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Memorandum M-2955

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DIVISION 6 - LINCOLN LABORATORY  
MASSACHUSETTS INSTITUTE OF TECHNOLOGY  
LEXINGTON 73, MASSACHUSETTS

SUBJECT: BIWEEKLY REPORT FOR JULY 30, 1954  
To: Jay W. Forrester  
From: Division 6 Staff

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Auth: DD 254  
By: R.R. Everett  
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SECTION I - CAPE COD SYSTEM

1.1 Group 61

1.10 General

(R.J. Horn, Jr.) (CONFIDENTIAL)

Work on the 1954 Cape Cod System programs continues. Program checkout and testing should begin the first week in August.

The Air Force Personnel training program is now scheduled to start 10 August for Officers and key NCO's and 24 August for all other enlisted men.

A large amount of Group 61 time was spent on preparation of preliminary drafts of a document to replace TM-20.

(D.R. Israel) (CONFIDENTIAL)

This biweekly period has been completely devoted to preparation of a document to replace TM-20. Drafts of Appendices A and B of this document have been prepared by Group 61 and distributed as M-2941 and M-2946 for comment.

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1.12 Data Screening

(R. L. Walquist) (CONFIDENTIAL)

Almost all of this biweekly period has been spent on Appendices A & B of the "Rewrite of TM-20". The rough drafts have been issued, but many of the Figures need additional work done on them.

Rough drafts of M-notes for the Track-While-Scan functions in the 1954 Cape Cod System have been prepared, and the memos should be issued shortly. Final flow diagrams have been drawn and initial coding started. Program testing should begin early in the next biweekly period.

(W. Attridge) (CONFIDENTIAL)

I am continuing programming some of the analysis of the 1953 System data as is described in an inter-office memo by J. Levenson. I am doing the analysis concerned with the general tracking situation and data inputs.

The Air Force Personnel training program is now scheduled to start August 10 for Officers and key NCO's and August 24 for all other enlisted men. Details may be found in M-2947.

(Frank Heart) (CONFIDENTIAL)

The major portion of time has been spent on 1954 Cape Cod Track-While-Scan problems, with special emphasis on monitoring.

Some time ago, work was done on WWI Dynamic program analysis, in order to study operation frequency-of-occurrence. Similar work has been in progress at Los Alamos, with an IBM 701. Through the courtesy of Dr. N. Metropolis and Mr. M. B. Wells this group furnished me with a set of results covering operation analyses on about six problems. As soon as the "language" conversion is completed, I will furnish copies of this material to anyone who so requests.

The paper, "The Programmed Synthesis of Digital Computers Within Digital Computers," has been issued as M-2913.

(J. Levenson) (CONFIDENTIAL)

The major part of my time has been spent planning, writing, and testing the analysis programs for track data collected during 1953 Cape Cod System operations. An inter-office memo was written to show approximately what information will be secured by the above programs.

Within the next biweekly period the remaining programs should be completed and tested.

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1.12 Data Screening (Continued)

(H. Peterson) (CONFIDENTIAL)

I spent most of the period aiding Ishihara in making up the Tracking Section's track-data storage, and I started work on rough programming of the monitor program to get a concept of amount of space needed.

(E. W. Wolf) (CONFIDENTIAL)

A memorandum containing a detailed description and block diagrams of Re 1954 CCS radar-data-input program has been completed. Work on the coding of this program has begun.

1.13 Tracking and Control

(W. Lone) (CONFIDENTIAL)

Margaret Allen, who has been working in the Print Room, will be working part time with the IBM punched-card equipment until September when she will be with us full time. Time was spent gaining familiarity with the equipment and laying out the procedures for processing punched cards for B. Smulowicz and R. Davis.

C. Gaudette and I have again taken up the subject of cameras for XD-1 and hope to complete the requirements within the coming biweekly period.

E. Yienger and I are writing a memo describing the operation and storage requirements of XD-1 utility programs.

(J. Eleanor Yienger) (CONFIDENTIAL)

Several different methods of writing a trace program for XD-1 have been investigated, and the preliminary coding for one of these has been started. A memorandum is also being prepared which will describe in detail, this and other utility programs which have been prepared for XD-1.

The following utility programs have been prepared within the last two months and are ready to be checked: an octal-print program, a binary-punch program, and a program which will load a program, previously stored on magnetic tape, from magnetic tape into core or drum memory.

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1.14 Weapons Direction

(H.D. Benington) (CONFIDENTIAL)

Over half my time during this biweekly period has been unexpectedly devoted to aiding in the revision of TM-20. This has delayed work on the 1954 Cape Cod System by about a week. Practically all decisions affecting operation of the Cape Cod Weapons Direction Stations and intercommunication between the programs have been made. This means that full-scale programming is about ready to begin.

Before the master makeup and display (MMD) programming starts, two memos will be issued: the program specifications and a memo on data-storage allocation. The latter memo, which was to be issued as an inter-office memo during the last period, is now ready to be published as an expanded M-note, "Weapons Direction Data Storage Allocation." Sections on drum storage and on joint track-data storage have been added.

(A.G. Favret) (CONFIDENTIAL)

A raid-size assessment test was conducted from S. Truro on 23 July 1954 with 6 - 7 aircraft in the primary formation. Useful data was accumulated during the test, but a thorough analysis has not been attempted as yet. Narrow pulse operation was used occasionally, and this procedure promises better results at short ranges. The test is summarized in a memo from the author to D.R. Israel and C.A. Zraket.

The draft of a memo describing the results of operation of the height-finder section from March through July 1954 was completed. Contributions were made covering AA for the revision of TM-20.

Preliminary programming of the AA sections of the 1954 Cape Cod System was initiated.

(F. Garth, S. Hauser) (CONFIDENTIAL)

A memo on the program specifications for the identification function of the 1954 Cape Cod System was written. It will soon be published as an M-note. The specifications were made in accordance with the revised version of operational specifications written in an inter-office memo, also to be published as an M-note. Some work was done in the preparation of flow diagrams for the identification programs. This work will continue through the next biweekly period when we expect to commence coding of the programs.

A brief account of operation of the 1953 identification function and of the results of operation was prepared for TM-20.

(C.C. Grandy) (CONFIDENTIAL)

Two successful raid-size assessment tests were conducted during this period, one on 23 July and one on 29 July. Both of these

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1.14 Weapons Direction (Continued)

(C.C. Grandy) (CONFIDENTIAL) (Continued)

missions were very good and have supplied much valuable data. Data from these tests and from that of 16 July is currently being analyzed by A.G. Favret and myself. Preliminary results indicate a good potential for reliable assessment but only at relatively short ranges (70 miles) from the height finder. The tests will be summarized in M-notes by Favret and Grandy. Much additional data is needed, and this series of tests will continue.

The operational specifications for the 1954 height finder system have been reviewed and brought up to date. Programming specifications are being rewritten and will be issued as an M-note when complete. Actual coding of this program should be underway very soon.

Some time was spent assisting in the preparation of material for the TM-20 revision. In this connection, the results of height-finder operation for the entire 1953 Cape Cod System testing were summarized. Results during the two periods -- October 1953 thru February 1954 and March thru June 18, 1954 -- were in excellent agreement, except that availability of height to other sections of the Direction Center increased markedly in the latter period. Results of the latter period are given in M-2929, "Results of Height-Finder Operations in the 1953 Cape Cod System: March-June 1954," A.G. Favret. (See also A.G. Favret's Biweekly Report.)

(S. Knapp, E. Bedrosian, C. Gaudette) (CONFIDENTIAL)

Three programs which perform the 1954 Cape Cod master control functions have been written. These are: the Master-Control-Test Storage Program, the Master-Control Subprogram, and the Start-Over Program. They have been operated on the computer several times and are well on their way to being checked out for use in checking out other 1954 Cape Cod programs. A memo describing these programs has been written and will be distributed during the next period.

Work has begun on the utility programs. Various printout and display programs will be provided to aid in the 1954 program checkout.

(W.Z. Lemnios) (CONFIDENTIAL)

The intercept calculations require that the height for interceptors during climbs be extrapolated on a scan-by-scan basis. Also, certain other quantities must be calculated each scan for interceptors during climbs. The method for doing this in the 1953 Cape Cod System was long, cumbersome, and, in some cases, led to rather large roundoff errors. A new scheme has been devised for doing these calculations which is only about 20 percent as long as the method used in the 1953 Cape Cod System. An error analysis has been done on this scheme which indicates that it is at least as accurate as the preceding scheme. Weapons

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1.14 Weapons Direction (Continued)

(W.Z. Lemnios) (CONFIDENTIAL) (Continued)

Assignment-Intercept Direction (WA-IND) programs have been written and issued in conjunction with L. Murray, J. Nolan, and C. Zraket.

(L. Murray) (CONFIDENTIAL)

The bulk of the past biweekly period has been devoted to familiarization with the 1954 Cape Cod System. Consideration has been given to the switch-interpretation program for the WD-IND section.

The inter-office memos on the intercept-saturation tests of the 1953 Cape Cod System and the proposal for fighter data storage (FDS) in the 1954 Cape Cod System are now being rewritten in M-note form.

(J. Nolan) (CONFIDENTIAL)

Time has been spent during the past period in modifying program specifications for 1954 CCS and in preparing a summary memo on the final-turn test program.

(F.A. Webster) (CONFIDENTIAL)

It has been decided that the interception display program should be adapted to the 1954 Cape Cod System and provide for 16 possible interceptions, instead of the 5 originally planned.

(C.A. Zraket) (CONFIDENTIAL)

Memorandum M-1807, Supplement #1, "Suspension of 1953 Cape Cod System Activities," has been issued; this memo gives the new schedule for the resumption of activities of the 1954 Cape Cod System.

A memo on the implementation of a training program for Air Force operational personnel for the 1954 Cape Cod System will be issued this period by Attridge and myself.

A number of meetings on Group 61 aircraft requirements for the next two years were attended. Results of the meetings have been summarized in memorandums to C.R. Wieser and D.R. Israel.

All operational and programming specifications for the 1954 Cape Cod System will now be reissued as M-notes. Program checkout and testing will commence about the first week of August.

The tenth status meeting of the Navy Intercept Project was attended on 21 July at BTL, Whippany, New Jersey.

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1.15 Direction Center Operations

(W. Vecchia) (CONFIDENTIAL)

Total Assigned Time

53 Hrs

Weapons direction	5H 05M
Data screening	18H 15M
Tracking and control	12H 25M
Total	<u>35H 45M</u>

Time given to Math Group	12H
Time given to systems	3H
Time lost to computer	2H 15M
Total	<u>17H 15M</u>

Grand Total	35H 45M
	<u>17H 15M</u>
	<u>53H 00M</u>

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## 1.2 Group 64

(S. H. Dodd) (CONFIDENTIAL)

Computer reliability dropped slightly during the past biweekly period. This was primarily caused by malfunctions of the terminal equipment and a blown fuse in the core-memory system which gave no blown-fuse indication.

A new complement of core-memory sense amplifiers has been installed in WWI to replace the amplifiers which came with the memory from MITC. These new amplifiers recover more rapidly from the effects of transients and are more tolerant toward tube and component deterioration than were the old ones. In addition, the output signal has a flat top which makes the strobe timing less critical.

The buffer drum is now operating with both buffer groups 0 & 1 in service. Ten MITE units have been installed, two for the long-range inputs and eight for the gap fillers. Demodulators have been installed for both of the long-range MITE's and for six of the gap-filler radars. The remaining two demodulators will be installed as soon as they are received.

Two additional groups of auxiliary storage have been installed on the buffer drum. These groups will be available to programmers as soon as crystals for the read gates, now two weeks overdue, arrive.

All of the work is now completed in Room 222 with the exception of the audible-alarm panels. The checkout is essentially complete, and the equipment is ready for use by Group 61.

## 1.21 WWI System Operation

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

The changeover to the sensing amplifier, Mod. III, has been completed. No difficulties were encountered. During the forthcoming biweekly period, we will probably reduce the required time for a core-memory cycle.

The magnetic-tape relay switch panel has been modified by the addition of two relays. The relays are used to eliminate crosstalk between Unit 2 when computer controlled and units functioning in the delayed-printout systems.

It is intended to revise the Room 156 power-control system. Several meetings have been held with McVicar, Healy, Roberts and Holmes in attendance. It is expected that a logical diagram for the new system will be completed during the coming biweekly period.



1.21 WWI System Operation (Continued)

(D. A. Morrison) (UNCLASSIFIED)

The WWI tube-statistic survey, part of the computer-reliability study, has just completed the data-collecting phase. Information should be forthcoming shortly.

Modification of the consolidated test program to allow starting PNC from line numbers inserted in FF 4 has been approved. When this has been accomplished a memo will be prepared concerning the consolidated test program.

1.22 Terminal Equipment

(R. H. Gould) (UNCLASSIFIED)

The Fairchild display-scope camera and its magazine have been modified to provide a film-supply alarm, and the necessary additions to the camera control panel will be done on 2 August. When the film supply in the magazine becomes dangerously low a light called "Film Alarm" on the camera control panel in TC 13 will light, and a buzzer on the panel will sound. Pressing the "Alarm Acknowledge" button on the panel will shut off the buzzer, but the light will remain on until the camera magazine is replaced. Up to 10 frames may safely be taken after the alarm first sounds, but the magazine should preferably be changed immediately.

A switch will be installed by 2 August in test control which when "ON" will cause the computer to switch to pushbutton (i.e., stop) on TP 8 of an si order whose address is either 0011(0) or 0012(0). Restarting from this point will allow the si order to complete its action and clear or complement the timing register. This facility should help prevent accidental destruction of the real-time count in the timing register.

The high-voltage transformers of all the 16-inch-scope high-voltage supplies have been anointed with a silicone grease which has shown significant effectiveness in preventing corona, arcing, and subsequent flames.

Magnetic Drums

(H. L. Ziegler) (UNCLASSIFIED)

Except for a few minor items, all parts of the new test setup have been received, and most of them are mounted in place. Wiring of the main panel will begin next week. (1 August)

The power supplies for this test setup have been checked out and except for the -30-v supply are ready for service. The -30-v is a new voltage in the drum systems, and some special work will be required to adapt the standard ERA regulator to this voltage.

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1.22 Terminal Equipment (Continued)

Magnetic Drums (Continued) (UNCLASSIFIED)

(L. D. Healy)

Groups 0 & 1 of the buffer drum are now in operation.

Group 2 of the buffer drum is ready to be tested, and group 3 will be ready as soon as the necessary IN92 crystals arrive.

The entire buffer-drum parity system must be altered to add the parity check for groups 2 and 3. The buffer-drum system will have no parity check for a day or two while this modification is taking place.

Raydist (CONFIDENTIAL)

(N. N. Alperin)

A phone-line transmitter to supply timing pulses for checking tracking accuracy with Raydist has been built and is being checked out.

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 16-29 July 1954:

Number of assigned hours	142
Usable percentage of assigned time	89
Usable percentage of assigned time since March 1951	87
Usable percentage of assigned time since September 1953	92
Number of transient errors	8
Number of steady-state errors	8
Number of intermittent errors	2

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1.23 Records of Operation (Continued)

Component Failures in WWI

(L. O. Leighton) (UNCLASSIFIED)

The following failures of electrical components have been reported since 16 July 1954:

<u>Components</u>	<u>No. of Failures</u>	<u>Hours of Operation</u>	<u>Reasons for Failure</u>
<u>Tubes</u>			
5687	2	10000 - 11000	1 short; 1 leakage
5963	3	2000 - 3000	3 low $I_b$
5965	1	0 - 1000	Short
6136	1	2000 - 3000	Short
6145	1	3000 - 4000	Leakage
	2	7000 - 8000	Leakage
7AD7	1	11000 - 12000	Leakage
	1	22000 - 23000	Low $I_b$
	4	24000 - 25000	1 accidental damage; 3 low $I_b$
	8	25000 - 26000	5 short; 3 low $I_b$
7AK7	1	7000 - 8000	Short
2D21	1	5000 - 6000	High tube drop
3E29	1	6000 - 7000	Low $I_b$
	1	26000 - 27000	Low $I_b$
6AG7	1	24000 - 25000	Low $I_b$
6AU6	2	0 - 1000	2 short
	2	1000 - 2000	2 accidental damage
	1	2000 - 3000	Short
6L6	3	10000 - 11000	Low $I_b$
	1	11000 - 12000	Low $I_b$
6SN7	1	25000 - 26000	Short
	1	26000 - 27000	Short
6Y6G	4	24000 - 25000	1 leakage; 3 low $I_b$
	3	25000 - 26000	1 short; 1 leakage; 1 low $I_b$
829B	1	5000 - 6000	Low $I_b$

1.25 AN/FSQ-7

Duplex Central

(B. E. Morriss) (CONFIDENTIAL)

During the first week of the period the following specifications for the duplex central were received:

Manual-Input Frame  
Area Discriminators  
Magnetic Drums  
General Switching Method for Simplexed Equipment  
Mechanical Clock

Some time was spent discussing the material prepared by the PCO for distribution outside of Lincoln on general building requirements, cooling, lighting, floor layouts, and power requirements.

AN/FSQ-7 Schedules

(T. R. Parkins) (UNCLASSIFIED)

During this period, my efforts were concentrated on preparing a Display System Progress Report, a small contribution to TM-20, and on the revision of XD-1 installation schedules.

1.26 New Computer Design

(N. L. Daggett) (CONFIDENTIAL)

Work of this group has consisted mainly of a continuing study of the general input-output requirements of the FSQ-7 system. Although we still maintain our rank amateur standing, it appears that we are developing some feeling for the problems involved in the gross logical design of such a system.

### 1.3 Group 65

#### 1.31 Activities of Group 65

(P. Youtz) (UNCLASSIFIED)

The Tube-Construction Section was on vacation this past period. During this period many of the tube-production facilities were overhauled and modified to meet the new needs that have arisen this past year.

I made two trips with the IBM Tube Group before they went on vacation on 24 July. We spent two days, 21 and 22 July, with General Electric at Owensboro, Kentucky, discussing the production specifications for the Z-2177. This included a thorough discussion of factory techniques and procedures besides the final tube specifications. The specifications were finalized sufficiently so that General Electric could produce and IBM could order production Z-2177. We spent one day, 23 July, with DuMont, Passaic, New Jersey, discussing the engineering specifications for the multiplier phototubes, 6291 and K1303, and the 16-inch cathode-ray tube for the video mapper. Sufficient information was obtained for IBM to write the preliminary engineering and purchase specifications for these tubes.

C. L. Corderman, F. A. Rodgers, and I spent 30 July with the National Union Radio Company at Orange, New Jersey, studying their work on dark-trace tubes. Several of their dark-trace tubes may be obtained for study at Project Lincoln. Under investigation is the feasibility of using a dark-trace surface with the Charactron optics to produce a Charactron-type tube with a memory surface.

Work was done at MIT and Convair on what has been designated as Mod. III Charactron optics. MIT received from Convair the new convergence coil for the Mod. III optics. This coil was evaluated immediately and information exchanged with Convair. Present indications are that Convair will have three preproduction Charactrons with Mod. III optics ready for our evaluation on 16 August 1954. Convair has reported satisfactory progress with their work on the helical-dag coatings.

Hughes Aircraft has made a Typotron with a third set of deflection plates for compensation. There have been frequent exchanges of information about this tube. Sydney Smith is planning to bring this tube to MIT 2 August for evaluation and a discussion about Typotron electron optics.

#### 1.33 Research and Development

(P. C. Tandy) (UNCLASSIFIED)

The helical-dag resistance of three 16-inch tubes, Cht-36, -37, and -43, was found to be 52, 100, and 125 megohms, respectively. All the resistances are higher than the 33.3-megohm average of the first 14 helical-dag tubes.



1.33 Research and Development (Continued)

(P. C. Tandy) (UNCLASSIFIED) (Continued)

Work is being done on a tentative life test for 19-inch Charac-trons. The logic and tentative operating conditions have been worked out, and the equipment needed will be determined shortly.

(H. B. Frost) (UNCLASSIFIED)

During the past two weeks my time has been spent almost ex-clusively on thesis writeup. At this time four chapters have been essentially completed. One chapter and two appendices remain to be written. This material should be completed during the first week of August.

(S. Twicken) (UNCLASSIFIED)

A trip was made with P. Youtz to G. E. at Owensboro, Ky. Talks were given to the factory personnel by a USAF Major, N. P. Edwards of IHM, and P. Youtz on the aims of the Lincoln program, how the Z-2177 fits into this program, and the necessity for meticulous care in the production of the tubes. Some spec changes were made, and inoperatives control and ca-thode melt selection tests were added to the spec. Approximately 2000 tubes have been made in the factory, but the majority are not yet tested and evaluated.

An analysis of 8 different engineering sample lots of Sylvania SR1782A's is being made. These sample lots were made in an effort to deter-mine the cause of decreased d-c plate current on life.

Some thought is being given to means of measuring the flash in-tensity and persistence characteristics of CRT's, specifically for the 19-inch Charactron.

(L. B. Martin) (UNCLASSIFIED)

The following is a list of Typotron tubes and their hours of operation in life test:

<u>Tube No.</u>	<u>Hours</u>
265	3334.5
280	2516.5
335	1699.5
366	997.7
389	913.9
390	997.7
392	997.7
394	215.6

1.33 Research and Development (Continued)

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

These tubes are in satisfactory condition except for No. 265 (as noted in previous reports) which will not store in the center because of ion damage.

The Typotron Leakage Report has been prepared and dispatched to the Print Room. It is interesting to note that not one of the 14 tubes passed the minimum leakage requirements proposed by Hughes. One tube failed by one test, three tubes failed by two tests, and the remainder failed by more than two tests.

Five MIT experimental Charactron tubes and six MIT storage tubes were leakage-tested for comparative purposes. The MIT tubes were far superior in this respect to the Typotrons.

Typotron tube No. 399 has not yet been operating satisfactorily. The original hypothesis of an open ion-collector lead has been discredited. The tube cannot be labeled defective until further tests have been made, but it is safe to call it at most marginal at this time. Since all 8 life-test positions are filled, further tests have yielded to more pressing matters. There is some reason to suspect that the storage surface is poisoned.

The new life-test-mount prints are being modified to provide separate control and measuring jack for the new  $A_2$  lead on the split-focus Typotron.

SECTION II - AN/FSQ-7

2.1 Group 62

(B. G. Farley) (UNCLASSIFIED)

Thought has been directed toward the possible advantages of "cooperating" computers in a complex system such as XD-1.

Some consideration has also been given to the advantages of a parallel circulating-pulse transistor computer.

A number of suggestions for XD-1 testing are now being written up.

2.11 Systems

(J. F. Jacobs, P. R. Bagley, R. P. Mayer, W. H. Thomas)  
(UNCLASSIFIED)

Our major activity has been the preparation of part of a revised version of TM-20, "A Proposal for Air Defense System Evaluation: The Transition Phase." We prepared a draft of Section II, Data Processing, now issued as part of M-2942, "Rough Draft of Appendix C of Revision of TM-20."

2.12 Magnetic-Core Memories

Magnetic-Core Memory with External Selection

(S. Bradspies) (UNCLASSIFIED)

The speed of operation of the proposed memory system is limited by the resistance of the loop joining the switch cores and the memory cores. The larger the loop resistance the shorter is the time constant of that circuit and consequently the faster is the memory cycle; unfortunately, the loop currents and the memory core outputs are reduced.

If the loop resistance is 0 ohms, about 1.8 microseconds are required between pulses; for 1-ohm resistance, about 0.3 microsecond; for 2 ohms, the time is less than 0.15 microsecond.

A great amount of data has been taken in trying to determine the nature of the loop joining the cores. Most of the data is only qualitative because the Tektronix 514 oscilloscope then available was not accurate for measuring short pulses. Some of the data is now being retaken with a Tektronix 517.

2.12 Magnetic-Core Memories (Continued)

Memory Test Setup VI

(J. L. Mitchell) (UNCLASSIFIED)

The debugging of the memory test setup is about half complete. The "shower" stall and its associated equipment are working; however, some of the logical equipment is not operating correctly.

The installation of air conditioning for the memory stack is complete except for the electrical wiring.

By the 6th of August we should be able to resume the testing of IBM memory planes.

MTC Core Memory

(J. L. Mitchell) (UNCLASSIFIED)

All prints of the selection-plane-drive system have been brought up to date. They now contain all the latest modifications including marginal-check lines.

(W. J. Canty) (UNCLASSIFIED)

All prints of the digits system of the 64 x 64 core memory have been brought up to date. Modifications to two panels have been suggested.

Larger Core Memories

(W. J. Canty) (UNCLASSIFIED)

Work has started on estimating tube counts for 128 x 128 and 256 x 256 core memories. Some very tentative estimates have been reached.

(J. Raffel) (UNCLASSIFIED)

A note on new sense-winding geometries is being written.

64-Position Core Switch

(A. Hughes) (UNCLASSIFIED)

The 64-position core switch is now being tested, using Model V core drivers as bias-current drivers and using the set-reset driver

2.12 Magnetic-Core Memories (Continued)

(A. Hughes) (UNCLASSIFIED) (Continued)

which was designed for the switch. Results, so far, are not good in that the output-current waveshapes are very poor. Work will continue to try improving output-current waveshape and to drive one memory plane as a first test.

2.13 Vacuum Tube Circuits

Trip to Vestal

(R. L. Best) (UNCLASSIFIED)

A trip was made with H. J. Platt to Vestal Labs to discuss console circuits. As a result of this, some of the specs for PCF's in the display frame were modified to make a compatible system. Some minor changes were suggested in some of the console circuits.

Phone-Line Demodulator

(E. B. Glover) (UNCLASSIFIED)

Final marginal data has been compiled on most of the demodulator, and as a result of this information a few minor circuit changes have been made. It is expected that the remaining data will be complete by 6 August.

Trip to Poughkeepsie

(D. Shansky) (UNCLASSIFIED)

The XD-1 digit-plane driver (production model) was found to be acceptable with a modified terminating resistor.

A conference regarding regulated-current pulse generators was held with a few people of the IBM Basic Circuits Group. The general philosophy of driver design was discussed. A driver for a magnetic-core matrix switch was designed to illustrate the procedure.

256 x 256 Core Memory

(D. Shansky) (UNCLASSIFIED)

Preliminary investigation of the problem of driving such a memory has begun.



2.13 Vacuum Tube Circuits (Continued)

Model C Flip-Flop

(E. Anfenger) (UNCLASSIFIED)

Data was taken for triggering the flip-flop as a function of marginal-check voltages.

Data is being taken in connection with margins vs. trigger amplitude for Model C flip-flop using new Z2177's replacing the 5965's. Z2177's are being simulated as down tubes by lowering heater voltage and measuring plate current at 100 volts plate supply and 200 microamperes grid current.

Constant Current Source

(H. J. Platt) (UNCLASSIFIED)

A constant current source has been designed that will deliver 32-42 milliamperes to a Hughes convergence coil and will regulate to 0.12 per cent against a 5 per cent excursion in supply voltages. At present work is going on to add a circuit to the current source which will correct the current level for variations in the Typotron accelerating voltage.

It is felt that with slight modifications this circuit will suffice for the Convair convergence coil for Charactron which has twice the impedance.

During the past two weeks a trip was made to Vestal Labs with Dick Best to discuss some of the console circuitry.

2.14 Memory Test Computer

General

(W. Ogden, W. Hosier) (UNCLASSIFIED)

Lack of d-c power has slowed somewhat the checking out of the system; MTC supplies (with the cooling necessary to operate them) will not be operating before 4 August, and current available from lab supplies, being limited to 5 amps or so, permits only piecemeal energizing of frames. Even so, much testing has been accomplished, notably on the accumulator, and advantage has been taken of the opportunity to work on various minor wiring such as the alarm system, start-stop controls, marginal checking, etc.

2.14 Memory Test Computer (Continued)

Control

(W. A. Hosier) (UNCLASSIFIED)

Available d-c power being insufficient to supply the entire MTC control, the over-all testing which it was hoped would be started during this period has not yet been possible. Individual panels and cabling have been sufficiently checked, however, so that one may be reasonably optimistic on control's passing the "turn-on" test. The alarm system has been simplified, and all necessary interwiring between it and the console has been completed.

The discovery during the past week that MTC standard buffer amplifiers are inadequate to drive a whole register of Mod II flip-flops at 2 megacycles (see John Crane's report of A-frame testing below) has made it necessary to add register drivers to the XD-1 circuit to certain CPO lines such as clear and complement for accumulator, A-register, and B-register. This in turn has demanded some alterations in cabling.

Crystal Gate

(J. Crane) (UNCLASSIFIED)

The possibility of using a pulsed crystal gate to replace some of the present gate tubes in MTC is being investigated.

A-Frame

(J. Crane, F. Durgin) (UNCLASSIFIED)

Power wiring and internal signal connections for the A-frame have been checked, and a more intensive check is being made to insure proper operation of the circuits when operated together as a unit such as the accumulator.

These tests have shown that the flip-flop being used in MTC must be modified to eliminate prf sensitivity. The modification is a minor one and is now incorporated in the accumulator flip-flops. Register drivers are being added in control to drive complement and clear lines to insure good margins where it is necessary to complement 9 or clear 17 flip-flops.

Undesirable ground noise in the accumulator was eliminated by addition of separate ground returns for each digit.

2.14 Memory Test Computer (Continued)MTC Display for Camera

(L. Sutro) (UNCLASSIFIED)

To meet the needs of Group 61 for a Charactron that could be photographed, plans were being made for a 16-inch Charactron and associated equipment to be mounted in two racks in the corner of MTC. Now J. Arnow and C. Corderman have decided that an experimental 19-inch Charactron to be connected to MTC early in the fall would meet the needs of Group 61 and that the most desirable Charactron display is that to be provided by the XD-1 display console, an engineering prototype of which is to arrive in the late fall. Accordingly, work on the 16-inch Charactron has stopped, and plans are being made to mount the Fairchild camera first on the experimental 19-inch Charactron and then, if possible, on the XD-1 display console.

2.16 Display

(C. Corderman) (UNCLASSIFIED)

Plans for a camera charactron for MTC have been modified because this unit is no longer needed 15 August. The 16-inch unit has been dropped, and a camera attachment will be added to the 19-inch experimental test setup. This can probably be available during the week of 23 August. Other arrangements will then be made later in the year for a permanent MTC Charactron installation.

A convergence coil to be used with the final Charactron has been received from Convair. Data taken on this coil have been checked against the measurements taken at Convair with good agreement. The final Charactron design has been made with this information, and at least one tube of this type will be available for tests at Convair during the week of 16 August.

The first Typotron having 3 sets of deflection plates is being delivered to MIT on 2 August by S. Smith from Hughes. It is hoped that a final Typotron design can be made during that week as a result of discussions and tests on that tube.

A visit was made on 30 July to National Union Radio Corp. in Orange, N. J., with P. Youtz and F. A. Rodgers. We observed several dash-trace tubes in operation. They have improved the erasure process considerably over previous DT tubes. The necessary writing charge for a satisfactory contrast will be examined further in some sample tubes to be ordered.

2.16 Display (Continued)

(R. S. Fallows) (UNCLASSIFIED)

Layout and packaging of the central-display-frame circuitry continues. Approximately half of the pluggable-unit types required are complete or in drafting. The first few experimental pluggable units have been received from the shop and have been satisfactorily type-tested.

Our releases to IBM suffered a slight setback last week when it was learned that the new hermetically-sealed chokes require more space than some of our cards provide. Bob Callahan has revised all drawings affected, and new drawings are in process.

The quest for rented engineers continues at a slow rate. Our total to date is one, with another in prospect soon.

(R. Gerhardt) (UNCLASSIFIED)

The design of the timing and control section of the situation-display-generator is complete except for considerations of pulse-driving requirements with respect to the frame layout. Almost all pluggable units have been designated, and some pluggable-unit wiring diagrams have been completed.

Before his termination, Dick Remis did approximately two weeks of experimental work on how to limit pulse amplifiers and register drivers when they are used to sense capacitor-diode or diode-capacitor gates. We have no written record of his results except his notebook. Upon terminating, he returned two notebooks to the Document Room. The books have vanished. No one at Barta can recall seeing them, and a thorough search of dead storage has failed to turn up the notebooks. If anyone has any thoughts about where these books might have gone astray, please contact someone in the Display Section.

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

The line driver with mean-level regulation discussed in the previous Biweekly has been developed to a point where the amplifiers will perform per design objectives. The mean-level regulator was sped up to recover within 10 microseconds. The difference output will recover to 99.0 per cent of the final value in 8 microseconds with a step-function input.

The problem of the 6146's plate caps being pulled off in normal use is under investigation. Some temperature measurements were made, and the bulb was found to be 370 F, while at the tube cap the temperature was 200 F. This indicates that a new type of cement may be needed.

2.16 Display (Continued)

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

The panels for Charactron display in MTC are under construction. The vector generator is being constructed in the shop, while the panels for the character-selection and position decoders along with the line driver are being constructed by the Display Group. Construction on these panels should be completed the week of 9 August.



2.2 Group 63 (Magnetic Materials)

2.21 Magnetic Cores

Preparation of Memory-Core Materials

(F. S. Maddocks) (UNCLASSIFIED)

Test firings of memory cores in the Harper furnace have been resumed. Because core-testing apparatus has not yet been set up, results are not available.

Eight new batches of memory-core material differing slightly in composition have been prepared.

Use of 208 volts a-c in the Hotpack furnaces has proved unsatisfactory; a temperature of 1000 C cannot be maintained.

(P. Reimers) (UNCLASSIFIED)

Continuing the investigation of manganese-magnesium-zinc ferrite, a new series DCL-5-1 is being processed, in order to complete information concerning this system. The whole process is being carried out in order to gain experience in the processing of ceramics and ferrites.

Current Rise-Time Effects

(N. Menyuk) (UNCLASSIFIED)

The effects of the current rise time upon the measured values of the switching coefficient have been determined for the case in which mass effects can be ignored. This is applicable for all measurements made to date. The effect is not negligible and should be taken into consideration for all cases in which the resultant value of  $S_w$  is to be used for a determination of the physical constants of the material involved.

Resistivity Measurements

(N. Menyuk) (UNCLASSIFIED)

The four-probe sample housing for low-temperature measurements has been completed. The design for a four-probe housing for measurements of resistivity at temperatures up to 1300 C has been completed and is now under construction.

2.2 Group 63 (continued)

2.21 Magnetic Cores (continued)

The Covalent Bond in Perovskites

(J. B. Goodenough) (UNCLASSIFIED)

The influence of covalent bonding on cation distribution, lattice distortion, and magnetic-exchange effects in the spinels has proven a fruitful approach. These same concepts are now being applied to some of the ferroelectric and ferromagnetic structures which have the perovskite lattice. Preliminary considerations indicate that these ideas will prove fruitful in these structures also.

Current Calibrators

(J. D. Childress) (UNCLASSIFIED)

A memorandum which describes the Current Calibrator (Chopper Model) and discusses current pulse measurements has been completed.

Pulse-Test Setups

(J. D. Childress) (UNCLASSIFIED)

Considerable time was spent in helping put magnetic-core pulse-test setups back into operation. At present, the  $S_w$  and "Delta" setups are operating.

2.22 Transistors

(D. J. Eckl) (UNCLASSIFIED)

The past two weeks have been spent getting the transistor power supply installed in the new laboratory.

The  $\alpha$  vs  $I_e$  plotter is being reworked to handle pnp and npn junction transistors, and a new version will be constructed soon.

Modifications will be made to the characteristic sweeper to enable observation of grounded-emitter junction characteristics.

Fifty Texas Instrument type 202 npn transistors and 40 Radio Receptor pnp units have been delivered and are being processed. These will make possible further study of junction-transistor circuits.

Early measurements on Texas Instrument npn silicon transistors indicated an  $\alpha$  of 0.85 - 0.90 instead of the  $> 0.9$  specified. It now appears that this was because measurements were made in the 0 - 1 ma  $I_e$  range.  $\alpha$  increases more slowly with  $I_e$  than is the case for germanium transistors.

2.2 Group 63 (continued)

2.2 Transistors (continued)

(S. Oken) (UNCLASSIFIED)

My thesis on "Transistor Magnetic Core Drivers" was completed.

The M-note on "High-Speed Carry Gate Employing a Magnetic Core and Transistors" has been put in rough-draft form. It will come out after my termination date of August 2.

Transistor Gates

(C. T. Kirk) (UNCLASSIFIED)

The majority of the experimental data on the transistor gates has been obtained for the thesis. The next several biweekly periods will be spent analysing this data and writing the thesis.

SECTION III - CENTRAL SERVICES

3.1 Material Requirements & Stock

(H. B. Morley) (UNCLASSIFIED)

Division 1 Stationery Stores has been provided with information to enable them to stock office supplies formerly furnished by Division 6 Stock Room. It is planned to transfer our entire stock of office supplies to Division 1 Stationery Stores at an early date.

We are encountering the perennial summer phenomenon of plant vacation shutdowns, which are creating the usual delivery problems.

Personnel are again reminded that all Division 6 requisitions are processed by this department, although the actual orders are now placed by Division 1 Purchasing.

Stock Room racks have been relocated to provide easier access, more light, and better ventilation. The new arrangement is much more satisfactory.

3.2 Construction

Production Control

(F. F. Manning) (UNCLASSIFIED)

There have been 32 Construction Requisitions totaling 289 items satisfied since 16 July 1954, and there are 26 Construction Requisitions totaling 1315 items under construction by the Group 60 Electronic Shops.

For further information please call the Division 6 Production Control Office (ext. 861).

Outside Vendor

(J. V. Mazza) (UNCLASSIFIED)

During the past biweekly period there have been no deliveries, and there are no outstanding orders.

3.5 Components and Standards

3.31 Component Studies

(B. B. Paine) (UNCLASSIFIED)

Equipment has been received which will enable us to make humidity and temperature-cycling tests on equipment as large as an IBM pluggable unit. One such unit will be tested during the last week of the IBM vacation period. Contact has been made with the environmental testing group at GE, West Lynn, who may later undertake more extensive testing for us.

The recording of computer-panel histories on IBM punched cards, rather than on large typewritten file cards as it is done at present, shows considerable promise. The details of a trial system are being worked out in co-operation with MTC.

Component selections, approvals, and the preparation of component drawings for SDV/DDR equipment in XD-1 are essentially complete. Similar work is starting on the nonstandard components for DDT.

Early and preliminary results of a study of etched-wiring board processing, conducted by R. W. Hudson of the Components Section and E. B. Murphy of Group 71, indicate that removal of the resistcoating on the boards should not be performed after etching but be delayed until just before the boards are to be fabricated.

It is requested that persons originating component test requests for this office make use of the Lincoln Laboratory Work Order Form, since it is nicely adapted to our internal procedure. All three copies should be forwarded; one will be returned after assignment of a job number.

Lab D-C Power

(R. Jahn) (UNCLASSIFIED)

D-c power distribution is complete except for three areas where it is not urgently required. The shortage of circuit breakers makes it necessary to substitute fuse boxes temporarily in these locations.

A memo on lab power is in preparation.

Regulated supplies now power all d-c lines. Voltages have been set with an accurate voltmeter, and they are checked each morning. If your Simpson meter reads  $\pm 10\%$  or normal voltage for a line, don't believe it. The probability is that the line is within  $1\%$  of rated voltage.



3.4 Test EquipmentTest Equipment Committee

(L. Sutro) (UNCLASSIFIED)

The Committee has approved transfer of the following Burroughs test equipment from Group 24 to Test Equipment Headquarters for distribution within Division 6. The equipment is at present provided with Cannon connectors and is intended to operate on Burroughs voltages which include +105 volts and -400 volts. Since there is a possibility of using these units together, they will not be modified to WW standards at present.

Multivibrator Pulse Gen.	1
Gas Tube Pulse Gen.	1
Flip-Flop	104
Gate-Tube Panel	53
Gate and Delayed Pulse Gen.	6
Delay-Line Panel	10
Pulse Gater	8
Rack Power Control Type 7203A	24
Relay racks for the above units	15
Power Supply Type 9001A	1

The Committee has approved purchase or construction of the following test equipment:

<u>Qty.</u>	<u>Unit</u>	<u>Manufacturer</u>	<u>Model</u>
2	Megacycle Meter	Measurements Corp.	59
1	Speedomax X-Y Recorder	Leeds & Northrup	69950-N3-Q1-425
2	Vacuum-Tube Voltmeter	Measurements Corp.	62
2	Electrostatic Voltmeter 0-15 KV	Rawson	518
2	Electrostatic Voltmeter 0-15 KV	Rawson	518
2	Multirange Milliammeter 0.5, 5, 50, 500-ma	Rawson	501
5	Regulated High-Voltage Supply	Northeast Scientific Co.	Modified RE-2002
1	DC Millivolt Meter	Millivac Inst. Co.	MV-17C
4	Volt-Ohm-Milliammeter	Simpson	262
20	Flip-Flop Mod II, MTC		

Test Equipment Headquarters

(L. Sutro and A. Bille) (UNCLASSIFIED)

The amount of repair required of both oscilloscopes and standard test equipment since the move to Lexington has been unusual. The reason may be damage caused by the move, or it may be the higher line

### 3.4 Test Equipment (Continued)

(L. Sutro, A. Bille) (UNCLASSIFIED) (Continued)

voltage here. Whereas in Cambridge 105 volts was common, here the no-load voltage has been as much as 20 volts higher. R. Jahn recorded the line voltage in Test Equipment Headquarters for 24 hours from 26 July to 27 July and found the voltage to vary between 122 and 126 volts. He is arranging to have the voltage lowered.

During the week of 28 June all of the 139 units of standard test equipment in MTC were tested. In five units tubes were replaced. In one unit a crystal was replaced.

### 3.5 Drafting

#### WWI Change Notices and Drawings

(A. M. Falcione) (UNCLASSIFIED)

In order to save engineering time and travel between Barta and Lexington, plans have been made whereby a member of the Drafting Department delivers tracings and change notices to Barta Building for signatures and approvals. This delivery is made every Wednesday morning at 9:30 a.m. Any engineers at Barta Building who have new drawings to be made and desire to submit this information to Drafting can deliver it to the Drafting representative at Barta on Wednesday mornings. He is available in Room 250 from 9:30 to 12:00 a.m.

#### Multilith Masters (Preprinted Form Type)

(A. M. Falcione) (UNCLASSIFIED)

All secretaries should take note that Lincoln Laboratory will stock in their Stock Room the multilith master which we have been using for some time, namely, the preprinted format type which has guide lines for left- and right-hand pages. An order has recently been placed, and the masters should be available in the Lincoln Stock Room by 20 August. Our present supply in the Division 6 Stock Room should be adequate until then.

#### Document Room Expansion

(A. M. Falcione) (UNCLASSIFIED)

At the present time, the area and facilities of the Document Room are quite crowded, and the efficiency of the group is seriously handicapped because of the crowded conditions. Additional space requirements should be seriously considered for the Division 6 Document Room, in order that we may be able to absorb the increased demands such as the

3.5 Drafting (Continued)

(A. M. Falcione) (UNCLASSIFIED) (Continued)

handling of all documents for the PCO Office (Production Co-ordination Office) together with the IBM classified documents which are now being handled by A. P. Kromer's office and which he desires to transfer to our Document Room.

3.6 Administration and Personnel

New Staff

(J. C. Proctor) (UNCLASSIFIED)

Robert D. Buzzard is a new DDL Staff Member in Group 62. Until recently he was a mathematician at Wright-Patterson Air Force Base.

Frank F. Gucker is a new DDL Staff Member in Group 61. Until recently he was a logic engineer at Digital Control Systems, Inc., California.

Staff Transfer

Victor Ellins has transferred from Group 62 to Group 64.

Staff Terminations

Donald Fisher  
Carl Schultz  
Stanley Oken

New Non-Staff

(R. A. Osborne) (UNCLASSIFIED)

Jean Devereaux is a new secretary in the Memory Section of Group 62.

Dorothy Roberts is a new clerk-typist in Group 62. She will operate the teletype machine.

Arthur Weiner is a Northeastern Co-op student who will work in Group 64.

Terminated Non-Staff

(R. A. Osborne) (UNCLASSIFIED)

Alfreda Parisi

3.6 Administration and Personnel (Continued)

Transferred Non-Staff

William Carroll to Division 1, Group 12.

James Johnson to Division 4, Group 45.

Louis Johnson to Division 1, Group 12

Open Non-Staff Requisitions

1 Electrical Detailer

1 Inspector

2 Secretaries for Group 60

1 Secretary for Group 63

2 Technicians for the Construction Shop