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Memorandum 6M-3630

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

SUBJECT: BIWEEKLY REPORT FOR 20 MAY 1955

To: Jay W. Forrester

From: Division 6 Staff

CLASSIFICATION CHANGED TO:  
Auth: DD 254  
By: XRG  
Date: 3-21-60

COVER SHEET

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To: Jay W. Forrester

From: Division 6 Staff

Approved: *JCP*  
John C. Proctor

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INTRODUCTION

Group 66 Organization

(R. R. Everett) (UNCLASSIFIED)

Lincoln Laboratory has regretfully accepted the resignation of A. P. Kromer effective June 1. S. H. Dodd is appointed leader of Group 66 as well as Group 64. B. E. Morriss has been appointed Division 6 representative in the Production Control Office. He has transferred to Group 66 and has assumed Kromer's previous responsibility for Division 6 liaison with the Air Force and with Western Electric on the SAGE System. H. Anderson replaces Morriss as head of the Systems Office; planning for both prototype and production systems is headed by K. E. McVicar.

To strengthen the technical liaison with organizations outside Division 6, the power and communication work are consolidated in Group 66. The Group 60 power section under J. Gano is transferred to Group 66 and will continue to be available to Division 6 for consultation on general power problems. The communications work under H. Kirshner is transferred to Group 66 and will continue to handle Division 6 responsibility in the Experimental SAGE Subsector and in the production SAGE systems.

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I - SYSTEM TEST & PLANNING

1.1 Air Defense

1.1.1 Test Program

(D. R. Israel) (CONFIDENTIAL)

Results of the first 2 weeks of active testing of the 1954 Cape Cod System have been somewhat disappointing, but not discouraging. Two initiation tests were canceled by unavailability of the Montauk radar; two monitoring tests were canceled because our programs were not completed; one tracking-accuracy test was conducted with some success, and another was canceled because of poor radar data resulting from anomalous propagation.

All currently planned tests have been scheduled. Close to 100% utilization of system operating time during May, June, July, and August has been scheduled. About 25% of the time in the remaining months of the year is already assigned to tests.

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Preparation of an over-all description of what the 1954 CCS Test Program should accomplish by 1 January 1956 will be undertaken immediately.

A first draft of a proposal for the ID-1 test-program activity during April, May, June, and July of 1956 has been written. The proposal was discussed in a meeting of members of the SAGE Test Committee on 16 and 18 May at BTL, Whippany. A second draft is now in preparation.

(E. Bedrosian, S. Manber) (CONFIDENTIAL)

The equipment modification to the Training and Battle Simulation Room in the 1954 Cape Cod System has been completed and checked out.

The old system-simulation program which can be used to generate data in the 1954 Cape Cod System operation has been revised and checked out.

The new system-simulation program has been written and is now being checked out.

(A. E. Budd) (CONFIDENTIAL)

The subroutine to read in magnetic tape records of the 1954 CCS is in the final checkout stage.

(O. T. Conant) (CONFIDENTIAL)

During this period I continued work on the track log printout program.

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

During the past biweekly period this Section scheduled ten missions in support of SAGE Test Office.

Seven of these were conducted, six being of the Raydist orientation type and one tracking accuracy. Three of the Raydist missions were combined to operate as a single mission of lengthy duration.

(F. W. Graham) (CONFIDENTIAL)

I am investigating the possibility of using Mode 2 of Mark I to improve the establishing of interceptor tracks. Work item 2.42.05 (See 6M-5001, "Outlines and work items for 1954 Cape Cod Test Program"; Harris, Israel, Nedzel, Wells; 6 April 1955.)

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I am making a study of the final phase of interception to establish what test specifications are necessary to test intercept accuracy. Work item 2.82.01 (See 6M-5001, "Outlines and work items for 1954 Cape Cod Test Program"; Harris, Israel, Nedzel, Wells; 6 April 1955.)

(I. B. Hazel) (CONFIDENTIAL)

I have completed writing a program that logs an operation summary of recorded data made during operation of the 1954 Cape Cod System.

I have been studying the program specifications for the identification function in the 1954 Cape Cod System and consulting S. Hauser and F. Garth in preparation for drawing up coding specifications for a computer analysis of the identification function.

(H. A. Keit) (CONFIDENTIAL)

Checkout of the magnetic tape-to-tape transfer program for 1954 CCS recordings continues.

Further progress was achieved in the study of radar-mapping procedures and initiation methods.

(D. Latimer) (CONFIDENTIAL)

I have checked out the parts of "detailed single track history printout" that do not require reconstruction.

Memorandum 6M-3568, "1954 Cape Cod System Data Storage Tables," for which I have compiled the tracking tables, is being prepared for publication.

(W. Z. Lemnios) (CONFIDENTIAL)

The draft of a survey memo outlining seven series of interception tests has been circulated. Comments from interested persons have been noted, and the memo is being revised.

Plans for the June seminar on interceptor vectoring are now entering the final stage. So far, 27 of the 35 organizations invited have informed us that they will send representatives. A total of 157 persons are expected as of today, and they will present 22 formal papers. Since the meeting has grown to such large proportions, we will hold it in Room #-190, MIT.

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The checkouts of the data-sorting and data-analysis programs written by M. Curran, M. Smith, and A. Budd for the tracking-accuracy tests are nearing completion. One tracking-accuracy test has already been held, and the processing of the data for this test will be completed as soon as the aforementioned checkouts are completed.

(J. Levenson) (CONFIDENTIAL)

During the past biweekly period, two Series A initiation tests were scheduled and canceled because the Montauk radar was shut down. The third test presumably will be run 25 May. In preparation for the test, I have modified the automatic-initiation program according to specifications in 6M-3274, and these changes are being checked out.

Completion of the CCS post-test data-reduction programs specified in 6M-3448 is long overdue. Delay is mainly caused by the fact that the programs require intimate knowledge of the CCS tracking programs, and, since no documentation has been published, the knowledge can only be acquired by word of mouth. Within the next 2 weeks, a general test parameter will be written to check all these programs.

(A. Mathiasen) (CONFIDENTIAL)

My section of the data-generation-tape printout program has been written. Memorandum 6M-3531, "Raydist Orientation of Radars," has been issued. The Raydist records are now reasonably up to date.

(W. Vecchia) (CONFIDENTIAL)

	<u>hr</u>	<u>min</u>		
Total Assigned Time			130	
Extra Assigned Time			<u>16</u>	<u>40</u>
			146	40
	<u>hr</u>	<u>min</u>		
Analysis and Program Checking	93	35		
Raydist	9	40		
Equipment Checkout	5	30		
System Operation	<u>16</u>	<u>05</u>		
TOTAL	124	50		
Time Given 6345	2	15		
Time Given Gr. 64	<u>16</u>	—		
TOTAL	18	15		
Time Lost to WWI	<u>3</u>	<u>35</u>		
TOTAL	21	30	124	50
			<u>21</u>	<u>50</u>
GRAND TOTAL			146	40

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1.1.2 Analysis and SimulationLincoln Laboratory Seminar on Interceptor Vectoring

(W. I. Wells) (CONFIDENTIAL)

The final program for the seminar on interceptor vectoring has been completed. The meeting will be held at MIT during the week of 6 June. About 175 persons from 26 organizations will attend. It is expected that the content of the papers presented will be published shortly after the meeting. These papers should afford a good survey of weapons, tactics, and problems that SAGE will have to meet in the future.

Radar Data Analysis

(H. Houser) (CONFIDENTIAL)

Sixteen runs of radar data were processed and punched out on binary cards for future analysis. Fifteen runs of radar data from the South Truro tests still must be processed.

Manned-Interceptor Simulation

(H. Houser) (CONFIDENTIAL)

Flow diagrams have been written to show how clutter is generated, how correlation will be done, and how the clutter and correlation program will be added to the manned-interceptor program now in existence.

(B. Smulowicz) (CONFIDENTIAL)

I am continuing work on the clutter-generation and correlation program to be used with the manned-interceptor simulation. The program specifications have been written, and several parts of the program have been coded.

(H. D. Neumann) (CONFIDENTIAL)

The 51 runs simulated by BTL on this NIP computer were run with our manned-interceptor simulation program and evaluated. An additional 128 runs were simulated to study the effect of quantization and radar scan rate. For this study another 128 runs will be simulated, 50% of which are completed.

The F-99 interceptor simulation program was modified considerably, to run the interceptions requested by Westinghouse. Parameter tapes were prepared to run 214 simulated interceptions with detailed printout.

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Analysis of Blip-Scan Data

(B. Stahl) (CONFIDENTIAL)

Some difficulties in writing the output section of the blip-scan data analysis program have delayed the completion of the program. It has been decided to make the output section as flexible as possible in order that interpretation of the results may be simplified. It is hoped that some preliminary analyses may be completed during the forthcoming biweekly period.

Data Processing

(H. Peterson) (CONFIDENTIAL)

The program to analyze radar weather clutter from the point of view of track initiation is about 75% completed.

Tracking and Monitoring Test Series

(J. Nolan) (CONFIDENTIAL)

The beginning test of the track-monitoring test series has been postponed until Thursday, 2 June. The postponement is due to the fact that the data-generation programs are not as yet completely checked out.

Work has continued, in conjunction with A. Mathiasen, in preparing a program to print and punch scan-by-scan control data on all simulated tracks formed by the data-generation program. The program is written and is now being checked out.

Automatic Initiation

(C. Friedman) (CONFIDENTIAL)

We have substantially completed the collection of data for subsequent studies in automatic initiation.

Preliminary investigations are being started on a statistical analysis of our MISP simulation program.

Passive Detection by Triangulation on Active Jammers

(R. Sittler)

The triangulation problem has been analyzed to determine how the expected number of ghosts varies with the number and density of aircraft, the number of triangulating radars, and the radar beam width. Curves illustrating these dependencies have been prepared.

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(F. Gucker) (CONFIDENTIAL)

Research is continuing on azimuth-only tracking. As part of this effort, I am working with F. Heart on an initiation-simulation program.

I have also been attending meetings of the Lincoln Radar Coordinating Committee.

1.1.4 Coordination

(A. W. Heineck) (CONFIDENTIAL)

Several sets of specifications must be written before the master programs for a Direction Center and a Combat Center can be coded. The job of writing these specifications has been broken into four parts:

A. Air Defense System

1. Broad Study - Operational Specs.
2. Detailed Study - Mathematical Specs.

B. Computer Program to Implement Air Defense System

1. Broad Study - Program Specs.
2. Detailed Study - Coding Specs.

Operational and mathematical specs are defined in Memorandum 6M-3618. Program and coding specs are defined in 6M-3624. The latter note, by R. Walquist, is now in draft form.

Minutes of a meeting on a program for the standby computer, 6M-3620, is now available. The division of the work between IBM and MIT is discussed.

Some progress has been made on a looseleaf document which will be called "Programmer's Summary Information." The first two sections, 1.0 Drum Organization and 1.1 Select Drum Code, will be run off soon. The next two sections, 1.2 Other Drum Instructions and 1.3 Word Layouts, should be available in 2 weeks. Future sections will be written on the display system, output system, etc.

(A. P. Hill) (CONFIDENTIAL)

The past biweekly period was spent conducting the SAGE Familiarization Course. Some valid criticisms were offered at a critique following the last lecture; these criticisms will be an invaluable aid in the preparation of future course outlines.

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Training

(P. R. Bagley) (CONFIDENTIAL)

IBM has offered to supply instructors to train personnel in programming for FSQ-7 and -8. A meeting was held at MIT on 11 May to discuss training classes. Current plans are to hold two similar 10-week classes, 1 July to 15 September and 15 September to 1 December, to accommodate 47 and 80 students, respectively. Lincoln plans to provide classroom and office space.

1.1.5 Tracking

(F. Brooks) (CONFIDENTIAL)

Checking out the manual-intervention utility program for XD-1 is well under way. I am still working on track-sorting schemes. A first draft of the radar-input operational specifications is being started.

(F. E. Heart) (CONFIDENTIAL)

With W. Wells, continued support has been given to the activities of the Lincoln Radar Coordinating Committee. Numerous interesting ideas have been discussed. The Committee has not yet reached what it feels are fully adequate solutions. It is expected that this activity will continue for at least another 2 weeks.

Study has continued on the problem of azimuth - only tracking. Despite a fair amount of additional work, it is still not clear whether such a system is feasible. Further work is in progress.

Some time has been spent getting up to date on the TALOS problem and certain associated systems.

On 17 May 1955 Mr. R. Benjamin from the British Admiralty visited the Laboratory to talk about systems planning and various advanced topics. This visit is reported in an inter-office memorandum to C. Wieser.

On 17 May 1955 Mr. O. Wade from Convair visited the Laboratory to talk about missile threat problems. This visit is reported in an inter-office memorandum to C. Wieser

(H. Seward) (CONFIDENTIAL)

The outline for the operational specifications for track crosstabling function was distributed and discussed at a meeting of the Tracking Section. Revisions are now being incorporated in an initial draft of the specs.

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(E. Wolf) (CONFIDENTIAL)

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An outline of a proposal for a data-input analysis program has been prepared.

Linear approximations to the transformation equations to further minimize the errors resulting from the equations now being used have been investigated. The problem of adjusting the Subsector boundaries to simplify crosstabling functions has also been studied. This problem arises from the fact that the curvature of the projected parallels of latitude is high near the center of coordinates. From the point of view of making the projected parallels straight lines, the center of coordinates of the Subsectors should be chosen in the region of our antipodes. This may be objectionable since the Air Force probably has only a limited interest in the coordinates of targets and interceptors relative to points in the Indian Ocean.

1.1.6 Program Organization

(R. L. Walquist) (CONFIDENTIAL)

The draft of a memo on "Coding of the Master Program for the SAGE System" has been distributed to a few people in Group 61 for comments. This memo attempts to define program specifications and coding specifications. It will be used as a guide for scheduling the work of the Program Organization Section. The memo itself should be distributed early in the next biweekly period. Benington and I are still working on a detailed time and manpower schedule for coding of the SAGE Master Program.

During the past 2 weeks our operations on the XD-1 machine have improved slightly, but the percentage of usable time is still quite low. The present reliability of the card reader and line printer is very low for our work. The following table is a record of our usable time.

<u>Time Period</u>	<u>Usable Time</u>
3/28 - 4/6	97.2%
4/7 - 4/13	85%
4/14 - 4/20	70.2%
4/21 - 4/27	72%
4/28 - 5/4	51.7%
5/5 - 5/11	82.2%
5/12 - 5/18	53%

The above figures are based on 1 hour per day operation, 5 days per week.

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

During the past 2 weeks, I have completed compilation of information for Memorandum 6M-3568, "1954 Cape Cod System Data Storage Tables," W. Ball, L. Collins, D. Latimer. The manuscript has been turned over to L. H. Linehan for follow up on publication.

(H. D. Benington) (CONFIDENTIAL)

All work described in the last Biweekly is continuing as scheduled: documentation for the 1954 Cape Cod System is complete except for typing and proofreading; the trace program will be checked out during the coming periods; as these two jobs are completed, all efforts will be directed to studying organization of the SAGE computer program.

(L. B. Collins) (CONFIDENTIAL)

I have completed preparation of 6M-2977 "1954 Cape Cod System Master Makeup and Display Program Specifications"; this memo will be issued during the week of 23 May. I am presently engaged in assisting in the preparation of 6M-3539 "1954 Cape Cod System Data Storage Tables," to be issued shortly.

(P. L. Guinard) (CONFIDENTIAL)

	<u>hr</u>	<u>min</u>
Total Assigned Time	13	
Extra Time Allotted	<u>1</u>	<u>1</u>
	14	1

	<u>hr</u>	<u>min</u>
Program Checkout		
Utility	10	12
Assembly		
Down Time		
In-Out Equipment	2	1
Computer Malfunction	<u>1</u>	<u>48</u>
TOTAL	14	1

(W. F. Harris) (CONFIDENTIAL)

I am continuing study of in-out timing and drum transfers for the SAGE master program sequence-control program.

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(R. R. Reed) (CONFIDENTIAL)

As part of the preparation of the SAGE Situation-Display memo, a chart is being prepared to show preliminary category and display-assignment bit assignments and routing to all consoles, the chart shows total display messages required, total drivers required with the load on each driver, total number of mixings necessary, number of input lines to each console, and number of toggle switches at each console.

The chart will be kept up to date using information from sections concerned with operational specifications, and the information will be summarized in the memo.

(A. Schwartz) (CONFIDENTIAL)

The interpretive subprogram of the new trace program is now well over half completed, and all but the section devoted to in-out instructions is ready to be checked out. The entire trace program will be completed and checked out during the next biweekly period.

(P. R. Vance, A. R. Shoolman) (CONFIDENTIAL)

We have completed 6M-3600, "Alarm and Intercommunication Facilities for AN/FSQ-7 Duplex Operation," dated 11 May 1955; and we have completed the draft of 6M-3628, "Guaranteed Data Storage in AN/FSQ-7 Duplex Computer Operation," to be issued.

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

The Card Room personnel have started to punch on IBM cards the property record of the Lincoln Property Office. After all the records have been punched on cards, the Card Room personnel will maintain files of the cards and provide the Property Office with monthly listings of these files.

A program has been written to punch out the contents of core or drum storage in binary form. These cards will contain the same control information contained on cards prepared by the assembly program, except that relocation bits will not be punched. Identification will be punched in the 12's row.

The binary-octonary loading program is now checked out and is being used during Group 61's computer time.

The new assembly program is checked out and is being used. This program does not include all the features that are being planned for the program which will use magnetic tape but is sufficient for our present needs.

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1.1.7 Weapons Direction

(P. Bragar) (CONFIDENTIAL)

A revised draft of the operation specification for the Subsector Command Post has been distributed for comment among Group 61 personnel.

A preliminary draft of the raid-forming function has been circulated with a limited distribution. The specifications will be revised and given wider distribution for comment during the coming week.

(J. Cahill, Jr.) (CONFIDENTIAL)

A meeting was held at Lincoln on 12 and 13 May with representatives of SCEL, IBM, Airborne Instruments Laboratory (contractor for SCEL), ADC, and Army uses agencies to discuss integration of antiaircraft and SAGE. A memo descriptive of the meeting will be written.

Three points were brought into salient relief by discussion at the meeting:

1. A new approach is demanded if timely agreement is to be reached on the question of whether to use AN/TSQ-7 data transmission or SAGE crosstell transmission between SAGE and AA.
2. There are broad questions regarding the operation of AA in the SAGE era which require answers.
3. No meaningful operational specification for the SAGE AA Direction Section can be written until the data transmission impasse is resolved and the operational questions are answered.

Local Department of Army and Air Defense Command representatives are cooperating in an attempt to solve these problems. I am drafting an M-note which is intended to define the problem areas and suggest solutions.

(A. R. Chandler) (CONFIDENTIAL)

I have written a memorandum which describes the utility programs which are available for the Cape Cod System. It is called "Utility Programs and Their Use in the 1954 Cape Cod System"; no M-number has as yet been assigned to it.

The memorandum will include programs for storage, maintenance, modification, and checkout of the CCS, as well as some miscellaneous programs. General use of these programs is described as well as operating procedures for each. The note is now being revised by H. D. Benington to include a description of the trace program now being written, and it will be issued next week. The note was written on my own time and did not delay my SAGE Weapons Direction effort.

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(H. Frachtman) (~~CONFIDENTIAL~~)

The height-finding operational specifications are being given continued study and consideration.

(C. Grandy, A. Chandler, R. Nelson) (~~CONFIDENTIAL~~)

We have continued work on weapons direction as outlined in the last Biweekly Report.

The material is being reorganized and augmented to include some new considerations and clarify others already included. The organization of the material is expected to be as follows:

- A. General Operation Control
- B. Threat Evaluation
- C. Weapons Allocation and Deployment
- D. Crosstelling for Weapons Direction
- E. Weapons Assignment
- F. Intercept Direction

A new draft is in preparation.

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

The memos, "Manual Inputs in SAGE" PL-AS-65 and "SAGE Operational Plan for Identification" PL-AS-64, which will be included in the "Guide to System Operation," have been completed and distributed. We are awaiting comment and discussion from ADC representatives.

A meeting was held with representatives from IBM, Washington Office, who presented information concerning IBM's policy on premium charges for multiple shift use of their standard machines. We presented the time usage we anticipated for the card punch (026) and verifier (056) machines to be installed in the Manual Inputs Room.

Likewise a half-day's time was devoted to lectures on identification and manual inputs given before the SAGE System Familiarization Group which met during the period 9 - 20 May.

(E. McEvoy) (~~CONFIDENTIAL~~)

The program to read in the preliminary Flexo tape for simulated data generation has been written and is almost completely checked out.

I have started to prepare specifications for track-monitoring test series II.

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1.2 Whirlwind I

1.2.2 WWI System Operation

Records of Operation

(J. White) (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 7-20 May, 1955:

Number of assigned hours	215
Usable percentage of assigned time	98
Usable percentage of assigned time since March 1951	90
Usable percentage of assigned time since September 1953	94
Number of transient errors	8
Number of steady-state errors	3
Number of intermittent errors	3

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, 6-19 May 1955, inclusive:

Total Number of Failures	21
Total Number of No-Lost-Time Failures	3
Total Number of Lost-Time Failures	18
Total Lost Time in Hours	7
Total Operating Time in Hours	286

Class of Failure	Attributable to New Installation or Modification		Chargeable to System			
			Explained		Unexplained	
	No.	Min.Lost	No.	Min.Lost	No.	Min.Lost
Tubes			1	0		
			1	25		
Fuses					1	0
			2	15	3	53
Alarms					1	0
			5	48	5	198
Miscellaneous	1	60			1	22
Number of Lost-Time Incidents	1	60	8	88	9	273
Number of No-Lost-Time Incidents			1	0	2	0



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

The computer reliability continues to be good. Almost all the maintenance effort is now confined to marginal checking. There were 18 lost-time failures which resulted in 7 hours of down time. The majority of this time was lost in correcting a trouble which appeared as an intermittent during the last biweekly period.

We are continuing to work with Group 22 and Group 24 in an effort to meet the equipment demands of the Group 61 schedule.

A system for locking the magnetic-tape units (Unit 2, Unit 3A, Unit 3B), in the read mode is being installed. An intervention bit will be set if any of these units is off, locked in read, or switched to the printout equipment.

### 1.2.3 Terminal Equipment

#### Radar Inputs

(A. V. Shortell, N. N. Alperin) (UNCLASSIFIED)

As of 13 May, all gap-filler demodulator slice level pots have been locked. Results of this action have been excellent thus far.

An effect which produces very large data pulses has been noted on some of the sites. This effect, which is attributed by Group 22 to envelope delay distortion of the phone-line signal, produces extra reference pulses at the demodulator output. The relative amplitude of these pulses never exceeds 8.0 units (based on a reference-pulse amplitude of 10.0 units), but the reference slicer must be set below this level to give a sufficiently wide gate on the double reference pulse. A scheme which will increase the hysteresis of the reference Schmitt circuit and thereby allow a higher reference slice level is being considered.

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

A proposal has been made to change the interlace of the buffer drum. This change would reduce the time required for bi and bo orders.

#### Room 222

(T. Sandy) (UNCLASSIFIED)

The modifications to stations H, I, M, Q, and V which were requested by Group 61 have been completed.

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Typewriter and Paper Tape

(L. H. Norcott) (UNCLASSIFIED)

Modification of the FL punches at Lexington is proceeding more rapidly than expected. Three of these punches will now punch gray tape; the remaining punch will be ready in a few days.

Maintenance Programming

(J. Ackley) (UNCLASSIFIED)

The running times of a sample program using the CS II (24,6) system, my new (30,15) PA, and (15,15) PA subroutine were measured, and the results were as follows:

<u>System</u>	<u>Relative Speed</u>
CS II (24,6)	1.00
(30,15) PA	1.42
(15,15) PA	2.39

These programs are utility subroutines for handling floating-point multiple-length arithmetic. The CS II (24,6) subroutine is the one presently in use. The new subroutines, which are available for general use, are particularly advantageous where faster computation is needed.

The Raydist tracking program has been modified to make its operation more automatic and to provide azimuth printout in degrees rather than in units of SDV quanta.

Power Supplies

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

It has been agreed to grout the base for the new WWI filament alternator instead of supporting it at six points.

The motor-generator set used to supply test voltages for Room 156 has been removed to make room for a multivalued standby WWI d-c supply. Room 156 now uses laboratory d-c instead of the M-G set.

The feeder supplying WWI filaments has been changed from 4-1/c-1/0-RH-75°C cable to 4-1/c-4/0-RH-75°C cable. This change was made because the 1/0 cable in this installation had a rating of only 280 amperes, the 4/0 cable has a rating of 408 amperes, and the load is 385 amperes. The insulation of the 1/0 cable had dried out because of the overload.

The +150-v, the +120-v, and the +90-v power supplies were momentarily de-energized on 18 May. The fault location is now isolated to a small part of the control circuit by a system of fault-indicating relays.

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II - AN/FSQ-7

General

(S. H. Dodd, N. H. Taylor) (UNCLASSIFIED)

In order to make the best use of our staff manpower, some reorganization within Groups 62 and 64 has recently taken place. In particular, the reorganization will foster coordination of Cape Cod System information and techniques with Experimental Subsector problems and will insure that these techniques are taken advantage of in production systems.

The Cape Cod Direction Center, Systems Office, and Test Planning Sections will be headed by Holmes and Roberts, Anderson, and McVicar, respectively, under the direction of E. S. Rich. The Testing Operations, Evaluation, and MTC Sections will be headed by Fallows, Canty, and Hosier under O'Brien's direction. The Basic Circuits and Display Sections will continue under the leadership of Best and Corderman, who report directly to N. H. Taylor.

The Communications and Power Sections under Kirshner and Gano will be transferred to Group 66. Morriss will coordinate the efforts of Group 66, under S. H. Dodd's direction, and become the Division 6 PCO representative.

To broaden the experience of our staff there will be opportunities for most people to work for a time in each of our activities - systems, planning, and testing operations.

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2.1 Liaison2.1.1 SystemProduction Coordination Office

(A. P. Kromer) (CONFIDENTIAL)

On Tuesday, 10 May, the regular ADES Monthly Status Meeting was held at 220 Church Street, New York City. All organizations concerned with the program were present. Several members from Lincoln Laboratory reported the activities here. The status of installation and performance of the XD-1 System was described by Norm Taylor. The schedule for equipment installation and checkout by 1 October 1955 and the program to be written and checked out by 1 April 1956 were presented. Thus, after April 1956 the XD-1 System should be in condition to be considered as completely operational and ready for large-scale test operations. Division 2 representatives reported on results to date and plans for AN/FST-2 (FGD equipment).

Both Burroughs and IBM reviewed the present status of their engineering and production programs. In general, it was indicated that these activities are proceeding satisfactorily so that the desired schedules will be met. The telephone company advised that they are proceeding with engineering and equipment specifications for the external portion of the communications. However, the production and installation schedules are extremely tight. Further, they advised that they had not, as of that date, received an order from the Air Force for the internal communications equipment for the first Direction Center.

The M-note describing necessary space at Lincoln Laboratory for non-Lincoln personnel has been revised and issued as Memorandum GM-3575-1. This indicates that approximately 350 non-Lincoln personnel will be working in this area in connection with the Experimental Subsector during 1956, 1957, and the first half of 1958. Following this it will taper off to approximately half of this number through 1959.

The second of a series of biweekly meetings between Lincoln and ADES personnel was held on Thursday, 12 May. Highlights of the over-all Experimental Subsector program were reviewed briefly, and considerable detailed discussion concerning the communications for SAGE System followed. The ADES people reviewed the status of their work and inquired concerning Lincoln's knowledge of possible future communication demands for various weapons and other outputs from the SAGE System.

In order to improve coordination of communications activity between the two organizations, a detailed procedure for such action was developed. It was left that ADES would check with the other affected organizations, primarily ADC and JPO, regarding establishment of this procedure as a basic mode of operation for all concerned.

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A meeting was held with IHM and AFCRC personnel to explore questions concerning procedures IHM should follow with regard to acceptance of FSQ-7 (XD-1) on a partial basis. A number of questions were raised on which the AFCRC representative, Lt. Camp, agreed to secure more detailed information and to advise Mr. Ed Quick of IHM. These concerned submission of test results, contractual paper work, etc.

Representatives from management of four of the operating telephone companies in the far western part of the country, who have been assigned the job of coordination of telephone requirements for the SAGE System, visited both the Barta Building and Building F installation to secure additional background regarding the system and its over-all performance.

SAGE System and XD-1 Schedules

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

The following XD-1 Status Report was released:

<u>Report No.</u>	<u>Subject and Status</u>
7	The drum-control frame 21 has been simple tested, and the drum-housing frame 22 is being system tested. It is estimated that all system testing will be completed by 15 June 1955, 6 1/2 weeks late.

Plans are presently being made to hold a Lincoln Laboratory meeting to review XD-1 and SAGE status prior to the WE-ADRES Monthly Status Meeting.

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

At a meeting at Lincoln on 11 May 1955, attended by B. E. Morris, E. D. Lundberg, and E. L. Smiley of Lincoln and J. V. Schmitz of IHM, it was tentatively decided that IHM would issue all dimensioned building requirements drawings, while Lincoln would continue to issue the general arrangement and equipment layout. Concurrence will be required by both parties before any drawings are issued or changed.

A workable lighting system has been designed and installed in B-034. We are now waiting for Group 38 to test and evaluate this system. It should be noted that the presently planned system is by no means the final answer. It is believed that by optimizing the present light filters the light level can be raised. Further improvement in light levels and light efficiencies may be possible with improvements in the Charactron output and light-gun characteristics. A general lighting specification will be written in the near future.

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2.2 XD-1, XD-2

2.2.1 Systems

(A. M. Werlin) (UNCLASSIFIED)

A meeting was held in which the requirements for crosstalling between XD-1 and WWI were set forth and various proposals for doing this were discussed. A study has been made of the amount of input equipment required at WWI for the most feasible system, and a rough block diagram has been made for this.

A/G Voice Radio for XD-1

(F. E. Irish, G. J. Carter) (UNCLASSIFIED)

Another meeting has been held to discuss keying facilities for the XD-1 A/G voice-radio system. It now appears that all of the voice-radio circuits except those going to the Lexington Field Station will use some form of "43A1" frequency-shift keying. Three circuits, one each to Brunswick, S. Truro, and Montauk, will be installed by 1 August using the 43A1 keying facilities. The circuit to S. Truro will also have provision for a "back-up" or "restoration" circuit. The 43A1 for that installation is being "hand made" by BTL; the others will be built by the WE "branch house."

AN/FSQ-7 (XD-1) Communications

(G. J. Carter, H. J. Kirshner) (UNCLASSIFIED)

The Building F dial exchange will be in operation on 23 May 1955.

Discussions were held with representatives of IBM and NET&T Co. on the implementation of teletype equipment in XD-1.

We have received word that Hq. EADF is studying our entrance facility requirements at ADC bases. They will advise us of the results of their study within the next biweekly period.

An exploratory discussion was held with Rosenbluth and Dominick of BTL-ADES on the subject of teletype facilities for SAGE Direction Centers. BTL-ADES will review the work done to date and prepare a comprehensive plan for these facilities.

Non-Filler Radar Installation Tests

(J. E. May) (UNCLASSIFIED)

Plans are being made for using NTN as a test facility for non-filler radar. The installation tests of the non-filler radar by

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General

(J. Giordano) (UNCLASSIFIED)

The following is a review of the records maintained by the Systems Office available to all interested personnel:

1. A brief file on various parts of the SAGE System. The briefs contain specifications, miscellaneous reports, letters, drawings, and schedules. 6M-3449-1 contains the XD-1, FSQ-7, and FSQ-8 brief index listings.
2. Change Evaluation Requests (C.E.R.'s) are controlled by the Systems Office. C.E.R. status reports are issued periodically. A detailed report on any C.E.R. can be obtained by contacting the Systems Office.
3. A reference AN/FSQ-7 drawing file.
4. Weekly logs on various XD-1 system testing, maintenance and method reports prepared by IHM.
5. A list and status of D documents (AN/FSQ-7 production specifications) with their corresponding DR numbers.

Logical Services Committee

(R. D. Buzzard, N. T. Jones) (UNCLASSIFIED)

Command Post DD Desk. Construction of the mockup is proceeding satisfactorily with completion expected by 27 May. A platform is being built so that the mockup may be placed in the position planned for the desk in the Command Post in Building F. The only troublesome detail at present is the availability of MI switch modules. We intended to borrow some of these units, but they may not be delivered in time.

Display Consoles

(R. D. Buzzard) (UNCLASSIFIED)

I have been assisting Hawley Rising in the compiling of a revision of 6M-3320, "Equipment Allocation and Layout for XD-1 Auxiliary Consoles and Wing Units."

Gap-Filler Radar Acceleration Tests

(J. P. May) (CONFIDENTIAL)

Plans are being made for using MTC as a test facility for quantitatively checking the acceleration rates of the gap-filler radars by

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using the slowed-down-video (SDV) signals sent over a phoneline data circuit. The SDV data receiver for MTC has been constructed and tested. The MTC program will be written next week. O. V. Fortier of Division 2 will provide the necessary anemometer and time recorder to take the necessary data at the radar sites.

### 2.2.2 Installation

(H. Wainwright, H. F. Mercer) (UNCLASSIFIED)

#### I. Building Construction

The general contractor still must install lock cylinders before he completes the requirements of the Air Force Contract within the building. The IBM phase of the work requires some touchup of paint, pointing around one of the equipment-cooling control panels, installation of door hardware in the basement, and final fabrication of the emergency fresh-air roof monitor. According to the general contractor, these items, for IBM, should be completed during the week of 23 May.

#### II. Equipment Cooling

Work remaining on this contract is principally testing and balancing of the installed equipment. Lincoln people (Division 1) are installing the combined end cover-air ducts for frames on the east side of the building.

#### III. Cabling

As last reported, cables required for the operation of new frames, delivered during this period, are being installed by both IBM/Lincoln technicians.

#### IV. Equipment Layout

Projection Room - preparation of new drawings and specifications has taken somewhat more time than anticipated. We hope, however, to deliver both the drawings and specifications to Division 1 for processing and construction shortly. We have set 15 August as our end date for the preparation and completion of this area.

#### V. Lighting

Tests continue in B-034 to decide the modification necessary to Building F's lighting installation.

Division 1 has been asked to install the fixtures in the mapper room.

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## VI. Telephones

It is planned to start operation of Building F's switchboard on Monday, 23 May. The telephone company is currently installing the public-address system.

## VII. General

Work orders have been forwarded to Division 1 for the fabrication and installation of the daises (for the S and W rooms). As last reported, all requests for building alterations or for construction of new equipment will be forwarded to Division 1.

2.2.3 Testing

(S. L. Thompson) (UNCLASSIFIED)

Work is continuing on the sandwich program, but a shortage of computer time is slowing down the program debugging.

An order has been placed for cables to connect the GFI frame to MTC. Test equipment and intercommunication equipment is being assembled.

(R. H. Gould) (UNCLASSIFIED)

Power is being wired to some of the Jones plugs on the computer frames for testing the cathode-follower probe. The probe has been bench-tested and has performed satisfactorily. Further work will be toward a more compact mechanical arrangement with equivalent electrical characteristics.

ID-1 Records

(J. D. Crane) (UNCLASSIFIED)

New forms for use in the ID-1 log system were tried by the computer operating personnel. Copies of the new forms will be made and bound in a suitable form for use on the computer in the near future.

ID-1 Evaluation

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

The third evaluation test run on the ID-1 computer was performed on 20 May 1955. Results of this test run and a study of the computer history (margins and reliability) for a 2-week period previous to 20 May 1955 will be presented in a forthcoming memorandum.

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D-C Supplies

(J. D. Clarke) (UNCLASSIFIED)

Inrush tests on the XD-1 units were conducted and indicated that power can be brought on to the d-c power supplies of the production units in one step by energizing the exciter field without having excessive inrush current. The presently planned method of bringing power on in two steps appears to give inrush currents that are tolerable. IIM has been asked to consider using the former method which eliminates relays.

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### 2.3 Production System

(K. E. McVicar) (UNCLASSIFIED)

A preliminary report for the Stewart Subsector has been written for the ADES System Operation and Testing Subcommittee. This document is being circulated for comments prior to Subcommittee action.

We are still accumulating the information necessary to produce similar reports for the Syracuse Direction Center and Combat Center.

(T. R. Parkins) (UNCLASSIFIED)

A list of external communications circuits necessary for systems testing at the Syracuse Combat Center has been compiled. This information will be used in a report for the ADES System Operation and Testing Subcommittee.

On 19 May I attended an IHM-Lincoln discussion concerning rental machines for FSQ-7.

(H. Rundquist) (UNCLASSIFIED)

The program written for MTC analyzing the problem of storage probability on the LRI input drum is almost completed. It is anticipated that some results will be available within the next biweekly period.

A flexible system of display is being incorporated into the program for monitoring purposes by R. P. Mayer.

Description of the problem, the programming approach, and final tabulated results will be published by A. D. Hughes and myself in 6M-3629.

### Test Equipment

(R. H. Gould) (UNCLASSIFIED)

DuMont expects to send us specifications and cost estimates for a dual-beam scope by the end of May. Electronic Tube Corporation has evinced interest in building a dual-beam scope, and a preliminary list of specifications has been drawn up for their consideration.

### Reliability Study

(R. C. Jeffrey) (UNCLASSIFIED)

Discovery of some errors postponed publication of 6M-3441, "Reliability of Duplexed Equipment," which was described as completed in the last Biweekly Report. It is now again "completed" and should be published during the coming 2 weeks.

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Outputs

(S. B. Ginsburg) (UNCLASSIFIED)

Present effort is directed towards generating a suitable program to operate with MTC which will adequately test the feasibility of interleaved or noninterleaved crosstell messages.

LRI Monitor Development

(J. P. May) (UNCLASSIFIED)

Two meetings were held between Division 6 and Division 2 personnel about an LRI (FST-2) fine-grain-data monitor. The basic differences are in operational requirements. Division 2 is planning an integrated system for both PPI and B-scan type displays for the output of one AN/FST-2. Division 6 is planning a monitor which will be time-shared for displaying the data from four AN/FST-2's simultaneously. The two equipment requirements are incompatible mainly in the time allowable for displaying one message.

Two meetings were held between IBM and Group 62 personnel on the specifications for the AN/FSQ-7 LRI monitor.

AN/FSW-1 Control Monitor Set

(J. P. May) (CONFIDENTIAL)

The AN/FSW-1 is remote gap-filler site supervisory equipment located at the neighboring long-range-radar (LRR) site. It is intended to monitor and control the operation of the unmanned gap-filler sites remotely. Each AN/FSW-1 can control a maximum of four gap-filler sites by using tone-multiplexed-coding over telephone lines. The planning is to have 30 supervisory and alarm conditions reported continuously to the LRR site with the LRR site being able to control 20 on/off conditions in the equipment at the gap-filler site.

I am studying this system to determine if any incompatibilities exist with the SAGE operations or equipment.

LRI Monitor Specifications

(A. D. Hughes) (UNCLASSIFIED)

A revision of 6M-3579, "LRI Monitor Specifications for AN/FSQ-7," was written based on meetings with J. P. May, A. M. Werlin, and IBM personnel in Poughkeepsie on 13 May and in Lexington on 18 May. Also, the document was rewritten so as to be unclassified. Comments were verbally received and, where applicable, incorporated for the revision by Attridge and Walquist.

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LRI Monitor Effects on Probability of Storage

(A. D. Hughes) (UNCLASSIFIED)

Work with Rundquist is continuing in an effort to solve the problem of probability of storage of LRI data. A memorandum describing the problem and the results is being written (GM-3629).

Power-Generation System

(J. J. Gano) (UNCLASSIFIED)

I am reviewing the first draft of the Jackson & Moreland report on the transient behavior of the first two Direction Center installations and the first Combined Center installation.

Engineers from Jackson & Moreland, Burns & Roe, and I intend to discuss the power-generation system for the second Combined Center the week of 23 May.

Jackson & Moreland is presently calculating the voltage magnitude of transients at the generating bus caused by all disturbances, including motor starting, electronic-equipment load changes, and various faults in the distribution system. The magnitudes will then be segregated into bands, and it is hoped to put a probability rate on them. With this information we may be able to determine the value of the sets as transient filters.

Power Distribution

(G. F. Sandy) (UNCLASSIFIED)

As mentioned in the last Biweekly Report, thermistors offer a promising solution to the filament-voltage problem. The necessary thermistors have arrived for experiments to determine their usefulness.

Power and Air Condition Loads

(R. Jahn) (UNCLASSIFIED)

Gano and I have been revising power and air-conditioning load estimates for duplex Centrals. The IBM load-estimate sheets have not been brought up to date with available measurements. Measured loads have been running 20% below the estimates. In reviewing the loads from an air-conditioning point of view, we are trying to clear up compounding of growth factors and diversification of loads.

## 2.4 Vacuum-Tube Circuits

### Gap-Filler Sweep Circuit

(B. W. Barrett) (UNCLASSIFIED)

The gap-filler sweep has a high ratio (200) of sweep time to retrace time. The sweep circuit is sensitive to the manner in which the sweep capacitor is discharged, because the external circuit loses control and must drift back to the proper operating point (in an elapsed time determined by the sweep rate). I am now optimizing a Miller sweep circuit which has both charge and discharge time constants predetermined and in which the external circuit is always in control.

### Vector Generator

(E. B. Glover) (UNCLASSIFIED)

It has proved impossible to meet all specifications of the sweep generator with the present circuit design. Therefore, this circuit will be optimized with its existing configuration as a temporary measure, and eventually a new design will be incorporated into the vector generator.

### Display-Line Driver

(J. Kriensky) (UNCLASSIFIED)

In checking several pluggable units, a very troublesome defect in card construction has been found to be poor connections between stand-off lugs and the printed wiring. By flexing the cards a slight amount, these connections can be made into high resistance contacts which disturb the operation of the line driver.

Other troubles occurring in the unit indicate that production testing of the preamplifier stage by itself is not a thorough enough check. The preamplifier stage should be tested together with the two output units so that the effects of feedback in the circuit are considered.

### Flip-Flop, Model E

(N. J. Ockene) (UNCLASSIFIED)

Promising results have been obtained in using a biasing network in the cathode circuit of the flip-flop. The purpose of this network is to increase the current flow of the "on" tube. This tends to produce additional cathode bias for the "off" section, thereby reducing the sensitivity of the flip-flop. At present, minor modifications of the above-mentioned circuit are being tried in an attempt to improve the operating margins.

Direct-Coupled Video Probe

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

The first series of tests has been completed, revealing such characteristics as a rise time of about 7 millimicroseconds, a permissible output of  $\pm 5$  volts with a nonlinearity not exceeding 2.5%, a drift rate of about a volt (at the probe tip) per day, and excellent reproduction of standard 0.1- $\mu$ sec pulses.

The only serious faults discovered were grid-current loading of the input attenuator and a variation of tube input capacitance with signal-level changes. Both effects result in transient errors of about 10% with full-scale signals. Compensation schemes are being tried to reduce these errors.

At least one power outlet will be wired in XD-1 by Monday, 23 May, and the probe system will be placed in experimental operation shortly thereafter.

Matrix Output Amplifier (256 x 256 Core Memory)

(D. Shansky) (UNCLASSIFIED)

The amplifier described in the last Biweekly Report has been breadboarded and debugged. Since the principle of operation (use of a Zener diode to secure a stable positive and negative reference level) would find wide application in power-cathode-follower circuitry, the mechanism of obtaining approval for this component has been set in motion. A number of these diodes will be placed on life test in this particular circuit.

ID-1 Memory

(D. Shansky, W. Canty, R. Zopatti, R. Best) (UNCLASSIFIED)

A further discussion of the selection-plane driver and sensing amplifier was attended in Poughkeepsie. The work of evaluating the ID-1 memory troubles and finding ways of curing them is proceeding as rapidly as computer schedules allow.

Sensing Amplifiers for Memory Planes

(R. C. Zopatti) (UNCLASSIFIED)

A plug-in unit of a new sense amplifier with a difference amplifier input has been built and will now be tested.

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## 2.5 Display

(J. Woolf) (UNCLASSIFIED)

The first display console for XD-1 is being checked in Building F utilizing the display tester. The circuitry associated with intensifying the tube and selecting the required characters is functioning properly. The feature and categories have to be checked. At present it is possible to deflect the beam with the X, Y circuitry; however, further tests are necessary to determine whether the expansion and off centering are functioning properly. The operation of frame 24 can now be studied with a meaningful display on the console.

Console 2 is being installed in Building F. This console should be in the same state of operation as console 1 within the next few days.

(H. Ziemann) (UNCLASSIFIED)

Recent difficulties in the line drivers reveal that the production testing of the preamplifier is not thorough enough to eliminate all faults. It is being suggested that the entire amplifier (preamplifier and two driver units) be tested as a unit. It is expected that similar difficulties will appear on the magnetic-deflection amplifier unless this is also tested as a unit. This is not to imply that the preamplifier must be operated with the two drivers with which it is tested, but that the preamplifier be tested as part of a feedback circuit to properly reveal its faults.

### Digital-Display Frame Testing

(R. Gerhardt, R. Paddock) (UNCLASSIFIED)

During the past biweekly period we again have experienced troubles with faulty Stemag resistors in power-cathode-follower, flip-flop, and analog line-driver circuits. Precision resistors to replace all Stemags in the frame have been ordered through R. Bottomley. To locate these faults, we must use the display tester which takes time from frame 24 testing operations.

Whenever power to the digital-display generator is turned off, power is also turned off the display tester; time again is taken from frame 24 testing operations. We have taken initial steps to have the display tester on separate power control.

We have taken one set of margins on all marginal check lines. More conclusive tests for accurate indications of m/c failures are being written.



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MTC Connection to Display Frames

(R. Gerhardt, R. Paddock) (UNCLASSIFIED)

The MTC drum was connected to the digital-display frame about 4 May. Since that time we have been unable to check fully the program or the logic of the terminal equipment for the reasons mentioned above. Today we discovered a program trouble. We have displayed several patterns on the Typotron using information stored on the MTC drum.

We are currently using drum fields 7, 8, 9, and 10. Once all drum fields have been added to MTC, we expect to use fields 11, 12, 13, and 14. It is hoped that programmers will restrict usage of these drum fields. These fields may be used from 5:30 at night to 8:30 in the morning or during the day, provided we are notified.

Automatic Camera and Camera Control

(L. Sutro) (UNCLASSIFIED)

The parts of this system are under construction or undergoing test, but the back-panel wiring has yet to be done. Relay logic has been changed to correct an error in the use of a 1/4-sec delay relay. Dick Best pointed out that this relay must be held in 1/4 sec to give a 1/4-sec delay on release. Since no other 1/4-sec delay is available in the system, he recommended holding the coil in except when the delay is wanted. With this correction, we are completing logic drawings. From these, the back-panel wiring will be planned, then installed.

Large-Board Display

(L. Sutro) (UNCLASSIFIED)

My job here is to get the system built. R. Buzzard has designed the logic of the timing circuit. I am getting XD-1 cards for this. Loren Prentice has designed the camera mount which is nearly built. A present problem in the system is a means of binding a transparency for projection within a period of several seconds. This has not been decided upon.

## 2.6 Vacuum Tubes

### 2.6.1 Activities of Group 65

(P. Youtz) (UNCLASSIFIED)

I spent the weeks of 9 and 16 May 1955 with IBM at the Convair Charactron Tube Plant trying to isolate the possible causes for failure of cathodes in Charactron guns. J. S. Palermo and F. H. Caswell spent the week of 9 May at the Convair Plant studying and comparing the Convair processes with the Lincoln Tube Laboratory processes. T. F. Clough will join me at Convair the week of 23 May and will be working with Walter Mutter of IBM on this problem.

At the moment it appears that the causes for failure of the Charactron cathodes have been isolated. The production run during the week of 23 May will give some indication if the corrective measures taken by Convair are adequate.

The tube-construction program of the Group at Barta Building was directed toward studying the processing of the Superior Electronics cathodes that are used in Charactron guns.

### 2.6.2 Tube Research and Development

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

J. S. Palermo, together with P. Youtz and F. H. Caswell, spent the week of 9 May 1955 at the Convair Charactron Project in San Diego, California, evaluating the in-line production compatibility with the Convair Manufacturing Process Specification (CMPS). An evaluation report was submitted to a joint Convair-IBM-MIT Committee 14 May 1955 in San Diego.

A study program to supplement the work at Convair continues in our laboratory at the Barta Building. Toward this end approximately thirty 2-inch CT envelopes and eleven 19-inch CHT bulbs have been prepared or are in some stage of processing.

In addition to this program, experiments associated with other display problems are being conducted for Group 25.

(S. Twicken) (UNCLASSIFIED)

A statistically valid specification for the 2420 gate pentode was agreed upon at Emporium by Sylvania, IBM, and MIT. It is very similar to the original objective specification and in some respects, e.g., shorts, it has tighter AQL's. The specification is representative of a large number of tubes which have been produced over a long period of time under fixed design and processing conditions, and there should be no problem of incompatibility of specification and product.

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I attended a meeting with Bendix at Kingston to discuss their effort as a second source of the gate pentode and the program to make Bendix's and Sylvania's tubes as identical as possible. Bendix appreciates the necessity and philosophy of this program but, at the same time, has some reticence about having its initiative stifled. Upon receipt from Sylvania of the design and process specifications of the 2420, Bendix will prepare a list of suggested constructional changes in line with their thinking on reliable tubes. These changes will then be approved or disapproved immediately so that their tooling program can get under way. A joint meeting of Bendix, Sylvania, IHM, and MIT is scheduled for 27 May at Kingston.

(T. F. Clough) (UNCLASSIFIED)

Proper maintenance procedures have been specified for the equipment and area where tubes are fabricated.

I will spend the week of 23 May 1955 at Convair, San Diego, with P. Youtz working on the Charactron Manufacturing Process Specifications.

(L. B. Martin) (UNCLASSIFIED)

I devoted full time to the automatic pulse-transfer curve plotter, and it should be completed within 2 weeks. I plan to include it in my Master's thesis.

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	9160.0	marginal <sup>1</sup>
280	8341.8	marginal <sup>2</sup>
389	6739.2	satisfactory
390	6823.0	satisfactory
392	6823.0	satisfactory
394	6040.9	satisfactory
11601	2135.6	satisfactory
11521	1891.1	satisfactory

<sup>1</sup>Tube 265 is marginal because of ion damage to center of storage surface. Tubes of a later model have ion-repeller screens.

<sup>2</sup>Tube 280 is considered marginal because of low beam current.

Tubes 11981, 12122, 12622, and 12641 have been on the 16-position life test for 1302.6 hours, while tubes 12242, 12461, and 12522 have been on for 576.9 hours. All are satisfactory.

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(P. C. Tandy) (UNCLASSIFIED)

Nine 19-inch tubes, CHT-61, CHT-62-1, CHT-72-2, CHT-73, CHT-75, CHT-80, Convair 14-1, 0083, and 0208, have completed from 493 to 4713 hours on life test. The status of these nine tubes and the two tubes which have failed since the last report, 0082 and 0199, is shown in Table I. Tube 0082 is marginal because it failed to meet the 50- $\mu$ a pulse-matrix-current requirement by 2 microamperes.

All the CHT's on life test are now operated at one-half cutoff voltage d-c, and the cathode uniformity was checked at the beginning and after 50 hours of operation. No appreciable change was noted on any of the tubes in that 50-hour period. Tube 0208 has also been operated at one-half cutoff d-c with no appreciable change in cathode uniformity after 93 hours.

Work on my Master's thesis is continuing.

Table I

Tube No.	Last Biweekly Report			Latest Results		
	Hours	Pulse O-Bias	Max. $I_K:I_M$	Hours	Pulse O-Bias	Max. $I_K:I_M$
CHT-61	4238	100	41.1	4449	88	38
CHT-62-1	4125	73	19.2	4356	78	19
CHT-72-2	1610	165	14.5	1824	195	12.2
CHT-73	1522	175	12.6	1687	170	14.5
CHT-75	2944	106	20.2	3108	140	17.2
CHT-80	2793	235	12.5	2959	270	11.4
14-1	872	58	27.2	989	90	18.4
0082	1413	81	68	1505	48	52.2
0083	712	335	9.1	877	380	9.1
0199	135	110	200	256	2.2	363
0208	116	320	13.5	256	280	21.8

## 2.7 Memory Test Computer

(W. Hosier) (UNCLASSIFIED)

Use of MTC for testing XD-1 system units (display) and planning for further tests of this sort (GFI) has continued during the past fortnight. A DD test pattern has been sent to the DD frame in Building F more or less continuously and has been displayed on the Typotron; so far nothing has been transmitted for SD display on the Charactron. A first test program for the GFI equipment has been worked out by John Newitt with Ralph Washburne of IHM, and the small amount of additional MTC hardware needed for this test is under construction. Sam Thompson is making arrangements for the necessary cables and test equipment to be supplied on the Building F end; also two intercom stations will be connected to the MTC console - one at the GFI frame, another in the mapper room.

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New decoders for the MTC display system were received from Production Control and are now being checked out. When these are installed, the present decoders will be used by McCusker to test his LRI r-θ conversion apparatus, a program which he has already in part begun while the decoders are still in MTC.

Farley is getting the outline of a general card-and-tape assembly program for symbolic addresses into sharper focus; in this connection a slight addition was made to the card read and punch instructions to enable a program to use nearly all of the 100 milliseconds between cards (see F. Durgin's report below) instead of the 24 milliseconds formerly available.

Stu Coffin of the power group is working on three new power supplies for MTC: a 50-amp replacement for the present 30-amp +150-v supply, a new +600-v regulated supply for Charactron and display, and a 30-amp variable emergency supply.

Louis Sutro has for most purposes left the MTC Section, transferring to XD-1 camera and display work under Gus O'Brien; however, he will complete the MTC camera improvements that he had begun.

Distribution of computer time continues with no pronounced changes except that a shift of effort of Corderman's Section to the Building F test and installation has cut his time on MTC to the small amount necessary to load DD test data on the drum; the resulting slack is being taken up by MTC display testing under Herb Ziegler.

There were no serious failures in MTC until near the end of this biweekly period. Thursday, 19 May, saw some 4 hours lost to circuit trouble (tube and wiring) in the Ferranti tape reader, and another 4 hours lost to a blown 125-amp a-c fuse in one phase of the alternator output (which was complicated by other fuses and CB's going out in consequence and by technicians' lack of familiarity with power-supply control). The cause of this is still unknown.

## Assigned Computer Time 7 - 20 May 1955:

<u>Application</u>	<u>Hours</u>	<u>Per Cent</u>
Programming	168.39	62.8
Development	9.80	3.7
Maintenance and Marginal Checking	32.06	12.0
Reliability Check Programs	35.96	13.4
Installation	13.05	4.9
Interrupting Failure	<u>8.52</u>	<u>3.2</u>
	267.78	100.0

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(B. G. Farley) (UNCLASSIFIED)

Work is continuing on specifications for a flexible symbolic address MTC assembly program for cards and tape.

Some thought is devoted to improved marginal checking, test, and diagnostic programs.

(J. H. Newitt) (UNCLASSIFIED)

I have temporarily discontinued my detailed study of MTC to set up an MTC test program for GFI equipment in XD-1. It is planned that we will use MTC to test the GFI equipment (exclusive of the DDR and drums); planning of necessary technical details to connect the two equipments (GFI and MTC) is complete. I have written two test programs for this undertaking and expect to write more as the tests proceed.

Scope-Display System

(H. Ziegler) (UNCLASSIFIED)

The new decoders were delivered early in the past biweekly period and have been connected into MTC. Preliminary tests have indicated some necessary changes, mostly in the line-driver amplifier. These changes should be completed within the next few days after which testing of the decoders can resume.

(E. Albanese) (UNCLASSIFIED)

The following is a summary, for the period 9 - 20 May, of defects found in tubes and in components in MTC:

<u>Tube or Component</u>	<u>Defect</u>	<u>Quantity</u>	<u>Hours Lost</u>
5965	Tap short	1	0
5998	Tap short	1	0
7AK7	Tap short	3	0
Z2177	Tap short	<u>6</u>	<u>0</u>
		11	0

## III. ADVANCE DEVELOPMENT

3.1 Chemistry of Magnetic MaterialsFerrite Symposium

(F. E. Vinal)

(UNCLASSIFIED)

An all-ferrite program was held on 17 May at the 21st Symposium on Ceramic Dielectrics, Rutgers University.

Of the nine papers presented, four were by Lincoln staff on aspects of our magnetic-materials program, as follows:

1. Limiting Compositions for Hysteresis Loop Squareness in the Magnesium Manganese Ferrite System.
2. Processing Control of Magnetic Properties in the Magnesium Manganese Ferrite System.
3. Preparation and Properties of Magnetic Solid Solutions of Ferrous Germanate and Zinc Ferrite.
4. Magnetic Characteristics of Magnesium Manganese Zinc Ferrites.

Inorganic Chemistry

(D. G. Wickham)

(UNCLASSIFIED)

Magnetic moments for compositions in the solid-solution range between ferrous germanate and zinc ferrite have been studied as a function of temperature and the saturation values at 0 K obtained by extrapolation of the curves from data taken at 78K.

<u>Composition</u>		<u>Saturation Moment</u>
<u>Fe<sub>2</sub>GeO<sub>4</sub></u>	<u>- ZnFe<sub>2</sub>O<sub>4</sub></u>	<u>(μ<sub>B</sub>/ molecule)</u>
20%	80%	4.3
30	70	4.8
40	60	4.6
50	50	7.1
60	40	3.7
70	30	3.2
80	20	2.5

The Curie points of these compositions appear to lie between room temperature and 111°C.

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Thermal Stability of Magnetic Spinels

(F. S. Maddocks) (UNCLASSIFIED)

The thermal-analysis curves of  $MnCO_3$  and  $Mn_3O_4$  have been obtained. Increased sensitivity in the present setup over that previously used is evident from the results. The curve for  $MnCO_3$  shows an endothermic reaction at 980C, corresponding to reduction of  $Mn_2O_3$  to  $Mn_3O_4$ , and another endothermic reaction at 1350, which may correspond to reduction of cubic  $Mn_3O_4$  to  $MnO$ .

Suggestions by Jim Schallerer to reduce further the a-c pickup in the differential thermocouple circuit by more effective shielding and better globar connections are being tried.

Experimental Ferrites

(D. L. Brown) (UNCLASSIFIED)

Attempts to improve the magnetic properties of lithium ferrite by the addition of zinc ferrite and manganese have not been successful. Zinc ferrite does improve the magnetic induction, as expected, but neither zinc ferrite nor manganese improves the squareness. Equipment is being assembled to make controlled atmosphere firings. New compositions containing additions of nickel ferrite and magnesium ferrite are being prepared.

Chemical Analysis

(E. Keith, P. Reimers) (UNCLASSIFIED)

Quantitative analyses of the following have been completed:

1. DCL-2-840 and DCL-2-841, memory-core compositions;
2. General Ceramics ferrite # 1331, a magnesium-manganese ferrite.

Quantitative analysis of the following is in progress:

Bell Laboratories ferrite "x", a magnesium-manganese ferrite.

Production of Memory Cores

(J. J. Sacco) (UNCLASSIFIED)

During this biweekly period, difficulties were encountered in several phases of the processing. However, the necessary adjustments have been made, and normal pilot-plant production will be resumed.



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Two new batches have been test-fired, and three more are being prepared. A stockpile of 135,000 "green" cores is on hand, and it is hoped that three full-capacity firings can be made during the coming week.

Core Testing

(J. W. Schallerer)

(UNCLASSIFIED)

During this biweekly period approximately 150,000 cores were double-tested. This brings the total to 734,000 cores double-tested for the 256 x 256 memory. A considerable amount of time has been lost because of track trouble on both the automatic and semiautomatic testers.

Switch Driven Memory Cores

(J. W. Schallerer)

(UNCLASSIFIED)

The measurement of half-selected memory-core outputs when switch driven presents additional problems over usual techniques. This is mainly due to the fact that a coincident-current magnetic switch contributes to the noise output of the memory cores. Thus possible excitations other than full selection with which a memory core may be driven are  $N$ ,  $2N$ ,  $\frac{I_m}{2}$  and  $\frac{I_m}{2} + N$  where  $N$  is the noise output of a half-selected switch core.

The necessary equipment to measure all the half selects under the above excitations has been set up and is now being debugged.

### 3.2 Physics of Magnetic Materials

#### The Noise Problem in a Memory Array

(J. B. Goodenough) (UNCLASSIFIED)

During a recent IBM visit it was called to my attention that there was some difficulty with the expression calculated over a year ago for the surface energy density of a plane distribution of magnetic poles at a grain boundary at which a domain of reverse magnetization has been nucleated. This calculation has been thoroughly reworked, and it was found that it should read  $\sigma = ms^2 \sqrt{2\pi(r/D)^2 - 1}^2 + \text{Harmonic Terms}$ ,<sup>2</sup> where  $L$  is a mean grain diameter,  $ms^2$  is the surface pole density,  $D^2$  is the fundamental unit of area, and  $r$  is the radius of the domain of reverse magnetization within this fundamental area. In the early expression for this energy, the term in the brackets had been taken as an absolute value rather than being squared. This correction is of immediate significance to the calculation of noise effects in magnetic-memory arrays. It does not alter any of the previous conclusions.

#### Magnetostriction Measurements

(N. Menyuk) (UNCLASSIFIED)

A calculation of the magnetostrictive constants of ferrite single crystals shows the experimental results are spurious. The external circuitry has been investigated thoroughly and is correct. Experimentation is continuing in an effort to determine the source of the error. This procedure is hampered by (1) limited access to the magnet, and (2) line-current effects which, on occasion, render experimental work impossible.

#### Magnetic Measurements

(D. Smith) (UNCLASSIFIED)

Measurement of the saturation moment as a function of temperature from -195 C to 20 C for eight Zn-Ge ferrites has been carried out using the vibrating-coil magnetometer (vcm) in Bldg. 20. The results provide a basis for further work on this series of compounds.

A complete vcm system is being designed for use at the Lexington laboratories.

#### Equation of Wall Motion for an Ellipsoidal Domain

(J. D. Childress) (UNCLASSIFIED)

As reported in the last Biweekly, the equation of wall motion for an ellipsoidal domain has been derived and simplified to a Riccati form. A solution has been found and indicates that the lag of the wall motion behind a step-field excitation (small fields) is less than 10 millimicroseconds.

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D-C Fluxmeter

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

The basic circuit has been completed and is operating satisfactorily. Several refinements are being incorporated, viz., extending some of the controls outside the thermal insulation, installing a test meter for watching zero drift and another for the positive feedback control. Work on auxiliary apparatus is also being done.

3.3 New Components and CircuitsTransistor-Circuit Work

(T.H. Meisling) (UNCLASSIFIED)

The current transistor-circuit work is aimed at finding optimum operating conditions for the logical circuitry and flip-flops. Transistor specifications are being developed in conformity with the circuit requirements.

8-digit Shift Register

(D. J. Eckl) (UNCLASSIFIED)

The transistorized shift register has been on life test for 911 hours. During this time errors (loss of pattern) have occurred at the following intervals: 72 hours; 73 hours; 469 hours; 52 hours; 90 hours; 143 hours to present. During the 72, 73, 52, and 90 hour runs a Tektronix scope was connected continuously to the shift register. During the 469-hour run and the present run the scope has been connected only at the time of observation. The scope, through the a-c line cord, is the only connection to the external world as the shift register and its supply are completely shielded. It appears from the above results that this has an adverse effect.

Shelf Life Test

(D. J. Eckl) (UNCLASSIFIED)

Sixteen surface-barrier transistors have been put on a shelf life test at the same location as the other life tests.

Transistor Parameter Measurements

(D. J. Eckl) (UNCLASSIFIED)

The measurements group at Philco has furnished us with complete parameter data on 23 of our SBT units. We will use these units as a basis for correlating measurements made by the two groups.

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Flip-Flop Studies

(E. U. Cohler) (UNCLASSIFIED)

Tests in progress on the tentatively accepted flip-flop seem to indicate good operation. The flip-flop is capable of driving up to seven inverters with normal transistors, or six inverters and a pulsed gate (input to another flip-flop). This load may be applied on each side of the flip-flop or on both sides. The output circuit used in these tests is the simple inverter. Curves of pulse duration vs. pulse amplitude show that the pulse amplitude required to trigger is constant down to 70 millimicroseconds and rises 50 percent at 40 millimicroseconds. Pulse amplitude at a duration of 110 millimicroseconds must be below 25 volts and at 120 millimicroseconds must be below 7.5 volts. The prf sensitivity of the flip-flop is constant to 6 megacycles, falls 20 percent to 8 megacycles and goes to zero somewhere between 8 and 9 megacycles.

The effects of unbalanced transistors, unbalanced loads, low-alpha transistors, current triggering, and parameter deterioration are going to be investigated shortly.

Transistors

(P.A. Fergus) (UNCLASSIFIED)

All measurements on the 200 GE pnp junction transistors have been completed. These measurements include alpha,  $I_{co}$ ,  $I_{eq}$ , rise-fall time measurements, and grounded-emitter characteristics. Seventy-six of this group have been distributed.

All Philco surface-barrier transistors received to date have been processed. Measurements of  $r_p$  and punch-through voltage have been made in addition to routine measurements of alpha,  $I_{co}$ , and  $I_{eo}$ . To date 630 surface-barrier transistors have been distributed.

Measurements of saturation  $\beta$  have been taken on 30 surface-barrier transistors to indicate range of saturation  $\beta$  to be found and variation of saturation  $\beta$  with collector current. Curves have been plotted, but results have not been completely analyzed.

Recovery Time in Surface-Barrier Transistors

(C.T. Kirk) (UNCLASSIFIED)

An experimental method for measuring effective lifetime of minority carriers in the base has been set up in order to find out if and how lifetime affects recovery time in the surface-barrier transistor. The method of measuring lifetime is based on a method described by S. Lederhandler and L. Giacoletto ("Measurement of Minority Carrier Lifetime and Surface Effects in Junction Devices") in the April 1955 issue of

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the Proc. I.R.E. Of 37 surface-barrier transistors selected at random, the average lifetime was found to be in the order of 7 microseconds with a range of from 0<sup>+</sup> microsecond (as determined by this method) to 21.8 microseconds. Some correlation between lifetime and recovery time was found, and in general those units having very short lifetimes were found to switch the fastest and those having very long lifetimes were found to switch the slowest.

#### Flip-Flop

(K. H. Konkle) (UNCLASSIFIED)

During the past several weeks, a printed-circuit board for the Group 63 flip-flop has been designed. It is now at the Div. 7 wiring shop and should be available within the next week for tests and incorporation into mockups of the multiplier.

Further tests are being made on this flip-flop to determine maximum loading, trigger requirements, and component margins.

#### Pulse Generator

(M.E. Petersen) (UNCLASSIFIED)

A breadboard transistor pulse generator has been completed. The driver is a Hartley oscillator followed by a buffer amplifier. This unit operates in the 4 to 10 megacycle pulse rate range.

The difficulty with hole storage in the pulse generator was reduced by using RC coupling from the emitter-follower driver. The generator will produce 50-musec pulses at any rate up to 10 megacycles when driven by a source with short rise time. A multivibrator has been used for pulse rates below 2 megacycles.

#### Alpha-Cutoff Frequency

(P. Griffith) (UNCLASSIFIED)

Measurements of alpha cutoff for the surface-barrier transistor are being studied with the transistor operated with grounded emitter.

#### Breadboard System of Pulse Distributor

(M. Cerier) (UNCLASSIFIED)

The breadboard system of a pulse distributor for the multiplier has been debugged. It was found that the system did not work well when the driving pulses come from an inverter. An amplifier using pulse transformers was tried, and it worked very well. The transformers tried

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were 0.1- $\mu$ sec pulse transformers available from stock.

The delay in the flip-flops is short enough so that all of the output gates operate at the proper time with respect to the input pulses.

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### 3.4 Memory

#### ID-1 Memory

(J. L. Mitchell) (UNCLASSIFIED)

The following changes have been made in Bank II of the ID-1 memory in an effort to improve the operating margins:

1. The d-c lines to the selection-plane drivers have been properly decoupled;
2. The ground return in the secondary circuit of the memory-driving pulse transformers has been eliminated in order to reduce the effective coupling between unselected X and Y lines and those digit-plane windings driven during write time;
3. The cathode followers on the  $2^0$  and  $2^6$  MAR flip-flops have been speeded up to eliminate a timing race in the read-write gate generators;
4. The driving currents have been adjusted so they are symmetrical.

In order for this memory to operate properly, two more situations need to be improved. The "start memory" pulse needs to be cleaned up, and the response of the sense amplifier needs to be improved so that it is approximately equal to the response of the MTC amplifier.

#### 256 x 256 Memory

(J. L. Mitchell) (UNCLASSIFIED)

The design of the vacuum-tube plug-in unit is about complete, and the design of the frame has started.

Fifty switch cores have been received from Magnetics, Inc.

#### 256<sup>2</sup> Plane

(J. Raffel) (UNCLASSIFIED)

First tests on the 256<sup>2</sup> plane have revealed some curious capacitive-coupling effects on the sense winding which are being investigated further.

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Visit to Philco

(J. Raffel) (UNCLASSIFIED)

Discussions with the transistor people at Philco have indicated a great deal of interest in the problem of designing transistor memory-line drivers, and confidence in their ability to apply the techniques used in SBT fabrication to higher-power transistors.

V.T. Plug-in Unit

(E. A. Guditz) (UNCLASSIFIED)

Drawings are completed and a prototype is being built.

Design of the racks to support the plug-in units has been started.

256 x 256 Memory

(E. A. Guditz) (UNCLASSIFIED)

The prototype 256<sup>2</sup> memory plane is undergoing tests.

Eighty-three mats have been made to date. Two mats have all windings installed, and 81 lack the second half of the sense winding. This wire will be installed when the mats are put into unit frames.

Eight wired unit frames have been received from the vendor and are being inspected.

Memory Test Setup VIII

(D. H. Ellis) (UNCLASSIFIED)

A prototype of the core-switch plug-in unit has been completed. The final construction details are being settled rapidly, and the units will go into production soon.

The third batch of switch cores has been received from Magnetics, Inc. Tests show an average increase in switching time of about 7% over the previous batch of cores. Succeeding test will indicate the effect of this difference on switch operation.

The memory-address register (MAR) and associated cathode followers have been assembled and checked out.



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Sensing Amplifiers, XD-1

(S. Bradspies) (UNCLASSIFIED)

Data is being accumulated in an effort to discover why the sensing amplifiers built for XD-1 do not operate satisfactorily, whereas those used in MTC are all right. The circuits are essentially the same, but the XD-1 amplifier is considerably slower than the other.

It is hoped that the weak spots can be discovered and corrected.

## 3.6 Systems Design

(J. Fadinan, Bob Hughes) (UNCLASSIFIED)

Work is continuing on optimizing the delay-line flip-flop. The addition of positive bias to the bases of the flip-flop and inverter transistor has improved operation so that the flip-flop operates with margins when unbalanced transistors of current gains equal to  $h_{fe}$  and  $h_{fc}$  are used. The output waveform has been improved, and a cascade output circuit is being studied.

(C. Norman) (UNCLASSIFIED)

Low-voltage characteristics of several Philco surface-barrier and General Electric 2N43A transistors have been plotted.

Resistance measurements are being taken on the plug-in unit sockets and the taper pin connectors.

(R. Sawyer) (UNCLASSIFIED)

A 3-digit accumulator is being assembled to collect data necessary in making some system decisions.

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## IV - CENTRAL SERVICES

4.1 Material Requirements & Stock

(H. B. Morley) (UNCLASSIFIED)

Electric Machinery Manufacturing Company expects to make early shipment of the 48-kva M-G set for WWI filament power.

We are cooperating with H. F. Mercer in obtaining information and samples for XD-1 lighting studies.

April was only slightly below the month of March (an all-time high) in number of requisitions placed.

4.2 Engineering Services4.2.1 Components

(C. Morrione, R. J. Biagiotti) (UNCLASSIFIED)

Biweekly visits to IBM's component sections at Poughkeepsie and Kingston are being made to avoid duplication of effort and to help with XD-1 component failures wherever possible.

An incremental inductance bridge has been ordered to increase the scope of our testing facilities.

The latest sample of the Nike style connector submitted by Cinch Manufacturing Corporation appears to be much better than its predecessor whose engaging screw threads stripped after a few engagements; it seems that we now have an acceptable model for duplex use.

4.2.2 Test EquipmentTest Equipment Committee

(L. Sutro) (UNCLASSIFIED)

Al Roberts has been elected to the Committee to succeed E. Rich as representative of Group 64.

The Committee has approved purchase of the following equipment:

<u>Unit</u>	<u>Mfr.</u>	<u>Model</u>	<u>User</u>
Incremental Inductance Bridge	Freed	1110-AB	Components Laboratory
Polyranger (ma and amp d-c scales)	Sensitive Research Instrument Corp.	1-C	Group 65 Barta Bldg.
Millivoltmeters	Millivac	MV-17C	Transistor Systems Sect., Group 63

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Test Equipment Headquarters

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

A. Bille spent 4 days at DuMont's Instrument Division in Clifton, New Jersey, to learn maintenance procedures for DuMont instruments. He brought back procedures which he is now teaching to the other test equipment technicians. He talked to the designers of the DuMont 336 scope who know our complaints about it. They are bringing out a new model that should overcome many of our objections. However, they plan to continue the use of printed wiring which we find can break without giving visible evidence.

The 140 units of test equipment built into MTC are undergoing test where they are. One technician operates portable test equipment at the front of a row of the computer while another makes power and signal connections at the back of the row. Each unit is marginal-checked by varying filament voltage and pulse amplitude.

4.2.3 Mechanical Engineering

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

Design is complete and fabrication is in progress for the adaptation of a standard O-15 Fairchild camera for recording ID-1 and ID-2 situation display.

Design involved reworking the camera film counter; mounting the camera to the console face through the use of a light-tight shroud; providing gages to optically align the tube to camera; supplying an auxiliary means of inspecting display without operational interruption; and, concurrence with IHM, leading to revision of the display console to restore functional design.

4.2.4 PowerLab D-C Power

(S. T. Coffin) (UNCLASSIFIED)

A Mod. II amplifier has been installed in the lab +10-v supply to improve regulation. All of the lab supplies except the low-voltage supplies (-150, -30, +10) are now regulated to within  $\pm 3\%$  throughout the lab and may be used to calibrate voltmeters.

Reconstruction work has been completed on the 30-amp, 0-500-v regulated supplies to be used as a lab and MTC spare.

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A +250-v and a -300-v regulated supply have been built for Group 65 to relieve the load on the Barta Bldg. lab supply.

A reshuffling of the lab supplies may be necessary to provide MTC with a +150-v, 50-amp supply.

#### 4.3 Drafting

##### Slides

(A. M. Falcione) (UNCLASSIFIED)

A master slide file is maintained in the Division 6 Document Room (C-129) for use of Division 6 staff members and other personnel. It is very important that slides be returned to the Document Room after their use so that they will be available to other personnel when required. We are currently making an inventory of all the slides on hand, to bring our slide file up to date. All missing slides will be duplicated by the Division 6 Photo Lab. A master card file is being established for each slide which can be used for reference by Laboratory personnel in locating slides for any particular use.

Some staff members have had slides made by the Lincoln Laboratory Photo Lab. It is the practice of the Lincoln Laboratory Photo Lab to make slides for individual requests. The slides and the negatives are given to the originator of the request. The Photo Lab had no files or records on hand for duplicate purposes, except for classified work. In order to keep our slide file up to date at all times, it would be greatly appreciated if staff members who have slides made in the Lincoln Laboratory Photo Shop return the negatives and slides to the Document Room so that they may be incorporated into the master slide file. All slides which are now not being used should be returned to the Document Room for safe keeping.

##### Distribution of Confidential Draft Memoranda

(A. M. Falcione) (UNCLASSIFIED)

In order to assist group secretaries in the distribution of classified draft memoranda, plans are being formulated to have the Division 6 Document Room take over this activity, especially where the memorandum has a wide distribution within the Laboratory. It will probably be some weeks before this plan is placed into operation because of the security requirements on new personnel. This will greatly assist the secretaries by eliminating time loss in the distribution of these memoranda.

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4.4 Administration & Personnel

4.4.1 Staff

(J. C. Proctor) (UNCLASSIFIED)

New

Richard Russo is a new staff member assigned to Group 61. He received his MA in Math from Boston College and was employed by the American Optical Company.

Terminations

Andrew Favret  
Philip Morrill

4.4.2 Non-Staff

(R. A. Osborne) (UNCLASSIFIED)

New

William Butler has returned from the Army to rejoin the Construction Shop.

Janet Mobilia is a new clerk in the Print Room.

Martina Van Oosten has come from the Division 1 Purchasing Office to be a secretary in the ADES Group.

Sidney Witzer has come from Group 3 to be a clerk in the Duplicating Room.

Terminations

Barbara Clouther  
David Johanson  
Richard Di Nolfo

Open Requisitions

1 Clerk for the Print Room  
2 Clerks for Group 61 (IBM Operators)  
1 Clerk for Group 62 (Systems Section)  
1 Clerk-Typist for Group 61  
1 Electronic Draftswoman  
1 Electro-Mechanical Checker  
2 Lab Assistants for Group 63 (Chem. Section)  
1 Secretary for Group 60  
1 Technician for Group 63 (Memory Section)

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UNCLASSIFIED

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Accessions List

(Frances Christopher) (CONFIDENTIAL)

The following documents were published by Division 6 or received from IBM during the period 9 May - 20 May 1955:

<u>NO.</u>	<u>AUTHOR</u>	<u>TITLE</u>	<u>CLS.</u>
6M-1377-6	J. K. Gerhardt	Internal Documents on Ferromagnetic and Ferroelectric Cores	U
6M-2953 S#1	C. C. Grandy	Revision of Program Specifications for Height-Finding Section of 1954 Cape Cod System (Supplement to M-2706: 1954 Cape Cod System)	C
6M-3159-1	E. D. Lundberg	Summary Equipment List for Sage System Direction Centers	U
6M-3330 S#3	A. R. Shoolman	Changes in 6M-3330 Occasioned by AN/FSQ-7 Direction Center Floor Plan Revisions	C
6M-3449-1	J. Giordano	Current XD-1, FSQ-7, and FSQ-8 Brief Index Listings	U
6M-3506 S#1	F. M. Garth	Errata in 6M-3506	U
6M-3575-1	S. J. Hauser R. R. Everett A. P. Kromer	Space for Non-Lincoln Personnel Associated with Operation of XD-1 Experimental Sub-Sector	C
6M-3452	J. Ackley	Description of ISR Series 3613	U
6M-3473	T. Clough	Vacuum Tube Failures During the Month of February 1955	U
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6M-3591	T. Clough	Vacuum Tube Failures During the Month of March, 1955	U
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6M-3594	TCSS Group 6I	Cape Cod System Weekly Operations Schedule	U
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6M-3596	J. J. Cahill	Proposed Operational Specification for the Sage Anti-Aircraft Direction Center	S
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6M-3598	A. Smalley	Cape Cod System Mission Specifications 67-55 for a Simulated Training Mission on May 19, 1955	U
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6M-3602	H. E. Anderson	Minutes of Sage Experimental Subsector Planning Approval Committee Meeting of May 9, 1955	C
6M-3607	A. Smalley	Cape Cod System Mission Specifications for a Track Monitoring Test (MS) on Friday 20 May 1955	U
6M-3608	A. Smalley	Mission Specification 71-55 for Orientation and Holmes Data Mission on Tuesday 17 May 1955	U
6M-3612	A. Smalley	Sage System Meeting 5 May 1955	U
6M-3681	A. Smalley	Cape Cod Mission Specifications 59-55 for Track Accuracy (ABN) Mission on Tuesday 10 May 1955	U

IBM DOCUMENTS

IBM-742	-----	Programmers Reference Manual -- Drum System	C
IBM-743	-----	Central Computer System -- Memory Element	U
IBM-744	-----	Project High Biweekly Progress Report #53	C
IBM-745	-----	Central Reference Room Bulletins #79	U
IBM-746	C. R. Gordon	Arithmetic Model From Production AN/FSQ-7	U
	J. W. Smith	Circuits	U
IBM-747	H. E. Cooley	Engineering Changes to Printed Circuit Cards and Card Assemblies	U
IBM-748	-----	Central Reference Room Bulletin #80	U
IBM-749	-----	Project High-Section 6.0-Warning Light System Subcontract Exhibit	U
IBM-750	H. Kurkjian	Input-Output Operations Traffic Charts for AN/FSQ-7	U
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IBM-751	H. Kurkjian	Warning Light System Test and Summary of System Test Activities Phase IX	U

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DR-234	D. C. Ross	Concurrence on Specifications for the Input Patterns Generator
DR-235	R. W. Lowrie	Supplement 6 to the Specifications for the AN/FSQ-7 Auxiliary Console
DR-236	R. W. Lowrie	Supplement 4 to the Display Console Specifications for AN/FSQ-7
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DR-238	R. W. Lowrie C. E. Walston	Concurrence on D-69. "Tape Power Supply Unit for AN/FSQ-7"
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6M-5000	STO	Sage Test Program Reporting Procedures
6M-5001	G. Harris et al	Outlines and Work Items for 1954 Cape Cod System Test Program
6M-5001 S#1	A. Wright	Same Title
6M-5002	STO	Sage Test Committee Meeting #1
6M-5003	STO	Computer Programs and Facilities Required for the Test Evaluation of the Experimental Sage Subsector
6M-5004	STO	Preliminary Outline of Test Program for Experimental Sage Subsector
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6M-5013	W. Z. Lemnios	Test Specifications: Interceptor Tracking Accuracy Tests, Non-Maneuvering Courses

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