Digital Computer Laboratory
Massachusetts Institute of Technology
Cambridge 39, Massachusetts

SUBJECT: BIWEEKLY REPORT, February 27, 1953

To: Jay W. Forrester

From: Laboratory Staff

1.0 SYSTEMS OPERATION

1.1 Whirlwind I System

1.11 Operation (F. J. Eramo)

The following is an estimate by the computer operators of the usable percentage of assigned operation time and the number of computer errors for the period 13 - 26 February 1953:

Number of assigned hours	111
Usable percentage of assigned time	91
Usable percentage of assigned time since March, 1951	85
Number of transient errors	44
Number of steady-state errors	8
Number of intermittent errors	14

(N. L. Daggett)

Recent changes to the check-register panels have accomplished two quite desirable results: (1) the alarm buffer amplifiers are brought within the check-register check loop and are therefore under marginal-checking control; (2) the logic of the check-register check operation has been so changed that it requires less than 1 microsecond for completion instead of the more than 2 microseconds previously needed. Since this has been the determining factor for the wait time which must precede a restoration, the way is now open for a considerable reduction in the time required for a restoration cycle. However, such a change will have to proceed cautiously in order to avoid unforeseen timing difficulties. Some compensating delay will probably have to be added to the ES Read cycle to allow adequate deflection setup time.

1.11 Operation (continued)

(D. M. Fisher and C. L. Corderman)

In preparation for the installation of storage tubes having a mica cross spacer, the storage array in WWI is being slowly expanded about the horizontal and vertical centerlines. In addition, the common-increment supply voltage is being raised in small steps and the level of the deflection lines has been adjusted for proper centering. These changes have caused some loss of storage reliability from tubes failing to hold positive spots properly in the portions of the storage surfaces which were previously unused. With some use, however, the new areas appear to operate properly.

The tubes only in Digits 15B and 5B have been interchanged in an attempt to separate the numerous troubles shown by Digit 15B into those caused by the tube and those caused by equipment in the 15B digit column. At least one type of trouble followed the tube in that the tube in Digit 5B has now switched positive as it was doing previously in Digit 15B.

1.12 Component Failures in WWI (L. O. Leighton)

The following failures of electrical components have been reported since February 13, 1953:

Components	No. of Failures	Hours of Operation	Reasons for Failure
Capacitors			
.001-mfd 300-V.	1	7000 - 8000	Internally broken pig-tail
Crystals			
D-358	1	4000 - 5000	Loose + lead
	16	15000 - 16000	Drift to low R_b
1N34A	3	4000 - 5000	High R_f
Resistors			
5000-ohm 8-watt w/w $\pm 1\%$	2	7000 - 8000	Below tolerance
Tubes			
2C51	1	12000 - 13000	Open heater
C16J	1	4000 - 5000	High arc drop
	1	5000 - 6000	High arc drop
C3J	1	16000 - 17000	High arc drop
6SN7	1	12000 - 13000	Short
	1	16000 - 17000	Low I_b
6X5GT	1	9000 - 10000	Low I_b
6Y6G	1	16000 - 17000	Short

1.12 Component Failures in WWI (continued)

Components	No. of Failures	Hours of Operation	Reasons for Failure
Tubes			
7AK7	1	0 - 100	Low I_b
	1	2000 - 3000	Grid emission
	1	1000 - 2000	Short
7AD7	5	0	Short
	1	5000 - 6000	Short
	5	9000 - 10000	3-Low I_b; 1-short; 1-leakage
	1	12000 - 13000	Low I_b
	3	15000 - 16000	2-Low I_b; 1-leakage
	5	16000 - 17000	2-Low I_b; 2-short; 1-leakage

1.13 Storage-Tube Failures in WWI (L. O. Leighton)

The following storage-tube replacements were reported during this biweekly period:

ST-733-1 was rejected after 135.4 hours of operation because of failure to hold a positive array.

ST-549 was rejected after 4470.1 hours of operation because of weak high velocity gun.

RT-344-C-1 was rejected after 2050.2 hours of operation because of failure to hold a positive array.

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

Following is the storage tube-complement as of 2400 February 26, 1953:

Digit	Tube	Hours of Installation	Hours of Operation
0 B	ST-619-C-1	10069	2664
1 B	ST-711-C	11989	644
2 B	ST-603	8322	4411
3 B	ST-601	8524	4209
4 B	ST-516	6641	6092
5 B	ST-730-1	12223	510
6 B	ST-604	10827	1859
7 B	ST-540	7937	5796
8 B	ST-739	12729	4
9 B	RT-347-C	10782	1951
10 B	ST-700-C	10917	1816
11 B	ST-717-C-2	11793	940
12 B	ST-742	12639	94
13 B	RT-346-C	10756	1977
14 B	ST-624-C-1	10507	2226
15 B	ST-729-1	12600	133
16 B	ST-716-C-1	11702	1031
16 A	ST-613	9046	3687

ES Clock hours as of 2400 February 26, 1953 12733

Average life hours of tubes in service 2225

Average life hours of last five rejected tubes . . . 1352

During recent weeks many storage tubes have been replaced merely to install as many new type tubes as possible. Accordingly the figures on tube life are of very much less significance than before this program was started.

2.0 CIRCUITS AND COMPONENTS

2.1 Circuits by System Number

2.13 Arithmetic Element (S.L. Thompson)

Change in the control circuits to eliminate a gate and delayed pulse generator has made operation of the control more reliable. However, the operation of the diode circuits cannot be considered satisfactory yet.

Diode Gate (R. Callahan, I. Aronson, A. Heineck)

Diode gating circuits are being investigated in a general manner. Design curves for the "and" gate, the "or" gate, and the "and-or" combination have been obtained.

Capacitor Storage Circuit (R.Callahan, I. Aronson, A. Heineck)

A general analysis has been made of the capacitor storage circuit to determine its suitability as a shifting mechanism in a high-speed accumulator.

Transistor Flip-Flop (E. Cohler)

During the past two biweekly periods, work has proceeded on the design and characterization of the transistor flip-flop. The flip-flop which is being studied is the common-emitter, two-transistor flip-flop triggered in the emitter. The investigation has led to a careful scrutinization of the causes and qualitative character of the hole-storage effect. Much has been learned about the parameters which influence the turn-off time in a transistor. This material will appear in a future note. In addition to the hole-storage study, methods of compensation for the flip-flop waveform are being studied. It is hoped that this will lead to a flip-flop which will operate at high prf's with a good waveform; the present tack looks promising.

2.14 Input-Output

M.I.T.E. (R. Paddock, A. Werlin)

The wiring and testing of the one rack of modified M.I.T.E. is essentially complete and has been used with the computer during the past week. Provisions have been made to clear and complement both counters to provide fixed spot presentation to the CRT filter for its calibration.

The block diagram, block schematic, layout, and wiring diagrams for the buffer storage registers to be used with the modified M.I.T.E. have been completed, and the wiring of the panels is proceeding according to schedule. It is expected that two registers should be completed by the next biweekly period; testing of the storage can begin about that time.

The decoder-output amplifiers have been mounted in rack K-2; within the next week, the CRT filter should be tied in with the M.I.T.E equipment.

2.2 Vacuum Tubes and Crystals

2.21 Vacuum Tubes (H.B. Frost)

Additional stocks of 6145 vacuum tubes have been received. At the present time, a sufficient number of these tubes is available to supply our current needs, but thus far the required preburning has limited severely the number which can be issued. Tested stocks are on the ragged edge, with most tubes being needed as soon as the testing is complete.

A shortage of 6AN5 tubes has been holding up the 2^6 low-speed counters. Lincoln Labs has loaned us enough tubes to take care of this immediate requirement.

Other tube types are either in stock or promised for early delivery in sufficient quantities to avoid difficulty. No serious delays caused by lack of vacuum tubes are foreseen.

On February 25, a meeting of JETEC 5.5 (Joint Electron Tube Engineering Council, subcommittee on vacuum tubes for computers) was attended. A questionnaire is being prepared by this group to be circulated to all computer activities in this country to determine use, practice, and life experience with pentode tubes. Formats for the specification of triodes and multigrid tubes for computer applications are being prepared. These formats spell out the points to be controlled for computer tubes and specify the sort of curves to be presented when tubes are registered. Such formats are used on a voluntary basis by tube manufacturers when new types are issued.

Some data has been taken on time variations of cathode interface impedance associated with 0.1 to 1.0-second transients. It is expected that this material will be presented to the Physical Electronics Conference at MIT in April.

Raw data for the calculation of SR1407 life has been obtained from the card file on this type. These calculations will be made by March 5.

Mr. Charl Cillié, an engineer in the sales organization of the General Electric Company, visited the Laboratory on February 26. He will handle tube sales to this Laboratory and other computer groups, at the same time maintaining effective liaison for tube-application problems. This promises to be a much more satisfactory arrangement than we have had previously with General Electric.

Visits are planned during the first two weeks of March to Sylvania headquarters in New York City and to the Owensboro plant of the General Electric Company. Engineering details of the tubes to be used in future development work will be discussed.

Additional progress has been made on my thesis work. Preliminary measurements have been made which indicate the feasibility of my method of approach. In addition, the status of my thesis proposal has been somewhat clarified. Extensive work should begin in the near future.

2.21 Vacuum Tubes (continued) (S. Twicken)

Circuitry for the last remaining unit of the new tube tester, the intermittents detector, has been designed and is ready for drafting. The Lincoln Drafting Department, scheduled to do the detailed mechanical design of the tester, has already postponed starting of the project two weeks.

A filament-current metering device for the Lab tube testers has been built and debugged. It consists of a 20:1 current transformer on which had to be wound and calibrated a tapped primary and a tapped compensating winding for the voltmeter.

500-hour data is being taken on the second life test of 5687's and 5963's. The 5963's are ~~being~~ run at a higher heater voltage and the 5687's at a lower heater voltage than the first test (rated conditions) on which the 5963's developed a higher interface resistance on the conducting side; in the same test, the 5687's while developing no interface, showed a difference in plate current between on and off sides apparently dependent on heater voltage during life.

2.22 Transistors

Transistor Accumulator (D.J. Eckl)

The accumulator has been operating 3100 hours.

The accumulator was shut down most of the past period for the installation of marginal checking for the transistor panels. The procedure for marginal checking is being developed, and the margins will be determined during the next few days. This system should make it possible to eliminate the less desirable transistors from the accumulator.

Life Tests (D.J. Eckl)

At a recent meeting with Professor Adler, it was decided that the destructive effects of temperature and humidity on transistors would be determined by his group. The life tests at Whirlwind will attempt to determine useful life under normal conditions.

Transistor Core Driver (S. Oken)

The emphasis in the work on the transistor core driver will be shifted from obtaining as large an output as possible to obtaining information as to which types of transistor circuits are best suited to drive cores. Although currents as high as 80 ma have been obtained from the transistor itself, the conditions of operation which lead to these high currents are not safe ones for the transistors. The maximum current pulses which can be safely obtained from transistors will be determined after the running of extensive life tests by the transistor group.

2.3 Ferromagnetic and Ferroelectric Materials

2.31 Magnetic-Core Materials (D. R. Brown)

Approximately 4500 cores for MTC have been delivered to Group 62. An additional shipment of from 10,000 to 15,000 cores from General Ceramics will be required in order to provide all of the cores needed for MTC. At present we have approximately 16,000 good cores which have passed the first screening test.

Memorandum M-1830 by James R. Freeman presents some pulse characteristics of MTC-type cores which are being placed on life test. His data indicates that the cores should not be operated at currents exceeding 1.1 ampere-turns and that the magnitudes of the undisturbed-one outputs vary proportionaly with the cross-sectional areas of the cores. Another report being prepared by Philip K. Baltzer shows the dependence upon signal ratios from the array upon the driving-pulse duration. The signal ratios from the array deteriorate rapidly as the pulse duration decreases towards one microsecond. A minimum driving-pulse duration will be established.

The first microphotographs of General Ceramics' square-loop ferrites have been obtained by Group 35. More photographs will be required before a correlation of microstructure and pulse behavior can be completed.

New Materials (B. Smulowicz)

Pulse tests have been performed on MF-1363, a General Ceramics' ferrite with a switching time of 2 μsec.

A new Deltamax core received from the Arnold Engineering Company is of theoretical interest. The pulse tests indicate very high selection ratio with a switching time of 40 μsec.

A new investigation has been made of several representative materials to provide data for a theoretical study by Phil Baltzer. The characteristic points for these materials have been arbitrarily chosen to correspond to optimum operating conditions in a coincident-current memory array.

Core Response (N. Menyuk)

The switching coefficient calculation $(H - H_o)$ ts has been completed with eddy-current considerations included. The work on core switching due to domain-wall motion has been included with the work of John Goodenough; an E-note covering the entire switching mechanism is now being typed.

Magnetism Seminar Reports (N. Menyuk)

During the past two weeks, twelve additional memoranda based on A. Loeb's Seminar on Magnetism have been printed. These reports cover meetings 24 to 34, inclusive, and an appendix.

2.31 Magnetic-Core Materials (continued)

D-C Hysteresigraph (R. Pacl)

The basic components of the d-c hysteresigraph have been determined. After talking with Gilbert of Weston, the Inductronic 1411 d-c amplifier has been selected as the null detector. He assured us that the magnitude of thermals and other similar error sources could be minimized to a considerable degree. The Brown X-Y function plotter has been selected for a recorder. Its characteristics are apparently comparable to the L & N equivalent; delivery will be much better.

A refined version of the present 60-cycle hysteresigraph is also being contemplated.

Effect of Current-Pulse Duration (P. K. Baltzer)

An experiment has been completed on the effect of current-pulse duration on the pulse response of cores that will be used in MTC. This experiment is in the process of being written up as an E-note.

The most pertinent information obtained from this experiment is that pulse operation is marginal for current pulses as short as 1.5 μsec in duration. A 64 x 64 size array seems to be the limit for reliable operation of the MTC cores. Calculations have also been made on the basis of using the "Helping Hand" technique, with results that indicate greatly improved operating margins.

Temperature Tests (J. D. Childress)

Plans and equipment are complete for a series of temperature tests to be made in the next period. These tests are to determine the temperature dependence of ∂_1, ∂_2, 1_a, 0_a, 1_d, τ_{od}, NS_1 and NS_2.

A second series of tests is being planned for τ vs T at different values of I for several material and I vs τ at fixed T.

Plug-In Units for Use in Test Logic (J. D. Childress)

Several questions have been asked about the results reported in M-1845. Further tests have been made and a revision of the memo is in process.

2.31 Magnetic-Core Materials (continued)

MF-1326B, F-291, Life Test No. 1 (J. R. Freeman)

Memorandum M-1830 which reports the results of the initial tests on the Life Test No. 1 has been distributed.

MF-1326B, F-291, Life Test No. 2 (J. R. Freeman)

Extensive information has been obtained on the variations of pulse-voltage outputs as a function of magneto-motive force. The tests were performed for 10-μsec. pulse duration. Results indicate a sharply defined region between 0.8 and 1.1 ampere-turns for which core operation is optimum.

Preparation of Ferromagnetic Materials (J. Sacco, R. Maglio)

Compounding of series of ferric oxide-nickelous oxide and ferric oxide-magnesium oxide is now underway. In each of these mixtures, samples have been prepared at 5-mol % intervals over the range of 0.30 - 0.70 mol fraction of Fe_2O_3 and at 10-mol % intervals outside of these limits.

A standard procedure for ferrite preparation is being developed. The steps involved are as follows: weighing, dry mixing, calcining, wet grinding, dehydrating, primary reaction, wet grinding, dehydrating and adding binder, granulation, forming, and firing.

At this time, the greatest concern is that of dehydrating the sample after wet mixing. Two methods are now employed--evaporation and filtration. Filtration is satisfactory but, due to the solubility of some of the components, this method cannot always be used. Long evaporation periods detract from an almost ideal method of dehydration but plans are now being made for infra-red radiation evaporation which should reduce the time required in this step by a considerable amount.

Magnetic Ceramic Toroids (G. Economos)

About 400 F-109 toroids have been fired covering the variables outlined in previous reports. No particular difficulties were encountered except that the manganese-ferrite toroids adhered; this series shows large grains on the surface. In most cases, it was impossible to separate the stacked toroids without breaking them. Platinum shims were used, permitting separation, but gave considerable trouble as they too adhered to the ferrite. A number of repeat firings must be made to replace the broken toroids.

The modified core winder has not been able to wind these F-109 toroids satisfactorily. It is desired that a uniform layer of as many as possible (over 125) of #30 wire be first laid down, then 100 turns of evenly spaced #28 wire for the secondary. The ends of the wire from each winding should be at least 10 inches long for use in making Curie Temperature measurements. There will be a total of some 700 toroids to be wound. The task of testing these toroids will be run parallel with the wound-core supply.

2.31 Magnetic-Core Materials (continued)

Production Tests (J. W. Schallerer)

The results of the temperature check, while inconclusive, indicated a definite trend in core output voltage. It was found that in general the core output increased as the temperature was increased. The range covered was from 22° C to 50° C. The room temperature during production testing has been found to vary from 22° C to approximately 28° C. The most extreme case of the ten cores tested in the temperature check gave a variation of 7 millivolts for this temperature range.

(W. J. Canty)

Production tests on MF-1326B, F-291, cores are progressing smoothly. To date, approximately 4500 of these cores have been completely tested and delivered to Group 62 for inclusion into memory arrays.

Production Testers (W. J. Canty)

A trip to General Ceramics was made last Tuesday, February 24. The semiautomatic core tester designedand built at General Ceramics was put into operation and found to work satisfactorily. In a few days time, when a core sorting device has been attached to this machine, it should be used for most of the pulse tests on MF-1326B, F-291, cores there.

(R. F. Jenney)

A semiautomatic tester employing quite different techniques from those in the present tester is being developed.

The present tester has been partially debugged and is working marginally. A new body will be machined to relieve the present difficulties (mostly jamming).

(J. W. Schallerer)

A memorandum on the production tester is being prepared. It will cover procedures for setting the tester up for operation and pertinent information for maintaining the unit properly.

2.32 Magnetic-Core Memory

Memory Test Setup I (S. Fine)

An E-note titled "Driving Current Margins on Memory Test Setup I" has been written and will be printed and distributed soon. An E-note on the effects of a half-amplitude z-plane disturb pulse on magnetic-core memory-plane operation is in the final stages of preparation.

2.32 Magnetic-Core Memory (continued)

Memory Test Setup I has been operating satisfactorily during the past biweekly period. Occasional errors have been assumed to be due to line transients.

Memory Test Setup IV (Ceramic) (J. L. Mitchell, R. S. DiNolfo)

Memory-plane #5 has been replaced by a new plane which will be called memory-plane #6. This new plane contains MF-1326, F291 cores and is much smaller than the other 16x16 planes that have been built. It is only 1 3/4-inch square. The previous 16x16 planes containing F291 cores were 3-inch square. Plane #6 is operating in a satisfactory manner, and the signal to noise ratio is about the same as that of plane #4.

Work on obtaining data to compare the two switch-core biasing modes is progressing.

Memory Test Setup V (E. A. Guditz)

The address registers for Memory Test Setup V are now in operation. All of the test-logic equipment is mounted and will soon be in operation. Work is now being done on the display decoders. The memory rack has been received; as soon as its panels arrive, they will be installed. The filament panels for the memory rack have been received and wired.

Digit-Plane Driver (C. A. Laspina)

The possibility of driving the digit plane through a transformer is being investigated. Results from some tests show that driving the digit plane through a transformer may be feasible with the correct transformer and proper terminations.

Testing of 32x32 Memory Plane (A. D. Hughes)

A tester for individual cores in a 32x32 memory plane was devised, and the first plane for MTC was tested. Currently, the tester is being improved for faster and simpler operation.

2.33 Magnetic-Core Circuits

Stepping-Register Improvements (G. R. Briggs)

The capacitor-coupled stepping register is being intensively investigated in order to improve it to the point where it can be extensively applied in low-speed (i.e., 100 kc) applications. The apparatus to test a four-or eight-bit binary counter is being assembled, and, as soon as the basic stepping register circuit is perfected to the point where it seems completely satisfactory, a binary counter will be constructed of the circuits and testing commenced. It

2.33 Magnetic-Core Circuits (continued)

is planned also to start testing 20 or more junction diodes under actual pulse conditions by using the diodes to charge capacitors from core outputs. Monitoring of the capacitor charges will detect drifting of the diode characteristics which are serious in the capacitor stepping-register circuit.

Capacitor-Coupled Stepping Register (H. K. Rising)

As another approach to the capacitor-coupled stepping-register problem, circuits are being investigated which employ a delay line in the link between cores. Two circuits have been built and partially tested. One employs junction diodes and a low-impedance line (about 20 ohms). The other circuit uses point-contact diodes and a 1000-ohm line. Difficulty has been experienced with the junction-diode decoupling time. With the line lengths used, this decoupling time is an appreciable fraction of the delay so that the registers with junction diodes tend to be unstable. The high-impedance circuits were investigated to make use of the better decoupling characteristics of point-contact diodes. A single core coupled back on itself through a 0.5-μsec, 1000-ohm line has operated at 1 megacycle. This circuit must be expanded into a register of some length before any definite statement can be made about reliable operating speed, however.

2.34 Ferroelectric Materials

Ferroelectric Hysteresigraph (C. Morrison)

A temperature test was started on some ferroelectric materials made some time ago by F. Vinal. The only sample tested previously (DCL-2-59A) has a squareness ratio of +0.6; this was the best ratio we have seen up to this time.

A problem developed when we found that some of the samples were too thick for the amount of driving voltage that was available. An attempt was made to lap down a sample that had been tested previously, but the preliminary results show that lapping tends to affect the characteristics of the material adversely. This problem will be studied further.

2.4 Test Equipment

Test Equipment Committee (L. Sutro)

A piece of test equipment now being considered by the Committee is a General Radio variable delay line built on the form usually used for a potentiometer. A sample is being circulated among engineers for trial. Delay is 0 to 0.8 μsec; characteristic impedance is about 700 ohms. Attenuation is between 30 and 35%. Distortion of the wave form that occurred in an earlier model has been greatly reduced by making the ground plate not of sheet copper as before, but of thin fingers of copper printed on plastic. The paths of eddy currents have thus been greatly reduced. The Committee will appreciate suggestions as to characteristic impedance, total delay, and allowable distortion. General Radio is willing to try to meet our specifications.

Test Equipment Headquarters (L. Sutro)

Please keep small tools and parts off the top of oscilloscope. Such things have fallen through the air vents to cause shorts. Recently, a piece of metal shorted a grid to ground, destroying the tube.

The first Burroughs High Frequency Pulse Generators have arrived. They have the same range as the Whirlwind Variable Frequency Clock Pulse Generator and have a reversing switch to invert the pulse. As delivered, they failed to give the full 32-volt amplitude at the highest frequency setting. Two changes recommended by Dick Best made the amplitude at this frequency over 40 volts.

Besides experimenting with changes in this Burrought unit, we have done the following work:

Standard Test Equipment		Oscilloscopes	
Repaired	1	Repaired	5
Inspected	69	Inspected	1
Video checked	69	Adjusted	7

2.5 Basic Circuits

(B. Remis)

Work is continuing on a high input-impedance flip-flop. The flop-flop is designed to drive the diode switching gates of a diode adder; it is triggered from the relatively high-impedance diode gates without an intervening trigger tube.

2.6 Component Analysis

(B. Paine)

During the last biweekly period, reliable components discussions were held at the International Resistance Company and the Sprague Electric Company concerning resistors and capacitors. The meetings will be summarized in M-notes to be issued shortly.

2.6 Component Analysis (Continued) (B. Paine)

Equipment for rapid testing of electrolytic capacitors has been built which will enable the capacitors to be tested for leakage current, dissipation factor, and capacitance, all at the rated voltage of the capacitor.

2.7 Memory Test Computer

A-Register (R. Pfaff)

The A-register has been tested and seems to work well with good margins.

B-Register (R. Pfaff)

The B-register has been tested. Corrections for prf sensitivity are being made.

Live Register (R. Pfaff)

The live register is complete and will be tested when tubes are available.

Accumulator (R. Hughes, R. Gerhardt, H. Anderson)

During the last biweekly period, the accumulator underwent the following tests successfully:

1. The partial-sum flip-flops and carry flip-flops were cleared.
2. All 1's were added into the partial sum.
3. All 1's were added in again, thereby creating a carry in each digit.
4. The command carry was performed next.
5. At this point the partial sum has all 1's. 1×2^{-15} is added to the partial sum thus sending a high-speed carry the full length of the register.
6. The partial-sum and carry flip-flops were cleared.
7. The number 0.101 010 101 010 101 was added in.
8. This was cycled right 3 times.
9. The same number was added again.
10. Step 5 was repeated.

If the accumulator did not perform the above test successfully, the test stopped and an alarm occurred.

The above test was designed so that every gate tube and buffer tube was tested at a time when it should pass a pulse and at a time when it should not pass a pulse.

2.7 Memory Test Computer (Continued)

During this test, the screens of the gate tubes were marginally checked separately and simultaneously. When checked simultaneously, the screen grid of all gate tubes could be reduced from +90V to +52V before an error occurred. The screens of all flip-flops could be varied from +55V to -45V before an error occurred.

All pulse amplitudes, durations, rise times, and general appearances were checked and found to be excellent.

Control (P. R. Bagley)

It has been agreed that the initial version of the MTC Control element will be kept as simple as possible. The original plan has been revised in order to make simpler the addition of new instructions at a later date.

The block diagram of control is in the process of being redrawn to conform to the latest changes.

Toggle-Switch Storage (J. Crane)

The toggle-switch-storage panel and the 32-position crystal-matrix-switch panel for MTC will be completed by March 18, 1953.

Construction has not begun on the cathode followers that drive toggle-switch storage. This cathode-follower panel is the only panel for toggle-switch storage that is not in production.

Miscellaneous Panel Design (P. R. Bagley)

The following panels have been designed and drawn:

Video Distribution Panel, MTC - Mods. I and II
Crystal Mixer Panel, MTC - Mods. II, III, IV, and V
Marginal Checking Pulse Mixer, MTC - Mods. I and II
Video Test Jack Panel, MTC.

The shop has already completed the sheet-metal work on the first order.

Cabling (P. R. Bagley)

All the indicator wiring is completed. The installation of control-pulse-output (CPO) cables to the A-register, B-register, accumulator, and "live register" (about half the total number to be installed) will be completed within a few days.

2.7 Memory Test Computer (Continued)

MTC Power Supplies (R. G. Farmer)

The design of the power supplies for MTC is completed except for the amplifier section of the regulator. Construction has been started on the rectifiers. The drafting on the series-tube section of the regulator is completed, and the regulator auxiliary supply is in Drafting. It is hoped that the amplifier section of the regulator will be in Drafting in another week.

MTC Publications (P. R. Bagley)

The MTC Instruction Code has been decided upon and will be published soon in an M-note entitled "Memory Test Computer: Guide to Coding and MTC Instruction Code".

A brief description of the Memory Test Computer is being prepared as an E-note.

Decoder Panels (H. Henegar)

The decoder panels have been interwired and are now installed in the computer. Final tests are awaiting arrival of the tubes.

3.0 STORAGE TUBES

3.1 Construction (P. Youtz)

The construction and processing of all 700-series storage tubes was continued this period with the improved techniques outlined in the previous biweekly report. Work was also continued this period on the problem of getting more uniform and closer spacing between the collector screen and the storage surface in order to obtain larger operating margins in ES row. Five storage tubes of this series had a mica quadrant spacer between the collector screen and the storage surface instead of a center post spacer. This mica quadrant spacer divided the storage surface into four distinct quadrants with a .040" strip of unusable area between quadrants. Operation of these tubes in ES row indicated that ES row was not ready for this type of tube. Therefore, we will make a series of replacement tubes for Bank B with the center post spacer.

One storage tube with a Philips "L" cathode in the high-velocity gun was constructed this period.

3.2 Test

Television Demonstrator (D. M. Fisher)

Five tubes were tested this period. ST740, ST742, ST743-1 and RT372-R2 were satisfactory. ST744-1 was marginal because of a small amount of leakage between the main collector and auxiliary collector.

A modification has been made on the Decoder Increment Generator at the TVD. It is now possible to conveniently vary the voltage between the 15th and 16th increment in both the horizontal and vertical sections. This alteration was made to facilitate the testing of storage tubes requiring different increment spacing.

A TVD signal-plate coupling unit is being constructed for the purpose of minimizing r-f pickup on the signal-plate leads.

Storage Tube Reliability Tester (R. E. Hegler)

In recent tubes where the target-to-collector spacing has been closer and more uniform due to the addition of a center post between the target and collector, the spot interaction area has become much larger. A new spot-interaction program has been incorporated in the STRT to subject the tube to more rigid operating conditions.

ST739, ST742, and ST743-1 were satisfactory at the STRT and were sent to WWI.

3.2 Test (Continued)

When ST738 was gently tapped near the target end it would make random positive and negative errors. After operating approximately 50 hours in the STRT it exhibited the lower stability failure which has been experienced in other ion-collector plate tubes.

3.3 Research and Development

Lower Stability Failure (C. L. Corderman)

None of the tubes having either vacuum or hydrogen-fired ion-collector plates has failed from internal breakdown and the accompanying loss of positive spot stability. Hydrogen firing of these plates will be continued unless further operating experience shows this procedure to be ineffectual.

Positive Switching (C. L. Corderman)

During the diagnosis of parity alarms occurring in the computer, TV observation of the surfaces frequently shows that a large portion of one of the surfaces has switched positive. In some cases, the readout from this large positive area has given the parity-check alarm. About 50% of the time, however, the tube with the positive area has just read out negative when it should have been positive. All attempts to monitor single storage tubes so that an alarm is obtained when the surface switches positive have been unsuccessful. So far these circuits have been designed to monitor elements of the tube which are involved if one postulates that the holding-beam supplies the current which switches the surface positive (i.e., the holding-gun cathode, the collector, and the signal plate.)

It has been suggested that the phenomenon which was burning out Nobleloy resistors in the deflection-plate leads might somehow be related to the positive switching. Since these resistors have been replaced with deposited carbon resistors which have better high-voltage characteristics, we may have simply exchanged Nobleloy resistor failures for positive switching of the storage surface. Exploratory investigations are now proceeding with this thought in mind.

Velocity Distribution Measurements (C. T. Kirk)

The method of improving the S/N ratio described in the last biweekly report has been tried and found to be quite satisfactory. The only disadvantage of this system is the long delay for a change in information to appear at the output due to a given change in input information.

3.3 Research and Development (Continued)

Laboratory reports on beam measurements are being read in order to obtain some background on the measurement and characteristics of electron beams.

"L" Cathode (T. S. Greenwood)

The research tube in which the "L" cathode heater had burned out during the previous biweekly period was reprocessed using an impregnated "L" cathode. In the first attempt the heater of this cathode burned out and a second reprocessing was carried out with a new heater. Despite the large amount of handling the tube had previously received, it was quite satisfactory after processing.

The major drawback to the immediate use of the impregnated cathode is the rather high heater voltage required. In order to operate at a cathode temperature of 925°C (brightness), it is necessary to use heater voltages of 9 to 10 volts. This temperature is about the lowest that can be used for satisfactory emission. Maximum beam currents of the order of 20 μa are available at this temperature. However, the cathode emission is a violent function of temperature and by raising the temperature to 1000°C, six to seven times as much beam current is available.

This is, of course, indication of temperature saturation of emission and because of non-uniform loading of the cathode such saturation may have deleterious effects on beam shape. Unfortunately this tube, RT372-R2, does not have a Faraday cage and beam measurements will not be made until the next tube is constructed.

Spot-interaction tests carried out on this tube showed a fairly small current area, but the area was a function of the heater voltage. This may be due to defocusing from temperature saturation.

The problem of mounting the impregnated cathode was bypassed in this tube by using the earlier type experimental mount. However, jigs for modifying this type cathode for use in the previously designed mount have been designed.

Pulse Readout (A. J. Cann)

Work on pulse readout continued.

The last week of this biweekly period was spent on vacation.

4.0 TERMINAL EQUIPMENT

Magnetic-Drum Systems (E. S. Rich)

Engineering Research Associates of St. Paul was visited on February 16 and 17 for a discussion of problems which have arisen during tests here on the auxiliary-drum system and to review the status of the buffer-drum system construction. The principal problem with the auxiliary system is temperature sensitivity in the new ferrite-core heads. After several weeks work, it appears that a satisfactory redesign has been obtained. Production quantities have yet to be made and tested. It is estimated that the latter may take about 6 weeks.

Assembly of the buffer-drum system is now in progress. Bay wiring of one bay is complete and system tests of the circuits in that bay are under way. Wiring in the remaining three bays is well along, so work seems to be progressing on schedule. Further difficulty with the head redesign, however, might adversely affect the schedule.

4.1 Typewriter and Tape Punch (L. H. Norcott)

Several "FL" Punches have been equipped with modified punch pins to improve their operation when perforating our heavy-weight paper tapes. To identify these modified punches, a horizontal orange band has been painted on their Jones plugs. The remaining punches will be so modified as time permits.

Fifty rolls of a new perforator tape have been delivered to us by Link Manufacturing Co. for testing on our punches. This tape, readily identified by its glossy black coating, is easily perforated on the modified "FL" Punches and is acceptable to PETR. It is less expensive than the tapes heretofore used; if it proves satisfactory after tests in the Tape Room, a larger quantity will be ordered.

The first of two "FL" Recorder-Reproducers ordered by the MTC Group has been modified and delivered to them. The second is now being modified in our shop.

Coils in the translators, readers, and punches of the above two "FL" Recorder-Reproducers are of higher resistance than those formerly furnished by the manufacturer. Actual values may be obtained from Bill Walker or Norcott.

4.2 Magnetic Tape (E. P. Farnsworth, J. W. Forgie, S. B. Ginsburg)

No computer errors attributable to magnetic tape have occurred during this report period although the usual Sunday checking has been temporarily suspended to permit auxiliary-drum testing.

4.2 Magnetic Tape (Continued)

A screw-terminal crystal-holding adapter which can be slipped over and sweated to the top slotted portion of any standard component board terminal post has been devised by A. X. Perry. These adapters will be installed in the magnetic-tape reading amplifiers and may become standard throughout Whirlwind if approved by the Standards Committee.

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

The final plug-in index-pulse counter was installed during this report period eliminating some bread-board equipment which had been a source of trouble.

Schematic sketches for the conversion of the delayed print-out from the old style Flexo-Writer to a new long carriage FL machine are complete. Cable harness and a junction box is ready to mate with the FL equipment and the bread-board control and register panel is nearly completed.

Operational use of the delayed punch-out has revealed several deficiencies which are corrected in the new circuitry. Automatic selection of punch only and seventh hole by digits zero and one respectively on the tape will be provided to permit feedout, punching converted tapes and identifying numerals, etc. as well as typing without manual intervention.

4.3 Display

Vector Generator (F. E. Irish)

The problems mentioned in the last biweekly report, with regard to the development of a vector generator, have been solved satisfactorily. These problems were: (1) the inability to align the two decoders so as to produce a resultant vector that was a straight line, and (2) the sensitivity of the system to power-supply fluctuations.

The technique developed to solve the first problem required that a null indicator be connected between the outputs of the two decoders (an oscilloscope was used). Adjustments can now be made using this visual null indicator as a guide to obtain an exact balance between the two outputs. This exact balance implies that the two outputs are identical. This can be done for all the digits. This visual display can also be used to line up the break points of the waveforms of the various digits in the same decoder. If these various outputs are aligned properly a fairly straight line can be produced for a vector.

The solution of the second problem required that all the voltages used in the system be regulated by a VR tube with respect to the -150 volt supply. Only two VR tubes are used.

4.3 Display (Continued)

Dumont 5-Inch Oscilloscope (R. H. Gould)

A Dumont Type 304-A 5-inch oscilloscope has been tried as a display scope. It has a 5ADP7 flat-faced CRT and shows definite improvement over the 304-H as to spot size and defocussing. The 304-A was designed for precise quantitative measurements and the manufacturers specifications imply that the amplifiers are more stable than in the 304-H.

Change of Camera Address (R. H. Gould)

In the interest of more efficient use of the in-out switch it seems desirable to change the camera address from si 0500 to si 00??. A strong effort to avoid this change will be made if a large number of adverse comments are received.

Indicator Light Registers (D. J. Neville)

Design of the Indicator Light Registers has been completed; circuit schematic and layout are in Drafting.

Activate Register (D. J. Neville)

The breadboard of the Activate Register is being constructed. Preliminary design includes a gas-tube holding circuit (with indicator light) and a gas-tube extinguishing circuit.

When one of the activate-register digits is selected by depressing a pushbutton, an indicator light comes "on", and remains until the computer has read out the selection.

Intervention Gate Circuit Matrix (S. B. Ginsburg)

A breadboard panel simulating the Intervention Gate Circuit Matrix was constructed and tested. A satisfactory design was reached; all sketches were sent to Drafting.

IOS Driver (S. B. Ginsburg)

The IOS Driver was designed and tested. It consists of a grounded-grid amplifier and cathode follower. Sketches for constructing two such drivers in one plug-in package were sent to Drafting.

4.3 Display (Continued)

Intensify Gate Amplifier (S. B. Ginsburg)

The Intensify Gate Amplifier circuit was designed and tested. Sketches for constructing two amplifiers in one plug-in package were sent to Drafting.

5.0 INSTALLATION AND POWER

5.2 Power Supplies and Control

Air Conditioning (R. E. Garrett)

The Air-Conditioning expansion program is progressing with all major equipment installed. Connection of the new refrigeration piping with the existing system is anticipated within the next month. I have been familiarizing myself with the power-supply and control situation with regard to adequacy of power and coordination of control with the existing WW system.

D-C Power Supplies (S. Coffin)

The -150-volt, 10-amp power supply is being rebuilt. It will be exchanged for the Whittemore 150-volt, 50-amp supply in order to have adequate capacity for WWI -150 volts.

6.0 BLOCK DIAGRAMS (J. H. Hughes)

The modifications to dm described in M-1793 have been made. M-1868 will describe logical changes which have been made in the check-register check system.

7.0 CHECKING METHODS

7.3 Checking Circuits (J. H. Hughes)

On February 26 the system for checking the check register on cp and sp was changed. M-1868 tells all about it.

7.4 Marginal Checking (J. H. Hughes)

We have run into some minor delays in the building of marginal checking, Mod II, but we should still be able to meet the estimated April 19 installation date.

8.0 MATHEMATICS, CODING, AND APPLICATIONS

8.1 Programs and Computer Operation

Progress on problems accepted by the S&EC Group has been impeded by the fact that the solution of these problems has coincided with the development of new techniques for the use of WWI. Since most of these problems have been new ones, the location of program troubles has been complicated by concomitant clerical and conversion errors. The new techniques have now been developed to the point where tape preparation and conversion have become more nearly routine operations. Also new methods for locating program difficulties are in use. These developments are reflected in the progress described below on S&EC problems. Progress during this biweekly period on each of these problems is given in terms of programming hours, minutes of computer time, and progress reports as submitted by the programmers in question.

The introductory course on WWI for training specially qualified persons is to be offered again during the next biweekly period. Programming pitfalls and the use of magnetic tape have been the subjects discussed in the first two seminars on programming techniques.

100. Comprehensive System of Service Routines: Briscoe, 47 hours; Demurjian, 33 hours; Denman, 17 hours; Frankovich, 49 hours; Hazel, 37.5 hours; Helwig, 60 hours; Kopley, 19 hours; Porter, 30 hours; Vanderburgh, 6.5 hours; WWI, 740 minutes

A series of meetings is currently being held by the S&EC group to outline future plans for the CS. It has been decided that inclusion of the drum in the CS should begin immediately but that the following items were worth while adding to the present CS using magnetic tape exclusively:

1) completion of the version of the CS which reads in the actual programs in the CS from magnetic tape;

2) reduction of feedout on standard tape by initially storing standard tape on magnetic tape;

3) display of tape title information and flad tables on the scope.

It is hoped that these additions will become available during the next biweekly period.

Some discussion has been carried on with the Air Defense group concerning a new input program using the drum which does not occupy all of test storage. The general features of such a program were outlined and it was decided to make such a program available as soon as possible for testing purposes.

Helwig

101. Optical Properties of Thin Metal Films: Denman, 1 hour; Loeb, 3 hours; WWI, 6 minutes

It was discovered with T2265m3 for one gold film, that if R and T are the reflection coefficients of a film of optical constants n and k, $R(n,k) = R(\frac{n}{2},k) = R(n,\frac{k}{2}) = R(\frac{n}{2},\frac{k}{2})$; $T(n,k) = T(\frac{n}{2},k) = T(n,\frac{k}{2}) = T(\frac{n}{2},\frac{k}{2})$

8.1 Programs and Computer Operation (continued)

Since the program appears to be correct and checks hand calculations, this would point to a heretofore unrecognized physical situation.

The discovery made above will be analyzed for generality. Some other samples should be analyzed for this equality before the automatic successive approximation program is tested.

Loeb

102. Scattering of Electrons from Gases: Uchiyamada, 2 hours; Uretsky, 10 hours; WWI, 71 minutes

Phase I has now been completed. Phase II, which is now in progress, involves a study of new potentials to be used in the electron scattering problem.

Uretsky

103. Transmission Cross Section of Absorbing Spheres; Spherical Bessel and Hankel Functions: Demurjian, 3.5 hours; Terrell, 3 hours; WWI, 35 minutes

Tape 2360-1, which contains the complete problem, was analyzed to find the source of a loop. An incorrect order was discovered. The tape was corrected, then run, and partial results were recorded on magnetic tape. However, in reading the results from magnetic tape back into storage in order to process the results for delayed-printer-output another loop developed.

Future plans are to analyze the results obtained so far and to determine the cause of the above loop.

Terrell

104. Hydro Thermal Power System; Calculus of Variations: Demurjian, .75 hours; Cypser, .25 hours; WWI, 38 minutes

A delayed-print-out of (24,6) numbers from storage using new tape was successful. The delayed-print-out of data read backwards from unit 0 was scrambled and an attempt to unscramble it was unsuccessful. We suspect that the block-markers are inadequate for reverse reading.

In the future we will modify the magnetic tape layout on unit 0, and will attempt to print out data laid on unit 1.

Cypser

106. MIT Seismic Project: Briscoe, .5 hours; Galpin, 10 hours; Robinson, 20 hours; Simpson, 20 hours; Smith, 20 hours; Vozoff, 20 hours; Walsh, 20 hours; WWI, 72 minutes

Prediction programs utilizing three seismogram traces instead of two have been written and tested. We hope that the use of another trace in the calculations will increase the accuracy of the predictions. A display program was tested.

8.1 Programs and Computer Operation (continued)

Magnetic tape output and scope display are planned for use in the future.
Robinson

107. (a) Autocorrelation and (b) Fourier Transform, Evaluate Integrals: Frankovich, 1.5 hours; Ross, 15 hours; WWI, 59 minutes

Only two runs of the Fourier Transform (T-2235) and Autocorrelation -- Simpson's Rule (T-2346) were run during this period.

A programming error, common to both programs, was found and corrected. T-2346-4 is giving alarms where earlier modifications worked. T-2235-11 has been partially corrected, but apparently errors remain.

As soon as these programs become operative the problem will be finished.
Ross

109. Fighter Gunsight Calibration, 8th Order D.E.: Hazel, .5 hours; Hellman, 20 hours; Zierler, 3 hours; WWI, 20 minutes

Two minor difficulties in the program were corrected.

It is expected that the program will run in the very near future.
Zierler

111. Fourier Analysis--Autocorrelation Problem: Hazel, .5 hours; Zierler, 20 hours; WWI, 10 minutes

The final program for this project was written and given a preliminary run to determine optimum values for certain parameters. However, the results obtained were not satisfactory. A study is now under way to determine the source of the difficulty.

Zierler

112. Lawley's Method of Factor Analysis; Characteristic Vectors (modified): Denman, 14.5 hours; WWI, 43 minutes

It appears that the iterative program for solving the matrix equation is correct and that our latest difficulties have been due to the accumulation of round-off errors in handling the single register numbers for the 9x33 matrix. In dealing with the 4x33 matrix, however, these errors are not so large, and therefore, a trial run was made with this size matrix. No alarms occurred in the first two complete iterations of the program. After checking the program with the known solution of the equation with an 8x8 R_{ij} matrix, it is planned to start production runs with the 4x33 solution.

Denman

113. Shear Wall Analogy, Simultaneous Linear Equations: Sydney, 20 hours; WWI, 32 minutes

One sample shear wall has been analyzed and the theoretical results match the experimental data fairly well.

8.1 Programs and Computer Operation (continued)

The reinforcing steel in the wall may reach its yield point at some stage of the analysis. The present program assumes that after the rupture of the concrete in a particular section of the wall, the entire load at this point is transmitted to the steel. As the loads are increased, the steel may start yielding. The effect of such yielding will have to be considered if it occurs. A new program will be written to take into consideration such yielding.

Sydney

114. Design of Optical Instruments: Helwig, 2 hours; Combelic, 50 hours; WWI, 64 minutes

Production runs are now under way on this problem. Approximately 16 minutes of computer time is required to calculate and record the results of 4 variations. Five sets of 4 variations each remain to be calculated. This should require about one and a half hours of computer time.

One of the 12 calculations involved in each variation is temporarily being by-passed because a satisfactory program for this calculation has not yet been produced. When this difficulty is overcome, separate runs will be made for only this one calculation for each of the 24 variations. At 2 minutes per calculation, about one hour of time will be required.

Combelic

115. Transient Aerodynamic Heating of a Flat Plate; linear partial differential equation: Helwig, 3 hours; Isakson, 8 hours; WWI, 226 minutes

All runs have been completed successfully. The job is now complete. A copy of the doctorate thesis describing this work will be submitted to the Digital Computer Laboratory as a terminating report.

Isakson

116. Torpedo Impulse Response; Convolution: Frankovich, 2.5 hours; Kramer, 20 hours; WWI, 29 minutes

During this biweekly period, attempts at using the assembled tape procedure and delayed printer were made--none worked. A fourth run was made using the same tapes as in one of the unsuccessful trials but without assembly and without the delayed printer. This run was successful.

The trouble in the unsuccessful runs has not been definitely located--the computer acts as if there were one extra piece of information in one section of the empirical function, but examination of the tapes fails to reveal any such discrepancy. The possibility that the computer is reading an extra carriage return is being investigated.

The successful run involved a system function which was determined with the aid of an analog computer. The results indicate that we are close to the correct function. The analog computer will continue to be used to estimate corrections to the system functions.

Kramer

8.1 Programs and Computer Operation (continued)

117. Speech Output; Counting and Assembly: Mayer, 1 hour; WWI, 121 minutes

The prepared tape mentioned in the previous biweekly was not particularly successful. Tape 2251-7 was designed for manual intervention to allow more extensive testing for "oo", "ee", and consonants. Only the "oo" was made to sound better, but not appreciably so.

The speech produced by the present method is barely understandable, except for a few words. This is, to a large extent, due to the fact that computation of the next waveform cannot easily be done without seriously disturbing the present waveform, due to lack of computer speed. The present method will be abandoned, and the problem will be resumed after a new method has been worked out.

Mayer

119. Spherical Wave Propagation: Fox, 33 hours; Ralston, 30 hours; WWI, 72 minutes

T-2325 has now worked successfully, computing ten points near the center of the sphere and one point at the center. This represents 25-50% of the whole job.

Trouble shooting two of the subroutines to be used in doing the complete program has gotten them close to working order.

The program which will do the complete problem is continuing to be built up subroutinewise.

Fox and Ralston

120. Thermodynamic and Dynamic Effects of Water Injection into Gas Streams of High Temperature and High Velocity simultaneous algebraic equations: Gavril, 80 hours; WWI, 73 minutes

Performance requests for this period were devoted to post mortem runs of successive modifications of Tape 2338 for the purpose of obtaining the best possible precision in the computations before beginning the long production runs. The post mortems (each of 167 registers) were compared to detailed hand calculations and the effect of round-off error noted.

Future plans are to terminate the testing of Tape 2338 with a modification that incorporates a 25-register sub-program for finding the quotient of two arbitrary positive fractions with the least scale factoring, hence minimizing round-off error. This will be followed by production runs as time becomes available. Preliminary work on the third program has begun; lengthy hand calculations for checking results of the planned program are about to be undertaken.

Gavril

121. Determination of Weak Signal plus Noise Probability Functions: WWI, 9 minutes

Satisfactory results have been obtained for the first part of the program.

Porter

8.1 Programs and Computer Operation (continued)

122. Coulomb Wave Functions: Combelic, 6 hours; Uretsky, 4 hours; WWI, 81 minutes

The subroutine for calculating the two basic hyper-geometric functions has been tested satisfactorily. Future work will involve the writing of auxiliary subroutines and the assembly of these into a final program; the final program will include a self-checking single-unit-magnetic-tape (SUMT) routine and a printing program using the delayed printer.

Combelic

124. Deuteron Binding Energy and Wave Functions: Denman, .5 hours; Combelic, 4 hours

A subroutine for calculating e^{-x} is under test. No other programming has been done on this problem during the past biweekly period.

Combelic

125. Analytical Differentiation: Nolan, 10 hours; WWI, 32 minutes

The program, modified to correct the error described in the last biweekly report, was run again using the same functions and it performed correctly. In addition three other functions, representing more complex combinations of sums, differences, products, and quotients were also correctly handled.

The reordering portion of the program, which is needed to obtain second and higher derivatives, failed to operate correctly. A delayed print-out (DPO) for error analysis could not be obtained due to the DPO typewriter being inoperative. However,this post mortem will be obtained and processed as soon as possible.

Future plans are to test the program with more functions.

Nolan

128. MIT Subject 6.537 - Digital Computer Applications Practice--Spring 1953: WWI, 116 minutes

The eight registered students in 6.537 are to use WWI in the solution of individual problems. All work for 6.537 on WWI will be counted under #128 for convenience. The time used this period and planned for the next period went into individual work by each of the students on a standard programming exercise - plotting the solution to the equation of motion of a bouncing ball as it is thrown slower and slower until it finally bounces through a small hole in the "floor".

Adams

129. MIT Subject 6.68--Special Problem(Round-off Error Study; Linear First-order Differential Equation: Hazel, 1 hour; Wong, 18 hours; WWI, 9 minutes

Donald Wong is carrying out an extension of work reported by C. W. Adams in M-1036, "The Differential Analyzer Approach in Digital Computers". The object is to determine whether speed and accuracy as well as complicity of comprehension and use can be obtained by using digital "integrators" (using straight unweighted sums, a rectangular integration rule) "connected" programwise in the same way they are connected in a differential analyzer.

Adams

8.1 Programs and Computer Operation (continued)

Tapes 2422 and 2423 have been run, and answers obtained. Tape 2423 shows that the round-off error for 2048 steps of integration is $-58 \cdot 10^{-4}$. This represents 50% of the job.

Tape 2422 will have to be corrected and run over since a "srh12" order is needed in place of a "srr12" order. Use of the "srr12" order made the round-off error for this tape the same as that of tape 2423.

In the future, tape 2422 will be run over in order to determine if there is any improvement in the round-off error in the proposed method.

Wong

Computer Time	
Programs	32 hours, 38 minutes
Conversion	14 hours, 30 minutes
Scope Calibration	23 minutes
Magnetic-Tape Test	01 minute
Total Time Used	47 hours, 32 minutes
Total Time Assigned	56 hours, 03 minutes
Usable Time, Percentage	84.8%
Number of Programs Operated	155

9.0 Facilities and Central Services

9.1 Publications

(Diana Belanger)

The following material has been received in the Library, W2-301, and is available to laboratory personnel:

LABORATORY FILES

No.	Title	No. of Pages	Date	Author
E-517	A Transistor Pulse Standardizer	4	1-21-53	E. Cohler
E-521	The Low-Speed 2^6 Counter, Model II	7	1-29-53	H. Platt
M-1812	The Philosophy of Statistical Filter Design	6	1-27-53	W. I. Wells
M-1819	Revised Control System for Transistor Accumulator	2	2-3-53	D. J. Eckl
M-1830	MF-1326, F-291, Life Test No. 1-Initial Tests	3	2-6-53	J. Freeman
M-1838	Specifications for the M-1734 Transistor	3	2-11-53	B. Farley D. Eckl
M-1845	Plug-In Units as Replacements for Burroughs Units	2	2-13-53	J. Childress
M-1846	Visit to Naval Material Lab, Brooklyn Navy Yard	2	2-16-53	C. W. Watt B. B. Paine H. Hodgdon
M-1849	Proposal for Mechanical Marginal Checking	2	2-16-53	D. McCann
M-1852	Biweekly Report, Feb. 13, 1953	39	2-13-53	
M-1855	Streamlining Print Distribution	3	2-17-53	F. Manning
M-1856	Basic Circuits: Level Amplifier	1	2-18-53	C. Laspina
M-1858	Pulse Standardizer	2	2-18-53	H. Zieman
M-1861	Visit to G. E., Schenectady, Feb. 20, 1953	2	2-24-53	R. Pacl
M-1862	High-Speed Flip-Flop Cathode Followers	1	2-24-53	H. Boyd
M-1864	Streamlining Materials Control Procedures	3	2-25-53	H. B. Morley C. W. Watt
M-1866	Diode-Driving Cathode Followers	1	2-25-53	B. R. Remis
M-1867	WWI Order Changes, Feb. 26, 1953	1	2-26-53	J. Hughes
M-1869	X and Y Plane Drivers for WW Memory	2	2-26-53	D. Shansky

LIBRARY FILES

No.	Identifying Information	Source
2244	Symbolic Synthesis of Digital Computers	Lincoln Lab.
2245	A Development Proposal for a Magnetic Arithmetic Unit	Magnetic Rsch. Co.
2246	Universal A-C Isolation Amplifier Type 1-A	Seay Instrument Co.
2247	Rectangular Hysteresis Loop Materials in a Nondestructive Read System, B. S. Thesis	W. I. Frank, MIT
2248	The Rayleigh Method in Network Calculation	AIEE
2249	Dielectric Amplifiers, I	AIEE
2250	Performance Test of the Philips Model 1/4D Air Engine	Lincoln Lab.

9.1 Publications (Continued)

LIBRARY FILES (Continued)

No.	Identifying Information	Source
2251	Precise Phase Measurements up to 20 Megacycles Per Second, M. S. Thesis	B. R. Remis
2252	Estimates of Sorting Rates for Digital Computers	N. B. S.
2253	System Specifications for the DYSEAC	N. B. S.
2254	First Q. P. R. for Improving Cathode Ray Storage for Computers	N. B. S.
2255	The Application of "L" Cathodes to Electron Guns, M. S. Thesis	T. S. Greenwood
2259	A Study of the Dynamics in the Inlet System of a Four-Stroke, Single-Cylinder Engines with Inlet Pipes of Different Lengths & Diameters, Sc. D. Thesis	D. Hsi-nien Tsai
2263	The Office of Naval Research Relay Computer	ONR
2264	How to do Research with the Dept. of the Army	Dept. of the Army
2265	An Integration Procedure of High Accuracy	Ballistic Rsch. Labs.
2268	Abstracts of Problems on the BRL Automatic Digital Computers	Ballistic Rsch. Labs.
2269	The Proceedings of the All Day Conference on Quality Control	A. S. for Q. C.
2270	A Radio Quantizer	Naval Rsch. Lab.
2271	The Manchester Electronic Computer (Brochure)	Ferranti
2272	A Ferroelectric Amplifier	Philco Rsch. Div.
2274	Ferroelectric Materials as Storage Elements for Digital Computers and Switching Systems	AIEE
2275	Further Considerations in the Detection of Pulsed Signals in Noise	Univ. Illinois
2276	Fundamental Problems in the Mathematical Theory of Diffraction	N. B. S.
2277	On Small Disturbances of Plane Couette Flow	N. B. S.
2278	The Verification of an Hypothesis Concerning the Normality of Distibutions by Small Samples	N. B. S.
2279	Four Articles on Numerical Matrix Methods	N. B. S.
2280	Solving Linear Algebraic Equations Can Be Interesting	N. B. S.
2281	Chebyshev Polynomials in the Solution of Large-Scale Linear Systems	N. B. S.
2282	On the Optimal Character of the (s,S) Policy in Inventory Theory	N. B. S.
2284	The Solution of a Class of Linear Operational Equations by Methods of Successive Approximations	N. B. S.
2287	The ABCs of Radio	General Electric Co.
2289	Equipment Conditioning Systems for Rooms 2-301A and 2-306-W2-3rd Floor	Francis Assoc.

9.1 Publications (Continued)

BOOKS

No.	Identifying Information	Source
B-242	NUMERICAL ANALYSIS, D. R. Hartree, 1952	Oxford Press
B-243	TECHNICAL DATA ON PLASTICS, 1952	Manufacturing Chemists Association
B-244	NOMOGRAPHY AND EMPIRICAL EQUATIONS, Lee H. Johnson, 1952	John Wiley and Sons
B-245	ADVANCES IN ELECTRONICS, Vol. IV, L. Marton, 1952	Academic Press, Inc.
B-246	COMPUTING MANUAL, Fred Gruenberger, 1952	Univ. Wisconsin Press
B-247	HANDBOOK OF CHEMISTRY & PHYSICS, C. D. Hodgman, 1952	Chemical Rubber Pub. Co.

9.2 Standards, Purchasing, and Stock

Procurement and Stock (H. B. Morley)

The new method of processing Production Control parts lists seems to be progressing smoothly. A trial run of several lists proceeded smoothly through Stockroom, Kardex, and Purchasing. Some minor revisions may be necessary, such as provisions for transferring charges from Account #100 to the appropriate Account # indicated by the parts list.

A new method of stock control is to be adopted whereby all controlled stock will be kept in base stockroom and charged out to open stockrooms in Whittemore and Barta Building. This system will obviate the necessity of withdrawal slips by laboratory personnel. Barta Building stockroom has already been organized in accordance with the above and it is expected that Whittemore will follow this plan shortly after April 1, 1953.

A revision of the system of requisitions and orders is being contemplated with the plan in view of consolidating the distribution of copies to those provided by the order form.

The Expediting System is also being revised to assure expediting of all critical orders in advance of the required delivery date.

All critical orders will include the indication of our estimate of a delivery date and the date such order should be expedited as well as the former promised and needed dates.

9.3 Construction

Production Control (F. F. Manning)

The following units have been completed since February 13, 1953:

CR#	Qty	Title	Originator
1633-5	3	D-C Circuit-Breaker Boxes	Mercer
1633-6	6	A-C Circuit Breaker Boxes	Mercer
1633-7	3	Laboratory Benches' Wiring	Mercer
1684	5	Low-Speed 2^6 Counters	Test Equip. Com.
1952-DD	24	Video Cables - MTC	Smead
1952-EE	1	64 Wire Cable 47 ft.	Smead
1952-FF	9	Video Cables - MTC	Smead
1952-MI	6	Fil. Trans. Mount. Panel - MTC	Smead
1952-U 1952-58 2025 2141	34	Lamicoid Labels	Von Buelow Smead J. Hughes A. Perry
1952-V	25	Standard Chassis Cable	Smead
1952-W	4	Power-Distribution Cables - MTC	Smead

9.3 Construction (Continued)

CR#	Qty	Title	Originator
1952-8C	1	T.S.S. Panel - MTC (Stamp Phenolic Strip)	Smead
1952-15	8	Crystal Matrix Switch, Mod. II	Smead
1952-58	4	Selector-Plane Drive-Control Switch (Rework Phenolics)	Smead
1952-63	21	Frame-Memory Plane	Smead
1952-76A	1	Relay Output Register	Smead
1952-77A	1	Alarm Relay Panel - MTC	Smead
1984-23	6	Core Driver, Mod. VI	Test Equip. Com.
2000-11	40	Video Cables	Norman
2028	1	Mechanical Tape-Recorder Clutch Control	Farnsworth
2029	1	Filament Alt.-Reg., Mod. II	Kerby
2034-7	1	Auxiliary Panel, 16" Scope	Israel
2034-9	1	16" Display-Scope Assembly	Israel
2102	6	Transistor D-C Strips	Eckl
2120-8	21	Blanking Circuit, 16" Scope (Rework Phenolics and add to chassis)	Newitt
2133	1	Mag.-Tape Print-Out Junction Box	Farnsworth

The following units are under construction:

CR#	Qty	Title	Originator
1633-5	8	D-C Circuit-Breaker Box	Mercer
1633-7	4	Lab Benches Wiring	Mercer
1684	9	Modify Low-Speed 2^6 Counter	Test Equip. Com.
1952-MI	6	Fil. Trans. Mount. Panel	Smead
1952-V	25	Stand. Chassis Cables	Smead
1952-8D	1	T.S.S. Panel - MTC	Smead
1952-15	8	Crystal Matrix Switch, Mod. II	Smead
1952-26A	5	Indicator Panel	Smead
1952-58	4	Selection-Place Driver-Control Switch - MTC	Smead
1952-67B	2	32-Position Crystal Matrix	Smead
1952-71	1	Video-Jack Panel	Smead
1984-8	5	Core Driver, Mod. V	Test Equip. Com.
1984-12	16	Video Probe Modification	Test Equip. Com.
1984-28	6	Burroughs Test Equip. Lamicoid Labels	Test Equip. Com.
2000-12	41	Video Cables	C. Norman
2033-1	3	Tester Gt., GT-BA, Dual-BA PIU Mod. II	A. Curtiss
2033-2	3	Tester D-C FF for PIU, Mod. II	A. Curtiss
2033-3	3	Tester Switch Unit PIU, Mod. II	A. Curtiss
2034-8	1	Blanking Circuit	Israel
2093	10	D-C Extension Unit	Carroll
2025	1	Marginal-Checking Control, Mod. II	J. Hughes
2102	6	Transistor D-C Strips	Eckl
2120-7	20	Auxiliary Panel 16" Scope	J. Newitt
2127	6	Current and Voltage Calibrator	Gurley
2401-1	3	In-Out Switch Matrix	Newitt
2403-1	1	Intervention Gate Circuit	Ginsburg
2405-1	1	Numerical Display Waveform Generator	Irish

9.3 Construction (Continued)

Outside Vendors (R. F. Bradley)

P.O.	From	Title	Ord	Del	Due	Type Work
L-32075	Advance Mach.	S.T. Parts	3821	2887	1270	Mach. Work
L-31854	Browning Lab.	16" Scopes	4	--	4:1	Assy. & Wire
L-31851	Dane Elect.	D-C Power Strips	20	5	2:27	" "
L-33677	" "	" " "	50	22	2:23	" "
L-32045	" "	Pwr.-Dist.Panels	10	--	3:31	" "
L-32305	Hauman Instr.	16" Scopes	10	--	5:1-15	Complete Fab.
L-31853	" "	Buffer-Ampl.Pls.	13	--	3:18	Assy. & Wire
L-31855	" "	Select.Plane Dr's.	16	8	3:2	" "
L-32108	Hardware Prod.	S.T. Parts	1000	350	3:2 on	Mach. Work
L-32218	A.J. Koch Co.	Sensing-Ampl.Pls.	20	--	3:10	Assy. & Wire
L-32304	MacLeod&Hanopol	16" Scopes	10	--	5:15 & 6:1	Complete Fab.
F-10440	Raytheon Mfg.	Gate Buffer	1503	463	543	" "
"	"	Flip-Flop	646	153	206	" "
"	"	Dual Buffer	260	258	96	" "
"	"	Switch Tube	272	263	116	" "
"	"	19" Mtg. Panels	65	32	30	" "
"	"	26" Mtg. Panels	310	87	70	" "
"	"	Spec. Delay Lines	800	150	--	" "
"	"	Chassis Only	150	150	--	" "
L-32105	Sealube Co.	S.T. Parts	105	47	3:6	Machine Work
			9085	4865		

9.4 Drafting (A. M. Falcione)

New Unit Drawings

Title	Cir. Sch.	Assy. & PL	Al Panel
Display Gate Circuits (Cape Cod)	SE-53911	SD-53918	E-53992
Remote Station Box (Cape Cod)	none req'd.	E-54020	see assy.
16" Scope Console (Cape Cod)	none req'd.	R-53973	none req'd.
Ind. Light Registers (Cape Cod)	SB-53833	SD-53976	
16" Scope Unit Mod II (Cape Cod)		R-53754	E-53841
P.I.V. Intensify Gate Ampl. (Cape Cod)	SC-53964	SC-53964	none req'd.
Digit Plane Driver P.I.V. (MTC)	C-53685	D-53570	D-53728
Regulator Series Tube Section (MTC)	C-53684	D-53807	D-53908
Memory Address Panel (MTC)	D-53716	E-53897	R-52850
-300V Aux. Supply Sect. (MTC)	SA-53795	D-53988	D-54006
Meter Panel, Pwr. Sup. Control (MTC)	SB-53893	D-53920	D-53921
Buffer Drum Plug-in Chassis (WWI)	none req'd.	D-53752	D-53753
Power Supply Control Panel (MTC)	SD-53895	E-53983	D-53984

9.4 Drafting (Continued)

Sketch Drawings

In order to facilitate drawings out of Drafting for the Cape Cod System, the following system is being put into operation.

1. Sketch drawings of circuit schematics will be reviewed and graded as Grade 2 Drawings. They will not be redrawn at this time, unless it is found absolutely necessary. Tentative Parts Lists will be made and graded as Tentative Parts Lists.

2. Sketch layout drawings as received from engineers for the particular unit will be used as received and graded. In the event the unit is to be built by an outside vendor, a Block Method of Assembly drawing will be made.

3. Drafting will make complete drawings for the necessary details, chassis, and aluminum panels necessary for the Shop to manufacture the items involved.

In order for the system to function satisfactorily, it is very important that the engineers put their drawings on reproducing vellum paper. This will save many hours of drafting time as it eliminates the necessity of making new drawings. It is also very important that engineers pay particular attention to the use of Standard Components and avoid the use of Nonstandard Items which may take months to obtain, and which would by necessity make obsolete any layout which they may have made using Nonstandard Components. Close liaison is being maintained with John Newitt and Chan Watt.

10.0 GENERAL

New Staff (J.C. Proctor)

John D. Bassett, a new DIC staff member assigned to work with Kromer in Group 62, received his ScB from Brown University. Bassett was formerly employed as an electronics design engineer with the National Bureau of Standards.

Dean N. Arden, assigned to Adams' group, received his BS degree in EE from the University of Michigan in 1946. He was formerly employed as methods analyst at the Willow Run Research Center and the Tabulating Service at the University of Michigan.

Patricia A. Fergus has transferred from the Center for International Studies to this Laboratory and has been assigned to Brown's group. She received her AB in Math from Emmanuel College in 1944 and at that time joined the staff of the Laboratory for Insulation Research.

New Non-Staff (R.A. Osborne)

Stuart Bemis is a new Photographer to assist Lloyd Sanford.

Frank Bispham is a laboratory assistant in Group 62 assigned to the Laboratory for Insulation Research.

Edward Gear is assigned to the Construction Shop as a laboratory assistant.

William Glass is an administrative assistant in Production Control.

Roberta McCluskey is a technical assistant in the 6345 Group.

Vincent Piraino is a new shop helper in the Machine Shop.

Sergio Valdes is an MIT student who has returned to work part time in Group 62.

Edward McCluskey is an MIT graduate student working with Linvill on Project 6782.

Robert Gildea is a new technical assistant in the 6345 Group.

Terminated Non-Staff (R.A. Osborne)

James Carey
Sylvia Chaplain
Rhea Freeman
Karl Jones
Agnes O'Keefe
Evelyn Williard

10.0 GENERAL (continued)

IBM Activity (A.P. Kromer)

For the most part, our combined work with IBM has consisted of continuing the series of discussions regarding background information obtained from WWI and their 701 machine, and planning for future developments. Specific discussions during the past two weeks have covered the following subjects: arithmetic element, logical design, vacuum-tube types for magnetic-memory driver application, ferrite-core development and application, mechanical design, component standardization, and programming terminology.

A joint visit by MIT and IBM personnel was made to Signal Corps Camp Evans Laboratory to secure information regarding a new, special type of display tube under development there.