Digital Computer Laboratory
Massachusetts Institute of Technology
Cambridge 39, Massachusetts

SUBJECT: BIWEEKLY REPORT, APRIL 18, 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 301 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 38 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.

It may be noted that progress reports have not been submitted for all of the problems that have made use of machine time. A report is required of an outside programmer after he has made use of 120 minutes of machine time or has had ten runs on WWI since his last report. For all other cases the programmer is allowed to evaluate his progress and decide whether his work during the two-week period merits a report.

The factor analyses that were carried out in cooperation with Dr. F. M. Lord of the Educational Testing Service, Princeton (Problem #112) have been analyzed and found to be satisfactory. Final results will be reported in the periodical literature.

Work has been begun on the following problems. Detailed descriptions will appear in future biweekly reports when each of the programmers involved submits his first report.

Problem #	Title	Originator
174 C	Tight Binding Calculations in Crystals	G.F.Koster, Solid State and Molecular Theory Group
175 C	Impurity Levels in Crystals	G.F.Koster
176 B	Connector Provision in Automatic Telephone Exchanges	B.Marrows - Elect. Eng. Dept.

177 D	Low Aspect Ratio Flutter	H.M.Voss Aero. Eng. Dept.
178 D	Trajectory Study Against an Evading Target	C. Block Instrumentation Lab.
179 C	Transient Temperature Response of a Box-Type Beam	L. Schmit Aeroelastic Lab.
180 B	Crosscorrelation of Blast Furnace Input-Output Data	R.G.Mills and H.J.Scholz Elect. Eng. Dept.
181 C	Perturbed Coulomb Wave Functions	R. Zimmerman Nuclear Science Lab.

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 suitably programmed arithmetic, cycle-counting, and output facilities.
:DCL Staff: Arden, 52 hours; Best, 80 hours; Combelic, 58 hours; Demurjian, 22.75 hours; Denman,61 hours; Frankovich, 40 hours; Helwig, 70 hours; Kopley, 6 hours; Porter, 4 hours; Siegel, 42 hours; WWI, 1373 minutes

The S&EC system of utility tapes has been in limited use during the past biweekly period. However, mistakes in the system are still being found and corrected.

Staff

(15,15) and (30,0) PA routines are being written for use with CS II. The programs will be used from tape (rather than from the drum) during the conversion process.

Helwig

An automatic post-mortem program differing slightly from the one recorded on unit 0 at the present time has been written and will be recorded on unit 0 in the near future.

Arden

The optimizing, recording, re-recording program described in the last biweekly seems to be working now.

Best

A conversion post-mortem for CS II has been written and tested. A preliminary form of the program was found to operate satisfactorily. The program will be revised slightly and will then be included as a permanent part of the CS II conversion program.

Siegel

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.); Briscoe, 36 hours; Simpson, 20 hours; Walsh, 20 hours
:DCL: WWI, 214 minutes

In addition to completing the checking out of a combined correlation spectrum program, the group has been working on several straight computational projects. One of these is the continued use of travelling spectral estimates of seismic traces as a means for categorizing non-stationary properties of these series. Another project involves spectrum factorization techniques in determining linear operators rather than Gauss methods. Finally an experiment has been begun for the purpose of testing a newly proposed criterion for operator selection involving multiple matrix inversion and minimum eigenvalue determination.

113 D. 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 Eng.
:by S. Sydney(Res. Assist. CMMC), 40 hours
:DCL: WWI, 341 minutes

Theoretical calculations for the moment at the midspan of the structure by the lattice analogy method have given results which agree within 10% with a photoelastic model analysis performed on a similar structure for the loading condition that has been analyzed thus far. Several more production runs will be made.

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), 15 hours
:DCL: WWI, 34 minutes

Numerical difficulties just before the shock continue to cause trouble. These are being worked on both by means of Whirlwind and by means of hand computation.

120 D. The Aerothermopressor. This problem is concerned with the development of a device for increasing the stagnation pressure of a hot, high velocity gas stream by means of evaporative cooling. The analytical investigation being carried out on Whirlwind I involves the step-by-step solution of seven simultaneous non-linear differential equations which describe the thermodynamic and dynamic behavior of the compressible flow within the Aerothermopressor.
:for Professor A.H. Shapiro, Department of Mechanical Eng.
:DIC 5-6985, ONR N5ori-07878
:by B.D.Gavril(DIC), 36 hours
:DCL: WWI, 96 minutes

Computations during the last two biweekly periods, both of which are covered by this report, were concerned primarily with revision and improvement of existing calculation procedures. Most of the productive computer time was used for testing these new programs.

The difficulty associated with numerical calculations in the vicinity of the speed of sound has been eliminated in the case of specified gas stream properties, such as Mach Number or temperature. Under these conditions the solution to the aerothermopressor equations does not possess a singularity, and these equations were rearranged to avoid the appearance of the quantity $(1-M^2)$ in the denominator of sensitive terms. This revision is of considerable importance since transition from subsonic to supersonic flow, and vice-versa, can now be effected without any special computational procedures.

A subroutine for treating aerothermopressors containing a variable diameter plug within a concentric, constant diameter cylindrical shell, was written and successfully tested. This program is now available for computations relative to the large aerothermopressor facility

now under construction in the MIT Gas Turbine Laboratory.

The subroutine handling the computations of entropy have been made a permanent part of the basic program. Since the entropy depends only on the stream properties and is not needed for continuation of the solution, it is computed only when the stream properties are printed.

Considerable effort is now being directed toward developing and programming a calculation procedure for systematically determining optimum performance of the aerothermopressor. This procedure, which is somewhat analogous to the Ritz method, involves a completely numerical approach to the variational problem associated with optimum aerothermopressor performance and will be discussed in later reports.

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), 25 hours
:DCL Staff: Demurjian, .5 hours; Porter, 1 hour; WWI, 131 minutes

The new program for calculating the Slichter Kernel is working with the exception of the subroutine for series calculation of $J_0(a)$ and $J_1(a)$. One trouble was found in the criterion for the smallest term kept. This was corrected but the subroutine still does not work satisfactorily. The routine will be retested, step by step.

The program for the analysis of the kernel has run through three complete relaxations and stopped when the square-error term increased. This is being run for a case in which the intermediate values have been hand calculated.

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 AR33(616)2038
:by D.T.Ross(DIC), 10 hours; Turyn, 140 hours; Hamilton, 40 hours
:DCL: WWI, 53 minutes

This report covers the work done on this problem during the last four weeks. Part 1 of the Data Reduction program is now operating correctly. Part 2 is being tested. The rest of the program has been written and will be converted as soon as Part 2 operates correctly.

The last table necessary in the program has now been fitted by a polynomial.

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: Demurjian, 1.75 hours; Denman, 1 hour; WWI, 88 minutes

On April 6, the laboratory was host to 37 visitors. Twenty-three had attended the Industrial Liaison Conference on "Control Applications in Business and Industrial Systems", 10 were from MIT, and the remaining 4 represented various laboratories in this area. These people were shown several slides, given computer and Flexowriter demonstrations, and were conducted on a tour of the laboratory.

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 6873
:by J.H.Runyon(E.E.Res.Assist.), 20 hours
:DCL: WWI, 56 minutes

The interpolation setup routine was tested successfully. Some correct results were obtained with the function inversion routine and it will probably be suitable for the purpose intended. The iteration process used in it does not converge very rapidly and would need to be made more efficient if the routine were to be used extensively.

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.), 10 hours
:DCL: WWI, 49 minutes

The program was run with special force constants inserted to serve as a check against a similar equation where the results were known. The results agreed. Further work is anticipated which will speed up the present program and make it more flexible so as to be usable for other cubic crystals. Also, the effect of varying the values of the atomic force constants is to be investigated.

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 6853
:by Dr. D.J.Howarth(DIC), 36 hours
:DCL: WWI, 108 minutes

Testing of the routines is nearing completion and the final production work will start shortly. Several modifications to existing routines have been made to enable further problems to be carried out without reproduction and conversion of the program tape each time.

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: WWI, 91 minutes

Specification of the five day pressure anomalies for half a hemisphere by means of fourteen numbers (standardized coefficients of orthogonal polynomials) for selected winter months of 1947 through 1952 has been completed.

It is intended that within the next two or three biweekly periods tests will be made to determine the most effective grid within which to specify the pressure pattern. The problem of specification will also be looked into from the standpoint of accuracy and its effect on making the specification variables better predictors.

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, DDL
:by A. Balser(Res. Assist., Columbia University)
:DCL Staff: Demurjian, 5.75 hours; WWI, 20 minutes

After making suitable checks, it was decided that the results from the test run for $0 \leq \alpha < \pi^2$ were correct for the interval used in the trapezoidal rule, but that this was not sufficiently accurate.

To obtain the additional accuracy desired, the intervals used in the trapezoidal rule were taken smaller around the singularity of the integrand. Corrections were made in the program to introduce these changes, and, so far, a successful run has not been obtained.

Once a successful run is completed on the above, the final section of the problem will remain to be done, i.e., the section for $-30 \leq \alpha < 0$.

A successful run was made for $200 \leq \alpha \leq 300$ in steps of 5.

163 C. Ferrite Phase Shifters in Rectangular Wave Guide; transcendental equation. The electromagnetic boundary value problem dealing with the nonreciprocal ferrite phase shifter in rectangular wave guide has been solved. Special cases (assuming negligible magnetic losses) of the resulting complicated transcendental equation have been computed by hand. Additional computations by machine are required to investigate other ferrite materials and to establish a frequency dependence. Since magnetic loss is a figure of merit for the system described, it is essential that some investigation be made. For cases in which the losses are significant the system will be a nonreciprocal ferrite attenuator. The numerical solution will be obtained by operating on two simultaneous transcendental equations.
:for Dr. Benjamin Lax(DDL)
:by K.J.Button(DDL), 80 hours
:DCL Staff: Denman, 1 hour; WWI, 119 minutes

This report covers the past four weeks. The attempt to perform Part I (assuming negligible magnetic losses) for a ferrite slab thickness of 2 mm. failed because the programmer's choice of the starting parameter, β_{MIN}, was too small. The program has been modified to reject automatically such unsuitable values and proceed to values large enough to satisfy the physical conditions. The program has also been modified to seek, automatically, the maximum value obtainable. Both modifications were found to be necessary when these endpoints became unexpectedly sensitive as the ferromagnetic resonance region was approached. The program for Part I is now performing very successfully. In addition to the data obtained at a frequency of 9375 Mcps., Part I has predicted the engineering design conditions required for the construction of a nonreciprocal phase shifter at a little more than half this frequency. An investigation of a new ferrite material which may be more suitable for phase shifters at this new frequency has also been successful.

Part II (yielding the attenuation constant) has had several poor performances. The delayed printer gave slightly scrambled results on one occasion. One slight change was made to automatically reject unsuitable values of α_{MIN} (similar to Part I above) but the Flexowriter duplicator made an error in the reproduction of the tape. When these matters were straightened out, a successful run was obtained. (See Lincoln Laboratory Quarterly Progress Report, Division III, March 31, 1954.) An effort is now being made to extend the curves into the region of the sensitive end points.

Three successful performances of Part II for parameters near resonance have predicted the necessity for modifying the program to handle ranges of α (ratio of α_{MAX} to α_{MIN}) as large as 1000.

166 D. Construction and Testing of a Delta Wing Flutter Model is being effected by replacing the actual wing by a structurally equivalent lattice network. An iterative procedure involving the evaluation of a matrix equation has been evolved for determining the bending and torsional stiffnesses of the component members of the network.
:for M. M. Chen (DIC)
:by S. Gravitz(Res. Assist. Aero. Eng.), 48 hours
:DCL Staff: Demurjian, 1.25 hours; Porter, 3 hours; WWI, 78 minutes

All of the routines corresponding to matrix algebra, both for matrices, each element of which is a single known number, as well as for matrices, each element of which is a combination of known coefficients of unknown quantities, have now been completed and satisfactorily tested.

A first draft of one cycle of the coordinated, integrated program for the solution of the problem has been set up. This involves approximately ten tapes fed into Whirlwind I in succession, theinput for each tape depending upon the outputs of the tapes preceding it. Of the five tapes that have been tested so far, four are working properly and the fifth is being corrected. Due to the extreme length of the program, many programming errors have crept into the tapes and are being weeded out.

Plans for the immediate future include first obtaining a properly functioning first cycle for the program, and then inserting in the program a criterion which is now being evolved to insure automatic iteration of the solution to the desired accuracy. When this program is successfully completed, it will be possible to go through a complete analysis of a lattice network wing in a small fraction of the time it has taken to evolve the program in the first place.

167 D. Transient Effects In Distillation are being calculated by solving sets of simultaneous non-linear ordinary differential equations using numerical integration methods. Several of the most important types are being explored and results of specific cases will be correlated.
:for Professor E.R.Gilliland, Chemical Engineering Department
:by J.F.O'Donnell(Res.Assist. CMMC), 80 hours; Polk, 40 hours; Smith, 40 hours; Myers, 20 hours
:DCL: WWI, 232 minutes

Work was done during this period on three different problems, all for binary mixtures.

For the problem of take-off in batch distillation, a program was written to calculate the instantaneous product composition as a function of time, using a second-order Runge-Kutta numerical integration method. The initial conditions in the system are calculated by the machine at the start, given the parameters of the system, using an iterative method. Also the average production composition during the take-off period is

calculated from the instantaneous values, using Simpson's rule. Periodically in the course of the calculation a material balance is made on the system. This serves as a check, primarily on the truncation error.

During this period, the program was checked. Several programming and coding errors were eliminated. It was determined that for the initial set of parameters the interval size was limited by stability problems. With the maximum satisfactory increment size (1000 increments/case) the results were deemed accurate in the fourth significant figure. This being resonable, the program is now being used to determine satisfactory increment sizes for other sets of parameters.

J.F.O'Donnell

For the problem of transients in continuous distillation the past two weeks have been spent debugging the following two programs: 1. determination of initial and final steady-state conditions by an iterative method; 2. determination of the change in product concentration with time after a step change in feed concentration or reflux ratio. This involves solution of a set of equations similar to those described under the first problem and again a second-order Runge-Kutta is being used.

These programs have been operated successfully now. The major difficulty was locating the reason for a convergence failure in the first program. It is hoped that considerable data may now be obtained using these programs. Each set of parameters will take about one minute in the first program and ten to fifteen minutes in the second program.

A third program has been drawn up which will determine the changes necessary in the reflux ratio with time in order to keep the product concentration constant when a step change is made in feed concentration. If time permits this program will be tested.

J. Polk and A.T.Smith

For the problem of tune-up in batch distillation, a program has been written. It is expected that this will be tested during the coming biweekly period.

J. Myers

171 C. Improved Power Spectrum Estimates are to be obtained by investigating modifications to existing techniques for the numerical calculation of Fourier cosine transforms to minimize the effects of truncation and to supply a confidence curve, based upon the interval variations of the calculations, which will help to evaluate the significance of the resulting spectrum estimate. The object is to obtain a method which will give significantly better power spectrum estimates than can be obtained using existing techniques.

:for J.E.Ward, Project Engineer, Servomechanisms Laboratory
:by D.T.Ross(DIC), 50 hours; Hamilton, 30 hours
:DCL: WWI, 122 minutes

Several test runs with the improved Fourier Transform program which uses weighted means have been made. As predicted the use of Simpson's rule in the multiple integrations involved causes the results to grow. The amount of growth corresponds exactly to the theoretical result. For this reason, the other version of the program which uses equivalent weighting functions and has only one integration will proabaly prove more desirable. CS II conversion difficulties with this tape have prevented testing so far. Both programs have been modified to plot all of the spectra on one frame after the completion of a run so that trends can be observed easily.

172 B. Overlap Integrals of Molecular and Crystal Physics. Two-center overlap integrals are to be evaluated between various Slater atomic orbitals, which are of the form: (power of r) x (exp -ar) x (spherical harmonic). By use of prolate spheroidal coordinates, formulas in terms of simple functions can be derived for these integrals but are unsatisfactory because they are of formidable complexity and have false singularities. The integrals are evaluated by recasting the expressions in terms of spherical Bessel functions of imaginary argument, which can be generated by a high-speed computer.
:for Professor J.C.Slater, Physics Department
:by F.J.Corbató(Res. Asst.,CMMC), 50 hours
:DCL: WWI, 111 minutes

The main subroutine, which calculates the basic overlap integrals, has been tested. The numerical accuracy achieved was found to be 7 significant figures, which should be quite adequate for the physical cases of interest.

At present, several auxiliary routines are being written which form useful combinations of these integrals. In addition, a curve fitting subroutine has been attempted but has not been entirely successful because of poor convergence and excessive oscillation in the iteration scheme.

For testing purposes the new CS II direct Flexo read-in scheme has been used and found to be very convenient and time-saving since no 556 punch-out is required.

173. MIT Course 6.537 Spring Term 1954. Twelve students have enrolled in the Electrical Engineering course 6.537, entitled Digital Computer Applications Practice, being given by Professor C.W.Adams. The purpose of the course is to study the advanced preparation of coded programs for automatic, electronic digital computers, in particular, for Whirlwind I. This study will include techniques for handling storage and terminal equipment, detecting errors and mistakes in programs, the control of scale factors, and the use of subroutines. Each student will program, prepare on punched tape, and execute on Whirlwind, one problem of his own choosing, making use of the CS II computer.
:DCL Staff: Combelic, 4 hours; Demurjian, .5 hour; WWI, 95 minutes

Problem 173-108 is concerned with the solution of a matrix equation by the Crout Method. The program has been worked to a successful form on a 3 x 3 . matrix and is now ready for use in a program which requires solution of a matrix of order 20 x 20.

P.F.Marino

Problem 173-102 is concerned with the evaluation of the spurious response of an ultrasonic delay line and is being done as partial credit for course 6.537. It has been found necessary to write (30,0) Programmed Arithmetic routines. This has been programmed and run successfully. At present 80% of the entire program has been coded and it is hoped that it will be completed soon.

J.B.Dennis

Problem 173-103 is concerned with taking a set of points for a function which can be defined over a period and resolving this function into its Fourier components. The program has been coded and trial runs have been partially successful. Results for a step function are nearly correct and at present the program is being run again to check the accuracy of these results and the method used.

W.J.Eccles

1.3 Operating Statistics

1.31 Computer Time

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

Programs	60 hours, 02 minutes
Conversion	20 hours, 11 minutes
Magnetic Drum Test	32 minutes
Magnetic Tape Test	51 minutes
Scope Calibration	24 minutes
PETR Test	03 minutes
Demonstrations (#131)	1 hour , 28 minutes
Total Time Used	83 hours, 31 minutes
Total Time Assigned	92 hours, 59 minutes
Usable Time, Percentage	89.8%
Number of Programs	301

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	50.6%
	Output	15.0%
2.	Computer Time Lost Due to Programmers' Errors	
	Technical	16.2%
	Logical	8.7%
3.	Computer Time Lost Due to Other Difficulties	
	Tape Preparation	1.1%
	Operators' Errors	1.0%
	Terminal Equipment Malfunction	4.2%
	Miscellaneous	3.2%

1.33 Tape Preparation

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 and 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	115	70	45	9
No. of Registers	24942	2020	150	
Time Consumed	71hrs.37min.	41hrs.22min.	3hrs.54min.	4hrs.46min.

Thus, it may be seen that the average length of an original complete tape is 217 registers requiring 37.4 minutes to prepare. A typed modification averages 28.9 registers in length and requires 35.5 minutes to prepare while manual modifications average 3.3 registers and require 5.2 minutes for preparation.

2. ACADEMIC PROGRAM

Course 6.537. Students in this course, which is being given by Professor C.W.Adams, have begun programming their individual problems. As of this date, none of the problems has been completed and the majority of the students are in the process of debugging their programs and making trial runs on the computer.

Most of the students have been making use of 10-212, the Program Preparation Center in the main building, to prepare their own tapes, to submit their performance requests, and to receive their results and post-mortems.

Course 19.33. On 13 April, J.D.Porter of the DCL Staff presented the first of a series of three lectures to be given as part of Professor T. Malone's course 19.33 on Applied Climatology. In addition to the graduate students enrolled in the course, about 12 staff members in the Meteorology Department attended. The first lecture covered the general subject of digital computers. The other two lectures will discuss programming.

Seminar on Advanced Programming Techniques of the Digital Computer Laboratory Staff. On 9 April, Professor C.W.Adams gave a talk on "Recent Developments in the Digital Computer Field Including Current Trends and New Computers." This talk concluded the series of lectures in this seminar for the academic year.

Seminar on Computing Machine Methods. On 6 April, Professor James B. Reswick of the Mechanical Engineering Department spoke on "An Electronic Analog Device For Delay Line Synthesis."

CS Programming Course. This course will probably be given again during the first two weeks in May.

3. COMPUTER ENGINEERING

(S.H.Dodd)

Estimates by computer operators of the usable percentage of assigned operation time reveal a reduction in computer reliability during the past biweekly period. Failures of the -450-v supply, wiring errors which caused a breakdown in the power-distribution system, and terminal-equipment troubles account for a large part of the loss of application time.

The supply presently being used for -450-v is overage and will be replaced sometime during the next biweekly period. The troubles in terminal equipment were in sections associated with the magnetic-tape and the magnetic-drum systems. Difficulties were encountered when using the delayed-print-out facilities, and on several occasions the group and address-selection operation failed on the buffer drum.

Marginal-checking lines are being installed in the delayed-print-out system, and the number of lines now checked on the buffer-drum system is being increased to cover additional circuitry in an effort to prevent recurrence of these malfunctions.

3.1 WWI Systems Operation

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

A core-memory parity alarm occurred on 4 April. The cause might have been tap shorts in two cathode-follower tubes. The tubes were being used to drive the core-memory matrices. Until this alarm occurred, no parity alarms had appeared from 11 March to 4 April.

3.12 Magnetic Tape (A.X.Perry)

Facilities for marginal checking of the delayed print-out have been installed this week, and work towards reaching an efficient preventive-maintenance program will begin.

Some of the difficulties encountered in the delayed print-out system during the last biweekly period were traced to two suspected bad thyratrons, two Clare-type relays with dirty contacts, a poorly seated 20-pin power plug, and four poor Amperex 1N38A crystals.

Two instances of damaged magnetic tape have occurred, and it is necessary to say that the dynamic operation of the tape system depends upon many factors, one of which is the care of the reels of tape. From now on, reels of tape will not be removed from the control-room area. When not in use, all reels will be stored in their respective slots in the metal boxes which have been provided for each group.

Until a training program for all systems technicians is initiated in the near future, no one is authorized to perform any mechanical adjustments or changes on the tape mechanisms except the writer.

3.13 Typewriters and Paper Tape (L.H.Norcott)

Modifications have been completed on two of the three FL Flexowriters which we received a few weeks ago. The third is now being modified and will be ready in about a week.

A recent occurrence points out the importance of properly logging all cases of equipment failure. Apparently, operators have been experiencing difficulty over a period of about a month with the delayed-output punch dropping code holes, but it was only brought to our attention a few days ago. The cause of the trouble has not been located definitely yet but appears to have been caused by a faulty thyratron or relay in the magnetic-tape print-out control register.

3.2 Terminal Equipment

3.21 Magnetic Drums (K.E.McVicar)

Some trouble was experienced with the buffer-drum system during the past biweekly period. The symptom was failure to select the proper drum group. Trouble-shooting was difficult because the malfunction was intermittent, and we could not aggravate the condition by varying voltage margins on any of the pertinent drum lines. The error was finally traced to the combination of a weak gate-buffer plug-in unit and failure of a gate level to rise sufficiently. These troubles were in in-out control and in circuits not usually checked during the marginal-checking routines. This oversight has now been corrected.

(H.L.Ziegler)

Installation of the new magnetic-drum-PETR monitor system took place on 29 March as expected. Except for a few minor items still to be checked, this system is now complete, and all prints are being brought up to date.

The parity digit for buffer-drum groups 4-7 should be in operation sometime during the coming week (April 12-18). All that remains to be done are several installation day "tie-ins" and a chassis modification.

4. ADMINISTRATION AND PERSONNEL

Staff Terminations (J.C.Proctor)

Milton I. Brand
Jack S. Gillette

Non-Staff Terminations (R.A.Osborne)

Donald Bowman
Gloria Clark
Robert McClellan
Marian Oken

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