Digital Computer Laboratory
Massachusetts Institute of Technology
Cambridge 39, Massachusetts

SUBJECT: BI-WEEKLY REPORT, ~~August 29,~~ SEPT. 12 1952

To: Jay W. Forrester

From: Laboratory Staff

## 1.0 SYSTEMS OPERATION

### 1.1 Whirlwind I System

#### 1.11 Operation (S. H. Dodd)

During the past two weeks the computer has been undergoing a number of tests to insure that complete recovery from the in-out installation has been achieved. Many of the test tapes have been converted and work on developing an adequate means of marginal checking is in progress.

During the in-out installation, electrostatic storage did not get an adequate amount of maintenance time. During the past two weeks ES operation has been materially improved, although an annoying intermittent has not yet been cured.

(N. L. Daggett)

The RF Pulser has given trouble for the last few weeks because of some intermittent difficulty which has caused unwanted spots to be written in storage. An alarm circuit is being added temporarily which will give an indication whenever the pulser is turned on outside an ES cycle.

(A. J. Roberts, H. L. Ziegler)

Storage reliability is slowly improving after the long shutdown. Several long periods of applications time will be necessary to provide information for adjusting storage tube parameters. Intermittent trouble with the RF Pulser has been the cause of most of the errors during the past week.

The third chapter of the WWI Service Manual has been distributed.

(S. E. Desjardins, A. V. Shortell)

Planning for the new Teletalk intercommunication system to be installed in the Barta Building has begun. Preliminary sketches for the voice and annunciator circuits have been prepared. Also, a circuit diagram

1.11 Operation (continued)

for the master stations has been drawn.

Installation of central junction boxes for voice and annunciator circuits will provide for ease of maintenance and flexible circuit interconnections.

Delivery of the Teletalk units is expected by the end of September. Additional material required for the junction boxes and for plug-in connections of the speakers in rooms 041, 156, and 263 is being estimated and will be ordered next week.

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

The following failures of electrical components have been reported since August 15, 1952:

| Component | No. of Failures | Hours of Operation | | Reason for Failure |
|---|---|---|---|---|
| Tubes | | | | |
| 7AD7 | 34 | 3 | 0-1000 | 1-Gas<br>1-Loss of vacuum<br>1-Low $I_b$ |
| | | 5 | 4000-5000 | 2-Low $I_b$<br>1-Mechanical<br>2-Change in Characteristics |
| | | 1 | 6000-7000 | 1-Mechanical |
| | | 6 | 7000-8000 | 6-Low $I_b$ |
| | | 1 | 8000-9000 | 1-Change in Characteristics |
| | | 8 | 10000-11000 | 1-Leakage<br>5-Low $I_b$<br>2-Mechanical |
| | | 2 | 11000-12000 | 2-Low $I_b$ |
| | | 4 | 12000-13000 | 2-Mechanical<br>1-Gas<br>1-Low $I_b$ |
| | | 4 | 13000-14000 | 2-Low $I_b$<br>2-Mechanical |
| 6V6 | 1 | | 13000 | Low $I_b$ |
| 7AK7 | 1 | | 12520 | Mechanical |

1.12 Component Failures in WWI (continued)

| Component | No. of Failures | Hours of Operation | Reason for Failure |
|---|---|---|---|
| Tubes | | | |
| 6SN7 | 3 | 2 12000-13000 | 2-Mechanical |
| | | 1 13474 | 1-Mechanical |
| 6AG7 | 1 | 11939 | Low $I_b$ |
| 6Y6G | 1 | 12996 | Low $I_b$ |

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

Following is the storage tube complement as of 2400 September 11:

| Digit | Tube | Hours of Installation | Hours of Operation |
|---|---|---|---|
| 0 B | ST-607-1 | 8954 | 888 |
| 1 B | ST-606-1 | 9599 | 238 |
| 2 B | ST-612 | 9575 | 262 |
| 3 B | ST-601 | 8524 | 1318 |
| 4 B | ST-516 | 6641 | 3201 |
| 5 B | ST-548-1 | 8299 | 1542 |
| 6 B | ST-534-2 | 7469 | 2373 |
| 7 B | ST-540 | 7937 | 1905 |
| 8 B | ST-549 | 8259 | 1583 |
| 9 B | ST-519 | 6624 | 3218 |
| 10 B | ST-544-1 | 8683 | 1159 |
| 11 B | ST-542 | 8148 | 1695 |
| 12 B | ST-608-1 | 8918 | 925 |
| 13 B | RT-258 | 5207 | 4635 |
| 14 B | ST-541-1 | 7961 | 1881 |
| 15 B | ST-603 | 8322 | 1519 |
| 16 B | ST-533 | 7801 | 2041 |
| 16 A | ST-613 | 9046 | 796 |

E S Clock hours as of 2400 September 11, 1952 . . . . . 9837

Average life hours of tubes in service . . . . . 1732

Average life hours of last five rejected tubes . . . . 2886

1.2 Five-Digit Multiplier (C. N. Paskauskas)

On 2 September the multiplier was placed in operation following the installation of a new brush in the +150V supply. Since then the multiplier has operated without error in the daytime but has made at least one error each night.

A tap check of all tubes on 9 September resulted in the removal of two tubes but this was not a cure for the nocturnal errors.

## 2.0 CIRCUITS AND COMPONENTS

### 2.2 Vacuum Tubes and Crystals

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

During this past period the short and leakage testers have come in for additional study. In the first place the duration of the flicker shorts in a group of 7AD7 tubes were measured by connecting a 514D scope into the tester and checking the waveforms of current through the short. A number of shorts were observed, their duration varied from about 100 microseconds on up to several milliseconds.

In addition the characteristics of the short-checking equipment were examined analytically. It had previously been determined experimentally that the tester could pick up a dead short lasting only one micorsecond. By calculating the various time constants for various interelectrode resistances, it can be shown that the tester should pick up a five megohm leakage path which lasts for only 75 microseconds. The time for a 300,000 ohm path is about five microseconds. It thus seems quite probable that the short detectors will indicate on any shorts which would be troublesome, since the time constant for the testers is much shorter than the duration of the shorts.

A sample of a new type of cathode ray tube was received from R.C.A. This tube has the same dimensions as the 5CP1, with the same connections. However, it has twice the vertical deflection sensitivity as well as a flat screen. These two features allow this tube to be used to very good advantage in the 514D scopes, in particular for photography. This tube does not yet have an RMA number, but its release is expected in the near future.

The high voltage transformer in the modified P5 scope used with the transconductance bridge equipment burned out last week for the fourth time in two years. As no more transformers were on hand, a spare Tektronix 420 power supply was installed. Some difficulty was caused by the fact that the power supply was not wired according to the description supplied by Tektronix, but had plate and filament transformers inverted.

#### 2.22 Transistors

**Transistor Accumulator** (D. Eckl, R. Callahan)

The inspection of the accumulator and associated test equipment has been completed and the accumulator is again in operation.

2.22 Transistors (continued)

As originally set up, the accumulator solved 21 problems per minute. With the recent arrival of new test equipment it has been possible to increase this to 376 problems per minute and thus reduce the idle time. The present test problem, which consists of adding 15 into the accumulator 12 times, was chosen because in its solution every circuit in the accumulator is pulsed at least twice.

During the past bi-weekly period, the accumulator has been operated overnight for periods of 19.6 hours, 17.6 hours, and 15 hours without error. The latter period was at the high recycle rate. This means that 348,400 problems were solved ($4.2 \times 10^6$ separate additions) without error.

In the above tests trouble-free operation has been obtained only at night during the hours 1700 to 0800. It is possible that changes in the unregulated lab supplies may be responsible for difficulties during the day.

The total indicated time on the accumulator at present is 264 hours.

Life Tests (I. Aronson)

The Pulse Amplifier and Jacobs Counter life tests were started on September 5. The repetition rate of the counter input has been changed to 200,000 pps to avoid jitter and to facilitate photographing the waveforms.

To date there have been no significant changes in the performance of any of the transistors in these two panels.

One blocking oscillator transistor has developed an intermittent failure that appears to be dependent upon temperature and/or humidity. This is currently under investigation, (waveforms observed every hour).

New Transistors

Thirty-six RCA TA-165's have been received and processed in the past two weeks with seven rejected for failing to meet our minimum alpha specification of 2.0.

2.22 Transistors (continued)

Visits (I. Aronson)

Scientific Specialties in Brighton was visited on September 10 with J.F. Jacobs. In addition to a tour of the plant, a discussion was held on gold-bonded diodes, point contact transistors, and transistor measuring equipment. The people we spoke to seemed quite confident that they could make 1698's to meet the Bell specifications.

Improved Static Flip-Flop and Gate (W. Klein, A. Heineck)

An attempt has been made to operate a diode gate from the flip-flop circuit developed by A. Heineck and reported in M-1555. This development has been undertaken with the aim of overcoming the frequency limitation exhibited by the transistor gate and flip-flop circuits now used in the transistor test accumulator.

Such a diode gate having practically no attenuation and a maximum selected-to-rejected pulse ratio of 20 v to 2 v has been developed.

In order for this circuit to be substituted in the transistor test accumulator, the gate output must be capable of complementing two flip-flops and driving a second gate. A pulse amplifier will be necessary. As yet, a satisfactory amplifier has not been developed.

SEAC (S.L. Thompson)

The 1-mc. clock generator that is to be used with the SEAC circuits is now in operation. The output is slightly distorted when the full load of two watts is being delivered, but this should not interfere with the operation of the SEAC. The four outputs are not spaced exactly 90°, but this should not disturb the functioning of the SEAC circuits either.

A power supply has been constructed that will supply operating voltages to the SEAC circuits. 6AS7-G tubes are used to reduce the laboratory bench voltages to the proper values. Although the d-c resistance of the tubes is about 1500 ohms, the dynamic resistance is only one-tenth this value. Therefore, the voltage regulation is ten times better than it would be if voltage dropping resistors were inserted in series with the line.

2.7 Memory Test Computer (R. Von Buelow)

Various minor circuits of the MTC were considered and breadboarded. Among these were a variable voltage supply to be used in marginal checking, a delay circuit to be used in the overflow alarm system, and a system to detect transients in the power supply.

It has been decided to use a parity check similar to that used in WWI.

The use of high speed carry and carry flip-flops in the accumulator seems probable.

(J.D. Crane, Jr.)

The delay line amplifier used in WWI is being adapted for use in the MTC control element. Two of these delay line amplifiers will be placed on a 3 1/2 strip for 19-inch racks.

Final physical layout of the special plug-in strip is being made.

(H. Smead)

The first plug-in mounting rack was delivered, and two more are currently in production.

It is expected that the power distribution panels and the plug-in mounting panels will be ready for production in several days.

(R.G. Farmer)

The past bi-weekly period has been spent ordering parts which will be needed for the Memory Test Computer power supplies. An electronic test load is being constructed which will be used to test the power supplies.

(R. Hughes)

Attempts to drive a 0.5-μsec. delay line from the peaker-gate were successful. But the signal to reflection ratio was not high enough to use this combination throughout the computer since more reliable methods are available (such as the carry flip-flop).

The flip-flop gate combination is now being pulse-tested to determine margins.

2.22 Transistors (continued)

Felker System of Bit Storage (R.H. Gerhardt)

The special delay lines for the designed circuit have been received and a breadboard model has been built. Preliminary testing has been started. The transformer requirements are being studied with the hope that a better waveform may be obtained. Termination of the delay lines is being checked.

The logic of a complete system is being studied with Dick Jeffrey.

Some time was spent on the special test equipment needed for this circuit.

## 2.3 Ferromagnetic and Ferroelectric Cores

### 2.31 Magnetic-Core Materials

#### Chemical and Ceramic Work (F. E. Vinal)

Planning of space and facilities is in progress. Some of the larger equipment items have been ordered while more details are sought for others. During this phase, a limited amount of laboratory work is being carried out in Building 20 with facilities of the Laboratory for Insulation Research.

#### Phase Investigation of Ferrites (J. H. Epstein)

Ceramic samples 1253A and 1326B, examined at a magnification of 500 X, suggest non-homogeneity but better polishing techniques are required before this can be definitely ascertained. One possibility for a second phase is $MnO \cdot Mn_2O_3$. A black crystalline material resulting from an attempt to prepare $MnO \cdot 2Mn_2O_3$ by F. E. Vinal will be examined by x-rays.

An attempt is being made to prepare mixed ferrites of Mg and Mn in several proportions by the method of coprecipitation of the hydroxides from a hydrochloric acid solution of the unreacted ferrite composition. It is hoped to obtain a small grain size in the ferrite and high degree of uniformity from the intimate mixture of the components in solution. It has not yet been ascertained whether this method will yield a product chemically comparable to that obtained from high temperature solid phase reaction of the oxides.

#### Core Stresses (P. K. Baltzer)

Further work was done on the effect of stresses on the 60-cycle hysteresis loop of Ferroxcube 4B. Curves of maximum flux density for the maximum squareness loop, coercivity for the same loop and maximum squareness ratio verses applied stress were obtained. Maximum flux density and coercivity increased with applied stress almost linearly. Maximum squareness increased greatly at low values of applied stress and appeared to approach a limiting value of .72 at high values of applied stress.

The squareness of the saturation loop increased with applied stress, but the maximum flux density and coercivity remained essentially constant.

#### Core Tester (J. Woolf)

The core tester is being assembled in the shop and will be ready for debugging in the near future.

2.3 Ferromagnetic and Ferroelectric Cores (continued)

Core Testers (J. H. McCusker)

One of the Model 4 Core Testers has been adapted to work from standard equipment.

An investigation of pulse current measurements has been started.

Hysteresis Loops (J. H. McCusker)

D-C hysteresis loops were run by B. Frackiewicz on two MF-1118 cores. These tests were designed to simulate pulse tests. Symmetrical and anti-symmetrical half-amplitude current disturbances were used.

(J. R. Freeman)

The circuits of the driver amplifiers of one of the Model 4 Core Pulse Testers have been modified in order to reduce the potential of the windings on the tested core to approximately ground level. This modification was originally made by Magnetics, Inc. to their test gear in order to insure safe handling of the core when mounted on the tester. Subsequent use of the modified unit has indicated the alteration to be satisfactory. It is expected that the other units also will be modified in this way.

Semi-Automatic Core Tester (J. D. Childress)

A semi-automatic core tester is being developed. The tester will produce a test mode of current pulse, the modes being automatically stepped through a range of currents.

The logic of the tester is blocked out but is not in construction yet.

Several component circuits have been breadboarded and are being tested.

2.32 Magnetic-Core Memory

Ceramic Array I (E. A. Guditz)

Data has been taken to determine the driving requirements of switch cores using smaller numbers of turns. This data has not yet been evaluated.

More data is being taken in a study of the differences in core outputs from half-selected cores containing ONES and half-selected cores containing ZEROS.

2.3 Ferromagnetic and Ferroelectric Cores (continued)

Ceramic Array II (J. L. Mitchell)

The job of pulse testing the switch cores used in Ceramic Array II has been completed and the switch cores have been connected back into the memory and switch assembly. Conclusive results of these tests will not be available until data has been taken with the switch cores actually operating in the memory.

16 x 16 Metallic Array (B. Widrowitz, S. Fine)

A device that made use of two sensing pulses to achieve better zero to one discrimination was tried with little success. Evaluation of this type of approach was inconclusive.

Work is being continued on the measurement of delta and an attempt will be made at a quantitative study of its effects and the effects of core variations upon driving current margins.

2.33 Magnetic-Core Circuits

Magnetic-Circuits (G. R. Briggs)

Extensive work has been done in the last two weeks with both the resistive and capacitive type of magnetic gate to determine the ultimate stepping rate of both types in a stepping register of F-259, MF-1118, cores such as Sims has operated successfully at 1 mc. with diode coupling. The capacitive coupled circuit has operated at 300 kc, whereas the resistive circuit fails to operate in the range available in the equipment, 120 kc minimum. The reason for this is that a period much larger than the period required to flip an individual stepping register core must be allowed between drive pulses in order for the gate core flux to leak off and prepare the gate core for the next drive pulse. Since the capacitive type of device shows the most promise for high-speed operation, this type is currently being concentrated upon.

2.4 Test Equipment

Test Equipment Committee ( L. Sutro)

The committee has received one-third of the 459 Burroughs units now on order. Nickerson's men continue to work three evenings a week to inspect and video check them. The resoldering that was required when the first units arrived in August has lessened but difficulty has been encountered in video testing. All the Gate and Delayed-Pulse Generators, for example, are being modified because it was found that not only the delayed pulse but the incoming pulse appeared in the output. In spite of such difficulties, 33 Burroughs units have been delivered to engineers.

2.4 Test Equipment (continued)

R-215 Standard Test Equipment has been prepared by Best, Drogue, Rathbone and Sutro at the request of the committee to describe all 38 of the pieces of standard test equipment. R-215 will replace R-143 which described only the 15 pieces that had been standardized when the latter was published in January 1949. The new report will contain a circuit schematic of each unit as well as a description and list of performance specifications.

The Core Tester Model V has been accepted by the committee as the 39th piece of standard test equipment. Twelve are being made in the shop at such a speed that the panels will not be engraved but simply rubber stamped.

There are now 114 Simpson meters in the laboratory. The committee has ordered 30 more, 10 to be distributed as needed and 10 to be used in each building as replacements while meters are recalled for checking every six months.

Transistor Curve Plotter (I. Aronson)

Four Sigma Relays were obtained to replace the millisec type in the transistor curve plotter. This was done because of the poor reliability observed with the millisec type. Fortunately, the Sigmas operate in the device with no circuit changes. All that remains now before assembling the final model is to determine the reliability of the Sigma relays. A life test for this purpose started today.

Gas Tube Pulse Distributor (J. Woolf)

The Gas Tube Pulse Distributor designed by D. Best will be ready for use when final tests are made.

Core Driver Model V (H. Boyd)

Core Driver (Model V) was formerly erroneously called Model II. The prototype was received from the shop and has been tested and found to be satisfactory--12 of these units are now being made.

2.5 Basic Circuits

Low Performance 12 AU7 Cathode Follower Flip-Flop (H. Boyd)

Successful operation of this unit has been achieved at 3 megacycles continuous operation driving 8 7AK7 gate tubes (4 per side). Since, however, the triggers must be between 15 and 25 volts in magnitude at 3 megacycles, efforts are now being made to extend the range in the order of 10-30 volts or better. (Rise time 4-GT's/side = .1 $\mu$ sec at 3 megacycles and .2 $\mu$ sec at 200 kc.)

2.5 Basic Circuits (continued)

Plug-In Flip-Flop (H. J. Platt)

Repeated tests with the plug-in flip-flop indicate that they will be able to be used in a counter. A significant test consisted of complementing the flip-flop and sensing the gate tube hung on the flip-flop x microseconds apart. A plot of the gate tube output vs x showed that the delay in switchover time was sufficient to allow the unit to count. This test was tried with a gate tube alone and with a peaker-gate tube combination successfully. A test with a gate tube-buffer combination will be tried next.

In the test with the peaker-gate tube, it was found that the gate tube output could be maximized by the addition of a small capacitor between the control and suppressor grids.

Plug-In Units (L. Sutro)

Designers of plug-in units are to be asked to write a page about each unit describing what purpose it serves, where it is used, how many were made and how well they worked. These pages will be collected by Louis Sutro and assembled in a looseleaf notebook, copies of which can be obtained by all who desire them.

## 3.0 STORAGE TUBES

### 3.1 Construction (P. Youtz)

The 600-series storage tubes constructed as replacements for Bank B were improved by moving the holding gun one inch closer to the target surface. All future storage tubes will have this feature.

All storage tubes constructed this past biweekly period, and those scheduled for construction, contain a small Faraday cage on the target assembly. This cage is used to investigate the beam distortion and deflection shift caused by positive ions. The multiple Faraday cage tube, RT319-C, used by J. Jacobowitz in his studies, was reprocessed this period.

Efforts were continued toward developing techniques for using a stannic-oxide coating instead of dag. Two research tubes with stannic-oxide coatings were processed this period.

Two research tubes were constructed and processed to study the conversion and activation processing of Philips "L" cathodes.

### 3.2 Test

#### Pretest (D. M. Fisher)

During this bi-weekly period, six tubes were pretested. ST621-C, ST622-C and ST624-C were satisfactory. ST623-C was rejected because the lower switching potential was above the prescribed limit, and ST625-C because of a bad area on the surface. ST625-C is to be dissected in an attempt to ascertain the cause of its unusual appearance. RT329, a stannic-oxide tube, was rejected because of difficulty in writing a positive array on one area of the surface.

(C. T. Kirk)

A rough draft has been prepared of a memorandum on the Block Diagram Operation of the TVD. A study of storage tube literature pertaining to current-density distribution of the high-velocity beam and experimental methods of its analysis was made in preparation for installing and checking out such a beam analyzer unit in the TVD.

#### Storage Tube Reliability Tester (C. L. Corderman)

Three storage tubes, ST619-C-1, ST620-C and ST622-C, all having Faraday cages, were checked at the STRT and passed as satisfactory. Their margins, particularly with regard to the holding-gun time required, were extraordinarily good. This may be the result of reducing the holding gun throw by one inch, a change which began with the introduction of the

3.2 Test (Continued)

Faraday cages. This reduction in holding gun throw was accomplished by moving the $A_2'$ cylinder toward the target so that it protrudes one-half inch out of the holding gun neck. This change was inaugurated in an attempt to get satisfactory holding beam coverage with $A_3$ below 150 volts.

ST621-C was much poorer than the three tubes mentioned above. It was originally classified as marginal, but this classification will be changed to rejected on the basis of a loss of high-velocity-gun current. On two overnight runs, one at a heater voltage of 6.3 volts and the other at 7.0 volts, the gun continued to deteriorate.

The prototype scanning unit was used to take high-velocity-beam distributions on all cage tubes. There was some correlation between the size of the spot interaction area and the peak current-density observed. This density on ST621-C was about one-half of that on the three satisfactory tubes, with values of 2.5 and 5.0 $ma/cm^2$ respectively. STRT tests on ST624-C should be quite interesting as cage measurements have shown this gun to give about 8.5 $ma/cm^2$ in the center of the beam.

The first research tube having a Faraday cage and an ion-collector ring will be available during the week of September 15th. This ring is a one and one-half inch circular band of stainless steel about one-half inch less than the I. D. of the tube and can be positioned lengthwise anywhere between the holding gun and the target. It is insulated from all other elements so that the effects of its potential and position upon the holding-beam distribution and ion collection can be observed. The tube will have a dagged $A_3$ to eliminate any unknown effects of the stannic oxide.

RT329-C, which has a stannic-oxide coating, has been examined for ion-deflection shift. Assuming a high-velocity beam distribution comparable to ST620-C, i.e., about 5 $ma/cm^2$ peak, the tube shows slightly more deflection shift than dag tubes with the same holding-beam current. The $SnO_2$ coating of RT329-C had been cleaned differently from previous tubes, however, so additional stannic-oxide cage tubes are being made. When a coating can be made which will not adversely affect the secondary emission of the surface, we will probably try to add an ion collector ring.

The first two days of the past week were spent in Toronto attending a conference of the Association for Computing Machinery. The session on Storage Devices was highlighted by a description of a new method of operating standard cathode-ray tubes (Williams System) in a manner which greatly reduces errors due to adjacent spot interference.

(R. E. Hegler)

During this bi-weekly period, I read information pertinent to the operation of the STRT and assisted in testing two tubes.

The summary of equipment for the Storage Tube Test Laboratory is nearing completion.

3.3 Research and Development (J. Jacobowitz)

During this period, RT319, the Faraday cage research tube, was reprocessed. The filament of the high-velocity gun had opened, therefore the only investigations previously undertaken were those depending solely upon the holding beam. After reprocessing both guns, the tube was examined at the TVD. The nine cages were clearly visible, and also an area surrounding each aperture. This area probably represents the mica separation which occurred during the forming of the entrance holes. Since the tube had a normal beryllium-on-mica mosaic, it was possible to write satisfactorily on the surface. However, the negative surface did not seem stable when $V_{AC}$ was above 360 volts, i.e., large areas suddenly switched positive. This switching appeared to be related to the holding-beam distribution.

It should be noted that the holding beam was considerably off-center and was brought on-center only by using a magnetic field. The resultant distortion of the beam was apparent.

Alignment Demonstrator (A. J. Cann)

The first six days of this bi-weekly period were spent on vacation.

The last four days were spent making a routine check on ST615 (used for pulse readout research) which showed that its spot interaction area had deteriorated considerably. The high-velocity gun transfer characteristic was unchanged and the holding-gun current seemed adequate. This tube was sent to the STRT for a recheck and ST517 (a WWI reject) was installed in its place.

Some work was done on filters for pulse readout.

Type "L" Cathodes (T. S. Greenwood)

During this bi-weekly period two research tubes, RT324 and RT325, were successfully activated using the schedule established on RT323. The uniform success of RT323 has established an activation schedule which can be used as a working base for subsequent investigations. RT323 and RT324 have been placed on life test and both tubes show a higher initial stability than any of the previous tubes.

At present, efforts are being devoted to attaining uniform grid-to-cathode spacing in subsequent tubes and choosing aperture sizes and spacings to give a desirable transfer characteristic.

The first week of this bi-weekly period was spent on vacation. The first two days of the second week were spent in Toronto attending a Conference of the Association for Computing Machinery.

## 4.0 TERMINAL EQUIPMENT

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

The first week of this bi-weekly period was spent on vacation.

The paper tape output selector relay panel was modified to provide for the use of one punch and three printers instead of two punches and two printers.

Five "FL" Flexowriters equipped with twenty inch carriages have been received and are now being modified to fit our needs. Extension brackets are being added to the carriages of these machines to prevent our continuous paper forms from catching on the carbon ribbon spools.

#### Buffer Drum Flexowriters (E. P. Farnsworth)

Operational features of the proposed buffer drum print-out and read-in circuits are covered in a description now circulating.

### 4.2 Magnetic Tape

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

Final drawings for the magnetic-tape print-out equipment are complete and all units have been ordered. Units are now under construction in the shop.

### 4.3 Display (D. J. Neville)

The Dumont 304-H scope, modified to increase stability, has been in use in WWI display for several days. There is no noticeable drift. Frequency response measurements are yet to be made.

An external control box for simplified scope operation is being constructed.

## 5.0 INSTALLATION AND POWER

### 5.1 Power Cabling and Distribution (G. F. Sandy)

All power supply control panels for the room 156 system are being built in the shop. These should be completed by October 10, 1952.

Next week, the two holes from the computer and test control rooms to room 156 for the wireways for the power and power supply control wiring will be cut. The measuring, cutting and marking of inter-panel wires will start next week.

5.1 Power Cabling and Distribution (Continued)

Arlex will start installing the MITE equipment racks and wireways September 17 or 18. They have promised completion of the installation by October 10.

A meeting was held with Joe Gano, George Thompson, Chan Watt and Ferrell Sandy participating to arrange a time schedule for the work that must be done. Wiring between panels, contactors, and alternators will proceed immediately and should be completed by October 10. From October 10 to October 20, connections to the new panels will be made. A full day will probably be required for the switch-over of the alternators, which should take place about October 21.

The tie-in between the WWI system and the room 156 system should take place about October 28. The crucial point seems to be the delivery of the new alternator. If it does not come in on time, the rest of the schedule will be correspondingly late.

5.2 Power Supplies and Control

Barta Building Power (J. J. Gano)

Cambridge Electric Company is drawing plans for installing a 500-KVA three-phase transformer in substitution for our 300-KVA group.

Whittemore D-C Supplies (J. J. Gano)

The -15, -30 and +150 volt supplies are now being tested by Power Equipment Company and will be shipped next week. The order is expected to be completed with the shipment of the +250, -300 and +500 the first week in October.

Regulator for New Filament Alternator (J. J. Gano)

Preliminary calculations indicate that the exciter field will have to be rewound with three times the number of turns in order to reduce the number of tubes in the output stage of the regulator. This revision will also permit the use of our standard power supply for regulator. The latter panel will be started in production at once.

Standby Power Supply (R. Jahn)

We are making a study of D-C generators which might be suitable as an emergency replacement for any WWI D-C supply.

Power Supply Test Panel (R. Jahn)

A centrally located test console is being designed for our routine operation checks. It will have facilities for measuring arc drop, ripple, and voltage regulation.

5.2 Power Supplies and Control (Continued)

New Filament Alternator (G. A. Kerby)

The reenforced base has been completed.

The new MG set was shipped from Rockford, Illinois on September 2 and has been expected during the past week.

The motor-starting equipment for the MG set was shipped on September 11 from Rochester, New York and is expected on Monday, September 15.

Delivery of the filament contactor is being expedited. It will probably be shipped on October 3. The fact that this will be late in delivery will not delay testing of the regulator.

The filament alternator control unit is being constructed in the shop.

6.0 BLOCK DIAGRAMS (J. H. Hughes)

Operation ql is to be moved September 16 to its permanent position, 30, where it will be called cl, cycle left.

I have been working on a block sketch of Norm Daggett's "Marginal Checking System Mod II".

(B. E. Morriss)

A short note has been written on the changes to the magnetic tape units which will affect programming. Up-to-date drawings of the buffer drum, including additions necessary for operating slow inputs and outputs, are being prepared. Also several changes in the in-out block diagrams are necessary because of changes during installation.

Some time was spent working with Guy Young on various methods of installing indicator-light registers and toggle-switch inputs as a part of the in-out systems. No plans have been made which actually incorporate such units.

The typewriter in room 222 which will respond to si 216 (octal) should be installed around the 19th of September.

## 7.0 CHECKING METHODS

### 7.4 Marginal Checking (T. Leary)

The following old test tapes are now available in new versions:

T-106 (M.C. program), now T-2004
T-208 (Stationary Checkerboard Check), now T-2012
T-697 (E.S. Comprehensive Test, Bank B), now T-2011
T-1046 (Special Display Test), now T-2047-1
T-1358 (Shift Check), now T-2010
T-1416 (Alarm Circuit Check), now T-2009-1

They operate as did the old ones with two exceptions: (1) the M.C. program now has no display, and (2) the Alarm Circuit Check doesn't check the inactivity alarm since we no longer have one.

Marginal checking is now back on a routine daily basis. At the moment all dangerously low margins on 2E or T-2004 have been tracked down. The excursions on the lines checked by these programs are being manually checked and adjusted at the rate of ten lines a day.

## 8.0 MATHEMATICS, CODING, AND APPLICATIONS

### 8.1 Programs and Computer Operation

Progress during this bi-weekly period on each general applications problem is given below in terms of programming hours spent by laboratory personnel (exclusive of time spent by outsiders working on some of the problems), minutes of computer time used, and progress reports as submitted by the programmers in question.

40. Input Conversion Using Magnetic Tape Storage: Kopley, 50 hours; Demurjian, 38 hours; Combelic, 36 hours; Aronson, 21 hours; Rotenberg, 56 hours; Gilmore, 60 hours; Helwig, 16 hours

The direct basic conversion program has been completed and is in the prodess of being tested on the computer. It should be available at the beginning of the next bi-weekly period. As soon as it has been successfully tested, a memo will be written to describe its vocabulary, storage location and tape preparation rules.

A more flexible program has been developed for assembling into storage from Magnetic Tape those portions of the PA, MD, and output routines which are called for by the programmer. This program operates during the final pass of the conversion program and utilizes information specified originally in the main program, which has been already processed by the "adaptation routine" during the previous pass of the conversion program. This "adaptation" process is used to specialize for a particular program the very general PA, MD, and output routines which are available on Magnetic Tape.

It has tentatively been decided that instead of restricting the programmer to only one means of output, that which employs the principle of program parameter decomposition, we shall make available several simple, concise and oft-used output routines.

This would considerably reduce the over-all length of the ultimate output routine in perhaps 90% of the cases. This alternative would be achieved by greater partitioning within the Comprehensive output routines resulting in an increased number of blocks.

The resultant additional burden will be absorbed by a more intricate adaptation program. This is a very desirable feature since the adaptation routine will have been written once and for all while the users of WWI need never concern themselves with its complexities.

The Comprehensive output routines using Flexo-Type have been assembled and those using Numeroscope are in the process of being written. Thought will now be given to the additional partitioning mentioned above.

67. A Method for Obtaining the Characteristic Values of Symmetric Matrices: Perlis, 72 hours

The report on procedures for obtaining characteristic roots and vectors has been completed.

## 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 REPORTS

| No. | Title | No. of Pages | Date | Author |
|---|---|---|---|---|
| E-477 | Magnetic and Dielectric Amplifiers | 13 | 8-28-52 | D. A. Buck |
| E-479 | Basic Conversion Program, Sept., 1952 | 4 | 9-4-52 | M. Rotenberg |
| M-1619 | Bi-Weekly Report, August 29, 1952 | 36 | 8-29-52 | |
| M-1620 | Interpretation of Transistor Data Cards | 3 | 8-21-52 | N. T. Jones |
| M-1621 | August 1952 Storage and Research Tube Summary | 4 | 9-3-52 | D. M. Fisher |
| M-1622 | Minutes, Test Equipment Committee Meeting of August 25, 1952 | 2 | 9-3-52 | L. Sutro |
| M-1624 | Short Guide to Coding and Whirlwind I Operation Code | 13 | 9-2-52 | P. Bagley |
| M-1627 | On the Raytheon Production of Plug-In Units | 2 | 9-2-52 | C. Watt |
| M-1628 | Minutes of the Test Equipment Committee Meeting of August 29, 1952 | 3 | 9-4-52 | L. Sutro |
| M-1629 | Discussion of Group 61 GOC Test of August 26, 1952 and Sept. 2, 1952 | 3 | 9-5-52 | M. I. Brand |
| M-1631 | Group 61 Subroutine Library | 2 | 9-5-52 | W. Lone |
| M-1632 | Proposed Machine Shop Expansion | 2 | 9-9-52 | C. Watt |
| M-1633 | Trip to Control Instrument Company, August 27, 28, 29, and Sept. 3, 1952 | 4 | 9-9-52 | B. Paine |
| M-1635 | MTC Meeting of September 9, 1952 | 2 | 9-10-52 | R. Everett<br>W. Hosier |
| M-1636 | Laboratory Personnel | 12 | 9-15-52 | |
| M-1637 | Minutes of the Test Equipment Committee Meeting of Sept. 8, 1952 | 3 | 9-11-52 | L. Sutro |
| A-114-1 | Military Security | 1 | 8-21-52 | J. C. Proctor |
| A-99-3 | Fire Drills - Barta Building | 3 | 8-22-52 | J. C. Proctor |
| A-139 | Telephone Systems in Barta and Whittemore | 3 | 9-11-52 | H. Fahnestock |

LIBRARY FILES

| No. | Identifying Information | Source |
|---|---|---|
| 1872 | Department Store Information Processing by Digital Computer Techniques, M. S. Thesis | B. E. Morriss, Jr. |
| 2040 | Technical Information Activities of the Department of Defense | Tech. Information Resch. Dev. Bd. |
| 2041 | Ferromagnetic Domains, J. Williams | Bell Tel. Labs. |
| 2042 | Washington Conference on Magnetism, Sept. 2-6,1952 | ONR/Wash. |
| 2044 | Detection and Measurement of Thin Surface Films on Solids | Wright Air Dev. Ctr. |
| 2045 | An Investigation of Magnetic-Core Stepping Registers for Digital Computers, M. S. Thesis | R. C. Sims |
| 2046 | Design of Low-Power Pulse Transformers Using Ferrite Cores, M. S. Thesis | R. D. Robinson |

9.1 Publications (Continued)

LIBRARY FILES (Continued)

| No. | Identifying Information | Source |
|---|---|---|
| 2047 | The Program of the Istitute Nazionale Per le Applicazione del Calcolo | ONR/London |
| 2048 | Maximum Convergence Intervals and a Gibbs Type Phenomenon for Newton's Approximation Procedure | Ballistics Rsch. Lab. |
| 2049 | Investigation of the Low-Frequency Wander Occurring in the Power Servomechanism of the M.I.T. Numerically Controlled Milling Machine | Servomechanisms Lab. |

JOURNALS

INDUSTRIAL DISTRIBUTION, September, 1952
ELECTRICAL MANUFACTURING, September, 1952
ELECTRICAL ENGINEERING, September, 1952
MONTHLY CATALOG, U. S. GOVT. PUBLICATIONS, 1952

## 9.2 Standards, Purchasing, and Stock

### Procurement and Stock (H.B. Morley)

A small quantity of Sylvania 1N38A's were promised us and have been received. These are being held awaiting internal allocation.

This may be the beginning of breaking the crystal log-jam, for promising negotiations with Amperex are in progress and an additional solution is being sought through Kemtron.

Pulse transformers were approved in 1 to 1 ratio with 2 mil cores. Added to the recent 3 to 1 ratio 2 mil core acceptance, these approvals should help considerably in breaking the pulse transformer bottleneck.

New Standards material orders are now completely placed.

All minimum stock orders have been placed, in accordance with the formula developed recently by the Standards Committee. This material should be flowing in steadily from now until Spring, 1953.

Telephone requests for stationery and office supplies should be made directly to the stock room, rather than to the buyer. The need, if in stock, can be more quickly filled.

A technician who terminated recently turned in a considerable amount of standard components withdrawn from stock, but never used. It will be most helpful if only approximate requirements are withdrawn, to avoid shortages.

The stock control system is in the active planning stage. Progress is satisfactory.

### Standards (H.W. Hodgdon)

No new or revised standards issued this period.

Proposed standard for selenium rectifiers, together with application design notes, has been circulated for comment.

C.P. Clare Co. has indicated that they are interested in making an A-C coil for the Type J plug-in relays, and further information has been requested.

Standards for connectors are now being prepared, but we still need a good design for a compact power connector which would be available in several different sizes (for instance, 12-, 24-, 36-, and 48- pins).

The number of standards books issued has been increased to 32.

## 9.3 Construction

### Production Control (F.F. Manning)

The following units have been completed since August 29, 1952.

| CR# | Qty | Unit title | Originator |
|---|---|---|---|
| 1942 | 50 | 91 ohm Terminator | Baltzer |
| 1492-31 | 2 | Special Delay Line for P.I.F.F. | Watt |
| 1916 | 1 | Semi-Automatic Core Tester | Hunt |
| 1922 | 5 | Delay Line | VonBuelow |
| 1951 | 6 | Plug-in Unit Stand | Smead |
| 1936 | 2 | 32 Pos. Crystal Matrix Switch | Shansky |
| 1648 | 1 | Mag. Core Tester Mod. III | Brown |
| 1909 | 1 | Mod. DCIOR Ser. #34 | Holmes |
| 1684 | 4 | Low-Speed $2^6$ Counter | Sutro |
| 1830 | 12 | Mod. D-C Outlet Boxes Mod. III | Manning |
| 1942 | 30 | 30" Power Cables | Baltzer |
| 1942 | 10 | 10' Power Cables | Baltzer |
| 1942 | 115 | Video Cables | Baltzer |
| 1954 | 17 | Video Cables | Leary |
| 1767 | 700 | 91 ohm Terminator | Sutro |
| 1633-3 | 5 | A-C Circuit Breaker Box | Mercer |
| 1916 | 1 | Semi-Automatic Core Tester | Hunt |
| 1492-24 | 2 | P.I. Dual Buffer | O'Brien |
| 1950-20 | 2 | MTC Var. Voltage Supply | Smead |
| 1948 | 12 | Delay Line | Heineck |
| 1492-25 | 2 | P.I. D.C.F.F. Mod. II | O'Brien |

The following units are under construction.

| | | | |
|---|---|---|---|
| 1283 | 1 | 10-amp 600 V Rectifier | Hunt |
| 1778 | 3 | Rack Power Control | Corderman |
| 1929 | 71 | 1:1 Pulse Transformer | Manning |
| 1780 | 2 | Gen. 4 Ind. Pulses | Briggs |
| 1958 | 12 | Core Driver Mod. 5 | Sutro |
| 1684 | 5 | Low-Speed $2^6$ Counters | Sutro |
| 1415 | 5 | S.T. Mounts | Dodd |
| 1941 | 1 | Ferroelectric Core Tester | Woolf |
| 1953 | 2 | Circulating Pulse Gen. | Gerhardt |
| 1492-18 | 3 | 19" Mounting Panel | Watt |
| 1788 | 10 | 8 Plug D-C Strips | Sutro |
| 1767 | 150 | D-C Power Cables | Sutro |
| 1767 | 1000 | Video Cables | Sutro |

## 9.4 Drafting (A.M. Falcione)

1. New Drawings

The following drawings have been processed during the last Bi-Weekly period.

9.4 Drafting (continued)

| Title | Cir. Sch. | Assy & PL | Al Panel |
|---|---|---|---|
| Magnetic Tape Print Out Thyratron Power Supply | B-51796 | D-51935 | D-52337 |
| MTC Power Distribution Panel Mod I | C-52063 | D-52417 | C-52067 |
| PEC 775 (-150V) DC, 25 amp Supply | E-51963 | | |
| Filament Transf. Panel Mod II | | D-51955 | D-51957 |
| Magnetic Tape Transfer Panel | C-52010 | D-52086 | D-52299 |
| MTC Power Dist. Panel Mod II | C-52069 | E-52410 | E-52416 |
| Power Supply Test Load | C-52384 | E-52496 | |
| Aux. supply for Power Supply Test Load | C-52383 | | |
| Fil. Voltage Control Panel Mod II | | E-52377 | D-52378 |
| Plug-in Unit Switch Ref. Voltage Reg. | A-51989 | C-52436 | |
| MT Print Out Index Pulse Counter | C-51866 | D-52061 | D-52155 |
| Core Driver Mod II | SB-52170 | | C-52172 |

2. Toroid Coil Winder

Complete drawings for the Toroid Coil Winder will not be completed September 15, as expected, because of major design changes found necessary in our checking procedures. Some of the basic changes were:

A. Redesign of the base to allow for removal of the components and servicing.

B. Motor support has been redesigned for simplicity.

C. Extension changes have been met on the work holder to simplify operation.

It is expected that the drawings will be complete by September 19.

3. Drawings to Subcontractors

Because of the work load of our present facilities it has become necessary to obtain outside sources to manufacture various items which formerly were made in our own machine shop. It is therefore very important that the print room be kept informed of any prints obtained which are to be submitted to a subcontractor for "Bid Quotations." All drawings so submitted should be graded and recorded under the name of the individual contractor to whom it was sent. In this manner the contractor will be immediately notified of any changes made on the "Bid Drawing" involved. Engineers should not requisition prints from the print room and have them signed out to them individually knowing at that time that the prints are

9.4 Drafting (continued)

scheduled to go to some outside vendor. If this procedure is not followed, it is possible for a subcontractor to manufacture an item from a drawing which may become obsolete or require extensive changes, if he is not kept properly informed of drawing changes. It is also very important to notify the print room as to what contractor has received the Bid, so that other contractors who have received prints of that particular drawing will be removed from the mailing list.

## 10.0 GENERAL

### New Staff (J.C. Proctor)

Sheldon Best, a BS in Engineering Physics from the University of Illinois has been assigned to Bob Wieser's group. He has had experience as a computer at the University of Illinois and as a test engineer for Micro-Switch.

Dr. Harry Deuman received a PhD in Physics from the University of Cincinnati where he was a Fellow in Physics and also a Research Associate while working for his doctorate. He also spent two years on radio repair in the USAAF. He has been assigned to work with Charles Adams' group.

Arthur Kromer who is working with Taylor holds a BS in ME from New York University and has had a wide experience with Western Electric and Eastman Kodak Co.

George Lexander, a graduate of Rindge Technical School, comes to us after thirty-seven years' varied experience with Socony-Vacuum Oil Co. He is working with Howell Morley on Stock.

Norman Menyuk, a new staff member working in Dave Brown's group, has a BS in Physics from Ohio State and has experience as an engineer for Sperry-Gyroscope and four years in the Army on radio repair. He also spent two years at Columbia on his PhD program.

Joseph Sacco, a BS in Chemistry is also assigned to Dave Brown's group. He spent three years as a cooperative student in chemical plants and was a Chemistry Assistant for one year at Boston Latin School.

William Wolf, a new member of Bob Wieser's group has an MS in Mathematics from the University of New Hampshire and spent a little over a year as a Mathematician at Frankford Arsenal.

Henry Zieman is an MEE from Rensselaer Polytechnic Institute where he was also an instructor and research engineer for two years. He has been assigned to work with Dick Best.

10.0 GENERAL (continued)

Staff Terminations

Alan Perlis
Irwin Mann
Robert Sims
Robert Sittler

New Non-Staff (R.A. Osborne)

The following technicians have joined the Construction Shop:

Joseph Caruso
Hugh Dawkins
Nelson Savoie

Diana Bierer and Lorraine Bruzzese are the new Whittemore Building messenger girls.

Theodore Chleboski is an MIT student working for the Test Equipment Committee on a part-time basis.

Gerald Goodman is the new outside messenger boy.

George Maynard is a technician assigned to the Systems Group.

Noble Pribble is an MIT student who has returned to work with Jacobs on a part-time basis.

Paul Quinn is a Lab Assistant working with Olsen.

Ronald Simonds is a new Lab Helper in the Machine Shop.

Theodore Cohen is a new Lab Assistant working in the Tube Test Lab.

Non-Staff Terminations

Robert Beoli
Dominic DiLuca
Charles Dunne
Thomas Keefe
Lester Larkin
Marcia McStravic
Harold Schapiro
Sergio Valdes