Digital Computer Laboratory
Massachusetts Institute of Technology
Cambridge 39, Massachusetts

SUBJECT: BIWEEKLY REPORT, JULY 27, 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 174 coded programs were run on the time allocated to the Scientific and Engineering Computation (S&EC) Group. These programs represent part of the work that has been carried on in 22 of the problems that have been accepted by the S&EC Group. Progress on 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.

Progress on the three comprehensive systems being developed by the S&EC Group is described under problem numbers 100, 140 and 150.

The system described under #100 is now complete with title punch-outs. The only additions contemplated for this system are new output routines. Direct output typing is now automatically available and it is expected that delayed printing via magnetic tape will be made available in the very near future. The program used for this system is referred to as CSM7. The 556 drum input program will be modified so that programs prepared for the summer session course will be handled by a special read-in program.

There were no new problems initiated during this period. Production runs have been completed in problem #120 (Aerothermopressor study) and a report is being prepared by Bruce D. Gavril of the MIT Mechanical Engineering Department.

The filming of the S&EC Group movie "Making Electrons Count" is nearly completed. It is hoped to have a version of the movie available for a showing to the ACM meeting at MIT in September.

1.2 Programs and Computer Operation

100. Comprehensive System of Service Routines: Demurjian, 19 hours; Frankovich, 21 hours; Helwig, 7 hours; Kopley, 11 hours; Porter,7 hours; Vanderburgh, 6 hours; WWI, 166 minutes

No further changes are contemplated for CSM7, the comprehensive system for conversion of Flexo programs to 556, except for occasional additions of new output subroutines. Titles are now being punched on 556 tapes and the new scope decoders setup is being used during the display of title and flad tables.

Frankovich

Errors were found in two of the scope post-mortem programs. These have been corrected.

Vanderburgh

The following modifications for the 556 drum input program are being written and tested and will be added as a group to the program when their testing is completed.

(1) The input program is being modified so that proper read-in will occur when one bank of ES is used.

(2) An entry point for the mechanical reader will be provided on drum group 11.

(3) The program will be modified so that the si707 instruction which selects the drum for recording blocks of tape on group 0 can be changed to an si703.

(4) The program will be modified so that the contents of the accumulator at the end of the bo which records blocks of tape on group 0 will be checked.

(5) The program will be temporarily modified so that tapes beginning with the special symbol SSSS will not be read in by the drum input program. Control will be transferred in this case to a special read-in program to be written for the summer course.

Helwig

The entry blocks to provide delayed printer output via magnetic tape automatically when requested by MOA(cf.E-516-2) have been written for decimal fraction, decimal integer, fixed point with scale factor, floating point with scale factor, floating point without scale factor, minus sign, plus sign, space, tab and carriage return. Another block was written to be used at the end of a recording on magnetic tape. This will be called in by the request "MOA." which means that a decimal point will not be available by itself as a special character in delayed printing. The new use of "MOA." will give a lower case, carriage return, and a stop character.

These entry blocks were written to be used with auxiliary blocks that are already being used with TOA entry blocks. Some of the TOA blocks had to be changed to obtain this added flexibility.

These blocks will be tested and when results are satisfactory this new version will be recorded for CS use.

Demurjian

101. Optical Properties of Thin Metal Films: WWI, 42 minutes

The results printed out appear to indicate that the successive approximation method for the optical constants converges. The index of refraction was found, but once this was accomplished theprogram no longer reset the absorption coefficient. Manual calculations from this point onward using the intermediate results printed out indicate that if the absorption coefficient had been reset the correct result would have been obtained.

Loeb

106. MIT Seismic Project: Simpson, 10 hours; WWI, 439 minutes

During the past two weeks our group has derived the following results;"error curves" and individual errors for some 32 linear operators and 260 auto-and cross-correlation curves. The latter, 100 lag correlation curves, would each require about 2 weeks of hand computation, but take about 1 minute of WWI machine time.

Robinson

108. An Interpretive Program: Zierler, 80 hours; WWI, 31 minutes

The time used this period was devoted primarily to an initial test of a large new interpretive program. It is expected, of course, that a considerable amount of trouble shooting will have to be done. Results from the initial test have just been received and will be studied as soon as possible.

Zierler

112. Lawley's Method of Factor Analysis; Characteristic Vectors (modified): WWI, 8 minutes

The supplementary check program does not work satisfactorily. Further production runs will be delayed until the error in this check program has been corrected.

Denman

114. Design of Optical Instruments: Mahoney, 20 hours; Combelic, 4.5 hours; WWI, 40 minutes

The revised version of the standardized ray-tracing program was successfully tested and then used to trace thirty rays through two different optical systems.

Mahoney

116. Torpedo Impulse Response; Convolution: Hamilton, 50 hours; Frankovich, .5 hour; WWI, 50 minutes

Four out of eight runs were successful. Of the unsuccessful runs, one was due to trouble in the read-out program, one due to a missing 7th hole in the impulse response data tape, and two due to PETR trouble.

The Fourier transform data is still being processed. We will proceed during the next biweekly period with more detailed corrections to the impulse responses already estimated and convolve these corrected responses with the various inputs.

Kramer

119. Spherical Wave Propagation: Fox, 13 hours; Combelic, 2 hours; WWI, 56 minutes

A successful run with useful results was achieved July 18. Further results would have been desirable but an error occurred probably due to the coasting of magnetic tape after a rerecord mode causing two block markers to appear between one pair of blocks on the tape.

Fox

120. Thermodynamic and Dynamic Effects of Water Injection into Gas Streams of High Temperature and High Velocity; Simultaneous differential equations: Gavril, 30 hours; WWI, 598 minutes

With more than 25 different runs dealing with the effects of injection rate,

water injection velocity, friction factor, and area variation, considerable information was obtained during this biweekly period which has already led to a better understanding of the Aerothermopressor process.

Recent calculations of flow conditions corresponding to the singular solution of the differential equations, as discussed in the previous biweekly, indicate that successful operation of the Aerothermopressor is highly contingent upon proper Mach number control by means of suitable area variation throughout the supersonic region of the flow. It was found that too rapid supersonic acceleration led to such low temperatures that the evaporation processes, which are the heart of the Aerothermopressor, were diminished and friction again began to play a dominant, though undesired, role.

The Whirlwind I computational program planned by the writer is ended with the calculations of the current biweekly, and full effort will now be directed to the preparation of a final report on this work. This report will be in the form of an ScD. thesis for the M.I.T. Department of Mechanical Engineering. Due to the importance of exploiting the knowledge thus far accumulated by means of Whirlwind, it is planned to carry out calculations with a systematic area variation requiring about 15 minutes computer time per week. These calculations require only the customary numerical parameters associated with the program, and no additional programming will be required.

Gavril

121. Determination of Weak Signal plus Noise Probability Functions: Porter, 1 hour; Sponsler, 3 hours; WWI, 40 minutes

The corrected program was halted manually after forty minutes of operation. Results showed negative values for the convolution integral which ought to be positive-definite. The program is currently under study to determine the origin of these negative function values.

Sponsler

126. Data Reduction: Cundiff, 80 hours; Hamilton, 20 hours; Frankovich, 2.5 hours; WWI, 31 minutes

The polynomial fit program has been punched on tape by the Flexowriter and has been converted by CS. A parameter tape with functional values has gone through the same process and is being used to test the polynomial fit program. Although two runs were made, neither was significant. In the first, an operator error prevented the program from being returned from group 0 to ES. In the second, a suggested change was made at the wrong point, causing the program to loop.

Parameter tapes have been devised in order to test the polynomial fit program to find out what effect scale factoring the functional values, say by 10^5 and 10^{-5}, has on the errors. These will be run as soon as the program is working.

The program to find arc sin, arc cos, the dot product of two vectors, and the magnitude of a single vector now works and will give answers with eight place accuracy.

Ross

131. Special Problems (Staff training, demonstrations, etc.): Kopley, 3 hours; WWI, 479 minutes

The colored-film "Making Electrons Count" being produced by the S&EC Group is nearing completion. Very few scenes are left to be taken. During this biweekly

period, a considerable amount of computer time was made available for "shooting" the film computer scenes.

Much splicing is now being done on the film. Nothing has yet been done on recording a narration and musical background for the movie. Although it is not expected that the film's final version will be made available by September 11, nevertheless it is planned that the film will be shown at the ACM Meeting at M.I.T. on that date.

Kopley

132. Subroutine Study for the Numerically Controlled Milling Machine: Runyon, 25 hours; Frankovich, 5 hours; WWI, 62 minutes

Two more subroutines were successfully tested. Four more still are undergoing test. Some programming errors have been found in these, and they are to be re-run. Several of the above errors were due to an unnecessary, incorrect assignment of a relative address which caused part of a subroutine to be obliterated.

Runyon

133. Non-linear Meson Equation: WWI, 13 minutes

Programming for this problem is completed. Before discussing results, some parameters will be varied, among them the asymptotic amplitude of the solution.

Finkelstein

134. Numerical Diagonalization Procedure: Arden, 6 hours; Meckler, 10 hours; WWI, 53 minutes

The routine, which is now operating satisfactorily, is being used to solve secular equations which appear in the theory of tightly bound electrons in crystals.

Meckler

136. Matrix Equations: Arden, 14 hours; WWI, 53 minutes

A single iteration has been checked completely, but there is still some error in the sequencing of the iterations.

Arden

The following method for solving a set of linear equations $Ax = b$ is being programmed:

If $[q_k]$ is a set of vectors, and h is the solution of $Ax = b$, then $(h, A^T q_k) = (Ah, q_k) = (b, q_k)$. Thus if the vectors $[A^T q_k]$ form an orthonormal set we have

$$h = \sum_k (b, q_k) A^T q_k$$

The program starts with the linearly independent set $p_j = (\delta_{1j}, \ldots, \delta_{nj})$ and by means of the Gram process generates a linearly independent set $[q_j]$ such that $(A^T q_j, A^T q_k) = \delta_{jk}$. The solution h can be expressed in terms of these.

The program should provide a quick method for inverting matrices of moderate order. It is not to be recommended for high order matrices because of the sensitivity to round-off errors.

Helwig

137. Investigation of Atmospheric Turbulence; Autocorrelation, Crosscorrelation and Fourier Transforms: Summers, 10 hours; Kopley, 1.5 hours; Block, 20 hours; Zierler, 4 hours; WWI, 212 minutes

Several attempts were made to run Ross' autocorrelation program (#2345m10) with data tapes, 2640m1 and 2642m1. These attempts were unsuccessful due to tape preparation errors and excessive machine parity alarms; some suspicion was also cast on #2345m10 and it is recommended that #2345m8 be used for future autocorrelation programs.

The crosscorrelation program (#2751) written by C. Block and N. Zierler was run for autocorrelation with data tape 2641m1. The first run was unsuccessful due to a technical program error, but this was corrected (#2751m1) and the second run was successful. This autocorrelation function checked very well with the function obtained using Ross' #2345m8 and the same data tape. Some time was then lost due to PETR trouble and an excessive number of machine parity alarms; finally, successful autocorrelation runs were obtained with data tapes 2640m1 and 2642m1. Six successful crosscorrelation runs have also been obtained.

It is now felt that programming difficulties have been sufficiently surmounted so that assigned computer time can be profitably used. The chief bottleneck remaining is the considerable time required to hand punch the lengthy data tapes.

Summers

138. Spheroidal Wave Functions: Little, 50 hours; Corbató, 10 hours; Combelic, 3.5 hours; WWI, 10 minutes

Another part of the program was successfully tested. This part calculates the ratios of the coefficients desired, preparatory to iteration for finding the separated constant.

Part of the lay-out for printing was tested, but some coding error caused the results to be unsatisfactory.

Little and Corbató

139. Line Shape Calculation: Porter 6 hours; WWI, 53 minutes

The results obtained for the evaluation of the function $F(\mu/a)$ described in the biweekly report of 29 June by means of the Gaussian quadrature formula for $n = 15$ and $n = 16$ were unsatisfactory. However, an evaluation by means of Simpson's rule with $n = 50$ was programmed, tested and found to be satisfactory. The Simpson's rule evaluation will be used to evaluate F for 11 values of μ/a and 8 values of β/a.

Porter

140. Summer Session System: Rotenberg, 66 hours; Finkelstein, 79 hours; Gill, 76 hours; Siegel, 39.5 hours; Combelic, 7.5 hours; WWI, 3 minutes

The Summer Session Conversion program has been written and is now in the testing stage.

The error-anticipation, division and multiplication routines for the Summer Session Interpretive program have been completed and will be tested shortly.

Gill, Finkelstein, and Rotenberg

A program is being written for providing the several forms of direct-print and direct-punch output of numbers required by the summer session system. The student will use an interpreted instruction to request printing or punching of numbers either as integers or in scientific notation. The number of digits to be printed and the treatment of initial zeros will be specified by the address section of the interpreted instruction. Special treatment of the number "0" and of the forms "$x10^0$" and $x10^1$" will be contained within the output routine. Mistakes of the student in requesting insufficient digits to express the number or in requesting the output of a number which extends into the "excess" register will be detected by the routine.

The program has been written, and an initial test on WWI revealed an error which has been corrected. Further tests will be carried out.

Siegel

141. S&EC Subroutine Study: Combelic, 8 hours; Frankovich, 3 hours; Vanderburgh, 3 hours; WWI, 26 minutes

The single-step, n-equation, fourth order Runge-Kutta integration subroutine has been placed in the library of subroutines. All tests were satisfactory except that the roundoff error is somewhat larger than was anticipated. This is the subject of some further investigations.

Frankovich

The (30-j,j) delayed/direct printer subroutine described in the previous biweekly has been tested satisfactorily. The 202 register subroutine is available as a Library Subroutine as 2756 latest mod.

Combelic

150. Drum Comprehensive System of Service Routines: Arden, 5 hours; Combelic, 33.5 hours; Frankovich, 38 hours; Helwig, 46 hours; Siegel, 22 hours; WWI,0 minutes

Consideration is being given to using floating-point integers for modifying address sections of instructions. This has the advantage of requiring only one interpreted accumulator, which might be called the Number Accumulator, abbreviated NA. This scheme, however, makes it necessary to distinguish instructions from numbers. Since all words referred to by the interpretive routine occupy two registers, all the addresses referring to such words can be even. Hence the last digit of such an address is always zero and can be omitted. The largest drum address will then require only 14 binary digits. If the left-most two binary digits of an address are always zeros, then such registers can be immediately distinguished from non-zero floating-point numbers, since the first two binary digits of these are either 10 or 01. With these facts in mind the following instruction structure has been set up.

1st reg.

2	14
00	1/2 actual Drum address

2nd reg.

Mistake Diagnosis	Counter Number	Operation
5	4	7

(Since operation zero is not defined, floating-point zeros are detected by checking the operation digits.)

Manipulations with instructions are carried on in the NA using the same operations as for numbers, the interpretation depending essentially upon whether a number

or an instruction is then in the NA.

Detailed programming of an interpretive routine based on the above scheme is now under way.

The report on subroutines, which was proposed in the last biweekly, has now been written.

Combelic

1.3 Operating Statistics

1.31 Computer Time

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

Programs	33 hours, 22 minutes
Conversion	11 hours, 04 minutes
Magnetic-Tape Test	10 minutes
Magnetic Drum Test	64 minutes
Scope Calibration	77 minutes
Demonstrations (#131)	7 hours, 59 minutes
Total Time Used	54 hours, 56 minutes
Total Time Assigned	66 hours, 24 minutes
Usable Time, Percentage	82.37 %
Number of Programs Operated	174

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 indicated 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	51.5%
	Output	16.0%
2.	Computer Time Lost Due to Programmers' Errors	
	Technical	19.5%
	Logical	3.6%
3.	Computer Time Lost Due to Other Difficulties	
	Tape Preparation	2.4%
	Operator's Errors	1.4%
	Terminal Equipment Malfunction	1.0%
	Miscellaneous	4.6%

1.33 Tape Preparation

An attempt has been made to obtain some idea of the time expended in the preparation of tapes. During the past biweekly period a check was made on about 60% of the tapes that were processed. A distinction was made between original tapes and modifications since the procedures for handling these two classes are different. The following information was compiled.

No. of original tapes processed	102
Total no. of registers	17,603
Time consumed (hours)	52.95
No. of modifications processed	110
Total no. of registers	5592
Time consumed (hours)	34.82

1.4 Summary of Tape Room Bulletin Board Memoranda (H. Uchiyamada)

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

Format Specifications

In accordance with the use of long-carriage typewriters the Format Specifications have been changed. Please make the following changes in E-516-2 (Comprehensive System of Service Routines):

On page 24

item c)
Maximum value of α is now 31(instead of 15).

item e)
Maximum number of spaces between words is 2 (instead of 6).
A tab is obtained by setting $\beta = 3$ (instead of 7)

Si Addresses

Digit 10 of IOS is now used when a MT unit is selected. This changes Bulletin Board Memo #19. For details see Bulletin Board Memo #30 in the Tape Room.

2. COMPUTER ENGINEERING

2.1 WWI System Operation (N.L.Daggett)

Electrostatic Storage continues to cause a very serious loss of computer time. Although we still have cases of surface switching and tube failures, the most serious problem is the inability of the ES deflection system to return to the same spot each time with a sufficiently close tolerance. This is not a new problem, of course, but the situation has been aggravated recently by at least three factors.

1. The arrays have been expanded to make room for the mica crossbars on the newer tubes. This has effectively demanded higher precision from the deflection system.

2. We have had a great deal of difficulty getting good drift-free 715C's for the decoder output amplifiers.

3. The spot size has been reduced generally to improve erasure margins. This has made the storage tubes more susceptible to deflection shift troubles.

(L.L.Holmes)

During the past biweekly period the new spare ES digits were placed in operation. The new digits have already proven very useful.

In addition to the new ES digits, two new Delay Line Amplifiers were placed in service in ES Control. The panels replace test equipment whose presence was always considered undesirable because of the lack of blown-fuse indication and marginal-checking facilities.

2.11 Electrostatic Storage (A.J.Roberts, S.E.Desjardins)

Poor storage reliability was experienced during this period because of deflection shift and a phenolic breakdown at the gate generator for the RF Pulser. In an effort to reduce the effects of the deflection shift the plate current in the 715's in the ESD output panels has been decreased and the writing gates have been adjusted to give bigger spot size. The change in the deflection level has caused some defocusing of the beam which together with the increased spot size make the tubes more sensitive to spot interaction. A change in the high-velocity-gun second-anode voltage will be made on the next installation day to improve the focus of the writing beam.

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

Chad disposal chutes have been made for Flexowriter tables in the tape preparation room. One table has been modified to take these chutes; the remaining tables will be modified shortly.

2.2 Terminal Equipment

2.21 Magnetic Tape System (E.P.Farnsworth)

The shipment of mylar base green oxide-coated magnetic tape has been received from 3M and will be installed on all units this coming Sunday. This tape has several times the tensile strength of the standard plastic-base tape, but it should be handled with great care to avoid dirt, scratches, creases, tearing, etc. as the cost is three times as great. The greater strength should eliminate tape breakage in normal operation and the increased output amplitude will improve the signal to noise ratio.

2.22 Magnetic Tape Print-Out (E.P.Farnsworth)

Installation of WWI design panels to replace the breadboard equipment is progressing. Two final panels are in, a third will be placed in service next week, and the assembly for the fourth is now being laid-out in drafting.

The installation of a special indicator light panel in TC17 this week, facilitates marginal checking and trouble shooting of the delayed punch and print system. Two defective flip-flops in the Index Pulse Counter were found and replaced.

A sound-proof enclosure is being designed for the delayed-output flexowriter table to reduce the noise which annoys and distracts other groups when the storage and delay feature of the equipment causes its use to overlap into other scheduled periods. The effectiveness of the celotex-lined plywood enclosure in the tape preparation room indicates that this will be a better solution to the noise problem.

2.23 Vector Generator and Character Generator (F.E.Irish)

The source of the distortion of the characters produced by the character generator was traced to the vector generator. During the character displays, the vector generator produced a spurious signal originating indirectly from the IOR. These signals were mixed onto the deflection lines along with the character generator waveforms resulting in the observed distortions. This has now been corrected.

2.3 Records of Operation

2.31 Storage-Tube Complement in WWI (L.O.Leighton)

ES Clock hours as of 2400 July 16, 1953	15295.7
Average life of tubes in service in Bank B	1684
Average life of tubes in service in Bank A	1128
Average life of last five rejected tubes	492

2.4 Group 65

2.41 Storage Tubes (P. Youtz)

Further research and development on the storage tubes has been curtailed. Most of the effort of the group has been directed toward the construction and testing of 800-series storage tubes and their installation in ES row.

The operational history in the computer of the 800-series storage tubes with stannic-oxide coatings has been satisfactory. During this period it was decided that all future tubes should have a stannic-oxide coating instead of dag. This was done with the full realization that oxide-coated cathodes do not activate so well in the presence of stannic-oxide coatings. However, there have been no recent problems of tubes failing because of weak cathodes.

Work was done this period on tubes for the cathode investigation of H.B.Frost.

3. LIBRARY ACCESSIONS LISTS

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

Laboratory Files

No.	Title	No. of Pages	Date	Author
E-549	Basic Conversion Program	4	7-2-53	H. Briscoe
E-550	Open-Circuit Impedance Representation of Transistors	7	7-9-53	N.T.Jones
M-2274	Basic Circuits -- Sensing Amplifier, Preliminary Specificantions, PB #20	2	7-3-53	C. Laspina
M-2276	Test Equipment Committee, Meeting of July 3, 1953	4	7-6-53	L. Sutro
M-2277	S&EC Group Computer Forms	6	6-30-53	K.J.Campbell
M-2279	June 1953 Storage and Research Tube Summary	5	7-1-53	D.M.Fisher
M-2290	Laboratory Personnel	16	7-1-53	
M-2293	Report of First Basic Materials Conference, New York City, 6-16 to 18-53	3	7-9-53	J. Bassett
M-2299	Reorganization of the Standards Committee	2	7-15-53	(H. Hodgdon (H. Wainwright

Library Files

No.	Identifying Information	Source
2428	Investigations of Methods of Data Preparation for a Numerically Controlled Planer	Servo Lab.
2429	Proceedings of the Association of Computing Machinery, Toronto Meeting	ACM

(continued on next page)

No.	Identifying Information	Source
2432	Mangefile - The New Electronic Business Machine	Macdonald Co.
2433	A Second Progress Report on German Computer Work	ONRL
2434	Symposium on Automatic Digital Computation at the National Physical Laboratory	ONRL
B-258	Introduction to Number Theory, T. Nagell, 1951	John Wiley & Sons
B-259	Experimental Designs, W. Cochran & Gertrude Cox	John Wiley & Sons
B-260	Tables of Chebyshev Polynomials Sn(x) 2nd Cn(x)	N.B.S.

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

No.	Identifying Information	Source
D-24	A Numerical Solution of Schrodinger's Equation in the Continuum W. Futterman, E. Osborne, D.S.Saxon	N.B.S. Report No. 2259 2 copies
C-62	A Generalization of the Theory of the Purely Discontinuous Stochastic Process of W. Feller W. Dubrovski	Compte Rendus de l'Academie des Sciences de l'URSS Trans A. Katz
D-30	A Generalization of the Kronecker-Capelli Theorem on a System of Linear Equations S.N.Tchernikow	N.B.S.Report No. 2346
C-64	Analytical Differentiation on a Digital Computer J. F. Nolan	MS Thesis MIT May 25, 1953
D-31	Partial Differential and Difference Equations Dr. I. L. Schoenberg	N.B.S. INA 52-1
C-66	The EDVAC - A Preliminary Report on Logic and Design	Moore School of EE Feb 16, 1948
B-258	Introduction to Number Theory Trygve Nagell	University of Upsala 1951
B-260	Tables of Chebyshev Polynomials $S_n(x)$ and $C_n(x)$	N.B.S. App Math Series No. 9 Dec 19, 1952
D-25	Introduction to the Theory of Stochastic Processes depending on a Continuous Parameter H.B.Mann	N.B.S. Math Series #24 Feb 11, 1953
D-26	Table of Sines and Cosines to Fifteen Decimal Places at Hundredths of a Degree	N.B.S. App. Math Series #5, May 2, 1949
D-27	Monte Carlo Method A.S.Householder, Ed.	N.B.S. App Math Series #12 June 11, 1951
D-28	Problems for the Numerical Analysis of the Future D.R.Hartree, S. Lefschetz, B. Friedman, G.B.Danzig	N.B.S. App. Math. Series #15 June 29, 1951
D-29	Tables of $n!$ and $\binom{n+1}{2}$ for the First Thousand Values of n H.E.Salzer	N.B.S. App. Math Series #16
C-61	A Comparison Between Theoretical and Experimental Pressures at Subsonic Speeds about a Haack Body H.J.Hauer	NAVORD Report 2027 Inyorken, Calif.
C-63	The Numerical Solution of Non-Linear Differential Equations by the Method of Steepest Descent J.W.Fischbach	Ballistics Research Lab Aberdeen Proving Grounds, M
C-65	Lists of R, E, and M, Series Memos	Internal Distribution MIT

No.	Identifying Information	Source
C-67	Computation of the Transonic Flow Over a Wedge with Detached Shock Wave by the Method of Steepest Descent J.W.Fischbach	Ballistic Research Lab Aberdeen Proving Grounds, Md.
C-68	Proceedings of the Association for Computing Machinery	Jointly Sponsored by the Assoc. and the Univ. of Toronto
C-69	Library Routines	Univ. of Illinois
C-70	A General and A Programmer's Description of the Logistics Computer	G. Washington Univ.
C-71	Electronic Business Machines--A New Tool for Management	Harvard Grad Sch. of Bus Admin.
C-72	Notes on Programming for the SEAC Computer	Various Authors
C-73	A Functional Description of the EDVAC	Moore Sch of EE

4. PERSONNEL

New Non-Staff (R. A. Osborne)

Constance De Caprio is a new messenger girl.

Frances Dobrovalsky is a clerk in the Tape Preparation Room.

Barbara Godfrey is a Laboratory Assistant in Group 64.

Terminated Non-Staff

Cornelius McLaughlin