

~~CONFIDENTIAL~~
UNCLASSIFIED

Memorandum M-2722

COPY NO. 115 OF 135 COPIES
Page 1 of 56

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

SUBJECT: BIWEEKLY REPORT FOR MARCH 12, 1954
To: Jay W. Forrester
From: Division 6 Staff

CLASSIFICATION CHANGED TO:
Auth: DD 254
By: R. K. Everett
Date: 2-1-60

CONTENTS

Section I - Cape Cod System	1
1.1 - Group 61	1
1.2 - Group 64	18
1.3 - Group 65	26
Section II - AN/FSQ-7	28
2.1 - Group 62	28
2.2 - Group 63	47
Section III - Central Services	50

SECTION I - CAPE COD SYSTEM

1.1 Group 61

1.10 General

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

The Track-While-Scan Section has submitted proposals for equipment changes for the 1954 Cape Cod System and is still considering program changes. In connection with current operations, programs to give past history of data or tracks are now available.

The evaluation of data concerning current Cape Cod operations by the Weapons Direction Section is nearing completion. Detailed plans for each station of the 1954 Cape Cod System are being prepared.

Tests during this period indicate a limited ability to do raid-size discrimination with current equipment.

Work concerned with assisting in XD-1 specifications, console design, and layout continues. An equipment layout for the Direction Center has been prepared.

UNCLASSIFIED
~~CONFIDENTIAL~~

1.12 Data Screening

(R. L. Walquist) (CONFIDENTIAL)

Considerable time and effort have been spent in studying the changes that might be made to the 1953 Cape Cod System to improve the Track-While-Scan operation. This study has been separated into two major parts consisting of equipment changes and program changes. A final proposal for equipment changes has been discussed with Wieser and Rich. The most difficult part of this proposal to implement is the changing of the console arrangement at stations F and G in Room 222. At present, there are four 16-inch display scopes at station G and two at station F. The proposed equipment change would give three 16-inch display scopes at each of these stations.

Program changes to the tracking section of the 1953 Cape Cod System are still being considered. Improved use of the Mark X data and the handling of crossing tracks are receiving major consideration. Better methods of initiation on interceptors and closer communication between the Intercept Directors and the tracking section are being studied. However, programming plans are still in the formative stage.

(W. S. Attridge, Jr.) (CONFIDENTIAL)

R. Walquist and I have completed equipment sketches for the Track-While-Scan section of the 1954 Cape Cod System. I have prepared a written proposal for the 1954 CCS program features in the TWS section; it is in the form of an inter-office memo to C. R. Wieser.

In order to intensify training and evaluation of the TWS section of the 1954 CCS, J. Levenson and I have been given full responsibility for this job and have been relieved of all other work. Therefore, all inquiries regarding the 1954 CCS or the XD-1 System should be directed to R. L. Walquist.

(J. Ishihara) (CONFIDENTIAL)

The 1953 Cape Cod Program, adapted for buffer-drum data input, has been successfully operated during last week's systems tests. Modifications to the Track-While-Scan program which were incorporated at the same time included (1) past radar-data display, (2) an assistance display for interceptor initiation (not operated as yet to avoid confusion), (3) monitor action on both correlated and uncorrelated radar data, and (4) a Tracking Officer light-gun action to mark data for Track Initiator/Monitor actions.

With the able assistance of Ardis Morris, two sets of 1953 Cape Cod Program records have been compiled and brought up to date. In the future a complete set of program records will be available in the Combat Center and in the Whittemore Building for reference.

1.12 Data Screening (Continued)

(H. Frachtman) (CONFIDENTIAL)

The biweekly period has been spent processing the data collected during System operation.

(D. L. Bailey) (CONFIDENTIAL)

This period was spent assisting Ishihara in testing the modified Cape Cod Program (including past-history display and buffer-drum correlation program). This program is now operating.

Currently, Hal Seward and I are surveying possible tracking improvements for the 1954 Cape Cod System; these include possible modification of the crossing-track procedures.

(H. H. Seward) (CONFIDENTIAL)

D. Bailey and I have been considering possible improvements in the handling of crossing tracks in the 1954 System.

In addition, we are investigating methods which might facilitate the tracking of turns or splits. However, a study of several track histories offers little encouragement along this line.

(J. Levenson) (CONFIDENTIAL)

A new program for testing, evaluating, and training Track-While-Scan personnel is being drawn up, and meetings will begin next week.

A new data-recording program for analysis is now operating in the System. Only one hour's worth of data has been analyzed, so no statistics are yet available. The results should give some idea of the efficiency of tracking, automatic initiation, and monitoring.

Some time was spent observing operations of the System to determine what information is pertinent to a System evaluation, and plans are being made for recording this data. Observation has shown the difficulty in reconstructing what actually happened from the accounts of operating personnel.

(H. Peterson) (CONFIDENTIAL)

During the last two biweekly periods the following has been accomplished:

~~CONFIDENTIAL~~

~~CONFIDENTIAL~~
UNCLASSIFIED

1.12 Data Screening (Continued)

(H. Peterson) (CONFIDENTIAL) (Continued)

I have a new past history of data program that can operate at some time on non-Track-While-Scan and has an additional factor of allowing the Tracking Officer to call attention of a monitor to any point on the scope.

I have again submitted a Track Monitor's manual for approval.

I have written for R. L. Walquist a personal evaluation of the September System with the 1954 System in mind.

I have written a past history of track program that on demand shows five former positions of a track one minute apart in position.

(W. M. Wolf) (CONFIDENTIAL)

A manual for the Mapping Supervisor is being written in the same fashion as that for the mappers.

An attempt will be made to take pictures of the data and the maps each time live data is used.

Programming of the input-radar-data-analysis program is continuing.

(E. W. Wolf) (CONFIDENTIAL)

The calibration of the gap-filler radars and of the Mark X, using S. Truro as a standard, is now in progress. At the same time spot checks are being made to assure the continued accuracy of the S. Truro calibration.

An error of about five units was detected in the azimuth zero of the Mark X on 26 February. This error has been reported to be corrected.

Calibration missions have been flown for the Clinton, Derry, Scituate, and Halibut gap fillers. The Scituate data indicate no calibration errors. The data from the other gap fillers are inconclusive.

1.13 Tracking and Control

(A. Mathiasen) (CONFIDENTIAL)

Arithmetic errors were discovered in the Raydist data-reduction program. Hand calculations have been carried through to check on the present arithmetic and to provide a check on the accuracy of the computer results.

~~CONFIDENTIAL~~
UNCLASSIFIED

~~CONFIDENTIAL~~
UNCLASSIFIED

1.14 Weapons Direction

(D.R. Israel) (CONFIDENTIAL)

Work continues on preparations and planning for the 1954 Cape Cod System:

1. M-2706, "Memos Concerning the 1954 Cape Cod System" (D. R. Israel), has been issued and established a new series of memos concerned with the 1954 Cape Cod System.
2. The functions of weapons assignment, intercept direction, anti-aircraft, height finding, and identification have been reviewed in considerable detail. The actions of the station and programs have been studied, particularly to extract information leading to the development of the master make-up (MMU) program which will tie the individual functions together. Benington and Zraket are coordinating this work.
3. The equipment requirements and panel positions for each operating station have been reviewed, and initial allocation of intervention-register space has been made. George Rawling is keeping the list of up-to-date allocations.
4. After discussion with R.L. Walquist, it has been agreed that the Weapons Direction Section will assume the programming responsibility for the master control program, simulation program, and output recording program of the 1954 CCS. The specifications of these programs will be carefully reviewed with the TWS Section. Gaudette and Knapp are preparing proposals, in memo form, for each of the functions.

Material for the summary report has been collected during this biweekly period. A memo covering the results of operation and evaluation of the 1953 CCS over the past 5-6 months is in preparation. This document will summarize all of the available data and statistics regarding the WD, IND, HF, AAA, and ID functions.

Estimates of the time and experience required to train personnel for the operating positions of the 1953 CCS Direction Center have been collected and are being published as M-2719, "Training Requirements for Operating Positions of the 1953 Cape Cod System," (Israel and Zraket).

A review of the flight-test requirements and program for the Intercept Direction section of the 1953 CCS is now under way. This will lead to the publication of a memo detailing the program for the next two months. This memo should be ready the week of 15 March.

1.14 Weapons Direction (Continued)

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

The ATABE (automatic target-and-battery evaluation) feature mentioned in the last report is practically programmed, and coding should be completed in the next period.

Three live AAA missions were performed this period.

On 2 March, five tracks were passed to AAA, and four were locked on, one being dropped by Track-While-Scan. Only three tracks were splashed, the fourth track breaking lock-on for no apparent reason.

On 4 March, four tracks were passed, three were locked on, and two splashed. Mission was terminated at request of AAA before completion of AAA action against all strikes.

On 11 March, six tracks were passed, three were locked on, and two splashed. Of the six passed, two were repasses of tracks dropped earlier by the Anti-Aircraft Liaison Officer because of poor tracking by TWS. The fourth actual strike was never tracked by TWS within 60 miles of Boston. The link with the FPS-3 radar was broken during the mission, but before that time several bad tracking situations developed.

The Combat Data Director complained of phone calls from the AALO calling the former's attention to situations already recognized during this last mission. It is necessary that the AALO call the CDD when tracking troubles develop for the following reasons:

1. Quite a few instances have occurred in the past where the AALO has noticed and called the attention of TWS to tracking troubles not noticed by the CDD or Tracking Officer.
2. The AALO has to know how long a tracking trouble is apt to last, so that he can tell whether to "fade" (continue a track without passing plots) or "scrub" (drop a track altogether to increase probability of success with other tracks).
3. When a new track suddenly appears in the general area of a tracking difficulty, the AALO has to know whether, in the judgement of the CDD, the new track corresponds to the old strike. He must do this for his own purposes, as well as to enable him to call the Identification Officer (IDO) and tell him not to make the strike aircraft a friendly, as is usually done.

If the CDD cannot handle the phone traffic at his station, it is suggested that he announce over the loud speaker tracking difficulties noticed which involve strike aircraft and the status of action being taken to correct them.

1.14 Weapons Direction (Continued)

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

A successful raid-size-determination exercise was held on 9 March. This has been reported on in an inter-office memo to C.R. Wieser. Further tests are scheduled.

(F.M. Garth) (CONFIDENTIAL)

The memorandum proposing a method for obtaining return-to-base minimum-fuel paths has been completed and distributed among members of the Weapons Direction group. Several helpful criticisms have been offered. It is felt that a careful analysis should be made of the parameters which affect minimum-fuel paths - climb rates, wind rates, cruise rates.

Digital-information display (DID) requirement forms have been filled out which suggest possible Intercept Director and Intercept Technician displays for the 1954 Cape Cod System. These include the selected and forced displays needed by the IND and the vectoring tote required by the INT. This work was done in collaboration with L. Murray. Characters for these same DID's were also suggested.

(G.H. Gaudette) (CONFIDENTIAL)

The action-analysis program is now ready for operation with the 1953 Cape Cod System. The section of the program which records on magnetic tape the action and intervention registers every frame has been checked out. The remaining section of the program, which analyzes these actions at the completion of the test, has been partially checked out, i.e., only the actions taken at the Flight Test Umpire station and Intercept Director stations may be analyzed. The analysis of the actions of the remaining stations will be added as soon as their programs are debugged.

An indoctrination program for new staff members of Group 61 has been prepared by C. Grandy and me. However, the program will be open to other interested and qualified people. The syllabus includes the 1953 Cape Cod System, 1954 Cape Cod System, and the Transition System. An M-note which gives the schedule has been written.

W. Lone and I have written an inter-office memo briefly describing programming for the XD-1 magnetic-tape units.

(C. Grandy) (CONFIDENTIAL)

The evaluation studies of the Cape Cod height finding continue with the completion of the analyses of data taken during February 1954. The results of these studies have suggested a number of improvements

1.14 Weapons Direction (Continued)

(C. Grandy) (CONFIDENTIAL) (Continued)

in the program and system operation. Whenever feasible, the improvements are being incorporated into the 1954 System. Planning for the 1954 height finding is complete except for a few details, and a flow diagram of the new program will be constructed during the coming biweekly period.

A successful raid-size test was held on 9 March 1954, during which useful data was taken. Results of the test, reported in detail in an inter-office memo, indicate a limited ability to do raid discrimination with the present facilities. These tests will continue.

A familiarization program to acquaint new Group 61 staff members with the Cape Cod and XD-1 Systems has been planned in cooperation with C. Gaudette. An M-note concerning this program will be issued during the week of 15 March.

(S. Hauser) (CONFIDENTIAL)

Evaluation of identification continues. Correlation of ID data with FTU data has assisted in accounting for unknown tracks in the System during test periods. Most recent data indicates that all uncorrelated flight plans are on aircraft flying over land.

To effect a new identification program with greater automaticity, certain changes in equipment, switches, and displays were discussed with D. Israel, C. Zraket, M. Brand, and H. Benington.

In the next biweekly period, M. Brand and I will prepare flow diagrams which will describe in detail the changes in the ID program and how these changes will affect the program of the entire System.

(F. Heart) (CONFIDENTIAL)

Effort has continued on various Cape Cod revision problems. Some thought is being given to threat-evaluation problems.

(S. Knapp) (CONFIDENTIAL)

Preliminary plans for the equipment and program requirements for the Flight Test Umpire monitor station in the 1954 Cape Cod System have been made. At this station will be all the facilities for controlling magnetic-tape recordings made during operation of the System for later analysis.

M-2677, "Data Storage and Program Organization of the Weapons Direction Section," written with C. Gaudette, is nearly complete and will

1.14 Weapons Direction (Continued)

(S. Knapp) (CONFIDENTIAL) (Continued)

be ready for distribution soon.

Two errors in the identification program (progressing), one of which has been cropping up every once in a while for the past few weeks, have been traced and corrected.

The action-analysis program for the Intercept Director stations has been checked out. It is hoped that the recording program will be used during actual System operation so that this analysis program can be used to provide some pertinent information for evaluation.

(W. Lemnios) (CONFIDENTIAL)

Records of all attempted intercepts from 1 October 1953 to 28 February 1954 have been summarized in two inter-office memos. These summaries also give averages of various parameters important in the evaluation of interceptions. A more detailed summary is being prepared.

Work on automatic threat evaluation has continued.

Some time was spent at the Barta Building while tests were being conducted.

(L. Murray) (CONFIDENTIAL)

The G/A D/L testing program has shown its first signs of promise. The D/L receivers are now being taken out of each aircraft, checked thoroughly, and then reinstalled with extreme care. This has been completed on three F-89's. One of these has been flight-tested successfully by Group 61, and a completely D/L-controlled interception has been conducted. The other two aircraft should have their D/L operational soon.

A visit to R. McMannus at AFCRC was made this week. The purpose of this was to exchange information on D/L operations and to determine what advantage could be gained by combining Broad Jump flights with our D/L testing. It seems doubtful that either party would gain by combining these tests. A more definite conclusion cannot be reached until their flight tests and procedures have been observed.

A proposal has been made for the format of the Intercept Director's (IND's) digital-information display (DID) in the 1954 Cape Cod System. This is now being considered by G. Zraket.

1.14 Weapons Direction (Continued)

(J. Nolan) (CONFIDENTIAL)

Time has been spent during the past biweekly period in work for 1954 Cape Cod:

1. Writing and operating, in conjunction with L. Murray, a program to give a mock digital-information display in the format proposed. This display indicated the quantity and spacing of digital characters within this format for optimum readability.
2. Assisting F. Heart in making a preliminary layout of intervention switches for the Weapons Assignment Direction station.
3. Determining the detailed format of digital displays for the Weapons Director's 5-inch scope.
4. Writing an inter-office memo on scramble procedures.

(G. Rawling) (CONFIDENTIAL)

Final proofing of M-2185-2, "Revised Wiring of Push Button Panels to Data Insertion Registers," is being completed. This will be a complete record of this type of equipment prior to change to the 1954 System. Rough-draft telephone labels are being prepared for the coming phone changes.

Allocation of data-insertion registers has commenced, with some reconciliation of supply and demand. Modification of some consoles and side frames has been done.

(F. Webster) (CONFIDENTIAL)

The problem of noise simulation and testing on MTC is being studied in conjunction with simulation projects on which W.I. Wells is working. Because of certain difficulties encountered in the generation of "pseudo-random" numbers, it appears advisable to program certain tests that can be applied to samples from the generator.

(C. Zraket) (CONFIDENTIAL)

A plan to have the computer take scan-by-scan pictures of the radar data and track-situation display during Cape Cod System operational tests will be tried during the next biweekly period. R.N. Davis has volunteered to process the pictures after the tests.

1.14 Weapons Direction (Continued)

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

Detailed plans on the inputs, outputs, and displays for each station of the Weapons Direction Section of the 1954 Cape Cod System are being formulated with other Group 61 staff.

A number of meetings on the evaluation program proposed by BTL for the Lincoln System have been attended.

The evaluation data collected during the past four months on the 1953 Cape Cod System will be processed during this period with D.R. Israel, and a memo will be issued. A test program for the next two months will also be drawn up. It should be noted that none of the Cape Cod tests conducted to date have been instrumented. Most of the evaluation data obtained pertains to System operation and is largely qualitative.

The operating procedures for Cape Cod tests are being reviewed with W.S. Attridge in the hope of increasing System efficiency during tests.

Material on Direction Center operations was prepared for H Benington for the Quarterly Summary Report.

1.15 Direction Center Operations

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

The following is a brief summary of the operation of the Cape Cod Direction Center during the past biweekly period. Detailed reports on any of the tests are available from P. Cioffi. Radar-calibration data is available from E. Wolf. The automatic ground/air data link has been successfully used operationally on one occasion during the past period.

Tuesday, 2 March - A System operational test utilizing 5 single aircraft raids (B-29's) on Ops Plan 12 was conducted. Four F-89 interceptors were available. No Mark X data from interceptors was available to the Direction Center because of malfunctioning of the equipment at Bedford. Nantucket was the only height-finder site on the air. Four interceptions were attempted, all final-turn beam attacks.

Two of the interceptions were successful, one being completed by AI radar pickup at 11,000 yards. The remaining two were not completed successfully because of inability to track the interceptors for lack of data. An AAA mission run concurrently on the 5 raids resulted in 3 out of 5 splashes.

Wednesday, 3 March - A radar-calibration mission employing a B-29 equipped with bombsight was successfully conducted.

Thursday, 4 March - A demonstration test for ADC visitors was conducted utilizing 3 single-aircraft raids (B-29's) on Ops Plan 12.

1.15 Direction Center Operations (Continued)

(C.Zraket, W.Attridge, P.Cioffi, R.Davis) (CONFIDENTIAL) (Cont'd).

Four F-89's and one F2H were available as interceptors. An AAA mission was run concurrently with the intercept mission.

Five interceptions were attempted, but only two were successful. The remaining three were not completed because of interceptor tracks being interchanged during a period when the Mark X data stopped coming in to the Center.

Friday, 5 March - A radar-calibration test utilizing a B-29 equipped with bombsight was conducted.

Tuesday, 9 March - A height-finder raid-size and accuracy test utilizing a single raid of 4 aircraft (B-29's) on Ops Plan 13 was conducted. Three F-89's and two F2H's were available as interceptors. The buffer drum and past-history display programs were used in the Track-While-Scan section. Both the Pigeon Hill height-finder site and the CPS-6B (V-beam) were not available for the test. No AAA mission was conducted.

A large amount of data was obtained from the operation of the Nantucket height-finder site on raid size and height accuracy. Three out of four interceptions attempted on the single raid were unsuccessful because of interruptions caused by three computer alarms.

Wednesday, 10 March - A radar-calibration test employing a B-29 equipped with bombsight was held.

Thursday, 11 March - A System operational test was conducted utilizing 4 raids (B-29's) on Ops Plan 12 and 8 interceptors (six F-89's, one F2H and one F9F). The test was concluded prematurely because of a primary radar-transmission-line failure. Four successful intercepts were completed of which one was by data link and one by AI radar pickup. One intercept was incomplete because of inability to track the interceptor. Mark X data was not completely effective in the north. Interceptor-target track cross-over troubles continued (track numbers interchanged).

Friday, 12 March - A radar-calibration test utilizing a B-29 equipped with bombsight was held.

~~CONFIDENTIAL~~
UNCLASSIFIED

1.15 Direction Center Operations (Continued)

(A. 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)	
	No. Hours	Per Cent	Hours	Per Cent
Assigned Time for System Operations	120	100	196.6	100
Unrestricted Operating Time	6.6	66.3	109.0	55.4
Down Time	0.4	3.7	29.8	15.2
Recovery Time	0.2	1.7	2.2	1.1
Limited Operating Time	2.8	28.3	55.6	28.3
Time Lost (Hours)				
	Down Time	Limited Operations	Down Time	Limited Operations
Computer Room 222	0.4	0.0	26.8	0.0
Radar and Input	0.0	0.0	2.6	48.7
Miscellaneous	0.0	2.8	0.3	41.0
	0.0	0.0	0.0	25.3

(W. Vecchia) (CONFIDENTIAL)

Computer Operations:

Total Assigned Time		82 hr
Weapons Direction	7 hr	
Track-While-Scan	20 hr 25 min	
Combined Weapons Direction and Track-While-Scan	13 hr 50 min	
Tracking and Control	7 hr 30 min	
Equipment Check (Guy Young)	1 hr 40 min <u>50 hr 25 min</u>	
Time Given to Math Group	26 hr 25 min	
Time Given to In-Out	15 min	
Time Lost to Computer (Malfunction)	4 hr 55 min <u>31 hr 35 min</u>	
	50 hr 25 min	
	31 hr 35 min	
Grand Total	<u>82 hr</u>	

~~CONFIDENTIAL~~

~~CONFIDENTIAL~~
UNCLASSIFIED

1.15 Direction Center Operations (Continued)

(C.Zraket, W.Attridge, P.Cioffi, R.Davis) (CONFIDENTIAL) (Cent'd)

Summary of Biweekly Operations:

	<u>Last Period</u>	<u>This Period</u>	<u>1954 Totals</u>
System Operational Test Sorties			
Requirement	50	50	250
Scheduled	50	50	250
Flown	8	18	78
Per Cent Flown (of required)	16	36	31
System Evaluation Test Sorties			
Requirement	24	24	120
Scheduled	24	24	120
Flown	7	22	65
Per Cent Flown (of required)	29	92	54
Components Test Sorties			
Calibration			
Requirement	2	2	10
Scheduled	4	4	20
Flown	3	4	11
Per Cent Flown (of required)	150	200	110
Per Cent Flown (of scheduled)	75	100	55
Data Link Sorties			
Requirement	0	0	0
Scheduled	14	16	57
Flown	2	9	19
Per Cent Flown (of scheduled)	14	56	33
Total Sorties			
Requirement	76	76	380
Scheduled	92	94	447
Flown	20	53	172
Per Cent Flown (of required)	38	70	45
Per Cent Flown (of scheduled)	22	58	36
Per Cent Scheduled (of required)	121	124	118

Evaluation of the 1953 Cape Cod System is being continued with emphasis on the trial of methods of data recording to form the basis of proposals for incorporation in future systems. This work is being coordinated with the evaluation effort of the TWS Section through J. Levenson.

~~CONFIDENTIAL~~

UNCLASSIFIED

1.16 AN/FSQ-7 XD-1 Support

(D.R. Israel) (CONFIDENTIAL)

In answer to a request from the Air Force Liaison Office, comments on the recommendations of the recent groups of visiting ADC controllers have been prepared in memo form as M-2711, "Action on the Recommendations of ADC Visitors," (D.R. Israel). This memo will be issued early next week.

A new familiarization program, similar to, but shorter than, the one given for ADC visitors, is being prepared by Grandy and Gaudette. This new program, which will be described in a forthcoming memo, is designed primarily for new staff members of Group 61. A limited number of outside participants will be included. This program is presently planned for the week of 29 March, with a repeat, if necessary, on 26 April.

Preparation of floor plans for the operating areas of XD-1 has continued. The first sketches prepared by Charlie Grandy have been reviewed with Forrester, Everett, Wieser, and Dodd, and drafted plans are now in preparation. In conjunction with this work, up-to-date information and estimates on the use and allocation of display consoles, auxiliary consoles, switching units, and switch panels has been accumulated and are being issued as M-2720, "Equipment Estimates and Allocation for XD-1 Operating Positions," (Israel and Rawling). This memo supersedes a previous inter-office memo of several weeks ago on the subject.

On 8 March, a group consisting of Everett, Wieser, Kromer, Ayer, Francis, Patterson (ADES), and myself visited the Combat Center of the 32nd Air Division at Syracuse and the COC of the EADF at Newburgh. The trip was highly instructive and clearly pointed up the operational requirements and problems of display at these places. Techniques for manual plotting on Flexiglas are highly advanced at Newburgh.

(R.L. Walquist) (CONFIDENTIAL)

The Operations Room floor plan for XD-1 has been studied. The only objection to the present layout which has been raised is the inability of the supervising personnel to see the various operators working under them. This is caused by the top of the console being at about eye level. Other console arrangements are being studied to determine if they might alleviate this difficulty.

(C. Grandy) (CONFIDENTIAL)

During the past biweekly period, the equipment layout of the XD-1 Direction Center on the second floor of Building F was completed in conjunction with D.R. Israel. Large-scale (3/4" = 1') drawings of the layout are being revised by the Drafting Room, and prints should be available early in the next period.

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

(H.J. Kirshner) (CONFIDENTIAL)

A meeting which was concerned with a maintenance intercom system for XD-1 was attended at Poughkeepsie. Results of the meeting are to be issued in memo form.

Proposed specifications for operation of the XD-1 tactical telephone system are currently being completed.

(W. Lone) (CONFIDENTIAL)

Decisions have been made with IBM regarding the magnetic-tape units to be used with XD-1. The basic design will be that of the 727 IBM magnetic-tape unit. Programming for it will be described in the revision to TR-7 which will be published in a month or so.

I have begun the programming for the XD-1 utility programs.

(J.H. Newitt) (CONFIDENTIAL)

The past biweekly period has been devoted to further work on console design. Conferences on this subject have been carried on between MIT and IBM. Preliminary design of the structure has started although there are many details yet to be frozen. The front-panel and side-frame configuration is still undergoing serious consideration, and a special study in Group 61 is being conducted to try to crystalize these requirements. Liaison has been established to coordinate the efforts of the industrial designers, the engineering designers, and the psychologists in respect to the finalizing of the various problems involved. A scheme to provide flexible access of air-conditioning ducts to the console has been worked out and is being checked against the building structure (for joist and beam interference) and the proposed center layout plans. I have started the design of some prototype models of a high-voltage power supply of the high-frequency type. It is expected that such a prototype would be used both as a basis for a supply to be used in future console designs and as a basis for replacement of the presently unreliable supplies in Cape Cod.

The air-conditioning spec for the Cape Cod revision is just about complete, and contractors will be called in for bids within the coming biweekly period.

(G. Rawling) (CONFIDENTIAL)

I have been assisting D.R. Israel in revision of personnel and equipment estimates and floor-plan modification.

1.2 Group 64

(S. H. Dodd) (CONFIDENTIAL)

As a result of some recent personnel reassignments, O'Brien has transferred to the XD-1 program in Group 62, and Rich has been transferred to Group 64 to supervise the Input-Output Section. The men who were in the Equipment Engineering Section of Group 61 have also been transferred to Group 64 and, with the exception of Morriss, will continue their work in Rich's Section. Morriss is commencing a study of some problems relating to the AN/FSQ-7 production-model design.

Computer reliability has maintained a high average during the past two weeks, but in spite of trouble-shooting efforts the source of several transfer-check alarms has not been found.

Construction requisitions for some items involved in the installation of the new Cape Cod mappers (CRT filters) have been written. Several other items for this installation are in the design or drafting stage.

The input buffer-storage section of the buffer drum is now available for use by Group 61 programmers in the Cape Cod tests. Actual computer experience with this equipment is needed to check its reliability before a decision can be made to remodel the three MTE units and flip-flop buffer storage which have been used in the past.

AN/FSQ-7 Production Design

(B. E. Morriss) (CONFIDENTIAL)

I have recently joined S. H. Dodd's group to work on the production model of AN/FSQ-7. Because the Big Switch notes are being used by a number of people as the method of building a duplex system, they are being critically analyzed as rapidly as possible. At present a group at IBM is investigating some of the possible ways of inserting data into the two machines and switching between them, and a group at MIT is preparing a proposed procedure for operating the duplex center.

Scheduling

(T. R. Parkins) (CONFIDENTIAL)

Detailed schedules have been initiated covering the following activities:

Basic Circuits
Display Circuits
Display Frames
MTC

Scheduling

(T. R. Parkins) (Continued) (CONFIDENTIAL)

Building F Construction
KD-1 Installation
KD-1 System Test

These schedules will be posted weekly. Once a month a brown-line copy of all schedules will be sent to the scheduling department at IBM (High Street). These copies will show cumulative posting information for the preceding month.

1.21 WWI System Operation

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

A prototype of the new core-memory sense amplifier is nearly complete. It is planned to install the unit in WWI for tests on Tuesday, 16 March. If the results of the tests are satisfactory, the unit will be left in service for a reliability check.

All of the fixed-voltage switching panels in Rack PO have been replaced by a new model. This is the initial step in our plan to replace all of the fixed-voltage switching panels and voltage-variation switching panels in P Row. The models contain more reliable relays and should therefore ease our relay maintenance work load.

During the past biweekly period, the majority of the systems testing time was used to investigate the main control section of the computer in search of the origin of several transient transfer-check alarms that have occurred. Several faulty tubes and crystals were located, but the trouble is believed to be still present. More testing will be done during the systems-testing period.

Typewriters and Paper Tape

(L. H. Norcott) (UNCLASSIFIED)

Commercial Controls Corp. reports that our three new Flexo-writers are now going through their final assembly line and will be shipped to us shortly. As soon as they are received, the Flexo shop will modify them for use with Whirlwind.

UNCLASSIFIED
CONFIDENTIAL

1.22 Terminal Equipment

(R. H. Gould) (UNCLASSIFIED)

One K1084P7M 16-inch cathode-ray tube that was removed from service because of spurious emission from the control grid has been successfully rehabilitated. R-F bombing of the control grid stopped the grid emission without apparent damage to the cathode.

Logical difficulties with block control have recently come to light, and a rather basic redesign of block control may be desirable. Other changes to in-out control to simplify magnetic-tape operation and to simplify in-out control generally are being planned.

Work continues on bringing in-out drawings up to date.

CRT Filter System

(S. B. Ginsburg) (UNCLASSIFIED)

Construction requisitions have been written for all necessary plug-in units to be used in the system. Four new types of plug-in units are being constructed.

1. Gate Tube, Mod. III

This unit has two gate tubes (7AK7) which take a positive input and supply a negative 0.1- μ sec pulse out.

2. Filter Delay Gate Generator

This unit contains two one-shot multivibrators which are triggered by a 0.1- μ sec pulse and supply a gate or differentiated gate output.

3. Filter Intensify Gate Driver

This unit works in conjunction with 2 (above) to drive a long line and also produce the double-stepped gate for intensifying and re-intensifying the CRT unit.

4. Filter Gate Driver

This unit works in conjunction with 2 (above) to drive a long line.

1.22 Terminal Equipment (Continued)Telephone Lines and Data Link

(H. J. Kirshner) (CONFIDENTIAL)

The telephone lines used for S. Truro SDV have been reassigned so as to function after measurements showed a difference in noise level among the three lines. The quietest line is used as the line from which azimuth and timing is derived, the more noisy line as the second line of the system, and the third as a spare.

A new-type demodulator was tested here in conjunction with a new-type modulator at the Clinton site, and both operated satisfactorily. The new demodulator will be connected permanently on 15 March.

Data Link equipment at the Barta Building appears to be operating satisfactorily. Some difficulties were encountered at Prospect Hill which were subsequently remedied. These difficulties were probably responsible for poor performance of the system during the week of 1 March. A successful Data Link controlled intercept was performed on 11 March.

Cape Cod Mappers

(A. V. Shortell, Jr.) (CONFIDENTIAL)

Work on the scan-synchronizer design is continuing. Present effort is devoted to designing a feedback circuit which will control a free-running multivibrator with a voltage proportional to the integral of an error voltage.

Pathfinder

(N. N. Alperin) (CONFIDENTIAL)

Work is continuing on the Raytheon Pathfinder modifications. I have completed the schematic for the control chassis and a wiring diagram for the entire unit.

Construction on the phototube pickups and sweep circuits will start in the next few days.

Al Smith expects to have a prototype azimuth drive ready for test on 12 March.

~~CONFIDENTIAL~~
UNCLASSIFIED

1.22 Terminal Equipment (Continued)

Marginal Checking

(T. Sandy) (UNCLASSIFIED)

The panel which will activate all the light guns in order to supply a closed loop for testing some of the display circuits has been bench tested and will be installed next week.

We are working on a method of marginal checking the intervention registers, activate registers, and indicator-light registers.

Buffer Drum System

(K. E. McVicar) (UNCLASSIFIED)

The buffer drum is now connected to the computer at all times and is available to programmers without special arrangement. The buffer section is connected to seven MITE units. Three of these are in parallel with the old MITE installation.

The auxiliary-storage section does not yet have a parity digit, but it is checked daily and can be used with reasonable assurance of reliable operation. The interlace on the auxiliary-storage section of the buffer drum is eight instead of four as on the auxiliary drum. It takes about twice as long to make a complete block transfer of one group from the buffer as it does from the auxiliary.

(L. D. Healy) (UNCLASSIFIED)

Recording of pulse waveforms at various buffer-drum terminals was continued.

Work was begun on the design of a d-c level setter to drive crystal gates in the buffer drum.

Magnetic Drums

(H. L. Ziegler) (UNCLASSIFIED)

Installation of electronic-write switching of heads in the auxiliary drum continues to progress satisfactorily. All hardware is on hand, and most of it is installed. Filament and d-c power wiring are nearly complete, and the bulk of the signal leads have been made up into cable form. These leads are to be placed in the wiring ducts during installation time Monday, 15 March, after which final wiring of the chassis plugs can begin almost immediately.

Magnetic Drums

(H. L. Ziegler) (Continued) (UNCLASSIFIED)

The magnetic drum-PETR monitor system is also nearing completion and may be completed during the week of 15 March. As presently planned, monitoring will be available for the entire auxiliary drum, groups 4-7 of the buffer drum, and the PETR output channels. Included in the new system is an entirely new switching panel designed to consolidate the present widely scattered controls and also to provide some desirable interlocking of these controls.

In-Out (MITE)

(R. R. Paddock, A. M. Werlin) (CONFIDENTIAL)

The past period has seen improvements, such as cable arrangements and margins for MITE, but no basic changes to the MITE with buffer-drum equipment.

Panel drawings for the new mapper controls are completed, and the cable schedules are in process. The new mapper control will permit both the monitoring of any one of the ten mappers and the spot reintensification of unmapped areas on each mapper.

It is anticipated that, in the very near future, the above equipment and several more buffer drum MITE's will be installed in Room 156 in the racks presently housing the old flip-flop buffer-storage MITE's. For this reason it is hoped that those affected henceforth will use the buffer drum and the associated MITE's exclusively insofar as is possible to facilitate the earliest possible installation of the new equipment.

Magnetic Tape

(E. P. Farnsworth) (UNCLASSIFIED)

The unit 2 delayed print-out equipment and test programs have been checked out and can be plugged into the second Flexowriter when the enclosure is completed. Switches to interchange unit 2 and unit 3 IOC, unit 2 and unit 3 print-outs, and to convert the unit 2 Flexowriter to standard FL or delayed print-out are under construction in the shop. The rewind indicator gong is installed and operating, and "ON LIMIT" lights are being mounted on each tape-unit control panel. Modifications are being made to improve the two-tone chime effect to prevent confusion with the computer alarm, and to change the "Rewind Unit 0" switch near PETR from a toggle to a push-button switch.

The delayed print-out functional schematic drawing was completed, and the block schematic for the entire magnetic-tape system has been brought up to date. Both drawings are in the ~~the~~ service file.

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 26 February - 11 March 1954:

Number of assigned hours	166
Usable percentage of assigned time	97
Usable percentage of assigned time since March 1951	87
Number of transient errors	15
Number of steady-state errors	1
Number of intermittent errors	12

Component Failures in WWI

(L. O. Leighton) (UNCLASSIFIED)

The following failures of electrical components have been reported since 26 February 1954:

<u>Components</u>	<u>No. of Failures</u>	<u>Hours of Operation</u>	<u>Reasons for Failure</u>
<u>Crystals</u>			
1N38A	2	0 - 1000	Low back resistance
1N38A	1	3000 - 4000	Low back resistance
1N38A	1	17000 - 18000	Drift
D-358	1	22000 - 23000	Unstable back resistance
D-358	1	23000 - 24000	Unstable back resistance
<u>Resistors</u>			
2500-ohm 1/2-watt $\pm 1\%$ deposited carbon	1	0 - 1000	Above tolerance
9000-ohm 1/2-watt $\pm 1\%$ deposited carbon	1	0 - 1000	Above tolerance
220-ohm 1/2-watt composition	1	5000 - 6000	Above tolerance
<u>Timers</u>			
TD-8, 0-15 Minute Cramer	1	22000 - 23000	Overheated
<u>Transformers</u>			
Plate transformer PEC 12 KVA	1	2000 - 3000	Short
Pulse transformer S 193-8 5:1	1	0 - 1000	Open primary

Component Failures in WWI

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

<u>Components</u>	<u>No. of Failures</u>	<u>Hours of Operation</u>	<u>Reasons for Failure</u>
<u>Tubes</u>			
5670	2	9000 - 10000	Low plate current
	1	11000 - 12000	Low plate current
5963	1	10000 - 11000	Low plate current
5998	1	0 - 1000	Short
6145	3	0 - 1000	Short
	1	0 - 1000	Short
	1	0 - 1000	Short
	3	1000 - 2000	2 leakage; 1 short
	1	3000 - 4000	Short
6Y6G	1	23000 - 24000	Low plate current
7AD7	1	6000 - 7000	Short
	3	22000 - 23000	Short
	2	23000 - 24000	Short
7AK7	1	14000 - 15000	Open filament
	1	20000 - 21000	Short
	2	22000 - 23000	1 leakage; 1 short
C6J	1	0 - 1000	High arc drop
	1	19000 - 20000	High arc drop

1.24 GeneralWWI Power Supplies

(D. M. Fisher) (UNCLASSIFIED)

A prototype of the new amplifier for the -450-v regulator has been constructed. Testing of the unit will now begin. If tests prove satisfactory, this amplifier will be used in the new WWI -450-v supply.

D-C Power Supplies

(S. T. Coffin) (UNCLASSIFIED)

The WWI +120-v, 10-amp d-c supply has been rebuilt and is now in the dynamic testing stage. It will be installed in WWI on 22 March.

The -30-v supply will be worked on next.

1.3 Group 65

1.31 Activities of Group 65

(P. Youtz) (UNCLASSIFIED)

Most of the effort of the Group continues to be expended on problems concerning the 19-inch Charactron and the 5-inch Typotron tubes.

Three tubes were constructed this period to improve the electron optics for better registration. One tube, Cht 17, was designed to evaluate the optics of the Typotron. This was to include a study of deflection difficulties and a comparison of pin-cushion distortion mis-registration in the projection optics and in the shadow-graphic optics. The second tube, Cht 21, was a Typotron designed around the most recent Hughes convergence coil with its electrode dimensions optimized to give best registration and deflection characteristics with the matrix centered in the convergence coil. The third tube, Cht 19, was a Charactron tube designed around a new convergence coil with its electrode dimensions optimized to give best registration characteristics with the matrix centered in the convergence coil. These tubes are undergoing evaluation and analysis by Frank Rodgers and Peter Tandy. On the basis of this analysis, new tubes will be designed for further studies.

Hughes Aircraft constructed two more tubes. John Koda of Hughes will bring these two new Typotron tubes East, so that they will be available for the test and evaluation period on 16 March 1954. These tubes will be similar to the Typotron tube 319 that I brought back on 26 February 1954.

The program with Joe Klein of Group 25 to evaluate aluminized phosphor screens continues. A trip was made to the General Electric Cathode-Ray Tube Division at Syracuse, New York, for technical discussions on aluminized screens, P7 and P19 phosphors, and nonreflective coatings.

Group 65 has continued to work with George Sponsler of Group 25 to set up an automatic electron-trajectory tracer in cooperation with the MIT Dynamic Analysis and Control Laboratory.

Work on helical coatings continues.

One trip is scheduled for next week to Sylvania to review their progress on the improved 7AK7 tube.

1.3 Group 65 (Continued)

1.33 Research and Development

(J. S. Palermo) (UNCLASSIFIED)

During the past period I visited the General Electric plant in Syracuse, New York, together with P. Youtz and J. Klein of Group 25, for a conference on cathode-ray-tube techniques and the present status of the indicator art.

Work on lacquer films for aluminized screens is now in progress in our Chemical Laboratory together with our program for the evaluation of helical-dag coatings.

In view of an increased demand for P₄ phosphor screens for research and experimental tubes, we are expediting the construction of a tilt table to facilitate the handling of 5-inch to 19-inch round cathode-ray tubes.

SECTION II - AN/FSQ-7

2.1 Group 62

2.11 Systems

Outputs

(I. Aronson) (UNCLASSIFIED)

Specifications have been written and orders placed for all nonstandard components in the SDU demodulator.

One demodulator panel was obtained from Division 2 for the purpose of measuring design margins and trying out the new components when they arrive.

An M-note is in progress describing a proposed schedule for the phone-line terminal devices.

Outputs Committee

(R. C. Hopkins) (CONFIDENTIAL)

The "Output System Performance Specifications" were published in M-2697 on 1 March 1954. Comments were obtained from concerned groups, and final agreement on the specifications was affirmed at a concurrence meeting of the EDO-SO at Poughkeepsie on 4 March 1954. A supporting document, M-2693, entitled "Background for Output Burst Counter Proposal for AN/FSQ-7," was also published during the period reported. Approval letter on the output system performance specifications was signed by Mr. Forrester on 12 March.

Output Section Development

(H. Rising) (CONFIDENTIAL)

The addition of a core buffer-storage register and reconnection of the magnetic-matrix switch to read out when reset would result in a considerable saving in cathodes by allowing the writing gates to be time-shared among the various output sections. Tests on a single core in a register show driving-current margins of 88-144 milliamperes for single disturb operation. A full size 25-position switch and a short buffer register are being constructed for further testing of this writing method.

A meeting was held in Poughkeepsie with R. G. Counihan to discuss criteria for a choice of systems for the output sections.

A meeting was held with R. C. Hopkins to discuss the details of the operation of each output section. The systems being proposed seem to have the flexibility required.

2.11 Systems (Continued)Logical Design

(W. A. Klein) (UNCLASSIFIED)

A Master's thesis proposal was completed during this biweekly period. The title is "Pulsed Sequential Switching Circuits," and the supervisor is Prof. D. A. Huffman.

Marginal Checking

(R. Pfaff) (UNCLASSIFIED)

The marginal-checking breakdown for memory has essentially been completed. The radar inputs, drums, and display are to be looked into next.

2.12 Magnetic-Core MemoriesXD-1 Memory

(W. J. Canty) (UNCLASSIFIED)

Discussions at Poughkeepsie on Monday, 1 March, Tuesday, 2 March, and Friday, 8 March, centered about the following items:

Sensing Amplifier: An etched-card prototype of the sensing amplifier has been built and is being debugged. Card layouts for the XD-1 units will differ slightly from those of the prototype because of a change in marginal-checking decoupling filters. However, most of the evaluation of layout for the XD-1 sense amplifiers will have to be done on the existing prototype.

Digit-Plane Driver: An etched-card prototype of this unit has been built. Evaluation of the card layouts pointed up a few serious errors. As a result of this, a new layout for one of the cards has been made. As soon as the new card is available the present prototype unit will be rebuilt and tested. The unit as yet is not in working condition. Card layouts for the XD-1 digit-plane driver units will differ slightly from the prototype unit because of a change in marginal-checking decoupling filters. However, as in the case of the sensing amplifiers, most of the evaluation will have to be done on the existing prototype.

Inhibit Gate Generator: A question has arisen about this unit. The circuit proposed by the Basic Circuits Group at IBM contains about 9 cathodes with at least three of these being 5998 cathodes. In MTC approximately the same load is being driven by 6 half-sections of 5965. Due to the short time remaining before construction of these units for XD-1, no changes will be made in the present circuit. However, since

2.12 Magnetic-Core Memories (Continued)

(W. J. Canty) (UNCLASSIFIED) (Continued)

the large number of cathodes seems to be a result of unrealistic specifications, a review of the specifications for this unit by all concerned might bring about its simplification for future machines.

Post-Write-Disturb Gate Generator: The large output signal (50-v pulse) and large capacitive load on this circuit make it a very difficult problem for the circuit designer. Members of the Basic Circuits Group at IBM have developed a circuit which will do the job but is rather complex. It will take four nine-tube pluggable units to hold the circuitry to supply post-write-disturb gating pulses to 33 digit-plane drivers. A proposal has been made to eliminate this gate generator and generate the post-write-disturb pulse in the memory by logical means (clearing MBR after the "Write," and reapplying "Inhibit" to the digit-plane drivers). There is some reluctance to design this change into XD-1 since it involves an untried scheme. The gate generator, as designed, has been laid out and released for production; further study will be given to the proposal for logical post-write-disturb.

Core Memory, XD-1

(J. L. Mitchell) (UNCLASSIFIED)

Frank Durgin (IBM) and I have worked out a preliminary proposal for marginal-checking the selection-plane-drive system. The proposal was discussed with the marginal-checking people and seems to be acceptable to them. IBM is going ahead with their design using this system; however, more experimental results are needed before this proposal should be considered final.

IBM is now testing a memory gate generator packaged in a "dual" plug-in unit. For the most part the layout seems to be satisfactory; however, a few changes that would reduce the length of the grid leads have been suggested.

The MAR cathode-follower design has been completed by IBM. We have suggested that the output lines of the cathode followers be fused to protect the crystal matrices. These fuses have proven their worth in MTC and WWI.

IBM had indicated that most of the memory equipment has been "released" and that construction is starting. The one exception is the "shower stall" which is still on the drafting board.

2.12 Magnetic-Core Memories (Continued)Memory Test Setup VI

(E. A. Guditz) (UNCLASSIFIED)

Sufficient data has been taken on the 64 x 64 memory plane made from RCA cores to show that the cores require higher driving currents than the MTC cores. Also, the ONE-ZERO margins are not as good as those for the MTC planes.

Some time has been spent with the IBM people at Poughkeepsie in modifying existing layouts of the memory cage and frame to provide greater accessibility to important test points. Considerable progress in this direction was made during the most recent visit.

External-Register- Selection Memory

(J. Raffel) (UNCLASSIFIED)

A preliminary evaluation of the 2-core-per-bit memory has been finished with encouraging results. Data taken on a 32-bit register (64 cores) has shown that it may be possible to gain some of the following advantages:

1. Positive ONES, negative ZEROS, and larger signals, thus easing the sense-amplifier problem;
2. A shorter cycle time (possibly 4 microseconds);
3. Reduced noise, hence possibly larger memory sizes;
4. Wider operating margins and/or wider acceptance specs on cores.

Some of the disadvantages are:

1. Increased driving ampere turns;
2. An extra driver per digit plane;
3. Over twice as many cores required.

Switch Cores

(A. D. Hughes) (UNCLASSIFIED)

A four-position switch was built and tested, with satisfactory results. The problem of noise from unselected switch cores producing a form of "delta" noise in the memory is being considered.

2.12 Magnetic-Core Memories (Continued)

3:2 Selection

(R. S. DiNolfo) (UNCLASSIFIED)

A core tester was set up, and the first data taken looked very poor. It was then discovered that the Mod. VI drivers, and the Mod. V drivers to a lesser degree, are prf sensitive. The cause of this was traced to the recent modification made in them. The newly added 0.25- μ f capacitor was removed, and at the expense of a slightly slower rise time (0.3 μ sec) the prf sensitivity was eliminated. Present results are somewhat more encouraging; operating conditions have been found (for MF 1326 B) under which the core retains information in the face of a large number of disturbing current pulses.

Sensing-Transformer Design

(S. Fine) (UNCLASSIFIED)

Investigation into linear transformers using ferrite cores for sensing-amplifier applications is continuing.

A toroid of Ferramic H, type 109-3, has been tried with good frequency response. A 10:1 turn ratio with 25 primary turns was used. However, a noticeable delay (over 1/2 μ sec) between primary and secondary signals was detected. The cause and correction of the delay is being investigated.

2.13 Vacuum-Tube Circuits

Typotron Display

(H. J. Platt) (UNCLASSIFIED)

The deflection amplifier was redesigned for the larger inputs available, and the frequency characteristic was stabilized.

The display of the matrix looks fairly good, and deflection compensation is good.

The Typotron will be displayed on Tuesday, 16 March, so that a decision can be made on whether it will be used.

Core-Memory Digit-Plane Driver, XD-1

(D. Shansky) (UNCLASSIFIED)

The trip to IHM (Poughkeepsie) resulted in some minor corrections of the digit-plane driver physical layout. We are presently awaiting a full set of layout and assembly drawings of the digit-plane

2.13 Vacuum-Tube Circuits (Continued)

(D. Shansky) (UNCLASSIFIED) (Continued)

driver from IHM.

Work on the DPD margins is progressing and has indicated the need for eliminating some superfluous cathodes in future designs.

Magnetic-Core-Matrix Switch Driver (for a core memory)

Some thought has been given to the geometry (proposed) of this circuit, and it is expected that this unit will be designed and bread-boarded in the near future.

Core -Memory Sense Amplifier

(C. A. Laspina) (UNCLASSIFIED)

Operation and margins of the XD-1 sense-amplifier prototype are being checked. Operation with various unbalanced tubes is very good.

A new-type sense amplifier using diodes and 3 tubes with no feedback was built and tried in MTC. Operation of the amplifier was very good. Gain stability and margins are now being checked.

Magnetic-Drum Circuits

(H. Anderson, H. Boyd) (UNCLASSIFIED)

Extensive data will be obtained on the XD-1 drum switch circuits for possible entry into the MRD Book. On or about 1 April work on these circuits will either cease or be carried on by IHM, depending upon whether or not the diode switch is approved for XD-1.

Phase Meter

(J. S. Gillette) (UNCLASSIFIED)

The input circuit has been redesigned to allow a larger range of input amplitude. The circuit must be repositioned to eliminate the tendency toward oscillation.

SDV Demodulator

(J. S. Gillette) (UNCLASSIFIED)

The demodulator has been obtained, and logic has been set up to drive the modulator which will drive the demodulator.

2.13 Vacuum Tube Circuits (Continued)

(E. K. Gates) (UNCLASSIFIED)

Pulse Transformers

From the tests on the MTC memory it looks as though faster rise times could be used on the read and write pulses without producing too much noise. The present rise time is about 0.5 microsecond. This will allow for a shorter memory cycle. In order to do this it will be necessary to speed up the rise time of the current driving the transformers.

Bill Canty and I have done some work on a pulse-transformer circuit to replace the present inhibit gate generator.

(B. Remis) (UNCLASSIFIED)

A set of marginal-checking curves has been completed for the Z-2177 used as a standard "model B" cathode follower.

(S. Bradspies) (UNCLASSIFIED)

A thesis proposal is being written in preparation for a thesis concerning noncoincident-current magnetic memory.

Power Supply Control

(D. Pinner) (UNCLASSIFIED)

Power Supply

(E. Gates) (UNCLASSIFIED)

UNCLASSIFIED

2.14 Memory Test ComputerGeneral

(W. Ogden, W. Hosier) (CONFIDENTIAL)

During the past fortnight, requests for use of MTC in testing various aspects of XD-1 equipment and programs have been made much more definite than heretofore: memoranda have been written by Arnow (on an air-defense data-reduction and simulation proposal) and by Corderman (on tests of XD-1 display equipment) indicating that beginning about 1 July, demands on MTC from these sources alone will amount to 40 hours a week or more.

Plans for reassembling MTC after the move to Lexington continue to be drawn in greater detail, taking into account the additions and modifications desired by Corderman and Arnow. Layout of the "A-frame" panels is complete, and CR's have been placed for most of the required additions.

Corderman's test schedule was further accelerated to the extent of testing XD-1 digital-expansion circuits here before MTC is moved; to this end two flip-flop registers with cathode-follower outputs are being added and addressed like flip-flop test storage. For want of better means at present, these registers will be read into by a rack of Burroughs dual gate units.

Work also continues, of course, on development of magnetic drum and Typotron.

Power-Supply Control

(D. Fisher) (UNCLASSIFIED)

Work has now been resumed on the new control system. A block diagram is being completed, and copies will be distributed to interested personnel. After the block diagram is completed, work will begin on designing the various units to be used in the control system.

Power Supplies

(D. Fisher) (UNCLASSIFIED)

Work is continuing to bring circuit schematics up to date, and units are being renamed to avoid confusion caused by similar units being used for different purposes.

2.14 Memory Test Computer (Continued)

Diode-Matrix Marginal Checking

(John Crane) (UNCLASSIFIED)

Marginal checking for the panel memory switch has been installed, and the margins were greater than 70 volts. The voltage used for marginal checking is the -150 volts connected to the cathode resistors of all cathode followers driving the switch.

12 $\frac{1}{2}$ - Inch ES Display Scope

(John Crane) (UNCLASSIFIED)

The decoder-output amplifiers for the A-register and accumulator decoders are now installed and tested. These amplifiers were used to drive the 12 $\frac{1}{2}$ -inch display scope. The results were satisfactory so the scope will be installed during the next biweekly period.

Switching facilities which enable the operator to select AMD or regular display are available on the scope panel. Also, intensification time can be controlled from the console for AMD and MD.

Magnetic Drum

(H. Anderson, H. Boyd) (UNCLASSIFIED)

A temporary supply-voltage-sequencing arrangement has been installed to keep the drum nonvolatile.

Drawings for plug-in units, panels, and a switch-housing drum stand should be available for the Drafting Room within a week.

(W. A. Clark, B. G. Farley) (UNCLASSIFIED)

Work has continued on the development and checkout of utility programs for MTC. A modification to be added to the octal constant conversion program will permit coding in relative address form and the accumulation of library routines in Flexo tape form. Two such subroutines have been written and tested: (1) a pseudo-random-number generator, and (2) a display of the output of this generator.

2.14 Memory Test Computer (Continued)

Typotron Test

(P. Bagley) (UNCLASSIFIED)

In preparation for an evaluation of the Typotron tube, a program is being written to simulate a DID (digital-information display) on the MTC Typotron.

MTC Basic Conversion Program

(P. Bagley) (UNCLASSIFIED)

The basic conversion program has been worked on at infrequent intervals and debugging is nearly complete.

Records Office

(L. Sutro, B. Kollet) (UNCLASSIFIED)

The task of converting the MTC Service File from the old system to the new has occupied the Records Office for the past two weeks and will probably continue to do so during the next two weeks.

Marginal Checking

(R. Hughes) (UNCLASSIFIED)

Several low margins in control, and in group and field control have been repaired.

MC-65, the master marginal-checking program, has been written, and additions are being made to it to include more equipment. Plans are being made to store this program on the drum.

Core Memory

(R. Hughes) (UNCLASSIFIED)

Two cold-solder joints have been found on the memory stack where the planes are interconnected. One bad joint definitely stopped computer operation last week.

2.14 Memory Test Computer (Continued)

Component Failures

(R. Hughes) (UNCLASSIFIED)

Six miniature toggle switches in toggle-switch storage have been replaced during the last biweekly period.

Four new 5965 tube failures have occurred: two were in core memory, one was in drum memory, and a 5965 removed from a high-speed flip-flop was retired because of low plate current.

2.15 System Liaison

Components

(C. W. Watt) (UNCLASSIFIED)

A procedure that will permit evaluation of components peculiar to XD-1 equipment designed at MIT has been set up. This procedure should allow component selection to proceed at maximum speed and reduce any time delay at Poughkeepsie. See Memo M-2710, "Approval and Procurement of Components for XD-1 Equipment Designed at MIT."

Drawings of XD-1

(C. W. Watt) (UNCLASSIFIED)

A file of selected drawings of XD-1 frames and electronic assemblies, filed by subject, is being collected in Watt's office. Files of all components and specifications are also maintained in the same office.

2.16 Transistors

RCA Transistors

(D. J. Eckl) (UNCLASSIFIED)

The material on the parameter distributions for the RCA TA-165 and TA-165K point-contact transistors has been compiled and is ready for publication. An M-note which covers the data on some 300 of these transistors will be available shortly.

2.16 Transistors (Continued)

Diode Characteristics Plotter

(D. J. Eckl) (UNCLASSIFIED)

Some minor modifications suggested by N. T. Jones have been made to the diode plotter. This should result in improved operation of the unit.

Texas Instruments Transistors

(D. J. Eckl) (UNCLASSIFIED)

A meeting has been arranged with W. E. Love of Texas Instruments to discuss their point-contact and junction transistors. Reports from other groups indicate that TI should be a good source of supply.

Transistor Products Transistors

(D. J. Eckl) (UNCLASSIFIED)

We have to date received 4 Transistor Products 2F transistors as samples for testing. We are awaiting a total of 20 each of their 2F, 2G, and 2C point-contact transistors. The 4 received appear to be good.

Diode Construction

(N. T. Jones) (UNCLASSIFIED)

Two more attempts are being made to solder and cement samples of the 0.00005-inch gold wire into the test jig. Because of the difficulty of handling this size wire it may be abandoned in the actual construction of diodes.

An additional instrumentation problem has appeared in the form of a lack of a suitable square-wave or pulse generator in Group 35. A pulse-generator design using the 513D rate generator as a trigger source is being considered. This will be breadboarded very soon.

Diode Storage

(N. T. Jones) (UNCLASSIFIED)

Samples of Western Electric 1821 and 1847 silicon-diffused junction diodes have been received from Bradbury of AFCRC and Schwarz of Group 35. The storage is an order of magnitude better than the GE

2.16 Transistors (Continued)

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

germanium-diffused junction 1N92 type but still worse than the worst gold-bonded types. Back resistance of all silicon units is phenomenal, measured in kilo megohms.

Curves of experimental and theoretical saturation and turn-off times in junction diodes have been plotted for inclusion in the partially completed memorandum on diode-storage measurements.

Transistor Storage

(N. T. Jones) (UNCLASSIFIED)

A new sample of transistors from Dillaby, Group 35, is being tested.

A group of transistors used for storage tests has now gone through a series of experiments using the emitter and collectors independently as diodes.

Counter Systems for Use with MTC

(E. U. Cohler) (UNCLASSIFIED)

The first of the 2^{11} counters to be used as angular-position counters has been completed and is under test. This counter uses a type of gate recently developed by C. Kirk and the two-transistor flip-flop designed by me some time ago. The counter has been tested to the extent of assuring that it works properly. Some margins have been taken on required triggers and some work done on the clear pulses needed. The preliminary results of these tests are:

Input required to counter: 0.1 microsecond, $\frac{1}{2}$ sinewave greater than 12-v/390-ohm.

Clear pulse (derived from circuits in the test system now being built): greater than 1.0 microsecond, greater than 5-v/200-ohm. The input (0.1 microsecond from drum circuits) required to trigger this test-system generator will be the same as required to count into the counter.

Maximum frequency: greater than 250 kilocycles (no tests have been performed at higher frequencies).

Power requirements: 4.05 watts (including 22 indicator lamps).

2.16 Transistors (Continued)

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

In addition to the counter, the test-circuit design has been completed on paper. We are ordering some transistors to build up parts of the test circuit and are proceeding with the construction of the rest of the test circuit. The logic of this system is identical to that used in MTC except that we do not attempt to run a coincidence detector, and our start pulses are independent of MTC.

Junction-Transistor Flip-Flops

(E. U. Cohler) (UNCLASSIFIED)

The report on the "Steady-State Conditions of a Junction Transistor Flip-Flop" will appear approximately concurrently with this Bi-weekly Report.

Transistor Magnetic-Core Drivers

(S. Oken) (UNCLASSIFIED)

The point-contact junction-transistor core driver was able to drive the equivalent of about 200 cores in series. The equivalent circuit was a 0.5-mh inductor in series with 100-ohm resistor with an appropriate damping resistor.

The M-note on junction-transistor core drivers is almost completed. The problem of finding an equivalent circuit for the transistor in the saturated condition has yet to be solved.

The core driver is being life tested. Some difficulty with the first stage of the driver has been encountered.

The problem of building a matrix to select an address in the memory will be tackled again when the note is completed. The use of junction transistors between the flip-flop and the diode matrix will be tried.

Transistor "Read-Write" Memory Driver

(S. Oken) (UNCLASSIFIED)

Through the property of complementary symmetry it should be possible to build a driver which can read and write on one winding. The driver which will be tried is made up of two parts. The first half is the same as the driver already discussed (npn type). The other half will employ a pnp junction transistor.

~~CONFIDENTIAL~~
UNCLASSIFIED

2.16 Transistors (Continued)

(S. Oken) (UNCLASSIFIED) (Continued)

The advantage that this driver has over similar vacuum-tube drivers is that here the cores will be in the collector of both circuits. In the vacuum-tube counterpart one tube has a plate-loaded circuit while the other has a cathode-loaded arrangement. Thus one driver will have a much lower output impedance than the other.

Transistor Gates

(C. T. Kirk) (UNCLASSIFIED)

In the process of trying some G11 transistors in the regenerative gate, we found that some of the supposedly "good" transistors were inoperative in the circuit. Investigation showed that these transistors had "locked up" in the "on" condition.

An analysis of the regenerative gate circuit showed that a stable operating point can exist when the transistor is in the on condition if (1) the internal base resistance was slightly greater than normal, and/or (2) the collector voltage was higher than normal (i.e., in the order of 30-50 volts).

Increasing the d-c emitter-load resistance eliminated this lock-up effect by shifting the d-c emitter load line in such a direction that a stable operating point could no longer occur when the transistor was in the on condition.

A new transistor gate has been developed whose operating speed is limited only by the rise time of the controlling flip-flop. The gate has a minimum power gain of 2 and delivers a 10-v output pulse, 0.2 microsecond wide, to a 1000-ohm load. The gate has been operated at a 1-mc repetition rate. Higher repetition rates have not been tried as it is difficult to get the flip-flops to go any faster.

The gate is essentially a grounded-base amplifier with the flip-flop control circuit in the base and the sensing-pulse input in the emitter.

2.17 Display

(C. Corderman) (CONFIDENTIAL)

A demonstration of the Typotron tube with MTC is planned for 16 March. A meeting will also be held at that time to decide upon the tube to be used for the 5-inch DID scope, i.e., Typotron or Charactron.

~~CONFIDENTIAL~~
UNCLASSIFIED

2.17 Display (Continued)

(C. Corderman) (CONFIDENTIAL) (Continued)

A proposed program for display tests with MTC has been drawn up and submitted to interested parties. It is hoped that the digital transmission and expansion system planned for XD-1 can be tested before MTC moves to Lexington.

(R. Callahan) (UNCLASSIFIED)

Most of the past biweekly period was spent in getting acquainted with display specifications and existing logic. An attempt is being made to decrease the number of tubes in the proposed D6U logic by reading into and out of flip-flop storage with diode-capacitor gates.

(M. Epstein) (CONFIDENTIAL)

Work was continued on erasure methods for the Typotron, and a method has been proposed that seems acceptable to Group 61. This method erases and redisplayes the Typotron several times per scan. A rough draft describing this proposal and several others has been finished.

An examination of the drum circuitry that reads to the DID generator has been started. It seems that the drum circuitry is not providing some pulses needed for the DID. This will be examined further.

(R. Fallows) (UNCLASSIFIED)

Discussions with the various groups at High Street concerned with the display frames have led to a clear definition of tasks to be performed by what date and by whom. An M-note will be published during the week of 15 March describing the situation. Preliminary schedules have been made; these will be revised and finalized in the next report period.

A review of the complete display logic has resulted in the assignment of tasks needing immediate action.

(R. H. Gerhardt) (UNCLASSIFIED)

A drawing showing the digital-expansion system for XD-1 was made. An M-note describing this circuit will be written during the week of 15 March.

A block diagram of the proposed character-positioning circuits was drawn and an M-note describing it has been started. The position of each format is variable with respect to the point and origin of the vector.

2.17 Display (Continued)

(R. H. Gerhardt) (UNCLASSIFIED) (Continued)

Some time was spent examining the logic of the situation-display generator and the associated timing and control.

(L. B. Martin) (UNCLASSIFIED)

The four tubes in the Typotron life test have been running approximately 600 hours. Tube 291 became unfit for service after about 150 hours, because some of the characters were "burnt in" the storage surface. Transfer tests show the writing gun of this tube is considerably "hotter" than the other writing guns by a factor of 5. It is possible that the high-density beam displaced "first-crossover" of the storage material to a point where low-velocity flood-gun electrons can switch the damaged areas positive.

The other three tubes are still in serviceable condition. It has been noted that the storage properties of a tube deteriorate with constant use but recover after a short period of rest. Shifting the characters slightly to a fresh area gives good results and allows "exhausted" areas to recover. Tests are under way to quantitatively describe this effect.

A series of experiments has been started in an attempt to restore the storage surface of tube 291 to a usable condition.

(J. W. Schallerer, B. Gurley) (UNCLASSIFIED)

We are investigating the use of magnetic cores for the buffer storage in the situation-display-generator unit. At present we are considering metallic cores driven by coincident voltage (diode switched) write and linear read. Efficient utilization of cores in such a small memory depends, to a large extent, upon the development of cheap core drivers.

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

A rather serious difficulty appeared in the vector generator which had been built. In the original scheme a sine wave was introduced into the cathode circuit of a six-bit decoder ladder. The output of the ladder was then amplified, passed through a full-wave rectifier and applied to one of the terminals of a standard d-c amplifier. To obtain negative and positive vectors, the output of the rectifier was applied to only one terminal of the d-c amplifier while the second terminal was grounded. The connections to the amplifier were then reversed electronically to change the polarity of the vector. Unless the potential

2.17 Display (Continued)

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

of the input grid of the d-c amplifier was at ground, the vectors showed an objectionable jump from the zero position. This jump could be minimized considerably by adjusting the potential of the input grids, but the adjustment was so critical that the system was undesirable.

A new system suggested by Dick Best has been tried and found quite satisfactory. In this new system a full-wave-rectified sine wave is applied to the cathode circuit of two parallel decoder ladders. The output of each ladder is connected to one terminal of a d-c amplifier. The signal is switched to one or the other ladder to obtain polarity reversal. This system produces very clean, sharp, straight vectors with no noticeable jump from the zero position. Further study is being carried out to determine a satisfactory method of turning the vector on and off. Some thought is also being given to packaging the equipment.

An oscillator is being designed for driving the vector generator. This oscillator will have to supply a 600-v(peak to peak) sine wave with an amplitude stability of 0.5 per cent into a 2.5 K load.

A ten-bit decoder for the Charactron console has been designed. The circuit schematic is being redrawn by the Drafting Department in preparation for building the unit for some MTC tests on a digital-expansion system. Ernie DiMarzio is at present laying out a breadboard for the construction department to work from. This experimental unit will be built using standard 1 per cent resistors and carbon potentiometers. However, the final (XD-1) decoder will require several 0.1 per cent resistors and precision potentiometers. B. Paine is investigating several different types of precision resistors and potentiometers to determine the most satisfactory ones for this purpose.

A driver stage for magnetic deflection of Charactron has been designed using 6161 tubes. This stage will supply an 800-ma push-pull maximum signal to the deflection coil using only two tubes per axis. This design depends on a 100 per cent tube and is to be used only for present testing. When the tube is at end of life (60 per cent) it can not supply more than a 650-ma push-pull signal without exceeding dissipations. This means that the XD-1 driver will either supply 650 milliamperes with two tubes per axis, or if 800 milliamperes is really required the driver will need four 6161 tubes per axis. Since the final deflection coil has not yet been determined, further design of this stage will be neglected until a coil has been chosen.

A driver stage has been designed for driving the cables from the main display frame to the individual consoles. This design is not final since the length and type of cables to be used in XD-1 are not yet determined. The present design has been based on driving 1000 feet of RG-62U. The driver will supply a maximum push-pull signal of 200 volts

2.17 Display (Continued)

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

with a rise time of 20 microseconds to 99.9 per cent of the final value. This requires six 5998 tubes per axis.

It had previously been planned to use the universal amplifier as a character-selection amplifier for both Charactron and Typotron. However, the requirements on the selection amplifier are so much less stringent than on the universal amplifier that a new unit is being designed which will contain both axes (two selection amplifiers) in one six-tube plug-in unit. This will reduce the number of plug-in units per display console by two.

2.2 Group 63 (Magnetic Materials)

(D. R. Brown) (UNCLASSIFIED)

General Ceramics is now firing ferrite memory cores for the second prototype memory.

Two lots received from RCA Victor on 11 March show improvement to the extent that they may be suitable for use in one of the prototype memories.

A 64 x 64 memory plane is being constructed from cores made in Group 63.

Ferrite-Domain Studies

(D. A. Buck) (UNCLASSIFIED)

One new nickel-ferrite crystal has been grown for us by Linde. Five (110) slices have been cut from previous nickel-ferrite crystals with a small percentage of zinc, and two of these have been mounted and are back to the X-ray group for angular orientation. A natural single crystal of hausmannite (Mn_3O_4) has been roughly indexed and is now being polished for more accurate X-ray back-reflection photographs.

Cryotron

(D. A. Buck) (UNCLASSIFIED)

Probe 3A, a resistor made of 0.010-inch tantalum wire controlled by a 2-layer copper-wire solenoid wound over the tantalum, exhibited characteristics roughly like those of a primitive vacuum-tube triode, where the current in the control winding of the cryotron is analogous to the voltage on the control grid of the vacuum tube. Operating temperature is 4.2 K. An attempt to build a cryotron flip-flop failed due to heating of the probe. Future designs will allow for better circulation of liquid helium throughout the probe and consequently better cooling.

S. Measurements (N. Menyuk, P. Fergus) (UNCLASSIFIED)

The switching coefficients of 1/8-mil, 1/4-mil, 1/2-mil, and 1-mil 4-79 mo-Permalloy tapes are being determined as a function of temperature. Measurements have been made to date at room temperature and 77 C. The results obtained at room temperature indicate lower switching coefficients for 1/8- and 1/4-mil tapes than was reported previously.

2.2 Group 63 (Continued)Two-Core-Digit Memory

(P. K. Baltzer) (UNCLASSIFIED)

The last two biweekly periods have been spent in a joint investigation with J. Raffel on the subject of a new memory scheme. This memory scheme utilizes two-core digits and a planar matrix switch, without the use of terminating resistors for the shaping of register-current waveforms. The results are very promising, and a memo is being prepared on the subject. Further tests on a larger scale are planned.

Production of Ferrite Cores

(F. S. Maddocks, J. J. Sacco) (UNCLASSIFIED)

Tests of a series of small lots of DCL-1-180 cores have been completed; 4800 cores were selected. Limits were: outputs between 90 and 105 millivolts when driven at 820 milliamperes; outputs greater than 60 millivolts at 740 milliamperes; outputs greater than 120 millivolts at 900 milliamperes. These cores represent a yield of approximately 50 percent of cores fired in four separate runs. Results of a fifth run are not included.

Cores selected are being wired into a 64 x 64 plane for further tests.

D-262 size cores, from the first series prepared with the intention of simplifying the firing process, have been fired and tested. These cores show considerable promise, and three more series are now being processed in an endeavor to improve upon the first results.

The Covalent Bonds in Spinel

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

The conductivity break of Fe_3O_4 at its ordering temperature is about twenty times as great as the break of Mn_3O_4 at its ordering temperature. Previously all authors took these data at face value, assuming that the change upon disordering is more radical in the case of Fe_3O_4 than in the case of Mn_3O_4 . Since the ordering temperature of Mn_3O_4 is 1443 K and that of Fe_3O_4 is 120 K, the breaks should actually be extrapolated to comparable temperatures, because an energy barrier caused by ordering is more easily overcome at high than at low temperatures. When this extrapolation is carried out, it appears that the effective conductivity break is greater for Mn_3O_4 than for Fe_3O_4 . This effect appears to be consistent with our hypothesis. That for Mn_3O_4 the order-disorder transition changes the valence system, while in the case of Fe_3O_4 ions merely migrate.

2.2 Group 63 (Continued)

The Covalent Bonds in Spinels (Continued)

The tetragonal symmetry of CaIn_2O_7 and CdIn_2O_7 has been explained on the basis of covalent bonding. It is also postulated that metallic indium (In) is tetragonal because of the formation of (dsp^2) bands.

D-C Hysteresigraph

(R. Pacl) (UNCLASSIFIED)

Preliminary work on the basic requirements and associated components has begun.

Semiautomatic Core Tester

(R. Pacl) (UNCLASSIFIED)

Most of the parts for the second semiautomatic core tester have been received, and the machine is half completed.

SECTION III - CENTRAL SERVICES

3.1 Purchasing & Stock

(H. B. Morley) (UNCLASSIFIED)

This department collaborated with R. A. Nelson in the preparation of the Financial Plan for Fiscal Year 1955 and the Budget Estimate for Fiscal Year 1956.

Barta stock requirements are being studied with a view towards expanding component stocks before the move to Lexington is accomplished.

A proposal submitted by B. Paine regarding component testing has been adopted by the Stock Room. Briefly, it is as follows: Inspection criteria will be established by the Components Section. Stock Room will sample test accordingly and send a report to the Components Section. This concerns only standard stock items such as resistors, capacitors, switches, chokes, etc.

A floor plan has been completed and approved for the Lexington Stock Room. Work is now in progress on final details such as shelving, etc.

3.2 Construction

Production Control

(F. F. Manning) (UNCLASSIFIED)

There have been 25 Construction Requisitions totaling 191 items satisfied since 26 February 1954, and there are 27 Construction Requisitions totaling 1519 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 3 orders now open with vendors totaling 145 items. Deliveries in the past biweekly period have totaled 53 items. Information on specific orders may be obtained from the writer (ext. 3492).

3.3 Component Analysis and Standards

3.31 Components

(B. B. Paine) (UNCLASSIFIED)

Due to variable quality level of Amperex diodes upon receipt, shipments have been stopped pending results of further tests. Several shipments of Hughes diodes have arrived and are extremely satisfactory. Type numbers of Hughes diodes differ from those which have been common here, but the Hughes units may be used as follows:

Hughes 1N116 may replace 1N34A
Hughes 1N68A may replace 1N38A

Heat-dissipating clamps should be used when installing Hughes diodes, and the leads should not be bent close to the case.

3.34 Vacuum Tubes

(H. B. Frost) (UNCLASSIFIED)

On Monday, 1 March, a visit was made to the General Electric plant at Owensboro, Kentucky. At this meeting a decision was made to center the Z-2177 characteristics at 16.7-ma I_b (200- μ a grid current, 100-v E_p). The development program can now be concentrated on manufacturing improvements and centering the characteristics at the desired point.

Additional work is being done on the old 7AK7 tubes from the five-digit multiplier in an attempt to learn the cathode condition of these tubes.

Thesis Research

During the first week in March a series of tests was run on RT 411. This tube has very close spacing (about 3 mils) and, consequently, high currents at low voltages. The agreement of this tube's behavior with theory is not as good as RT 414 and RT 413, but the difference may be caused by nonuniform spacing.

On approximately 2 and 3 March RT 426 was processed. It has been under test during the past week. Tests have been complicated by nonuniform contact potentials. It is not known yet whether satisfactory operation of this tube can be obtained.

Calculations for the theoretical decay and recovery of cathode current have been completed using the WWI computer.

3.34 Vacuum Tubes (Continued)

(S. Twicken) (UNCLASSIFIED)

On 1 and 2 March a meeting was held at the General Electric plant at Owensboro, Kentucky, on the Z-2177. Three lots of tubes with different turns-per-inch on the grid had been evaluated in basic circuits at MIT and IBM with concurrence by both groups on Lot K, which was the first produced. This lot is the closest compromise with the 5965 curves with true zero-bias current somewhat lower, positive-grid-current-plate current somewhat higher, and μ just slightly lower (44). The characteristics of this lot are now the design objectives for the Z-2177.

A meeting of the JETEC 5.5 Task Force on Gas Tubes was attended on 4 March. The object of this group is to write a format for gas tubes for computer use, the 2D21 being considered first. The present MIL spec was discussed and various changes suggested. The problem of ratings was deferred to the next meeting, but RCA and GE were given the AN/FSQ-7 Tube Application Memo on the 2D21 for study and comment.

Analysis of the multiplier tubes is continuing. An attempt is being made to determine the state of the cathode of the 30,000-hour tubes in comparison with new tubes.

(T. F. Clough) (UNCLASSIFIED)

A visit was made to the General Electric plant at Owensboro, Kentucky, with S. Twicken, H. B. Frost, and some of the IBM Tube Group to reach a final decision on the objective specification for the Z-2177.

Discussions were carried on with various companies to locate a technically qualified vendor who would process the gold electrode that Groups 25 and 65 require for their electrolytic-tank studies. Circuitron Incorporated, Rockville, Connecticut, will prepare this electrode using printed-circuit techniques.

(A. Zacharias) (UNCLASSIFIED)

Further tests were carried out on the multiplier 7AK7's. The decay in plate current was definitely centered on the cathode, with six cases of screen-grid misalignment adding to the plate-current decrease. It is not known whether these six tubes initially had screen misalignment, since no initial pulse data is available. The misalignment is so slight that it only shows up on positive grid tests.

Tests are now being conducted to determine cathode condition by means of lowering the heater voltage. The results seem promising as to determining how good the cathode is; as yet, however, no information has been obtained about deterioration as a function of time. The main detail

3.34 Vacuum Tubes (Continued)

(A. Zacharias) (UNCLASSIFIED) (Continued)

lacking is the initial pulse currents of the tubes. The unavailability of such data invalidates any statements made about absolute decreases in current.

To obtain some information, nine new 7AK7's were placed on life test, $E_{c1} = E_{c3} = 0$ volts and $E_{c2} = +90$ volts with $E_b = +150$ volts. These 7AK7's will be run for 800 hours and compared with initial condition. The changes in these 7AK7's will be compared to those in 7AK7's made in 1948, life tested for 800 hours in 1949, and then shelved until the present time. These tubes along with other 7AK7's which were made in 1948, but never used, have characteristics somewhat between those for new tubes and the multiplier 7AK7's.

3.4 Test Equipment

Test Equipment Committee

(L. Sutro) (UNCLASSIFIED)

At a special meeting on 2 March the Committee estimated needs of commercial test equipment that would cost more than \$500.00 and would be purchased in the fiscal years 1955 and 1956. The list contains 17 items and is printed in the minutes of the meeting of 2 March as presented in Memorandum M-2707. At a regular meeting on 10 March the Committee approved purchase of 10 probes for Tektronix scopes and approved modification of two 514D scopes so that they would be the same in every way as 514AD scopes. Previously all 514D's had received the same cathode-ray tubes and driver circuits as the 514AD's. Now two 514D's will have the same preamplifier circuits as well.

The Committee membership is now as follows:

<u>Group</u>	<u>Representative</u>
60	L. Sutro
61	E. Rich
62	R. Best
	C. Corderman
	J. O'Brien
	L. Sutro
63	D. Brown
64	E. Rich
65	To be appointed

3.4 Test Equipment (Continued)

Test Equipment Headquarters

(L. Sutro) (UNCLASSIFIED)

When N. Savoie set up a shop within Test Equipment Headquarters to repair instruments, it was expected that he would complete all of the instruments in Division 6 within a short while and then devote most of his time to instruments from other Divisions. His work has become known within the Division, and he has continued for 3 months to devote nearly all of his time to Division 6 instruments. Engineers have come to him with problems of calibration and requirements of special shunts and multipliers. He has a backlog of work for Division 6 and only the beginning of the work that is expected to come from other Divisions.

3.5 Drafting

Drawings for Central Display XD-1

(A. M. Falcione) (UNCLASSIFIED)

During the past week, I spent several days at Poughkeepsie, New York, reviewing procedures, drawings, and various other factors related to making drawings at MIT for the central display system. It is expected that within the very near future the Drafting Room will be ready to handle most of the drawings required for pluggable-unit assemblies. The back-panel-wiring drawings have not been reviewed as yet, because IBM has not quite solved the system of making drawings for this phase.

MTC Drawings

The Drafting Room is giving high priority to all MTC unit drawings, so that the units can be constructed in our shops, tested, and installed prior to the move to Lexington.

3.6 Administration and Personnel

New Non-Staff

(R. A. Osborne) (UNCLASSIFIED)

Renee Feinstein is a new secretary in the Publications Office.
Lester Gediman is a new member of the Drafting Department.

Terminated Non-Staff

Jean Pfaff
Mildred Stickney

3.6 Administration and Personnel (Continued)

Transferred Non-Staff

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

Alexander Boggs to Division 1

Robert Johnson to Division 1

Open Non-Staff Requisitions

1 Electrical Detailer

1 Secretary for Group 61

1 Secretary for Group 64

New Staff

(J. C. Proctor) (UNCLASSIFIED)

Eli Anfenger is working as a DDL Staff Member and has been assigned to Group 62. Mr. Anfenger received his B. S. from Clarkson College and his M. S. from Harvard University and until recently was associated with Pickard and Burns, Needham, Massachusetts.

Edward Glover is working as a DDL Staff Member and has been assigned to Group 62. Mr. Glover received his B. S. from the Georgia Institute of Technology and until recently has been working as an Instrument Engineer for the E. I. DuPont de Nemours Co., Augusta, Ga.

Transfers

Benjamin Gurley has transferred from Group 63 to Group 62.

Benham Morriss has transferred from Group 61 to Group 64.

John O'Brien has transferred from Group 64 to Group 62.

Edwin Rich has transferred from Group 61 to Group 64.

James Schallerer has transferred from Group 63 to Group 62.

Guy Young has transferred from Group 61 to Group 64.

3.6 Administration and Personnel (Continued)

(J. C. Proctor)(UNCLASSIFIED) (Continued)

N. Alperin has transferred from Group 61 to Group 64.

J. Forgle has transferred from Group 61 to Group 64.

H. Kirshner has transferred from Group 61 to Group 64.

A. Shortell has transferred from Group 61 to Group 64.