

UNCLASSIFIED  
Division 6 - Lincoln Laboratory  
Massachusetts Institute of Technology  
Lexington 73, Massachusetts

SUBJECT: BIWEEKLY REPORT FOR SEPTEMBER 10, 1954

To: Jay W. Forrester

From: Division 6 Staff

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By: R. L. Everett  
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SECTION I - CAPE COD SYSTEM

1.1 Group 61

1.12 Data Screening

(R. L. Walquist) (CONFIDENTIAL)

The remaining two memos defining the tracking operation in the 1954 Cape Cod System (the automatic tracking memo and the monitoring memo) are close to completion; they will be issued early in the next biweekly period. Computer programming for the tracking function is from one-half to two-thirds completed. Individual program checkout is about one-third completed. It is expected that the various track-while-scan programs will be ready for integration into a single operating program by the last week in September.

Analysis of the computer-recorded data for the track-while scan function in the 1953 Cape Cod System is still being done by . . . W. Attridge and J. Levenson. Evaluation of the automatic-initiation function has been completed; a memo will be issued the first part of the next biweekly period. The results indicate that for the present radar-data quantization, a five-scan initiation period is not sufficient to distinguish aircraft tracks from radar noise. The results also indicate that the initiation program spends over 90% of its time on clutter returns.

(W. S. Attridge) (CONFIDENTIAL)

Preparation for the training program starting next week has occupied most of my time during the past two weeks.

1.12 Data Screening (Continued)

(W.S. Attridge) (CONFIDENTIAL) (Continued)

Specifications for the TWS illuminated labels have been checked with G. Rawling.

Specifications for the TWS evaluator actions have been frozen.

(D.L. Bailey, H. Seward) (CONFIDENTIAL)

The track-sort program and the correlation program (Tracking I and Tracking II) have been coded and have successfully passed initial testing on the computer.

The smoothing and prediction program (Tracking III) is in the coding stage (about 30% complete) and coding will be completed within the next biweekly period.

(H. Frachtman, H. Peterson) (CONFIDENTIAL)

We continued work on programming the monitor section of TWS and spent three days revising the memorandum for TWS.

(J. Levenson) (CONFIDENTIAL)

Data analyses are still being carried out for tracking in the 1953 Cape Cod System. The results of a study of automatic initiation have been written up and will be issued soon.

(S. Manber) (CONFIDENTIAL)

The program to test the activate and insertion switches has been completed and will be checked out next week. Gap-filler data recorded during an ECM test in August was processed for Bell Labs. Both single and four successive scans were printed out.

(E.W. Wolf) (CONFIDENTIAL)

The data-collection section of the radar-data input program is now operational. Work on the coding of the remainder of the program is continuing.

M-2498, Supplement 1, "Storage of Programs on Magnetic Tape" and M-2922, "Radar Data Input Program, 1954 Cape Cod System" have been issued. Two lectures on the data-input system were given in connection with the training program for new staff and Air Force personnel.

1.13 Tracking and Control

(W. Lone) (CONFIDENTIAL)

Some sections of the Group 61 Quarterly Progress Report have been rewritten.

I attended a meeting at IBM on 7 Sept. to discuss the status of the XD-1 utility programs. Ideas were exchanged regarding the features of the XD-1 assembly program to be written by IBM. M-3024, which describes the status of the XD-1 utility programs, has been issued.

1.14 Weapons Direction (CONFIDENTIAL)

(H. D. Benington, O. T. Conant, F. F. Gucker, I. B. Hazel)  
(CONFIDENTIAL)

The master makeup and display (MMD) is proceeding according to schedule.

Most subprograms which will be required by the digital-display program have been written. The over-all program has been organized, including the functions performed for the tracking program. F. Gucker is responsible for this work.

The height, antiaircraft, and identification portions of MMD are planned, and flow diagramming is under way. All program communications and MMD responsibilities have been settled with the respective programming groups for height, AA, and identification. The cycle program has been designed, and its communications with other sections of MMD have been decided. O. Conant is responsible for this work.

The situation-display and alarm program has been flow-diagrammed, and programming is under way. A complete program will be written for non-interceptor and non-hostile tracks so that subprograms within the program can be tested and so that character size can be set. I. Hazel is responsible for this work.

The intercept-direction and weapons-direction responsibilities for MMD are almost decided. This work is proceeding parallel to the development of the interception program. H. Benington is responsible for this work.

(J. J. Cahill, Jr.) (CONFIDENTIAL)

The second raid-size estimation test with B-47 targets was performed on 10 September. Results were consistent with those of the first such test.

Work on the proposals for integrating AAA with AN/FSQ-7 has progressed to the point where other interests in Lincoln Lab can now be consulted.

The 1954 CCS AAA program has been checked out, as far as operation with paper-tape parameters is concerned. Further testing will be postponed until the program can be operated with MMD.

(A. R. Chandler) (CONFIDENTIAL)

All programs for the checkout of equipment in Room 222 have been revised for the 1954 CCS. They are all on paper tapes. It is expected that the entire checkout will be run the night of 10 September for the purpose of trouble-shooting those programs which have not previously been run and in order to test the equipment.

1.14 Weapons Direction (Continued) (CONFIDENTIAL)

(A. R. Chandler) (Continued) (CONFIDENTIAL)

The only programs incomplete at this writing are the calibration and light-gun test (see the Group 61 Biweekly for 27 August) and the insertion-switch test, which is complete for only a few stations. These will be used 10 September in the checkout. Tests will continue on a weekly basis until the 1954 CCS is operating.

The programs to be used in 1954 are the calibration light-gun test, si display test, indicator-light test, and insertion-switch test and trouble printout.

(P. O. Cioffi) (CONFIDENTIAL)

A study has been initiated to determine the foundations of an adequate communications scheme for use in Cape Cod air-defense systems.

This and a compilation of material for inclusion in a manual for flight crews participating in Cape Cod testing have constituted the main work for the past few periods.

(A. G. Favret) (CONFIDENTIAL)

The raid-size test of 27 August 1954 (see M-3028) indicated that aircraft aspect is more important with jet aircraft than with B-29's. The results were very good and one or two more tests of this type should be adequate. A second raid-size test with B-47's was conducted on 10 September 1954.

The AA programs for the 1954 Cape Cod System were checked out successfully on 9 September. Some minor changes will still be made, and a few parameters have not been finally determined.

(C. Grandy) (CONFIDENTIAL)

M-3011, "Raid-Size Assessment Test of 12 August 1954," was prepared and issued during this period. This is a summary of the last B-29 test held in the current series of raid-size tests (see M-2869). Additional tests have been conducted with B-47 jet aircraft as reported by A. G. Favret.

Several days were taken to attend the critique of the recent air-defense exercise "Checkpoint." This critique was held at ADC Headquarters in Colorado Springs, Colorado, and was attended by a large number of Air Force personnel from Defense Force and Air Division level. A complete report on this meeting will be made in a memo to C. R. Wieser.

Work on the WD simulation program, interrupted by the trip, has been resumed, and writing of operational and programming specifications should be completed in the near future. It is planned that this program will be ready for the first checkouts of the 1954 Cape Cod WD Program within two weeks.

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1.14 Weapons Direction (Continued) (CONFIDENTIAL)

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

M-3030, "Geography Display Program Specifications," and M-3003, "Summary of Operations with Crosstell, Early Warning, and GOC in the 1953 CCS," were completed. The 2-hour lectures on identification were given to the indoctrination group. These contained mostly material on the 1954 CCS.

It is expected that by the end of the next biweekly period checkouts will have begun on the five identification programs which are being written for the 1954 CCS. These include the geography display, the expanded display, the air-movements data, the air-movements processing, and the extrapolation programs.

(W. Lemnios and L. J. Murray) (CONFIDENTIAL)

The past biweekly period was spent preparing the flow diagram for the 1954 Cape Cod System intercept calculations. The flow diagram is now substantially complete, and programming will begin during the next biweekly period.

(C. A. Zraket) (CONFIDENTIAL)

Programming for the 1954 Cape Cod System is continuing with hopes of a completion date in 4 weeks. All operational and programming specifications for the system have been written as notes in the M-2706 series and are now being or have been, issued. Planning for the operational phase of the 1954 Cape Cod System will commence during the next biweekly period. The latter will include training, equipment-checkout procedures, operational procedures, computer operation, etc.

1.15 Center Operations (CONFIDENTIAL)

(Walter Vecchia) (CONFIDENTIAL)

TOTAL ASSIGNED TIME  
1/2 HR EXTRA FROM MATH GROUP

53.5 Hr  
5  
54

	Hr	Min
Data Screening	24	20
Weapons Direction	8	40
Equipment Check (Rm. 222)	6	
	39	
Data Trouble (Rm. 224)	2	
Unassigned Time	1	
Hurricane Danger (Power Shutdown)	2	
	5	
Time Given Systems	4	30
Time Given Math Group	4	30
Time Lost to Computer (Malfunction)	1	
	10	0

Memorandum M-3036

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1.16 AN/FSQ-7 (XD-1) Support (CONFIDENTIAL)

(C. Grandy) (CONFIDENTIAL)

Considerable time has been spent correlating the FSQ-7 Direction Center equipment allocation with the Production Control Office. M-3012, "Allocation of Consoles to Operational Areas of the AN/FSQ-7 Direction Centers," has been written in conjunction with D. R. Israel. This allocation has been reconciled with floor plans being prepared by the PCO and with other equipment allocations prepared by that office.

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1.2 Group 64

(S. H. Dodd) (CONFIDENTIAL)

During the past biweekly period computer operators estimated that 98 per cent of their assigned time was usable. Most of the lost time was the result of improper fusing in some newly-installed power wiring and a faulty head on one magnetic-tape unit.

The principal effort of the Systems-Engineering Section is now directed toward studies of system reliability and improvement of the maintenance and checking procedures. For the 1954 Cape Cod System some installation work still remains on the SDV demodulators, the FGD, MITE, the radar mappers, and the output coder.

1.21 WWI System Operation

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

Computer reliability was excellent during this period. The majority of the down time was caused by the undersized fusing of the new power wiring for the output coder and a faulty head for magnetic-tape unit 3B.

The magnetic-tape-printout control equipment will be moved to E row on Saturday, 18 September.

A new test-storage input program will be set up in toggle-switch storage on Monday, 27 September. Flip-Flop Registers 4, 5, and 6 will be moved to new test-storage addresses. Any programs using these flip-flops should be corrected prior to this date.

Test Program

(D. A. Morrison) (UNCLASSIFIED)

M-2882, "WWI Voltage Interlock panel," has been released.

The consolidated test program, T3432, is now in a separate folder in WWI test control. PMC programs are also in a properly marked folder.

A memo concerning the consolidated test program will be released during the next biweekly period.

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1.21 WVI System Operation (Continued)Marginal Checking

(T. J. Sandy) (UNCLASSIFIED)

The program for marginal-checking the intervention registers has been completed and works fairly well. The program automatically takes the margins on each digit and prints out these margins. This data has been very helpful in determining low back-resistance crystals on the intervention-register panels.

1.22 Terminal EquipmentInput Records

(N. N. Alperin) (UNCLASSIFIED)

During the last biweekly period H. J. Kirshner transferred to me all records concerning data inputs and telephone lines for the Cape Cod System. I am now in the process of familiarizing myself with this information. I hope to be able to get all equipment and cabling in Rm. 224 standardized so that a routine for operation and maintenance can be set up.

Data Inputs

(N. N. Alperin) (UNCLASSIFIED)

On Thursday, 9 September, Ed Rich and I attended a meeting with the people in Group 22 responsible for site operation. We discussed criteria for setting signal levels at the sites. Ideally we would like to eliminate all "knob twisting" at both ends of the line. However, since this seems quite remote, we will try to minimize the changes in pot settings at either end. As a first step we agreed on a new procedure for setting up at the sites which will assure that the levels at all sites will be the same. In this way we will be able to determine if we can tolerate differences in phone-line characteristics and day-to-day changes in these characteristics. Some inconveniences might be experienced since we at the receiving end will, for the period of this test, have to make the best of what we get.

Raydist

(N. N. Alperin) (UNCLASSIFIED)

Decoupling has been added to the timing-mark receivers for Lexington to offset the noisy power supplies in the display room in Bldg. B.



1.22 Terminal Equipment (Continued)Buffer Drums

(L. D. Healy) (UNCLASSIFIED)

Buffer-Drum Group 3 is now in operation. Buffer-Drum Group 2 will operate but has a margin 25% lower than the other groups.

Buffer-Drum Groups 0 and 1 are now operating with MITE's 4, 5, 6, 7, 14, 15, and 17.

Data Link

(R. B. Paddock) (UNCLASSIFIED)

All rack interpanel wiring in E2 and E3 is complete. Wiring schedules and video-cable orders have been placed, and the work has been done for the most part. Much of the testing has been done on the phone-line-modulator panel, and its output waveform is nearly good enough for present use with the output coder. Further testing is in progress.

CRT Filters

(A. V. Shortell) (UNCLASSIFIED)

The problem of intensification during retrace has been investigated and is being corrected. For the GF scopes the problem can be corrected by integrating the gate that triggers the sweep generator, thereby delaying the start of the sweep so that the last strobe pulse intensifies the scope before the retrace starts. In the CR case there are two causes of intensification during retrace, one due to the last strobe pulse as in the G.F. case, the other due to the reference pulse being intensified on all three data lines at 200-usec intervals. The reference pulse on the latest timing line causes no trouble since the sweep is triggered on sync reference. Use of the sync reference pulse to clear the storage FF's in the other two data lines prevents the reference pulse from getting through these lines to intensify the scope.

At a meeting with E. Rich, N. Alperin, and A. Werlin, means for testing the data-input equipment were discussed. It was decided to break the tests down into four categories. Two of these concern the CRT filters directly. One is a test of the azimuth drive and scan sync functions of the scope. The other will test phototube and intensification circuits. I plan to start working soon on a scheme for testing the drive functions. It appears that this can be tested fairly easily with a computer-generated test signal similar to the signal used for testing the IBM mapper and a pulse generated by the cam-operated switch on the scope.

At present we have eight filters installed. Of these eight sites three are unoperative. The remainder (1 LR and 4 GF) are being kept on an operational basis for the use of Group 61.

1.22 Terminal Equipment (Continued)

FGD MITE

(A. M. Werlin) (UNCLASSIFIED)

Testing of the fine-grain-data MITE is progressing satisfactorily; it appears to be operating correctly with test-equipment simulated data input. Pulse-amplitude and timing measurements are being taken, and thus far they all look satisfactory. It is planned to have a program written for computer checking of this MITE. The second FGD MITE is under construction and should be ready in about 3 weeks.

Progress is being made in the writing of the MITE section of the Technician's Manual.

Mods have been written to eliminate critical timing of the large MITE timing channel and to eliminate scope intensification during retrace of the video filters.

Magnetic Drums

(H. L. Ziegler) (UNCLASSIFIED)

The drum-monitoring-system writeup has been completed and is to be included in the Technician's Manual for the drums. A similar writeup of erasing methods is being prepared for this same manual.

Wiring of the new test rack is nearly complete, and most of it has been checked out. This rack should be ready for use early in the coming week.

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 27 August - 9 September 1954:

Number of assigned hours	124
Usable percentage of assigned time	98
Usable percentage of assigned time since March 1951	88
Usable percentage of assigned time since September 1953	92
Number of transient errors	4
Number of steady-state errors	2
Number of intermittent errors	0

1.23 Records of Operation (Continued)Component Failures in WWI

(L. O. Leighton) (UNCLASSIFIED)

The following failures of electrical components have been reported since August 27, 1954:

<u>Components</u>	<u>No. of Failures</u>	<u>Hours of Operation</u>	<u>Reasons for Failure</u>
<u>Crystals</u>			
1N92	1	3000 - 4000	Drift
1N34A	1	7000 - 8000	Low back resistance
<u>Resistors</u>			
9000 + 1% carbon-deposited	1	0 - 1000	Above tolerance
<u>Tubes</u>			
5963	1	4000 - 5000	Short
	3	9000 - 10000	Low $I_b$
5881	1	0 - 1000	Short
2D21	2	1000 - 2000	High firing point
	1	2000 - 3000	High firing point
	3	3000 - 4000	High tube drop
	1	13000 - 14000	High firing point
C16J	1	4000 - 5000	Intermittent Conduction
6Y6G	1	11000 - 12000	Short
	1	12000 - 13000	Short
6SN7	2	26000 - 27000	1 open heater; 1 short
	2	27000 - 28000	1 short; 1 low $I_b$
6145	1	0 - 1000	Leakage
	1	1000 - 2000	Leakage
	1	2000 - 3000	Short
	1	3000 - 4000	Leakage
	4	5000 - 6000	4 short
	1	6000 - 7000	Leakage
	1	8000 - 9000	Leakage
	1	9000 - 10000	Short

1.23 Records of Operation (Continued)Component Failures in WWI (Continued)

(L. O. Leighton) (UNCLASSIFIED)

<u>Components</u>	<u>No. of Failures</u>	<u>Hours of Operation</u>	<u>Reasons for Failure</u>
<u>Tubes</u>			
5670	1	13000 - 14000	Short
5687	1	16000 - 17000	Low $I_b$
7AD7	7	25000 - 26000	5 low $I_b$ ; 2 short
	15	26000 - 27000	15 low $I_b$
	7	27000 - 28000	7 low $I_b$

1.25 AN/FSQ-7AN/FSQ-7 Schedules

(T. R. Parkins) (UNCLASSIFIED)

In the past 2 weeks, two new schedules have been issued and posted:

XD-1 Installation and Building F Construction  
Central Display Frames

IBM has issued the final draft of the New Year's Eve Projection (equipment-delivery schedule) which should be posted and distributed at MIT during the week of 13 September.

The Project High progress report for August will also be distributed here during the week of 13 September.

During the past two weeks I attended a display-system progress meeting at Lexington and a production co-ordination meeting at Plant 2, Poughkeepsie. A full report of these meetings has been issued to personnel concerned.

1.3 Group 651.31 Activities of Group 65

(P. Youtz) (UNCLASSIFIED)

Several 19-inch Charactron tubes were constructed at MIT this period. One tube had the optimum electron optical system with the new small matrix. This tube was sent to Lexington for evaluation with MTC. The remaining tubes will be put on the life-test rack at the Barta Building. A preproduction tube was also received for Convair evaluation. After tests have been completed on this tube, it will be put on life test at Barta.

Work continued on making and evaluating an optimum aluminized P7 screen for the Charactron. J. A. Klein, P. C. Tandy, and A. Zacharias continued their assignment of building a test setup for evaluating these aluminized phosphor screens.

A trip was scheduled to the west coast for the monthly meeting with Convair and Hughes Aircraft. H. Beatty of the IBM High Street Tube Group will also make the trip.

1.33 Research and Development

(S. Twicken) (UNCLASSIFIED)

In conjunction with the IBM Tube Group a trip was made to the Evans Signal Labs to discuss possible means of marginal-checking a thyatron. We also discussed what test conditions most readily indicate a deteriorating tube. A suggested means of marginal-checking some of the 2D21 pulse generators in XD-1 has been the voltage across a resistor between shield and cathode. Some tests here have indicated that this may not be so. Apparently a much higher current level during the pulse may be necessary to differentiate between good and failing tubes. This will be investigated. Another matter to be looked into is whether the rate of rise of cathode current is indicative of the state of the thyatron.

Fifty 5844's were tested as our portion of the JETEC round-robin evaluation of the design of our intermittents detector.

(A. Zacharias) (UNCLASSIFIED)

Design was begun and completed on an SR-1782A life rack; the drawings are now in Production Control. The rack will be for 90 tubes, 45 of which may be operated in two separate conditions, and the remaining 45 in two other separate conditions. In each of these sections 15 tubes operate under identical conditions. The four major operating conditions are concerned with G3, namely  $E_{c3}$  at: - 15 volts, 0 volts,

1.33 Research and Development (Continued)

(A. Zacharias) (UNCLASSIFIED) (Continued)

+ 10 volts,  $E_b$  (for tetrode operation). Provision is made for operating  $G_1$  of any tube as may be desired, either pulse or d-c.

Some work was done with Frank Caswell on aluminizing. The main problem here is keeping aluminum on the tungsten heater. Normally aluminum and tungsten amalgamate when aluminum is fluid. This action holds the fluid aluminum onto the tungsten heater. However, the heaters being presently used are stranded and hot-wound, then cleaned electrolytically; but the  $WO_2$  formed between the strands cannot be removed since that area will pass no current to the electrolyte. Hence, the oxide remains between strands and the aluminum cannot wet the surface until it can creep under the oxide and lift it from the tungsten surface. This does not occur before the aluminum drops from the heater. The heaters were then additionally cleaned in  $NH_4F-HF$  dissolved in conc.  $HNO_3$ . This reduces the size of the strands and dissolves the  $WO_2$  between strands. A heater so cleaned held aluminum in sufficient quantity to evaporate. Further attempts at evaporation with a tungsten cap as the heater are to be tried.

(P. C. Tandy) (UNCLASSIFIED)

One 19-inch Charactron has completed 65 hours on life test without apparent cathode deterioration. About 11 to 12% of the cathode current reaches the matrix. One other 19-inch tube will be put on life test today.

Equipment for measuring initial excitation of phosphor is complete. The low light level of the long persistence presents a problem. A 10-stage photomultiplier will have to be used for this measurement.

(T. F. Clough) (UNCLASSIFIED)

Together with representatives of the IBM Tube Group Saul Twicken and I attended a technical discussion at Raytheon in Newton. We discussed the various aspects of the possibility of Raytheon serving as a second source for an improved pentode of the 7AK7 type. After a review of characteristics, material and construction, processing procedures, and philosophy, an inspection was made of the special-tube plant where such a tube could be made.

SECTION II - AN/FSQ-7

2.1 Group 62

2.11 System Evaluation Committee

(P. R. Bagley) (UNCLASSIFIED)

A new member of the Laboratory, James P. May, has joined the System Evaluation Committee on a full-time basis, bringing the total membership of the committee to ten.

Because of the critical shortage of trained staff members in the Systems Office, the activities of the Committee have been largely redirected toward solving pressing problems relating to the design and construction of FSQ-7. Here is a brief summary (by task number) of the new tasks assumed by the Committee this biweekly period:

13. The Direction Center has no means of knowing, other than by voice messages, what areas are being mapped out at the heavy-radar sites. Determine if it is desirable to transmit this information by automatic or semiautomatic means; if so, what equipment would be necessary. (Assigned to Platt and Hughes.)
14. Confirm the structure of the messages to and from the height-finder sites, as outlined in memo PLJ-816 by Paul Sebring. Make sure that it is compatible with the present equipment design. (Feldstein.)
15. In view of the recent addition of Digital Display scopes to the Sector Command Post, find out if the total number of drum registers required for generating the digital display exceeds the 2048 presently available. (Buzzard and Bagley.)
16. Propose designs for a special display system for use with a xerographic projector. (Mayer.)
17. Evolve a general notion of the types of test programs to be used with the display system, with the objective of suggesting what facilities should be provided on a display test console. (Farley.)
18. Determine if the output frame as presently designed would be compatible with the BTL discrete-address data link if it were to be used. If it would not be compatible, propose a logical design of the necessary changes. (Bagley.)
- 19, 20, 21, 22. Review IIM's test programs TSRMEN-03, ITS-JF-01, ITS-JF-02, and ITS-JF-03. Submit to the originators (IIM's Diagnostic Programming Group) a letter of comments on each program. (May.)

2.11 System Evaluation Committee (Continued)

(P. R. Bagley) (UNCLASSIFIED) (Continued)

At the request of IBM's Diagnostic Programming Group, members of the Committee will undertake to review and comment upon whatever test programs IBM submits. Although definite arrangements have not been made, the IBM publications group will probably submit the IBM PM-series manuals for the Committee's comments.

A report on Task 11 was published as M-3022, "Programmed Rejection of Radar Data From Arbitrary Areas," by P. R. Bagley.

2.12 Magnetic Core Memory

Memory Test Setup VI

(E. A. Guditz) (UNCLASSIFIED)

During the last two-week period, MTS VI has been used exclusively for gathering data on sense-winding problems.

Printed Wiring

(E. A. Guditz) (UNCLASSIFIED)

Several experiments have been performed on dip-soldering connections for the modular memory plane. These have all been successful.

Contact has been made with two commercial firms which use techniques that could be very helpful in making a completely printed memory plane. One firm does very fine "inlaid" wiring, the other performs a type of "photochemical" machining of glass to very close tolerances.

New Memories

(J. Raffel) (UNCLASSIFIED)

A study is being made of the possibility of using combinations of various types of core memory in a computer to obtain greater efficiency. Equipment estimates as well as rough block diagrams are being considered.

A cathode count of 3000 and a cycle time of five  $\mu$ seconds appears a challenging goal for the 256 x 256 33-digit memory which is now being considered.



2.12 Magnetic Core Memory (Continued)

XD1 Memory

(J. L. Mitchell) (UNCLASSIFIED)

IBM has connected the old shower stall to the memory modules and is now starting to test the memory frame as a unit. The assembly of the actual XD-1 shower stall has been started and seems to be progressing at a satisfactory rate.

64 x 64 Memory-Plane Outputs

(J. L. Mitchell) (UNCLASSIFIED)

Experiments run on Memory Test Setup VI with half the cores on the selected line in the "read disturbed" state and the other half in the "write disturbed" state indicate the memory should operate satisfactorily under these conditions. The operating margins when the strobe time is at the optimum point are still adequate.

2.13 Vacuum-Tube Circuits

Pulse Lines for FSQ-7

(R. L. Best) (UNCLASSIFIED)

In a meeting at High St., it was decided to make the pulse lines at a ground level instead of -15 volts. An a-c coupling circuit will restore the pulse level to -15 at the input of each gate tube or pulse amplifier. In any event, these cards have to be modified to accommodate the new land pattern. Flip-flop input transformers will be moved to ground, but the flip-flop cards have to be redone to accommodate circuit changes necessary to allow the use of the Z-2177 tube. These changes will eliminate the need for isolation boxes in pulse lines and will simplify the switching problem.

Special-Circuit Release

(R. L. Best) (UNCLASSIFIED)

Ray Nienburg and I have approved the manual-input shift-register driver.

2.13 Vacuum-Tube Circuits

Memory Driver

(D. Shansky) (UNCLASSIFIED)

A bread-board of the selection-plane driver for the 256 x 256 memory has been constructed and is now being tested. Preliminary results would seem to indicate that one cathode (5998) per x or y line per direction will be adequate. Additional evidence to support this view will be collected in the next period.

Poughkeepsie Trip

(D. Shansky) (UNCLASSIFIED)

A trip to Poughkeepsie resulted in some suggestions for modification to a magnetic-core-matrix switch driver to prevent it from oscillating.

Phone-Line Modulator

(E. B. Glover) (UNCLASSIFIED)

Because of the poor margins of the input stage the input circuitry has been redesigned. The success of this design has not been established, however, due to a nonlinearity distortion somewhere in the amplifier that has not as yet been corrected.

Typotron Intensification Circuit

(R. C. Zopatti) (UNCLASSIFIED)

I have continued testing this circuit trying to center the input grid swing that is required to have the first tube just conduct (0.05 ma) and to conduct fully (5 ma). Using external power supplies I have been able to do this. I am now trying to eliminate these power supplies using the normal supply voltages.

Probes for XDI

(R. C. Zopatti) (UNCLASSIFIED)

Since E. Anfenger left the Laboratory, I have taken over this circuit. The circuit schematic has been checked and approved.

2.14 Memory Test Computer

General

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

MTC is now operating with all instructions checked out although the marginal-checking system is still not in use.

Considerable effort is being devoted to installation and operation of the Charactron equipment.

MTC Records

(L. Sutro) (UNCLASSIFIED)

The entire component and tube history of MTC is now being coded preparatory to punching this information on IM cards. A form in which the technician making a report can code most of his information has been designed and tried. R. Biagiotti is acting as co-ordinator between MTC and WWI, trying to lead both MTC and WWI personnel to agree on the same report form.

Flexowriter Control

(E. Gates) (UNCLASSIFIED)

The new system of Flexowriter control is in operation and is functioning properly. This system does not employ any relays so that the previous trouble due to poor contacts has been eliminated. However, the contacts within the Flexowriter itself may still give trouble.

The Ferranti PETR has the new WWI amplifiers installed and is operating properly. Along with the amplifier change is a change in the circuit for coincidence of the seventh hole and feedhole which makes it less susceptible to noise.

Technician Training Course

(A. Vanderburgh, Jr.) (UNCLASSIFIED)

The starting date for the technicians' training course is 13 Sept. Classes will be held each day from 9 to 11. Room D-218 will be used unless otherwise noted on MTC Bulletin Board in the computer room. Course is limited to MTC personnel.

2.15 System Liaison

(A. P. Kromer) (UNCLASSIFIED)

Conferences relative to budgeting FY '55 public-works money for the Direction Center and Combat Center buildings and to programming FY '56 funds for maintenance services and spare parts for the prototype XD-1 and XD-2 System have been held by the Air Force Joint Progress Office.

Requirements for the actual design of the Direction Center building are to be finalized through a series of discussions scheduled for next week. After these discussions each change affecting the Direction Center building structure or utility services must be regarded as a potential source of delay for the building schedule.

SAGE Equipment

(P. J. Gray) (UNCLASSIFIED)

Memorandum M-2622-1, the revised equipment list for the SAGE system Direction Center, has been completed. It is expected that this list will be released by the Production Coordination Office on 10. Sept.

A very preliminary draft of the equipment list for the SAGE Combat Center has been written and distributed for comment. Quantities of consoles, DID units, etc., are only guesses, since the operational concept of the Combat Center has not yet been completely defined. The purpose of this list is to allow IBM to consider the effect of eliminated equipment and reduced quantities on frames which could be supplied without all the electronics to be supplied in corresponding frames in the Direction Center. It is expected that an equipment list for the Combat Center will be released by the PCO in late September.

Work is continuing on definition of functional responsibilities of the various organizations concerned with construction and installation of the SAGE system. Two meetings have been held in New York for preliminary work. First-draft charts will be prepared for distribution for comment within the next two weeks.

Technical Information Releases

(P. Bragar) (UNCLASSIFIED)

The following Technical Information Releases have been made during the past two weeks:

TIR 1-15 M-2925-1, "Physical Characteristics of AN/FSQ-7 D.C. Equipment";

2.15 System Liaison (Continued)

Technical Information Releases

(P. Bragar) (UNCLASSIFIED) (Continued)

- TIR 1-16 M-2814-3, "XD-1 Specifications Listing";
- TIR 1-17 M-2848-1, "Proposal for Communication Between AN/FSQ-7 and F-99 Bases";
- TIR 1-18 Div 2 Group Report 20-1, "SAGE Equipment at Long-Range Radar Sites";
- TIR 1-19 Div 2 Group Report 20-2, "Pre-SAGE Equipment at Long-Range Radar Sites";
- TIR 1-20 M-2622-1, "Equipment List of AN/FSQ-7 Equipment in SAGE System D.C."

The PCO is now issuing a Weekly Status Report listing TIR's issued during preceding week, and documents to be released together with release target dates and current status. Future weekly status reports will list meetings to be held during the following week.

Direction Center Design

(W. H. Ayer) (UNCLASSIFIED)

The past period has been spent developing requirements and plans for the sub-sector command post in the Direction Center building; resolving building problems with Western Electric, (ADES); preparing preliminary requirements for Combat Center facilities, arranging Francis Assoc. -- Burns & Row contacts for cooling-equipment design details; and resolving lighting problems in the Direction Center buildings.

2.16 Display

(J. Woolf, C. Corderman) (UNCLASSIFIED)

The decoders and line drivers for electrostatic compensation and position were debugged and installed in MTC. The simulated console was installed in MTC with the following circuits being checked: the intensification circuits console attenuator network, magnetic amplifier, and all high-voltage circuitry. The selection and position decoders were also checked with their line drivers. The vector generator has some problems which shows up as a change in length of vector with a change in quadrant. However, this is a function of the decoder ladder and with modification will perform as desired. The digital expansion has to be debugged, and then the system will be available for simulated programs.

2.16 Display (Continued)

(R. Gerhardt) (UNCLASSIFIED)

The characters used with the display of radar data in XD-1 will be derived from the radar category. The y addresses of the radar characters are the same. Hence, the y address is set in the character selection register by a gate tube controlled by the radar-data level. Each flip-flop of the x-axis portion of the character selection register is set by a gate tube. The gating level is from an eight-way "OR" circuit. Each "OR" circuit is independent so that all eight radar categories may use the same character if the need arises. It should be emphasized that it is not possible to use a focused point with radar-data displays.

Much of the past biweekly period has been spent checking card assemblies and pluggable-unit wiring diagrams drawn by the Drafting Room. The load placed on the Drafting Room has been very great and is not expected to lighten very soon. The quality of the work is very good although the pressure has been great.

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

The drawings for the 2-3 bit or 1-6 bit decoder for XD-1 are in Drafting. They will be checked and then sent to the shop for assembly. The line driver is in a similar condition. This includes the preamplifier and regulator in one package and the output stage in two.

2.2 Group 63 (Magnetic Materials)2.21 Magnetic CoresEvaluation of MgO-Fe<sub>2</sub>O<sub>3</sub>-MnO System

(J. B. Goodenough) (UNCLASSIFIED)

On the basis of current ideas about the conditions for obtaining B-H loop squareness, about the chemistry of the final product, and about magnetic-exchange mechanisms, qualitative predictions are being made for the expected squareness ratios, inductions, and Curie points over an as-blended compositional diagram after various firing treatments. So far the squareness-ratio and induction predictions have been completed and are found to be in satisfactory agreement with the experimental data thus far accumulated on the MgO-Fe<sub>2</sub>O<sub>3</sub>-MnO system. One relation of possible significance is the estimate that a criterion for loop squareness is

$$B_s < 200 H_c(\sigma_w) / (\cos \theta_1 - \cos \theta_2)^2$$

where  $B_s$  is the saturation induction,  $H_c(\sigma_w)$  is the contribution to the coercive force from the surface-energy of the domain walls, and  $\theta_1, \theta_2$  are the largest angles the respective magnetization vectors in any two neighboring grains make with the normal to their common boundary. In grain-oriented materials  $B_s$  may be as large as in metals, but in non-oriented materials, such as is apparently the case for the ferrites, the requirement is  $B_s < 4000 H_c(\sigma_w)$ . Such a condition for loop squareness may limit the  $B_s/H_c$  ratio which can be attained in a non-oriented, square-looped ferrite.

The Alignment of Magnetic Domains in Polycrystalline Ferrites

(P. K. Baltzer) (UNCLASSIFIED)

The square B-H loops obtainable in ferrites may be due to a grain-to-grain alignment of the directions of magnetization throughout these polycrystalline materials. The basic elements of a possible alignment mechanism have been advanced; if the magnetoelastic energy due to magnetostriction effects is great enough, relative to the energy of the crystalline anisotropy, a grain-to-grain alignment would be obtained. The alignment and alignment mechanism in ferrites possessing square B-H loops will be investigated in a Master's thesis this fall term. A thesis proposal, M-3035, "The Alignment of Magnetic Domains in Polycrystalline Ferrites" has been written. The grain-to-grain alignment of the directions of magnetic moment will be determined from magnetostrictive measurements on polycrystalline samples. The theory concerning the alignment mechanism will be developed and then evaluated by correlation of single-crystal and polycrystalline measurements.

2.2 Group 63 (continued)

2.21 Magnetic Cores (continued)

Resistivity Experiment

(N. Menyuk) (UNCLASSIFIED)

The vacuum system for resistivity measurements at low temperatures has been reassembled but has not yet been checked for possible leakage. The metal-wire-to-glass seals still must be completed before resistivity measurements can be resumed.

The sample holder for resistivity measurements at high temperature has been completed, and a furnace housing is now under construction.

Pulse Response of Ferrite Memory Cores

(J. D. Childress) (UNCLASSIFIED)

Work has been resumed on the study of the effects of current-pulse rise time and pulse duration on the pulse response of ferrite memory cores. A series of tests were made earlier with rise times of 0.2 and 0.5 microsecond. A new series is being made with longer rise times.

Automatic Core Tester

(R. Pacl) (UNCLASSIFIED)

The new two-band selector mechanism is being completed in the machine shop.

Metallographic Examinations

(F. S. Maddocks) (UNCLASSIFIED)

Two complete metallographic examinations of all DCL experimental ferrite compositions in the  $MnO-MgO-Fe_2O_3$  system have been undertaken in order to plot accurately the areas of second-phase precipitation. The first series will be an examination of ferrites fired identically. The second series will be an attempt to find firing conditions necessary to give the same grain size for all compositions. The data will be used for grain-size-dependent calculations and to ascertain the importance of the grain-size variable.



2.2 Group 63 (continued)

2.21 Magnetic Cores (continued)

X-Ray Diffraction

(F. E. Vinal) (UNCLASSIFIED)

In anticipation of the purchase of diffraction equipment, the floor plans of the chemical-laboratory section have been revised to accommodate the equipment. The required rearrangements may now proceed simultaneously with equipment procurement.

Chemical Analyses of Ferrite Cores

(E. Keith, P. Reimers) (UNCLASSIFIED)

Many of the more widely used reagents for chemical analyses were prepared, including standard solutions.

The analysis of ferrite batches DCL-2-418 and DCL-2-720 was undertaken. Both batches are manganese-magnesium ferrites. The percentage of binder still in the final product is also being determined.

(D. Wickham) (UNCLASSIFIED)

An improved procedure for the analysis of manganese-magnesium mixed ferrites is being developed. It will be possible, with this new procedure, to determine magnesium and manganese in the same sample. Also, the time required for a complete analysis will be shortened.

Memory-Core Production

(J. Sacco) (UNCLASSIFIED)

The optimum firing conditions have been determined for memory-core batch DCL-2-720, and several hundred acceptable F-395 cores have been produced.

Electrical measurements taken on these cores and compared to typical General Ceramics lots show that the DCL cores have the same switching time and half-selected outputs while the peak GNE outputs are approximately 50% greater than those of the General Ceramics cores.

More than 100,000 green cores from this batch are on hand; at the present time, a duplicate firing is under way. Future plans call for several more small lot firings before a large-scale production run is attempted.

2.2 Group 63 (continued)

2.21 Magnetic Cores (continued)

Memory Core Evaluation

(P. A. Fergus) (UNCLASSIFIED)

The following series of cores was received and evaluated by the routine B-H loop test and pulse test:

DCL-5-15A through DCL-5-26A	DCL-5-1C-1 through DCL-5-11C-1
DCL-5-15A-1 " DCL-5-26A-1	DCL-5-15 " DCL-5-26
DCL-5-15B " DCL-5-26B	DCL-5-15-1 " DCL-5-26-1
DCL-5-15B-1 " DCL-5-26B-1	DCL-2-615 " DCL-2-627
DCL-5-15C " DCL-5-26C	DCL-2-615-1 " DCL-2-627-1
DCL-5-15C-1 " DCL-5-26C-1	DCL-2-615A " DCL-2-627A
DCL-5-1C " DCL-5-11C	DCL-2-615B " DCL-2-627B
	DCL-2-615C " DCL-2-627C

Lot 5-DCL-2-720H2C-1, a lot of F-395 cores, was tested for B-H loop properties and for pulse characteristics. Results indicated excellent properties definitely meeting specifications.

DCL Memory Cores

(J. Schallerer) (UNCLASSIFIED)

DCL-2-720H2C-1 passes the memory-core specifications in every way. The peak  $uV_1$  outputs are about 30% higher, while the peak half selects remained about the same or slightly less than the values for General Ceramic's cores.

DCL Experimental Core

(J. Schallerer) (UNCLASSIFIED)

DCL-5-19A-1 is another interesting core turned out by Group 63's Ceramics Lab. This core switches in about 0.5 microsecond with 1 ampere turn driving force in the F-262 die size. In a memory-core size, this core would switch in the same time with about a 250-milliampere drive. The core is not suitable for coincident-current applications but might be applied in gate and register-drive type circuits. The Curie temperature of this body is only 75 C, and it is likely to be temperature sensitive in operation.

Automatic Core Tester

(E. J. Stevens) (UNCLASSIFIED)

Work on the automatic core tester has been completed as far as possible. We are now awaiting the control panel which should complete the tester logic.

2.2 Group 63 (continued)

2.21 Magnetic Cores (continued)

Detailed wiring and logic diagrams are being drawn and will be completed by Wednesday, 15 September, my scheduled date of termination.

Since this will be my last biweekly report, I wish to state my appreciation to all members of Group 63 and of Lincoln Laboratory for the cooperation which has made my stay at MIT a pleasant and memorable one.

2.22 Transistors

Plug-In Flip-Flops

(D. J. Eckl) (UNCLASSIFIED)

Our first model of a printed high-speed transistor flip-flop is progressing satisfactorily through the shop, and we expect to be able to test the unit shortly.

These plug-in flip-flops will enable us to breadboard logical circuits using transistors with a minimum of time.

WESCON

(E. U. Cohler) (UNCLASSIFIED)

Some very interesting reports on transistor reliability were given at the convention (at Los Angeles). These seem to indicate that all the transistor types are as reliable as "reliable" vacuum tubes and the point-contact types are, if anything, more reliable than junction types. Hughes had some interesting data on the recombination velocities in silicon diffused-junction transistors which they are trying to develop.

Flip-Flop Triggering

(E. U. Cohler) (UNCLASSIFIED)

We have completed the FF triggering tests as far as we wish to carry them and are now writing a report on the subject.

Diode Tests

(E. U. Cohler) (UNCLASSIFIED)

We are engaged now in testing the properties of diodes in a circuit similar to that encountered in a single-line core shift register, especially with regard to the recovery properties. So far, it has been found that the T-5 (Transitron) has surprisingly commendable quality and uniformity in this aspect of its characteristics. The method, results, and suggestions for improvement in diodes will be forthcoming presently; it is hoped that Group 35 will be able to aid us in this last aspect of the problem.

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2.2 Group 63 (continued)

2.22 Transistors (continued)

Core Circuitry

(E. U. Cohler) (UNCLASSIFIED)

The experimental shift register which Hawley Rising had operating will be reactivated soon; we may test some of the new cores developed by the ceramics lab that promise to make ferrites feasible for core circuitry.

SECTION III - CENTRAL SERVICES

3.1 Material Requirements & Stock

(H. B. Morley) (UNCLASSIFIED)

The requisition for X-ray equipment for Group 63 has been processed and is now in the hands of the Purchasing Department.

In connection with the projected transfer of Division 6 standard stocks to Division 1, lists are being prepared giving Division 6 consumption figures; physical transfer of components will start soon.

The present system of filing requisitions and purchase-order copies is being reviewed in the light of experience to date with the idea of effecting improvements.

3.2 Construction

Production Control

(F. F. Manning) (UNCLASSIFIED)

There have been 35 Construction Requisitions totaling 292 items satisfied since 27 August 1954, and there are 28 Construction Requisitions totaling 628 items under construction by the Group 60 Electronic Shops.

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

3.3 Components and Standards

3.31 Components, (B. B. Paine) (UNCLASSIFIED)

Evaluation, approval, and release of special components for the SDV, DDR, and DDT portions of XD-1 and for the display system are nearly complete. One day each week has been spent at IBM for the past four weeks to review with IBM Components Group personnel all of the purchase specifications and drawings for electronic components to be sure that these documents are adequate for use in purchasing components for the duplex centrals. Results of inspection tests performed by IBM personnel and at vendor's plants are being summarized and digested to provide basic information for this review.

A report on the use of punched cards for computer records has been prepared by R. A. Cesari (a staff member loaned to the Components Section for the summer by the Standards Committee), and has been issued as M-3025. Multi-copy forms are now being printed for the use of WWI and MTC in reporting component failures and equipment stoppages.

3.4 Test Equipment

Test Equipment Committee

(L. Sutro) (UNCLASSIFIED)

Word has been received that a request for 10 Tektronix Type 535 scopes has been approved for purchase out of Air Force P-200 money. Four of these scopes should arrive in September or October.

The Committee has approved purchase of two DuMont Type 322 dual-beam scopes to be used as monitors on the SDV and MRL equipment in XD-1 and approved construction of 12 of the new probes and probe cathode followers developed by the Vacuum-Tube Circuits Section for XD-1.

Test Equipment Headquarters

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

A pulse distributor is being assembled out of 38 pieces of Burroughs test equipment. It will distribute data pulses to 13 radio-transmission channels in succession. A link in the experimental data-transmission system between MTC and Prospect Hill field station, it will be located at Prospect Hill. A 1600-pound Burroughs 9001A power supply is being put in to supply this equipment.

A setup for J. W. Degan of Group 38 is being assembled from 18 pieces of test equipment to assist him in light-gun research. Both the pulse distributor and the setup for J. W. Degan are assists to groups outside of Division 6. In addition to this work the Headquarters checked 60 pieces of standard test equipment during the week of 6 Sept. and repaired 21 of these pieces.

3.5 Drafting

Bill of Materials for MTC

(A. M. Falcione) (UNCLASSIFIED)

Arrangements are now underway to compile a bill of materials for MTC similar to the one for WWI which is issued quarterly. As soon as the list of panels now in use in MTC is made available to Drafting, the bill of material will be started. It is expected that it will be approximately 6 months before a complete bill is available. Many of the drawings for MTC have not been completed as yet.

3.5 Drafting (Continued)

Drafting Equipment on Loan

(A. M. Falcione) (UNCLASSIFIED)

Some time ago the Drafting Room transferred all portable drafting boards to the Div. 6 stockroom. These boards are only issued on a temporary basis and should be returned to the stock room when use is completed so that they may be issued to others. This is also true of templates and other drafting equipment.

Drawings for Laboratory Memoranda

(A. M. Falcione) (UNCLASSIFIED)

It has been the practice for some time to notify Drafting in advance when drawings are to be used in a Laboratory Memorandum. Upon notification Drafting processes the drawings for Multilith reproduction (7-10 days). This method resulted in little or no loss of time in publishing and distribution. For the past several months engineers have deviated from this procedure with the result that reproduction and distribution of memoranda which incorporate drawings are being held up pending the processing of the drawing negatives.

3.6 Administration and Personnel

New Staff

(J. C. Proctor) (UNCLASSIFIED)

Frona Brooks is a new DDL Staff member assigned to Group 61. Miss Brooks received her AB from Radcliffe in June of this year and spent the summer as an Engineering Assistant at General Electric, Schenectady, N. Y.

James May is a new DDL Staff member in Group 62. He received his BS from Pennsylvania State College and was employed by the National Security Agency, Washington, D. C.

Donald Wickham is a new DDL Staff member assigned to Group 63. Mr. Wickham received his Ph.d from MIT this year and was a Research Assistant in Chemistry at the Laboratory for Insulation Research.

3.6 Administration and Personnel (Continued)

Transfers

(J. C. Proctor) (UNCLASSIFIED)

Wesley Clark has transferred from Group 61 to Group 64.

Belmont Farley has transferred from Group 61 to Group 62.

Robert Sittler has transferred from MIT Staff to DDL Staff.

Terminations

(J. C. Proctor) (UNCLASSIFIED)

H. Bonnell Frost

Edward O'Connor

Eli Anfenger

New Non-Staff Personnel

(R. A. Osborne) (UNCLASSIFIED)

Ralph Richardi is a new member of the Inspection Department.

Roberta Wallace is a new secretary in the Division 6 Headquarters.

Leroy Dozier is a new technician in the Construction Shop.

Terminated Non-Staff Personnel

(R. A. Osborne) (UNCLASSIFIED)

Edward Cottier

Donald Haff

Barbara Hanlon

Earl Hilar



3.6 Administration and Personnel (Continued)

Transferred Non-Staff Personnel

(R. A. Osborne) (UNCLASSIFIED)

Norman Leafer to Group 45.

Open Non-Staff Requisitions

1 Administrative Assistant for Group 61

1 Clerk (Male) for Print Room

2 Clerk-Typists for Group 65

1 Clerk-Typist for Group 61

1 Electrical Detailer

1 Laboratory Assistant for Group 61

1 Layout Draftsman (Mechanical)

3 Technicians for the Construction Shop

8 Technicians for Group 64.