

Digital Computer Laboratory  
Massachusetts Institute of Technology  
Cambridge 39, Massachusetts

SUBJECT: BIWEEKLY REPORT, JANUARY 10, 1954

To: Jay W. Forrester

From: Scientific and Engineering Computation Group

1. MATHEMATICS, CODING, AND APPLICATIONS

1.1 Introduction

During the period covered by this report 204 coded programs were run on the time allocated to the Scientific and Engineering Computation (S&EC) Group. These programs represent part of the work that has been carried on in 22 of the problems that have been accepted by the S&EC Group. Progress on 17 of these problems is given below in terms of programming hours, minutes of computer time, and progress reports as submitted by the programmers in question.

The first half of this biweekly period overlapped with the last week of the academic Christmas recess. This combined with the machine shutdown over the New Year weekend to produce a significant decrease in the activity of the Group.

Four new problems have been accepted for solution on the WWI time assigned to the S&EC Group. One of these (#154) is described below; the other three will be described in future biweekly reports. In problem #154 calculations were carried out for the magnetic susceptibility of non-homogeneous ferrites. The results have been turned over to Dr. J.O. Artman of Lincoln Laboratory and the problem is terminated.

Tests are being carried out on the revisions that are to be introduced into the Comprehensive System of Service Routines. Progress in this work is reported under problem #100. It is planned to have all of these tests completed by March 15, 1954. Until that time the Comprehensive System now in use will be kept intact. It is hoped that Scientific and Engineering Computation programmers will become aware of the changes proposed in the "new" CS so that the transition scheduled for late in March will be a smooth one. To aid the programmer the first three of the seminars on advanced programming

techniques have been scheduled to describe the proposed revisions for the CS. On January 8, 1954, F.C. Helwig spoke on the revisions for the programmed arithmetic routines. These revisions are also described in Digital Computer Laboratory Memorandum M-2553. On January 15, 1954, J.M. Frankovich will describe the changes being made in the conversion routines. On February 12, 1954, J. D. Porter will describe the automatic procedures available in selecting output routines and in the use of auxiliary storage media. The new CS will actually be made available under very special circumstances to programmers who have an immediate need for some of the new provisions (e.g., problem #126).

Because of the Christmas holidays the Seminar on Computing Machine Methods did not meet during this biweekly period. The next meeting, which will be the last one for the Fall term, will be held on January 12, 1954. It is planned to resume the seminars during the Spring term.

It may be noted that the appearance of this biweekly report has been altered. Since a large portion of the material (viz. the problem abstracts and section headings) typed for each biweekly will be repeated from time to time, this material has been punched on Flexowriter paper tape. Thus a good deal of each report will now be typed out automatically by means of the Flexowriter, leaving suitable spaces for the progress reports, etc. Since this new material will be typed in by means of a mechanical typewriter which has a smaller type size, the typed appearance of this new material will differ from that typed on the Flexowriter. However, the anomalous appearance of the biweekly is in the interest of mechanization and the desire to minimize the amount of time the Flexowriter equipment is diverted from processing tapes for use with WWI.

## 1.2 Programs and Computer Operation

The following summary is included as a guide for interpreting the abbreviations used below. A more detailed description of the terms involved can be found in M-2497.

- a. The upper case letter following the problem number has the following significance:
  - A implies the problem is NOT for academic credit, is UNsponsored.
  - B implies the problem IS for academic credit, is UNsponsored.

C implies the problem is NOT for academic credit, IS sponsored.

D implies the problem IS for academic credit, IS sponsored.

The absence of a letter indicates that it is an internal S&EC problem.

b. DIC denotes the Division of Industrial Cooperation.

DCL denotes the Digital Computer Laboratory.

CMMC denotes the Committee on Machine Methods of Computation.

DDL denotes the Division of Defense Laboratories.

100. Comprehensive System of Service Routines, developed by the S&EC

Group at the Digital Computer Laboratory for the input conversion of suitably prepared punched paper tapes. When so requested, these routines automatically provide a program with suitable programmed arithmetic, cycle-counting, and output facilities.

:DCL Staff: Arden, 35 hours; Best, 57.5 hours; Combelic, 35 hours; Demurjian, 20 hours; Denman, 29 hours; Frankovich, 30 hours; Helwig, 35 hours; Kopley, 28 hours; Porter, 11 hours; Siegel, 17 hours; WWI, 949 minutes

Testing and modification of the revised Comprehensive System routines continues. An attempt is being made to keep a working copy of the new CS on unit 0 along with the old CS but it should not be assumed that it will always be possible to do this.

The Programmed Arithmetic (PA) adaptation program has been modified so that the PA blocks can be recorded on unit 0 as 556 tape. Thus the reading in of these blocks for the purpose of punching them out no longer requires a special program.

Procedures for recording the CS, the new post-mortem program, and the various other utility tapes on unit 0 are being considered. It has tentatively been decided to record the programs as numbered blocks on unit zero and to modify the input program so that it can search for the numbered blocks. Such searching will be done automatically in some cases (i.e., the desired block will be selected by the initial character on the tape being read in). The possibility of a manual search (by setting up the number of the desired block in an intervention register) will be provided in any case. Search routines and recording routines have been written and are being tested.

Methods for directly storing words from a 556 tape in arbitrary registers on the drum are also being considered. One method would be to generalize the control word tsn to a positive integer,  $+m$ , where  $m$  is the drum address at which the initial word of a block is to be stored. This method would work without ambiguity for groups 0-7 but will not work for group 8 because of the ambiguity with the tsn control word. Various methods of circumventing this difficulty are being considered.

Helwig

The new "OCTAL" conversion modification for the "new" CS has been tested satisfactorily. Several more modifications which allow more efficient use of magnetic tape unit 3 and otherwise incorporate suggested changes have been made and are being tested.

The title program of the CS currently in use has been modified to punch and display properly the new form of tape titles.

Frankovich

Programs are being written to measure three characteristics of the Ferranti reader: (1) The time permissible between a rd instruction and deselection of the reader. (This program works now.) (2) Tape speed as a function of time the motor has been running (program written but untried). (3) The time it takes the tape to stop after the reader has been deselected (program not yet written).

A precise description of the tests made on the new PA is being written up for limited distribution so that those interested can suggest further tests which should be made.

Best

The part of the Basic Conversion program that punches the tape number has been changed to punch a space whenever a dash occurs in the new tape numbers.

Briscoe

DIB, DOB, iDIB and iDOB are now available for reading from and recording on the drum. These modes circumvent the restrictions imposed by the notion of groups which does not permit overlapping from one group to the next without using a new si instruction. Bulletin Board memo #48 describes the use of these special instructions.

Additional tests have been made to determine the operational time of the CS instructions. These tests reveal that the new CS is considerably faster than the old one. A CS Guide to Coding has been prepared along the lines of the Summer Session Guide to Coding and will be available very shortly.

Kopley

Provisions are being made to extend the number of automatic output requests available in the CS. In particular it is planned to make special output characters (such as signs, decimal points, spaces, tabs, carriage returns, column shifting and picture framing on the scope, etc.) available in the interpretive mode. In addition it is planned to combine the scope plotting instructions (SOCx, SOCy) into the single instruction DISPLAY AT al (which may be abbreviated as DIS al). This request will operate in a manner similar to the Summer Session computer instruction PLOT AT al.

Demurjian, Porter

- 101 C. Optical Properties of Thin Metal Films on transparent backings are determined and printed out automatically by this program; the input data consist of the observed reflection and transmission coefficients, the index of the backing, the wavelength, and the sample thickness. The program calculates by means of an iterative procedure and prints out the index of refraction and the absorption coefficient of the film, the rate of variation of these constants with reflection and transmission, and the film's conductivity and dielectric constant.
- :for Professor L. Harris, Chemistry Department, Dr. A.L. Loeb  
 :by Dr. A.L. Loeb, (DIC), 8 hours; J. Richmond(DIC), 15 hours;  
 :DCL Staff: Derman, 1 hour; WWI, 38 minutes

Four tables of data reported by Krautkräemer were processed. Two of these ran

without difficulty. Of the other two, one gave an alarm for the last (eleventh) sample; the other samples ran successfully. On the fourth table the eighth sample gave an alarm; apparently the remaining three were not tried. Since two more tables had been run previously without difficulty, it would appear that these alarms were not due to a logical error.

- 108 C. An Interpretive Program is being developed that will accept algebraic equations, differential equations, etc. expressed on Flexowriter punched paper tape in ordinary mathematical notation (within certain limits imposed by the Flexowriter) as input and automatically provide the desired solution.  
 :for Dr. J.H. Laning, Jr., Instrumentation Laboratory  
 :by J.H. Laning Jr. (DIC), N. Zierler(DIC), 40 hours  
 :DCL: WWI, 113 minutes

As a partial test of the program, it was used during the period to solve a set of six simultaneous differential equations associated with the kinematic problem of aerodynamic lead pursuit in three dimensions. The equations, involving highly complicated algebraic and trigonometric calculations, required slightly over two hours to program and the program ran successfully on the first trial.

As a further test a table of values of  $n \log_2 n$  and  $n \log_{10} n$  for  $n = 2, 3, \dots, 1000$  was computed for Mrs. Patricia Ross of the Computation Group at Project Lincoln. The program which consisted of only about 8 instructions - for the interpretive program - ran successfully on the first trial. A check of ten or so values indicated slightly better than 7 decimal digit accuracy.

- 113 C. A Stress Analysis of an L-shaped Homogeneous Planar Structure is being made for the case of a concentrated static load. This structure is approximated by a framework of bars which will deform in the same manner as the prototype. This framework is then analyzed using the principles of virtual work and Southwell relaxation techniques. Boundary conditions have been specified for the edge of the framework so that the deformations of the model will conform to the actual deformations of the structure.  
 :for Professor J.S. Archer, Department of Civil and Sanitary Engineering  
 :by S. Sydney (Res. Assist. CMMC), 70 hours  
 :DCL Staff: Kopley, 2 hours; WWI, 794 minutes

Results have been obtained for the two load conditions under analysis. Two modes of output are used, scope displays and punched tapes. It has been necessary to redisplay the results on the oscilloscope because in some regions of the negatives, notably the upper left corner, there is often a considerable amount of distortion. Some trouble has occurred in the delayed punch output, but these results can be easily checked and reproduced if necessary. The program is working satisfactorily and the results are quite encouraging.

- 116 C. Torpedo Impulse Response is to be determined by solving the convolution integral equation. An approximation for the impulse response is convolved with the known input data. The calculated output is compared with the measured output response to obtain a new approximation for the desired impulse response.  
 :for Prof. G. C. Newton Jr., Electrical Engineering  
 :by R. Kramer (DIC) D. Hamilton, 40 hours  
 :DCL: WWI, 63 minutes

In problem 116 WWI has been used to obtain the solution for a convolution integral in which the output and input are known. The input data have been convolved with an estimated impulse response giving an output which is compared with the measured output. If the differences between the measured and computed output are greater than a certain specified amount, the impulse response is corrected and is convolved with the input data.

This procedure was used successfully for determining impulse responses for each measured input-output pair. A few more runs have been made or will be made involving convolutions and Fourier Transforms for checking purposes or for points of interest in other problems.

We are now making a correction to a model impulse response and convolving this with input data of one of the runs. This response may be convolved with input data of other runs.

- 126 C. A Data Reduction Program for use in the Servomechanisms Laboratory is being developed in separate stages to be combined at a later date. The first stage is concerned with devising a program to fit polynomials to arbitrary empirical functions using a least squared error criterion. The procedure makes use of Legendre polynomials and matrix multiplication.  
 :for J.E. Ward, Servomechanisms Laboratory, DIC No. 7138,  
 AF33(616)2038  
 :by D.T. Ross (DIC), 20 hours; Turyn (DIC), 80 hours; Hamilton, 20 hours  
 : DCL: WWI, 63 minutes

The error in the Polynomial Fit program was traced to an incorrect change that was made in modifying the program for use with the new CS. The program has been corrected and further tests will be made with the new CS.

The interpolation program has given very good results with the six-point formula; the four-point formula, as was to be expected, is slightly less accurate on functions like the cosine and much less accurate on steep exponential curves.

An extra subroutine will be added to the post-mortem to punch out given blocks of information in storage or on the drum. This will be useful in the sectional testing of the Data Reduction problem.

131. The Training of New Personnel, Tours and Demonstrations are among those activities included in this problem. Generally speaking, any approved staff problem relating to training and/or demonstrations is considered to be in this category.  
:DCL Staff: Kopley, 2 hours; WWI, 27 minutes

Six M.I.T. students and staff members were conducted on a tour of WWI on Tuesday, January 5. The tour included demonstrations on the computer and the Flexowriter equipment and a description of the major computer components.

- 134 C. Numerical Diagonalization Procedure. This program computes the eigenvalues and eigenvectors of a symmetric matrix by a method of successive rotations. The program is available for use in any problem in which this calculation is required.  
:for Professor J.C. Slater, Physics Department  
:by A. Meckler (DIC), 25 hour  
:DCL: WWI, 21 minutes

The routine has been rewritten in subroutine form and will be tested to ensure a correct transcription. There will be two diagonalization programs. One will be a Library of Subroutines program which simply diagonalizes a matrix set up by an external program, the results to be used and displayed by the external program. There also will be a tape which begins with a fed-in matrix, diagonalizes it, displays the results on the scope, and calls in the next matrix through PETR and so on.

136. Matrix Equations. Various methods have been studied for the solution of a set of linear algebraic equations. A variation of the Hestenes-Stiefel conjugate gradient method has been programmed and tested for insertion in the S<sup>2</sup>EC Library of Subroutines.  
:DCL Staff: Arden, 10 hours; WWI, 131 minutes

A system of 30 linear equations in 30 variables was solved using the subroutine previously described under this problem number. The solution was only obtained to about 1.5 significant figures.

- 138 B. Spheroidal Wave Functions are solutions of the scalar Helmholtz equation separated in spheroidal coordinates. A program has been developed for tabulating both the coefficients obtained by expanding the angular solutions of the first kind in associated Legendre functions and the coefficients obtained by expanding the radial solutions of the first kind in spherical Bessel functions. By analytically substituting these expansions in the separated ordinary differential equations, 3-term recursion relations are obtained for the coefficients, and the radial and angular coefficients are found to be simply related. Both sets of coefficients are then determined by applying an iterative procedure to a continued fraction equation derived from one of the 3-term recursion relations. The iteration proceeds until a

value of the unknown separation constant of the differential equation which appears in the continued fraction is found such that it makes the coefficients compatible with their boundary conditions.

:for Professor P.M. Morse, Physics Department  
 :by F.J. Corbató (Res. Assist. CMMC), 50 hours; J.D.C.Little, (Res. Assist. Op. Res.), 50 hours  
 : DCL Staff: Combelic, 1 hour; WWI, 147 minutes

This report covers the last 6 week period. In this time we have adapted the program for the new CS PA (Comprehensive System Programmed Arithmetic). This revised program has been tested and production runs have commenced.

The major difficulty in the revision for the new PA was found to center about the change in the "ict" order.

140. Summer Session System consists of a conversion program, an interpretive routine, and mistake diagnostic routines stored in WWI. A special mnemonic instruction code has been developed for use with this system thus simulating a computer with characteristics quite different from those of WWI. This Summer Session (SS) computer was developed for the use of students participating in the MIT 1953 summer session course on Digital Computers and Their Applications. The SS computer is being used by the E.E. Department courses 6.535 and 6.25 and is available to programmers with suitable problems.
- :DCL Staff: Best, .5 hour; Combelic, 9 hours; Denman, 20 hours; Hoy, 20 hours; Siegel, 39 hours; WWI, 107 minutes

Rewriting of the Summer Session conversion post-mortem routines to locate more than one tape error has begun. At present, this post-mortem stops after finding the first mistake.

Test Programs are being written to time the several SS operations. To facilitate this, means have been devised which permit limited use of WWI instructions with SS operations in the same program.

- 147 C. Energy Bands in Crystals are being studied by finding solutions of the corresponding second order linear differential equation satisfying boundary conditions at the origin. The solutions are found approximately by using the Gauss-Jackson formula for forward integration. The solutions and their first derivatives are to be combined in a sum, the weighting factors being functions of an independent parameter.
- :for Professor J.C. Slater, Physics Department, DIC No. 6853  
 :by Dr. D.J. Howarth (DIC), 30 hours  
 :DCL Staff: Arden, 3 hours; WWI, 179 minutes

Testing has proceeded slowly on the incorporation of the root finding routine into the main routine. After various experiments on the most economical method of ordering the problem, it has been planned to follow the original scheme of computing the function  $F(E, E_0)$ , of which the roots are required, as a function of  $E$  for a given  $E_0$ . After repeating this for a set of  $E_0$ , these functions are rearranged to appear as  $F(E_0)$  for given  $E$ , and the roots of these functions obtained.



Testing has almost been concluded, and production work has recommenced on the first part of the program.

- 153 C. Gust Response of a Flexible Swept-Wing Airplane is to be determined for various values of wing loading functions, aircraft configuration and dynamic condition parameters, as input data, giving dynamic output data determining the effect of wing flexibility on gust response. The solution involves the calculation of forcing functions and the evaluation of Duhamel integrals by numerical methods. Approximately 120 pairs of linear integro-differential equations are to be solved.  
 :for Professor T.H.H. Pian, Aeronautical Engineering Department  
 DIC No. 6691  
 :by K. Foss (DIC), D. Sternlight(Math. Dept.), 80 hours  
 :DCL Staff: Porter, 3 hours; WWI, 54 minutes

The arithmetic of the routine combining the very special functions of the problem has been tested successfully. Drum routines have yet to be combined to provide a complete program.

- 154 C. Magnetic Susceptibility Calculations are being carried out for non-homogeneous ferrites by means of a Simpson's Rule evaluation of the corresponding double integral.  
 :for Dr. J.O. Artman, Lincoln Laboratory,  
 :DCL Staff: Porter 2 hours; WWI, 20 minutes

In the study of the magnetic susceptibility of non-homogeneous ferrites, the following expression was derived for the susceptibility:

$$\bar{\chi} = \int_{-1}^1 \int_{-1}^1 \chi \, dN_x \, dN_y$$

where

$$\chi = \frac{2(\Delta H) H_0 M [H + N_y M]}{[a + (H + N_x M)(H + N_y M)]^2 + b}$$

It was desired to obtain a plot of  $\bar{\chi}$  versus H for comparison with results obtained experimentally. If the calculations do explain the shape of the tail of the  $\bar{\chi}$  vs. H curve obtained experimentally, then these calculations can be used in the design of ferrite devices.

The expression for  $\bar{\chi}$  was evaluated using Simpson's Rule. The numerical results have been given to Dr. Artman of the Lincoln Laboratory for processing.

- 156 A. The Evaluation of the Reflection Coefficient in a Semi-Infinite Open Rectangular Wave Guide is obtained approximately by using Fourier transform techniques on the integral equations of the Wiener-Hopf type. The integrals are to be evaluated by the trapezoidal rule.  
 :for Dr. M. Balser, Lincoln Laboratory, DDL  
 :by A. Balser (Res. Assist., Columbia University)  
 :DCL Staff: Porter, 2 hours; WWI, 88 minutes

The problem has been run successfully for the range  $10 \leq \alpha \leq 100$  in integral steps. Since the differences between the values of the function at integral points of the range  $10 \leq \alpha \leq 20$  were found to be too large for suitable interpolation, it will be desirable to obtain values for  $\alpha = 9.9, 10.5, 11.5, \dots, 19.5$ .

Another section of the problem, for the range  $\alpha = 100, 105, 110, \dots, 200$ , has been coded and is ready to be run; the coding on the section for the range  $0 \leq \alpha \leq \pi^2$  is almost finished.

- 157 C. Rectangular Matrix Multiplication is being programmed for inclusion in the S&EC Library of Subroutines.  
 :for Dr. A. Meckler, Solid State Physics  
 :by Dr. A. Meckler (DDL), .25 hour  
 :DCL: WWI, 7 minutes

An error was made in transcribing the routine into a form suitable for the Library of Subroutines. This error has been found and corrected.

### 1.3 Operating Statistics

#### 1.31 Computer Time

The following indicates the distribution of WWI time allocated to the S&EC Group.

Programs	44 hours, 35 minutes
Conversion	8 hours, 31 minutes
Magnetic Drum Test	35 minutes
Magnetic Tape Test	26 minutes
Scope Calibration	42 minutes
Demonstrations (131)	27 minutes
Total Time Used	55 hours, 16 minutes
Total Time Assigned	57 hours, 35 minutes
Usable Time, Percentage	95.9%
Number of Programs	204

#### 1.32 Program Time Distribution

The following table attempts to show how the WWI time expended on S&EC programs was distributed with respect to machine runs that gave meaningful results (productive computer time) and runs that gave unsatisfactory results (lost computer time). Productive computer time is subdivided to indicate the time involved in actual computations as contrasted with the time expended getting information out of WWI. Computer time lost is subdivided to show the portion of time lost due to errors in the programmer's formulation of his problem (logical errors); due to errors in the programmer's use of the WWI code, CS Conventions, etc. (technical

errors); due to tape preparation errors; due to errors by the S&EC computer operators in running the program; due to malfunctioning of terminal equipment; and finally due to miscellaneous causes.

These times are determined as percentages of the time listed above in section 1.31 for programs. The times used in computing these figures are extracted from the biweekly report forms submitted by the various programmers who have used S&EC allocated WWI time.

1. Productive Computer Time
  - Computation 50.5%
  - Output 24.8%
2. Computer Time Lost Due to Programmers Errors
  - Technical 13.7%
  - Logical 5.7%
3. Computer Time Lost Due to Other Difficulties
  - Tape Preparation 3.5%
  - Operator's Errors .3%
  - Terminal Equipment Malfunction 0%
  - Miscellaneous 1.5%

1.33 Tape Preparation (M. Mackey)

An attempt is being made to obtain some idea of the time expended in the preparation of tapes. During the past biweekly period a check was made on the tapes processed.

Due to the variations in procedures involved we have distinguished among original complete tapes and the following three types: typed modifications - changes of 11 or more registers which must be typed, converted, then attached to the main program or changes which must be made in the body of a Flexowriter tape; manual modifications - changes punched directly in 556 form and attached to a converted tape; combined tapes - which require duplication of two or more complete tapes.

The following information was compiled:

	<u>Complete Tapes</u>	<u>Typed Mods</u>	<u>Manual Mods</u>	<u>Combined Tapes</u>
No. of Tapes	70	42	19	10
No. of Registers	14408	795	83	
Time Consumed	46 hrs.39 min.	13 hrs.55 min.	2 hrs.48 min.	2 hrs.44 min.

Thus, it may be seen that the average length of an original complete tape is 206 registers requiring 49 minutes to prepare. A typed modification averages 19 registers in length and requires 20 minutes to prepare while Manual Modifications average 4 registers and require 8 minutes for preparation.

## 2. COMPUTER ENGINEERING

### 2.1 WWI Systems Operation

(S. E. Desjardins)

The consolidated test program has been rewritten to include the drum-check programs and will be tested as soon as the tape is made up. The completed tape will then contain seven of the eight test programs which are used daily and will expedite marginal checking tremendously.

#### 2.11. Core Memory (N.L.Daggett)

Six hours of computer time were lost last week because of damage to one of the selection matrices for the core memory. Twelve crystals were ruined by a dead short which occurred in one of the driving cathode follower tubes. Part of the time was lost through attempts to find the bad crystals by a logical process based on voltage readings of the selected and deselected lines. This method appeared to be unworkable because of the multiple failures; therefore, the brute-force approach was used. Each output line was measured for the back resistance of its five associated crystals. Each bad group was opened up to determine which of the five crystals was bad.

We will attempt to make changes to prevent repetition of this type of failure. The problem is not a simple one, however. It is aggravated by two things: (1) The matrices are not operated at ground level. (2) They are driven by cathode followers rather than plate-loaded stages. This means that failure of cathode-follower plate voltage can cause serious trouble.

(L.L. Holmes, A.J.Roberts)

A modification is in progress to provide separate post-write disturb pulses for each bank of storage. At present post-write disturb is applied to both banks on each storage cycle regardless of which bank is selected. The change should allow more time for the sense amplifiers to recover.

#### 2.12 Magnetic Tape (E.P. Farnsworth)

The new shipment of MMM mylar-base tape has arrived and is being used to replace all acetate and old, spliced, worn, and wrinkled mylar. No splices have been found so far in the new shipment.

Dynamic torque unbalance in one servo amplifier has been traced to the mercury-vibrator servo-discriminator relay. These Western Electric relays are conservatively rated at one billion operations, which is approximately the number of operations in service to date. The exact nature of the defect causing unbalance and the normal operating conditions of the Raytheon circuit are being studied.

The final thyratron register panel for delayed print-out was installed and several wiring errors corrected. This panel was modified to include series-dropping resistors in the punch circuit to reduce heating of the solenoids. This change was suggested by Norcott and is now recommended by the manufacturer for all Flexowriter punch circuits.

### 2.13 Typewriter and Paper Tape (L.H.Norcott)

A panel has been installed on the Flexowriter table to permit the operator to control the direct-output punch from the keyboard of the direct-output Flexowriter.

## 2.2 Terminal Equipment

### 2.21 Magnetic Drums (K.E.McVicar)

We have increased the writing current on the auxiliary drum in an attempt to reduce the effects of writing between the slots. This change seems to have been of some value, but we have not had enough experience yet to draw any definite conclusions.

Preliminary investigation of the relation between write-pulse width and definition of the read-back signal indicates that we can safely increase the write-pulse width by a large factor. A wider write pulse should further reduce sensitivity of the system to between-the-slots writing.

### 2.22 PETR (F.E.Irish)

A Ferranti photoelectric tape reader has been installed as a replacement for the ERA reader. All of the tapes used with the ERA reader should read in using the new reader without any trouble. The new reader is initiated on a si 211 order and is stopped on the clearing of the IOS, after an alarm, or after a "switch to push button" (stop).

The new reader is able to stop the motion of the tape in about 1 millisecond. This means that if the stop is ordered immediately following the last rd order the tape will stop with the last character to be sensed still resting on the sensing holes. Eventually, this ability to stop rapidly will permit the fences used at present in Flexowriter tapes to be eliminated. Until further experience is gained, however, programmers should not depend on the reader stopping any faster than did the ERA reader.

When the new reader is stopped by some method that does not change the IOS, program alarms will be generated if the tape is then manually moved. The generation of program alarms signifies that extra information has been put into the IOR.

3. ADMINISTRATION AND PERSONNEL

Terminated Staff (J.C.Proctor)

M. Geraghty

Terminated Non-Staff (R.A.Osborne)

Nancy Toorok

4. LIBRARY ACCESSIONS LIST

The following material has been received in the Library, W2-325.

Library Files

<u>No.</u>	<u>Source</u>	<u>Title</u>
2612	AIEE	American Standard Mathematical Symbols (approved by the American Standards Assoc.)
2616	IRE	Transactions of the IRE--Professional Group on Information Theory: A bibliography of information theory, communication theory, cybernetics
2619	Berkeley Scientific	Application of Transistors to Electronic Counting Equipment
2621	IRE	Proceedings of the Western Computer Conference: Los Angeles, Feb. 4-6, 1953

The following material has been received in the S&EC Library, Barta 109.

Library Files

<u>No.</u>	<u>Author</u>	<u>Title</u>
G-82	Grace Hopper	Compiling Routines
G-82	Richard K. Ridgway	Compiling Routines
G-81	H.G.Kahrimanian	Analytical Differentiation by a Digital Computer Analytical Differentiator