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Memorandum M-2662

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

SUBJECT: BIWEEKLY REPORT FOR JANUARY 29, 1954  
To: Jay W. Forrester  
From: Division 6 Staff

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

1.1 Group 61

1.10 General

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

Summary

Equipment for testing the IBM radar-mapping console for XD-1 has been assembled, and delivery of the mapper is expected in the next biweekly period. Work on the new radar-mapping consoles for the Cape Cod System is continuing. In connection with the current mappers, considerable promise is shown by a new mapping method which consists of applying a mixture of "Flo-Master" transparent inks with a "Flo-Master Fountainbrush."

The AFCRC ground-to-air data link is still undergoing extensive testing and evaluation. A C-47 is being used to permit in-flight maintenance.

Mark X data has proved very successful in improving the tracking of interceptors during Direction Center Operations.

The primary emphasis of the Weapons Direction Section has been on evaluating the various operating stations. In addition, considerable time has been spent with visiting ADC personnel.

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1.10 General (Continued)

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

Considerable effort is being expended on work associated with AN/FSQ-7 (XD-1). This work includes both personnel and equipment requirements and proposals. Definite proposals have been made in many areas.

1.11 Equipment Engineering

(N. Alperin) (CONFIDENTIAL)

I have been evaluating two new photomultiplier tubes for use in the radar mappers. They show promise in that they have end-on cathodes which allow us to use a dichroic mirror for parallax correction. An indicator is being considered for setting the scope intensity.

(H.J. Kirshner) (CONFIDENTIAL)

The new two-channel demodulator for Truro SDV is now operational. The older unit will be retained as a standby.

We are awaiting delivery of tape idlers for both 14-track recorders. The idlers will be used to correct deficiencies in the tape-handling mechanism which have been causing poor recordings and playbacks.

(D. Neville) (CONFIDENTIAL)

Group 22 has been carrying on a strenuous data-link test with a C-47 this past week for evaluation of the System under ideal or maximum maintenance conditions.

Failures at the Barta Building have occurred on the average of once or twice per flight. Equipment breakdown has been:

- a. power fuse blown,
- b. faulty transmitter,
- c. timing generator,
- d. mechanical test-message generator.

AFCRC is planning to send over their monitoring equipment soon, which, in theory, will give a dynamic check of the link.

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1.11 Equipment Engineering (Continued)

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

During the past biweekly period we were able to resolve the general approach to XD-1 console design. While many details are as yet to be decided, the major decisions have been settled. The background material for the decision is contained in M-2642, "Summation of Comments on XD-1 Console Mock-Ups."

An IBM-MIT meeting was called to discuss the console design approach. Present were J.W. Forrester, R.R. Everett, C.R. Wieser, A.P. Kromer, N.H. Taylor, J.F. Jacobs, R. vonBuelow, C.L. Corderman, D.R. Israel, B.F. Green, and J.H. Newitt of MIT with N.P. Edwards, R.G. Mork, G.V. Mankiewicz, M.W. Olsen of IBM, and H.F. Weber of Sonberg & Farrar (Industrial Designers). This meeting, after some discussion and examination of full-scale mock-ups, resulted in the following agreement:

- a. Scope is to be centered in the console (left to right).
- b. Center line of scope (axis) is 13 inches from top of console.
- c. Height is to be 48 inches, width to be 32 inches maximum but to be designed for 30 inches if possible. 26 inches is to be maintained as the under shelf dimension.
- d. DID will be located in upper right corner with protruding vertical face.
- e. Angle of console face is  $27^{\circ} \pm 5^{\circ}$ .
- f. Side frames will be used (for switches) and will be capable of being placed on left or right sides parallel or at an angle to console face.
- g. Top of side frame can be cut 3 modules if necessary.
- h. Shelf shall be removable. Several interchangeable models will be designed.
- i. Off-centering switches will be on left side and along top of console.
- j. Telephone will be off console proper (may be on shelf).
- k. Light gun will be on console face.
- l. Shelf space shall be 9 inches clear to 12 inches maximum.

This agreement is of course subject to some slight modification as design requirements may dictate, but it does tie down the problem to a specific approach and defines reasonable and expected limits.

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

A breadboard of an experimental scan synchronizer for the new mappers is being constructed.

The new illuminating scheme was installed on scope Y33 on the last installation day. While this was a slight improvement over the old

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1.11 Equipment Engineering (Continued)

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

scheme, it illuminates the CRT face considerably. An attempt will be made during the next biweekly period to reduce the amount of light incident on the CRT face without reducing the illumination of the safety glass appreciably.

(G.A. Young) (CONFIDENTIAL)

Traffic diagrams of the in-out instructions have been drawn and are available in the print room as drawing SB-57720.

A method of bringing the outline of mapped-out areas and rejected data into the computer via the buffer drum has been proposed by B. Morriss and myself. The logical design of the unit has been considered briefly to obtain an estimate of the equipment required.

A Master's Thesis, entitled "Digital Techniques for Sorting by Areas in a Plane," has been completed and is available in the library.

1.12 Data Screening

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

Tests with the new smooth-and-predict program have been successful to the extent that this new program will be made a permanent part of the System program. It incorporates a new type of breakpoint calculation described in the Biweekly Report of 23 October 1953.

Detailed scan-by-scan visual analysis of tracking by several people in Division 6 and Group 22 was carried out by providing each observer with facilities for voice recording of his comments. The recordings have not yet been analyzed but for the most part it is felt that the tracking is good considering the data with which the program must work.

(D.L. Bailey) (CONFIDENTIAL)

The Mark X correlation program with a data-analysis section included is now operating. This program displays Mark X data by means of a distinctive symbol to facilitate identification of these returns.

A program is available for use with the combined Cape Cod programs which displays the time as indicated by the real time clock. This is intended for use in identifying scans during certain evaluation tests.

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1.12 Data Screening (Continued)

(H. Frachtman) (CONFIDENTIAL) (Continued)

Some time has been spent evaluating the records of the quantities of radar data received during System tests. The principal conclusion reached is that the System can use considerably more data than it has been getting.

The logic and a portion of the writing have been completed on a general program which will compute the frequency of occurrence of the number of scans which intervene between any selected pair of monitor actions and track troubles.

(J. Levenson) (CONFIDENTIAL)

The program to check the response of the new IBM mapper to variations in azimuth has been checked out without the equipment and 1600-cycle timing input. As soon as the equipment is available, final tests will be made.

The Track Initiator's Manual is complete except for illustrations.

Again, time was spent with the ADC visitors, lecturing on and demonstrating TWS manual operations. Additional time was spent observing and tallying monitor actions during System operations for evaluation.

(H.H. Seward) (CONFIDENTIAL)

The input simulator program for testing the north-seeking features of the IBM mapping equipment has been completed and tested out satisfactorily with the real time clock. A test will be made also with the 1600-cycle clock when available.

The buffer-drum testing program awaits time for checking out.

Time was also spent observing operational monitors for the purpose of TWS evaluation.

(E.W. Wolf) (CONFIDENTIAL)

Calibration operations on S. Truro thus far may be summarized by stating that a one-unit error in both the range zero and the azimuth zero has been detected and acknowledged. The azimuth error is reported to have been corrected. The range error has been located in the S. Truro-SDV but has not yet been corrected. There is no incremental error in either range or azimuth.

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1.12 Data Screening (Continued)

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

Not enough information is as yet available to make any definite statements about the calibration of the Mark X. Calibration operations this week have been severely handicapped by bad weather.

The dual-tracking calibration program has been modified to meet the requirements dictated by operating experience. These modifications have been of the form of aids to identifying the target aircraft from the returns of both radars. The substitution of the Mark X for S. Truro as the main radar, and the subsequent use of S. Truro as a gap-filler radar have also been made possible.

(W. Wolf) (CONFIDENTIAL)

A new mapping method has shown itself to be encouraging. It has passed initial tests and will be extensively tested operationally. The method consists of applying a mixture of inks through what is sold commercially as a "Flo-Master Fountainbrush." The inks are made expressly for the brush which is shaped like a fat fountain pen and is composed of a well for holding the ink, a spring valve, a felt nib and an adapter which is a sleeve for accommodating the small nib used.

A manual for the radar mappers was written and will be issued as an M-note.

The data "filter" program was operated without the two-mile quantization and worked as it should with the exception of one programming error which is being corrected.

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1.13 Tracking and Control

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

Closely sandwiched between two parity alarms, the tracking program which compares the tracking of four gap-filler radars (Scituate, Foxboro, Derry, and Halibut) against that of an AA tracking radar (Belmont) finally met success as equipment cooperated with a program to produce a track print-out from all the radars. While data and tracking were not uniformly good, enough information has been obtained, it is hoped, to provide some scant knowledge of the system errors, at least on the day of this run. Thanks are due to George Harris for his active part in this undertaking.

Since the computer broke down immediately upon performance of this feat, a program written by B. Stahl, designed with Raydist data in mind, was not able to be run.

1.14 Weapons Direction

(D.R. Israel) (CONFIDENTIAL)

A careful review and study of all log and summary sheets for tests prior to 1 January 1954 has been completed. The desired evaluation statistics and figures have been taken and may be issued as an M-note in the near future. Similar data, as well as special evaluator's logs, has been accumulated for all tests since that date. A report on these tests will not be made until the end of February.

Zraket and I have prepared a memo outlining the objectives of the February and March flight-test program. This will be issued next week. The chief objectives are to obtain data on raid-size discrimination, height accuracy, and intercept capacity and accuracy. For the latter, both maneuvering and non-maneuvering target flights are planned.

An inter-office memo from Major Burns indicates that the turnover of Air Force personnel manning the Cape Cod Direction Center will be quite high in the next six months. Serious consideration is again being given to an extension of the training program which Nolan and Murray have been conducting. Another step is the preparation of a memo outlining the training period and necessary experience for various Cape Cod operating positions.

Gaudette and Knapp are re-establishing an indoctrination program for new Group 61 staff personnel.

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1.14 Weapons Direction (Continued)

(H. Benington) (CONFIDENTIAL)

The study of possible revisions in Cape Cod display is continuing. A definite proposal for track situation display has been prepared.

Two groups of visitors were taken through the Center. Four sessions with ADC personnel were attended.

(Milton I. Brand) (CONFIDENTIAL)

During the last biweekly period the evaluation of the Identification Section of the Cape Cod System has been continuing. In conjunction with S.J. Hauser I have accumulated data and analysis sheets of all the live-data tests which have been run. One very interesting evaluation study is now progressing. This particular study considers the Cape Cod area of surveillance broken down into sections defined by four concentric circles and twelve radial lines. In these sections the courses of every flight plan that has ever been received by the ID section have been plotted. In this way it has been possible to determine the distribution of flight plans over the entire area. If the assumption is made that every flight plan should have associated with it a track which correlates with it, then the ratio of correlated flight plans to total flight plans in each section becomes a measure of the tracking efficiency of the System. The results based upon this data have given a dismal picture. The over-all average has been found to be about 45 per cent with the highest figures (crossing the AADIZ) about 60 per cent. The results were then recalculated omitting from the data flight plans with filed altitudes too low to be picked up at distant ranges. This improved the picture somewhat giving an over-all figure of about 60 per cent with the highest (crossing the AADIZ) close to 80 per cent. Analysis of these results is continuing.

Work is progressing on the planning of a manual-inputs system. Sample program and detail cards for all the foreseeable manual inputs are being designed.

I have spent time with R. Ehmer of Group 38 analyzing job descriptions and standard operating procedures of personnel in the ID section. A memo will soon be forthcoming of the results of these discussions.

Work is continuing on the design of future ID systems. I have completed the flow diagram of an automatic-manual identification system employing priority determination.

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1.14 Weapons Direction (Continued)

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

Discussions with AAA personnel regarding present and future AAA Guidance programs are continuing. Many useful ideas are being offered by these people and will be considered in the preparation of proposals for future systems.

Two AAA Guidance exercises were performed this period. On 19 January four tracks were passed to AAA and all were acquired. The TWS program switched aircraft for one track after lock-on, so just three were engaged and splashed by AAA. On 21 January five tracks were passed and four were locked-on - the first being dropped for lack of data. Of the four, two were engaged, one was reidentified as friendly, and the AAA failed to engage the fourth, although it was in gun range. No explanation was offered by AAA for this failure.

The M-1815 supplement on AAA Guidance has been rewritten to answer some of the more frequent questions of AAA people regarding Cape Cod AAA support. It will be issued in the next period.

Assistance is being given to C. Grandy in evaluating Cape Cod height finding. A summary of results has been prepared for Group 22, at R. Mechlin's request, and is now being typed.

(O.T. Conant) (CONFIDENTIAL)

Reorganization of the intercomm system has been delayed by nonavailability of certain necessary components from N.E.T.&T. All work possible without these components has been accomplished, and the job will be completed as soon as they are received.

Interesting comments and suggestions were made by the ADC and ADES visitors concerning future Cape Cod intercomm developments, including the possibility of testing both old and new systems and components. Practicability of the suggestions is under consideration.

(F.M. Garth) (CONFIDENTIAL)

Evaluation techniques for the Intercept Direction station have been fairly well established. This work, previously done jointly with W. Lemnios has been taken over in its entirety while he is on vacation.

The evaluation day for this past week proved of little worth due to scrambles upon the hostiles at a time when they were headed

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1.14 Weapons Direction (Continued)

(F.M. Garth) (CONFIDENTIAL) (Continued)

beyond possible interception ranges. Later the targets were brought back into the system, but by this time interceptors were low on fuel and operations had to be shut down due to computer failure.

Interception tactics were discussed with the present participants of the nine-day familiarization schedule. Recommendations and comments made by this group were put in memorandum form by J. Nolan and myself.

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

The AA-HF simulated-flight-test plan is now complete and will be available for use as soon as a checking period on the computer can be obtained.

An indoctrination program for new Group 61 personnel is now being set up. Previous indoctrination programs are being studied and obsolete material removed or replaced. Four notebooks containing the memos we have chosen are now available.

An action-analysis program is being written to aid in the evaluation of the Cape Cod System. The program will be in two parts; the first, to be run during operation of the Cape Cod Program, will record on magnetic tape all the actions taken in each frame; the second, to be run by itself, will analyze this information and print it out in a form convenient for study.

(C. Grandy) (CONFIDENTIAL)

The major portion of the past two weeks has been devoted to administering and participating in the program for visiting ADC personnel. M-2619-1, "Revised Schedule for Familiarization with the Cape Cod and Transition System," was issued, presenting the new program for a ten-day period. Preparations for the next group of visitors have been completed.

Evaluation of the height-finding section has continued, and all records for 1953 have been analyzed and the results summarized. Analysis of the 1954 tests will commence at once. A report of the results will be forthcoming during the next biweekly period.

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1.14 Weapons Direction (Continued)

(S.J. Hauser) (CONFIDENTIAL)

A geographical illustration was constructed from summary data to show areas of poor flight-plan correlation for Cape Cod System tests. Some areas of high density showed very low percentage of correlation. A later modification to this illustration revealed that the principal contribution to poor correlation was made by flight plans with low altitude. Special emphasis will be given in future tests to evaluation of flight-plan correlation. Also, a format of summary data on evaluation of the Identification Section is in preparation.

(Frank Heart) (CONFIDENTIAL)

Part of the last biweekly period was spent participating in various discussions with the ADC visitor group. Additional time was spent monitoring Direction Center operation.

Effort is continuing on study of proposed Cape Cod revisions and applications to AN/FSQ-7 planning.

(L. Murray) (CONFIDENTIAL)

The ground-to-air data link is still not ready for use in the 1953 Cape Cod system, and from all appearances it will be some time before it will be operational. The testing procedure has progressed to a point where the people concerned feel that some positive work can be accomplished. The present plans are as follows:

I. Flight Tests With C-47

The advantages of these are:

- a. Several receivers may be checked during one flight.
- b. Flight time will be increased.
- c. Maintenance can take place during flight.

The results of these tests are somewhat arduous to obtain. A picture is taken of the dials and indicator lights each time a message is received.

Messages should be received at a rate of six per minute, and five bits of information are on each picture; hence, the analysis is time consuming. One major problem has been that the camera has not been synchronized with the messages, and the result has been no pictures or double exposures. From these tests some indications have been noted, and Group 22 hopes that from these the receiver can be made more reliable.

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1.14 Weapons Direction (Continued)

(L. Murray) (Continued) (CONFIDENTIAL)

II. Flight Tests With F-89's

When reasonable results are obtained from the C-47, tests will again be conducted with the F-89's. Two of these A/C will be maintained exclusively for these tests. This will enable Group 22 to keep the required maintenance on the receivers and the A/C should be available for tests at all times. If there is a noticeable decrease in reliability when the receivers are checked in the F-89's, a study will be made of the installation problem.

At present, about four hours of C-47 flight tests have been analyzed. The results are encouraging, but more tests of this sort should be conducted before anything positive will be obtained.

Radio Operator

Evaluations have been made of the Radio Operator's function in the 1953 Cape Cod System. At present, only a better definition of his position has been acquired. This has been written as an operational procedure for the position. A basic reason for not having an estimate of the capacity of his station is that the tests have not been such that good data could be obtained.

Air Force Training Program

The training program for the Air Force personnel has been resumed. Two examinations have been given and results indicate that more drill will be required. Plans have been made to conduct classes more frequently.

(J. Nolan) (CONFIDENTIAL)

L. Murray and I gave the second of a series of tests on the operating procedures to the Air Force personnel of the Weapons Section.

The rewriting of the Weapons Assignment and Direction (WA/D) operating procedures memo has been completed and will be issued shortly.

Two days were spent with F. Garth, F. Heart, and C. Zraket in discussion with the present participants of the 9-day familiarization schedule. These discussions covered Weapons Direction problems in the Cape Cod and Transition Systems.

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1.14 Weapons Direction (Continued)

(C.A. Zraket) (CONFIDENTIAL)

Some time has been spent in discussions with the visitors sponsored by ADC about weapons assignment and direction problems and intercept-direction problems for both the Transition System and Cape Cod. An inter-office memo has been written by the Weapons group summarizing the discussions and recommendations of the visitors.

With D.R. Israel, a proposed flight-test program for Cape Cod for February and March has been formulated. An M-note describing this program and its objectives will be issued as soon as possible.

A large amount of qualitative and statistical data derived from the operation of the Cape Cod System for the past four months and from the evaluation program has been collected from the responsible people and is in the process of being reviewed and summarized.

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1.15 Direction Center Operations

(P.O. Cioffi) (CONFIDENTIAL)

The following table is a summary of the flight-test schedule for this period. During winter months a high rate of cancellation can be expected for our type of combined operations in which we survey the air situation and intercept scheduled strike aircraft. This cancellation is due largely to the inability of the Base to hangar the B-29's and other heavy aircraft. These aircraft ice up rather badly when left outside exposed to weather.

Actual details of flight-test results are published daily on a summary form provided for that purpose. This summary at present has limited distribution; however, anyone interested in the details of test performance may request this information from the author.

At the present time ideas are being put together based on experience with the system thus far to define the function and organization of the FTU counterpart in the future systems. Some of these have appeared in separate memos for use in the flight-test section. It is expected that these will be incorporated to cover more comprehensively the proposal for the integration of an FTU, or possibly, more appropriately, a flight-test direction or control group.

A review of the records kept at the Direction Center to date shows that there is still a good deal of concentration required on this matter in order to record a useful set of figures. It is agreed that this record keeping is somewhat of a burden during operations, particularly during peak load times; however, until this function is mechanized, i.e., relegated to the computer for automatic data recording, it will be necessary to make an extra effort to record this data in order that a good measure of system performance and effectiveness can be made. A memo is being written to explain the use of the present set of data forms. As soon as this is available, a meeting with Direction Center operational personnel will be called to discuss it.

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DATE	TIME	SCHEDULED TEST		TEST ACTUALLY RUN		REASONS FOR CHANGES OR COMMENT
		A/C	Description	A/C	Description	
1/15	1000-1200	1	Data Link	1	As Scheduled	
	1300-1500	1	Calibration	1	As Scheduled	
1/18	1000-1200	1	Data Link	-	Cancelled	Aircraft mechanical
1/19	1000-1200	1	Data Link	-	Cancelled	Aircraft mechanical
	1300-1600	15	Combined Mission	10	held with 5 target aircraft	unable to obtain 10 aircraft (procurement)
1/20	1000-1200	1	Data Link	-	Cancelled	Weather
	1300-1600	1	Calibration	-	Cancelled	Weather
1/21	1200-1400	11	Combined Mission	10	as scheduled with 4 target aircraft	1 target aircraft aborted due to aircraft mechanical
1/22	1300-1600	1	Calibration	1	As Scheduled	
1/26	1300-1600	17	Combined Mission	7	held with 3 target aircraft	aircraft procurement and aircraft mechanical troubles
1/27	1300-1600	1	Calibration	-	Cancelled	Weather
1/28	1300-1600	11	Combined Mission	-	Cancelled	ice on runways and B-29 aircraft
1/29	1300-1600	1	Calibration	-	Cancelled	ice on runways and B-29 aircraft

\* Added to Schedule during week of test

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 1.15 Direction Center Operations (Continued)  
 (P.O. Cioffi) (CONFIDENTIAL) (Continued)  
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1.15 Direction Center Operations (Continued)

(C.A. Zraket) (CONFIDENTIAL)

The following is a brief summary of the operation of the Cape Cod Center during the past biweekly period. Detailed summaries of the tests are available from P. Cioffi.

Tuesday, 19 January - A live test utilizing three strikes of B-29's and Mark X-equipped F-89's from Bedford was conducted. No interceptions were attempted due to the fact that the target aircraft reached the mainland before the interceptors could be scrambled. The interceptors were later scrambled and successfully tracked from Mark X/data.

Wednesday, 20 January - A radar-calibration test was cancelled due to aircraft unavailability. The calibration data of 15 January was analyzed. A simulated test was conducted for the benefit of the ADC visitors.

Thursday, 21 January - Demonstration. Five successful interceptions, two with AI radar lock-on, were conducted. The high degree of success was due to successful interceptor tracking from Mark X data. A simulated test was later held for the ADC visitors.

Friday, 22 January - A radar-calibration test using a B-29 equipped with bombsight was held.

Tuesday, 26 January - Test was aborted due to computer failures and failure of target aircraft to maintain flight plan.

Wednesday, 27 January - The calibration data of 22 January was analyzed. A simulated test was held for the ADC visitors.

Thursday, 28 January - A simulated test with recorded data was held for the formal demonstration for IBM.

Friday, 29 January - Tracking evaluation test.

(E.W. Wolf) (CONFIDENTIAL)

Cape Cod System operations have now stabilized in the sense that the effects of recent equipment troubles have been either negligible or such that operations had to be shut down. This means that almost all of the Assigned Time is accounted for by Unrestricted Operating Time and by Down Time. There has been relatively little Limited Operating Time. The statistics follow:

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1.15 Direction Center Operations (Continued)

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

	Last Biweekly Period		Cumulative Period (since 9/29/53)	
	Hours	Per Cent	Hours	Per Cent
Assigned Time for System Operations	13.0	100.0	155.4	100.0
Unrestricted Operating Time	7.7	59.0	78.0	50.2
Limited Operating Time	1.7	12.7	49.0	31.5
Down Time	3.6	28.3	26.6	17.1
Recovery Time	0.0	0.0	1.8	1.2
Time Lost (Hours)	Limited Operations	Down Time	Limited Operations	Down Time
Computer	0.0	3.6	0.0	23.9
Room 222	1.7	0.0	48.7	2.6
Radar and Input	0.0	0.0	34.4	0.0
Miscellaneous	0.0	0.0	25.3	0.0

(W. Vecchia) (CONFIDENTIAL)

Computer Time:

Assigned Time	80.5 hr
Reassigned Time	<u>3.5 hr</u>
Total	84 hr

Weapons Control      1 hr 15 min  
TWS                    28 hr 20 min

Combined Weapons  
Control & TWS        23 hr 50 min

Tracking & Control    10 hr 25 min  
Total                    63 hr 50 min

Time to Math Group    10 hr 55 min  
Lost to Computer      9 hr 15 min  
Total                    20 hr 10 min

63 hr 50 min  
20 hr 10 min

Grand Total

84 hr

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1.16 AN/FSQ-7 XD-1 Support

(D.R. Israel) (CONFIDENTIAL)

The second of the three 2-week familiarization programs for ADC personnel was conducted during this biweekly period. Attendance at this program consisted of three ADC operational personnel from Western Air Defense Force, three civilian personnel from the ADES group, and Colonel Carey and Major Hairston of the Liaison Office. This group is preparing a set of recommendations based on the discussions of the past two weeks. Group 61 should receive these recommendations early next week. As with the first program, it is felt that both the participants and the Group 61 personnel who led the discussions benefited from the interchange of information.

The third program will begin on Monday, 1 February, with all lectures and discussions scheduled for the conference room on the fourth floor of the Whittemore Building. The attendance at this program will consist of 3 controllers from Central Air Defense Force, 4-5 officers from Headquarters ADC, 4-5 people from ADES, and Colonels Schieble and Pamplin of Lincoln. The day-by-day schedule for the program is given in M-2619, "Schedule for Nine-Day Familiarization with the Cape Cod and Transition Systems," (C. Grandy and D.R. Israel) and M-2619-1.

The specifications for the track situation and digital information displays, given in M-2606, "Specifications for AN/FSQ-7 Display System," (R. vonBuelow) have been reviewed by Benington, Conant, and Israel. Two inter-office memos containing several comments and suggestions have been forwarded to Group 62. Except for several minor items listed in the inter-office memos, M-2606 appears to provide for a very satisfactory display system. The off-centering and expansion facilities appear to be adequate for XD-1 or for a Direction Center installation; the adaptability of the off-centering and expansion to the problems of scope displays at a Combat Center may present some difficulty under the current plans for these displays. Study on the exact requirements for these displays are now being made. An M-note containing Group 61's concurrence to the specifications in M-2606 will be prepared during the coming week.

Further decisions have been reached on certain specifications for the activate buttons and indicator lights for XD-1. These are given in M-2656, "XD-1 Activate Buttons and Indicator Lights," (D.R. Israel).

At a meeting on Thursday, 28 January, Cahill, Grandy, Sebring, and I discussed the contents of Sebring's memo of 12 January, "Transition Height Finder Remoting System." A number of points were discussed and definite proposals were made for the types of request and reply messages. Sebring will incorporate these in a revision to the memo.

M-2640, "Flight Test Umpire Facilities for XD-1," (D.R. Israel, 20 January), has been issued. It is hoped that a preliminary proposal of the required facilities will be made after a meeting early next week.

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

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

At a recent meeting with IBM personnel, Division 6 made firm specifications for the quantity of the basic items for XD-1. Among the items specified were 72 display consoles, 100 DID's, 43 auxiliary consoles, and 120 console wings or frames. This is sufficient equipment for the personnel requirements of M-2618, "Personnel Requirements for FSQ-7 Installations." Estimates are now being made of the push-button panel and insertion digit requirements for the various positions.

(H. Benington) (CONFIDENTIAL)

The memo describing situation displays in XD-1 for Group 61 staff has been rewritten and submitted. The display specifications prepared by Group 62 were considered and suggestions submitted to D. Israel. The question of off-centering and expansion has led to investigations of probable sector and sub-sector boundaries, the area covered by different scopes in a center, the problem of combat center display, and the effects of different methods and requirements for cross-telling.

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

At a meeting with D. Israel and C. Grandy of Group 61 and P. Sebring of Group 24, on 29 January, the proposed height-finding system for the AN/FSQ-7 was discussed. Some points in Sebring's memo on the system, PL-J-599, were clarified and, in general, agreement was reached regarding the form the system should take.

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

Two memory test programs for MTC have been completed:

- a. An "inchworm" program which extends the range of testing to all fields or preselected combinations of fields.
- b. A "bootstrap" program which writes and tests a checkerboard pattern in all quadrants of core memory.

(O.T. Conant) (CONFIDENTIAL)

The ADC and ADES visitors of this period were most emphatic in stating that the capabilities of future intercommunication systems must not be limited by the use of present standard components and techniques. The possibility of implementing their suggestions will be looked into. Meanwhile, the search for standard components which most

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SECURITY INFORMATION

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

(O.T. Conant) (CONFIDENTIAL) (Continued)

nearly satisfy requirements is under way, having begun with a meeting with H. Kirshner and Prof. Tucker (consultant).

Assistance in formulating Group 61's comments on the display specifications was given to D. Israel and H. Benington. The comments were forwarded to Group 62.

(J. Hayase) (CONFIDENTIAL)

The XD-1 display-simulation program for MTC has been block diagramed and portions of the display program have been coded in order to determine the time required to display 100 slots. Present estimates indicate that 1 second will be required for the display of 100 slots.

(W. Lone) (CONFIDENTIAL)

Part of this period was spent completing a report written with Walker Thomas at Poughkeepsie during the previous biweekly period. It will be issued shortly as M-2645 and deals with the proposals for utility programs to be used with XD-1. Descriptions of the binary and octonary cards are given.

Work is progressing on the revision of TR-7, the XD-1 programmers manual. I am working with C. E. Walston of IBM on this.

Some time was spent participating in the Cape Cod and Transition System program.

(E. S. Rich) (CONFIDENTIAL)

A rackful of Burroughs test equipment and special panels has been assembled for producing the SDV input signals desired for testing the IBM (XD-1) mapper console. This setup has been bench tested and installed in Room 156. Necessary cabling and a special switch panel for connections to MITE's 1 and 2 are also installed. Computer programs for controlling this equipment have been written by Walquist's section. These will be tested with the equipment during the next week. It is anticipated that the mapper will be delivered from IBM for testing during the following week.

(F. A. Webster) (CONFIDENTIAL)

Initial programming is under way for testing a group of control problems on MTC.

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SECURITY INFORMATION

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

(F.A. Webster) (CONFIDENTIAL) (Continued)

Together with W. Wells some consideration has been given to critical density problems in the detection of tracks.

XD-1 console models have been examined and comments submitted to J. Newitt.

1.17 Associated Studies

(H.D. Neumann, B. Smulowicz)

See M-2663 (SECRET) for this item.

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1.2 Group 64

(S. H. Dodd) (UNCLASSIFIED)

Two minor changes were made in the circuitry of Core-Memory Control during the past biweekly period. A tendency to oscillate in the digit-plane drivers and a high cathode-to-shield potential in the memory-address-register cathode followers have been eliminated. Both of these conditions had caused Core-Memory failures.

Recent auxiliary-drum parity alarms have been almost exclusively of a type caused by writing between the slots. This spurious writing is attributed to power-supply malfunctions. Two temporary supplies, now in use, will be replaced 1 February; this should eliminate the trouble.

1.21 WWI Systems Operation

(S. E. Desjardins) (UNCLASSIFIED)

The consolidated test program has been tested and now functions properly. It now contains 7 test programs that are program marginal checked daily. Steps are being taken to record this program (T-3432) on the magnetic-tape unit 0.

(D. A. Morrison) (UNCLASSIFIED)

The Voltage Interlock Panel is now being assembled.

Work has begun on additional material for the WWI Service Manual.

Core Memory

(N. L. Daggett) (UNCLASSIFIED)

A number of Core Memory parity alarms have occurred recently because of trouble in the digit-plane drivers. These units were modified recently to remove capacitors which were operated at over twice rated voltage. It appears that minor movement of leads made at this time aggravated the tendency of the circuit to oscillate. Any of several possible lead-length reductions will stop the oscillation. All of these changes will be made.

1.21 WWI Systems Operation (Continued)

Core Memory (Continued)

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

A shield-to-cathode short in a memory-address-register cathode follower destroyed 8 crystals in the Core-Memory matrix. The shields have now been returned to near-cathode potential, and fuse panels have been installed at the outputs of the cathode followers.

A recent modification of the digit-plane drivers resulted in oscillations in these units. This has been remedied by shortening lead lengths and adding a parasitic suppressor.

Digits 0-11 of the parity register are now d-c coupled.

There will be a complete power shutdown over the weekend of 20 February to provide installation and maintenance time for the power group.

Magnetic Tape

(E. P. Farnsworth) (UNCLASSIFIED)

Power wiring changes affecting MTC have resulted in an unstable condition in the reel-tension servo of several units when the d-c rack power is shut off and a-c power remains on. The instability is apparently caused by operation of the servo alerting relays; corrective measures are being investigated.

New mylar tapes on spare reels have been distributed to the groups using magnetic-tape facilities. These groups have also been supplied with containers fitted out by the shop to protect the magnetic tape and reels from damage, dust, and loss or misplacement. A new reel of mylar tape for unit 0 is being passed around for recording permanent storage programs to replace the old tape and to reallocate footage. Part of the old reel was recently damaged when the tape was allowed to come off some of the idlers during warmup, but the tape is still readable, even where the mylar is severely stretched!

Snap-on mountings for the original slack take-up covers are being installed on all tape mechanisms. These covers will prevent the tape from slipping off at least some of the idlers when the tension is off and will also simplify threading tape on the machines. The snap-on mounting will alleviate the maintenance problem which was the reason for removal of the covers.



1.21 WWI Systems Operation (Continued)

Auxiliary-Drum System

(K. E. McVicar) (UNCLASSIFIED)

Work is progressing satisfactorily on the power-supply-control-system changes for the auxiliary drum, which should eliminate the bulk of our trouble with writing between the slots. Operation during the past biweekly period has been good except for a few occasions when we have had parity alarms attributed to spurious writing.

The problem of write-group selection has been outlined in a memo which includes some suggestions for improving this function. The memo has been circulated to interested parties for comments, and further work awaits their reply.

Flexowriters and Paper Tape

(L. H. Norcott) (UNCLASSIFIED)

Metal deflector plates have been mounted above the die blocks of our FL punches to cure chad-disposal problems that arose when we started to use our present blue tape.

Three new Flexowriters are scheduled for delivery to us in March. Parts necessary to modify them for our use have been ordered from Commercial Controls and from our shops.

1.22 Terminal Equipment

(J. A. O'Brien) (UNCLASSIFIED)

Noise in the display system is still a problem, and some work is being done on a new design for the decoder and deflection system. A very simple design has been breadboarded, but it has noise in it also; this is caused by drift of some component, presumably tubes, due to load changes.

Design work and installation planning is under way to accommodate the new video mappers to be installed in Room 228 and the data-filter system for Room 156.

1.22 Terminal Equipment (Continued)

Buffer-Drum System

(K. E. McVicar) (UNCLASSIFIED)

Connection of the buffer drum to the WWI power system has been delayed a week at the request of the systems group. The change in schedule was to avoid interference with WWI operation which might be caused by the buffer drum being on WWI supplies. Present plans are to put the buffer drum on WWI power Monday, 1 February.

When the buffer drum has been switched to WWI power, it will be left on continuously and should be available for programmers at all times. However, programmers are cautioned that operation may be less than perfect for several weeks so that they may experience occasional interruptions.

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 15 - 28 January 1954:

Number of assigned hours	165
Usable percentage of assigned time	83
Usable percentage of assigned time since March 1951	86
Number of transient errors	16
Number of steady-state errors	17
Number of intermittent errors	12

Component Failures in WWI

(L. O. Leighton) (UNCLASSIFIED)

The following failures of electrical components have been reported since 15 January 1954:

<u>Components</u>	<u>No. of Failures</u>	<u>Hours of Operation</u>	<u>Reasons for Failure</u>
<u>Potentiometers</u>			
25000-ohm 2-watt	1	1000 - 2000	Irregular taper
<u>Tubes</u>			
6L6	1	7000 - 8000	Low $I_b$
	1	22000 - 23000	Low $I_b$

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>
<u>Tubes</u> (Continued)			
6Y6G	1	0 - 1000	Leakage
	2	21000 - 22000	1-leakage; 1-short
7AD7	1	1000 - 2000	Short
	3	15000 - 16000	Short
	3	21000 - 22000	Short
	1	22000 - 23000	Short
	1	23000 - 24000	Low I <sub>b</sub>
6145	7	0 - 1000	3-leakage; 2-short; 2-unbalanced
	2	1000 - 2000	1-unbalance cutoff; 1-short
	1	2000 - 3000	Short
7AK7	1	1000 - 2000	High I <sub>c1</sub>
5687	2	7000 - 8000	Short

1.24 General

WWI Power Supplies

(D. M. Fisher) (UNCLASSIFIED)

The +200-v, 5-amp power supply has been permanently installed. A maintenance guide booklet was prepared for this supply, giving normal voltages and photographs of waveforms at various portions of the amplifier-regulator section. This booklet will be located near the supply at all times. It is hoped that this guide booklet will decrease trouble-shooting time in the event of regulator failure.

The -60-v, 5-amp power supply was assembled, debugged, and tested during the last biweekly period. This supply is expected to be installed during the next period. A maintenance booklet is also being prepared for this unit.

1.24 General (Continued)

D-C Power Supplies

(S. T. Coffin) (UNCLASSIFIED)

During the past week, the old +250-v, 50-amp WWI supply was modified and moved to Whittemore to become the lab +250-v supply. The lab 250-v, 10-amp supply was then converted to become the lab +90-v supply. This allowed the lab +90-v, 25-amp supply to be withdrawn for redesigning. When completed, this 25-amp supply will be installed in WWI to replace the present heavily loaded +90-v, 10-amp supply.

1.3 Group 651.31 Activities of Group 65

(P. Youtz) (CONFIDENTIAL)

Groups 25 and 65 and C. L. Corderman of Group 62 are doing considerable work on the electron optics of the Charactron and Typotron tubes to complement the works of Convair and Hughes respectively on these tubes. Two research tubes, Cht 11 and Cht 12, which implement this program, were discussed in the last Biweekly Report. Another research tube used for this program, Cht 13, was constructed during this period. This tube has a sliding target which slides almost 18 inches. This will be used to find the focal points of the Hughes convergence coil for the case of  $90^\circ$  rotation of the image. The convergence-coil designs for Charactron tubes will be evaluated with Cht 16. This tube will be constructed during the next biweekly period.

Another tube scheduled for construction is Cht 14, which is similar to Cht 12 except that it will have an improved selection of electrode parameters based on the tests of Cht 12. The purpose of this tube will be to evaluate methods of reducing registration problems in Charactrons and increasing deflection sensitivity in Typotrons.

In the case of Charactrons the problem in post-acceleration is to get sufficient accelerating voltage without serious loss of deflection sensitivity. Tektronix developed a helical-dag coating which permits a low voltage in the deflection region and a very high voltage at the phosphor screen. They indicated they were not getting reproducible results without a large number of failures. Our program to produce helical coatings indicates that it may be difficult to get reproducible results. However, we will continue our work on these helical coatings. We will also investigate the feasibility of multiple-band tubes. Group 65 will make some tubes for this investigation. Group 25 will compare the trajectories in different types of multiple-band tubes with those of helical-coated tubes. Corning Glass Works is not eager to put multiple anode buttons in glass envelopes for multiple-band tubes. A helical-coated tube would require only one anode button.

C. L. Corderman and I with representatives from IBM and Convair visited Corning Glass Works. There was technical agreement upon details of the envelope for the 19-inch Charactron tube. The envelope is sketched on our drawing SD-57725. This envelope will be a sealed bulb with the front face panel of the 19-inch color-television tube. The funnel will be spun in an enlarged mold made from the 19-inch color-television mold. In order to expedite the program while negotiations between IBM and Convair on the Charactron tube continue, IBM has agreed to buy the molds and tools to make these 19-inch envelopes. The envelopes for the 19-inch Charactron will not be ready before 1 May 1954. Meanwhile developmental work will continue with commercially available 16- and 19-inch glass envelopes.

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SECURITY INFORMATION



1.31 Activities of Group 65 (Continued)

(P. Youtz) (CONFIDENTIAL) (Continued)

Work continued for Group 25 on the sublimation of cadmium sulphide, coating of glass aperture masks, settling of phosphor screens, and study of properties of potassium-chloride films. W. L. Gardner of Group 25 also requested some work on molded thermionic cathodes.

A two-day trip to IBM at Poughkeepsie was made during this period in support of the reliable-receiver tube program as well as the Charactron program.

1.33 Research and Development

(J. S. Palermo) (UNCLASSIFIED)

During this past period several 16-inch tubes were coated with ink helices. One such tube will be prepared and processed in order to obtain further data on this ink. We are continuing the evaluation of several variations of ink for this purpose.

The methods of preparing phosphor screens have been the subject of study during this past week for use on the Charactron.

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## SECTION II - AN/FSQ-7

2.1 Group 622.11 SystemsOutput Shift Registers

(H. Rising, I. Aronson) (CONFIDENTIAL)

As a result of tests made on the "shmoo" plotter, a 35-turn shift register was substituted for the 75-turn register in the test set-up. This 35-turn register has wider margins than either the 50-turn or 75-turn registers previously used. Margin tests on the three registers have shown that power requirements for a 16-bit register cannot be reliably supplied from a single 7AK7.

Writing-margin data has been taken on the 50-turn and 75-turn registers, but no analysis of the data has been made as yet. Further data will be taken on the 35-turn register before any analysis is made. A test for simultaneous reading and writing showed that it is possible to read from one register while writing in the other, but reading and writing simultaneously in the same register is not reliable.

Shift-Register Evaluation

(C. J. Schultz) (CONFIDENTIAL)

A comparison was made of simulated single-winding-type magnetic-core shift registers with 35, 50, and 70 turns. For each of the above conditions, the R, L, and C values were varied one at a time in order to optimize the operating limits of the register. An analysis of the data indicates that the 35-turn register operates over the greatest range and for the smallest values of advance pulse amplitude and length.

Drum Installation

(R. Callahan, A. Heineck) (UNCLASSIFIED)

The major portion of this past biweekly period was spent in expediting the panels and plug-in units required to install the drum system in MTC.

Both the drum writer and the read-write switch were finished during this period.

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SECURITY INFORMATION

2.11 Systems (Continued)

Outputs

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

M-2648, "Information Regarding Performance Specifications for AN/FSQ-7 Output Frame" (Harrington and Arnow), has been received and is being used as a basis for a first draft of the output-frame specifications. A study by Harrington and Reed indicates that use of a single-error correcting, double-error detecting code may be advisable for the cross-telling system.

Marginal Checking

(R. J. Pfaff) (UNCLASSIFIED)

M-2603, "Marginal Checking Breakdown of the Instruction Frame" (R. J. Pfaff), has recently been published. Larry Walters has published the marginal-checking system specifications as H-64.

2.12 Magnetic-Core Memories

Miscellany

(W. Papien) (UNCLASSIFIED)

The 64 x 64 is ready for MTC; the transfer of the stack awaits complete checkout of the stall and surrounding equipment in MTC. A large amount of data, including a "shmoo" on an average plane, has been taken and continues to be encouraging.

The bouncing baseline in the sense amplifiers has been temporarily cured by shortening the amplifier's time constants. Work on a new design continues.

With the help of Baltzer of Group 63, a further look will be taken at Olsen's suggested single-coordinate-read, two-core-per-bit memory system.

64 x 64 Memory

(E. A. Guditz) (UNCLASSIFIED)

The 64 x 64 memory continues to give good test results. It will be installed in the MTC sometime this week.

A 64 x 64 plane made of RCA XT-45 cores is completed and being inspected. It will be installed in Memory Test Setup VI for initial checks and will go into MTC for further testing if necessary.

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SECURITY INFORMATION

2.12 Magnetic-Core Memories (Continued)

(E. A. Guditz) (UNCLASSIFIED) (Continued)

Sixty-four selection-plane-driver pulse transformers have been manufactured by our inspection department and are installed in the MTC memory-driver panels.

Selection-Plane Driver System

(J. L. Mitchell) (UNCLASSIFIED)

All the panels have been installed in MTC, and the d-c and video wiring is completed. Preliminary tests have been made and it is expected that the testing will be complete in the next few days. At that time the stack of planes will be moved to MTC.

Sprague has delivered 26 additional memory-driving transformers.

Mod. II Sense Amplifiers

(W. J. Canty) (UNCLASSIFIED)

The original design of the Mod. II sense amplifier has been compromised to overcome the base-line bounce. This bounce occurred in the presence of large inhibit and post-write-disturb noise signals at the input to the sense amplifier. Time constants of the coupling circuits of the amplifier were shortened considerably. Large noise signals will still cause grid-current flow in the third stage of the amplifier as before, but the resulting charge buildup on the coupling condensers is not passed on (and amplified) to succeeding stages due to short time constants in the coupling networks of these stages. An amplifier of this compromise design was tried in the Memory Test Setup and found to work very satisfactorily. Therefore, all the Mod. II sense amplifiers were modified accordingly.

Post-Write-Disturb Gate Generator, MTC

(W. J. Canty) (UNCLASSIFIED)

Much difficulty has been experienced in finding a suitable circuit to supply the post-write-disturb gating pulse at the parallel inputs of 17 Mod. II digit-plane drivers. The required gating pulse is a negative pulse of about 1.5 microseconds in duration, 50 volts in amplitude, and 0.3- $\mu$ sec rise and fall time. The capacitive load on the gate generator is about 1200 micromicrofarads. Since a gate generator needed to fit these requirements appears to be a complicated one, I have proposed an alternate solution to the problem. By a change of logic (complementing the A-register at the proper time) a pulse at the

2.12 Magnetic-Core Memories

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

inhibit enabling gate input of each digit-plane driver can be made to produce either inhibit or post-write-disturb pulses in the memory. This scheme will be tried in MTC as soon as the 64 x 64 core memory is operating. If use of it proves successful a similar scheme will be proposed for XD-1. If used in XD-1 this would allow the complete removal of all the post-write-disturb gate-generator panels.

Core Switch

(J. Raffel) (UNCLASSIFIED)

Construction of the 256-position switch is well under way and the cores are being mounted.

Tests are being made to determine the feasibility of operating the switch from the logic and drivers of the metallic memory-array setup.

2-Core-per-Bit Memory

(J. Raffel) (UNCLASSIFIED)

Work has been done with P. Baltzer to set up experiments to evaluate the 2-core-per-bit memory system suggested by K. Olsen.

2.13 Vacuum-Tube Circuits

(B. Remis) (UNCLASSIFIED)

M-2612, "Marginal Checking of Logical Diode Circuits," was completed. Methods of marginally checking diode AND gates driven both by cathode followers and OR gates, diode OR gates driven both by cathode followers and AND gates, positive diode matrices, and negative matrices were covered.

Another M-note containing supporting data and general design procedure for the small and medium cathode followers of the MRD Book is under preparation.



2.13 Vacuum-Tube Circuits (Continued)Delay-Line Circuits

(J. S. Gillette) (UNCLASSIFIED)

The delay circuit which was presented in M-2493 and the similar circuit now in the MRD Book have been modified. The new circuit, which is similar to the  $me_1$  in the MRD Book, is usable to  $prf$  rates up to 500 kilocycles or  $2 \times \text{delay}$ , whichever is lower. The delay available will be 0.5 to 2.0 microseconds when driven with a C pulse amplifier and 0.5 to 1.5 with a B. Gate. The circuit cannot drive a flip-flop directly. For shorter delays IBM's low-impedance lumped delay lines may be used.

Digit-Plane Driver

(D. Shansky) (UNCLASSIFIED)

A new circuit which does substantially the same job as the MTC digit-plane driver, Mod. II, has been designed, constructed, and debugged. The new circuit uses 2 fewer cathodes and in general is less costly than the previous circuit. Although it is probably too late to use this circuit in XD-1, work will be continued on it concurrently with the work that is presently being done on the older circuit. Test equipment to facilitate taking data to be used in writing the final M-note on the digit-plane driver (XD-1) is currently being built, and the required data will be collected in the next period.

Typotron Display

(H. J. Platt) (UNCLASSIFIED)

The Typotron display setup has been completely assembled. It will be brought up to MTC late today or on Monday, 1 February. A few hours of work may be necessary to make sure the entire system is operating correctly. Then it will be ready for demonstration purposes.

Pulse Transformers

(E. Gates) (UNCLASSIFIED)

Several transformers have been delivered to J. Woolf for use in vector-generating circuitry. These transformers needed low phase shift from 1 kilocycle to 1 megacycle.

We received 26 more memory-driving transformers from Sprague of which 25 were good. The remainder of the order is expected in 2 weeks.

2.13 Vacuum-Tube Circuits (Continued)

(E. Gates) (UNCLASSIFIED) (Continued)

A new transistor flip-flop which can be triggered from low-level 0.1- $\mu$ sec pulses uses a transformer for coupling between the two transistors. Formerly two 0.1- $\mu$ sec pulse transformers were used, but placing the four windings on one core produces better results due to better coupling and also saves space.

2.14 Memory Test ComputerGeneral

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

Installation of magnetic-drum memory was given temporary priority over that of the core memory because of the importance of evaluating diode switching of read and write circuits and memory fields. The work on each memory system is progressing rapidly and when completed MTC will contain 28,736 registers divided into 15 fields as listed below.

<u>Group</u>	<u>Field</u>	<u>Address</u>
Panel Memory		
(toggle switch)	0	0-31
(plugboard)	0	32-63
Core Memory	1	0-2047
	2	0-2047
Drum Memory	3	0-2047
	thru	
	14	0-2047

The computer will use approximately 45 kilowatts and will contain over 3200 tubes.

Study of the Charactron display was continued, and a Typotron and its associated equipment are about to be tested.

Construction of equipment to make up a vector generator and a manual-intervention register was started. These units will be used to evaluate display techniques and test production models of the Charactron tube.

MTC will be disassembled and moved to Building B about 1 May of this year depending upon the delivery of additional air-handling equipment. The computer will be located on the north side of the 1st floor between columns 13 and 17. It is hoped that the computer will be back in operation by 1 June.

2.11. Memory Test Computer (Continued)

Decoder-Output Amplifiers

(J. Crane) (UNCLASSIFIED)

Direct-coupled amplifiers for the A-register and accumulator decoders will be installed in MTC during the next biweekly period.

Tests made on the decoder amplifiers showed that recovery times of less than 5 microseconds can be obtained with an equivalent load of 300 feet of cable (Federal, Type K111).

MTC Records and Drawings

(L. Sutro) (UNCLASSIFIED)

The overhaul of MTC drawings continues. The drawings of seven plug-in unit mounting panels are now marked up and ready for the Drafting Department; they will make seven detailed sets of drawings in place of the one general set that existed previously.

Magnetic Drum

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

The drum has been installed in the computer and is operating with a gold bonded-diode read-write switch. Parts procurement has limited the installation to six digits in each of two fields. By simulating the missing parts of the system, however, all circuits have been loaded to capacity. A preliminary evaluation of the system has been made and is very encouraging. This evaluation consisted of observing all waveforms, measuring d-c voltages, measuring operating margins, and observing the selected to nonselected writing ratios.

Input and Conversion

(P. R. Bagley) (UNCLASSIFIED)

M-2527, Supplement 1, "Input and Basic Conversion Programs for the Memory Test Computer," has been completed and distributed. The basic conversion program is now being written, and it should be ready for use about 15 February.

2.14 Memory Test Computer (Continued)

Alternator

(R. Hughes) (UNCLASSIFIED)

The alternator will run in excess of its rated load (40 kilowatts) when the memory installation is complete.

Core-Memory Installation

(R. Hughes) (UNCLASSIFIED)

The installation is nearly complete. The memory wing, which contains the core-address register, its cathode followers, and the X and Y read-write gate generators, has been voltage and pulse tested.

Marginal Checking

(R. Hughes) (UNCLASSIFIED)

Seventeen marginal-checking lines have been added to the system for checking the digit-plane driver by varying the reference voltage in the unit.

2.15 Equipment Design and Schedules

Mechanical Design, XD-1

(C. W. Watt) (UNCLASSIFIED)

A file of drawings giving basic information on XD-1 mechanical design is being set up in W4-424. This will be added to as more drawings become available, and an attempt will be made to keep it up to date. The drawings are filed by subject.

Liaison with IBM mechanical designers is being maintained, and preliminary prints of up-to-date versions of parts of the machine will be kept in this file, as well as final drawings.

2.16 Transistors

Transistor Accumulator

(D. J. Eckl) (UNCLASSIFIED)

The operating time on the accumulator has passed the 10,000-hour mark.

## 2.16 Transistors (Continued)

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

One of the supply voltages for the flip-flops has recently been eliminated. Three small supplies are being constructed to remove the accumulator from the battery supplies.

### Transistor Characteristics

(D. J. Eckl) (UNCLASSIFIED)

Memorandum M-2616 will soon be available listing the characteristics of the General Electric G11-A transistor. Similar reports on the RCA TA-165 and the Bell 1698 are in preparation.

### Flip-Flops

(E. U. Cohler) (UNCLASSIFIED)

A new flip-flop using transformer coupling in the feedback loop has been developed. This seems to be an excellent type. It will trigger easily on 0.1- $\mu$ sec half-sine-wave pulses, despite the fact that it operates as a saturating type. At 500 kilocycles it requires approximately 6 volts to trigger and about 4.5 volts at lower frequencies. The maximum prf is about 500 kilocycles, but operation to a megacycle would be easily obtained with smaller transformers and larger triggers (of the order of 10 volts). A load of 56 micromicrofarads has little effect on the operation, and in fact improves the waveform by eliminating overshoots. This flip-flop is also the simplest as far as parts are concerned. With a complement input (no set or reset) it requires two transformers, two transistors, five resistors and no diodes. The rise and fall times are about equal and less than 0.2 microsecond. The output swing is about 25 volts with a 35-v supply. If higher frequencies are desired, a nonsaturating type could be expected to operate with ease to 2 megacycles with good waveform and excellent sensitivity. This would mean that one would have to put up with decreased output swing and lower capacitive loads.

### Transistor Magnetic-Core Drivers

(S. Oken) (UNCLASSIFIED)

"Power" Transistors. The two point-contact transistors which were immersed in silicone oil and potted were not found satisfactory. This was made evident by the development of a hysteresis effect in the transistors' characteristics and a large decrease in  $R_{CO}$  after only several hours of operation at 200 milliwatts. This measurement will be further



2.16 Transistors (Continued)

(S. Oken) (UNCLASSIFIED) (Continued)

checked because the  $R_{CO}$  measured several days later was the original value. This smaller  $R_{CO}$  may be due to a temporary heating of the collector in the transistor.

An npn junction transistor similarly potted seems to be able to dissipate 200 milliwatts safely. The design of a core driver using this transistor in the grounded-base connection will be undertaken. This driver will be a two-stage device. One stage will give a large current output at a low impedance, and the second stage will convert the voltage source to a current source.

Address Selection System. The problem of building a system for selecting a core in a memory can be solved by using diode gates instead of a diode matrix. A diode matrix forces one transistor flip-flop to load another flip-flop. The flip-flop used cannot operate with this type of load.

Diode Construction

(N. T. Jones) (UNCLASSIFIED)

The final models of both the current source and limiter for bonding diodes have been finished and tested. Their operation is better than originally anticipated.

Microscopic examination of the Taylor process wire intended for cat's whiskers for the bonded diodes has shown that four of the five samples are discontinuous. One sample is broken into many pieces about 10 mils in length. This is now being discussed with the supplier.

Diode Storage

(N. T. Jones) (UNCLASSIFIED)

D. Smith is now completing the most recent series of tests on the point diodes. This data is being summarized for inclusion in the diode reverse recovery memorandum.

Transistor Gates

(C. T. Kirk, Jr.) (UNCLASSIFIED)

A memorandum is being written on the development of a high-speed gate using point-contact transistors.

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UNCLASSIFIED

### 2.17 Display

(C. L. Corderman) (CONFIDENTIAL)

On 20 January I attended an EDO-SO conference at High St. concerning display specifications for XD-1 as presented in M-2606. No major revisions were made in these specifications but they will be re-written in order to clarify some points and to introduce appropriate changes in terminology. One addition proposed by Group 61 has been included whereby one of the 91 display-assignment bits will be used instead as a display-suppression control bit. If this bit is a zero, it will take precedence over all other display-selection paths and suppress the display of this slot on all scopes. This will allow the use of all track display drum space for additional auxiliary memory with a minimum of bookkeeping. Another recent proposal from Group 61 to allow mixed display-assignment bits is being evaluated. This scheme seems to be very helpful for certain supervisory and initiating operators and can probably be included without undue difficulty.

Two items in the specifications which received considerable attention were digital expansion and off-centering and the shape of the over-all display area. These two aspects are related, and a realistic discussion of them must recognize the basic difference in neck shadow effects between tubes operating with (Charactron) and without (Cape Cod) post-acceleration. In tubes without post-acceleration the only effect of over-deflection (i.e., so that the beam hits the tube neck) is that the beam is blanked. However, in tubes employing post-acceleration, secondary electrons released when the beam hits the neck are accelerated to the screen. This current can give appreciable light output in the form of a diffuse blotch near the center of the screen. On the assumptions that this diffuse illumination is undesirable and that the circuitry to perform the algebraic operations to limit the display to the circular tube face would be costly and unstable, it has been proposed that the display area in XD-1 be limited to the inscribed square and that digital expansion only be used. This proposal has received EDO-SO concurrence and has been accepted by Group 61. This discussion has emphasized the need for:

- a. Development of a large square-face tube after techniques of irrotational convergence and post-acceleration in square tubes have been studied.
- b. Making full use of the advantages of digital expansion by reducing the long-term persistence presently employed in Cape Cod.
- c. Modification of the present Charactron design so that the matrix is not bombarded with the full screen voltage in tubes which do not employ post-acceleration.

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2.17 Display (Continued)

(R. H. Gerhardt) (CONFIDENTIAL)

M-2652, "Character Positioning Circuits for XD-1," was written and it will be issued during the next biweekly period.

Some time was spent examining a proposal by IHM to use cores for the display selection. This scheme would require approximately 3800 cores.

I am currently working on block diagrams for digital expansion of XD-1 situation displays. Most consoles will have displays of three different scales. The scales and off-center positions will be fixed with plugboard connections.

Vector Generator

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

An a-c amplifier has been built to drive the half-wave rectifiers. Measurements taken on the amplifier indicate that it may be necessary to use feedback pairs rather than feedback around a complete unit; this is due to the phase shift in the output transformer. Another alternative is a transformer with little phase shift until 5 megacycles.

A new scheme is under investigation for selecting negative or positive vectors. If feasible the requirements on the output transformer will not be as severe as at present.

The basic amplifier to be used in the display system has been given some tentative specs. A tube complement has been decided on which consists of one 6072, two 5965's, two 7AK7's, and one 5651.

The display console in MTC was demonstrated to interested groups during the past period.

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SECURITY INFORMATION

## 2.2 Group 63 (Magnetic Materials)

(D. R. Brown) (UNCLASSIFIED)

Nearly all the cores shipped to IBM by General Ceramics have been tested. This should provide enough cores for the first memory bank.

Cores for the WWI memory, MTC memory, and first bank of XD-1 were all made from General Ceramics' second batch. General Ceramics is now attempting to duplicate this second batch. Cores from batches 3, 3a, 4, 4a, and 5 are being evaluated at MIT.

A 1000-core lot of Ferroxcube cores, the first sizeable lot from Ferroxcube, had poor uniformity, and 60 per cent of the cores were badly disturb sensitive at 0.82 ampere.

Results from the 64 x 64 made from RCA cores are expected during the next period.

High uniformity is indicated for cores fired at MIT. Sample tests show a 92-per cent yield for one lot.

### Memory Digits for Linear-Selection Schemes

(P. K. Baltzer) (UNCLASSIFIED)

With the assistance of J. Raffel, a two-register memory has been built to provide further information on a linear-selection memory employing two-core digits. Each register consists of 32 two-core digits, DCL-3-70, F-394, being driven by an MF-1312, F-304, switch core. Since single-digit data indicated extremely wide limits on register drive excitation, no loading resistor will be used to shape waveform from the switch core. Testing equipment has been assembled and initial testing started. It is still too early for any evaluation.

### High-Current Pulse Generators

(F. W. Sarles) (UNCLASSIFIED)

A high-current pulse generator has been under development primarily for use in conjunction with work on the determination of ferrite switching coefficients as a function of various external parameters, e.g., temperature and stress. Such a pulse generator would be required to deliver a 1- $\mu$ sec flat-topped pulse with low rise time and high current amplitude. It is preferable also that the pulse have negligible sensitivity to back voltage effects from cores which are being tested.

2.2 Group 63 (Continued)High-Current Pulse Generators (Continued)

(F. W. Sarles) (UNCLASSIFIED) (Continued)

Two such pulse generators are under construction at the present time. One of these, using a 3C45 hydrogen thyratron, has given the following performance:

Rise Time	30 millimicroseconds
Pulse Length	0.6 microseconds
Repetition Rate	Variable to about 5000 pulses/sec.
Maximum Pulse Amplitude	30 amperes

The performance thus far of the second generator, using a Western Electric mercury contact relay, is as follows:

Rise Time	Less than 10 millimicroseconds
Pulse length	1.5 microseconds
Repetition Rate	60 pulses/sec.
Maximum Pulse Amplitude	Between 20 and 25 amperes

No determination has yet been made as to the sensitivity of these generators to the back voltage effects from cores under test.

Resistivity Measurements

(J. D. Childress) (UNCLASSIFIED)

Design is being completed for an electrometer circuit to measure resistances of ferrite samples. The instrument will have a range of  $10^3$  to  $10^{11}$  ohms and will drive an X-Y recorder.

Core Testing

(J. H. McCusker) (UNCLASSIFIED)

Approximately 20,000 cores for XD-1 were selected in this biweekly period. Only 1 to 2 weeks more should be required for XD-1 core testing.

Cores are also being tested for a 128 x 128 plane.

Sample tests were made on several DCL batches. One small batch seemed very uniform and would be satisfactory for use in the memory.



2.2 Group 63 (Continued)RCA Plane

(J. R. Freeman) (UNCLASSIFIED)

Final tests have been made on the 64 x 64 memory plane constructed from XF-345 ferrite cores produced by RCA. The voltage-output wave-shapes of these cores differ radically from the General Ceramics ferrites. The voltage outputs of the XF-345 cores are not uniform in appearance and lack the symmetry of other types. Considerable difficulty was experienced in selecting cores because of this diversity. A 30-mv selection band was used which gave a yield of less than 50 per cent. The plane tests indicated very wide variations in disturbed-ONE outputs among cores. The low yield prohibited a band split which would have been highly desirable. The XF-345 plane is not expected to compare favorably with similar MF-1326-B planes.

Semiautomatic Core Tester

(R. A. Pacl) (UNCLASSIFIED)

The old semiautomatic core tester is being revised to use the same basic subassemblies as the new one. This will eliminate much of the maintenance problem as well as reduce the number of spare parts on hand.

Ferrite Synthesis

(F. E. Vinal) (UNCLASSIFIED)

There has been little progress in the development of improved memory-core materials during recent weeks as efforts have centered about production techniques for cores which will meet the present memory-core specifications. In this respect, some progress may be reported. A trial firing of DCL-1-180, comprising about 300 cores, showed a yield of 92 per cent acceptable cores. Further, the divergence of the cores within the acceptance limits was much less than for any previous test batches, showing a degree of uniformity not previously observed.

Immediate objectives are to repeat this performance on a pilot-plant scale and to repeat the over all preparation and firing of this composition.

(J. J. Sacco) (UNCLASSIFIED)

Batch DCL-1-180 has been fired at 12 different time-temperature schedules to determine the conditions for optimum electrical properties.

Several firings have also been made in the  $MgO.MnO.Fe_2O_3$  ternary system in order to add to the data compiled thus far on this oxide system.

2.2 Group 63 (Continued)Ferrite Synthesis (Continued)

(F. S. Maddocks) (UNCLASSIFIED)

Chemical analysis of General Ceramics MF-1326-B fines (less than 325 mesh) indicates appreciable enrichment in manganese oxide over previous analyses made here on the MF-1326-B as pressed. Fines of our own preparation (DCL-1-180) will be examined for any similar enrichment.

Pilot-Plant Production of F-394 Memory Cores

(R. A. Maglio) (UNCLASSIFIED)

The latest pilot-plant firing, 26 January 1954, consisted of approximately 28,000 DCL-1-180 cores pressed at the Digital Computer Laboratory. Of these approximately one half were pressed from a granulation of 60-200 mesh and the other half from 200-325 mesh. To these were added 8,000 cores of the same preparation pressed at RCA, making a total of approximately 36,000 cores. Preliminary checks indicate, as might be expected, somewhat variable results for the three different pressings.

Further refinements are being made in the preparation of ferrite powder for use in the Stokes press. These revisions have to do with the addition of binder, die lubricants and the calcination temperature of the ferrite powder. The further improvement of the pressing properties of ferrite powders is necessary for extending die life (now 25,000 cores per die set) and improved core forming.

Single Crystals of  $Mn_3O_4$ 

(J. B. Goodenough) (UNCLASSIFIED)

A natural crystal of  $Mn_3O_4$  was obtained from Harvard University. It has been roughly oriented by geometric methods and will be polished and cut along specific crystallographic planes. This material is expected to show an anisotropy in electrical resistivity below 1170 C and a discontinuity in resistivity at 1170 C.

Damping Effects in Metallic Toroids (N. Menyuk) (UNCLASSIFIED)

A study is under way to determine the relative values of eddy current and relaxation effects in damping motion of domain walls during the magnetization reversal of 4-79 Mo-Permalloy toroids. The toroids used in this experiment are made of ultra-thin tapes of 1/8-mil, 1/4-mil, and 1/2-mil thickness, manufactured from the same melt. The eddy current and relaxation effects can be separated by a determination of S as a function of thickness. This experiment will be performed over a range of temperatures.

SECTION III - CENTRAL SERVICES

3.1 Purchasing and Stock

(H. B. Morley) (UNCLASSIFIED)

A new system of handling hookup wire has been initiated with a view toward improved efficiency and economy.

Stock Control problems attendant upon adoption of Lincoln Lab numbering systems have been partially solved by cross-indexing with DCL numbers on Kardex cards.

Personnel are again reminded that all requests for petty cash should be cleared through the Purchasing Department before the purchase is made.

Month of January

Total Orders Received - 326

Received on time	136	41%
Received 1-7 days overdue	104	32%
Received 8-14 days overdue	36	11%
Received 15-22 days overdue	23	7%
Received 23-30 days overdue	7	2%
Received 1-2 months overdue	15	5%
Received 2-3 months overdue	3	1%
Received 3 or more months overdue	2	1%
	<u>326</u>	<u>100%</u>

3.2 Construction

Production Control

(F. F. Manning) (UNCLASSIFIED)

There have been 24 Construction Requisitions totaling 320 items satisfied since 15 January 1954, and there are 27 Construction Requisitions totaling 1529 items under construction by the Group 60 Electronic Shops.

For further information please call the Production Control Office (Ext. 3492).

3.2 Construction (Continued)

Outside Vendor

(J. V. Mazza) (UNCLASSIFIED)

There are 3 orders now open with vendors totaling 89 items. Deliveries in the past biweekly period have totaled 37 items. Information on specific orders may be obtained from the writer (Ext. 3492).

3.3 Component Analysis and Standards

3.31 Component Analysis

(B. B. Paine) (UNCLASSIFIED)

The phenomenon of silver migration in plastic materials has been studied further during the last period with Arthur Loeb and John Little of IBM; particular attention was paid to laminated material for use in AN/FSQ-7 etched-wiring cards. Visits were made to Squier Signal Laboratories and Bell Telephone Laboratories. It is now evident that use of silver in the presence of moisture and d-c potential should be avoided entirely.

Marginal-Checking Relays

(R. Jahn) (UNCLASSIFIED)

The XD-1 marginal-checking relays are being tested for bouncing contacts, contact resistance, time of operation, and current handling capacity. Preliminary tests have demonstrated a very bad bounce when the coil is deenergized, probably caused by excessive contact leaf spring tension.

3.33 Standards

(H. W. Hodgdon) (UNCLASSIFIED)

DCL Standards 6.031-1 and 6.134-1 were issued with unintentional errors and omissions. Corrected revisions are being sent out immediately.

Standardized methods of mounting fixed wire-wound resistors are being recommended. (See DCL Standard 6.150-1.)

### 3.33 Standards (Continued)

#### Component Standards

(C. W. Watt) (UNCLASSIFIED)

The Radio-Electronics-Television Manufacturer's Association (RETMA) has a committee on Electronic equipment reliability with which liaison has been set up and will be maintained. A meeting of the planning subcommittee of this committee was attended in New York on 20 January by Taylor and Watt at which time the group discussed what if any cognizance the RETMA should take of the component purchase specifications written by MIT and IBM for Project High. The group was very interested, especially in the application notes in the MRD Book and in the philosophy used in performing the specs. It was agreed to refer the specs and the application notes to the proper RETMA subcommittees on components for study.

### 3.34 Vacuum Tubes

(H. B. Frost) (UNCLASSIFIED)

During the past period curves were completed for the 7AK7 in the region where the SR-1782A will operate in the ANFSQ-7 system. These curves will be redrawn by IBM for issue in a Tube Application Memo. The curves have been checked against SR-1782A tubes and found to be valid.

Some difficulties have been encountered with 6L45 tubes which drive a matrix in the storage system of WWI. Three gas arcs have occurred which caused two shutdowns of WWI; both shutdowns lasted several hours. The long down-time was needed to replace crystals which were damaged by the high current through the 6L45 tubes when they failed. These arcs were caused by excessive voltage between the cathode and the shield of these tubes. The shield voltage has now been changed to bring the shield to the average cathode potential. In addition, the crystal matrix has been fused in an effort to avoid the loss of crystals in the event of any future gas arcs.

Conferences have been held with IBM during this period on the 2D21 and SR-1782A. Sylvania representatives discussed applications of the SR-1782A with the circuit designers. These meetings will be reported more completely by the people involved.

#### Thesis Research

(H. B. Frost) (UNCLASSIFIED)

Continued tests have shown that very good data can be obtained from cathodes when they are well activated and uniform. With my optica, which average the effects over a large area of the cathode, very uniform cathodes are essential. In checks made on RT 414 when its cathode was in good



3.34 Vacuum Tubes (Continued)

(H. B. Frost) (UNCLASSIFIED) (Continued)

condition, very good correspondence between the behavior of the cathode and the theory was found. I hope to continue and possibly complete tests on RT 414 during the next period.

A critical examination of the results of the calculated data on transient changes shows that there are fairly large errors (greater than 1 per cent) in the evaluation of the integral which is proportional to the cathode-coating resistance. This integral has been evaluated by trapezoidal integration; evaluation by Simpson's rule will be required in the future. Additional data on the calculations can be found in the 6345 Biweekly Report.

(T. F. Clough) (UNCLASSIFIED)

During this biweekly period the failure of two 6145's burned out several crystals and caused a computer shutdown. Retest of these tubes indicated open cathodes. A dissection and careful examination of these tubes showed that a gas arc had caused heavy cathode currents which had practically vaporized about three-fourths of the cathode tab. This arc had apparently been initiated by a spark across a leakage path formed by the normal sublimation on the top mica between the shield and the cathode. This in turn liberated some gas and soon resulted in a self-sustaining arc.

The 6145 micas are well designed and slotted to minimize leakage. It is unlikely that this arc would have occurred except for the approximately 300 volts of potential difference which existed between the shield and the cathode.

It is evident that this tube was designed to operate with the shield potential very close to that of the cathode. This failure was discussed with Norm Daggett, and he has had the WWI circuitry changed to result in a much smaller potential difference.

The cause of the second 6145 gas-arc failure was somewhat more obscure, but it could well have been the result of the jarring of the panel such as might be caused by trouble shooting or the removal or replacement of a tube in the same panel.



### 3.34 Vacuum Tubes (Continued)

#### (A. Zacharias) (UNCLASSIFIED)

This period was devoted to the completion of the 7AK7 pulse characteristics including tetrode connection. The equipment was modified to allow the control grid to be pulsed to +30 volts. Tetrode characteristics were taken up to this voltage; pentode, up to +25 volts. Data was taken on type SR-1782A which was previously tested by IBM. The characteristics were the same as those of the 7AK7 as was expected. The entire characteristics, pentode and tetrode, are now being sent to Sylvania.

The construction of the Z-2177 life rack is progressing favorably. Completion is expected on 3 February.

#### (S. Twicken) (UNCLASSIFIED)

A trip was made to Poughkeepsie to review progress on the SR-1782A (the improved 7AK7) with Sylvania and the Project High Tube Group. Progress in setting up the line and building the tube has been good; however, no characteristic data is available from Sylvania because of Project High's demands for the tubes before testing had been completed. This situation has cleared up, and we can expect data from Sylvania in the near future.

The discrepancy between our data and IBM's on pulse-characteristic measurements has apparently been resolved. The elimination of cross coupling in the IBM equipment now gives readings which agree with ours within the tolerances of measurement. Data which we have taken on the 7AK7 under pulsed-positive grid conditions, both pentode and tetrode connected, will be sent this week to IBM for inclusion in the Tube Application Memos for AN/FSQ-7 as tentatively describing the SR-1782A.

Two tubes with their test data have been sent to Sylvania to correlate their pulse equipment with ours. When an agreement is reached and enough tubes measured, Sylvania will provide final characteristic curves for the SR-1782A.

Two days were spent with the Project High Tube Group representative on gas tubes. We worked on the purchase specification and Tube Application Memo for the 2D21. No means of marginal checking thyratrons have as yet been found to be practical.

### 3.4 Test Equipment

#### Test Equipment Committee

(L. Sutro) (UNCLASSIFIED)

It is probably time to list again the personnel of the Committee and whom they represent. They are:

David Brown, Chairman	Group 63
Richard Best	Group 62
Charles Corderman	Group 62
John O'Brien	Group 64
Edwin Rich	Group 61
Louis Sutro	Groups 60 and 62

At its meeting on 28 January the Committee approved purchase of a Rubicon Voltage Box, Model 2795. It received copies of test specifications for all standard test equipment prepared by the Test Equipment Headquarters and discussed plans for the new Test Equipment Headquarters at Building B in Lexington.

#### Test Equipment Headquarters

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

The variable-frequency clock-pulse generator yields both a standard pulse and a negative noise pulse about 3 volts in amplitude. Investigation showed that the noise pulse was due to the trailing edge of the negative pulse that cuts off the peaker tube. This noise can be eliminated by preceding the peaker tube with a differentiating circuit.

### 3.5 Drafting

#### Tube Tester Model III

(A. M. Falcione) (UNCLASSIFIED)

Division 7 made complete drawings for the Tube Tester Model III, which has been constructed and tested and is now in operation. During the testing period, many alterations and changes were made in the actual unit and have not as yet been recorded on the drawings. It is very important that the changes be recorded on the drawings at this time, because many of the additions and revisions made may be overlooked when the drawings are brought up to date if more tube testers are required.

3.5 Drafting (Continued)

MTC Drawings

(A. M. Falcione) (UNCLASSIFIED)

The Drafting Room has been working on MTC drawings for the past 2 weeks. We are planning to make complete drawings for each unit in MTC. It is hoped that they will be complete prior to the anticipated move of the Laboratory to Lexington.

3.6 Administration and Personnel

New Staff

(J. C. Proctor) (UNCLASSIFIED)

Mrs. Elaine Keith is working as a DDL Staff Member and has been assigned to Group 63. Mrs. Keith received her B.S. in Chemistry from Simmons and recently had been employed by Sylvania Electric.

New Non-Staff

(R. A. Osborne) (UNCLASSIFIED)

Marilyn O'Donnell is a new secretary in Group 62.  
Elizabeth Welch is a new messenger girl at the Barta Building.  
Constantine Rhodes is a new technician in the Systems Group.

Terminated Non-Staff

(R. A. Osborne) (UNCLASSIFIED)

Philip Chandler  
Mary Toner  
Delight Nease

Open Non-Staff Requisitions

(R. A. Osborne) (UNCLASSIFIED)

Senior Detailer