Digital Computer Laboratory
Massachusetts Institute of Technology
Cambridge 39, Massachusetts

SUBJECT: BIWEEKLY REPORT, January 16, 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 2 - 15 January 1953:

Number of assigned hours	90
Usable percentage of assigned time	76
Usable percentage of assigned time since March, 1951	84
Number of transient errors	28
Number of steady-state errors	13
Number of intermittent errors	7

(T. J. Leary)

A good deal of applications time was lost during the period because of a wiring error during one installation period which placed too high a plate supply voltage on some gate tubes in flip-flop Storage. These gate tubes determine which flip-flop register is to have the use of the flip-flop-storage Output panel. Because the plate resistors in these gate-tube circuits were gradually changing value, the trouble was intermittent, PRF-sensitive, and difficult to locate. When the trouble was present, it was impossible to read tapes into the computer.

One other large amount of applications time was lost because of inability to read in tapes. This was eventually found to be caused by improperly seated tubes which were presumably jarred loose during an installation period.

(S. E. Desjardins)

A master station of the new Teletalk Intercom has been installed in Room 222 and two others will be installed the early part of next week. Auxiliary equipment required to adapt a handset to the master station in test

1.11 Operation (continued)

control, to be used in conjunction with speaker stations, has been ordered.

The S. T. Monitor Intensifier has been installed in test control and is now in use.

Work has also been done on the proposed E-note on the functioning of test control and the test-control synchronizers.

(A. J. Roberts)

Two new ion-collector tubes have been replaced during this period because of failure to hold a plus array after what appears to be an arc discharge in the storage tube. Aside from these sudden failures, storage reliability continues to be good. One further cause of positive switching seems to originate within the storage tube which may lead to the rejection of some tubes.

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

The following failures of electrical components have been reported since January 3, 1953:

Component	No. of Failures	Hours of Operation	Reasons for Failure
Choke			
100-μh 125-ma	1	6916	Open
Condenser			
0.001-mfd mica	1	14356	Intermittent open
Resistor			
1000-ohm 50-watt w/w Koolohm	1	6914	Insulation on inside of resistor worn off so terminal was shorted to mounting clip
1000-ohm 50-watt w/w Koolohm	1	1080	Short between mounting clamp and terminal lug
220-ohm 1-watt composition type 5%	2	5376	Burn out
	1	9886	Burn out
Transformer			
1:1 Type S-193-6	1	7996	Open secondary

1.12 Component Failures in WWI (continued)

Component	No. of Failures	Hours of Operation	Reasons for Failure
Tubes			
3E29	6	1 - 6000 - 7000	Low I_b
		1 - 10000 - 11000	Low I_b
		1 - 13000 - 14000	Gassy
		1 - 14000 - 15000	Low I_b
		2 - 15000 - 16000	1-Low I_b; 1-broken envelope
6SN7	2	1 - 14000 - 15000	Short
		1 - 15000 - 16000	Leakage
6AS7	1	1 - 12000 - 13000	Gassy
6AL5	2	2 - 0 - 1000	Low I_b
6AK5	14	3 - 0 - 1000	Low I_b
		6 - 1000 - 2000	4-Short; 2-low I_b
		5 - 8000 - 9000	5-Short
6AG7	1	1 - 8000 - 9000	Short
7AD7	10	1 - 4000 - 5000	Short
		3 - 5000 - 6000	1-Mechanical; 2-low I_b
		1 - 7000 - 8000	Low I_b
		2 - 8000 - 9000	Low I_b
		1 - 9000 - 10000	Low I_b
		2 - 10000 - 11000	Low I_b
7AK7	3	1 - 3000 - 4000	Short
		1 - 11000 - 12000	Low I_b
		1 - 14000 - 15000	Short
829B	1	1 - 1000 - 2000	Leakage
12AY7	2	1 - 1000 - 2000	Short
		1 - 2000 - 3000	Low I_b

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

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

ST-606-1 was removed after 2241 hours of operation to allow installation of an ion-collector tube.

ST-721-C was rejected after 14 hours of operation because of internal breakdown.

ST-709-C-1 was rejected after 343 hours of operation because of a spot in vicinity of register 1762 which was hard to erase.

ST-719-C-2 was rejected after 31 hours of operation because tube failed to hold a plus array with V_{HG} at 140 volts.

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

Following is the storage-tube complement as of 2400 January 15, 1953:

Digit	Tube	Hours at Installation	Hours of Operation
0 B	ST-619-C-1	10069	1901
1 B			
2 B	ST-603	8322	3652
3 B	ST-601	8524	3451
4 B	ST-516	6641	5334
5 B	ST-702-C	11113	857
6 B	RT-344-C-1	10637	1333
7 B	ST-540	7937	4038
8 B	ST-549	8259	3716
9 B	RT-347-C	10782	1189
10 B	ST-700-C	10917	1053
11 B	ST-717-C-2	11793	177
12 B	ST-604	10827	1143
13 B	RT-346-C	10756	1214
14 B	ST-624-C-1	10507	1463
15 B	ST-716-C-1	11702	269
16 B	ST-533	7801	4184
16 A	ST-613	9046	2929

ES Clock hours as of 2400 January 15, 1953 . . . 11970

Average life hours of tubes in service 2230

Average life hours of last 5 rejected tubes . . 979

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 Elements

High-Speed-Carry Line (A. Heineck, R. Remis)

A 16-digit diode high-speed-carry line has been built and tested. The propagate time for 16 digits is 0.6 microseconds. A new design may reduce this time to 0.4 microsecond or less.

2.14 Input-Output (J. Dintenfass, T. Sandy)

The new plug-in-unit mounting panels to be used with the auxiliary drum were video checked. New cabling for the bi and bo orders and the auxiliary drum were installed and checked.

MITE (R. Paddock, A. Werlin)

One complete rack of MITE has been wired and inspected; sufficient plug-in units are now available to begin video checking about the first of next week. Wiring and inspection of more mounting panels is progressing steadily. Drawings for the individual mounting panels have been completed by Drafting and have been checked.

2.2 Vacuum Tubes and Crystals

2.21 Vacuum Tubes (H.B. Frost, S. Twicken)

At the present time sufficient vacuum tubes are on hand for requirements within the next few months, except for a few types on which early delivery is promised. However, the work load in the shop is extremely heavy, since large amounts of equipment built by outside concerns are being delivered. It would be appreciated if anyone needing tubes in any quantity could advise Nyberg, Twicken, or Frost several days in advance of the date needed. There may be delays in the handling of small lots of tubes returned for test during this present heavy load.

The design for Tube Tester, Mod. III, which is needed to alleviate the situation described above, is being carried forward. At the present time, the circuit schematics are essentially complete; however, only rough mechanical layouts exist. Non-standard electrical components have been ordered.

The new intermittents detector has been installed in Tube Tester, Mod. II, and is now operating. Calibration showed that the tapper had essentially the same characteristics as the older unit. The pickup time for dead shorts is about 1-2 microseconds; this time is adequate since most shorts last 100 micrsoeconds or more. This tester is being used for testing of 6145 and 7AD7 tubes and is expediting this work.

Three 5ADP2 oscilloscope tubes were received for evaluation this week. These are new precision tubes mechanically interchangeable with the 5CP1A.

2.21 Vacuum Tubes (Continued)

Early tests show them to be quite satisfactory in a 514D scope, with minor modifications in the sweep circuits. Rise time remains within the scope specification (less than 0.04 microsecond.).

2.22 Transistors

Life Tests (N.T. Jones)

A new, larger set of life tests is being planned. They will be patterned after the present life tests but will include more transistors and more tests.

Hole Storage (N.T. Jones)

Work on the relationship of hole storage in diodes with forward current and back voltage has been done. A measurement of hole storage is being set up for use on all transistors.

Measurements (N.T. Jones)

Revision of the hole storage and the rise and fall time measurements is being accomplished in an effort to put them into a form suitable for construction as individual, complete pieces of test equipment. At the present time, these measurements exist as bread-boarded circuits.

Visits (N.T. Jones)

Eckl, Jones, Oken, and Cohler discussed various common problems on Tuesday, January 6, with Lebow, Baker, and McCann of Lincoln Laboratory in Lexington.

The same four engineers visited Bradbury's group at AFCRC on Thursday, January 8, to discuss transistor circuits and measurements.

Transistor Accumulator (D.J. Eckl)

The total operating time for the accumulator is 2380 hours.

The accumulator was shut down for a week while the original low-voltage protection relays in the d-c power supply were replaced by standard relays. This should eliminate difficulties in starting this supply due to poor relay contacts.

Operation was resumed on January 12. It was necessary to replace one flip-flop and one gate before satisfactory results were obtained. Operation has been more reliable during the day than during the evenings since the shutdown.

Arcing at the contacts of the relay operating the mechanical error counter has caused some difficulty. Additional bypassing has improved the situation.

2.22 Transistors (continued)

Electronic Holding Circuit (I. Aronson)

Most of the past biweekly period was spent on the electronic holding circuit described in E-498. The unit was built up in its original form as shown in SA-53033 to confirm analytical results.

The circuit was then modified to use a 5965 in place of the 5687. In addition, the new design provides for cutting off the cathode follower in the "0" condition.

The remainder of the period was devoted to studying diode gates in an and-or-and combination.

Transistor Core Driver (S. Oken)

The problems involved in driving cores with transistors instead of vacuum tubes are being studied. The feasibility of using transistors for this job will be determined after a study of previous work done along this line is completed.

Transistor Coupling Circuit (W.A. Klein, S. Oken)

The report on this circuit has been completed and will be issued as soon as possible.

Two-Transistor Flip-Flop (E. Cohler)

The two-transistor flip-flop is under investigation for the purpose or perfecting its operation. At present, studies are being made of the d-c operating conditions for optimum operation, and of the coupling and feedback circuits desirable for best waveshape. The criteria for the determination of the optimum d-c operating point include such factors as: maximum allowable dissipation in the transistor; amount of hole storage allowable(the emitter resistance is a function of this criterion); the rise times desired (which will limit the size of external resistors); and the load conditions.

In addition to considering the d-c factors, compensation circuits will be investigated for restoring the waveshape which is distorted in going through the transistor. This distortion may result from such factors as: hole storage; transit-time effects (rise time); and stray circuit capacities.

Finally, various triggering arrangements will be studied in order to determine which is simplest and most reliable, as well as compatible with the pulse-delivering circuit. In this part of the study, certain methods for complementing at a single point will be tried; simple memory circuits for remembering previous state will be used at these points to improve reliability.

At present, the work is still in the analysis stage, and the steady state and transient theory of the flip-flop is being worked out.

2.22 Transistors (continued)

(S. Thompson)

More progress has been made toward adapting Hal Boyd's flip-flop to diode gating circuits.

2.3 Ferromagnetic and Ferroelectric Cores

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

Over 10,000 tested cores for MTC are on hand. These are now being retested and will be available for construction by January 21. General Ceramics has had considerable difficulty during the last month and has been unable to produce any satisfactory lots with the hand press which was used in making previous lots. They are now sending us 5000 cores made with the automatic press from which a 50-percent yield is expected. An additional 15,000 cores have been pressed in the automatic press and are now being processed.

Pulse-test equipment for evaluation of coincident-current memory cores was set up at RCA, Camden, on January 13 and 14. Samples were evaluated which are as good as any we have ever seen.

A new General Ceramics body MF-1359B is believed to be superior to our present body, MF-1326B. It requires approximately one half the current and will switch in twice the time.

Preparation of Ferromagnetic Materials (J. Sacco)

The difficulties being encountered on the Stokes pill press appear to be due to the automatic feeding mechanism. Two different batches were tested in the hopper. One contained Carbowax 4000 and the other, Elvanol 51-05 as binders. Both had been granulated to pass a 100-mesh screen but neither material gave a satisfactory toroid when fed in automatically. A new batch is being fabricated and will be used to test various binders in an effort to solve this problem. A number of samples containing varying amounts of Carbowax 4000, Elvanol 51-05, zinc stearate, and the General Ceramics binder will be available for testing within a week.

Domains of Reverse Magnetization (J. B. Goodenough)

A semiquantitative calculation of the necessary conditions for grain boundaries to act as nucleating centers for domains of reverse magnetization has been completed. The essential parameters entering this condition are related as

$$\frac{I_s^2 L (\cos \theta_1 - \cos \theta_2)^2}{\sigma_w} > \text{const.}$$

2.31 Magnetic-Core Materials (continued)

where I_s is the saturation magnetization, L a mean diameter of the grains, $\cos \theta_1$ and $\cos \theta_2$ the angles made by the directions of easy magnetization of two neighboring grains with the normal to their common grain boundary surface, and σ_ω is the energy per unit area which is required to form a 180° Bloch wall. When an external stress is applied to the cores, the axes of easy magnetization, formerly determined by the crystal symmetry of the individual grains, become aligned by the common direction of stress. This causes a sharp decrease in the factor $(\cos \theta_1 - \cos \theta_2)^2$ which can result in the inhibition of the formation of domains of reverse magnetization at the grain boundaries. This is believed to be an essential factor in the stress-sensitive properties of hysteresis loops which have been observed.

Core Response (N. Menyuk)

A physical model has been assumed to explain the observed core response. On the basis of this model, a calculation has been made which predicts that the product of the effective magnetic field and the switching time should be a constant for a particular material. That is, $(H-H_o) = K$

The response obtained from a 1/8-mil molybdenum permalloy core was in agreement with the above prediction.

Since a low value of K is to be desired, a study is being undertaken by Ben Gurley and myself to determine the variables which are most effective in reducing K and the extent of the reduction.

Nine additional memoranda have been printed of A. Loeb's seminar on magnetism. They include sessions 10 through 17 and one appendix.

Chemical and Ceramics Laboratory (F. E. Vinal)

Active installation of the chemical-laboratory facilities is now in progress. Only a few days are required to complete the job.

Visit to RCA Ferrite Laboratory (F. E. Vinal)

The writer visited RCA Victor's ferrite development laboratory in Camden on January 13. Equipment, procedures, and processing are very similar to our own. They have a small Stokes press also like ours and have made cores of good appearance with it. No information is available on electrical properties, however. Mr. Robert Hurley of RCA has polished some ferrite specimens for study of microstructure and had considerable success in achieving well polished specimens. He has numerous photomicrographs of his specimens but has some difficulty in interpreting the structures he observes.

2.31 Magnetic-Core Materials (continued)

Seminar on Magnetism (A. L. Loeb)

Because of illness, the seminar was not held this past week. Quantum mechanical resonance has been derived. The notes have been typed through lecture 23.

Statistical Model of Magnetism

Memorandum M-1744 has been typed and will be issued shortly.

WWI Applications to Thin-Film Research

The Biweekly Report, Section 8.1.21 for the period ending December 19 describes the problem of finding optical constants, etc., of thin metal films that is being solved in the Chemistry Department with the aid of WWI. Henceforth, the progress of this project will be reported biweekly under the heading, "Mathematics, Coding, and Applications," problem 101.

Metallic-Core Production Tester (A. D. Hughes)

Progress is being made in setting up a production tester for metallic cores with the ferrite production testers.

New Materials (B. Smulowicz)

Pulse tests have been performed on General Ceramics ferrites, MF-1312, MF-1312B, MF-1366B and MF-1131, in F-262 form, with various values of driving current. A new helipot control panel has been constructed for the Model III tester to permit more accurate current adjustment.

Toroid Preparation (G. Economos)

The preparation of toroids from the prepared standardized compositions is being delayed by a faulty die.

Production Tester (J. Schallerer)

A 50-microsecond delay multivibrator was designed and is now being constructed. A new current calibrator is also being constructed. With this calibrator it will be possible to display upper and lower limits on the scope while the core output is being read. If the output at the selected time is within the limits, the core is good.

Lot 23A of MF-1326B, F-291, was found to be disturb sensitive. $N.S._1$ and $N.S._2$ seemed to have the same amplitude in the majority of the cores.

2.31 Magnetic-Core Materials (continued)

Production Tester (R. F. Jenney)

The semi-automatic production tester now works well with cores from the automatic press at General Ceramics, but no testing has been done because of the small number of these cores available.

Nondestructive Readout (R. F. Jenney)

A new scheme for nondestructive readout of ferrites was given some preliminary tests and found quite promising.

Model IV Core Tester (J. D. Childress)

The Model IV Core Tester and power supplies have been delivered to RCA and are reported to be working satisfactorily.

Life Tests (J. D. Childress)

Equipment has been completed for the short-time life tests. Plans are that these tests will start early next week.

Another series of life tests is being planned. These tests will study time effects at different temperatures.

Analysis of Ferromagnetic Materials (J. H. Baldrige)

Recent determinations include magnesium and iron determinations in A-series ferrites. I am working at present on two determinations of manganese in these materials.

X-ray Study of Ferrites (J. H. Epstein)

An investigation of the ionic and covalent radii of the atoms which can form spinels is being undertaken. This is with the hope of determining which type of bonding is taking place and of predicting the observed lattice constants.

The permanent magnet material $BaO \cdot 6Fe_2O_3$ has been looked at with x-rays. It does not show a simple spinel structure, as the Ba^{++} ion is too large for the interstitial positions.

Special Pulse Testing (P. K. Baltzer)

Assembling of a versatile new pulse tester has been completed. The scope that will be used for measuring output of cores has been calibrated for time and voltage.

2.32 Magnetic-Core Memory

MTC Memory (W. Papian, W. Ogden, E. Guditz)

Repeating the rough specs on this memory: It is to consist of 17 digit planes each containing 32 x 32, or 1024, Ferramic cores like those now in the two planes operating in Test Setup IV. It will be vacuum-tube (6080) driven and have a read-write cycle time of the order of 8 microseconds.

Almost all of the design work is completed, all of the important drafting is either in progress or completed, some sheet metal work is done, the bulk of it is expected to be under way within two weeks, and the peak load on panel wiring may occur in late February. A tight time schedule shows all of the equipment completed by April 1st.

The first 32 x 32 plane itself is now being wired by Joe Piro, and a laboratory assistant is now being trained for the work; another laboratory assistant is to start training in about two weeks so that we expect to have three people wiring planes by late February. Production then should be about three planes per week.

Test Setup V is being put together now. If the work goes as planned, it should be running by March 1st, ready to give us some important answers about 32 x 32 planes and ready to test the production planes before they are wired into MTC Memory. It is extremely important that Setup V be running soon, and every effort will be made in that direction.

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

The construction of Memory Test Setup IV has been completed and the system is now operating. The test setup now contains memory planes #4 and #5 and matrix switch #1. The memory planes were in operation four days ahead of schedule, the actual down time being only seven days.

Checking circuits have been incorporated into the system so that we can insert identical random patterns into the two planes and check the two planes against each other. In case of an error the system stays on the address where the mistake occurred; the operator can note which core made the error and trace the cause of the mistake.

Switch-Core Study (A. Katz)

Several metallic-ribbon switch cores have been designed and are now on order. In contrast to the ribbon memory cores which require on the order of 10 wraps, the switch cores require over a hundred wraps.

Work with ferritic switch cores is progressing satisfactorily. It has been found that the transformer action of the cores can be significantly improved by stacking the cores several high. Although not as effective in making the core behave as an ideal transformer as increasing the number of turns per winding, this procedure does lead to a simpler construction and, hence, may be preferable.

A 16-position matrix switch using MF1131 (F262) cores is nearing completion. In the near future, switches utilizing stacked cores will be constructed and studied.

2.32 Magnetic-Core Memory (continued)

Digit-Plane Driver (C.A. Laspina)

The digit-plane driver (formerly called the Z-plane driver) has been debugged and packaged in a plug-in unit. The operation of the packaged unit was quite different from the operation of the breadboard, and changes were made so that the performance of the plug-in unit was equal to that of the breadboard model.

The driver is a regulated device capable of maintaining the output current within ten percent for 30-40% variations in tubes. A current pulse of 250 to 800 ma with a rise time of about .1 μsec is available from the unit.

Memory Test Setup I (B. Widrowitz, S. Fine)

The read and write switch current resistors were changes to a higher voltage rating and the current settings recalibrated.

An intermittent noise pulse in the sensing amplifier is giving trouble and will be traced to its source and corrected.

The MTC-type sensing amplifier has been modified and is being evaluated for this setup.

In order to facilitate the measurements of the properties of magnetic cores with respect to RF pulsing, new RF current sources have been designed driven by standard pulses. It will be possible to control the amplitudes and shapes of the envelopes of the RF pulses. A new block diagram has been drawn which will supply the standard pulses for the RF current drivers.

2.33 Magnetic-Core Circuits

Capacitor-Type Stepping Register (G.R. Briggs)

Preliminary investigation of the capacitor type of stepping register for low-speed applications has indicated that it will be very useful for the problem we are interested in. By using two capacitors and an air inductance in the coupling circuit to give some delay-line action, the circuit can be greatly improved in speed, reliability, and usefulness in logical applications. Operation at 100 kc with 5-AT drive using 300-watt, 1/4-mil cores 1/4-inch in diameter and 3/16-inch long has been successful. Certain basic circuits needed for an adder have also been built and successfully operated using this circuit as a starting point. It is felt that this circuit is the one to use in all-core counting and adding circuits; more intensive investigation is planned.

Waveform Calculations (H.K. Rising)

More experimental evidence has been obtained to substantiate the basic assumptions of the step-by-step method of calculating waveforms in core circuits. The assumption that the form of the voltage waveform from a core driven by a square pulse of current is constant has been checked in two ways. One way shows that there is a linear relation between peak voltage and one over the time (1/t) to the peak.

2.33 Magnetic-Core Circuits (continued)

The other way shows that the voltage-versus-flux curve for a core is of constant shape. Since the voltage-versus-flux curve appears in the step-by-step method of calculation, work at present is concentrated on trying to improve this curve for calculations.

2.34 Ferroelectric Materials

HV Circuits (J. Woolf, C. Morrison)

The HV circuits are now in operation; however, the inhibit circuit is still faulty. The trigger from the inhibit circuit appears to be feeding through to other circuits. It seems to be necessary to incorporate more time delay between the plate and grid of the tube that we are driving down in order to prevent the 2D21 from conducting.

2.4 Test Equipment

Test Equipment Committee (L. Sutro)

At the request of the Committee, Dick Best has experimented and found ways of using +150 volts instead of +120 volts on all Burroughs equipment and in two out of the three kinds of Whirlwind test equipment that use +120 v. Burroughs has agreed to make these changes in the 549 units they are making for us. We will make the changes to the units we have already purchased as each unit is brought in for a routine maintenance check. A year from now it should be possible to eliminate the +120 supply from Whittemore. The supply will still be needed in Barta Building where a-c coupled register panels use +120 volts for the screens of 7AD7's.

The Tektronix 517 scope has arrived. It has a pass band of 100 cps to 60 mcps and an accelerating potential of 24KV. Bonnell Frost will use it for the first week.

Each Committee member is calling on engineers in the group he represents to learn how many more pieces of Burroughs and Whirlwind test equipment will be needed after the present orders are filled. With this information, the Committee will place further orders to be filled in the spring.

Test Equipment Headquarters (L. Sutro)

People calling the Test Equipment Headquarters, 3471, will be answered by Lorraine Bruzzese who can give information on the location of test equipment and take information on change of location. To request test equipment, ask for Jim Delmege who will know what kinds of test equipment are coming in and when they will be available. To request repairs to a scope in Whittemore building, ask for Tony Kyricos.

Since the last report, the Test Equipment Headquarters has performed the following:

2.4 Test Equipment (continued)

Standard Test Equipment

Video checked	20
Repaired	3
Modified	21
New kinds of equipment debugged	2

Tektronix Equipment

Inspected and adjusted (Type 517)	1
Repaired and adjusted (Type 513D)	1
(Type 514D)	5

(D. Shansky)

It has been determined that the Burroughs test equipment will operate satisfactorily if the screen of the 6AG7 RLC peaker is returned to +150 v through a 3.9K bypassed by 47µµf, thus eliminating the need for +120 v.

With reference to the 6AG7 inverter tube in the Burroughs delay-line panel, a satisfactory solution seems to be to tie the present screen-decoupling circuit to +150 v instead of +120.

2.5 Basic Circuits

5965 Flip-Flop (H.W. Boyd)

As inferred in the last report, a flip-flop was desired that possessed flat prf response characteristics with heavy 7AK7 gate-tube loading, wide trigger range, low minimum trigger, and high prf. A flip-flop was recently precipitated that possesses suitable characteristics. The flip-flop's overall characteristics are, roughly, as follows:

1) 20-volt nominal trigger, with trigger range from 10 to 30 volts.

2) 4-megacycles maximum prf.

3) Maximum capacitive loading 100 µµf per side (6-7, 7AK7 gate tubes per side).

4) Tube reliability -- worst tube for proper output:
$I_b \geq 5$ ma 120 v E_b and $E_c = 0$

(about 1/5th as good as average tube, and 1/3d as good as worst tube specifications will allow).

5) Supply tolerances -- ± 30% and greater.

6) Resistor and diode tolerances -- depend upon position in circuit and other components. Varying only one resistor at a time, the resistor tolerance range is from 13% in the most critical spot to 50% in the least critical spot.

2.5 Basic Circuits (continued)

The most critical resistors are four in number, and, in the worst possible combination of resistor deviations, the tolerances of each is about 3% maximum.

The least critical diodes can have back resistances as low as only 7K; whereas the more critical diodes can have back resistances as low as about 50K or less.

7) The flip-flop has practically flat prf response up to 4 megacycles with small loads but rises slightly at higher prf's with heavier loads.

2.6 Component Analysis (B.B. Paine)

Comparative studies have been made of the abrasion resistance and general merits of various kinds of magnet wire. The test used has been correlated with the abrasive action of ferrite cores. Types of wire tested were heavy Formex, heavy Formvar, heavy Teflon insulated with triple Teflon, Nylon film, ceramic and Teflon, and quadruple Formex. The quadruple Formex insulated wire withstood abrasion about ten times as long as any other wire tested; for this reason it is recommended for winding ferrite cores. An M-note is being prepared which will present the test results in detail.

The standard Zyglo technique for detecting cracks in non-ferrous materials has proved ineffective for finding leaks in the glass-to-metal seals of crystal diodes. Some work is now being done here with Fluorescent materials in volatile solvents, which are to be forced into any leaks in the crystal seals under heat and pressure.

2.7 Memory Test Computer

Block Diagrams and Logic (W.A. Hosier)

It has been tentatively agreed that in a month or two, when most of the assembly of MTC has been finished, Ralph Butler of IBM and some of our own personnel will construct circuits to tie MTC to IBM card equipment. Such circuits will be built of our components substantially according to block diagram SB-37384-2; presumably, they will be ready to try out the card machines when they arrive, as now anticipated, in June or July.

With the design of a simple inactivity alarm circuit, now being constructed, the means for instrumenting block schematic SA-53569-1 of the MTC alarm system are all at hand; plans for wiring and cabling this system are now in process.

Setup and Test of the Step and Program Counters (R. Callahan, W. Klein)

The past biweekly period has been spent in a preliminary investigation of MTC logic and circuitry. In particular, the MTC Mod. I flip-flop and the cathode-follower circuit have been investigated both for purposes of familiarization and also to provide information to the AE group.

2.7 Memory Test Computer (continued)

Flip-Flop Testing (H. Henegar)

A plug-in d-c flip-flop tester has been constructed and is operating satisfactorily. Work has been started on the testing of the first 16 flip-flops which are to be used in a counting circuit.

Accumulator (H. Anderson)

Tests have been conducted on the first gate-buffer-amplifier panel. It was connected as a high-speed-carry line and a carry pulse was sent through 16 stages in series. The results of this test made several changes appear desirable. The exact nature of these changes is now being considered.

MTC Toggle-Switch Storage (J. Crane)

A layout for 17 cathode followers, MTC, Mod. II, has been made for use in cabinets on the MTC console.

It was necessary to design a cathode follower to drive the toggle-switch storage. The 6BL7 tube is being used in the cathode-follower circuit and the circuit is called cathode follower, Mod. III, MTC.

Construction (H.K. Smead)

All racks for MTC have been delivered and are now installed in the MTC room. The MTC dual-gate units have been delivered, and the first plug-in mounting panel has been received from the outside vendor. Push-button pulse generators are now being assembled.

Control Element (R. Hughes)

Control has run well during this last biweekly period. Six errors occurred; all are suspected power-supply transients. A defective crystal in a Burroughs crystal mixer was found by marginal checking. No other components have failed.

Panel Design (P.R. Bagley)

A crystal-mixer panel and a video-jack panel have been designed and sketched.

Cabling Diagrams (P.R. Bagley)

A preliminary sketch of the pulse and d-c level cabling for the main frame has been drawn. The cabling for the memory, control, and power racks will be drawn up as soon as the rack layouts have been decided upon.

2.7 Memory Test Computer (continued)

(R.H. Gerhardt)

The dual-gate circuit and the gate-buffer circuit were studied in order to become familiar with the circuits.

One dual-gate panel has been received from the Inspection Department and is being tested according to the specifications set up by Hugh Henegar. The panel has passed the d-c resistance measurements and will be checked for d-c voltages and pulse operation.

3.0 STORAGE TUBES

3.1 Construction (P. Youtz)

The production of 700-series storage tubes for replacement in ES row was normal during this period.

Experimental tubes were constructed to study the conversion and activation of Philips "L" cathodes.

Work was continued 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. The closer spacing was obtained by putting a small center post between the collector and storage surface. Larger operating margins were obtained in these tubes.

Intensive work will be done during the next period to correct the failures reported by C.L. Corderman in Section 3.3 of this biweekly report.

3.2 Test

Television Demonstrator (D.M. Fisher)

It is the practice at the TVD to obtain, visually, the lower switching potential of the storage tubes from a positive array displayed on a TV screen. An investigation has begun to determine if this test can be performed adequately by an electronic means.

Eight storage tubes were tested, ST719-C-2 through ST726-C. The results for all these tubes were satisfactory.

Storage-Tube Reliability Tester (R.E. Hegler)

ST719-C-2 through ST725-C-1 were tested at the STRT during this period and all were considered satisfactory for WWI use.

ST723-C-1, ST724-C-1 and ST725-C-1 contain a center post between the target and collector to facilitate closer target-to-collector spacing. The center post was avoided by expanding the 16's deflection increment. The margins on these tubes are considerably larger due to the closer target-to-collector spacing.

3.3 Research and Development

Lower Stability Failure (C.L. Corderman)

Two more 700-series tubes have exhibited the lower stability failure in WWI. After forty hours for ST719-C-2 and sixteen hours for ST721-C-1, both the A_3 and auxiliary collector decoupling resistors (220Ω, 1ω) were found burned out. Subsequent testing showed that a V_{HG} of at least 150 volts was needed for holding positive areas. ST719-C-2 was again tested about six hours after the resistor burnout took place, and the tube appeared normal in all respects except for the

3.3 Research and Development (continued)

higher stability voltage. After a three-hour test period, the tube was removed from the mount and the 39Ω decoupling resistors on the signal plate coupling unit were examined. Both A_3 and AC resistors showed definite signs of overheating. The tube was then dissected and examined for evidence of internal breakdown which must have accompanied the burnout of the resistors. No indications of arcing were found; however, the auxiliary-collector screen and the holding-gun second anode cylinder were both coated with a film of carbon. In addition, many small bits of dag were on the ion-collector plate. There was no carbon on the collector screen. It was presumed that the A_3 dag had been subjected to rather severe ion bombardment.

ST721-C-1 was tested at the STRT within two hours after the resistors burned out, and current monitoring meters were connected to the tube before power was applied. The currents to the auxiliary collector, A_3 and holding-gun cathode were observed to be normal for a few minutes, and then they began to increase slowly. When they had built up to about four times their normal value, a sudden jump took place. The auxiliary collector and cathode currents were several hundred ma, and the current to A_3 was of the same magnitude but opposite in sign from the normal direction of flow. These currents fluctuated considerably, and possibly a relaxation oscillation occurred with a period of a few seconds. The currents all dropped to zero when the holding gun was biased off, but they would rise again quickly whenever the holding gun was allowed to conduct.

These abnormally large currents were accompanied by a glow discharge which was clearly evident within the holding-gun structure. A measurement of gas pressure immediately after the tests described above and again after sixteen hours without power gave pressures between 10^{-4} and 10^{-5}, i.e., the tube was quite gassy. There is some possibility that the gas is argon, since the color of the discharge is appropriate and the holding-gun cathode was not poisoned. Although the ion-collector plate is bombarded with positive ions during tube operation, it is difficult to conceive that enough argon would be liberated from this mechanism alone to initiate the discharge. Assuming that an additional burst of gas is released by an arc within the tube, we have taken steps to eliminate the most probable points of arcing. In addition, the ion-collector plates are being vacuum fired, and during all glass sealing operations, we will flush the tubes with helium instead of argon. The results of these changes should be fairly well established during the next two to three weeks. We have also initiated the requirement that tubes must be operated at the STRT at least fifty hours before being sent to Whirlwind.

Tests on the IBM Electron Gun (C.L. Corderman)

RT369-C-1, which contains an IBM-85 electron gun, has been tested. This gun is used in a William's-type storage tube developed by IBM and gives a smaller beam than the 5UP gun which is used in our storage tubes. Although the Faraday cage-aperture size used was too large to give absolute measurements, it was evident that the beam size at a given current was 10 to 20% smaller with the IBM gun. The peak current density was probably somewhat greater, but this too was masked by the large cage aperture. The maximum available current was only 16.5 μa, however, and since the loss in cathode emission with age should be approximately the same for both gun types, this figure seems too low for satisfactory operation after some period of use. The tube will be placed in the STRT as soon as possible for spot interaction and life tests.

3.3 Research and Development (continued)

"L" Cathodes (T.S. Greenwood)

In order to effect a saving in processing time of "L" cathodes in storage tubes and to reduce the amount of unwanted material evaporated onto the grid during conversion, three XTs were constructed to test preprocessing of these cathodes. In effect, the cathode in its mount is converted and activated in a small envelope which is subsequently sealed off under vacuum. When the cathode is ready to be used, the seal is broken under an atmosphere of argon. This reduces the possibility of reconverting the barium and barium oxide back to the carbonate. The cathode should then be exposed to air for only as long as is necessary.

These XT's were built using a new lot of "L" cathodes which had extension leads built into the heater. In trying to use these leads, the conversion heat schedule apparently crystalized this extension lead and two tubes were lost by heater burnouts. Upon return to our old method, XT61 was successfully processed and its cathode built into RT365-1. Results were encouraging: lower conversion pressure and much shorter activation time. It appears that the most trouble will come from the necessity of rewelding the heaters in the second assembly. In RT365-1, an internal short occurred which lowered the heater resistance by one third, and this was reflected in the heater-voltage vs. cathode-temperature calibration.

In preparation for use of cathodes in storage tubes, arrangements have been made for fabricating parts for the cathode mounting, and this work is under way.

The major effort during this period was directed toward preparing the thesis report, "The Application of "L" Cathodes to Electron Guns."

Pulse Readout (A.J. Cann)

A 7AK7 gate tube on the end of the r-f amplifier produces a 30-volt output pulse. The feedthrough is held to less than 1 volt by a neutralizing circuit without critical adjustment. The timing tolerance on the sensing pulse is $\pm$ .01 μsec for a polka-dot array. The figure previously reported was for entirely positive and negative surfaces.

TV readout has been obtained by operating the system at 2 mc, not synchronized with the sweep. Picture quality seems adequate even though the picture is only sampled.

Memorandum M-1755, a thesis proposal on this work, has been distributed.

Velocity-Distribution Measurements (C.T. Kirk)

During this period, some time was spent reading the Engineering Note E-418, on the development of an r-f readout system. On the basis of the r-f shielding afforded by a storage-tube mount, it was decided to modify a storage-tube mount for cage readouts. The altered storage-tube mount will be ready for testing early in the next biweekly period.

4.0 TERMINAL EQUIPMENT

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

Thirty rolls of unoiled black perforator tape have been received from the manufacturer and are now available for use with the "FL" punches. Negotiations are under way to obtain a larger quantity of this tape.

Some of our recent trouble with the carriages binding on our 20"-carriage Flexos has been traced to the fact that the manufacturer equipped them with too long a carriage-return clutch spring. The manufacturer will shortly furnish us with the correct springs for these Flexos.

4.2 Magnetic Tape

Magnetic-Tape Mechanisms (E. P. Farnsworth)

The two tape units scheduled for modification by Raytheon were prepared for shipment and delivered to them last week. The realignment and machine work begun by Mr. Gillissen at the Servo Lab was completed by him the day following the removal of the troublesome third tape unit from WWI for shipment to Raytheon. We now have three tape mechanisms in the computer, all of which are capable of reading and recording in reverse as well as in the forward direction.

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

The special-stop orders si 1x4 (forward) and si 1x5 (reverse) have been incorporated in the computer. These modes may be used to stop the tape automatically on the erased portion following the record operation.

Memorandum M-1794 was issued covering a change in the designation of magnetic-tape units to make three units available for automatic control by the computer.

High oil level in the clutch gear case is believed to have been the cause of tape creepage in one tape unit. The oil level has been corrected.

The cause of occasional drop-outs of one or more digits by the reading amplifiers is now being studied. Some consistent drop-outs have been traced to faint scratches on the tape. Readjustment of the slicing circuit has eliminated this trouble while introducing other difficulties. Dust adhering to the tape has been suspected as the cause of occasional transient drop-outs. A dust cover has been added to unit 0 to control this problem.

4.2 Magnetic Tape (Continued)

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

The final index pulse counter panel is ready to be installed in the computer, but actual operation must await construction of the plug-in cathode followers.

Requests for a long-carriage typewriter on the magnetic-tape print-out equipment, plus the advantage of equipment uniformity in test control indicate the desirability of circuit changes to accommodate a new FL Flexowriter in place of the old-style machine. This will involve only one panel of the magnetic-tape print-out equipment, and the necessary circuitry has already been designed for the buffer-drum print-out. The breadboard panel now being built for the buffer-drum print-out (see sec. 4.4) can be substituted in the magnetic-tape print-out system whenever a long-carriage FL machine is available. The control circuits will be considerably simplified by this change.

The correct address to record for print-out from magnetic tape is now si 136 as discussed in Memorandum M-1794. Temporarily, delayed print-out facilities are effectively limited to one tape mechanism.

4.3 Display (R. H. Gould)

A trip was made to Syntronic Instruments, Inc., who have supplied us with our most satisfactory deflection yokes for the 16-inch display scopes. Dr. Washburn of Syntronic feels certain that we can get much faster operation with our scopes without much difficulty. An order has been put in for 10 yokes and experiments will be made to determine the optimum impedance for use with our deflection amplifiers.

4.4 Magnetic Drums (K. E. McVicar)

Part of the past biweekly period has been spent in such orientation work as measurement of pulse levels, tagging pulse lines, and checking d-c voltages. In addition, some marginal checking has been done, studies of readout-signal variation as a function of drum temperature have been started, and disconnect panels which permit operation of the system either with the computer or test equipment have been constructed and installed.

It is planned to connect the drum with the computer on a temporary basis this coming weekend. This experimental setup will be for the purpose of determining what, if any, operation problems are present in addition to those which have been uncovered by our tests with test equipment.

4.4 Magnetic Drums (Continued)

Careful studies are being made of the individual track readouts in an attempt to discover variations in signal which are a function of temperature and aging. When these results have been checked during operation with the computer an attempt may be made to put all the good tracks together in the same groups so that troublesome tracks will be isolated in groups not to be used by the computer. This should give reliable operation of the groups available though all twelve groups will probably not be usable.

Buffer-Drum Print-Out (E. P. Farnsworth)

Operation of the proposed buffer-drum print-out and punched-tape read-in equipment is described in M-1781 and M-1782 issued this week. A developmental model of the print-out control circuit and thyratron register now being wired by A. X. Perry will be checked out with an FL Flexowriter. This panel will then be temporarily substituted for the present magnetic-tape print-out control-register panel for further testing and to permit long-carriage FL print-out from magnetic tape until final modifications can be made.

Erase System (H. L. Ziegler)

Details have been worked out for an erase system that uses the normal writing circuits at normal repetition rates and that does not require any change in circuitry or cabling when in use. One operation of the single pushbutton control causes the selected group to be erased in about 15 or 20 seconds. Tests made with manual variation of writing currents and a Test Equipment erase control gave satisfactory erasures. To make the operation completely automatic a breadboard panel is being built to provide automatic stepping of the writing currents.

Auxiliary-Drum Monitoring (H. L. Ziegler)

At the present time methods of monitoring the auxiliary drum outputs are being considered. A system similar to the ES TV display may be a practical solution to this problem.

Voltage-Sensor Circuits (H. L. Ziegler)

C. W. Simmonds has begun a study of the voltage-sensor circuits in order to evaluate the present design. Eventually, voltage sensors are to be provided for each voltage used in the auxiliary-drum system.

(C. W. Simmonds)

For the past week, I have been making tests and taking measurements on a voltage-sensor circuit built in breadboard form. The purpose of this is to learn the peculiarities and limitations of the circuit.

5.0 INSTALLATION AND POWER

5.1 Power Cabling and Distribution

Room 156 Power Distribution (G. F. Sandy)

The starter arrived for the drum's M-G set. However, it is too small. It is planned to replace it with one a size larger.

Gavitt Mfg. has completed the delivery of the power cables for MITE.

5.2 Power Supplies and Controls

Whittemore Building Supplies (R. Jahn)

Most of the temporary wiring has been replaced, and several supplies have been moved to their permanent location. More work of a similar nature is planned during the next few weeks.

+90-V Supply (R. Jahn)

The +90-V d-c regulated power supply is being tested prior to installation with the other Whittemore d-c supplies. It should be ready early next week.

Sine-Wave Generator (R. E. Hunt)

We are designing and will construct a sine-wave generator for the power-supply group that will be continuously adjustable from 0.1 cycle to 90 cycles. Materials will be on hand in about two weeks. Another two weeks will be required for construction and debugging.

6.0 BLOCK DIAGRAMS (J. H. Hughes)

A new edition of D-35146, "Control-Pulse Output Connections, WWI", will come out soon. It includes bo and bi.

The orders bo and bi worked successfully with paper-tape punch and readers and magnetic tape when they were tried out 15 January 1953.

The flip-flop-storage reset panel has been modified. Any programmer who uses FFS resets should read M-1792 which describes the change.

At Walter Attridge's suggestion, I have written a proposal for a new order ab (ADD BR TO REGISTER X) and a modification to dm (see M-1793).

8.1 Programs and Computer Operations (continued)

113. Shear Wall Analogy, Simultaneous Linear Equations: Kopley, 7.5 hours
Sydney, 30 hours

The program has been rewritten for the comprehensive system. The new system makes it easier to incorporate program corrections into the tape.

The tape preparation of the program has been delayed because of a misunderstanding in the programming of Floating Addresses and Ditto Instructions.

It is expected, however, that a series of solutions will soon be obtained.

Sydney

114. Design of Optical Instruments: Helwig, 3 hours; WWI, 46 minutes

The ray-tracing program has been tested satisfactorily. Tests on the matrix subroutines for floating-point numbers have been completed. The matrix subroutines comprise: (1) multiplication of two n x n matrices, (2) form the transpose of an arbitrary n x n matrix, and (3) transfer an n x n matrix from one block of storage to another block. In each of these subroutines, n is selected by the programmer by setting the cycle-count index register to -n, and the cycle-count comparison register to 2n, just before entering the subroutine. The relevant ES addresses are program parameters following the sp to the subroutine.

All the magnetic-tape subroutines discussed in the previous bi-weekly have been thoroughly tested and are now available in the subroutine library. Copies of a report describing these latter subroutines are now available in Room 218, Barta.

Combelic

115. Transient Aerodynamic Heating of a Flat Plate; linear partial differential equation: Helwig,6 hours; WWI, 62 minutes; Isakson, 3 hours

Results for 11 parameters in the I-beam problem have been obtained. It is planned to run about 50 more parameters for the I-beam problem and about 45 parameters in the plate problem.

Isakson

116. Torpedo Impulse Response; Convolution: Frankovich , 2 hours; WWI, 62 minutes; Kramer, 80 hours

Computer work has progressed in two directions: improvements in the scope display program and more trial responses. Two corrections were made in the scope display program. Six runs were made with the program yielding outputs for three trial responses. Two additional trials were made using the program for simple integration, but neither worked. Work on an alternative method for obtaining the convolution kernel is continuing.

One difficulty in the integration trials was due to improper scale factoring. The other has not yet been determined.

We will continue the procedure of manually correcting the impulse response function and continue to investigate other approaches to the problem.

Kramer

8.1 Programs and Computer Operation (continued)

109. Fighter Gunsight Calibration, 8th Order D. E. : Hazel, 4 hours; WWI, 9 minutes; Zierler, 3 hours

We have not yet obtained any satisfactory results. Our difficulty is an arithmetic one and we have been unable to determine its origin. However, we hope to correct this difficulty as soon as possible.

Zierler

110. Mk. 47 Evaluation: Kopley, 4.5 hours; WWI 13 minutes; Pitcher, 1 hour

This problem is an evaluation of the performance of a gunsight. It involves the point by point solution of differential equations representing the computer performance and various flight paths.

A trial run was made and it revealed a programming error. This error has been corrected and the program will be rerun.

Pitcher

111. Fourier Analysis--Autocorrelation Problem: Hazel, 1 hour; WWI, 07 minutes Zierler, 2 hours

This problem is concerned with the analysis of servomechanism performance data. We have now correctly calculated and printed out all 30 of the Fourier coefficients involved. It is hoped that the programming of an auto-correlation procedure will soon be completed.

Zierler

112. Lawley's Method of Factor Analysis; Characteristic Vectors (modified): Denman, 79.5 hours; WWI, 84 minutes

A 33-by-33 matrix, R, of correlation coefficients (r_{ij}) has been computed. WWI is to solve for the factor loadings, F, the matrix equation $JF = FS^{-2}(R - S^2)$, where J is an unknown diagonal matrix, S^2 is a diagonal matrix whose elements are $s_i^2 = 1 - \sum_{r=1}^{m} f_{ri}^2$, where f_{ri} is an element of the m-by-33 matrix, F. This equation is to be solved for m = 4,5,6,7,8, and 9.

Input and output programs have been checked in actual operation.

The same 1,089 parameters must be read from MT during each iteration and used in computing without slowing down the computations. No time is available for reversing the MT, so a loop is needed.

In the future the main computing program will be checked in operation.

Lord

8.0 MATHEMATICS, CODING, AND APPLICATIONS

8.1 Programs and Computer Operation

Time for scientific and engineering computation (S&EC) is now assigned in accordance with the policy described by C. W. Adams in E-484. Consequently, it is necessary for anyone who desires S&EC time to describe his problem on form DL-518 (obtainable on request) and submit it to Room 218, Barta Building. This problem will then be considered by members of the S&EC staff. If necessary, the author may be called in for discussion. If the problem is deemed feasible, it will then be accepted, given a problem number, and assigned to an S&EC staff member who will serve as a consultant. Requests for S&EC computer time should be made on form DL-527. The amount of time required for the satisfactory solution of a problem is taken into account in determining the feasibility of that problem.

Progress during this biweekly period on each general applications problem is given below in terms of programming hours, minutes of computer time, and progress reports as submitted by the programmers in question.

84. Departure Curves for Various Types of Resistivity Logs in Oil Wells: WWI, 47 minutes

In checking over the complete sets of results for this problem it was discovered that four of the four hundred sets of results had been run with the wrong set of parameters. These four sets have been rerun and the results have been forwarded to Dr. L. de Witte at the Continental Oil Company.

Porter

100. Comprehensive System of Service Routines: Briscoe, 57 hours; Demurjian, 23 hours; Frankovich, 66.5 hours; Hazel, 24 hours; Helwig, 41 hours; Kopley, 18 hours; Porter, 14 hours; WWI 454 minutes

The punched paper-tape version of the comprehensive system of service routines (CS) has been completely replaced by a magnetic-tape version of the program which uses one magnetic-tape unit and which punches out 5-56 paper tape. The read-in procedure for the latter program is not too difficult, and it is unlikely that conversion errors due to incorrect read-in will occur frequently in the future.

A new magnetic-tape version of the CS is being tested and should be ready to use in a few days. This program uses two magnetic-tape units and records the 5-56 version of the program on magnetic tape.

Plans for the future are to record the CS itself on magnetic tape. This procedure will require at least two magnetic-tape units.

A more efficient version of the first pass of the comprehensive conversion program (CCP) has been written and tested. This will be incorporated into the CS.

Work is continuing on the output section of the CS. Subroutines are now

8.1 Programs and Computer Operation (continued)

being written which store 24,6 numbers on the magnetic tape for delayed printing and which display 24,6 numbers on the oscilloscope.

A subroutine which facilitates the storage of binary data on magnetic tape is now available. The procedure for using this subroutine has been described in an interoffice memorandum.

Helwig

101. Optical Properties of Thin Metal Films: Denman, 2 hours; WWI, 21 minutes; Loeb, 5 hours

T #2265 did not work because of: a) illegal icm order, b) illegal use of 2t and 3t in PA, c) inconsistent floating address.

We plan to correct these errors and rerun the tape.

Loeb

102. Scattering of Electrons from Gases: Uchiyamada, 2.5 hours; WWI, 36 minutes; Uretsky, 10 hours

Error diagnosis has been done on the original program. Completion of this phase is expected in about two more runs.

The run was wasted because the punch had skipped some number blocks on 5-56 tape during conversion. The remainder of the time was used for error diagnosis. Additional runs had been scheduled (approximately 24 minutes) for the last night of the biweekly period but were not made because of prolonged computer failure.

The next biweekly period should see the end of error diagnosis and commencement of phase 2.

Uretsky

103. Transmission Cross Section of Absorbing Sphere; Spherical Bessel and Hankel Functions: Demurjian, 5 hours; WWI, 07 minutes ; Terrell, 4.5 hours

Tape 2199-3 was analyzed in order to determine what caused a loop to develop during the run. The cause was an incorrect system of addresses for intermediate and final results using the 24,6,0 system. Tape 2199-4 was prepared and run, and the results were satisfactory.

The next step is to prepare and run a tape which will compute the complete program described on form DL-518 dated Nov. 12, 1952. This will be the final task. Tapes 2188 and 2199 comprise major portions of procedures which will be incorporated into this tape.

Terrell

104. Hydro Thermal Power System; Calculus of Variations: Demurjian, 4.5 hours; WWI, 95 minutes ; Cypser, 62 minutes

Early attempts to read tapes into the computer were unsuccessful because of incorrect conversion. A later attempt went through two blocks of the magnetic tape (one iteration) but stopped on an overflow alarm at the third block. The proof sheets and program were checked and are all right. An error is suspected

8.1 Programs and Computer Operation (continued)

in the 5-56 tape T 2259.

Plans for the future are to read back the magnetic tape, using delayed print out, to search for errors in the 5-56 tape T 2259.

Cypser

105. Crystal Structure: Fourier Series Summation: Kopley, 9.5 hours; WWI, 19 minutes; Blackmore, 6 hours

Several delays have been encountered in attempting to reconstruct a program that ran successfully about eight months ago.

After the program has been reconstructed, we plan to use it with many parameters.

Blackmore

106. MIT Seismic Project: Briscoe, 2.5 hours; WWI, 92 minutes; Robinson, 40 hours; Simpson, 20 hours; Vozoff, 20 hours

The predictions and error curves of two seismograms were computed.

Time was lost in read-in due to an excessive number of tapes.

In the future these tapes will be combined onto one large tape.

Robinson

107. (a) Autocorrelation and (b) Fourier Transform, Evaluate Integrals: Frankovich, 1.5 hours; WWI, 80 minutes; Ross, 30 hours

Autocorrelation (T-2249-6) has now been checked out and found operative. Hence the modification Autocorrelation-Simpson (T-2301-0) is now being typed by the tape room. Fourier Transform (T-2235-6) with further modifications still must be tested. Roughly 85% of the testing is completed.

Two programming errors (in translation of old program to CS) were found and one misplaced earlier modification corrected. One CS conversion error was corrected by 556 modification. About 25 minutes were lost due to computer malfunctioning. The same programs ran properly when tried again.

The plans for the future are to complete checks on T-2235-6 and T-2301-0, after which the problem will be completed. Then we plan to start a new problem.

Ross

108. An Interpretive Program: Hazel, 6 hours; WWI, 25 minutes; Zierler, 5 hours

The program for interpreting negative exponents is not functioning satisfactorily. It is hoped to correct this difficulty and to complete the part of the program that will allow iterations to be performed.

Zierler

8.1 Programs and Computer Operations (continued)

Computer Time	
Programs	19 hours, 33 minutes
Conversion	11 hours, 43 minutes
Scope Calibration	54 minutes
Magnetic-Tape Test	05 minutes
Total Time Used	32 hours, 15 minutes
Total Time Assigned	48 hours, 09 minutes
Usable Time, Percentage	67%
Number of Programs Operated	121

9.0 Facilities and Central Services

9.1 Publications

(Diana Belanger)

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

LABORATORY FILES

No.	Title	No. of Pages	Date	Author
R-219	Electronic Selection and Control of Read-Record Heads of Magnetic Tape Units	51	12-15-52	J. A. O'Brien
E-511	The Four-Digit Transistor Accumulator	17	12-4-52	(D. J. Eckl (R. J. Callahan
E-512	A Method for Acceptance Testing of Ferrite Core Production Lots	4	12-4-52	P. K. Baltzer
E-515	The Technique for Evaporation of a Beryllium Mosaic	8	12-16-52	T. F. Clough
E-518	New Metallic Cores from Magnetic Metals	3	1-2-53	A. D. Hughes
E-519	General Ceramics Materials, MF-1348B and MF-1359B	1	1-5-53	B. Smulowicz
M-1759	Single-Transistor Circulating Pulse Circuit			
M-1776	Laboratory Personnel	15	1-15-53	
M-1777	Defective Tee Connectors	1	12-29-52	B. B. Paine
M-1778	December 1952 Storage and Research Tube Summary	5	1-7-53	D. M. Fisher
M-1779	Bi-Weekly Report	34	1-2-53	
M-1781	Proposed Print-Out Via Buffer Drum	2	1-5-53	E. P. Farnsworth
M-1782	Proposed Read-In Via Buffer Drum	3	1-5-53	E. P. Farnsworth
M-1783	Incoming Inspection of Crystal Diodes	2	1-6-53	B. Paine
M-1784	Meeting Held January 5, 1953 to Discuss Additional Work to be Done on Auxiliary Drum	2	1-7-53	F. Sandy
M-1785	Testing of Metallic Cores	3	1-7-53	A. D. Hughes
M-1787	Test Equipment Committee Meeting of Dec. 31, 1952	3	1-8-53	L. Sutro
M-1789	Breadboards and Experimental Work	1	1-9-53	Prod. Control
M-1792	Modifications in Test Control	1	1-14-53	J. H. Hughes
M-1793	Proposed New Order, ab, and Modification of dm	3	1-15-53	E. P. Farnsworth
M-1794	Designation of Magnetic Tape Units	2	1-12-53	E. P. Farnsworth
M-1796	Test Equipment Committee Meeting of January 12, 1953	3	1-16-53	L. Sutro

9.2 Standards, Purchasing, and Stock

Procurement and Stock (H.B. Morley)

Difficulties with Flexowriter tape performance may soon be eliminated. Improved material has been received from our regular source; another vendor is cooperating and may be able to supply reliable material.

Because of failure to meet incoming acceptance tests, returns of material to manufacturers are increasing. This growing problem is being studied, and a general policy will be devised.

Partial deliveries of the Cinch loktal socket #52A13500 were made. About 3500 sockets have been received since the last biweekly report, following successful contact with the Chicago factory. A thorough search was made for a similar socket from other sources. Cinch evidently makes the only unit suitable for our needs, for no vendor could offer material equal to it. To offset the long delivery time, another order was placed to insure our supply of this item.

Standards (H.W. Hodgdon)

Information on standards, component selection and evaluation, and similar items is now being distributed biweekly in a series of office memoranda. A tentative distribution list of about forty persons in the lab has been made up, and will be modified as necessary. It is hoped in this manner to obtain the benefit of a larger cross section of opinions on component selection and evaluation.

Watt, Paine, and I spent a day this week at Fort Monmouth, discussing standards with Armed Services Electro Standards Agency and visiting Squier Signal Lab. As a result, we feel that arrangements can be made to obtain more information on components from the military services, particularly on new items.

(C.W. Watt)

Wednesday, January 14, was spent at the Armed Forces Electro Standards Agency, Ft. Monmouth, N.J., discussing JAN & MIL specs. Col. Thew J. Ice, Jr., the Director, devoted several hours to a discussion with us of how the standards are prepared, and how manufacturers' products are qualified. He was extremely cooperative, and a good understanding of the operation of ASESA was obtained. The discussion was followed by a trip through the Signal Corps Testing Labs at Squier Signal Labs, Fort Monmouth. Paine, Hodgdon, and Watt represented MIT, and Gaetz represented IBM.

9.3 Construction

Production Control (F.F. Manning)

The following units have been completed since January 2, 1953:

9.3 Construction (continued)

CR#	Qty	Title	Originator
1492-35	75	Indicator-Light Brackets	Paddock
1684	2	Low-Speed 2^6 Counter, Mod. II	Test Equip Com.
1788	6	D-C Power Strip (8 Plug)	" " "
1952-1A	100	P.I. Flip-Flop Modification MTC	Smead
1952-2B	4	GT-BA Panel	Smead
1984-8	5	Core Driver, Mod. V	Test Equip Com.
1984-24	200	91-Ohm Terminators	Sutro
1984-28	172	Lamicoid Labels	Test Equip Com.
2000-7	367	Video Cables	Norman
2000-8	95	Video Cables	Norman
2000-9	5	Video Cables	Norman
2053	1	Volt-Meter Box	McCusker
2058	1	0.06-μsec Delay Line	Canty
2074	1	Light-Gun Breadboard	Alperin
2092	1	R.F. Current-Source Breadboard	Widrowitz

The following units are under construction:

1492-33	16	Switch-Voltage Reference Regulator	Werlin
1492-35	350	PI-Panel Indicator-Lamp Bracket	Paddock
1684	19	Modify Low-Speed 2^6 Counter	Test Equip Com.
1767	100	Video Cables	" " "
1795	23	Fil. Transformer Panel	" " "
1952-2B	4	Modify GT-BA Panel, MTC	Smead
1952-6C	2	Assy. Cathode Follower, Mod. II	Smead
1952-3B	3	PI Mounting Panel, MTC	Smead
1952-7B	2	Decoder Panel	"
1952-9B	2	Parity-Check Panel	"
1952-57	1	Cathode Follower, Mod. II	"
1952-64	3	PI Cathode Follower	"
1952-68	1	Indicator Panel, MTC	"
1984-8	12	Core Driver, Mod. V	Test Equip Com.
1984-12	18	Video Probes Modification	" " "
1984-28	102	Lamicoid Labels	" " "
2028	1	Mech. Tape-Reader Clutch Control	Farnsworth
2062	5	Sample Model Board	Watt
2073	10	D-C Extension Unit	Carroll

Production Engraving (R.E. Hunt)

The old mico engraver is being rebuilt and modified to provide a much more rapid means of engraving lamicoid labels than is now possible. It will have turret stencils and an adjustable bed so that the process will be more like typing than printing. Design and construction should require another 3 to 4 weeks.

9.3 Construction (continued)

Outside Vendors (R.F. Bradley)

P.O.	Firm	Ord.	Del.	Type
L-33713	Advance Machine Tool	24	0	Machine Work
L-33721	Advance Machine Tool	50	0	" "
L-31722	Advance Machine Tool	40	10	" "
L-14099	Advance Machine Tool	1835	1342	" "
L-33515	G.P. Clark Co.	40	1	Wiring & Assy.
L-33677	Dane Electronic	50	0	" "
L-33372	Dane Electronic	40	20	" "
L-33785	Hauman Instrument Co.	7	0	" "
L-33790	A.J. Koch	5	0	" "
L-33949	A.J. Koch	50	0	" "
L-33950	A.J. Koch	8	0	" "
L-31656	Metallic Arts of N.E.	5	0	Machine Work
F-10440	Raytheon Mfg. Co.	4022	675	Complete Fabrication
		6167	2048	

9.4 Drafting (A.M. Falcione)

1. New Drawings

	Cir. Sch.	Assy.&PL.	Al. Panel
Low-Speed 2^6 Counter, Mod. II (TE)	D-53269	E-53271	C-53286
Video Connector Panel #2 (WWI)		D-53606	
Video Connector Panel #1 (WWI)		D-53480	
Plug-in Unit Mtg Panel, Mod. I (MTC)		R-53623	D-53545
Plug-in Unit Sensing Ampl., Mod 1 (MTC)	C-53071	D-53585	D-53424
Parity Check Panel A (MTC)	D-53572	E-53582	R-52706
Parity Check Panel B (MTC)	D-52942	E-52946	R-52706
Selection Plane Current Control Panel(MTC)	B-53301	D-53591	D-53592
32-Position Crystal Matrix (MTC)		R-53570	R-53047

2. Thesis Drawings

Thesis drawings for S. Greenwood, W. Frank, and B. Remis are complete. However, because of the delay in the Multilith typed masters, the theses will not be turned in until Monday, January 19, 1953.

3. Production Control

There has been some evidence that there has not been sufficient liaison between Production Control and the Drafting Department, which in some cases has caused delays in our operations. In order to circumvent this situation, a weekly meeting is now held between the Drafting Department and Production Control to iron out any problems arising from new designs and to determine priority on work to be scheduled in the shops and Drafting.

10.0 GENERAL

New Non-Staff (R.A. Osborne)

Vincent Cuzziere is a part-time student in the 6345 Group.

Joane Diebert is a laboratory assistant in the Print Room.

Jean Garborino is a senior clerk in the General Engineering Group.

Robert Johnson is a technician in the Systems Group.

Marguerite Marean has joined the 6345 Group as a senior clerk.

Robert Martin is a new laboratory assistant in the Construction Shop.

Richard Mayer is a laboratory assistant in the 6345 Group.

Michael Storm has joined the Construction Shop as a laboratory assistant.

Gerard Perrone is a part-time student working for B. Paine.

Ethel Voedisch is a new girl in the Drafting Room.

Terminated Non-Staff (R.A. Osborne)

Joseph Caruso
John Doherty
John Anestis