Digital Computer Laboratory
Massachusetts Institute of Technology
Cambridge 39, Massachusetts

SUBJECT: BIWEEKLY REPORT, NOVEMBER 16, 1953

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 208 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 24 of the problems that have been accepted by the S&EC Group. Progress on each 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.

Three new problems were initiated during this period. Problem #152 is a study of the diffusion of barium atoms in an oxide-coated cathode. This problem is being carried out in cooperation with B. Frost of the Digital Computer Laboratory. Problem #149 is being carried out by G.P. Dinneen of Lincoln Laboratory. This problem investigates digital methods of detecting signal from noise. The third problem (#155) is concerned with utilizing pressure patterns for temperature prediction. This work is being carried out by R. Miller of the MIT Meteorology Department.

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, 7 hours; Combelic,6.5 hours; Demurjian, 9 hours; Denman, 30 hours; Frankovich, 18 hours; Hazel, 7.5 hours; Helwig, 60 hours; Kopley, .5 hours; Porter, 20 hours; WWI,236 minutes

A tentative version of a revised 24,6 programmed arithmetic subroutine has been written and is now under test as part of the comprehensive system. The new PA is designed primarily to correct several shortcomings of the previous PA. However, greater speed and increased use of mistake anticipation have been incorporated into the new PA. A short written description of the subroutine will be issued as soon as the programs are definitely decided upon.

Helwig

The flad table routine for delayed print was tested in conjunction with J. Frankovich's test for unassigned flads. A number of changes were made to improve the form,and the routine will soon be incorporated into CS.

The program for the interpreted instructions post-mortem routine has been moved to occupy the end of the second bank of high-speed storage. This means that the programmer may now have the interpreted instructions stored in the range 40(32) through 3310(1736) printed out.

Hazel

The changes and corrections in the comprehensive system previously described have not yet taken effect. These revisions will take effect as soon as the necessary programs are recorded on unit #0. The format and content of the flad table which will be printed out are being changed to incorporate suggestions made by other staff members.

A (24,6) arc sin subroutine has been written, tested,and included in the library of subroutines.

Frankovich

Further revisions have been made in Chapters 5 through 8 of CS Manual I. It is hoped to make copies of these four chapters available during the next bi-weekly period.

The completion of these eight chapters will mean that we can furnish an applicant having no previous programming experience with sufficient information so that he can program his problem making use of the comprehensive system.

Denman, Kopley, Porter

The purpose of CS Manual III is to record the inner workings of the CS system so that they will be comprehensible to S&EC Staff members who were not among the group that created the system. Annotated program manuscripts of every routine of the CS,(i.e., all routines recorded on MT #0) and of those control routines essential to its operation, will be included in the Manual. It is intended that CS Manual III will completely document the CS system. The entire system is covered by the annotated program manuscripts, the text serving as a supplement. Work on the first draft of the text will end as of January 31, 1953 -- those details not covered therein being left to the manuscripts.

As of this date, the introduction, the First Pass Program section, and the Second Pass Program section have been completed. Due to current work on the PA, the Third Pass Program section will be tackled next and the PA, OT, Flad and Title Display, and Control programs will follow.

Vanderburgh

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
:by Dr. A. L. Loeb,(DIC),20 hours; J. Richmond(DIC), 15 hours
:DCL Staff: Denman, 4 hours; WWI, 41 minutes

In order to find out how fast the program converges a timed run was performed on one set of data with different first estimates. The correct result was n = 0.302, k = 3.269; a first estimate of n = 0.3, k = 3.3 required 10 seconds for the film-incidence calculation with 6 additional seconds for backing incidence, while a first estimate n = 0.45, k = 4.5 required 18 seconds for film incidence, 10 seconds for backing incidence. This indicates very satisfactory convergence.

To save computer time the program has been modified for the delayed printer instead of the direct one. This program worked, but the column-headings program was accidentally omitted from the tape.

106 C. MIT Seismic Project 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 E.A.Robinson(Res. Assoc.),H.Briscoe,36 hours; S. Simpson, 60 hours; W. Walsh, 40 hours
:DCL,232 minutes

Attempts to solve 9 x 9 and 7 x 7 matrices using the library subroutine for Craig's method were all unsuccessful. Both gave overflows while computing a directional vector.

A new prediction program utilizing a graph-plotting subroutine is being tested but has been plagued with typing errors.

Four frequency spectra were computed by a program using the method of J. Tukey.

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),25 hours; N. Zierler(DIC), 40 hours
:DCL Staff: Hazel, 1 hour; WWI, 80 minutes

The program was successfully used for the first time during this period. A number of Fourier transforms were computed for problem 137 and the results are reported in more detail under that problem number.

Some time was lost this period because the computer failed to stop on si 1 on several occasions even though the stop on si 1 switch was on.

There is an error in the part of the program that handles the printing of superscript variables with variable index, but it will be corrected in the next few days. Tapes of the program for the automatic solution of differential equations are now being prepared and will be tested in the coming biweekly period.

109 C. An Airplane Pursuit-Course Program is being developed which will take account of airplane dynamics and projectile ballistics and thus determine an airplane pursuit course in three dimensions. The problem consists essentially of solving 14 simultaneous non-linear differential equations by the Runge-Kutta Method which is of fourth-order accuracy.
:for Mr. J.B.Feldman, Instrumentation Laboratory
:by M.H.Hellman(DIC), 80 hours
:DCL Staff: Porter, 3 hours; WWI, 24 minutes

The two-dimensional pursuit-course problem was programmed using the CS before attempting the more complicated three-dimensional problem because answers for a particular solution of the former were available for checking purposes.

113 C. A Stress Analysis of an L-shaped Homogenous 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),60 hours
:DCL Staff: Kopley, 2 hours; WWI, 104 minutes

A major portion of the program has been written, and some of the tapes have already been successfully tested. Before the program can be completely run, several additional tapes must be tested.

119 C. Spherical Wave Propagation produced by the sudden release of a spherical distribution of compressed air in the atmosphere is being studied by numerical means. This involves replacing a set of non-linear hyperbolic partial differential equations in 2 independent and 2 dependent variables by a set of difference equations written along characteristics. An iterative procedure is used to solve these equations.
:for Professor C.C.Lin, Mathematics Department
:by A. Ralston, CMMC, 12 hours
:DCL Staff: Combelic, 1 hour; WWI,123 minutes

The initial density distribution has been changed so that now at the center of the sphere the initial density is six times atmospheric density rather than the initial value of three times atmospheric density used in the previous work.

Two programs for different initial mesh widths were run using the new initial density distribution. The results from both indicate the formation of a shock this time. With the formation of the shock various difficulties arise in connection with the numerical process being used. These difficulties necessitate a great deal of work off the computer before the computation can be continued on WWI.

123 C. Earth Resistivity measurements are used to calculate the Slichter kernel function which, in special cases, can be analyzed to give the actual distribution of resistivity. The method involves least-square fitting a set of polynomials to the measured surface-potential function and integrating the product of this set and the zero-order Bessel function.
:for P.M.Hurley, Department of Geology and Geophysics, DIC 5-6915
:by K. Vozoff(Res. Assist. CMMC),4 hours
:DCL: WWI, 34 minutes

The tape for computing $J_0(x)$ and $J_1(x)$ was completed. The program, written in CS, computes the two functions simultaneously using a difference equation. This corrected subprogram will be inserted in T-2698, the program for computing the Slichter kernel, and the latter will be retested.

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),60 hours; D. Hamilton,60 hours; R. Turyn(DIC),80 hours
:DCL: WWI, 196 minutes

The Mistake Diagnosis Routine (MDR) program has now been put in final form, and several applications have been made to the Polynomial Fit Program for the investigation of round-off errors. Copying errors in the final version of the MDR and in a small routine necessary to sample one section of the Polynomial Fit Program have delayed results. A check-order alarm during the execution of a bo order on the latest run is unexplained. The report on the MDR is being published.

The Lagrange Interpolation and Post-Mortem programs have not yet operated successfully. Modifications are being made and testing continues.

Excellent results were obtained by fitting a fifth-order polynomial to an empirical function using the Polynomial Fit. The maximum error was 0.16 out of 14,500 with variance of all the errors .0015.

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, 3.5 hours; WWI, 52 minutes

Three tours of WWI, listed below, were given during the past biweekly period. All three demonstrated several programs on the computer and included a general tour of the installation. The first two groups mentioned below were also given a Flexowriter demonstration.

Date	Time	Number	Represented
November 3	5-6 PM	23	19 from Sylvania 4 self
November 14	10-11 AM	10	Institute for Radio Engineers
November 15	8-9 PM	13	Old South Church, Reading, Mass.

132 C. Subroutines for the Numerically Controlled Milling Machine are being revised and tested. The set of subroutines facilitates programming of the computations involved in the preparation of numerical data used to control the milling machine. The subroutines involve routine numerical and logical operations.
:for J.O.McDonough, Servomechanisms Laboratory, DIC Project 6873
:by J.H.Runyon(E.E.Res. Assist.),10 hours
:DCL Staff: Combelic, 2 hours; WWI, 8 minutes

Testing of subroutines for finding points on the series 16 symmetrical section and camber line was continued. One error, an incorrect address, was found and corrected in the routine for the symmetrical section. The routine then worked properly. The camber line routine still has not operated properly.

A 90° section of a supersonic nozzle was cut using the tape prepared on WWI. Results were very satisfactory.

137 D. Investigation of Atmospheric Turbulence as a noise input to airborne control systems. A stationary random process is assumed so that the methods of generalized harmonic analysis may be used to describe the turbulence components in terms of their power spectral densities.
:for Professor R.C.Seamans,Department of Aeronautical Engineering
:by R.A.Summers(Res.Assist.), 8 hours; N.Zierler,4 hours;C.Block,2 hours
:DCL: WWI, 87 minutes

The generalized program of problem 108 has been successfully utilized by N. Zierler to compute a Fourier transform(power spectral density). The results show all positive "power" out to 10 radians/second, except for one isolated and very small negative number at 4 radians/second. This result is also in agreement with an independent CPC computation.

It must therefore be concluded that the Fourier Transform program of problem 107, which (for the same data as above)produced all negative power above 5 rad./sec., contains some inherent innaccuracy,perhaps in the approximate recursion formulae for sine and cosine. This program is being checked with a view to eventually using it, in its corrected form ,for the Fourier transform calculations; the generalized program of problem 108,while being very accurate and reliable, may not be fast enough for taking the large number of Fourier transforms required in

problem 137.

Completion of problem 137 depends on a satisfactory correction of the Fourier transform program of problem 107.

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 equation 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),30 hours; J.D.C.Little(Res.Assist. CMMC), 30 hours

:DCL Staff: Combelic, 2.5 hours; WWI, 164 minutes

Production was barely started when an error was discovered in the present PA buffer. Statistically the buffer contents are incorrect one in every 1024 its operations. This occurs because a round-off made in the 25th binary digit occasionally causes a change in the first 15 significant binary digits. The effect of this error is to reduce the accuracy from 30 to 15 binary digits. This mistake will be eliminated in the new CS PA being written by Helwig.

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 in the E.E.Department course 6.535 and is available to programmers with suitable problems.

:DCL Staff: Combelic, 42.5 hours; Frankovich, 4 hours; Helwig, 10 hours; Hoy, 58 hours; Siegel, 45 hours; WWI, 184 minutes

During this biweekly period, attention was principally directed toward developing the automatic title display described in the preceding biweekly report. A program for the title display on the oscilloscope, which is the most difficult case of the three, is undergoing test. Satisfactory operation has not yet been attained, but it is expected that the scope-title feature will be in operation before the end of the next biweekly period.

Several programs were run on the SS computer for students in Course 6.535. The operation of the computer was entirely satisfactory.

A significant mistake in the conversion of the floating-point number zero was located and corrected.

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 subroutines, 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: Arden, 6 hours; Denman,10 hours; WWI, 9 minutes

A routine making simple formats available has been added to 2756m5 and is currently available in the Library of Subroutines as 3217m5.

143 D.. The Vibrational Frequency Spectrum of a Copper Crystal is to be determined by solving a 3 x 3 secular determinant, each term of which consists of a finite Fourier Series of 12 terms. This equation must be solved for 24,495 different values of the wave-propagation vector.
:for Professors B.E.Warren and J.C.Slater, Physics Department
:by E.H.Jacobsen(Res. Assist.), 12 hours
: DCL Staff: Combelic, 5 hours; WWI, 205 minutes

A double integration concerned with describing the scattering of X-rays from a crystal lattice has been performed successfully 21 times (i.e., for 21 different values of a parameter). The double integration must be performed 6 more times to complete this phase of the problem.

144 C. Self-Consistent Molecular Orbitals are the optimum choices of linear combinations of atomic orbitals determined through a process described as a self-consistent field approximation. The numerical procedure involve matrix-vector multiplications, vector additions, and matrix diagonalization.
:for Professor J.C.Slater, Physics Department
:by Dr. A. Meckler(DDL), 5 hours
:DCL Staff: Arden, 8 hours; WWI, 83 minutes

The program has run through one iteration without an alarm. The next problem to be investigated is the convergence behavior of the entire scheme. With different initial guesses to the density matrix, the machine will be forced through different iteration routes, revealing the possibility of divergence and the rate of convergence.

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), 16 hours
:DCL Staff: Arden, 12.5 hours; Porter, 2 hours; WWI, 109 minutes

The recurrence relation which was originally used to compute the spherical Bessel functions $j_\ell(x) = \sqrt{\frac{\pi}{2x}}\, J_{\ell+\frac{1}{2}}(x)$ proved to give a large accumulation of error when $\frac{2\ell-1}{x} > 1$. It has therefore been decided to compute $j_\ell(x)$ as follows:

defining $\Lambda_\nu(x) = \Gamma(\nu+1)\, 2^\nu\, x^{-\nu} J_\nu(x)$, $\Lambda_\nu(x)$ varies slowly with x, and $\Lambda_\nu(0)=1$.

For high ν, Λ_ν may be obtained from a power series, and use can then be made of the backward recurrence relation

$$\Lambda_{\nu-1}(x) = \Lambda_\nu(x) - \frac{x^2}{4\nu(\nu+1)}\Lambda_{\nu+1}(x)$$

This proceeds without loss of accuracy provided $\frac{x^2}{4\nu(\nu+1)} < 1$. There is insignificant loss of accuracy for $\nu \geq \frac{1}{2}$ for all x used here ($x < 8$). A subroutine to perform the above calculation has been programmed. The testing of the final part of the main program has been completed; some difficult errors have been eliminated.

149 C . Digital Methods of Detecting Signal from Noise are being investigated. A sequence of binary numbers will simulate the message wherein regions of high density of ones are signal regions and those with low density of ones are noise regions. Various methods of detecting the change from one region to another, as well as the length and midpoint of the signal regions are being studied.
:for J.V.Harrington, Lincoln Laboratory
:by G.P.Dinneen, Lincoln Laboratory
:DCL: WWI, 14 minutes

Two basic schemes are to be investigated first. One is a sequential observer as described in Lincoln Laboratory Technical Report No. 20 and the other a success run observer. The Sequential Observer employs a biased counter with an upper and lower threshold and another counter which measures target length, triggered by the attainment of the upper threshold and reset when the lower threshold is reached. The success run has a single counter which counts every pulse and is reset by some configuration of pulses. These two schemes or modifications of them will be tried for various signal to noise ratios and signal lengths.

A program for two sequential observers and a success-run observer was run off, and results obtained. The success-run observer appeared more selective for this case. However, it was determined that the number of bits per experiment should be increased and a new method of handling the end of the experiment should be devised. These changes were incorporated in a modified program which should be run during the next period.

152 D . Diffusion in an Oxide-Coated Cathode is a program to calculate 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.), 8 hours
:DCL Staff: Denman, 2 hours; Porter, 6 hours; WWI, 336 minutes

The equation governing the process is a second order non-linear partial differential equation of parabolic form, as follows:

$$\frac{\partial n}{\partial t} = D\left(-C\,\frac{\partial \sqrt{n}}{\partial x} + \frac{\partial^2 n}{\partial x^2}\right)$$

where n is the concentration of barium donor centers, D is a thermal diffusion constant, and C is a parameter depending upon coating thickness, the coating conductivity, the current through the cathode, and temperature. The concentration n is normalized and has the value 1 for $0 < x < a$, $t=0$. The basic boundary condition, resulting from the fact that donor centers do not migrate across the boundary, is

$$\frac{\partial n}{\partial x} = C' \sqrt{n}$$

an auxiliary condition, very useful as a check on errors in computation is

$$\frac{\partial}{\partial t} \left(\int_0^a n(x,t)dx \right) = 0$$

This problem may be set up in the following difference equation form:

$$\frac{n_{(x,t+1)} - n_{x,t}}{h_t} = D\left(-C' \frac{\sqrt{n_{x+1,t}} - \sqrt{n_{x-1,t}}}{2h_x} + \frac{n_{x+1,t} - 2n_{x,t} + n_{x-1,t}}{h_x^2}\right)$$

for $0 < x < N$.

Setting $h_t = \frac{h_x^2}{2D}$, $\gamma = \frac{h_x C'}{2}$ and $h_x = \frac{a}{N}$

yields

$$n_{x,t+1} = \frac{1}{2}\left[n_{x+1,t} + n_{x-1,t} - \gamma\left(\sqrt{n_{x+1,t}} - \sqrt{n_{x-1,t}}\right)\right]$$

The boundary conditions may be approximated to the second order at constant t by

$$n_N = \frac{4}{3} n_{N-1} - \frac{1}{3} n_{N-2} + \frac{1}{2}\left(\frac{4}{3}\gamma\right)^2 + \frac{4}{3}\gamma\sqrt{\frac{4}{3} n_{N-1} - \frac{1}{3} n_{N-2} + \left(\frac{4}{3}\gamma\right)^2}$$

and

$$n_0 = \frac{4}{3} n_1 - \frac{1}{3} n_2 + \frac{1}{2}\left(\frac{4}{3}\gamma\right)^2 - \frac{4}{3}\gamma\sqrt{\frac{4}{3} n_1 - \frac{1}{3} n_2 + \left(\frac{4}{3}\gamma\right)^2}$$

There are two results of prime interest which have physical significance. These are

$$f_1(t) = \frac{1}{a} \int_0^a \frac{1}{\sqrt{n(x,t)}} dx$$

and $f_2(t) = \sqrt{n(0,t)}$

The integral may be approximated satsifactorily by trapezoidal integration.

During the past period machine runs have been made to eliminate programming difficulties. With a good program, results have been obtained for $\gamma = 0.03$ using approximately 300 minutes of machine time. The results can be compared to steady-state solutions available by analytic methods. The comparison shows a truncation error in the integral

$$\int_0^a n(x)\, dx$$

of 0.0015%, with a probability that this error would increase further if the problem were run longer.

Efforts are being directed toward reducing the running time and improving the accuracy. Most of the machine time is used for calculating square roots. A considerable saving can be accomplished through the use of a square-root subroutine which makes use of available good approximations to the roots desired. Such a program has been written.

A better approximation to the boundary conditions has been derived using third differences. This approximation has been tried for the first three steps of calculation, with a reduction in the total truncation error by greater than a factor of two and a reduction in the rate of increase at the third point by a factor of five. This approximation looks very favorable. It requires less computation than the present boundary conditions since it requires one less square root operation.

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)
:DCL Staff: Arden, 10 hours; WWI, 26 minutes

Several errors in this program have been eliminated.

1.3 Operating Statistics

Computer Time

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

Programs	38 hours, 38 minutes
Conversion	17 hours, 56 minutes
Magnetic Drum Test	20 minutes
Magnetic Tape Test	16 minutes
Scope Calibration	78 minutes
Demonstrations (#131)	46 minutes
Total Time Used	59 hours, 14 minutes
Total Time Assigned	60 hours, 55 minutes
Usable Time, Percentage	97.67%
Number of Programs	208

1.4 Summary of Tape Room Bulletin Board Memoranda (I. Hazel)

(These memos are intended to inform programmers of changes in coding procedure, WWI facilities, etc.)

The Cycle Count Instructions

For a detailed description of the Cycle Count Instructions, see Bulletin Board Memo #44, which is posted in the Tape Room, Barta 110.

Multiple-Buffer Subroutines

This subroutine actually modifies the PA routine so that the PA routine refers to 2 constants in the multiple-buffer subroutine. The reference to these two registers is made during the execution of each interpretive instruction whether or not the instruction refers to the multiple buffers. For this reason, the multiple-buffer subroutine must remain permanently in high-speed storage at a permanent location for a given program.

The use of the regular buffer of the PA (symbolized by b) will have no meaning when the multiple-buffer subroutine is used.

2. COMPUTER ENGINEERING

2.1 WWI System Operation

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

The majority of low margins in the system have been cleared up. Excursions have been set in on the marginal-checking lines for core-storage control, and all margins are reasonable.

The installation of the parity-check system for the drum was delayed until November 16.

A program for generating a "worst possible pattern" in the cores should be ready for trial in a few days.

2.12 Auxiliary Drum (K.E.McVicar)

With the exception of one instance the auxiliary drum has operated without known error during the last biweekly period. On one occasion an intermittent readout was obtained during program operation. The trouble was traced to writing between the slots on the drum surface. A visual check had been made of the drum tracks on the previous day, and no serious defects were noted in the waveforms. It is assumed that the writing between slots was caused by the marginal checking which was done on the morning of the day the readout failure occurred. Investigation of the problem revealed that three lines could cause writing between the slots in case of certain failures caused by varying the operating voltages. These lines have been temporarily removed from the routine marginal-checking procedures. In the meantime work is in progress on a new program for marginal checking the drum on the read operation only, except where the write function itself is to be checked.

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

During the past two weeks we completed routine overhaul on the remainder of our long-carriage Flexowriters.

I have been working with Farnsworth and Perry to locate the cause of intermittent errors appearing recently in both tapes and printed copy produced on the delayed-output Flexowriters. The work is not completed, but it now appears that the trouble is in the magnetic-tape equipment rather than in the Flexowriters.

2.2 Terminal Equipment

2.21 Magnetic Tape (E.P.Farnsworth)

Several defective tubes, crystals, and tapes were located by marginal checking and replaced during this period. Other troubles experienced were caused by a defective paper-tape punch on the delayed-output Flexowriter, and failure of programmers to use the si stop magnetic tape order when recording.

Minnesota Mining is now working on a triacetate tape for us to replace mylar as they have been unable to get a definite commitment from Dupont on the supply of unspliced mylar. Triacetate is stronger than acetate, though not as strong as mylar, but it does not stretch like mylar. Stretching has been the main cause of failure of mylar tape.

3. LIBRARY ACCESSIONS LIST

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

Library Files

No.	Source	Title
2566	Willow Run Rsch. Ctr.	MIDAC Automatic Computer (Brochure)
2570	ONR/London	Computers at the Federal Institute of Technology, Zurich
2577	Lincoln Laboratory	Symbolic Design of Digital Computers

Laboratory Files

No.	Author	Title
M-2461	C.Fleming-M.Demurjian	Instructions for the Use of the Flexowriter-Verifier Equipment
M-2465		S&EC Biweekly, 10-19-53

4. ADMINISTRATION AND PERSONNEL

Terminated Staff (J.C.Proctor)

G. A. Murdoch
D. Goldenberg

New Non-Staff (R. A. Osborne)

James Mahoney has returned to the Laboratory and is now a member of the Whittemore Building janitor crew.

Charles Muhle is a new technician in Group 64, temporarily assigned to the Construction Shop.

John A. O'Brien is a new technician in the Construction Shop.

Ralph Porter is another new technician in the Construction Shop.

Terminated Non-Staff

Gordon Kane
Michele Rheume
James MacDonald