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

SUBJECT: BIWEEKLY REPORT FOR 22 APRIL 1955

To: Jay W. Forrester

From: Division 6 Staff

Approved: John C. Proctor

CONTENTS

I - SYSTEM TEST & PLANNING

1.1 Air Defense

1.1.1 Test Program

(D. R. Israel) (CONFIDENTIAL)

Progress on the 1954 Cape Cod Test Program continues at an accelerated pace. Large-scale testing will definitely be under way by mid-May and is now scheduled through November of this year. An important factor in the satisfactory progress over the past few weeks has been the generous cooperation and assistance of Henry Frachtman and Jack Nolan.

A good deal of the initial planning for the test program for the Experimental Subsector (XD-1) has been completed. These plans have been prepared as proposals for the SAGE Test Committee; the Committee may later issue this material in M-note form.

The research reported in this document was supported jointly by the Department of the Army, the Department of the Navy, and the Department of the Air Force under Air Force Contract No. AF 19(604)-458.

(E. Bedrosian) (CONFIDENTIAL)

The magnetic-tape read-in subprogram of the system-simulation program has been written but has not been checked out as yet. The association subprogram is in the process of being written. These subprograms will be checked out simultaneously.

(A. E. Budd) (CONFIDENTIAL)

Because of a slight delay in programming, the subroutine to read in data from magnetic-tape records will not be checked out before 1 May.

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

Groups 22 and 61 have combined their scheduling endeavors for technical evaluation requirements into a single effort currently coordinated through the Test Coordination Sub-Section. The TCSS scheduled 27 missions:

4 Holmes' (for fine-grain-data test)

3 Orientation (OBX and OBS)

2 Semiautomatic height (Ht)

1 Live training (LT)

1 Radar mapping (RM)

4 Power level (PL)

4 Lobe structure (C)

2 Informal demonstration, simulated

6 Mark X blip scan (BSX)

The live-training test was cancelled as being inappropriate at this time. One of the Holmes' tests was cancelled for nonavailability of aircraft. The remaining 25 were conducted as scheduled.

(F. W. Graham) (CONFIDENTIAL)

I am writing a routine for sine ($\theta + \Delta\theta$).

(I. B. Hazel) (CONFIDENTIAL)

I completed the writing of the situation-display specifications. This was part of my contribution to a comprehensive memo on master makeup display specifications of CCS 1954.

I was briefed on the recording program of CCS 1954 and tracking functions. I am at present drawing up a flow diagram to give an operations summary printout, which will print out selected counts which summarize, scan by scan, the over-all system activity.

(H. A. Keit) (CONFIDENTIAL)

Work progressed on the program for transferring data from one magnetic-tape record (1954 CCS) to another. The writing of this program was completed and checkout on WWI begun.

The assignment to work with W. P. Harris of Group 38 initiated the study and observation of mapping procedures.

(D. Latimer) (CONFIDENTIAL)

I have begun preliminary work on the proposed "detailed single track history printout" program, and I am continuing to rewrite the tables in Memorandum 6M-3078 to be included in the memorandum of all CCS tables.

(W. Z. Lemnios) (CONFIDENTIAL)

A survey memo is being written which will outline all tests involving interceptions. The memo will be circulated to interested persons for their comments.

Letters were sent to 20 organizations, inviting them to send representatives to the June seminar on interceptor vectoring. Some replies have already been received.

I spent 2 days talking with Dr. Harold Linstone of Hughes Aircraft Co. on interception problems which may arise in the past-1960 era. Dr. Linstone is making a study of these problems and has agreed to keep us informed of some of his findings.

(J. Levenson) (CONFIDENTIAL)

A rough draft of a memo entitled "Considerations in the Design of the Data-Simulation Facility for the 1954 Cape Cod System" has been completed.

Programming of the post-test data-reduction programs described in 6M-3448 (issued as a draft memo on 14 March 1955) should be finished in 2 weeks. I have written one of these programs which will display and photograph track positions and track numbers.

(A. H. MacIntire) (CONFIDENTIAL)

During the past biweekly period the SAGE Test Office has issued 6M-5002, "SAGE Test Committee Meeting No. 1," and has continued discussion of forms and routines for scheduling work items.

The draft of 6M-3385, "Outlines and Work Items for the Test Program," has been retyped and will be issued as 6M-5001.

(A. Mathiasen) (CONFIDENTIAL)

The Raydist data collected so far is being processed as it comes from the Tape Room.

The calibration program has been run with only one set of data, collected on 5 January. Values of the parameters a, b, c, and d in the equations

$$R = ar + b$$

$$\Theta = c\theta + d$$

where r and θ are the radar range and azimuth, and R and Θ are the range and azimuth given by Raydist, were determined for Mark X and South Truro. For South Truro, these values are

$$a = 1.05$$

$$b = -4.07$$

c = 1.00

d = +1.69

Strictly, these numbers are valid only for the intervals (78.5, 107.75) in r and (196.5, 229) in θ. Thus a 1-mile correction is the maximum made for r in this range.

For Mark X, the values

c = 0.99

d = 3.14

were obtained. This is for the interval (206, 224) in θ. Since all the data occurred at approximately the same range, no determination of a and b could be made for Mark X.

It should be noted that the accuracy of the determination is dependent on the length of the interval as well as the distribution of data over the interval. For a longer interval, it seems likely that the constant terms will be closer to zero than those given above. A further point to be made is that the Raydist data upon which this is based has not itself been checked for accuracy, and that until this has been done, results have to be taken on faith.

The Raydist memo has been typed for publication, but this will be slightly delayed until an appendix describing operating procedures has been written.

I am gradually embarking upon the program of track-monitoring tests. Jack Nolan and I have had a couple of discussions on the over-all problem.

(E. McEvoy) (CONFIDENTIAL)

Two tests of the 1954 Cape Cod System semiautomatic height finding were conducted in the past biweekly period. The first test was fairly successful, but the second was almost entirely worthless because of a disagreement of parity between South Truro equipment and that at Barta and large errors in x, y to r,θ conversion at the site.

The extrapolation mode of the new start-over program was used operationally for the first time and operated successfully.

(R. L. Smith) (CONFIDENTIAL)

A second interceptor simulator station was proposed for the 1954 CCS. The drawings required to effect this change have been completed.

I am presently familiarizing myself with mission operations.

(W. Vecchia) (CONFIDENTIAL)

	hr	min
Total Assigned Time	113	
Extra Assigned Time	1	25
	114	25

	hr	min
Raydist	30	25
Analysis	20	05
Tracking and Weapons Direction	17	45
Equipment Checkout	5	20
System Operations	12	35
Indoctrination	1	30
TOTAL	87	40
Time Given 6345	13	30
Time Given Systems	11	
Time Lost Computer (malfunction)	2	15
TOTAL	26	45

	hr	min
	87	40
	26	45
GRAND TOTAL	114	25

1.1.2 Analysis and Simulation

Manned-Interceptor Simulation

(H. D. Neumann) (CONFIDENTIAL)

A new control program which punches the results of 100 runs in binary form on IBM cards was added to the manned-interceptor simulation program. This enables one to read this information back into the computer for evaluation at any desired time by another program.

A program was also written which adds increments to the reference starting positions of the target and the interceptor in x and y. The increments are evenly distributed within ± 1 mile. Also, a program is available which adds normally distributed noise to the simulated radar data R and Θ of target and interceptor with specified standard deviations.

(B. Smulowicz) (CONFIDENTIAL)

The MTC displays of all 320 vectoring limits have been photographed. However, because of improper scope and camera adjustment, many of the photographs turned out to be of insufficient quality, and most of the process will have to be repeated.

Work is being continued on the correlation program to be used with the manned-interceptor simulation.

Tracking and Monitoring Test Series

(J. Nolan) (CONFIDENTIAL)

Test specifications for the series of tests of the 1954 Cape Cod System tracking-monitoring tests have been written. The form of tabular data to be derived in an initial stage of data reduction is included. I have begun work on a program to process the output data of the data-generation program, which is recorded on magnetic tape, and to derive from this data a printed record of the actual positions and velocities of the simulated tracks and a punched paper-tape record of the same data in 556 form. This punched paper-tape record will be used as one input to data-reduction programs for post-test analysis.

Charactron Display

(H. D. Houser) (CONFIDENTIAL)

No further work has been done checking out a combined Charactron-Typotron display, since the Typotron tube has not been installed in the display console yet.

Analysis of Blip-Scan Data

(H. D. Houser) (CONFIDENTIAL)

A program to punch out blip-scan data stored on four drum fields of MTC and a program for reading this information back into the computer are being written.

Numerical Evaluation of Markov Processes

(C. Friedman) (CONFIDENTIAL)

A new program has been written and is presently being checked out. The purpose of this program is to evaluate the existing initiation schemes and compare them with other forms of initiation.

Raydist Tests

(B. Stahl) (CONFIDENTIAL)

Almost 50% of this period was spent on routine duties associated with the Raydist program and the memorandum concerning it. It is believed that with the publication of the Raydist memorandum my attention may be directed entirely to the works in Wells' Section.

Having become somewhat familiar with MTC, I have now begun to work on the blip-scan ratio analysis program. Several sections of the flow diagram have been written, and parts of the program are coded.

Data Processing

(H. Peterson) (CONFIDENTIAL)

The data-mapping program mentioned in the last Biweekly has been converted and is awaiting its initial checkout on the computer.

While waiting for the program to be converted, I have been annotating the monitor program for the 1954 CCS.

MTC Diagnostic Program

(R. Sittler) (CONFIDENTIAL)

A general-purpose diagnostic program for MTC has been completed.

Radar Coordinating Committee

(W. Wells) (CONFIDENTIAL)

A Radar Coordinating Committee has been formed to study the needs of new types of radars for use by SAGE. Along with F. Heart and F. Gucker, I have attended several of these meetings. The Committee has expressed a need for more information about the data requirements of SAGE. Questions of radar-data accuracy, ratio, and resolution in any or all coordinates, have arisen. While our knowledge of specific numbers is limited, we have been asked for our best guess along these lines. I am preparing a brief memo discussing these parameters. This memo will be circulated in Group 61 for comment. A final copy will be presented to the Coordinating Committee.

Passive Tracking

(F. Gucker) (CONFIDENTIAL)

Study is continuing on multiple-aircraft tracking using azimuth information only. During the past biweekly period I have attended several meetings of the Radar Coordinating Committee with W. Wells and F. Heart.

1.1.3 SAGE Training

(S. Hibbard) (CONFIDENTIAL)

The Training Section in conjunction with Section "C" has been developing an experimental training program for operators of the Cape Cod 1954 System. Rough drafts of all position manuals have been written, and some training aids such as charts and slides have been procured. The prospect of the above course seems to have generated a good deal of interest by agencies outside of Lincoln interested in the SAGE System.

The Training Subcommittee held a meeting at ADES, W. E. Co. in New York on 21 April, at which the report for "Proposed Training Personnel Study for the McGuire Subsector" was discussed. The report will eventually be a document telling how the personnel for McGuire can be trained in a specified amount of time. It does not say that it must be done this way, only that it can be done. The Air Training Command representative on the Subcommittee was noncommittal as to whether or not the Air Training Command would agree with the report. In that it did not commit Lincoln to any action not already concurred in, Lincoln representatives offered no objections to the report.

1.1.4 Coordination

(P. R. Bagley) (CONFIDENTIAL)

I have prepared an M-note proposing the establishment of a SAGE programming information service. This service would undertake to provide answers to questions relating to computer programming in the SAGE System and would keep programmers informed of all changes and additions in the System which affect programs and programming techniques.

I have prepared a second M-note outlining an abbreviated training course to teach personnel already experienced in programming for Cape Cod to program for XD-1.

Work continues on a proposal for training all personnel who will need knowledge of computer programming in the SAGE System.

(A. P. Hill) (CONFIDENTIAL)

The final draft of the syllabus for the next Air Defense Familiarization Course to be given by Group 61 has been prepared and will be published as an M-note within the next 2 weeks. It is now planned that the next course will be given from 9 May through 20 May 1955.

(H. K. Rising) (CONFIDENTIAL)

Time-Division Data Link

A BTL proposal for providing a time-division data link capable of communicating with both the proposed GE Time Division aircraft receiver and the BTL receiver was presented to members of Divisions 2,3, and 6 at a meeting in R. R. Everett's office on 14 April 1955. The BTL proposal was generally accepted as adequate for our data-rate needs and compatible with the output from an uninterleaved output section.

Console Layouts

The console layouts have been completed on work sheets for signoff by Group 61. These revised layouts for XD-1 and for production machines should be ready for publication by the end of next week. The switch-label information is being obtained as the layouts are being approved, so this information should also be available by the end of next week for publication the following week.

1.1.5 Tracking

(W. Attridge, D. Bailey) (CONFIDENTIAL)

We have continued working on the operational-specifications outlines concerning radar inputs, automatic tracking, and initiation.

(P. Bragar) (CONFIDENTIAL)

I have prepared a preliminary outline of the operational specifications for the Subsector Command Post. This consists of specifications for the "big board" display and specifications for the Command, Staff, and the Liaison Personnel associated with the Command Post. These specifications will be circulated within Group 61 during the next 2 weeks for comments, corrections, and additions.

We are receiving active and excellent cooperation from the ADC personnel now at Lincoln in the preparation of the specifications.

(F. Brooks) (CONFIDENTIAL)

I have been working on operational outlines, on coverage masking and area discrimination, and on an XD-1 utility program.

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

Initial outlines of the operational specifications for the crosstelling and monitoring functions are being prepared prior to discussion of the outline with the Tracking Section.

(W. Lone) (CONFIDENTIAL)

An outline is being drawn up for the operational specifications of the raid-forming function in a SAGE Direction Center.

Repeated requests for flexibility in the Subsector Command Post of a SAGE Direction Center, an area lacking operational experience, have been unheeded. As a result, no movement of consoles will be possible if decisions made 6 months ago on their location should prove incorrect.

(E. W. Wolf) (CONFIDENTIAL)

A number of operational outlines of the SAGE System data-input and Mapping Supervisor functions have been submitted for discussion purposes.

Work on the memorandum dealing with SAGE System data conversion and transformation is continuing. Preliminary calculations indicate that automatic tracking in areas of overlapping coverage requires that the locations of the radar sites be determined to within 7 seconds.

1.1.6 Program Organization

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

For the past 2 weeks I have continued to revise memory tables for the 1954 Cape Cod System. These revisions will be incorporated in a memorandum to be published the first week in May.

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

We have continued studying utilization of AN/FSQ-7 situation display off-centering and expansion facilities; a memo covering this work will be published the week of 25 April as Memorandum 6M-3549, entitled "Proposed Utilization of AN/FSQ-7 Off-Centering and Expansion Facilities for SAGE Subsectors 1-11."

(L. B. Collins) (CONFIDENTIAL)

I have been engaged in the preparation of Memorandum 6M-2977, "Master Makeup and Display Program Specifications," to be issued shortly.

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

Work continues on programming, checking out, and wiring printer boards for the following utility programs:

1. Assembly
2. Read in
3. Subroutines

Memorandum 6M-3494, "XD-1 Card Forms and Card Preparation," has been issued.

(P. Guinard) (CONFIDENTIAL)

	hr	min
Total Assigned Time	9	20
Program Checkout		
Utility	7	40
Down Time		
In-Out Equipment		50
Computer Malfunction		50
TOTAL	9	20

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

We have defined the logical categories to be used to provide each situation-display console with necessary displays, subject to the questions presented for consideration in PL-XX-87, "Operational Questions Affecting Situation Display Specifications for the SAGE System," circulated this week. We are completing organization of Memorandum 6M-3550, tentatively titled "AN/FSQ-7 Situation Display System Specifications," to be issued.

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

We have been assigned to the Program Organization Section to study standby computer operations. We have prepared a rough draft of our work schedule through 15 September and have started familiarizing ourselves with the facilities for intercommunication between the active and standby computers.

1.1.7 Weapons Direction

(C. A. Zraket) (CONFIDENTIAL)

Group 61 requirements for the scheduling of equipment installation (radars, communications, computer, etc.) for the first SAGE Subsector at McGuire AFB and the utilization of the Direction Center for system checkout and tests have been reviewed with K. McVicar. The same requirements for the XD-1 Subsector have also been reviewed with J. Jacobs. In connection with both of the above, all three Sections in Group 61 associated with SAGE planning are now preparing detailed work schedules for the preparation of operational and program specifications and for the coding and checkout of the Direction Center master program. These should be availably by 11 May 1955. All groups desiring such information should route their requests to J. Jacobs.

The integration of the AA System with SAGE was discussed with representatives of Signal Corps Engineering Labs (SCEL) at a meeting held at Lincoln Laboratory on 20 April 1955. The Army proposal outlined in SCEL Memorandum 1650 was discussed. A second meeting on the same subject is scheduled for about 11 May 1955. Refer to J. Cahill's biweekly report for further details.

This Section is now preparing and discussing detailed outlines for the five functions (weapons direction, identification, manual inputs, height finding, and AA) which are its responsibility. These outlines serve only to define the job to be done. Detailed proposals will be forthcoming in about 4 weeks after discussions on mutual problems have taken place with the Tracking and Program Organization Sections.

Work on the Quarterly Progress Report for the last quarterly period has been started. A rough draft should be available by 27 April.

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

A meeting was held at Lincoln on 20 April 1955 to discuss the problems of integrating antiaircraft with SAGE. SCEL, ADES, IBM, ADC, Army "user" agencies, and Lincoln were represented. Certain areas of agreement were discovered and problem areas defined. Results of the meeting will be reported in an inter-office memo and will be reflected by the forthcoming operational specification for SAGE antiaircraft direction.

(A. R. Chandler) (CONFIDENTIAL)

I have completed my responsibilities for master makeup and display program specifications for the 1954 Cape Cod System. I have begun the study of the problem of weapons direction for the SAGE System. Within the next biweekly period, I also shall publish a memorandum describing utility programs available for the Cape Cod System.

(H. Frachtman) (CONFIDENTIAL)

The outline of the height-finding-section specifications for the production system has been finished.

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

A directive for planning and discussion of the operational specifications of the identification and manual-input sections has progressed to a rough-draft stage. Final draft will be ready for publication by the week of 25 April.

(R. A. Nelson) (CONFIDENTIAL)

I am working with Grandy and Chandler on writing operational specifications for the Weapons Direction Section; specifically I am concerned with crosstelling as it affects weapons direction and with intercept direction.

1.1.8 Special Studies

(A. G. Favret) (CONFIDENTIAL)

Information has been received indicating that the Army has adopted the plan for employment of antiaircraft as proposed by the Signal Corps Engineering Laboratories (SCEL) in their TM 1650. (Pertinent portions of this document are available as DR 207.) The integration of this separate system within SAGE poses a number of operational and equipment problems, some of which are presented in 6M-3525. In order to resolve these questions, a meeting with appropriate Army agencies is planned about the middle of May. A preliminary meeting was held at Lincoln Laboratory on 20 April with SCEL representatives to discuss most of these questions.

Several Boeing representatives visited the Laboratory on 21 and 22 April to discuss possibilities for testing the IM-99 (Bomarc) or its guidance equipment under SAGE conditions, ground-to-air data-link status, test plans, and simulation results.

(F. E. Heart) (CONFIDENTIAL)

Most of the last biweekly period has been spent attending meetings of the Lincoln Laboratory Radar Coordinating Committee and studying problems associated with these meetings.

Effort is continuing on the problem of tracking with azimuth information only.

1.2 Whirlwind I

1.2.2 WWI System Operation

Records of Operation

(M. F. Currier, B. H. Jacobs) (UNCLASSIFIED)

The following is an estimate by the computer operators of the usable percentage of assigned operation time and the number of computer errors for the period 8 - 21 April 1955:

Number of assigned hours	165
Usable percentage of assigned time	97
Usable percentage of assigned time since March 1951	90
Usable percentage of assigned time since September 1953	94
Number of transient errors	3
Number of steady-state errors	4
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, 8 - 21 April 1955, inclusive:

Total number of failures	17
Total number of no-lost-time failures	1
Total number of lost-time failures	16
Total lost time in hours	7
Total operating time in hours	273.2

Class of Failure	Attributable to New Installation or Modification		Essential Maintenance		Chargeable to System			
					Explained		Unexplained	
	No.	Min.Lost	No.	Min.Lost	No.	Min.Lost	No.	Min.Lost
Tubes					1	5		
Video Cables and Jacks; Wiring Errors					1	0		
Passive Electrical Components	1	60			1	70		
Fuses					1	23	2	128
Alarms					1	5	6	28
Miscellaneous			1	20			2	76
Number of Lost-Time Incidents	1	60	1	20	4	103	10	232
Number of No-Lost-Time Incidents					1	0		

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

The computer reliability for this period was very good. The majority of down time was caused by a faulty relay in a switch panel for the Ferranti reader. Seven transient alarms interrupted computer operation.

One of the reasons for the increase in computer reliability may be the decrease in the number of installation periods and changes in design that are being made. Almost all the maintenance work has now been confined to marginal checking.

1.2.3 Terminal Equipment

SDV Signal Generator

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

The test-equipment setup originally assembled for the IBM mapper test has been installed in Room 224. The logic has been modified to produce test signals which will be useful for Ampex recorder tests and SDV demodulator studies.

Room 224 Power

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

Due to increased loading of the laboratory +250-v supply by Group 65, it has been necessary to switch Room 224 over to WWI supplies. Until an increase is made in the capacity of the lab supply, Room 224 will remain on WWI power. No difficulty is anticipated provided rack power controls in Room 224 are left on.

14-Channel Ampex Recorder

(N. N. Alperin) (UNCLASSIFIED)

A playback preamplifier panel is being built to improve the reliability of the Ampex recorders. In order to check the preamplifiers and the new Mylar tape, a computer program was written which will give a count of the various types of extra data introduced by the recorder. (Contrary to popular belief, data is not lost in recording.) The program was checked and found to work; however, the criteria used to detect this extraneous data were found to be wrong. A new set of criteria was chosen and will be checked during the next biweekly period. I hope that by these checks on the recorder a quantitative rather than qualitative picture of the Ampex reliability will be obtained.

MITE

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

The parity FF of MITE 0 has been changed to accommodate the odd parity of the phone-line messages.

The marginal-checking program for Room 156 now includes the complete MITE checking routine and is used regularly.

Typewriter and Paper Tape

(L. H. Norcott) (UNCLASSIFIED)

We recently received complaints that Flexowriter platens would not feed our continuous paper forms. Measurements showed that (1) the last lot of forms we received were up to 3/32 inch undersize; and (2) a couple of the Flexo platens were as much as 1/16 inch oversize. The paper manufacturer has replaced the faulty forms, and the Flexo shop is correcting the platens.

Power Supplies

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

On 22 April a ground appeared on the 575-v distribution system. A scope between the grounded phase and building showed indications of an arcing ground. It took about an hour to locate the ground after discovering the condition. The ground had occurred in the motor on the roof. The motor had burned out but had not tripped its starter. If the distribution system was operated with a grounded neutral, the best modern practice, instead of floating, the fault would have cleared itself and WWI equipment would not have been subject to overvoltages and the possibility of damaging overvoltages. As is typical with failures of this type, the ground occurred on a piece of noncritical equipment not regularly maintained, so nothing was gained by having an ungrounded system. Since the service is a delta-delta transformer bank and not a delta-wye bank, it is no easy matter to properly ground the system.

Maintenance Programming

(J. N. Ackley) (UNCLASSIFIED)

I've been trying to write a multiple-aircraft multiple-radar tracking program for studies of track-data history, but a program of this nature becomes quites large for one person to handle in a short period of time. To provide some quick track-data histories, I have modified Ben Stahl's Raydist tracking program for direct track-data printout.

A program was also prepared to display any quadrant of the FGD input for an expanded-scale presentation of the FGD data.

II - AN/FSQ-7

2.1 Liaison

2.1.1 System

Production Coordination Office

(A. P. Kromer) (CONFIDENTIAL)

The regular Monthly Status & Progress Meeting covering implementat on of the SAGE System was conducted by ADES on 12 April 1955. The principal items discussed were:

1. The Air Force announced a decision to rent DDR-DDT equipment from the Bell System, except equipment located at gap-filler sites and Texas Towers. Bell Laboratories is going ahead with the design of the equipment on this basis.

2. The maintenance intercom system for Direction Centers, as proposed by Lincoln and IBM, has been approved by the Air Force. This will be a leased, dial system.

3. AT & T Company indicated that they have received necessary authorization to start engineering on external telephone circuits and related equipment for SAGE Subsectors 1 and 2.

4. ADC established a requirement that overlap radars be tied into the Direction Center by the operational date of the subsector concerned. This needs investigation as other schedules, e.g., FST-2 installation, are not set up on this basis.

5. IBM indicated that they did not agree that all proposed class "A" changes (reference TIR 1-57 and associated M-notes) had to be incorporated into the first machine. ADC and ADES will investigate this matter.

6. Following the regular meeting, the decision was made to authorize the six additional auxiliary-memory drums for the AN/FSQ-8. AFCRC Exhibit 18, which is being processed by CRC, will include this requirement in the initial issue of the document.

7. Burroughs made their initial report on the status of AN/FST-2 equipment. They indicated delivery dates for Lincoln model and AF service test units would be 30 days later than initially requested. They asked for contractual coverage for the first group of production (duplex) equipments immediately, since the lead time is already less than the desired 18 months.

At the next status meeting on 10 May 1955, Lincoln Laboratory is to review the status and plans for the Experimental SAGE Subsector.

The Engineering Installation Committee held a meeting on 13 April to consider schedules for installation and associated test work for Subsector 2 (Stewart). While detailed schedules were not available in all areas, it was agreed that they would closely parallel those previously established for Subsector 1.

A draft of a proposal for training AF operational personnel has been prepared by Western Electric - ADES. This was reviewed by Lincoln personnel and preliminary comments forwarded to Western Electric. Use of XD-1 for long-term training is considered inadvisable because of the limitations this would impose on use of the system for development and test work.

The Bell Telephone Laboratories - ADES group has assigned an additional group of men to be resident at Lincoln Laboratory. These men will acquire background in programming and system operation in order to prepare test procedures and evaluation studies for Subsector 1. The group will be headed by Mr. M. Burger, assisted by F. Ong.

(E. L. Smiley) (UNCLASSIFIED)

A proposed revised layout (Dwg. C-62459) of the equipment for the Manual Inputs Room in the D. C. building is being circulated for comments within the Laboratory. All pertinent comments will be appreciated.

A proposed revised layout (Dwgs. SD-75203 and SE-75225) of the Sector Command Post are being circulated among the various outside organizations for comments.

A set of building plans for the fourth building has been received from Burns & Roe for Lincoln comments. These plans are scheduled to go out for bid on 9 May 1955.

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

A date correlation of the IBM and Lincoln Systems Office schedules was tabulated, and variances in the delivery dates was the only alarming factor. It has been suggested that Lincoln Systems Office check into these IBM schedule changes.

A set of SAGE Experimental Subsector schedules (B-75119-1) was posted from the latest information available and issued 22 April 1955. Also, the SAGE and XD-1 progress has been posted weekly on mechanical Produc-trol Boards. Frame status was extrapolated from the latest firmed-up information available. These schedule boards are in the Production Coordination Office for interested people to view.

B-reductions have been made of the SAGE equipment-layout drawings for the purpose of making a handy reference drawing booklet. This booklet contains all equipment-layout drawings necessary for a Direction Center and a Combat Center-Direction Center. Booklet will be ready early in the week of 25 April.

Technical Information Release

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

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

TIR	M-Note	Subject
1-71	6M-3147-2	Master Reference List, Lincoln Laboratory Requirements for Direction Center Buildings.

2.2 XD-1, XD-2

2.2.1 Systems

Logical Services Committee

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

Command Post DD Desk. Three console designs were discussed in the meeting of 6 April which was reported in the last Biweekly. Perspective, side-elevation, and panel-layout drawings are now being prepared for two of the proposed designs. Preliminary sketches indicated that the third design could not satisfy the panel space and line-of-sight requirements, so this design has been dropped. We plan to write a memorandum covering these proposals for the purpose of soliciting comments, so that we may arrive at a final design.

We are working closely with G. Mico, R. Lowrie, and C. Walston of IBM on the writing of specifications for the Desk.

Large-Board Display. We have completed the second revision of the specifications as Memorandum 6M-3439-2, "Proposed Specifications for Large Board Display, Prototype and Production AN/FSQ-7." This has been published and should be distributed by 25 April.

Lexington-Poughkeepsie Data Circuit

(J. P. May) (UNCLASSIFIED)

The use of the Memory Test Computer to generate GFI test patterns to be transmitted to Poughkeepsie to test the mapper consoles has been partially completed. About one-half of the test patterns were fed directly into the gap-filler-input mapper, and the results were satisfactory. The personnel to operate the mapper were not available because of an increased workload at Poughkeepsie; therefore, the remainder of the test patterns was recorded on magnetic tape to be run in the future.

Long-Range-Radar Input Processing of South Truro Fine-Grain Data

(J. P. May) (UNCLASSIFIED)

The equipment changes and contingent schedule were concurred upon by IBM and the Systems Office.

XD-1 Equipment Testing by MTC

(H. I. Rundquist) (UNCLASSIFIED)

Various test patterns generated by MTC were transmitted to Poughkeepsie and recorded for future mapper-console tests. This completes the present testing.

A/G Voice Radio for XD-1

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

A meeting was held on 18 April with representatives of NET&T, AT&T, Division 3, and Division 6 to firm up our requirements for temporary A/G voice-radio circuits for the SAGE Experimental Subsector.

The schedule for the installation of the A/G voice-radio system into the XD-1 Direction Center has now been changed. The site-selection and channel-assignment equipment will not be needed until 1 February 1956. By that time the designed-for-SAGE equipment should be available; therefore, it will not be necessary to provide improvised equipment as previously thought necessary.

Diode-Transformer Gate

(J. D. Crane) (UNCLASSIFIED)

There is a possibility that the physical layout of XD-1 will permit the use of a diode-transformer gate, so a study of the distances and circuits involved is being made before any extensive circuit work is completed.

2.2.2 Installation

XD-1 Installation Information - Report #33 (Extract)

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

I. Building Construction

Since 28 February we have been expecting building acceptance each week. Unfortunately, the current estimate of about 2 weeks is no better than previous ones. CRC Procurement will not accept for the government if certain deficiencies are not corrected; and then, assuming acceptance, Baltimore must be notified and approve such acceptance; further, Air Force transfer to DDL must occur.

At best, 2 weeks seems to be extremely optimistic, but that is the latest estimate we have.

II. Equipment Cooling

Insofar as is possible at the moment, this installation is completed, and testing and checking of the system and its controls is in progress. Final duct installations depend on delivery of the remaining first-floor frames and second-floor consoles. Balancing must follow installation of these items.

III. Cabling

Power cabling, as required under the Livingston Company's contract, will be completed during the week of 25 April, and the contractor is expected to be off the job on or before 29 April. Technicians will install signal cables, as they become available, after 29 April.

IV. Equipment Layout

Projection Room - Francis Associates drawings are being reviewed and modified by Cleverdon, Varney & Pike and this office.

Air Force approval of the layout has not been received. Assuming that this area has to be ready by 1 July, as indicated by the "XD-1 Large Board Display Schedule," dated 31 March, it is hoped that approval will be granted shortly.

V. Lighting

A letter describing what, in our opinion, are deficiencies in the lighting system was sent to the Air Force on 30 March. No formal reply has been received. This, together with the fact that the Air Force is preparing to accept the interior, indicates to us that our complaint is not considered valid. Since the whole dimmable lighting system is under study and probably will be remodeled, we cannot push our claim with any great strength of conviction.

VII. General

The general contractor expects to finish his work inside the building within the next 2 weeks. Under the Air Force contract, delivery of Sargent lock cylinders seems to be a problem, but delivery has been promised this week. Under the IBM contract, delivery and installation of the roof monitor movable sash, emergency air requirement, is the problem.

It would seem that a conditioned acceptance by the Air Force is the only assurance of early turnover to us, but there is some doubt that the Air Force will accept the building if deficiencies exist.

Communications

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

A meeting was held on 14 April with representatives of the Long Lines Department of AT&T Co. and NET&T Co. to discuss transmission and facility problems connected with Long Lines circuits for XD-1.

Memorandum 6M-3000, Supplement 11, "Teletype Facilities for SAGE System Experimental Subsector," has been published in draft form and circulated for comment.

Memorandum 6M-3000, Supplement 7, "SAGE Experimental Subsector External Voice Circuit Appearances in the Dial System and Manual Switchboard," has been published.

The Systems Office Communications Committee moved to its new office (B-110) on 22 April. The new telephone extension is 478.

2.2.3 Testing

XD-1 Central Computer

(J. D. Crane) (UNCLASSIFIED)

A new 2-mc oscillator has been installed, and signal amplitudes affected by this change were checked.

Difficulties with the card machines and marginal-checking control, both manual and automatic, were experienced.

Two machine failures were revealed by the MIT programming group's operations which were not detected by present reliability programs. These failures resulted from missing jumper wires on printer co-selector relays and a bad plug-in unit in the in-out address counter.

Many failures of Stemag 1% resistors were noted during the past biweekly period.

A trouble now exists in Memory II, the cause of which has not yet been determined.

(S. L. Thompson) (UNCLASSIFIED)

A "sandwich" program that will test several frames at once is being investigated. If it works, it will reduce the time required to test XD-1 by about 4 weeks.

Drums

(H. Boyd) (UNCLASSIFIED)

My latest efforts have been directed at increasing the usefulness of system test programs, and thought is being given to acceptance tests.

Acceptance Tests

(W. J. Canty) (UNCLASSIFIED)

IBM has indicated a wish to have parts of XD-1 accepted this summer. A study has been started to determine what general features should be included in any acceptance and, in a very general manner, what results should be expected.

Power System

(A. Chopourian) (UNCLASSIFIED)

The following difficulties present in the motor-generator switchgear control have been eliminated by circuit revisions:

1. The power input to the d-c supplies was being removed in one step instead of by cycling down;

2. Five percent variation in the output of the generators was causing a power shutdown instead of a warning signal;

3. Starting of the spare M-G set caused a power shutdown;

4. The closure of the battery-disconnect switch before starting the system would energize the emergency-off circuit. This trouble had been obviated by the operation of a manual switch. It is now automatic.

Power Distribution

(G. F. Sandy) (UNCLASSIFIED)

As a result of two meetings held recently (one with IBM and one with IBM and Struthers-Dunn) regarding the high failure rate of the Struthers-Dunn relays, the following actions have been or are to be taken on XD-1:

1. Half the relays on the central-computer MCD (marginal checking and distribution) frame will be replaced Saturday, 30 April, by a relay that Struthers-Dunn considers to have a much better contact design.

2. Half the relays on the outputs MCD frame have been given a "burning in" run with lamp loads by IBM.

3. Half the relays on the display-MI,W1 MCD will be replaced by a relay which we believe to be much better, made by Signal Engineering Company.

4. The relays on the drum MCD and the PCD (power control and distribution) frames have been covered with a clear plastic dust cover. The relays on the mapper MCD will be covered during the next biweekly period.

It is hoped that a proper evaluation of the various possibilities can be made by comparing the failure rates of the four setups listed above against the failure rates of relays in the other half of the central computer, outputs, and display-MI-W1 MCD frames.

(J. D. Clarke) (UNCLASSIFIED)

The XD-1 logs show that the number of failures has decreased as the installation progresses. Although the failures do not occur as often (due to load frames running continuously) the percentage of failures occurring when trying to come on has decreased only slightly.

D-C Power Supplies

(S. Coffin) (UNCLASSIFIED)

I have written a report summarizing the results of the regulation tests conducted on bank A of the XD-1 d-c supplies. These tests indicate that most of the supplies have not yet been adjusted to operate as well as they should. G.E. will resume working on these supplies when they have the manpower available.

2.3 Production System

(R. H. Gould) (UNCLASSIFIED)

With Dick Best and Bill Santelmann, I visited DuMont Instrument Division in Clifton, N. J., on 11 April. We discussed single- and dual-beam scopes and agreed that DuMont shall draw up specifications and cost estimates for a dual-beam scope using the vertical amplifier of the type 336 scope. DuMont engineers showed interest in the cathode-follower probe problem, but there was not time for detailed discussion. Since both Lincoln and IBM are working on probe design, it does not seem necessary to bring DuMont in at present.

LRI Monitor

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

Writing of specifications for the LRI monitor for AN/FSQ-7 was started.

Study of Probability of Storage for LRI Monitor

(A. D. Hughes, H. I. Rundquist) (UNCLASSIFIED)

In writing the specifications for the LRI monitor, a problem arises as to how the delay of information to be displayed affects the storage of information on the drum. The detailed solution of this problem is rather complex, but some results might be obtained by programming the problem on MTC. A tentative MTC program is being studied.

GFI Monitor and Mapper Supervisor's Position

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

A meeting was held in Poughkeepsie to discuss specifications for the Mapper Supervisor's position for AN/FSQ-7. Attending were C. E. Walston, R. W. Lowrie, C. J. Kraus, and R. C. Marden of IBM, and the Inputs Committee from MIT. It was decided that in order to be in line with other equipment specifications for AN/FSQ-7, the Mapper Supervisor's position, as such, would not be specified, but rather the individual equipments at the Mapper Supervisor's position not already specified. Of this unspecified equipment, specifications for the GFI monitor and camera equipment were discussed.

Maintenance Console Auxiliary Panel

(J. J. Gano) (UNCLASSIFIED)

In a letter to J. J. Carson and other interested personnel I gave my comments on a power and air-conditioning status indicator in the maintenance-console area (mimic panel.) There has been some controversy on the necessity of the panel. The letter classifies the type of information that should be displayed and lists design considerations. The utility value of such a panel has been set at $5-10,000.

Power

(R. Jahn) (UNCLASSIFIED)

I am still checking power estimates for the production units. Console loads have been accurately determined, but measurements on the computer frames indicate that these estimates are high. Load variations due to different programs are being investigated with a recording ammeter. I am also gathering information on Combat Center loads.

(S. Coffin) (UNCLASSIFIED)

I am reviewing the AN/FSQ-7 d-c power-supply regulation specifications to see if any revisions should be made. The supplies could be made much simpler in design and easier to operate than the XD-1 supplies by relaxing the regulation requirements somewhat, and not requiring the supplies to operate over such a wide range of input-voltage change and output-voltage adjustment. This would eliminate the main source of trouble we have experienced on the XD-1 supplies, which has been the complexity of the adjustments and controls and the consequent reduction in reliability.

2.4 Vacuum-Tube Circuits

Pulse Test vs. Pulse Performance

(B. Barrett) (UNCLASSIFIED)

Because of some error in the testing equipment, the previous 7AK7 test-plate currents furnished to me were incorrect, and I have received a corrected set of readings. The graphs using this corrected set of readings still fail to show any correlation between the APA output-pulse amplitude and the acceptance-test currents. The acceptance-test current referred to is the plate current of a 7AK7 when the control and suppressor grids are driven to +10 volts.

Gap-Filler Sweep Circuit

(B. Barrett) (UNCLASSIFIED)

The gap-filler sweep circuit is in the final stages of being debugged now that the deflection yoke has arrived from IBM.

Pulse Amplifiers (Models A, B, and C)

(B. Barrett) (UNCLASSIFIED)

The pulse-amplifier report was issued as Memorandum 6M-3484.

Vector Generator

(E. B. Glover) (UNCLASSIFIED)

Investigation proved that the sweep generator was inadequate, since the start of the sweep was delayed because of the Miller effect. This circuit has been redesigned and breadboarded. Tests proved that the basic design of the new circuit was satisfactory; however, the output-amplitude requirements were not definite at the time of design, and a redesign is now necessary in order to meet the new specifications.

Display-Line Driver

(J. Kriensky) (UNCLASSIFIED)

D-c measurements have been performed on this circuit at zero output and at maximum output. As a result of these tests, some changes in components have been made to prevent any part of the circuit from becoming overdissipated. Some resistors are being changed to establish all the d-c levels in the circuit at the proper values so that the circuit will operate correctly.

Flip-Flop, Model E

(N. J. Ockene) (UNCLASSIFIED)

An analysis has begun to determine the correlation, if any, between the condition of the tubes (Z-2177's) in the flip-flop and the performance of the flip-flop. It is hoped that this analysis will throw some light upon the phenomenon of high sensitivity which the Z-2177's exhibit. The tubes used in this analysis will be categorized into various groupings which conform to both standard and nonstandard tube test procedures. When the results of the flip-flop analysis are completed, a correlation with the tube test data will be attempted.

Direct-Coupled Video Probe

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

A probe system has been built and is being tested. It consists of three tubes, two 6197 pentodes paralleled as the cathode follower and one Z-2177 as a variable screen-voltage supply, mounted on a metal box 1 3/4" x 2 1/4" x 4".

This box is designed to clip onto the wiring boards in XD-1 and carries an input connector for a standard oscilloscope probe, an output connector for 185-ohm RG 114/U cable, and two controls for adjusting attenuation and d-c balance. It is intended to be used in place of the usual 10:1 ratio passive probe with the added limitation of ± 50 input volts.

Tests are under way with 100 feet of RG 114/U cable to determine the line reflections, rise time, bandwidth, d-c drift, linearity, noise level, and response to a standard pulse of the entire system. To date, the results are encouraging.

A trip to the DuMont Labs in Clifton, N.J., was made on 11 April 1955 with R. L. Best, R. H. Gould, and R. A. Waters for the purpose of discussing specifications for the maintenance oscilloscope and probe system.

Gate Generator (Magnetic-Core Matrix Switch Driver)

(D. Shansky) (UNCLASSIFIED)

Prf sensitivity in this circuit has been eliminated.

Digit-Plane Driver (256 x 256 Core Memory)

(D. Shansky) (UNCLASSIFIED)

In view of the larger number of drivers necessary (120), a simpler driver has been designed. Preliminary measurements indicate a stability

in output current of the order of 1 or 2% for the usual variations in tube current. A total of three cathodes is used in the driver.

Poughkeepsie Trip

(D. Shansky) (UNCLASSIFIED)

A conference regarding the digit-plane driver (XD-I, Mod. II) was attended. The discussion also involved redesign of several other circuits in an attempt to meet the timing specification.

Sensing Amplifiers for Memory Planes

(R. C. Zopatti) (UNCLASSIFIED)

The input circuit of the amplifier continues to be a serious problem. The input transformer can be designed with sufficient bandwidth and a long time constant recovery time so that, when the memory cycle is speeded up, the read pulses are not excessively attenuated. However, the signal at the secondary of the transformer is now at a low level. This makes rectification difficult because of the high forward resistance of diodes at these levels and the recovery time of diodes which causes an overshoot at their output.

2.5 Display

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

Several tests have been carried out on the new magnetic-deflection amplifier to determine its behavior in the display console operated in MTC. The settling time has been determined to be 20 microseconds, except for some second-order effects in the core which are now being investigated. A correlation has been made between the time integral of the output-stage plate voltage and the beam position. This gives us a method for studying the amplifier behavior without necessarily using MTC except for final tests.

Two amplifiers built here are operating satisfactorily. However, a set of these same amplifiers built and operating at Vestal Lab does not appear to do as well. A trip is being planned for the week of 25 April to determine any possible differences between the Vestal effort and ours.

Some questions had been raised by Hazeltine concerning the validity of our tests, since their calculations of the minimum theoretical rise time of the deflection yoke indicated that the rise time should be somewhat slower than we appear to have achieved. A review of their calculations revealed that a basic assumption of a current step producing a minimum rise time was in error. They will try to recalculate this rise time using a voltage step on the grids of the driver tubes.

An amplifier has been designed for a 5-inch Charactron using electrostatic deflection. The amplifier now has a 2-μsec rise time with a 550-v push-pull swing. The linearity of this amplifier still has to be checked.

A training program is being started for the IBM personnel who will be concerned with the installation and maintenance of display consoles.

(R. Paddock) (UNCLASSIFIED)

While a Typotron test setup was being completed, frame 25 was free for work requiring a power shutdown. Accordingly, all required modifications were completed during this period, the major modifications providing for operating the digital display from two drum fields and for generating intensification gates only during the "display" period.

The Typotron test setup has been completed and is now being wired to frame 25.

MTC Connection to the Display System

(R. Gerhardt) (UNCLASSIFIED)

Test equipment has been assembled and is currently being cabled. We should have all cabling done by the time the cables from MTC are connected to the junction box in Building F. W. Wells has written the pro-

grams for loading the drum with digital-display information. R. Reed of Hazeltine has undertaken the job of writing programs to load the drums with situation-display data.

Display System Test Plans

(R. Gerhardt) (UNCLASSIFIED)

The programs for digital display (DD) have been run on the 701 computer in New York. This operation is necessary to convert cards from octal to binary codes. The DD programs will have to be revised to incorporate the Start DD#1 and Start DD#2 commands, because the programs were written prior to concurrence on this change.

P. J. Williams of IBM is writing programs which check radar-data displays and which check for correct transfers from the drum to the various storage registers in the situation-display frame. Other programs are contemplated but are not yet firm enough to give to the programmers.

Camera Control and Camera

(L. Sutro) (UNCLASSIFIED)

Work is progressing on many fronts. Pluggable units containing the control circuits are under construction in the shop. We are planning the back-panel wiring as we complete the IBM-style block schematics of the system. Samples of the relays in the system are now being tested in circuits identical to those that will be used in the final system. One of the results has been surprising. The shutter relay in the camera, rated to operate in 12 milliseconds, opens the shutter in 20 milliseconds. Control of intensification, which must follow shutter opening, is being changed accordingly.

A further modification to the Fairchild camera has been agreed upon that will cause an alarm when the film magazine is lacking. Fairchild is now making this and other modifications. Design of the camera mount is nearing completion under the direction of L. Prentice. The principal remaining problem for him is design of a mirror and peephole in the mount which permits viewing the scope without removing the camera.

2.6 Vacuum Tubes

2.6.1 Activities of Group 65

(P. Youtz) (UNCLASSIFIED)

I spent the week of 11 April on the west coast with the newly formed IBM-MIT Display-Tube Committee and M. J. Raffensperger. This Committee was set up by IBM to study thoroughly the present status of display tubes with respect to tube specification and production and compatibility of tube specifications with system and circuit requirements.

At Hughes three of their personnel were members of the Committee. A. V. Haeff acted as chairman concerning Typotron study and problems.

At Convair three of their personnel were members of the Committee with G. T. Gerlach acting as chairman on the study of the Charactron problem. Minutes of these meetings will be issued on a company-confidential basis.

I have been asked by the Committee to return the week of 25 April 1955 to Convair with F. H. Caswell and J. S. Palermo. We will work with the Convair Quality-Control Group and Tube Plant Group until all Charactron Manufacturing Processing Specifications are issued and signed by Convair. Henceforth, Charactrons will be manufactured to these specifications except when IBM releases a change in specification on request from Convair.

2.6.2 Tube Research and Development

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

During the past biweekly period we prepared 2-inch bulbs for cathode studies, 7-inch bulbs for A. Zacharias' phosphor evaluation, and 19-inch bulbs for C. L. Corderman.

Groups of 7AK7 and 2420 tubes were polycast for the dimensional-analysis-study program.

We studied and checked the Convair Manufacturing Process Specifications and the Lincoln Tube Process Specifications.

(S. Twicken) (UNCLASSIFIED)

I attended a meeting at Kingston with Hazeltine and the IBM Tube Group to discuss Hazeltine's suggestion of changing the Charactron deflection driver from the triode 6161 to the tetrode 4X150A. Hazeltine had felt that the settling-time specification could not be met with the triode 6161 and present circuitry. The circuit groups involved at MIT and Endicott feel that the 6161 is adequate, and until such time as inadequacy can be shown, the matter of approval of the 4X150A is closed.

A suggested specification for the 3002420, based on a statistical analysis of the lot-evaluation program, has been received from Sylvania and will be compared with the IBM-MIT Tube Group analysis currently under way.

Data taken on the 3002420 dimensional-analysis program to date is being collated and studied.

A meeting is scheduled with IBM for the week of 25 April to coordinate and intensify the program to determine the physical cause of the 0528 (Z-2177) difficulties.

(T. F. Clough) (UNCLASSIFIED)

I spent the majority of the past biweekly period writing the Lincoln Tube Process Specification for the 19-inch display tube.

(P. C. Tandy) (UNCLASSIFIED)

Ten 19-inch Charactrons, CHT-61, CHT-62-1, CHT-68-1, CHT-72-2, CHT-73, CHT-75, CHT-80, Convair 14-1, 0082, and 0083, have completed from 487 to 4085 hours on life test. The status of these ten tubes and the five Convair tubes, 14-5, 0117, 0123, 0124, and 0127, which failed since the last report is shown in Table I.

Table I

Tube No.	Before Last Biweekly		After Tube Cutoff for 12 Hours		A_2 Changed from 200 to 50 volts	
	Hours	Pulse 0-Bias I_{Matrix}	Hours	Pulse 0-Bias I_{Matrix}	Hours	Pulse 0-Bias I_{Matrix}
CHT-61	3527	134 μa	3768	91 μa	4064	130 μa
CHT-62-2	3411	190 μa	3654	123 μa	3955	88 μa
CHT-68-1	827	100 μa	1067	73 μa	1369	135 μa
CHT-72-2	831	340 μa	1071	200 μa	1373	195 μa
CHT-73	742	220 μa	982	225 μa	1285	195 μa
CHT-75	2166	150 μa	2406	122 μa	2707	149 μa
CHT-80	2015	320 μa	2255	310 μa	2556	275 μa
14-1	0	190 μa	288	150 μa	590	110 μa
14-5	4	460 μa	264	40 μa		
0082	583	460 μa	824	245 μa	1121	245 μa
0083	4	590 μa	261	320 μa	475	360 μa
0117	4	520 μa	265	8.7 μa		
0123	5	400 μa	262	35.5 μa		
0124	5	82 μa	267	15.5 μa		
0127	5	280 μa	267	270 μa	475	0 μa

All the tubes have gold-plated G_1 apertures except Convair 0117, 0123, and 0124.

A power-supply failure caused the tubes to operate for about 12 hours cut off (grids not pulsed on). The first group of transfer characteristics since the last report was made shortly after this 12-hour period. The pulse zero-bias-matrix current of 12 of the 15 tubes dropped off from the previous test. Four of the 12 tubes failed to meet the 50-μa-matrix-current requirement and were rejected. The zero-bias-matrix current of three of the remaining eight tubes, which had dropped after the 12-hour cutoff, had recovered to its precutoff condition at the last testing period. Convair 0127 did not drop appreciably after being cut off for 12 hours, but no emission was observed at 475 hours, and the tube was rejected.

The reliability of the Charactron life test is being threatened by the approach to the limit of power available from the laboratory power supplies. A power-supply failure will cause the tubes to be operated at a cutoff condition unless it is noted and the life test shut down. The capacity of the laboratory power supplies should be increased as soon as possible to alleviate this condition.

Work on expansion of the Charactron life test from 15 to 20 positions is continuing. Convergence-coil drivers are completed, and tube control boxes have been started. The major holdup appears to be delivery of 6.195.3 filament transformers.

(L. B. Martin) (UNCLASSIFIED)

Difficulty with the lab power supplies has impeded work on the Typotrons. At one time there were 22 volts of 60 cycle on the -150-v line; at last measurement there were 6 volts. This ripple caused marginal operation in almost all the equipment including the line-driver amplifiers and was particulary objectionable in the writing-gate generators. Accurate current measurements are impossible for high net-bias conditions when taking pulse-transfer data. The +250 supply is running at or slightly above rated capacity when maximum load is on. There have been several interruptions of this supply during the last month. D. Mach has started using a small motor-generator for additional +250-v current as a stop-gap measure.

Typotron 268 has been continuously monitored for flood-gun grid-cathode leakage with flood-gun heaters energized. The leakage (or emission) has been constant at 9 microamperes. The test will be discontinued.

Hot and cold grid-cathode leakage tests were made on 9 Typotrons for both guns. In each case the grid was held 500 volts below the cathode. The results appear below.

Tube	Flood Gun		Writing Gun	
	Cold	Hot	Cold	Hot
12242	0.2 μa	5.3 μa	0 μa	0.03 μa
12522	0.7 μa	12.3 μa	0 μa	0.005 μa
12461	0.07 μa	5.5 μa	0 μa	0.1 μa
12622	0.17 μa	4.5 μa	0 μa	0 μa
12523	0.001 μa	0.08 μa	0.39 μa	shorted
12221	0.005 μa	0.01 μa	2.6 μa	7.5 μa
12641	0.22 μa	12.6 μa	0 μa	0.009 μa
11981	0.005 μa	0.03 μa	0 μa	0 μa
12122	0.005 μa	shorted	0 μa	0 μa

The two shorts listed above were cleared by discharging a capacitor into the short. C. L. Corderman has reduced the hot-leakage test voltage to 150 volts on the writing gun but retained the flood-gun voltage at 500 volts. A 1.2-megohm series resistor was used in these tests. Hot and cold leakage tests will be made on other tubes that have been in the old life test.

Tube 280 is now considered marginal after 7799.2 hours because of low-beam current. The falloff of beam current has been gradual, and this decision to call it marginal is rather arbitrary. Perhaps a minimum of writing time at zero net bias should be agreed upon for a marginal tube. I suggest 50 microseconds minimum writing time as the dividing line.

Work continues on the automatic-curve tracer but at a low priority. Most likely it will not be finished before June.

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

Tube	Total Hours	Condition
265	8617.2	marginal
280	7799.2	marginal
389	6196.6	satisfactory
390	6280.4	satisfactory
392	6280.4	satisfactory
394	5498.3	marginal
11601	1593.0	satisfactory
11521	1348.5	satisfactory

The following tubes have been on the 16-position life test for 776.9 hours and are satisfactory: 11981, 12122, 12523, 12622, and 12641.

(A. Zacharias) (UNCLASSIFIED)

Investigations of CRT cathodes were continued during this period. As a result of evidence presented in the literature and experimental results, it can be easily shown that the simple observation of beam current, "activation" current, or any ratio will not allow one to determine even moderate differences in cathode condition between guns of similar-type construction. Variation in "activation" current (diode current) will be more strongly dependent on G_1-K spacing than on cathode work factor for most conditions. Beam current (IA_3) is dependent upon cutoff (G_1-K spacing) and gun geometry in general (aperturing) more than on cathode condition in most cases concerned with on initial life. The ratio of IA_3 to cathode current or A_2 current is dependent upon the geometry of the gun. The only way in which cathode condition will affect these is on life where changes can be found. From tube to tube, cathode condition will only show up if poisoning and saturated emission are present. Neither life nor saturated emission at initial life was deemed useful enough for determining cathode condition.

However, an analysis of beam production in the gun was made which determined that only the central portion of the cathode should contribute to beam current, aperturing being done as a "field stop" much more than an "aperture stop." Since the central portion of the cathode is at highest-current density due to maximum penetration of the G_2 field, the beam is produced from a more saturated portion of the cathode than IA_2 is drawn. Hence, reducing cathode temperature should reduce IA_3 a greater proportion than IA_2. A procedure for determining the condition of a cathode would be to take the ratio IA_2/IA_3 at fixed E_{c_1} and then reduce cathode temperature. The increase in this ratio will give an indication of the nearness of the current density of the axial portion of the cathode to temperature limiting.

These points were brought out by experiment and the theory deduced from the data. The deductions were then verified by the information found in the literature.

There are a number of assumptions which must be verified before a procedure can be set for testing the cathode emission in a given gun. The first is the variation of cutoff with cathode temperature due to thermal expansion changing the G_1-K spacing. The field at the cathode is principally affected by grid drive, i.e., $E_{c_1}-E_{c_o}$ where E_{c_o} is cutoff voltage. The value of current density at the cathode center due to geometry will remain fixed for a given gun if the drive is maintained constant. However, it would be laborious to determine the value of E_{c_o} at all cathode temperatures before testing. If a plot is made of IA_2/IA_3 vs. E_{c_1} at fixed temperature (1100 K), then in all tubes a "plateau" is reached in ratio for E_{c_1} from -30 volts to -10 volts in almost all cases. If the cathode temperature is reduced, E_{c_o} is (in magnitude) decreased, and E_{c_1} held constant, the value of the drive (E_d) is reduced with temperature. However, if E_{c_1} is held at -10 volts, the value of drive is reduced through the "plateau." Even though the drive changes with temperature the geometric value of IA_2/IA_3 will not change. An increase in the ratio must then be due to (to first order) temperature limiting of the cathodes.

A value of ratio increase from E_H = 7.0 volts to E_H = 5.0 volts at E_{c_1} = -10 volts is reduced to percent based on the 7.0-v ratio. This percentage is termed η'. For the RCA 5C guns η' = 4% initially, in the Superior 5C guns η' = 15 to 25%, and the same for the Sylvania 5C guns. These cathodes were processed by the vacuum-tube laboratory at Barta to various schedules, which indicated the variation of the schedule made no difference in initial characteristics.

In order to compare the η' of various geometries, the loading at the cathode axis for each geometry must be found. Using an empirical equation found in the literature, values of ρc were found for the three types of guns in question. The RCA 5C has ρc = 10.7 ma/mm^2 at E_{c_1} = 0 volts; Superior 5C, ρc = 12.2 ma/mm^2 at E_{c_1} = 0 volts; Sylvania 5C, ρc = 12.4 ma/mm^2 at E_{c_1} = 0 volts. These figures are based on average cutoffs for the guns. RCA, E_{c_o} = -62 volts; Superior, E_{c_o} = -62 volts; Sylvania, E_{c_o} = -77 volts. These values are averages taken from the guns whose η' had been taken. Saturated emission (d-c) of an oxide cathode at 1100 K is of the order of 10 ma/mm^2 so that all guns are not to be operated for any life at zero bias. However, as far as the comparison of η' for the various guns is concerned, the only possibilities that exist are that either the RCA cathodes are better, or that the cathode-temperature-heater-voltage characteristic is different. This latter possibility cannot be simply determined at present, so that the trial of life testing must be the only method of comparison at the moment.

2.7 Memory Test Computer

General

(W. Hosier) (UNCLASSIFIED)

This biweekly period has seen completion of the MTC end of the display-test link to Building F, consisting of 64 drum heads, field switching equipment, read amplifiers, and output gates and line drivers. Tests indicate that the equipment will provide standard pulses of at least 28 volts into 93 ohms at the far end of 700 feet of modified RG 62 A/U coax. Delays in production and delivery of the cable have held up the connection between Building B and Building F, but if the cable is on hand as expected Monday morning (25 April), it should be possible to make preliminary tests of the whole setup by Thursday, 28 April.

New decoders for the 12 1/2-inch console display scope are finally in the shop; DuMont has delivered the K1187 P11 tubes; Herb Ziegler is proceeding with design and test of new amplifiers and power supplies; thus the wheels are well in motion to give MTC a high quality precision display for photographic purposes.

It has become apparent to members of Group 61 and of Division 2 using MTC that computer time on some of their longer programs could be reduced materially by having a block-transfer instruction which would (hopefully) transfer a whole field in one drum revolution. We are now investigating means of providing such an instruction.

Future SAGE test work scheduled for MTC is gradually becoming more specific (see for example M-note 6M-3523 by Walter Wells). It has already become apparent that three-shift operation of the computer will be necessary; accordingly, a "graveyard" shift (midnight to 8 a.m.) is being formally started as of Monday, 25 April.

Distribution of computer time, 9-22 April, inclusive:

Application	Hours	Per Cent
Programming	86.00	55.6
Development	48.49	31.4
Maintenance and Marginal Checking	12.69	8.2
Interrupting Failures	3.14	2.0
Installation	4.34	2.8
	154.66	100.0

(F. R. Durgin) (UNCLASSIFIED)

Detail drawings of the card-machine circuits are being made by Drafting. The card-machine programming report is being rewritten to include a basic description of IBM cards.

A study of the proposed block transfer of information between core memory and drum memory is being made to determine how much time can be saved (as compared with a programmed transfer of 13 instructions) and what this will cost in terms of installation and alteration.

Drums

(E. Gates) (UNCLASSIFIED)

The heads for the link between Building F and MTC are installed and adjusted. The control equipment on the MTC end of the system has been tested, and we are ready to send signals to Building F as soon as the cable is installed.

Scope-Display System

(H. Ziegler) (UNCLASSIFIED)

Addition of a "floating" bias supply to the camera-scope power supply, plus careful adjustment of CRT parameters and of the camera stop, has resulted in considerably improved pictures of scope displays. As these pictures are considered adequate by MTC users, further modifications to the system will be checked out on the basement test setup. Desirable modifications of the system will then be included in the revision of the entire display system at the time the new decoders are installed.

Control

(H. Ziegler) (UNCLASSIFIED)

Lately there has been considerable clamor for a block-type storage transfer order. Accordingly, a study is being made to determine if an order of this type is feasible. As yet no definite conclusions have been reached on the matter.

MTC Technician Training Manual

(A. Vanderburgh, Jr.) (UNCLASSIFIED)

The MTC Technician Course has been postponed until the present chapter of the manual (Chapter III, "Programming") is finished and the first draft of Chapter IV is ready for distribution to class members. The estimated date for the resumption of classes is 10 May 1955.

III. ADVANCE DEVELOPMENT

3.1 Chemistry of Magnetic Materials

Inorganic Chemistry

(D. G. Wickham) (UNCLASSIFIED)

Magnetic moments have been measured at room temperature for compositions in the solid solution range between zinc ferrite and ferrous germanate. The maximum moment among samples annealed at 650C occurs for a solid solution of 30% ferrous germanate, 70% zinc ferrite.

Small discs are being prepared for a study of magnetic moment as a function of temperature, for temperatures down to that of liquid nitrogen (-195.8C).

More precise crystallographic measurements than previously reported are being made.

Experimental Ferrites

(D. L. Brown) (UNCLASSIFIED)

The nickel chromite-ferrite series, DCL-1-239 to 249, was completed. The compositions prepared were $(NiOFe_2O_3)_{1-\alpha} + (NiCr_2O_3)_{\alpha}$, where α = 0, 0.1, 0.2, 0.3,....., 1.0. D-262 toroids of each composition were fired at 1350, 1400, and 1450C for 6 hours; none were refired.

Results: Compositions became increasingly difficult to sinter as α increased. Hysteresis-loop data were not obtainable above α = 0.3.

α = 0 to 0.3: The saturation flux density decreased and the coercive force increased as α increased. The maximum squareness was from very low to negative, decreasing as the firing temperature increased.

At present, no further experiments are planned for chromium substituted ferrites.

Additional firings of the lithium ferrite-zinc ferrite series were made. The tabulation of data from this series is nearing completion.

Thermal Stability of Magnetic Spinels

(F. S. Maddocks) (UNCLASSIFIED)

Several further test runs of the thermal-analysis furnace have been made. The capacity of the furnace power supply has been increased to compensate for increased heating-element resistance due to aging.

A-c pickup by the differential thermocouple continues to prevent use of the furnace for analysis of magnetic spinels. Ceramic thermocouple protection tubes are being replaced with fused silica tubes, and solder joints in this circuit are being remade, using a low-thermal-EMF solder.

Chemical Analysis

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

Quantitative analyses of the following have been completed:

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

Quantitative analyses of the following are in progress:

DCL-2-836 and DCL-2-261F, memory-core compositions.

Production of Memory Cores

(J. Sacco) (UNCLASSIFIED)

Memory-core production for this biweekly period was lower than anticipated because of difficulties encountered in the pressing operation. However, a test firing of 10,000 cores was made on a new batch, DCL-2-840, and a large production firing of this material is now under way.

Cores for 256 x 256 Memory

(J. Schallerer) (UNCLASSIFIED)

The number of cores double-tested now stands at 465,000. Roughly 200,000 of these cores have been turned over to the memory-plane construction section. Only 77,000 cores were double-tested this biweekly period.

Automatic Core Tester

(J. Schallerer) (UNCLASSIFIED)

The automatic core tester has been moved out of the air-conditioned area. The core handler and sensing amplifiers have been mounted inside a Tenney temperature control box with $\pm 1^{\circ}$C control. The move was necessary because of variable room temperature.

3.2 Physics of Magnetic Materials

12-inch Magnet

(J. B. Goodenough) (UNCLASSIFIED)

The original order for a 6-inch electromagnet for magnetic measurements has been changed to a 12-inch electromagnet in order to permit use of the new techniques for measuring saturation moments, anisotropy, and magnetic susceptibilities as functions of temperature which have been developed by Dr. Donald Smith, who will be starting work here Monday, 25 April.

Remagnetization Process

(N. Menyuk) (UNCLASSIFIED)

A group at the Armour Research Foundation has proposed a new model of the remagnetization process based on the continuous rotation of electron spins. An assumption of zero magnetic anisotropy (K) appears to be implicit in such a model. An approximation was made by considering the equation of motion of domain walls, as arrived at in this laboratory, in the limit $K \rightarrow 0$. This yielded a relaxation delay which was of the same order of magnitude as that found by the Armour group. A more refined derivation, again based on our model in the limit $K \rightarrow 0$, duplicates their result. However, this result does not agree with experiment. This is not surprising since, in all probability, $K \neq 0$.

Magnetostriction

(N. Menyuk) (UNCLASSIFIED)

A number of polycrystalline samples fired by D. L. Brown, of the type $[MgFe_2O_4]_{.85(1-\beta)} + [ZnFe_2O_4]_{.85\beta} + (Mn_3O_4)_{0.15}$, are being prepared for magnetostriction measurements. In addition, single crystals of $NiOFe_2O_3$ and Mn_3O_4 are ready for magnetostriction measurements. A magnet has become available temporarily, and further single-crystal measurements will be begun the week of 25 April.

Delta Noise

(J. D. Childress) (UNCLASSIFIED)

Further calculations on incremental permeability at remanence show that the mechanism responsible for delta noise is not the rotation of atomic moments as previously reported but is largely the growth of domains of reverse magnetization.

D-C Fluxmeter

(R. A. Pacl) (UNCLASSIFIED)

The auxiliary amplifier used in conjunction with our high gain Inductronic amplifier has been checked out. It is quite stable (drift less than 0.5 percent of its 70-ma output per day), and no departure from linearity over its range (± 70 milliamperes) can be observed with the available meters.

3.3 New Components and Circuits

Flip-Flops

(J. R. Freeman) (UNCLASSIFIED)

Data on the various double-rank flip-flop circuits definitely demonstrates the advantage of R-C base coupling. The use of 680-ohm and 150-μμf in a 1.5-v double-rank flip-flop results in at least a 2-mc improvement in the complementing rate.

SBT Life Tests

(D. J. Eckl) (UNCLASSIFIED)

1. The original flip-flop tests have been operating for the following times:

8 transistors - 3550 hours
16 transistors - 2750 hours

There has been one failure which occurred at 250 hours.

2. A double-rank eight-digit shifting register was put on life test a week ago (15 April). This unit contains 80 surface-barrier transistors. The pulse source and control contain another 19 transistors. The shift rate is 1 mc/sec. The power dissipation of the shift register and control is 420 mw with a B battery supply of 3 volts. The entire unit is shielded at present. The unit has held a 11001000 pattern for 3 days on two separate occasions. The loss of the pattern on the first occasion occurred at roughly the same time the lab a-c power went off, although we do not use a-c. The reason for the second loss of pattern is unknown.

A second similar shift register is under construction to get more life-test data. This unit will be run at 4 mc/sec with a crystal controlled clock.

Transistors

(P. A. Fergus) (UNCLASSIFIED)

Results of routine measurements of alpha, I_{co}, I_{eo}, grounded-emitter and grounded-base characteristics, and rise-fall time measurements made on 80 G.E. pnp junction transistors were about as expected.

Distribution curves of alpha, I_{co}, and I_{eo} have been plotted for the 500 Philco surface-barrier transistors. To date 445 of this group have been given out.

Routine measurements made on 75 of the next group of 300 Philco surface-barrier transistors indicate good characteristics in general.

Ten Minneapolis-Honeywell H_2 power transistors have been tested in routine fashion, but additional investigation is contemplated before an evaluation is made.

Pulse Buffer

(A. L. Pugh) (UNCLASSIFIED)

An improved version of an emitter follower has been developed and has been used to drive 10 and 20 inverters in parallel. Each inverter represents one pulse input to a flip-flop. The delay from the input of the emitter follower to the output of the inverter is 50 millimicroseconds.

Replacing the emitter resistor in the emitter follower with a transistor has greatly increased the input impedance. Returning the base of the added transistor through an R and C in parallel to a small resistor in the collector of the emitter follower turns this added transistor off during the pulse and on again hard after the pulse. Consequently, the emitter follower does not have to supply any current to anything other than the succeeding stages. This circuit is almost as fast as the emitter follower with a 91-ohm emitter resistor.

Components

(C.T. Kirk, E. U. Cohler) (UNCLASSIFIED)

We are studying the possibility of using miniature components to build our circuits. It has long been thought that the only feasible way of using transistors in a computer is by paying great attention to physical design. This is especially true in the light of present circuits and transistors which appear to allow us to operate much faster than MTC or XD-1. Thus we must pack the circuitry as tightly and efficiently as possible. Assortments of subminiature capacitors and resistors have been ordered for our circuits.

Flip-Flops

(C. T. Kirk, E. U. Cohler) (UNCLASSIFIED)

We have approached a near optimum R-C-coupled flip-flop and are now performing various tests upon it. Delay lines (0.05 microsecond, 250 ohms) have been ordered from Technitrol. These lines will shorten the delay in the flip-flop and allow faster operation. Their cutoff frequency is beyond 40 megacycles. With present lines (0.1 microsecond, 250 ohms) the flip-flop operates at 5 megacycles with ease.

Hole Storage

(C. T. Kirk, E. U. Cohler) (UNCLASSIFIED)

We have made a steady-state solution to the diffusion equation for a heavily saturated surface-barrier transistor and are proceeding with a transient solution of this case.

Pulse-Generator Circuits

(M. E. Petersen) (UNCLASSIFIED)

Several types of multivibrator circuits have been tried on the SBT pulse generator. The minimum pulse width is approximately 60 millimicroseconds, and the maximum rate is approximately 6 megacycles in all of the circuits used.

The pulse width depends on the degree of saturation of the SBT's. This characteristic limits the usefulness of the circuit for generating short pulses.

Model of Sequence Control

(M. M. Cerier) (UNCLASSIFIED)

A breadboard model of the sequence control for the multiplier has been built. The problems of connecting flip-flops and gates together to form a system of this sort are being investigated. The following are some of the problems that arise:

The flip-flops used are somewhat sensitive to the load on them.

The design of the inverter in an inverter chain is dependent upon how many bases the inverter must drive.

Care must be taken in making the ground connections.

3.4 Memory

(S. Bradspies) (UNCLASSIFIED)

External Selection

Careful tests have shown that reasonably good results can be expected with a 3-usec cycle time in the three-core-per-bit memory unit. Using very small memory cores, the driving current per line need not exceed 2.5 ampere-turns in order to obtain large signal-to-noise ratios.

The fragility of these minute memory cores is, however, a serious problem.

Plug-in Switch

(D. H. Ellis) (UNCLASSIFIED)

Physical-layout drawings and wiring diagrams for the switch have been completed. As soon as cores are available, a 16 x 16 matrix will be built for Memory Test Setup VIII.

Switch-Core Testing

(D. H. Ellis) (UNCLASSIFIED)

Tests of the open-circuit and loaded characteristics of switch cores have been made. The results indicate that an open-circuit test of incoming cores is sufficient.

The last batch of cores from Magnetics Inc. have better switching characteristics than any of their previous ones.

Sense Amplifier

(J. Raffel) (UNCLASSIFIED)

The design of a satisfactory transformer sense amplifier has still not been achieved. Diode recovery time seems to be responsible for part of the difficulty.

256 x 256 Test Setup

(J. Raffel) (UNCLASSIFIED)

A complete breadboard test setup is being put together for dynamically running the first 256 x 256 plane.

256 x 256 Memory Planes

(E. A. Guditz) (UNCLASSIFIED)

All 16 modules for the first 256 x 256 memory plane have been tested. A low-output core was found in each of three modules. These cores are being replaced, and the modules will be retested.

Production of 700 more module frames has been started.

A design has been accepted for the support frame for 16 memory-plane modules, and drawings are being made.

Twenty-five "mats" have been made to date. Nineteen of these have x, y, and digit windings, and six have x and y wires installed. (A mat is a memory-plane module less its frame.) These mats will be wired into frames as they become available.

256 x 256 Memory

(J. L. Mitchell) (UNCLASSIFIED)

The plug-in unit size will be fixed during the week of 25 April, and at that time we will be able to complete the design.

Rough cost estimates have been made for the power supplies and air-conditioning.

The physical design of the magnetic-core switch is about 90% complete.

3.5 Logical Design

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

We are preparing a block diagram which shows the minimum form of a machine capable of being expanded to incorporate the logical techniques previously discussed. We will also prepare a block diagram of a skeletal machine capable of functioning with a large memory but with a minimum number of registers and a very small order code.

3.6 System Design

(R. Hughes) (UNCLASSIFIED)

A study is being made of circuits that will step up the flip-flop output to voltages that can be used by the memory vacuum-tube circuits.

(C. Norman) (UNCLASSIFIED)

One digit of a display decoder has been built and is being tested.

(J. Fadiman) (UNCLASSIFIED)

A new mechanical design for an etched-board plug-in flip-flop is being tried out.

(R. Sawyer) (UNCLASSIFIED)

A test panel for marginal checking and repairing plug-in units is being built. A record system is being set up to keep track of the units.

IV - CENTRAL SERVICES

4.1 Material Requirements & Stock

(H. B. Morley) (UNCLASSIFIED)

All property and materials have been removed from our storage area at Fort Heath and disposed of through the proper channels.

The requisition for the 12-inch electromagnet for Group 63 has been processed, and it is expected that the order will be placed at an early date.

Local representatives of electronic manufacturers have been helping to bring our catalog library up to date by reviewing our files, discarding obsolete material, and adding latest catalogs.

Electric Machinery Manufacturing Company, who will supply the 48-kva M-G set (WWI filament power), has informed us that the shipping date has been postponed to 18 May. Every effort is being made to expedite delivery of this machine.

4.2 Engineering Services

4.2.1 Components

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

The Components Section office now has a fairly complete catalog file on miniature components, which is available for use by anyone desiring such information.

Morrione visited the IBM component group (Technical Laboratory) at Kingston on Monday, 18 April 1955. No facilities are set up yet for extensive component failure analysis. They hope to accomplish this function without specially trained technicians by setting up standard test procedures. It is our feeling that this is not an effective method and that a better means can be devised. We will render whatever assistance we can, based on our own experience with component failure analysis, in an effort to promote an effective and workable plan.

Hodgdon attended a joint conference with IBM and Struthers-Dunn Company representatives at High Street on 11 April 1955, to discuss troubles encountered with S-D relays used in XD-1. Struthers-Dunn proposed to submit improved relays which they believe will be satisfactory. These will be installed in an XD-1 frame for evaluation of performance.

4.2.2 Test Equipment

Test Equipment Committee

(L. Sutro) (UNCLASSIFIED)

A survey has been conducted by the Committee to determine whether existing scopes are adequate and if not what would be adequate. Groups 60, 64, and 65 reported that after distribution of the ten recently received Tektronix 535's, their needs would be satisfied. Group 63 and the Vacuum Tube Circuits Section of Group 62 reported the need for a scope with the widest available bandwidth and greatest available sensitivity. Since the Tektronix 541 and 545 meet these requirements, the Committee approved purchase of five of each type. An order for five type 541 had already been approved.

Test Equipment Headquarters

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

All the test equipment in Group 65 at Barta was tested and repaired in 6 man-days of work. The scopes will be tested again in 6 months and the standard test equipment in a year. This method of testing all the equipment at once is already our practice with MTC.

Three of the six new DuMont type 336 scopes have gone back to the dealer, R. A. Waters, for repairs. There is a 1-year guarantee which covers the cost of repair.

4.2.3 Mechanical Engineering

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

A core loader has been developed for Dr. Vinal's Section which increases the cores fixed on one plate by 60%. The loading time is decreased 75%.

4.4 Administration & Personnel

4.4.2 Non-Staff

(R. A. Osborne) (UNCLASSIFIED)

New

Mrs. Jo Ann Kleinsmith is Mr. Everett's new secretary.

Terminations

Dolores Pereira

Open Requisitions

1 Clerk for Gr. 60 (Duplicating Room)

1 Clerk for Gr. 60 (Multilith Operator)

1 Clerk for Gr. 60 (IBM Operator)

1 Clerk for Gr. 62 (Systems Section)

1 Computer Operator for Gr. 61

2 Electronic Draftsmen for Gr. 60

1 Laboratory Assistant for Gr. 63 (Chemistry Section)

1 Secretary for Gr. 60 (Div. Headquarters)

2 Secretaries for Gr. 61

2 Technical Assistants for Gr. 61

1 Temporary Technician (Female) for Gr. 63 (Memory Section)

Accessions List

(D. B. Helwig) (CONFIDENTIAL)

The following documents were published by Division 6 or received from IBM during the period 8 - 22 April 1955:

NO.	AUTHOR	TITLE	CLS.
6M-3403	E. Glover	Digital-Data Receiver and Gap Filler Input Receiver	U
6M-3415	H. Platt	Proposed Changes to be Made to AN/FSQ-7 XD-1 Equipment	C
6M-3417	F. W. Sarles	A Transistorized Amplifier-Discriminator for Core Memory Output Sensing (MS Th. Prop.)	U
6M-3463	H. Boyd R. Dawson	Results of Phase I Tests (H-165) on XD-1 Drums	U
6M-3464	H. Boyd	Supplement to and Some Corrections of Material in M-2883 and M-2884	U
6M-3486	W. Lone F. Heart	FSQ-8 Cross-Telling Requirements	C
6M-3494	J. Yienger et al.	XD-1 Card Forms and Card Preparation Procedures	U
6M-3505	J. Raffel S. Bradspies	Experiments on a Three-Core Cell for High Speed Memories	C
6M-3510	R. Biagiotti	Component Failures from Jan. 1 to March 31	U
6M-3511	L. Sutro	Test Equip. Committee Meeting, April 8	U
6M-3512	J. O'Brien R. Gould	Maintenance Coordination within the XD-1 Subsector	U
6M-3513	J. Giordano R. Mayer	Minutes of IBM-MIT Concurrence Meeting No. 23	U
6M-3514	J. Jacobs	Proposed Objectives and Method of Operation of Operation of the Coordination Section	U
6M-3515	H. Platt	Proposed List of Sites and Equipment in the SAGE Experimental Subsector	S
6M-3516	H. Anderson	Minutes of SAGE Experimental Subsector Planning Approval Committee Meeting of 4-4-55	C
6M-3517	E. Lundberg	SAGE System Meeting of April 11, 1955	U
6M-3518	- - -	Biweekly Report of April 8, 1955	C
6M-3519	D. Israel	Test Program Procedures and Memos	U
6M-3520	E. McEvoy	Program Specs. for the Start-Over Program of the 1954 CCS (M-2706S)	C
6M-3523	W. Wells	Analysis and Simulation Section Time Requirements for MTC	C
6M-3524	J. Jacobs	FSQ-8 Display-Slot Capacity Meeting 11 April	C
6M-3525	A. Favret	Army Plan for Employment of AA in SAGE, SCEL 1650	C
6M-3526	J. Schallerer	X-Y Tests on Memory Plane Units	U
6M-3527	H. Hodgdon C. Morrione	Meeting with Continental Connector Company to Discuss Nike Connector Modifications	U
6M-3528	C. Morrione	Trip to Cinch Mfg. Corp., Chicago, Illinois	U
6M-3532	A. Smalley	CC Mission Specs. (4-55) for Radar Mapping Test on Monday, 18 April 1955	U

Accessions List (Continued)

NO.	AUTHOR	TITLE	CLS.
6M-3533	L. Grush	CC Mission Specs. (42-55) for Three Blip-Scan Range Tests to be Conducted Wed., Thurs., Fri., 20, 21, and 22 April	U
6M-3534	L. Grush	CC Mission Specs. (48-55) for Six-Power Level Tests for Wed., Thurs., Fri., 20 - 22 April	U
6M-3535	J. Giordano	IBM-SO Concurrence Meeting No. 24, 14 April	U
6M-3538	E. Lundberg	SAGE System Meeting 18 April 1955	U
6M-3540	S. Manber	Test Storage, Proposed Change for WWI	U
6M-3541	L. Grush	CC Mission Specs. (50-55) for Three Blip-Scan (C) Range Tests to be Conducted 26 - 29 April	U
6M-3542	L. Grush	CC Mission Specs. (51-55) for Eight-Power Level (PL) Tests to be Conducted 26 - 28 April	U
6M-3544	H. Anderson	Minutes of SAGE Experimental Subsector Planning Approval Committee Meeting of 11 April	C
6M-3545	H. Anderson	Minutes of SAGE Experimental Subsector Planning Approval Committee Meeting of 18 April	C
6M-3547	P. Bagley	Plan for Abbreviated XD-1 Training Course for Experienced Programmers	U
		IBM DOCUMENTS	
IBM-723	- - -	AN/FSQ-7 Engineering Progress Report, March 1	S
IBM-724	A. Quick	Scope of IBM Responsibility (H-152)	U
IBM-725	- - -	Outlines for Defense Field Training, Sept. 1954 to March 1955 (IM-125)	C
IBM-726	D. Ross	AN/FSQ-7 Equipment List (IM-102-2)	S
IBM-727	- - -	Central Reference Room Bulletins 72 - 76	U
IBM-728	- - -	Project High Biweekly Progress Report, April 15	C
		DIVISION 6 LL-DR REPORTS	
DR-184	N. Jones	Concurrence on Arithmetic Element Specifications (D-6-1)	U
DR-185	N. Jones	Conc. on Program Element Specifications (D-5-2)	U
DR-186	R. Lowrie	Modification to "Keyboard Inputs, Duplex Central (D-7-1)	U
DR-187	N. Jones	Conc. on Selection and Input-Output Control Specs., DC (D-19-1)	U
DR-188	R. Martin	Conc. on AN/FSQ-7 Output System (D-24-2)	U
DR-190	R. Lowrie	Dummy Loads (D-25-1)	U
DR-189	D. Ross	Conc. on Marginal Checking System (D-33-1)	U
DR-191	D. Ross	Conc. on the Gap-Filler Input Mapper Console Specs. for the AN/FSQ-7 (D-34-1)	U
DR-192	D. Ross	Conc. on the GFI Console (D-34-2)	U
DR-193	D. Ross	Conc. on Gap-Filler Mapper-Counter Frame Specs. for the AN/FSQ-7 (D-35-1)	U
DR-194	D. Ross	Conc. on the AN/FSQ-7 Data-Telling Input Specs. (D-51-1)	U

Accessions List (Continued)

NO.	AUTHOR	TITLE	CLS.
DR-195	W. Squire	Proposed Warning Light Specifications , DC (D-52-1)	U
DR-196	N. Jones	Drum Specifications for the Production System (D-13-2)	U
DR-197	N. Jacobs	Card Machine Input (Duplex Central) (D-10-2)	U
DR-198	R. Keating	Power Conversion System for the AN/FSQ-7, D. Central (D-40)	U
DR-199	C. Walston	Manual Input Interconnection Unit for the Production Machine - Conc. (D-80)	U
DR-200	C. Walston	Manual Input Interconnection Unit for the Production Machine (D-80)	U
DR-201	C. Walston	Conc. on D-79	U
DR-202	R. Imm	Revisions to Simplex Maintenance Console (D-46-2)	U
DR-203	W. Hunt	Drum Specs. for the Production System (D-13-3)	
DR-204	R. Lowrie	Minutes of Concurrence Meeting #21	U
DR-205	C. Walston	Minutes of Concurrence Meeting #20	U
DR-206	W. Hunt	Selection Control (D-19-3)	U
DR-207	Signal Corps Eng. Lab.	Advanced Notes and Reference Material for a Revised CA-AA Defense System for Integration with AF SAGE Air Defense System (TM-1650)	C
DR-208	R. Lowrie	Duplex Central Specs. for the Gap-Filler Input Mapper-Counter Frame (D-35-1)	U
DR-209	C. Walston	Concurrence on D-80	U
DR-210	C. Walston	Manual Input Interconnection Unit for the Production Machine (D-80)	U
DR-211	A. Hughes	Concurrence Letter on 6M-3276, Supp. #2 (D-50-1)	U
DR-212	C. Walston	Concurrence on D-79	U
DR-213	F. Gewickey	Concurrence on D-62	U
DR-214	W. Squire	Specs. for the Input Pattern Generator (D-74-1)	U
DR-215	F. Gewickey	Display Console GB Frame, Prod. Mach. (D-57-1)	U
DR-216	F. Gewickey	Concurrence on D-57-1	U
DR-217	C. Walston	Concurrence on D-27-1	U
DR-218	C. Walston	Maintenance Card Machines (D-73)	U
DR-219	W. Hunt	PERSELBSN Codes (D-16-4)	U
DR-220	J. Giordano	Concurrence on D-46-2	U
DR-221	J. Giordano	Concurrence on D-13-2	U
DR-222	J. Giordano	Concurrence on D-19-3	U
DR-223	J. Giordano	Concurrence on D-16-4	U

The following numbers have also been assigned this Biweekly period:

DR-136	C. Walston	Concurrence on D-7-1	U
DR-137	C. Walston	Concurrence on D-25-1	U
DR-138	C. Walston	Concurrence on D-52-1	U
DR-139	M. Dudek	Proposal for the Auxiliary Drum MCD Unit, D-72	U
DR-144	C. Walston	Fund. Technical Requirements for Digital-Data Transmitters, Receivers & Assoc. Equipment (D-66)	U