BIOGRAPHY FOR NCTA

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Mr. Mason is the Technical Director of MITRE's Systems Development Division. He has been with MITRE for ten years, working on a variety of civil and military systems projects.

Before MITRE, he worked thirteen years at Hazeltine Electronics Corporation on radar and beacon systems.

He has an ME from Stevens Institute of Technology and an MSEE from Brooklyn Polytechnic Institute.

BIOGRAPHY

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Associate Department Head, MITRE Computer Systems Department and Project Leader of MITRE's TICCIT (Time-Shared Interactive Computer-Controlled Information Television)

Mr. Stetten joined MITRE in 1968. He is the originator of the TICCIT minicomputer technical concept and is the co-inventor (patent pending) of the Television Home Computer Terminal. He has had 15 years of diversified experience in information systems and other technologies. His previous work encompasses the areas of CRT development and TV systems, space electro-optical instrumentation, infrared chemical warfare and airborne contaminant detection/identification and a vast range of related technologies. He served as an officer in the U.S. Air Force Special Weapons Center. He holds 5 U.S. patents.

Mr. Stetten holds a B.S. in Engineering Physics from Lehigh University and an M. A. in Physics from Boston University.

A LOW COST INTERACTIVE HOME TV TERMINAL

William F. Mason & Ken Stetten
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As part of the design of a cable system for a large city, MITRE has had to take an objective look at the many ideas that have been proposed relative to providing new services into the home via cable. Part of the analysis involved identification of the variations in home terminal hardware that would be required to provide these services.

Types of Home Terminals

Figure 1 indicates one way in which the hundreds of services that have been proposed can be grouped into the eight fundamental hardware configurations that would be needed to provide them. Starting on the left of the figure with conventional black and white television, the cost rises with color or an A-B switch or converters, as additional channels are added. In group two we add the ability to encode transmissions for selective distributions to people who have unscramblers in their homes. Special distribution/capabilities on the network can also be "hardwired" to provide exclusive distribution to groups of subscribers, e.g., doctors.

Adding some form of a frame grabber (third category) allows distribution of another class of service wherein a single channel can provide many different displays, e.g., stock reports, ballgame scores, local activity schedules, etc. In this case, each frame is coded and the subscriber can set his decoder to choose any of hundreds of services on a single channel (more about this later).

Going now into two way services, we have the conventional voting or polling capability wherein a central computer polls the network and accepts the votes or selections input from each subscriber. This class of terminals ranges from inexpensive, where there are only a few voting options, to an elaborate alphanumeric keyboard capability for use in general two way communications.

In category five, a credit card checking device is added to the network capabilities of category four. This category is listed separately because of certain validation procedures that should be part of such a system. Meter reading, burglar and fire alarms, etc., are possible in the next category, wherein various types of sensors in the home are used to measure or monitor various phenomena and then report to the central system using the fundamental hardware provided in category four, but with special interface to the various sensing devices in the home. We include in this category the ability of the central system to control certain devices in the home if desired. For example, the second heating element in a hot water

heater can be controlled by the utility company to help alleviate peak power problems. Utility customers have been offered lower rates for such cooperation.

Category seven provides interactive communications of the type that would be needed for sophisticated computer aided instruction (CAI) or computer mediated instruction (CMI) into the home. Finally, we have services that involve high bandwidth digital or video communications between terminals.

Demonstrating These Capabilities

In order to examine the hardware involved in each of these categories as regards both cost and technical feasibility, MITRE has installed in six homes in Reston, Virginia, a terminal system that is capable of providing most of the services in Figure 1. Reston is located about 10 miles from the MITRE facilities in McLean, Virginia, and our computer is connected via a microwave link to the Reston Transmission Company headend in Reston. Reston has a dual cable distribution system and Channel 13 of their A-cable is used to distribute computer interactive services. Figure 2 is a schematic of the system showing that the computer provides on a single channel, 600 different frames of information, any of which can be selected by any subscriber having the appropriate terminal equipment. We call this the "public service" channel because of the types of information we are putting on it. The subscriber simply selects with a thumb dial on the home equipment, Figure 3, any of the demonstration material that we are interlacing (Figure 4). The particular materials we are providing are simply to show the types of things that may be offered on such a system.

The demonstration terminals also have the capability to let the subscriber interact dynamically with the computer. Since the Reston cable system is not equipped for two-way services yet, we are using telephone lines for the up-link from the subscriber to the computer. (Within the MITRE facilities we use two-way cable.) This class of service allows the subscriber to telephone the computer and receive a response on his TV screen that is not seen by other subscribers. He first receives a frame that introduces him to the services available. The touch-tone telephone is used as an input device to select services. Our demonstration allows subscribers to take computer-aided instruction in math or to use the computer to perform mathematical calculations (add, subtract, multiply, divide, raise to powers, take square root, store, etc.) or, more simply, to use the computer to sort through a variety of information. For example, we allow the subscriber to look up telephone numbers using his TV screen.

The "home calculator" demonstrates how computational capabilities can be provided in the home. The educational and social materials illustrate more wide ranging possibilities.

Our system also has the capability to record programs off-the-air or to record movies addressed to a single address, possibly during the quiet hours of the night, for replay as desired. Although full movies by this method would be impractical, we plan to use this capability to send short sequences of frames that can be "stepped" onto and off the tape recorder in a manner that might be used for delivering newspapers or mail by TV.

In this demonstration MITRE has concentrated on the use of readily available equipment in the home, i.e., the TV set and the telephone. The only special equipment that has been added is the circuitry for decoding the material sent to the home and a video tape recorder, which we feel will be a common item in a few years. As a matter of fact, the technical services that we are demonstrating in Reston will have a tremendous influence on the popularity of these video tape recorders if the addition of the simple circuits to grab a frame and refresh a TV set are added, as in the models we are using.

Cost Information

Although this is not the platform for publicizing the information we have accumulated relative to cost, a few comments are in order. The Figure 1 chart indicates the general range of costs for home terminals of various types assuming reasonably large implementation. Two-way digital services are not all that "futuristic" but we have avoided putting bounds on what the terminals may cost because it is so dependent on bandwidths used, etc. On the other hand, a sufficient number of devices can be bought in the $150 to $350 range so that this category of services should not be considered impractical. Studies now being performed by and for various large companies indicate that a very practical system can be described for certain types of markets. Within each Figure 1 system classification there are of course cost variations, depending on the particular service offered, how fancy the terminal is to be made, production quantity, implementation density, etc. Each of you will have opinions relative to the particular category of services of interest to your company or provided by your system. MITRE would be interested to have your comments relative to our cost summary.

Now let's turn to the cost of providing the computer services. We have made a number of analyses that indicate that interactive service can be provided into homes at a cost of around 20 cents per terminal hour. Roughly it goes like this: a minicomputer center to provide services to a population of around 10,000 would cost about $150K. Amortizing this over four years gives $37K per year. Adding $18K maintenance, clerical overhead and floor space, gives $55K per year to provide to each of 10,000 subscribers one hour a day interactive with the computer. (The actual computer time is a very small part of this because we serve an average of 100 interactive terminals at a time; more during peaks.) This amounts to about $55.00 per year or $5.00 per month cost to the

operator. This can also be considered as $5.00 for thirty hours of use, or about 20 cents per hour of use by the subscriber. He would probably pay several times this for the service. Billing would be handled by the computer. If the system operator provided $400.00 worth of capabilities from Figure 1, he would have to charge around $10/month, which seems very attractive for the kinds of services we are discussing.

Conclusion

A complete analysis of the types of capabilities discussed here will be published by MITRE in the near future, but sufficient information has been summarized in this paper to indicate our belief that the time to start large scale experiments with computer interactive TV is now.

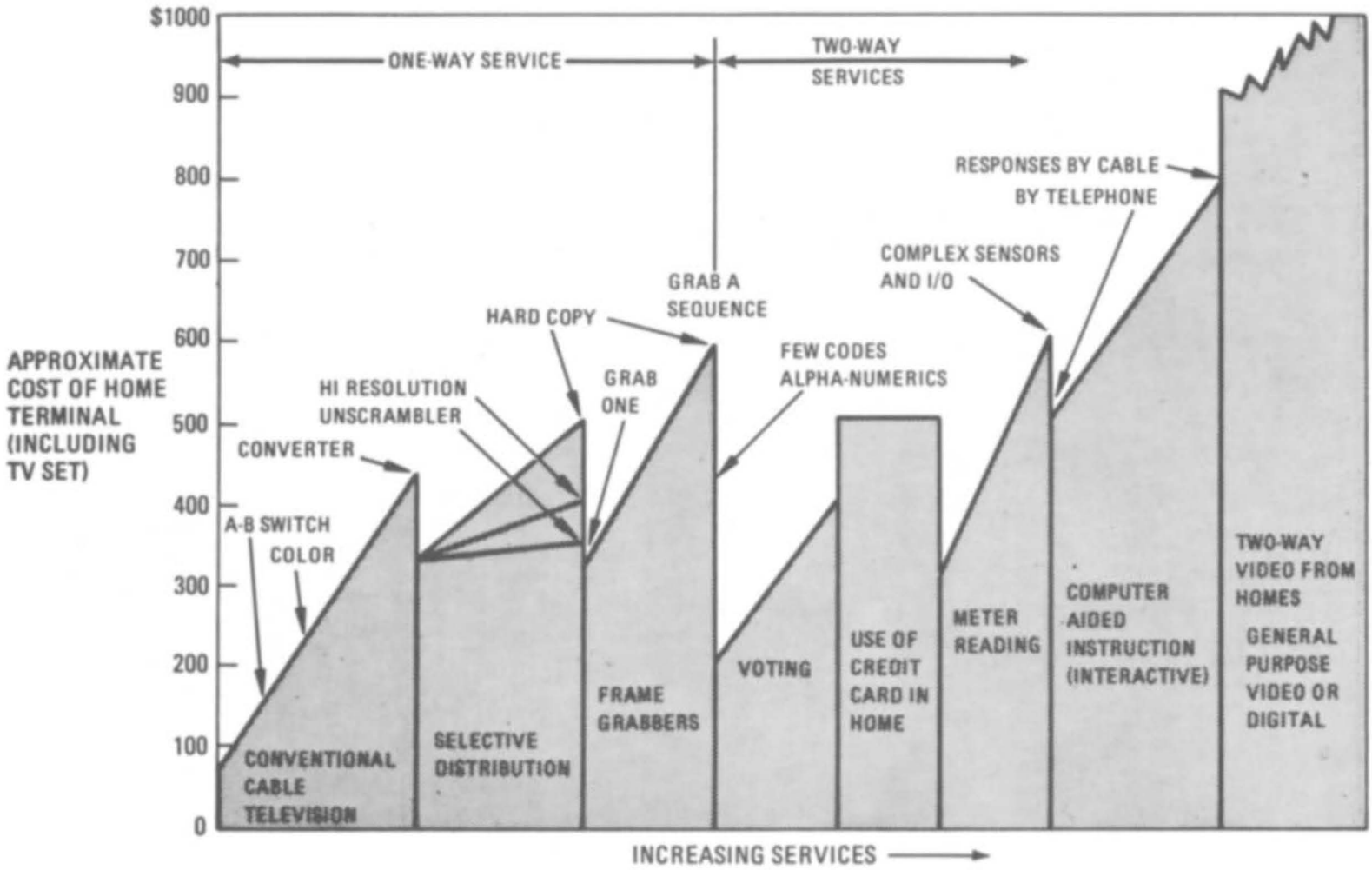

FIGURE 1
HOME TERMINAL OPTIONS

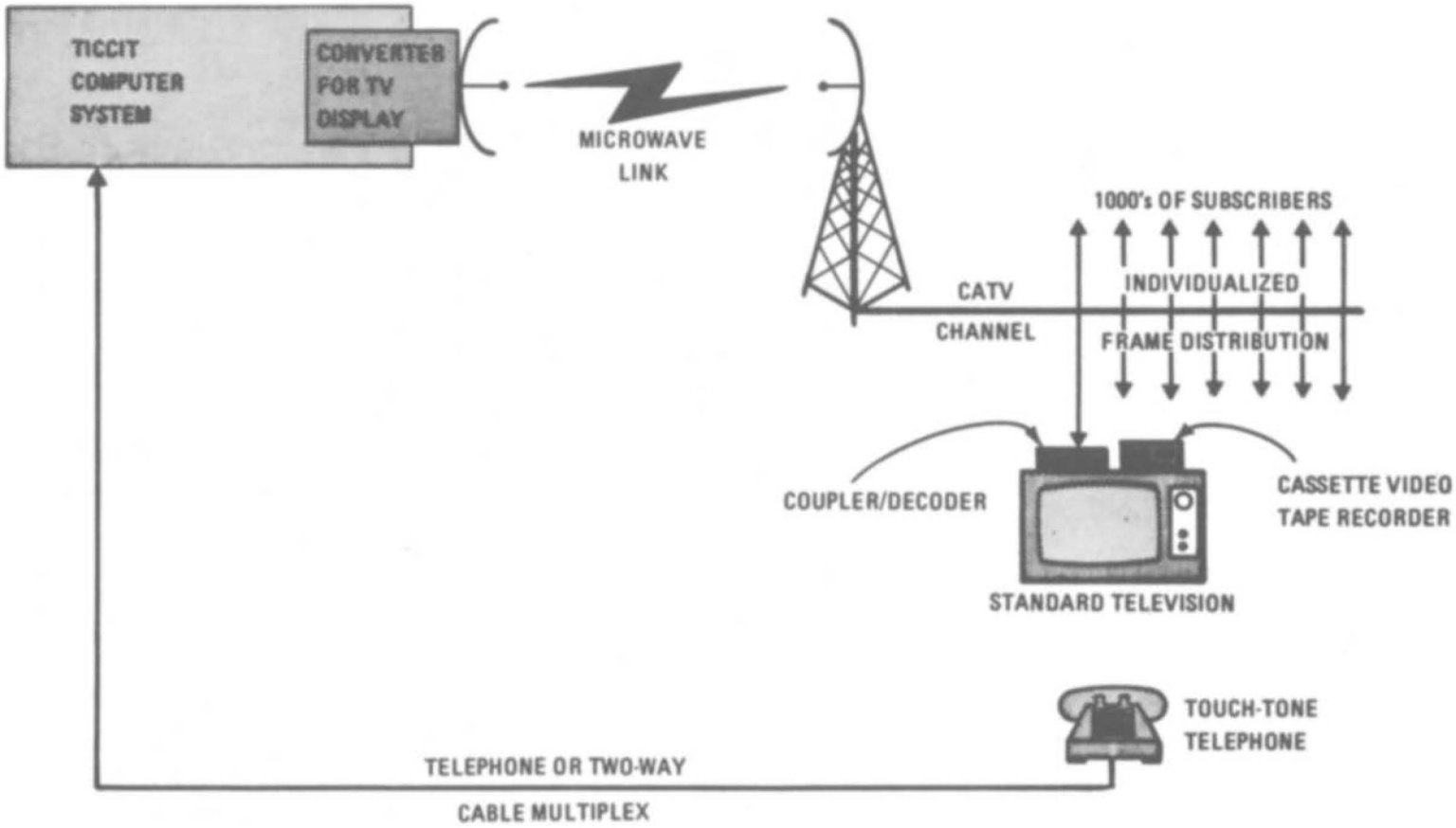

FIGURE 2
SYSTEM DIAGRAM

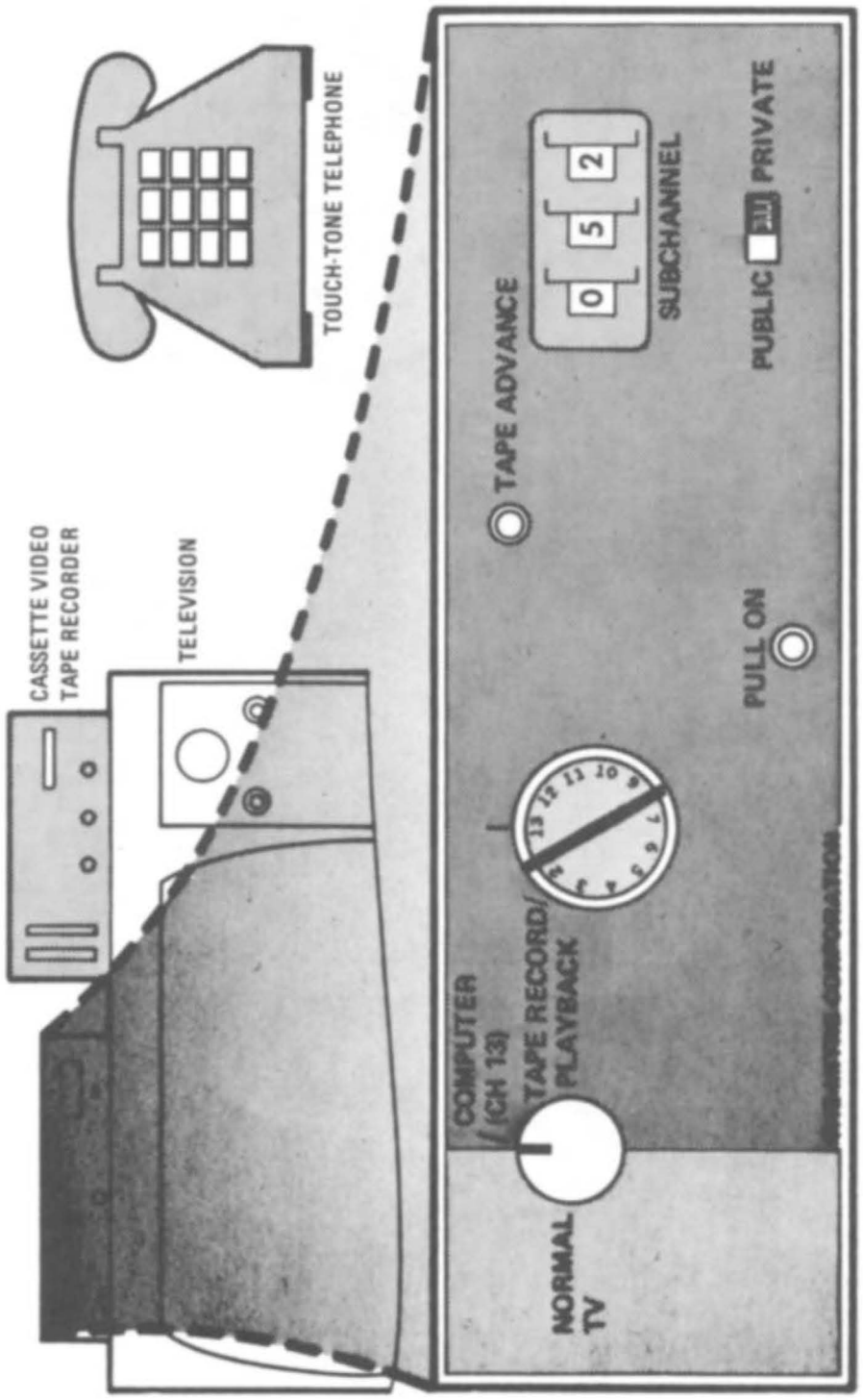

FIGURE 3
COUPLER/DECODER ("BROWN BOX")

DIRECTORY OF INTERACTIVE SERVICES

- RESTON COMMUNITY INFORMATION
  - DIRECTORY OF RESTON COMMUNITY ORGANIZATIONS – LIST OF 30 AND FILES ON EACH (SEE TEXT)
  - RESTON TELEPHONE DIRECTORY
- HOME CALCULATOR: ADD, SUBTRACT, MULTIPLY, SQUARE ROOT, RAISE TO POWER ETC.
- COMPUTER AIDED INSTRUCTION MATERIALS
  - ADDITION LESSON 2 DIGIT NUMBERS (CARRY)
  - ADDITION DRILLS (STANFORD U. CAI PROJECT)
- DIRECTORY DF NON-INTERACTIVE SERVICES (PUBLIC MODE)

DIRECTORY OF NON-INTERACTIVE SERVICES (PUBLIC MODE)

TIME OF DAY
ADVERTISEMENT
DIRECTORY OF NON-INTERACTIVE SERVICES (PUBLIC)
WEATHER REPORT
DIRECTORY OF INTERACTIVE SERVICES (PRIVATE)
BASEBALL SCORE BOARD (NATIONAL LEAGUE)
BASEBALL SCOREBOARD (AMERICAN LEAGUE)
MOST ACTIVE STOCKS, NYSE
MOST ACTIVE STOCK, AMEX
FISHING REPORT
DAILY RACING FORM (SHENANDOAH)
DAILY RACING FORM (PIMLICO)
SPECIALS AT THE DELICATESSEN
CLASSIFIED ADVERTISEMENTS
TELEVISION LISTINGS
PERSONAL STOCK PROFILE
ACTIVE BASEBALL GAMES
SUMMER SKI REPORT
VOTER REGISTRATION INFORMATION
VOTER ELECTION INFORMATION
COMMUNITY RECYCLING INFORMATION
NEW FICTION IN THE LIBRARY
NEW NON-FICTION IN THE LIBRARY
DEPARTURES RESTON COMMUTER BUS
K ST. ROUTE
M ST., CONSTITUTION AVE., PENTAGON
MENU RESTON CHILDREN'S CENTER

FIGURE 4
LIST OF INTERACTIVE AND NON-INTERACTIVE SERVICES
AVAILABLE AT RESTON DEMONSTRATION

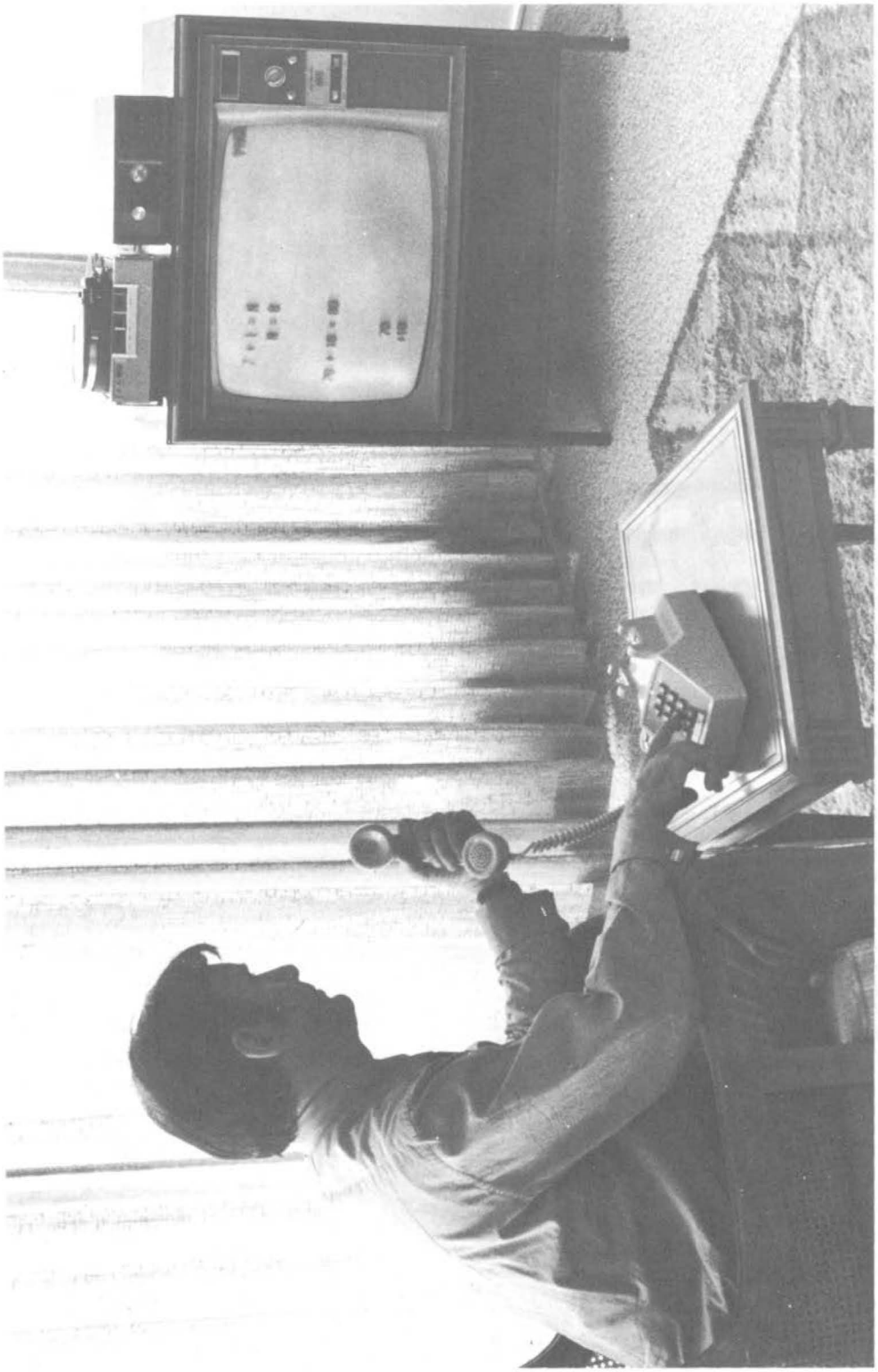

FIGURE 5
TERMINAL INSTALLED IN HOME