

Memorandum M-2876

COPY NO 115 OF 135 COPIES  
Page 1 of 32

Division 6 - Lincoln Laboratory  
Massachusetts Institute of Technology  
Cambridge 39, Massachusetts

SUBJECT: BIWEEKLY REPORT FOR JUNE 18, 1954

To: Jay W. Forrester

From: Division 6 Staff

CONTENTS

Section	I -	Cape Cod System	1
	1.1	Group 61	1
	1.2	Group 64	1
	1.3	Group 65	10
Section	II -	AN/FSQ-7	14
	2.1	Group 62	14
	2.2	Group 63	24
Section	III -	Central Services	30

SECTION I - CAPE COD SYSTEM

1.1 Group 61

The Biweekly Report of Group 61 is omitted because of the move to Lexington.

1.2 Group 64

(S. H. Dodd) (UNCLASSIFIED)

Computer operation has continued to suffer from the extensive installations of and modifications to the terminal equipment. Another month of large-scale changes is planned, but efforts are being made to reduce the amount of interference caused computer operation by this work.

Effective 21 June the equipment in Room 222 will not be usable for a period of about three weeks. As of the same date the MITE slot assignments on the buffer drum will be changed, and only 14 digits will be read to the computer. About two weeks will be required to make these changes during which time the MITE units will be unavailable for operation. After the changes have been made operators must adapt their programs to the new arrangement of the MITE units.

1.21 WWI System Operation

(A. J. Roberts, L. L. Holmes) (UNCLASSIFIED)

Several intermittent troubles caused a considerable loss of computer time during the last two weeks. The majority of down time was caused by the following troubles:

1. Installation faults - A cathode-follower resistor and a terminating choke were damaged during modification of the in-out registers. A wiring error resulted in lack of plate voltage to the buffer-drum writing circuits.
2. Photoelectric reader - The trouble with the Ferranti reader experienced during the last biweekly period continued. The fault was finally traced to poorly soldered connections in the amplifier.
3. Buffer-drum parity alarms - Intermittent parity alarms have occurred when Group 61 operates with the buffer drum. The cause of these alarms has not yet been determined.
4. Magnetic-drum matrix - Some time was lost because of an open filament in a cathode follower in this matrix. This is the third tube in the matrix to develop this fault. A new set of tubes has been put into service.
5. Magnetic-tape Unit 0 - Several errors have been detected in the recording on Unit 0. In an effort to reduce the time lost as a result of these errors two tapes will be recorded and checked as often as necessary.

Core memory continues to operate with excellent reliability. Operation from 2 May to 10 June was error-free.

(D. A. Morrison) (UNCLASSIFIED)

Work continues on the WWI reliability study. I have prepared a memo describing the WWI voltage-interlock panel.

Typewriter and Paper Tape

(L. H. Norcott) (UNCLASSIFIED)

An additional cam and set of contacts have been installed in the translator of MTC's Flexowriter 1102 to permit advancing or retarding timing of the translator completion signal. Flexowriter 1100 will be similarly modified next week. These machines are to be used in a new printout system being designed for MTC.

1.22 Terminal Equipment

(A. M. Werlin) (UNCLASSIFIED)

The layout for the shift register to be used with fine-grain-data input has been made using presently available plug-in units. It will require about a hundred plug-in units with an additional twenty for control.

The cable revisions necessary for the insertion of the MITE units into different drum slot and group positions will be the first thing done during the shut-down period. This will be followed by the substitution of the new demodulators in place of the ones presently used and by the removal of the demodulator-filter switch panel.

Magnetic Drums

(K. E. McVicar) (UNCLASSIFIED)

Several additions and modifications are in process or have recently been made to both the auxiliary and the buffer-drum systems.

Electronic group selection has been installed in the auxiliary-drum system for ten digits. It is planned to complete the installation of the remaining seven digits during the coming biweekly period.

Two additional groups of auxiliary storage, to be designated Groups 2 and 3, are being added to the buffer-drum system. This work will be done without interfering with the normal operation of the buffer drum except that there will be no parity check on any of the buffer-drum transfers for a period of about a week. Programmers wishing to assure themselves of the operation of the buffer drum during that period should run a drum-check program prior to their computer run.

All of the MITE units now connected to the buffer drum will be shifted in slot position, and the digits of the IOR to which they read will be changed. A memo will be issued shortly outlining these changes.

Two additional MITE units will soon be installed which utilize shifting registers instead of counters. Several possible shift-register ideas have been considered including those using magnetic cores. In view of the fact that standard WWI plug-in units are readily available in quantity and are of known quality, it has been decided to use a conventional system similar to that now employed in WWI.

1.22 Terminal Equipment (Continued)Magnetic Drums

(H. L. Ziegler) (UNCLASSIFIED)

Ten digits of the auxiliary drum are now converted to electronic write-switching of heads, and the remaining six digits should be changed over by the 1 July "target" date for this job. Programmers should note that the present 32-msec change-group delay will be eliminated at the completion of the changeover.

It has been decided to proceed with the standardization of voltage connections for the magnetic-drum chassis. The necessary modification notices are being prepared now.

Design of the new test rack is progressing satisfactorily, and prints are being drawn up for construction purposes.

(L. D. Healy) (UNCLASSIFIED)

The auxiliary-drum checking procedure is being modified to take care of the electronic switching which is replacing relay switching in the system.

Data Inputs

(H. J. Kirshner) (CONFIDENTIAL)

Two meetings were attended with other interested Division 6 and Division 2 personnel relative to the status of the various data inputs to be associated with the 1954 Cape Cod System. The target dates to be met by Division 2 on the various equipments were obtained, and the dates will be used in planning by Division 6.

Installation of the new CRT mappers will begin on 21 June, coincident with the removal of the present mapper installation.

Ferranti PETR

(F. E. Irish) (UNCLASSIFIED)

The Ferranti PETR amplifier that has been in service during the past month appears to have been the direct source of the intermittent trouble that has been experienced during reader operations. A replacement amplifier has been installed, and the intermittent troubles have not recurred. An inspection of the amplifier circuitry revealed several "cold" soldered joints that most likely were the cause of our past operational troubles.

1.22 Terminal Equipment (Continued)Data Link

(R. B. Paddock) (CONFIDENTIAL)

Routine coder maintenance has demanded increasing attention. Having nearly full-time demands for operation but not having marginal checking, the coder at present does not qualify as a unit of completely operational equipment. On last Friday, a meeting at CRC was held among E. S. Rich, R. B. Paddock, A. L. Fullerton and Dr. Reiger relative to improving the system operation. Agreement was reached that a new coder should be made of our standard plug-in units and that the groups represented should make a joint effort to improve the D/L system reliability. This was followed by approval of the plan within Group 64. Therefore, plans are in progress for meeting our commitment during the summer shutdown and prior to phase III if possible.

Azimuth-Drive Units

(A. V. Shortell) (UNCLASSIFIED)

The first four units are due from the outside vendor on 21 June.

In line with a suggestion from H. B. Frost, the gas-tube pulse-generator circuit has been modified to take advantage of the more carefully controlled  $G_1$  characteristic. The addition of a feedback path around the gas tube should produce much more reliable operation of this circuit.

Mapper Testing

(A. V. Shortell) (UNCLASSIFIED)

Consideration has been given to various means for testing the functional parts of the mappers for the 1954 Cape Cod System. A rough draft of these ideas is being typed.

1.23 Records of Operation

(F. J. Eramo) (UNCLASSIFIED)

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 4-17 June 1954:

Number of assigned hours	154
Usable percentage of assigned time	85
Usable percentage of assigned time since March 1951	87
Usable percentage of assigned time since September 1953	92
Number of transient errors	5
Number of steady-state errors	9
Number of intermittent errors	5

Component Failures in WWI

(L. O. Leighton) ((UNCLASSIFIED))

The following failures of electrical components have been reported since 4 June 1954:

<u>Components</u>	<u>No. of Failures</u>	<u>Hours of Operation</u>	<u>Reasons for Failure</u>
<u>Crystals</u>			
1N34A	3	1000 - 2000	2 low $R_b$ ; 1 drift
	1	7000 - 8000	Shorted <sup>b</sup>
	1	8000 - 9000	Low $R_b$
<u>Rectifiers</u>			
Selenium, DCL No. 134-1 19 P&G	1	0 - 1000	Intermittent
<u>Switch</u>			
SPST	1	24000 - 25000	Intermittent operation
<u>Transformer</u>			
1:1 Pulse Transformer 1 193-6		4000 - 5000	Open secondary

1.23 Records of Operation (Continued)

Component Failures in WWI

(L. O. Leighton) (Continued) (UNCLASSIFIED)

<u>Components</u>	<u>No. of Failures</u>	<u>Hours of Operation</u>	<u>Reasons for Failure</u>
<u>Tubes</u>			
5687	1	10000 - 11000	Leakage
5963	2	7000 - 8000	Low $I_b$
5965	1	5000 - 6000	Short
2D21	1	1000 - 2000	High firing point
5Y3GT	1	11000 - 12000	Open filament
6AN5	2	0 - 1000	Broken envelope; gone to air
6136	1	0 - 1000	Broken envelope
6L6	1	11000 - 12000	Low $I_b$
0A2	1	No hours kept	Short
6145	1	No hours	Short
	6	0 - 1000	1 open filament; 5 short
	2	1000 - 2000	Unbalance
	2	2000 - 3000	Short
	2	4000 - 5000	1 short; 1 leakage
	3	5000 - 6000	1 leakage; 1 short
	1	8000 - 9000	1 leakage
7AK7	7	2000 - 3000	4 low $I_b$ ; 1 short; 2 leakage
	1	7000 - 8000	Leakage
7AD7	1	7000 - 8000	Leakage

1.24 Power

D-C Power Supplies

(S. T. Coffin) (UNCLASSIFIED)

Frequency-response tests conducted thus far on the WWI d-c standby generator indicate that it will be extremely difficult to obtain dynamic response satisfactory for WWI use, even with the use of large output capacitance. We may try replacing the rotary exciter with a rack of 6L6's to extend the cutoff frequency of the generator field circuit.

General

(D. M. Fisher) (UNCLASSIFIED)

The capacity of the -60-v power supply was increased from 4.8 amperes to 6 amperes. The present load on the supply is 4.2 amperes. The increase in capacity was made to accommodate any future change in capacity and to lower the present average current passed by each series tube now in use.

All of the series-tube regulated power supplies are going to have their regulator sections air-conditioned. This work is presently going on and is expected to be completed before the hot weather sets in.

1.25 AN/FSQ-7

AN/FSQ-7 Schedules

(T. R. Parkins) (UNCLASSIFIED)

During the past two weeks, posted XD-1 schedules and the May issue of Project High Progress Report were distributed to persons concerned.

Successful negotiation has been carried on with Mr. Hunton of IBM to increase the detail in the next Project High Progress Report; the system summary reports, appearing on the cover page, will more clearly describe the status of XD-1 equipment. Mr. Hunton and I will continue collaboration in report improvement.

~~CONFIDENTIAL~~  
UNCLASSIFIED

1.25 AN/FSQ-7Communication Requirements

(H. J. Kirshner) (CONFIDENTIAL)

The Bell Labs. design of a push-button panel for the XD-1 and production telephone intercom system has been accepted by ADES and Lincoln as meeting operational requirements. IBM is co-operating with Bell Labs. on the incorporation of this design in the consoles.

Specifications for a maintenance intercom system have been given to the AT&T Co. AT&T will advise whether this system can be obtained early enough for initial use at Poughkeepsie.

Internal requirements of data-circuit distribution were discussed at a meeting with IBM and AT&T. IBM is now committed to install a telephone-data-circuit patching panel for radar-data inputs. It appears now that this commitment should be changed so that the Telephone Company provides two patching panels with its installation of the data circuits. These are to be a patching panel in the inputs room and another in the outputs room.

1.26 New Computer Design

(N. L. Daggett) (CONFIDENTIAL)

A small group has been formed to work toward the logical design of a new computer. Initially, the group will consist of Wes Clark, Jim Forgie, Jack Raffel, and myself. The objective will be a machine capable of handling the type of problems handled by FSQ-7 but which draws upon whatever new techniques and components may be available to provide greater simplicity and reliability.

The work of this group will lean heavily on a parallel investigation by Group 63's Transistor Section of the components and techniques that could be used as building blocks in a new system. We will rely for questions of memory design on the Memory Section of Group 62. The Building 10 program will break off and investigate problems that arise in the work of these groups.

UNCLASSIFIED  
~~CONFIDENTIAL~~

### 1.3 Group 65

#### 1.31 Activities of Group 65

(P. Youtz) (UNCLASSIFIED)

Three trips were made by members of Groups 25 and 65 to IBM and tube manufacturers in behalf of the program to produce reliable tubes for AN/FSQ-7. Group 65 had several visitors from tube manufacturers.

Several of the tube programs are still facing difficulties, and these must be surmounted. Since early this year Sylvania has been unable to process any of the tubes in the "7AK7 family" so that the cathodes do not fail under certain life conditions. At the moment the trouble is attributed to the material and processing of the screen grid. This problem will be under intensive investigation both at MIT and Sylvania. However, IBM needs 2420 or 1782A tubes immediately to fill production-work sockets. Fred Ordemann and I reviewed all test data on the tubes at Emporium on 18 June 1954. Although the tubes don't meet all specifications, they meet sufficient specifications to enable IBM to use them in almost all of the sockets requiring a 1782A. Fred Ordemann brought back approximately fifteen hundred 1782A's to Poughkeepsie. Approximately seven thousand 2420 tubes could be available at Emporium with a waiver on one of the specifications.

Joe Klein, Group 25, and I made a trip to DuMont with IBM. DuMont has made some ruggedized K1211 tubes (K1303). IBM has ordered five of these tubes and will put them under test. Present indications are that the K1303 will be a satisfactory tube. Specifications for the video mapper 16-inch cathode-ray tube were not completely clarified at the end of this biweekly period. The Video-Mapper Group would prefer a low-voltage self-focussing electrostatic gun which doesn't require a centering magnet. This would require a special DuMont development which could not start until August; evaluation would not be completed until late autumn of 1954. A high-voltage focussing gun is available without further development. However, there is no life data on this gun.

Frank Rodgers and Group 65 have been working intensively on the electron optics of the Charactron and Typotron in preparation for a visit to the west coast the week of 21 June 1954. Also, significant progress was made on the helical-dag and aluminizing processes in preparation for the new 19-inch Charactron bulbs. Corning Glass Works assures us that we will receive our first bulbs about 1 July 1954.

Frank Rodgers, Group 25, Charles Corderman, Group 62, Ralph Mork, IBM, and I will visit Convair 21, 22 June 1954, Hughes Aircraft 23, 24 June 1954, to discuss Charactron and Typotron progress.

1.3 Group 65 (Continued)

1.33 Research and Development

(P. C. Tandy) (UNCLASSIFIED)

Two helical-dag aluminized tubes have been life tested. The first tube cracked after being based with less than 15 minutes of operation. The second tube, not yet based, is still good after approximately 21 hours of operation.

A storage-tube research mount has been modified again to facilitate electron-optic tests on 5-inch Charactron tubes.

Power supplies are still preventing life testing of more than one helical-dag tube at a time. It is hoped that the required power supplies can be completed in the near future.

(S. Twicken) (UNCLASSIFIED)

On 7 June 1954 I attended a meeting of the JETEC Task Force on Computer Gas Tubes. This task force is attempting to write a specification format for computer gas tubes, principally the 2D21 thyratron. Some progress has been made, and the manufacturers have been appraised of the dearth of information on ratings and characteristics needed for proper tube applications; as yet this information has not been available from the manufacturers. The work of this task force will resume in the fall.

A meeting of representatives of the MIT-IBM Tube Group and the Display Group was held at High Street on 8 June 1954 to discuss desired characteristics of the 16-inch cathode-ray tube to be used in the mappers. Some complications have been introduced by design of the CRT housing and power supply having been frozen before adequate consideration had been given to the CRT itself.

As a follow-up to discussions previously held with us on tube noise and intermittents, Hytron requested and obtained intermittent and leakage tests on some 20 noise-reject tubes. Our tests indicated only a few shorts but considerable nonlinear heater-to-cathode leakage.

Considerable time has been spent in preparing for the move of part of our facilities to Lexington.

(T. F. Clough) (UNCLASSIFIED)

An analysis of the Sylvania 7AK7 has been made to survey the various changes in mount materials and geometry which took place between 1948 and 1953. The results have been reported to P. Youtz.

1.33 Research and Development (Continued)

(T. F. Clough) (UNCLASSIFIED) (Continued)

As previously reported, Group 65 will have a tube-test laboratory in Room D-237 at Lexington to service the Lexington operation of Div. 6. The Test Equipment Committee has approved the purchase of certain essential equipment for this facility. Facilities will be continued at the Barta Building also to service Barta requirements.

The portion of our facilities which is going to Lexington is scheduled to be moved 24 and 25 June. This is being done with a minimum disruption of our service.

(A. Zacharias) (UNCLASSIFIED)

I devoted the first week of this period to the experimental tubes being made as prototypes for Charactrons. While two of these tubes were being tested on P. C. Tandy's unit, it was discovered that the screens were not aluminized, although aluminum had been evaporated onto them. I devoted the remainder of the week to finding a method for aluminization. D. V. Mach brought up a modification of Dr. Klein's method for measuring the aluminum-coating thickness. Mr. Mach proposed that a commercial "Grid-Dip" meter be used; the conductive coating loads the coil and changes the frequency of the tuned circuit of which the coil is the inductive part.

I spent the remainder of the period continuing the report on the 7AK7 research.

(H. B. Frost) (UNCLASSIFIED)

One problem which has come to my attention in recent weeks is the determination of the delay necessary in the application of d-c power to the FSQ-7 system when there is an interruption of primary system power. The requirements of the system dictate that this delay be as short as possible. For the times involved the primary limit is not heater-surge current but reduction in cathode emission because of cooling. The power must be cycled in the shortest possible time and still allow computer operation as power is restored to the d-c supplies. Don Fisher of the Power System Group is taking oscillograms of plate-current changes in various tubes for a number of different interruption times. The problem is complicated by inexact knowledge of the actual power-outage times to be encountered.

During the past week I have read two articles in a French journal. These articles are the published forms of two papers presented in a French engineering conference last June. The first relates to cathode interface impedance; it is mainly a review of published material with a little original work to check others' results. The author states "The Anglo-Saxon literature has oversimplified the problem." With this conclusion we agree.

1.33 Research and Development (Continued)

(H. B. Frost) (UNCLASSIFIED) (Continued)

The second article, "The Telephone Repeater Tube," was much more interesting. It contains a rather excellent treatment of the problems of vacuum-tube reliability. In addition, it discusses some novel and apparently very good tube-construction and processing techniques. An effort will be made to obtain a translation of this article.

Thesis Research

During the past period work has continued on the preparation of drawings which present experimental results. Considerably more work remains to be done here. A drawing which shows the variation in space-charge-limited current as the cathode emission changes has been prepared. This drawing required a very considerable amount of calculation as well as the preparation of a number of auxiliary interpolation drawings.

## SECTION II - AN/FSQ-7

2.1 Group 622.11 SystemsSDV Receivers

(I. Aronson) (CONFIDENTIAL)

A new blocking-oscillator circuit has been installed and seems to work well. Final marginal on the whole circuit will start next week. Calculations have been started to assure that all tubes and components are being used within prescribed ratings.

Digital-Data Receivers

(I. Aronson) (CONFIDENTIAL)

IBM has decided to package the SDV receivers in 9-tube pluggable units. Since this is the configuration we were planning to use for the digital-data equipment, we will be able to use their physical design practically "as is."

Further consideration of tape recorders indicates that the FM type of recording system used in some models of Ampex will probably be satisfactory for our purposes. This will simplify the problem of testing the digital-data receivers.

2.12 Magnetic-Core MemoriesXD-1 Support

(J. Mitchell) (UNCLASSIFIED)

The IBM array tester now seems to be giving satisfactory results. The "shmoos" now being obtained from their memory planes compare favorably with the data we have obtained at MIT.

Automatic Shmoo Plotter

(J. Mitchell) (UNCLASSIFIED)

The debugging of the system is proceeding at a very satisfactory rate. The plug-in logic is now working very well; however, there are still a few problems in the decoder that have to be ironed out.

2.12 Magnetic-Core Memories (Continued)

Selection-Plane Driver System

(J. Mitchell) (UNCLASSIFIED)

I am in the process of determining a method to calculate the impedance presented by the wire and cores in a memory. The missing link in the problem is some experimental data which will be accumulated in the near future.

Memory Test Setup VI

(E. A. Guditz) (UNCLASSIFIED)

The memory tester has been modified to permit evaluation of XD-1 memory planes manufactured at IBM. The first two planes have arrived and are being tested.

The 128 x 128 experimental memory plane is completed except for the sensing winding. The insertion of this winding is being delayed pending the results of tests on a new type sense winding now being wound on an experimental 64 x 64 plane.

Experimental work continues on both the new 128 x 128 printed wiring plane frame and the small model of a completely printed plane. Results are still encouraging in both cases.

Considerable thought is being given to the problems associated with the construction of memory planes of the 256 x 256 size.

Sense Windings

(J. Raffel) (UNCLASSIFIED)

An analysis of different sense-winding configurations has shown a number of possible layouts which will be applicable to the printed-circuit techniques being considered by Guditz.

A plane is being wound with a new sense winding, and the results will be compared with those obtained with a winding of the old type.

Bi-Stable Oscillator

(G. Davidson) (UNCLASSIFIED)

A bi-stable oscillator was constructed and tested for J. Raffel. The oscillator has two magnetic cores and one vacuum tube. Two stable states were observed: one oscillating at 3 megacycles and the other not oscillating. The state was changed by switching one or both cores.

2.12 Magnetic-Core Memories (Continued)

64-Position Core Switch

(G. Davidson) (UNCLASSIFIED)

The first ten switch units were tested for construction errors.

(A. D. Hughes) (UNCLASSIFIED)

Ten 4-core plug-in units of the switch have been constructed. A breadboard bias driver has been built and is ready for testing. (Twelve bias drivers will be used for the switch.) The diode matrix and cathode followers have been designed.

Logic and physical layout have been designed for testing one 64-position switch, and the required test equipment has been ordered.

Magnetic-Core Memory with External Selection

(S. Bradspies) (UNCLASSIFIED)

Using a badly mismatched set of cores (the switch cores were Mo-Perm 4-79, 1/4 mil x 1/4 inch, with 50 wraps, and the memory core was MF1326B, F-394), the results were poor. The flux stored in the switch cores was about 30 times that stored in the memory cores. This led to a rapid destruction of information in the memory core in half-selected cases.

An undisturbed ONE was 0.72 volt. A once-disturbed (half-selected) ONE was 0.4 volt. Three disturbs lowered the ONE output to 0.12 volt.

2.13 Vacuum-Tube Circuits

Constant Current Source

(H. J. Platt) (UNCLASSIFIED)

Two circuits for constant current sources for use with convergence coils for Typotron and Charactron were tried. One circuit was the cascade 7AK7 triode-connected regulator. The other was the normal single-loop feedback circuit.

The range of current needed is from 30-60 milliamperes. Both circuits regulate to about 0.2 per cent in the middle of the range. At the extremes the regulation becomes poorer.

In order to make the cascade circuit regulate properly, 8 voltage-regulator and voltage-reference tubes are needed. This number

2.13 Vacuum-Tube Circuits (Continued)

(H. J. Platt) (UNCLASSIFIED) (Continued)

may be cut somewhat after further investigation.

The feedback circuit needs some work to make it regulate over a wide range.

An additional problem has been encountered. It is desired to correct the current source for variations in the accelerating-voltage supply to prevent misregistration. The variation in current is inversely proportional to the square root of the variation of accelerating voltage.

XD-1 Digit-Plane Driver

(D. Shansky) (UNCLASSIFIED)

M-2842, describing this piece of equipment, has been issued.

Magnetic-Core-Matrix Switch Driver (set and reset)

(D. Shansky) (UNCLASSIFIED)

Parasitic oscillations in the output stage of this driver continue to be troublesome.

Magnetic-Core-Matrix Switch Driver (bias)

(D. Shansky) (UNCLASSIFIED)

This driver has been designed and constructed. Debugging will commence in the next period.

Power Cathode Follower

(D. Shansky) (UNCLASSIFIED)

A general-purpose power cathode follower has been designed for J. Schallerer for use in his pluggable-unit tester. Three half sections of a 5998 may be driven with 0.5- $\mu$ sec rise and fall times (+10-v to -30-v).

2.13 Vacuum-Tube Circuits (Continued)

Phone-Line Demodulator

(E. B. Glover) (UNCLASSIFIED)

The blocking oscillator has been redesigned along the lines of the real-time-clock arrangement. This has proved quite satisfactory. The test circuit was rewired to include the maximum load conditions of the blocking oscillator, and preliminary marginal checks look very encouraging.

There has been some delay in getting final marginal-check data on this part of the circuit because of an instability in the logic and difficulty in externally triggering the scope to be able to accurately measure the blocking-oscillator output.

Video Probe

(E. Anfenger) (UNCLASSIFIED)

Two circuits have been tried. One seems okay to be built up in a box.

D-C Triggering Mod. C Flip-Flop

(E. Anfenger) (UNCLASSIFIED)

The flip-flop was wired into the plug-in unit and is operating. No further work has been done on this unit.

2.14 Memory Test Computer

(W. A. Hosier) (UNCLASSIFIED)

Sheet-metal work (rack installation, cable ducts, etc.) was substantially completed by 12 June, and good progress has been made in wiring and cabling during the past week. Further wiring and cabling of the central machine (not including terminal equipment and probably not core memory) will occupy most of the next two weeks. During this time, also, the Test Equipment Group will make a thorough check of all test-equipment units used in MTC control.

Power-Supply Control

(A. Chopourian) (UNCLASSIFIED)

Construction and installation of the power-supply-control system for MTC will probably be completed by the latter part of August.

2.15 System Liaison

(J. D. Bassett) (UNCLASSIFIED)

Action is being taken to provide a minimum operational partitioning arrangement on the first floor of Building B in Lexington, so that Group 62 can begin its move on or about 6 July. Wood studding and paneling will be used where fabricated-steel partitions are not available. The full partitioning arrangement will be completed after the move when steel partitions are again available from the factory.

Draft proposals on three sections of the Lincoln "Construction Practice" manual have been received for comment from Technical Marketing Associates. The sections are (a) Layout and Construction, (b) Care and Use of Tools, and (c) Appendix. These proposals are being reviewed by members of the Good Construction Practice Subcommittee and other interested personnel. Proposals are now being prepared on wiring and soldering, components and materials, and inspection and testing.

A review and proposal for design and manufacture of AN/FSQ-7 (XD-1) digital-data transmitters and receivers is being prepared and will be issued in the near future as an M-note.

(W. H. Ayer) (CONFIDENTIAL)

Work on the AN/FSQ-7 Direction Center and Combat Operations Center has proceeded in parallel with the detail design of the cooling-equipment and lighting systems for XD-1. Francis Associates is scheduled to deliver drawings and specifications to Lincoln this week on both the cooling equipment and lighting.

A meeting will be held on 22-25 June in New York to continue COC facility planning with ADES people. The DC building requirements, in those areas in which MIT has an interest, will be the subject of an M-note in the near future. In addition, an addendum to the XD-1 cooling-equipment specifications is in preparation.

(P. Bragar) (UNCLASSIFIED)

The Lincoln Production Coordination Office (formerly the Transition System Planning and Control Office) has been established to serve as the point of contact at Lincoln for the Air Force and its contractors. Details concerning the procedures of this office will be issued shortly.

(P. J. Gray) (CONFIDENTIAL)

Amendment 3 to Exhibit AFCRC has been prepared and forwarded to CRC. This provides for inclusion of the miscellaneous radar inputs

~~CONFIDENTIAL~~  
UNCLASSIFIED

2.15 System Liaison (Continued)

(P. J. Gray) (CONFIDENTIAL) (Continued)

(FGD, Mark X, automatic height finding) group in the XD-1 System. An additional amendment will be prepared to provide for emergency cooling of XD-1 by the use of outside air.

The duplex central exhibit, AFCRC-17, is nearing completion, and drafts will be distributed for comment in the near future.

A comparative equipment list for simplex vs. duplex Combat Operations Centrals has been prepared as a working guide for estimates being made by the Western Electric Company on various arrangements of Combat Centers. A meeting is scheduled during the week of 21 June in New York to discuss space and cost requirements for these various plans.

2.16 Display

(C. L. Corderman) (CONFIDENTIAL)

Meetings on 16 and 17 June resulted in concurrence for the display console and the display specifications for XD-1. The only logical decision which needs to be made concerns the transfer to the MIB of the new radar identity bit which was recently added. A final DD matrix layout will be needed on or about 1 September 1954 and will complete the specifications.

Tests on the light gun have shown that the yellow filter presently used in Cape Cod reduces the output of the phototube by a factor of 36. Contact has been made with the local Rohm and Haas distributor in an effort to find a Flexiglas color which will transmit more blue light for the phototube and still not give excessive flash to the operator. After some tests on sensitivity, it is hoped that a few of the Cape Cod filters can be modified to the new color. Long period tests can then be made to check the relative degree of eye fatigue to the operator.

I will spend the week of 21 June on the west coast in discussions at Convair, Hughes, and other companies doing work in various phases of display tubes, such as large, color and/or storage-type displays.

(J. Woolf, H. Zieman) (UNCLASSIFIED)

The line driver mentioned in the last Biweekly was tested and met all the objectives set in the original specs. A new line driver is under construction. This driver was designed for the same over-all response but with an attempt to do away with the -450-v supply.

The Drafting Department is completing drawings on the vector generator which is to be mounted on an MTC panel. They will start on a

2.16 Display (Continued)

(J. Woolf, H. Zieman) (UNCLASSIFIED) (Continued)

panel which will mount two decoders and three line drivers.

The MRD reports on a basic current source for the decoders and a sweep generator for the vector generator are being prepared.

(B. R. Remis) (UNCLASSIFIED)

A breadboard setup of pulse amplifiers (<sub>a</sub>PA, <sub>b</sub>PA and <sub>a</sub>RD) driving flip-flops as units of load has indicated the following:

1. Considerably more flip-flop units of load can be driven than can gate-tube units of load. Thus the MRD Book, which lists the driving capabilities of the pulse amplifiers in terms of gate-tube units of load, does not lead to an optimum design if only flip-flops are driven.
2. Variations in the number of units of load, such as occur when part of the load is driven through pulsed diode-capacitor gates, can be effectively handled by simple limiting circuits at the output of the driving-pulse amplifier.

(J. Schallerer) (UNCLASSIFIED)

The pluggable-unit tester marginal-check supply has been constructed and partially tested. Several other units have been tested and found satisfactory. The tester should be complete in another week or two.

Three more pluggables have been laid out and turned over to the Drafting Room for final drawings. Work has started on packaging the vector generator and the character-selection circuits.

(L. B. Martin) (UNCLASSIFIED)

Tubes now on test are the following:

<u>Tube</u>	<u>Hours</u>
265	2396.5
280	1618.5
335	801.5
366	99.7
389	15.9
390	99.7
392	99.7

~~CONFIDENTIAL~~  
UNCLASSIFIED

2.16 Display (Continued)

(L. B. Martin) (UNCLASSIFIED) (Continued)

Tube 268 has been refired after 2326.7 hours because of high background light. Tube 326 was refired at 1577.2 hours, developing a crack. The buttons on tube 389 have been resoldered and this tube started on life. Also started are tubes 366, 390, and 392.

Tube 389 has a P-1 phosphor. The tubes with separate third screen are temporarily running with this screen tied to +250-v through a 10K resistor. A pot has replaced the A<sub>2</sub> supply, and each mount supply fused. In the weeks that this has been in operation, no fuse has blown. The original supply has also been operating during this time without incident.

A short Typotron report has been prepared containing a list of Typotron around Lincoln Laboratory along with a brief history, data from focus-voltage tests, a statement about cracked 326, and photographs of A<sub>1</sub> weld failure of 383 and cracked face of 326.

(M. Epstein) (UNCLASSIFIED)

The biweekly period was spent working on pluggable-unit layout.

Timing and Control

(R. H. Gerhardt) (CONFIDENTIAL)

The requirements of the manual-input system with regard to the light-gun operation were reviewed with W. McMillan of IBM. As a result of this, the "conditional unblank" pulse will occur 10 microseconds after the unblank of the point and character in tabular messages and radar messages, respectively. The "conditional sample" will occur 17.5 microseconds after the unblank pulse. The timing of these pulses may be changed by back-panel wiring.

The logic of the timing-and-control section of the situation-display-generator element is being reviewed and revised. The added "radar identification bit," which allows additional radar categories, makes it necessary to set other characters in the character decoder. The timing of all pulses (e.g., unblank, blank) is being reviewed. For each case where the timing might be changed after XD-1 has been built, the pluggable units will be designed so that the changes can be done in back-panel wiring.

UNCLASSIFIED  
~~CONFIDENTIAL~~

2.16 Display (Continued)

(R. Fallows) (UNCLASSIFIED)

The major effort on the central display frames continues to be packaging into pluggable units. At this time some 13 units have been designed and released to Drafting. These units, together with some IBM-designed units from other frames, will make up more than one-third of the pluggable-unit construction for our frames. Thus, emphasis is on getting these units through Drafting and the shop in order to release them in time for IBM to meet our original production schedule.

Some redesign was caused by the introduction of four new radar categories, but this should not cause any serious additional delay.

2.2 Group 63 (Magnetic Materials)

2.21 Magnetic Cores

(D. R. Brown) (UNCLASSIFIED)

The present ferrite-memory-core specification will be released by IBM. A joint IBM-MIT committee is preparing a new, simplified specification which is expected to result in a more economical testing procedure but no change in core characteristics. This new spec is expected about 1 September.

Setter plates appear to be affecting some cores fired in the Harper furnace. Cores have been fired on platinum sheets in the effort to isolate the difficulty.

Two transistor makers were visited, RCA Victor and Texas Instruments. Point-contact transistors at RCA are now troubled by surface contamination. The new temperature-stable grown-junction silicon transistors were discussed at Texas Instruments.

Preparation of Memory-Core Materials

(J. J. Sacco) (UNCLASSIFIED)

It has become necessary to carry out the test firings on F-394 cores from batch DCL-2-418 to a greater extent. Certain inconsistencies, which are not readily explained, have been observed in the test data. It would seem that these differences are not caused by temperature variations within the muffle but instead may be due to a reaction between the cores and certain alumina setter plates. No large firings of these cores will be made until this fault has been overcome.

Core Specifications

(J. H. McCusker, J. R. Freeman) (UNCLASSIFIED)

A one-day visit to General Ceramics Corp. was made during which the newly proposed memory-core specifications were discussed and the General Ceramics' production data studies. General Ceramics has delivered three Ferramic S-1 memory-core lots to Group 63 on a loan basis; these lots were selected by us for their particular  $rV_1$  distributions.

At a memory-core-specifications meeting with IBM on Thursday, 17 June, tentative selective-test specifications were agreed on. These specifications will be tried and evaluated with the three Ferramic S-1 lots above.

2.2 Group 63 (continued)

Core Drivers

(J. D. Childress) (UNCLASSIFIED)

The rise time of the current pulses from the Models V and VI core drivers depends on the quality of the 5687 in the voltage-amplifier stage. If the shortest rise time is greater than 0.15 microsecond, the 5687 may be "weak" and should be replaced.

High-Resistance Wheatstone Bridge

(J. D. Childress) (UNCLASSIFIED)

The first model of the high-resistance Wheatstone bridge has been completed and tested. The bridge can measure resistance from 10 ohms to  $10^9$  ohms with an accuracy of 1.5 percent; it is capable of measuring up to  $10^{11}$  ohms with an accuracy of 2.5 percent, but these higher scales are not built into the present model.

The bridge uses an electrometer detector which draws less than  $10^{-13}$  amperes at balance.

Single-Crystal Window Frames

(J. B. Goodenough) (UNCLASSIFIED)

A jig has been designed for polishing single-crystal window frame surfaces parallel, within 0.1 degree, to specific crystallographic axes.

Polycrystalline Domain Patterns

(J. B. Goodenough, P. K. Baltzer) (UNCLASSIFIED)

Annealed, large-grained specimens of 68 Permalloy and 3 percent silicon-iron are being polished in preparation for domain-pattern studies.

(J. B. Goodenough, A. L. Loeb) (UNCLASSIFIED)

A first draft of a paper entitled "A Theory of Ionic Ordering, Crystal Distortion and Magnetic Exchange Due to the Covalent Forces in Spinels" has been finished.

(A. L. Loeb) (UNCLASSIFIED)

The movie "Making Electrons Count" was provided with a musical score.

2.2 Group 63 (continued)Stress Sensitivity

(P. K. Baltzer) (UNCLASSIFIED)

It has been shown, as reported previously, that magnetostriction may cause grain-to-grain alignment of the magnetic moment in a polycrystalline material. Because of the counteracting effects of larger magnetostriction and grain-to-grain alignment, the stress sensitivity of a polycrystalline should have a maximum in the range of  $0 \leq \rho \leq 1$ , where  $\rho$  is the ratio of magnetostrictive energy to anisotropy energy.

An expression for stress sensitivity at remanence,  $\frac{dB_r}{d\sigma} / B_r$ , has been derived as an explicit function of  $\rho$ , where  $B_r$  is the remanent flux density and  $\sigma$  is the applied external stress. The maximum predicted in stress sensitivity was found at  $\rho = 0.707$ . Sufficient data exist in the literature on nickel ferrite to permit a verification of the theory at one value of  $\rho$ . The theoretical value and experimental measurement of stress sensitivity were found to agree within a factor of 2. This is excellent agreement considering that the data used were measured by different people and on different samples.

Testing of Memory Cores

(P. A. Fergus, E. J. Stevens) (UNCLASSIFIED)

Pulse data has been taken on samples representing each of the firings of the DCL cores. No definite trend has been observed. However, peculiarities in firing have been indicated.

Investigation is being made of Ferroxcube cores to determine squareness ratio, pulse characteristics, and uniformity. So far, results of these tests have indicated favorable properties, although the current at which the cores become disturb sensitive seems questionable--possibly because of temperature sensitivity.

## 2.22 Transistors

### Visit to RCA

(D. J. Eckl) (UNCLASSIFIED)

I. Lebow, R. Rediker, S. Schwartz (of Groups 24 and 35), and I visited the transistor-development division of RCA at Harrison, N. J. They have been experiencing some difficulty with shelf life in terms of increasing  $I_{CO}$  and as a result have temporarily shut down their main production line. Transistors are still available from an engineering-development line. We were shown this line which has a fair capacity. I would estimate this to be in the hundreds. R. M. Cohen, manager of the applications division for RCA, who conducted the tour was very cooperative. RCA will send us some special samples for evaluation. RCA should be considered a good potential source of low-speed p-n-p junction and of point-contact transistors.

### Transistor Gates

(C. T. Kirk, Jr.) (UNCLASSIFIED)

This biweekly period was spent taking data on the experimental gates for my thesis.

### Diode Evaluation

(E. U. Cohler) (UNCLASSIFIED)

The work on evaluating the reverse-recovery characteristics of diodes for use in shift registers has progressed to the point where we now have built up most of the test equipment necessary for the proposed tests. It now remains to set up the experimental procedures. What we are trying to measure is the charge which a diode will pass in the back direction before it turns off. This charge is a function of the time it was in forward conduction, the current it was previously conducting, and perhaps the back voltage applied. The experiment is very similar to actual operating conditions and so should apply easily to the evaluation of diodes.

### Flip-Flops

(E. U. Cohler) (UNCLASSIFIED)

Bob Burke is in the process of testing the new transformer-coupled junction flip-flop which I developed recently. When this work is finished we may issue a report on the triggering characteristics of various flip-flops.

2.22 Transistors (Continued)Angular Position Counter

(E. U. Cohler) (UNCLASSIFIED)

The APC has been out of commission for the past few weeks because there are no drum pulses left around this building. Upon resuming our proximity to a ready source of drum pulses, we will get full operating specs on this device and set out to develop a coincidence detector to match.

Thesis

(S. Oken) (UNCLASSIFIED)

The first draft of my thesis on transistor magnetic-core drivers has been completed.

Transistor-Magnetic Core High-Speed-Carry Gate

(S. Oken) (UNCLASSIFIED)

A proposed high-speed-carry gate employing transistors and a magnetic core has been designed and built. The testing of the gate will be done during the next biweekly period.

Diode Construction

(N. T. Jones) (UNCLASSIFIED)

The gold-wire samples made poor diodes, while the 2-mil gold-gallium wire produced good bonded diodes. Therefore, an electro-plating process was used to plate indium, a p-type material, on the gold whiskers. This has resulted in good bonded diodes. The reverse-recovery time is about an order of magnitude below what was theoretically predicted, but this is reasonable in light of the reduction of hole lifetime in the vicinity of the junction because of very large hole concentrations.

A 12-v, high-current supply has been used with a 20-ohm series resistor as a current source for bonding the large-area diodes. Since the forward resistance is about 1.5 ohms at 500 milliamperes, the supply does act as a current source.

Diode Storage

(N. T. Jones) (UNCLASSIFIED)

If the turn-off time of a diode is defined as a constant times the loop series resistance (say 50), then the factor  $I_{RM}$  is predominant.

2.22 Transistors (Continued)

(N. T. Jones) (UNCLASSIFIED) (Continued)

The turn-off time increases with increasing  $V_r$  with  $I_{RM}$  constant, and it increases markedly with increasing  $I_{RM}$  with  $V_r$  constant.

Transistor Storage

(N. T. Jones) (UNCLASSIFIED)

The same is true of storage in transistors. Defining  $I_{RM}$  as  $\frac{V_{CC}}{R_L}$ , increasing  $V_{CC}$  at constant  $I_{RM}$  independent of  $V_{CC}$  decreases the storage time.

## SECTION III - CENTRAL SERVICES

The following sections have been moved to Lexington:

MTC	June 9 to 11
Stock Room	June 17
Group 61	June 18
Materials Requirements	June 19
Gen. Engn. & Inst. Off.	June 19
Editorial	June 19
Production Control	June 19
Model Shop	June 15-18-19

3.1 Purchasing & Stock

(H. B. Morley) (UNCLASSIFIED)

The Stock Room has accomplished the move to Lexington and is now located at D-025 and D-037 (Building D basement).

The moving date for the Purchasing Department is Saturday, 19 June. The new location is D-213, and the new name is Material Requirements Section. As in the past, requests for material for Division 6 will be processed by this Department.

3.2 ConstructionProduction Control

(F. F. Manning) (UNCLASSIFIED)

There have been 31 Construction Requisitions totaling 349 items satisfied since 4 June 1954, and there are 22 Construction Requisitions totaling 1564 items under construction by the Group 60 Electronic Shops.

The new location at Lexington for Group 60's shops and Production Control are as follows:

Production Control	Room D-139
Model Shop	Room D-120
Electronics Shop	Room D-109
Inspection Shop	Room D-125
General Engineering	Room D-109C

Outside Vendor

(J. V. Mazza) (UNCLASSIFIED)

There are 6 orders now open with vendors totaling 99 items. Deliveries in the past biweekly period have totaled 83 items. Information on specific orders may be obtained from the writer.

3.5 Drafting

Move to Lexington of Drafting, Print, Reproduction, & Document Rooms

(A. M. Falcione) (UNCLASSIFIED)

The Drafting, Print, Reproduction, and Document Rooms will be moving to their new quarters in Lexington on 26 and 27 June and will be located on the first floor of Building C. The Drafting Room is 130, Print Room 117, Reproduction Room 133, and Document Room 129. By necessity the move will inconvenience some people; however, the mail service between Lincoln and Barta should be adequate to take care of the drafting requirements of those at Whitemore and Barta. In the event that it is not, please advise the writer so that other possibilities or arrangements can be looked into.

3.6 Administration and Personnel

New Staff

(J. C. Proctor) (UNCLASSIFIED)

Alan R. Chandler is working as a DDL Staff Member in Group 61. Until recently he was a part-time instructor at Boston University and a Ph.D. candidate.

William J. Eccles is a new DIC Staff Member working for Charlie Adams for the summer. He received his SB from MIT in June of this year.

Nicholas J. Saber is a new DIC Staff Member working for Charlie Adams for the summer. He received his SB from MIT in June of this year.

Richard E. Watson is a new DIC Staff Member working for Charlie Adams. He received his BS in Physics from Amherst College in June 1953.

Staff Transfers

(J. C. Proctor) (UNCLASSIFIED)

John Frankovich has transferred from MIT Staff to DIC Staff.

Frederick Sarles has transferred from MIT Staff to DDL Staff.

Staff Terminations

(J. C. Proctor) (UNCLASSIFIED)

Robert Hopkins  
Robert von Buelow  
William Wolf

3.6 Administration and Personnel (Continued)

New Non-Staff

(R. A. Osborne) (UNCLASSIFIED)

Jane Aldenberg is Dave Israel's new secretary in Group 61.

Donald Bloom has joined Group 64 as a Laboratory Assistant.

Eleanor Derby is a Radcliffe student who will work for the summer as a clerk in Group 6345.

Barbara Hanlon is a high-school student who will work for the summer as a clerk in the Print Room.

Warren Hollis and Sidney Wood have been transferred from the Director's Office to the Group 60 Standards Section, where they have actually already been for some time.

Vincent Kelly has joined the Construction Shop as a Laboratory Assistant.

Elizabeth Osenton is a new clerk-typist who will operate the teletype in Group 62.

Edward Reardon is a new member of Group 62 temporarily assigned to the General Engineering Section of Group 60.

Rex Sinclair is a new Laboratory Assistant in the Memory Section of Group 62.

Robert Thornton is a Tufts student who will work in the Drafting Room for the summer.

Terminated Non-Staff

(R. A. Osborne) (UNCLASSIFIED)

Joseph Dankese  
Leila Buckner  
Alfred Perry  
Margaret O'Brien

Open Non-Staff Requisitions

(R. A. Osborne) (UNCLASSIFIED)

1 Secretary for Group 62