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Memorandum M-2635

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

SUBJECT: BIWEEKLY REPORT FOR JANUARY 15, 1954

To: Jay W. Forrester

From: Division 6 Staff

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By: R. K. Cullett
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SECTION I - CAPE COD SYSTEM

1.1 Group 61

1.10 General

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

Summary

Plans for testing the IBM (XD-1) mapper console at MIT in February are nearly complete.

The buffer drum will be used on a continuous basis around the middle of February. Present plans are for the drum to accept data from S. Truro, Mark X, and any 2 gap-filler radars. The auxiliary memory fields of the drum will be used for the past-history display program.

The Mark X tracking program is now operative. A program which displays to the track monitors the command heading of all interceptor tracks which are in tracking trouble is also operative.

An expanded display has been provided to make initiation on interceptors easier. Semiautomatic procedures to improve the initiation on interceptor aircraft are being studied.

Proposals for an automatic manual identification system and automatic identification-priority filtering have been prepared.

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1.10 General (Continued)

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

A memo giving some initial results of the evaluation of the Weapons Direction part of the Cape Cod System should be available soon. Memos describing the Weapons Direction positions and functions are being prepared and issued.

The first two-week visit of Air Defense Command personnel was very successful and produced many new ideas.

Memorandum M-2618, "Personnel Requirements for FSQ-7 Installations" (D. Israel), gives full-load, normal-load, and total-complement personnel requirements for AN/FSQ-7 Direction Centers, Combat Centers, and heavy-radar sites.

1.11 Equipment Engineering

(E.S. Rich) (CONFIDENTIAL)

Some decisions affecting the plans for the new Cape Cod radar-mapper installation have been made during the last two weeks. The decisions are the following:

a. We will use the IBM azimuth-pulse-synchronizer design only for the long-range radars. For the gap-filler radars it will be necessary to devise a design of our own. The main reason for this is that the IBM design will not operate with the extreme azimuth pulse jitter that is present with the flip-flop type of SDV integration. Division 2 has informed us that reducing the jitter by logical redesign or by substituting storage-tube-type SDV integrators is impractical for the gap-filler sites.

b. The new XD-1 type of SDV modulation will be installed on the FPS-3 radar some time in February, and on all gap-filler lines by June 1954. This will mesh with the installation of the new Cape Cod mappers. In addition to providing experience with this new equipment, installation of the new units will allow some simplification in circuit design in the mapper consoles.

c. The new mapping consoles will be operated largely from WWI power (except for high-voltage supplies). Power will be fused and switched in a manner similar to that for the present display consoles. Actual connection to the mapper consoles will be through plugs so a complete console can be replaced with a spare in a few minutes time.

(N.N. Alperin) (CONFIDENTIAL)

The new light-gun system has been installed. If a light gun becomes inoperative during a test, it can now be easily replaced with a

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1.11 Equipment Engineering (Continued)

(N.N. Alperin) (CONFIDENTIAL) (Continued)

spare wheel obtained from Charlie Greim. The guns that were removed from service are being modified in the construction shop and will be available as spares and for the proposed scope marginal-checking system.

(H.J. Kirshner) (CONFIDENTIAL)

A new sixty-cycle pulse source for the "Time Register" has been completed and will be installed during the next installation period.

A meeting was attended at A.T.&T. Co. in New York. As a result of this meeting a small working group of Lincoln, A.T.&T., and Bell Labs people was assigned the task of setting up specifications for data telephone lines.

(B. Morriss) (CONFIDENTIAL)

Part of the period was spent working on a system proposed by Ed Rich for operating the IBM radar mapper under simulated conditions. The rest of the period was spent considering and discussing alarms and indicators which might be helpful on XD-1. This study is being made primarily to see what alarm and indicators would be useful for program trouble shooting.

A discussion with H. Logemann of Group 23 revealed that he believes all past difficulties with the Mark X have been taken care of and that the set is now calibrated to within 1/10 of an azimuth unit with a dispersion of about 1.4 degrees for returns. His work is discussed in some detail in the Division 2 biweekly progress report.

(D. Neville) (CONFIDENTIAL)

I have been assisting in the data-link flight tests now being carried on for the purpose of evaluating the data-link system.

Design of equipment to change the transmitted serial message to parallel form and to store the message in a register is now being carried on. The purpose of this equipment is to check the message transmitted to the aircraft from Prospect Hill.

(J.H. Newitt) (CONFIDENTIAL)

The past period has been devoted to the determination of the most suitable approach to XD-1 console design. Discussions with programmers,

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1.11 Equipment Engineering (Continued)

(J.H. Newitt) (CONFIDENTIAL) (Continued)

operators, ADES personnel and other interested parties have fairly well defined a path of action. A number of unsettled details remain, however, and packaging requirements of the internal electronics must now be studied for compatibility with present design plans. I made a trip to Vestal Lab (IBM) during the first part of this period to discuss some of the problems in XD-1 console design.

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

The sweep and intensification circuits on the new Pathfinder have been modified to test the intensification circuits built by S. Ginsburg. Using gates of equal length (30-40 microseconds each), differing in amplitude by 5 or 6 volts, produces spots which have good contrast in intensity and approximately a two-to-one ratio of diameters.

Poor operation of the mapping scopes last weekend was traced to decreased intensity. Since this effect was noted on all scopes, it is presumed to be due to reduced line voltage, although this was not apparent in measurements of line voltage.

(G.A. Young) (CONFIDENTIAL)

The problem of obtaining a display of the mapped-out areas from the mapping room via the computer is being considered. Photographs of several different methods of displaying the map have been taken. An estimate is now being made of the amount of equipment required to sense for the data needed for each method of display.

An E.E. Master's Thesis, entitled "Digital Techniques for Sorting by Areas in a Plane," is in the process of being completed.

The equipment in Room 222 was checked out four times during the last biweekly period by the Air Force personnel.

1.12 Data Screening

(R.L. Walquist) (CONFIDENTIAL)

The Mark X tracking program now appears to be operative. It will be included as part of the regular Cape Cod System program the first part of the next biweekly period. The command-heading display program is also operative. This program displays to the track monitors the command heading of all interceptor tracks which are in tracking trouble.

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1.12 Data Screening (Continued)

(R.L. Walquist) (CONFIDENTIAL) (Continued)

A detailed study is being made of the problems involved in converting the present data-collection program over to the buffer drum. It is expected that the buffer drum will be used on a continuous basis in the Cape Cod program by about the middle of February. Present planning calls for a program which will accept data from S. Truro, Mark X, and any 2 gap fillers. The auxiliary memory fields of the buffer drum will be used for the past-history display program. This in turn should result in better monitoring and the possibility of raising the illumination level in Room 222.

In order to improve the initiation procedure on interceptor aircraft, semiautomatic procedures are being studied. The proposal is to make use of information from the IND (Intercept Director) telling when an interceptor is airborne and its heading. This information would be used to set up an automatically dead-reckoned interceptor track which would be directly presented to a track monitor. The interceptor track would be dead-reckoned until the track monitor established which pieces of radar data belonged to the interceptor and indicated this to the computer program by a reinitiation action. It is felt that the elimination of the initiators from this process and the display of the interceptor track position to the monitor will greatly improve the initiation and identification of interceptor aircraft.

(W.S. Attridge) (CONFIDENTIAL)

C. Zraket and I have written M-2611 describing the standard operating procedures to be used to facilitate tracking and control of interceptor aircraft. These SOP's have already become a most valuable addition to the operation of the Cape Cod System despite the fact that the airmen are not yet fully efficient in using them.

As a further aid to the initiators for initiating on interceptors, an expanded display has been provided on their 16-inch scopes. Initial operation with this expanded display has shown that the initiators have a much easier time.

Initial attempts to discover specific tracking faults by means of a scan-by-scan visual analysis of one track proved difficult because the observer could not watch the scope and write down all his comments. Further tests will be run using Audograph machines.

Forms have been prepared for observation and evaluation of Track Monitor and Track Initiator actions.

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1.12 Data Screening (Continued)

(D.L. Bailey) (CONFIDENTIAL)

A program has been written to display command-heading vectors on operational aircraft. This program has been successfully operated with the Cape Cod System.

A program is available to record scan-by-scan the information in track-data storage for a selected track. The program operates satisfactorily but several minor modifications will be made to increase its utility.

The Mark X correlation program has been modified to include data analysis. This will be tested in the next period.

(H. Frachtman) (CONFIDENTIAL)

The track-radar-data recording programs are completed.

(J. Ishihara) (CONFIDENTIAL)

Testing of the Mark X correlation program with live data was tried during this last period. The relative calibration of the Mark X and S. Truro was appreciably off on the two days that recordings were made, and no conclusion about the relative merits of this program could be drawn from these results. The S. Truro data of 7 January was remarkably good, however, and tracking of tracks with Mark X and radar data, even with the calibration discrepancies, was good. Mark X misses on maneuvering aircraft were satisfactorily filled in by Truro returns.

(J. Levenson) (CONFIDENTIAL)

Two days were spent with the ADC visitors acquainting them with the manual operation of Track-While-Scan and supervising their operation of the Initiator and Monitor stations.

At present I am completing a program to generate azimuth pulses at varying rates to test the behavior of the new IBM mappers under conditions of azimuth jitter, extra azimuth pulses, missing azimuth change pulses, and varying scan times.

(H. Peterson) (CONFIDENTIAL)

During this period the old past-history program was demonstrated several times, and further study was done on the picture-taking program.

The new past-history program is finished but has not been tested.

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1.12 Data Screening (Continued)

(H. Peterson) (CONFIDENTIAL) (Continued)

Some time has been spent working as a monitor and initiator both for instructional purposes and to aid Weapons Control when they needed this service in their program checking.

(H.H. Seward) (CONFIDENTIAL)

Work continues on a checking program for the IBM mapping equipment. A modification of the buffer-drum checking program has been made and awaits check-out on the computer.

Evaluations of some of the TWS operations are also being conducted.

(E.W. Wolf) (CONFIDENTIAL)

A calibration mission, employing a B-29 aircraft equipped with a bombsight, was flown on 8 January. The purpose of the mission was to check the calibration of S. Truro against five known checkpoints. Bob Mechlin advised, prior to the beginning of the mission, that range data above 75 miles may be in error up to 7 miles due to unstable delay lines. The results of the mission may be summarized as follows:

At a range of 97 miles the indicated range was 3 miles too low. At ranges of 38, 43, 50, and 66 miles the indicated ranges were correct. All indicated azimuths were one unit too low. This is probably caused by the fact that the zero-azimuth box is not where it should be.

As computer time was not available when the mission was flown, the radar data was recorded on Ampex tape for subsequent playback. This had the disadvantage that the pilot could not be instructed to repeat his pass over a checkpoint when radar data were being consistently received during that pass. Data from two passes were lost on this account.

Another mission scheduled for 13 January was cancelled because no aircraft were available.

Except for the matter of the quality of radar data, the equipment reliability of the Cape Cod System operations continues to improve; Unrestricted Operating Time exceeded 75 per cent of all time assigned for System operations for the fourth consecutive biweekly period.

As indicated in the last biweekly report, a detailed analysis of the quality of the radar returns is not easy. For example, for the period covered by this report well over 200 entries in the Y Station Log would have to be analyzed. Since it was never intended that these reports should be so elaborate, the "Radar and Input" column of this

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1.12 Data Screening (Continued)

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

report henceforth will include only an analysis of relatively major equipment failures, such as the complete shutdown of a radar site, etc.

	Last 2 Biweekly Periods		Cumulative Period (since 9-29-53)	
	Hours	Per cent	Hours	Per Cent
Assigned Time for System Operations	23.8	100.0	142.4	100.0
Unrestricted Operating Time	17.9	75.2	70.3	49.3
Limited Operating Time	5.0	21.0	47.3	33.3
Down Time	0.9	3.8	23.0	16.2
Recovery Time	0.0	0.0	1.8	1.2
Time Lost (Hours)				
	Limited Operations	Down Time	Limited Operations	Down Time
Computer	0.0	0.9	0.0	20.3
Room 222	4.3	0.0	47.0	2.6
Radar & Input	0.0	0.0	34.4	0.0
Miscellaneous	2.5	0.0	25.3	0.0

(W.M. Wolf) (CONFIDENTIAL)

The Group 0 utility program with final modifications has been checked out and will be recorded on magnetic tape.

The off-centering and expansion controls about the airbases of Otis and Bedford and about a point half way between Otis and Bedford were calibrated. The controls are installed at the F stations.

Forms to be used in the radar mapping room for keeping records of interference reports and magnetic-tape recordings were drawn up with Sgt. Sharkey and Airman Birckett.

Work on the data "filter" program is continuing.

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1.13 Tracking and Control

(J. Arnow) (CONFIDENTIAL)

I attended a guided missiles meeting at the Naval Research Laboratory on 7 January. The meeting was concerned with the various missiles and problems facing the Navy in incorporating guided missiles aboard ship. Very little of the meeting was of direct interest to the Project.

(A. Mathiasen, B. Stahl) (CONFIDENTIAL)

Most of this biweekly period was spent in checking out and improving the radar-accuracy test program. Every indication is that the program is now working correctly, although this statement cannot be conclusive because of the continued failure of the input equipment to supply complete radar data to the computer. In spite of this handicap the program was run on the computer, and a preliminary print-out of data was obtained.

(H.D. Neumann) (CONFIDENTIAL)

The Master's Thesis "A Comparison between Numerical and Differential Analyzer Methods of Solving Differential Equations," was completed during the period covered by this report.

1.14 Weapons Direction

(D.R. Israel) (CONFIDENTIAL)

The evaluation of the Weapons Direction parts of the Cape Cod System continues. It is hoped that a memo giving some of the initial results will be available in a week or so.

The descriptive and SOP memos on identification and height finding have been issued. Memos on weapons assignment, pilot procedures, and the use of the Teleregister gear are in preparation.

The first nine-day visit of Air Force personnel for familiarization with and discussion of the Cape Cod and XD-1 systems has been successfully completed. The visit was of great value to Group 61 personnel and stimulated ideas and thinking on the 1954 Cape Cod System as well as XD-1. The officers (from Eastern Air Defense Force) submitted an informal list of recommendations on their departure. In addition, Group 61 personnel have taken notes during all sessions. A report on the visit will not be made until the next two nine-day visits by personnel from Central Air Defense Force and Western Air Defense Force are completed in the middle of February.

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1.14 Weapons Direction (Continued)

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

The nine-day program is described in detail in M-2619, "Schedule for Nine-Day Familiarization with the Cape Cod and Transition Systems" (Grandy and Israel).

Plans for revisions of the Cape Cod System are being gathered by Frank Heart. These will undergo careful study and evaluation as soon as a definite decision is made on when the 1954 version of the Cape Cod System should be operative.

(M.I. Brand) (CONFIDENTIAL)

Identification. During the last biweekly period the following proposals were written:

a. Proposal for Automatic Priority Filtering for Identification General Situation Displays. This assumes that each track will have computed for it a priority score based on the various parameters which influence an identity decision. The proposal would provide for redisplay on a special line all those tracks whose priority exceeds some predetermined figure. This method would serve to filter the General Situation Display without use of scope-line switches.

b. Proposal for an Alternate Automatic-Manual Identification System. Having written into the system a priority program for Identification, it becomes a trivial problem to make the system completely automatic except for certain trouble situations. This memo proposes a switch on the ID console which would allow the ID system to operate either automatically or manually.

During this last period some time was spent discussing the Identification Section with the three ADC Captains who were visiting us. It was their opinion that the entire ID problem today is so mathematical in nature that it should be made a completely automatic feature of an Air Defense System.

In conjunction with Steve Hauser I am continuing work on the evaluation of the Cape Cod Identification Section. We have completed a study of all past records and have taken special data on recent tests. All this data has been analysed and has been written up in inter-office memo form. At a later date we will issue the data in a more complete form.

(J.J. Cahill) (CONFIDENTIAL)

An evaluation has been made of Cape Cod AAA Guidance exercises to date. This exists in the form of an inter-office memo to C. Zraket.

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1.14 Weapons Direction (Continued)

(J.J. Cahill) (CONFIDENTIAL) (Continued)

A visit was made to the Signal Corps Engineering Laboratory Field Station No. Four at Fort Meade, Indiana, where the AN/GSG-2 Improved Antiaircraft Operations Center (Project 414) is being installed. This visit was reported on in the form of an inter-office memo to C.R. Wieser.

Two AAA Guidance exercises were performed this period. On 5 January, five tracks were passed to AAA, and four were acquired. The fifth did not enter lock-on range in time for acquisition before the mission ended. Only one track was engaged by AAA. Two events which had never occurred before combed to prevent engagement of the other three tracks:

a. At a crucial moment the TWS program switched aircraft, for one track, and the bogey aircraft did not enter gun range.

b. Two tracks were assigned to AAA by the WD after they had entered gun range, reached Boston, and flown out the other side of the gun-range area.

On 7 January, five tracks were passed to AAA, three were acquired and two were dropped for lack of radar data. All three acquired entered gun range, but only two were engaged. The AA Operations Officer had no explanation for AAA's failure to engage the third track.

(O.T. Conant) (CONFIDENTIAL)

The New England Telephone Co. is now making the requested equipment changes in the intercomm system. As soon as this has progressed far enough, the complete reorganization of intercomm lines will be accomplished by jack-field reconnection, and new temporary labels will be applied to all comm boxes. It is hoped that this work will be completed before 22 January. A supplement to M-2187 specifying the new circuit arrangement is being prepared and should be available about that time. G. Rawling has sent to the drafting room instructions for the production of permanent edge-lit Plexiglas labels; these should be installed on the comm boxes within a few weeks.

Some time during this period was spent in briefing the ADC controllers; both Cape Cod and XD-1 intercomm systems were discussed. The briefing will be continued with subsequent groups during the next two biweekly periods.

A study of revision of Cape Cod DID's to conform as closely as possible to the anticipated XD-1 system is being undertaken with H. Benington. Some assistance should be derived from the current evaluation program. This study will culminate in a proposal in the near future.

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1.14 Weapons Direction (Continued)

(F.M. Garth) (CONFIDENTIAL)

Forms for daily and monthly evaluation summaries of the Intercept Direction station were devised and completed for all Cape Cod System flight tests up to the present date.

A profitable day was spent discussing interception and weapons direction with the ADC group. Suggestions and criticisms were noted for consideration in the spring rewrite.

Further programming and research was done on a return-to-base minimum-fuel path.

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

This period has been spent in drawing up flight plans for use with simulated tests. One such flight plan, comprising 12 hostile and 4 friendly tracks, was finished and has been used in several simulated tests. It has been suggested, however, that in order to evaluate such functions as AAA and height finding, a more specialized flight plan be drawn up. We have almost finished one which will test the operation of these stations when the load is increased appreciably over what it has been during previous evaluation tests. It is possible that still another flight plan will be plotted to test the Identification Section, should it be necessary or desirable.

(C. Grandy) (CONFIDENTIAL)

The evaluation of the height-finding section of the Cape Cod System has been continued with assistance from G. Rawling. An analysis of records of operation of the System during eleven tests in the period 29 October to 11 December 1953, has been made. The results of this analysis indicate good performance of the height section as such (only 20 per cent negative replies to more than 1300 requests), but also indicate a marked lack of ability to supply the altitude information needed by other sections of the System (due mainly to the limited coverage of the height-finding radars). The work will continue in an effort to further reduce the percentage of negative replies.

The major portion of the past two-week period has been devoted to administering and participating in the program for the visiting ADC operational personnel. Reports summarizing this visit are currently being collected from other staff members, and preparations are being made for the next group of visitors.

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1.14 Weapons Direction (Continued)

(S. Hauser) (CONFIDENTIAL)

A summary of data compiled by the Identification Section from 7 October to 17 December was made and significant percentages computed. Further data was collected and evaluated in two later tests. Some results indicating small percentage of flight-plan correlation are being examined by a more detailed study.

From data accumulated during evaluation and from the suggestions of some well-informed visitors we are outlining a more automatic system of identification.

(F. E. Heart) (CONFIDENTIAL)

Most of the past biweekly period was spent considering proposed logical changes in the Cape Cod System and applications to AN/FSQ-7.

Some time was spent participating in discussions with ADC visitors.

(W. Z. Lemnios) (CONFIDENTIAL)

Data was taken for the evaluation of the intercept team. A rather detailed evaluation is being made of all tests held prior to 1 January 1954. It was found that from 1 October 1953 until 15 January 1954 a total of 26 interceptions were successfully completed out of 60 attempted during live tests. The low percentage of success is due to the fact that extreme difficulty was experienced in tracking interceptors when the system was first put in operation. The percentage of successful intercepts has been about 75 per cent recently.

Conferences were attended with members of ADC relative to present and future intercept techniques.

(J. Nolan) (CONFIDENTIAL)

Evaluation data was taken on the operation of the Weapons Assignment and Direction position on two occasions, a live test on 5 January and a simulated test on 8 January.

Some time was spent discussing Weapons Direction problems with three visiting ADC officers. Work has continued on rewriting the WA/D operating-procedures memo. The first of a series of tests on operating procedures for the Air Force personnel of the Weapons Section was given.

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1.14 Weapons Direction (Continued)

(G. Rawling) (CONFIDENTIAL)

The past period has been spent in modifying edge-lit panels to conform with changes in data-insertion wiring. Group 61 members are urged to submit suggested improvements in data-insertion panels to me for action.

With the assistance of O. Conant, new sets of telephone intercomm-box labels have been prepared for the change in communications.

The memorandum on use of Teleregisters has been completed. The Teleregisters failed to pass a check-out program designed to simulate Air Defense Operation, with an intermittent skip developing. J. Leary of Group 22 has been informed and will correct this condition. UNDER NO CIRCUMSTANCES ARE TELEREGISTER SYMBOLS TO BE ROTATED BY HAND.

Work to be done on the Teleregisters is as follows:

- a. J. Leary will install new decals on symbol drums.
- b. R. Gould is considering edge-lit panels for both illumination and protection of the indicators.

Part of the period was spent assisting C. Grandy as an evaluator for the height function of the Cape Cod System.

A cleaned-up lettering on push buttons, featuring a standard-size alphabet, is being tested, and a search for a suitable ink is under way.

(F. A. Webster) (CONFIDENTIAL)

Work has been continued on an unclassified discussion of the operation of a digital computer in control applications.

(C. A. Zraket) (CONFIDENTIAL)

A considerable amount of time during the past week was spent with the visitors sponsored by ADC. A summary of the discussions held with them has been written as an inter-office memo addressed to C. R. Wieser and D. R. Israel.

Memorandum M-2611, "Experimental Operating Procedures for Interceptors in the Cape Cod System," was issued during the past week by W. S. Attridge and C. Zraket.

A number of changes to the Weapons Direction Section of the Cape Cod System have been proposed as a result of the data obtained from the operation of the Center for the past four months and from a series of evaluation tests. These changes are being collected in written form by F. Heart.

1.15 Direction Center Operations

(C. Zraket) (CONFIDENTIAL)

The following is a brief summary of the operation of the Cape Cod Direction Center during the past biweekly period.

5 January - A live test was conducted resulting in three successful interceptions. Only the Bedford station was operational.

6 January - An evaluation test using both live data and simulated aircraft was held.

7 January - A live test for the visitor demonstration was held. Three successful interceptions were conducted.

8 January - An evaluation test using simulated data was held. In addition, radar-calibration data was recorded and later analyzed. (See E. Wolf's biweekly). A B-29 equipped with a bombsight was used for the calibration test.

12 January - A test using simulated data was conducted for the benefit of the visitors sponsored by ADC who operated the Weapons Direction stations.

13 January - The calibration data taken on 8 January was analyzed.

14 January - A live test was conducted for the visitor demonstration. Trouble with north-marker pulses in the radar data nullified any attempts at successful tracking.

15 January - A radar-calibration test was hampered by computer trouble. The data was recorded for later analysis.

Copies of the summary and evaluation sheets completed for the foregoing tests and for previous tests are available from P. Gioffi.

In conjunction with Group 22, we are continuing testing of the automatic ground-to-air data link. Reliability of the data link has increased considerably during the past biweekly period.

(R.N. Davis) (CONFIDENTIAL)

Logeman now believes that the Mark X system is reasonably well calibrated. We have had one fair check and have recorded a slight amount of additional data that is yet to be printed out by Wolf. Even if there should remain some drift in the system and some small errors in calibration, I believe that there is much merit in providing at least a temporary program that will allow for tracking the interceptors during our Tuesday missions. By so doing we may well determine some of the requirements for the writing of the complete program, and we will be able to carry

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1.15 Direction Center Operations (Continued)

(R.N. Davis) (CONFIDENTIAL) (Continued)

on the evaluation of the Intercept Direction functions much more realistically than we are now doing. The current evaluation of IND functions cannot be realistically accomplished because of the poor tracking of the interceptors and the great number of times during nearly every intercept that the tracking either fails to track or tracks the wrong thing even when we are able to follow the radar data on the FTU scope. We do not yet know how often and for how long the Mark X returns will be lost during turns at various altitudes and ranges nor do we know what the effect of aircraft altitude upon reliability of return signal is; but, because of the very low clutter and the fewness of Mark X returns, tracking and re-establishment of tracks should be much more dependable and less confusing with the Mark X than it is now. As far as I have been able to determine, no one plans to run any intercept control systems in the near future without beacon assist of some nature on the interception aircraft. It is, then, completely logical that our IND evaluations should be based upon Mark X tracking. I believe that we will be able to gather more good data toward the requirements of future tracking programs by gaining experience and recording data about blip-scan counts vs. range and aircraft altitude while using the interceptors with Mark X than we will be attempting to establish an exhaustive program to determine these characteristics from a series of tests covering several months in competition with our already heavy operational and calibration program.

Flight Test Coordination Office

Group 61 Flight Test Section has been assisting and cooperating with the Lincoln Laboratory Flight Test Coordination Office through its embryonic stages. The Coordination Office was established within Group 22 by authority from the Lincoln Laboratory Director's office to coordinate all of Lincoln Laboratory flying with the military and civil agencies supporting and/or supplying aircraft and facilities. In addition, the Coordination Office controls the scheduling of much of the electronic equipment supporting WWI operations. We now submit all of our flying requirements to the Coordination Office, and they schedule these with the appropriate supporting agencies. Daily alterations to schedules are also handled through the Coordination Office as are most of the last minute details of missions. This system is working well now and is reducing the load carried by Group 61 as well as giving better utilization of the limited supply of aircraft. For additional details see "Coord. Memo - No. 1" issued by the Lincoln Laboratory Flight Coordinator dated 16 December 1953 and subsequent memos from that office.

Responsibility with Airborne Interceptors

We have recently been guilty of flying interceptors without adequately experienced controllers in attendance and of shutting the system down while interceptors are still airborne. We must do all we can to keep

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1.15 Direction Center Operations (Continued)

(R.N. Davis) (CONFIDENTIAL) (Continued)

our equipment functioning under competent operators until the interceptors are on the ground (or released to another agency capable of fulfilling the safety obligations). Even when the aircraft is released for landing over a marker and has gone to let-down or tower frequency, we must continue to stand by until it is assured that the aircraft is on the ground. We have had a case where the interceptor letting down has become lost and has required our help. There should be supplied somewhere in the system a PPI that can be used for the recovery of our interceptors even when the computer is not operational. This PPI should have range and azimuth abilities as well as radio and telephone connections. Zraket and Attridge have established a procedure to assure that the system is not shut down while interceptors are still airborne. This procedure must be enforced if we are to fulfill our safety obligations and if we are to maintain the confidence of the flying personnel.

Air Rescue Service

Recent discussions with visiting Air Force personnel have revealed that our primary emergency contact may not be with the CAA. The Air Force Rescue Service has the responsibility for either all Air Force or all military search and rescue operations. They maintain aircraft and helicopters for search and rescue and have direct lines to agencies able to aid them. The 32nd Air Division has an Air Rescue Officer on continuous duty. Lincoln Laboratory has a direct line to the 32nd headquarters. This is the line that was installed for the Quick Fix program and has recently been in use by Phoenix. We are now exploring the possibilities of either acquiring this line or of establishing a method of obtaining priority use of it when needed.

The Meaning of H Hr.

The time specified as H hr. for our operational missions is the pivotal time around which our scheduling is planned. It is the time at which the interceptor aircraft and crews are scheduled to be ready for instructions from our IND teams; i.e., they are scheduled to be in the ready room on 15-minute alert with the aircraft suitably placed and ready to be started with all equipment checked out. It is the time from which the target aircraft times of departure from their Control Points (CP) are figured so that the targets will be available to our system at the planned times accomplishing the planned tactics. H. Hr. is, therefore, the time at which the WWI system must be ready to start handling the planned situation. This requires that all operating personnel be in their positions prior to H Hr. so that they may be adequately prepared to operate their station in the prescribed manner. In the past it has been the practice to schedule computer time starting 30 minutes before H hr. so that the programs may be inserted and checked, so that the Identity team may have their flight plans inserted, and so that the WD and IND teams may have their communication and electronic checks completed. In other words, it is the time at which

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SECURITY INFORMATION

1.15 Direction Center Operations (Continued)

(R.N. Davis) (CONFIDENTIAL) (Continued)

the system should be in routine operations. It is very poor practice to require aircraft to hold while we prepare. This is sometimes necessary but should be reduced to the absolute minimum. It is nearly impossible to require alterations in flight plans when several aircraft are participating in the exercise as on our Tuesday and Thursday operations. There have been, and will continue to be, times when the target or calibration aircraft are unable to make good their CP departures, but this does not excuse us from our obligation to be completely prepared to be operational when they are available. It is better that we waste some time manning the positions while we wait than to be late when the aircraft are available. If conditions arise that require delays in aircraft schedules, the Flight Test Director or his appointed representative must be informed as soon as possible in order that as much of the mission as possible may be salvaged.

(P. Cioffi) (CONFIDENTIAL)

The following table is a summary of the flight testing scheduled for this past period.

I have consulted with S. Knapp and C. Gaudette on the reinstatement of large-scale simulated testing. Such testing is expected to be available in the event of a cancellation of any live test or as otherwise scheduled. Whenever possible the simulated problem will be superimposed on the daily radar picture or a recording. This presentation duplicates a real situation. I modified the operational procedure at the FTU position for simulated tests to alleviate certain bottleneck situations arising out of communications introduced by the simulation process. The operation runs more smoothly and does not put the operating personnel at the FTU station under excessive demands.

Flight-test analysis functions are being more closely defined and assisting personnel are being organized to accumulate necessary data. The finally approved version of a Direction Center test summary sheet has been sent out for reproduction. This form is to be used to report the results of all Center operations. A memo is being prepared describing the intended use of the new set of Direction Center operations-data record sheets.

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SECURITY INFORMATION

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1.15 Direction Center Operations (Continued)

(A.P. Hill) (CONFIDENTIAL)

DATE	TIME	SCHEDULED TEST		TEST ACTUAL RUN		REASONS FOR CHANGES OR COMMENT
		Description	A/C	Description	A/C	
1/4	1000-1200	Data Link	1	Cancelled	-	Due to ground equipment (D/L transmitter)
1/5	1000-1200	Data Link	1	Cancelled	-	Ground equipment D/L Transmitter inoperative
	1300-1600	Combined Mission	16	held with 5 target aircraft	11	could not obtain 10 target a/c, procurement troubles
1/6	1000-1200	Data Link	1	Cancelled	-	Weather
	1300-1500	Calibration	1	Cancelled	-	Weather
1/7	1000-1200	Data Link	1	As Scheduled	1	
	1300-1600	Combined Mission	13	As Scheduled	13	
1/8	1000-1200	Data Link	1	As Scheduled	1	
	1300-1500	Calibration	1	As Scheduled	1	
1/11	1000-1200	Data Link	1	Cancelled	-	Weather
1/12	1000-1200	Data Link	1	Cancelled	-	Weather
	1300-1500	Combined Mission	18	Cancelled	-	Weather
1/13	1000-1200	Data Link	1	Cancelled	-	Weather
	1300-1500	Calibration	1	Cancelled	-	Weather
1/14	1000-1200	Data Link	1	Cancelled	-	Field conditions (ice)
	1300-1500	Combined Mission	11	held with 5 target a/c	10	1 target aborted due to mechanical troubles
1/15	1000-1200	Data Link	1	held from 1200-1400	1	delayed due to weather
	1400-1600	Calibration	1	As Scheduled	1	

* Added to Schedule during week of test

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1.15 Direction Center Operations (Continued)

(W. Vecchia) (CONFIDENTIAL)

Computer Operation

Total Assigned Time 85 hr

Weapons Control	1 hr
TWS	22 hr 25 min
Combined Weapons Control and TWS	25 hr 45 min
Tracking & Control	<u>5 hr</u>
Total	54 hr 10 min
Time to Math Group	10 hr 50 min
Time to In-Out	4 hr 30 min
Computer Shut-down (weather conditions)	5 hr
Lost to Computer (malfunctions)	<u>10 hr 30 min</u>
Total	30 hr 50 min
	<u>54 hr 10 min</u>
	<u>30 hr 50 min</u>
Grand Total	85 hr

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SECURITY INFORMATION

1.16 AN/FSQ-7 XD-1 Support

(D. R. Israel) (CONFIDENTIAL)

Memorandum M-2618, "Personnel Requirements for FSQ-7 Installations" (D. Israel), is a Secret memo describing the results of a meeting at Colorado Springs on 6, 7, and 8 January. Full-load, normal-load, and total-complement personnel requirements are given for AN/FSQ-7 Direction Centers, Combat Centers, and heavy-radar sites. Standard names and abbreviations are included. The biggest change from previous estimates of M-2409 is the dropping of the Radio Operator's position. The RO's duties will be assumed by the Intercept Technician.

Many important ideas relating to the organization of duties in the XD-1 system were generated by the recent nine-day visit of AF personnel. It is hoped that time will permit the preparation of a memo outlining the organization of Weapons Direction activities.

Conant and I are preparing estimates of the intercomm system for XD-1.

Benington and Hayase are preparing a program to simulate XD-1 displays on MTC.

A memo describing information required for the preparation of estimates of the XD-1 FTU facilities is being prepared for distribution.

H-87, "O26 Card Reader Specifications" (W. McMillan), has been reviewed with M. Brand and S. Hauser. The provisions appear quite satisfactory.

Grandy and I have reworked the console and auxiliary console estimates without arriving at a significant change.

(J. A. Arnow) (CONFIDENTIAL)

A first draft of an answer to the Output Committee's request for a list of certain requirements of the output system was written. This should be completed during the next biweekly period.

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

At the request of Groups 62 and 63 work is under way on test programs for the new 64 x 64 magnetic-core memory soon to be installed in MTC.

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SECURITY INFORMATION

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

(O. T. Conant) (CONFIDENTIAL)

Problems concerning the intercommunication system have been discussed with various persons in Divisions 2 and 6 and with the visiting ADC controllers. An estimate of circuit requirements based directly on present Cape Cod practice demonstrates forcibly the necessity of a considerably different approach. Comments of the ADC men have been very valuable and seem to indicate that direct phone lines should follow the "chain of command" very closely, resulting in a drastic reduction in the number of circuits, while most other internal communications, and all which are purely routine, should be handled through the computer by means of displays.

It appears likely that the special telephone switching panels being designed by IBM for AT&T production will not be available in time for incorporation in the XD-1 center. Consequently, an alternative plan for the use of standard, presently available AT&T equipment is necessary. The initial phase of this planning is being undertaken by H. Kirshner and O. Conant, with Prof. Tucker, MIT Staff, as consultant.

Programs currently getting under way for MTC simulation of XD-1 display and for revision of Cape Cod displays to conform as closely as possible to the XD-1 system should prove very valuable in working out details of the organization of DID's.

(J. Hayase) (CONFIDENTIAL)

The past biweekly period has been spent making preparations to write programs for the Memory Test Computer (MTC) that will simulate XD-1 displays.

The first half of the period was spent getting familiar with the MTC order codes and programming conventions in general. Currently plans are being made with H. Benington for the formulation of the display program itself. A reasonable arrangement of information within a slot for tabular messages to be displayed has been devised, and a block diagram for the display program is being prepared.

(E. S. Rich) (CONFIDENTIAL)

Plans for testing the IBM (XD-1) mapper console at MIT in February are nearly completed. The general plans for this are stated in M-2607. A day (14 January) was spent at IBM determining the installation requirements for the equipment we will receive, and the special construction and wiring that is called for will be started next week. Two special panels required in the test setup have already been obtained from Group 24. Computer programs to generate the desired sequences of signal to modulate the SDV transmitter are being written by Walquist's section.

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SECURITY INFORMATION

1.16 AN/FSQ-7 XD-1 Support

(F. A. Webster) (CONFIDENTIAL)

Additional discussions have been held concerning the coding problems of the XD-1 console and associated devices. The schedule is such, however, that much of the functional coding that might be desirable will have to wait for subsequent models.

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SECURITY INFORMATION

1.2 Group 64

(S. H. Dodd) (UNCLASSIFIED)

Computer operation has remained good during the past biweekly period. Efforts of the systems group were concentrated on jobs which look to long-term reliability and convenience of computer operation.

Occasional intermittent computer operation over a 36-hour period was traced to a loose lug on a power strip in In-Out Control. The lug would sometimes fail to make connection, and this opened up the supply-voltage line to the flip-flop screens.

Much of the trouble with writing between the slots on the auxiliary drum was traced to improper sequencing off of the supply voltages. This was due to a wiring error which has now been corrected.

1.21 WWI Systems Operation

Core Memory

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

To provide protection for the crystals in the Core-Memory matrices, we are installing 60-ma fuses in the memory-address-register cathode-follower output lines. The panels are now being built and will be installed on Monday, 25 January.

A permanent post-write-disturb system was installed on Saturday, 9 January. The new system uses a cathode follower, two gate-tube buffers, and two flip-flop plug-in units. The change resulted in improvement of the Bank A margins while the Bank B margins remained good.

We have completed the modification of the selection-plane-driver control switches. The changes improved margins for both banks.

Work is being continued on the parity registers. Digits 0 - 9, inclusive, now have d-c coupled units.

The PIU digit-plane drivers are being modified to provide one more marginal-checking circuit.

Magnetic Tape

(E. P. Farnsworth) (UNCLASSIFIED)

The proposed "magnetic-tape print-out recording error alarm" circuit is complete in breadboard and test-equipment form and is ready to be

1.21 WWI Systems Operation (Continued)Magnetic Tape

(E. P. Farnsworth) (Continued) (UNCLASSIFIED)

tied into the delayed-output system. The final modification will require the addition of one tube and relay to the FL register and the substitution of two GT-GT and one FF PIU for the three GT-BA's in the index pulse counter.

The "magnetic-tape limit alarm and indicators" panel is under construction. This panel will permit rewinding unit 0 for the console, as well as indicating which units are rewound and giving an audible signal whenever a unit encounters a limit mark.

Some limitation on the proposed use of unit 2 for print-out appears desirable to encourage the use of scope-camera output, distribute a reasonable print-out load, and provide operational convenience and reserve output capacity, rather than encourage excessive use of Flexoprinting. The desired effect might be achieved by (a) restricting long print-outs to unit 2, (b) locating the second Flexowriter in the tape room (thus permitting long runs to be printed out only during the periods when the tape room is staffed), (c) plus the fact that unit 2 is the system spare and will be out of service whenever a mechanical failure in an operational unit requires a replacement assembly. Construction of the register panel and installation of completed panels is going ahead although no decisions have been reached regarding use or location of the additional equipment.

Auxiliary-Drum System

(K. E. McVicar) (UNCLASSIFIED)

Our recent trouble with writing between the slots on the auxiliary drum is now tentatively ascribed to power-supply malfunctions. One source of power transients was the +5-v supply which we formerly shared with Room 222. This is a high-impedance supply, and we feel that it is likely that transients from Room 222 could cause our flip-flops to go over. A separate source of +5 volts is now being used for the drum and Room 222.

We have also found that the voltages to the drum are no longer being sequenced off in the proper manner with the result that the positive and negative supplies now drop out together. This is probably a malfunction of power-supply control for Room 156 and is now being investigated.

The third power-supply difficulty which we suspect as a source of spurious writing is the -60-v supply. This is a temporary supply which is used for bias. The a-c for the supply is now being taken from the laboratory regulated a-c line. We plan to transfer this to WWI regulated a-c on the next installation day.

1.22 Terminal Equipment

(R. H. Gould) (UNCLASSIFIED)

The power to the Translite edge-lit switch labels will be run through a switch at E31 so that the lights can be turned off when not in use. This should lower the extremely high bulb-failure rate.

The yellow Plexiglas shields on the 16-inch display scopes are nearly as effective as the amber cellophane in filtering out the blue flash. More comments are needed from the users before more yellow shields are ordered.

The clocks at all the consoles in Room 222 are controlled by a switch next to the clock at P station.

It has been decided to replace the four panels of the In-Out Control Counter with two plug-in-unit mounting panels. The Control Counter has long been a source of difficulty. The plug-in units should afford much greater reliability.

CRT Filter System

(S. B. Ginsburg) (UNCLASSIFIED)

Several of the circuits which are to be used in the CRT filter system have been designed and breadboarded. They are being tested with the new Raytheon Pathfinder.

MITE

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

During the past period MITE 3 for buffer drum in L4 has been completed and is now waiting for sufficient quantity of plug-in units before it will be fired up. MITE 1 in rack L2 is partially completed. Arrangements are being made to test the new video filter and demodulator which has been proposed. It will be tested with computer-simulated data and use the old MITE 1 and 2, along with test equipment. A special switch is now being installed to accomplish this changeover.

The special demodulator for MITE 0 in K11 has been modified and will be tested early next week.

The MITE and buffer-drum testing is continuing, and effort is directed towards improving the margins.

1.22 Terminal Equipment (Continued)

Buffer-Drum System

(K. E. McVicar) (UNCLASSIFIED)

The buffer-drum system has been tested with five MITE units using both computer-simulated and tape-recorded data. System operation is fairly good, and we are proceeding with the changeover of power and installation of a remote-indicating fuse system. Upon completion of this work the system should be ready for use by Group 61. We anticipate that this will be about the first of February.

Ferranti PETR

(F. E. Irish) (UNCLASSIFIED)

Two Ferranti readers are available for use in the computer system. There are several alternatives for a design of the control for two readers. The alternatives that have been considered are:

- a. One reader could be installed, and the second could be left on a shelf as a spare.
- b. Two readers could be installed with a common control. Either reader could be put into standby condition just by pressing a button. This method allows the operator to load tape into the second unit while the first is reading a tape. Either unit could be removed from service without disturbing the remaining one.
- c. Two readers could be installed with individual controls. The programmer in this case could actually program the use of two different units. In addition, the si addresses for the two units could be interchanged by pressing a button; this would allow the operator to "read in" using either unit.

Two readers in service (b and c) provide the most flexibility. If one fails, the operator can use the other. This flexibility is gained at the cost of a relay switching panel (5 relays).

An installation where both readers can be programmed into operation (c) is gained at the expense of a complete control (26 vacuum tubes and 2 relays).

A definite decision as to which of these installations is to be used has not been made, but serious thought is being given to the last method (c).

Any comments by programmers on the value of being able to program the operation of two readers will be appreciated.

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 1 - 14 January 1954:

Number of assigned hours	121
Usable percentage of assigned time	95
Usable percentage of assigned time since March 1951	86
Number of transient errors	5
Number of steady-state errors	1
Number of intermittent errors	5

Component Failures in WWI

(L. O. Leighton) (UNCLASSIFIED)

The following failures of electrical components have been reported since 31 December 1953:

<u>Components</u>	<u>No. of Failures</u>	<u>Hours of Operation</u>	<u>Reasons for Failure</u>
<u>Crystals</u>			
1N34A	4	2000 - 3000	Low R _b
1N38A	2	7000 - 8000	Low R _b
<u>Switches</u>			
STSP (Grayhill)	1	12000 - 13000	Defective
<u>Tubes</u>			
5651	1	22000 - 23000	High starting voltage
2JC6J	2	22000 - 23000	1-high arc drop, 1-high filament resistance
3E29	2	13000 - 14000	1-low I _b , 1-short
7AD7	2	0 - 1000	1-low I _b , 1-short
	1	2000 - 3000	Short
	3	16000 - 17000	Short
	4	21000 - 22000	Short

1.23 Records of Operation (Continued)

Component Failures in WWI

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

<u>Components</u>	<u>No. of Failures</u>	<u>Hours of Operation</u>	<u>Reasons for Failure</u>
6145	2	0 - 1000	Short
	1	1000 - 2000	Leakage
	1	2000 - 3000	Open cathode
	3	5000 - 6000	Short
2D21	1	No Clock Hours	Short
5963	1	4000 - 5000	Low I _b
5965	1	1000 - 2000	Leakage
	1	No Clock Hours	Short
715C	4	No Clock Hours	3-low I _b , 1-grid emission
6AG7	1	13000 - 14000	High screen cut-off
6080	1	0 - 1000	Low I _b
	1	2000 - 3000	Short
6080WA	1	0 - 1000	Marginal plate current
6Y6G	1	5000 - 6000	Gassy
	5	21000 - 22000	1-short, 2-leakage, 1-low I _b , 1-gassy
	1	22000 - 23000	Short
7AK7	1	20000 - 21000	Low I _b
	4	21000 - 22000	2-short, 2-low I _b

1.24 General

(D. A. Morrison) (UNCLASSIFIED)

Work on the voltage interlock panel is progressing according to plan. The electrical layout will be ready when the panel arrives from the shop.

A memo concerning the recording of WWI computer alarms by the computer operators has been revised and reissued (M-1671-1).

The Computer Operations Report slip has been revised to conform to the above-mentioned memo.

1.24 General (Continued)

D-C Power Supplies

(S. T. Coffin) (UNCLASSIFIED)

The rebuilt WWI +150-v, 50-amp d-c supply will be installed in WWI on 18 January; it will be operated on the regulated a-c line. Its regulator section has been changed to the fast-response type.

The next modification will be to replace the present +90-v, 10-amp supply with a new 25-amp supply.

WWI Power Supplies

(D. A. Fisher) (UNCLASSIFIED)

The amplifier circuit in the regulator section of the new 200-v, 5-amp supply for WWI was modified to improve stability. Preliminary testing of the supply indicates that oscillations have been eliminated, but a lower output impedance would be desirable at frequencies around 4 kilocycles. This problem will be overcome, and the supply should be installed during the next biweekly period.

1.3 Group 651.31 Activities of Group 65

(P. Youtz) (CONFIDENTIAL)

In December a Charactron tube, Cht 11, was reprocessed with a small-angle electrostatic-deflection system in the deflection-yoke region for character compensation, character position, and making vectors. Although the parameters in the electron-optic system were not optimum, this tube demonstrated the feasibility of electrostatic compensation. It was recommended that electrostatic compensation be written into the specification for the Charactron tube. This tube was evaluated by C. L. Corderman.

Another Charactron tube, Cht 12, was reprocessed to attain an improvement in registration and compensation. The electron optics of this tube were chosen so that the electron rays deflected from the first/second set of section plates focussed in the center of deflection of the first/second set of compensation plates by the convergence coil. It was thought that there would be no misregistration problems, since the beam would be traveling along the axis of the tube as it entered the deflection field independent of which symbol was chosen. This tube was evaluated by C. L. Corderman of Group 62 and Frank Rodgers of Group 25. Several tubes will be scheduled for processing with a better selection of the electrode parameters.

Work is continuing in the Group on the helical-dag coating for the Charactron tube.

Several trips were made in behalf of the Charactron program. A four-day visit was made to Convair to discuss the technical specifications of the 19-inch Charactron and to review the program for the construction of these tubes. A trip was made to Corning to discuss the 19-inch and 5-inch bulb requirements with the Corning engineers.

Hughes Aircraft was visited to discuss the status of the Typetron program. We brought four Typetron tubes back with us. These tubes will be put on a life-test rack which is under construction in Room 026.

Together with the Receiver-Tube Group I visited the General Electric Plant at Owensboro on 11 and 12 January to discuss the progress and status of the Z-2177 (improved 5965) tube program.

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1.33 Research and Development

(J. S. Palermo) (UNCLASSIFIED)

The many helical ink coatings produced during this period have been unsuccessful insofar as the resistances were too high. Readings of 200 to 500 megohms, which are easily obtained after inking, measured infinity after the bakeout process.

Microscopic examinations of many samples of ink for spiral coatings revealed considerable crazing which resulted in discontinuity of the carbon. Modifications of the Tektronix ink formula 32 were prepared and tested. Although some adequate samples have been produced, research and development of the formula and technique will continue.

SECTION II - AN/FSQ-7

2.1 Group 622.11 SystemsOutputs

(R. C. Hopkins, R. C. Jeffrey) (CONFIDENTIAL)

Substantial agreement has been reached among the members of the Outputs Committee, J. Harrington, and J. Arnow on requirements for AN/FSQ-7 outputs. Harrington and Arnow are preparing answers to a list of detailed questions on those requirements on the basis of which a first draft of the proposed AN/FSQ-7 output-frame performance specifications will be written during the next biweekly period.

On 13 January, J. Cahill, R. Cypser, R. Hopkins, and R. Jeffrey visited the AN/gsg-2 Anti-Aircraft Defense System installation at Fort Meade, Md.

Shift-Register Evaluation

(C. J. Schultz) (CONFIDENTIAL)

Photos have been taken to illustrate the effect of sample cores of known characteristics upon the operating margins of a register containing Mo-Permalloy $\frac{1}{8}$ mil cores ($\frac{5}{16}$ -inch diameter, $\frac{1}{8}$ -inch wide, 20 wrap), 1000- μ f capacitors, 15-mh inductors, and 4700-ohm resistors. This information will help to determine the allowable deviations in magnetic-core characteristics for predetermined shift-register operating limits.

Instruction-Frame Logic

(R. P. Mayer) (UNCLASSIFIED)

IBM has requested that concurrence be given to 33 of the 36 drawings required for the instruction frame. The remaining three drawings are nearing completion. The 36 drawings (consisting of 48 sheets) are under study.

It is fairly difficult to follow the logical functioning of the frame from these drawings, since they were prepared specifically to aid in constructing the frame. A drawing is being prepared to show the logical functioning of the frame as shown on the set of 36 drawings.

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2.11 Systems (Continued)

Output Shift Registers

(H. K. Rising) (UNCLASSIFIED)

The feasibility of coincident-current selection and writing into shift registers has been demonstrated. Measurements are being made on the registers in an effort to improve the operating margins.

2.12 Magnetic-Core Memories

Miscellany

(W. Papian) (UNCLASSIFIED)

The 64 x 64 stack now contains 18 satisfactory planes and 1 plane which has a single bad position; this unsatisfactory plane will probably not be replaced until the experimental plane made of RCA cores is ready to put in its place.

The memory, although working well enough to warrant its installation in MTC, still has some problems (sense-amplifier base-line bounce and the problem of the gate generator for the post-write disturb signals), and probably will not be moved for another week. In the meantime tests on the memory and work on the sense amplifiers and gate generators can continue with maximum rapidity.

64 x 64 Memory

(E. A. Guditz) (UNCLASSIFIED)

Test results on the 64 x 64 memory continue to look good. One plane definitely has one bad core and the other plane had a sense winding which missed three cores. This plane was successfully replaced. Replacement time was about 6 man-hours.

A 64 x 64 plane is being constructed from RCA cores. This plane will be installed in the stack in place of the plane with the bad core and undergo tests in the MTC.

Sixty-four more selection-plane-driver pulse transformers are being constructed here to cover the incomplete delivery of an order of transformers from the vendor; they are needed for the MTC memory panels.

2.12 Magnetic-Core Memories (Continued)

Mod. II Sense Amplifiers

(W. J. Canty) (UNCLASSIFIED)

The base-line bounce discovered in this amplifier has been traced to grid current in the third stage whenever the extremely high inhibit and post-write disturb memory-output signals are present. The design of the amplifier will be compromised sufficiently to minimize this problem so that operation in MTC will be tolerable; investigation of other sense-amplifier designs and techniques continues in the meantime.

Selection-Plane Driver System

(J. L. Mitchell) (UNCLASSIFIED)

Three different read-write gate-generator circuits are being investigated. All are being breadboarded and will be tested in the next few weeks. Two of these circuits look as though they will offer improvements over the ones used at this time.

Core Switch

(J. Raffel) (UNCLASSIFIED)

Final designs for the 256-position switch and the 16 x 16 x 16 memory which it will drive have been compiled; the necessary mechanical construction is in the shop.

A combination sense and inhibit unit (3 tubes) has been designed, and preliminary tests indicate satisfactory operation on the 4-turn sense-inhibit winding which will be used on the memory.

2.13 Vacuum-Tube Circuits

Summary

(R. L. Best) (UNCLASSIFIED)

Progress in evaluating a diode switch for a drum is good. It appears that we will have one field with all digits and one digit with 2 live and 37 simulated fields by 1 February.

Many MRD reports are being rewritten and supporting notes written to bring the MRD Book up to date. It is important that this be done so that they may be used as part of the frame-release procedure.

Development work with memory circuits continues as new ideas for driving and sensing memory evolve.

2.13 Vacuum-Tube Circuits (Continued)

(B. Remis, A. Heineck) (UNCLASSIFIED)

The past biweekly period was spent revising and bringing up to date the following MRD reports:

- a. Small Cathode Followers (5965 Triode Type)
- b. Power Cathode Follower
- c. Diode OR Circuits
- d. Diode AND Circuits

In addition Basil Remis wrote M-2612, "Marginal Checking of Diode Circuits."

M-notes on marginal checking of cathode followers and general design procedure for cathode followers, as well as a table for selection of cathode-follower type (5965, 5998, 7AK7), are in preparation.

Magnetic-Drum Circuits

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

The circuits necessary for the MTC drum installation have been designed and breadboarded. These are:

- a. Read-write switch
- b. Field driver
- c. Read driver
- d. Writer
- e. Write driver

A test setup using the above equipment has been assembled. The equipment will be used to read and write on 1 digit in 2 fields.

Magnetic-Drum Write Circuits

(S. Bradspies) (UNCLASSIFIED)

Tests have been run on the magnetic-drum write-circuit field selector. The results were very encouraging, due to the fact that the voltage regulation was excellent. The fall time is about 20 microseconds.

Calculations were run through in order to determine the power requirements from the various voltage supplies in MTC due to the drum.

2.13 Vacuum-Tube Circuits (Continued)Typotron Display

(H. J. Platt) (UNCLASSIFIED)

Work on this unit continues. We are about to start mechanical work on mounting panels, setting up the Typotron tube, etc.

Some difficulties have been encountered with the deflection amplifier. So far, I have not been able to make it stable. Two interstage networks used to date either make the amplifier conditionally stable or peak the high frequencies excessively; other networks will be tried.

High-Speed Flip-Flop

(C. A. Laspina) (UNCLASSIFIED)

Further tests on the prf sensitivity of the input circuit of the HSFF show that a parallel RC circuit in series with the bias end of the input transformer minimizes the sensitivity.

Memory Sense Amplifier

(C. A. Laspina) (UNCLASSIFIED)

Two types of sensing amplifiers are being designed: one uses a transformer as an input and the other a differential amplifier. Both circuits will use at least 50 per cent fewer tubes than the present MTC sense amplifier.

The MTC sense amplifier is being modified so that it will operate satisfactorily with noise pulses twice as large as anticipated.

Read-Write Gate Generator, Mod. II

(D. Shansky) (UNCLASSIFIED)

This circuit (which makes the selection-plane-driver tubes look like cascade drivers) is presently being investigated again since it seems to offer a savings in total cathode count over the existing gate-generator circuit. The circuit has been debugged, and it is expected that operating margins will be taken during the next biweekly period.

2.13 Vacuum-Tube Circuits (Continued)

Pulse Transformers

(E. Gates) (UNCLASSIFIED)

Three transformers were designed for M. Zimmerman in Lexington to be used in a carrier system to generate deflection voltages for display tubes.

The Lab started to make 64 more memory-driving transformers for use in MTC. This was necessary since Sprague Electric Co. has not yet shipped the whole order of driving transformers.

I am starting the design of a transformer for J. Woolf to be used in the circuitry for producing vectors on the Charactron tube.

Delay Lines

(J. S. Gillette) (UNCLASSIFIED)

I have tested 17 GE high-impedance delay lines which gave a delay of 2 microseconds. It appears that the lines with the greater number of turns per inch, e.g., the 2- μ sec lines with the shortest physical length, have more noise preceding the output pulse. This may be due to the increased capacity between turns on the closely wound coils, which reduces the delay for the high-frequency components of the pulse. I believe that GE lines for use in our delay circuit can be selected on a delay/length criterion.

A unique method has been discovered for obtaining two output pulses separated by a fixed delay and both delayed by a fixed amount from the input pulse. This is done by driving a delay line with part of the coil side of the line shorted out. I plan to investigate this circuit further.

Shift-Register Core Driver

(J. S. Gillette) (UNCLASSIFIED)

The volts/turn/coil has increased from $\frac{1}{4}$ volt to $\frac{1}{2}$ volt. This means that our driver must provide twice as much power as originally requested. It now seems more desirable to use 25 turns/coil instead of the 50 turns now being used on the shift winding.

2.14 Memory Test Computer

General

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

MTC has been undergoing finishing touches for core memory (anticipated installation date--25 January) and drum (analogous date--21 January). Control circuits for both have been checked out and are apparently in order.

Expansion of the computer has continued, and doubtless will continue as long as space, power, and cooling capacity are available. The power supplies were moved slightly to make room for two more power-supply racks; these, it is fervently hoped, will absorb whatever growth occurs before summer of this year. The largest single known addition after memory and drum appears to be display-simulation gear occupying six or eight 6-inch x 45-inch panels. Come summer, probably MTC will either be in Building B at Lexington or its present quarters will have been enlarged, with great increase of cooling capacity in either case.

Block Diagrams and Block Schematics

(P. R. Bagley) (UNCLASSIFIED)

The following block diagrams and block schematics were issued or revised during this biweekly period. Since minor changes frequently occur in the systems which these drawings represent, the engineers responsible should be consulted when up-to-date information is needed.

Proposed Block Diagram, MTC, SD-47011 (revision 3)

Simplified Block Diagram, MTC, D-47039 (new -- available in A-reduction)

Block Diagram, Pulse Control, MTC, SC-37460 (revision 8)

Block Schematic, Drum Storage System, MTC, SD-56291 (revision 3)

Block Schematic, Drum Control, MTC, SC-57465 (new)

Block Diagram, Group & Field Control, MTC, SB-47038 (revision 1)

Block Schematic, Group & Field Control, MTC, SD-56909 (revision 1)

Control Element Tests

(P. R. Bagley) (UNCLASSIFIED)

The preliminary tests of Central Control, including group and

2.14 Memory Test Computer (Continued)

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

field control, and of Drum Control, are essentially complete. Further tests await the actual installation of the core and drum memories.

Decoder-Output Amplifiers

(J. Crane) (UNCLASSIFIED)

Direct-coupled amplifiers to be used on the A-register and accumulator decoders have been designed.

Magnetic Drum (See Vacuum-Tube Circuits Section.)

(H. Anderson, H. Boyd, & R. Callahan) (UNCLASSIFIED)

The read amplifiers and writers should be out of the shop within three days. Mounting panels for these units have been made.

For the 1 February MTC drum installation, the field, read, and write drivers will be on breadboards.

A suitable timing track has been written on the drum; and the drum timing panel, housing a time-pulse generator and read amplifier, was tested with drum control.

The drum and appurtenances will be moved to the Computer Room on Thursday, 21 January.

The read-write switch panels are now under construction and should be ready by Thursday also.

(R. A. Hughes) (UNCLASSIFIED)

The drum-read amplifier and writer mounting panels have been built and installed.

Core-Memory Installation

(R. A. Hughes) (UNCLASSIFIED)

Most of the d-c and a-c wiring has been completed. The driver transformers have not yet been received, and some hardware has been slow in arriving.

2.14 Memory Test Computer (Continued)MTC Power Supplies

(R. A. Hughes) (UNCLASSIFIED)

The power supplies were moved without any difficulty. This allows us to expand the supply capacity and take care of the increased load required by the magnetic drum (3.5 amperes at +250 volts).

MTC Records and Drawings

(L. Sutro) (UNCLASSIFIED)

Engineers in the MTC Section have marked up prints of all the dual-gate panels to show modifications and are now being asked to mark up flip-flop mounting panels. Drafting has started work on the dual-gate panels.

Elinor Albanese is to join the Section when a replacement for her can be found. With her help it should be possible to copy onto cards the history of each panel which is now spread out in five logbooks.

2.15 Equipment Design and Schedules

(A. P. Kromer) (CONFIDENTIAL)

A meeting was held at ADC Headquarters with representatives of Project ADES, as well as the new special project group set up by Air Defense Command. The budgetary estimates for FY 54 and FY 55 which were based on L-113 and the conference of last August were reviewed, and revised figures covering the duplex-central concept were established for submission to USAF. The revised program indicates that the sum of money previously discussed for FY 54 is approximately the amount required to cover the revised program. However, the original FY 55 figures are approximately 25 per cent too low.

(W. H. Ayer) (UNCLASSIFIED)

The final load figures for the XD-1 system have been accumulated and a request made to CRC for the necessary chilled water to cool the equipment. The total electronic load, including safety factors, was specified as 607 kilowatts. The addition of building load, outside air, people, and lights brings this figure up to 1482 kilowatts or 420 tons of refrigeration.

An M-note giving the complete design specifications for the cooling equipment is being prepared at the present time for submission to the EDO-SO for approval.

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2.15 Equipment Design and Schedules (Continued)

(J. D. Bassett) (UNCLASSIFIED)

A meeting was held at the Plastilight plant, producers of the copper-clad laminate being used for etched circuits in AN/FSQ-7, on Friday, 8 January. Methods for maintaining quality and production control of the laminate were discussed, and certain parts of the procurement spec were revised. Details of this meeting will be published by J. H. Hauser of IBM.

Coating materials for the etched-circuit cards have been received, and the initial evaluation tests will be studied by B. B. Paine's people in the near future.

Several test cards have been ordered from Electralab, both with and without silver used in the hole-plating process. These cards will be tested in a saturated atmosphere, with 300 volts d-c applied between test conductors, to determine whether cards containing silver exhibit any signs of silver migration.

(P. J. Gray) (CONFIDENTIAL)

Amendment 1 to Exhibit AFCRC-1 has been completed and forwarded to AFCRC. A draft of Amendment 2, which covers the description of the equipment in a CIC, is being prepared and will be circulated for comment during the next biweekly period.

As an aid to contract negotiation and planning for production of AN/FSQ-7 installation, an equipment list covering a duplex central is required. A draft of M-2622, "List of Equipment for AN/FSQ-7 Duplex Central," has been circulated for comment. It is hoped that this list can be published in the next two weeks.

2.16 Transistors

Transistor Accumulator

(D. J. Eckl) (UNCLASSIFIED)

The recent modifications in the accumulator control circuits have improved operation. A recent run of 144 hours without error has been completed. Further modifications are being made in the read-out circuit.

Semiconductor Physics

(D. J. Eckl) (UNCLASSIFIED)

The sixth note on semiconductor physics, M-2628, entitled

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SECURITY INFORMATION

2.16 Transistors (Continued)

(D. J. Eckl) (UNCLASSIFIED) (Continued)

"Properties of Holes and Electrons," has been written and should be available in about 2 weeks. The seventh note in the series will deal with the theory of crystal rectifiers.

Diode Construction

(N. T. Jones) (UNCLASSIFIED)

A limiter for the bonding process has been designed and constructed. This device puts out a 100-v, wide pulse with 200-usec rise time with an input rate of change of 10 volts per second. The rise time of the output pulse depends on the rate of change of the input waveform. The limiting level may be set in the range of 3 to 6.5 negative volts. Sensitivity is expected to be less than 0.1 volt.

A current source for bonding purposes is now being designed. Only detail difficulties are being encountered.

Diode Storage

(N. T. Jones) (UNCLASSIFIED)

Samples of new National Union small-area junction diodes were received recently. These have the static characteristics of a junction and reverse recovery approaching point diodes. These may be useful in many switching applications.

D. Smith is running a new series of tests for storage on the point diodes. When this is completed she will do the same for the junction-diode samples.

Transistor Magnetic-Core Drivers

(S. Oken) (UNCLASSIFIED)

The junction-type core driver did not prove feasible since the rise time was 3 microseconds. A maximum rise time of about 1 microsecond is needed. The circuit may prove useful for smaller currents when high-frequency junction transistors are obtained.

Two Bell 1698 point-contact transistors were immersed in silicone oil by S. Schwartz at Building 22. These two transistors can be run at higher collector dissipations. D-c powers of 240 milliwatts have been dissipated in the collectors so far. It is hoped to build a driver using these transistors which will act like a current source and drive larger memories.

2.16 Transistors (Continued)

(S. Oken) (UNCLASSIFIED) (Continued)

The design of a 4 x 4 diode matrix to select core drivers has been investigated. A Cohler flip-flop with a coupling circuit has been used for this purpose. One of the main problems is the low-input impedance of the core drivers. This is encountered because a diode shunts r_{er} . This diode is needed to increase the maximum repetition rate of the core driver.

Latest tests have shown the presence of slight hysteresis loops in the various branches of the I_c, V curves. So far this has not been serious enough to impair circuit operation. However, such a loop has previously been an indication of moisture penetration and imminent failure. It is not known whether silicone oil has the same adverse effects as water vapor or whether water in the oil is responsible.

Flip-Flops

(E. U. Cohler) (UNCLASSIFIED)

The study of the current type of flip-flops has continued, and Williams' methods seem to lead to single-transistor flip-flops with fine stability. Moreover, the method of triggering which he suggests is much less critical than any previous methods which we have found. The project on comparison of various triggering methods with various flip-flop circuits is through one stage. We now have trigger-amplitude vs. pulse-width characteristics for several different types of triggering for both the saturating and nonsaturating types, as well as some data on the current flip-flop. During the past week I have spent some time developing a one-shot which will provide pulses of rectangular shape and variable duration up to prf's of 2 megacycles. This generator now lacks only a proper pulse transformer for its completion.

Gates

(E. U. Cohler) (UNCLASSIFIED)

A new gate has been investigated which works in conjunction with the current flip-flop. Its characteristics seem to be excellent for certain applications. Its discrimination and resolution are both excellent, it is not prf sensitive, i.e., it will operate as fast as the flip-flop, its output is standardized, and its gain is about 2-1/2 in current and 10 in voltage. Its chief disadvantages are that it cannot drive much capacitive load (with present loading methods) and that there is a slight level change when the flip-flop opens or closes the gate. The ratio of this level change to the output pulse is about 1:5.

2.16 Transistors (Continued)Transistor Gates

(C. T. Kirk) (UNCLASSIFIED)

This biweekly period was spent preparing a Master's Thesis Proposal on transistor gates.

The proposal is entitled "Investigation of Semiconductor Devices as Gated Amplifiers," and it will be issued as Memorandum M-2625.

2.17 Display

(C. L. Corderman) (CONFIDENTIAL)

During the week of 4 January P. Youtz and I visited the Convair and Hughes Aircraft tube facilities in California. Discussions were held concerning all phases of tube design and construction. Considerable progress has been made by Convair towards the design of a Charactron tube using electrostatic compensation.

Improved convergence coils to minimize misregistration have also been investigated. Photographic work relating to the new Mod. V matrix layout was essentially complete, and the new matrix should be in production by this time. Several minor changes in the Mod. V layout were required for proper etching so it is being redrawn as Mod. VI.

In the visit to Hughes we were joined by Dr. F. A. Rodgers of Group 25. Preliminary specifications for 5-inch Typotrons prepared by Dr. Rodgers were discussed. Four additional Typotrons were received to be used for MTC and life tests. This life test should be started during the coming week with at least two tubes. All control and deflection circuits have been assembled and the mounts which hold the tubes are near completion.

Conferences were held this past week at Vestal concerning high-voltage power supplies and electrostatic amplifiers within the display consoles and at the Corning Glass Works concerning the proposed Charactron envelope.

(M. Epstein) (CONFIDENTIAL)

An equipment count was made for the most likely methods of digital-display selection. In the next biweekly period a decision should be made as to which system will be used in XD-1.

Work was started on putting the present digital-display proposal in block-diagram form.

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2.17 Display (Continued)

(R. H. Gerhardt) (CONFIDENTIAL)

Three block diagrams of the character-positioning circuits were made. These will be evaluated and an M-note written.

Some time was spent working on the console selection unit (CSU). The Harper gate requires a diode which will stand 80 volts back voltage and greater than 50 milliamps forward current. The gate circuit must work at 20 kilocycles. The only solution seems to require a smaller input pulse or limit the grid current of the gate-tube circuit which follows the Harper gate. Except for the diode problem, the Harper gate appears to be the best circuit for the CSU's.

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

A 10-bit decoder for the X and Y position on the Charactron tube has been built and is undergoing intensive testing, in order to determine the unit's reliability. The .1 per cent precision components necessary for the decoder make the packaging a problem which will have to be given further study.

The alignment of Charactron will be easier in the future due to the removal of the balance and gain controls from the chassis, with new mounting positions on the front of the console. This will enable one operator to set up a console with direct view of the tube.

A 6-bit decoder for the vector generator has been built with the modulation process incorporated in the decoder. The output amplitude is an accurately weighted binary function.

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2.2 Group 63 (Magnetic Materials)

(D. R. Brown) (UNCLASSIFIED)

Testing of ferrite memory cores for XD-1 continues at MIT and IBM (High Street). Progress is seriously impeded by the lack of a satisfactory automatic core-handling device. The core-testing program is not seriously behind schedule, however.

A lot of tested RCA Victor cores is being made into a 64 x 64 plane that will be tested in MTC. If results are favorable, purchase specifications will be written for RCA cores.

Memory-core synthesis here at MIT is still confined to studies of the $MgO \cdot MnO \cdot Fe_2O_3$ system. The last pilot-production lot was overfired; a new lot is being prepared.

Several experiments are being planned for fundamental magnetic measurements. One of these involves use of a vacuum system for low-temperature measurements.

Core Testing

(E. J. Stevens) (UNCLASSIFIED)

Lots D-28, D-79, F-99, and G-17 were tested and turned over to IBM (a total of 30,000 accepted cores for XD-1).

A new control panel is in the process of being installed in the automatic core tester.

Time is now being used in finding inherent delays in various pieces of logic equipment which have been giving erroneous time readings in the semiautomatic core testers.

(J. W. Schallerer) (UNCLASSIFIED)

Sample tests on six lots just received from General Ceramics indicate a yield between 80 and 90 per cent. These cores will probably be used for construction of a 128 x 128 plane.

Two thousand cores were turned over to Art Hughes to be used as a dummy load for a magnetic switch.

2.2 Group 63 (Continued)

Special Tests

(J. D. Childress) (UNCLASSIFIED)

Tests have been started to determine the effects (if any) of temperature cycling of memory cores.

At present, difficulty is being experienced with the measuring equipment. The special test setup has had its core drivers and voltage calibrator replaced. The change in current waveforms due to the change in drivers has strongly affected the half-select signals

Photoelectric Core Counter

(B. Gurley) (UNCLASSIFIED)

This unit has been operating successfully for about two weeks. Cores are fed to the counter by a syntron, and they then fall past a photomultiplier. The output is a standard pulse. The average photomultiplier anode current is stabilized by feedback through the exciter lamp. Schematic and mechanical layouts are being sent to IBM.

Non-Blocking Amplifier for Delta Measurements

(B. Gurley) (UNCLASSIFIED)

The first goal in this effort is a scope preamplifier with a gain of 100 which will not block on a 10-volt, 1- μ sec input. This is for 100-core delta measurements. The second amplifier, for single-core tests, needs a gain of 10,000.

A breadboard has been completed which approaches the first goal. The output following a 10-volt, 2- μ sec pulse is about 0.1 volt (equivalent to 1-mv input).

Test Equipment

(R. A. Pacl) (UNCLASSIFIED)

The frame for the new 1:1 scope camera has been completed. This will permit actual-size pictures to be taken of the display on 514- and 512-type scopes. Preliminary experiments indicate that the mounting is rigid enough to prohibit blurred pictures due to vibration.

2.2 Group 63 (Continued)

Ferrite Synthesis

(J. J. Sacco) (UNCLASSIFIED)

Two series in the $MgO \cdot MnO \cdot Fe_2O_3$ system are being prepared in an endeavor to verify some of the previous data. At the same time a new series composed of varying mol percentages of lanthanum and strontium manganites has been started.

A number of preliminary firings of F-394 cores have been made. Among these batches is one prepared at RCA using our processing techniques. The data is as yet incomplete, but results indicate that this material shows promise for memory applications.

SECTION III - CENTRAL SERVICES

3.1 Purchasing and Stock

(H. B. Morley) (UNCLASSIFIED)

Orders have been placed for all of the critical items for replacement of WWI power racks. Sufficient lead time was allowed so that orders were placed directly on manufacturers at a considerable dollar saving. No trouble is anticipated with deliveries.

A change order is being issued on the Westinghouse transformer order (AN/FSQ-7 Power) cancelling the switchgear, which will be ordered by IBM, and changing specifications. Copies of the requisition will be sent to all concerned.

Requests for purchases should be written rather than telephoned to the buyer, except in case of emergency. A written requisition, showing the greatest possible number of specifications, actually saves time and overcomes the misunderstood-information problem which often occurs in telephone requests.

3.2 Construction

Production Control

(F. F. Manning) (UNCLASSIFIED)

There have been 28 Construction Requisitions totaling 397 items satisfied since 31 December 1953, and there are 28 Construction Requisitions totaling 1704 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 two orders now open with vendors totaling 102 items. Deliveries in the past biweekly period have totaled 9 items. Information on specific orders may be obtained from the writer (Ext. 3492).

3.3 Component Analysis and Standards

3.31 Component Testing

Relay Power Supplies

(R. Jahn) (UNCLASSIFIED)

Power supplies for relay testing have been installed in the Whittemore Building power-supply room. These supplies are rated at 250 volts, 10 amperes, and 150 volts, 10 amperes. They will also be available as standing supplies.

The Whittemore d-c supplies are still blowing anode fuses. The cause of these surges is being sought.

3.33 Standards

(H. W. Hodgdon) (UNCLASSIFIED)

Several items in our standard line of general-purpose power transformers and filter chokes have been discontinued by the manufacturer (Freed). Suitable substitutes for the transformers can be procured, which will match the originals quite closely both in electrical characteristics and in mounting and over-all dimensions. There are no exact replacements for the filter chokes, but reasonably close substitutes are available for three of the five items, and the other two will be discontinued as obsolete.

Additional copies of the Circuit and Tube Application Sections of the MRD Book have been ordered to fill requests and will be distributed when available.

3.34 Vacuum Tubes

(B. Frost) (UNCLASSIFIED)

My time during the past two weeks was spent primarily in trying to unravel a particularly vexing problem associated with my thesis. However, other members of the Section have been quite active.

I have spent a little time attempting to understand a proposed method of emission testing developed at the Brooklyn Navy Yard. There appears to be a fundamental misconception in this work with a confusion in the assignment of proper reference levels for potentials.

On 11 and 12 January a meeting was held at Owensboro, Kentucky, with IBM, GE, and MIT engineers attending. Details will be reported by Twicken and Clough who participated.

3.34 Vacuum Tubes (Continued)

(B. Frost) (UNCLASSIFIED) (Continued)

A new life-test set has been designed by A. Zacharias for 5965 and Z-2177 tube types. A life-test setup for SR-1782A and SR-2420 tubes remains to be designed.

Thesis Work

(B. Frost) (UNCLASSIFIED)

A major problem in my thesis is associated with the method I am using to measure resistance. At low values of current the characteristic plots which should correspond to the voltage drop across the cathode coating depart markedly from straight lines. Some progress has been made in unraveling the reason for the curves, but the solution is not yet in sight.

It has been demonstrated that the electrons that reach the collector have a Maxwellian energy distribution. However, the electron temperature does not correspond to the cathode temperature; neither does it correspond to the apparent temperature of those electrons which reach the anode when it is operated as a retarding-potential collector.

There appears to be some possibility that these effects may be caused by interchange of electron energy within the space charge. Similar interchanges are important in the theory of traveling-wave tubes. Some preliminary efforts to gain understanding of these phenomena will be made during the next period.

A great deal of data has been taken on RT 414 in pursuit of the studies discussed above. These data have been tested for agreement with the diffusion theory. Good correspondence has been found with theoretical predictions for the reduced current on d-c test. In addition, a series of points showing the observed increase in resistance when d-c current flows have been compared to the theoretical values. Fairly good correspondence was found.

(T. F. Clough) (UNCLASSIFIED)

Together with the IBM Tube Group, R. S. Fallows, S. Twicken, P. Youtz, and I visited the General Electric Plant at Owensboro, Kentucky. The purpose of this trip was to discuss the XD-1 tube-development program with the manufacturer. This discussion included a review of the objective electrical and mechanical specification of the Z-2177 in light of the latest manufacturing experience and the application requirements. The constructional data gathered during the past few bi-weekly periods proved useful for this discussion.

3.34 Vacuum Tubes (Continued)

(S. Twicken) (UNCLASSIFIED)

A trip was made to the General Electric Plant at Owensboro, Kentucky with T. F. Clough, R. S. Fallows, and P. Youtz. The purpose of the visit was to review the status of development of the Z-2177 and to clearly define its desired characteristics. These characteristics will be different from the 5965 due to a contact-potential change introduced by a gold-plated grid. The objectives are a somewhat tighter cutoff than the 5965, zero-bias plate current about 2 milliamperes less at 100 volts, plate current at 200 microamperes, and grid current about 5 milliamperes higher at 100 volts.

An incomplete examination of the 7AK7's from the five-digit multiplier shows the major difficulty to be sublimation leakage.

A life-test rack for Z-2177's has been designed, and drawings were turned over to the shop for construction.

The drawings of the new console tube tester have been reviewed, and the final corrections are noted. Division 7 can now complete the drafting job which was started almost a year ago.

The meters and duty-factor calibration of our pulse tester are being examined in an attempt to explain systematic differences between our readings and IBM's on the pulse characteristics of the 7AK7.

(A. Zacharias) (UNCLASSIFIED)

The layout design of the life rack for the Z-2177 was completed, and the drawings have been submitted to Production Control for construction of the rack. This rack will hold 96 tubes in groups of 12; each group can be operated in a manner independent of the other groups except for the same heater voltage on all 96 tubes. The modes of operation consist of operating a given triode at either 10-ma plate current or cutoff. Provision was made for pulsing the tubes.

Also completed was the shorts testing of the 30,000-hour 7AK7's from the five-digit multiplier. Substantial evidence was found of conductive deposits forming between electrodes. The magnitude of this resistance was variable but in the region of 10 to 20 megohms. However, the resistance would decrease considerably for transient periods during tapping, so that these tubes tested as "short" in the standard shop test.

3.4 Test EquipmentTest Equipment Committee

(L. Sutro) (UNCLASSIFIED)

The committee has approved purchase of the following equipment:
Approx.

<u>Mfr.</u>	<u>Item</u>	<u>Model No.</u>	<u>Price</u>	<u>User</u>
DuMont	Dual Beam Oscillograph	322	\$835	Group 61
General Radio	Adjustable Filter	1231-P5M	215	B. Paine
Rubicon	Potentiometer	2732	265	Instrument Maintenance

Special test equipment approved for construction includes two voltage supplies for checking instruments. The scope camera with the 1:1 object-to-image ratio approved last summer has been completed and is in use in Group 63. This Group is at present building a delay-line gas-tube pulse generator.

Test Equipment Headquarters

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

A difficulty has become apparent in measuring small signals with the 514D scope. Carl Schultz reported that a signal appeared to be 1.6 volts when passed through the preamplifier and 2.0 volts when passed only through the amplifier. The same difficulty has since been found in varying amounts in other Tektronix 514D scopes. We are taking more data and consulting with the Tektronix representative.

3.5 DraftingReproduction of Laboratory Reports and Memorandums

(A. M. Falcione) (UNCLASSIFIED)

Recently Administrative Memorandum A-128-1, "Multilith Reproduction Procedures," was issued to all secretaries in order to coordinate the typing of masters so that quick service may be rendered by the reproduction group.

Administrative Memorandum A-155, "Ditto Reproduction Procedures," will be distributed within the next few days for the attention of all secretaries. The reproduction group has found many inconsistencies in the typing of Ditto masters, which have involved delay in publications. A-155 is a supplement to Secretarial Manual A-128, "Office Procedures." During the next week it is planned to hold a secretarial meeting to discuss both Ditto and Multilith reproduction procedures in order to eliminate any confusion and delay through misinformation on the secretary's part. If the procedures set forth in the above memorandums are maintained, it will greatly increase the productive capacity of the reproduction group.

3.6 Administration and Personnel

New Staff

(J. C. Proctor) (UNCLASSIFIED)

Philip Bragar is working as a DDL Staff Member and has been assigned to Group 62. Mr. Bragar received his B.S. in Economics and Engineering in 1948 from MIT and recently has been employed by Kaiser Frazer Corp.

Andrew Favret is working as a DDL Staff Member and has been assigned to Group 61. Mr. Favret received his M.S. in EE from the Univ. of Pennsylvania. He was just recently released from the Army.

Transfers - Staff

(J. C. Proctor) (UNCLASSIFIED)

Inez Hazel has transferred from DIC Staff to DDL Staff and has been assigned to Group 61.

New Non-Staff

(R. A. Osborne) (UNCLASSIFIED)

Frank Furman is a new technician in Group 64.

Barbara Ritchie is a new clerk-typist in Group 62.

Louise Shamgochian is a new messenger in the Whittemore Building.

Terminated Non-Staff

(R. A. Osborne) (UNCLASSIFIED)

Barbara Godfrey

Open Non-Staff Requisitions

(R. A. Osborne) (UNCLASSIFIED)

1 Electronic Technician for Group 64

1 Messenger Girl

1 Senior D_etailer