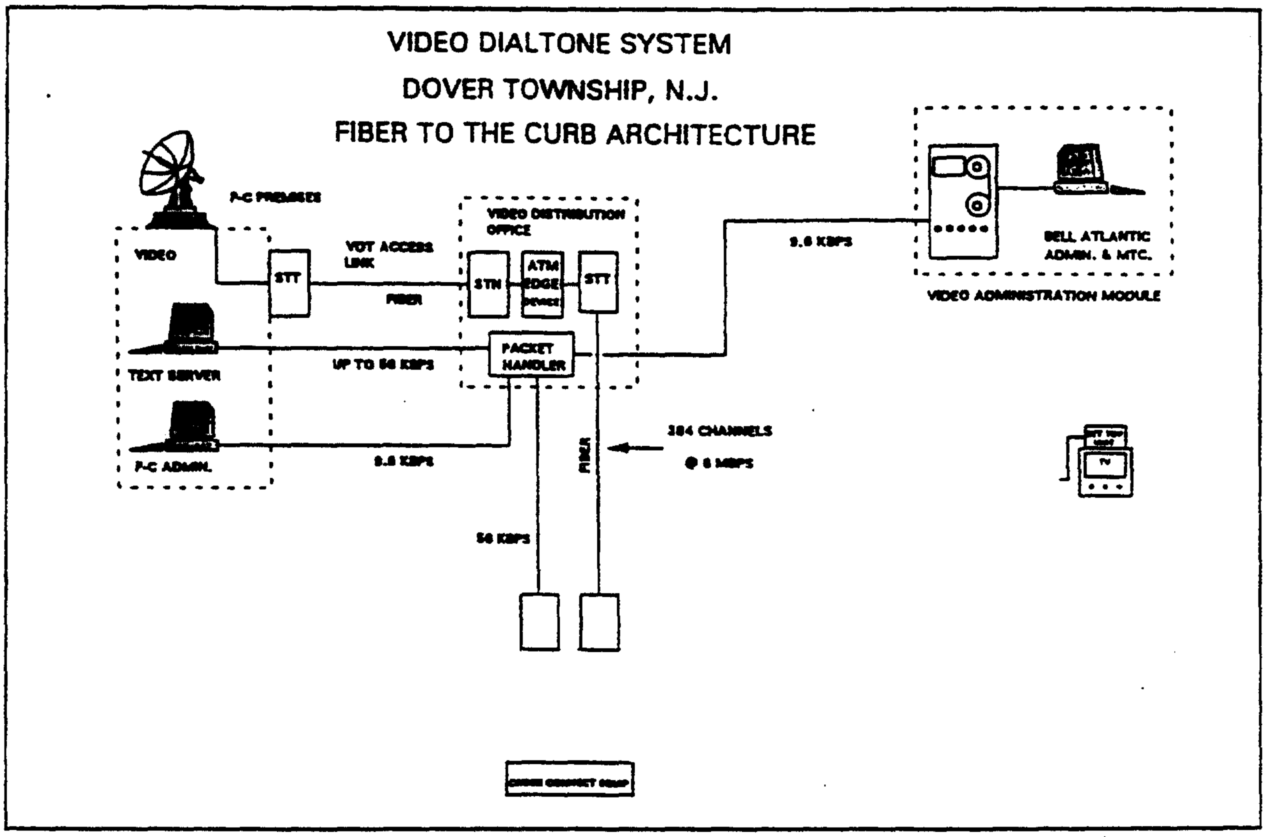


**Figure 2 Obviously Video-Only Portions of VDT Network**

13. Figure 3 shows the portions of the network that are similarly easily identifiable as used only for voice.

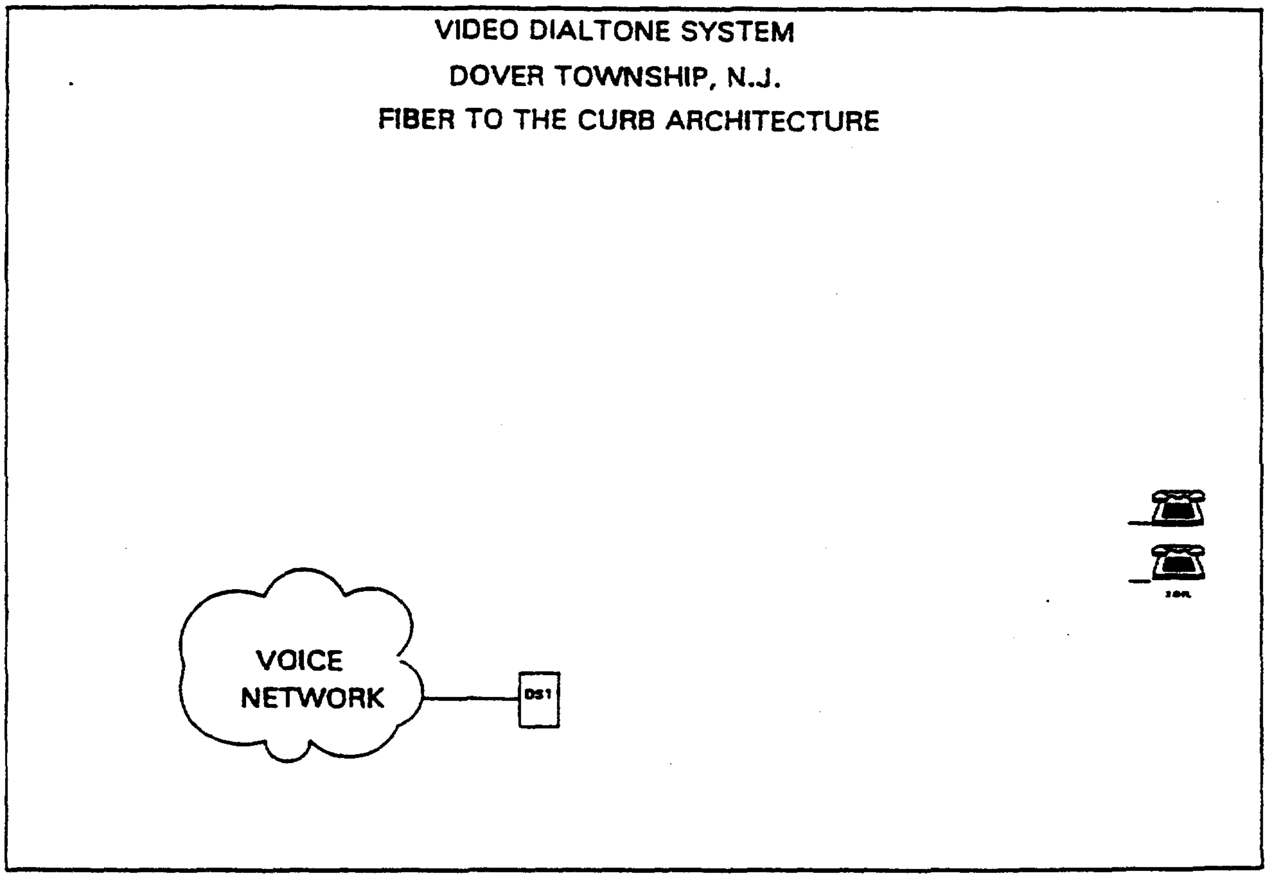


**Figure 3 Obviously Telephony-Only Portions of VDT Network**

Note that the figures as drawn include telephones, television sets, and other CPE which will be customer-owned equipment and will not be part of the regulated network. These elements are included in order to make the system architecture more easily understood.

14. Examination of Figures 2 and 3 shows that significant portions of the system can easily be partitioned between video and telephone service. In particular, the top portion of Figure 1 (system architecture) includes a substantial video-only segment of the system which is shown in Figure 2. This video-only section consists of the video transport, administrative communications and ATM multiplexing gear. For example, the video signals are carried from the programmer-customer premises or, as described in the tariff, from the programmer-customer's serving wire center, to the video distribution office over a VDT access link — a one way, dedicated fiber link. The signals generated by the video-only equipment are transmitted to the unit that combines video and telephone signals (the Host Digital Terminal). Similarly, the telephone signals are transmitted to the Host Digital terminal. Other parts of the system are shared by the video and telephone service. In particular, the Host Digital Terminal ("HDT") and the neighborhood nodes [the Optical Network Units ("ONUs")] process both video and telephone signals. The investment inside each of these units can be assigned to video, telephone or joint use by applying these same principles, and I consider each of these units in the following paragraphs. The newly-installed fiber transmission line to the neighborhood is shared by both services and must be classified as joint use equipment.

15. The HDT provides both routing and multiplexer functions. Looking at the HDT from the point of view of signals flowing towards the consumer, it takes as input multiplexed digital voice signals, multiplexed digital video signals, and control signals. It packages the voice and video signals destined for a specific subscriber, together with a portion of the control messages and transmits that combined signal out towards the subscriber. Operation in the reverse direction is similar. The HDT takes the return signals from the consumers and separates them and routes them appropriately. The HDT is constructed from a number of major subassemblies. An HDT is a large assembly filling a full relay rack — about the size of a refrigerator. Clearly the rack, electrical power to the cards in the rack and to external systems (provided by the quad current limiter), cooling fans, and alarm and maintenance systems are shared subsystems used jointly by voice and video services. An additional common element is presented by the processor card (which runs the software controlling operation of the HDT) and its hot-standby spare. The HDT

also has dedicated line cards which connect with the voice and video signals coming from the telephone network or VDT network, respectively. These line cards can properly be assigned to voice and video service respectively. The HDTs also contain line cards that transmit and receive the multiplexed signals to and from the ONUs. These line cards manipulate the combined voice/video signal and are properly thought of as common equipment.

16. The ONU takes the multiplexed voice/video signal coming from the HDT, converts it to an electrical signal, separates it into voice and video signals and routes those signals appropriately to the drop wiring running to the households. The ONU enclosure and the broadband controller card that contains the interface with the multiplexed signal from the HDT are clearly shared investment. The enclosure is obviously used jointly for voice and video services; the controller card processes the combined voice/video signal arriving on the fiber. Some individual voice and video line cards are not shared; rather their cost can be directly assigned to the specific services. The drop from the ONU to the household consists of two pairs of conductors, one copper twisted pair and the other coaxial cable, which can be directly assigned to voice or video service, respectively. In addition, any trenching required to extend buried drops to the household can be considered a shared network component.

17. I have examined the equipment assignments used by Bell Atlantic in its tariff filing of January 27, 1995 and found that those assignments among telephone, video and shared use are consistent with the discussion above and the principles I have put forward in this affidavit. Bell Atlantic did consider the individual subassemblies comprising the Host Digital Terminal, the Optical Network Unit, and the Drop, and did, in my opinion, properly assign the equipment among the three categories video, telephone, and joint. Hence, I believe that the classification of equipment among telephone, video and joint use employed by Bell Atlantic in its Dover VDT Tariff filing is reasonable and appropriate.

18. One commentor has claimed that "one can readily conclude that the allocations are unreasonable by simply examining their results." She then goes on to state that "the level of directly assignable costs is unreasonably low by any standard."[1] Similarly, NCTA concludes that "a very high proportion of common costs of the broadband network should be assigned to video."[2] My examination of the design does not support these broad assertions. I see in the Dover Township system design a broadband distribution system designed to provide asymmetric digital communications to the home (much wider bandwidth to the home than from the home to the rest of the world). That general design has been specialized to meet important market needs — in particular to connect with the existing telephones and TV sets in consumers' homes. I note that an analysis performed by BroadBand Technologies, Inc., the hardware supplier for this system, indicates that "Broadband systems benefit from the result [presented earlier in the paper] that a low degree of sharing is all that is required for cost-effectiveness in narrowband systems."[3] The authors then go on to conclude that this technological fact makes it possible to add video service to a fiber system designed for telephone service at relatively little additional cost. One can also go back to my earlier example of a PC being used for word processing and computer games. When one buys such a computer today it typically has a processor chip and hard disk that have more capability than is needed for today's word processing and games. The cost of buying a computer with a 486/66 chip or a Pentium™ chip rather than with the slower 486/33 chip shows up in a common cost — a cost which cannot be allocated solely to either word processing or games, or to other applications that can be run on those systems.

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1 Declaration of Patricia D. Kravtin at 16. Attachment to Petition of the Atlantic Cable Coalition, February 21, 1995, ("Kravtin Decl.").

2 NCTA, Petition to Reject, February 21, 1995, at 14.

3 J. Richard Jones and Randall B. Sharpe, "Cost Aspects of Narrowband and Broadband Passive Optical Networks," Broadband Technologies, Inc., presented at SPIE's Technical Symposium on Fiber Networking, Telecommunications and Sensors, September 1990.

19. Some parties have compared one component of the video transport service offered under the tariff — namely, the video dialtone access link — to DS3 service (e.g., MCI Petition at 12, Cablevision Comments at 25, Kravtin Decl. at 22). Such a comparison is quite misleading and is probably based on consideration of the electrical signal format used rather than consideration of all elements of the service. The video dialtone access link provides a high-speed digital link capable of carrying 96 video channels (each digitized at 6 Mbps). It connects to other equipment using an electrical interface similar to that used for DS3 signals. I believe that the use of such a standard interface simplifies the design task, by allowing reuse of existing hardware and software designs, and simplifies electrical interconnection and testing at both the programmer-customer's location and at the Bell Atlantic facilities.

20. Notwithstanding this electrical interface, there are several elements that make it improper to compare the access link service with traditional DS3 service. First and foremost, the access link service is a one-way service (appropriate for video distribution) rather than the two-way service provided by DS3 circuits (appropriate for telephone calls). Second, the VDT access link does not provide the redundancy and alternate route protection for the video transport service that is a part of DS3 service. This new video transport service operates using a single fiber. In contrast, DS3 service is normally provisioned using four fibers — primary transmit, backup transmit, primary receive, and backup receive. The backup fibers for DS3 service are normally routed over different routes than the primary fibers thereby increasing reliability by giving protection against compromises to the fiber system. Third, all 96 video channels follow the same routing from the programmer-customer's location to Bell Atlantic's video distribution office, unlike the case with DS3s which are individually routed. That is, a customer who purchases multiple DS3s can route each DS3 to different destinations. In contrast, the entire bundle of digital video channels is delivered to a single destination. The DS3 service requires additional distribution electronics to accommodate such routing — electronics that are not required for the video access line service. These major differences make any one-for-one comparison of the video dialtone access link with DS3 service improper and misleading, and give rise to cost differences.

Charles L. Jackson

Subscribed and sworn to before me this 6th day of March, 1995.

Notary Public
FINDA SHARPE
NOTARY PUBLIC STATE OF MARYLAND
My Commission Expires February 12, 199-

STRATEGIC
POLICY
RESEARCH

**CHARLES L. JACKSON**

Received a B.A. degree from Harvard College in Applied Mathematics and the degrees of M.S., E.E. and Ph.D. in Electrical Engineering from the Massachusetts Institute of Technology. At MIT, he specialized in operations research, computer science and communications. While a graduate student at MIT, he held the faculty rank of Instructor, taught graduate operations research courses and was co-developer of an undergraduate course in telecommunications.

Before co-founding Strategic Policy Research, Inc. (SPR), Dr. Jackson was staff engineer for the Communications Subcommittee of the U.S. House of Representatives and was on the staff of the Federal Communications Commission. He has also worked as a digital designer and computer programmer. After leaving government, Dr. Jackson co-founded the telecommunications consulting firm of Shooshan & Jackson Inc., whose practice was later combined with that of the National Economic Research Associates, Inc.

Dr. Jackson has served as an expert witness in litigation on computer services and software and has testified before several state utility commissions.

He has authored or co-authored numerous studies on public policy issues in telecommunications and has testified before Congress on issues of technology and telecommunications policy. Over the last several years, he has also directed or participated in projects in acquisition analysis, market planning and product pricing. He has written for both professional journals and the popular press with articles appearing in publications ranging from *The IEEE Transactions on Computers* to *Scientific American* to *The St. Petersburg Times*. He holds a U.S. patent on an alarm signaling system.

Dr. Jackson is a member of the IEEE, the Internet Society, the American Mathematical Society, and Sigma Xi. From 1982 to 1988, he was an adjunct professor at Duke University.

## EDUCATION

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
Ph.D., Communications and Operations Research, 1977
M.S. and E.E., 1974

HARVARD COLLEGE
B.A., Honors in Applied Mathematics, 1966

## EMPLOYMENT

| | |
|---|---|
| | STRATEGIC POLICY RESEARCH, INC. (SPR) — Bethesda, Maryland |
| 1992- | Principal. Telecommunications and public policy consulting services for a variety of clients in the telecommunications industry. |
| | NATIONAL ECONOMIC RESEARCH ASSOCIATES, INC. (NERA) — Washington, D.C. |
| 1989-1992 | Vice President. Telecommunications and public policy consulting services for a variety of clients in the telecommunications industry. |
| | SHOOSHAN & JACKSON INC. — Washington, D.C. |
| 1980-1988 | Principal. Telecommunications and public policy consulting services for a variety of clients in the telecommunications industry. |
| | COMMUNICATIONS SUBCOMMITTEE, U.S. HOUSE OF REPRESENTATIVES — Washington, D.C. |
| 1977-1980 | Staff Engineer. Responsible for common carrier legislation and spectrum related issues. |
| | COMMON CARRIER BUREAU, FEDERAL COMMUNICATIONS COMMISSION — Washington, D.C. |
| 1976-1977 | Special Assistant to Chief. Responsible for technological issues and land mobile policy. |
| | FEDERAL COMMUNICATIONS COMMISSION — Washington, D.C. |
| 1975-1976 | Engineering Assistant to Commissioner Robinson. |
| | CNR, INC. — Boston, Massachusetts |
| 1973-1976 | Consultant. Worked on implementation of digital communication systems over dispersive channels. |
| | MASSACHUSETTS INSTITUTE OF TECHNOLOGY (MIT) — Cambridge, Massachusetts |
| 1973-1976 | Instructor. |

MIT — Cambridge, Massachusetts
1971-1973 Research and Teaching Assistant.

SIGNATRON — Lexington, Massachusetts
1968-1971 Research Engineer.

STANFORD RESEARCH INSTITUTE — Menlo Park, California
1966-1968 Programmer.

## PROFESSIONAL ACTIVITIES

Member, Sigma XI, Institute of Electrical and Electronics Engineers (IEEE), IEEE Computer Society, IEEE Communications Society, IEEE Information Theory Society, American Association for the Advancement of Science, the Internet Society, and the American Mathematical Society.

From 1987-88, served on Board of Directors of Telecommunications Policy and Research Conference. Chairman of Board 1988.

Chairman, IS/WP1 (Policy and Regulation) of the FCC's Advisory Committee on Advanced Television.

Executive Committee Member, University of Florida's Public Utility Research Center (PURC).

Member, U.S. Department of Commerce Spectrum Planning and Policy Advisory Committee.

## TESTIMONIES

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Rebuttal testimony filed before the Public Service Commission of the District of Columbia on behalf of the Chesapeake and Potomac Telephone Company, Formal Case No. 814, Phase III. November 1992.

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## SPEECHES

Participant in the 11th annual Practising Law Institute/Federal Communications Bar Association Conference on "Telecommunications Policy and Regulation." Washington, D.C. December 10, 1993.

"How Auctions Will Work." Presented to the TeleStrategies Spectrum Auctions Conference. Washington, D.C. November 1, 1993.

"Ensuring Efficient Competitive Outcomes." Presented to the "PCS Summit." Washington, D.C. October 13-15, 1993

"Carrier Perspectives on Government Investment in Public Telecommunications Infra-structure." Presented to the Computer Science and Telecommunications Board workshop on the Changing Nature of Telecommunications Infrastructure. Washington, D.C. October 12-13, 1993.

"The Impact and Implications of Changing Technology: Competition in LEC Markets." Presented at the United States Telephone Association Congressional Staff Seminar. Williamsburg, Virginia. June 3-4, 1993.

"Regulation of the Spectrum." Presented to the Industrial Liaison Program Symposium of the Massachusetts Institute of Technology on Universal Personal Communications: Technologies and Policies for Seamless, Digital, Wireless Communications. Cambridge, Massachusetts. March 30-31, 1993.

"Cost Structure of Competitors." Presented to the Pricing and Costing Strategies for a Competitive Environment. A TeleStrategies Conference. Washington, D.C. March 9-10, 1993.

"Spectrum Allocation for Personal Communications." Presented to the MIT Communications Forum. Cambridge, Massachusetts. February 25, 1993.

"Ensuring Efficient Competitive Outcomes." Presented to the Personal Communications Services Conference. Dallas, Texas. February 2-3, 1993.

Comments on PCS licenses. Presented to the Wireless Datacomm '92 conference. Boston, Massachusetts. December 8-9, 1992.

"ISDN." Presented to the Information Gatekeepers. Reston, Virginia. November 19, 1992.

"What Can You Do with a Cordless Telephone?" Presented to the Nineteenth Annual Telecommunications Policy Research Conference. Solomons Island, Maryland. September 28-30, 1991.

Participated in the Congressional Budget Office's (CBO) round-table on the budgetary implications of auctioning new radio frequency licenses. Washington, D.C. November 20, 1991.

Moderator. "Personal Communications Services In The '90s." Annual public relations seminar of the United States Telephone Association — "Public Relations Imperatives For the '90s." Washington, D.C. September 13, 1991.

"LEC Gateways: Provision of Audio, Video and Text Services in the U.S." Presented to the National Economic Research Associates, Inc., Telecommunications in a Competitive Environment Seminar. Scottsdale, Arizona. April 15, 1989. Also presented to the 8th Annual ITS International Conference. Venice, Italy. March 1990.

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"Is Bypass Still A Threat Today?" Speech presented to the Telecommunications Policy In a Competitive Environment Seminar. Scottsdale, Arizona. March 4-7, 1987.

With Jeffrey H. Rohlfs. "Improving the Economic Efficiency of NTS Cost Recovery." Presented to the Fifth Biennial Regulatory Information Conference. Columbus, Ohio. September 3-5, 1986.

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Remarks presented to The Council of State Planning Agencies. Lincoln, Nebraska. October 20-21, 1985.

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