Digital Computer Laboratory
Massachusetts Institute of Technology
Cambridge 39, Massachusetts

SUBJECT: BIWEEKLY REPORT, February 13, 1953

To: Jay W. Forrester

From: Laboratory Staff

1.0 SYSTEMS OPERATION

1.1 Whirlwind I System

1.11 Operation (F. J. Eramo)

The following is an estimate by the computer operators of the usable percentage of assigned operation time and the number of computer errors for the period 30 January - 12 February 1953:

Number of assigned hours	109
Usable percentage of assigned time	92
Usable percentage of assigned time since March, 1951	85
Number of transient errors	28
Number of steady-state errors	8
Number of intermittent errors	18

(C. L. Corderman)

An unusually large number of parity alarms were recorded during this period. Digit 15B was responsible for almost half of the alarms; in all cases the tube either read out correctly when the register failing was examined, or the surface had switched partially positive. Since the tube has good margins, it is being left in service. It is hoped that the source of the failure can be isolated with the aid of special alarm circuits on that digit only.

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

The following failures of electrical components have been reported since January 30, 1953:

1.12 Component Failures in WWI (continued)

Component	No. of Failures	Hours of Operation	Reasons for Failure
Crystals			
1N38A	1	1 - 2000 - 3000	Low back resistance
	1	1 - 7000 - 8000	Low back resistance
D-358	7	7 - 15000 - 16000	Low back resistance
Resistors			
0.1-meg, 1-watt Nobleloy	2	2 - 7000 - 8000	1-open; 1-above tolerance
Transformers			
1.1 pulse transformer	1	1 - 15000 - 16000	Intermittent lug connection on primary side
Tubes			
12AY7	2	2000 - 3000	Low I_b
	1	1000 - 2000	Leakage
C16J	1	6000 - 7000	High arc
5670	1	1000 - 2000	Low I_b
6SN7	1	10000 - 11000	Low I_b
3E29	1	7000 - 8000	Low I_b
7AD7	7	7000 - 8000	6-low I_b; 1-short
	2	8000 - 9000	1-Low I_b; 1-short
	2	10000 - 11000	1-low I_b; 1-short
	1	11000 - 12000	Short
	2	12000 - 13000	Low I_b
	1	13000 - 14000	Short
	4	16000 - 17000	3-low I_b; 1-short
6AS7	1	0	Open cathode
	1	3000 - 4000	Short
	2	12000 - 13000	1-gas; 1-short
6AL5	1	5000 - 6000	Short
	1	8000 - 9000	Low I_b
	2	10000 - 11000	Low I_b
6AG7	1	2000 - 3000	Short
	1	8000 - 9000	Short
	1	10000 - 11000	Low I_b
6AK5	5	10000 - 11000	Low I_b

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

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

ST-702-C was temporarily removed after 1351 hours of operation because of low margins.

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

Following is the storage-tube complement as of 2400 February 12, 1953:

Digit	Tube	Hours of Installation	Hours of Operation
0 B	ST-619-C-1	10069	2424
1 B	ST-711-C	11989	504
2 B	ST-603	8322	4171
3 B	ST-601	8524	3969
4 B	ST-516	6641	5852
5 B	ST-733-1	12465	28
6 B	RT-344-C-1	10637	1856
7 B	ST-540	7937	5556
8 B	ST-549	8259	4234
9 B	RT-347-C	10782	1711
10 B	ST-700-C	10917	1576
11 B	ST-717-C-2	11793	700
12 B	ST-604	10827	1666
13 B	RT-346-C	10756	1737
14 B	ST-624-C-1	10507	1986
15 B	ST-730-1	12223	270
16 B	ST-716-C-1	11702	791
16 A	ST-613	9046	3447

ES Clock hours as of 2400 February 12, 1953 12493

Average life hours of tubes in service 2360

Average life hours of last five rejected tubes . . . 95

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

2.0 CIRCUITS AND COMPONENTS

2.1 Circuits by System Number

2.13 Arithmetic Element (B. Remis)

A diode "AND-OR" gate combination has been built for marginal checking and several curves were taken. An input square wave with 1-mc repetition rate was put into the combination, and circuit voltages and resistors were systematically varied until the rise time of the output wave fell to 0.5 μsec.

Several modifications of the input triggering circuitry of the Boyd 5963 flip-flop have been made. Two flip-flops were adapted for use in a 2-digit diode adder.

(A. Heineck)

Further work was done on the diode high-speed-carry line. The minimum propagate time for 16 digits is about 0.6 μsec.

Two states of an accumulator consisting of Boyd's flip-flops and diode gates are being built. Add and shift and add, shift, and carry techniques will be studied.

Delay-Line Carry (R. Callahan)

A delay-line-carry unit has been built using a 0.5-μsec, 400-ohm delay line. To simulate actual use in a computer, the delay line was made to drive a Whirlwind-type gate tube and buffer amplifier. It was possible to terminate the delay line so that 0.1-μsec pulses with no evidence of reflections were observed at the signal grids of the gate tube and buffer amplifier.

Two-Digit Arithmetic Element (I. Aronson, S. Thompson)

A two-digit arithmetic element that uses diode circuits has been built. A modified version of the cathode-follower coupled flip-flop designed by Hal Boyd is used in the accumulator. The principal sources of errors are transients on the d-c supply lines.

A diode pulse-gating circuit for reading into the accumulator has been under investigation for the past week.

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

Pulse-amplitude tests were continued on the new part of in-out control which connects the auxiliary drum to the computer.

2.14 Input-Output (WWI) (continued)

The necessary expansion for the in-out switch (WWI) was laid out as required by MITE and the matrices ordered.

The designs for the remote-location terminal boxes, 1, 2, and 3, are in drafting.

2.2 Vacuum Tubes and Crystals

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

A recent difficulty in the 513D scopes was traced to excessive grid emission in 12AT7 tubes. The basic trouble is excessive grid impedance in a cathode follower, but slightly abnormal tubes aggravate the situation considerably. This particular instance of poor design may be tolerated if Sylvania 12AT7 tubes are used in the critical cathode-follower socket instead of the RCA tubes supplied with the scopes. The circuit primarily concerned is V3 in the 513D; however, V4 of the 513D and V4 of the 514D may give similar difficulties. Trouble with V3 is evidenced by low gain and distortion, in V4 (either scope), by shift in baseline with position of step attenuator.

It has been noted of late that many circuit designers are specifying obsolete tube types for their circuits. Some types which are no longer being used still appear on many new parts lists. In particular, the 6145 has superseded the SR 1407 and 7AD7 in new equipment design. All 2C51's have been replaced in WWI by 5670's, and all 6AK5's are being replaced by 5654's. However, 5670's and 5654's are not recommended for new design because of the extremely close grid-cathode spacings. In addition, 12AU7's have been superseded by 5963's, although replacements will be made only as 12AU7's fail. A memo will be prepared on this subject in the near future.

Life tests of types 5687 and 5963 have completed 2000 hours. Both tests were run on the basis of one-section-on, one-section-off, with both cathodes hot. In the 5687 tubes, it was found that the cathode of the cut-off side was damaged, so that space current decayed rapidly when this side was switched on for test. The 5687 cathode temperature is about 800°C brightness, measured at the end, which means that the true temperature is probably near 900°C, perhaps higher, at the end. This temperature is too hot for long operation without deterioriation, so an additional life test has been started at lower heater voltage (12.0 rather than 12.6) to evaluate operation.

The situation with the 5963 is somewhat different. This tube has a cathode temperature at the end of 800°C brightness with a heater voltage of 16 volts. This corresponds to a true temperature of

2.21 Vacuum Tubes (continued)

about 800° C at 12.6 volts. This type develops more interface impedance on the normally-on than on the normally-off side, which is believed due to the low cathode temperature. An additional life test is being run with 13.8 volts on the heater to check this behavior.

A plate family for the 6BL7GT corresponding to the tubes now being used has been prepared. The number of this drawing is SA40543. It is suggested that designers using the 6BL7GT use this curve rather than A51178 sheet 4, the Sylvania published data. The average plate current of the tubes now being received is considerably below bogie, so that A51178 is misleading.

2.22 Transistors

Measurements (N. T. Jones)

Parameter-distribution bar graphs for the recent shipment of 50 GE G11A and 20 special GE transistors were prepared by D. Smith. A short memorandum will be written summarizing these groups of transistors, particularly with respect to previous groups of GE transistors.

Test Equipment (N. T. Jones)

A breadboard circuit of the base-driven hole-storage time measurement has been constructed and put into use. The parameter, r_{bo}, has been set up as a breadboarded direct-reading measurement in the same manner as r_{co}, α, and V_{c34}. These prototypes, as well as the one for rise and fall time reported in the last biweekly report, will be used to measure all transistors until time permits the engineering of final models.

Transistor Accumulator (D. J. Eckl)

The accumulator has now been operating 2920 hours.

The power supply for the transistor marginal-checking voltage has been completed by R. Burke, and the transistor marginal-checking panel is under construction. A marginal-checking supply for the Burroughs flip-flop has also been completed.

Transistor Adders (D. J. Eckl)

Several different types of adders described by Bell Labs are being studied. These include (1) flip-flop registers and diode logic, and (2) delay-line storage and diode logic. Some tests will probably be made on the more promising types.

2.3 Ferromagnetic and Ferroelectric Materials

2.31 Magnetic-Core Materials (David R. Brown)

We now believe that we have received almost enough cores from General Ceramics to obtain the 20,000 good cores for MTC. The number of good cores which have been selected by the first pulse test is now approximately 16,000. One thousand two hundred and sixty cores for the first MTC array have been delivered to Group 62. All 20,000 cores should be delivered to Group 62 by March 16.

Experimental and theoretical work indicates that if the coercivity of magnetic materials is reduced, the switching time in the coincident-current memory increases. If our present hypothesis for the factors determining the switching time is correct, we should be able to achieve some reduction in coercivity without increasing the switching time. In the case of the materials we have examined, however, we have found that in every case longer switching times are associated with smaller coercivities.

A sample ferrite submitted for evaluation, Ferroxcube R, did not exhibit significant rectangularity. The squareness ratio was 0 : 3.

The Chemistry Laboratory is now being put into operation and the preparation of ferrites in the Whittemore Building may now be carried out.

Production Tester (J. W. Schallerer)

The two 50-microsecond delay units and the limit calibrator have been installed in tester #2. The units were found to be operating properly with satisfactory accuracy. A pickup problem has been encountered in the probe, however, and the probe is now being redesigned.

It was decided in the last biweekly period to take a "temperature" versus "core-output" curve. The equipment has been set up, and testing will start next week. A more extensive test is now being prepared by Jim Childress.

(W. J. Canty)

Trouble in the production testers, which caused poor reproducibility of measurements, has been traced to faulty 10-ohm-current measuring resistors. These resistors have been replaced. Logic has been added to the production testers for making disturb sensitivity measurements.

On February 11 and February 12 a visit was made to General Ceramics. Two Model V and one Model VI core drivers were set up for use with their semiautomatic core tester.

2.31 Magnetic-Core Materials (continued)

Seminar on Magnetism (A. L. Loeb)

The formal part of the seminar has concluded with consideration of Pauli's exclusion principle and the resulting Fermi and exchange energies which determine the stability of magnetized states. The seminar continues with two principal purposes:

1. Discussion of recent developments in the fundamental theories of magnetism;

2. Discussion of fundamental research being done in Group 63 in particular.

As a first project, we are studying a series of articles recently published by Zener on the interaction of adjacent d-shells. It is expected there will be more general participation in the discussion than has been the case so far.

Test Equipment for Magnetic-Core Measurements (B. Gurley)

In the last two weeks, I have finished debugging a current and voltage calibrator for core testing. This produces pulses of adjustable and measurable amplitude. I sent the schematics, etc., to the shop where six units are to be built. I am presently debugging a time comparator for use with the above to measure switch time of cores.

(J. D. Childress)

A logic for a magnetic-core tester was assembled with plug-in units. The results of the tests of the PIU are given in M-1845.

Automatic Curve Plotter (J. D. Childress)

Part of the equipment for the automatic curve plotter has been delivered. Preliminary tests are being conducted.

The Switching Mechanism (J. B. Goodenough)

An E-note is being completed in which the concept of nucleating centers for domains of reverse magnetization and their relation to the switching mechanism is introduced and discussed. The essential parameters influencing squareness ratio and switching time are indicated on the basis of this model. The relationship of these parameters should give a basis for a systematic development of the best possible magnetic core.

2.31 Magnetic-Core Materials (continued)

Core Response (N. Menyuk)

A determination has been made of the energy associated with a cylindrical Bloch wall in a core with a single direction of easy magnetization. It has been found that

$$\sigma_w = 4\sqrt{KA}$$

where σ_w is the Bloch-wall energy per unit area, K the anisotropy constant, and A the exchange constant.

For materials in which eddy-current effects may be ignored, the resultant product of effective magnetic field and the core switching time given in the previous report is amended to read

$$(H-H_o)\, t_s \approx \frac{I_s \Delta \rho}{\gamma (\Delta^2 + \gamma^2 I_s^2)} \sqrt{\frac{Kza}{2kT_c}}$$

where z is related to the number of nearest neighbors in the lattice, and the other terms were previously defined.

Special Pulse Testing (P. K. Baltzer)

The data has been taken for an experiment on the effect of the duration of current pulse on pulse response of MTC memory cores. Calculations and measurement corrections have yet to be made before evaluation of the experiment is possible.

Chemical and Ceramic Facilities (F. E. Vinal)

The laboratory contractor has completed the installation of the chemical facilities in the third floor Whittemore Building and at present, laboratory furnaces are being installed and tested. Actual chemical work will commence on Monday, February 16. The Pilot Plant in the basement of the Whittemore Building has not as yet received any equipment but the room is now ready for these pieces as received.

Microstructure of Ferrites (F. E. Vinal)

The metallographic specialist in Group 35 has polished and etched several samples of ferrites for observation of the microstructure. Results are thus far scattered and have not yet been correlated with electrical properties. A considerable amount of time has been spent in developing, polishing, and etching techniques as metallographic techniques can only be used as a guide in preparing samples of ferrites.

2.31 Magnetic-Core Materials (continued)

Preparation of Ferromagnetic Materials (J. H. Baldrige)

A series of "A"-type ferrites is being prepared with compositions close to that of 3A10. Specimens will be fired within the next two weeks in order to determine the effect of composition changes on electrical properties.

Ceramic Ferromagnetic Toroids (G. Economos)

The preparation of the new series of toroid specimens (F-109) of ferrites has been completed. Firing of these is now in progress and should be complete before the next biweekly report is due. The first series will consist of 486 (54 per day) toroids which will be wound at the Digital Computer Laboratory, then returned to the Laboratory for Insulation Research for testing. When the testing is completed, these toroids will become available for any other test or examination.

It was desired to make and fire F-304 toroids at this time also, but the die was broken. As soon as a replacement part is received, specimens of this size will be made.

Toroid-Strain Measurement (J. H. Epstein)

Apparatus is being designed to strain a toroid to a known stress while measuring the strain with x-rays. Samples will be prepared in a special-sized die but otherwise under the same conditions being used by F. Vinal.

Magnetostriction Measurements (J. H. Epstein)

The magnetostriction measurements were rather inconclusive due to experimental difficulties. In the remanent state, the lattice constant of Mn-Mg ferrite changes by less than 10^{-5} in the direction perpendicular to the magnetic field. In the saturated state, the effect appeared larger but was more likely due to temperature fluctuation.

Literature Survey (R. Maglio, J. Sacco)

Most of the time has been directed to studying the literature of spinel systems and the reports on research work from General Ceramics.

Study of Ferrite Bodies (R. Maglio, J. Sacco)

A plan for the chemical compounding of ferrite bodies has been drawn up. This plan consists of investigation of a number of parallel systems which have the same ratios of +2 cations lattice constants. For example, a MnO-NiO-Fe_2O_3 will be paralleled with a MnO-MgO-Fe_2O_3 system through all mole-fraction ratios of MnO-NiO and MnO-MgO (keeping stoichiometric composition). Depending upon which element is the major (+2) component of the

2.31 Magnetic-Core Materials (continued)

system, the second (+2) component will be added so as to strain the lattice in a positive or negative direction.

In this plan a schedule is in order for the weighing, calcining, milling, pressing, and firing of the ferrite bodies.

Trial Runs with Burrel and Hotpack Furnaces (R. Maglio, J. Sacco)

Number 3 Burrel furnace and Hotpack furnace are now undergoing their initial test run. This test has been designed (1) to obtain a qualitative measure of temperature gradients within the muffle and heating zone, (2) to calibrate the Brown Pyro-Vanes with a potentiometer, (3) to determine the time required to bring the furnaces to peak temperature.

2.32 Magnetic-Core Memory

Switch-Core Study (A. Katz, J. Rafíel)

A 32-position switch, using MF-1131 (F-282) cores stacked 3 high, is being constructed in a modified planar array. A second such switch, differing only in the core body, will be designed shortly.

The 16-position switch constructed some time ago is exhibiting some noise effects which are as yet unexplained. These are under investigation.

MTC Memory Plane Tests (A. D. Hughes)

A test setup was completed which will be used to test each core in each 32 x 32 memory array for MTC. The testing is done before the z winding and sensing winding are added so that a bad core can be easily replaced.

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

Observations have indicated no noticeable change in distribution or amplitude of cores. The array has been operating successfully using 3 to 1 selection with a switching time of 6 μsec and total read-rewrite time of 18 μsec. The time can be shortened further by increasing the driving current.

A report on current margins in magnetic-core memories is in the final stages of preparation.

RF Nondestructive Readout (S. Fine, B. Widrowitz)

By exciting with d-c, pulsed d-c, and RF pulses separately and simultaneously, the frequency-mixing properties of small metallic cores are being studied. It is hoped that a simple explanation of the physical phenomena involved will come out of this. We have worked out a more general proof that the phase of the difference-frequency signal changes by 180° when the core is switched.

2.32 Magnetic-Core Memory (Continued)

Digit-Plane Driver (C. A. Laspina)

The digit-plane driver for use in MTC was tested driving the digit plane of a 32 x 32 memory. The effects of terminating the digit plane and sensing winding were noted.

2.33 Magnetic-Core Circuits

Magnetic-Core Carry Storage Circuit (C. J. Schultz)

This circuit was investigated for its possible use as a substitute for the carry flip-flop and gate in an arithmetic element. It consists of two cores (MF-1326B, F-291) which operate from 0.1-μsec pulses of 5-watts minimum peak power. The necessity of driving from a standard WWI gate circuit or WWI buffer-amplifier circuit limited the driving-current amplitude. The current supplied by either of these is insufficient to produce core switching, by a factor of at least two.

2.34 Ferroelectric Materials

Ferroelectric Pulse Generator (J. Woolf, C. D. Morrison)

The droop of the positive-sections square pulse was rectified. The amplitude control was modified to give greater range. The pulse generator is now capable of developing +1, +1/2, and -1 voltage pulses of adjustable amplitude and width. A new single-shot multivibrator is being designed to have a pulse width of 40 microseconds and a rise time of less than 1 microsecond. The preliminary circuit contains 2CS1's (5670) because most of the multivibrators now in the pulse generator contain this tube.

Ferroelectric Hysteresigraph (C. D. Morrison)

A new temperature-control system for use with the hysteresigraph and the pulse tester has been devised so that the oil can be heated and cooled in a much shorter time than was previously possible. The heater for the oil is controlled directly from a variac. With this system, a complete temperature test of all available ferroelectric samples will be carried out in the next few weeks.

2.4 Test Equipment

Test Equipment Headquarters (L. Sutro)

Burroughs units have been coming in steadily from the factory. Inspection and testing are being performed soon after their arrival. As a result, everyone in the Laboratory who has asked for delivery of Burroughs equipment prior to February 13 has received this equipment with the exception of those who requested High-Frequency Pulse Generators and Rack Power Controls. The latter two types are expected from the factory this coming week. The stock of test equipment available for distribution is growing. Those desiring Burroughs equipment at a date earlier than they originally requested it may obtain it now.

Work performed in the past two weeks:

Standard Test Equipment		Tektronix Scopes	
Inspected	37	Repaired	3
Tested	43	Adjusted	2
		Completely serviced	2

Test Equipment Committee (L. Sutro)

At meetings on February 2 and February 5, the Committee considered surveys of the needs for additional standard test equipment and additional commercial test equipment. It found that the long-standing dream of having enough of every type of standard test equipment may soon come true. The Committee approved orders for the few types that are expected to be in short supply after present orders are filled. It approved purchase of the following commercial test equipment:

Item	User
20 Simpson meters	General use
1 Pulse Generator, Rutherford B2	A.E. Section
1 Pulse Generator, Hewlett-Packard 212A	Mag. Cir. Section
1 Amplifier, Leeds & Northrup 9835	Group 63
1 Potentiometer, Rubican 2730	Group 63
1 Audio Signal Generator, Hewlett-Packard 205A	Group 63

Rapid-Rise Gate Generator (S. Bradspies)

A rapid-rise (0.2 μsec), rapid-fall (also 0.2 μsec) gate generator has been constructed. The gate length may vary between 0 and 100 μsec.

2.4 Test Equipment (continued)

It will be triggered by a gate and two 2D21 thyratrons. This unit has not yet been tested.

Models V and VI Core Drivers (H. Boyd)

E-note 523 has been prepared for the Models V and VI Core Drivers and will be issued soon.

Core Driver, Mod. VII (H. Platt)

The feedback circuit used to regulate the output current was stabilized. The circuit met all requirements except for dynamic response. Consequently, the feedback and comparison circuits were redesigned using "hotter" tubes. The new circuit has been built but not tested.

2.6 Component Analysis (B. Paine)

Trips have been made recently to National Union's crystal-diode facility, International Resistance Company's plant, and the Navy Materials Laboratory to become more familiar with component construction and testing procedures.

A new system for keeping track of component failures from WWI, MTC, and standard test equipment using color-coded index cards is now in use.

Life tests are to be set up shortly to determine the effects of applying continuous back voltages of various magnitudes within the ratings of the diode both at room and at elevated temperatures.

A new model of the plug-in relay tester for production testing in the Laboratory is under construction.

2.7 Memory Test Computer

MTC Control (K. Olsen)

An interesting feature of Burroughs test equipment has been found when long lines are being driven in MTC. In Burroughs equipment, there is a crystal in series with the output; looking into the output jack, a positive pulse sees infinite impedance, so that a reflection coming back from the receiving end of a cable returns from the sending end just as large as when it started. The output impedance of WWI equipment tends to terminate 100-ohm cables and so cuts down the amplitude of reflections.

(P. Bagley)

The block diagram of MTC control is being brought up to date.

Planning has begun for the physical arrangement of panels in the control racks.

Toggle-Switch Storage (J.D. Crane)

Drawings for the cathode followers to drive toggle-switch storage in MTC are complete; construction will begin during the next biweekly period.

Cathode followers that drive the lines from the output of toggle-switch storage to the A-register read-in gates have been made.

MTC Panels (H.K. Smead)

Almost all MTC panels have now been delivered and are being installed in the racks. This includes dual gates, parity check, decoders, plug-in flip-flop mounting panels, gate tube-buffer amplifiers, cathode followers, pulse generators, and delay-line amplifiers. The buffer-amplifier panels and toggle-switch-storage panel have not yet been completed. Construction of the power supplies for MTC has started.

(H. Henegar)

The two parity-check panels have been connected as a unit and inter-wired. Work is starting on modifying the Decoder panels.

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

The accumulator is now complete and operating on pushbutton pulses. All waveforms are now being checked and cleaned up. Refinements such as marginal checking and filament cycle-up will be added next week.

Power Supplies (R.B. Farmer)

The design of the series tube section and the auxiliary supply section of the regulators has been completed. The two sections are now in drafting. It is hoped that the design of the amplifier section will be completed within the next two weeks.

2.7 Memory Test Computer (Continued)

A-Register (R. Pfaff)

The A-register for MTC has been completed. It will be tested when tubes are available.

Plug-In Flip-Flop Testing (H. Henegar)

Practically all of the first 100 MTC flip-flops have been tested and accepted. Some time was spent in determining why 30 of the units originally failed to pass the balance tests. This was found to be due to the method of testing and not to any defects in the flip-flops.

General (R. von Buelow)

Design of the circuits for the control of the power supply and the interlock systems have been completed and are in drafting.

That portion of the air-conditioning system which is in or next to the computer room is almost completed.

A new alarm called Hyper Activity or Extra Activity has been added. This alarm will be actuated if more than one pulse is circulating in the control at any one time.

Cathode Follower, Mod. IV (P. Bagley)

A set of sketches for a cathode-follower panel, Mod. IV, has been drawn and two panels requested from the shop. Each unit houses ten independent cathode followers in a standard 19-inch rack panel.

Magnetic-Core Memory (W. Ogden)

Two experimental 32 x 32 memory planes were completed and are under test. The first of 17 MTC planes is in construction. It is hoped that a construction rate of 3 planes per week will be attained by the end of this month.

Digit-Plane Driver (P. Bagley)

A model of the digit-plane driver plug-in unit has been constructed and sent to C. Laspina for testing. The completion of the assembly drawing of the digit-plane driver is awaiting final acceptance of the model.

The sheet-metal work is under way for 24 plug-in units of this type.

3.0 STORAGE TUBES

3.1 Construction (P. Youtz)

The construction and processing techniques of all 700-series storage tubes have been modified during the past two biweekly periods to stop the recent run of failures caused by a possible breakdown and gas discharge within the storage tubes containing ion-collector plates. The ultimate vacuum of these tubes was improved by using a lighter gas during the glassworking stages and baking the tubes at a higher temperature. However, two recent storage tubes which were processed in this manner failed in the overnight runs in the STRT. These failures prompted further measures to improve the cleanliness and the ultimate vacuum of the tubes. The ion-collector plates will be given a special processing and the vacuum systems will be overhauled to improve the operation.

One research tube was constructed this period for the Philips "L" cathode studies.

3.2 Test

Television Demonstrator (D. M. Fisher)

Partial results obtained from a lower switching detection device indicate that there is a need to eliminate r-f pickup in the equipment. This will be minimized by adequate grounding and bypassing of all units associated with the readout signal. This is the objective at the present time.

Seven tubes were tested since the last report. ST733-1, ST735, ST737, ST738, and ST739 were acceptable and were transferred to the STRT for further testing. ST736 was rejected because of buckling mica. ST734-R1 was rejected because of low resistance between A_2 and A_3.

A lower stability test was performed on ST736 for approximately 24 hours. The tube did not fail during this time.

Storage Tube Reliability Tester (R. E. Hegler)

ST733-1, ST735, and ST737 were given spot interaction tests and were found to have satisfactory operating margins. After operating 25 hours in the STRT, ST735 exhibited the lower stability failure as indicated in previous reports. After 50 additional hours of operation, the lower stability appears to be approaching normal. It can now be operated with no errors.

ST737 exhibited the lower stability failure during the evening which would indicate that failure took place in less than 24 hours. A resistor in the cathode circuit of the holding gun and both the A_3 and

3.2 Test (Continued)

auxiliary-collector decoupling resistors (220 ohms, 1 watt) were burned out. A hi-pot test showed leakage between the ion-collector plate and A_3. This failure damaged the HV cathode so the target surface could not be evaluated on the TV display.

RT371 and ST731-1 which were rejected at the TVD operated for over 90 hours at the STRT with no lower stability failure.

ST724 which was rejected from WWI because of intermittent readout was found to have leakage between the ion-collector plate and A_3. It was also found that the HG cathode resistor and both the A_3 and auxiliary-collector decoupling resistor were burnt out.

RT370 was rejected for WWI use because of buckling mica. It operated 72 hours with no lower stability failure.

3.3 Research and Development

Lower Stability Failure (C. L. Corderman)

Two of the tubes which were processed at 475°C and which had helium used during glass sealing have exhibited the lower stability failure recently observed in ion-collector tubes. Apparently this new schedule alone is not enough to eliminate the breakdown which initiates the lower stability failure. Further checking of the storage tube records has disclosed that the first three tubes of this series had ion-collector plates which had been vacuum fired in addition to the new processing treatment. None of these three tubes has failed as yet. ST729-1 had 142 hours of operation at the STRT and is now a Whirlwind spare; ST731-1 was rejected because of buckled mica but was operated for 95 hours at the STRT; ST730-1 has now been in WWI for 283 hours in addition to 50 hours at the STRT.

The vacuum firing of the ion-collector plates was discontinued for two reasons. First, there was no observable pressure rise when the firing took place which indicated that very little gas was being released. Secondly, it was necessary to cut the plates in half to prevent warpage due to nonuniform heat distribution during firing. With the new evidence concerning tube operation, however, the plates will again be either vacuum or hydrogen fired.

"L" Cathodes (T. S. Greenwood)

More work was done on developing the cathode mount. It now seems undesirable to use the mounting technique which involved simple clamping of the cathode. Because of the flexibility of tantalum, positive

3.3 Research and Development (Continued)

control is not afforded by friction mounting. Instead, a welded construction is required. This offers some difficulty because tantalum does not weld to molybdenum easily under conditions of low contact area and low pressure. It has been found, however, that platinum provides a suitable flux for this operation. It is now felt that a satisfactory mount has been evolved for the cavity-type "L" cathode.

The impregnated-type "L" cathode consists of a smooth cylinder, and the problem of mounting is more difficult. The present line of investigation involves the addition of a ridge to this cylinder to reduce its mounting problem to that of the cavity type. The small size of the cathode and limitations on the amount of time it may be exposed to the air makes the solution difficult to achieve.

During the period, one storage tube was built containing an "L" cathode in the HV gun (RT372). The heater of this cathode burned out during conversion. This is the fourth cathode of the present lot which has been used, and all have exhibited signs of internal heater shorts. It is felt that a contributing factor to these shorts is the addition of an internal wire within the heater coil. This wire was added by Philips, presumably for the purpose of extending the heater legs. Its length, unfortunately, is such that a considerable portion of the heater is shorted. Because of the experience with these cathodes their use is being discontinued. Since the cathodes are made in Holland, some delay in obtaining the older type is to be expected. Meanwhile emphasis will be shifted to the impregnated type.

Pulse Readout (A. J. Cann)

All ten of the 6J6 one-shot multivibrators in the deflection generator of the Alignment Demonstrator were found to have interface resistance from 135 ohms to over 275 ohms on the normally-off side. They were replaced by 5964's, and a minor circuit change was made. In addition, all ten 12AT7 flip-flops were found to have almost no transconductance on the normally-off side and were replaced. They have been submitted for interface measurements.

The 0.01-microsecond steps of the variable delay line are too coarse. A vernier delay with a range of 0.01 microsecond has been added in the form of a 3-ohm, 25-watt rheostat in series with the first section.

Feedthrough in tubes with an ion-collector plate seems to be more troublesome with pulse readout than with r-f readout. So far, it has been established that the feedthrough is picked up in the wiring and radiated by the collector plate. It can be reduced by grounding the HG cathode at the socket and removing the old lead; it can be almost removed by applying a properly delayed and attenuated pulse to the HG cathode.

3.3 Research and Development (Continued)

Velocity-Distribution Measurements (C. T. Kirk)

This biweekly period was spent attempting to improve the signal-to-noise ratio of the cage readouts. Available literature on detecting signals in noise has led this writer to realize the following generalization: if one is willing to sacrifice time for the communication of a given amount of information through a system, rather severe reductions in the bandwidth of the system can be made without any loss of the information. Consequently, a large increase in S/N can be expected.

The following scheme is being tried with this idea in mind. The cage voltage is swept through its range very slowly, the total sweep time being in the order of 10 seconds. The detected output of the cage is passed through an exponential integrator having a very long time constant. The output of the integrator is then presented on a high-persistent cathode-ray tube with a time base of 10 seconds.

4.0 TERMINAL EQUIPMENT

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

"FL" Tape Punch #1739 has been modified by grinding the top of the punch pins to an angle of 10°. After modification, this punch satisfactorily perforated our heavy-weight gray tape, so we intend to make this modification in all of our "FL" punches.

Search for a more satisfactory opaque paper tape continues, however. Purchasing Department has placed a small order for a light-weight opaque tape which it is hoped will be more durable, more opaque, more easily perforated, and less expensive than the product we are now using.

"FL" Recorder-Reproducer #1467, one of two ordered by the MTC Group, has been received and is undergoing modification to make it similar to our other long-carriage Flexowriters.

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

Reliability of the magnetic-tape system has been good for the past week. The 12AY7 tubes in the read-record switch and reading amplifiers were changed to GL-6072 tubes. The GL-6072 is a GE 5-star equivalent of the 12AY7. In the past, failures of the 12AY7 tubes have accounted for most of the electronic troubles experienced with the system. It is hoped that the new tubes will give better results in the circuit. So far performance has been good, but not enough time has elapsed to permit an evaluation of the new tube type.

4.2 Magnetic Tape (Continued)

Recent troubles with the tape system have been traced in every case to two sources. Trouble with unit #1 when changing direction was due to sticking between the coaxial reel drive shafts. This difficulty appeared only when skipping back or reading backwards over a long recording. The trouble was corrected temporarily by replacing the reel drive mechanism. Several instances of lost pulses on units 3(a) and 3(b) were traced to deposits of foreign material on the tape. The source of these deposits is unknown. In every case it has been possible to clean off the deposit with a heptane-soaked Kleenex. Every effort is being made to inspect and check the entire length of all tapes on a weekly basis. So far, no bad spots have been found on the tapes presently on units #0 and #1.

Trouble with the delayed print-out equipment has been due to sticking flip-flops and typewriter failures. The flip-flops are test equipment and breadboard models which are now being replaced with plug-in units. The plug-in units could not be installed earlier because a pair of cathode-follower units was not available.

4.3 Display

Display Scope (R. H. Gould)

Display Scope Serial 2 with a Syntronic Instruments deflection yoke has been installed on the shelf at TC14 in Test Control. The prototype scope which the new scope replaces has been sent to Dick Best for experimentation on the deflection amplifiers. Photographs were taken of a scope display to determine the relative amounts of noise present for various connections of the deflection lines and the deflection-amplifier input. The results seem to signify that most of the noise is not caused by pickup on the deflection lines.

Lengthy experiments have been made to determine the optimum scope intensity and camera diaphragm settings for photographing scope displays with the Fairchild camera. The quality of the negatives seems to be dependent on the computer program which theoretically should not happen. Random factors such as the operators are not yet under complete control.

A new type of film was tried to improve the contrast of the scope pictures but it was found to be much too slow. A search will be made for a more suitable film.

Vector Generator (F. E. Irish)

A vector generator is being designed which will display a continuous line for a vector instead of a line composed of a series of points. This latter method is the one used at present.

4.3 Display (Continued)

Two 8-digit binary numbers representing the x-axis component and the y-axis component of the vector are set into two flip-flop registers. These two registers will control two 8-digit binary-to-analogue decoders. So far, the system is identical to the decoders used in WWI at present. The difference lies in the fact that a one in a digit of the decoder register is not alone sufficient to produce an output from the decoder. A coincidence requirement must be met. This second waveform is a triangular waveform which turns on the selected digits of the decoder linearly with time. The output from the decoder also has a triangular waveshape with a peak amplitude determined by the binary number previously set into the decoder register. This waveform provides the vector deflection along one axis. A second identical unit provides the deflection for the other axis. This system does have provision for display vectors in all four quadrants.

A breadboard model of a 5-digit vector generator has been built and operated. The main problems so far encountered which have not been satisfactorily solved have been to produce a resultant line on the oscilloscope which is straight and to produce a system which is insensitive to small power-supply fluctuations.

4.4 Magnetic Drums (K. E. McVicar, P. W. Stephan)

Some fairly elaborate programs have been written to test the circuitry and tracks on the magnetic drum. These programs, along with our marginal-checking facilities, have enabled us to make extensive checks on the drum tracks. About half of the tracks have proved to be reliable, the other half are questionable.. We are presently regrouping the tracks to put all the good ones together. The marginal tracks will be investigated and reclaimed where possible.

With the exception of the power supplies, only minor troubles have been found in the drum circuitry. It is possible that at least some of the trouble encountered has resulted from our attempt to operate ERA's flip-flops, which were designed for 0.5-μsec pulses, on 0.1-μsec pulses.

Although the drum system is not yet available for use by programmers on a full-time basis, we would like to have as many programs as possible run by special appointment. This will help us find obscure troubles which may exist and, at the same time, provide the programmer with experience in drum programming. A call to any member of the magnetic-drum group will arrange a drum time.

(H. L. Ziegler)

The TV-type monitoring system for the auxiliary drum was assembled in a rather "haywire" fashion and tested. Results obtained indicate that the system, though workable, would require considerable design and

4.4 Magnetic Drums (Continued)

development work. It has been decided to build a simpler system in order to avoid this extra development work. Basically, the system will be made up of a suitable scope already available in the lab and a rather flexible synchronizing control.

A study is being made to determine what inter-communication facilities (indicator lights, reset controls, etc.) between test control and the auxiliary drum should be provided.

(C. W. Simmonds)

Tests on the original voltage sensor circuit have been completed. A new circuit has been devised by Herb Ziegler which, as tests have proven, performs with at least the same degree of sensitivity as the original and has the additional advantage of sensing voltage fluctuations in both directions. Tests and conclusions will soon be made concerning this new circuit and its applicability to the magnetic-drum system.

5.0 INSTALLATION AND POWER

5.1 Power Cabling and Distribution

Modifications to Power-Supply Control System, WWI (G. F. Sandy)

The power-supply control system for Whirlwind proper and for Room 156 has been modified to provide a power-failure interlock to lock the system out if power fails to the power-supply control panel.

5.2 Power Supplies and Controls

600-Amp Filament Alternator (G. A. Kerby)

We expect to receive the estimate for the new base from Westinghouse shortly. The final chassis of the Filament Alternator Regulator, Model II, is nearly assembled.

MTC Alternator Regulator (G. A. Kerby)

A breadboard detector circuit is being built which will use a single temperature-limited diode to monitor the three-phase alternator output. This saving will be achieved by actuating the diode with a three-phase to single-phase synchro transformer. A hybrid transformer will also be tried. It can be much smaller than the synchro and more sensitive due to null indication.

5.2 Power Supplies and Controls (Continued)

A thermistor bridge detector which requires no vacuum tubes will be tried if time permits. It would incidentally eliminate a high-voltage transformer required by the diode.

The filament-voltage control and power-supply chassis are in the shop. The alternator control panel is being redesigned to accommodate new equipment to be sent by Electric Machinery Mfg. Co. Information about this equipment has just arrived.

MTC Alternator (G. A. Kerby)

Shipment of the alternator will be on February 20 as scheduled. We have been advised by the supplier not to attempt shock-mounting with rubber pads since the base will not be self-supporting. However, it is expected that the unit will operate quietly due to integral construction and its favorable speed of 1200 rpm.

Test Equipment (G. A. Kerby)

All parts for the mechanical oscillator have arrived. If breadboard tests show an accuracy poorer than 4%, a tachometer will be incorporated which will give direct frequency readings to an accuracy of 0.4 percent. This unit is made by Metron.

MTC Alternator Installation (G. A. Kerby)

All equipment on hand is being installed. The main contactor will be shipped in three weeks.

All wireway is installed and gutter installation and power cabling will be done next week.

Magnetic-Drum Power Supplies (R. Jahn)

Experiments with different brushes and brush settings have failed to reduce the ripple on either generator. Each generator will require 2000 mfd of shunt capacitance to reduce the peak-to-peak ripple to 0.5 volts.

Marginal-Checking-Generator Regulator (R. Jahn)

A breadboard of the marginal-checking-generator regulator has been completed and will be used to study improvements in the voltage variation system. It will also be used to test the new amplidyne.

7.0 CHECKING METHODS

7.4 Marginal Checking (J. H. Hughes)

Installing the marginal checking, Mod II, has become a WWI systems priority job. We have worked up a tentative production schedule for the various panels involved, and we should be able to have everything ready for installation on the holiday weekend of April 19. Donald Morrison, Larry Holmes, John Hughes, and Jim Ricketts will be working on this job. I will send copies of the production schedule to persons who are likely to be interested.

8.0 MATHEMATICS, CODING, AND APPLICATIONS

8.1 Programs and Computer Operation

Progress on the comprehensive system of service routines (CS) is described below. Consideration of the use of the auxiliary magnetic drum in this system has been initiated. Until the system reaches a steady state, programmers will necessarily be working under a handicap. At present it does not appear necessary or desirable to limit the efforts of the S&EC Group to the development of the CS. Many useful ideas and corrections for the CS have come out of the work done on the general applications problems. Progress during this biweekly period on each of these problems is given below in terms of programming hours, minutes of computer time, and progress reports as submitted by the programmers in question.

The introductory course on WWI described in the last biweekly is now in progress. Because of the large number of applicants for this course, a good deal of screening had to be done. It is planned to restrict admission to this course to people who are or are about to be actively engaged in programming an approved problem for WWI. Other applicants with special recommendations may also be accepted. The advanced seminar on programming techniques has also begun.

100. Comprehensive System of Service Routines: Briscoe, 56.25 hours; Demurjian, 34.5 hours; Frankovich, 16.5 hours; Hazel, 39.5 hours; Helwig, 60 hours; Kopley, 16 hours; Vanderburgh, 12 hours; Porter, 34 hours; WWI, 455 minutes

A version of the CS in which the conversion section is read into ES from magnetic tape was written and successfully tested. It did not, however, include the programmed arithmetic and output sections of the CS. This program when completed will cut down considerably on conversion time and will simplify the conversion procedure.

The revised output adaptation program allowing up to 20 output requests per program is under test. The four-way post-mortem program using the delayed printer has been rewritten so that the contents of storage are initially read onto magnetic tape. With this program no restrictions need be placed on the ranges of storage which can be printed out. The program is not yet completely tested.

The programmed arithmetic post-mortem program is being rewritten to record on the delayed printer.

A post-mortem program which displays the contents of storage as octal fractions has also been written and tested.

Consideration is being given as to the best methods for incorporating the magnetic drum into the CS.

Helwig

8.1 Programs and Computer Operations (continued)

101. Optical Properties of Thin Metal Films: Kopley, .5 hours; Loeb, 11 hours; WWI, 2 minutes

During the previous biweekly period T2265m3 was successfully checked for three samples, with separate read-ins of T2265m3 between parameters. The procedure was repeated with T2265m3 read-in only before the parameter read-in, but without the repeated T2265m3 read-ins between parameters. This test was also successful and saved a great deal of time (at least 50%). The test required 2 minutes.

Programming time has been devoted to finishing the program for the automatic successive approximations of optical constants. T2265m3 is being used to investigate the possibility that multiple sets of optical constants correspond to observed reflections and transmissions.

Loeb

102. Scattering of Electrons from Gases: Uretsky, 2 hours; WWI, 25 minutes

One run was made during this biweekly period. Evaluation is not complete since the academic vacation intervened.

During the next biweekly period, phase I will be completed and phase II will probably be started.

Uretsky

103. Transmission Cross Section of Absorbing Spheres; Spherical Bessel and Hankel Functions: Demurjian, 3.25 hours; Terrell, 1 hour; WWI, 54 minutes

Tape 2360-0 which is the program for the entire problem went into a loop. A programming error was discovered and corrected. Tape 2360-1 was prepared but the same loop resulted. Print-outs of the storage registers involved have been obtained to allow us to analyze further the cause of the loop.

Terrell

104. Hydro Thermal Power System; Calculus of Variations: Demurjian, 2 hours;

Search continues for flaw in delayed print-out or magnetic-tape programs. Test programs have been devised for delayed print-out. Also the magnetic tape will be tested reading backwards to transfer 5-56 data on tape 0 to flexo data on tape 3.

Cypser

106. MIT Seismic Project: Briscoe, 2.5 hours; Robinson, 20 hours; Simpson, 10 hours; WWI, 91 minutes

In the preliminary analysis of a seismogram, the variability of trace amplitudes as a function of time should be determined. A variance program which fulfills this purpose was written and tested successfully in this biweekly period. In addition, a scope display sub-program was tested.

In the first variance program tested, overflow alarms occurred for data in upper magnitude ranges. Thus a new program was written and tested which takes

8.1 Programs and Computer Operations (continued)

into account different ranges of the magnitude of data.

In order to save computer time, we intend to change all of our programs so that all print-outs will be without spacing, and without carriage returns except at the end of a line.

Robinson

107. (a) Autocorrelation and (b) Fourier Transform, Evaluate Integrals: Frankovich, 3 hours; Ross, 20 hours; WWI, 55 minutes

Tapes T2345-3 and T2249-7, which compute the autocorrelation functions, are now completely checked and correct. T2345-3 uses input in standard Flexo-code. T2249-7 uses input in special Flexo-code.

Errors in programming were found in T2235 involving work with double register numbers without sign agreement. (This was corrected in T2235-10.) An error in programming was found in T2346 involving complex timing between various asynchronous parts of the program. (This was corrected in T2346-3.) Typing errors occurred on T2345 and T2346.

We plan to continue checking T2235-10 and T2346-3.

Ross

112. Lawley's Method of Factor Analysis; Characteristic Vectors (modified): Denman, 28 hours; WWI, 45 minutes

It was found that the main program was not operating correctly for the first iteration although the results appeared satisfactory. A summation-type check of the material read in from the magnetic tape has been added to the program.

It is hoped that the remaining errors in the program can be removed and the main body of computation started.

Denman

113. Shear-Wall Analogy, Simultaneous Linear Equations: Kopley, 9 hours; Sydney, 20 hours; WWI, 58 minutes

Alarms occuring during the operation of the program have been eliminated. Results have been obtained in the form of decimal fractions and decimal integers. The criterion for stopping the computation is still not correct but is under study.

The program will be tested until it is operating correctly. If an additional government contract for the investigation of shear walls is received, the program will be rewritten for multiple-length numbers.

Sydney

114. Design of Optical Instruments: Helwig, 8 hours; Combelic, 10 hours; WWI, 21 minutes

This biweekly was devoted to trying to get the program converted from Flexo to 5-56. An error in the conversion program was finally found and corrected; it is hoped that this correction will enable the program to be converted.

Combelic

8.1 Programs and Computer Operation (continued)

115. Transient Aerodynamic Heating of a Flat Plate; linear partial differential equation: Helwig, 2 hours; Isakson, 10 hours; WWI, 281 minutes

The plate problem has been completed. The I-beam program was modified to save computer time and the modification remains to be tested. About 25% of the job is represented in the results.

Some runs on the I-beam problem were taking too long, and were stopped before results were obtained. A considerable amount of time was spent exploring this difficulty. The cause is not yet definitely established, but it is believed that the estimated running time was too low for some cases. A small amount of time was lost due to program errors.

It is expected that the problem will be completed in the first week of the next biweekly if the modification to the I-beam program is successful.

Isakson

116. Torpedo Impulse Response; Convolution: Frankovich, 1.5 hours; Kopley, .5 hours; Kramer, 40 hours; WWI, 47 minutes

This biweekly period was spent trying to get a streamlined tape-handling procedure to work. Five runs were made, totaling thirty minutes. Because of the streamlining various errors were made in the prepared tapes. These errors have been corrected.

Attempts are being made to use an analogue computer to get within a few percent of the solution and then refine it on WWI.

Kramer

117. Speech Output; Counting and Assembly: Demurjian, 1.25 hours; Mayer, 8 hours; WWI, 34 minutes

The counting test was performed more slowly for analysis of consonants, and a fundamental-frequency correction provided a better test on the vowels. An entirely different way of generating vowels indicates that it may eventually be feasible to reduce the amount of computing time used during speech.

A tape has been prepared which tests a new technique for generating "oo" and "ee". It also tests various parameters used in consonant-generation. If these tests are successful, then understandable counting should be obtainable by selecting the proper parameters.

Mayer

119. Spherical-Wave Propagation: Fox, 50 hours; Ralston, 10 hours; Vanderburgh, 10 hours; WWI, 37 minutes

The past biweekly period has been devoted to trouble-shooting the double-length logarithm and exponential subroutines. These programs T2221m0 and T2218m2 respectively are now satisfactory.

A program designed to initiate the computation and to test a numerical

8.1 Programs and Computer Operation (continued)

extrapolation scheme for points near the center of the sphere is being tested as T2325.

A later program which will do all the aspects of the computation together with the logic and logistics of sorting the points in the computation is being built up subroutinewise.

Fox and Ralston

120. Thermodynamic and Dynamic Effects of Water Injection into Gas Streams of High Temperature and High Velocity; simultaneous algebraic equations: Demurjian, 1.5 hours; Gavril, 80 hours; WWI, 120 minutes

About half the data required for the first program described in the last biweekly has been completed. This information was obtained from four successive production runs of Tape No. 2264m16. The second program, Tape No. 2338, has been written and runs were made with satisfactory results.

Due to faulty performance of the delayed magnetic printer, one block of the above calculations was printed erratically and could not be interpreted. This block, representing 24 minutes of computation time, will probably have to be run again.

It is hoped that the current program, Tape No. 2338, can be put into production as soon as possible. Tape No. 2338 takes over the computations of the previous tape in addition to those of its own.

The third program, containing the differential rather than algebraic relations of the problem, is now being contemplated.

Gavril

122. Coulomb Wave Functions: Combelic, 6 hours; Uretsky, 2 hours; WWI, 14 minutes

The Schroedinger equations for a coulomb potential can be put into the form of the hypergeometric equation. A sub-routine which will be used to calculate the two basic hypergeometric functions of the imaginary argument is still under test.

The present mod 2 was converted incorrectly; one 5-56 block was not punched out.

In the future, the sub-routine when working properly will be used as the nucleus of a program for generating a table of the above mentioned functions for various values of the parameters.

Combelic

125. Analytical Differentiation: Nolan, 60 hours; Porter, 1 hour; WWI, 34 minutes

Problem: The projected program is intended to investigate and illustrate the possibility of manipulation by WWI of functional relations in their analytical form. The problem is related to possible future use of compilation routines and procedures for the processing of standard types of programming problems.

8.1 Programs and Operation (continued)

This objective is to be accomplished specifically by illustrating the process of analytical differentiation by WWI. The program will read in the function in a coded form and type out, in the same coded form, the first and higher derivatives of the function.

The function is represented and handled by WWI as a finite combination of binary operations. Thus the information given to and received from the program will consist of the sequence of binary operations which form the function or derivative and the specification of the two arguments involved in each operation. For example, the simple function $(x \cdot y)/z$ involves two operations. The Operation "/" operates on $x \cdot y$ and z. The operation "·" operates on x and y.

Three simple functions involving addition, subtraction, and multiplication were tested and gave correct results. This represents about 10% of the problem. However, due to a programming error, functions using quotient forms were not handled correctly. The error involved the omission of a difference operation needed to express the differentiated form of a quotient.

Program modifications have been made to correct this error. The program will be rerun with the quotient functions. More complex functions involving all four operations will also be tested.

Computer Time

Programs	23 hours, 27 minutes
Conversion	16 hours, 19 minutes
Scope Calibration	29 minutes
Magnetic-Tape Test	30 minutes
Total Time Used	40 hours, 35 minutes
Total Time Assigned	47 hours, 4 minutes
Usable Time, Percentage	86%
Number of Programs Operated	109

9.0 Facilities and Central Services

9.1 Publications

(Diana Belanger)

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

LABORATORY FILES

No.	Title	No. of Pages	Date	Author
E-520	The WWI Auxiliary Magnetic Drum System	30	1-9-53	J. Forgie
M-1814	Laboratory Personnel	15	2-1-53	
M-1818	Bi-Weekly Report, January 30, 1953	41	1-30-53	
M-1820	January 1953 Storage and Research Tube Summary	4	2-4-53	D. M. Fisher
M-1823	Assignment and Utilization of Group 61 Computer Time	2	2-5-53	M. I. Brand
M-1827	Magnet Wire Tests	3	2-5-53	B. B. Paine
M-1828	Design and Testsof Electronic Circuits for Operating Safety Margins	3	1-27-53	J. Forrester
M-1829	Phenolic Dielectric Breakdowns in WWI	2	2-6-53	B. B. Paine
M-1831	Auxiliary Drum Testing - Summary #1	5	2-9-53	K. E. McVicar E. S. Rich
M-1837	Test Checking of a Magnetic Drum Buffer System Progress Report No. 2	1	10-24-52 to 1-30-53	C. Zraket
M-1843	Use of the Auxiliary Drum	1	2-11-53	R. L. Walquist
M-1844	Test Equipment Committee Meeting of 2-5-53	3	2-13-53	L. Sutro
A-141-1	Mail Delivery	2	1-29-53	H. B. Morley
A-119-1	Security	7	2-2-53	J. C. Proctor

LIBRARY FILES

No.	Identifying Information	Source
2236	The Transient Response of Transistor Switching Circuits	Lincoln Lab.
2237	A Survey of the Swedish Computing Machine Development	ONR, London
2238	The Unwritten Laws of Engineering - Reprinted from Mechanical Engineering for May, June and July, 1944	American Society of Mechanical Engineers
2241	Determining the Usefulness of Barium Titanate Material for Memory Devices in Large Scale Digital Calculators Progress Report No. 1	C. U. A.
2242	A Matrix Treatment of the Approximation of Power Series Using Orthogonal Polynomials Including Applications	AFCRC
2243	Abstracts of Theses, June 1951	MIT

9.2 Standards, Purchasing, and Stock

Procurement and Stock (H.B. Morley)

A plan is under active consideration for increasing tele phone lines and expanding the office area to accommodate additional desks and filing cabinets in order to alleviate the now overcrowded conditions.

Large quantities of former Standard components have been located in stock. Arrangements have been made to issue this acceptable material until depleted. To illistrate, 5% 1-watt resistors will be issued from old stock when 10% resistors are requested. This will give stockroom more shelf area for binning new Standard materials.

An IBM rental order was placed through the internal MIT system. This order should process through far more quickly than the first one, which was delayed by the need to establish an internal precedent.

Every requisition received to date for Cape Cod has been ordered or issued from stock. As larger orders for stock are placed, it is intended that a major part of Standard components can be issued directly from the stockroom to fill construction requisitions.

Overall office and procedural methods progress favorably; Kardex is gradually extending control over stock; the sign-out system for materials issued from the stockroom seems satisfactory; and as new personnel become familiar with their work, overall efficiency is increasing.

Standards (H.W. Hodgdon)

Standards meetings are now being held biweekly on alternate Wednesdays, with a memo being issued after each meeting summarizing the action taken and setting up an agenda for the next meeting. The memos are being distributed to about fifty persons in the lab.

(C.W. Watt)

Paine, Hodgdon, and I spent Wednesday, February 11, at the Brooklyn Navy Yard in discussions on the value of JAN and MIL specs. We also inspected the equipment there used for electronic component test. The Naval Material Lab does about one half of the type tests of components submitted for JAN and MIL spec approval by manufacturers. We gained a new viewpoint on the value of these specs from the visit. Our findings are reported in Memorandum M-1846.

9.3 Construction

Production Control (F.F. Manning)

The following units have been completed since January 30, 1953.

9.3 Contruction (continued)

CR#	Qty	Title	Originator
1492-36	225	Potentiometer Brackets	Paddock
1900-3H	7	Volt. Var. Switch Panel, Mod. II (Rework)	F. Sandy
1900-3K 1952-70 1952-M1	28	Lamicoid Labels	F. Sandy Smead
1952-S	50	UG-625/U Connector Mtg. Bkt.	Smead
1952-3B	3	PI Mounting Panel, MTC	Smead
1952-8A	1	TSS Panel, MTC	Smead
1952-51	5	Pushbutton Pulse Generator (Rework)	Smead
1952-53	7	Buffer Amplifier, MTC (Rework)	Smead
1952-68	1	Indicator Panel, MTC	Smead
1952-70	2	Crystal Mixer, MTC	Smead
1952-74A	1	Relay Input Register, MTC	Smead
1952-75A	1	In-Out Control Panel	Smead
2000-10	88	Video Cables	Norman
2034-4	30	Deflection Amplifier (Rework)	Israel
2034-12	1	Power Cable - 16" Scope	Israel
2050	2	PI D-C Cathode Follower	Farnsworth
2073	10	D-C Extension Boxes	Carrol
2096	4	Power Cables, Rack AX3	Dickie
		The following units are under construction:	
1633-5	11	D-C Circuit Breaker Box	Mercer
1633-6	6	A-C " " Boxes	Mercer
1633-7	3	Lab Benches	Mercer
1684	14	Modify Low-Speed 2^6 Counter	Test Equip. Com.
1952-M1	12	Fil. Trans. Mount. Panel	Smead
1952-V	50	Stand. Chassis Cables	Smead
1952-W	4	Power Dist. Cables, MTC	Smead
1952-15	16	Crystal Matrix Switch, Mod. II	Smead
1952-26A	5	Indicator Panel	Smead
1952-63	20	Memory Plane	Smead
1952-71	1	Video-Jack Panel	Smead
1952-77A	1	Alarm-Relay Panel, MTC	Smead
1984-8	5	Core Driver, Mod. V	Test Equip. Com.
1984-12	16	Video Probe Modification	Test Equip. Com.
1984-23	6	Burroughs Test Equip. Lamicoid Labels	Test Equip. Com.
2028	1	Mech. Tape-Reader Clutch Control	Farnsworth
2029	1	Fil. Alt. Regulator, Mod. II	Kerby
2034-8	1	Blanking Circuit	Israel
2034-9	1	16" Display Scope	Israel
2093	10	D-C Extension Unit	Carroll
2025		Marginal-Checking Control, Mod. II	
2034-7		Aux. Panel, 16" Scope	
2102	6	Transistor D-C Strips	Eckl
2127		Current and Voltage Calibrator	
2133		MTPO Junction Box	

9.3 Construction (continued)

Production Control - Outside Vendor (R.F. Bradley)

Bids on the 16" scopes have been solicited from the following vendors with dates noted below:

1/29	National Co.	Reply 2/11	No bid, unable to meet schedule.
2/2	Browning Lab. Inc.	" -	Due 2/23
2/2	Vectron	" 2/10	Bid under consideration here.
2/9	Raytheon Mfg. Co.	" 2/13	Advised, bid in our hands 2/16.
2/9	MacLeod & Hanopol	" "	" " " " "

P.O.	FROM	TITLE	ORD.	DEL.	TYPE
L-14099	Advance Mach. Tool	S.T. Parts	1835	1810	Machine
L-32075	" " "	"	3821	-	"
L-31854	Browning Lab	16" Display Scopes	4	-	Wir. & Assy.
L-33515	G.P. Clark Co.	Rack Power Ind. Panels	40	25	" "
L-32045	Dane Electr. Co.	Power-Dist. Panels	10	-	" "
L-31851	" " "	D-C Power Strip (4 Plug)	20	-	" "
L-33677	" " "	D-C Power Strip (8 Plug)	50	-	" "
L-31853	Hauman Inst. Co.	Buffer-Ampl. Panels	13	-	" "
L-31855	" " "	Selection Plane Drivers	16	-	" "
L-32108	Hardware Products Co.	S.T. Part	1000	-	Machine
L-33949	A.J. Koch Co.	PI D-C Flip-Flop Assembly	50	-	Wir. & Assy.
L-31656	Metallic Arts N.E.	Grid Clamp Ring	5	-	Machine
F-10440	Raytheon Mfg. Co.	Gate Buffer	1503	463	Compl. Fab.
"	" " "	Flip-Flop	646	104	" "
"	" " "	Dual Buffer	260	258	" "
"	" " "	Switch Tube	272	263	" "
"	" " "	19" Mtg. Panels	65	12	" "
"	" " "	26" Mtg. Panels	310	87	" "
"	" " "	Spec. Delay Lines	800	150	" "
"	" " "	Chassis only	150	-	" "
L-32105	Sealube Co.	Backing Plates	105	6	Machine
			10,975	3,178	

9.4 Drafting (A.M. Falcione)

1. New Unit Drawings

Title	Cir. Sch.	Assy.& PL	Al. Panel
Plug-in Unit IOS Cathode Follower (WWI)	SB-53748	SB-53748	
Numerical Display Waveform Gen. (WWI)	D-53689	D-53690	D-53797
Intervention Gate Circuits (WWI)	SE-53852	R-53806	E-53803
Plug-in Driver (WWI)	SC-53853	SC-53853	

9.4 Drafting (continued)

Title	Cir. Sch.	Assy & PL	Al Panel
Display Gate (WWI)	SE-53911		
Plug-in Mtg Panel, Mod. I (MTC)		R-53623	R-53527
Regulator Series Tube Section (MTC)	C-53684	D-53807	D-53908
Memory Address Panel (MTC)	D-53716	E-53897	R-52850
Scope Switch Panel (WWI)	E-53368	E-53761	D-53762
Selection Plane Driver Control Sw.(MTC)	C-53341	D-53687	D-53687

2. Print Reproduction

During the past week, a new Ozalid operator has been employed to run the old Streamliner, which previously was in standby condition. With the two operators now working on Ozalid reproduction work, we should be able to eliminate any back-log on print requisitions. According to the instructions issued to the Print Room personnel, prints will be made in the following priority:

1. Drawing requisitions for the Construction Shop received from Floyd Manning
2. Print requisitions from Production Control for Outside Vendor Distribution (R. Bradley)
3. All other drawings

3. Multilith Reproduction Work

Our Multilith reproduction work is backlogged approximately two weeks. We are doing everything in our power to rectify this condition by alternating our work week, so that we will get six-days' operation from the machine, and also alternating noon hours so that we get an additional hour's work everyday. Important memos should be printed with a high priority; therefore please advise A. Falcione of projected memos as soon as possible.

10.0 GENERAL

New Staff (J.C. Proctor)

Stewart T. Coffin, a new staff member assigned to work with Gano, received his BS in EE at the University of Massachusetts in January of this year.

Jack S. Gillette is a Research Assistant assigned to Taylor's group. He received his BS degree in Mathematics at the University of Michigan in January.

Robert E. Garrett is a new staff member assigned to work with Gano. He received his BS degree in EE at the University of Missouri in 1949. Since that time, he has been a Field Inspector with Black and Veatch, Consulting Engineers.

William Ayer, a new staff member assigned to work with Kromer, received his BS in EE from MIT in 1948. For the past five years, he has been on the staff at Tracerlab as Product Engineer.

10.0 GENERAL (continued)

Terminated Staff (J.C. Proctor)

Robert E. Hunt

New Non-Staff (R.A. Osborne)

Perryno Alexander is a laboratory assistant in the Inspection Department.

Arthur Aquaviva is a new messenger boy.

Harold Atlas is a new laboratory assistant in Inspection.

Stephan Collins is the Barta Building Janitor.

Florence DeCastro is a new Print Room clerk.

Richard Downey is a laboratory assistant in Group 61.

Gordin Edlin is a part-time MIT student in Group 62.

Thomas Kee has joined the Systems Group as a laboratory assistant.

James MacDonald is a laboratory assistant in Group 6345.

Walter Majkowski is an MIT student working part-time in the Storage Tube Group.

Robert Pearlman is a Harvard student working part time in Group 60 for B. Paine.

Vincent Piraino is a new machinist.

Donald Reece is a new laboratory assistant in the Construction Shop.

Peter Sorrentino is returning to work in the Drafting Department for a short time.

Ralph Thuftedal is a new stock clerk.

Daniel Wells is a new Construction Shop laboratory technician.

Roberta McCluskey is a new technical assistant with the 6345 Group.

Terminated Non-Staff

Andrew Bowen
Nicholas DiMille
Warren Foster
Cynthia Koatz
Richard Taylor

10.0 GENERAL (continued)

IBM Activity (A.P. Kromer)

During the biweekly period, a number of combined MIT-IBM discussions have been held. Subjects included display generation and distribution, standardization of components, memory (including MTC), and organization and planning of time schedules for the project.

IBM has added a number of engineers to the project. Several of these have made their initial visits to MIT to obtain background concerning our work.