

~~CONFIDENTIAL~~

Memorandum 6M-3518

UNCLASSIFIED

COPY NO 1 OF 155 COPIES

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

SUBJECT: BIWEEKLY REPORT FOR 8 APRIL 1955

To: Jay W. Forrester

From: Division 6 Staff

CLASSIFICATION CHANGED TO:
Auth: DD254
By: RRS
Date: 3-21-60

COVER SHEET

This document is issued for internal distribution and use only by and for Lincoln Laboratory personnel. It should not be given or shown to any other individuals or groups without express authorization. It may not be reproduced in whole or in part without permission in writing from Lincoln Laboratory.

The research reported in this document was supported jointly by the Department of the Army, the Department of the Navy, and the Department of the Air Force under Army Contract No. AF 19(122)-878.

This document contains information affecting the national defense of the United States within the meaning of the Espionage Laws, (Title 18 U.S.C. Sections 793 and 794). Its transmission or the revelation of its contents in any manner to an unauthorized person is prohibited by law.

UNCLASSIFIED

~~CONFIDENTIAL~~

Memorandum 6M-3518

Page 1 of 53

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

SUBJECT: BIWEEKLY REPORT FOR 8 APRIL 1955

To: Jay W. Forrester

From: Division 6 Staff

Approved: *JCP*
John C. Proctor

CONTENTS

Section I - System Test & Planning	3
Section II - AN/FSQ-7	20
Section III - Advance Development	39
Section IV - Central Services	48

INTRODUCTION

College Recruiting Program

(R. J. Horn, Jr., W. Ogden, Jr.) (UNCLASSIFIED)

During the last biweekly period (25 March 1955 - 8 April 1955) the following recruiting trips were made:

<u>Representative</u>	<u>College</u>	<u>Date</u>
W. Attridge, S. Manber	Williams	28 Mar.
D. Bailey	U. of Notre Dame	28 Mar.
D. Bailey, J. Jacobs	Marquette U.	29 Mar.
	U. of Wisconsin	30 Mar.
J. Cahill	NYU Uptown	28 Mar.
	Brooklyn	28 Mar.
	St. Peter's	29 Mar.
	CCNY	6 Apr.
C. Zraket, E. Rich	U. of Florida	28-29 Mar.
	Miami	1-3 Apr.

This document is issued for internal distribution and use only by and for Lincoln Laboratory personnel. It should not be given or shown to any other individuals or groups without express authorization. It may not be reproduced in whole or in part without permission in writing from Lincoln Laboratory.

The research reported in this document was supported jointly by the Department of the Army, the Department of the Navy, and the Department of the Air Force under Air Force Contract No. AF 19(122)-458.

This document contains information affecting the national defense of the United States within the meaning of the Espionage Laws, (Title 18 U. S. C. Sections 793 and 794). Its transmission or the revelation of its contents in any manner to an unauthorized person is prohibited by law.

Memorandum 6M-3518

Page 2

<u>Representative</u>	<u>College</u>	<u>Date</u>
C. Zraket, E. Rich	Duke Georgia Tech	1-3 Apr. 4-6 Apr.
H. Seward, E. Rich	Alabama Polytech Georgia	30-31 Mar. 4-5 Apr.
W. Hosier, V. Nedzel	Roosevelt U. Loyola U. De Paul U. U. of Chicago Northwestern U.	4-8 Apr. 4-8 Apr. 4-8 Apr. 4-8 Apr. 4-8 Apr.

~~CONFIDENTIAL~~

UNCLASSIFIED

Memorandum 6M-3518

Page 3

I - SYSTEM TEST & PLANNING

1.1 Air Defense1.1.1 Test Program

(D. R. Israel) (CONFIDENTIAL)

A rough schedule of the flight tests for the next 6 months has been prepared in conjunction with Bob Davis. The activity begins in May and builds up to full load in June and July and continues at a peak. During this period, we will be operating about 5 hours a day, 4 or 5 days a week. By the end of August the initial series of initiation, monitoring, and tracking-accuracy tests should be completed. In accordance with a recent decision, we will now coordinate and schedule our tests together with Group 22 as "Cape Cod Tests."

In conjunction with S. Hibbard and Captain Bacon, plans for a revitalized training program for the Air Force personnel operating at the Cape Cod Direction Center are being prepared. An integral part of this program will be the scheduling of one 2-hour live mission and two 1-hour simulated missions each week specifically for training.

The establishment of the SAGE Test Committee and SAGE Test Office was formalized with the issuance of 6M-3476, "SAGE Test Office," (Harris, Israel, Nedzel, and Wells: 18 March 1955). The first meeting of the Committee was held on Wednesday, 6 April, and is reported in Anne MacIntire's biweekly.

Plans have been made with P. Sebring and P. Rosen of Division 2 to expedite the testing of the present semiautomatic height-finding system. These tests should be completed within 6 to 8 weeks.

Preparation of the data-generation and data-reduction programs for the 1954 CCS continues with estimated completion date of 1 May. Following this, members of the Section will be assigned responsibilities both for specific tests and for the collection and processing of operational data from those functions such as mapping, ID, and height, which will be evaluated as part of normal operations rather than specific tests.

(E. Bedrosian) (CONFIDENTIAL)

The specifications for the system-simulation program have been revised. The flow diagrams for the magnetic-tape read-in and the association subprograms of the system-simulation program have been written; these subprograms will be written simultaneously.

(A. E. Budd) (CONFIDENTIAL)

Work continues on the subroutine to read in data from magnetic-tape records with no apparent delay.

~~CONFIDENTIAL~~

~~CONFIDENTIAL~~
UNCLASSIFIED

Memorandum 6M-3518

Page 4

(R. Davis, A. Smalley, P. Dolan) (CONFIDENTIAL)

Test Coordination Sub-Section scheduled three Raydist, one accuracy, one saturation, and one live test, two semiautomatic height tests, and one data-program analysis.

Two Raydist tests were conducted as scheduled. One was canceled because of the lack of electric power in the Cape area.

Both the accuracy and saturation tests were conducted with good results. The live training test had to be canceled because of the lack of electric power at the South Truro site.

The two semiautomatic height tests were conducted as scheduled. The data-program-analysis test was conducted as scheduled. Additional computer time was scheduled for equipment and program checkouts.

Under the recent reorganization, the Test Coordination Sub-Section has spent considerable time planning and scheduling tests and aircraft requirements for the next 6-month period.

(E. J. McEvoy) (CONFIDENTIAL)

The past biweekly period has been spent gaining information concerning the data-generation program. I have started to write a part of the program and will continue to work on it with H. Frachtman.

A. Budd and I have set up a series of seminars for the Test Planning Section. The first was held on Thursday, 7 April 1955.

(F. W. Graham) (CONFIDENTIAL)

My activities for the period 28 March through 8 April 1955 were as follows:

1. Final phases of the indoctrination program were completed, and the "card sort" program was run successfully on WWI;
2. A sine-cosine routine was checked for Sol Manber to determine accuracy and errors;
3. I attended a seminar on Raydist;
4. I investigated the possibility of using aerial photography to establish an accurate aircraft track. This track could possibly be used to evaluate both Raydist and radar data.

~~CONFIDENTIAL~~
UNCLASSIFIED

~~CONFIDENTIAL~~

Memorandum 6M-3518

Page 5

UNCLASSIFIED

(I. B. Hazel) (CONFIDENTIAL)

A. Chandler and I have been working together rewriting and organizing those sections for which we are responsible of a memo entitled "Master Make-up and Display Specifications." I attended two seminars as part of the training for my new job in the Test Planning Section.

(A. P. Hill) (CONFIDENTIAL)

I am in the process of gathering material to be used for the next familiarization course. It is expected that this material will also aid S. Hibbard in setting up the training program for Air Force personnel.

(H. A. Keit) (CONFIDENTIAL)

Completion and checkout of the indoctrination card-sort problem was achieved.

Work began on a program for transferring data from one magnetic-tape record (1954 CCS) to another.

(D. Latimer) (CONFIDENTIAL)

I am getting information to rewrite the tables in the memorandum 6M-3078, and I am coordinating this with the rewriting being done for weapons direction. I hope to finish during the week of 11 April, at which time I will begin to write the proposed "detailed single track history printout" program.

(W. Z. Lemnios) (CONFIDENTIAL)

An M-note has been written for the test specifications of the tracking accuracy of F2H type aircraft.

W. Wells and I are formulating detailed plans for the forthcoming seminar on interceptor vectoring. Letters will be sent to about 15 or 20 organizations which are interested in this problem.

(J. Levenson) (CONFIDENTIAL)

Draft copies of 6M-3498, "Test Specification: Track Initiation Study with Single Coverage SDV Data," have been distributed for comments. A rough draft has been prepared which outlines the data processing necessary for these initiation tests. The first test is tentatively planned for the week of 2 May, pending the completion of necessary data-reduction programs.

~~CONFIDENTIAL~~

UNCLASSIFIED

~~CONFIDENTIAL~~

Memorandum 6M-3518

Page 6

UNCLASSIFIED

(A. MacIntire) (CONFIDENTIAL)

The organizational meeting of the SAGE Test Committee was held in the office of D. R. Israel on 6 April 1955. The Committee includes S. Dodd, Group 64, G. Harris, Group 22, A. Herckmans, BTL, D. Israel, Group 61, A. Nedzel, Group 22, and W. Wells, Group 61. The Committee has the responsibility for planning the over-all Test Program effort, for assigning responsibilities and priorities for individual pieces of work, for initiating schedules, and for monitoring and reviewing the progress of the work.

The SAGE Test Committee approved and appointment of Mr. A. Wright of BTL and A. MacIntire of Group 61 as initial personnel of the SAGE Test Office. It was agreed that their duties would include the following:

1. Issue minutes of SAGE Test Committee meetings;
2. Develop and issue a summary of test requirements;
3. Prepare coordinated schedules of aircraft and equipment requirements for the 1954 Cape Cod testing;
4. Develop and issue a record of accomplishments for both aircraft and equipment;
5. Issue biweekly progress reports on all work items.

(S. Manber) (CONFIDENTIAL)

During the last biweekly period, I have been continuing the documentation of the 1954 CCS programs. This work will be completed during the next biweekly period. M. Curran (BTL) and I have started tests of Ampex magnetic-tape recordings of SDV to determine the suitability of this recording system for future CCS tests. The new staff members (M. Smith, BTL, F. Graham, H. Keit) have completed the first phase of their indoctrination in WWI programming and are now working on programming involving in-out units.

(A. A. Mathiasen) (CONFIDENTIAL)

The Raydist conversion program, in lieu of one using a better method, will be used to convert current data after preparation by the Tape Room. They now have all data which has been counted.

The orientation program seems to be operative. It is somewhat lacking in precision, but this is being corrected.

Plots of Raydist data and South Truro radar calibration indicate a unit error in range and azimuth.

~~CONFIDENTIAL~~

~~CONFIDENTIAL~~

Memorandum 6M-3518

Page 7

UNCLASSIFIED

I gave a talk to the Test Program Section on the Raydist system as used in radar orientation.

(R. L. Smith) (CONFIDENTIAL)

Additional work was performed bringing M-2851, "Specifications of Scope Display Equipment in the 1954 Cape Cod Direction Center," up to date. Errata No. 1 will be issued in the next biweekly period.

A lesson plan on the workings of the equipment checkout is being written for presentation to Air Force enlisted personnel.

(W. Vecchia) (CONFIDENTIAL)

		<u>hr</u>	<u>min</u>
	Total Assigned Time	123	05
	<u>hr</u>	<u>min</u>	
Raydist	29	05	
Analysis	13	30	
Weapons Direction	15	05	
Equipment Checkout	5		
Tracking	23	30	
System Operation	<u>15</u>	<u>15</u>	
TOTAL	101	25	
Time Given 6345	14		
Time Given System	7		
Time Lost Computer (malfunction)		35	
TOTAL	21	35	
		<u>101</u>	<u>25</u>
		<u>21</u>	<u>35</u>
GRAND TOTAL		123	

1.1.2 Analysis and Simulation

Manned-Interceptor Simulation

(H. D. Neumann) (CONFIDENTIAL)

Parameter tapes and vectoring-limit tapes were prepared for the initial runs of the manned-interceptor simulation program. They represent the same cases which were tested by SFL on the NIP Simulator.

~~CONFIDENTIAL~~

~~CONFIDENTIAL~~

Memorandum 6M-3518

Page 8

UNCLASSIFIED

(B. Smulowicz) (CONFIDENTIAL)

Work is continuing on the track-correlation program to be used with the manned-interceptor simulation program. Because of lack of storage space in the MTC core memory, most of the correlation program will have to be stored on the drum and brought back into core memory once every scan, resulting in a considerably slower operation of the simulation program.

(W. I. Wells) (CONFIDENTIAL)

MISP was reorganized so that data could be punched on IBM cards, making the operation program much simpler. We hope this simplification will enable the operator rather than the programmer to run the program.

Charactron Display

(H. D. Houser) (CONFIDENTIAL)

During the past biweekly period, the Charactron program which displays track messages, and the input and conversion program which loads the track-message slots from a parameter tape, were modified so that a typical summary photo display could be photographed. Work is continuing on a combined Charactron-Typotron display program for use with the display console connected to MTC.

Numerical Evaluation of Markov Processes

(C. Friedman) (CONFIDENTIAL)

The past 2 weeks have been spent in solving problems for the automatic initiation program.

Radar-Data Processing

(H. Peterson) (CONFIDENTIAL)

I have written a program to map data via the area discriminator stored on Raytheon tape (as described by 6M-3422) and leave the data on the magnetic drum. The program should be converted next week.

On Saturday, 2 April, I went with the indoctrination group to South Truro to see our equipment there.

~~CONFIDENTIAL~~

UNCLASSIFIED

~~CONFIDENTIAL~~
UNCLASSIFIED

Memorandum 6M-3518

Page 9

Study of Blip-Scan Models

(R. W. Sittler) (CONFIDENTIAL)

Work is continuing on testing blip-scan models by means of statistical tables derived from a special MTC program.

Countermeasures

(F. F. Gucker) (CONFIDENTIAL)

During the past biweekly period a large part of my effort has been spent with F. Heart and H. Seward planning a computer simulation program to investigate the possibility of tracking using azimuth information only. Meanwhile, I have begun gathering background information on electronic countermeasures as part of a long-range study.

Tracking - Monitoring

(J. F. Nolan) (CONFIDENTIAL)

Test specifications for a proposed series of tests of the tracking-monitoring process in the 1954 Cape Cod System will be available in rough-draft form within a week. This test series will produce empirical data on the nonload tracking effectiveness of the man-machine system for automatic, selective monitoring and continuous monitoring modes of operation upon varied combinations of the tracking parameters of blip-scan ratio, noise, and aircraft maneuvers.

At present, attention is being given to defining reasonable numeric measures for "tracking effectiveness" and to outlining the data recording and data reduction needed to extract these measures from the tests.

The tests will be run with simulated track and noise data, thus allowing for strictly controlled inputs and for comparison of the different modes of automatic and manual operation. The track data will be generated to represent SDV returns from B-29 type aircraft for the South Truro FPS-3. The data patterns will follow recently derived empirical models of scan-to-scan correlation of hits and frequency distributions of "multiple print" returns.

1.1.3 SAGE Training

(S. B. Hibbard) (CONFIDENTIAL)

Background experience available to implement a training course for SAGE System operations personnel is not considered sufficient to be effective at this time. An experimental training course, using the 1954 Cape Cod System, is being generated by section 61 and the Training Section of Group 61 to compile as much of the desired information as is

~~CONFIDENTIAL~~

~~CONFIDENTIAL~~

Memorandum 6M-3518

Page 10

UNCLASSIFIED

possible. Several outside agencies interested in background information for the SAGE training program have indicated a desire to take part in the course and to assist in the evaluation of the experience gained. Interested agencies are:

1. Air Force Personnel Training Research Center
2. ADES, Western Electric Co.
3. JPO
4. Bell Telephone Laboratories

1.1.4 Coordination

(P. R. Bagley) (CONFIDENTIAL)

I am beginning a survey to determine the requirements for training personnel to be able to program for the FSQ-7. This survey will involve:

1. Determining how many people will need to be trained by Group 61, when they will need to be trained, what they will need to learn;
2. Outlining a training course to fill the above needs;
3. Proposing a means of implementing the training course: what the schedule should be, who should act as instructors, what training material should be prepared, and how best to train efficiently persons who are beginning at different dates and with different amounts of previous training;
4. Estimating amounts of computer time on XD-1, WWI, and MTC needed for training purposes.

I have begun training on an informal basis for two members of Group 61 and two engineers from Hazeltine.

(M. Feldstein) (CONFIDENTIAL)

An investigation has been made of the facilities of the IBM Card Preparation Room in light of the anticipated demands of programming and data processing.

~~CONFIDENTIAL~~

UNCLASSIFIED

~~CONFIDENTIAL~~

Memorandum 6M-3518

Page 11

Some of the conclusions are:

1. The floor space in the Card Room, including expansion of file storage, is adequate;
2. Another 056 verifier should be added. Three 026 punches and two 056 verifiers should be sufficient;
3. Additional operators will be required.

(A Heineck) (CONFIDENTIAL)

My immediate task is to help establish what information and in what detail should be included in the operational specifications for the SAGE Direction Center.

I have discussed the problem with some members of Group 61 and plan to see others in the near future.

In addition, a means of collecting and filing operational specifications and their supporting documents is being worked out.

(L. R. Jeffery) (CONFIDENTIAL)

Memo 6M-3499, "Study of FSQ-7 Cycle Time," has been completed in draft form and will be issued as soon as a few corrections have been made. A goal of 13.5 seconds cycle time is justified in this report.

(H. Rising, J. Ishihara) (CONFIDENTIAL)

The situation and auxiliary-console layouts for XD-1 and AN/FSQ7 are being revised and correlated. Detailed equipment lists and revised memos defining the panel equipment and panel layouts for each of the operating positions will be forthcoming in the next biweekly period.

1.1.5- Tracking

(W. Attridge, J. Ishihara) (CONFIDENTIAL)

We have made initial plans for generating the operational specifications in the Tracking Section. First work will be done on preparing initial detailed outlines.

(D. L. Bailey) (CONFIDENTIAL)

I am working with W. Attridge and E. Wolf on the operational specifications for initiation and automatic tracking in the SAGE System. Several preliminary meetings have defined the areas which must be covered.

~~CONFIDENTIAL~~

~~CONFIDENTIAL~~

Memorandum 6M-3518

Page 12

UNCLASSIFIED

The primary concern at this time is the operator-equipment relationship, but program details are being considered where they are useful in clarification of our thinking on the operational aspects.

(H. Benington, W. Harris, A. Shoolman) (CONFIDENTIAL)

We are nearing completion of work on specification of display-selection switches, assignment of display-category and display-assignment-bit lines to each situation-display console in XD-1 and AN/FSQ-7 Direction Centers, and utilization of the AN/FSQ-8 situation-display system. A memorandum covering this work will be published in the next week.

(P. Bragar) (CONFIDENTIAL)

I have started to accumulate information on which to base the operational specifications for the Subsector Command Post.

(F. Brooks) (CONFIDENTIAL)

Work continues on track-sorting schemes, on programmed coverage masking and area discrimination, and on a manual-intervention utility program.

(F. Heart, W. Lone) (CONFIDENTIAL)

An initial FSQ-8 requirements study has been completed. The following memoranda have been published:

6M-3489, "FSQ-8 Display Slot Capacity"
6M-3488, "FSQ-8 Cross-Telling Requirements"
6M-3486, "FSQ-8 Auxiliary Storage Requirements"

As a result of studies following publication of 6M-3486, Lincoln has recommended (6M-3487, J. Jacobs) that the FSQ-8 be equipped with the extra auxiliary-drum memory frame recently planned for the FSQ-7. Studies regarding the display-slot capacity are still in progress.

(E. W. Wolf) (CONFIDENTIAL)

Memorandum 6M-3481, "Test Specification: Initial Mapping Tests," has been issued. The mapping study has been taken over by Sol Manber and Bill Harris (Group 38).

A draft of a memorandum outlining data-conversion and transformation procedures and site-location accuracies has been completed.

~~CONFIDENTIAL~~

~~CONFIDENTIAL~~

Memorandum 6M-3518

Page 13

1.1.6 Program Organization

(L. Collins, W. E. Ball, Jr.) (CONFIDENTIAL)

During the past 2 weeks our major effort has continued to be directed towards the compilation of an up-to-date memorandum cataloguing all information pertinent to weapons-direction data storage.

(C. Gaudette, S. Knapp, J. Yienger, R. Gildea) (CONFIDENTIAL)

An IBM 407 accounting machine has been ordered for the Card Preparation Room and will be delivered some time after June. The machine will replace the Type 402 machine which is being used in this room at the present time.

The trace program and octonary print-out program are checked out and are now available for use in program debugging.

A table of sine-cosine values of the first quadrant of FGD units has been computed on WWI using the CSII system. Decimal values have been obtained, and a program to compute the octal values is ready for performance.

(P. L. Guinard) (CONFIDENTIAL)

	<u>hr</u>	<u>min</u>
Total Assigned Time	8	0
Program Checkout		
Utility	7	45
Down Time		
In-Out Equipment		15
TOTAL	8	

(P. R. Vance) (CONFIDENTIAL)

The past 2 weeks were devoted to studying XD-1 programming.

1.1.7 Weapons Direction

(C. A. Zraket) (CONFIDENTIAL)

Documentation of the 1954 CCS is essentially complete. Notebooks containing flow diagrams and annotated program copies have been made up and distributed to interested people. Memoranda describing the System and the Direction Center operational procedures have been issued with the exception of the following: master makeup and display program specifications, start-over program specifications, utility programs, and storage bit allocation. The latter work is in final stages and will be completed by 15 April 1955.

~~CONFIDENTIAL~~

~~CONFIDENTIAL~~

UNCLASSIFIED

Memorandum 6M-3815

Page 14

In line with the new Group 61 organization (see 6M-3084-1 for the SAGE program), the following work assignments have been made for the Weapons Direction (WD) Section:

Weapons Direction ----- C. Grandy, A. Chandler, R. Nelson

AAA ----- J. Cahill

Height Finding ----- H. Frachtman, J. Cahill

Manual Inputs ----- F. Garth, S. Hauser

Identification ----- F. Garth, S. Hauser

During the next 2 weeks, detailed outlines will be prepared for each of the five major functions listed above. These outlines will contain a list of the individual problems that must be looked into and the over-all policy questions that must be answered before detailed operational specifications can be generated.

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

The Army has responded to Lincoln's proposal for integrating anti-aircraft with SAGE (Lincoln TM-63) by adopting an Anti-aircraft Defense System described in Signal Corps Engineering Laboratories (SCEL) Memo M-1650, 30 March 1955. I am in the process of writing a proposed operational specification for a SAGE anti-aircraft direction program to operate with the Army's system. The specification will contain several questions which must be answered before a final specification can be written.

It is expected that representatives of Lincoln and SCEL will meet within the next 2 weeks in an attempt to find areas of agreement between the two organizations regarding the specification. Shortly thereafter, a second meeting will be held with SCEL and the operational Army agencies concerned to seek answers to remaining questions and to initiate Army concurrence in the specification.

(A. Chandler) (CONFIDENTIAL)

I have been organizing notes for a forthcoming memorandum on specifications for the master make-up and display programs in the 1954 Cape Cod System. I have also been familiarizing myself with the problem of weapons direction for the SAGE System.

(H. Frachtman) (CONFIDENTIAL)

Coding for the data-generation program has reached a peak of intensity.

Some thought has been given to SAGE system height finding.

~~CONFIDENTIAL~~

~~CONFIDENTIAL~~

Memorandum 6M-3518

Page 15

(C. Grandy) (CONFIDENTIAL)

Several tests of the 1954 Cape Cod System semiautomatic height-finding system were conducted and led to the discovery of two inadequacies in the program and minor equipment difficulties. Both the program and the equipment have been corrected, and meaningful test data should be obtained from additional tests of the System. Division 6 Memorandum 6M-2953, Supplement 1, Correction 1, has been written to document the program corrections.

A preliminary outline of the work to be accomplished by the WD Section concerning weapons direction has been written. Bob Nelson, Al Chandler, and I will expand this outline which will lead to the detailed operational specifications for SAGE weapons direction.

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

Our efforts to specify identification procedures of operation have taken the form of an organized list of questions which we seek to have answered by consultation, discussion, and research. A summary of these questions will appear in a work schedule published by the Weapons Direction Section of Group 61.

We are writing specifications for data analysis of the identification function for the Test Program Section. The specifications will be ready the week of 11 April.

(B. R. Stahl) (CONFIDENTIAL)

Additional work was done on the Raydist program preparatory to turning it over completely to A. Mathiasen. Manual plots of radar and Raydist data for one mission were drawn up by Maureen Cronin. cursory analysis of this type of plot indicates that it is of value in radar-orientation studies until such time as the computer program for orientation is working.

I have prepared and delivered to D. R. Israel a summary and current status tabulation of data from all useful radar-Raydist missions. In the future all questions concerning Raydist or radar orientation should be directed toward Mr. Israel or Mr. Mathiasen. A memorandum will be issued shortly containing a complete discussion of the Raydist problem.

1.1.8 Special Studies

(A. G. Favret) (CONFIDENTIAL)

On 30 and 31 March I attended a conference with M. Hubbard at CINCLANT (Atlantic Fleet Headquarters), Norfolk, Va. This conference

~~CONFIDENTIAL~~

~~CONFIDENTIAL~~

Memorandum 6M-3518

Page 16

UNCLASSIFIED

considered the problem of establishing an air-surface, under-water surveillance system for the entire Atlantic area and is reported in more detail in an inter-office memo to J. Arnow.

Work is progressing on a listing of all console labels for FSQ-7 to include a standardized list of all position designations.

(H. Seward, F. Heart) (CONFIDENTIAL)

Study is continuing on the problem of a multiple-radar, multiple-aircraft tracking system using azimuth information only.

UNCLASSIFIED

~~CONFIDENTIAL~~

1.2 Whirlwind I

1.2.2 WWI System Operation

Records of Operation

(M. F. Currier, B. H. Jacobs) (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 25 March - 7 April 1955:

Number of assigned hours	183
Usable percentage of assigned time	97
Usable percentage of assigned time since March 1951	90
Usable percentage of assigned time since September 1953	94
Number of transient errors	1
Number of steady-state errors	3
Number of intermittent errors	4

Analysis of WWI Failures

(A. R. Curtiss) (UNCLASSIFIED)

The following is a breakdown of interrupting and potentially interrupting failures occurring in the WWI computer system for the bi-weekly period, 25 March - 7 April 1955, inclusive:

Total Number of Failures	28
Total Number of No-Lost-Time Failures	8
Total Number of Lost-Time Failures	20
Total Lost Time in Hours	5.6
Total Operating Time in Hours	285

Class of Failure	Essential Maintenance		Chargeable to System			
	No.	Min. Lost	Explained		Unexplained	
	No.	Min. Lost	No.	Min. Lost	No.	Min. Lost
Tubes			2	0		
	1	10	1	5		
Passive Electrical Components			1	0		
			3	0	1	0
Fuses			1	5		
					1	0
Alarms			3	91	9	107
Miscellaneous						
	1	45	3	45	1	30
Number of Lost-Time Incidents	2	55	8	146	10	137
Number of No-Lost-Time Incidents			6		2	

~~CONFIDENTIAL~~
UNCLASSIFIED

Memorandum 6M-3518

Page 18

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

For this period there were 26 incidents of interruption resulting in the loss of 5.6 of the 285 hours of operation. Computer alarms accounted for 50% of the stoppages and 70% of the down time. All of the alarms were of the transient type with the exception of a steady-state alarm that required 45 minutes to correct. The source of one-half of the transient failures was located during a scheduled maintenance period.

Fine-Grain-Data Tests

(A. J. Roberts, L. L. Holmes, C. S. Lin) (UNCLASSIFIED)

During the past 6 weeks we have conducted 11 tests each lasting 2 hours. We have received and displayed time-multiplexed fine-grain-data and Mark X data test patterns. Live fine-grain data has been received twice. Photographs have been taken of the live-data displays.

John Ackley is going to prepare test programs that will give a finer evaluation of the system.

During this period several members of Group 64 visited the S. Truro installation, and the members of Group 24 responsible for the testing of the fine-grain-data equipment at S. Truro visited WWI. The visits should provide a better understanding of the over-all system.

1.2.3 Terminal EquipmentAmpex Recorders

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

Ten reels of mylar-backed tape, properly wound on our oversize reels, were received from the Radio Shack on 6 April. Initial checking of the quality of recording indicates some improvement in the dropout problem. Drafting for the playback preamplifier panel is nearing completion. It is hoped that the combination of the preamplifiers and the new tape will appreciably reduce the frequency of dropouts.

Equipment Malfunction Reports

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

A summary has been made for the period 15 March to 31 March covering five scheduled missions. Some modification to this summary may be necessary before publication. Changes in Group 61 organization with respect to Cape Cod have introduced a transient in our malfunction reporting. It is hoped that this condition will be rectified within the next biweekly period.

~~CONFIDENTIAL~~

Memorandum 6M-3518

Page 19

MITE

(C. S. Lin, L. D. Healy) (UNCLASSIFIED)

The MITE check program for marginal checking is written and is being added to T-3800.

A timer has been installed in the buffer-drum system to delay the switching on of the +200-v to the writers until 20 seconds after the control a-c is on.

The resistors in the xtal "and" circuits on the M. D. type 15 chassis are being changed from 220K to 47K.

Power Supplies

(E. W. Pughe, Jr.) (UNCLASSIFIED)

Blown-fuse indicator lights have been installed on the -60-v power supply series-tube panels. Sufficient voltage to light the neon bulbs was obtained by connecting a 180-K resistor between the plate and cathode of each series tube.

It has been decided to cycle on the new filament alternator by using a motor-driven rheostat and a commercial alternator regulator. This system was chosen in preference to an electronic system because it appears to be simpler and more reliable.

Maintenance Programming

(J. N. Ackley) (UNCLASSIFIED)

I have been continuing a study of the radar-input systems. It appears that although much of the routine maintenance and trouble location can be done independently of the computers by using the monitor scopes and other built-in test equipment at each site, there is a need for computer-programmed checks for final system adjustment and testing.

Display System

(T. Sandy) (UNCLASSIFIED)

A dust cover for the 16-inch scope in test control is being drawn up by the Drafting Department.

A successful height test was run using the new audible-alarm switching gear.

Memorandum 6M-3518

Page 20

II - AN/FSQ-7

2.1 Liaison2.1.1 SystemProduction Coordination Office

(A. P. Kromer) (UNCLASSIFIED)

Release of information (TIR's) defining system requirements and endorsing planning documents is continuing. These releases follow consideration and concurrence by all Lincoln Laboratory groups concerned with each specific item.

(E. L. Smiley, W. H. Ayer) (UNCLASSIFIED)

A major problem has developed in the matter of cabling in the production buildings. Because no cabling information was available until the last few weeks, the air-conditioning duct work was laid without regard for the location of signal-distribution boxes. No actual work had been done on planning the location of these boxes or the cable routing to and from these boxes until Hazeltine Corp. was brought in to supply the display system. Present engineering estimates show a need for eighteen 8' x 4' x 2' distribution boxes under the fourth floor, plus one in the Command Post, one under the liaison and observers level, and one under the maintenance and programming area. In addition to the dimensions quoted above, each box requires a minimum of 2 feet on each side of the box for installation and maintenance. Locating these boxes for maximum efficiency of distribution has required changing the location of various air ducts, but even this has left several distribution boxes with only the minimum clearance for working area. This means that working conditions around these boxes will at best be cramped and precarious.

The worst cable conditions exist under the command level where the cables must be snaked in and around tortuous routes, crossing steel beams and air ducts, in order to reach the consoles and command desk. The steel framing of this area is such that the location of the consoles is severely restricted to practically the location as presently shown. In addition, this same frame work has entirely blocked off cable and duct access to this area except for the present route, which has been shown to be an inferior route.

However, in spite of all these disadvantages, the problems are being resolved and a solution will be found, even though the maintenance problems will be difficult.

Memorandum 6M-3501, "Annunciator System For Monitoring of Air Flow in SAGE Direction Centers," will be distributed for concurrence in the next biweekly period.

The experimental lighting work is now concerned with a determination of the best room color scheme, a cheaper eggcrate ceiling, and a supplier for the blue filters.

~~CONFIDENTIAL~~
UNCLASSIFIED

Memorandum 6M-3518

Page 21

SAGE System and XD-1 Schedules

(W. H. Ayer, J. J. Carson, F. F. Manning) (UNCLASSIFIED)

We have prepared and forwarded to ADES-WE current information on the Experimental SAGE Subsector and XD-1 installation plan at Lexington for the April SAGE Status and Progress Report 16.

Using the Systems Office SAGE Experiment Subsector schedules as a format, a set of posted schedules (B-75119) was formulated. Frame status was extrapolated from the latest information available. Confirmed information will be forthcoming after the Schedule Meeting at Poughkeepsie, 8 April 1955.

Technical Information Releases

(E. D. Lundberg, J. J. Carson) (UNCLASSIFIED)

The following material has been released as engineering data for AN/FSQ-7 and SAGE System.

<u>TIR</u>	<u>M-Note</u>	<u>Subject</u>
1-68	6M-3266	Ground-to-Ground Outputs from the SAGE System
1-69		Engineering-Installation Phasing Committee, Summary Report #6
1-70	6M-3396	Number of Active Data Circuits from a Long-Range Radar Site (AN/FST-2)

2.2 XD-1, XD-22.2.1 SystemsSAGE Experimental Subsector Planning

(H. E. Anderson, I. Aronson, H. J. Platt) (CONFIDENTIAL)

Only one meeting of the Planning Approval Committee was held during this period because of the unavailability of several of the participants. At the meeting on 4 April 1955, an approval letter was signed covering the ground-to-air data link and the solution to the South Truro-XD-1 compatibility problem.

We are now engaged in compiling a set of memoranda which will fully describe the operation and equipment in the Experimental Subsector. Included are notes concerned with areas of responsibility, definitions of equipment, lists of sites and equipment, and a map of the Experimental Subsector.

~~CONFIDENTIAL~~
UNCLASSIFIED

~~CONFIDENTIAL~~

Memorandum 6M-3518

Page 22

UNCLASSIFIED

A display cabinet containing 1955 schedules for the Experimental Subsector has been placed in N. H. Taylor's office.

Logical Services Committee

(R. P. Mayer) (UNCLASSIFIED)

The Systems Office Training Program, announced in Memorandum 6M-3348, is nearly completed. H. D. Benington, from Group 61, is our guest lecturer for April 6, 8, and 13. He is presenting, for the first time "in public," a coherent discussion of how the operational programs are specified, planned, and organized into an efficient unit capable of doing the job. Such lectures are helpful in giving an insight into the reasons for some of the equipment requirements and may contribute to a more satisfactory match between equipment and program designs.

(N. T. Jones) (CONFIDENTIAL)

Command Post DD Desk. Meetings with representatives of Hazeltine, IBM, Group 61, and Group 38 were held on 5 and 6 April. Details of desk design were discussed, including physical and electrical requirements, packaging, and front-panel layout.

Large-Board Display. Memorandum 6M-3439, "Proposed Specifications for Large Board Display (XD-1)," will be rewritten in final form in the near future. Comments on this document should be sent to R. D. Buzzard or N. T. Jones as soon as possible.

XD-1 Large-Board Display

(B. B. Paine) (UNCLASSIFIED)

A demonstration of the display-projection system using Polaroid transparent film was given during the week of 4 April for officers of ADC and others. Transparencies made from the 5-inch and 19-inch Charactrons were shown, with several fictitious display formats.

The ADC personnel indicated that the display from either tube size was satisfactory for their initial purposes.

Long-Range Radar Input (LRI) Changes

(J. P. May) (UNCLASSIFIED)

A study was made of Change Evaluation Requests (CER) 11 and 13. CER 11, which requested channel identity bits, was rejected, since this would not furnish the maintenance personnel any additional data. CER 13, which requested a parity rate alarm, was recommended for inclusion in the system as soon as possible, because it is necessary for adequate maintenance.

~~CONFIDENTIAL~~

~~CONFIDENTIAL~~
UNCLASSIFIED

Memorandum GM-3518

Page 23

Mapper Supervisor's Position

(J. P. May, A. M. Werlin) (UNCLASSIFIED)

The data-gathering phase was begun for the study and evaluation of IBM proposal D-78, for the specifications of the Mapper Supervisor's position for XD-1, XD-2, and the production AN/FSQ-7's.

XD-1 Equipment Testing by XD-1

(H. I. Rundquist) (UNCLASSIFIED)

Testing of the XD-1 mapper console at Poughkeepsie, using simulated data from MTC, has begun. Several difficulties in signal transmission and reception have been encountered and as yet are unresolved. These appear at the mapper console in the form of excessive jitter. On 1 April 1955 I visited C. J. Kraus at Poughkeepsie to discuss future mapper-console tests.

A/G Voice Radio for XD-1

(C. J. Carter, F. E. Irish, H. J. Kirshner) (CONFIDENTIAL)

Our present policy with regard to the design of the switching equipment, channel and site selection, for the A/G voice-radio system for XD-1 is to use the same design as that being used for SAGE. However, the design of the SAGE equipment will not be completed in time to allow its use for the initial XD-1 installation. (The site-selection equipment will become available about December 1955, while the channel-assignment switching will become available during 1956.) Prior to the arrival of the designed-for-SAGE equipment, it will be necessary to use some improvised equipment for channel and site selection. Since the initial number of channels will be quite small, the equipment needed for this temporary installation will be quite simple.

2.2.2 Installation

(C. J. Carter, F. E. Irish, H. J. Kirshner) (CONFIDENTIAL)

A meeting was held at the Bell Telephone Laboratories in Murray Hill, N. J., on 30 March 1955 with representatives from BTL, AT&T, NET&T, and Lincoln present. The problems of delivery and installation of telephone key units for XD-1 were discussed. Types of facilities and equipment and tentative schedules for telephone service connected with the XD-1 ground/air radio system were firmed up.

A meeting was held at NET&T Co. with representatives from Lincoln on 6 April 1955 to discuss availability of certain types of telephone facilities for XD-1.

UNCLASSIFIED
~~CONFIDENTIAL~~

~~CONFIDENTIAL~~

UNCLASSIFIED

Memorandum GM-3518

Page 24

Specific orders for leased circuits needed for XD-1 by July 1955 will be placed within the next 2 weeks.

Drawing D-75189, "Telephone Key Unit Assignments for AN/FSQ-7 (XD-1)," is available in the Division 6 Print Room.

XD-1 Installation Information - Report #32 (Extract)

(H. Mercer, P. Morrill, H. Wainwright) (UNCLASSIFIED)

I. Building Construction

We have again checked with the Air Force, through the Air Installations Office and CRC Procurement, to get an estimate of the time of building acceptance. The latest estimate is about 15 April.

II. Equipment Cooling

The base chilled-water system was back in operation by 1 April. Since we are on the low point of the chilled-water line, it was decided to install a strainer in the main in Building F to safeguard the XD-1 installation. The strainer was installed during the shutdown.

Most of the sheet-metal fabrication will be completed by 15 April. Balancing and testing of the system is under way.

III. Cabling

Frames 31 and 37, the last of the MCD's, were delivered on 29 March. Hookup between these frames and the PCD should be completed by 11 April.

It is expected that the electrical contractor will be off the job during the week of 25 April.

We hope to have all signal cables on the job by 31 May.

IV. Equipment Layout

Projection Room - until Air Force approval of the layout is received, we cannot proceed with necessary room changes.

IBM Basement - much of the work in this area has been completed. Occupancy should start within the next 2 weeks.

V. Lighting

Since last report, we have again notified the Air Installations Office that, in our opinion, the second-floor lighting installation in rooms D, X, Y, and Maintenance is not in compliance with the lighting specifications. Completion of the lighting system, therefore, is depend-

~~CONFIDENTIAL~~

UNCLASSIFIED

Memorandum 64-3518

Page 25

ent on Air Installation Office's disposition of our letter.

VI. Telephones

The installation is about 50% complete. It is expected that the switchboard will be in operation by about 1 May.

XD-1 Drum System

(H. Boyd) (UNCLASSIFIED)

All 31 CD-addressable fields are now in working order. Margins for all CD reading, writing, and switching special circuits indicate very reliable operation. Margins on the encoder, time-pulse distributor, read-write controls, and other logic groups have yet to be taken.

The MI-OD field is now in working order, but margins indicate that about 20% of the MI-OD heads need readjustment. The DD-OD heads are being adjusted. The OD sides of TD and RD fields will be adjusted on completion of the DD-OD field.

The GT's that are necessary to prevent mutual interference between the computer and drum during manual testing of the drums will probably be installed over the weekend of 16 April. Delay was incurred in the procurement of necessary coaxial cables.

Situation-Display Generator Element

(B. Gurley, R. Callahan) (UNCLASSIFIED)

The wiring of the situation-display generator element is nearly complete, and power will have been applied to the frame before publication of this Biweekly.

R. Callahan spent 3 days at IBM clearing up difficulties in the testing of display pluggable units.

Display

(R. B. Paddock) (UNCLASSIFIED)

Frame 25 now lacks pluggable units only for decoders and drivers and two power CF's; all other circuits have been plugged into the frame, and the associated logic has been checked out. Termination for all complete lines has been determined and installed.

Plans are now being made to use a Typotron test setup in conjunction with frame 25 for initial evaluation and, possibly, for initial marginal checking of the digital-display system.

Memorandum 6M-3518

Page 26

2.2.3 Testing

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

As a result of a meeting of the Maintenance Coordination Committee, a short note (6M-3512) has been written proposing that a maintenance coordination scheme similar to the one now operating in the Cape Cod System be set up within the Experimental Subsector.

XD-1 Evaluation Preparations

(J. D. Crane) (UNCLASSIFIED)

A study of the core inputs and drum inputs associated with the manual-inputs system of the AN/FSQ-7 has been made. The description of an evaluation test to be performed on this system is being prepared.

An effort to promote a system of records which will provide a means of monitoring adequately the performance of XD-1 has been made. Mr. W. Mitchell of IBM is concentrating his efforts on this matter.

XD-1 Central Computer

(J. D. Crane, S. L. Thompson) (UNCLASSIFIED)

A test-storage program to check the automatic marginal-checking system was run for 5 minutes without error.

Manual marginal checking is continuing. Some margins have been improved.

Unexplained memory-parity errors still occur. Card-reader card-feed jams also occur.

Most of the central computer's time was used to test the drum system.

LRI Monitor Display

(J. McCusker) (UNCLASSIFIED)

Diode multipliers and diode sine generators for displaying LRI data were set up to generate circles; the results are not promising so far.

Memorandum 6M-3518

Page 27

Power Distribution

(G. F. Sandy, J. Clarke) (UNCLASSIFIED)

In order to reduce the number of failures of Struthers-Dunn relays in the power-distribution equipment due to dust collection on the contacts, the relays in all frames will be provided with individual covers.

The Struthers-Dunn relays in the PCD frame were covered on 19 March. Although no firm conclusions can be drawn, there has already been a large reduction in the failure rate.

(J. Clarke) (UNCLASSIFIED)

In order to facilitate an analysis of the reliability of power-conversion and power-distribution equipment, a system of log keeping has been set up.

Equipment Cooling

(A. Chopourian) (UNCLASSIFIED)

The air-handling units for the central computer are now on automatic control. Air temperatures to the load frames, chilled-water temperatures, and flow and pressure for chilled water and steam are being automatically recorded.

2.3 Production System

(S. H. Dodd) (UNCLASSIFIED)

An attempt is being made to define Group 64's areas of responsibility in a more definite manner than they now exist. After the outlines appear more clearly a memo will be written which will document this definition.

Once this has been done it will be possible to more effectively reorganize the group effort necessitated by the recent personnel changes in the Systems Office.

(K. E. McVicar) (UNCLASSIFIED)

I am assisting F. C. Ong of BTL-ADES in a rewrite of our report on SAGE System Test Planning. This memo should be ready for publication sometime during the next biweekly period.

~~CONFIDENTIAL~~
UNCLASSIFIED

Memorandum 6M-3518

Page 28

(C. J. Carter, F. E. Irish, H. J. Kirshner) (CONFIDENTIAL)

A meeting among ADC, ADES, AT&T, and Lincoln was held at Colorado Springs for the purpose of receiving a draft of Combat Center communications plans prepared by ADES-BTL. A revised version of these plans based on these discussions will be released by ADES-BTL.

Communications plans for Direction Center external circuits have been revised by ADC. The major revision involves the manner in which external voice "duplex" circuits are terminated. It is now planned to terminate the "alternate" half of a duplex circuit in a switchboard so that the circuit will be available for normal as well as restoration service. This revision modifies the ADES "grey book" on external circuits dated 18 March 1955.

Entrance facilities to some of the sites planned for the Experimental Subsector are now being used to capacity. Additional circuits for the Experimental Subsector will require the new cable entrance facilities to be constructed, probably at Lincoln expense. A survey of all sites is required to determine the amount of new construction involved. This construction is apart from that planned by NET&T Co. for extension of its facilities to meet Experimental Subsector circuit requirements.

Production Coordination Meeting (AN/FSQ-7)

(T. R. Parkins) (UNCLASSIFIED)

On 8 April, I attended a Production Coordination Meeting at IEM, Kingston, N. Y. IEM reported to Air Force representatives on the status of prototype and production AN/FSQ-7's.

Among the Class "A" changes to AN/FSQ-7 System 1, only the auxiliary-drum housing has been scheduled. This frame is due to be released about the middle of May 1955. Mr. J. H. Fraser (IEM) stated that although System 1 manufacturing schedules might be affected by the addition of an auxiliary-drum frame, the schedules will not be changed now but will be reviewed during January 1956.

A more comprehensive report of this meeting is being written for the PCO.

Double-Beam Oscilloscope

(R. H. Gould) (UNCLASSIFIED)

Experience with the type 336 DuMont scopes has shown that the amplifier response is adequate for observation of 0.1- μ sec pulses and would be a satisfactory amplifier to have in a dual-beam scope for AN/FSQ-7 maintenance. However, three of our five 336 scopes have been returned to the manufacturer's representative for repair of defective components. We

~~CONFIDENTIAL~~

Memorandum 6M-3518

Page 29

will make further efforts to interest another manufacturer in a dual-beam scope.

The question of automatic equipment shutdown in the event of an air-conditioning failure has been deferred until data is available on how soon equipment is damaged after a loss of cooling. One school of thought holds that the extra complexity of automatic shutdown is justified only if the time involved is too short for a human operator to react. I feel that, regardless of the time, automatic shutdown would provide greater safety for the equipment.

Gap-Filler Inputs (GFI)

(A. D. Hughes, J. P. May, A. M. Werlin) (UNCLASSIFIED)

Writing of the first draft of an adequate GFI specification has begun. Problems concerning the GFI mapper console were discussed with C. J. Kraus and R. W. Lowrie at Poughkeepsie on 1 April 1955.

Power Generation

(J. J. Gano) (UNCLASSIFIED)

Two groups of engineers from Burns and Roe, Western Electric consultants, were given tours and shown movies, to give them a greater appreciation of their part in the program.

(R. Jahn) (UNCLASSIFIED)

Air-conditioning and power-supply loads for the consoles were obtained from Mr. Walsh at Endicott. These loads are based on actual measurements and supersede all other estimates.

2.4 Vacuum Tube Circuits

Flip-Flop, Mod. A

(N. J. Ockene) (UNCLASSIFIED)

Tests have been performed to show the relationship of various circuit parameters to the sensitivity of the flip-flop; "40% down" Z2177 tubes were employed in most of the tests.

It was found that a combination of 680 ohms and 680 micromicrofarads is an optimum circuit combination between the primary of the trigger transformer and ground for reducing sensitivity. However, this optimum was obtained in conjunction with a specific cathode-bias circuit configuration. Tests are presently being performed to indicate whether the

Memorandum 6M-3518

Page 30

trigger circuit is optimum for other cathode bias circuits.

In addition, the above conditions are being checked with other than 1:1 ratio trigger transformers. The results will be written up in the next biweekly period.

Gap-Filler Sweep Circuit

(B. Barrett) (UNCLASSIFIED)

I visited IBM at Poughkeepsie to determine their requirements for a gap-filler sweep circuit. A circuit satisfying these requirements has been designed and is being breadboarded.

Experimental High-Speed Flip-Flop

(B. Barrett) (UNCLASSIFIED)

Marginal checking of the experimental high-speed (10-mc) flip-flop has shown it to be a satisfactory piece of test equipment. The output is a step which goes from ground to -27 volts (across 570 ohms) and which has a 50-musec rise time and a 20-musec fall time. Both a positive going and a negative going output step are supplied.

Sensing Amplifiers for Memory Planes

(R. C. Zopatti) (UNCLASSIFIED)

I am now using the output from the sense winding of a memory plane as the source for the sense amplifier in order to provide the proper source impedance. The input circuit of the amplifier (transformer and triode rectifiers) does not have sufficient bandwidth, and, because of the recovery times of the transformer and diodes, the signal or read pulse is attenuated as the memory cycle is speeded up.

Display-Line Driver

(J. Kriensky) (UNCLASSIFIED)

I have been familiarizing myself with this circuit and have begun making some tests with it. A Kay Lab Absolute D-C Power Supply, used in testing the display-line driver, developed trouble which was found to be caused by the shorting to ground of filament leads of two rectifier tubes, causing the fuse to blow.

Memorandum 6M-3518

Page 31

Selection-Plane Driver (256 x 256 Core Memory)

(D. Shansky) (UNCLASSIFIED)

An apparent prf sensitivity in the gate generator is under investigation. This sensitivity manifests itself as a reduction in current at high prf's.

Vector Generator

(E. B. Glover) (UNCLASSIFIED)

After becoming familiar with the circuit, I have started taking data in an effort to optimize the circuit design.

Pulse Converter

(W. F. Santelmann, Jr.) (UNCLASSIFIED)

This project is being transferred to R. A. Hughes with the design, construction, and testing of a final circuit. The new seven-tube circuit has been built and is now being tested. In general, pulse rise times of about 15 millimicroseconds have been observed with pulse durations from 40 to 300 millimicroseconds. The most serious remaining trouble seems to be in passing the generated pulses through an output transformer without distortion.

Direct-Coupled Video Probe

(W. F. Santelmann, Jr.) (UNCLASSIFIED)

Design work has been started on a direct-coupled video probe for use on the XD-1 computer. It will be similar to the Model 2 video probe used on WWI but will differ by being direct coupled, smaller, lighter, and more easily used. Noise tests on a terminated cable in XD-1 indicate that only 50-mv peak noise occurs in the worst case. A cathode-follower probe, which will function as an ordinary 10:1 ratio passive probe, is being built for further noise tests in XD-1.

2.5 Display

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

The 5-inch and 19-inch Charactrons were photographed with the objective of determining which would present a more intelligible large-board display.

In order to focus the beam through the large hole in the matrix,

Memorandum 6M-3518

Page 32

another decoder bit will have to be added to the selection and compensation decoders.

Because of the unequal light output from long and short vectors, another decoder will have to be designed with associated line driver. This line driver will have common-mode rejection built into the circuit. Preliminary measurements showed the display intensity modulated by 60 cycles coming from the vector-intensity modulator. This circuit plus the point focus described above will require the addition of at least two nine-tube plug-in units.

E. Glover of D. Best's Section will modify the circuit and compile the necessary information in order to obtain circuit approval for the vector generator.

A workable model of the digital-display circuitry within the console will be furnished to the people checking out frame 25. This will enable them to determine whether their frame is operating in a normal manner.

The X, Y deflection amplifier in the console is being reworked to incorporate the new design of H. Ziemann. This will enable us to determine if the amplifier will settle down to 99.9% of its final value in 30 microseconds or less.

(H. E. Ziemann) (UNCLASSIFIED)

The magnetic-deflection yoke driver and preamplifier have been modified to decrease the required settling time for the magnetic-deflection system. At present two possibilities are available. By changing values of certain components in the preamplifier and driver, the rise time has been decreased to 28 microseconds, but without individual tailoring the probability of coming within this time on all manufactured consoles is not good. With the addition of an extra Z2177 as a cathode follower to drive the output driver, we have achieved rise times in the order of 20 microseconds. With this arrangement it can be guaranteed that all consoles would fall within the desired 30 microseconds. There still exists a possibility of decreasing both rise times with a special feedback circuit, but this has not yet been tried.

All the above statements refer only to the cathode current of the output-driver stage. Measurements will still have to be made to prove that this cathode current is proportional to the magnetic field. The existence of an iron core time constant will modify these results.

Automatic Camera Control and Camera

(L. Sutro) (UNCLASSIFIED)

Several delays have occurred in the drafting and construction of the control circuit. The drawings for the new pluggable units have

Memorandum 6M-3518

Page 33

just been signed, after processing by Drafting of some small revisions. The circuit cards have been ordered and will arrive in time for assembly by 22 April. Relays are promised from the Clare factory, but drawings for the relays, three of which are new to XD-1, are held up awaiting some specifications from Clare. The camera has arrived and gone out to Fairchild for modification. Design of the camera mount is standing still awaiting the decision on whether to use a 5-inch or 19-inch tube. Vestal Lab is designing the modifications that will be made to the camera console when it arrives here to make it perform as part of the camera-control system.

2.6 Vacuum Tubes

2.6.1 Activities of Group 65

(P. Youtz) (UNCLASSIFIED)

I attended several conferences with the IBM Tube Group and receiver-tube manufacturers. Progress is slow at Tung-Sol on the improvement program of the 5998. Tung-Sol is behind on the delivery schedule to IBM of the production 5998 but has given assurance that this will be corrected.

General Electric at Owensboro is having production problems with the Z-2177. GE has asked IBM to relax the specification until the problem can be investigated and a solution found. This request is under intensive study at IBM and MIT. GE has promised to put considerable effort into improving production.

We have been producing a number of electron guns for Convair in CT tubes to study the health of the cathode processing schedules and beam uniformity. This program will continue with very high priority until a satisfactory gun is found and Convair is able to produce these guns satisfactorily. Several tubes were started for C. L. Corderman's and W. L. Gardner's work on large display. Plans were initiated to increase the size of the Charactron life-test rack from 15 to 20 positions. The changes in production procedures at the vendors' plants must be monitored with the proper life-test and evaluation program.

2.6.2 Tube Research and Development

(D. C. Lynch, J. S. Palermo) (UNCLASSIFIED)

Controlled experiments were continued at the Barta Building chemical laboratory to check phosphor settling and aluminizing procedures. This data was used to check the Lincoln Tube Process Specification and the Convair Manufacturing Process Specification. The techniques were employed to process a number of bulbs for the current cathode studies and for the large-display work of C. L. Corderman.

Memorandum 6M-3518

Page 34

A group of type 2420 receiver tubes was polycast to aid the dimensional-analysis study program.

A vacuum furnace was constructed and delivered to Dr. Stabler of Group 25.

(S. Twicken) (UNCLASSIFIED)

I attended a progress meeting on the DT-438 (improved 5998) program held at Tung-Sol. An industry-wide inquiry into the use of carbon parts in oxide-cathode tubes shows very little actual experience. Users of carbon in high-vacuum thoriated tungsten filament tubes and gas thyatrons indicate the necessity of considerable know-how and close processing controls. In view of Tung-Sol's unfamiliarity with carbon, the proposed anode redesign using carbon anode spacers has been shelved, and major effort will be placed on relatively smaller redesign changes. One lot of tubes using carbon anode spacers will be made and placed on extended life test. Mounting and processing equipment is almost complete, and the first mounts should be made using these facilities during April.

I attended a meeting at High Street with IEM Tube and Circuits Groups and GE personnel to discuss the present production difficulties on the O528 (Z-2177), the slight redesign necessary to bring the tube back to original characteristics, and the evaluation to be performed to give some indication of the effect of low plate current on circuit operation and margin.

Four groups of Z-2177's have been placed on life test at dissipations ranging from 4.1 watts/bottle to cutoff. D-c life tests have also begun on type 2420.

(T. F. Clough) (UNCLASSIFIED)

Lincoln Tube Process Specifications were completed for all bulb-preparation procedures used in the 19-inch display tube.

A. Zacharias and I have initiated a radiographic study of the Sylvania and RCA electron guns to determine quantitatively the extent that the processing temperatures affect the grid-cathode spacings.

(P. C. Tandy) (UNCLASSIFIED)

Fifteen 19-inch Charactrons, CHT-61, CHT-62-1, CHT-68-1, CHT-72-2, CHT-73, CHT-75, CHT-80, and Convair 14-1, 14-5, O082, O083, 117, 123, 124, and 127, have completed from 165 to 3763 hours on life test. At the last testing period CHT-61, CHT-62-1, CHT-68-1, CHT-72-2, CHT-73, CHT-80, and Convair O082 had shown no appreciable change. The zero-bias pulse-cathode current of CHT-75 dropped from 2550 to 1850 microamperes, while the pulse-matrix current rose from 120 to 150 microamperes. There was, therefore,

Memorandum GM-3518

Page 35

a change in maximum ratio of the two currents from 22 to 14 between the hours of 1913 and 2166 on life.

Since the last report seven Convair tubes, 14-1, 14-5, 0083, 117, 123, 124, and 127, were started on life test. The only tube that did not appear good was 124. This tube had a zero-bias pulse-matrix current of 82 microamperes and a maximum ratio of pulse-cathode current to pulse-matrix current of 22.7. The other tubes had zero-bias matrix currents ranging from 190 to 590 microamperes, and the maximum ratio ranged from 7.2 to 12.9. Gas tests, leakage tests, and screen Capacitance (C) and Dissipation (D) factor tests were made on these tubes before they were put on life. Table I shows the results of the gas test and C and D test. The Convair limit on gas-test ion current is 100 millimicroamperes. Typical values of C are 350 micromicrofarads and D are 0.01.

Table I

Tube	Gas Test	C	D
	I_{Ion}		
14-1	0.7 millimicroampere	311 micromicrofarads	0.012
14-5	3.0 millimicroamperes	359 micromicrofarads	0.0084
123	0.1 millimicroampere	359 micromicrofarads	0.011
117	4.0 millimicroamperes	352 micromicrofarads	0.0082
124	0.5 millimicroampere	371 micromicrofarads	0.0255
127	0.7 millimicroampere	338 micromicrofarads	0.008
0083	2.4 millimicroamperes	48.5 micromicrofarads	0.015

The only values that are not typical are D in 124, which is 0.0255, and C in 0083, which is 48.5 micromicrofarads. The aluminum screen backing of 0083 was probably not sufficiently conductive. Leakage checks were made on 0083, 117, 123, 124, and 127. At -3300 volts tube 0083 had leakage currents of 1.8 - 2.8 microamperes on selection plate 2, while tube 117 had leakage currents of 0.34 microampere on compensation plate 3. The other tubes did not show noticeable leakage. Helical accelerator resistances between 68 and 132 megohms were measured on these five tubes.

Work on the expansion of the Charactron life-test equipment from 15 to 20 positions has begun.

(L. B. Martin) (UNCLASSIFIED)

Since Group 65 will soon have 100 or more cathode-ray tubes on various tests that require pulse-transfer tests at regular intervals, it has been decided to make an automatic transfer test unit. A. Zacharias and I are now engaged in its design. Essentially, the unit will supply a ramp of pulses to the grid of the tube under test. The output is then presented on a display scope. Calibration points are written between pulses. The switching circuits and logic have been designed and tested. The gated writing-pulse amplifier is being breadboarded. To expedite the project, as much standard or commercial equipment as possible is being used. Completion date will depend on other work loads.

Memorandum 6M-3518

Page 36

Only six Typotron tubes are presently on the new life-test rack because of deflection-panel modifications. Four more will be put on test as soon as panels are received from Lexington.

The following is a list of tubes, their condition and total hours on the eight-position life test:

<u>Tube</u>	<u>Total Hours</u>	<u>Condition</u>
265	8264.2	marginal ¹
280	7446.2	satisfactory
389	5843.6	satisfactory
390	5927.4	satisfactory
392	5927.4	satisfactory
394	5145.3	marginal ²
11601	1240.0	satisfactory
11521	995.5	satisfactory

¹Tube 265 has been marginal for 5336.7 hours because of ion damage to center of storage surface. Tubes of a later model have ion repeller screens.

²Tube 394 has been marginal from the start of life. Some areas of the storage surface switch positive at collector potentials too low to store data on other areas.

The following tubes have been on the 16-position life test for 530.3 hours and are satisfactory: 11981, 12122, 12221, 12523, 12622, and 12641.

(A. Zacharias) (UNCLASSIFIED)

Life-test data on six CT's was completed. The three RCA guns tested were satisfactory. Zero-life evidence on cathode instability on one tube was not observed. Life was 1200 hours. One cathode specially sprayed, with nickel powder mixed into the oxides, was totally poisoned. Life was 1200 hours. Two Sylvania guns were totally poisoned. Life was 1200 hours; evidence of the presence of H₂S was found upon dissection of these two guns. The three RCA guns will be returned to life.

Investigation of grid-cathode misalignment causing center shift was pursued in five Superior 5C guns; center shift corresponding to G₁-K misalignment was found on three guns, while no center shift or misalignment was found on the remaining two.

Poisoning of the two Sylvania guns is believed caused by improper gold-plating baths used on the G₁ discs. This will be investigated further as more Sylvania guns with gold-plated G₁ discs and the five Superior guns with gold-plated G₁ discs are put on life.

Phosphor measurements using the 20-kv regulator were conducted successfully.

Memorandum 6M-3518

Page 37

2.7 Memory Test Computer

(B. G. Farley) (UNCLASSIFIED)

I have commenced duties as a programming consultant to MTC. Suggestions are being solicited for the continued improvement of MTC as a useful machine from the programming point of view.

MTC Records

(B. B. Paine) (UNCLASSIFIED)

Several minor modifications to the MTC record-keeping system have been instituted, to allow accurate evaluation of operating time lost because of computer malfunctions. Any trouble in reading in, converting, or operating a program will be charged against the computer, unless it is apparent to the programmer and the technician on duty that the trouble was due to defects in the program or tape.

The help of all who use MTC is requested in calling the duty technician whenever any trouble of any sort is encountered.

MTC Drums

(E. Gates) (UNCLASSIFIED)

The equipment for the link between MTC and Building F is ready to be tested as a system as soon as the heads are lined up on the drum. The individual pieces of equipment have been tested separately.

Half of the coax cable which will be run between MTC and Building F has arrived. The rest of the shipment is not expected for at least 2 weeks; a decision must be made whether to pull these cables through the conduit now or wait until the remaining cables arrive. Since present needs call for only half of the cables, we can gain 2 weeks of testing time, by pulling in the available cables, at the expense of complicating the installation of the remaining cables later.

Scope-Display System

(H. L. Ziegler) (UNCLASSIFIED)

A display-system test setup is being constructed in the MTC power-supply room (B-051). Necessary improvements of the system to provide high-grade photographic displays can then be designed and tested without use of computer time.

Display power-supply requirements have been discussed with Clem Moritz of Northeast Scientific Co., Cambridge. Dr. Moritz expects to sub-

mit a proposal within a few days.

Ready for test at this time are a new scope-intensification amplifier and a floating bias supply. If satisfactory, they will be installed immediately into the present camera scope to improve the stability of the display.

MTC Technician Training Manual

(A. Vanderburgh, Jr.) (UNCLASSIFIED)

Chapter III on elementary programming is nearing completion and should be ready for publication on 20 April 1955. Programming is treated as being analogous to English composition or report writing. A section on standard programming procedures is included.

(J. Salvato) (UNCLASSIFIED)

Distribution of computer time, 2 weeks ending 8 April 1955:

<u>Application</u>	<u>Hours</u>	<u>Per Cent</u>
Programming	95.51	47.3
Development	64.15	31.7
Maintenance & Marginal Checking	30.20	15.0
Installation	4.80	2.4
Interrupting Failures	<u>7.30</u>	<u>3.6</u>
	201.96	100.0

(E. Albanese, B. Searle) (UNCLASSIFIED)

The following is a summary, for the period 28 March to 8 April, of defects found in tubes and in components in MTC:

<u>Tube or Component</u>	<u>Defect</u>	<u>Number</u>	<u>Hours Lost</u>
6145	Shorted	1	0.90
7AK7	Shorted	1	0.50
Diode, type 1N34A	Open	1	0.30
Toggle Switch	Open	1	0.00
Toggle Switch	Intermittent	<u>1</u>	<u>0.00</u>
		<u>5</u>	<u>1.70</u>

Memorandum 6M-3518

Page 39

III. ADVANCE DEVELOPMENT

(D. R. Brown)

(UNCLASSIFIED)

The first 16 modular memory planes, each 64×64 , are being tested for assembly into a single 256×256 memory plane. This large plane requires 65,536 cores. Over 388,000 cores have been accepted from our own pilot production for the fabrication of this and subsequent 256×256 planes. A total of 38 planes, requiring 2,490,368 cores, is to be constructed.

Basic computer circuits using surface-barrier transistors are being developed for test in a small system, a demonstration multiplier. A number of variations of the very simple direct-coupled circuits proposed by Philco are being investigated. Components are added to the Philco circuits to improve their transfer characteristic, voltage swing, and speed. Maximum prf appears to be about 5 megacycles. The basic flip-flop and gate circuits to be used are nearing completion, but many associated circuits, such as drivers, are yet to be developed.

3.1 Chemistry of Magnetic MaterialsExperimental Ferrites

(F. E. Vinal)

(UNCLASSIFIED)

Inquiries for a low-flux core for experimental memory work led to the suggestion that if NiFe_2O_4 were 25 mol % substituted with Cr_2O_3 , the net moment would be zero. A series of chromium-substituted nickel ferrites has been prepared to test this premise. Preliminary test data does not look promising; magnetism at room temperature disappears at about 15 mol % substitution and does not reappear in any higher substitution. It is suggested that Cr^{3+} moments align antiparallel to other Cr^{3+} neighbors on B sites in the spinel lattice, and it appears that this effect takes over where magnetism disappears. Those compositions which were magnetic will be tried with Mn_2O_3 to promote loop squareness and tested again before the project is abandoned.

Inorganic Chemistry

(D. G. Wickham)

(UNCLASSIFIED)

The unit-cell edges for seven solid solutions between zinc ferrite and ferrous germanate have been measured and compared with the values for the pure end members. There appears to be a small positive deviation from Vegard's law between pure zinc ferrite and 30% ferrous germanate. A larger negative deviation is found for compositions between 30% ferrous germanate and pure ferrous germanate. It is hoped there will be a correlation between this data and the magnetic data which will soon be available.

Memorandum 6M-3518

Page 40

A new synthesis of ferrous germanate has been developed. Anhydrous ferrous chloride reacts with sodium germanate to yield the desired ferrous germanate and sodium chloride as a byproduct. Analogous reactions can be used to prepare a number of heavy metal germanates, ferrites, zirconates, and titanates of current interest.

Thermal Stability of Magnetic Spinels

(F. S. Maddocks)

(UNCLASSIFIED)

Several trial runs of the thermal-analysis furnace have been made. By adapting the Harper furnace control equipment to operate this furnace, a nearly constant rate of temperature rise of 13C per minute between 200C and 1350C is possible.

Difficulties with the differential thermocouple have been encountered. A-c pickup by this thermocouple has been partially eliminated by grounding the nickel specimen block. Proper settings for the d-c preamplifier and recorder have not yet been determined, and no runs have been made yet on magnetic spinels.

Experimental Ferrites

(D. L. Brown)

(UNCLASSIFIED)

Preparation has been continued of a magnesium-copper ferrite to observe the influence of Cu^{+2} ion in loop squareness and tetragonality.

A series of magnesium-manganese ferrites of the type of General Ceramics 1331 ferrite is being prepared for the use of Group 37. It is hoped that this series will indicate trends toward further understanding of this type of ferrite.

Chemical Analysis

(E. Keith, P. Reimers)

(UNCLASSIFIED)

Quantitative analyses of the following have been completed:

1. DCL-2-833, a memory-core composition;
2. A sample of manganese dioxide.

Quantitative analyses of the following are in progress:

1. DCL-2-810 and DCL-2-835, memory-core compositions;
2. A sample of lithium ferrite.

The development of the method for the analysis of manganese by the Beckman automatic titrator, given by Vogel in Quantitative Inorganic Analysis, was completed and is now in use.

Memorandum 6M-3518

Page 41

Production of Memory Cores

(J. J. Sacco)

(UNCLASSIFIED)

Pilot-plant production of the DCL-2-832 type core has been increased. During this biweekly period, approximately 200,000 cores were fired. Upon completion of a satisfactory core loader, it is hoped that production will be further increased to the rate of 175,000 fired cores per week.

Cores for 256 x 256 Memory

(J. Schallerer)

(UNCLASSIFIED)

We have to date double-tested 388,000 cores for this memory. This represents a net increase of 138,000 for this biweekly period, the best since this testing program was started. It is hoped that the final rate will be 200,000 acceptable cores per biweekly period.

The last three lots tested have had an average yield of better than 95%.

Memorandum 6M-3518

Page 42

3.2 Physics of Magnetic MaterialsPerovskite-Type Magnetic Materials

(J. B. Goodenough) (UNCLASSIFIED)

A manuscript has been prepared for joint publication in the Physical Review with a paper by W. C. Koehler and E. O. Wollan of Oak Ridge National Laboratory. The manuscript is entitled "Theory of the Role of Covalence in the Perovskite-Type Manganites (La,M(II))MnO₃."

Magnetostriction

(N. Menyuk) (UNCLASSIFIED)

The five magnetostriction constants of a single crystal of nickel ferrite have been determined at 26 C, 0 C, and -78 C. In addition, a two-constant approximation has been made at all three temperatures to obtain the values of λ_{100} and λ_{111} .

D-C Fluxmeter

(R. A. Pacl, Jr.) (UNCLASSIFIED)

A new mutual inductor has been wound for the fluxmeter. It was wound as a solenoid on a lathe, using a Lucite rod for the core. It was subsequently heated and bent into a toroid to provide the astatic characteristic necessary for stable operation.

Curie-Temperature Measuring Equipment

(J. D. Childress) (UNCLASSIFIED)

Modifications have been made on the Curie-temperature measuring equipment to correct the severe interaction of the controls. The oscillator circuit will be rebuilt to simplify the use of the instrument.

3.3 New Components and CircuitsTransistors

(P. A. Fergus) (UNCLASSIFIED)

Routine measurements of alpha, I_{CO} , and I_{EO} have been made on the 500 surface-barrier transistors received from Philco 24 March. Results indicated that 96 percent of the transistors were acceptable according to specifications. Approximately 20 percent exhibited high

Memorandum 6M-3518

Page 43

I_{CO} or high I_{EO} , and another 2 percent were somewhat unstable in regard to these characteristics. All had acceptable alphas. Distribution curves of alpha are being plotted.

Twenty power transistors were received from Sylvania. Routine measurements of alpha, I_{CO} , I_{EO} , grounded-emitter and grounded-base characteristics, and rise-fall time measurements were made and photographs taken. Results indicated rather poor characteristics.

Three-hundred additional surface-barrier transistors were received on 1 April; 200 pnp junction transistors have been received from Germanium Products Division of G. E.; and ten power transistors have been received from Minneapolis-Honeywell Co.

Flip-Flops

(C.T. Kirk, K.H. Konkle, E.U. Cohler) (UNCLASSIFIED)

The final design and testing of flip-flops is now going on for a decision on a standard circuit on 15 April. The outlook at this time for a 10-mc flip-flop with good margins is poor. We shall attempt to make the best flip-flop possible for 5-mc operation, while allowing for increased speed with improved transistors. At 5 megacycles we expect to have excellent waveforms and reasonable margins.

Flip-Flops

(M. Cerier) (UNCLASSIFIED)

A single-rank flip-flop can now be built that will complement with input pulses at over a 5-mc rate.

The problems that arise when representative basic circuits are connected together to make a system are being investigated. Breadboards for parts of the multiplier control are being built which incorporate a 5-mc flip-flop. It is expected that the system will run with 5-mc clock pulses.

Flip-Flops

(J. R. Freeman) (UNCLASSIFIED)

The use of d-c drive to cause free-running complementation continues to yield useful information about flip-flops.

Loading tests with the one-digit SBT shift register reveal that resistive loads of less than 130 ohms prohibit complementation. Satisfactory operation is not obtained with load resistances below 200 ohms. These tests were run without inverter amplifiers on the outputs.

Memorandum 6M-3518

Page 44

Pulse Buffer

(A. L. Pugh) (UNCLASSIFIED)

At the moment the emitter follower is still the best circuit for driving a large number of transistors. The difficulties are that the emitter follower gets out of the active region on the trailing edge of the pulse (discussed in the last Biweekly) and the large current through and the high peak power dissipated in the emitter follower. In particular, two inverters in tandem are slower than the emitter follower.

Pulse Generator Circuit

(M. E. Petersen) (UNCLASSIFIED)

A pulse-generator circuit employing four surface-barrier transistors has been developed which will generate 60-nsec. pulses of 2.5-v. amplitude at a repetition rate of 6 megacycles.

Memorandum 6M-3518

Page 45

3.4 Memory

(W. N. Papian) (UNCLASSIFIED)

The major power users and power dissipators in the experimental computer will be the memory units. As a consequence, the Memory Section finds itself with responsibility for the large power supplies and the air conditioning in the new installation. Fortunately, Group 60 has offered to cooperate. Gano's Section will work on power problems; Wainwright's Section will broaden their work with us to include some help with the air conditioning.

Switch-Core Testing

(D. H. Ellis) (UNCLASSIFIED)

Tests of the switching characteristics of metallic-tape cores are being made to compare the outputs of the cores while open-circuited and loaded.

The results of these tests will indicate the validity of an open-circuit test of the cores for the matrix switch.

Memory with External Selection

(S. Bradspies) (UNCLASSIFIED)

A scheme that may be used for testing high-speed memory systems has been finished.

It has been found that some of the relatively poor results obtained lately in the three-core memory have been, to a large extent, caused by pickup. This has been almost entirely eliminated now by the use of shielded cable, and the results promise to be very good. It would seem that the best possibility for the three-core memory lies in using the fast General Ceramics cores as switches and the standard memory-core material as the memory core.

Testing the 64 x 64 Modular Planes

(J. L. Mitchell) (UNCLASSIFIED)

Testing has been resumed after being held up for a few days when an error in the wiring of the connecting jigs was found.

Memorandum 6M-3518

Page 46

Plug-in Unit

(J. L. Mitchell) (UNCLASSIFIED)

A design of a tube-socket mount has been received from Francis Associates, and this design is now being evaluated. The design of the plug-in unit should be completed in the very near future.

Power Supplies

(J. L. Mitchell) (UNCLASSIFIED)

The responsibility for the power supplies for the 256 x 256 memory has been assumed by this Section, and, as a result, I have started to investigate the problem of procuring power supplies.

256 x 256

(J. Raffel) (UNCLASSIFIED)

Tests indicate that the delay between the extremities of a single x or y coordinate line (256 x 38 cores) may be as much as 0.4 microsecond.

Recovery in pulse transformers for sensing continues to be a serious problem. It is possible to design to eliminate this, but the resultant attenuation makes it impossible to use diodes in the transformer secondary for rectification.

Mechanical Design and Layout of 256 x 256 Memory

(E. A. Guditz) (UNCLASSIFIED)

All 16 modules for the first 256 x 256 memory plane have been completed. Four have been tested and are ready for assembly.

Production of the rest of the seven-hundred 64 x 64 modules for the large memory will begin the week of 11 April.

Work on the production drawings for the plug-in unit will begin the week of 11 April. The design of this unit meets air-conditioning requirements recommended by Francis Associates.

A new design of the support frame for the 256 x 256 plane has been accepted. Drawings will be started soon.

Memorandum 6M-3518

Page 47

Memory Test Setup VI

(E. A. Guditz) (UNCLASSIFIED)

The memory tester will be in operation full time for the next several months testing finished 6 $\frac{1}{2}$ x 6 $\frac{1}{2}$ plane modules.

Printed Plane

(E. A. Guditz) (UNCLASSIFIED)

Cores and printed-circuit plates have been supplied to Electro-Tec Corporation. They hope to deliver to us a finished 4 x 4 printed plane ready for electrical testing.

3.5 Logical Design

(N. L. Daggett, J. W. Forgie, W. A. Clark) (UNCLASSIFIED)

A first draft of the block diagram of the experimental computer has been completed for study. It has been discussed with members of the System Design and Memory Sections. Several simplifications in the system have been uncovered during these discussions. It appears, for example, that separate memory address registers for each memory unit may not be required. These changes will be made in the next draft of the system block diagram which will be available for examination the week of 11 April.

3.6 System Planning

(K. Olsen, J. Fadiman, R. Hughes, C. Norman, R. Sawyer) (UNCLASSIFIED)

Work has concentrated on making flip-flops independent of loading and input variations. Loads of several hundred micromicrofarads and cables up to 500 feet have been driven with a flip-flop running at 5 megacycles with good rise times.

An effort is now being made to limit the dependency upon transistor parameters. A quick-check beta test was built to help this study, but there are other characteristics that also influence operation; interelectrode capacity and hole storage time are being studied to see if they are important.

IV - CENTRAL SERVICES

4.1 Material Requirements & Stock

(H. B. Morley) (UNCLASSIFIED)

March broke all previous records for number of requisitions placed, exceeding February by about 45.3%.

Most of the equipment has been removed from Fort Heath. The balance of this equipment will be turned over to the Navy.

Two inventories are now in progress, one covering components, the other covering Division 6 numbered equipment.

Personnel, especially those engaged in design and production, are reminded that the new Lincoln Laboratory Standards are gradually replacing the old Digital Computer Standards. An up-to-date cross reference from old to new numbers is maintained at this office.

4.2 Engineering Services4.2.1 Components

(H. W. Hodgdon, C. Morrione, R. J. Biagiotti) (UNCLASSIFIED)

Morrione visited Cinch Manufacturing Corporation in Chicago, Illinois, with IBM components personnel to inspect plant facilities and to discuss further modifications of the Western Electric Nike connector necessary to qualify it for duplex use. A trip report will be issued shortly.

Hodgdon and Morrione met with DeJur-Amsco Continental Connector Division representatives and IBM components personnel at High Street to discuss modification of the Western Electric Nike connector for duplex use.

These companies are preparing sample connectors which will be evaluated here and at High Street, so that at least one and probably two manufacturers will be approved for production of this item.

Failures of Struthers-Dunn relays in XD-1 have made it necessary that corrective measures be taken. These relays will not be approved for Duplex production unless quality can be improved immediately. We are maintaining close contact with all concerned.

Memorandum 6M-3518

Page 49

4.2.2 Test EquipmentTest Equipment Committee

(L. Sutro) (UNCLASSIFIED)

There is a growing demand for scopes with wider band width and sensitivity than the Tektronix 514, which has been the Division's standard for 3 years. Approximately 70 Tektronix 514's are in use. To find out the extent of the need for a better scope, Committee members will interview the chiefs of all the Sections in the Division. They will ask for estimated needs through 1 July, since orders for the new Tektronix scopes take 2 months to fill.

The Committee has approved purchase of the following:

<u>Unit</u>	<u>Mfr.</u>	<u>Model</u>	<u>Qty.</u>	<u>User</u>	<u>Group</u>
Scope Camera	DuMont	297	2	Olsen	63
Graphic Ammeter	Esterline-Angus	AW	1	Menyuk	63
1.0-wa D-C Full-Scale Amplifier	Liston-Becker	14	1	Menyuk	63
Diode Resistor	General-Radio	1432-M	2	Menyuk	63

4.2.3 Mechanical Engineering

(A. R. Smith, L. B. Smith, L. B. Prentice) (UNCLASSIFIED)

Specifications approval test on the redesigned Colton-Rotary Table Press is scheduled to take place in two weeks. Upon acceptance, the press will be shipped to us. It is believed the press will be in operation by the middle of May.

4.2.4 Power

(S. Coffin) (UNCLASSIFIED)

We have been working with the Standards Committee and members of other divisions to develop a set of specifications preliminary to the design of a line of standard regulated power supplies for general laboratory use. The proposed supplies would range from 0.2 to 1.2 amps and 60 to 300 volts.

Reliability, simplicity, versatility, and good regulation are being stressed in the design. A tentative proposal describing these supplies will soon be circulated to various groups in the lab for suggestions.

Memorandum 6M-3518

Page 50

4.3 Drafting

Flow-Diagram Drawings

(A. M. Falcione) (UNCLASSIFIED)

In the past few months we have had many requests to make drawings of flow-diagrams and charts for Group 61. Up to this point, we have been using a long-carriage typewriter (manual type) using orange-carbon backing and typing directly on the vellum sheet. This method of producing drawings having large amounts of written matter saves many hours of drafting time. The present machine does not have large enough type-face letters; consequently, when the drawing is reduced photographically to an A size for Multilith reproduction, the copy is not legible. We have been investigating the typewriter manufacturers to determine whether or not a long-carriage typewriter is available on the market with a large type face which when reduced 70% is legible.

Contoura-Constat

(A. M. Falcione) (UNCLASSIFIED)

The Contoura-Constat machine is now available for reproduction of opaque material. This machine will reproduce either one opaque copy or a vellum transparency. The materials required to operate this machine are on hand and are available to Lincoln Laboratory personnel for use.

4.4 Administration and Personnel

4.4.1 Staff

(J. C. Proctor) (UNCLASSIFIED)

Transfers

Philip Bagley has transferred from Group 62 to Group 61.

Philip Bragar has transferred from Group 66 to Group 61.

Melvin Feldstein has transferred from Group 62 to Group 61.

Arthur Heineck has transferred from Group 62 to Group 61.

John Jacobs has transferred from Group 62 to Group 61.

Lawrence Jeffery has transferred from Group 62 to Group 61.

Hawley Rising has transferred from Group 64 to Group 61.

Memorandum 6M-3518

Page 51

Terminations

John Bennett

Peter Cioffi

Lee Mah

4.4.2 Non-Staff

(R. A. Osborne) (UNCLASSIFIED)

New

Alberta Rackliff has joined Group 63 as a Technician in the Memory Section.

Termination

Alfred Wojcicki

Open Requisitions

1 Clerk for Group 60 (Reproduction Room)

1 Clerk-Typist for Group 62

1 Computer Operator

1 Electro-Mechanical Checker

1 Layout Draftsman

2 Secretaries for Group 60

1 Technical Assistant

~~CONFIDENTIAL~~

Memorandum 6M-3518

Page 52

Accessions List

(D. B. Helwig) (CONFIDENTIAL)

The following documents were published by Division 6 or received from IBM during the period 25 March - 8 April 1955:

NO.	AUTHOR	TITLE	CLS.
6M-3084-1	C. Wieser	Reorganization of Group 61	C
6M-3104	C. Grandy	Weapons Direction Simulation Programming Specifications (M-2706S)	C
6M-3189-2	E. McEvoy E. Lundberg	Summary of Lincoln Lab. TIR's Pertaining to SAGE System Issued by the PCO (1 April)	U
6M-3266	A. Favret	Ground-to-Ground Outputs from the SAGE System	C
6M-3382	A. Hughes	Justification of the Long-Range Radar Input Specifications for AN/FSQ-7	C
6M-3396	J. May	Number of Active Data Circuits from a Long-Range Radar Site (AN/FST-2)	C
6M-3402	E. Glover	Digital Data Transmitter	U
6M-3411	H. Rising et al.	Output System Specifications for AN/FSQ-7	C
6M-3462	J. Mazza	Notes on System Planning Meeting 14 March	C
6M-3475	Op. 61 TS-SS	Instructions for Use of Op. 61 Operational Forecast Form	U
6M-3476	D. Israel et al.	Sage Test Committee, Sage Test Office	U
6M-3477	W. Lemnios	Reference List of M-Notes Concerning the Test and Evaluation of the 1953 and 1954 CCS	C
6M-3478	J. Crane	Results of the XD-1 Central Computer Evaluation 18 March 1955	U
6M-3480	S. Twicken	SR-1782/3002420 Meeting of 17 March 1955	U
6M-3481	W. Harris E. Wolf	Test Specifications: Initial Mapping Tests	C
6M-3482	- - -	Biweekly Report of March 25, 1955	C
6M-3483	- - -	Laboratory Personnel of April 1, 1955	U
6M-3484	B. Barrett	Pulse Amplifiers (Models A, Band C)	U
6M-3485	E. Lundberg	SAGE System Meeting March 28, 1955	U
6M-3487	J. Jacobs	Backgrounds and Justification for Increase in Auxiliary Memory in FSQ-8	S
6M-3488	W. Lone	FSQ-8 Cross-Telling Requirements	C
6M-3489	F. Heart W. Lone F. Heart	FSQ-8 Display Slot Capacity	C
6M-3490	A. Smalley	Op. 61 Mission Specs. (38-55) (LLUO)	U
6M-3491	A. Smalley	Op. 61 Mission Specs. (37-55) (LLUO)	U
6M-3495	D. Eckl	Trip to NSA, Washington (IDO)	U
6M-3496	F. Garth	Estimates of O26 Card Punch Requirements and Manual Input Messages for SAGE	C
6M-3500	S. Hauser	SAGE System Meeting of 4 April 1955	C
6M-3502	E. Lundberg	AFCRC-Collins Groundair Data-Link Program	C
6M-3506	L. Murray S. Hauser F. Garth	Verification Equipment in SAGE	C

~~CONFIDENTIAL~~

~~CONFIDENTIAL~~
UNCLASSIFIED

Memorandum 6M-3518

Page 53

Accessions List (Continued)IBM DOCUMENTS

<u>NO.</u>	<u>AUTHOR</u>	<u>TITLE</u>	<u>CLS.</u>
IBM-715	R. Castle	IBM 718 Printer Control Panel (H-169)	U
IBM-716	- - -	AN/FSQ-7 Biweekly Progress Report of 3/18	C
IBM-717	S. Guterman et al.	Use of Magnetic Cores for Logic and Control (Reprint 1954 IRE Convention Record)	U
IBM-719	R. Cunningham	Card Assemblies Released for AN/FSQ-7 (IM-122)	U
IBM-720	W. McCoy	Prototype Card Assembly Testing (IM-131)	U
IBM-722	- - -	Project High Biweekly Progress Report	C
IBM-723	- - -	AN/FSQ-7 Engineering Progress Report	S

DR DOCUMENTS

DR-160	C. Walston	Concurrence on Warning Light Specs. for Duplex Central (D-2-1)	U
DR-161	C. Walston	Concurrence on Modification to Keyboard Inputs, Duplex Central (D-7-1)	U
DR-162	C. Walston	Conc. on Dummy Loads (D-25-1)	U
DR-163	R. Lowrie	Duplex Central Specs. for the Gap Filler Input Mapper-Counter Frame (D-35-1)	U
DR-164	R. Keating	Duplex PCD Frame for Production Machine (D-48-1)	U
DR-165	R. Keating	Simplex PCD Frame for Production Machine (D-64)	U
DR-166	F. Gewickey	Conc. on Duplex Input MCD Specs. (D-62)	U
DR-167	R. Keating	Conc. on D-48-1	U
DR-168	R. Lowrie	Duplex Central Specs. for the GFI Mapper Consoles (D-34-1)	U
DR-169	R. Imm	Revision of Specification of the Magnetic Tape Element (D-4-3)	U
DR-170	R. Imm	Index Registers, Program Element (D-5-1)	U
DR-171	R. Imm	Signal Switching Conc. (D-23-2)	U
DR-172	W. Hunt	Power and Air Condition Status Indicators in the Duplex Maintenance Control Area (D-63-1)	U
DR-173	R. Imm	Core Memory Assignment Switch Conc. (D-70)	U
DR-174	R. Imm	Magnetic Tape and Reels for AN/FSQ-7 and AN/FSQ-8 (D-76)	U
DR-175	R. Imm	Selection and Input Output Specs. for the Production System (D-19-2)	U
DR-176	D. Ross	Parity Count and Parity Check Controls Conc. (D-6-2)	U
DR-177	R. Imm	Parity Count and Parity Check Controls, D-6-2	U
DR-178	W. Squire C. Walston	Ground Rules for Cabling and Allocation of Manual Inputs and Warning Lights to Display Consoles (D-79)	U
DR-179	R. Lowrie	Auxiliary Console Specs. (D-65-1)	U
DR-180	M. Dudek R. Imm	Proposal for Maintenance Card Machines (D-73)	U
DR-181	R. Keating	Simplex PCD Frame for Production Machine Conc. (D-64)	U
DR-182	D. Ross	Input Channel Switching Specs. for AN/FSQ-7 Conc. (D-60)	U
DR-183	N. Jacobs	Centralized Probe System (D-56) Conc.	U

~~CONFIDENTIAL~~
UNCLASSIFIED