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Memorandum 6M-3482

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

SUBJECT: BIWEEKLY REPORT FOR 25 MARCH 1955

To: Jay W. Forrester

From: Division 6 Staff

COVER SHEET

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

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Approved: John B. Bennett
John B. Bennett

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INTRODUCTION

College Recruiting Program

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

During the last biweekly period (14-25 March 1955) the following recruiting trips were made:

Representative	College	Date
J. Cahill	Cooper Union	14 Mar.
	St. John's U.	15 Mar.
	Iona	16 Mar.
	Fordham U.	18 Mar.
H. Peterson	Denver U.	15 Mar.
W. Attridge, S. Manber	Buffalo U.	15 Mar.
	Rochester U.	16 Mar.
	Syracuse U.	17 Mar.
	Union	18 Mar.
E. Wolf	U. of Cincinnati	17-18 Mar.

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Representative	College	Date
D. Bailey, J. Jacobs	U. of Wisconsin	20 Mar.
J. Nolan, H. Anderson	Oklahoma A&M U. of Oklahoma	21-25 Mar.
E. Rich, C. Zraket	Duke U. U. of Miami	21-25 Mar.
C. Grandy	Queens	23 Mar.

(R. R. Everett) (UNCLASSIFIED)

Recent studies of Lincoln's responsibility for the operational computer programs for the SAGE System have led to a reorganization of Group 61 and the transfer of certain Division 6 staff to this Group.

Changes in Group 61 include the combination of the former Test Planning and Cape Cod Operations Sections into a Test Program Section under D. R. Israel. Three sections under Arnow, Walquist, and Zraket have been formed to prepare the operational specifications for the SAGE computer program. A Special Studies Section, also under Arnow, has been formed. The Analysis and Simulation Section under Wells and the SAGE Training Section will continue as before.

J. F. Jacobs has transferred from Group 62 to Group 61 to head a new section for coordination of formal Lincoln and Air Force concurrence on program specifications and liaison with equipment design groups. Messrs. Bagley, Feldstein, Heineck, L. Jeffery, and Rising have transferred from Groups 62 and 64 to Jacobs' new section.

R. A. Nelson has transferred from the Division Office to Group 61 to assist in the preparation of operational specifications. Philip Bragar of Group 66 will also transfer to Group 61 as soon as he can be released from his present duties.

Further details of the Group 61 organization can be found in Memorandum 6M-3084-1.

S. H. Dodd, Leader of Group 64, will spend the next few weeks in a study of the SAGE test program now in progress in Lincoln and BTL. This program is of the utmost importance: a decision to increase the effort must await the completion of Mr. Dodd's study.

Clarence W. Farr, formerly Assistant to the Vice-President, Marketing, Dewey and Almy Chemical Company, has joined the Laboratory and will act as assistant to Mr. Forrester. Mr. Farr has had a broad engineering and technical administrative experience with DuPont and Dewey and Almy; as Technical Assistant to the President of Dewey and Almy he participated in the development of their food-packaging film and their automotive-battery separator.

Research

(B. G. Farley) (UNCLASSIFIED)

During the previous period I presented a paper, written jointly with W. A. Clark, entitled "Generalization of Pattern Recognition in a Self-Organizing System," at the Western Computer Conference in Los Angeles. I also visited Dr. R. W. Gerard at the Center for Advanced Study in the Behavioral Sciences in Stanford for discussions on simulating neural nets by computer.

During this period I gave an invited lecture entitled "Attempts to Simulate Learning by Digital Computer" for the Pittsburgh Section of the I.R.E.

I - SYSTEM TEST & PLANNING

1.1 Air Defense

1.1.2 Cape Cod System Operation (See also page 13)

(E. Bedrosian) (CONFIDENTIAL)

At present I am working on the magnetic-tape read-in subprogram of the system-simulation program. I expect to have this read-in program written and checked out within the next biweekly period.

(P. O. Cioffi) (CONFIDENTIAL)

My activity during the past few biweekly periods (and expectedly for the remainder of the month) has been in the direction of cleaning up and turning over my work in Group 61 prior to termination of employment. This has included:

1. Completion of memoranda connected with the 1954 Cape Cod System;
2. Direction Center operations;
3. Conferences with S. Hibbard and other members of Group 61 and AC&W, Section C.

The emphasis of my activity has been largely on item 3, above. I have covered the mechanics of Direction Center operations with particular notice to those aspects requiring attention and refinement. The main concern in the discussions has been to go over systems organization and operations to reveal existing weaknesses and to direct recommendations for formulating adequate training and operations programs.

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

Test Coordination Sub-Section scheduled two accuracy-training, two saturation, three Raydist tests, and one data program analysis study.

One accuracy-training test was put into operation. This cancelled after two unsuccessful intercept attempts because of a number of equipment failures, primarily Mark X. The remaining test time was used as a simulated training test. The second scheduled accuracy test was cancelled because of maintenance required on the S. Truro bent antenna shaft. In its place a simulated training test was conducted.

All five strike aircraft were airborne for the first saturation training test. Interceptors were cancelled because of Mark X failure. The balance of the scheduled time was used as a simulated training mission. The second saturation test was conducted with five strike aircraft. Six of the interceptors scheduled were employed, but mapping operations, Mark X malfunction, and poor velocity computations resulted in poor intercepts.

All three Raydist tests were cancelled one because of maintenance on the S. Truro FPS-3 antenna, two because of weather.

The data program and analysis study was conducted as scheduled.

(A. P. Hill) (CONFIDENTIAL)

A rough draft of the **syllabus** for the next familiarization course to be given by Group 61 has been completed. It is expected that the next course will be given sometime during the month of May.

Some time has also been given in helping to set up an indoctrination program for new Group 61 staff members. Part of this program includes trips to the S. Truro site: two such trips were made during the last 3 weeks.

(D. Latimer) (CONFIDENTIAL)

I have completed gathering information to revise Memorandum 6M-3078 and have it in rough form. This will be issued as 6M-3078-1. I have been assigned to D. R. Israel's Section in the Group 61 reorganization.

(W. Vecchia) (CONFIDENTIAL)

	hr	min
Total Assigned Time	117	
Extra Assigned Time	2	35
	119	35

	hr	min
Analysis	35	20
Equipment Checkout	4	10
Weapons Direction	20	05
Tracking	9	30
Raydist	12	25
Systems Operation	26	50
TOTAL	108	20

(CONTINUED)

	hr	min
Time Given 6345	5	45
Time Given Systems	1	
Time Lost (computer malfunction)	4	30
TOTAL	11	15

	hr	min
	108	20
	11	15
GRAND TOTAL	119	35

1.1.3 XD-1 Programming (See also page 13)

(F. Brooks) (CONFIDENTIAL)

Recommendations based on times required for the (r,θ) to (x,y) conversion programs have been made for the bit layouts in the radar input drum registers, both for XD-1 and for AN/FSQ-7. I have begun studying the problems of cross-telling area discrimination and LRI coverage masking. A manual-intervention program for XD-1 is half written.

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

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

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

Starting 21 March, Group 61 was assigned time (1 hour per day) on the XD-1 computer. The utility program section has used the time this week to test the following programs:

1. Trace;
2. Octonary print;
3. Octonary loading;
4. Radius vector subroutine;
5. Arctangent subroutine;
6. Control section of the assembly program (a program to be used only temporarily until installation of the magnetic-tape units).

(C. C. Grandy) (CONFIDENTIAL)

Analysis of the 1954 Cape Cod System interception program gives the following equation for operating time (excluding drum access and transfer time):

$$T = C(383 + 1802m + 682f)$$

C = WWI average time per operation

m = number of active interceptors in system (on mission or return-to-base)

f = number of interceptors employing final-turn tactics.

Thus one final-turn interception requires 71.7 milliseconds and one collision-course interception 54.6 milliseconds. These analytic results agree with 99 experimental observations with less than 5% error. Operating time for this program in the SAGE System has been estimated by extrapolating these results. Interception calculations for the SAGE System may take 2.25 seconds of the computation cycle. A complete report of this work enumerating all assumptions and results has been made to C. A. Zraket.

Division 6 Memorandum 6M-2953, Supplement 1, has been written and will be issued by 31 March 1955. This memo documents revisions to the 1954 Cape Cod System height program concerning use of the semiautomatic height finder and the use of the program to automatically request height for interceptor aircraft.

(F. F. Gucker) (CONFIDENTIAL)

During the past biweekly period a preliminary investigation was made of switch actions to be taken by the Track Monitors, Senior Track Monitors, Tracking Supervisor, and Tracking Officer. An outline was made for other aspects of monitoring that need further study.

(P. Guinard) (CONFIDENTIAL)

			hr	min
Total Assigned Time			5	0
Program Checkout		hr	min	
Utility		3	45	
Down Time				
In-Out Equipment			15	
Computer Malfunction		1	0	
	TOTAL	5	0	

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

We have submitted an estimate of the number of 026 card-punch machines necessary for manual data insertion for Subsector 1 and a recommendation for one 056 verifier. Both recommendations were made on the basis of observations resulting from training and test sessions conducted during the last 4 weeks and on the basis of the number and types of input sources for Subsector 1.

Discussions are in progress on the operational specifications of the identification function in SAGE. In conformity with the schedule set up last week at a reorganization meeting conducted by C. R. Wieser, the work on operational specifications will continue for another 6 months. Subsequent biweekly reports, therefore, will indicate progress in setting up these specifications.

(P. R. Vance) (CONFIDENTIAL)

The past 2 weeks were devoted primarily to studying the weapons-direction problem in the XD-1 System. This work has been terminated because of the group reorganization.

1.1.4 SAGE Planning

(W. S. Attridge) (CONFIDENTIAL)

Specifications for activate and key release button locations and for light-gun connection are being prepared as a supplement to 6M-3330.

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

We have begun work on specification of display-selection switches and assignment of display-category and display-assignment-bit lines to each situation-display console in XD-1 and AN/FSQ-7 Direction Centers, and we have initiated a study of the utilization of the AN/FSQ-7 situation-display system.

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

I am in the process of gathering material for use by the Army agencies involved in the evaluation of the Lincoln proposal for the integration of antiaircraft with SAGE.

(A. G. Favret) (CONFIDENTIAL)

On 16 March a meeting was held at Lincoln Laboratory to reach agreement on the coding of Mark X replies from the IM-99. Representatives of Boeing, AFCRC, WADC, and RADC were present as well as Division 2 and 6 personnel. The results are contained in an inter-office memo to J. Arnow dated 18 March 1955.

On 18 March I attended a preliminary discussion with representatives of Divisions 2 and 3 regarding communication requirements and proposals for transmitter-site equipment for a time-division ground-to-air data link. A meeting at Whippany, N. J., was scheduled for 21 March 1955 with representatives of BTL.

(F. E. Heart) (CONFIDENTIAL)

A group from the Signal Corp Engineering Laboratory visited Lincoln 17 March to discuss countermeasures. This visit is reported in an inter-office memo to C. R. Wieser dated 18 March 1955.

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

A memo describing FSQ-8 auxiliary storage, display slot, and crosstelling requirements has been written. We have been attending meetings with B. Housman of IBM, and P. Bagley preparatory to writing specifications for FSQ-8.

(L. R. Jeffery) (CONFIDENTIAL)

A study of the scan time for the SAGE System was recently conducted by Group 61. I am writing a report on this effort, which will be issed as an M-note during the next biweekly period.

(H. H. Seward) (CONFIDENTIAL)

The estimate for the frame time of the SAGE System was completed during the last biweekly period.

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

An intensive effort is being made to determine the feasibility of a multiple-radar, multiple-aircraft tracking system using azimuth information only. Initial results are somewhat encouraging for quantities of aircraft in the neighborhood of 50. The problem is of interest as related to countermeasures. Frank Gucker, representing Wells' Section, has recently joined this effort.

1.1.5 SAGE Training

(S. B. Hibbard) (CONFIDENTIAL)

Training on the Cape Cod System has reached a point where the effectiveness of the manual problems created in the Training and Battle Simulator is questionable. It is felt that a programmed training problem should be written to more closely simulate an actual live problem that would provide more extensive training at all stations. It is understood that the writing of such a program is under consideration.

A concentrated effort is under way, in conjunction with Air Force personnel assigned to Group 61, to write operator manuals for the Cape Cod 1954 operator positions. A target date of 30 April has been set for completion of this task. These manuals will be used in training newly assigned personnel and will provide a ready source of information for the continued operation of the Cape Cod 1954 D.C. It is expected that the writing of these manuals will provide a guide for the writing of manuals for XD-1 and they, in turn, for the SAGE System. It is hoped that a training representative from ADES Western Electric can be assigned to Lincoln Laboratory to assist in this work.

1.1.6 Test Program Planning

(D. R. Israel) (CONFIDENTIAL)

With the increase of personnel in the Systems Test Planning Section as a result of Group 61 reassignments during the past week, a concentrated effort will be made to speed the completion of the data-generation and data-reduction programs required for the test-program activities. This effort will be given highest priority with hopes for completion and checkout by the end of April.

We still continue to suffer from poor reliability of the Ampex tape units. Until this condition is improved, we cannot reliably record and play back radar data to obtain comparative data on various programs and modes of operation.

The work of the past several months indicates a number of unresolved problems in the processing and use of Raydist data. Although it is hoped that the situation is well enough in hand to check radar orientation and proceed with initial tracking-accuracy tests, the problem requires a good deal more attention. It is hoped that outside help, in addition to Group 22's assistance, can be used here.

(A. E. Budd) (CONFIDENTIAL)

Specifications have been established for a subroutine to read in data from the 1954 CCS magnetic-tape records, reorganize to general-purpose form, and store in magnetic-core memory.

I am programming this subroutine at present and expect it to be completed by 25 April.

(W. Z. Lemnios) (CONFIDENTIAL)

The study of tracking accuracy has been expanded to include F2H and B-47 type aircraft, as well as the original B-29 aircraft. Relative to this, I held several discussions with R. Davis on the procurement of F2H's and B-47's and the type of flight tests needed. The general specifications for these tests are now being written as an M-note.

A reference list of 34 M-notes relating to the test and evaluation of the 1953 and 1954 Cape Cod Systems has been compiled and issued as an M-note.

(J. Levenson) (CONFIDENTIAL)

A draft of 6M-3448, "General-Purpose Data-Reduction Programs for the 1954 Cape Cod System," has been issued for comments. Programming should begin during the week of 28 March.

Test specifications are almost finished for the first tests of track initiation. Decisions are now being made on data-processing procedures.

(R. L. Smith) (CONFIDENTIAL)

Errata 2 to M-2854 was processed and issued. A supplement to M-2897 is being prepared.

The station checkout manuals of the equipment-checkout program are being brought up to date.

(E. W. Wolf) (CONFIDENTIAL)

The initial photographs from the new camera at the monitor scope are sufficiently encouraging to warrant the scheduling of the first mapping tests. The resolution is not fine enough to count blips in dense areas, but these can be calculated from the data counts and from counting track data. The difference in intensity between mapped and unmapped data is satisfactory.

An outline of the plans for the initial monitoring and trouble-detection tests has been completed.

Data counts before and after mapping from the various sites are now being collected regularly. In view of the large number of counts involved, this information is only statistically significant. At present these statistics must be computed manually. Program modifications to have the computer do this are in process. The mean and variance will be computed.

1.1.7 Analysis and Simulation

1. Charactron Display

(H. D. Houser) (CONFIDENTIAL)

A program written by P. Bagley which simulates DID displays on the Typotron tube has been modified to work with the present MTC setup. This program is partially checked out. The program displaying 80 tracks on the Charactron as requested by Group 38 has been completed.

2. Manned-Interceptor Simulation

(H. D. Neumann) (CONFIDENTIAL)

The control program for the manned-interceptor simulation and evaluation programs is now checked out. It makes the simulation of runs, the evaluation, and the reduction of data by vectoring limits fully automatic, so that runs can be made during night hours by a computer operator. Parameter tapes are being prepared.

To complete the study of radar scan rate and quantization, approximately 4000 interceptions were simulated by the F-99 simulation program.

(B. Smulowicz) (CONFIDENTIAL)

The weather-clutter generator program for the manned-interceptor simulation has been written.

I am presently working on a single-track correlation program which will operate with the weather-clutter generator, using the techniques adopted for the 1954 Cape Cod System.

3. Numerical Evaluation of Markov Processes

(C. Friedman) (CONFIDENTIAL)

A display program has been added to the program which evaluates first-order Markov processes. This display program describes the curve of the probability of initiating the track for a given blip-scan ratio and a given scheme of automatic initiation. Numerical and graphical data will be obtained for various blip-scan parameters and several schemes of initiation.

4. Small Samples Statistics

(R. Sittler) (CONFIDENTIAL)

A series of computer runs is being completed to print tables of Chi-squared statistics for small sample sizes (sample sizes from 10 to 20) for various probabilities. These tables will be used in the fitting of the blip-scan data to certain mathematical models.

5. Design of Blip-Scan Data-Processing Programs

(W. Wells) (CONFIDENTIAL)

A series of MTC programs is being outlined which will analyze the blip-scan data collected by Group 22. These will make use of the card (IBM) read-in programs that have already been written.

1.1.2 Cape Cod System Operation (Continued)

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

Trouble with the Raydist conversion program due to earth curvature has made impossible the finding of solutions for hyperboloids which actually intersect at a very small angle, but do not intersect (or intersect at a large range) when a flat-earth approximation is made. In spite of this, one Raydist data tape was converted. In a comparison with radar data it was found that a zero burst on the Raydist record was ignored so that the whole Raydist track was displaced in time. This renders the computer-orientation program inoperative. On a purely visual inspection of the Mark X data, it appears that the orientation is good.

Correspondence between the three sets of Raydist solutions is not good. A set of data converted for Dr. Rawson of Group 24 in which a zero height stereographic projection of the Raydist coordinates was made had excellent internal consistency. The Raydist conversion will be tried with these coordinates on already converted data to see if there is any improvement.

1.1.3 XD-1 Programming (Continued)

(A. Chandler) (CONFIDENTIAL)

During the past biweekly period I have been compiling information on Cape Cod System utility programs and the master make-up and display group for forthcoming memoranda. Inter-office memoranda will be issued shortly concerning operation of the Cape Cod System with the new weapons-direction programs, available records of the weapons-direction programs, and utility programs available for CCS. M-notes will be issued on the utility programs and on MMD programming specifications.

(I. Hazel) (CONFIDENTIAL)

I have been compiling the functional aspects of the situation-display programs for a joint effort on a comprehensive memo on the MMD specifications for the 1954 CCS. I also continued study of XD-1 programming.

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 11-24 March 1955:

Number of assigned hours	191
Usable percentage of assigned time	96
Usable percentage of assigned time since March 1951	90
Usable percentage of assigned time since September 1953	94
Number of transient errors	8
Number of steady-state errors	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 biweekly period, 11-24 March 1955, inclusive:

Total Number of Failures	28
Total Number of No-Lost-Time Failures	5
Total Number of Lost-Time Failures	23
Total Lost Time in Hours	11
Total Operating Time in Hours	287

Class of Failure	Essential Maintenance		Chargeable to System: Explained		Chargeable to System: Unexplained	
	No.	Min. Lost	No.	Min. Lost	No.	Min. Lost
Tubes	1	13	3	105		
Fuses			3	0		
Alarms			2	0		
			7	108	10	86
Miscellaneous	1	76	1	273		
Number of Lost-Time Incidents	2	89	11	486	10	86
Number of No-Lost-Time Incidents			5	0		

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

Tests have been run in conjunction with Group 24 on the fine-grain-data system. Partial test patterns have been received, and some progress has been made in correcting the message structure and improving operation. Four hours a week are being devoted to these tests.

The fine-grain-data display system has been installed and appears to be operating satisfactorily. The system has not yet been completely checked. The permanent installation should be complete by the end of the next biweekly period.

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

The majority of computer down time for this period was attributable to three types of failures:

1. Two and one-half hours were lost as the result of open heaters in a cathode follower for the auxiliary drum. The personnel present at the time of failure were not familiar with the drum circuits.

2. Several transient alarms interrupted computer operation. The majority of these were caused by power transients generated when racks of equipment were switched on and off.

3. A failure of Cambridge Electric power resulted in a loss of approximately 4 hours.

Power Supplies

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

The power to the Barta Building was off 4 hours 24 March because of an underground feeder fault on the Cambridge power system. This fault again pointed out the need for some sort of emergency power.

It appears that the additional capacity that has been put across the -60-v supply maintained bias long enough to avoid spurious writing on the drums due to a power failure.

1.2.3 Terminal Equipment

Equipment-Malfunction Reports

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

Various methods of summarizing equipment-malfunction reports have been considered. A scheme proposed by Bob Davis of assessing points for each malfunction promises to produce data which will show potential effects on an idealized system for a standard-type mission.

Output Coder

(L. H. Norcott) (UNCLASSIFIED)

A couple of wiring errors were made in installing a new stepping switch in the test-message selector. These errors are now being corrected, and the test-message selector will be retested 28 March.

Maintenance Programming

(J. Ackley) (UNCLASSIFIED)

The major portion of required reliability programs for WWI now complete, I have relinquished most of my responsibilities for maintenance programming to those directly responsible for the maintenance of particular sections of the WWI system.

I have begun a study of radar input for the Cape Cod and XD-1 Systems with an eye for reliability and maintenance problems.

Display System

(T. Sandy) (UNCLASSIFIED)

The horizontal and vertical display decoders and the display vector generator were aligned.

The Mark X display decoder was installed and aligned with an accuracy of about 2%. A computer program is being prepared which should enable us to align the decoder to 0.1%.

MITE

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

MITE 0 has been modified so that it is now ready to receive the duplexed phone-line messages that will arrive at the Barta Building soon. Test programs have also been modified to check MITE 0 under this new condition.

II - AN/FSQ-7

2.1 Liaison

2.1.1 System

Production Coordination Office

(A. P. Kromer) (UNCLASSIFIED)

Draft of AFCRC Exhibit 55-18, covering the AN/FSQ-8, was reviewed with IBM for final concurrence and released to CRC for processing and transmittal to RAFD where it will be used as a reference in contractual negotiations.

A proposed amendment to AFCRC Exhibit 1A (covering AN/FSQ-7 (XD-1) prototype) to include the Command Post equipment (display consoles, DID desk, etc.) has received IBM concurrence. However, the matter of modification of the room (projection booth, dais, partition changes, etc.) remains unresolved. Plans for the XD-1 Command Post have been forwarded to ADC for review and approval. Orders for actual installation cannot be released until both these matters are settled.

Completion of Lincoln Laboratory Memorandum 6M-3330, covering assignment of intervention switches, warning lights, etc., has resulted in a request for certain changes in equipment arrangement in the several operation rooms on the fourth floor of the Direction Center. This matter will be processed for concurrence by the Air Force and other organizations and revised requirements drawings released with a TIR. IBM is proceeding to work according to the new information in its cabling design work on the assumption that requested changes will be approved. Western Electric Co. will also work according to the new information for revising the air-duct layout. This revision is necessitated by interference between ducts and cable support structure.

The monthly AC&W Phasing Group (Air Materiel Command) held its regular meeting at AFCRC on 23 and 24 March 1955. During this time the group visited the XD-1 installation in Building F and was guided through by Lincoln and IBM representatives.

Technical Information Release

(P. Bragar, 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
1-67	6M-3330	Auxiliary Console and Wing Unit Equipment Allocation and Layout for AN/FSQ-7 D.C.'s

Sage System and XD-1 Schedules

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

On 24 March W. H. Ayer and J. J. Carson, together with C. Watt and T. Parkins of Group 64, attended a meeting at Kingston, New York, concerning IBM scheduling procedures. A proposal was made to facilitate the exchange of information affecting duplex schedules with a view toward predicting and circumventing potential problem areas.

The following XD-1 Status Reports have been written:

Report	Subject and Status
4	The manual-data-input frame 23, MDI interconnection frame 28, and warning-light-control frame 30 are being scheduled for simple testing on XD-2 at IBM. The probable delivery date according to Lincoln schedules will be 15 April, 6 weeks late.
5	The drum-housing and the drum-control frames, 21 and 22, were scheduled for delivery 21 February. They actually arrived at Lincoln on 16 March, 3 weeks late.

(E. L. Smiley) (UNCLASSIFIED)

The remodeling of the light-testing room (B-034) was completed 17 March; the room is available for testing purposes. Additional work is being done in an attempt to provide a less expensive louvered ceiling. Experiments with different types of ceilings and different color schemes will continue for the next several months.

We have obtained concurrence between Lincoln and IBM personnel regarding the display-equipment layout. This agreement was reached 25 March 1955 at a meeting with the following people:

Lincoln	IBM
R. R. Everett	J. V. Schmitz
S. H. Dodd	E. Burke
B. E. Morriss	
J. A. Arnow	Western Electric
W. S. Attridge, Jr.	
A. P. Kromer	W. Ormsbee
E. Lundberg	
E. L. Smiley	

It should be noted that, in order to keep the building construction on schedule, this change should be regarded as final for sites 1, 2, and 3. Any further changes in equipment location must be absolutely essential to system operation.

Considerable time has been spent discussing operational console cabling problems. There is interference between the present air-ducting layout and the proposed cabling layout. This problem must be resolved within the next biweekly period if the building construction is to be finished on schedule.

2.1.2 Technical

(C. W. Watt, T. R. Parkins) (UNCLASSIFIED)

Scheduling of Systems Office activity is under way; five of the ten schedules have been generated. In their final form these schedules will show manpower distribution in the various activities.

The help the Systems Office will need from Group 61 has been analysed and reviewed and a corrected draft memo prepared. This new draft is now under discussion.

A meeting was held Thursday, 24 March, in Kingston among IBM scheduling people and representatives of Groups 64 and 66. We hope that our scheduling activity will become a more effective link between IBM and MIT.

Reliability of Duplexed Equipment

(R. C. Jeffrey) (UNCLASSIFIED)

A final draft of 6M-3441, "Reliability of Duplexed Equipment," is being prepared. It will contain formulas for estimating reliability of duplexed equipment on the basis of reliability data on the two halves. As part of an effort to estimate the reliability of the duplexed parts of the AN/FSQ-7, estimates are being sought for the time it would take the SAGE operational program to regenerate track data after simultaneous failures of both computers.

2.2 XD-1, XD-2

2.2.1 Systems

Outputs

(M. D. Feldstein, S. B. Ginsburg, H. K. Rising) (CONFIDENTIAL)

On Thursday, 24 March 1955, a meeting was held at AFCRC on weapons availability for XD-1 testing. A report of this meeting has been issued as 6M-3479.

A formal request has been made to IBM to initiate a study to determine the electronic problems involved in providing an uninterleaved ground-to-ground type of output by modifying the readout winding geometry in the core-storage arrays.

Time Division G/A Data Link

(M. D. Feldstein, S. B. Ginsburg, H. K. Rising) (CONFIDENTIAL)

A meeting was held at Whippany with BTL, Div. 2, Div. 3, and Div. 6 representatives to discuss the possible methods for transmitting ground-to-air messages to G.E. time-division receivers and BTL D/A receivers via the same ground equipment. Two proposals will be further investigated. AT&T will look into the problem of using program lines to send data-link modulation directly from the computer at a 5-kc rate. J. R. Davey of BTL and H. K. Rising will look into the problem of the equipment required to operate the time-division data links with standard 1300-pps data circuits. A report on this meeting will be issued soon.

Bomarc

(M. D. Feldstein, S. B. Ginsburg, H. K. Rising) (CONFIDENTIAL)

A meeting was held with J. Rawls of Boeing Airplane Company to discuss the bit layout of ground-to-air words for Bomarc. The presently planned G/A output words for use with the G.E. frequency-division data link may be suitable for use without change for Bomarc in its new mode of operation, i.e., addressing four missiles on a subcarrier by address bits rather than by transmitter radio frequency.

(XD-1) LRI Inputs

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

Supplements were written for 6M-3333 and 6M-3334 amending the bit layout on the LRI drums for both South Truro and production P-sites. These new bit arrangements have the approval of the people from Group 61.

(J. Giordano) (UNCLASSIFIED)

IBM-SO concurrence for AN/FSQ-7 (XD-1) has been accorded to:

1. Core Memory Assignment Switch Using "Space" Toggle Switch on Maintenance Console (C.E.R. No. 10);

2. "Lock Address Counter" Modifications by A. Gayle, dated 12/22/54 (C.E.R. No. 17);

3. Change in the Rewind Specs. stated on page 7 of "Magnetic Tape Proposal" by F. A. Glenn, Jr. (C.E.R.) No. 16);

4. Revision in the equipment list to add 3 special display modules and a situation-display camera control panel; and

5. Building F Basement Layout (Temporary IBM No. 163).

Logical Services Committee

(R. P. Mayer) (UNCLASSIFIED)

A memo is being written telling how to speed up AN/FSQ-7. One trick is to use both memory banks at the same time. Also, special orders can be designed to repeat a given function many times. Four times the present speed seems possible. (Fog index: 6.2)

A detailed drawing schedule was prepared. Drawings for the central computer should be done by 1 May. We are now three weeks late. Nolan Jones is now busy on the display system specifications. Every effort will be made to get the drawings done on time. (Fog index: 5.4)

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

Memorandum 6M-3439, "Proposed Specifications for Large Board Display, (XD-1)," was published to document a system developed by Dr. Frank Rodgers and Group 25. Further tests are being made preparatory to a demonstration for the Air Force. This system involves photographing a situation display on Polaroid film and projecting the photographic image on a large screen.

A study of the requirements of the Command Post Digital Display Desk was completed and an initial design proposed. This design is being discussed with various groups within the Laboratory and at IBM.

XD-1 Equipment Testing by MTC

(H. I. Rundquist) (UNCLASSIFIED)

One of the planned applications of MTC (refer to Memorandum 6M-3445) is to test the XD-1 mapper console. I have written a program to simulate the output of a gap-filler radar subject to variations in angular velocity. Tests with the mapper console at Poughkeepsie are scheduled to commence the week of 28 March.

Power Distribution

(G. F. Sandy) (UNCLASSIFIED)

Of the seven documents describing the XD-1 power-distribution frames, two have been concurred upon, four more have been written and are now being corrected, and the last will be written in the near future.

2.2.2 Installation

XD-1 Installation Information - Report 31 (Extract)

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

I. Building Construction

Testing of the sprinkler system and installation of the lighting were pointed out as major deterrents to Air Force acceptance of the building interior in our last report. Since that report, the sprinkler system was successfully tested, using a hydrostatic test, on 19 March; lighting installation should be completed by the end of March. The Air Force, through Air Installations Regional Office, has indicated a wish to inspect Building F, interior only, for acceptance within a week to 10 days.

II. Schedules

A new summary schedule will be issued the week of 28 March.

III. Equipment Cooling

It is expected that sheet-metal fabrication will be completed by 1 April. Testing and balancing of the system, insofar as possible prior to delivery of all electronic equipment, will proceed immediately thereafter.

We have had to operate without chilled water since 17 March, when the chilled water system at the base power plant failed because of a combination of events. Repairs should be completed by 30 March. Fortunately, the temperature of the outside air has been cold enough to permit XD-1 operation by using outside air for cooling.

IV. Cabling

A. Power

Hookup to frames has kept pace with the receipt of equipment. Since last report the drum system has been tied in along with the situation-display generator. Hookup from the display-console circuit-breaker frame to the power-distribution boxes continues.

Except for console power cabling, all other power cables are in place and awaiting frame delivery.

B. Signal

Provisions have been made to tie the display frames to MTC to test display before the display system is connected to the drums and central computer on about 1 June.

Signal-cable installation for first-floor equipment is on time and, in some cases ahead of schedule. Second-floor installation will be delayed about 2 weeks because of modifications and reworking of cables. This does not seem to be a serious problem in light of the console delivery schedule.

V. Equipment Layout

Projection Room - until the PCO is advised by responsible Air Force personnel that the current layout is satisfactory or is changed to reflect Air Force requirements, we cannot proceed with necessary room changes.

IBM Basement - All contracts have been let, and the work is progressing.

VI. Lighting

A meeting was held on 18 March to discuss deficiencies of the lighting system as installed in Building F. Items of major concern were second-floor corridor lighting and the lighting in rooms D, X, Y, and Maintenance on the second floor.

At the meeting it was agreed the contractor could not be held for the corridor lighting deficiency; it was, however, agreed that the contractor should correct the deficiencies in the four rooms noted above, and the Air Installations Office representative at the meeting so instructed the contractor.

On 21 March we were informed that the Air Installations Office, after further investigation, had rescinded its directive to the contractor regarding rooms D, X, Y, and Maintenance. AIO is of the opinion that the contractor has complied with the lighting drawings and specifications.

VII. Telephones

The switchboard is being installed. Most of the equipment is on the job. Console cables are still being pulled into place; frame wiring continues in the basement.

VIII. General

It is felt that our housekeeping problems might be greatly eased if the AF would accept the building and then turn it over to Lincoln Lab for operation and maintenance.

XD-1 Drums

(H. Boyd) (UNCLASSIFIED)

The last of the "Lost Battalion" has been working this past week on the XD-1 drums, helping to put them back in running condition. We've been experiencing a great many difficulties in this respect but still hope to run the CD side with the central computer in April.

2.2.3 Testing

XD-1 Evaluation

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

The second in a series of XD-1 central-computer evaluations has been made. Information from logbook entries and results of an 8-hour computer test on 18 March 1955 provide the data for this evaluation; the results are being published in 6M-3478, "Results of the XD-1 Central Computer Evaluation 18 March 1955."

XD-1

(S. Coffin) (UNCLASSIFIED)

The outputs of the filament alternator and d-c supply alternator are being monitored with a chart-recording voltmeter to determine whether the machines are regulating properly. During a 3-day period there was a slow drift of 1%, an intermittent hunting of 4%, and numerous load and line transients of 4% or less. Attention is being given to improving the regulation by proper damping and isolation from line transients.

D-C Power Supplies

(J. Clarke) (UNCLASSIFIED)

Inrush currents on +250 and -150-v units and the total inrush to all units was measured. Tests were conducted at full and half voltage application. The results showed that the generator voltage dipped to approximately one-half of its rated output resulting in reduced inrush currents. The results of this test indicate that full voltage can be applied to the d-c supplies without exceeding breaker rating.

Motor Generator Sets

(A. Chopourian) (UNCLASSIFIED)

The increase of filament load caused by the addition of the drum system resulted in an oscillation in the generator output. Increasing the damping by adjustment of a resistor in series with the damping transformer primary eliminated the trouble.

Equipment Cooling

(A. Chopourian) (UNCLASSIFIED)

Failure of relaying at the Air Force power plant to protect against the overload applied to the chilled-water pumps while testing the XD-1 system damaged the cooler tubes, resulting in a loss of chilled water. When the equipment was taken apart for repairs about 100 pounds of debris were found; therefore, strainers are not going to be put into the chilled-water line. Equipment in Building F will be cooled by the use of outside air until the power plant is operative sometime late in the week of 28 March.

The equipment-cooling contractor discovered that the fan shafts of nearly all air handlers are too small in diameter and improperly polished for use on sleeve bearings. The manufacturer will replace them.

2.3 Production System

(S. H. Dodd) (UNCLASSIFIED)

At a meeting attended by representatives of Divisions 2, 3, and 6 and ADES on Tuesday, 22 March, the Engineering-Installation Phasing Committee Summary Report No. 6 was approved as a working document. This report is a schedule of the activity during the 8-months installation and test period at the Direction Center for Subsector 1. Although portions of the report are incomplete, it was agreed that the document was adequate as a starting point.

(K. E. McVicar) (UNCLASSIFIED)

The System Operation and Testing Section of the ADES Engineering-Installation Phasing Committee Report is being rewritten to take into account the new plans for writing the operational program. Simultaneously, the schedule is being expanded to include the second Subsector.

AN/FSQ-7 Communications

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

Memorandum 6M-3275, "Leased Telephone Circuits for AN/FSQ-7 (XD-1)," has been published and is available in the Division 6 Document Room. This memo is a prospectus for XD-1 external voice, data, G/A radio, and teletype circuits but is not a definite order or commitment. Firm orders for those circuits needed prior to 1 August 1955 will be placed soon.

Drawing E-75168, "Internal Telephone Circuit Appearances AN/FSQ-7 (XD-1)," is a diagram of XD-1 internal telephone circuits similar to E-75068 except that the station name is indicated. This drawing is available in the Division 6 Print Room.

Conferences have been held with representatives of NET&T and AT&T in an effort to estimate the installation cost and monthly charge for the XD-1 internal and external telephone system. AFCRC requires this information for budgetary purposes.

A meeting was held among ADC, ADES, AT&T, BTL, and Lincoln for the purpose of discussing further the BTL draft covering SAGE ground/air radio facilities (see 6M-3457, p. 26). A target date of 2 May 1955 was set for completion of firm specifications. Further conferences are scheduled so that mutually agreeable specifications for XD-1 equipment may be arrived at.

Gap-Filler Inputs (GFI)

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

Data gathering for writing adequate GFI specifications for AN/FSQ-7 is nearing completion. A study of this data will be started in the next biweekly period.

Pattern Generators for Input-Element Testing

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

A meeting was held in Poughkeepsie on 23 March to discuss the proposed pattern generators for testing the automatic input elements (LRI, XTI, and GFI) with simulated data. The functions to be performed by the generators and who was to construct them were tentatively agreed upon. The question of inserting time allowance into the construction schedule must still be decided.

Outputs

AN/TSQ-7 Type Output

(M. D. Feldstein, S. B. Ginsburg, H. K. Rising) (CONFIDENTIAL)

A proposal is being prepared on means of communicating with an Army AN/TSQ-7 communications system. There are two methods:

1. A new ground-to-ground output section modified to transmit at 750 pps;

2. A black-box conversion unit, located at any point between the Direction Center and the AN/TSQ-7 receiver, which would have a single 1300-pps input and either one or two 950-pps outputs.

In either case, the SAGE System message format would have to be modified to conform with the AN/TSQ-7 message format.

At this time, it seems that a black-box conversion unit would be justified because of the relatively low data rates required in the Army system.

FSQ-8 Auxiliary Memory Requirements

(J. F. Jacobs, P. R. Bagley) (UNCLASSIFIED)

The results of a study of the requirements for auxiliary memory in FSQ-8, made by F. Heart and W. Lone of Group 61, are being prepared for presentation to the Air Force on 31 March.

Power Generation

(J. J. Gano, P. Morrill) (UNCLASSIFIED)

A meeting with Burns & Roe and Jackson & Moreland representatives on 28 March is expected to resolve the one or two differences in the power-distribution system for the fourth Direction Center.

Power Distribution

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

Documentation of extracts from the XD-1 and XD-2 logs confirmed our belief that the Struthers-Dunn relays used for the control of power in the marginal checking and distribution (MCD) and power control and distribution (PCD) frames are very unreliable; they should be replaced as soon as possible and should not be used in the production machine.

Power Generation

(R. Jahn) (UNCLASSIFIED)

I have been obtaining more accurate electrical-load estimates for Direction Centers. Many of the original estimates are out of date or too high, because no account was taken of diversity factors. Some duty cycles were unknown. IBM submitted unrealistic figures in two or three areas. After being referred from person to person and completing a circle two or three times, the figures were reduced by factors of 2 to 4, and one of them is still subject to closer investigation.

Accurate electrical-load figures are necessary, because air-conditioning loads are becoming critical.

2.4 Vacuum Tube Circuits

XD-1 Digit-Plane Driver (Mod. II)

(J. Kriensky) (UNCLASSIFIED)

The design of the input diode circuitry has been changed, and now this part of the circuit operates properly. Another change will be necessary in order to obtain a larger output amplitude than is presently realized.

Flip-Flop, Mod. A

(N. J. Ockene) (UNCLASSIFIED)

The past period has been spent investigating an IBM Model A flip-flop, a production plug-in unit that will go into XD-2 equipment. This model was found to have a maximum sensitivity of 5 volts when "40% down" Z2177 tubes were used.

Present production units built by IBM have been found to trigger with voltages as low as 5 or 7 volts even when bogie tubes were employed.

The problem, therefore, is to determine the relationship between these highly sensitive circuits and the conditions causing them.

Phone-Line Demodulator

(E. B. Glover) (UNCLASSIFIED)

M-note 6M-3403, "Digital Data Receiver and Gap Filler Input Receiver," has been checked and corrected. It will be sent to the Duplicating Room the first part of the week beginning 28 March.

Vector Generator

(E. B. Glover) (UNCLASSIFIED)

Part of the past biweekly period has been spent familiarizing myself with the theory of operation of the vector generator in preparation for circuits work on this unit.

2.5 Display

(J. Woolf) (UNCLASSIFIED)

The preprototype console which will be used for photographic work is in operation. Dr. Gardner and Mr. Zimmerman of Group 25 have

taken pictures of the 5-inch Charactron. Their program calls for future use of the console with either the 5-inch or 19-inch Charactron with the P-11 phosphor.

The display console developed some bugs which were traced to faulty relays in the digital expansion. This resulted in the intensity pulse modulating the x,y position. The display appeared with a smear, similar to insufficient settling time in the deflection yoke.

In the future the point and vector will be written through the large hole at the top of the matrix. Additional circuitry is required to accomplish this.

Henry Zieman and I met Dr. Volkers of Millivac Instruments at the IRE convention in New York. He is the designer of the Volkers and Schaeffer scope. Discussions with him proved very interesting in that he is attempting to solve problems very similar to those of our display group. Ground work was laid for future meetings.

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

All wiring on frame 24, except for the intermodule wiring, has been inspected, and all errors have been rectified. The installation of intermodule wiring has started.

(H. E. Zieman) (UNCLASSIFIED)

Marginal checking of all display decoders has been completed and reviewed by Dick Best. An M-note (6M-3885) is being written which will describe the operation of all the decoders, the marginal-check data, any voltage and current relations which might aid in trouble-shooting the decoders, and all input-output requirements necessary for an IBM Military Reference Data Book report.

As I have more pressing work, the marginal checking of the display-line driver will be completed by J. Kriensky of Dick Best's group.

An intensive study of the magnetic-deflection-driver amplifier is being undertaken to speed up the rise time of the present amplifier.

Display System Test Planning

(R. H. Gerhardt) (UNCLASSIFIED)

The digital-display (DD) system test planning is 100% complete. D. J. Williams of IBM reports that the programs are written and punched on octal-form cards. The programs are yet to be punched on binary-form cards and checked. Diagnostic programming without marginal checking has begun.

System test plans for the situation display (SD) have started. We plan to use a different approach to this test. The program will be written from a reliability standpoint and will indicate failures without locating the trouble.

Display Generator

(R. B. Paddock) (UNCLASSIFIED)

The frame-testing of the digital-display generator has been progressing very satisfactorily; surprisingly few troubles have been encountered in the operation of sections plugged in thus far. Lack of sufficient pluggable units has now centered our attention on details of line terminations; section operation-checking will be resumed in about a week, subject to receipt of a quantity of pluggable units.

Automatic Camera Control and Camera

(L. Sutro) (UNCLASSIFIED)

With the camera-control circuit determined we have turned our attention to detailed design of the pluggable units and the camera mount. B. Gurley is designing the pluggable units. L. Prentice and A. Smith are designing a temporary camera mount for XD-1 and XD-2.

The camera mount for the production units may have a folded light path so that it will be smaller and better looking. To consider this and the modifications that need to be made to the camera, L. Prentice and I visited Fairchild Camera and Instrument Company on 22 March. Fairchild proposed a camera mount with a light path that folded down along the face of the tube, then outwards. We think this is little improvement over a straight path. Fairchild is now working on a proposal to fold the light path up and back.

2.6 Vacuum Tube Circuits

2.6.1 Activities of Group 65

(P. Youtz) (UNCLASSIFIED)

I spent most of the week of 14 March 1955 with IBM personnel and tube manufacturers discussing second sources for the critical tubes in AN/FSQ-7. As a result of these meetings, joint IBM-MIT engineering recommendations were made to the IBM contracting officers.

I spent most of the week of 21 March 1955 at the IRE meeting and at Poughkeepsie with IBM personnel and tube manufacturers discussing production problems associated with the critical tubes in AN/FSQ-7.

Two special 5-inch flat-face Charactron tubes with P11 screens were constructed for the large-display program. A 19-inch Charactron with a P11 screen was also constructed for the photographic studies in the large-display program.

Several control tubes for the phosphor studies were constructed and tested.

2.6.2 Tube Research and Development

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

Controlled experiments were continued in the Barta Building chemical laboratory to check phosphor settling and aluminizing procedures and to estimate the margins within different specifications. Techniques were also developed for settling and aluminizing P11 phosphor screens. These techniques were employed to do some phosphor settling for the large-display program.

A number of electron guns and receiver tubes were polycast to aid the dimensional-analysis study programs.

(S. Twicken) (UNCLASSIFIED)

Together with the IBM Tube Group I attended a progress meeting on the 3002420 at Sylvania. Present production has been increased to 9000 tubes per month and is well in hand. Plans were being made to transfer gradually 2420 production to the Brookville, Pennsylvania, plant by April 1956, since facilities at Emporium are not sufficient to produce IBM's total requirements should the second source have difficulties. This production transfer is a potentially dangerous situation; we plan to follow it very closely. Sylvania has restated its position on relations with a second source of the gate pentode, namely, that it will cooperate to the fullest extent possible.

The first tubes of Sylvania's dimensional-analysis test program show the pulse-plate current to be almost invariant with electrode spacings within the ranges of the tests; this is very unusual. Measurements here show major discrepancies in pulse-current readings, and Sylvania has agreed to postpone dissection of the tubes pending resolution of the differences.

Engineering decisions on second sources for the low-power twin triode and the gate pentode were reached at a meeting with IBM at Kingston.

(T. F. Clough) (UNCLASSIFIED)

During this period the sections of the Lincoln Tube Processing Specifications concerning lacquering and phosphoring were completely rewritten. Each section of the specifications will be kept up to date by

noting all changes made from the procedure originally specified.

During the week of 21 March 1955 I attended the National IRE Convention to discuss new electron tubes and tube materials with company representatives.

(A. Zacharias) (UNCLASSIFIED)

Electron-gun studies were continued to determine the causes of astigmatism and beam-center shift present in the Convair Charactron tubes. The program of imbedding in thermo-setting plastic electron guns exhibiting these phenomena did not yield any positive results. There was some indication that the cathode structure of these tubes was tilted and off center. We will continue these studies next period.

Five tubes were received from Superior for analysis. Superior also sent ten tubes of this lot to Convair for analysis. We will put two of these guns in CT type tubes to investigate astigmatism and beam-center shift.

Under construction and test is a very stable high-voltage regulator for phosphor studies. This should be in operation the week of 28 March.

(P. C. Tandy) (UNCLASSIFIED)

Eight 19-inch Charactrons, CHT-61, CHT-62-1, CHT-68-1, CHT-72-2, CHT-73, CHT-75, CHT-80, and Convair 0082, have completed from 510 to 3454 hours on life test. At the last testing period CHT-62-1, CHT-72-2, CHT-73, CHT-80, and Convair 0082 had shown no appreciable change. The zero-bias pulse-matrix current of CHT-61 dropped from 172 to 136 microamperes between 3083 and 3274 hours, while the maximum ratio of pulse-cathode current to pulse-matrix current rose from 25.4 to 30.4 microamperes. Between 411 and 574 hours CHT-68-1 showed a drop in zero-bias matrix current from 220 to 86 microamperes, while the ratio of cathode to matrix current rose from 14 to 32 microamperes. In CHT-75, I_{Matrix} dropped from 175 to 120 microamperes, and the ratio of $I_k:I_{Matrix}$ changed from 15.4 to 22 microamperes.

Convair 7-1 was taken off life test after 640 hours, because the pulse zero-bias matrix current at 288 hours had not met the requirement of 50 microamperes.

Checks made on CHT-67, CHT-68-1, CHT-73, CHT-75, CHT-80, Convair 7-1, 0082, and 0091 showed no appreciable leakage.

Table I shows the leakages measured on other tubes.

Table I

Tube	Element	Leakage Current Measured	Hours on Life
CHT-61	S1	0.16 microampere	3341
CHT-62-1	S1	33 microamperes	3226
	S1, S2, S3, S4	20 microamperes	
CHT-72-2	A_2-Matrix	70-74 microamperes	643
Convair 14-1	A_2-Matrix	0.19 microampere	0
Convair 14-5	C_3	3 microamperes	0
	A_2-Matrix	1 microampere	

Leakage limits are 1 microampere.

The capacitance, C, and the dissipation factor, D, of a 12-inch diameter aluminum disc to A_3 button was measured. No more than experimental error was noted in the following tubes: CHT-61, CHT-62-1, CHT-68-1, CHT-72-2, CHT-75, CHT-85, and Convair 7-1. Table II shows the changes noted between testing periods.

Table II

Capacitance and Dissipation Factor of Aluminum Screen Backing

Tube	Capacitance	Dissipation Factor	Hours on Life
CHT-73	345	0.01	0
	122	0.086	592
CHT-80	142	0.099	1114
	119	0.015	1867
CHT-84*	374	0.0074	0
	331	0.013	0

*Tube has no life-test hours--first measurement made in Vacuum-Tube Laboratory after processing. Second measurement made at life test.

By 1 April 1955, 15 positions should be available on life test. The voltage distribution and convergence-coil drivers have been completed. The individual tube control boxes should be completed within a week.

(L. B. Martin) (UNCLASSIFIED)

A program has been inaugurated to correct leakage between elements, a serious problem with Typotrons. Experiments to date indicate that most of the leakage is from high-field emission rather than conduction paths. Typotrons 291 and 12303 have been opened for further leakage experiments.

Six tubes are now in operation on the 16-position life test; four additional tubes will be put on test as soon as more positions are checked out.

The viewing screen button on tube 12522 came off because of poor soldering.

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

Tube	Total Hours	Condition
265	7927.5	marginal[1]
280	7109.5	satisfactory
389	5506.9	satisfactory
390	5590.7	satisfactory
392	5590.7	satisfactory
394	4808.6	marginal[2]
11521	658.8	satisfactory
11601	903.3	satisfactory

[1]Tube 265 has been marginal for approximately 5000 hours because of ion damage to center of storage surface. Tubes of a later model have ion repeller screens.

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

The following tubes have been on the 16-position life test for 265.3 hours and are satisfactory: 11981, 12122, 12221, 12523, 12622, and 12641.

2.7 Memory Test Computer

General

(W. A. Hosier) (UNCLASSIFIED)

John Newitt joined the Section this period, thus augmenting our staff capabilities with his considerable repertory of experience and technique, which will be brought to bear as soon as he can acquaint himself with such MTC "facts of life" as control logic, programming, and basic circuits.

A good deal of effort these last 2 weeks has gone into organization and planning so that MTC may assist to an ever-increasing degree in more aspects of SAGE System testing. Impetus for this is largely as set forth in 6M-3445 of 14 March by Phil Bagley and Jim May, which mentions assorted SAGE System remote units (e.g., FGD and SDV links, mappers, output data links, etc.) for which more test time is likely to be needed than will be available on XD-1.

From our standpoint this has meant, first, an increased emphasis on maintenance and record keeping, since a test can hardly be more valid than the test apparatus is reliable. Second, it means incorporating logical "transducing" equipment such as phone-line DDT and DDR apparatus into the computer's standard terminal equipment; one of our technicians, Don Duncklee, has been working full time on this for the last 10 days.

The cold-water system blockage and freeze-up of 17 March, causing shutdown which is not expected to be restored until 28 March, has so far not interrupted MTC operation. Outside air is available to the computer, and with existing weather conditions computer-room temperature has never risen above 80 F. The power supply room in the basement, though, having no fresh-air intake, rose to 110 F until an emergency duct was tapped into the building air, bringing it down to about 92 F. Measures are now being taken to provide for this room air intake and exhaust normally dampered to a small flow but expandable to full flow in event of repeated cold-water shutdowns.

Computer time this period has been devoted more to programming (primarily Group 61 simulation studies) and less to development than previously.

Application			Hours	Per Cent
Programming			99.5	60.9
Development			36.0	22.1
Maintenance and Marginal Checking			20.7	12.7
Power Supply	6.1	Interrupting Failures	7.0	4.3
Other	0.9		163.2	100.0

The 4.7 hours of down time due to power supplies was an intermittent oscillation of the +150-v supply traced to a grid-cathode short in one of the series regulator tubes.

The other 1.4 hours were because of an open circuit-breaker in the alternator control, which in turn had blown a small fuse in the power-supply-control system.

The down time not due to power supplies was mainly trouble with diodes in drum circuits as mentioned below by Earle Gates.

Scope Display System

(H. Ziegler) (UNCLASSIFIED)

A study of the MTC scope-display system has revealed the following:

1. Scope intensification is highly prf sensitive;
2. There appears to be some 60-cycle modulation of scope deflection;
3. Cathode-ray tube is being operated below optimum ratings of manufacturer.

Sensitivity of intensification to the repetition rate was traced to buildup within the high-voltage power supply of the CRT control-grid bias. This high-voltage supply was originally designed for a visual monitor of storage and is completely inadequate for photographic display work. A completely new high-voltage supply has been designed and is under construction. Increased output from this new decoder and the use of optimum accelerating voltage on the cathode-ray tube makes necessary new deflection amplifiers. Design of these should start soon.

Card Machine

(F. R. Durgin) (UNCLASSIFIED)

A report on card-machine operation is being written. Block diagrams and circuit schematics for this device are being refined for Drafting.

Drums

(E. Gates) (UNCLASSIFIED)

During the past week several diodes in the drum diode switch had to be replaced. Two diodes were open, and the others had low back resistance. The reason for these failures has not been determined.

In-Out

(E. Gates) (UNCLASSIFIED)

At the IRE show I looked at the new Teletype printer which has been operated at 600 words per minute. Further information is needed to determine the feasibility of using this as a high-speed printer for MTC.

MTC Programming Manual

(P. R. Bagley) (UNCLASSIFIED)

The MTC Programming Manual is being completely rewritten and brought up to date. It will be issued in the near future as 6M-2527-2.

Analysis of MTC Tube & Components Defects

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

The following is a summary, for the period 14-25 March, of defects found in tubes and components in MTC:

Tube or Component	Defect	Number	Hours Lost
6080	Tap short	1	4.6
6145	Tap short	2	0
6145	Grid emission	1	0
Z2177	Tap short	1	0
Crystal type 1N34A	Back resistance too low	1	0
Resistors	Burned out	3	0
		9	4.6

III. ADVANCE DEVELOPMENT

3.1 Chemistry of Magnetic Materials

Improved Memory Cores

(F. E. Vinal) (UNCLASSIFIED)

Experiments have been initiated with the aim of further decreasing the switching time of memory cores from the present value of 0.95 microsecond, holding other specifications the same. Also, some attention is being given to development of an extremely fast switching core which would require greater driving currents.

Production of Memory Cores

(J. J. Sacco) (UNCLASSIFIED)

Approximately 150,000 D397 memory cores of the DCL-2-832 type have been prepared from batch DCL-2-833.

Four more 1.5-kg batches have been processed and test-fired. Pilot-plant production from one of these, DCL-2-835, will begin immediately, and production of this type core will be continued.

Inorganic Chemistry

(D. G. Wickham) (UNCLASSIFIED)

A series of solid solutions between pure zinc ferrite and ferrous germanate has been prepared. Seven samples ranging from 20% zinc ferrite to 80% zinc ferrite will now be examined to determine their magnetic and crystallographic properties.

Nickel Ferrite-Nickel Chromite

(D. L. Brown) (UNCLASSIFIED)

A series of nickel ferrite-nickel chromite compositions is being prepared to observe the effects of Cr^{+3} substitution for Fe^{+3} in the B site of the spinel lattice.

Magnesium-Copper Ferrite

(D. L. Brown) (UNCLASSIFIED)

A series of magnesium-copper ferrite compositions is being prepared for study of the effects of Cu^{+2} ion in causing tetragonality of a spinel.

Analytical Methods

(P. Reimers, F. Maddocks) (UNCLASSIFIED)

A Beckman automatic titrator has been set up in the laboratory. Analytical methods already in use in the laboratory for the determination of iron in ferrites and standardization of $KMnO_4$ stock solution were found to be readily adaptable to potentiometric procedures. Results are achieved more rapidly and more reproducibly than with previous methods. However, the present method for the determination of manganese in ferrites was found unsuitable for potentiometric titration. Experiments with a method given by Vogel in Quantitative Inorganic Analysis indicate that this method is accurate and reproducible, and the saving in time is considerable.

A method for the analysis of chromium, given by Hillebrand and Lundell in Applied Inorganic Analysis, was tried for the assay of Cr_2O_3.

The analysis of lithium ferrite seems difficult. No methods tried thus far have been satisfactory.

Chemical Analysis

(E. Keith) (UNCLASSIFIED)

Quantitative analyses of the following have been completed:

1. A batch of copper carbonate;
2. A batch of nickel carbonate.

Quantitative analysis of DCL-2-833, a memory-core composition, is in progress.

Cores for 256 x 256 Memory

(J. W. Schallerer) (UNCLASSIFIED)

We have to date double-tested approximately 185,000 cores for this memory. With the addition of the 65,000 tested for the first 256 x 256 plane, a total of 250,000 cores has been tested for this project. The cores are being tested both automatically and semiautomatically.

X-Y Testing

(J. W. Schallerer) (UNCLASSIFIED)

The results of the testing of 16 modules for the first 256 x 256 plane indicate that the X-Y test is not necessary when the cores are double-tested. Two cores were replaced because of marginal electrical properties in a total of seven planes constructed with double-tested cores, while six cores were replaced in six planes using single-tested cores. A few other cores have been replaced because of physical damage.

3.2 Physics of Magnetic Materials

The Perovskite-Type Manganites $(La_1M^{(II)})MnO_3$

(J. B. Goodenough) (UNCLASSIFIED)

A conference was held with Koehler of the Oak Ridge National Laboratories while I was attending the Physical Society meeting in Baltimore, Md. Koehler has been studying the crystallographic and magnetic properties of the manganite system with neutron-diffraction and X-ray techniques. The results he has obtained are in excellent agreement with the predictions I have made for this system using a covalent-bond model and the concept of semicovalent exchange. The system consists of five magnetic and crystallographic phases: four of the magnetic phases are antiferromagnetic, and one is ferromagnetic; three of the crystallographic phases are distorted perovskite, and two are cubic perovskite. The striking agreement between experiment and theory is strong support for the covalent-bond and semicovalent-exhange hypotheses which have been proposed for the spinel- and perovskite-type lattices containing manganese.

Single Crystals

(N. Menyuk) (UNCLASSIFIED)

A disk has been cut out in the (110) plane of a single crystal of manganese ferrite. The orientation of the crystal axes of this disk has been determined. Magnetostriction measurements on a similar disk of nickel ferrite have been completed. A second nickel-ferrite disk, cut out of the same original crystal, has been oriented. Further magnetostriction measurements must await the availability of the magnet.

Temperature Properties of Memory Cores

(J. D. Childress) (UNCLASSIFIED)

We are continually embarrassed by our lack of data on the temperature properties of memory cores. Although temperature is not an important factor in the present coincident-current memory, it is a parameter which has not been optimized. For the operation of higher-speed memories, the temperature properties of the magnetic cores used may be quite critical. Therefore, a series of tests is planned to:

1. Obtain temperature data on the present memory cores; and
2. Set up temperature-evaluation criteria

D-C Fluxmeter

(R. Pacl) (UNCLASSIFIED)

The regulated power supplies are being modified to induce greater stability in the power-amplifier section of the flux meter. The construction work is proceeding as usual.

3.3 New Components and Circuits

BTL Computer

(T. H. Meisling) (UNCLASSIFIED)

Mr. Cagle, Mr. Schonneman, and Mr. Sumner from the Bell Telephone Laboratories in Whippany visited us recently and told us about the laboratories' effort to transistorize the telephone switching network. This problem is attacked as a computer problem. Very high reliability will be required of the system. The prf will be approximately 1 megacycle. This is close enough to our requirements to make their project, which is still in a very early stage, of great interest to us.

It is interesting to note that BTL plans to use a barrier-grid electrostatic memory tube. This tube, which has been developed at BTL is expected to operate reliably with a high storage capacity.

Power-Transistor Measurements

(D. J. Eckl) (UNCLASSIFIED)

Since 20 type 2N57 power transistors recently obtained from Minneapolis-Honeywell appear to have questionable characteristics, we are setting up a heat sink apparatus to enable us to make measurements in the 100-ma region where they are rated.

Dunn Associates Plotter

(D. J. Eckl) (UNCLASSIFIED)

The new characteristic curve plotter was delivered, but a number of modifications were necessary before satisfactory operation was obtained. The unit now appears to be operating properly.

Visit to Philco

(D. J. Eckl) (UNCLASSIFIED)

The next monthly meeting to discuss progress on subcontract 49 will take place at Philco Plant 2 in Philadelphia on 5 April.

Pulse Buffer

(A. L. Pugh) (UNCLASSIFIED)

The emitter follower as a pulse buffer for driving a large number of stages appears to lack the necessary drive on the trailing edge of the pulse. Hole storage in the stages being driven permits the emitter follower to get out of the active region. Thus the driving impedance of the trailing edge of the pulse is only the emitter resistor.

Transistors Received

(P. A. Fergus) (UNCLASSIFIED)

Twenty power transistors were received from Minneapolis-Honeywell Co. Routine measurements of alpha, I_{co}, I_{eo}, grounded-emitter and grounded-base characteristics, and rise-fall time measurements were made and photographs taken.

Five-hundred surface-barrier transistors were received from Philco and are currently being processed.

Delay Lines

(E. U. Cohler) (UNCLASSIFIED)

The search for a good lumped delay line has led to the conclusion that a constant "k" structure cannot yield reasonable rise time to delay ratios (say 1/5) without an excessive number of elements (20-200). Certain other design procedures have been investigated and reveal the weakness of frequency-domain systhesis. For instance, a "flat-flat" design for a constant-amplitude linear-phase network approximates a delay line except for a rather sizable pulse at the origin. If this pulse is filtered out, the rise time of the delay line is deteriorated. Thus it appears that there is some basic limit on the rise time to delay ratio for a given amount of distortion and given number of elements. Work in the literature is sadly lacking on this point.

Flip-Flops

(E. U. Cohler) (UNCLASSIFIED)

A series of tests on various flip-flop designs is now being carried out. These will yield "shmoo" plots for certain important parameters in each flip-flop. So far the most promising design seems to be one which employs grounded-emitter amplifiers for buffering. Some of this research indicates that we may be able to use diode gates in an "admittance" complement input, thus eliminating two transistors.

(J. R. Freeman) (UNCLASSIFIED)

Tests with the SBT one-digit shift register when silicon diodes are used in the base leads show improved performance. The flip-flop voltage swings more than double, and the maximum free-running complementing rate is increased from approximately 5 megacycles to at least 6 megacycles.

(M. M. Cerier) (UNCLASSIFIED)

Flip-flops using lumped delay lines and silicon diodes at the bases of the gating transistors have been complemented with 0.1-μsec input pulses at 5 megacycles. The lumped delay lines used are made of nine

or ten passive elements. It seems reasonable to expect that a faster flip-flop can be made using a shorter delay and shorter input pulses.

A complement input has also been made using two T25G diodes as gates. This type of gating seems to work well with the lumped delay lines, although it is prf sensitive.

A Single-Rank Surface-Barrier-Transistor (SBT) Flip-Flop
(C. T. Kirk) (UNCLASSIFIED)

The single-rank SBT flip-flop discussed here employs lumped delay-lines in the level output circuits in order to accomplish the temporary storage necessary for single-rank operation of the flip-flop. The major difficulty with this type of flip-flop is reflections occurring in the delay line. A study of various lattice structures for lumped delay lines has shown that the simple L-type lattice structure has as good delay-line characteristics as the more complicated structures.

A flip-flop employing this L-type lattice structure in the lumped delay lines has been designed and built. It will be tested and evaluated as to its performance during the next biweekly period.

Cryotron

(D. A. Buck) (UNCLASSIFIED)

A 20-cryotron clock circuit composed of three flip-flops with six input gates and eight output gates connected so as to free-run through a six-period cycle does so at about 1 kilocycle. The frequency is limited by the L/R time constant of the circuits and agrees with the calculated frequency. Thinner structures will increase the speed by lowering the inductance and raising the resistance. Thinner wires, however, have a slightly lower superconducting transition temperature. Experiments are being designed, therefore, at a lower temperature.

The operating region (shmoo plot) of the 20-cryotron clock circuit is large, indicating stability. A second such clock is under construction. A cryotron winder is nearing completion in the model shop.

3.4 Memory

(W. N. Papian) (UNCLASSIFIED)

The plane assembly work is now installed in B-170. Two positions are presently in operation, a third will start in about a week, a fourth in a month or so; an outside electronic assembly outfit will add their help soon. The latest figure on the number of digit planes for the 256 x 256 memory comes to 36 plus 1 parity and 1 wired-in spare. Including those slated for Group 24, this amounts to 640 module planes (64 x 64); we are ordering parts and laying plans to build up to 700 of these modules.

Visitors last period included Messrs. Kincaid and Gordon of Laboratory for Electronics. We gave them what advice we could on their problem of designing a small core memory for a military airborne application.

Visitors

(E. A. Guditz) (UNCLASSIFIED)

Messrs. Art Lewis (Project Manager, Assembly Division) and Winston Van Kleeck (Engineer, Methods Department) of IBM visited the Lab on Thursday, 17 March, to discuss memory-plane construction. They received a detailed tour and demonstration of all aspects of our memory-plane manufacturing facilities.

Mechanical Design and Layout of 256 x 256 Memory

(E. A. Guditz) (UNCLASSIFIED)

Ten memory-plane modules have been completed for the first 256 x 256 memory plane. The testing of these planes on Memory Test Setup VI has already begun. The remaining six module planes are in various stages of construction.

Discussions were held with Francis Associates on cooling the new memory. Vacuum tubes will be cooled as is done in XD-1

A prototype aluminum frame for holding the 16 memory-plane modules has been constructed and is being evaluated.

Paper

(J. Raffel) (UNCLASSIFIED)

A paper entitled "Experiments on a Three-Core-Cell for High-Speed Memories" was delivered at the I.R.E. Convention in New York.

Sensing

(J. Raffel) (UNCLASSIFIED)

Experiments on mixing of outputs from sense-winding transformers (with center-tapped secondaries and diode for inversion) have proved successful. The main problem to be solved is that of cutting down the transformer recovery from the inhibit transient so that time will not be lost. More information on diodes at low levels would also be helpful.

Memory with External Selection

(S. Bradspies) (UNCLASSIFIED)

It has not been possible to build a memory cell that uses the fast General Ceramics 2201B cores exclusively. The low coercive force always yields a unit that is disturb sensitive, whether the loop resistance is large or small, and whether the driving current is large or small. I was able to construct a cell that was relatively insensitive to disturbs by substituting a 11DCL-2-720H2L-1 core for the memory core; however, the results were not very impressive.

An attempt is being made to lay out a system for testing fast memory arrays.

Tape Cores for Switch

(D. H. Ellis) (UNCLASSIFIED)

Tests have been made on the Burroughs metallic-tape cores. The results show that these cores switch faster than the cores made by Magnetics Inc. There is a decrease in the ratio of full output to half-select noise indicating some loss of squareness.

Data will be supplied to Burroughs along with information on the characteristics we desire.

Magnetic-Core Switch Driver

(J. L. Mitchell) (UNCLASSIFIED)

It has been determined that four 5998 cathodes will be needed to drive each switch line; the design of the driver will proceed on this basis. The addition of an R-C network in the plate of the driver tubes enables us to reduce the dissipation and increase the margin on the driver tubes.

Testing the 64 x 64 Modular Planes

(J. L. Mitchell) (UNCLASSIFIED)

A routine is being set up to test the 64 x 64 modules on Memory Test Setup VI.

Plug-in Unit

(J. L. Mitchell) (UNCLASSIFIED)

A meeting was held with Francis Associates regarding air conditioning. Francis Associates is going to design a tube-socket mount containing an orifice for cooling the tube.

3.5 Logical Design

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

Block diagrams for the proposed experimental multiplier are now available (SB-47192 through SB-47196). These block diagrams are similar to those used in the past but incorporate slight differences in notation to emphasize the differences inherent in transistor logic. In addition, block schematics (SB-62272, 3, and 4) of the multiplier have been drawn. The block schematics show individual transistors and are very nearly circuit schematics. Together with a timing diagram (SB-62271) and a little knowledge of transistor operation, the block diagrams should enable anyone to understand the block schematics, which in turn exactly specify the operation of the multiplier. It should be noted that the block schematics were generated directly from Boolean algebra some weeks ago, but experience gained in showing them to various people quickly showed that they were very nearly unintelligible by themselves. Accordingly, the series of block diagrams was prepared to assist the uninitiated. To avoid confusion, publication of the block schematics was held up until the diagrams were ready.

The general problem of explaining our logical designs has been occupying this Section for the past few weeks and will continue to occupy it for some time in the future.

3.6 System Design (Ken Olsen)

(Demetri Parfenuk) (UNCLASSIFIED)

A number of packaging methods have been experimented with, but etched circuits still seem to be fastest and most convenient. Our first model etched-board plug-in unit took less than 1 day to process. The Division 7 etched-wiring shop is efficient and very cooperative.

(R. A. Hughes) (UNCLASSIFIED)

A transistor crystal oscillator and pulse shaper has been built. This unit will generate pulses having a repetition rate from 2-10 megacycles depending on the crystal used and a pulse width of 0.05 microsecond.

(Royce Sawyer) (UNCLASSIFIED)

An indicator-light circuit using a low-current, low-voltage, incandescent bulb has been incorporated into a transistor flip-flop. Two transistors of the Radio Receptor PNP type were used to operate a G.E. 49 bulb.

(Jonathan Fadiman, Chesley Norman) (UNCLASSIFIED)

A six-digit counter is being assembled to study system problems. Two digits have been made to count at 5 megacycles, but operation is marginal.

IV - CENTRAL SERVICES

4.1 Material Requirements & Stock

(H. B. Morley) (UNCLASSIFIED)

The reorganization of our catalog files continues, with obsolete catalogs being discarded and new material added daily. The long-range objective of this program is to have available the latest catalogs of all major electronic manufacturers.

We are going to stock 8-ft relay racks again. These should be available in Div. 6 Special Stockroom in about 30 days.

4.2 Engineering Services

4.2.1 Components

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

Information on miniature components is rapidly accumulating, and after it has been evaluated the most likely items will be ordered and tested as time permits. Anyone wishing to have any such components evaluated should contact this Section.

Glass-body carbon film resistors are being investigated as a possible answer to the problem of the instability of regular 1% deposited carbon resistors.

4.2.3 Mechanical Engineering

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

Experimentation with 0.0025-inch Formex wire, helically wound on 0.004-inch lead wire, suggests a successful conclusion to the hitherto dubious design requisite of 0.004-inch lead and niobium wound cryotrons.

4.3 Drafting

Contoura-Constat

(A. M. Falcione) (UNCLASSIFIED)

We have purchased a Contoura-Constat machine which enables us to reproduce opaque material with a resulting transparent vellum from which we can reproduce either on Ozalid or by Multilith method. This machine is similar in operation to the Kodak-Verifax machines which are being used in several offices in the Laboratory. We expect to have the materials required to operate this machine within the next few days.

In the event that anyone is interested in this process, I have samples available in my office for demonstration purposes. The machine will be kept in the Duplicating Room (C-133).

Secretarial Manual

(A. M. Falcione) (UNCLASSIFIED)

The secretarial manual which John Bennett has been working on for some time is about ready for reproduction and will be issued to all secretaries in Division 6. It has been necessary to compile and rewrite many of the former Administrative Memoranda to agree with present procedures. Two others are yet to be revised to complete the manual.

4.4 Administration & Personnel

4.4.1 Staff

Termination

(J. C. Proctor) (UNCLASSIFIED)

Leroy Murray

4.4.2 Non-Staff

Termination

(R. A. Osborne) (UNCLASSIFIED)

Thomas Malloy

Open Requisitions

(R. A. Osborne) (UNCLASSIFIED)

1 Clerk-Typist for Group 62
2 Electronic Draftsmen
2 Secretaries for Group 60
1 Senior Secretary for Group 60
1 Technical Assistant

Accessions List

(D. B. Helwig) (CONFIDENTIAL)

The following documents were published by Division 6 or received from IBM during the period 14-28 March 1955:

NO.	AUTHOR	TITLE	CLS.
6M-3104	C. Grandy E. McEvoy	Weapons Direction Simulation Programming Specifications (6M-2706S)	C
6M-3275	H. Kirshner	Leased Telephone Circuits for AN/FSQ-7	C
6M-3277	W. Lemnios	Test Specification: Tracking Accuracy Tests Non-Maneuvering Courses	C
6M-3367	R. Gerhardt	The MTC Drum as a Temporary Signal Source for the XD-1 Display System	U
6M-3407	P. Bragar	SAGE System Meeting Feb. 28, 1955	U
6M-3410	E. Rich	Analysis of Recent Performance Records for the Whirlwind Computer System	U
6M-3424	H. Kirshner	Review of ADES Document "SAGE System Communications - Internal Voice System" Pt. I, Dir. Ctr., AN/FSQ-7	C
6M-3432	- - -	Group Organization List	U
6M-3436	H. Kirshner	Comparison of Dial and Manual Maintenance Intercom Systems for AN/FSQ-7 Systems	U
6M-3438	A. Werlin	Acceptance of the South Truro Fine Grain Data (FGD) Message by the Cape Cod System	C
6M-3439	R. Buzzard	Proposed Specifications for Large Board Display	C
6M-3440	A. Favret	DD Slot Assignment for SAGE and XD-1	C
6M-3442	E. Rich	Maintenance Coordination in the 1954 Cape Cod System	U
6M-3443	J. Crane S. Thompson	Results of the XD-1 Central Computer Evaluation, 1 March 1955	U
6M-3444	A. Heineck H. Boyd	Some Proposals and Recent Changes in the XD-1 Drum System - Part III	U
6M-3445	P. Bagley J. May	Proposal for the Use of Memory Test Computer as an Equipment Testing Facility	U
6M-3449	J. Giordano	Current XD-1 and Duplex Central, FSQ-8 Brief Index Listing	U
6M-3450	J. Ackley	Demonstration Program T-3782	U
6M-3451	J. Ackley	Hints for Whirlwind I Maintenance Programmers	U
6M-3453	A. Smalley	Mission Specs. (30-55) for Raydist Orientation on Wed. 23 March 1955	U
6M-3454	P. Bragar	SAGE System Meeting of March 14, 1955	U
6M-3455	A. Smalley	Mission Specs. (29-55) for an Accuracy Training Test on Tues. 22 March 1955	U
6M-3456	A. Smalley	Op. 61 Mission Specs. (31-55) for a Saturation Test on Thursday 24 March 1955	U
6M-3457	- - -	Biweekly Report of March 11, 1955	C
6M-3458	A. Smalley	Op. 61 Mission Specs. (32-55) for Program and Data Studies on Friday, 25 March 1955	U

Accessions List (Continued)

NO.	AUTHOR	TITLE	CLS.
6M-3459	H. Anderson	Minutes of SAGE Experimental Subsector Planning Approval Committee Meeting of 15 March 1955	C
6M-3460	M. Feldstein	Discussion with Bell Telephone Labs. on Errors in Digital Data Messages	U
6M-3461	P. Cioffi	Procedure for Reporting 1954 Cape Cod System Live Test Operations	C
6M-3465	L. Sutro	Test Equipment Committee Meeting, Feb. 25	U
6M-3466	H. Kirshner	SAGE System Teletype Requirements	C
6M-3467	A. Smalley	Op. 61 Mission Specs. (33-55) for an Accuracy Training Test on Tues. March 29	U
6M-3468	A. Smalley	Mission Specs. (34-55) for Raydist Orientation on Wed. 30 March	U
6M-3469	A. Smalley	Mission Specs. (35-55) for a Saturation Test on Thursday 31 March	U
6M-3470	A. Smalley	Op. 61 Mission Specs. (36-55) for Program and Data Studies on Friday, 1 April	U
6M-3471	P. Bragar	SAGE System Meeting of March 21, 1955	U
6M-3472	E. Lundberg	Discussion of Lincoln Concurrence on Engineering-Installation Phasing Committee, SR#6	U
		IBM DOCUMENTS	
IBM-708	H. Heath	Component Removal (H-168)	U
IBM-709	- - -	Central Reference Room Bulletins 70 - 71	U
IBM-711	F. Schulman	System Test Plans, Phase VII, DRUMS	U
IBM-712	- - -	AN/FSQ-7 Biweekly Progress Report (PBW-49)	C
IBM-713	M. Astrahan	DC-1 Specifications	U
IBM-714	R. Cigledy	MRD Codes	U

In accordance with Administrative Memorandum 6A-172, the following pages list all of the Division 6 DR Reports received as of this Biweekly date. This basic list is also available in the Document Room as 6M-3400.

Accessions List (Continued)

NO.	AUTHOR	TITLE & IBM NO.	CLS.
DR-1	- - -	Maintenance Intercom, Production Machine (D-38-1) (Drawing)	U
DR-2	M. Dudek	Concurrence Letter on D-38-1 and Specifications	U
DR-3	R. Imm	Specifications for the Duplex Maintenance Console of AN/FSQ-7 Production System (D-32)	U
DR-4	R. Imm	Concurrence Letter on D-32	U
DR-5	R. Imm	Specifications for the Simplex Maintenance Console (D-46)	C
DR-6	M. Dudek	Proposal for the Duplex Central Switching Console (D-59)	U
DR-7	N. Jacobs	Proposal for the Centralized Probe System of Maintenance (D-56)	U
DR-8	R. Imm	Test Equipment Quantities (Tentative)	U
DR-9	W. Squire	Proposed Warning Light Specifications, Duplex Central (D-52)	U
DR-10	D. Ross	Memory Element for the AN/FSQ-7 Production System (IM-97) (D-14)	U
DR-11	D. Ross	Corrections to IM-97, dated 7-20-54 (D-14)	U
DR-12	D. Ross	Concurrence Letter on IM-97 (D-14)	U
DR-13	B. Morriss	Report on Concurrence Meeting, 12-2-54)	U
DR-14	C. Baccari R. Imm	Specifications of the Arithmetic Element for the AN/FSQ-7 Production System (IM-95) (D-6)	U
DR-15	D. Ross	Concurrence Letter on IM-95 (D-6)	U
DR-16	- - -	Number not used, information in DR-17	
DR-17	H. Kurkjian J. MacDonald	XD-1 Parity Count and Parity Check Controls (D-22)	U
DR-18	R. Imm	Relay Clock and Master Clock, Production Central (D-22)	U
DR-19	D. Ross	Concurrence Letter (D-22-1)	U
DR-20	R. Martin	Program Element for AN/FSQ-7 Production System (IM-94) (D-5)	U
DR-21	D. Ross	Program Element, Duplex Central, Concurrence Letter (D-5)	U
DR-22	R. Imm	Proposal for Change in "Control Clear" for AN/FSQ-7 Production System (D-42)	U
DR-23	D. Ross	Concurrence Letter on D-42	U
DR-24	R. Imm	Proposal for "Arithmetic Compare" in the AN/FSQ-7 (D-41)	U
DR-25	S. Thompson	The Instruction Control Frame (TR-15) (D-15)	U
DR-26	R. Imm	Concurrence Letter on TR-15	U
DR-27	R. Imm	Proposal for Automatic Branch on Alarms for the AN/FSQ-7 Production System (D-21)	U
DR-28	J. MacDonald	Automatic Branch Mode for Duplex Machines (D-21)	U
DR-29	D. Ross	Concurrence Letter on D-21	U
DR-30	R. Douglas	Proposal for an Automatic "Branch to Zero" Under Switch Control (D-45)	U
DR-31	D. Ross	Concurrence Letter for D-45	U
DR-32	R. Douglas	Cyclic Program Control	U
DR-33	H. Kurkjian	Selection and Input-Output Control Spec. (TR-240) (D-19)	U

Accessions List (Continued)

NO.	AUTHOR	TITLE & IBM NO.	CLS.
DR-34	R. Imm	Amendments to TR-24 (D-19) 7-19-54	U
DR-35	D. Ross	Amendments to TR-24 (D-19) 8-31-54	
DR-36	R. Imm	Proposal to Operate IO Interlock for the AN/FSQ-7 Production System (D-37)	U
DR-37	R. Imm	Concurrence Letter on DR-37	U
DR-38	R. Marden	Marginal Checking of Intercommunication Sense and Operate Circuits in the Production Machine (D-43)	U
DR-39	D. Ross	Concurrence Letter on D-43	U
DR-40	R. Imm	Specifications for the Duplex Maintenance Console of AN/FSQ-7 Production System (D-32)	U
DR-41	J. Murphy	Proposal for Test Memory (IM-79)	U
DR-42	D. Ross	Concurrence Letter on IM-95 (D-6)	U
DR-43	D. Hallock	Magnetic Tape Proposal for AN/FSQ-7 Production System (D-4)	U
DR-44	D. Ross	Concurrence Letter on D-4	U
DR-45	R. Imm	Magnetic Tape Drivers (D-4-1)	U
DR-46	- - -	Programmer's Reference Manual (PM 8-5 - IBM-584) (D-16)	U
DR-47	D. Ross	PERSELBSN Codes, Production System (D-16)	U
DR-48	- - -	Refer to 6DR-96	U
DR-49	D. Ross	Concurrence on D-16	U
DR-50	R. Imm	PERSELBSN Codes (D-16-1)	U
DR-51	F. Glenn et al.	Card Reader, Printer, and Punch Specifications for the AN/FSQ-7 Production System (D-12)	U
DR-52	D. Ross	Maintenance Area Card Machines, Duplex Central (D-12)	U
DR-53	H. White	Drum Specifications for Production Machines (D-13-1)	C
DR-54	C. Walston	Concurrence on D-13-1	U
DR-55	M. Dudek	Proposal for the Drum MCD Frame for the Duplex Central (IM-36)	U
DR-56	H. White	Changes to the Drum Specifications, D-13-1	C
DR-57	- - -	See DR-55	
DR-58	W. Fitzgerald	Power Conversion System for the AN/FSQ-7 Duplex Central (D-40)	U
DR-59	- - -	Concurrence Letter on D-40	U
DR-60	R. Keating	Duplex PCD Frame for Production Machine (D-48)	U
DR-61	R. Keating	Simplex PCD Frame for Production Machine (D-64)	U
DR-62	R. Marden	MCD, CB and PD Frames, Duplex Central (D-31)	U
DR-63	R. Marden	Concurrence on D-31	U
DR-64	R. Marden	Power Distribution System, Duplex Central (D-47)	U
DR-65	D. Ross	Concurrence on D-47	U
DR-66	R. Marden	Marginal Checking System for the Production Machine (D-33-1)	U
DR-67	M. Dudek	Proposal for the Drum MCD Frame for the Duplex Central (D-36)	U
DR-68	R. Imm	Concurrence on D-36	U
DR-69	N. Jacobs	Central Computer Marginal Checking Distribution Frames for the Duplex Central (D-39)	U
DR-70	R. Marden	Concurrence on D-39	U
DR-71	G. Rosenberger	Display ML-WL MCD Frame, Production Machine, D-44-1	U

Accessions List (Continued)

NO.	AUTHOR	TITLE & IBM NO.	CLS.
DR-72	D. Ross	Concurrence on D-44-1	U
DR-73	G. Rosenberger	Output MCD Frame Specifications for the Duplex Central (D-49)	U
DR-74	D. Ross	Concurrence on D-49	U
DR-75	G. Rosenberger	Duplex Inputs MCD Frame (D-62)	U
DR-76	F. Gewickey R. Marden	Simplex Input MC Frame Specifications (D-53)	U
DR-77	- - -	Not yet written.	
DR-78	F. Gewickey R. Marden	Simplex Input PD Frame Specifications (D-54)	U
DR-79	D. Ross	Concurrence on D-55	U
DR-80	F. Gewickey R. Marden	Simplex Input CB Frame Specifications (D-55)	U
DR-81	- - -	Number not used.	U
DR-82	F. Gewickey R. Marden	Display Console CB Frame Specifications (D-57)	U
DR-83	- - -	See DR-100	
DR-84	B. Kippenhan	General Switching System, Duplex Central (D-23)	C
DR-85	D. Ross	Concurrence on D-23	U
DR-86	R. Marden et al.	Marginal Checking System for the Production Machine (D-33)	U
DR-87	R. Marden	Concurrence on D-33	U
DR-88	M. Astrahan	Equipment Not Provided in P-1 Machine	U
DR-89	B. Kippenhan	Duplex Central Specifications for the Gap-Filler Input Mapper-Counter Frame (D-35)	U
DR-90	B. Kippenhan	Duplex Central Mapper Consoles (D-34)	U
DR-91	R. Lowrie	Proposed Duplex Central Specifications for the GFI Camera Monitor Console (D-61)	U
DR-92	W. Squire	Proposal for Crosstelling Input Specifications Duplex Central (D-51)	C
DR-93	R. Jeffrey	Errata for D-51	U
DR-94	T. Francis	Electronic Loads for Air Circuit Diagram Calculations DC Guilding - Modification "A"	C
DR-95	- - -	Proposed Program to Meet Production Schedules	U
DR-96	- - -	To be published as 6M-3286	
DR-97	J. Gano	Protection of Electronic Equipment Upon Failure in the Air Conditioning System for Equipment Cooling	U
DR-98	J. Gano F. Sandy	Concurrence on Power Distribution System, Duplex Differences Between the MIT and IBM Power Groups	U
DR-99	J. Walsh et al.	Design Specification, Display Console for AN/FSQ-7, XD-1 and XD-2 (H-139)	C
DR-100	- - -	Minutes of Concurrence Meeting of January 6, 1955	U
DR-101	R. Marden	Manual Input Frame, Duplex Central (D-18)	C
DR-102	D. Ross	Concurrence on D-18	U
DR-103	- - -	This number was not used.	
DR-104	D. Ross	Card Machine Input - Duplex Central (D-10)	U
DR-105	W. McMillan	026 Card Reader Specifications (H-87)	U
DR-106	R. Wilser	Modified 026 (TR-13)	U
DR-107	D. Ross	Input Card Machines, Duplex Central (D-10)	U

NO.	AUTHOR	TITLE & IBM NO.	CLS.
DR-108	N. Jacobs	Proposal for Additional Features to be Added to the 020 Card Machine (D-10-1)	U
DR-109	D. Ross	Concurrence on D-10-1	U
DR-110	M. Astrahan	Concurrence on H-87	U
DR-111	R. Marden	Keyboards Input, Duplex Central (D-7)	U
DR-112	D. Ross	Concurrence on D-7	U
DR-113	R. Marden	Area Discriminators, Duplex Central (D-26)	U
DR-114	D. Ross	Concurrence on D-26	U
DR-115	B. Kippenhan	Concurrence on D-26-1	U
DR-116	R. Marden	Light Guns, Duplex Central (D-17)	U
DR-117	D. Ross	Concurrence on D-17	U
DR-118	W. Squire	Proposed Changes to the Output System Alarm Specifications, PN 31	U
DR-119	W. Squire	Concurrence on PN 31	U
DR-120	W. Squire	Proposed Changes in the Output System Specifications M-2697 for XD-1 and XD-2, PN 73	U
DR-121	P. Rocco R. Murray	A Proposal for Testing the Output System with the Miscellaneous Radar Input and Crosstelling Input for XD-1 and XD-2	U
DR-122	H. White	Preliminary Output Specifications for the Production Machine (D-24-1)	C
DR-123	W. Squire	Concurrence on PN 73	U
DR-124	H. White	Preliminary Output Specifications for the Production Machine (D-24)	C
DR-125	B. Kippenhan	Display Specifications for the Duplex Central (D-27)	C
DR-126	C. Walston	Concurrence on D-27	U
DR-127	R. Mork	Design Specification, Display Console for AN/FSQ-7, XD-1 and XD-2 (H-139A) (D-25)	U
DR-128	B. Kippenhan	Design Specifications (Changes) for above	U
DR-129	D. Ross	Concurrence on D-25	U
DR-130	W. Squire	Crosstelling Input Specifications, Duplex Central, (D-51-1)	C
DR-131	R. Marden	Auxiliary Console Specifications (D-65)	C
DR-132	W. Hunt	Changes in the Arithmetic Element of the Production System Caused by the Addition of the Auxiliary Memory Element (D-6-1)	U
DR-133	W. Hunt	Changes in the Selection and Input-Output Control Specifications for the Production System Caused by the Addition of the Auxiliary Memory Element (D-19-1)	U
DR-134	W. Hunt	Changes in the Program Element for the Central Computer for the Production Machine System Caused by the Addition of the Auxiliary Memory Element (D-5-2)	U
DR-135	W. Hunt	Drum Specifications for the Production System (D-13-2)	C
		DR Numbers 136 through 139 have not been turned in.	
DR-140	N. Jones	Concurrence on D-5-2	U
DR-141	N. Jones	Concurrence on D-6-1	U
DR-142	N. Jones	Concurrence on D-13-2	U
DR-143	N. Jones	Concurrence on D-19-1	U

Accessions List (Continued)

NO.	AUTHOR	TITLE & IBM NO.	CLS.
DR-144	- - -	Number not used.	
DR-145	W. Hunt	PERSELBSN Codes (D-16-3)	U
DR-146	D. Ross	Organization of MCD Frames, Concurrence (D-20)	U
DR-147	R. Marden	General Switching System, Concurrence (D-23-1)	U
DR-148	W. Fitzgerald	Prime Power Proposal, Duplex Central (D-29)	U
DR-149	W. Hunt	Spare Plane Frames of the AN/FSQ-7 Production System Memory Element (D-14-1)	U
DR-150	D. Ross	Concurrence on D-14-1	U
DR-151	D. Ross	Maintenance Control Area, Concurrence (D-58-1)	U
DR-152	C. Walston F. Irish	Input Channel Switching Specifications for AN/FSQ-7 (D-60)	U
DR-153	D. Ross	Maintenance Area Card Machines, Concurrence (D-12)	U
DR-154	D. Ross	Duplex Switching Console, Concurrence (D-59)	U
DR-155	R. Imm	Specifications for the Magnetic Tape Unit, Concurrence (D-4-2)	U
DR-156	R. Imm	Specifications for the Simplex Maintenance Console, Concurrence, (D-46-1)	U
DR-157	R. Imm	Specifications for the Simplex Maintenance Console (D-46-1)	C
DR-158	W. Hunt	Power and Air Conditioning Status Indicators in the Duplex Maintenance Control Area (Mimic Panel (D-63)	U
DR-159	M. Dudek	Proposal for Maintenance Card Machines (D-73)	U