DOCUMENT RESUME

ED 047 460 EC 031 602

TITLE	Final Report to Social Rehabilitation Administration Department of Health, Education and Welfare.
INSTITUTION	Massachusetts Inst. of Tech., Cambridge. Sensory Aids Evaluation and Development Center.
SPONS AGENCY	Rehabilitation Services Administration (DHEW), Washington, D.C.
PUB DATE	31 Dec 70
NOTE	89p.
EDRS PRICE	EDRS Price MF-$0.65 HC-$3.29
DESCRIPTORS	Braille, Computer Programs, Electromechanical Aids, *Material Development, Mobility Aids, Research and Development Centers, *Sensory Aids, Technology, *Visually Handicapped, *Visually Handicapped Mobility, *Visually Handicapped Orientation

ABSTRACT

The report describes and discusses the activities and programs of the Sensory Aids Evaluation and Development Center (Massachusetts Institute of Technology, Cambridge, Mass.) in the period between January 1, 1969 and February 28, 1970. It is written for an audience concerned with technological developments and approaches in sensory aids for the blind. The work areas and tasks of major concern during the period covered were braille codes, brailling devices, automated braille, mobility and orientation devices, and communication devices for the deaf-blind. Specifically, the following projects and devices are reviewed: MIT-BRAILLEMBOSS, folding cane, pathsounder, pocket communicator, sound source ball, DOTSYS II, linear tape measuring device, electrified Perkins brailler, computer generated mathematical table, and braille computer codes. The report also summarizes the seminars, presentations, conferences, publications, and other special activities of the Center conducted for the purpose of information dissemination. Appended are evaluations of the MIT automatic brailler and the crook handle folding cane, and a copy of the electrified Perkins evaluation data package. (KW)

FINAL REPORT

to

SOCIAL REHABILITATION ADMINISTRATION
DEPARTMENT OF HEALTH, EDUCATION AND WELFARE

Washington, D.C.

of work done under Contract SRS-69-41

for the period

1 January 1969 through 28 February 1970

from

THE SENSORY AIDS EVALUATION AND DEVELOPMENT CENTER

Massachusetts Institute of Technology

292 Main Street
Cambridge, Massachusetts 02142

31 December 1970

FINAL REPORT

to

SOCIAL REHABILITATION ADMINISTRATION
DEPARTMENT OF HEALTH, EDUCATION AND WELFARE

Washington, D.C.

of work done under Contract SRS-69-41

for the period

1 January 1969 through 28 February 1970

from

THE SENSORY AIDS EVALUATION AND DEVELOPMENT CENTER

Massachusetts Institute of Technology

292 Main Street
Cambridge, Massachusetts 02142

31 December 1970

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

PREFACE

This report describes and discusses the activities and programs at the Sensory Aids Evaluation and Development Center under contract with the Social and Rehabilitation Services, Dept. of Health, Education and Welfare, the John A. Hartford Foundation and other private sources of funding. The reporting period covers the work accomplished from January 1, 1969 through February 28, 1970. The report is written for an audience concerned and interested in technological developments and approaches in Sensory Aids for the Blind at MIT. Detailed information on each project is available upon request.

The programs, work areas, and tasks of chief concern covered during this time period are:

(a) braille codes, brailling devices and automated braille,

(b) mobility and orientation devices,

(c) communication devices for the deaf-blind, and

(d) dissemination of information through seminar activities, presentations and written material.

The outstanding successes of the Sensory Aids Evaluation and Development Center originated initially from professor and student participation through these activities, and then brought to the Center for further development, demonstration, and evaluation under field test conditions. Examples of these devices exemplifying this process of student and professional interaction are the MIT BRAILLEMBOSS, DOTSYS(braille translation program), and the folding cane. The significance of these achievements is that the Sensory Aids Evaluation and Development Center has demonstrated its capability to develop and deliver functional and useful devices and programs directly to the blind consumer and agencies serving the blind.

As in the past, these accomplishments have been carried out through the guidance, support, and assistance of people and organizations intimately involved and concerned with the Centers productivity and existence. I appreciate the assistance and support provided By Dr. Jerome B. Wiesner, Provost of MIT, Professor A. H. Shapiro, Chairman of the Mechanical Engineering Department, and Professor R. W. Mann, Chairman of the Steering Committee. A special acknowledgement is made to the Northwest Foundation for the Blind and HYCOR, Inc. for making possible and participating on the production and distribution of the straight handle folding cane. I congratulate the Instrumentation Laboratories (Draper Labs), for their successful participation on the MIT BRAILLEMBOSS terminal. I also extend my appreciation to the MITRE Corp. for the development of a transferable braille translation program, DOTSYS II. In particular I thank the staff, personnel, and consultants of the Sensory Aids Evaluation and Development Center for their loyal and devoted efforts.

Vito A. Proscia
Director

I. INTRODUCTION

The Sensory Aids Evaluation and Development Center was established on September 1, 1964, under Contract SAV-1036-65 from the Vocational Rehabilitation Administration of the Department of Health, Education and Welfare. Members of the Staff of the Center include:

Mr. Vito A. Proscia, Director

Mr. George F. Dalrymple, Electrical Engineer

Mrs. Chantal Teller, Secretary

Miss Nancy Brower, Secretary

Miss Annette Yevick, Secretarial help

Mr. Norman Berube, Mechanical Technician

Mr. Alexander Glimcher, Electrical Technician

In addition to the regular staff members, the following persons performed work on specific projects (on a part-time basis) during the fifth contract year:

Mr. Murray Burnstine, Mechanical Engineer

Mr. Lindsay Russell, Electrical Engineer

Mr. Ranulf Gras, Mechanical Engineer

Mr. John Burke, Consultant Peripatologist

Mr. William Curtis, Consultant Peripatologist

Mr. Paul Maccarrone, Layout Draftsman

Mr. Ernest Johnson, Engineering Assistant

The Steering and National Advisory Committee provide necessary leadership and advice.

The scope of activities, as outlined in the initial contract, is as follows:

"The Center's activities consist of the following: (1) Evaluation of existing sensory aids and devices; (2) Location of new and promising aids for evaluation; (3) To encourage others to develop new aids which then can be submitted for production engineering at the Center; (4) In conjunction with the above, but to a lesser degree, development of new sensory aids for the blind; (5) Development of training principles and techniques for blind users of the sensory aids; (6) Behavioral research with blind users under field conditions; and (7) Development of objective standards to evaluate such devices.

Basic research and development will not constitute a major activity of the Center."

During the first contract year, the Center concentrated on staffing, facilities, laboratory equipment, arrangements with rehabilitation agencies and local manufacturers, and reliability engineering of prototypes.

During the second and third years, emphasis was placed on final field testing, production engineering, and negotiations with rehabilitation facilities for applications.

During the fourth contract year emphasis was placed on the development of the evaluation process and objective standards for the evaluation of existing devices. In addition a significant contribution was made in the demonstration of the feasibility of the current technology in sensory aids communication systems.

During the fifth contract year major effort was devoted to application engineering and the establishment of effective industrial liaison for the commercial production of at least one device. Also the year saw the development of an additional communication system with application to the deaf blind.

II. PROJECTS AND ACTIVITIES

A. MIT-BRAILLEMBOSS

The redesign of the MIT High Speed BRAILLEMBOSSER, now referred to as "MIT-BRAILLEMBOSS", has been completed, including the assembly of a number of production machines. A prototype machine was fabricated and tested in early 1969 and was used to verify some of the new design features incorporated in the limited production run. A grant from the Hartford Foundation which terminates in June 1970 has provided support for this program. Since 1967, the Sensory Aids Evaluation and Development Center has utilized drafting and shop facilities of the MIT-Instrumentation Laboratories. This program is considered to be one of the first major successes of early student participation through feasibility studies and thesis activities, and production engineering which has been accomplished under the direction of the Center. The various design evolutions and modifications have been briefly described in previous Final Reports.[1,2] However, updated changes will be described in this present Report.

Two models of the presently configured Model 3 MIT-BRAILLEMBOSS are available. A summary of their uses is shown in Table I. The first model, shown in Fig. 1, consists of what is considered to be a standard embosser which is to be used as a literary braille production device. The MIT-BRAILLEMBOSS can be hooked on-line to a computer, and reproduce braille information directly from computer input data. The BRAILLEMBOSS could also be used in an interactive mode where braille is produced by keyboarding standard English text into a computer from a teletypewriter or standard electric typewriter console. The production of braille can be further enhanced by driving the MIT-BRAILLEMBOSS off-line with paper tape readers, magnetic tape readers, card readers, etc.

The second model, Fig. 2, features a 42 character line format, including easy accessibility for reading braille material without requiring a line feed. This has been accomplished by designing the machine with a manual raised platen mechanism which exposes the braille to the user. A simple lifting action raises the platen from the paper which allows enough space for the user to read the braille. When the bar is returned to its original position, the MIT-BRAILLEMBOSS is ready to operate once again. These features have been specifically designed in the MIT-BRAILLEMBOSS in order to increase its utility as a time-sharing terminal.

1. The MIT-BRAILLEMBOSS as A Time-Sharing Terminal

Early in the development of the model 3 MIT-BRAILLEMBOSS, it was realized by the staff of the Center that a useful application of this terminal would be in the time-sharing mode. Plans were made to install the prototype embosser at the Center as an experimental terminal which would be connected via telephone lines to the MIT-CTSS 7094 time-sharing computer system. The system was installed in June 1969 and was tested and exercised for a period of several months by Michael L. Lichstein, a doctoral candidate in the Department of Economics at MIT. The installation of this system accomplished a two-fold purpose. First, it allowed Mr. Lichstein to be hired as a Systems Analyst in programming in the area of Econometrics for the Department of Economics, and second, it substantiated the initial recognition of the MIT-BRAILLEMBOSS as a useful and essential tool for a blind programmer in a time-sharing environment. Mr. Lichstein related his experiences in a paper[3] which has been widely distributed to interest groups and potential users of this system. Mr. Lichstein reports in his paper that the MIT-BRAILLEMBOSS provides the blind programmer with the same advantages as other programmers in the time-sharing mode. That is, whatever the computer can provide the sighted operator, it can provide the blind programmer with a braille duplicate of this material. This includes both input and output data. Mr. Lichstein says,

> "This means that in a large number of cases, it is possible for the blind investigator to carry on his research independently, or as a fully functional member of a group. The tedious problems of data collection, which are literally impossible for a blind individual, are to a large extent solved. Further, complete compatability is available with a sighted co-worker, since both braille and print outputs are obtained. It is thus possible for two investigators, one blind, the other sighted, to work side-by-side receiving the same information with no time lag. It is this type of interaction which makes a blind individual a fully functioning member of a research team."

Due to the success experienced with Michael Lichstein in operating the MIT-BRAILLEMBOSS in a time-sharing environment, a second embosser was subsequently installed in the office of Dr. John Morrison, a blind mathematician employed at NASA Electronics Research Center. Appendix A is a report written by Dr. Morrison using the editing routines in NASA's PDP-10 time-sharing computer, a teletypewriter, and the MIT-BRAILLEMBOSS.

In early 1970, another MIT-BRAILLEMBOSS was installed at the Perkins School for the Blind in order to initiate a demonstration program of an interactive braille system. The BRAILLEMBOSS was connected to the G.E. commercially available time-sharing system in order to teach selected students from the Upper School, programming methods and languages. Data on the success of this system will be accumulated and reported in future reports.

2. Mechanism Improvements

The redesign of the mechanical unit of the BRAILLEMBOSS was concerned with increasing the reliability, reducing the operating noise, and to decrease the manufacturing costs of the machine. Whenever possible with the new design, commercially available parts were used. The following paragraphs describe the changes and improvements made in the BRAILLEMBOSS.

The component that prevented the earlier braillers from meeting the speed specification of 16 characters per second was the cycle clutch. Several clutches were tried in Machine No. 6 but only a Precision Specialties Inc. Clutch Brake, Model CB-2 demonstrated that it satisfied the requirements. This unit incorporates a brake to supply the required stopping torque as well as a cycle clutch to couple the drive torque. The clutch is assembled by the manufacturer on the cycle shaft furnished by the MIT Sensory Aids Evaluation and Development Center.

The cam drive mechanism of the platen was a major source of noise on the earlier machine. The cam followers would leave the cams as the platen overtraveled on the emboss (down) stroke. A crank drive eliminates the slap when the cam followers return to the cam after overtravel. To improve the control of the platen position, a pivot and arm mechanism was included to eliminate a sliding contact of the earlier machines.

The selector bars of the earlier machines had inadequate torsional stiffness. The actual stroke of the selector bars was a function of the head position and could not be correctly adjusted over the entire range of head positions. As a result, braille dots would often be missing. The addition of a tube member to the selector bars gives adequate torsional strength and makes minimal change in the machine.

A new paper drive based upon fan-folded sprocket-drive paper was used. The sprocket drive units were purchased from Kidder Press and the drive motor is a Ledex Digimotor. They replaced two critical assemblies of the old machine. The friction roller drive was very difficult to adjust for straight paper motions and the earlier drive devices were either difficult to make or adjust.

A true escapement was developed for head positioning, i.e., the head is constrained to move only one space per cycle shaft rotation. The rack, built up to two adjacent double pitch racks displaced by one cell width, is moved from side to side to advance the head. The rack motion is controlled by an eccentric rotating at one-half the cycle shaft rotation speed. The earlier machines lowered the rack by a cam and lever to advance the head. The former approach required a very careful balance between the rack displacement, rack displacement time, head friction forces, and the force advancing the head to control the amount of head advance. The new method removes this set of critical adjustments and substitutes a simple set of independent adjustments.

The new escapement eliminates the "fly around" method of carriage return. The heads must now be stepped around. The "step around" method causes only a small time penalty. The carriage return time from the first cell position for the "fly around" is approximately 2 seconds versus 2.4 seconds for the "step around" system. The new escapement adds a gear box, but deletes several complicated parts and a solenoid. It also reduces the noise by eliminating a cam, cam follower and stop.

The head hold-down method has been changed to dovetails and gibs. This head support arrangement gives better positioning of the heads than the methods used previously. Also, the support track has been lengthened to provide adequate support for the head at both ends of the line.

A new head design compatible with the hold down arrangement was made. Plastics were used wherever possible to reduce the weight. A new plunger plate was designed which has lengthened skirts to prevent the head from catching on the edge of the paper as the head moves around the sprocket onto the support track. The "back porch" of the plunger plate is recessed for possible later use of a solid Estane Platen. (The preliminary experiments with a solid Estane Platen did not produce a satisfactory braille).

The selector bar solenoids are now Guardian T6X12 Cont. 24 V.D.C. tubular solenoids. They are modified to fit by drilling and tapping and removing the original mounting threads at the plunger end of the solenoid. The force and electrical characteristics of these solenoids are quite similar to the custom-made solenoids of the earlier machines.

The selector bar solenoid cooling was changed such that the solenoids now receive approximately equal amounts of cooling air. A small pancake fan, mounted on the baseplate, and an air duct direct the cooling air to the appropriate locations. For braille production applications each machine and its electronics are mounted in an enclosure typical of those used for electronic equipment. The Brailler, paper supply, and solenoid power supply are in the lower half of the enclosure. The Brailler is mounted on pull-out slides for easy servicing. The Control Panel and electronics rack are in the turret above including space for one additional electronic rack for code conversion equipment as required.

3. Electronics

The early electronics were made from Digital Equipment Corporation (DEC) R- and W- series modules. At the beginning of the Grant, this series of modules offered the least expensive and shortest time method to obtain working electronics which could be easily maintained using commercially available plug-in circuit cards. Two sets of electronics were constructed. One still drives the No. 6 machine and the other is used for mechanical test purposes.

The electronics were designed to operate from four data sources - tape reader, binary divider (Bidot) exerciser, equiprobability (Equidot) exerciser, and manual input. The equiprobability exerciser embosses all possible combinations of dots before repeating. Teletype operation was not included as both the size and cost of a code translator made from this series of logic cards was prohibitive.

The final electronics uses DEC K-series modules. The K-series is slower, less expensive, has greater noise immunity and is better suited for the Brailler application than the R- and W- series. In addition, the K-series has a group of modules designed for code conversion. These have been used to construct a teletype code (ASCII(63)) to one-cell braille translator for a time-sharing computer terminal with braille output.

The number of operational modes has been increased with the K-series electronics. These modes are:

1. Exerciser
2. Manual (panel operation)
3. Paper Tape Reader
4. Teletype (through a code converter) and,
5. Keyboard

The exerciser is now a plug-in unit and is no longer an integral part of the electronics. The code converters are mounted on separate rack panels below the electronics main frame rack.

The operational sequence of the BRAILLEMBOSS is similar to that previously used, except one major revision in the logic was made to increase both the speed and accuracy of the Brailler. The timing of the Carriage Return (CR) termination and the Auto Line Feed (ALF) initiation is now done by an electronic time-delay instead of by the head striking the End-of-Line (EOL) switch. The EOL switch now arms a circuit when the embossing head is located in the last cell position. This circuit, when armed, generates a pulse at the time the selector bar pulse is terminated. This method insures that the embossing pins are free of the paper before line feed occurs. This change permits the data reading device to be interrogated before the emboss operation is complete without losing data. This feature is significant when the Friden tape reader (with its 23 milli-second delay) is used.

B. Folding Cane Projects

Since its founding in 1964 the MIT SAEDC has been pursuing development of folding canes. The previous Final Report[2] described in detail an evaluation program for the crook-handled swaged-tube central-steel-cable folding cane which has now been completed. The report is attached as Appendix B.

During the evaluation 84 crook-handle folding canes were manufactured and distributed. Of these, complete data was returned from 53 users, and incomplete data was received on 9 others. Twenty-four canes were returned for repairs, several canes more than once. The maintenance experience was used to improve some important design details. Several canes were returned for repairs after more than six months use. Many of the canes are still in use, only six have been voluntarily returned.

The evaluation demonstrated that the crook-handled, swaged-tube central-steel-cable folding cane is a very close approximation to a long, rigid, one piece cane. The chief difficulties of the crook cane were the small diameter grip and the size of the crook. The crook size presents some storage difficulty when folded.

During the evaluation of the crook-handle folding cane, development was continuing on a straight handle cane made using the same construction and folding techniques. A cane demonstrating the locking principle for the straight handle cane was shown in a previous report[1]. A usable prototype was constructed using machined aluminum extrusions for the handle. This cane has seen extensive use by the Director of the Center.

Based upon the early experience with the first prototype a second straight handle cane was built. It has a notch in the handle that serves two purposes. First it permits easy access to the locking handle and second, it can be used as a "pistol grip" to control the precise hand position on the handle.

A production cane was then designed and built using an aluminum sand casting for the handle. This cane showed great promise of being a potentially manufacturable folding cane which overcame almost all difficulties reported during the crook-handle cane evaluation. The three development models of the straight handle canes are shown in Fig. 3.

The Center then searched for a method to make this straight handle folding cane commercially available. A manufacturer(see below) was found who could produce the canes at a small profit provided certain non-recurring costs were supported through a subsidy source. The Northwest Foundation for the Blind agreed to furnish a small subsidy for machinery, tooling, production engineering and production drawings provided the manufacturer offered 1,000 canes for sale within a year.

The folding cane is now being produced by HYCOR, Inc. in Woburn, Mass. as the "HYCOR Cable Cane". It is for sale at $12.00 with a one year guarantee. HYCOR has produced a similar cane using rubber shock cord in place of the central-steel-cable and with a simplified handle. (The two HYCOR canes were announced by letter offering samples of the two folding canes to various agencies serving the blind on April 1, 1970, and as of September 1, 1970 over 1,000 canes have been distributed).

C. Pathsounder

The Pathsounder[1] is a small electronic travel-aid for the blind, designed to supplement both the protection and travel information obtained with the long cane. The cane provides protection for the lower half of the body and locates the surface at the point the traveller will step next. The cane provides good travel data for the lower half of the body, however, the part of the body above the hips passes through space where the cane cannot provide data. It is for this part of the body that the Pathsounder provides protective travel information.

The Pathsounder has undergone several redesigns. A pictorial history of the Pathsounder is shown in Fig. 4. The 1968 unit is also called the Model H.

There have been 13 of the "H" model Pathsounders made. Five have been purchased from L. Russell by the Center during the preceding reporting period and were delivered during March of 1969. Four other Pathsounders have been purchased by the VA for use at their Blind Rehabilitation Centers. Four other early instruments remain the property of L. Russell but have been used by the Center in the Pathsounder Evaluation Program. It was these early instruments that were used in the Pathsounder evaluation described in the previous report[2].

A "Pathsounder Instructor's Handbook"[4] was published during the period. The Handbook has been included in the package each time a Pathsounder was sent to a user. Several Pathsounders have been loaned for brief periods of time to other users than reported below.

One Pathsounder was loaned to the V.A. Rehabilitation Center at Hines, Illinois on an interim basis pending their receipt of instruments of their own. With this Pathsounder, a 20 year old youth became, within the Hospital confines, "wheelchair mobile". He had lost both legs, as well as his eyesight in Vietnam. A brief report on this case, by the Staff at Hines, notes the following:

> "Prior to using the device (Pathsounder), the patient was not very well motivated, and his mode of travel was to trail the wall with one hand and propel himself in the chair with the other. With the device and training, he is able to reach almost any familiar area independently and venture out without reservations. This mode of travel, although at times slow, has meant much to him".

Two Pathsounders (H5 and H6) are on loan to the New York Association for the Blind. Reports of one user have been very encouraging, however, she would like to use a Pathsounder permanently only if it could be made lighter and smaller.

Two other Pathsounders (H6 and H11) are on loan to the Greater Pittsburgh Guild for the Blind. They have been aids used for staff training and efforts are being made to obtain suitable clients, but to date no client training has been reported.

Experience with the Pathsounder has indicated that the instrument increases a user's ability for safe travel, but a smaller and lighter instrument would increase its acceptability. In its present form, (or with small modification), it has found much greater use with multiply handicapped individuals. Future work should be directed to provide a tactile display to increase its usefulness to the multiply handicapped and to miniaturize the instrument.

D. Pocket Communicator

In the SAEDC search for methods, technology can serve the blind. The Center was introduced to the problem of alerting and communicating with the deaf-blind. The immediate application was a fire alarm system for the "Mop Shop" of the Industrial Home for the Blind (IHB) where fire drills must be performed periodically.

The present method of alerting a deaf-blind employee for a fire alarm requires a supervisor to locate the employee and inscribe an "x" on the back of the neck of the deaf-blind person. This method is slow and in a real emergency could result in the overlooking of a person if he is not at, or near the customary place.

Study of this problem led to "TAC-COM", a small cigarette package size device worn in a pocket or holster. The receiver is shown in Fig. 5. When TAC-COM is signaled, it vibrates vigorously in the wearers pocket. By controlling the signal, several codes can be distinguished, i.e., fire alarm, doorbell ringing, telephone ringing, or other similar messages.

For various technical and practical reasons, e.g., licensing, interference, false alarms, reliability, electromagnetic induction is used as the signaling link. This is relative short range link and requires the area where the user is located to be wired with simple wire loops. These loops are connected to the transmitter and operate at very low voltages. The control circuitry, which can be a simple doorbell type switch, must be connected to the transmitter.

During this period a single TAC-COM, an experimental fixed transmitter, and a portable hand held transmitter with a range of 6 feet was available for use and demonstration.

Experiments and demonstrations with this equipment were encouraging and have lead the National Center for Deaf-Blind Youths and Adults to order 10 receivers and 5 fixed station transmitters. The National Center for Deaf-Blind Youths and Adults operated by Industrial Home for the Blind and SAEDC are conducting an evaluation program.

E. Sound Source Ball

The experience with the sound source ball at Perkins, using the student developed ball encouraged the Center to experiment further. The covering of this ball is not puncture resistant and permits damage to the bladder. No improved covering could be found for the existing design that meets all the requirements. Efforts were then made to use commercial basketballs for both skin and bladder. Several methods of mounting electronics within and without the bladder were explored without success.

It was then decided to use a standard football as the starting point to produce a sound source ball. A ball was designed and built incorporating a sound source and rechargeable batteries. The ball has had only limited use but represents a very interesting concept that should be developed for use in both orientation training and recreation for the blind.

F. DOTSYS II

An important part of an automated Braille system for rapid production of braille is a computer program to translate the text material into Grade II Literary Braille. Several programs have been written, e.g., at APH, at IBM, at MIT project Mac, at MIT RLE, at MIT SAEDC and by Wexler and Argonne National Laboratories. However, each of the systems have been restricted to either a unique computer or a restricted class of computers.

The Braille Translation program used with the BRAILLEMBOSS is known as DOTSYS. It is written in a language unique to computers built during the 1950's. There are only a few of these computers available now and in the near future MIT will shut down its one remaining computer of this class. A new program had to be written. One of the requirements is that it be able to run on almost any sufficiently large computer.

A method to design in transferability for a computer program is to write it in a "higher level" language that uses the computer to convert the program into the actual language that particular computer uses. There are several of these languages available, e.g., COBOL (COmmon BUsiness Oriented Language), FORTRAN (FORmula TRANslation).

During the period of this report the choice of COBOL[5] was made for the program language and DOTSYS II was written. It has produced braille on the BRAILLEMBOSS using punched card output which was then converted to punched paper tape by a small computer, since the large computer used an IBM System/360 Model 50 did not have punched paper tape output. DOTSYS II also has a mode to produce braille by the "elastomer" method on a chain printer. It uses the period for dots and a soft facing (elastomer) on the chain printer hammers; a technique previously used by many programmers.

DOTSYS II has also produced "Proof Braille" on a chain printer. It was this form that was used to successfully demonstrate the program in January of 1970. DOTSYS II has been run on three different configurations (a later version is now being used by the Atlanta Georgia Public School System to produce education materials).

G. Linear Tape Measuring Device

There are several length measuring devices available to the blind, such as a 12 inch braille ruler, braille micrometer, etc. These are of limited utility for a blind carpenter or cabinet maker because of the coarse graduations and/or the limited range of the various instruments known to us. A tape measure was adapted into a digital reading unit with accuracies of better than 0.1 inch to overcome these difficulties for a blind carpenter, using a paper tractor from the BRAILLEMBOSS. The device is shown in Fig. 6.

A 10 foot commercially available tape measure was perforated to fit the sprocket drive paper tractor and the tractor was geared to a counter similar to one used as the mileage indicator of an automobile. The counter was modified into a tactile indicator by adding braille numbers. All components were mounted on a base that also serves as a zero reference while using the tape.

To measure an item with the tactile digital tape, the base reference edge is placed over one end of the item. The counter is zeroed by retracting the tape (or checking that the end of the tape is flush with the base), then reset to zero. The end of the tape is then pulled out to the other end of the item being measured as is normally done with a standard tape measure. Then the user reads the counter to obtain the measurement. It can be used in a similar sequence to mark a piece for cutting. The tape can be locked at any setting for repeated measurements. A knob is provided to return the tape to the container.

The digital tape measure is both more convenient and more accurate than the usual measuring devices available to the blind to measure distances from the range of about 6 inches to 10 feet. The range could be extended if required by using a longer tape.

H. Electrified Perkins Brailler

The method of evaluation used on the folding cane project was adopted for the electrified perkins evaluation as it has many desirable features, such as a widespread geographical distribution and a representative cross section of subjects essential if the evaluation has validity. Also, since different people assist in the collecting of the data during the evaluation, a complete set of instructions and questionnaires had to be developed to insure accurate, uniform, and complete results.

This data package developed includes:

1. A cover letter
2. Release
3. General Information Questionnaires
4. Instructions for Electrified Perkins Brailler
5. Electrified Perkins Brailler Questionnaire.

A copy of each form of the data package is included as Appendix C.

The "Cover Letter" provides instructions on the use of the other forms, i.e. when that form is to be used, and where to send the completed forms. The Release is a legal form protecting M.I.T. from liability resulting from the subject's participation in the evaluation. The General Information Questionnaire provides both background data on the subject and an indication of the brailling skill and experience of the user, and the braillewriter normally used. It also records the interviewers name if one is used.

The "Instruction for the Electrified Perkins Brailler" briefly describes the machine and contains both installation and operation instructions. It also has a warning of dangers that may exist if unqualified personnel tamper with or attempt to repair a malfunctioning brailler.

The "Electrified Perkins Brailler Questionnaire" is designed to record the users opinion on the speed, error rate, convenience and noise level of the brailler as well as the quality of the braille produced.

The user is asked, as a summary question, would he buy or trade for an electrified brailler.

A draft copy of the data package was sent to certain qualified, interested people for review and for such modification, additions, and deletions that they would suggest. As a result of this review the various forms were changed using many of the changes and additions recommended.

Ten Electrified Perkins Braillers were completed. However, several hardware problems developed such that only 3 were available for evaluation without extensive additional rework on the machine. The three braillers were sent to qualified users for their evaluation. This limited sample reported that their brailling speeds either increased or remained constant, that less effort was required to braille, and that the brailler noise was unpleasant.

The last question, "Would you purchase the Electrified Brailler if reasonably priced?" was answered maybe in all cases.

I. Computer Generated Mathematical Table

An example of the use of the BRAILLEMBOSS as an output device of a time-sharing computer is the production of a braille inches to millimeters conversion table. Such a table was prepared in December 1969 for a rehabilitation client of the Massachusetts Commission for the Blind. The client has been trained to repair and rebuild foreign car automatic transmissions. The only braille micrometers available for his use are based on English units and uses inches. The transmissions are measured in metric units, i.e., in millimeters.

The table was produced using the CTSS (an IBM 7094) time-sharing computer running a FORTRAN II program, a teletype, punched paper tape reader, and the Braillembosser. The table was embossed in Grade C or "one-cell" braille, developed for computer programmer use. This braille system has a one-to-one correspondence between the braille and inkprint characters. The inkprint characters are those used in the 63 character ASCII (American Standard Code for Information Interchange) character set used in the model 33 and 35 teletype. Table II lists the correspondence of the Grade II and the Grade C symbols.

For several reasons punched paper tape was used as a buffer between the computer terminal and the Embosser. The first was to make a machine readable master such that multiple braille copies could be produced without incurring the costs of additional computer and terminal time. In addition, it facilitated the writing of the program, since Brailler timing considerations could be handled by an asynchronous punch paper tape system instead of special programming techniques not readily available in FORTRAN II. The Brailler carriage return (CR) time is in general much longer than the time for the teletype and computer CR time, such that data would be lost during the time the Brailler is executing a CR. All other functions of the Brailler, except the end of page function, are accomplished in less time than with the teletype.

Fig. 7 is a printout of the program. It is written in FORTRAN II in a form adapted to the CTSS time-sharing computer. It consists of two nested DO loops with the necessary format statements. The outside loop, DO 100 J=J1, J2 is performed once per page. The starting point for this loop is J1, while the ending point is J2. These two numbers, externally supplied integers, are the starting page and ending page respectively of the computer run.

Next the page number is converted into a form that the operations of the inner DO loop require. The table entries for this page are then calculated by the inner DO loop. Variables A and C are the inch entries on a line, 0.020 inches apart, while B and D are the corresponding millimeter entries. After the entries for a page are calculated, the outer DO loop prints out the entire page and then proceeds to the next page.

Four PRINT statements with their corresponding FORMAT statements are used to print each braille page. The first PRINT statement produces the range of the page at the top of the page and skips the next line. The second PRINT statement prints the columnar heading. The next PRINT statement has an implied DO loop as part of it and prints the tabular entries, four entries per line and twenty lines. The last PRINT statement skips a line, prints the page number, and then skips three lines to set up for the start of the next page.

The program was compiled or converted by the computer into a form that it can use to compute the table. The computer time used to write and compile this program is not representative since this was the author's first attempt to use FORTRAN II and to use the BRAILLEMBOSS as an output device. A program of similar complexity was written using one-half man day and four minutes of computer time to write, compile, and test.

The compiled program was loaded into the computer, and the initial and final page numbers were typed in, one page number per line. The Model 35 ASR teletype was set to produce both the punched paper tape as well as the printed copy. After a page had been produced by the computer the end of the paper tape was loaded into the tape reader and the BRAILLEMBOSS produced the braille pages. The normal tape reader input to the BRAILLEMBOSS uses the Brailler code, not the ASCII used by the teletype. A cable adapter was built such that while the tape reader was driven in its normal mode, the output data was fed into the teletype input jack of the BRAILLEMBOSSER. The BRAILLEMBOSSER running time was slightly longer than the terminal time (in spite of the fact that the BRAILLEMBOSS is operated at a faster rate than the teletype) since each BRAILLEMBOSSER carriage return took longer than with the teletype. The running terminal time used for this table was 2.5 hours, but the computer time used was 1.9 minutes. It also took approximately three man hours to run the program and to emboss the first copy.

Seven copies of the table have been produced. Two were delivered to the Massachusetts Commission for the Blind for their use, one was sent to the Braille Book Bank of the National Braille Association for thermoform distribution, and one to George Magers, SRS. Three additional copies were bound by the Howe Press. One of these was retained at the Center for demonstration purposes, one given to Perkins Institute, and one sent to Robert Bray of the Library of Congress.

The table as produced by the BRAILLEMBOSSER is embossed on one side only. If interpointed braille is desired, a suitable converter could be constructed such that the APH Automatic Sterograph at Howe Press could use the ASCII tapes to emboss the zinc plates for press use. Alternatively, the translator in the present embossing system could be used to drive a tape punch to produce paper tapes in the Brailler code used by the sterograph.

This demonstration has shown that the MIT BRAILLEMBOSS when properly interfaced with a time-sharing computer, can produce mathematical tables embossed in braille of any mathematical functions that can be programmed into a computer.

J. Braille Computer Codes

A computer programmer must use very strict rules of format and syntax. A missing space, an incorrect spacing, or a single character out of place can spell failure for the program. Therefore, the blind programmer must use a braille code where each inkprint character has an equivalent single braille sign. A specialized braille is also required as many computer symbols, such as +, *, =, etc. have no Grade I braille equivalent.

Braille codes have been devised for this application. Each set used by others and known to us was designed for a particular character set, i.e., IBM BCD, or IBM EBCD, both hollerith card codes. These character sets did not include all the printing teletype (ASCII) codes.

In conjunction with experienced blind programmers[6], the Center established a braille code (one-cell braille) using the 63 printing characters of the ASCII code used by Model 33 and 35 teletypewriter. The letters in one-cell braille follow the same pattern as the Nemeth Code without any number signs, i.e., the braille signs for a through j are dropped one row to become the numbers 1 through 0. This is still a unique set because of the braille pattern used for the letters. Wherever possible, the punctuation marks and special symbols were carried over unchanged. Then the remaining braille signs were assigned with the least ambiguous signs corresponding with the most used symbols used in FORTRAN programming.

The resulting one-cell braille is very similar to the other braille codes known to us, with only minor discrepancies. Table II lists the resulting code along with both literary equivalent Grade I and II. For convenience the ASCII Octal equivalent is included. It is this code that is implemented in all translators built by the SAEDC.

K. Technical Rehabilitation Specialist

Through an effort initiated by Professor R. W. Mann, the late John K. Dupress, and R. A. J. Gildea, a proposal was submitted to SRS by the Mass. Commission for the Blind requesting support for a technical specialist to be assigned to the staff of the Commission. It was established in the proposal that a technical specialist could be beneficial and of considerable service to the rehabilitation counsellors in assisting them to procure and specify technical devices to aid clients in their rehabilitation training and employment. When the grant was received Professor Mann proceeded to review and screen potential candidates and recruited Mr. Phillip J. Davis, then a recent Mechanical Engineering graduate from MIT, who was appointed to the position in January 1969. During this period Mr. Davis has worked with the staff of the Sensory Aids Evaluation and Development Center and has used its facilities in his efforts to provide technical support of rehabilitation needs of the Mass. Commission for the Blind clients.

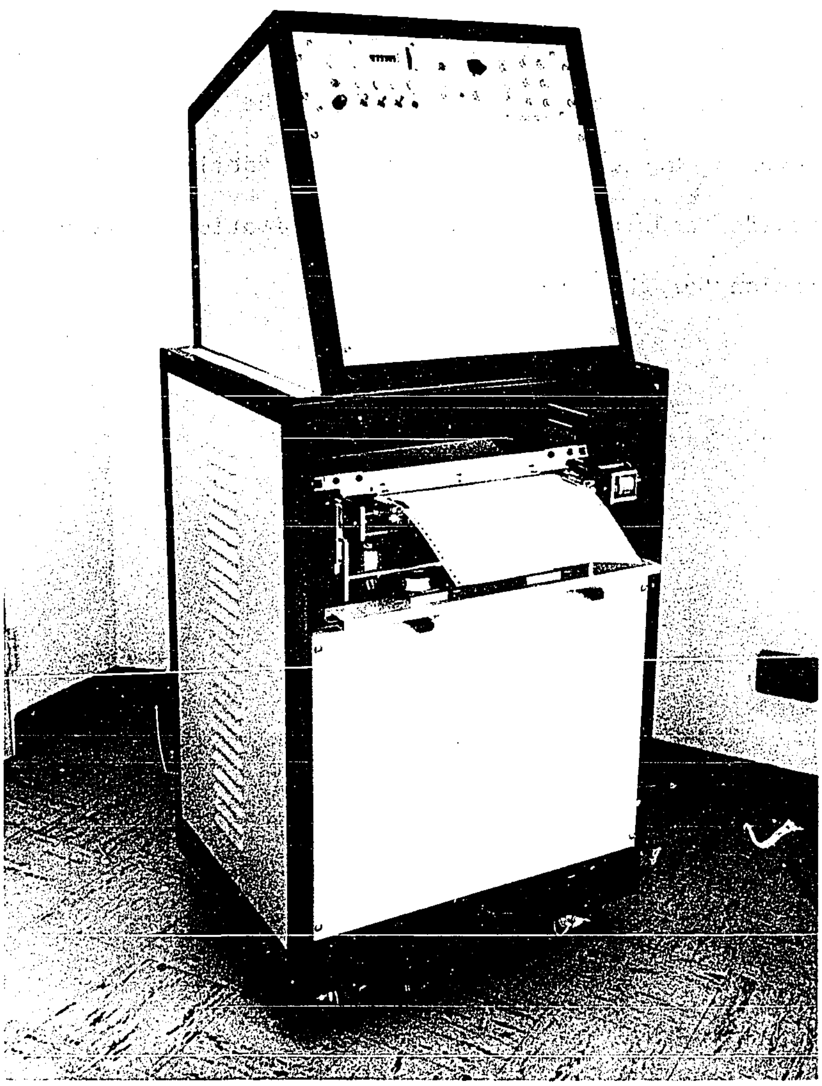


Figure 1

Model 3 BRAILLEMBOSS

Figure 2

MODEL 3 - LIFTING PLATEN BRAILLEMBOSS

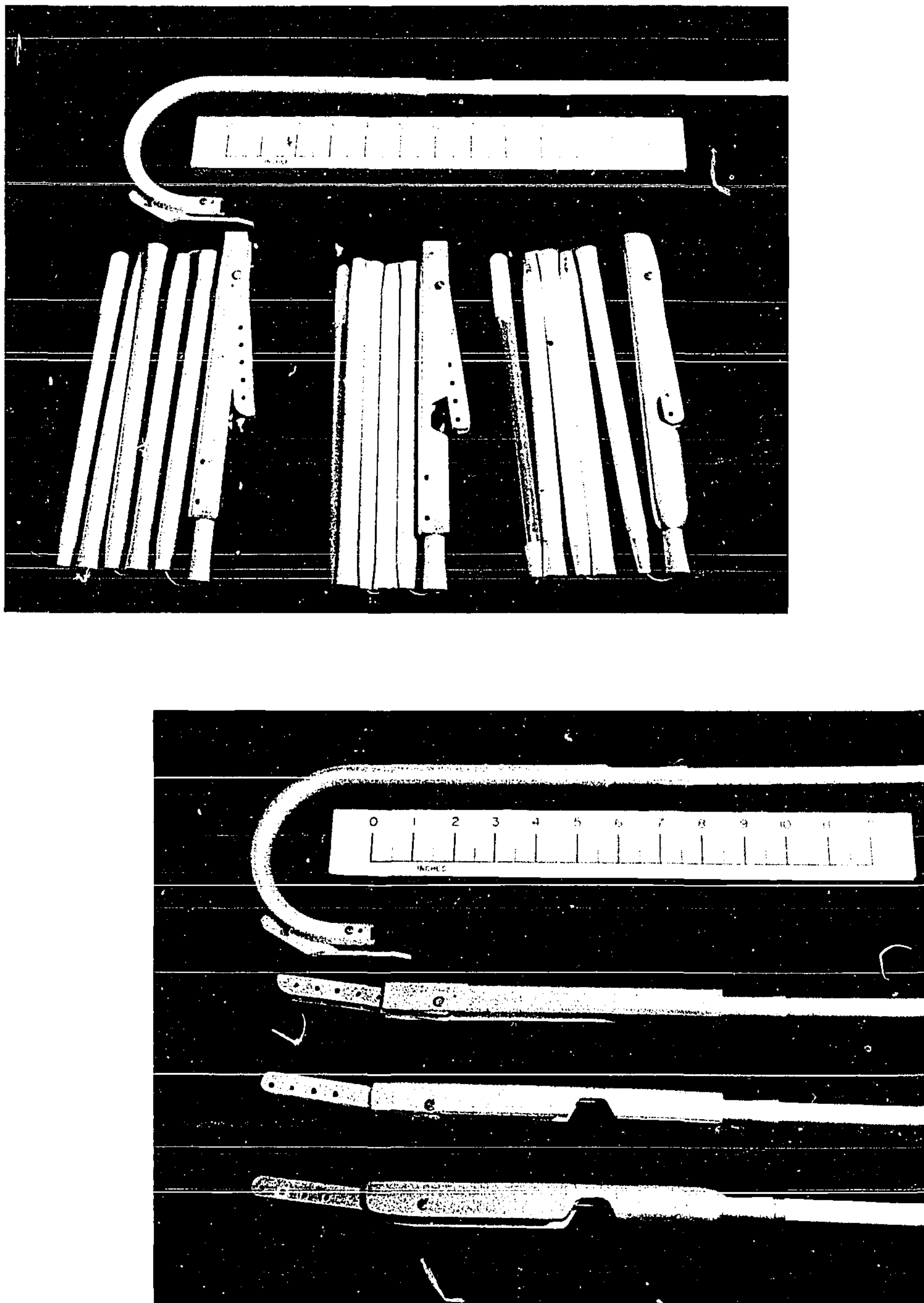


FIGURE 3

PROTOTYPE STRAIGHT HANDLE CANE

(CROOK HANDLE CANE FOR REFERENCE)

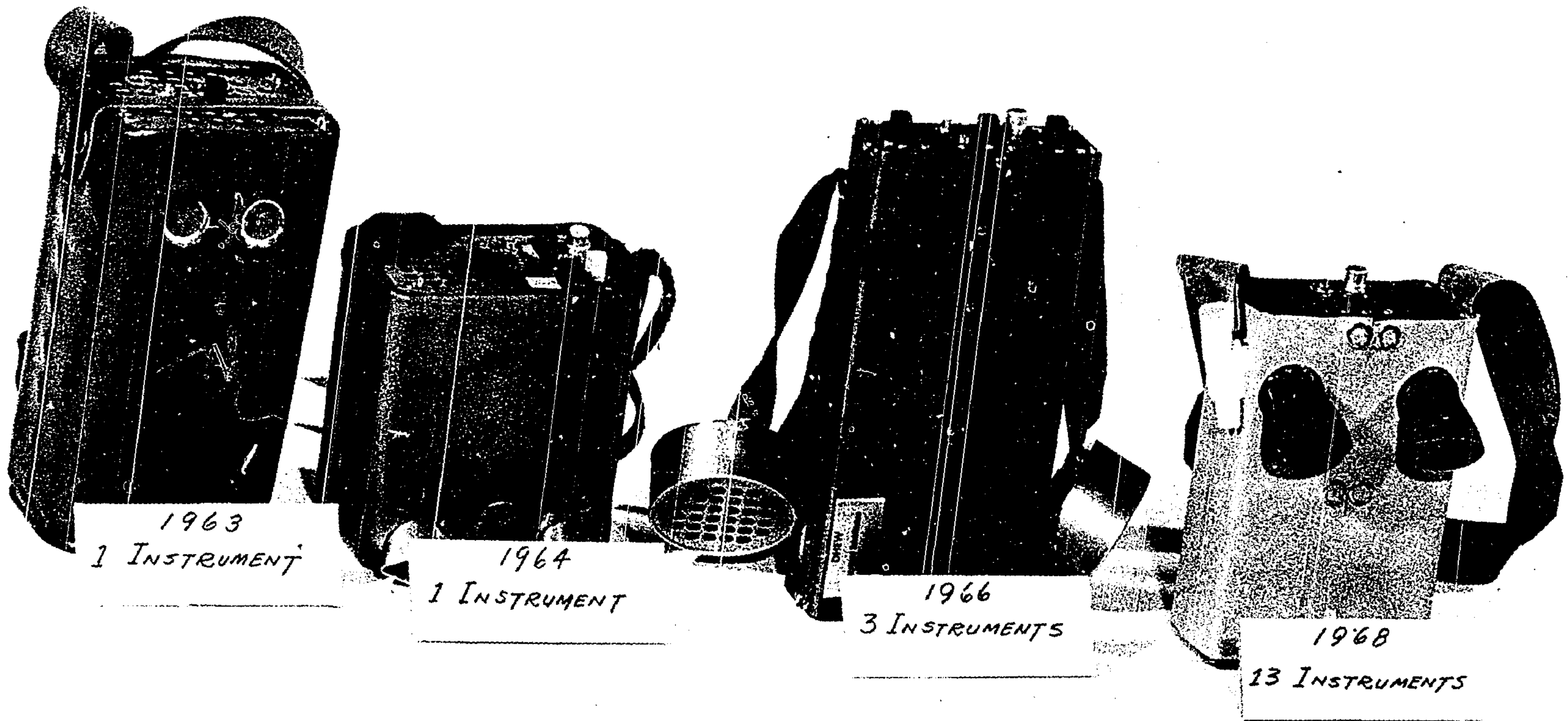


FIGURE 4.
PATHSOUNDERS

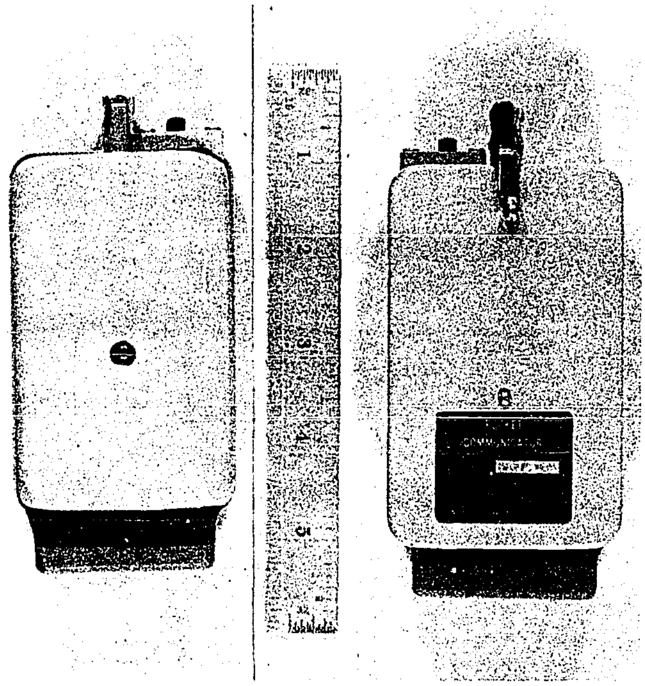


Figure 5
TAC-COM RECEIVER

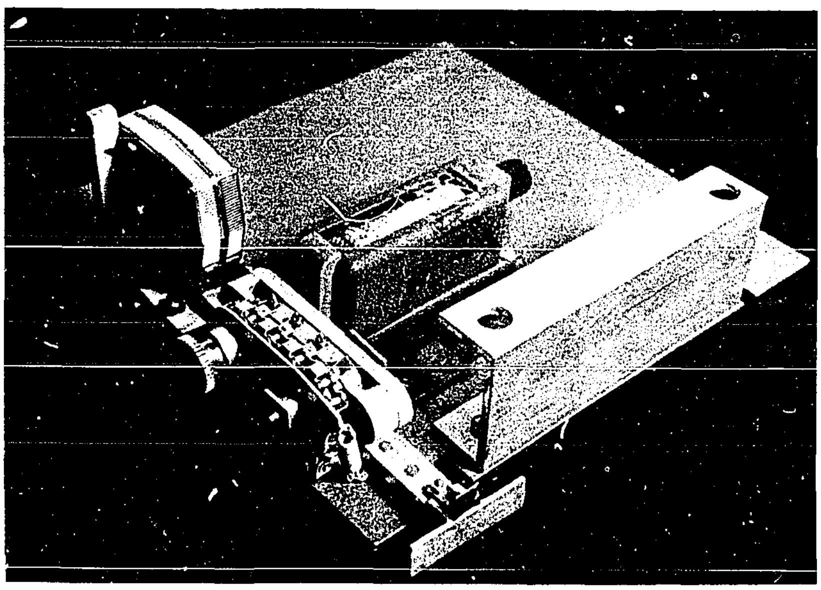


Figure 6

LINEAR TAPE MEASURE

Fig. 7

```
PRINTF METRIC MADTRN
W 1643.9
C   A PROGRAM TO PRINT A CONVERSION TABLE OF INCHES TO
C   MILLIMETERS IN A BRAILLE COMPATABLE FORMAT.  THERE
C   ARE FORTY ENTRIES PER PAGE.  THE RANGE PER PAGE
C   IS 0.04*(J-1)+0.001 TO 0.04*(J-1)+0.040 INCHES
C   WHERE J IS THE PAGE NUMBER.
C   THE STARTING PAGE NUMBER IS J1, THE ENDING IS J2.
C
        DIMENSION A(20),B(20),C(20),D(20)
 19     FORMAT (I3)
 20     FORMAT (13X,F8.3,3H TO,F8.3/)
 23     FORMAT (3X,33HINCHES   M.M.        INCHES  M.M.)
 21     FORMAT (1X,F8.3,F8.3,4X,F8.3,F8.3)
 22     FORMAT (/29X,5HPAGE ,I3///)
        Z=25.4005
        READ 19,J1,J2
        DO 100 J=J1,J2
        K=J
        Y=FLOATF(K-1)
        DO 50 I=1,20
        K=I
        X=FLOATF(K)
        A(I)=.04*Y+.001*X
        B(I)=Z*A(I)
        C(I)=A(I)+.02
        D(I)=Z*C(I)
 50     CONTINUE
        PRINT 20, A(1),C(20)
        PRINT 23
        PRINT 21, (A(K),B(K),C(K),D(K),K=1,20)
        PRINT 22, J
 100    CONTINUE
        END
R .950+.466
```

TABLE I

BRAILLEMBOSS TYPE SUMMARY

BRAILLEMBOSS Type	Quantity	Purpose
First Prototype	1	To verify the design of the Model 3 BRAILLEMBOSS
Model 3	14	A Braille Page Printer with immediate but not instantaneous access to the braille page
Second Prototype	1	To verify the design changes for the Lifting Platen
Model 3 Lifting Platen	5	A braille page printer for a time-sharing computer terminal where instantaneous access to the braille is required.

TABLE II
BRAILLE CODES
LITERARY AND COMPUTER

BRAILLE OCTAL	BRAILLE LEVELS	LITERARY CHARACTERS GR 1	ADDL GR 2	COMPUTER CHARACTER	TELETYPE OCTAL
300	------78	SPACE	SPACE	SPACE	40
201	1------8	A		A	101
202	-2-----8	COMMA	EA	1	61
03	12------	B	BUT	B	102
204	--3----8	APOST		'	47
05	1-3-----	K	KNOWLEDGE	K	113
06	-23-----	SEMI	BE BB	2	62
207	123----8	L	LIKE	L	114
210	---4---8	ACCENT		@	100
11	1--4----	C	CAN	C	103
12	-2-4----	I		I	111
213	12-4---8	F	FROM	F	106
14	--34----	/	ST STILL	/	57
215	1-34---8	M	MORE	M	115
216	-234---8	S	SO	S	123
17	1234----	P	PEOPLE	P	120
220	----5--8		PREFIX	"	42
21	1---5---	E	EVERY	E	105
22	-2--5---	COLON	CON CC	3	63
223	12--5--8	H	HAVE	H	110
24	--3-5---	ASTER	IN	9	71
225	1-3-5--8	O		O	117
226	-23-5--8	EXCL	TO FF	6	66
27	123-5---	R	RATHER	R	122
30	---45---		PREFIX	↑	136
231	1--45--8	D	DO	D	104
232	-2-45--8	J	JUST	J	112
33	12-45---	G	GO	G	107
234	--345--8		AR	>	76
35	1-345---	N	NOT	N	116
36	-2345---	T	THAT	T	124
237	12345--8	Q	QUITE	Q	121
240	-----6-8	CAPS		[	133
41	1----6--		CH CHILD	*	52
42	-2---6--		EN ENOUGH	5	65
243	12---6-8		GH	<	74
44	--3--6--	HYPHEN	COM	-	55
245	1-3--6-8	U	US	U	125
246	-23--6-8	QUO QUES	HIS	8	70
47	123--6--	V	VERY	V	126
50	---4-6--	ITALICS	PREFIX	.	56
251	1--4-6-8		SH SHALL	%	45
252	-2-4-6-8		OW	,	54
53	12-4-6--		ED	$	44
254	--34-6-8		ING	+	53
55	1-34-6--	X	IT	X	130
56	-234-6--		THE	!	41
257	1234-6-8		AND	&	46
60	----56--	LETTER		;	73
261	1---56-8		WH WHICH	:	72

262	-2--56-8	PERIOD	DIS DD	4	64
63	12--56--		OU OUT	\	134
264	--3-56-8	UNQUOTE	WAS BY	0	60
65	1-3-56--	Z	AS	Z	132
66	-23-56--	PAREN	WERE GG	7	67
267	123-56-8		OF	(	50
270	---456-8		PREFIX	←	137
71	1--456--		TH THIS	?	77
72	-2-456--	W	WILL	W	127
273	12-456-8		ER	]	135
74	--3456--	NUMBERS	BLE	#	43
275	1-3456-8	Y	YOU	Y	131
276	-23456-8		WITH	)	51
77	123456		FOR	=	75
101	1-----7-	CR & LF			105
303	12----78	PAGE			104
305	1-3---78	LINE SPACE			102
377	12345678	RUBOUT			
102	-2----7-	BS*			10
106	-23---78	TAB*			11
123	12--5-7-	STOP*			4
143	12---67-	BELL*			7
167	123-567-	SHIFT*			
321	1---5-78	START*			
377	12345678	UNSHIFT*			

* THIS FUNCTION NOT AVAILABLE ON BRAILLEMBOSS

III ADMINISTRATIVE STRUCTURE

The SAEDC is administered through the Mechanical Engineering Department of M.I.T. The Director and Staff of the Center are members of the System and Design division of the department, with Professor R.W. Mann the faculty representative for the Center.

As a part of M.I.T. the Center cooperates with members of other departments where mutual interests exist for aids for the sensory deprived. The Center uses consultants from schools, rehabilitation agencies, and social service agencies, both in the local Boston area and across the country.

Two committees serve to help guide the Center, the Steering Committee provides close interaction and advice, and The National Advisory Committee provides both liaison and planning for the Center. The committees are:

National Advisory Committee

Dr. R. A. Bottenberg, Air Force Personnel Lab., Lackland A.F.B., Texas
Mr. Leon Harmon, Bell Telephone Labs, Murray Hill, New Jersey
Prof. E. Foulke, Department of Psychology, University of Louisville
Prof. R. H. Gibson, Department of Psychology, University of Pittsburgh
Dr. H. Goldstein, Children's Bureau, H.E.W.
Dr. M.D. Graham, American Foundation for the Blind
Prof. J. G. Linvill , Electrical Engineering Dept., Stanford University
Prof. I. F. Lukoff, School of Social Work, Columbia University
Dr. C. Y. Nolan, American Printing House for the Blind
Dr. R. A. Scott, Sociology Department, Princeton University
Dr. M. R. Rosenzweig, Psychology Department, Univ. of California, Berkeley
Dr. W. P. Tanner, Jr., Sensory Intelligence Lab, University of Michigan
Dr. B. W. White, Psychology Department, San Francisco State College

Steering Committee

Mr. C. Davis, Perkins School for the Blind
Prof. R. Held, Psychology Department, M.I.T.
Prof. S. J. Mason, Electrical Engineering Department, M.I.T.
Prof. A. W. Mills, Psychology Department, Tufts University
Prof. R. B. Morant, Psychology Department, Brandeis University
Mr. J. F. Mungovan, Massachusetts Commission for the Blind
Dr. L. H. Riley, American Center for Research in Blindness and Rehabilitation
Dr. O. Selfridge, Lincoln Lab, M.I.T.
Prof. T. B. Sheridan, Mechanical Engineering Department, M.I.T.
Dr. M.L. Simmel, Psychology Dept., Brandeis University
Prof. R. W. Mann, (Chairman), Mechanical Engineering Department, M.I.T.

During this year the contacts with the Steering and National Advisory Committees were for the most part on an informal basis.

IV. ACTIVITIES

A. Industrial Cooperation with the Center

In accordance with the statements outlining the initial contract agreements with SRS the Center has devoted its resources to the location of new devices for evaluation, to the involvement of others in developing new devices and to the development of new sensory aids for the blind. In order to fulfill the implicit purpose of these agreements an essential step has been included in the scope of our activities. The goal of this program is to explore industrial involvement and participation in the production of devices in the area of sensory aids for the blind.

The development and evaluation of aids or devices, by themselves, will not put the aids in the hands of the blind user. However, this process helps to sort out the appropriate and useful aids which then can be applied as serviceable tools. The Center is only geared to handle a very limited production of any of these devices and then only for evaluation purposes. For example, the crook handle folding cane, the BRAILLEMBOSS, and the Sound Source Ball. The responsibility for production must be accepted by manufacturers. Therefore the Center's present role is to confront industry and acquaint them with the facts related to the production of sensory aids: 1) the necessity to align the product with the capability of the firm; 2) the extent of initial investments necessary to become involved; 3) marketing and distribution problems. The Center is willing to explore with any responsible industrial or manufacturing organization or firm the nature of these problems. The HYCOR cable cane is one result of this type of interaction. The Center also remains willing to explore joint participation efforts in order to allow industrial cooperation and involvement in products and development program.

B. Guests Hosted by the Center

The following enumeration of guests is a partial listing of people and members of organizations received at the Center as part of its seminar, consultation, industrial, interest group and other educational activities:

Irma Virkki	Helsinki
Kaarlo Virkki	Helsinki
Rev. J. M. Adams, C.F.S.	Australia
Tee Tee Chua	Malaysia
Louis Mitchell	Scranton Univ.
Berdell Wurzburger	San Francisco
& peripatology students	State
Marc Lewkowicz	Alfred Univ.
F. Thorpe	IBM
Sheldon Epstein	Chicago, Ill.
Joseph Anthony	Muskegon, Michigan
Jasha Levi	
Dan Gopinath	India
B. Venket Reddy	India
Lois Leffler	Argonne, Illinois
Matthew Prastein	Argonne, Illinois
Tom McConnell	Atlanta Pub. School
Arnold Grunwald	Argonne, Illinois
Norman Reimer	New York
Dr. Robert Bowers	Columbia Univ.
& Special Education Students	

John Siems	Amer. Printing House
N. Sutherland	Bedford, Mass.
D. Westaway	Melbourne, Aus.
Leslie Kay	New Zealand
Charles Kern	Boston, Mass.
Dr. Enid Wolf	Wash., D.C.
Dr. M. Valach	Georgia Tech,
Mr. Janses	Georgia
T. Toussig	Berkeley, Cal.
Wm. Heisler	Perkins
& Special Education Students	
R. Morrison	Sun City, Ariz.
C. Leonard	Burlington, Vt.
P. Moss	San Rafael, Cal.
I.M. Neou	W. Virginia Univ.
K. Sibert	Modesto, Cal.

V. SEMINARS, PRESENTATIONS, CONFERENCES and PUBLICATIONS

Seminars and Presentations

1. The Director of the Center spoke to the students of the "Material Information Center" at Hunter College on January 7, 1969.

2. A Presentation on SAEDC activities was held for the staff and counsellors of the Massachusetts Association for the Blind at the SAEDC on February 3, 1969.

3. A one day seminar was held for graduate students in peripatology at San Francisco State College, February 5, 1970 at SAEDC.

4. The Director spoke to the students at Perkins School for the Blind, Career Day, on March 1, 1969.

5. A Presentation on Sensory Aids to the Blind was held at Fairchild-Stratos Corporation, Bay Shore, Long Island on April 22, 1969.

6. The MIT SAEDC Sensory Aid devices were exhibited at MIT Alumni Day and Open House on May 1 and 3, 1969.

7. The Director spoke to a group at the Northwest Foundation for the Blind and met individually with several people on May 15, 16, 1969.

8. A seminar was held for Perkins Teacher Trainees at the SAEDC on June 5, 1969.

9. A two day seminar was held at the MIT Faculty Club for special education students of Teacher College, Columbia University on August 20,21, 1969.

10. A lecture was given by the Director to a Lions Club on Long Island, N.Y., on September 16, 1969.

11. The Director presented a paper on Electronic Mobility Aids to the Northeast Regional Chapter of the AAWB at South Athol, Mass. on September 18, 1969.

12. A presentation was made to the Washington, D.C. Development Center and their guests on November 18, 1969.

13. A seminar was held at the SAEDC for graduate students in the peripatology program at Boston College on November 21, 1969.

14. A seminar was held at SAEDC for peripatology graduate students from San Francisco State on January 28, 1970. A sample seminar agenda is included as Appendix D .

Conferences

1. The Center participated in "The Blind in Computer Programming; an International Conference", sponsored by the Association for Computing Machinery, the Cleveland Society for the Blind and Social Rehabilitation service of Department of H.E.W., held in Cleveland, Ohio on December 9,10,11 of 1969. A BRAILLEMBOSS was demonstrated using teletype prepared punched paper tapes. The Director delivered a paper on Braille Activities at MIT.

2. The Center was host for a Workshop on Blind Computer Programming on January 22, 1970 for the Massachusetts Commission for the Blind.

3. The Center was host for a conference on New Process in Braille Manufacturing on February 12 and 13, 1970.

Publication

1. Russell, Lindsay, "Pathsounders Instructor's Handbook", M.I.T. SAEDC, Cambridge, Mass. January 1969.

VI. SPECIAL CONFERENCES

1. A meeting was held at Listening, Inc. Arlington, Mass. on January 10,1970 with V. A. Proscia, Emerson Foulke, and L. Clark visiting.

2. A visit by SAEDC personnel and consultants on January 13, 1969 to EG&G in Bedford, Mass., to discuss their participation in BRAILLEMBOSS production and other sensory aids.

3. A meeting at SAEDC on January 14, 1969 to discuss DOTSYS improvement and modification. The attendees include Joseph Schack, Ann Schack, R. W. Mann, R. A. J. Gildea, G. Dalrymple, and V. A. Proscia.

4. A meeting was held on March 5, 1969 at Industrial Home for the Blind (IHB) to discuss deaf-blind communication system.

5. Prof. R. W. Mann and V. A. Proscia visited the Atlanta Public School System, Atlanta, Georgia, on March 9, 1969 to discuss "Braille in the Classroom".

6. Prof. R. W. Mann and V. A. Proscia attended the "Tactile Display Conference" at Stanford Research Institute on April 2,3,4 of 1969.

7. Prof. R. W. Mann and V. A. Proscia attended the Visual Prosthesis Conference in Chicago on June 2,3,4, of 1969.

8. V. A. Proscia attended the AAWB Conference in Chicago on July 20 and 22 of 1969.

9. Mr. V. A. Proscia and Lindsay Russell visited the Greater Pittsburgh Guild for the Blind, Pittsburgh, Pa. on August 7, 1969 to discuss Pathsounder training and evaluation program.

10. A group of people from Industrial Home for the Blind (IHB) visited at the SAEDC on August 13, 1969 for a demonstration of TAC-COM, a deaf-blind communication system.

11. Personnel from MITRE Corp. presented the "Proof Braille" output to demonstrate the Grade II Braille Translation ability of DOTSYS II.

12. Mr. V. A. Proscia attended an ACM Committee on Professional Activities for the Blind meeting in Washington, D.C. on February 25, 1970.

VII. SUMMARY

1. The BRAILLEMBOSS has been used with 4 different types of time sharing computers by 2 professional programmers and by 3 classes of blind students learning computer programming. The design of a BRAILLEMBOSS specifically for time-sharing computer terminals has been completed.

2. The folding cane projects have been successfully concluded by finding and then assisting a manufacturer to make the folding canes developed at M.I.T. commercially available.

3. The Pathsounder program has progressed by adding four additional agencies or hospitals where qualified Pathsounder instructors and/or users exist.

4. A communication system for the deaf-blind has been developed. Evaluation is now being conducted at the National Center for the Deaf-Blind Youths and Adults operated by Industrial Home for the Blind (IHB in New Hyde Park, L.I.)

5. A sound source football has been constructed and demonstrated.

6. A transferable Grade II braille translation computer program has been written. It has been demonstrated on two different computers.

7. Initial distribution of the Electrified Perkins Brailler has taken place.

8. A computer generated braille mathematical table was produced for a rehabilitation client of the Massachusetts Commission for the Blind.

VIII. REFERENCES

1. Final Report to SRS under Contract SAV-1057-67 for December 1966 through November 1967.

2. Final Report to SRS under Contract SAV-1057-67 for December 1967 through December 1968, dated 30 April 1969.

3. Paper by Michael Lichstein, SAEDC, August 1, 1969.

4. Russell, Lindsay, "Pathsounder Instructor's Handbook", SAEDC January 1969.

5. Millen, J.K., "Choice of COBOL for Braille Translation, MITRE Corp., December 1969.

6. Private Communications, R.A.J. Gildea, M. Lichstein, K. Ingham.

Massachusetts Institute of Technology
SENSORY AIDS EVALUATION AND DEVELOPMENT CENTER
292 Main Street, Cambridge, Massachusetts 02142

APPENDIX A

Evaluation of the M.I.T. Automatic Brailler

15 January 1970

The M.I.T. Brailler has been located in my office in N.A.S.A.'S Electronic Research Center in Cambridge, Mass. for three months. The Brailler is connected to a teletypewriter which is, in turn, connected by a telephone line, to a Digital Equipment Corp. PDP-10, a digital computer. I share this office with one other person.

I am blind; my office mate is not. Both of us are PH.D., Aerospace engineers, employed by N.A.S.A. to pursue research in the application of orbital mechanics to the determination of the motion of earth satellite. The teletypewriter has been used exclusively by us.

I have been involved in this type of work for ten years. By the nature of the work, it has been essential to program the results of my research on a computer for purposes of verification of the accuracy of the calculations, evaluation of the methods employed and investigation of possible applications. As is not unusual, I have called in programmers to carry out the actual programming and running of the results on a computer. I have had to rely on others to at least scan the numerical output in order to keep abreast of progress. The whole procedure has been quite unsatisfactory. The effort, time, cost, red tape, and the inefficiency of the procedures have led, in practice, to laying aside possible fruitful avenues for investigation.

With the advent of time-sharing capability, the situation has been completely altered. A scientist can now have direct access to the computer and almost zero turn-around time. However, for a blind scientist the time-sharing capability of computers is absolutely useless without a braille output device to reproduce the teletype output. It was my good fortune that, when the time-sharing facility became available to me, almost simultaneously, the M.I.T. Brailler was put at my disposal for evaluation purposes.

From a purely personal point of view, I cannot emphasize enough the almost unanticipated boost in morale the Brailler has afforded me. For the first time, I can access the computer directly and, for the first time, I can read the results of my labor. It is no exaggeration for me to say that, for the past three months, I have spent just about every waking moment either sitting at the Brailler and teletypewriter or preparing my next numerical experiment. Needless to say, I have not nearly exhausted the backlog, built up during the past ten years, of possible uses for the computer.

From the point of view of a productive worker, my contribution to the in-house effort has kept pace with my colleagues, which would not have been the case had I not had the Brailler at my disposal. I consider it an indispensable instrument for my work. Should I be deprived of its use, my value to my employer would suffer commensurately.

In my opinion, every possible effort should be made to ensure the development and further refinement of the M.I.T. Brailler and its availability to all blind persons who can demonstrate a legitimate use for it. The potential uses for the Brailler are by no means limited to my particular applications. The least that can be said is that whatever is available to a sighted person through a teletypewriter is available to a blind person through the addition of a Brailler. This capability alone is sufficient to justify the development of the Brailler.

The M.I.T. Brailler does have some shortcomings, but they do not nearly cancel its advantages. One difficulty with the present design, and one which will take some ingenuity to eliminate, is the dropping of a character at the end of a line. This defect has been more of an annoyance to me, rather than a hindrance, since properly formatting the output circumvents line-overlap. Noise is another annoyance which can probably only be ameliorated under the present design. Some aspects of the Brailler which can be improved are: size of the machine, manner of presentation of the brailled material as it issues from the machine, and reliability.

John Morrison

Dr. Morrison wrote this report directly into the PDP-10 computer using a teletype and BRAILLEMBOSS. A text editor program, TECO (Text Editor and COrrection) was used to correct, insert, delete, and modify report as necessary. Dr. Morrison then used an auxiliary program to format the report for the line length of the BRAILLEMBOSS. Following Dr. Morrison's directions a teletype at the SAEDC was attached via telephone to the computer and the report requested. The report was printed on the teletype directly from the computer's memory. This copy was retyped from the teletype copy without further editing.

George F. Dalrymple

APPENDIX B

CROOK HANDLE FOLDING CANE EVALUATION

Since its founding in 1964, the M.I.T. SAEDC has been pursuing a development of folding canes. The learning process has been a long and tedious one; past reports have indicated and have been documented as to the effort and emphasis that has been placed in the evaluation and development of existing folding canes. Studies included testing of commercially available canes which are distributed and sold to the blind for mobility purposes. However, these canes do not meet with the rigid requirements specified by the M.I.T. studies in the area of folding canes as specified as early as the Final Report for fiscal year 1965-1966 of M.I.T. SAEDC. The requirements laid down by the Center state that the folding cane must be portable, lightweight, durable, rigid when extended, balanced, economical, and must have a lifetime of at least one year. The Center feels that the swaged tube, central steel cable folding cane presently meets many of these specifications.

During the Conference for Mobility Trainers and Technologists, the Center was urged by the attendees to distribute the present configuration of the swaged tube, central steel cable crook handle folding cane for evaluation purposes to appropriate agencies and participants. Shortly after the Conference, the project was undertaken at the Center to manufacture and distribute 100 folding canes to subjects for evaluation.

EVALUATION PROCESS

The subjects for the evaluation project should come from many parts of the country and not from the New England area only. Since the M.I.T. SAEDC is limited in budget and personnel, it was necessary to enlist aid from qualified people in other geographical areas to assist in performing the field work of the evaluation. These persons serve as advisors who select the subjects, instruct the subjects in the care and folding of the cane and collect the data for transmission to the Center.

Schools, hospitals, agencies and individuals served as advisors. Some were selected because of their known interest and competence in the field. Others were recruited through a request published with an announcement of the Program in the "Proceedings, Conference of Mobility Trainers and Technologist, December 1967," an announcement at the AAWB meeting in Toronto, July 1968, and also, through the "grapevine."

A data package including instructions was designed to accompany each cane. The data package included:

1. Check List of Supplies
2. Instructions for Advisors
3. Introduction - Folding Cane Evaluation, Inkprint and Braille
4. Instructions, Inkprint and Braille
5. Release
6. General Information Questionnaire
7. Pre-Test Questionnaire
8. Post-Test Questionnaire
9. Malfunction Report - Folding Cane
10. Cane in a reusable shipping carton.

The check list of supplies is a check list or packing list of the materials furnished to each advisor. The Instruction for Advisors* is a step by step instruction sheet for the evaluation. It also includes instructions for the correct methods of folding and extending the cane. These instructions are illustrated with step by step photographs. Caution notes are included to warn the advisor to look for bad techniques by the subject that could reduce the life of the cane.

*The Instructions for Advisors was published in the SAEDC Final Report Contract SAV-1057-67, 30 April, 1969, Appendix 5.

The Introduction-Evaluation of Folding Canes describes the folding cane, some of the design criteria, and the evaluation procedure. The Instructions are a review of the techniques for folding and extending the cane for use by the subject as a reference after the advisor has instructed him in the correct techniques. The Release is a legal form protecting M.I.T. from liability resulting from the subject's participation in the evaluation. The General Information Questionnaire provides a very brief description of the subject.

The Pre- and Post-Test Questionnaires are used to gather the data of the evaluation. The Pre-Test is answered by the subject before he is given the SAEDC folding cane and it is meant to determine his attitudes and opinions towards canes he has used in the past and towards cane travel in general. The main questions about previous canes concern: durability, the material of which the canes were made, the material of which the tips were made, the presence of absence of reflectorized coating, compactness of the canes, and whether they were folding or rigid. And finally, a series of questions ask how the subject feels about the cane as a sign to others that he is blind. After completing this questionnaire the subject is given a crook handle folding cane, instructed in its use and asked to use it for a two month evaluation period. At this time the subject is asked to fill out the Post-Test Questionnaire. This questionnaire has as its main purpose to determine the attitudes and opinions of the subject on the cane, both independently and relative to his past canes. The questions about the folding cane concern: its rigidity, balance, ease of assembly and disassembly, compactness, durability, comfort of the grip, capacity to relay information along the shaft and comparative weight. Again, the subject is asked how he feels about the cane as a sign to others that he is blind and whether the folding cane has made any difference to his attitudes. These Questionnaires are the same developed previously at the Center for a more modest folding cane evaluation conducted during the development of the crook handle cane.*

A Malfunction Report form was used to report troubles and to record the subject's opinion of the trouble. This form helped in the mechanical improvement of the cane and in the determination of design changes. The cane was shipped in a reusable carton to facilitate its return, if required. The carton was of the slide and sleeve type with two sheets of plastic foam inside to cushion the cane.

PRODUCTION OF CANES

The design of the crook handle cane used in the evaluation was essentially the cane shown at the 1967 Mobility Conference used by John K. Dupress, and this cane is both a product of earlier evaluations and of John's use of it. The assembly of the canes was performed at the Center, but the various parts were purchased from local machine shops.

Each cane was made to order after the length and tip data was received from the advisor. The lengths were restricted to even number inches, i.e., 48", 50", 52", etc. The exact length could not be specified to closer than about 1/4 inch as the cable tension is determined by a final length adjustment. The tips used were either the AFB glide tip or the Veterans Administration nylon tip.

*The Questionnaires were previously published in Final Report Contract SAV-1045-66, 3 April, 1967.

DISTRIBUTION

A total of 84 canes were made for distribution. Seventeen (17) agencies, schools, and hospitals helped in the evaluation. Nine states as well as England was represented in the evaluation. The agencies used in the evaluation were listed in the previous final report.*

The length of the canes evaluated varied from 34 inches (for an eight year old girl) to 56 inches. The most common length was 52 inches. The distribution of lengths is shown in Figure B-1. The tip choice is also shown in the figure. The VA nylon tip was the most requested with 44; the AFB glide tip was used on 40 canes, and was generally used on the shorter canes.

Complete usable data sets were received from 53 of the cane users. No data was received on 22 canes and either defective or incomplete data was received on nine canes. While each subject was asked to return the cane if continuing use would not occur, only six canes were returned. These were reissued, but data has been received for only one of the six.

FOLDING CHARACTERISTICS

One goal of the development was to produce a cane with good folding and extending characteristics, and one that is convenient to store on a person or in a pocketbook. One measure of how well the cane meets these requirements is the number of times per day a user folds or extends the cane. The number of operations per day for each cane is given in Figure B-2. Another measure of how well the cane meets the folding requirements is that over 80% of the subjects could fold or extend the cane easily within the time available and without harm to themselves or others. A third measure of the cane meeting its development goals is the feelings of the users when sitting down and who must

* Final Report To SRS, 1968.

find a place to store the cane. Eighty-one percent (81%) felt more comfortable with the folding cane than with a rigid cane.

The cane has demonstrated it meets the requirements for foldability but the large crook detracts from its storage characteristics. The folded cane met the storage requirements of 50% of the users, but on an open-ended question regarding which features of the cane that the user disliked, 49% mentioned the large crook and 11% thought the folded cane was not compact. In a similar open-ended question about what features the user liked, 43% listed foldability of the cane.

MECHANICAL CHARACTERISTICS

Another goal of the cane development was one with the same mechanical characteristics as the VA Tyflocane. The material used in the folding cane is the same alloy and has physical specifications as that used in the original VA cane. The techniques used in the joint is one that provides easy assembly and disassembly while being essentially as strong as the one piece cane when held together with sufficient force. The strong steel central cable with the lever and latch mechanism provide the required forces for a rigid cane.

The users response to the question concerning joint characteristic as well as bounce and springiness characteristics is a subjective indication of the cane's mechanical characteristics. Table B-I is a composite of the answers to the two questions regarding these characteristics. The bounce and springiness can be different from a one piece cane and this is probably due to the cable vibrating inside the cane. Over 84% of the users indicated the cane was firm, but only 37% said the cane had the same bounce and springiness of their regular cane.

Weight and balance of a cane are important. Approximately one-half (49%) liked the balance of the folding cane while the remainder of the users were equally divided on whether the cane was heavy at the tip or at the handle. The cane felt as if it weighed more than the regular cane used by 22% of the subjects. On the open-ended questions about the features of the cane, 45% liked the firmness, 38% disliked the grip. In response to a question about thermal characteristics, i.e., does the cane get too hot or cold for comfort, 51% asked for a grip in the remark section of the question.

CONFIDENCE CHARACTERISTICS

An important factor in the acceptance of the folding cane is the confidence of the users in it. Questions were asked of the users feelings of security and safety when using the folding cane as compared to their feelings when using their regular cane. Eighty-one percent (81%) felt as secure with the folding cane as with their regular cane, while 62% felt as safe or safer when using the folding cane. The test users were further asked if the folding cane was too fragile or wobbly for regular use. The same number, 81%, felt the cane was strong enough to be their regular cane. Figure B-3 shows the interrelationship of the users responses to these questions. (Both users who thought the cane was too fragile but did not feel less safe or unsure with it had the cane severely damaged by malicious mischief or had the cane severely bent when run over by an automobile. The damaged cane could be folded and extended in spite of the damage).

An additional measure of the users confidence in the cane is the amount of use each cane received. The distribution of use is shown in Figure B-4. In the lower part of each bar in the graph is shown the number of users with feelings of insecurity or reduced safety when using the folding cane.

SENSOR CHARACTERISTICS

An important function of the cane is to provide mobility data to the user. The usefulness of the folding cane is in a large sense dependent upon its ability to generate and transmit the required data in a manner identical or quite similar to that of the rigid cane. The users were asked a series of questions regarding several ways data is generated or created by the cane. A composite picture of the sensor characteristics is given in Table B-II. The folding cane provided the same amount of information for 55% of the subjects as did their regular cane.

The subjects were asked if the sounds produced by the cane, both direct and echos were different than those produced by their regular canes. Table B-III summarizes those responses. While a majority said the sounds generated were different, 85% felt that they had the same distance measuring ability as with their regular canes.

Another data mode is the direct transmission of the data by the cane when it strikes an object or surface. Sixty percent (60%) thought their ability to make fine discriminations of texture changes while 62% felt the folding cane gives as much information as their regular cane when the cane comes in contact with an object.

MAINTENANCE

All canes returned to the Center were examined by design personnel before the canes were repaired. In many instances, wear marks not related to the more obvious defects indicated the user was not properly instructed in the assembly and disassembly of the cane. Several returned canes were damaged by abuses which no design could eliminate, i.e., "run over by automobile", "bashed against steps by naughty child", etc. Based on field failures, the following changes were made.

The Center purchased a better designed ferrule crimping tool to secure the loops at either end of the central steel cable. The new tool features dies that cannot be closed beyond the optimum distance required for maximum cable strength.

The roll pin cable attachment design at the lower cane section has been replaced by a tapered aluminum plug. The described design change improves cane balance, facilitates cane assembly and improves the exterior appearance of the cane.

Additional changes made for the straight handle cane include a heavier cable with a roller to protect or thimble to strengthen the cable loop. The heavier cable will reduce the cutting of the plastic sleeve.

A more positive method of securing the tension adjustment has been adopted to prevent the canes from loosening. Set screws that both mar and deform the top section are used to prevent slipping.

Twenty-four (24) of the 84 canes distributed were returned. Several canes were returned more than once for a total number of 30 repairs. The number of times canes were returned with respect to the duration of time the cane was used prior to malfunction is shown in Figure B-5. The cause of return, except for maltreated canes, or accidents, has either been eliminated or drastically reduced by the design changes adopted.

CONCLUSIONS

The M.I.T. SAEDC folding cane has demonstrated that it is a rigid cane suitable for heavy use, but with two shortcomings: the large crook and a poor gripping surface. The results of the evaluation and the design changes from the maintenance requirements have been incorporated into the Straight Handle Cane.

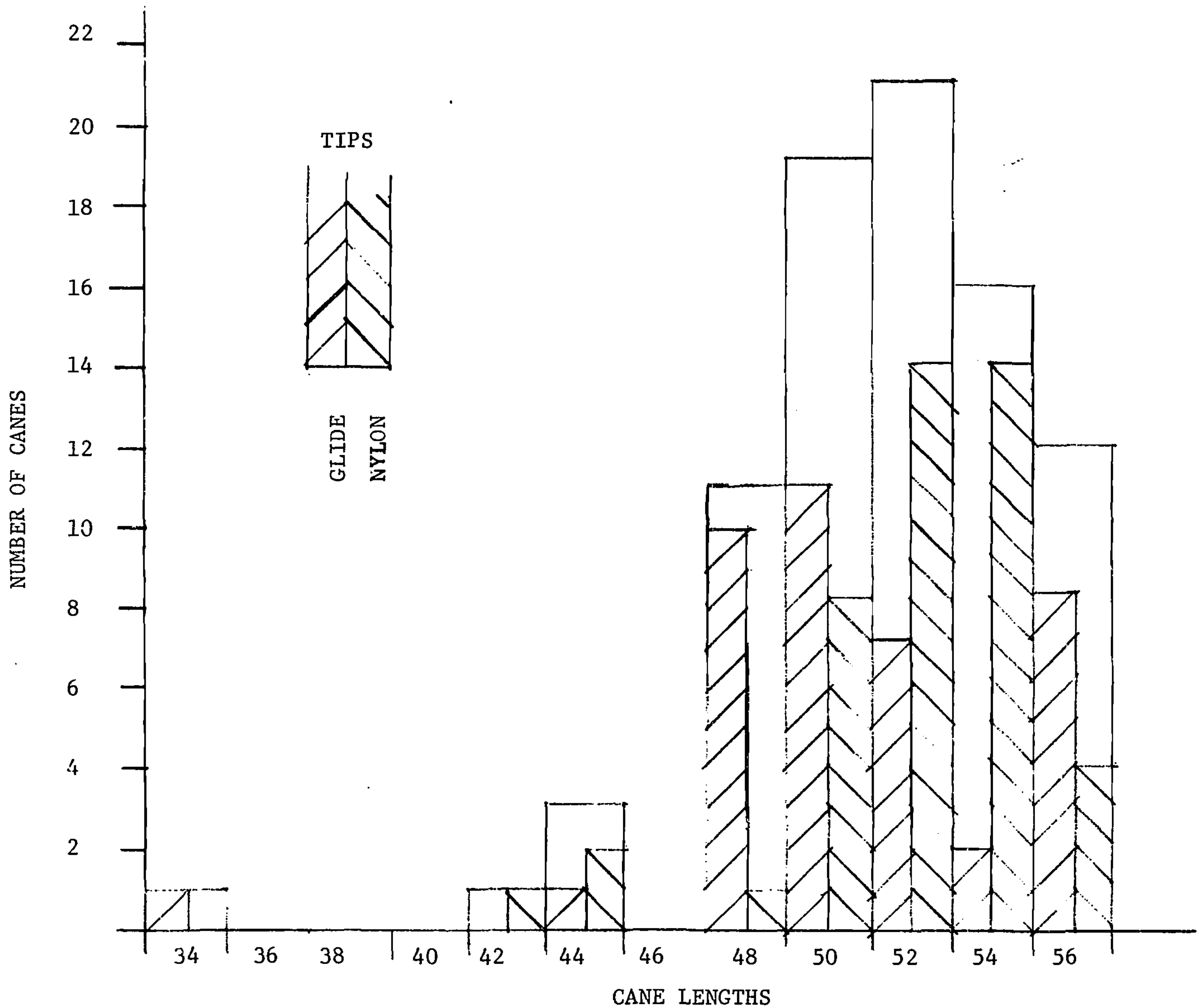


Fig. B-1
Distribution of Cane Lengths and Tips

FIGURE B-2

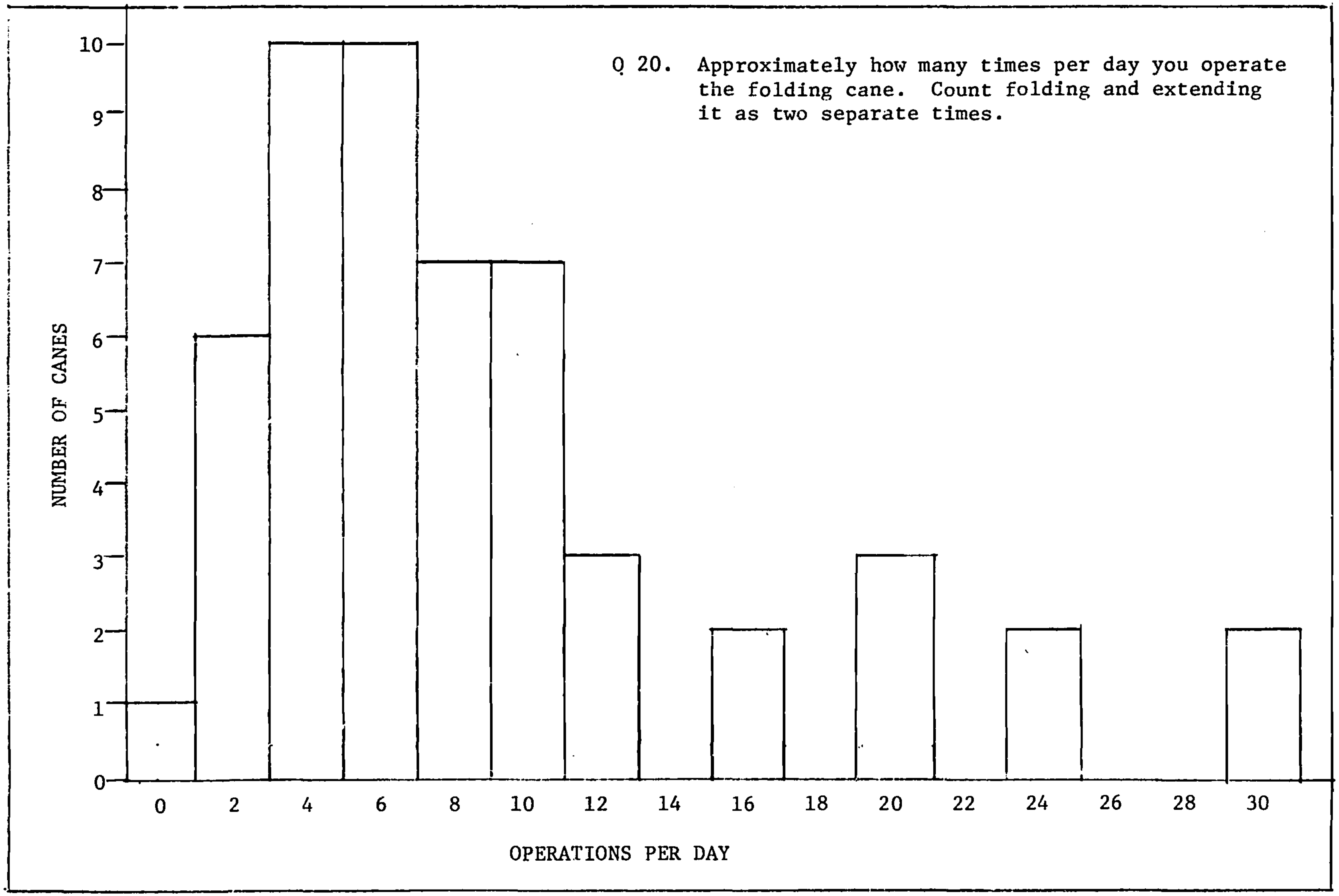
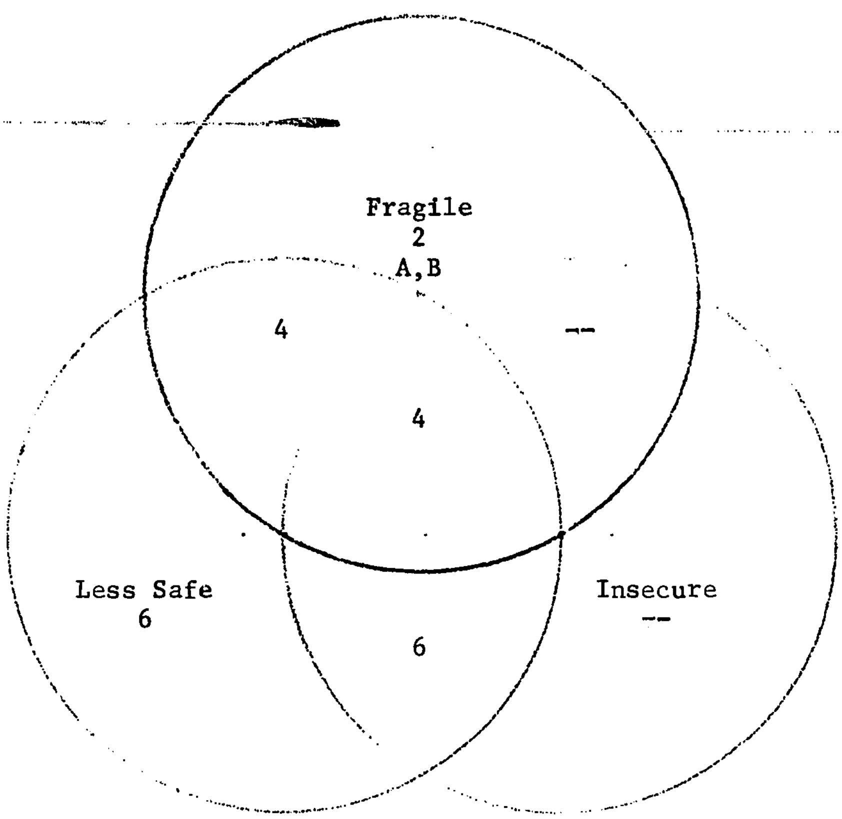

Q 20. Approximately how many times per day you operate the folding cane. Count folding and extending it as two separate times.
NUMBER OF CANES
10
9
8
7
6
5
4
3
2
1
0
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
OPERATIONS PER DAY

FIGURE B-3

Q 2 Do you feel secure using the folding cane?

Q 4 Do you feel the folding cane is too fragile or wobbly for your regular use?

Q 38 In comparison to your regular cane, does the folding cane feel safer (same) (less safe) then your regular cane?



A Bent Locking Lever, Repaired. Run over by Automobile, Replaced.

B Damaged by older sister, Repaired.

gfd 19 feb 70

gfd 1/28/70

FIGURE B-4

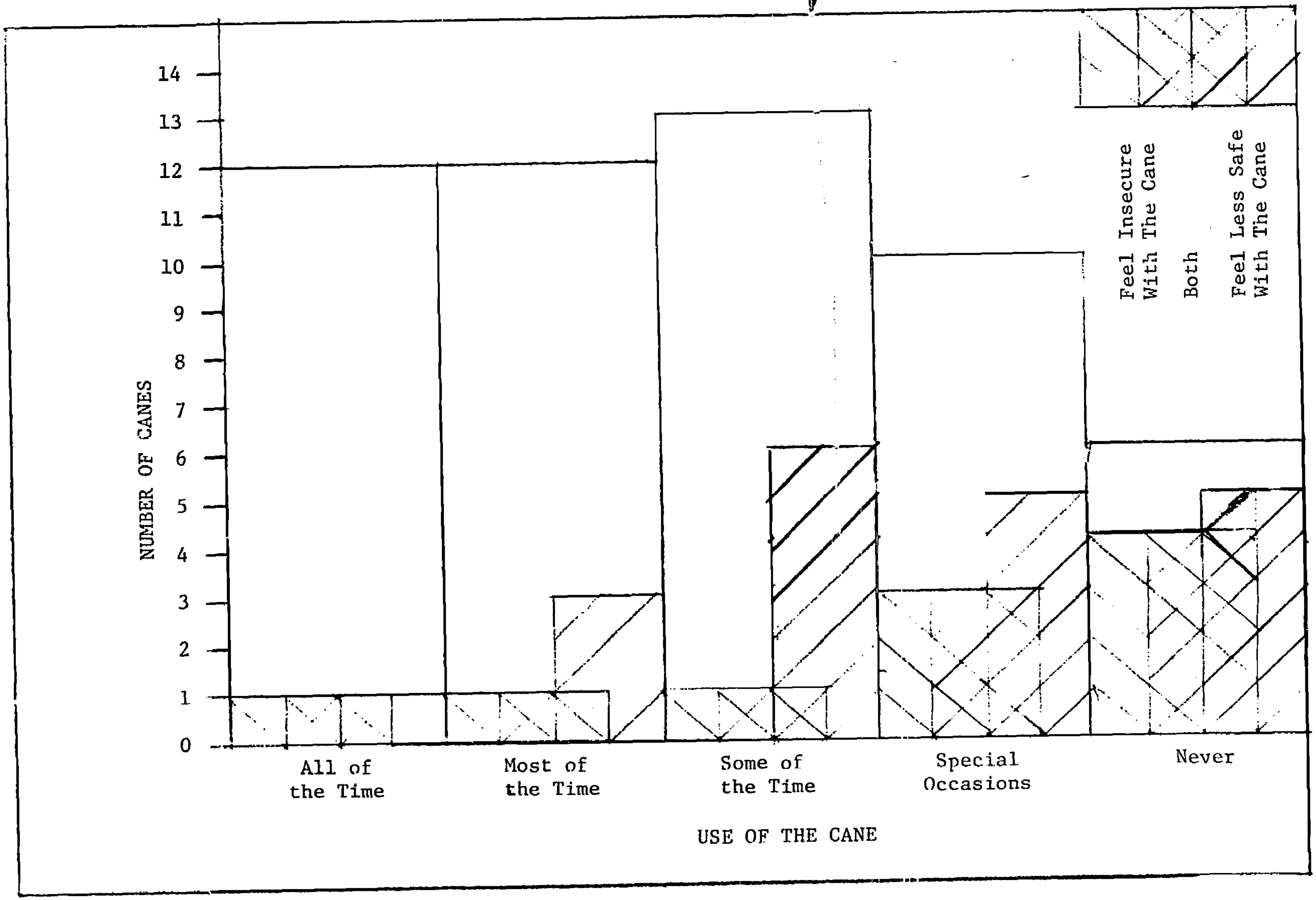
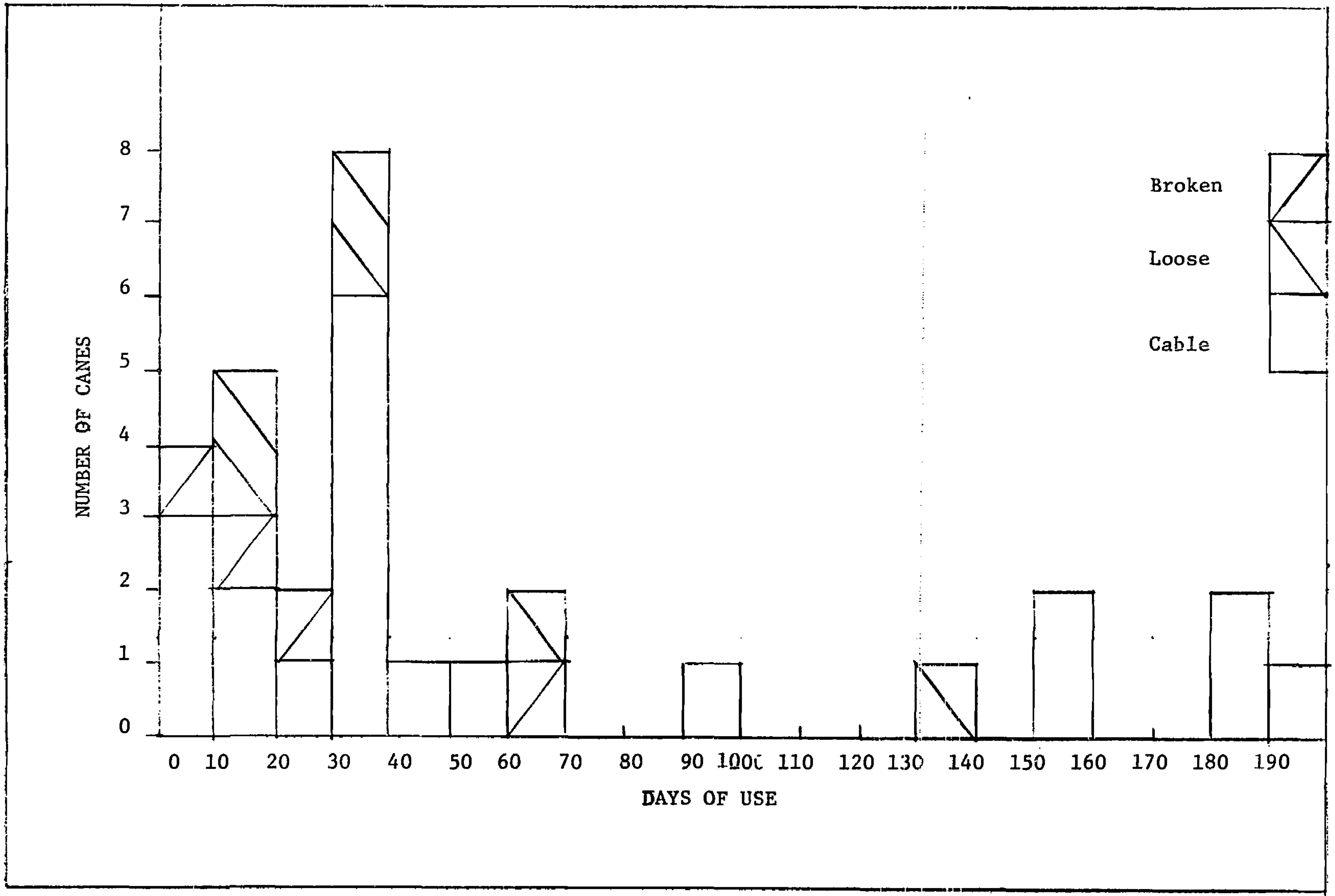


FIGURE B-5



gfd 18 feb 70

TABLE B-I

JOINT CHARACTERISTICS	Bounce and Springiness with respect to regular cane		TOTAL
	SAME	DIFFERENT	
VERY FIRM	15 28.3%	20 37.7%	35 66.0
SOMEWHAT FIRM	4 7.5%	6 11.3%	10 18.9
SOMEWHAT LOOSE	1 1.9%	6 11.3%	7 13.2%
VERY LOOSE	--	1*	1 1.9%
TOTAL	20 37.7%	33 62.3%	53 100%

*After cane repair this subject reported very firm joints and same bounce and springiness.

TABLE B-II

Quantity of Information obtained with folding cane with respect to your regular cane.

DIRECT CONTACT \ TOTAL	MORE	SAME	LESS
SAME	3.8% 2	54.7% 29	3.8% 2
LESS	—	7.5% 4	30.2 16

TABLE B-III

SAME DIRECT SOUNDS	23	44.2%
DIFFERENT DIRECT SOUNDS	29	55.7%
SAME ECHO	20	38.5%
DIFFERENT ECHO	32	61.6%

		DIRECT SOUNDS	
		same	different
ECHOS	Same	18 34.6%	2 3.8%
	Different	5 9.6%	27 51.9%

APPENDIX C

Electrified Perkins Evaluation Data Package

Cover Letter

Release

General Information Questionnaire

Instructions for Electrified Perkins Brailler, and

Electrified Perkins Brailler Questionnaire

Sensory Aids Evaluation and Development Center, M.I.T.

292 Main St., Cambridge, Mass. 02142 (617) 864-6900 X 5331

Dear Evaluator:

When you receive this package please sign the Release and have it witnessed, then fill in the General Information Questionnaire. Send both of these forms immediately back to us:

Sensory Aids Evaluation and Development Center
292 Main St.
Cambridge, Mass. 02142

Now read the instruction carefully before you proceed to use the machine. The period of evaluation is two months long. This means that your evaluation period will run from:

______/______/______ (add two months) ______/___/______
(today's date) (end of evaluation)

When the two months have lapsed please complete the Electrified Brailler Questionnaire and return it to the Center. Thank you and good luck !

RELEASE

I, ____, wish to participate in a program conducted by the Sensory Aids Evaluation and Development Center of Massachusetts Institute of Technology. I am participating in this project entirely upon my own initiative and at my own risk and responsibility. In order that Massachusetts Institute of Technology will consider me eligible to participate in this program, I release Massachusetts Institute of Technology, its agents and employees, on my own behalf and on behalf of my heirs and administrators, from all liability whether based on negligence or otherwise, which may arise out of my participation in this program, including use of experimental devices such as the "electrified Perkins brailler".

The foregoing has been read to me by the witness hereof and I hereunto set my hand and seal this day of

in (city and State).

____

I hereby state that I have read this document in its entirety to the signer hereof prior to the affixing of his or her signature.

WITNESS:____

(If the participant is a minor, the following must be completed)

I, individually and as a parent and guardian of the above-named minor, do hereby release and discharge Massachusetts Institute of Technology, its agents and employees, from any and all liability as aforesaid on account of the participation in such experimentation of my child and ward.

IN WITNESS WHEREOF, I have hereonto set my hand and seal at

this day of

WITNESS________________________________(Parent or Guardian)______________________

Sensory Aids Evaluation and Development Center, M.I.T.
292 Main St., Cambridge, Mass. 02142 (617) 864-6900 X 5331

General Information Questionnaire on the Electrified Perkins Brailler

1. Name: ____________________

2. Address: ____________________

3. Date: ___/___/___ 4. Model #: ____________

5. Birthday: ___/___/___ 6. Sex: M___ F___

7. Degree of vision — REMARKS
   a. blind ______
   b. sighted ______

8. Other physical disabilities ____________________

9. Type of braillist
   a. volunteer ______
   b. student ______
   c. professional ______

10. Years of brailling experience ____________________

11. Formal brailling lessons
    a. Yes ____
    b. No ____

12. Type of machine currently used
    a. Perkins ______
    b. Lavender ____
    c. Other ______

13. Employment and position ____________________

____

14. Education and degrees
    a. no high school diploma
    b. high school diploma only
    c. some college, no degree
    d. BA or BS only
    e. some graduate work
    f. higher degree
    g. no information

15. Date machine received ________/__/__________

16. Scheduled end of evaluation period __________/__/__________
(add 2 months to the date in #15)

17. Interviewer: ______________________________

18. How many hours per day do you use your regular machine?
   a. less than 2 __________
   b. 2-5 __________
   c. more than 5 __________

19. How many pages per day do you produce on your regular machine?
   a. less than 5 __________
   b. 5-10 __________
   c. more than 10 __________

NOTES: 1) The evaluation will not exceed two months.
2) If, when you have completed the evaluation questionnaire you feel that you have not been able to fully express your views and opinions about the electrified Perkins brailler, please feel free to attach separate sheets with all additional remarks.

Signature of Evaluator ______________________________

Instructions for the Electrified Perkins Brailler

PRECAUTION: Under no condition should you tamper with or attempt to repair the electrified Perkins brailler or remove any covers

I Description

The electrified Perkins brailler in your possession is a standard Perkins brailler which has been modified by incorporating an electronic circuit to automatically emboss braille when the keys are depressed. Line feed, carriage return and backspace functions have not been modified and remain the same as in the original Perkins brailler.

II Examine Your Machine

1. Carefully unpack the electrified brailler and place it on a table or desk which is convenient to a 110 volt A.C. outlet.

2. Upon examination of the machine you will find a line cord attached to the left rear side of the brailler directly under the paper feed knob.

3. On the right side of the brailler you will find a knob which rotates similar to the paper feed knob and is similar in action to a volume control knob on a radio. This knob will be labeled "adjustment knob".

4. If the adjustment knob is rotated as one would feed paper into the machine (toward you), minimum noise and minimum embossing dot-height will be obtained. If the adjustment knob is rotated away from you or in the direction to roll paper out of the machine, maximum noise and excellent braille should be produced.

5. By properly regulating the adjustment knob a combination of minimum noise with acceptable braille can be obtained.

6. The adjustment knob can be varied according to the weight of the paper (heavy weight or light weight).

III Operating Instructions

1. Plug the line cord from the brailler into your A.C. outlet. Note: When you do this the machine will automatically click and space one cell.

2. Insert paper into the machine, adjust your margins and pull the embossing head to the left hand margin.

3. You are now ready to try out the electrified Perkins brailler.

4. Emboss one test-line of "for" signs, that is, emboss all the dots across a single line. Now examine the braille on the test line.

5. If the braille appears to be weak rotate the knob away from you until you attain the best balance of noise and braille quality.

6. After you feel that you have attained an acceptable balance between noise and braille insert a new sheet of paper and proceed with your work.

7. Re-adjustment may be necessary as you become more familiar with the brailler. Adjustments can be made at any time during embossing but they should be rarely needed.

8. Whenever the brailler is not in use remove the plug from the A.C. outlet.

9. If the electrified brailler fails to operate pack it in its original carton and mail it to:

Sensory Aids Evaluation and Development Center
292 Main Street
Cambridge, Mass. 02142

REMINDER: For safety's sake do not tamper with or remove any covers from this machine !

Sensory Aids Evaluation and Development Center, M.I.T.
292 Main Street, Cambridge, Mass. 02142 (617) 864-6900 X 5331

Name____

Date______________________________Model #____________________

Electrified Perkins Brailler Questionnaire

Instructions: Please fill in the questionnaire as completely as possible, and make full use of the space in the right hand margin for all Remarks after you have filled in the numbered questions. Your answers are vital to the judging of this device and will be very important in deciding what changes might be made in the machine in the future.

SPEED

1. With the electrified brailler has your brailling speed
   a. increased ____________
   b. decreased ____________
   c. remained the same______

2. How many pages per day do you produce on the electrified brailler?
   a. less than 5 ________
   b. 5-10 __________
   c. more than 10 ______

3. Do you braille
   a. more _______
   b. fewer ______
   c. the same ____

   number of pages per day with the electrified brailler as with your original machine?

4. How much have you also used your manual brailler during the evaluation period?
   a. less times than the electrified brailler ______
   b. more time _____
   c. equal amount of time ______

5. How many hours per day do you use your electrified brailler
   a. less than 2 ______
   b. 2-5 _______
   c. more than 5 __________

6. Do you spend
   a. more time _____
   b. less time ______
   c. the same amount of time ______
   brailling per day with the electrified brailler as with your original machine?

REMARKS

7. Does it take
   a. less ______
   b. more _____
   c. the same amount ______
   of muscular effort to braille a page with the electrified brailler than it does with your original machine?

QUALITY OF BRAILLE

8. Is the braille produced on the electrified brailler
   a. easier to read __________
   b. harder to read __________
   c. the same ______________
   as that on your original machine?

9. Have "ghosts" appeared in your work during embossing or spacing
   a. never _________
   b. often _________
   c. sometimes _______

10. There is a knob on the right hand panel of the electrified brailler which controls both the quality of the impression and the noise level. Have you been able to adjust this knob to account for heaviness of paper and other variables to your satisfaction?
    a. always _______
    b. never _______
    c. sometimes_______

11. Has the electrified brailler ever skipped or failed to imprint a cell?
    a. never ____________
    b. often ____________
    c. sometimes__________

ERROR RATE REMARKS

12. The electrification makes it essential that the selected keys be depressed simultaneously. Do you find that this caused the number of errors you make to increase?
    a. No _____
    b. Yes _____
    c. Maybe ____

13. Did you find the directions for the use of the electrified brailler answer all the questions you had about the new aspects of this machine?
    a. Yes ____
    b. No _____

14. Would more complete directions have facilitated the adjustment from your original machine to the electrified brailler ?
    a. No ____
    b. Yes ____

CONVENIENCE

15. Do you
    a. like ______
    b. dislike ____
    c. feel neutral about ____
    the way in which the keys react to your touch?

16. If you find it necessary to carry your machine about do you find the electrified brailler to be
    a. lighter _____
    b. heavier ______
    c. as heavy as _______
    your original machine?

17. If you find it necessary to carry your machine about have you been inconvenienced by the need for an electrical outlet?
    a. never ________
    b. always _______
    c. sometimes________

18. How much of your brailling time is in a place where you have no access to an outlet?
    a. none_______
    b. all _______
    c. some ______

19. The only way to turn off the electrified brailler is to unplug it. Have you found that this caused you to leave the machine on when not in actual use?
   a. never ______
   b. long periods of time_______
   c. short periods of time ______

20. If a pilot light were installed to show when the machine was on would you find that this increased the convenience?
   a. not at all ____
   b. a great deal ____
   c. some ______

21. Has the operation of the electrified brailler interfered with or caused static in other electrical appliances in the vicinity?
   a. never ____
   b. always ____
   c. sometimes ____

22. Have other electrical appliances in the vicinity of the electrified brailler caused interference in the brailler?
   a. never ____
   b. always ____
   c. sometimes____

NOISE LEVEL

23. Does the electrified brailler make
   a. less noise ____
   b. more noise ____
   c. as much noise ____
   as your original machine?

24. Do you find the noise of the electrified brailler
   a. more pleasant ____
   b. less pleasant ____
   c. the same ______
   as your original machine?

25. When you use the electrified brailler have other people around you at the time thought the noise unpleasant or too loud?
   a. never ____
   b. always ____
   c. sometimes____

GENERAL

26. Would you trade in your manual brailler for the present model of the electrified brailler?
    a. Yes _____
    b. No ______

27. Would you purchase the electrified brailler if reasonably priced?
    a. Yes ____
    b. No ____
    c. Maybe _____

APPENDIX D

Massachusetts Institute of Technology
SENSORY AIDS EVALUATION AND DEVELOPMENT CENTER
292 Main Street, Cambridge, Massachusetts 02142

AGENDA

Overview of Sensory Aids Activities for the Blind

I. HISTORY ORGANIZATION AND PERSONNEL AT THE CENTER.

II. BRAILLE ACTIVITIES.

A. MIT BRAILLEMBOSS System.
   1. Redesign of BRAILLEMBOSS under a Harford Foundation grant.
   2. Production of (20) BRAILLEMBOSS systems completed June 1970.

B. Applications of BRAILLEMBOSS.
   1. Braille terminal for programmer at U.S. Department of Transportation.
   2. Braille terminal on General Electric time-sharing system for students at Perkins School for the Blind.
   3. Braille terminal at Sensory Aids Center for demonstration projects.
   4. Braille terminal for UPI wire services.
   5. Other applications.

C. DOTSYS III.
   1. A grade II braille translation program written in higher level language, COBOL.
   2. DOTSYS III, a transferable program.
   3. DOTSYS III, and the Atlanta Public Schools system.

III. FOLDING CANE PROJECTS.

A. The crook handle folding cane.
   1. Production and distribution of crook handle folding cane.
   2. Evaluation with fifteen agencies.

B. Development of straight handle folding cane.
   1. Design based on crook handle cane.
   2. Production engineered at the Sensory Aids Center.

C. HYCOR, Inc. Industrial Participation.
   1. A subsidy program to support the manufacture of the straight handle folding cane.
   2. Approximately 1,000 canes are presently in circulation.
   3. HYCOR services (2) folding canes.

IV. TAC-COM, A COMMUNICATION SYSTEM FOR THE DEAF AND DEAF/BLIND.

A. Evaluation of TAC-COM at the National Center for Deaf/Blind Youths and Adults, as a fire alarm and doorbell system.

B. Extended applications of TAC-COM.
   1. End-of-Line indicator for braille writer and typewriter.
   2. Telephone bell indicator.
   3. Projected applications.
      a. telephone communicator,
      b. auditory cue indicator,
      c. ambient and artificial light indicator.

V. PATHSOUNDERS PROGRAM.

A. Evaluation of Pathsounder field test environment.
   1. New York Association for the Blind.
   2. Veterans' Administration.
   3. Individuals.

B. Pathsounder Instructor's Handbook.

VI. ELECTRO-TACTER, A TACTILE DISPLAY FOR METER READ-OUT.

VII. SOUND SOURCE BALLS.

A. Student project activities, basketball.

B. Sound Source football.

VIII. VIDEOVISION, CLOSED-CIRCUIT TELEVISION AS A LOW-VISION AID.

A. MIT student participation.

B. Construction of (6) Low Vision TV aids at the Sensory Aids Center

IX. SEMINAR ACTIVITIES AND BROCHURES.

A. Technical Description Sheets.

B. Seminars and Lectures.