APPROVED FOR PUBLIC RELEASE. CASE 06-1104.

Digital Computer Laboratory
Massachusetts Institute of Technology
Cambridge 39, Massachusetts

SUBJECT: BI-WEEKLY REPORT, August 29, 1952

To: Jay W. Forrester

From: Laboratory Staff

1.0 SYSTEMS OPERATION

1.1 Whirlwind I System

1.11 Operation (D. Morrison)

Due to the installation of the in-out equipment no applications time was provided during this period.

(S.H. Dodd)

The installation and integration of the new in-out system is proceeding satisfactorily. Essentially all of the new equipment has now been installed and most of the integration and testing has been done.

The magnetic-tape system still needs a substantial amount of checking to bring us up to the operating level of the rest of the in-out system.

Next week we hope to complete work on the magnetic-tape system and will then completely check out all phases of the in-out system and work on developing adequate marginal checking techniques.

(N.L. Daggett)

Approximately 24 hours of computer time were lost last week because of an intermittent trouble which was finally traced to the ES control flip-flop in clock pulse control. The flip-flop had not been thoroughly marginal checked since changeover of the photoelectric reader and had apparently deteriorated rapidly.

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

The following failures of electrical components have been reported since August 15.

Component	No. of Failures	Hours of Operation	Reason for Failure
Crystals			
D-358	3	1- 11000-12000	Drift
		2- 12000-13000	2 low R_b

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1.12 Component Failures in WWI (continued)

Component	No. of Failures	Hours of Operation	Reason for Failure
D-357	1	11339	Drift to low R_b
Capacitors			
.01 mfd mica	1	89	Shorted
Resistor			
220 ohm 1 watt ± 5% Allen Bradley	1	89	Burned out
Transformer			
Pulse	1	11666	Open secondary
Tubes			
7AD7	2	2000-3000	Low I_b
	2	5000-6000	Low I_b
	3	6000-7000	2-low I_b 1-Mechanical
	2	8000-9000	Low I_b
	1	10000-11000	Mechanical
	2	11000-12000	Low I_b
	4	12000-13000	Mechanical
	3	13000-14000	Mechanical
3E29	2	4000-5000	Low I_b
7AK7	1	13505	Mechanical
6-SN7	2	12000-13000	1 low I_b 1 Mechanical
715B	1	1479	Mechanical
2D21	1	9999	Change in characteristics

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

The following Storage-Tube Failures were reported during this bi-weekly period:

RT-247 was rejected after 4377 hours of operation because of open High Velocity Gun Heater.

ST-521 was rejected after 2540 hours of operation because of severe after storage and weak HVG.

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

Following is the storage-tube complement as of 2400 August 29:

Digit	Tube	Hours at Installation	Hours of Operation
0 B	ST-607-1	8954	655
1 B	ST-606-1	9599.1	5
2 B	ST-612	9575.1	29
3 B	ST-601	8524	1085
4 B	ST-516	6641	2968
5 B	ST-548-1	8299	1309
6 B	ST-534-2	7469	2140
7 B	ST540	7937	1672
8 B	ST-549	8259	1350
9 B	ST-519	6624	2985
10 B	ST-544-1	8683	926
11 B	ST542	8148	1462
12 B	ST-608-1	8918	692
13 B	RT-258	5207	4402
14 B	ST-541-1	7961	1648
15 B	ST-603	8322	1286
16 B	ST-533	7801	1808
16 A	ST-613	9046	563

ES Clock hours as of 2400 August 29, 1952 9604

Average life hours of tubes in service............. 1499

Average life hours of last 5 rejected tubes........ 2886

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

On August 18 an intermittent loss of restorers was traced to poor waveform of the 1-mc pulses from the crystal clock. Replacement of two crystal diodes and a 6L6 tube restored normal operation.

Periods of continuous errors on 26 August and 28 August were due to sparking at the brushes of the +150 v supply.

At 1415 28 August the multiplier was shut down because the +150 v supply was sparking so badly.

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2.0 CIRCUITS AND COMPONENTS

2.1 Circuits by System Number

2.14 Input-Output (J.A. O'Brien, R.H. Gound)

The new in-out system is now in operation in the computer. With the exception of magnetic tape, all of the features of the new system have been installed and tested and found to operate as desired. The magnetic tape system has been installed but not yet operated with WWI because of the desire to use the time perfecting the operation of the other in-out devices.

The light guns have not been tried as yet, but no difficulty is expected with them.

(R. Paddock, A. Werlin)

The construction of the three-panel terminal equipment prototype has been completed and video testing is progressing satisfactorily. The testing of these panels required a low-frequency pulse generator which we constructed. Both lumped constant delay lines and the special delay lines as used in the plug-in Flip-Flops are used in the test prototype, and it will be determined which type is better. Pulse amplitudes appear satisfactory and the flip-flop waveforms seem to be proper.

2.2 Vacuum Tubes and Crystals

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

During this past week a great deal of time has been spent in studying and correcting a low-speed drift in the Tektronix 514D scope vertical amplifier. Two sources of trouble were found and corrected. First, the 6AH6 tubes in the vertical amplifier were replaced by 6AN5 tubes. Second, the phase inverter action was improved to reduce the voltage change across the heater string of the preamplifier. 6CB6 and 5654 tubes were tried in the vertical amplifier without improvement. The drift, which is about 5% in most 514D scopes for 10-second pulses, was reduced to about 1%. The change to 6AN5 tubes resulted in a loss of gain amounting to 40% or about 4 db. For many uses this loss of gain is not serious. This work was done in conjunction with a thesis research which will study changes in vacuum tubes with the same sort of behaviour with time.

Techniques for casting defective tubes in plastic in order to determine the arrangement of the elements have been studied with some success. In this technique, a mixture of resin and catalyst is prepared. Then the tubulation is broken with the opening under the surface of the resin. The tube is filled with resin by atmospheric pressure. The resin being used is the clear laboratory standard resin. Some experimentation has been done to determine a proper resin catalyst ratio and optimum curing schedule to set the resin to brittle hardness without excess

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2.21 Vacuum Tubes (continued)

shrinkage. Once a tube has been embedded in resin it is cut up on the glass cutoff wheel so that cross sections can be studied. The technique is very similar to that used at IBM by Jack Goetz for the same purpose.

2.22 Transistors

Transistor Circuits (A. Heineck, J. Jacobs, W. Klein)

A dynamic flip-flop with a complement circuit has been designed. This flip-flop will demonstrate the reliability of the inhibitor gate which was used in the flip-flop reported in the last bi-weekly period. We are now awaiting completion of transformer and delay lines.

A diode "and" gate which has no capacitors has been used with transistor flip-flops. This gate shows promise of overcoming the limitations of the four digit accumulator which Eckl and Callahan have built.

A complement circuit using a transformer in the place of two diodes and a capacitor has been successfully used at prf of one megacycle.

Felker system of Bit Storage (R. Gerhardt)

The study of the Felker system of bit-storage without flip-flop is continuing. At present we have a circuit which may be set or cleared with single pulses. Special delay lines are being built so that a circuit which can be complemented can be completed.

Attention is being given to special equipment that will be needed for an accumulator. A circulating pulse indicator was designed and has been sent to the shop for construction. Work is beginning on a pulse generator which will give output pulses in synchronism with a sine-wave input. The sine-wave input will be obtained from a four-phase oscillator developed by Sam Thompson.

Transistor Accumulator (D. Eckl, R. Callahan)

In preparation for more stringent tests, the entire accumulator and associated test equipment has been undergoing inspection during the past two weeks. Particular attention has been given to waveforms and pulse amplitudes. These checks have shown in particular that the reference pulses in the error system were of marginal amplitude. Buffer amplifiers will be installed to improve this

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2.22 Transistors (continued)

situation. Some transistors which produce poor waveforms in the flip-flops have been replaced. RCA transistor replacements in the partial sum register have made it possible to vary the base voltage, previously a somewhat critical parameter, from +25 to +40 volts with a continued satisfactory operation of the register.

A power distribution system with interlocks to enable external regulated supplies to be used for critical test equipment voltages is being completed.

Other members of the transistor group are working on more satisfactory gate and flip-flop circuits which may possibly be substituted in the test accumulator in the near future.

The total indicated time on the accumulator at present is 140 hours.

SEAC (S.L. Thompson)

Power amplifiers for the 1-mc clock oscillator are being constructed. The oscillator has four separate outputs, each requiring a power amplifier capable of delivering two watts to 100 ohms. To simplify the operation of the equipment, it has been decided to use class A amplifiers.

It has been difficult to design transformers that will operate properly in the 1-mc power amplifier and in the pulse reshaping amplifier used in the basic SEAC package. Determining the proper air gap has been especially difficult. The transformer-design department has been assisting in this work.

Two-Transistor Flip-Flop (J. Woolf)

The major effort of the two-transistor Flip-Flop is being spent on methods of triggering. From preliminary checks it appears that triggering at the emitter might have some advantages over other forms of triggering.

The transistor seems to be more stable with inductance in the base. Another advantage gained is somewhat faster rise and fall times.

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2.22 Transistors (continued)

Test Equipment (I. Aronson)

The automatic curve plotter has been completely debugged. The chassis and phenolic panel are in the shop and all special parts are on order. Reliability tests are in progress to determine the life expectancy of the Millisec relays.

Life Tests (I. Aronson)

The transistor static and blocking oscillator life tests started on August 22. The standard measuring procedure as set up by N.T. Jones has been used twice and seems satisfactory.

A pulse generator to drive the pulse amplifier life-test panel has been designed and constructed. This generator, using two 12AU7's and one 6Y6, puts out a 1.0-µsec pulse at a repetition rate of 100 kc with an internal impedance of about 100 ohms. After a few minor adjustments, the pulse amplifier life test will be under way.

A one-tube blocking oscillator pulse generator has been designed and bread-boarded to drive the 3-stage Jacobs counter. Results are quite satisfactory with repetition rates of 33-cps to 10 kc, and the final model is now in construction. The counter and pulse amplifier life tests will probably be started by September 3.

Thermal Variation of Parameters (I. Aronson)

Robert Schmidt and Dorothy Smith are continuing in their work on the evaluation of thermal test data. A desk calculator has helped immensely but there remains a large backlog of calculations to be done. Another week will be required to finish this phase of the work.

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2.3 Ferromagnetic and Ferroelectric Cores

2.31 Magnetic-Core Materials

General Ceramics (D. R. Brown)

The First Quarterly Progress Report from General Ceramics covering work done on our sub-contract No. 15 is due today. They have been operating our pulse-test equipment at their plant during the last month to evaluate approximately 200 samples of ferrite cores. The best body at the present time is MF-1326 which has a switching time of 1 microsecond and signal ratios measured at the time of the peak of the disturbed one which are greater than can be measured--that is, greater than 30. A small ring having an outside diameter of 0.090 in. is very satisfactory for coincident-current memory application, requiring a peak total current of 1.2 amperes. Continued improvement of ferrite cores is expected. Cores about half the size of part number F-291 should be possible. Two thousand of part E-291, MF-1326B, have been ordered.

Study of Microstructure of Ferramic Cores (L. Gold)

1) Preliminary study of the microstructure in a series of Ferramic Cores (MF-1118) has brought to light several interesting features:

1. Presence of a 2-phase system
2. Hard grains dispersed in a relatively softer matrix which has the appearance of a pearlitic configuration.
3. Grain size ranges 1-100 μ with lamellae of matrix well below 1 μ.

2) The core showing relatively little "pearlite" phase with concomitant coarser grain texture evidently correlates with a more satisfactory hysteresis loop.

3) Apparently, the usual mixed ferrites show complete range of solubility--a point which ought to be confirmed by detailed study of the kind disclosed here. It is significant, then, that a two-phase system appears in the Ferramic series. This might indeed account for its selection as a likely rectangular hysteresis loop material.

4) The inference that is tentatively offered is that ferrimagnetic materials which are amenable to precipitation hardening inherently are suited for memory cores since they allow controlled introduction of microstresses via heat treatment.

5) In the case of Ferramic cores, it is essential that the phase diagram be elucidated so that optimal temperatures and compositions for precipitation hardening may be deduced.

6) Differences that have been noted in what were presumably identical Ferramic cores might well be explained by the roll of precipitation hardening, and to a lesser degree perhaps by the grain texture.

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2.3 Ferromagnetic and Ferroelectric Cores (continued)

Hysteresis Tests (C. D. Morrison)

The bi-weekly period was spent testing new cores (LIR 1A3, 1A1, 1A2; Mo Perm 1/8 x 1/8 x 1/8 x 10 wraps; MF-1326B).

Some data was taken, on the heat test for the maximum squareness ratio (R_s), at the following temperatures: 255° C, 235° C, 220° C and 190° C. More data will be taken in the next few days.

Metal-Core Testing (R. F. Jenney)

Metal core testing is proceeding slowly. Attempts to speed up testing by using special test boards have been fairly unsuccessful. It has been noted that the application of stresses to the metal wraps of bad cores improves their pulse characteristics.

Life Test (P. K. Baltzer)

Ferrite cores have been life tested for 500 hours with no definite deterioration being measured. The two driver tubes, 6CD6's, had to be replaced because of poor emission. One was replaced at the end of 300 hours and the other at 500 hours. They were operated as current pulse generators, plate voltage of 250 volts, screen voltage of 150 volts, and required to deliver 500 ma at 10% duty factor.

Core Pulse Test (P. K. Baltzer)

Ferrite cores of body MF-1326B, part No. F-291, were pulse tested and found to show promise for use as memory cores. For an N. I. of 1.2 amp-turns, the switching time is 1 μ sec. and an output voltage of 0.22 v. The zero disturb at the time of the maximum one disturb cannot be measured.

Preparation of Ferromagnetic Materials (J. H. Baldrige)

A pound of polyvinyl alcohol (51-05) has been received from DuPont and used as a binder for a quantity of magnesium-manganese ferrite prepared from reagents obtained from General Ceramics. A number of toroids were pressed, using the new F-304 die, and fired. Some cylinders of this material are being prepared in order to measure shrinkage upon firing.

Diffraction Patterns of Sample Materials (J. H. Epstein)

X-ray diffraction patterns have been taken of several samples of Fe_3O_4, $MgFe_2O_4$ and $MnFe_2O_4$. These materials are found to be quite distinquishable by the size of their unit cells. However, the internal structure, coming from intensity measurements, will require a great deal more work before anything definite can be said.

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2.3 Ferromagnetic and Ferroelectric Cores (continued)

Toroidal Coil Winder (R. E. Hunt)

The redesign of the toroidal coil winder is complete except for checking. I will commence contacting outside shops for the construction of one of these units immediately.

Seminar on Field of Magnetism (A. Loeb)

Standard and recent literature relating to the broad field of magnetism have been searched, and the most useful references organized for use in a seminar scheduled to begin on September 16. This seminar is planned to consist of two parts:

A. An evaluation and review of many important physical properties such as dia-, para-, ferro-, and ferrimagnetism, the metallic state, electric conductivity, magnetic resonance, etc.

These properties will be related to fundamental properties of matter in order to discover which phenomena are interdependent and which would be expected to be capable of being changed independently.

Fundamental theories required to explain the properties under examination will be introduced.

B. A discussion of the fundamental theories introduced under A, such as electron spin, perturbation theories, degenerate states and exchange integrals, with applications to simple examples which can be extended at least qualitatively to the practical cases under discussion.

2.32 Magnetic-Core Memory

Switch-Core Study (A. Katz, E. Guditz)

Analysis of the experimental data on switch cores has been continuing. This data indicates that under the conditions of constant load and of relatively slow rise time (0.8 μ sec.) of the current pulse on the primary winding, the switching time and the peak secondary voltage output for MF-1131 ferramic cores are nearly independent of driving magnetomotive force. Some of these experiments will be repeated so that more accurate measurements may be made and the results corroborated.

Ceramic Array I (A. Katz, E. Guditz)

Guditz has built and tested an array of 16 x 16 fibre washers so as to determine the significance of winding inductance of the z-axis. As predicted analytically, it was found that this inductance is a significant proportion of the total z-axis with ferramic cores. Gudtiz found that an equivalent circuit for the dummy array consisted of a 1-μh inductor in series with a 1-ohm resistor.

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2.3 Ferromagnetic and Ferroelectric Cores (continued)

Delta Output from Mo Permalloy Cores (W. Ogdon, J. Raffel)

It has been assumed that the algebraic sum of the non-selected pulses in a magnetic-core memory would approach zero if the sensing winding passed through successive cores in opposite directions. "Delta" has been defined as the difference between a non-selected ONE and a non-selected ZERO and is of great importance in connection with the success of the above scheme.

Several attempts have been made to measure the delta output from small Mo-Permalloy cores with indifferent success. Present indications are that the ratio $\frac{\text{Disturbed One}}{\text{Delta}}$ is greater for the recently received 1/8 mil cores than for the cores in use in the 16 x 16 metallic array.

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

A Y read switch panel was constructed so that the Y driver current could be delayed before being turned on. By doing this, the sensing output can be shifted away from the starting noise pulses. A definite improvement in operation was noticed. Further study of sensing methods is being carried on in order to improve the operation of the array. A probe was designed and constructed that will enable us to observe the sensing winding output.

Ceramic Array II (J. L. Mitchell)

The switch cores in Ceramic Array II were tested for winding errors with the 60-cycle tester. The results obtained from this test seemed to correlate with previous results in that the switch cores with winding errors were those which were giving poor output pulses when connected in the memory.

The winding errors were corrected and the cores retested. In every case the correction indicated by the first test was applied and the results of the retest showed that the windings now contained the correct number of turns.

The job of pulse testing the cores is now under way.

Sensing Panel Development (C. A. Laspina)

The direct coupled sensing panel mentioned in the last bi-weekly report is now being tested.

Z-axis Driver (C. A. Laspina)

A z-axis driver was designed and built using 6BL7's. Manufacturer's characteristics curves showed that with 150 volts on the plate and 0 bias, the plate current should be in excess of 120 ma. A test on the unit showed that from six 6BL7's that were available, no more than 100 ma from any one could be obtained. A check of these tubes by the tube shop showed them to 20% under rated values plate current-wise.

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2.3 Ferromagnetic and Ferroelectric Cores (continued)

The new driver operates 6BL7's with 190 volts on the plate, 0 bias, and delivers about 130 ma.

2.33 Magnetic-Core Circuits

Magnetic Circuits (D. A. Buck)

Magnetic and Dielectric Amplifiers, a paper on the subject to be delivered at the M. I. T. Summer symposium on Dielectric Materials and Applications was issed as Engineering Note E-477.

(R. C. Sims)

A thesis entitled "An Investigation of Magnetic-Core Stepping Registers for Digital Computers" has been completed. This is a report of the work that I have done in regard to this subject. Copies are available in the library.

A Proposed Simplified Symbol for Magnetic Circuits (R. P. Mayer)

Note E-472, "The Mirror", briefly describes a simple symbol which is proposed for use in drawing and explaining all magnetic circuits.

Driving Circuits for Magnetic-Gate Stepping Register (G. R. Briggs)

The new driving circuits for the magnetic-gate stepping register are now finished and operating very satisfactorily. Four stepping pulses of current (one ampere per pulse) can be generated in sequence on a single scope sweep. The pulses are to drive a stepping register of four information cores with four associated gate cores. The output of the last core can be fed back into the input of the first core. Hence, a "one" can be cycled continuously. The stepping register has cycled successfully without attenuation and without spurious "one" build-up in the stepping cores. Capacitor coupling is necessary. The maximum frequency has been 300 kc to date. MMF drive requirements are much lower than heretofore have been necessary.

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2.4 Test Equipment

Burroughs Test Equipment (D. R. Brown)

I visited the Control Instrument Company in Brooklyn on August 18 and August 27 to discuss production of test equipment. All units on our current order for 459 panels are being manufactured by Electronics and Nucleonics Company in Manhattan. These are being sent to Control Instrument Company for inspection. As of August 26, 94 panels had been shipped to M.I.T. and a total of 133 panels had been received at Control Instrument Company from Electronics and Nucleonics. The condition of the units received here has been unsatisfactory, necessitating 100% inspection in our own inspection department and resoldering of nearly all joints. As the result of a discussion of soldering techniques with the foreman of the wiring department at Electronics and Nucleonics, we believe that future units will have satisfactory joints. B. Paine is spending most of this week at the Control Instrument Company and the Electronics and Nucleonics to advise them on the quality of work which is required. Production is still uncertain and being shifted from one type of panel to another as the result of parts shortages. However, Control Instrument Company hopes to complete the order by the end of September.

Test Equipment Committee (L. Sutro)

The flow of Burroughs units from the vendor, through our inspection and testing department to our engineers, is suffering another delay. Inspection of the first three units of the 459 due this summer revealed 6 unsoldered joints and so many poorly soldered joints that inspectors' tags covered each unit. To correct units received here, six of Paul Grant's men have come in each evening and resoldered. To prevent delivery of more poorly soldered joints, the committee asked Ernie Nickerson to visit the factory to give instruction in soldering and B. Paine to go to the factory's inspection area and pass on all units there. Accompanied by Dave Brown, Ernie Nickerson and B. Paine went to the factory August 27. Paine stayed through August 29.

The present status of Burroughs units is as follows: 88 units have been delivered out of 459 on order. Of the 88, 51 have been resoldered. Of those; 27 have passed visual inspection. Finally of these 27, 12 are ready for delivery to engineers

The committee has received from the shop 40 4-foot 12-wire power cables and 10 8-foot 10-wire power cables. These are now in the stockroom.

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2.4 Test Equipment (continued)

The changes occasionally made to standard and commercial test equipment by engineers should be recorded, the committee has decided. A label is to be printed which will say that the equipment to which it is attached has been modified according to entry No. ________ in the log of the Test Equipment Committee.

Magnetic-Core Tester (R.E. Hunt)

The semi-automatic core tester is about 75% complete in the machine shop. Operation by hand seems to be very promising.

Some work is being done on the design and procurement of a vibrating feeder to feed cores one by one to the machine.

Hysteresigraph (R. Pacl)

The standard mutual inductors for calibration of flux on the hysteresigraph have been completed. Two different methods of checking the mutual inductance were used, and it was found that the observed values agreed with the calculated values to within 1.5%.

2.5 Basic Circuits

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

The results of work with the plug-in flip-flops has not been too satisfactory. The pulse tolerance has been increased so that a pulse 0.2 μsec wide and 70 volts high will still complement. The prf is from 2 to 3 mc depending on the condition of the tubes. The best prf is for balanced high-current tubes.

The poor results were had in trying to satisfy other conditions of switching and rise times. It was thought that sufficient delay could be had in switching, due to the inherent circuit characteristics, so that the flip-flops could be used in counters and shift registers. At present, it appears that the flip-flops could be used as desired if precise timing and pulse shapes are maintained. It is desired to relax these last conditions without adding external delay lines.

2.7 Memory Test Computer (J.D. Crane, Jr.)

A test rack is being constructed to aid in the testing of flip-flops and other circuits to be used in the M.T.C.

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2.7 Memory Test Computer (continued)

Final decision on the means of containing wires for voltage distribution is being deferred until a final rack design is made. Present plans utilize the 4 x 4 Wirewa produced by National Electric Products Corporation.

Final approval of the special plug-in mounting panel depends on the approval of the Winchester plug, which is being investigated by B.B. Paine.

(R. Von Buelow)

Power distribution panels for M.T.C. have been constructed and approved. Final drawings of these units are almost completed.

It has been decided to locate the M.T.C. in the area now occupied by the library. This section of the third floor of Whittemore 2 will be partitioned off and cooling equipment will be installed. The basic decisions for this system have been decided and Francis Associates are about to prepare a specification for the equipment and its installation.

(R. G. Farmer)

During the bi-weekly period specifications have been drawn up for the power transformers which will be used in the power supplies of M.T.C. These specifications have been sent to the Colin Campbell Company which promises delivery in 30 to 60 days. All necessary filament transformers have been ordered and delivery has been promised for November 1, 1952.

Circuit schematics have been drawn for an electronic load and its auxiliary power supply. The schematics have been sent to the drafting room where layouts are being made. The electronic load will be used to test the M.T.C. power supplies when they are completed.

(H. Smead)

It seems that delivery of parts that have been specified for M.T.C. plug-in units will be satisfactory.

A fairly detailed schedule of operations for the construction of the M.T.C. has been prepared, and a model of the rack for the plug-in units is being built.

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2.7 Memory Test Computer (continued)

(R. Hughes)

The peaker buffer has worked out satisfactorily. It will make a 0.1-μsec pulse out of almost any negative waveform. Work is continuing on it to make it drive a 0.5-μsec delay line as efficiently as possible. Six adapters to facilitate working on plug-ins are being constructed in the shop.

M.T.C. Block Diagrams (W.A. Hosier)

H. Anderson has made "guided tour" drawings of some 28 orders traced through MTC Control as it was projected about August 1; block diagrams were also drawn for the Accumulator and A-Register. Recent proposals have rendered all these somewhat obsolete, and drawings with any degree of authenticity must await decisions on such proposals. (See minutes of recent MTC meetings.) Meanwhile, we are studying the various available alternatives to see how best to accomodate them in the system when decisions are made.

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3.0 STORAGE TUBES

3.1 Construction (P. Youtz)

Some of the efforts of the Construction Group during this last bi-weekly period were directed toward starting production facilities after a complete shutdown during vacation.

A few 600-series storage tubes were constructed as replacements for Bank B. Four research tubes were constructed to study conversion and activation processing of Philips "L" cathodes. Efforts were continued toward developing techniques for using a stannic-oxide coating instead of dag.

3.2 Test (C. L. Corderman)

A breadboard prototype of a control unit to be used for scanning the Faraday Cages has been constructed and operates properly with batteries supplying the positioning voltages. To prevent distortion of the apparent beam shape as the cage is scanned, the noise and drift of the deflection voltages must be less than 0.05 volts. The final Cage-Scanner Unit has been designed with three separate, regulated supplies in order to eliminate the batteries in the final system. In this unit, the high-velocity beam is swept over the cage with a 60cps sawtooth, the amplitude of which may be adjusted to give from 10 - 500 mils across a 514D scope face. The cage is scanned alternately in the horizontal and vertical directions, so that both distributions are presented on one scope.

The ten-inch TV display and monitor unit formerly used in Whirlwind is being installed at the STRT. D. Mach is designing the necessary amplifier and high-voltage circuits.

A two-stage potentiometer circuit with a Weston Standard Cell has been constructed to measure the -2370 volt supply used with storage tubes. A steady drift was observed in the unit, but its source, as yet, has not been isolated.

Pretest (D. M. Fisher and C. T. Kirk)

ST619-C-1 was pretested during this period and found to be satisfactory. Preliminary investigation of RT319 showed that the high-velocity-gun filament was open.

A memorandum is being prepared on the present operation of the TVD equipment.

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3.2 Test (Continued)

(R. E. Hegler)

During this bi-weekly period, I have completed a list of all commercial and standard test equipment in compliance with Memorandum M-1558-1. I am using this list of standard test equipment to bring the file of schematics up to date.

Some testing was done during this period on a tube which had been processed on Vacuum System #7. This system is arranged in such a manner that a tube placed on it will be mounted in a vertical position. This type of mount requires that a greater amount of metal surround the holding-gun neck than was the case when the tubes were mounted horizontally. During the testing of one of these tubes at the TVD, a question arose as to how much the residual magnetism of the additional metal would shift the centering of the holding gun during degassing of the target by the holding gun.

As much of the mount as could conveniently be removed from System #7 was placed in the TVD and the amount of shift observed. The residual magnetism of the additional metal shifted the holding gun diagonally, from left to right, about .25 of an inch. It is conceivable that if the holding gun was off-center, the additional shift could cause uneven degassing of the target.

3.3 Research and Development

Deflection-Shift Problem (J. Jacobowitz)

A thesis report on the effects of ions in the storage tube has been completed and submitted to the Department of Electrical Engineering.

This thesis investigation demonstrated experimentally and theoretically that positive ions, created by the holding beam and trapped in the body of the tube, are responsible for a shift in the deflection of the high-voltage beam. In a few-hundred μseconds, enough ions are created to deflect the beam by a measurable amount. These ions require about 30 μseconds to disperse, after the holding beam is cut off. The principal dispersion mechanism is probably diffusion to the dag walls. However, gating the dag negatively does not materially increase the rate of diffusion because the outermost ions shield the body of the tube from the effect of the dag potential. Therefore, the most effective approach for the ion problem is to attempt to cut down the number of ions in the tube. The two possible ways of doing this are: 1. To reduce the gas pressure; and, 2. To continually remove ions from the tube.

The first approach is exemplified by the studies presently being conducted to find a replacement for the dag wall coating. The second approach has not yet been adequately explored, but one method seems to be to add an ion collector electrode to the tube.

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3.3 Research and Development (Continued)

Lowering the holding-beam current is the temporary method presently used to reduce deflection shift. Another possible expedient is to lower V_{A_3}. However, a redesign of the holding-gun system seems necessary to prevent extreme distortion of the holding beam at very low A_3 voltages.

A somewhat different readout method was used during this investigation. This method provided a two-polarity readout signal without gating the signal plate or r-f modulating the high-voltage beam. Access times were limited only by pulse-transformer ringing, hence reading could take place one or two μseconds after holding-beam cutoff. This readout method is much simpler than r-f readouts for experimental investigations.

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

During the last bi-weekly period, a thesis proposal was prepared entitled, "The Engineering Application of Stable Emitters to Electron Guns". This paper will be issued as M-1616.

Four "L" cathode research tubes, RT321, RT322, RT323 and RT324, were constructed and the first three were processed. The results were varied. RT321 developed a grid-to-cathode short during initial processing and was later opened to increase the G-K spacing. Following the resealing of the tube and vacuum bakeout, the cathode presented a strange appearance. The tungsten cap was blue in color and, at the junction of the cap and the body, there was a considerable amount of white material which had the appearance of having been extruded through the tungsten-molybdenum junction. The tube was subsequently activated and the white material disappeared. The color of the tungsten also returned to its normal silver-grey.

RT321 and RT322 both activated to moderate levels although the activation was very slow. RT322, in addition, required a long time for conversion because of the very large amount of gas which was liberated. The source of the gas is unknown. This same tube suffered a heater burnout shortly after activation.

RT323 was accidentally activated without drawing emission current. When the situation was corrected after about an hour and a half, activation was found to be above normal. Within another half hour activation was complete. The emission from this tube was very close to the value we eventually hope to obtain. To establish the repeatibility of this activation, the same schedule will be used on RT324 which is identical in construction.

Pulse Readout (A. J. Cann)

Work on pulse readout schemes has continued. The problem is essentially that of separating a 2mv pulse from a 20v gate, a difference of 80db. Therefore, we are attempting to build a system capable of 100db resolution. To accomplish this goal, we will have to make full use of time

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3.3 Research and Development (Continued)

separation (pulse delay from start of gate), frequency separation (ratio of pulse rise time to gate rise time), and any other means that can be devised. Our object, of course, is to keep the total time required for readout to a minimum. Many other people have worked on this problem (Campling, Nolan, Stein, to mention a few) and their reports have been very helpful. I don't know whether the state of the art has advanced sufficiently to permit a solution.

I have tried the following circuits: a delay-line differentiator, a negative capacity amplifier for increasing the output from the storage tube, a crystal limiter, and some 3rd order Butterworth low-pass and high-pass filters. The latter appear quite promising. The alignment demonstrator is very convenient for this type of investigation.

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4.0 TERMINAL EQUIPMENT

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

The new paper tape output panels were installed in Whirlwind and are now operable. As presently installed, the programmer can select either of two flexo punches or printers as an output unit. These units may be either old or "FL" model units.

However, it is now planned to modify the system to provide for the use of only one punch but three printers, the third printer to be placed in room 222. Modifications to accomplish this are now being written up by Fred Irish and myself for approval.

All three of our present "FL" typewriters and all four of our old style punches have been modified for use with our new paper tape output system. At present old reader #3 is the only old reader completely modified to date, but it is planned to modify the others as time permits.

Based on the assumption that Commercial Controls Corp. will ship our 5 new "FL" recorder-reproducers on August 29, it is planned to have them completely modified and available for use by September 15.

Two new stocks of perforator tape have been received from Paper Manufacturers Co.; a heavy gray, and a lighter weight black. On the basis of limited tests to date, it appears that both of the new tapes are easier to perforate than our original blue-gray variety, but further tests must be made with the light weight black tape to determine if it will work satisfactorily on PETR.

Photoelectric Tape Reader (F. E. Irish)

The PETR has been successfully installed into the final in-out system. After the change over to the new system the reader was plagued by poor margins in the information channel amplifiers. These poor margins were found to be caused by the position of the tape as it passed over the apertures leading to the photoelectric tubes. The information holes in the tape were apparently not centered on the apertures thereby eclipsing part of the aperture and reducing the intensity of the light reaching the photo tube. This was corrected by replacing a guide pin which keeps the tape properly centered.

Buffer Drum Flexowriter (E. P. Farnsworth)

Circuitry to permit Flexowriter print-out from buffer drum channel group no. 2 and read-in to buffer drum group no. 3 from paper tape punched and checked on another FL Flexowriter has been worked out. Certain possible manual and automatic control features remain to be evaluated. A proposal will be written to describe the operational details.

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4.2 Magnetic Tape (K. E. McVicar)

The final magnetic-tape system has been installed in the computer and some tests have been made during times when the computer was otherwise unused. Since more pressing work on the in-out system remains to be done the final testing of the tape system with the computer has been postponed until all other equipment is installed and completely tested.

4.3 Display (D. J. Neville)

Stabilization of the Dumont 304-H oscilloscope has been accomplished. Operation in the WWI output system and other tests remain to be made on the modified scope.

4.5 Auxiliary Magnetic Drum (P. W. Stephan)

I am testing the electronic components which ERA is supplying with the auxiliary magnetic drum.

Breadboard models of basic circuits such as flip-flops, gate-writing amplifiers, and flip-flop writing amplifiers have been built and are being tested. ERA has supplied their transformers and drum head.

The flip-flop was found to have a 4-5 μsec rise time (to peak value) which, since it is an ordinary triode flip-flop, is to be expected.

The gate-writing amplifier has as its output one of the drum heads. A pulse into the amplifier causes a pulse of current through the head. The amplifier was found to be p.r.f. sensitive, with the head current pulse (measured across 1 ohm in series with the head) decreasing to 2/3 of its value at 8 μsec pulse separation when the pulse separation was decreased from 8 to 6 μsec, and the pulse increasing over 1 1/2 times when the pulse separation was increased from 8 to 16 μsec. If the pulse separation was increased from 16 μsec to 30 or more μsec, not much further change in pulse amplitude occurred.

The head current (peak) for an 8 μsec pulse separation was just over 300 mils.

Measurements were made on the Tektronix scope. The amplitude loss on fast rise-time signals referred to in M-1604 by Herbert J. Platt was noticed. Also excessive length of signal leads resulted in considerable pickup at low signal levels.

Testing is now being started on the possibility of spurious noise generation from biased crystals in ERA's reading circuit.

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5.0 INSTALLATION AND POWER

5.1 Power Cabling and Distribution (C. W. Watt)

During the week ending August 22, Racks P16 and P17 were completely wired up and the paper-tape output panels were installed.

Power Supply Control

Work has been progressing as fast as possible on the physical design of power supply control panels for the MITE and drum equipment. Panels have been laid out, and the shop is about to start work on them. Cabling layout has been started. A cabling diagram has been made, and details of cable runs are now being determined.

Power Supplies for Drums and MITE

The new 900 A filament alternator will be shipped to M.I.T. Tuesday, September 2.

Racks for MITE

The rack installation will be complete in room 156 on October 10, according to Arlex, the fabricator.

5.2 Power Supplies and Control (G. Kerby)

The new MG set should arrive about Friday, September 5. A re-enforced base is being prepared to mount it.

Deliveries on associated equipment will be satisfactory.

Interconnections with MITE have been coordinated. All filament power source interconnections will be accomplished with the main filament contactors.

(R. Jahn)

Bias Interlock

A drawing complete with operating instructions has been prepared for the bias interlock. Switches have been labeled, and a copy of the new drawing has been placed near the interlock for the convenience of anyone who wishes to reset the interlock.

Arc Drop Measurements

We have completed a clipping circuit which will make it unnecessary to use a special oscilloscope for our weekly arc drop measurements. It can be used with any calibrated d-c oscilloscope.

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5.2 Power Supplies and Control (Continued)

D-C Voltage Monitor (S. E. Desjardins)

A circuit for monitoring d-c voltage is being investigated. This novel circuit consists of a gate tube which is pulsed on the control grid and has a d-c level applied to the suppressor grid. The plate output is then compared with the screen grid output through a three-winding transformer. When the circuit is balanced there is no signal on the third winding. When the d-c level shifts or has ripple, a signal is detected on the third winding. Mr. Earl Gates is winding some trial transformers which are being tried in a breadboard circuit.

6.0 BLOCK DIAGRAMS (J. H. Hughes)

A three-page table, SB-37346, "CPO Unit Outputs and Interconnections", is complete except for some of the in-out equipment connections. It traces the output pulse of each CPO unit, showing jack numbers and cable numbers, to the input of the unit or units where the pulse performs its title function. This table is probably not in its final form. If you have suggestions for improving it, tell me.

(B. E. Morriss)

The conversion program written by C. Adams and Briscoe has been operated several times and initial failures were traced to IOS and not to the program. This program is a modification of the conversion program used in the past and the conventions which must be used are the same. The program interprets the new in-out orders as well as previously prepared master tapes and produces a tape on the old punch which can be read using the PETR and the new read-in program described in E-473. The program could be easily modified to operate with the new punch.

At present the mechanical reader operates by being selected by an <u>si</u> order which does <u>not</u> initiate the reading of a character, and each <u>rd</u> initiates the reading of one word or character and when it has been placed in IOR transfers the word into AC. Thus a sequence of orders written for PETR will operate the mechanical reader successfully if the address of the selecting <u>si</u> is changed to that of the mechanical reader. It is not possible to exchange the mechanical reader for the PETR with a switch although this facility should be provided in the near future.

One of the two punches will be omitted and a third printer will be substituted in its place. This printer will be placed in room 222.

Several unforeseen or overlooked difficulties have been found with the magnetic tape units. When de-selected and stopped when recording the section of tape which the unit coasts over will <u>not</u> be erased with a

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6.0 BLOCK DIAGRAMS (Continued)

signal of full strength. The signal has not been measured but is estimated to be from 1/4 to 1/2 full strength. Thus in the present system the space between blocks may not be adequately erased. It appears necessary to add another mode of operation to handle this situation. This would be an si (stop after recording) mode which would see that erasing continues until the unit has stopped and that a space as large as any which could be formed after reading will be formed.

Several programs have been written for operating external units with different modes of operation for testing.

7.0 CHECKING METHODS

7.4 Marginal Checking

Programmed Marginal Checking System (D. Morrison)

The WWI Systems Group has received a prototype gas tube counter for use in the programmed marginal checking system. The unit is under investigation.

A prototype line selector has been constructed for use with the counter and the marginal checking panel selection frame is being re-designed to contain the PMC equipment.

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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: J. Frankovich, 54 hours; H. Briscoe, 70 hours; M. Rotenberg, 80 hours; D. Combelic, 80 hours; E. Kopley, 76.5 hours; J. Porter, 8 hours; Demurjian, 78 hours; Aronson, 26 hours; Perlis, 20 hours

Three new input conversion programs are being written for use by the applications group when the computer is again available. One will enable a programmer to use an extensive vocabulary subject to relatively few restrictions, i.e. "grammatical" rules. This conversion program will be put on magnetic tape, along with a selected set of library subroutines, at the beginning of an application period and will be used piecemeal by the computer during the conversion of each Flexo-coded program, the eventual result in each case being the completely converted program and the desired subroutines in ES. The advantages peculiar to this conversion program are the availability of all of ES to the programmer, a generalized floating address notation, and the simplification, in the sense of the addition of explicit, non-ambiguous mnemonic aids, of coding for extra-precision number system interpretive subroutines. The increased time required for converting a program, due to the use of magnetic tape, is expected to be compensated for by the abolition of the previous practice of reading into the computer several special tapes in order to accomplish a comparable result.

The other two conversion programs are the equivalents of Jack Gilmore's earlier programs. These will accomplish the conversion of a Flexo-coded program to binary form directly into ES or onto punched paper tape (this tape will be in a "556" form, equivalent to inverted 5-5-6 tape). The vocabulary for these programs will be no larger than the one formerly available, and the previous limitation is similarly imposed that not all of storage is available unless a sizeable portion of the program is first converted to 556 form.

Although only two-register multiple precision arithmetic is being considered at the moment, the addition of three-register (e.g., 39,6) routines will be very easy. (30,0) fixed point, (15,15) and (30-n,n) are the three basic routines which will be available to the programmer. These routines are called in automatically by specification, in the tape title, of the appropriate number pair, e.g., (24,6). As outlined in M-1590 (page 10), the PA Routines will have an optional "cycle-control" feature. In addition, optional use of a "buffer" register (actually 3 consecutive registers) will be provided. The buffer register operation is as follows. When a (30-n,n) number, say, for example, a (24,6) number is normally transferred to storage from the 3-register MRA, it is packaged into two registers. In (24,6)

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8.1 Programs and Computer Operation (continued)

arithmetic this packaging entails the loss of the last six binary digits of the (30,15) number which was in the MRA. By specifying "b" as the address section of any interpreted arithmetic operation (e.g., its b, ica b, etc.) that operation will be carried out by referring to a 3-register "buffer" register wherein the number retains 30 binary digit precision. The cycle count and buffer features are optional, and the final length of the PA routine in storage will depend on which of these additional features are desired.

In order to have a working version of the Programmed Arithmetic routines completed as soon as possible, little has been done on the less important associated Mistake Diagnosis routines.

Work is progressing on output programs that will consist of blocks stored on magnetic tape as a part of the Comprehensive Conversion System. The following is still of a tentative nature.

The programmer need only write "$\left.\begin{matrix}\text{typ1230}\\ \text{0504}\end{matrix}\right\}$" let us say, in order to obtain Flexowriter Typewriter output where the "2" indicates decimal fraction; the "1" indicates ± sign with a decimal point; the "3" indicates the type of terminating character such as carriage return, space after word, etc.; the "0" indicates that the programmer is not specifying a scale factor that he might have used; the 05 and 04 denote 5 digits to the left and 4 digits to the right of the decimal point respectively.

If the programmer desires to have the number which is being taken out of WWI altered by a fixed scale factor, he need only insert a "1" in the 4th position following the three letter output designation TYP. The scale factor is then inserted in the line following the 0504. This information will be processed by the conversion program in the following way:

$$\left.\begin{matrix}\text{sp 256}\\ \text{0.23457}\\ \text{+.1416}\end{matrix}\right\}$$

where sp256 is the entry point of the decimal fraction output, 0.23457 the information described in paragraph 2 as a program parameter and +.1416 is the scale factor.

Besides the typewriter, other forms of output will be available such as oscilloscope, magnetic tape, etc., characterized by NSC, MST, etc., respectively.

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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-472	The Mirror: A Proposed Simplified Symbol for Magnetic Circuits	3	8-13-52	R. P. Mayer
E-473	Input Program, September, 1952	4	8-21-52	C. W. Adams
M-1596	July 1952 Storage and Research Tube Summary	4	8-4-52	R. E. Hegler D. M. Fisher
M-1597	Discussion of Group 61 GOC Test of July 15, and July 29, 1952	3	8-13-52	M. Brand
M-1599	Bi-Weekly Report, August 15, 1952	33	8-15-52	
M-1601	MTC Meeting of August 15, 1952	2	8-20-52	W. A. Hosier
M-1602	MTC Meeting of August 18, 1952	2	8-20-52	W. A. Hosier
M-1604	The Use of the Tektronix Scope with Fast Rise-Time Signals	3	8-20-52	H. J. Platt
M-1605	MTC Meeting of August 4, 1952	6	8-20-52	W. A. Hosier
M-1606	Naming of Equipment and Drawings	1	8-21-52	H. Fahnestock
M-1611	MTC Meeting of August 22, 1952	2	8-22-52	R. R. Everett W. A. Hosier
M-1612	Test Equipment Committee Meeting of Aug. 18	3	8-25-52	L. Sutro
M-1613	Power Supply Control Meeting, August 10, 1952	4	8-26-52	C. Watt
M-1614	Discussions of Magnetic Drum Systems at Engineering Research Associates, August 14 & 15, 1952	6	8-26-52	E. S. Rich C. Watt
M-1615	Test Checking of a Magnetic Drum Buffer Storage System (M.S. Thesis Prop.)	6	8-29-52	C. Zracket
M-1616	The Engineering Application of Stable Emitters to Electron Guns (M.S. Thesis Prop.)	9	8-29-52	T. S. Greenwood
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

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9.1 Publications (Continued)

LIBRARY FILES (Continued)

No.	Identifying Information	Source
2010	Circuit Stability in Guided Missiles	R.C.A.
2011	Some Tests of the Randomness of a Million Digits, B. Brown	Rand Corp.
2012	The Theory of Linear Inequalities, T. Motzkin	Rand Corp.
2013	Lagrangian Interpolation of Maxima and Minima and Points of Inflection	Rand Corp.
2014	Elementary Theory of Convex Polyhedrons, U. H. Weyl	Rand Corp.
2015	A Note on the Numerical Problem of Matrix Inversion, W. B. White	Rand Corp.
2016	Linear Approximations in a Class of Non-Linear Vector Differential Equations	Rand Corp.
2017	On the Iteration of Power Series in Two Variables, R. Bell	Rand Corp.
2018	Project Scoop Linear Programming, R. W. Shepard	Rand Corp.
2019	A Class of Integral Equations, R. Latter	Rand Corp.
2020	Notes on the Solution of Linear Systems Involving Inequalities, G. W. Brown	Rand Corp.
2021	Some Computation Methods for Linear Systems Involving Inequalities, G. W. Brown	Rand Corp.
2022	Randomness, O. Helmer	Rand Corp.
2023	Hermite Polynomials of Imaginary Argument, H. Germond	Rand Corp.
2024	Compound Randomization in the Decimal System, G. Brown	Rand Corp.
2025	Note on a Functional Form for Polynomials, D. Gross	Rand Corp.
2026	Empirical Analysis, Exponential Series, H. Germond	Rand Corp.
2027	Empirical Analysis, Power Series, H. Germond	Rand Corp.
2028	A Class of Integral Equations, R. Latter	Rand Corp.
2029	Asymptotic Solutions for a Class of Integral Equations and their Applications to a Neutron Transmission through a Finite Slab	Rand Corp.
2030	On the Number of Eigenvalues of a Certain Symmetric Kernel, O. Gross	Rand Corp.
2031	The Evaluation of a Definite Integral, R. Isaacs	Rand Corp.
2032	Extracting Roots of Polynomial Equations, I. Greenwald	Rand Corp.
2033	SEAC Operating and Programming Notes, I	Nat. Bur. Standards
2034	Effects of Ions in the M.I.T. Electrostatic Storage Storage Tube, M. S. Thesis	H. Jacobowitz
2036	A Permanent-Magnet Type Electric Actuator for Servovalves, R. H. Frazier, R. D. Atchley	Dynamic Analysis & Control Lab

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9.1 Publications (Continued)

LIBRARY FILES

No.	Identifying Information	Source
1987	An Alternative "Predictor-Corrector" Process	Nat. Bur. Standards
1988	Iterative Methods of Solving Linear Problems on Hilbert Space, R. M. Hayes	Nat. Bur. Standards
1989	An Iterative Method for Finding Characteristic Vectors of a Symmetric Matrix, W. Karush	Pacific Journal of Mathematics
1990	On the Truncation Error in the Solution of LaPlace's Equation by Finite Differences, W. Wasow	Nat. Bur. Standards
1991	Recording Fluxmeter of High Accuracy and Sensitivity, P. Cioffi	Bell Telephone Labs.
1992	Progress Report of the AIEE Magnetic Amplifier Subcommittee	A.I.E.E.
1993	Transient Response of Saturable Reactors with Resistive Loads, H. F. Storm	A.I.E.E.
1994	Magnetic Amplifiers of the Balance Detector Type, Their Basic Principles, Characteristics and Applications, W A. Geyger	A.I.E.E.
1995	A Magnetic Amplifier Frequency Control, L. Johnson	A.I.E.E.
1996	Non-Harmonic Oscillations as Caused by Magnetic Saturation, R. Rudenberg	A.I.E.E.
1997	The Fundamental Operation of the Amplistat-A Magnetic Amplifier, R E. Morgan	A.I.E.E.
1998	Standardization of Reactor Ratings, F. H. Kierstead	A.I.E.E.
1999	Universal Curves for D-C Controllable Reactors, R. Alley	A.I.E.E.
2000	Saturation Effect on Leakage Reactance, T. C. Lloyd	A.I.E.E.
2001	Some Fundamentals of a Theory of the Transductor or Magnetic Amplifier	A.I.E.E.
2002	Bibliography of Magnetic Amplifier Devices and the Saturable Reactor Act, J. G. Miles	A.I.E.E.
2003	A High-Speed Flip-Flop Circuit Using Junction Transistors, M.S. Thesis	A. M. Heien
2004	Dynamic Analysis of Regulated D-C Supplies for Large Loads, M. S. Thesis	J. J. Gano
2005	Adjustment Procedure for Kinescope Ion-Trap Magnets	R.C.A.
2006	Horizontal-Deflection-Output and High-Voltage Transformer RCA-230T1 for 18-Kilovolt Kinescope Operation	R.C.A.
2007	Phase Sensitive Demodulation with Symmetrical Non-Linear Resistors	Redstone Arsenal
2008	Sweep Frequency Generator for UHF Television Band	R.C.A.
2009	Ferrite Applications in Electronic Components	R.C.A.

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9.2 Standards, Purchasing, and Stock

Procurement and Stock (H.B. Morley)

Pulse transformers having been approved with 2-mil cores in 1-to-1 and 3-to-1 ratios, will be ordered. This should provide a good backlog of 1-mil cores, when Westinghouse finally delivers.

Most major orders have been placed, including, racks, wireways, voltage variation switching, fixed voltage switching and fuse indication panels.

Approval has been received for fabrication and wiring of plug-in units and panels. This order will be placed as soon as quantities are determined.

New Standards material orders are being placed.

Planning for the new stock control system is progressing.

During the early Spring and Summer, deliveries eased; full advantage was taken of this softening, and large orders placed. Deliveries are now becoming progressively slower. Larger orders for later deliveries should now be placed, as this condition is expected to continue to slow down through the Winter and early Spring.

It is imperative that requisitions for materials allow for maximum lead time and delay.

Standards (H.W. Hodgdon)

New and revised standards issued this period.

6.013-1	Panels, 19", 1/16" thick	issued	8-14-52
6.014-1 thru -3	Relay Racks	"	8-14-52
6.073-1 thru -6	Rubber Grommets	"	8-27-52
6.074-1	Machine Screws	"	8-14-52
6.074-2	Machine Screw Nuts	"	8-14-52
6.074-5	Washers, Locking	"	8-14-52
6.074-6	Washers, Insulating	"	8-14-52
6.074-7	Wood Screws	"	8-14-52
6.074-8	Cap Screws	"	8-14-52
6.074-9	Set Screws	"	8-14-52
6.074-10	Self-Tapping Screws	"	8-14-52
6.075-1	Standoffs, Metallic	"	8-14-52
6.075-2	Standoffs, Insulating	"	8-14-52
6.147-2	Relay, A-B BX-44	Revised	8-26-52
6.147-3	Relay A-B BX-84	issued	8-26-52
6.151-1 thru -3	Resistors, Fixed Composition	Revised	8-26-52
6.171	Switches, Sensitive	issued	8-14-52
6.173	Switches, Selector	"	8-14-52
6.174	" "	"	8-14-52
6.192-8	Transformer, Power	"	8-27-52
6.192-10	Transformer, Power	Revised	8-27-52

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9.2 Standards, Purchasing, and Stock (continued)

6.195-13	Transformer, Filament	issued	8-27-52
6.195-15	Transformer, Filament	"	8-27-52
6.195-16	Transformer, Filament	"	8-27-52
6.195-18	Transformer, Filament	"	8-27-52
6.195-20	Transformer, Filament	"	8-27-52
6.195-21	Transformer, Filament	"	8-27-52

Gano and Farmer have submitted a proposal on power transformers for lab power supplies of uniform design. They would provide for all our standard lab voltages in both 5 and 10 amp ratings. Tentative specs have been drawn up and submitted to a manufacturer for design and quotation.

The subject of 5% tolerance components has been brought up for discussion again. The majority committee opinion is still that the 10% tolerance components will serve equally well in the vast majority of applications in this lab. In the case of resistors, any need for better than 10% tolerance can be met by the 1% deposited carbon types. In this connection, circuit designers are cautioned not to go "overboard" in the use of premium components where others will serve equally as well. The use of a precision, premium-quality (and premium-price) component simply because "it's a better one" can scarcely be justified in most cases. As a partial concession to those who feel that 5% tolerance components are necessary, present stocks will be kept separate from the 10%. Periodic checks on their usage may indicate reconsideration of this subject at some future date.

9.3 Construction

Production Control (F.F. Manning)

The following units have been completed since August 15, 1952.

CR#	QTY	Unit Title	Originator
1492-21	10	D-C Flip-Flop Special Delay Line	Werlin
1492-23	2	Plug-in Gate Buffer Amplifier Serial #60,61	O'Brien
1684	1	Low Speed 2^6 Counter	Sutro
1775	48	Clip Leads	Nickerson
1836	7	3:1 Pulse Transformers	Hunt
1880	100	Cable terminators 91 ohm	Smead
1881	40	Clip Leads	Smead
1767	100	D-C Power Cables	Sutro
1890	80	Video Cables	Smead
1892	40	Video Cables	Corderman
1908	1	Modify DCIOR Serial #22 Restart Interlock	Desjardins & Holmes
1910	1	Modify DCIOR Serial # 35 Read-in Interlock	Desjardins & Holmes
1924	9	Video Cables	Briggs
1932	20	Video Cables	Eckl
1945	18	Video Cables	Leary

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9.3 Construction (continued)

CR#	QTY	Unit Title	Originator
1469	3	Filament Power Panel Serial #6,7,8.	Papian
1492-12	12	Plug-in Gate Tube Serial #13 Through 24	Watt
1492-13	15	Plug-in Gate Buffer Serial #45 Through 59	Watt
1492-15	10	Plug-in Flip-Flop Serial #33 Through 42	Watt
1633-1	17	Mounting and Cabling Lab Benches	Mercer
1789	15	D-C Power Strips (4 Plug)	Sutro
1824A	4	Current Pulse Generator (Breadboard)	Briggs
1830	13	Modified D-C Outlet Boxes Mod III	Manning
1927	1	Core Driver Mod V Prototype	Boyd
1934	1	Aux. Panel Tape Output Relay Register Prototype	Norcott
1943	4	D-C Power Cables	Nickerson
1492-20	3	Test Panels for Plug-in Units	Werlin

The following units are under construction:

1929	71	1:1 Pulse Transformer	Manning
1415	5	Storage Tube Mount	Dodd
1767	700	91-ohm Terminator	Sutro
1922	5	Delay Lines	VonBuelow
1909	1	Modify DCIOR Serial #34	Desjardins & Holmes
1633-1	3	Mounting & Cabling Lab Benches	Mercer
1778	3	Rack Power Control Panel (Test Equipment)	Corderman
1936	2	32 Pos Crystal Matrix	Shansky
1684	5	Low Speed 2^6 Counter	Sutro
1941	1	Ferro Electric Core Tester (Breadboard)	Woolfe
1492-18	2	19" Mounting Panel Plug-in Unit	Papian
1942	40	D-C Power Cables	Baltzer
1942	50	Terminators 91-ohm	Baltzer
1942	115	Video Cables	Baltzer
1948	12	Delay Lines	Heineck
1492-31	2	D-C Flip-Flop Special Delay Lines	Watt
1953	2	Circulating Pulse Indicator (Breadboard)	Gerhardt
1951	6	Plug-in Unit Test Stands (Breadboard)	Smead
1492-27	1	Plug-in Gate Buffer Serial #	Watt
1492-28	1	D-C Flip-Flop Plug-in Serial #	Watt
1492-29	1	Plug-in Dual Buffer Amplifier Serial #	Watt
1492-30	1	Plug-in Switch Serial #	Watt

9.4 Drafting (A.M. Falcione)

1. Component Numbering

Over a period of the last five years a certain system has been established for component numbering of WWI Drawings. This system is not only recorded on all existing drawings, but is also covered by the Digital Computer

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9.4 Drafting (continued)

Laboratory Electrical Drafting Standards Book, Class 3. From time to time different groups of engineers insist on using a number system which is contradictory to our present standards. From the discussion I have held with various engineers, there is merit to both systems. However, it is not felt that it is wise to use different numbering systems for components which are contradictory to the existing standards. The main objection being that if several systems are employed there will be quite a bit of difficulty reading the drawings at some later date, because of their different meanings. This situation not only affects draftsmen, but various other individuals, and upsets the whole standard numbering system. I would suggest that this matter be brought before the group leaders meeting, so that a system of numbering components can be adopted and abided by by the various groups in the Project.

2. Drafting and Reproduction Costs Required for Specific Charges

There have been several instances in the past where we have reproduced certain material for other projects, and for which the cost of reproduction was to be reimbursed to 6889. However, this department was not notified in sufficient time to properly keep track of the cost involved, and subsequently some average factor was arrived at for the purpose of transfer of funds. In the event it is necessary to keep track of cost for Drafing or Print Room Reproduction Work in the future, it would be greatly appreciated if the group leaders or section heads would notify the writer prior to the work being done, so that accurate figures can be obtained.

3. Standards

During the past few months I have attended several meetings with other MIT Drafting Supervisors to discuss standardization of drafting standards. I have collaborated with Mr. DeSantis, Project Lincoln Group 14.3; Mr. Victor Howes of the Instrumentation Laboratory, and James Aitken of Building 20. At the present time these laboratories are now using copies of our Class 2 and Class 3 Standards, Mechanical and Electrical.

4. Microfilming WWI Drawings

Within the next month plans are being formed to microfilm various WWI Drawings in accordance with our security procedure. At that time in addition to WWI Drawings, we will also microfilm the following:

A. Video Cabling Schedules
B. Dial Directories
C. WWI Bill of Materials
D. WWI Log
E. Parts Lists
F. Computer Program

We are planning to have all the microfilming done in the Whirlwind Building, so that no records will leave the Project. In the event that other records of importance should be microfilmed, other than those listed above, please notify the writer, so that arrangements may be made to have them included at that time.

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10.0 GENERAL

New Staff (J.C. Proctor)

James Childress is a new staff member assigned to Brown's group. He has a BS in Physics from the Louisiana State University and a year's experience as an Electronic Engineer with Melpar.

James Freeman came to us from the University of California where he has been a full-time lecturer in Electrical Engineering for the past four years. He also served in the Navy for two years as a communications officer and holds a BS in EE from the California Institute of Technology and an MS in EE from the University of California. He has been assigned to Brown's group.

Robert Pfaff, a lieutenant in the Air Force has been assigned to the Laboratory. He worked in the Digital Computer Laboratory as a thesis student and after obtaining his degree last June was commissioned in the Air Force. He has been assigned to active duty with this project.

Orin T. Conant, a new staff member assigned to Wieser's group on applications has a BS in Math from the University of Wisconsin and served as a radio operator in the Army for two years.

Bronislaw Smulowicz received an outstanding SM in EE from MIT and has had five years' varied experience. He has been assigned to Brown's group.

Francis E. Vinal who is now a member of Brown's group has already contributed a great deal to the Project. He has worked in Von Hippel's Lab, and is a ScD from MIT and was an Assistant Professor in the Metallurgy Department.

Staff Terminations (J.C. Proctor)

Gerald Cooper
Richard Robinson
David Wheeler
Thomas Walkinshaw

New Non-Staff (R.A. Osborne)

The following technicians have joined the Construction Shop:

Vito Augello
William Butler
Richard Driscoll
Robert Jeffrey
Joseph O'Leary
Victor Tessari
Philip White

Roland Favreau has been assigned to the Machine Shop as a Lab Helper.

Murray Hill is a new janitor at the Whittemore Building.

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10.0 <u>GENERAL</u> (continued)

Barbara Jacobs has joined the Tube Testing Shop as a Clerk Typist.

Arnold Klayman is a new technician working in the Systems Group.

Robert Laird has been assigned to work in Dave Brown's group as a technician.

James Mooney is a new Lab Helper in the Sheet Metal Shop.

Carol Small is a new member of the Drafting Department where she is a detailer.

Anne Sparling is a new Print Room clerk.

Alan Tritter is a student in C. Adams' Group.

<u>Terminated Non-Staff</u> (R.A. Osborne)

Davis Bates
David Bray
Gordon Caswell
Norman Doelling
Rita Langley
Rosemary Parkins
Sheldon Teicher
Helen Wetherbee