Digital Computer Laboratory
Massachusetts Institute of Technology
Cambridge 39, Massachusetts

SUBJECT: BI-WEEKLY REPORT, April 11, 1952

To: Jay W. Forrester

From: Laboratory Staff

## 1.0 SYSTEM OPERATION

### 1.1 Whirlwind I System

(H.F. Mercer)

#### Operation

The following is an estimate by the Computer operators of the usable percentage of assigned operation time and the errors due to the Computer. This covers the period 28 March through 10 April:

| | |
|---|---|
| Number of assigned hours | 103.5 |
| Number of transient errors | 23 |
| Number of steady state errors | 4 |
| Number of intermittent errors | 30 |
| Percentage of assigned time usable | 83 |
| Percentage of assigned time usable since March 1951 | 85 |

(S.H. Dodd)

During the past bi-weekly period the Computer has been troubled by several intermittent and sudden failures. Some of these were traced to open wirewound and Nobeloy resistors. Each failure is being investigated in an effort to prevent a repetition of the trouble.

Time schedules for the proposed multiple terminal equipment for WWI have been made by Rich, Watt, Newitt, and Dodd and have been carried close enough to completion to give a good picture of the overall program. Schedules will not be analyzed to show manpower requirements and portions will be transferred to production control schedules.

(N. Daggett)

The computer has been plagued by an unusually large number of troubles during the last bi-weekly period. The most serious of these is an intermittent trouble which has not yet been frequent

1.1 Whirlwind I System (continued)

(N. Daggett) (continued)

enough to be tracked down. Several troubles were traced to loose or defective video cables. Trouble with a standard gate-generator circuit was traced to a carbon resistor which had increased in value. Since this particular failure has occurred several times in identical circuits, a wire-wound resistor will be substituted to prevent a recurrence of the difficulty.

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

Storage tube operation for most of the bi-weekly period was very satisfactory. Few gate adjustments had to be made to maintain reliable operation. Transfer characteristics have been taken for all the tubes which should aid in adjusting parameters. No tubes were replaced during this period.

Computer operation this past period has been plagued by numerous intermittent troubles. Considerable data has been obtained in an effort to determine the causes.

(H.F. Mercer)

Storage Tube Complement in WWI

Following is the storage tube complement of Bank B as of this date:

| Digit | Tube | Hrs. at Install | Hrs. of Operation |
|---|---|---|---|
| 0 | RT233 | 4722 | 2278 |
| 1 | ST500 | 6113 | 887 |
| 2 | RT247 | 5198 | 1802 |
| 3 | RT234 | 4705 | 2295 |
| 4 | ST516 | 6641 | 359 |
| 5 | RT237 | 4714 | 2286 |
| 6 | ST503 | 6417 | 583 |
| 7 | ST508 | 6321 | 679 |
| 8 | ST505 | 6176 | 824 |
| 9 | ST519 | 6624 | 376 |
| 10 | ST504 | 6665 | 335 |
| 11 | ST520 | 6639 | 361 |
| 12 | RT258 | 5207 | 1793 |
| 13 | ST517 | 6493 | 507 |
| 14 | RT230-R2 | 4726 | 2274 |
| 15 | RT255 | 5150 | 1850 |
| 16 | ST506-1 | 6218 | 782 |

One column gives ES Clock Hours at the time of installation for each tube and another column gives the total hours of operation in the Computer for each tube through April 11. ES Clock Hours this date 7000. No tubes were replaced during this bi-weekly period.

1.1 Whirlwind I System (continued)

(L.O. Leighton) Component Failures in WWI

The following failures of electrical components have been reported since March 28, 1952:

| Component | No. of Failures | Hours of Op. | Reason for Failure |
|---|---|---|---|
| **Resistor** | | | |
| 2200 ohm 1 watt carbon | 1 | 9629 | Overheated |
| **Tubes** | | | |
| EL3C | 1 | 4335 | Change in characteristics |
| ELC165 | 1 | 1313 | Change in characteristics |
| 6AS7 | 1 | 356 | Mechanical |
| 7AD7 | 1 | 2771 | Low $I_b$ |
| | 1 | 3178 | Low $I_b$ |
| | 1 | 3256 | Mechanical |
| | 1 | 9000 | Mechanical |
| | 1 | 9649 | Low $I_b$ |
| | 2 | 10771 | Mechanical |

1.2 Five-Digit Multiplier

(C.N. Paskauskas)

The multiplier has been operating without error since 1 April. During the period of this report the following were replaced as a result of marginal checking.:

1 6AG7 FF tube -- 5323 hours in service
2 7AD7 FF tubes -- 5346 hours in service

Replaced as a result of troubleshooting:

1 6AS6 check gate tube -- 23017 hours in service

## 2.0 CIRCUITS AND COMPONENTS

### 2.1 Circuits by System Number

#### 2.14 Input-Output

(R.H. Gould)

Power has been applied to the IOC panel in AX4 and temporary video cables have been installed. Most of the permanent video cables between IOC and the delay counter have been installed. IOC will be first tested by simulating the computer pulses needed for the display equipment. A si (DISPLAY)-rc cycle can be simulated with the test equipment now installed and the action of IOC will be observed. More complex operations will follow in order to test IOC in all its possible modes of operation.

(C.W. Watt)

The first production -- or preproduction -- frame assemblies for the Mod II Plug-In units have been made. They seem to go together well. A total of 150 will be made on this pilot run in our own shop, and the balance will probably be purchased from an outside vendor.

(D. Morrison)

Special Adjustable Constants Switch

D. Israel has requested a switching unit to be built for inserting information into certain specified flip-flop registers. A design has been approved and construction of one unit started.

#### 2.18 Electrostatic Storage Circuits

(B. Remis)

During the past bi-weekly period a literature search was inaugurated to determine just what has been done in the line of high-frequency phase measurements and what would remain for a master's thesis on that subject.

The numerous r-f pulser drawings were checked out and a report on the operation of the pulser started. A study of the alignment procedure for the r-f amplifier of EST output, is also under way.

### 2.2 Vacuum Tubes and Crystals

#### 2.21 Vacuum Tubes

(H.B. Frost, L. Sutro, S. Twicken)

A much improved version of the transconductance bridge has now been completed. The transconductance bridge and associated complementary network are now mounted on a standard 8-1/2 x 19 relay-

2.21 Vacuum Tubes (continued)

(H.B. Frost, L. Sutro, S. Twicken) (continued)

rack panel, along with appropriate meters. Minor but numerous "bugs" have been removed. Most of these bugs were due to the very high sensitivity and wide bandwidth of the equipment. It is now more accurate and versatile than before by a considerable margin.

A list of all vacuum-tube uses in WWI is being compiled. All tubes are being catalogued according to their use. This data will be transferred to the punched cards. The analysis of the failure patterns of various circuits can then be made.

Two part-time students are now working the night shift in the vacuum tube shop. This extra time is needed because of the very large number of tubes to be used in the new Burroughs test equipment and the terminal equipment. A total of between 5000 and 6000 tubes must be tested in the next few months, in addition to all the routine work for WWI and experimental purposes.

Twenty-five 5670 tubes have been received. These tubes are the ARINC (or GE Five-Star) version of the 2C51. These tubes were received on allocation; more tubes will be received 1 May and 1 June. These tubes appear to be very well constructed, with very few tap shorts and well-controlled characteristics. However, the plate current average is somewhat below that of the 2C51. It is very near the published characteristics, whereas the 2C51 was somewhat above the published characteristics.

(H.B. Frost)

A paper, "The Measurement of Cathode Interface Impedance," was presented before the MIT Physical Electronics Conference on March 27.

2.22 Transistors

(N.T. Jones)

Fifty Bell 1698 and one 1689 transistors, and five 1727 junction diodes were received during this period. The rise and fall time measurement (described in E-455, Measurement of Collector Current Rise and Fall Times.),was applied to the transistors, producing a minimum of parameter data for experimental circuit work. The remainder of the measurements are now being made.

The shunt capacities of the diodes were measured at a relatively high back voltage by Irving Aronson. He is now beginning a study of the variation of capctity with back voltage and other characteristics of the junction diodes.

2.22 Transistors (continued)

(N.T. Jones) (continued)

The manually-controlled magnetic-core gate-driving transistor circuit was delivered to Carl Schultz.

Three E-Notes on Transistor Measurements are still nearing completion.

A discussion was held with Mr. R. Bradbury of AFCRC concerning our new rise and fall time measurements. This measurement was reported to the transistor seminar on Tuesday, April 1, 1952.

A conference of the Building 20 Transistor Group (Professor Adler, C. Hurtig, W. Morrow) and the engineers of the Scientific Specialities Corp. about a proposed transistor tester was attended. This unit is being designed primarily to measure small signal transistor parameters, but it would be useful in our experimental work.

(J. Jacobs, R. Callahan)

Work has been continued toward improving the two-transistor flip-flop. Both the rise and fall times of the output wave have been decreased. The rise time is now about 0.1 μsec, and the fall time is about 0.2 μsec.

(D.J. Eckl)

Preliminary work has been started on the design and construction of a four-bit test accumulator and A register using transistor flip-flops and gates. The complete system will require 52 transistors and should operate in the 500 kc region. A control system has also been designed and is in the process of construction. At the present time emphasis is being placed on flexibility so that as better flip-flops and gates become available they may be readily substituted.

2.3 Ferromagnetic and Ferroelectric Cores

(E.A. Guditz, W.N. Papian)

Ceramic Array & Switch I

This period was devoted to improving the memory coordinate driving currents in three ways: shape, symmetry, and uniformity.

The unfavorable clipping effect of the FF buffers, which are triodes, was rediscovered and remedied by a redesign which replaced the triodes by pentodes. This significantly improved the shapes and symmetry of the coordinate currents.

2.3 Ferromagnetic and Ferroelectric Cores (continued)

(E.A. Guditz, W.N. Papian) (continued)

The remaining lack of symmetry and lack of amplitude uniformity was remedied after a good deal of study, by adding and subtracting turns on the switch-core driver windings.

The coordinate currents were then reshaped to give flatter tops, by parameter adjustments in the driver-tube circuits.

Lastly, a new design sensing panel was installed. It accomplishes impedance matching and full-wave rectification with two 5:1 WWI "gate" transformers; this is followed by two stages of straight voltage amplification, and the output signal is fed to a gate-tube suppressor grid; advantage is then taken of the time dependence of the ONE-ZERO ratio by "sensing" the gate tube at the optimum moment.

8-by-8 operation is now possible with fair margins; the array tolerates driver-current variations up to almost ± 15%. Signal-to-noise ratios are considerably improved, and arbitrary patterns can be held fairly well for long periods.

(K.H. Olsen)

Ceramic Array II

The electronics for the second ceramic memory has been assembled and most of it debugged. We are now waiting for tested cores for the memory.

A 128-position switch has been built to use in debugging the memory drivers and to study some of the problems involved in making large switches.

(G.A. Briggs)

1) Investigation of the feasibility of three types of permanent magnetic memory has been nearly completed.

a) Quadrature Field type.

An extra Z-drive matrix is required of cores. Driving these cores is a requirement, and thus no time saving due to the inherently greater speed of the quadrature field type is forthcoming. Also this type will have a poor signal-to-noise ratio if sensing is done in the conventional way. No better way to sense the output has so far been devised.

b) Core Disturb Type

This type involves only partial flipping of the memory cores, and is faster than present type of memory, but still requires re-writing, and its inherent speed cannot be utilized

2.3 Ferromagnetic and Ferroelectric Cores (continued)

(G.A. Briggs) (continued)

because of the Z-drive matrix necessary for R.O.; thus it has been dropped from consideration, although experiment has shown it to work as a practical P.M.M.

c) Double-Core Type

This has never been shown to work in experiment yet, but is now being analyzed theoretically. Again, a Z-drive matrix is desirable for best S/N and non-critical operation, hence no time-saving occurs. Even in conventional R.O. drive, single re-setting of the R.O. cores is necessary. No time-saving occurs.

Conclusions:

a) None of the P.M.M. schemes so far suggested will lead to a time-saving, because of the necessity of providing a separate matrix for R.O., and the necessity of providing a reset pulse for the Olsen switches and cores in this matrix. In the case of the double-core type, the extra matrix can be dispensed with, but re-setting of the memory-output signal cores is still required.

b) The only possible saving is in the elimination of the -i/2 inhibiting currents required at present during rewrite after R.O.

2) S/N Ratio Improvement Investigation

Use of the additional matrix with present memory will lead to a S/N improvement of 20-100 or possibly more. The reset problem is not difficult, and can be accomplished at the same time as the re-write operation. One core has to drive a possible number of cores = to number of digits in each word. This must be investigated, but should work without trouble, although the speed may be considerably less than when one core only is being driven.

3) Possible uses for double-cores and other P.M.M. devices in the rest of the machine is under investigation. The double-cores appear most promising, because of the great isolation possible between elements utilizing them, allowing one to use logical design methods. A complete adder with high-speed carry has been designed around these cores, each digit requiring 6 of the double cores plus extra cores of the ordinary type for the carry matrix (see below). Three time pulses are required for add:

1) Add No. to Accumulator
2) Make carries
3) Reset cores, leaving new sum in AC.

4) A high-speed carry matrix has been designed, without the necessity of one core driving following cores. $N^2/2$ cores are required, where N is the number of digits in the AC. Partial sum F.F.'s are required, capable of being triggered, and special decoding apparatus

2.3 Ferromagnetic and Ferroelectric Cores (continued)

(G.A. Briggs) (continued)

to detect a 0-0 or a 1-1 partial addition required. This has been designed using double cores (see above).

(C.J. Schultz)

Magnetic-Core Gate

Data for the input, output and bias characteristics of two magnetic cores has been taken and the results are being analyzed for possible application as a gate circuit with a transistor flip-flop.

(R. Pacl)

Magnetic Core Testing

A hysteresigraph was assembled using a Tektronix 512 dual input scope and preamplifier-integrator using 5879's (low noise pentodes) connected push-pull, with screens and cathodes connected together to reduce the effect of voltage fluctuations and resistor noise. Deposited carbon resistors were used to further reduce noise. Although direct coupling is preferable as regards low-frequency phase shift, it was found that using large coupling capacitors was satisfactory. The signal-noise ratio is good, but low-frequency excursions are noticeable with cheerios, and other low output cores.

(W. Ogden)

Single-Core Pulse-Test Equipment

The subject equipment was modified to provide for testing at pulse repetition frequencies up to 250 kc. Tests were conducted on type MF1118(259) Ferramic cores suspended in still air and a second run was made using a small fan for cooling. The results clearly indicate that the MF1118 core can be operated satisfactorily at PRF's up to 250 kc provided that some means of forced air cooling is used. The test data were plotted and the following print is available:

SA-48339-G MF1118(259) Disturbed One and Disturbed Zero vs Pulse Repetition Frequency

(R.D. Robinson)

Pulse Transformers

The new Burroughs miniature [1:1] pulse transformer was tested and compared with the WWI [1:1] transformer. Tests showed the

2.3 Ferromagnetic and Ferroelectric Cores (continued)

(R.D. Robinson) (continued)

Burroughs component to reduce the pulse amplitude and narrow the pulse width. It is also necessary to change the shunt tail reversing inductance in order to eliminate positive reversals of the tail. This Burroughs transformer is a cup core construction with a hole in the center for assembly. The necessity of bobbin winding and the reduction of core material in this design had previously eliminated this particular shape for our WWI application. It is perfectly possible, of course, to design a cup core shape which will work. This can be done by increasing the cross sectional area through the center of the coil, and lengthening this center piece to permit a wider coil to be wound. Unfortunately such a shape becomes costly (a deep core is required) and bulky. For this reason we prefer a toroid or C-shape.

The work on pulse transformers for radar application by the Radiation Laboratory is being studied. Since the materials used for this research were Hypersil, Hypernik, and silicon steel the eddy current effects masked the induction mechanisms so that a vigorous mathematical analysis was difficult. We hope this will not be true with ferrite cores.

(R.E. Hunt)

Development of the toroidal winder is now at a stand-still while I recoup my losses. Data was taken on the original prototype, on wire tensions, operational ease, etc. It was found that the design had to be strengthened in two respects: (a) wire tension from the bobbin had to be made more uniform and higher, (b) wire in the slack part of the cycle has to be restrained from skipping back and allowing the "just wound" coil from uncoiling.

Thought was given to these matters and the shop is now constructing a new bobbin which is (a) smaller (.090 Dia.) (b) much more concentric (c) easier to break and space. A new pendulous wire tensioning device is being constructed and will be added.

When I receive these new parts in about one week I can proceed with development work.

(D.R. Brown)

Laboratory for Insulation Research

We have received our first samples from Laboratory for Insulation Research. These are similar in composition and processing to the General Ceramics body MF-666. A hysteresis loop obtained from a disc sample, which had a hole cut in it, indicates the body is not suitable for computer application and is not as rectangular as MF-666. Ring samples from Laboratory for Insulation Research are expected next week.

2.3 Ferromagnetic and Ferroelectric Cores

(D.R. Brown)

Pulse Tests at General Ceramics

The single-core pulse tester was set up at General Ceramics in New Jersey on March 20 and since that time a number of batches of ferrites have been tested there. The first batch of small memory cores using MF-1118 appears to be superior to subsequent batches of MF-1118. About five batches have been produced since the first one and only two of these appear at all usable. Some new bodies, MF-1312 and MF-1316, have been produced with very low coercivity, as low as 0.5 oersted. Though these bodies were designed to work as memory cores, they appear to be more useful as switch cores than memory cores. We have ordered 60 rings of the low coercive force, MF-1312 die size F-259. Inadequate operation of the single-core pulse tester necessitated returning two panels to the lab here for correction, causing an interruption of the pulse tests at General Ceramics. The panels have been corrected and will be returned to General Ceramics next week.

(J.H. McCusker)

Pulse-Test Equipment

The single-core tester at General Ceramics was found in general to be satisfactory, but was returned for modifications because of bad parasitic oscillations.

MF-1118 cores are being tested for uniformity for a second ceramic array.

(R.L. Best)

The general-purpose ferrite core tester has been returned from General Ceramics to have parasitic oscillations eliminated. The parasitics appear to have been eliminated, and the unit will be used here for a few days before being returned to General Ceramics.

2.5 Basic Circuits

(T. Roess, J. Dintenfass, A. Werlin)

An investigation was made of the effect of a series grid limiting resistor in a standard gate-tube circuit. For large inputs, a double humped output pulse appears. The grid resistor lessens the distortion but at the expense of reducing the normal output pulse amplitude for small inputs.

With +150 plate voltage the output pulse starts to distort at about 17 volts. For +250 plate voltage, however, no distortion starts to appear until about 20 volts input. If a small amount

2.5 Basic Circuits (continued)

(T. Roess, J. Dintenfass, A. Werlin) (continued)

of distortion can be tolerated for larger input pulses, a series grid limiting resistor does not seem necessary with a +250 volt plate.

2.6 Component Analysis

(B.B. Paine)

A study of test equipment needed to carry on an effective acceptance testing program has been completed. Some of the equipment now used will be duplicated in order to make available at least one of each unit for general laboratory use.

Etched circuit construction, utilizing conductors formed from copper foil bonded to a phenolic base, may prove useful in future circuit packaging techniques. Much preliminary study has been done, and materials are now being assembled to try out some of these techniques. This method would eliminate the use of most flexible wires and individually soldered joints, but would retain the advantages of our present components, and should somewhat increase overall reliability, and greatly increase the speed of assembly of computer elements.

## 3.0 STORAGE TUBES

### 3.1 Construction

(P. Youtz)

Work on the two new vacuum systems is progressing on schedule. One vacuum system will be in operation before the end of this next bi-weekly period.

Work continues on the program to produce 500-series storage tubes as replacements for Bank B. Test results indicate the desirability of getting closer collector-to-mosaic spacing in the target assembly. Design work has been started on an assembly to provide this closer spacing and prevent the mica from buckling under the electrostatic forces.

A research tube, RT306-1, was constructed. One-third of the mosaic in this tube had 80 mil beryllium squares and the remaining surface was covered with the regular 70-mesh mosaic. This tube will be used to explore the feasibility of storing one spot per mosaic square.

### 3.2 Test

(A.J. Cann, R.E. Hegler)

During this bi-weekly period, nine tubes were available for pretest: RT311, RT310-R1, ST523, ST524, ST525, ST522-R2, ST526-1 ST527-1 and ST528-1.

RT311 was rejected. A stannic-oxide conductive coating was used in this tube to determine if it would minimize the deflection shift caused by positive ions. It was very difficult to write plus in the lower left hand corner. This area appeared to have a low secondary emission ratio at 2500 volts. RT310-R1 was rejected. This tube had a stannic-oxide coating and had the same trouble as RT311. RT291, which also had a stannic-oxide coating, was checked to see if it exhibited some of the properties of RT311 and RT310-R1. The notebooks of RT291 through RT299, which tubes have stannic-oxide coatings, were checked. On all of these tubes it was either difficult to write plus or they lost spots on the left-hand side of the array which is opposite the tubulation. This suggests, together with the test results of tubes RT310-R1 and RT311, a contamination of the beryllium during bakeout due to the position of the tube.

ST523, ST524, ST525 and ST522-R2 were marginal. These tubes showed the formation of a positive area on ion-current test under 17 seconds. If the $V_{HG}$ was switched from 0 to 150V (not increased gradually) an area in the center of the mosaic would switch positive. If the $V_{HG}$ was increased gradually, the same area would switch positive at $V_{hg}$ = 300 volts. This has previously been investigated and found to be due to a buckling mica. This

3.2 Test (continued)

(A.J. Cann, R.E. Hegler) (continued)

condition is not serious, however, and the tubes should be satisfactory for computer use.

ST526-1 and ST527-1 were both found to be satisfactory after the $A_3$ was increased to 150V to give sufficient holding-beam coverage in the corners.

ST528-1 was satisfactory.

During this bi-weekly period, considerable time was spent maintaining the test equipment.

1. A 5687 was replaced in the high-velocity gun driver.
2. The TV bias adjustment lost control of the r-f drive to the storage tube. A defective 5587 tube in the leakage- and ion-current test control panel was replaced.
3. A very weak picture and poor resolution of the TV presentation was remedied when the oscillator tube was replaced and the r-f pulser was re-tuned.
4. A 0-50μamp meter was burned out due to arcing in the HV gun. This was replaced.
5. Some time was spent mounting junction boxes and re-routing power cables.

Part of this bi-weekly period was spent in helping with the installation of new power circuits.

(T.S. Greenwood, C.L. Corderman)

During the last bi-weekly period, two tubes were sent to Whirlwind. These tubes, ST524 and ST525, had fair margins although ST524 had slightly narrow margins. ST523 was also checked and had a small spot interaction area; however, a satisfactory operating point for reduced time writing could not be found and since the mica apparently showed a tendency to buckle, the tube was not sent to Whirlwind.

Two stannic-oxide coated tubes were made during this period. Both of these when checked in the TVD showed very poor readout. This was eventually traced to the fact that the secondary emission of the surface fell off sharply above 2000 volts. Some rough checks of secondary emission showed that at normal HV gun accelerating voltage (2500V), the secondary-emission ratio was just above unity. One of these tubes, RT310-R1, was tested for spot interaction. At normal acceleration voltages no error-free operation could be obtained. However, when $V_k$ was reduced to -1800, a fairly satisfactory area was found. These tubes were originally made to investigate deflection shift as a function of HG duty cycle. However, since the tubes could not be operated with normal-velocity electrons the studies have not as yet been carried out.

3.2 Test (continued)

(T.S. Greenwood, C.L. Corderman)(continued)

RT306-R1 was also received during this period. Approximately one-third of the mosaic of this tube had 80 mil beryllium squares, the remainder were normal 70-mesh squares. Preliminary observations on the tube showed that the large squares have very desirable lower-switching qualities both in uniformity and in magnitude. All of the large squares switch negative in the range from 30 to 27 volts $V_{HG}$ compared with a range of about 55 to 40 volts for the 70-mesh area and normal 500-series tubes. In the STRT, spot interaction studies were carried out on an 8 x 16 spot array in both the large square and normal regions. The spot interaction area for the large square region was comparatively small. This was primarily due to the large currents required to write a single square. These currents were somewhat in excess of the amount which calculations indicated would be necessary. The cause of the discrepancy has not yet been located. There is also a variation in the minimum currents from square to square, an effect which was not anticipated.

Actually the meaning of the relative size of the spot interaction area is difficult to interpret because the area taken on the normal mosaic was larger by a factor of two or three than those being obtained on normal 500-series tubes. Further evaluation of the single-square storage is being carried out.

(H.J. Platt)

The holding-gun driver described previously has been completed and checked out. Also completed were three regulators to supply +150, +120, and +90 volts to the Alignment-Demonstrator and a filament supply panel for the storage tube and display scopes. Modifications and additions having been completed, the revised r-f pulser now awaits checking. One feature of the pulser is that a 2" phase monitoring scope has been added directly to the unit. This eliminates the need for a separate 5" scope as used in the STRT.

Final power installations have not been completed as yet. Two or three more days of work are still necessary. The design for a TV sweep generator has just been finished. To eliminate possible interference, the vertical sweep is triggered from 60 cycles.

Work is now being concentrated on completing a block diagram.

(T.S. Greenwood)

Life testing on Type "L" cathodes continues with no significant change in the emission of RT264 and a slight decrease in that of RT265.

3.2 Test (continued)

(A.J. Cann)

Bill Carroll has completed the conduit and wiring required for the new power supplies. Control circuits have been completed. On Saturday, the 12th of April, the new -300-volt supply will be installed and connected so that next week the old -300-volt supply can be converted to -150 volts and installed without interrupting operations. At present, it appears that the complete system will be finished by the 19th of April.

An attempt has been made to reduce fraying of storage tube leads by applying protective vinyl sleeving as early in the processing as possible, i.e., after the last bakeout. Memorandum M-1447 describes the procedure. To minimize risk of damage to the tube, the sleeving is being applied only to those leads which appear frayed after the last bakeout.

(A.M. Stein)

Tests were conducted on RT280, which has a variable auxiliary-collector to collector spacing, in order to determine the effects of this spacing on fringe behavior. With the linear portion of the curves of spot radius vs ln $W^+$ time considered to have a slope "$r_e$" a plot of five different values of auxiliary-collector to collector spacing vs "$r_e$" gave a straight line with an intercept at a spacing of zero mils. This test was repeated using a $V_{AC}$ of 100 volts instead of 400 volts with the same results. This seems to indicate that a smaller auxiliary-collector to collector spacing than is presently used will result in a beam at the surface containing a smaller fringe region.

Attempts were made to investigate the effects of the collector in the 300-series tube. Unfortunately, RT125, which has a variable collector-to-surface spacing, is at present in the hands of the Bureau of Standards. However, tests were made on ST365, a good sample of the 300-series, to determine the effects of collector voltage on "$r_e$". It was found that a plot of "$r_e$" vs ln $V_{HG}$ resulted in a straight line. A similar result was obtained when plotting "$r_e$" vs $V_{AC}$ in the case of the 400-series. In the absence of additional tests, this suggests a strong similarity between auxiliary-collector and collector behavior in their effects upon the fringe region.

Further exhaustive tests on ST365 revealed that most of the other tube parameters have little effect on the fringe behavior.

A theoretical study of dispersion of secondary electrons resulting from the impact of primary electrons on a round wire are being made. A survey of the available literature has proved to be little help. Attempts to correlate the observed results with theory have not been successful to date.

## 4.0 TERMINAL EQUIPMENT

(E.S. Rich)

### Terminal Equipment Planning

The first draft of a set of schedules covering the foreseeable work for the next 15 months has been completed by Watt, Dodd, Newitt, and myself. More detailed work on these schedules will be done now to obtain accurate estimates of manpower requirements (engineering, shops, and drafting) for the remainder of this year. Newitt will keep the master schedules for terminal-equipment installation posted and will revise them from time to time to keep them up to date. These schedules show that integration of the initial IO system (IOS, IOC, IOR, paper tape equipment, and scopes) will be finished by September 1, 1952, and magnetic-tape units will be added by the middle of November, 1952. The two magnetic drum systems, the multiple input counters, and other miscellaneous devices will have integration completed by the Fall of 1953.

## 4.1 Typewriter and Tape Punch

(L.H. Norcott)

Sketches have been completed on a tape-comparer, and the machine shop has scheduled the necessary work for completion about the middle of May.

Most of the parts for converting two "FL" readers for use with the tape comparer have been received, and Bill Walker is now working to modify the readers.

On April 2, Mr. Thalstrup of Commercial Controls Corp. visited Whirlwind to discuss some of the problems we have experienced trying to perforate our gray tape on the "FL" punches. Thalstrup has been working with Paper Manufacturers Co. trying to develop an opaque tape which can be easily perforated, and brought with him specimens of standard weight tape which he dyed black to increase its opacity. Commercial Controls is considering having some sample rolls made up, and has agreed to send us a few rolls when available.

## 4.2 Magnetic Tape

(J.A. O'Brien)

Satisfactory progress is being made on all phases of the terminal equipment program. The interim magnetic tape system is working well and it is beginning to be used by the applications groups.

The magnetic-tape print-out equipment has performed very well and we are beginning to think about a final design.

4.2 Magnetic Tape (continued)

(J.A. O'Brien) (continued)

Preliminary testing of In-Out Control has started, and no troubles have showed up so far.

Circuits and layouts for magnetic tape control and IOS matrices have been almost all completed. There remain one circuit schematic and two layouts, and we expect to have these into the drafting room by the time they are ready for them.

(B. Ginsburg, K. McVicar)

The move of the magnetic-tape system into the computer room has been accompanied by some backsliding in system reliability. So far most of the trouble has been in the cables, connectors, and test equipment. It was also expected that we would have more trouble with microphonics because of the vibration in AX1 and AX2 where the read-record switch panels and amplifiers are mounted. To date such trouble has not developed, possibly because the amplifiers are less resistive to vibration than they formerly were.

We are still having trouble with the d-c power, especially +150. This seems to be caused by overloading of the lab supply when both the equipment in Room 224 and Magnetic Tape are operating with a resulting drop in the voltage of as much as 25 volts.

(E.P. Farnsworth)

Recordings made by the computer on magnetic tape at speeds up to 150 characters per second have been printed out on a Flexowriter typewriter at ten characters per second. An elaborate program for recording and checking information in Flexowriter code on magnetic tape has been written by J.T. Gilmore to facilitate testing of the magnetic tape printing-out equipment.

Reading back and checking of such recordings by the computer is assisted by the fact that block marks (rc*) may be programmed for the convenience of the computer, although a dummy (rc 0) may be used only to precede each Flexowriter character. The print-out cycle is initiated by the index channel pulse of a dummy, but the printing-out equipment is insensitive to block marks, which lack the index pulse.

(J.W. Forgie)

Layout sketches for the Magnetic-Tape Read-Record Switch and Reading Amplifier panels have been sent to the drafting room, and the drawings have been finished. However, work is still continuing to eliminate certain faults in the two breadboard models of the circuit which have been constructed. Although nominally the same, the two models have been far from identical in performance. Some difference was due to physical layout of the components, and this

4.2 Magnetic Tape (continued)

(J.W. Forgie)(continued)

difference has been corrected. A more basic difference has been traced to the frequency characteristics of the input transformer. Apparently it will be necessary to adjust some of the other components to compensate for differences in the transformers in the final panels.

Layout and design work is in progress on two other panels for the magnetic-tape control system.

## 5.0 INSTALLATION AND POWER

### 5.2 Power Supplies and Control

(J.J. Gano)

D-C Supply -150 volt, 10 amperes

Frequency response tests have been completed. A compensating circuit is being planned prior to closing the loop.

(G.A. Kerby)

Continued with revisions and requisitions for the rectifier/regulators.

Designed an interlock for the bias voltages in the Whittemore power supplies.

(R. Jahn)

Whittemore Building D-C Supplies

A new regulated power supply has been tested and installed in place of the temporary unregulated -150-volt power supply. A bleeder across the output of this supply is used to provide -15 and -30 volts.

The new +120-volt power supply relay control circuit is being revised to eliminate a number of unnecessary auxiliary contacts which are potential sources of trouble.

-15-Volt Regulator Panel, WWI Power Supplies

The new regulator panel for the -15-volt power supply has been installed and is operating satisfactorily.

5.3 Video Cabling

(T. Leary)

The 49 in-out cables mentioned in the last bi-weekly have been built by the shop, not without considerable difficulty occasioned by the necessity of using improperly-manufactured braid clamps.

The paper work for another group of 118 cables has been completed. These are for the in-out panels in AX4 and for extending the main bus to the new Display Decoders and the In-Out Switch Bus Driver in AX6.

6.0 BLOCK DIAGRAMS

(J.H. Hughes)

I have been working on a block diagram of the entire arithemetic element for further indoctrination of myself. I propose to get copies made and make "guided tours" through the various arithmetic operations in red pencil, one diagram per operation. I believe that the resulting diagram will be useful both to new indoctrinees and to engineers who want to "bone up" on computer workings.

7.0 CHECKING METHODS

(M.F. Mann)

The new order, cycle left, has been added to the marginal checking test program T-106 but has not yet been fully tested with this program because of computer difficulties.

7.4 Marginal Checking

(R.E. Hunt)

The new cold cathode stepping circuits for marginal checking employing 5823 miniature tubes are pretty well worked out. We will connect a prototype counter to the cross-bar switch and measure all the margins.

We have operated these tubes for over 200,000 operations with loads equivalent to the cross-bar switch and have found no deterioration in tube firing sensitivity.

Some thinking remains to be done on interlocks and "fail safe" operation.

## 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.

4. Floating Point and Extra Precision Interpretive Subroutines (Programmed Arithmetic, PA): Frankovich, 27 hours; WWI, 13 minutes

Two new Programmed Arithmetic interpretive subroutines have been written and will be tested this week. One is the new 24,6,0 subroutine which minimizes the time required for WWI to perform each of the interpreted instructions and also allows a programmer to keep intermediate results in the 30,15,0 number system. The other is the 39,6,0 subroutine; the short (timewise) version requires about 350 registers of storage.

7. Industrial Problem C: Frankovich, 1 hour

Discussions are continuing about the paper being written about the problem.

8. Magnetic Flux Density Study: Helwig, 0 hours; WWI, 77 minutes

The (30,0,0) Runge Kutta solution for the magnetic tape problem was tested and is working properly. Several sets of parameters will now be used to obtain printed results.

13. Point-by-Point Scope Plotting of Calibrated Axes (Output Camera, OC 2): Kopley, 1 hour; WWI, 14 minutes

Two display subroutines, 863-5 and 788-4, were run and pictures were successfully taken of both programs. The pictures show that the programs were successful. Caliber of pictures might be improved by more careful camera focusing.

21. Optical Constants of Thin Metal Films: Carr, 2 hours; Neeb, 2 hours; WWI, 21 minutes

The subroutine to evaluate $e^x$ has been partially tested, and the results indicate that the accuracy obtained is within the limits of the problem in which it will be used.

23. Print-Out of Contents of Storage (Post Mortem Error Diagnosis, PM): Carr, 2 hours; Combelic, 37 hours; Helwig, 22 hours; WWI, 25 minutes

An auxiliary subroutine which will control printing for ED is under test. This subroutine will cause printing for ED to occur only when control passes through registers selected by the programmer. An interpretive subroutine which will count the number of operations performed

8.1 Programs and Computer Operation (continued)

by a closed subroutine is under test. This subroutine will print out the address of the sp or cp(-) instruction which sent control to the closed subroutine, the C(AC) upon entering the closed subroutine, the C(AC) on leaving, and the number of operations performed by the closed subroutine.

24. Matrices, Determinants, and Systems of Linear Equations: Aronson, 12 hours; Carr, 17 hours; WWI, 107 minutes

Continued testing of the Gauss-Seidel Iterative Matrix solution is under way to determine more about the behavior of the program. A Relaxation solution has now also been programmed in an attempt to compare the two methods as to speed, number of iterations, and accuracy. Probably neither will be used in any final matrix solution, but experience is greatly needed in such solutions. It is planned to code a general elimination scheme for lower order matrices.

26. Subroutine Orientation Procedures: Carr, 10 hours; WWI, 75 minutes

Two memoranda were written and turned over to C. W. Adams as suggestions for use with further conversion programs. These stressed certain of the automatic assembly methods and suggested several changes in the conversion program notation.

28. Ambipolar Diffusion: Gilmore, 4 hours; WWI, 327 minutes

(The diffusion of electrons and ions in a plasma in the presence of space charge leads to two coupled 2nd order, 2nd degree equations. Compatible values of electron and ion concentration are desired.) The operation of additional parameters has indicated some difficulty in the program in meeting certain criteria. It may be necessary to display some of the solutions in order to easily observe the behavior for certain parameters. A few more parameters are going to be operated with the printing output before we decide to incorporate a display routine.

30. Digitally-Controlled Milling Machine Program: Frankovich, 8 hours; WWI, 18 minutes

Mr. Runyon has completed a new tape preparation program for the digitally-controlled milling machine. The program will convert information typed in the different Flexo codes used by the Flexo equipment here and in the Building 32 Servomechanisms Laboratory to the NMM code used by the milling machine.

36. Investigation of Methods of Approximating Functions: Aronson, 5 hours; Helwig, 5 hours

A (75,0,45) flexowriter to octal conversion program was rewritten to use the new flexowriter code.

8.1 Programs and Computer Operation (continued)

37. n-th Root Approximation for Subroutines: Demurjian, 3 hours; WWI, 21 minutes

Another test program is being written to test Gaudette's method for deriving the square root by additions.

38. Typewriter Print Out for Subroutines: Carr, 1 hour; Demurjian, 31 hours; Helwig, 2 hours; WWI, 10 minutes

The page layout routine for printing C(v3) through C(v4) as an octal number (OT 1.7t) has been changed to give either a normal space layout of ten words to a line with one space between words or an optional tab layout with six words to a line. The new tape number is T-1060-2.

The decimal fraction routine with round-off in the last digit is being tested in the new form which allows one to vary the number of digits printed. Methods for combining routines for the general output routine are being developed.

39. Subroutine Library Editing: Carr, 4 hours; Lenihan, 28 hours

See Section 8.2.

40. Input Conversion Using Magnetic Tape Storage: Frankovich, 11 hours; Gilmore, 41 hours; Helwig, 7 hours; WWI, 178 minutes

The present semi-direct-photoelectric-reader-magnetic-tape-conversion program which is in the process of being tested is actually a prototype of a more elaborate conversion program. By writing a program which uses the fundamental methods of conversion and magnetic tape routines, we hoped to uncover any illogical or impractical ideas before trying to write the final program. This has proven worthwhile and, at present, meetings are being held approximately every two days to discuss ideas and plans for the complete conversion program. Briefly the program will convert regular instructions, octal numbers, single length decimal integers and multilength fixed or floating point decimal numbers which may be expressed with exponents of any base from binary to decimal. Utilization of the magnetic tape will increase the number and kind of preset parameters (including a set for floating addresses) and improve the method of orienting subroutines so that programs may be automatically assembled by the computer.

41. Binary Matrix Product Statistics: Carr, 4 hours; WWI, 242 minutes

Three of the networks for which statistics are to be evaluated were calculated on Whirlwind with satisfactory results by Rotenberg. However, a mistake was found in the program for more involved networks. Also, transfer of control to test storage being generally unsatisfactory, an electrostatic read-in program for the random number tape is now being added to the program.

42. Spherical Waves - Numerical Integration of Hyperbolic Partial Differential Equations via Characteristics: Aronson, 8 hours; WWI, 48 minutes

8.1 Programs and Computer Operation (continued)

42. (continued)

Before any further progress can be made on this problem, a nth root subroutine must be written. At present, Miss Phyllis Fox is in the process of testing such a program.

43. Generation of Random Numbers: Carr, 1 hour; WWI, 86 minutes

The 100,000 random number conversion program was used to convert about 10,000 random decimal digits to equivalent 5-5-6 form. These are now available for general use. The proper subroutine with which to use them will be included in the subroutine library.

45. Crystal Structure: Aronson, 24 hours; WWI, 19 minutes

46. Torpedo Depth Response: Neeb, 3 hours; WWI, 5 minutes

The results from the (24,6,0) program still do not agree with those obtained experimentally.

47. Partial Differential Equations of Engine - Part I: Carr, 0 hours; WWI, 50 minutes

This program has been coded and all the various subroutines tested. The main program is now being typed and will go under test soon. This program will have two outputs, one with the oscilloscope, and one printed. An error in the program was found to be caused by a faulty square root subroutine, which has been corrected in the Library of Subroutines.

48. Gust Loads on Rigid Airplanes in Two Degrees of Freedom: Helwig, 10 hours

The program for the computation of the response of an aircraft to a step function gust load was rewritten and has been submitted to the tape room. A program for the response to a graded gust load has also been written by C. Brenner. This will make use of data computed by the above tape.

50. Lattice Analogy Applied to Shear Walls: G. D. Galletly; WWI, 140 minutes

The lattice analogy program has been operated successfully and produced reliable data. At present, extra parameters are being operated on the computer for various sets of initial conditions.

52. Oil Reservoir Depletion Analysis by Iteration: Kopley, 76 hours; Porter, 50 hours; WWI, 34 minutes

Preliminary runs have indicated the desirability of one scale factor adjustment and of smoothing the prescribed production data.

53. Solution of Schrodinger's Wave Equation which Contains a Singularity at the Origin: Gilmore, 4 hours; WWI, 112 minutes

Two more parameters of the basic program were operated and produced reliable data. Work on the routine for automatic selection of the most desirable eigenvalue has been started and a second program should be ready by the end of the month.

8.1 Programs and Computer Operation (continued)

54. Optimizing the Use of Water Storage In a Combined Hydro-Thermal Electric System: Demurjian, 10 hours; WWI, 209 minutes

The programs for storage of data on magnetic tape, checking the recorded information, computations using the recorded data and finally the print out routine have all been completed. The results from the computer were negligible due to faulty operation caused by the appearance of spurious digits during read-in with PETR.

56. Determining Pupil Dates and Two Dramatic Aberrations in Optical Lens Systems: Helwig, 3 hours

Dr. Wachendorf has submitted a program for calculating third order aberrations in an optical system. This is being tested.

57. Runge-Kutta Differential Equations: Carr

Mr. Zieler of Instrumentation Laboratories has been aiding Dr. Laning, and is now working with Aronson, Rotenberg, and Wendroff on a random number generation test program.

58. Determination of Energy Levels of Oxygen Molecule: WWI, 162 minutes

The polynomial root evaluation program works satisfactorily for isolated roots. However, degenerate roots have proved very difficult to isolate, since round-off in the (24,6,0) scheme provides actually a multiplicity of roots at any multiple zero in the real polynomial. Two paths of investigation are needed here: a further solution with a longer register length (preferably 39,6,0) and an analytic investigation of just how the "machine polynomial" behaves. The final eigenvector evaluation program has been under test, but it has not yet proved satisfactory. The "Method of Successive Traces" appears to have too much round-off involved to prove satisfactory for evaluating eigenvectors and eigenvalues of matrices with degenerate eigenvalues.

59. AEC Positron-Electron Calculation: Carr

Several letters were written to Oak Ridge.

60. Calculation of Deuteron Energy Levels: Combelic, 11 hours; WWI, 53 minutes

Various sections of the program were tested individually during this bi-weekly period. From tests of the integration section information will be obtained to aid in determining the optimum interval in the independent variable.

63. M.I.T. Seismic Project: WWI, 5 minutes

64. Meteor Computation III: Frankovich, 3 hours; WWI, 13 minutes

Two solutions have been obtained using two different numerical schemes and are being analyzed by the originators.

8.1 Programs and Computer Operation (continued)

65. Meteor Computation IV: Frankovich, 2 hours

A solution was obtained using the method of successive approximations. Analysis revealed sufficiently large oscillations near the end of the solution to warrant recomputing it with a different extrapolation method.

66. Round-off Error Test: Perlis; WWI, 53 minutes

Results on the round-off calculations for a digit-by-digit logarithm program are apparently pessimistic. Results on a test program using 24,6,0 reveal that, for numbers in $(\frac{1}{127}, 1)$ the log program is good to, between, $\frac{35}{5}$ and $\frac{45}{5}$ digits where s is the number of digits handled in the arithmetic operations. Further tests on 30,0,0 fixed point are to be run. A program for similarly analyzing an arc-cosine routine is to be constructed.

67. A Method for Obtaining the Characteristic Values of Symmetric Matrices by Direct Diagonalization: Perlis

A program has been prepared in 24,6,0 which approximately diagonalizes a symmetric matrix of arbitrary order and hence directly yields approximate characteristic values of said matrix. Tests are to be run on matrices to determine the time required to obtain accuracies in the eigenvalues of various orders.

68. Logarithm and Exponential Subroutines: Wendroff, 12 hours

See Section 8.2.

TOTAL COMPUTER TIME USED FOR PROGRAMS: 40 hours, 48 minutes

TOTAL COMPUTER TIME USED FOR CONVERSION: 5 hours, 8 minutes

TOTAL COMPUTER TIME USED FOR DEMONSTRATIONS: 2 hours, 16 minutes

TOTAL COMPUTER TIME USED: 48 hours, 12 minutes

TOTAL COMPUTER TIME AVAILABLE: 55 hours, 59 minutes

USABLE TIME PERCENTAGE: 86%

TOTAL # OF PROGRAMS OPERATED: 107

## 8.2 Subroutine Library

Below are listed all subroutines which have been suggested, worked on, or completed during this bi-weekly period.

### Completed

| LSR # | Tape # | Title | Programmer |
|---|---|---|---|
| EX 0.1t | T-1048-1 | $e^{-x}$, $0<x<1$ | Wendroff |
| OT 1.7t | T-1060-2 | Print C(v3) Through C(v4) as Octal Number, Sign Digit and Complement, Point, Page Layout | Demurjian |
| OT 109.10t | T-930-2 | 15n,0,0 MRA Print and/or Punch, Decimal Fraction, Sign, Number of Digits Arbitrary, No Carriage Return, Sign Agreement (Interpreted) | Helwig |

### Being Tested

| LSR # | Tape # | Title | Programmer |
|---|---|---|---|
| ED 1.1t | T-874-3 | Print for ED Only when Control Passes Through Registers Selected by Programmer | Combelic |
| | T-1122 | Print Out Address of sp or cp(-) Instruction Which Sent Control to Closed Subrou-Time, C(AC) on Entering Closed Subroutine, C(AC) on Leaving, and Numbers of Operations Performed by Closed Subroutine | Combelic |
| EX | T-1049-1 | Log x(base e) | Wendroff |
| NR 2.2 | T-552-1 | Square Root of C(AC), Gaudette's Method, Result in AC | Demurjian |
| OC 2.2 | T-788-4 | Display Octal Number, Octal Point and Sign | Kopley |
| OC 2.4 | T-863-4 | Decimal Fraction Display | Kopley |
| OT 1.8t | T-936-3 | Print C(AC) as Decimal Fraction, Round-off, Sign and Magnitude, Point, Single Column Layout | Demurjian |
| PA | T-723 | Operations on Real 30-n,n,0 Numbers where $1 \leq n \leq 15$ (same as PA 2.2t) | Frankovich |

### Being Written

| LSR # | Tape # | Title | Programmer |
|---|---|---|---|
| EX | | Subroutines of the type $e^{-x}$ and log x (base e) in more general number systems than (15,0,0) are being written | Wendroff |

8.2 Subroutine Library (continued)

| LSR # | Tape # | Title | Programmer |
|---|---|---|---|
| | T-1082 | Roots of Polynomials | Carr |
| NR | | 24,6,0 Square Root Subroutine | Carr |
| | Suggested | | |
| IP | | 15,15,0 Input Conversion to handle nullifies and other superfluous characters | Frankovich |
| IP | | General magnetic tape input program (floating address system, etc.) | Frankovich<br>Helwig<br>Combelic<br>Gilmore<br>Adams |
| | | Input and output subroutines for laying information on magnetic tape and getting it out again. | Gilmore |

8.3 Procedures

(F. Helwig and J. Frankovich)

A procedure for the conversion of numbers of the form

$$\pm D_1 \ldots D_n \cdot d_1 \ldots d_m \cdot r_1^{\alpha_1} \cdot \ldots \cdot r_e^{\alpha_e}$$

from flexowriter code to a binary number of the form (a,b,c), a, b and c arbitrary, is being programmed.

## 9.0 FACILITIES AND CENTRAL SERVICES

### 9.1 Publications

(Anola Ryan)

The following material has been received in the Library, Room 217, and is available to laboratory personnel.

LABORATORY REPORTS

| No. | Title | No. of Pages | Date | Author |
|---|---|---|---|---|
| E-452 | Relay and Contact Life Test | 3 | 3-3-52 | R. E. Hunt |
| E-456 | Block Diagram of Control for Printers and Paper Tape Units for the Final In-Out System | 3 | 4-2-52 | P. W. Stephan |
| M-1427 | Vacuum Tube Failures During the Month of October, 1951 | 8 | 3-14-52 | H. B. Frost<br>A. J. Parisi |
| M-1434 | Procedure for Stripping Enameled Wires | 1 | 3-27-52 | B. B. Paine |
| M-1435 | Bi-Weekly Report, March 28, 1952 | 38 | 3-28-52 | |
| M-1437 | March 1952 Storage and Research Tube Summary | 5 | 4-1-52 | A. J. Cann |
| M-1439 | Progress Report No. 2, M. S. Thesis: Dynamic Analysis of Regulated D. C. Power Supplies for Large Loads | 2 | 3-14-52 to 4-1-52 | J. J. Gano |
| M-1440 | Laboratory Personnel | 8 | 4-1-52 | |
| M-1441 | Vacuum Tube Failures During the Month of November, 1951 | 8 | 4-3-52 | H. B. Frost<br>A. J. Parisi |
| M-1446 | Progress Report No. 2, M. S. Thesis: A System for Testing M. I. T. Electrostatic Storage Tubes | 2 | 2-23-52 to 3-31-52 | H. J. Platt |
| M-1447 | Application of Vinyl Sleeving to Storage Tube Leads | 2 | 4-8-52 | A. J. Cann |
| M-1450 | Progress Report No. 2, M. S. Thesis: Ferroelectrics for Digital Information Storage and Switching | 2 | 1-15-52 to 4-7-52 | D. A. Buck |
| M-1451 | Vacuum Tube Failures During the Month of December, 1951 | 5 | 4-9-52 | H. B. Frost<br>A. J. Parisi |
| M-1452 | General Nature of Work Involved in Using a Digital Computer as a Control Element in Physical System | 2 | 4-10-52 | D. R. Israel<br>R. A. Nelson |
| M-1454 | Discussion of Magnetic Drum Systems at Engineering Research Associates March 25 and 26, 1952 | 9 | 4-11-52 | E. S. Rich |
| A-128 | Supplement 1: Multilith Reproduction Procedure | 4 | 3-14-52 | A. M. Falcione |
| A-131 | Accounting Procedures, DIC 6889 | 3 | 3-26-52 | H. Fahnestock |
| A-132 | Barta Building Guard Instruction | 7 | 4-1-52 | J. C. Proctor |

9.1 Publications (Continued)

LIBRARY FILES

| No | Identifying Information | Source |
|---|---|---|
| 47 | Technical Information Pilot: Cumulative Index for 1950 | Office of Naval Research, Library of Congress |
| 178 | Mathematical Tables and Other Aids to Computation January, 1952 | |
| 280 | Digital Computer Newsletter: April, 1952 | ONR/Washington |
| 622 | Aerovox Research Newsletter: April, 1952 | Aerovox Corp. |
| 963 | Signal Corps Electronic Computer Research and Development: Quarterly Report No. 8, October 4, 1951 to January 3, 1952 | Moore School, Univ. of Pennsylvania |
| 1455 | Approximations in Numerical Analysis: Additions to Data Sheets, Form 15. February 25, 1952 | C. Hastings RAND Corp. |
| 1477 | Notes on Numerical Methods: Additions to Course Notes. February 20, 1952 | A. S. Householder Oak Ridge Ntl. Labs. |
| 1671 | Nuclear Science Abstracts: March 31, 1952 | Atomic Energy Commission |
| 1764 | IBM Electric Punched Card Accounting Machines: Card Programmed Electronic Calculator, Principles of Operation | International Business Machines Corp. |
| 1765 | The Flow of Scheduled Air Traffic. Volumes 1 and 2 Technical Report 199. May 2, 1951 | R. B. Adler S. J. Fricker R. L. E./M. I. T. |
| 1766 | Synthesis of a High-Speed Flight-Simulator. Meteor Report No. 71. August, 1951 | D. G. O'Brien Dynamic Analysis and Control Lab./M. I. T. |
| 1767 | A Design Method for Automatic Longitudinal Control Systems. Report GM-538. Project MX-775. February, 1952 | F. Stevens K. M. Stevenson Northrop Aircraft Co. |
| 1768 | Electronic Failure Prediction: Progress Report. NBS Report No. 1438, February 1, 1952 | J. H. Muncy Natl. Bur. Stds. |
| 1769 | Quick Methods for Evaluating the Closed Loop Poles of Feedback Control Systems. Engineering Report No. 38, D. I. C. 6506. March 24, 1952 | G. A. Biernson Servomechanisms Lab./M. I. T. |
| 1770 | A Storage Type Cathode Ray Tube for Digital Computers. VCRX266. November, 1951 | L. S. Allard, R. T. Hill General Electric Co. England |
| 1771 | Biassed Random Walks in Classical, Statistical, and Quantum Mechanics. Technical Report No. 5. July 20, 1951 | G. W. King Arthur D. Little Co. |
| 1772 | The Computation of Fourier Syntheses with a Digital Electronic Calculating Machine. Reprint from Acta Crystallographica January, 1952 | J. M. Bennett J. C. Kendrew |
| 1773 | Bibliography on the Use of IBM Machines in Science, Statistics, and Education. January, 1950; January, 1952 | A. D. Franklin E. V. Hankan, comps. Watson Scientific Computing Lab./I. B. M. |

9.1 Publications (Continued)

LIBRARY FILES (Continued)

| No. | Identifying Information |
|---|---|
| B-187 | Illustrated Technical Dictionary. Maxim Newmark, editor. Philosophical Library, 1944. |
| B-188 | Proceedings of the International Congress of Mathematicians. American Mathematical Society, 1952. 2 volumes. |
| B-189 | Proceedings of the Symposium on Spectral Theory and Differential Problems. Mathematics Department, Oklahoma Agricultural and Mechanical College, 1951. |
| B-190 | Proceedings of a Computation Seminar. C. C. Hurd and Applied Science Department, editors. International Business Machines. 1949 |

Electrical Engineering: April, 1952
Electrical Manufacturing: April, 1952
Machine Design: April, 1952
Oil and Gas Journal: April 7, 1952
Physics Abstracts: March, 1952
Physics Today: February, 1952
Proceedings of the I. R. E.: April, 1952

9.2 Standards, Purchasing, and Stock

(H.B. Morley)

It is requested that all possible vendor contacts be carried on through this department unless permission is granted to do otherwise. In this event, all correspondence should be given the regular laboratory distribution, including the Purchasing Department. Refrain from making purchase commitments of any sort and advise that Purchasing will handle all business details including necessary DO ratings and applicable allocations.

This department has always recognized that certain personnel might find it necessary to engage in technical discussions or correspondence with the vendor. However, implied commitments to purchase and requests for small quantities or samples could result in embarrassment and unnecessary expense to the laboratory.

It is important that every order for materials or services clear through the Receiving Room so that all records will be complete. In many instances, the specified material or services have been received without proper notification to the Receiving Room. Such instances can be caused by anyone who picks up this material direct from the vendor or oversees the work or services specified, or makes any change in the order direct to the vendor. No change in an order should be made without the prior knowledge and consent of the Purchasing Department, in addition to necessary engineering approval.

It is therefore requested that anyone who is concerned in such matters notify the Receiving Room or Purchasing Department immediately.

(H.W. Hodgdon)

Standards sheet masters for capacitors have been typed and will be ready for printing as soon as drawings and the introductory section are completed. Rough drafts on wire and cable are completed, and will be circulated this week for comments.

A statement of policy and introduction to the Standards Book has been drafted, and will be issued shortly as a general memorandum.

A display board for composition resistors has been completed, and work started on several others.

Rough drafts are now being prepared on tube sockets and switches.

9.3 Construction

(F.F. Manning) Production Control

The following units have been completed since March 28, 1952:

15 D-C Power Cables (Papian)
100 Cable Terminators 91Ω(Corderman)
3 Burroughs Gate & Delay Modification (Olsen)
49 Video Cables (Leary)
2 Buffer Amplifier Panel Breadboard (Widrowitz)
4 Power Equipment Supplies Modification (Jahn)
1 Core Tester Pulse Distributor Breadboard (Best)
1 HG Anode Supply II (Watt)
1 Delay Line for IOC Reset Control (Paine)
22 Pulse Transformers (3:1) (Hunt)
2 Vacuum System Switch Panels (Palermo)
44 Leads for Power Supply (Caswell)

The following units are under construction:

10 Crystal Mixers (Papian) Breadboard
10 Polarity Inverter (Papian) "
10 Pulse Switch (Papian) "
6 Power Supply Filter (Woolfe) "
21 Lamicoid Labels (Caswell)
30 Rack Power Cords (Corderman)
2 ESD Output (Dodd)
1 IOC Reset Control (O'Brien)
1 15A, 100V. Variable D-C Power Supply (Hunt)
3 Indicator Unit (Eckl) Breadboard
5 Storage Tube Mounts (Dodd)
1 2 Channel Gate Mixer Amplifier (Platt)
1 Standardizer Amplifier (Mercer)
1 Pulse Generator (Woolfe)
1 ESD Termination Panel (Watt)
1 In-Out Switch Display Matrix (O'Brien)
10 D-C Circuit Breaker Boxes (Gano)
1 Marginal Checking Generator (Gano)

(C.W. Watt)

The scheduling work that has been going on the past few weeks points up the need for added help in all the shops, and for at least one more engineer to work on installation and wire planning. Specific requests will soon be made for more shop help, and a number of prospects have been interviewed for the engineering job. No one has yet been hired for it.

9.4 Drafting

(A.M. Falcione)

1. New Drawings:

a. 520 Magnetic-Tape Control Read-Record Switch and Reading Amplifier

A set of drawings for this unit is complete except for checking. Circuit Schematic, E-50987; Block Schematic B-50998; Assembly and Parts List, E-50999.

b. 26-Inch Rack for Test Control Room

Drawings for this rack were completed, however, because of certain design changes, the drawings are now undergoing revisions.

c. 520 Magnetic-Tape Control Mode Switching Flip-Flop

The complete drawings for this unit have been graded and distributed within the last few days. Block Schematic, B-50834; Circuit Schematic, D-50853; Assembly and Parts List, D-51054; Aluminum Panel, D-51055.

d. 420 In-Out Switch Magnetic-Tape Matrix

Complete drawings for this unit are ready for grading. Circuit Schematic, C-50916; Aluminum Panel, D-51157; Assembly and Parts List, D-51153.

2. Microfilming of WWI Drawings

In line with our current practice, the microfilming of WWI drawings semianually, 1,065 tracings were microfilmed on the 7th of April, 1952, by the Graphic Microfilm Company of New England.

3. Parts List Preparations

In connection with the new system being set up by Production Control, tentative parts lists will be made up upon completion of the Circuit Schematic. This tentative parts list will be forwarded to Production Control for the Collection of components from Stock. This will enable them to order missing parts which are not in Stock. Pat Falcione has been employed by the Drafting Department for the purpose of making up all tentative Circuit Schematic parts lists. This system should expedite construction and procurement of parts and prevent delays, as we have had in the past.

## 10.0 GENERAL

(J.C. Proctor)

### New Staff

John J. Cahill, Jr. who received his B.S. in Physics from Fordham and M.S. in Physics from the University of Akron, has joined Wieser's group. For the past three years, he has been a project engineer with Mergenthaler Linotype in New York.

Wesley A. Clark, Jr. has also been assigned to Wieser's group. He received his A.B. in Physics from the University of California, and until recently, he was a Group Head in the General Electric Nucleonics Department, Hanford Works in Richland, Washington.

Irving Aronson is now working with Taylor's group. He received his B.S. in EE from Northeastern University. He was employed as an electronics technician at Sylvania while attending Northeastern.

Jack L. Mitchell, who received his B.S. in EE from the University of Colorado, has also joined Taylor's group. He has been a custom engineer with IBM in San Francisco for the past two years.

Philip Baltzer, who has been assigned to work with Brown, received his B.S. in EE from Northeastern. He was formerly employed as a draftsman with Bethlehem Steel for one year and as an electrical engineer with the C.J. Main, Inc. in Boston for four years.

Prof. Francis Vinal, George Economos and Bronislaw Frackiewicz of Prof. Von Hipple's Laboratory have been transferred to the staff of this Laboratory. They will, however, continue to do their work at Prof. Von Hipple's Laboratory.

### New Non-Staff

Pasquale E. Falcione is an administrative assistant assigned to work on Parts Lists in the Drafting Room.

Diana M. Belanger is a secretary assigned to work with Anola Ryan in the Library.

Francis L. Stone is a janitor working in the Barta Building.

Donald C. Allen is an electronics technician working with Dodd's group. He is temporarily assigned to the Construction Shop.

10.0 **GENERAL** (continued)

(J.C. Proctor) (continued)

Four students from Boston University have been assigned to work with Adams as part-time student technicians. They are Henry B. Hayes, Holly M. Ward, Martin Cohen and Arthur Ehrenberg.

Carol Schwartz and Richard H. Daly, students at MIT, are part-time student technicians working with Frost in the Tube Testing Lab.

Terminated Non-Staff

George Brogna
Rita Censale
John Quigley
Romeo DiCicco