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Memorandum M-2855

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

SUBJECT: BIWEEKLY REPORT FOR JUNE 2, 1954

To: Jay W. Forrester

From: Division 6 Staff

CLASSIFICATION CHANGED TO:
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Date: 2-1-60

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SECTION I - CAPE COD SYSTEM

1.1 Group 61

1.10 General

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

During the two weeks remaining before shutdown, flight-test activity will concentrate on final-turn-intercept tests.

A new standard operating procedure for the Height-Finding Section is in effect. This SOP should speed processing of requests but may decrease the percentage of height replies. The effect in these respects will influence XD-1 proposals.

Extension of an analysis of the Track-While-Scan Program in the 1953 Cape Cod System to a system of 400 tracks and 2000 radar returns (including provisions for more complicated processing of the data) indicates a time requirement of about 7 seconds using the XD-1 machine.

A design for the Charactron matrix for XD-1 has been prepared.

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1.12 Data Screening

(R.L. Walquist) (CONFIDENTIAL)

The display facilities of the radar-data-history drum for XD-1 have been reviewed because of the desire to display Mark X data with a distinctive symbol. Group 61 opinion is that more than two display categories (uncorrelated and correlated radar data) should be provided. To accomplish this, one of the nine data-storage fields on the drum probably would have to be used to provide the necessary control digits.

The time analysis of the Track-While-Scan Program in the 1953 Cape Cod System has been completed, and a memo is in the process of being prepared. Extension of the results to a system of 400 tracks and 2000 radar returns (including provisions for more complicated processing of the data) indicates a time requirement of about 7 seconds using the XD-1 machine.

All three proposals (radar-data input, tracking, and monitoring) for TWS in the 1954 Cape Cod System have been written and issued as inter-office memos. The radar-data-input proposal has been reviewed by the Data Screening Group, and several modifications have been suggested for improving the automatic control of the input data. The remaining two proposals will be reviewed during the early part of the next biweekly period. As soon as all three proposals are acceptable to the Group, actual programming can be started.

The following report has been issued by the Data Screening Group this past biweekly period: "Monitor's Operation Manual for the 1953 Cape Cod System" (M-2827) by Homer Peterson.

(W.S. Attridge) (CONFIDENTIAL)

With the CCS shutdown just two weeks away, the weekly training meetings with the Air Force personnel have ceased. During the summer, Sgt. Sharkey and A1/c Faulk will prepare a summary report on data kept in the Mapping Supervisor's log during operation of the 1953 CCS.

Another data analysis of the FPS-3 radar has been made with C. Uskavitch of Group 22. Photographs of the data are being prepared, and the data has already been plotted by Group 22. An informal memo will be prepared on this analysis.

(W.M. Wolf) (CONFIDENTIAL)

The past biweekly period was spent in writing the proposal for the radar-data-input section of the 1954 Cape Cod Program.

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1.12 Data Screening (Continued)

(D.L. Bailey) (CONFIDENTIAL)

The time required for operation of the past-history program has been measured as a function of the amount of radar data. This information, along with the time required by other TWS programs, is in the hands of R. L. Walquist.

The tracking proposal for the 1954 Cape Cod System has been completed by Ishihara, Seward, and myself; it has been distributed to all TWS people for comments.

All TWS proposals for the 1954 Cape Cod System are being studied in order that some final agreement may be made within the next week or so.

(H. Frachtman) (CONFIDENTIAL)

The past two weeks have been spent in planning the monitoring programs for the 1954 Cape Cod System.

(F. Heart) (CONFIDENTIAL)

Consideration is being given to various modifications and additions to track-while-scan procedures. In the last two weeks emphasis has been placed on 1954 Cape Cod monitoring techniques.

Some time was spent assisting in demonstration of the Cape Cod Direction Center.

(J. Levenson) (CONFIDENTIAL)

In line with the evaluation of the TWS personnel, I have been spending at least one hour of each period of System operation observing one of the operators. Through on-the-spot questioning of the monitors, much interesting information has been obtained for evaluation. This information can also be used to evaluate plans for monitoring in the 1954 Cape Cod System.

(E.W. Wolf) (CONFIDENTIAL)

All calibration missions for the past biweekly period were cancelled. The rectangular co-ordinates with respect to S. Truro, and the angle between true north and zero azimuth for the Montauk radar have been calculated.

The proposal for the radar data input section of the 1954 Cape Cod System has been completed.

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1.12 Data Screening (Continued)

(E.W. Wolf) (CONFIDENTIAL) (Continued)

Work has begun on the editing and revision of Dan Goldenberg's report on the earth's curvature problem.

1.13 Tracking and Control

(W. Lone) (CONFIDENTIAL)

The XD-1 octal-to-binary conversion program was not checked further during this biweekly period because the IBM programming group at Poughkeepsie did not have adequate computer time. The 701 computer there is undergoing extensive modifications, and computer time there and in New York is very limited.

The utility program mentioned in the last biweekly which senses and prints out registers (drum or core) that have been changed by program operation is nearing completion.

(A. Mathiasen) (CONFIDENTIAL)

The third part of the tracking-analysis program, except for what appear to be minor errors, has been checked out. An additional section is being written to provide further information.

1.14 Weapons Direction

(D.R. Israel) (CONFIDENTIAL)

Lee Murray and Jack Nolan have begun a memo describing the results of the saturation tests, the discontinuance of which was described in the last biweekly. The final-turn tests are proceeding satisfactorily, and shortly after the completion of the tests on 18 June a memo will be started describing the results.

Several meetings during the past week have been devoted to a re-examination and consideration of the planned raid-size assessment tests to be held this summer. Cahill, Davis, Favret, and Grandy are now preparing an M-note describing in detail the nature of these tests. Colonel Israel of the 32nd Air Division has volunteered his help in supplying aircraft for such tests.

Progress with the 1954 System is somewhat slower than had been expected. This stems from two sources: (1) the large amount of time currently being devoted to matters of the 1953 Cape Cod System and to XD-1, and (2) the general slowness of the Air Weapons Direction --

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1.14 Weapons Direction (Continued)

(D.R. Israel) (CONFIDENTIAL) (Continued)

Track-While-Scan meetings. It is now hoped that full-scale programming can be under way by 14 June. For assistance in their planning, Peg Mackey and the Tape Room have been informed of the expected load on the tape preparation facilities beginning 14 June and extending to August.

(H.D. Benington) (CONFIDENTIAL)

Over-all programming features and equipment facilities for the 1954 Cape Cod System are still being considered. Additional meetings were held with the Tracking Section; programming responsibility within the WD Section is being clarified; a proposal for data-storage allocation has been written.

Inez Hazel and I will issue M-2851, "Specification of Scope Displays in 1954 Cape Cod Direction Center," early in the next period. This memo should be useful to both programmers and Group 64 equipment engineers.

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

The remaining AA-guidance missions have been cancelled to permit the completion of the current series of final-turn-intercept tests. It is understood that this step was necessary because of aircraft procurement difficulties.

M-2781, "Results of Operation of the Antiaircraft Section of the 1953 Cape Cod System: October 1, 1953 to March 1, 1954", has been issued.

On 3 June, a meeting was attended with representatives of Bell Telephone Labs, Group 61, and Group 22. The current ADES program to test the CCS surveillance system was discussed. Additional time was spent assisting BTL people with this program.

Considerable time was spent in preparing a detailed proposal for the raid-size assessment test program to be conducted during the shut-down and in discussing this proposal with D. Israel and other interested Group 61 personnel.

Some time was spent discussing the 1954 height-finder priority program with D. Israel, C. Grandy, and other interested personnel.

Time was spent on two occasions showing visitors around the Direction Center.

An attempt is being made to prepare a detailed program description and flow diagram for ATABE, in order that comments from those Weapons Dir-

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1.14 Weapons Direction (Continued)

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

ection Section staff members interested in weapons assignment can be obtained in time to affect the special 1954 weapons-assignment program. Very little time has been available for this work, and little progress has been made.

The writer's notes on the recent SCEL meetings have been forwarded from SCEL and will be written into an inter-office memo as soon as time is available.

(A.G. Favret) (CONFIDENTIAL)

Timing checks of height-finder operations were conducted during some flight tests. Height-finder records for April 1954 were checked and summarized.

Some correlations were made between H/F negative reports and Tracking Monitor printouts when available. This usually permits a considerable number of otherwise "unexplained" negative reports to be accounted for as tracking difficulties. Unfortunately, these printouts have been available for only a limited number of flight tests.

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

On the basis of changes proposed in the inter-office memo "1954 Cape Cod System" by H. Benington and C. Zraket, we have been investigating necessities for effecting these changes. The flow diagrams and program designs we have already considered have led us to suggest certain modifications to the proposals. These modifications are of minor significance and will not affect the over-all logic of the proposed system. Our suggestions will be reviewed in later discussions which will probably be scheduled after more fundamental decisions have been reached by the section leaders and their assistants.

(C. Grandy) (CONFIDENTIAL)

A new standard operating procedure has been placed in effect (on 1 June 1954) for the Height-Finder Section. This SOP is experimental and simulates part of the operation to be used in the semiautomatic system proposed for XD-1. The SOP is expected to speed processing of requests but may decrease the percentage of height replies. Determination of the exact effect in these two respects will directly affect the system proposed for XD-1.

Plans for the 1954 Cape Cod height finding are firm; however,

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1.14 Weapons Direction (Continued)

(C. Grandy) (CONFIDENTIAL) (Continued)

some details need to be ironed out before programming can begin. Work on this has been neglected because of the press of other tasks.

(S.C. Knapp) (CONFIDENTIAL)

Three proposals were written in inter-office memo form for presentation at the joint Weapons Direction-Tracking Section meetings. These were in regard to the 1954 master-control, simulation, and recording programs. Plans for all three programs are now in fairly good shape, and the two groups have reached agreement on most of the important points.

(W.Z. Lemnios) (CONFIDENTIAL)

A meeting was held with C. Zraket and L. Murray to discuss command tracking for interceptors in the 1954 Cape Cod System. The results of this meeting have been written by L. Murray in an inter-office memo. Briefly, the TWS Section will be supplied with the ground-velocity components of all interceptors on command tracking. The velocity components are obtained from the time air speed and heading of the interceptor. However, while climbing, the time air speeds of interceptors are neither specified nor known. Climbs are executed with given throttle settings, and calculations during climbs are based on the time to climb and the horizontal distance travelled while climbing. An analysis is being made therefore to obtain, if possible, a given time air speed for each type of interceptor and each throttle setting such that the resulting error in extrapolated position lies within certain limits.

A small modification has been made to the final-turn program. The "pursuit" case has now been programmed so that a one-scan lead exists at the time of interceptor rollout. The modification was made to allow pilots twelve seconds after rollout before the target crossed their path.

(L. Murray) (CONFIDENTIAL)

The saturation-test program for the 1953 Cape Cod System has been discontinued. The reasons for this are as follows:

1. The results of the first three tests were of a negative nature.
2. The remaining tests for the 1953 System can be used for more positive information in the final-turn test program.
3. The present feeling is that more realistic results for saturation tests can be realized in the 1954 Cape Cod System.

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1.14 Weapons Direction (Continued)

(L. Murray) (CONFIDENTIAL) (Continued)

The results of the three saturation tests have been summarized and are now being typed as a rough draft.

The G/A D/L testing program will be discontinued 18 June 1954. A proposal for the use of AFCRC G/A D/L in the 1954 Cape Cod System has been written.

(J. Nolan) (CONFIDENTIAL)

The past period has been spent in the main in working on final-turn flights tests. The results of two missions held on 26 and 27 May have been summarized in an inter-office memo.

(G. Rawling) (CONFIDENTIAL)

The memorandum M-2854 "Assignment of Light Gun Connections, Intervention, and Activation Registers and Digits" is nearly complete. It provides necessary information for programming the 1954 Cape Cod System.

The study of check-out programs and their flow sheet preparation for testing the 1954 Cape Cod System has commenced in conjunction with Guy Young. Existing test programs must be modified to incorporate wiring changes.

(F.A. Webster) (CONFIDENTIAL)

Final programming has been started on the drum-leading portion of the interception-display program for recorded data.

(C.A. Zraket) (CONFIDENTIAL)

A summary of Direction Center Operations is given in the following section. Final-turn intercept tests continued during the past biweekly period with satisfactory results. A detailed analysis of the results of the tests will be issued in inter-office memo form by J. Nolan. Testing will continue until the system is shut down on 18 June.

Raid-size assessment tests will be conducted through the summer without the use of the computer or Direction Center. A test program has been formulated and aircraft requirements forwarded to the Lincoln Flight Test Coordinator, P. Hilar. In addition, aircraft requirements for the Group 61 flight-test program for the next two years have been formulated in a series of meetings with Hilar and Air Force and Navy representatives.

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1.14 Weapons Direction (Continued)

(C.A. Zraket) (CONFIDENTIAL) (Continued)

A memo describing this flight-test program will be issued in the near future.

An inter-office memo describing a proposal for the training of Air Force personnel to man the 1954 Cape Cod System has been sent to C. R. Wieser for comment. It is hoped that a training program can be set up commencing in August.

Most of the major decisions affecting the 1954 Cape Cod System have been made in a series of meetings with the Track-While-Scan Section. Inter-office memos describing the results of the discussions will be issued by the responsible people. Programming is expected to start during this biweekly period.

1.15 Direction Center Operations

(C. Zraket, W. Attridge, P. Cioffi) (CONFIDENTIAL)

Following is a brief summary of the Cape Cod Direction Center operations for the past biweekly period. Details on any of the Systems tests are available from P. Cioffi. Results of radar calibration and automatic ground/air data-link test details are available from E. Wolf and L. Murray, respectively.

25 May 1954 (Tuesday) - A systems-evaluation test to study final-turn-intercept accuracy was cancelled because of weather.

26 May 1954 (Wednesday) - Two B-29 targets were flown for final-turn-intercept accuracy studies. A total of seven intercepts were attempted with 5 interceptor aircraft (three F-89's and two F-2H's), but none completed successfully. Ineffective tracking of interceptors particularly corrupted intercept attempts. The situation is attributed to bad Mark X (Lex.) equipment operation - appreciable azimuth shift of returns. This azimuth shift was responsible for the TWS shifting of interceptor tracks in the final phases of intercepts, thereby corrupting the solution for measurement purposes.

27 May 1954 (Thursday) - Three target aircraft (B-29) were flown for final-turn-intercept studies. Four interceptors (three F-89's and one F-2H) were used for a total of 5 intercepts attempted. One of four scheduled targets was cancelled on the ground for mechanical reasons, and one interceptor available (F-2H) was not used because of inoperative Al radar. Continued Mark X (Lex.) ground equipment malfunctioning (azimuth shift of returns) caused four of the five attempted intercepts to be incomplete or with big separations and bad positioning for Al pickup. One intercept was completed successfully for measurement purposes.

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1.15 Direction Center Operations (Continued)

(C. Zraket, W. Attridge, P. Cioffi) (CONFIDENTIAL) (Continued)

28 May 1954 (Friday) - Two F-89's were flown as scheduled for automatic ground/air data-link testing. Calibration test scheduled was cancelled because of weather.

1 June 1954 (Tuesday) - Two target aircraft (B-29) were flown for final-turn-intercept studies. Four interceptors (two F-89's and two F-2H's) were run for a total of four intercepts attempted. Two of four targets scheduled and one F-89 were cancelled because of limited aircraft availability. Only one of the attempted intercepts was completed successfully. Radar tracking was particularly bad. Target aircraft did not leave good returns even at ranges of about 50 miles. Mark X (Lex.) equipment was inoperative at times and had azimuth shift when on. These factors were easily responsible for the number of incomplete intercept attempts.

2 June 1954 (Wednesday) - Final-turn-intercept measurement test was cancelled because of weather.

3 June 1954 (Thursday) - Four target aircraft (B-29) were flown for final-turn-intercept studies. Four interceptor's (two F-89's and two F-2H's) were used for a total of five attempted intercepts. All intercepts were completed by AI radar contact with good results. The radar presentation this test was singularly good - no noise interference of any kind. Target aircraft were tracked consistently to maximum range of about 150 miles. Two interceptors with defective Mark X equipment were radar-tracked well to about 70 miles. All five intercepts were good for measurement purposes.

(Ardis Morriss) (CONFIDENTIAL)

The following is the statistical breakdown of the equipment-reliability reports for the Cape Cod System operations during the past biweekly period. Data for the cumulative period are also included.

	Last Biweekly Period		Cumulative Period (Since 9/29/53)	
	Hours	Per Cent	Hours	Per Cent
Assigned Time for System Operations	16.4	100	274.3	100
Unrestricted Operating Time	12.5	76	173.8	63
Limited Operating Time	1.7	11	61.2	22
Down Time	1.6	10	35.9	13
Recovery Time	0.6	3	3.4	2

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1.15 Direction Center Operations (Continued)

(Ardis Morriss) (CONFIDENTIAL) (Continued)

Time Lost (Hours)	Down Time	Limited Operations	Down Time	Limited Operations
Computer	1.6	0.0	32.9	0.0
Rm. 222	0.0	1.7	2.6	51.6
Radar & Input	0.0	0.0	0.3	43.7
Misc.	0.0	0.0	0.0	25.3
Telephone Trouble	2.1 hr		7.7 hr	

(Edward Cottier) (CONFIDENTIAL)

Total Assigned Time - 83 hr 30 min

Weapons Direction	5 hr 05 min
Data Screening	4 hr 40 min
Combined Operations	
Data Screening & Weapons Direction	17 hr 40 min
Tracking and Control	43 hr 25 min
Equipment Check	1 hr 25 min
	<hr/>
	72 hr 15 min
Time Given to Math Group	5 hr
Time Lost to Computer (Malfunction)	6 hr 15 min
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T o t a l	11 hr 15 min
	72 hr 15 min
	11 hr 15 min
	<hr/>
Grand Total	83 hr 30 min

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

(D.R. Israel) (CONFIDENTIAL)

The program for the Air Division Commanders was held during the week of 24 May. The Lincoln Laboratory presentations and the reactions to them appeared to be quite favorable.

C.R. Wieser, C.A. Zraket, and prepared flight-test and air-

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

(D.R. Israel) (CONFIDENTIAL) (Continued)

craft requirements through June of 1956 for Pete Hilar.

R.L. Walquist, H. Benington and I prepared a design for the Charactron matrix for XD-1, and it was given to C. Corderman. This matrix is shown in Drawing A-59098. In response to questions from Dick Fallows, problems relating to the driving, mixing and allocation of various display-assignment bits and categories are now under study.

The latest floor plans for the operations areas of XD-1 have been reviewed, and problems arising from the nature of the building construction and its effect on the flexibility of the layout have been discussed with H. Wainwright. After several small changes for the plan shown in E-58233-3, the current layout seems quite satisfactory. A revised plan for the Subsector Command Post has been prepared and will be included in the next revision of E-58233.

(H.D. Benington) (CONFIDENTIAL)

D.R. Israel and I, at the request of the Display Section (Group 62), considered the allocations of mixed and unmixed categories and display-assignment bits to consoles. Although this question in no way affects the logic of the XD-1 display system, it does dominate the problem of driver capacity, cabling, and mixing circuitry. It is quite easy for Group 61 to give a very gross answer; an accurate estimate would definitely require an extended study of operational plans for XD-1. Since the latter solution is prohibitively expensive and the former is liable to cause difficulties, R.S. Fallows and I will propose precise specifications of driving requirements -- these specifications should reflect both Group 61's desire for long-term flexibility and Group 62's responsibility for immediate design.

(B. Smulowicz)

See M-2856 (Secret) for this entry.

1.2 Group 64

(S. H. Dodd) (UNCLASSIFIED)

Computer reliability decreased during the past biweekly period, partially because of troubles introduced by modifications of terminal equipment. Bugs in the recently installed Ferranti photoelectric tape reader and failures of the auxiliary drum were the major contributors to the lost computer time.

The auxiliary-drum write-group-selection system is being converted to electronic switching, digit by digit. It was intended to do this without interfering with the use of the auxiliary drum by WWI. However, by some means as yet undetermined, the information on group 11 is occasionally altered during the switchover of the write circuitry. Since the read-in program is on group 11, this has caused programmers some inconvenience.

1.21 WWI System Operation

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

The computer dependability decreased from 99 per cent for the previous biweekly period to 85 per cent for this present period. Approximately 14 of 164 assigned computer hours were unusable because of several types of failures. A list of some of the troubles follows:

1. A phenolic breakdown caused by silver migration in the multiply-shift-control panel resulted in the loss of 15 minutes;
2. Unintentional erasures of part of the information on the locked out group 11 of the auxiliary drum resulted in the loss of approximately 4 1/2 hours;
3. Two separate failures of the Ferranti PETR caused the loss of approximately 4 hours;
4. A faulty tube socket on an auxiliary drum chassis resulted in the loss of approximately 1 1/2 hours;
5. A loose filament transformer connection in rack C7 caused the loss of approximately 30 minutes;
6. A faulty 5Y3 in the 500-v regulator resulted in the loss of approximately 30 minutes.

The second magnetic-tape-printout system has been completely checked out and has been placed in operation. A memorandum is being prepared that will explain the operation and flexibility of the two systems.

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1.21 WWI System Operation (Continued)

(D. A. Morrison) (UNCLASSIFIED)

Tube data continues to be collected for the computer-reliability study. The data is being arranged to allow consideration of blocks of equipment and/or the complete computer.

Measurements are being taken of the in-out control matrices' input and output voltages to assure proper operation. These matrices are not marginal-checked.

Typewriter and Paper Tape

(L. H. Norcott) (UNCLASSIFIED)

The Flexo shop installed pinfeed platens in two of our 12-inch-carriage Flexowriters for use by the MTC Group.

It has been proposed that the remaining short-carriage Flexo be sent to the factory to be equipped with a 20-inch carriage and a pinfeed platen capable of handling our wider forms. We are awaiting a quotation from the manufacturer before proceeding further.

1.22 Terminal Equipment

(R. H. Gould) (CONFIDENTIAL)

The audible-alarm circuits in the 1954 Cape Cod System will be such that when a ONE is read into the appropriate indicator-light-register digit the alarm circuit will fire regardless of the previous contents of that digit. The alarm circuits of the 1953 System will fire when a ONE is read into the digit only if the digit has held a ZERO for a few seconds. The circuits for the 1954 System will be simpler and more reliable than the present circuits.

A special 8-position, 45° index, rotary switch used in the "Speed and Heading" panels for the Cape Cod Control Room has been mislaid. I would appreciate any information on its whereabouts. No reward.

A conference was held with Paul Harris of Group 22, E. S. Rich, and H. J. Kirshner on the use of WWI to correlate Raydist track data and computer tracks. There should be no difficulty in inserting the Raydist data into WWI.

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1.22 Terminal Equipment (Continued)

CRT Filter System

(S. B. Ginsburg) (UNCLASSIFIED)

The system has been installed in K-row of Room 156. It is complete except for the connections to the demodulators and to the CRT units. The system is presently being video checked.

Marginal Checking

(T. J. Sandy) (UNCLASSIFIED)

A program was written to measure the length of the marginal-checking cycle. The slow cycle required approximately 10 to 15 cycles to settle down to a steady cycle. After the first 15 cycles the length of the slow cycle varied from 6.3 seconds to 6.9 seconds in a random manner. The fast cycle required approximately 3 cycles to settle down to a steady cycle. After the first 3 cycles the length of the fast cycle varied from 2.1 seconds to 2.3 seconds in a random manner.

Investigation of methods to marginal check the indicator-light registers is continuing.

Magnetic Drums

(L. D. Healy) (UNCLASSIFIED)

Work has been begun on the circuit additions and modifications necessary for the addition of two groups of auxiliary storage to the buffer-drum system.

MITE

(A. M. Werlin) (UNCLASSIFIED)

The construction of the new MITE units and mapper control in Room 156 is essentially completed and preliminary testing has begun.

Plans are now being made for the block diagrams and layouts for the fine-grain-data input equipment.

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1.22 Terminal Equipment (Continued)

Data Inputs

(H. J. Kirshner) (CONFIDENTIAL)

Investigations of a display system for fine-grain-data, a system of time synchronizations for Raydist data, and the requirements for introducing automatic height data are proceeding.

Production of CRT filters will be slightly hampered by the moving of the shops to Lexington; however, it appears likely that at least four units will be operating by 12 July.

Data Link

(R. B. Paddock) (CONFIDENTIAL)

The over- and under-voltage coder protection relays have been modified and operated satisfactorily.

After routine coder maintenance, most of the remaining available time has been spent repairing the first three stages of the old monitor system: this much, at least, must be returned to service before any new monitoring equipment can receive final checks.

Pathfinder Modification

(N. N. Alperin) (CONFIDENTIAL)

Two units have been delivered and preliminary testing started. It is planned to have 4 units modified and tested by 21 June. This will allow time for installation and testing in the system. The original plans called for all but 4 units to be completed by 21 June, but because of some unavoidable delays the original estimate had to be revised.

Fine-Grain-Data Display

(N. N. Alperin) (CONFIDENTIAL)

I have started considering various methods of displaying the fine-grain data which will be available from Truro near the end of the summer.

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1.22 Terminal Equipment (Continued)

Azimuth-Drive Units

(A. V. Shortell) (UNCLASSIFIED)

Drafting has been completed and sheet-metal work is to commence during the week of 7 June.

Pathfinder Scopes

(A. V. Shortell) (UNCLASSIFIED)

A test equipment setup has been made for checking out these scopes as they are received from the shops.

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 21 May - 3 June 1954:

Number of assigned hours	164
Usable percentage of assigned time	85
Usable percentage of assigned time since March 1951	87
Usable percentage of assigned time since September 1953	92
Number of transient errors	8
Number of steady-state errors	7
Number of intermittent errors	10

1.23 Records of Operation (Continued)Component Failures in WWI

(L. O. Leighton) (UNCLASSIFIED)

The following failures of electrical components have been reported since 21 May 1954:

<u>Components</u>	<u>No. of Failures</u>	<u>Hours of Operation</u>	<u>Reasons for Failure</u>
<u>Tubes</u>			
5687	2	0 - 1000	Leakage
	1	1000 - 2000	Leakage
	1	2000 - 3000	Leakage
	1	10000 - 11000	Leakage
5963	1	1000 - 2000	Leakage
	5	2000 - 3000	Low I_b
	1	7000 - 8000	Low I_b
	2	10000 - 11000	1 short; 1 low I_b
6072	1	8000 - 9000	Low I_b
	1	10000 - 11000	Low I_b
6145	2	0 - 1000	1 short; 1 leakage
	2	1000 - 2000	1 short; 1 leakage
7AD7	2	20000 - 21000	Low I_b
	11	24000 - 25000	7 low I_b ; 4 short
	2	25000 - 26000	Short
6BL7	2	0 - 1000	Short
SR-1407	1	10000 - 11000	Short
7AK7	1	0 - 1000	Open filament
	2	1000 - 2000	1 short; 1 open filament
	1	2000 - 3000	Short
6136	2	0 - 1000	1 broken pin; 1 short
	1	1000 - 2000	Broken envelope
6SN7	1	11000 - 12000	Low I_b
	1	24000 - 25000	Short
OC3	1	3000 - 4000	High starting voltage

~~CONFIDENTIAL~~
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1.24 Power

D-C Power Supplies

(S. T. Coffin) (UNCLASSIFIED)

A regulator panel is being designed for the WWI d-c standby generator. When completed, this unit may be substituted for any WWI d-c supply by means of a selector switch and jacks.

General

(D. M. Fisher) (UNCLASSIFIED)

The new 10-v, 10-amp lab supply has been moved to Lexington. The permanent installation will be made as soon as the space becomes available in the new building.

Work has begun on the simplification and modernization of the WWI power-supply-control-block diagram.

1.25 AN/FSQ-7

Duplex Central

(B. E. Morriss) (CONFIDENTIAL)

The request that as many people as possible read IM-91, "Draft of Proposal for AN/FSQ-7 Duplex Central," and submit comments is repeated. It is very important that the IBM-MIT duplex planning group receive comments as soon as possible so that their work will not be held up or changed later. Copies of IM-91 have been sent to many of the interested parties, and additional copies are available from A. P. Kromer's secretary.

A list of 59 questions and tasks on the duplex central was received from Dan Ross at IBM and is being investigated by the people working on the duplex. A considerable amount of time has been spent dividing and scheduling the work to be done on the central. Some time has been spent considering production-machine concurrence procedures.

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UNCLASSIFIED1.25 AN/FSQ-7 (Continued)Duplex Planning

(H. K. Rising) (CONFIDENTIAL)

A meeting with R. R. Everett, S. H. Dodd, and B. E. Morriss resulted in revision and informal agreement upon a proposal for the concurrence procedure for duplex-central elements. This proposal was discussed with D. C. Ross at IBM and was informally agreed upon. The concurrence procedure provides two check points for joint MIT-IBM concurrence, one at the specification level and one prior to release for production. The specifications for all elements of the XD-1 system will be reviewed and concurred upon for the duplex system. Briefs are being set up, and most of the information for the briefs on XD-1 equipment has been obtained.

Communications Requirements

(H. J. Kirshner) (CONFIDENTIAL)

A report, in draft form, of the results of a recent meeting held with ADC, ADES, AT&T and Lincoln relative to FSQ-7 internal communications has been prepared with M. L. Rosenbluth of ADES.

A draft of the report of another meeting of the same group on the subject of external communications requirements for FSQ-7 has been read and appears to be in error in several respects. In particular, the nationwide totals for telephone lines for the Transition System is incorrect. The source of error is that incorrect multiplying factors for each type of line were used in arriving at the totals. A study of each subsector's requirements is necessary before an over-all total can be obtained.

AN/FSQ-7 Schedules

(T. R. Parkins) (UNCLASSIFIED)

I spent 27 May at IBM Vestal Laboratory, Endicott, N. Y., becoming acquainted with the display-console project. In spite of many changes in console design, it appears now that prototype consoles will be completed on schedule.

Three conferences with R. Fallows were held this period to determine how work on the display frames can be brought back on schedule. Some engineering overtime is contemplated.

On 4 June I attended an XD-1 Installations Group progress meeting; I expect to be spending half my time with this group for the next few months.

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1.25 AN/FSQ-7 (Continued)

Duplex-Central Inputs, Outputs and Displays

(R. C. Jeffrey) (CONFIDENTIAL)

The following problems are being investigated in collaboration with Marden, Kippenhan and White of IBM.

1. Input Buffer Drum: preliminary specifications, detailed proposal on cross-telling and miscellaneous radar inputs.
2. Input System: location of information-switching relays, packaging of radar-input equipment, possible elimination of patch panels.
3. Display System: preliminary specifications for warning-light frame and manual-interconnection unit, location of information-switching relays.
4. Output System: detailed proposal on DDT element, testing and marginal checking, possible elimination of test loop, method for checking the G-A message after transmission.

Power

(P. Morrill) (UNCLASSIFIED)

Bldg F. I received design drawings from Cleverdon, Varney, and Pike complete except for a small amount of lacking information for Electrical Contract No. 1.

AN/FSQ. Two drawings and cost estimates for comparison of two schemes for power supplies have been completed.

~~CONFIDENTIAL~~

1.3 Group 65

1.31 Activities of Group 65

(P. Youtz) (UNCLASSIFIED)

Several trips were made by members of Group 65 to IBM and tube manufacturers in behalf of the program to produce reliable tubes for AN/FSQ-7. Two trips were made in pursuance of the research program, one to an ASTM meeting and the other to a JETEC meeting. The Group had several visitors from tube manufacturers and Corning Glass Works.

Several of the tube programs are facing difficulty, and this must be surmounted. Sylvania is still unable to process the SR-1782A so that the cathodes do not fail under certain life conditions. This problem had been under investigation for several months and to this date the satisfactory solution has not been found. Sylvania had certain other minor problems with the SR-1782A which have been or will be corrected. DuMont has been studying the K1211, the 3/4-inch photomultiplier tube for the light gun, and apparently can produce a tube that will meet our requirements. Specifications for the video mapper 16-inch cathode-ray tube must be clarified before DuMont can proceed with this assignment.

The second monthly letter report from Convair, covering the period 15 April to 15 May 1954, was received. Convair shipped the three sample 19-inch Charactrons (C19JYFA) as required by the scope of work in their IBM contract. Work is continuing at Convair on:

1. The study and evaluation of deflection elements with the objective of finalizing the designs of the convergence coil and deflection yoke.
2. Completion of special equipment and tooling necessary to fabricate prototype and production tubes. This will include such items as special exhaust ovens, cleaning systems, helical-dagging equipment, jigs and fixtures for Charactron gun assembly, etc.
3. Design and construction of special test equipment.
4. Refinement of special techniques necessary for construction of the final tubes and personnel familiarization with those techniques.
5. The modification of a demountable envelope and vacuum system to permit a series of tests in connection with the study of the electron optics of these tubes.

1.31 Activities of Group 65 (Continued)

(P. Youtz) (UNCLASSIFIED) (Continued)

A telephone report from Hughes Aircraft indicates that they have made three or four more good Typotrons during the past fortnight. These will be shipped East for evaluation and life-test studies. The contractors have finished Hughes' new tube-production facilities. The tube-production personnel expect to move into the new plant about 15 June. This crew has been making our Typotrons in the tube research and development laboratories. The recent Typotron tubes have been made with matrices supplied to Hughes Aircraft by the W. & L. E. Gurley Company of Troy, New York.

The construction section of Group 65 has been concentrating this past period in complementing the work of Convair and Hughes Aircraft. Previous efforts to process cathodes in tubes with the helical-dag coating were unsuccessful. As reported by P. C. Tandy, this series of tubes died early on life test. This problem has been studied, and it is believed that the next series of tubes can be processed so that the cathodes will endure on life test.

At our request American Optical Company of Southbridge, Massachusetts, put nonreflective coatings on two sides of a flat piece of Flexiglas and on the front-face panel of a 19-inch tube. These surfaces were turned over to Group 62 and Francis Associates for their evaluation and their light studies.

1.33 Research and Development

(P. C. Tandy) (UNCLASSIFIED)

Encouraging results have been obtained from initial tests made on the first aluminized, P7, helical-dag tube. The screen had good, long persistence characteristics. Deflection tests and a life test will be made on this tube.

Of the three tubes that were put on life test, two were rejected for poor cathodes, one after 26 1/2 hours and the other after 32 1/2 hours. A third tube which had been processed three times operated for 196 1/2 hours at a 1-ma cathode current before it was rejected for poor light output. The cathode of this tube was about 95 per cent bad after about 160 hours. The poor light output appears to be a function of cathode condition. When the center of the cathode is bad, most of the cathode current being drawn from around the usual area is collected by the G₁ or some other electrode. This results in poor light output at the specified cathode current.

Life-test equipment is progressing. Power supplies are the only units which have to be constructed before several tubes can be life tested at a time.

1.33 Research and Development (Continued)

(S. Twicken) (UNCLASSIFIED)

A trip to Sylvania on the SR-1782A revealed continuing processing problems and subsequent poor life. In addition, the old problem of pulse-current measurement correlation again appeared. Sylvania's equipment continued to indicate higher currents than the equipment in our laboratory, IBM's at High Street, and our equipment on loan to Sylvania at Emporium. Accordingly, a group of tubes was brought back here, measured, taken to High Street, and read there. The two measurements agreed quite closely. Two days were then spent at Emporium going over their equipment. The difficulty was found to be that positive and negative deflections on their scope for a given input pulse amplitude differed by 10 per cent, causing their readings to be 10 per cent high. With this corrected, our readings are substantially in agreement.

(T. F. Clough) (UNCLASSIFIED)

I attended a meeting at DuMont with S. Twicken, Division 6, and F. A. Ordemann and A. Myers, IBM, to discuss the KL211 photomultiplier tube for the XD-1 display. DuMont's plans to minimize short circuits and improve the mount by ruggedization were discussed. They seem to be anxious to improve this tube to the extent the application requires and are determined to hold the cost increases resulting from these changes to an absolute minimum. DuMont will submit an improved design to IBM in the near future, possibly within one week.

The cathode-ray tube required for the XD-1 display was also discussed. DuMont will submit to IBM a proposal on a 16-inch metal-cone CRT with a 40-inch curvature faceplate and a bent low-focus-voltage gun. The beam current and phosphor characteristics will be optimized to the application insofar as the essential engineering compromises will permit.

(A. Zacharias) (UNCLASSIFIED)

During this period I devoted time to writing a report on 7AK7 research. As the report was being started certain points became evident, and more data had to be compiled. The results were that, possibly because of statistics, the bogie anode current used for the multiplier 7AK7's was high; the true value for $E_A = 90$ volts, $E_H = 6.3$ volts, $E_{C1} = +25$ volts is $I_A = 350-370$ milliamperes, and not the 420 milliamperes previously used. Because of the small number (only 15) of tubes available with good cathodes and the wide variation (approximately 50 milliamperes) in the anode current at the previously mentioned test point, the bogie of 350-370 milliamperes is still not certain. Essentially, data on the triode perveance of these tubes is necessary before any conclusions can be drawn. Sylvania has promised to supply this data.

1.33 Research and Development (Continued)

(H. B. Frost) (UNCLASSIFIED)

On Monday, 24 May, a meeting of the ASTM task force on cathode interface impedance was held at the Bell Telephone Laboratories, Murray Hill, New Jersey. At this meeting an analysis made of roundrobin results was presented by Dr. Terry, Bell Telephone statistician. These results showed fair correlation among equipment located at General Electric, Sylvania, Raytheon, and MIT. There is also a fair correlation between the equipment mentioned above and that located at the Signal Corps Laboratory in Belmar, New Jersey. Some confusion existed because of several other tests which were also made at the Signal Corps Laboratory. Equipment located at Cornell University did not correlate with the results from the above laboratories.

A serious defect in the planning of the roundrobin tests was revealed by the statistical analysis. Because of the way in which the tests were conducted, information was not available to separate changes in the tubes from calibration errors and reproducibility limitation of the various equipment. Two additional tests will be made, at this laboratory and at General Electric, to supply data for such an analysis.

I attended a meeting of JETEC 5.5 on 3 June 1954. The work of this committee over the past year has been quite successful. Formats have been prepared and approved for twin triodes and multigrid tubes; a thyratron format is in preparation. The understanding of tube manufacturers of the importance of shorts in computer tubes seems to have improved considerably, also.

Thesis Research

I have continued to prepare drawings for my thesis during the past two weeks. The drawings now in process are those reporting experimental results. Calculations have been made to determine the theoretical change in current for a diode with fixed voltages but varying cathode emission.

After the interface-task-force meeting discussed above was adjourned, I discussed some of the results of my thesis research with interested personnel at Murray Hill.

SECTION II - AN/FSQ-7

2.1 Group 622.12 Magnetic-Core MemoriesMiscellany

(W. Papian) (UNCLASSIFIED)

The general subject of larger memories is receiving a fair amount of attention. So far, the basic system presently used in the MTC (64 x 64) memory continues to be regarded favorably; that system appears capable of carrying us one (128 x 128) or two (256 x 256) steps farther. Many systems are being considered: the external-register-selection scheme (Olsen, Raffel) has serious physical-realization problems and only a few advantages; the external-bit-selection scheme (Raffel, Bradspies) requires 3 cores per bit and has very serious physical-realization problems to offset its dramatic advantages; the 4-coordinate, 3:2 system (DiNolfo) has large "noise" problems presently outweighing its reduced driver-count advantage.

The first 128 x 128 plane has all its X and Y lines in; it should be ready, in a couple of weeks, for tests which will supply additional data for the work on larger memories. A good deal of worthwhile work on plane-frame design is also taking place.

IHM Trip

(W. J. Canty) (UNCLASSIFIED)

Wednesday, 2 June, was spent at High Street trouble shooting the logic of the XD-1 memory-array tester. Because of the day's 85 F temperature, and the lack of cooling equipment for the memory cores, it was impossible to take any data on memory-plane operation.

Sensing Amplifier Mod. IV, MTC

(W. J. Canty) (UNCLASSIFIED)

A pulse source has been made which will simulate information pulses coming from the sensing winding of a memory plane. With this source a series of ONE's, all of the same polarity, can be generated to test for base-line shift and transformer remanance effects in the sensing amplifier. Tests on the Mod. IV sensing amplifier using this source have indicated little base-line shift or remanance effect but have pointed up the need for further investigation of diodes for rectification at low signal levels.

2.12 Magnetic-Core Memories (Continued)

XD-1 Support

(J. Mitchell) (UNCLASSIFIED)

On 27 May Al Guditz and I discussed with the IBM people the problem of evaluating memory planes. Some of the logic that is used in our array tester was explained, and in addition we helped them outline a procedure for obtaining the data necessary for writing specifications on individual memory-plane performance.

Automatic "Shmoo" Plotter

(J. Mitchell) (UNCLASSIFIED)

The debugging of the "shmoo" plotter system and equipment will begin during the week of 7 June.

Memory Test Setup VI

(E. A. Guditz) (UNCLASSIFIED)

M-2840 has been issued describing the results of tests on the DCL (Group 63 cores) 64 x 64 memory plane.

An experimental 128 x 128 memory plane is partially constructed and should be completed in two or three weeks.

Work is continuing on the design of a 128 x 128 prototype frame which could be used in a working memory. Results are very satisfactory.

The attachable jumper strips which were designed to facilitate plane changing in the memory tester have been tried and are satisfactory.

A model of a 4 x 4 memory plane which would utilize printed wiring has been constructed to demonstrate the feasibility of some of the mechanical requirements of such a plane.

A day was spent at IBM discussing test procedures for evaluation of memory planes.

64-Position Core Switch

(A. D. Hughes) (UNCLASSIFIED)

Construction of the switch has now begun. Construction (by Andy Bowen) should take about 3 weeks. The expected load on the set and reset drivers has been simulated. Tests of the drivers designed for this load by Dave Shansky have begun.

2.12 Magnetic-Core Memories .(Continued)

Memory-Plane Windings

(J. Raffel and G. Davidson) (UNCLASSIFIED)

An investigation of possible new winding layouts has been undertaken with a view to larger arrays and the application of new construction techniques.

2.13 Vacuum-Tube Circuits

Display-Console Circuits

(H. J. Platt) (UNCLASSIFIED)

The following circuits are being investigated for application in the display consoles:

1. Constant-current source for convergence coils
2. Typotron intensification circuit
3. Typotron erase and contrast circuits
4. Charactron intensify and defocus circuits
5. A2 constant-voltage source

Some of these circuits were discussed at a meeting at Vestal Labs in order to try to set specifications.

The first circuit being investigated is the constant-current source for the convergence coils. A 1 per cent error in beam rotation will cause a 30 per cent error in registration of the characters on the scope face. This is the maximum allowable. The rotation error can be caused by a change in convergence-coil current or by a change in accelerating potential. To minimize the error caused by the coil current, it is desired to regulate the coil current to 0.1 per cent. A cascade cathode follower will be tried since the regulation of a single tube 7AK7 cathode follower is a little more than 1 per cent.

(D. Shansky) (UNCLASSIFIED)

M-2834, "Proposed Memory Address Selection System," has been issued. The chart on Page 3 of this note contains an error which may be rectified by interchanging the headings on the last two columns in the chart.

2.13 Vacuum-Tube Circuits (Continued)

(D. Shansky) (UNCLASSIFIED)

M-2842, "The XD-I Digit Plane Driver," has been written and is awaiting the arrival of a schematic diagram (Multilith master) from IBM, Poughkeepsie, before it can be issued.

XD-I Digit-Plane Driver

(D. Shansky) (UNCLASSIFIED)

A trip to Poughkeepsie revealed the presence of oscillation in the digit-plane driver, presumably caused by layout. Lack of time prevented a more detailed diagnosis.

Phone-Line Demodulator

(E. B. Glover) (UNCLASSIFIED)

Since the output of the slicer tube is not critical as long as it is large enough, the trouble there has been eliminated by raising the value of the plate resistance of the second tube in the Schmitt circuit.

All components in the amplifier circuit are now standard including transformers 1 and 2 and the chokes on the +90 and -150 lines. The only change that has been found necessary so far has been to change the values of the AGC voltage divider.

Work on the component testing has been interrupted in order to obtain some information on the timing-output circuit. It was found that the output pulse was altogether unsatisfactory. It is fairly certain that a new arrangement of the blocking oscillator including design features from the real-time-clock blocking oscillator will give satisfactory results, plus the fact that this arrangement uses standard components.

Further checks will be made on the timing output to ensure its adequacy, and then efforts will be returned to the checking of components for the remainder of the circuit.

Blocking Oscillator Core Drivers

(E. Anfenger) (UNCLASSIFIED)

M-2820, "Blocking Oscillator Core Drivers for Use in Display Generator Buffer Storage," was checked and issued, and a few errors were noted:

2.13 Vacuum-Tube Circuits (Continued)

(E. Anfenger) (UNCLASSIFIED)

1. Page 2 - Under word driver item (d) should read "20 to 40 volts" instead of "10 to 40 volts."
2. Top of Fig. 1 - Should read "32 bit drivers" instead of "16."
3. Fig. 4a - Return to -300v should be from lower winding of 225T and condenser should go to ground as in Fig. 4b.
4. Fig. 6a - Cathode return 6293 should read "-150v" instead of "+150v."

2.14 Memory Test Computer

General

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

MTC was shut down as scheduled, and dismantling began on Monday, 24 May. Moving, originally scheduled to begin Monday, 7 June, has been postponed two days to Wednesday, 9 June, because of minor difficulties in preparing the new location, B-154.

Thanks to energetic work both by the MTC crew and by personnel generously lent us from the shop, the dismantling has been, if anything, ahead of schedule, and it has been possible to effect a considerable amount of the reorganization that would otherwise have had to wait until after the move.

Frank Durgin has just been made a welcome addition to the MTC staff, which numbers 7 full-time and about 2 part-time for the present.

MTC Modifications

(J. Crane, R. Hughes) (UNCLASSIFIED)

Gates are being added to make live registers 3 and 4 serve as regular live registers in MTC in addition to their use as special-purpose registers for display functions. These gates are the only panels requiring any extensive modification prior to the installation of MTC in its new location. Minor modifications on some panels are still required. These changes apply only to those panels affected by bus-wiring changes.

Panels have been placed in the frames according to the final layout in the "A" type of frame. These units will be made ready for shipment to Lexington next week.

The new d-c power wiring is being installed.

2.14 Memory Test Computer (Continued)

Power-Supply Control

(A. Chopourian) (UNCLASSIFIED)

The remaining panels comprising the power-supply control for MTC have been designed and are presently in Drafting.

These panels include:

- Start-Stop Panel (Console Desk)
- Power-Supply-Control Panel
- A-C Interlock Panel
- Bus-Control Panels A, B, & C.

(E. Gates) (UNCLASSIFIED)

Construction has started on the new in-out control system. The PETR is being modified at Barta.

Use of MTC; Component Failures

(L. Sutro) (UNCLASSIFIED)

During the quarter, 1 March to 1 June, the hours of applied a-c (used only for filaments) and d-c power were as follows:

<u>Type of Power</u>	<u>Clock Hours</u>	<u>Total Hours</u>
a-c	2369.2 to 3293.8	924.6
d-c	2015.6 to 2859.8	844.2

While records were kept of the use of the computer during all of this time, analysis of the use has been made only from 13 April through 22 May. The analysis shows the computer to have been used as follows:

Development and Installation	48%
Programs	16%
Routine Testing and Marginal Checking	33%
Trouble Shooting	3%
	<u>100%</u>

Component failures during the quarter consisted of:

Electron tubes	75
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2.14 Memory Test Computer (Continued)

(Souis Sutro) (UNCLASSIFIED)

Capacitor	1
Lamp	1
Filament Transformers	2
Crystals	6
Resistors	6

The crystals and resistors failed as a result of the failing of 5965 vacuum tubes that went to air because of faulty manufacture. The total number of components that failed on their own account, therefore, is the sum of the first four items above, totally 79. Tables showing the reasons for the failures will appear in the quarterly report. The approximate number of electron tubes in MTC is 3500. The 75 failures, therefore, are 21% of the total.

2.16 Display

(C. Corderman) (UNCLASSIFIED)

The rewriting of the display specifications in final XD-1 form is under way. This should be completed during the week of 7 June, and a concurrence meeting will be set up for the week of 14 June. ~~After copies~~ have been circulated for comments. This will probably be on 17 June at MIT.

Discussions on the console circuitry and design were held at Vestal on 3 and 4 June. A meeting on console concurrence is tentatively planned for Wednesday, 16 June at MIT.

Breadboards of line drivers are being tested, and specifications for the main frame decoders have been set up.

(R. Fallows) (UNCLASSIFIED)

Construction of cards and pluggable units for design test has started in the shop. It appears that approximately forty pluggable-unit types will be used in the display-generator frames. Of these, all but four or five will be specially designed for these frames.

Preliminary frame layouts have been made, and some preliminary procurement information has been sent to IBM. Marginal-checking design has started.

2.16 Display (Continued)Timing and Control

(R. H. Gerhardt) (UNCLASSIFIED)

The timing and control section of the situation-display generator is being packaged in pluggable units. It appears that the complete unit (less RD's and input gate drivers) will be packaged in about 25 pluggable units. There are many 6-input AND circuits at the cathode-follower inputs and, in order to make a flexible PV, only 7 cathode followers can be in one pluggable unit.

(L. B. Martin) (UNCLASSIFIED)

Typotron tubes now on life test:

<u>Tube</u>	<u>Hours</u>
265	2297.3
268	2287.2
280	1479.3
326	1479.3
335	662.3

Tube No. 292 retired because of open flood-gun lead. Tube No. 268 is now considered useless because of excessive background light and will be replaced when the three tubes on hand are started on life. Measurement difficulties and equipment failure have retarded the starting of these tubes on life. Considerable logic modifications were necessary for the preliminary tests. There is no doubt that a change in focus voltage causes a change in beam position.

Five-inch charactron No. 0044 was uncrated and found damaged.

It has been decided to build new line drivers in Room 026, Barta. One is completed and a second started. Because of the heat developed in the plate resistors, it is not possible to include them in the 5-inch chassis. A separate semiopen panel will be made to hold all four sets of plate resistors and will be easily force cooled, if necessary.

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

A new line driver has been designed and built but not tested. The calculated response gives a rise time of 20 microseconds to within 99.9 per cent. A new method of common-mode rejection has been tried using an active circuit in a special feedback loop. This system should give a common-mode gain of less than 10^{-3} and should also provide excellent regulation of the mean-output level.

The vector generator is now being packaged in 9-tube plug-in units. Four plug-in units will be required.

2.16 Display (Continued)

Digital Display

(M. Epstein, B. Remis) (UNCLASSIFIED)

Two wiring diagrams were finished, and the test units are now in the shop. Another plug-in-unit type is being designed but is being held up until B. Remis can find an acceptable manner of limiting the pulses driving the diode capacitor gates.

We have given the Basic Circuits Group our problems of terminating gate tubes and pulse amplifiers. They are also working on the power-cathode-follower problems. A preliminary marginal-checking breakdown should be finished in the next biweekly period.

2.2 Group 63 (Magnetic Materials)

2.21 Magnetic Cores

(D. R. Brown) (UNCLASSIFIED)

Ferrite memory cores for the fourth prototype memory bank will be ordered from General Ceramics to the present specification. A new, simplified specification is being prepared by a joint IBM-MIT committee.

Detailed information relating the disturbed-ONE voltage, switching time, etc., to the firing time is being obtained preparatory to firing a large batch of memory cores in the Group 63 pilot plant.

The influence of the covalent bond on ion ordering and lattice distortion in spinels is discussed in a memorandum in press, M-2474.

Vanadium Impurities

(J. B. Goodenough) (UNCLASSIFIED)

A model has been proposed which can explain the sharp reduction of conductivity about a small per cent range of vanadium impurity in Ni-Zn ferrite. It is assumed that the relatively high conductivity of these ferrites is caused by the presence of FeO, i.e., of Fe^{2+} cations. The Fe^{2+} cations act as donors of electrons to the conduction band. V^{3+} , however, is believed to act as an acceptor of electrons. If the number of vanadium ions equals the number of Fe^{2+} ions, then the electrons which are donated by the Fe^{2+} ions are accepted by the V^{3+} and no conduction electrons remain. If an excess of vanadium is present, the ferrite becomes a p-type semiconductor, and the conductivity is again high. If this model is correct, then we have a ferrimagnetic semiconductor which can be made n-type or p-type by varying the amount of FeO and of V_2O_3 present.

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

Memorandum M-2474, dealing with the influence of covalence on ion ordering and lattice distortion in spinel-like crystals, has been typed, proofread, and corrected.

D-C Conductivity

(N. Menyuk) (UNCLASSIFIED)

The vacuum system constructed for measurement of electrical and magnetic properties as functions of temperature has been completed, and a test run has been made of the temperature dependence of the d-c conductivity of magnetite. The resistance followed the normal semiconductor

2.2 Group 63 (continued)D-C Conductivity (continued)

relationship, $R = R_0 e^{\epsilon/kt}$, over the temperature range from -185 C to -100 C. The value of the actuation energy changed at approximately -150 C. However, the expected resistance transition at this temperature did not appear. This leads to the conclusion that the sample either contains impurities or is not stoichiometric.

The Statistical Problem of Grain-to-Grain Alignment

(P. K. Baltzer) (UNCLASSIFIED)

Analysis of the role of magnetostriction and crystalline anisotropy in the production of grain-to-grain alignment of the magnetic moment throughout a polycrystalline material is being continued. First-order calculations concerning these effects neglected the statistical aspect of the problem. It is therefore necessary to consider the effect of neighboring grains in producing an average environment for any one grain.

Each grain is considered identical and an iteration procedure derived. It is assumed that the individual probability distribution of the direction of the magnetic moment of all grains is the same. This individual distribution must be averaged over neighboring grains, giving an environmental distribution. The interaction of the environmental distribution and the distribution of the crystalline anisotropy produces the individual distribution, which must be compared with that assumed at the beginning.

Cryotron

(D. A. Buck) (UNCLASSIFIED)

Cryotron 12 was tested at low audio frequencies. Output waveshape follows input waveshape up to at least 20 kilocycles, the limit of the oscillator used. Eddy currents in the brass sleeve on which the copper control winding is wound cause a drop in amplification as frequency goes up. At low audio frequencies, cryotron 12 gives a sinewave output of about 0.75 volt peak-to-peak across a 30-ohm load resistor in series with a 3-volt plate battery when driven with a sinusoid of 10-ma control-current swing. When the cryotron is pulled up out of the liquid helium, the output disappears.

Core-Output Voltages

(J. D. Childress) (UNCLASSIFIED)

A study is being initiated to determine the effects of current-pulse waveforms on core-output voltages. Some qualitative work has been done; the present study is an attempt to determine the limits and optimum values of rise time, fall time, droop, overshoot, flatness, etc.

2.2 Group 63 (continued)

Ferrite-Memory-Core Pulse Testing

(J. R. Freeman) (UNCLASSIFIED)

Pulse testing of ferrite memory cores aimed at obtaining detailed information concerning the response characteristics continues. A mounting board is now used which allows four core samples to be tested simultaneously. Two current-control boxes make the driver control highly versatile.

Three test programs are under way using this equipment: (1) observation of the effect of firing time on pulse responses, (2) special investigations of driving modes for the new core test specifications, and (3) general pulse-response investigations.

Production and Testing of Memory Cores

(P. A. Fergus, J. Sacco) (UNCLASSIFIED)

F-394 cores from batch DCL-2-418 have been fired at 1350 C for 12, 18, and 27 hours. Measurements have been made on these and on cores fired 4, 6, 7, and 8 hours to determine the effect of firing time on output and on switching time. Results indicated increase in output values of cores fired up to 12 hours. Results on switching time are at present inconclusive, and additional firings of 9, 10, and 11 hours will be made.

2.22 Transistors

Decoders

(D. J. Eckl) (UNCLASSIFIED)

An experimental version of an 8-stage transistorized decoder has been made to operate successfully. Each stage acts like a current source. Two transistors and one diode are required per stage. The power supply which supplies emitter current to the transistors must have the same accuracy as that required of the decoder output. Adjustments must be made for the variation in α from transistor to transistor. Silicon transistors which are on order should improve operation.

A second type of decoder which uses a "voltage" ladder looks more promising on paper but has produced several practical difficulties. This would require one transistor and two diodes per stage. However, more stringent requirements are placed on the power supply and the resistance network. So far this type has not operated satisfactorily. The reasons are not entirely understood.

Visit from Texas Instruments

(D. J. Eckl) (UNCLASSIFIED)

Mr. W. E. Love of Texas Instruments visited the laboratory to discuss the new silicon transistors. These are grown n-p-n units. TI has perfected the growing technique to the extent that they can make these units with base widths one-half those of germanium transistors and thus keep the frequency response high.

(E. U. Cohler) (UNCLASSIFIED)

This biweekly period has been spent largely in study on the diode problem for single-line shift registers and in meetings with various visitors. Hawley Rising and I have had a lengthy discussion on the problem of diode characteristics and have come up with the following results.

1. Forward-current rating X back-voltage rating should be as large as possible,
2. Forward voltage at maximum rated current should be much less than the back-voltage rating,
3. Back-voltage rating/forward-current rating should be small in order to use a small number of turns on the core,
4. The reverse-recovery charge constant must be small and the time constant large. This requirement is self-inconsistent and is a

2.22 Transistors (Continued)

(E. U. Cohler) (UNCLASSIFIED) (Continued)

function of the forward-current rating; more work is being done on relating these constants to the other ratings.

We were visited by people from Texas Instruments and the Jet Propulsion laboratories. We exchanged information and views with both companies on cores and transistors. The Texas Instruments representatives brought with them two random samples of their silicon transistors (of which we have ordered 6), and they were notably excellent in both their static and dynamic characteristics.

Transistor Magnetic-Core Drivers

(S. Oken) (UNCLASSIFIED)

The 4-position magnetic-matrix switch is now working satisfactorily. It selects one of the four "X" or "Y" plane drivers in a 4 x 4 coincident-current memory plane.

I have obtained several n-p-n junction transistors from S. Schwartz of Group 35. They are type 202 and are produced by Texas Instruments.

Transistor Gates

(C. T. Kirk) (UNCLASSIFIED)

The main problem with transistor gates is one of "hanging" several gates on one side of a flip-flop. It appears that this can be overcome by using a buffer amplifier between the gates and the flip-flop. A successful experiment has been run using a grounded-base buffer amplifier to drive 4 gates from a Carlson point-contact flip-flop running a prf of 1 megacycle.

SECTION III - CENTRAL SERVICES

3.1 Purchasing & Stock

(H. B. Morley) (UNCLASSIFIED)

The order has been placed for the Raytheon Ultrasonic Machine Tool. Present schedules call for the machine to be delivered at Lexington in August.

After the move to Lexington, this department will place no more orders directly but will act as a requisitioning center for Division 6 and will be known as the Material Requirements Section. Plans are being made to operate under this system, and a memo will be issued as soon as they are complete. Procedures are also being worked out for requisitioning material and performing related services for Barta personnel.

Month of May
Total Orders Received - 372

Received on time	153	41%
Received 1-7 days overdue	124	33%
Received 8-14 days overdue	42	11%
Received 15-22 days overdue	22	6%
Received 23-30 days overdue	14	4%
Received 1-2 months overdue	12	3%
Received 2-3 months overdue	2	1%
Received 3 or more months overdue	3	1%
	372	100%

3.2 Construction

Production Control

(F. F. Manning) (UNCLASSIFIED)

There have been 30 Construction Requisitions totaling 477 items satisfied since 21 May 1954, and there are 33 Construction Requisitions totaling 1816 items under construction by the Group 60 Electronic Shops.

For further information please call the Production Control office (ext. 3492).

Outside Vendor

(J. V. Mazza) (UNCLASSIFIED)

There are 8 orders now open with vendors totaling 229 items.

3.2 Construction (Continued)

(J. V. Mazza) (UNCLASSIFIED) (Continued)

Deliveries in the past biweekly period have totaled 96 items. Information on specific orders may be obtained from the writer (ext. 3492).

3.3 Component Analysis and Standards

3.31 Components

(R. J. Biagiotti) (UNCLASSIFIED)

Ten Transatron S-82 gold bonded diodes are undergoing life tests under back-voltage conditions of 60 volts d-c and 10-v pulses of 1 micro-second duration (20% duty factor). After 500 hours the characteristics of these diodes have not changed significantly.

Ten diodes are being life tested under forward-current conditions of 10 milliamperes d-c with 120-ma pulses superimposed on the d-c level. The forward resistance of all diodes has increased, the average increase being by a factor of 1.06 and the maximum 1.14. Also, after approximately 1000 hours of operation, back resistance of all diodes has increased by an average factor of 1.27, with a maximum of 3.

Modifications to Lab-Bench Wiring

(R. Jahn) (UNCLASSIFIED)

Forty-one lab benches have been rewired to conform with standards on grounding at Lexington. In this modification, d-c grounds were removed from the d-c bench-outlet box, and a grounding wire which bonds all electrical fixtures on the bench was brought in from the a-c line cord.

D-c breaker boxes will be modified by adding a 600-v fuse and removing case grounds. Grounding for the box will be through conduits only.

3.5 Drafting

Drawings for Central Display, XD-1

(A. M. Falcione) (UNCLASSIFIED)

The Print Room now has all the necessary form drawings for the use of engineers in making sketches of drawings for central display. These form drawings have been assigned form numbers and are available upon request.

3.5 Drafting (Continued)

Drawings for DDR & DDT

(A. M. Falcione) (UNCLASSIFIED)

All drawings for the digital-data receivers and transmitters will be made using the IBM drawing format with MIT drawing numbers. The drawing numbers assigned to this group have been reserved and are 75,000 through 80,000. It is assumed that when the units have been completely designed and tested in XD-1, the drawings will be absorbed and integrated into the IBM system; at that time IBM will assign their own production part numbers to the drawings. In order to eliminate confusion between this group of drawings and those for central display, it is very important that engineers submitting drawings for DDR & DDT to drafting inform us that the drawings involved are for this group, so that MIT drawing numbers can be assigned in lieu of IBM numbers which are used for the central-display drawings.

3.6 Administration and Personnel

New Staff

(J. C. Proctor) (UNCLASSIFIED)

Francis R. Durgin is working as a DDL Staff Member in Group 62. He had been employed, until recently, as a Technical Engineer for IBM.

Gerald E. Mahoney is a new DIC Staff Member working for Charlie Adams for the summer. Until recently he was a Teaching Fellow, Ph.D candidate at Boston University.

Staff Transfers

Arthur D. Hughes has transferred from MIT Staff to DDL Staff.

Richard S. DiNolfo has transferred from MIT Staff to DDL Staff.

Earl K. Gates has transferred from MIT Staff to DDL Staff.

Staff Termination

William Klein

New Non-Staff Personnel

(R. A. Osborne)

Jean Bowse has joined Group 62 as a secretary.

3.6 Administration and Personnel (Continued)

(R. A. Osborne) (UNCLASSIFIED) (Continued)

Judith Brask is a new secretary in the Publications Office. She is a transfer from Group 3.

Lillian Connors is a new secretary for Frank Ryder.

Frank Vecchia is a new technician in the Construction Shop. He transferred from the Flight Control Laboratory

James Johnson is also a technician from the Flight Control Laboratory who will be working in the Inspection Department.

Jean Randall is a new member of the Drafting Room.

Open Non-Staff Requisitions

(R. A. Osborne) (UNCLASSIFIED)

1 Secretary for Group 61