Digital Computer Laboratory
Massachusetts Institute of Technology
Cambridge 39, Massachusetts

SUBJECT: BIWEEKLY REPORT, JANUARY 24, 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 292 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 26 of
the problems that have been accepted by the S&EC Group. Progress on 16 of
these problems is given below in terms of programming hours, minutes of com-
puter time, and progress reports as submitted by the programmers in question.

Tests have continued on the revisions to be introduced into the Comprehen-
sive System of Service Routines. In addition a study has been carried out on
the actual time required for the evaluation of instructions using the CS now
in effect, the "new" CS, and WWI itself. These developments are discussed un-
der problem #100.

Two new problems were initiated during this period. Problem #159 is con-
cerned with the optimum response of an ideal, third-order relay servomechanism
to a reference input. This problem was programmed and successfully completed
by D. Combelic in cooperation with J. W. Stearns Jr. of the MIT E.E. Depart-
ment. Problem #160 is concerned with the development of a routine for effect-
ing a similarity transformation of a square matrix. This work is being carried
out by Dr. A. Meckler of the Solid State and Molecular Theory Group.

The Seminar on Computing Machine Methods met on 12 January. Dr. Per-Olav
Löwdin of the University of Uppsala spoke on "Some Aspects of the Numerical
Integration of Ordinary Differential Equations."

On 15 January, J. M. Frankovich of the Digital Computer Laboratory Staff
spoke at the seminar on advanced programming techniques for Whirlwind I.
Frankovich described and answered questions about some of the revisions to be
introduced into the conversion program for the Comprehensive System.

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 <u>NOT</u> for academic credit, is
<u>UN</u>sponsored.
B implies the problem is for academic credit, is <u>UN</u>sponsored.
C implies the problem is <u>NOT</u> for academic credit, <u>IS</u>
sponsored.
D implies the problem is for academic credit, <u>IS</u> 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. <u>Comprehensive System of Service Routines</u>, developed by the S&EC
Group at the Digital Computer Laboratory for the input con-
version 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, 42 hours; Best, 51 hours; Combelic, 39.5 hours;
Demurjian, 42.5 hours; Denman, 26 hours; Frankovich, 30 hours; Helwig,
53 hours; Kopley, 43.5 hours; Porter, 4 hours; Siegel, 35 hours;
WWI, 939 minutes

    Testing and modification of the new CS and the input program are
continuing.

    The input program has been modified so that it can search for numbered
blocks on unit 0. The new CS and several utility programs have been recorded
on unit zero with appropriate tags. An entry point has been provided in the
input program which records a stop character on unit 3 and then restores magne-
tic core storage to its original contents

                                                             Helwig

    All modifications now incorporated in CS mod 2, the new version of CS
being prepared for March 15, appear to be working satisfactorily. Work on
an additional set of changes is now being begun. These will include a scheme
for storing blocks of a program where desired on the drum but with relative

and floating addresses corresponding to the position these blocks will oc-
cupy in magnetic-core memory. Another major change will enable CS to per-
form a "direct" read-in of a program into storage using only Flexo tapes as
well as the present indirect read-in which involves producing a 556 tape.

                                                            Frankovich

    A program that sum checks an arbitrary range on the auxiliary magnetic
drum has been written and checked.

    A section of the proposed automatic post-mortem program has been written
and is being tested.

                                                            Arden

    A Guide to CS Coding has been completed and is being circulated within
the S&EC Group. It will be kept up to date so that by the March 15th dead-
line it will be ready for general distribution.

    An evaluation of the execution time for CS instructions indicates that
the present CS is about 45-48 times slower than WWI and that the revised CS
is about 40-43 times slower than WWI.

    Scope Output blocks (SOA, iSOA) are being written with the assumption
that by March 15 the character generator will be operating satisfactorily
and the scope three-way switch will be available. Position 1 will permit the
present calibration scheme, position 2 will have the scope calibrated for the
character generator, and postion 3 will have the scope calibrated for point-
wise generation.

                                                            Kopley

The operation times for all the WWI instructions except bi and bo have been
both calculated and measured (using the real time clock). These results
will soon be published in a Memo.

                                                            Denman

    The results from previously mentioned programs to measure the Ferranti
reader's characteristics are being used to write a program which can be used
by computer operators to check the reader.
    Tests on the new Programmed Arithmetic routines are continuing to be
made as they are suggested.

                                                            Best

    A program has been written which will produce, from any number of 556
tapes, a single 556 tape, which is of the shortest length, to be both equiva-
lent to the originals when read into WWI and easily read manually. The new
tape refers only to those registers referred to by the originals and contains
no redundancies; i.e., it refers to no register more than once. Any unneeded
sections of the original tapes may be kept from appearing in the revised
version by use of the manual intervention registers.

    This program will be used to generate the versions of service and utility
programs which will be recorded on magnetic tape, thereby minimizing the
amount of magnetic tape required.

                                                            Siegel

106 C.   <u>MIT Seismic Project</u> is concerned with the development of
         methods for locating deep reflections from underground
         strata in seismic prospecting. The basic method is one
         of prediction by means of an optimum linear operator.
         :for Professor P.M. Hurley, Geology and Geophysics;
         Professor G. Wadsworth, Mathematics Department
         :by <u>E.A. Robinson</u> (Res. Assoc.);Briscoe, 36 hours; Simpson,30
         hours; Walsh, 25 hours
         :DCL: WWI, 267 minutes

     During the past two weeks the group has been primarily preparing for
fairly extensive computation. One aspect of this has been the use of a checking
program to determine if the group's long combined data tapes have been properly
prepared and converted. In this manner errors were discovered on about 9 out
of 70 tapes. Although these have not been completely studied the main trouble
has been the misassignment of data by basic conversion. Most of the difficulties
have been corrected, but other checking programs are being written to verify
the preparation of other tapes of the group.

     Some computation has been done involving the formation of 12 matrices
and the prediction of 10 seismic traces.

113 C.   <u>A Stress Analysis of an L-shaped Homogenous Planar Structure</u>
         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 protype. This
         framework is then analyzed using the principles of virtual
         work and Southwell relaxation techniques. Boundary con-
         ditions 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 <u>S. Sydney</u> (Res. Assist. CMMC), 60 hours
         :DCL: WWI,158 minutes
     Two production runs were made for new loading conditions on the plate.
A program was written and tested for calculating deflections of points along
the edges of the plate. Another program has been written for checking the
static equilibrium of the plate after the forces in the plate have been com-
puted for a condition of elastic compatibility. The compatibility relation-
ships should not affect the conditions of static equilibrium.

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 approxi-
         mation for the desired impulse response.
         :for Prof. G. C. Newton Jr., Electrical Engineering
         :by R. Kramer (DIC),1 hour; Hamilton, 20 hours
         : DCL: WWI, 33 minutes
Only one of the four runs attempted during this biweekly period gave
satisfactory results. One of the runs was unsuccessful due to a tape room
error and two others failed because of errors in input data.

We are now analyzing the results from this and the previous Fourier
Transform runs. This analysis will determine whether further convolution
and transform runs will be made on WWI.

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), 25 hours; Turyn, 40 hours; Hamilton, 40 hours
         :DCL: WWI, 143 minutes
         Tests of the Polynomial Fit program with the revised CS are in progress.
So far the results are inconclusive.

The Mistake Diagnosis Routine Report is available and will be distributed
to all interested.

Part I of the Data Reduction program is operating correctly; testing of
the rest will commence soon.

The punch-out subroutine in the post-mortem is working correctly. A
special subroutine will be used to read in the post-mortem automatically;
this will provide in effect a 30-register (24,6) print-out and punch-out
subroutine and, it is hoped, end tape-room confusion about the special read-
in procedure necessary for the post-mortem.

131.   <u>The Training of New Personnel, Tours and Demonstrations</u>
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, 6 hours; WWI, 106 minutes

The Digital Computer Laboratory was host to 70 members of the American
Society of Heating and Ventilating Engineers during the evening of January 19.
The evening's program consisted of an after-dinner lecture on digital compu-
ters at the MIT Faculty Club, and then a tour of the WWI installation with
demonstrations of several programs on WWI and a demonstration of the
Flexowriter equipment.

134 C.   <u>Numerical Diagonalization Procedure</u>. 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 <u>A. Meckler</u> (DIC) .5 hour
:DCL: WWI, 42 minutes

Various discrepancies in the transcription into subroutine form were
found and corrected. However, trouble still exists with the full secular
equation routine, the one designed for production runs. The difficulty is
still to be isolated and eliminated.

138 B.   <u>Spheroidal Wave Functions</u> 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 re-
cursion 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 con-
tinued fraction equation derived from one of the 3-term
recursion relations. The iteration proceeds until a
value of the unknown separation constant of the differ-
ential 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. Corbato (Res. Assist. CMMC), 100 hours; Little,
           50 hours
          :DCL: WWI, 459 minutes

     Fifty-two runs were completed this period bringing the total to 64 out
of an eventual 80.

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 sum-
             mer session course on Digital Computers and Their Applica-
             tions. The SS computer is being used by the E.E. Depart-
             ment courses 6.535 and 6.25 and is available to programmers
             with suitable problems.
          :DCL Staff: Combelic, 8 hours; Siegel, 35 hours; WWI, 105 minutes

     The modification of the fourth pass of the SS conversion program to
detect cycle-count instructions without a required counter letter has been
completed and tested. This feature will not be placed in operation, however,
until the rewriting of the conversion post-mortem is complete, because the
existing post-mortem program makes no provision for this mistake.

     Test of the new conversion post-mortem, which detects more than one tape
error, have shown that the SS conversion program is not directly compatible
with the new post-mortem. Although all mistakes are detected, the indication
of their location in the program is incorrect. The method for finding this
location will be revised, and further tests will be made.

141.   S&EC Subroutine Study has been undertaken for the final
             testing of subroutines selected for incorporation
             into the Library of Subroutines. Although very little
             effort is going into the specific development of sub-
             routines, programs that have been written for other S&EC
             problems and seem to be of general use will be suitably
             modified for the S&EC Library.
          :DCL Staff: Best, 16 hours; Denman, 26 hours; WWI, 10 minutes

     Two square root subroutines have been written, utilizing iterated New-
ton's method. Both of these should be faster on the average than the present

Library square root subroutine. One of these is 6 registers shorter than the present Library subroutine but goes through a fixed cycle of 4 iterations without checking the result. The final result, however, has the same accuracy as the present subroutine. The other is two registers longer, but uses an improved check for convergence after going through one iteration without checking.

Denman

A (30-j,j) exponential routine is being developed.   Best

147 C.   Energy Bands in Crystals are being studied by finding
             solutions of the corresponding second order linear diff-
             erential 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), 48 hours
         :DCL: Arden, 8 hours; WWI, 594 minutes

After some difficult trouble shooting, the last errors in the program have been eliminated, and a final production version of the program has been written and is undergoing testing. This will be the program to be used in any further application of this work to other metals.

Thanks to the allocation of a large amount of computer time to this problem, production work has progressed at an unexpectedly fast rate and the work using the particular potential considered to represent metallic copper is very near completion. The root finding technique has proved successful in substantially reducing the output required without appreciably altering the amount of computer time involved; the results continue to show an encouraging agreement with theoretical predictions.

152 D.   Diffusion in an Oxide-Coated Cathode is a program to cal-
             culate the effects of combined thermal and electrolytic
             diffusion that occur in an oxide-coated cathode when
             current is caused to flow through the cathode.
         :for W.B. Nottingham, Physics Department, DIC No. 6345
         :by H.B. Frost (Res. Assist. E.E. Dept.), 3 hours
         :DCL: WWI, 103 minutes

Slight modifications have been made in the program to increase the utility of the output information. Two additional parameters have been run to fill gaps in previous data.

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), 80 hours; Sternlight, 24 hours
           :DCL: WWI, 38 minutes

Instead of storing intermediate results on the magnetic drum, these results
will be punched in 556 form on paper tape. This 556 tape will then be read in
later as needed.

The program for calculating the h-function has been corrected and further
tests will be carried out. The program for calculating the I-function has
been working satisfactorily giving results to four significant figures.

It is hoped that during the next biweekly period complete solutions for
the gust response may be obtained for various values of the airplane confi-
guration parameters.

155 B.   Synoptic Climatology. A multiple regression formula is
           used to predict temperatures from pressure distributions
           described by Tschebycheff polynomials. The matrix of
           scalar products which is used in the calculation of the
           coefficients of the multiple-regression system is being
           calculated on WWI.
           :for Professor T.F. Malone, Meteorology Department
           :by R. Miller (DIC), 25 hours
           :DCL: Arden, 4 hours; Demurjian, 1 hour; Porter, 7 hours; WWI, 99 min.

An objective method for describing the pressure pattern of a daily
weather map has been devised. This description is accomplished by means of
fourteen numbers which are standardized coefficients of orthogonal polyno-
mials. To obtain a sufficiently large sample of daily weather maps described
in this fashion for climatological purposes, a rather large calculational
problem is involved.

A program has been developed for Whirlwind that will calculate these
fourteen numbers and punch them out directly in a form suitable for later
processing. At present the program is in operational form and parameter
tapes are being punched.

158 B.   **Relay Servo Response** considers the optimum response of an ideal, third-order relay servomechanism to the reference input

$$\theta_i = A_k + W_k t + \tfrac{1}{2}\alpha_k t^2$$

The system error and its derivatives must be brought to zero from their initial values (A_0, W_0, and α_0) with no overshoot in the minimum time, t_0. To do this, two reversals of the manipulated variable input θ_c, are required at times, t_x and t_y.

:for J. W. Stearns Jr., Servomechanisms Laboratory
:by J. W. Stearns Jr.
:DCL Staff: Combelic, 5.5 hours; Porter, 3 hours; WWI, 142 minutes

The critical times (t_x, t_y, and t_0) are related by the equations

$$(1) \quad (1+g)t_y = 2t_y - \beta_1 + \sqrt{\left[(1-g)t_x - \beta_1\right]^2 - (1+g)\left[\frac{\beta_1^2}{2} + (1-g)\beta_2\right]}$$

$$(2) \quad (1-g)t_0 = 2(t_y - t_x) + \beta_1$$

$$(3) \quad (1-g)\,e^{at_0} = 1 + \frac{\alpha_0 - \alpha_k}{\theta_{fm}}a + 2(e^{at_y} - e^{at_x})$$

where

$$\beta_1 = \frac{W_0 a}{\theta_{fm}} + \frac{\alpha_0}{\theta_{fm}}$$

$$\beta_2 = \frac{A_0 a}{\theta_{fm}} + \frac{W_0}{\theta_{fm}}$$

$$g = \frac{\alpha_k a}{\theta_{fm}}$$

and θ_{fm} and a are parameters of the system. The quantities to be found are the critical times as functions of the other parameters.

The method used was to find numerical values for the critical times for several different values of each of the 4 parameters A_0, W_0, α_0 and α_k, which specify the initial error, and for each of the 2 system parameters, a and θ_{fm}. Calculations on the Whirlwind Computer was made for about 250 sets of parameters. From these results an expression was derived for the critical times as a function of 6 parameters.

Hand calculations of 6-figure accuracy required about 30 minutes per set of parameters.

The procedure was to assume a value of t_x, solve equations (1) and (2), and substitute values into equation (3). The amount by which the two sides of (3) failed to agree was used as a basis for estimating the next trial value of t_x. This was continued for a given set of parameters until all three equations were satisfied.

The results of the calculations have been included as part of a thesis entitled "Phase-space Considerations in Performance of Relay Servo-mechanisms". The thesis has been submitted by John Wesley Stearns, Jr., to the MIT Department of Electrical Engineering in partial fulfillment of the requirements for the degree of master of science.

160 C. Similarity Transformation of a Matrix desires to de-
        velop a routine to peform a similarity transforma-
        tion of a square matrix; symbolically, to find UAU^t
        where A is an n x n matrix, U is m x n, and U^t is
        the transpose of U. The input consists of U and A
        and the output is UAU^t displayed on the scope.
        :for Dr. A. Meckler (DDL) Physics Dept.
        :by Dr. A. Meckler, 2 hours
        :DCL: WWI, 31 minutes

The purpose of this problem is to develop a program that will effect a similarity transformation of an arbitrary matrix (order less than or equal to 30). The program is a simple extension of matrix multiplication developed under problem #157. The program is designed for production runs; that is, the main program is assigned to a fixed postion in Magnetic Core Storage and uses no preset parameters which may be a function of the order of the matrix to be handled. Thus, it can be converted once and for all. The matrices are put on a separate tape and many can be put on one tape. After a pair of matrices (the one to be transformed and the one which trans- forms) is read in, control is transferred to the main program which is in MCS and the main program trnsfers control to the read-in program after com- pleting the transformation and display of results. The next pair of matrices is read in and so on.

Similarity transformations occur frequently in the matrix formalisms used in the theory of molecular structure. In particular, it is possible to express the transformations of electronic interaction integrals evaluated on a basis of one type of electronic wave function to a basis of some other type of electronic wave function by means of a similarity transformation. Dr. McWeeny, who is associated with the MIT Solid State and Molecular Theory Group, will use this program to re-express a set of electronic interaction integrals.

Some difficulty has been encountered on the reading-in of the matrices. It is planned to locate and correct this difficulty.

1.3 Operating Statistics

1.31 Computer Time

The following indicates the di...bution of WWI time allocated to the S+EC Group.

Programs	53 hours, 53 minutes
Conversion	12 hours, 03 minutes
Magnetic Drum Test	22 minutes
Magnetic Tape Test	32 minutes
Scope Calibration	35 minutes
Demonstrations (#131)	1 hour , 46 minutes
Total Time Used	69 hours, 11 minutes
Total Time Assigned	83 hours, 06 minutes
Usable Time, Percentage	83.5%
Number of Programs	292

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   60.8%
   Output   11.5%
2. Computer Time Lost Due to Programmers Errors
   Technical   11.7%
   Logical   4.3%
3. Computer Time Lost Due to Other Difficulties
   Tape Preparation   1.7%
   Operator's Errors   1.0%
   Terminal Equipment Malfunction   8.6%
   Miscellaneous   .4%

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:

	Complete Tapes	Typed Mods	Manual Mods	Combined Tapes
No. of Tapes	85	65	30	10
No. of Registers	15340	1081	56	
Time Consumed	69 hrs.59 min.	30 hrs.29 min.	2 hrs.46 min.	3hrs.34 min.

Thus, it may be seen that the average length of an original complete tape is 180.5 registers requiring 49.4 minutes to prepare. A typed modification averages 16.6 registers in length and requires 28.1 minutes to prepare while Manual Modifications average 1.87 registers and require 5.5 minutes for preparation.

2. COMPUTER ENGINEERING

2.1 WWI Systems Operation

2.11 Core Memory   (L.L.Holmes, A.J.Roberts)

To provide protection for the crystals in the Core-Memory matrices, we are installing 60-ma fuses in the memory-address-register cathode-follower output lines. The panels are now being built and will be installed on Monday, January 25.

A permanent post-write-disturb system was installed on Saturday, 9 January. The new system uses a cathode follower, two gate-tube buffers, and two flip-flop plug-in units. The change resulted in improvement of the Bank A margins while the Bank B margins remained good.

We have completed the modification of the selection-plane-driver control switches. The changes improved margins for both banks.

Work is being continued on the parity registers. Digits 0-9, inclusive, now have d-c coupled units.

The PIU digit-plane drivers are being modified to provide one more marginal-checking circuit.

2.12 Magnetic Tape   (E.P.Farnsworth)

The proposed "magnetic-tape print-out recording error alarm" circuit is complete in breadboard and test-equipment form and is ready to be tied into the delayed-output system. The final modification will require the addition of one tube and relay to the FL register and the substitution of two GT-GT and one FF PIU for the three GT-BA's in the index pulse counter.

The "magnetic-tape limit alarm and indicators" panel is under construction. This panel will permit rewinding unit 0 for the console, as well as indicating which units are rewound and giving an audible signal whenever a unit encounters a limit mark.

Some limitation on the proposed use of unit 2 for print-out appears desirable to encourage the use of scope-camera output, distribute a reasonable print-out load, and provide operational convenience and reserve output capacity, rather than encourage excessive use of Flexoprinting. The desired effect might be achieved by (a) restricting long print-outs to unit 2, (b) locating the second Flexowriter in the tape room (thus permitting long runs to be printed out only during the periods when the tape room is staffed), (c) plus the fact that unit 2 is the system spare and will be out of service whenever a mechanical failure in an operational unit requires a replacement assembly. Construction of the register panel and installation of completed panels is going ahead although no decisions have been reached regarding use of location of the additional equipment.

2.13 Auxiliary-Drum System   (K.E.McVicar)

Our recent trouble with writing between the slots on the auxiliary drum is now tentatively ascribed to power-supply malfunctions. One source of power transients was the +5-v supply which we formerly shared with Room 222. This is

a high-impedance supply, and we feel that it is likely that transients from
Room 222 could cause out flip-flops to go over. A separate source of +5 volts is
now being used for the drum and Room 222.

We have also found that the voltages to the drum are no longer being sequenced
off in the proper manner with the result that the positive and negative supplies
now drop out together. This is probably a malfunction of power-supply control
for Room 156 and is now being investigated.

The third power-supply difficulty which we suspect as a source of spurious
writing is the -60-v supply. This is a temporary supply which is used for bias.
The a-c for the supply is now being taken from the laboratory regulated a-c line.
We plan to transfer this to WWI regulated a-c on the next installation day.

2.2 Terminal Equipment

2.21 Ferranti PETR   (F.E.Irish)

Two Ferranti readers are available for use in the computer system. There
are several alternatives for a design of the control for two readers. The
alternatives that have been considered are:

a. One reader could be installed, and the second could be left on a shelf
as a spare.

b. Two readers could be installed with a common control. Either reader
could be put into standby condition just by pressing a button. This method
allows the operator to load tape into the second unit while the first is reading
a tape. Either unit could be removed from service without disturbing the remain-
ing one.

c. Two readers could be installed with individual controls. The programmer
in this case could actually program the use of two different units. In addition,
the si addresses for the two units could be interchanged by pressing a button;
this would allow the operator to "read-in" using either unit.

Two readers in service (b and c) provide the most flexibility. If one fails,
the operator can use the other. This flexibility is gained at the cost of a
relay switching panel (5 relays).

An installation where both readers can be programmed into operation (c) is
gained at the expense of a complete control (26 vacuum tubes and 2 relays).

A definite decision as to which of these installations is to be used has not
been made, but serious thought is being given to the last method (c).

Any comments by programmers on the value of being able to program the operation
of two readers will be appreciated.

2.3 General   (D.A.Morrison)

A memo concerning the recording of WWI computer alarms by the computer operators has been revised and reissued (M-1671-1).

3. PERSONNEL

New Staff   (J.C.Proctor)

Philip Bragar is working as a DDL Staff Member and has been assigned to to Group 62. Mr. Bragar received his B.S. in Economics and Engineering in 1948 from MIT and recently has been employed by Kaiser Frazer Corporation.

Andrew Favret is working as a DDL Staff Member and has been assigned to Group 61. Mr. Favret received his M.S. in EE from the University of Pennsylvania. He was just recently released from the Army.

Transfers - Staff

Inex Hazel has transferred from DIC Staff to DDL Staff and has been assigned to Group 61.

New Non-Staff   (R.A.Osborne)

Frank Furman is a new technician in Group 64.
Barbara Ritchie is a new clerk-typist in Group 62.
Louise Shamgochian is a new messenger in the Whittemore Building.

Terminated Non-Staff

Barbara Godfrey