

~~CONFIDENTIAL~~

Memorandum 6M-3287

UNCLASSIFIED

COPY NO 1 OF 145 COPIES

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

SUBJECT: BIWEEKLY REPORT FOR 14 JANUARY 1955

To: Jay W. Forrester

From: Division 6 Staff

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

COVER SHEET

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

The research reported in this document was supported jointly by the Department of the Army, the Department of the Navy, and the Department of the Air Force under Air Force Contract No. AF 33(121)-458.

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

~~CONFIDENTIAL~~

UNCLASSIFIED

Memorandum 6M-3287

Page 1 of 54

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

SUBJECT: BIWEEKLY REPORT FOR 14 JANUARY 1955

To: Jay W. Forrester

From: Division 6 Staff

Approved: John B. Bennett
John B. Bennett

CONTENTS

Section I - Cape Cod System	2
1.1 - Group 61	2
1.2 - Group 64	11
1.3 - Group 65	15
Section II - AN/FSQ-7	18
2.1 - Systems Office Activities (Ops. 62 & 64)	18
2.2 - XD-1 Testing	27
2.3 - Other Activities (Op. 62)	27
Section III - Magnetic Materials & Advance Development	36
3.1 - Magnetic Materials	36
3.2 - New Components & Circuits	40
Section IV - Central Services	46

Academic Courses

(J. W. Forrester) (UNCLASSIFIED)

A memo will soon be circulated listing MIT subject to be taught next term in the Lincoln buildings. Staff members are encouraged to enroll. Any subject for which there is insufficient enrollment will be cancelled.

Monthly ADES Review

(J. W. Forrester) (UNCLASSIFIED)

The regular (second Tuesday of each month) ADES review was held this week in New York. In preparation for the meeting, Western Electric posts progress schedules and prepares comments on the several parts of the SAGE System program. This prepared material is discussed at the meeting and later mailed out by Western Electric.

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

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

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

~~CONFIDENTIAL~~

Memorandum 6M-3287

Page 2

UNCLASSIFIED
SECTION I - CAPE COD SYSTEM1.1 Group 611.11 System Operation

(C. A. Zraket) (CONFIDENTIAL)

Live testing of the Cape Cod System during the past biweekly period was cancelled because of equipment modifications being made at S. Truro to both the FPS-3 and Mark X installations. Instead, training missions utilizing simulated data were conducted. It is expected that all Cape Cod inputs will be operational during the week of 17 January in preparation for the three demonstrations to be held that week.

A demonstration of the Cape Cod System was held on 6 January for members of the RCAF and representatives of the Air Force, Army, and Navy.

Checking of the automatic data-recording program has been started and should be completed by 21 January.

Work has also been started on the data-generation and the simulation programs. Specifications for these are contained in 6M-3262 and 6M-3073, respectively.

The final-turn interception program has been checked out and is now included in the Cape Cod System program.

The collection of test data on radar-data characteristics has been held up because of the unavailability of the radar inputs. It is expected that this part of the test program and the tracking-accuracy tests utilizing SDV and Raydist data will be under way the last week of January. An Operations Plan for the tracking-accuracy tests is now being drawn up by R. N. Davis.

(E. Bedrosian) (CONFIDENTIAL)

I assisted in writing a flow diagram which is part of records necessary for Cape Cod System program documentation.

I am reading memoranda preparatory to writing the system simulation program in conjunction with Henry Frachtman.

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

Test Coordination Sub-Section scheduled four Raydist orientation tests, three training missions, and one demonstration mission.

UNCLASSIFIED
~~CONFIDENTIAL~~

~~CONFIDENTIAL~~

Memorandum 6M-3287

Page 3

1.11 System Operation(R. Davis, A. Smalley, P. Dolan, A. Hill) (CONFIDENTIAL)
(Continued)

Two of the scheduled Raydist tests were flown. Tracking was unsatisfactory for one, as neither the S. Truro radar nor Mark X data was available. No Mark X data was available for the second, but tracking with S. Truro FPS-3 was sufficient to obtain satisfactory results. Two Raydist tests were cancelled because both S. Truro FPS-3 and Mark X were unable to supply data.

Of the three training missions, strike aircraft flew part of one test but failure of the Mark X made it necessary to cancel the interceptors. Two training missions were conducted entirely as simulated missions because neither S. Truro FPS-3 nor Mark X was operative.

For the demonstration mission strike aircraft were airborne, but failure of S. Truro FPS-3 and Mark X data made it necessary to cancel the strike and interceptors scheduled and conduct the demonstration as a simulated mission.

Montauk long-range and FPS-6 height-finder radar data continued to remain unavailable for Direction Center operations.

Twenty-four Raydist orientation missions have been scheduled to date. Three of these have supplied analysis data.

(H. Frachtman) (CONFIDENTIAL)

The data-recording program has been revised to operate twice per frame instead of four times. This will temporarily cause some data to be omitted.

Memorandum 6M-3262, "Data Generation Program," is being studied in preparation for the writing of a computer program according to the specifications described therein.

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

The 6520th AC&W personnel assigned to the Identification Section met with us to discuss their problems and learn of recent 1954 Cape Cod System innovations. The agenda of the meeting included an explanation of new data-input cards which had been designed by 6520th personnel for easy recording and reference. A/2C Raymond W. Snow, who had recently returned from an assignment at P-10, was in attendance. He emphasized the communication problems he had experienced in getting information from P-10 to the CCS ID station.

Within the next week we hope to hold a similar meeting with this same group. Until the automatic recording program is in operation we want the ID Section to manually record important identification data. We prepared special forms for this purpose, and printed copies have been received from Publications.

~~CONFIDENTIAL~~

CONFIDENTIAL

Memorandum 6M-3287

Page 4

1.11 System Operation

(S. Manber) (CONFIDENTIAL)

During the last biweekly period, modifications were made to the data-collection programs for noise study. Worcester Polytech and Clark University were visited in line with the personnel recruiting drive.

It has been discovered that the Raytheon tape units are not operating correctly in the si read mode when bi instructions are followed by RD instructions. This condition has been reported to Group 64, and they expect to correct it in the near future.

Group 64 reports that the Montauk SDV reference pulse coincides with the -1 time pulse rather than the zero time pulse. The result of this condition is that all Montauk data from the B-counters (range) will have a -1 mile error.

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

Of the two Raydist missions scheduled for this period, one was successful. In addition to conducting these missions, we spent this period in checking out Raydist computer programs and revising the memo concerning the Raydist system.

(P. Vence) (CONFIDENTIAL)

Part A of the start-over program for the 1954 Cape Cod System was written.

(W. Vecchia) (CONFIDENTIAL)

	<u>hr</u>	<u>min</u>	
Total Assigned Time	120		
Extra Assigned Time	<u>5</u>	<u>50</u>	
	125	50	
	<u>hr</u>	<u>min</u>	
Analysis	21	05	
Combined Operations)			
Tracking	18	30	
Weapons Direction			
Equipment Check	4	25	
Weapons Direction	35	30	
Tracking	31	35	
Raydist	6		
TOTAL	117	05	
Time Lost to Computer (malfunction)	8	45	
	<u>hr</u>	<u>min</u>	
	117	05	
	<u>8</u>	<u>45</u>	
GRAND TOTAL	125	50	

CONFIDENTIAL

~~CONFIDENTIAL~~

Memorandum 6M-3287

Page 5

UNCLASSIFIED

1.12 XD-1 Programming

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

We have prepared a proposal outlining a schedule of tests to determine the range of speeds and error quotas in the operation of an O26 Card Punch and O56 Card Verifier to be used in the manual-inputs system of XD-1. The tests are scheduled to be in the week of 17 January and to continue until sufficient data is taken to arrive at convincing conclusions concerning the rate of data input, qualifications of operating personnel, and an optimum system's design for the insertion of flight plans, auxiliary tracking data, weapons' status, and weather reports.

In preparation for these tests we have designed detail cards and programs cards, requisitioned equipment, and outlined in detail a procedure for an initial preliminary test to be staged Monday, 17 January.

1.13 SAGE Planning

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

We attended a meeting on SAGE telephone communications in Colorado Springs from 4 to 6 January. Although the meeting was supposed to be concerned with specifications for Subsectors 1 and 2, it developed into only a formulation of rules to be applied to all Subsectors. Results will be described in an inter-office memo as soon as possible.

(A. Favret, J. Cahill) (CONFIDENTIAL)

The AA-SAGE proposal is approaching a finalized form. On 7 January 1955 the current draft was discussed informally with Lt. Col. D'Arezzo and members of his Section (Air Defense Section, R&D Div., Dept. of the Army) with specific reference to completeness, clarity, and terminology from the Army's point of view. At the regular Lincoln-SCEL meeting on 11 January 1955 a verbal presentation of the AA-SAGE proposal was given. The ensuing discussion indicated the desirability of using the AN/TSQ-7 digital-data equipment within Army units. This might be accomplished by modifying the TSQ-7 equipment to accept 1300-pps data or by generating appropriate 750-pps data either from the SAGE Direction Center or from the Army AACC (Antiaircraft Operations Center). Final submission of the recommendation is being delayed temporarily to permit more detailed consideration of the TSQ-7 and the implications of the various alternatives. A trip to Bell Telephone Laboratory during the week of 17 January is planned for this purpose.

On 12 January 1955 a meeting was held at AFCRC to discuss the operating of land-based Talos (a surface-to-air guided missile) within the SAGE System. The report of this conference is contained in an inter-office memorandum to J. Arnow.

~~CONFIDENTIAL~~

UNCLASSIFIED

~~CONFIDENTIAL~~

Memorandum 6M-3287

UNCLASSIFIED

Page 6

1.13 SAGE Planning

(F. Heart) (CONFIDENTIAL)

Continued effort has been spent on SAGE System communication planning.

System use of AEW is still being studied.

On 11 January 1955 a group of people from General Electric Corporation visited the Laboratory to discuss various aspects of tracking, smoothing, sorting, and correlation techniques. This visit is documented in an inter-office memorandum to C. R. Wieser dated 11 January 1955.

On 14 January Mr. W. Zimmer from the Navy Special Devices Center visited the Laboratory to discuss the applications of digital computers to simulation problems.

(W. Lone) (CONFIDENTIAL)

I am continuing to investigate the crosstell equipment in the SAGE System.

Attempts are being made to decide what functions will be carried on in the SAGE Combat Centers in excess of those outlined in the operational plans. Many questions regarding the Combat Center operation will remain unanswered until the operations of more than one Subsector, dependent on adjacent Subsectors for information, are more clearly defined.

(H. Seward) (CONFIDENTIAL)

A meeting was held to discuss the proposals for increasing the capacity of the digital-display subsystem (6M-3180). It was decided that one of the proposals would be included in the specifications in lieu of an additional display field.

The estimate for SAGE auxiliary-drum storage was completed (6M-3248, "Auxiliary-Drum Storage Requirements for AN/FSQ-7 (SAGE);" H. Seward). It is most evident that the presently specified capacity is insufficient. At a meeting held on the subject, Group 61 requested a total of 65,000 registers of high-speed and auxiliary storage.

A proposal was entertained with R. Buzzard to have the vector length for a vector slot vary in accordance with the expansion factor in order that certain displays might not become distorted upon expansion. Because such a feature would involve a significant design change, it was pursued no further.

A sketch proposal for the operation of the weapons-allocation section at the Combat Center was written and discussed with W. Lone. On the basis of this discussion, a more detailed proposal is being drafted.

~~CONFIDENTIAL~~

~~CONFIDENTIAL~~

Memorandum 6M-3287

Page 7

UNCLASSIFIED

1.13 SAGE Planning

(A. Shoolman) (CONFIDENTIAL)

I have completed 6M-3012-2, "Allocation of Consoles to Operating Areas of the AN/FSQ-7 Direction Centers," and 6M-3265, "Recommended Radar Coverage of SAGE Subsectors 1 and 2" (both yet to be issued). I have continued revision of M-2720-2 "Equipment Allocation for XD-1 Operating Positions."

1.14 SAGE Training

(S. Hibbard) (CONFIDENTIAL)

The Training Section has been functioning since November. It is felt that considerable progress has been made in fitting a training program to the eventual SAGE System.

J. Massey from ADES Training Group in New York visited the Lab on Tuesday and Wednesday, 11 and 12 January. He was well pleased with the cooperation and assistance everyone gave him. He stated that his trip to the Bart. Building gave him a much better insight into the training problem and felt that others from the ADES Training Group should make a similar trip.

1.15 Test Program Planning

(D. Israel) (CONFIDENTIAL)

The major activity of the past biweekly period has been the arranging for and preparing of a series of recruiting trips to a large number of colleges throughout the country. Plans are now nearing completion for about 12 Group 61 members, together with staff members from Groups 62, 63, 64, and 22, to make 1-week trips to various areas of the country.

Progress on the test program continues to be slow, the principal sources of delay being a lack of sufficient manpower and the diversion of available manpower to other tasks, principally assisting in demonstrations. This state of affairs appears to be getting worse instead of better. Fortunately, this condition is balanced by similar delays in preparing the 1954 Cape Cod System for test purposes.

At the present time, active work is proceeding on the following aspects of the test program:

1. Data characteristics;
2. Data input and mapping;
3. Initiation;
4. Tracking accuracy.

Preliminary consideration is being given to the ways in which the track-trouble detection and monitoring functions can be evaluated.

~~CONFIDENTIAL~~

~~CONFIDENTIAL~~

UNCLASSIFIED

Memorandum 6M-3287

Page 8

1.15 Test Program Planning

(W. Lemnios) (CONFIDENTIAL)

The intercept-calculations program is now checked out. Programming on the weapons-assignment program is almost completed.

A study of tracking accuracy will be made by comparing positions, velocity components, velocities, and headings between the tracking program and Raydist data. Specifications are being prepared for a program which will record and analyze the above differences.

(J. Levenson) (CONFIDENTIAL)

Preliminary specifications have been prepared for the first of a series of special tests to collect data on the initiation function in the 1954 Cape Cod System. A memo will be distributed for comments and corrections before the final specifications are made.

6M-3274, "Program Changes in Automatic Initiation," has been issued by R. Sittler and myself in order to simplify and improve the automatic-initiation program in the 1954 CCS before the special tests are run.

6M-3262, "Program Specifications for Data Generation Program" (Levenson, Nolan, Wolf), was issued.

(J. Nolan) (CONFIDENTIAL)

Consideration has been given to constructing a simplified model representative of the entire 1954 Cape Cod System. The operating performance of the System may be described roughly in terms of a limited number of parameters which represent the interrelations between the major component functions (tracking, identification, etc.). These parameters may be determined from averaging empirical data from test operations over long periods of time. The first step, therefore, is to determine which data will most simply characterize the dynamics of System operation and to make certain that this data is automatically recorded.

(E. Wolf) (CONFIDENTIAL)

A matrix representation of parts of the 1954 CCS tracking program has been completed. The problem involved in constructing such a representation are largely semantic. A study of this matrix indicated that the tracking program classifies all possible distributions of the radar data about a track's predicted position into a small number of categories. If the relative frequency of occurrence of these categories were known or experimentally determined, the statistical behavior of the program could be computed directly from this matrix. In particular, it would then be possible to ascertain the frequency distribution of those sequences of data configurations which cause tracks to require monitoring.

~~CONFIDENTIAL~~

~~CONFIDENTIAL~~
UNCLASSIFIED

Memorandum 6M-3287

Page 9

1.15 Test Program Planning

(E. Wolf) (CONFIDENTIAL) (Continued)

Technical Report No. 67, "A Common Coordinate System for the Utilization of Data from Several Radars," has been issued.

A camera and control box to accomplish the necessary scope photography for the mapping and data-input studies has been procured. It is hoped that these studies can now get under way within about a month.

1.16 Analysis and Simulation (CONFIDENTIAL)

1. Personnel Recruiting

(W. I. Wells)

Arrangements have been made for a trip to seven colleges in the midwestern U.S. This initial contact will be made during the week of 24 January. Its main purpose will be to acquaint the professors with the manpower needs of the Laboratory.

2. Manned-Interceptor Simulation

(W. I. Wells)

Plans have been completed (with H. D. Neumann) for recording the data from the manned-interceptor simulation program (MISP). The data will be stored in the computer in such a way that it can be punched out on IBM cards or processed directly in the computer. It is still not clear whether there is any particular advantage to be gained by using the IBM cards to store the results. It may happen that one can store a library of various parameter tapes more economically than the results themselves.

(H. D. Neumann)

The command-computations section of the manned-interceptor simulation program has been checked out. The evaluation section is being written.

(B. Smulowicz)

A data evaluation program is being prepared to process the results of the manned-interceptor simulation. This program will use the vectoring index proposed by BTL and will operate directly on the data stored in the computer.

~~CONFIDENTIAL~~
UNCLASSIFIED

~~CONFIDENTIAL~~

Memorandum 6M-3287

Page 10

1.16 Analysis and Simulation

3. Help on Radar Design

(H. D. Neumann)

The permutation program for the Bomarc simulation has been written. The program will include 8400 separate runs. Its purpose is to determine a relation between sampling and quantization under certain restricted conditions.

4. Numerical Evaluation of Markov Processes

(C. Friedman)

A program is being written to compute the transient and steady-state response of a general first-order Markov process.

5. Charactron Display

(H. Houser)

The input and conversion program for generating displays on the MTC Charactron tube has been written and is being checked out.

6. Multiple Radar Coverage

(R. Sittler)

The effect of multiple radar coverage on the operation of automatic initiation systems has been investigated. The optimum number of radars is determined chiefly by the interaction of three parameters: radar-noise area density, target blip-scan ratio, and maximum traffic-rate capability of the human monitors.

~~CONFIDENTIAL~~

Memorandum GM-3287

Page 11

1.2 Group 641.21 Cape Cod System Engineering

(E. S. Rich) (UNCLASSIFIED)

The value of comprehensive records to computer-system performance as an aid in trouble location was demonstrated in three instances during the past 2 weeks. A following section on WWI operation describes the discovery and elimination of three causes of transient computer alarms. Repeated occurrences of such failures are necessary in order to establish patterns that will indicate probable causes of the errors. Since alarms which show similar failure symptoms may occur only once in several weeks, the necessary correlation of failure data would be impossible without adequate records of conditions at the time of the error. In the three instances referred to, alarm records used in the analyses dated back from 6 months to a year. Although it is impossible to prove conclusively that the defects found were the actual causes of the past failures, there is strong evidence that such was the case. The system records, therefore, are amended to show these as "explainable" failures. These revised records, then, provide a more accurate picture of system reliability.

1.22 WWI System OperationRecords 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 31 December - 13 January 1955:

Number of assigned hours	178
Usable percentage of assigned time	94
Usable percentage of assigned time since March 1951	89
Usable percentage of assigned time since September 1953	93
Number of transient errors	3
Number of steady-state errors	4
Number of intermittent errors	5

1.22 WWI System Operation (Continued)

Analysis of WWI Failures

(A. R. Curtiss) (UNCLASSIFIED)

The following is a breakdown of interrupting and potentially interrupting failures occurring in the WWI computer system for the bi-weekly period, 31 December 1954 to 13 January 1955, inclusive:

Total Number of Failures	29
Total Number of No-Lost-Time Failures	4
Total Number of Lost-Time Failures	25
Total Lost Time in Hours	15.5
Total Operating Time in Hours	237.5

Class of Failure	Attributable to New Installation or Modifications		Essential Maintenance		Chargeable to System			
	Number	Min. Lost	Number	Min. Lost	Explainable		Unexplainable	
					No.	Min. Lost	No.	Min. Lost
Tubes					1	0		
					4	365		
Passive Electrical Components					2	80		
Fuses							1	0
Alarms					5	32	4	26
Design Weakness					5	265		
Miscellaneous			1	5	2	104	2	60
Number of Lost-Time Incidents			1	5	18	846	6	86
Number of No-Lost-Time Incidents					1		3	

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

The computer reliability declined from 98% for the previous bi-weekly period to 94% for this period. Two-thirds of the computer down time can be attributed to power-supply troubles.

A shorted tube caused the -60-v power supply to fail. Five hours were required to return the computer to an operating condition.

The -450-v power supply developed oscillations in the amplifier section of the voltage regulator. The amplitude and frequency of the oscillations could be varied by moving adjacent wires and replacing series-

~~CONFIDENTIAL~~

Memorandum 6M-3287

Page 13

1.22 WWI System Operation (Continued)

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

tube panels. Temporary measures were taken to eliminate the oscillations. Earl Pughe is planning a redesign of the amplifier section of the regulator. Four hours were lost to this trouble.

We believe we have located and corrected the sources of three types of transient failures that have occurred over a period of 6 to 12 months. The computer records for this period provided sufficient information to allow us to localize the troubles.

A poorly soldered connection in the operation matrix resulted in five transfer-check alarms, the first of which was recorded in July 1954.

A second type of transfer alarm occurred ten times since April 1954. The trouble was sensitivity to repetition frequency and was apparently caused by a tube having low plate current.

Since December 1953 there have been ten inactivity alarms with similar symptoms. The failures occurred when a gate tube supposedly cut off was transferring pulses. The cathode follower that controls the gate tube was replaced.

1.23 Terminal EquipmentData Inputs

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

Equipment Checkout. The change in site operating procedure which eliminates comparator warnings seems to have produced good results. The job of readjusting demodulator controls just before mission time has been reduced considerably.

Telephone Circuits. The job of converting the data circuits to conform to SAGE System specifications is delayed because of lack of coordination within the phone company. As yet the necessary terminal equipment has not been installed at Barta, Lexington, or at any of the sites. Presumably, the telephone company is expediting the installation of this equipment following discussions between R. Enticknap of Group 22 and E. McGinnis of the telephone company.

Fairchild Camera for Mapping Monitor. The breadboard switching circuit was tried out, but several modifications must be made to improve its modes of operation. A camera mount will be designed the week of 17 January.

~~CONFIDENTIAL~~

Memorandum 6M-3287

Page 14

1.23 Terminal Equipment (Continued)

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

The demodulator auxiliary for MITE 1 has been modified to make it more tolerant to variations of the input signals.

The calibrate count of MITE's 1 & 2 has been extended from 128 to 200. The scope strobing, however, still starts at the count of 128.

Gate writers have been installed in Group 1A of the buffer drum and are operating satisfactorily.

Power Supplies

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

A new WWI filament alternator and drive motor is being ordered as the present WWI filament alternator needs major repairs. The present alternator must be kept in operation until the new alternator is ready. To make room, the present regulated laboratory a-c synchronous motor will be removed. The new synchronous motor will be used to regulate the laboratory a-c. The additional load of the filament alternator would overload the present series reactors, so new reactors, sized to require minimum reactive kva in the motor, will be installed. The alternator will be 120-v, 60-cycle, one-phase, 120-amp, and the motor will be 75-hp, 70% power factor, 575-v, three-phase, 60-cycle. The regulated laboratory a-c will be rated 75 kva at 115 volts. Shunt capacitors will be used on the 575-v line to reduce the reactive kva demand on the synchronous motor.

Typewriters and Paper Tape

(L. H. Norcott) (UNCLASSIFIED)

In our search for an acceptable opaque uncoiled perforator tape we came across a gray tape which is opaque, punches cleanly, and has good tensile strength. Unfortunately, chad from this tape quickly jams up the FL die blocks so badly that the punch pins fail to perforate.

When various lubricants (oil, graphite, candle wax, water, etc.) were applied to the tape just before it entered the die, the tape perforated easily. The tape manufacturer is now making up some samples of this tape coated with a thin film of wax for us to test.

The model shop modified one die block to permit easier ejection of chad, and we are using this now with unlubricated tape. This modified die block has operated satisfactorily for about 4 hours at this time. (Unmodified units failed after a few seconds.)

Memorandum 6M-3287

Page 15

1.3 Group 65

1.31 Activities of Group 65

(P. Youtz) (UNCLASSIFIED)

All construction and processing procedures for building a 19-inch Charactron tube in the Barta Building tube laboratory were reported in rough-draft form this past 2 weeks. After this information is edited and studied, it will be published. This report gives one method of making a quality Charactron tube, and it can be used as a guide for studying and evaluating any production methods of making large-display tubes.

We have been reproducing some of Convair's critical production techniques in our laboratory.

The life-test programs for the Charactron, Typotron, and sintered cathode have been progressing satisfactorily.

I attended conferences with the IHM Project High Tube Group on second sources of commercial tubes. No definite conclusions were reached. Several alternative proposals were reviewed and discussed with the IHM engineering groups.

I made a trip to the General Electric Plant in Owensboro, Kentucky, to review the production progress of the Z-2177. GE was behind schedule on the production of tubes but has agreed to add another mount team and increase production without sacrificing quality. The present mount team is doing very satisfactory work. However, tubes that meet the original objective specification are not being produced.

I visited Sylvania at Emporium, Pennsylvania, to review progress on the production of 2420 tubes and improvement of the SR-1782A tubes. Sylvania has agreed to add more mount teams to meet IHM's production needs. A review of Sylvania's data on the improvement program indicates that some tolerances on the dimensions of the grids may be incompatible with the tube's plate-current specifications. We have agreed to polycast a number of their tubes, dissect them, and check mechanical dimensions. These mechanical dimensions will be correlated with the electrical characteristics. Out of this program we expect to get sufficient data to guide the improvement program.

1.33 Research and Development

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

During the past 2 weeks we spent time revising two memoranda entitled "Chemical Processing Procedures" and "Construction of a 19-Inch Display Tube."

Memorandum 68-3287

Page 16

1.33 Research and Development (Continued)

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

We also investigated techniques for the electropolishing of stainless steel and the application of liquid gold and silver to a 19-inch Charactron bulb.

(T. F. Clough) (UNCLASSIFIED)

The DuMont Research Laboratory has agreed to furnish our section with a few special 5-inch flat-face CRT bulbs which are required for display-tube research.

The record section at Project High will soon complete punching in the Z-2177 tube-installation data from MTC. During the next 2 weeks some members of the Barta tube section will be trained in the technique of measuring polycast tube sections. The data so obtained will be correlated with readings of SR-1782A electrical characteristics.

(L. B. Martin) (UNCLASSIFIED)

The 16-position life test is ready to test Typotrons. Many details are being completed on this rack while we are waiting for tubes.

The following is a list of Typotrons, their condition, and total hours on life test:

<u>Tube</u>	<u>Total Hours</u>	<u>Condition</u>
265	6674.8	marginal
280	5856.8	satisfactory
335	5039.8	satisfactory
366	4338.0	satisfactory
390	4338.0	satisfactory
392	4338.0	satisfactory
389	4254.2	satisfactory
394	3555.9	marginal

(S. Twicken) (UNCLASSIFIED)

I made a trip with the Project High Tube Group to the General Electric Company, Owensboro, Kentucky, to ascertain the status of Z-2177 production. The present mount line is insufficient to meet scheduled requirements and will be increased. In order to meet objective requirements, additional engineering effort must be applied by GE on the following:

1. A cathode free from interface (from the materials and processing approaches);

Memorandum GM-3287

Page 17

1.33 Research and Development (Continued)

(S. Twicken) (UNCLASSIFIED) (Continued)

2. Cause and remedy of early-life instability;
3. Perpetual campaign for the reduction of intermittent shorts.

Detailed plans for these programs were discussed.

I made a trip with the Project High Tube Group to Sylvania, Emporium, Pennsylvania, to check on production progress and progress being made toward objective requirements. In view of the long-range machine requirements as given by IBM, plans were made to further increase production. A critical review of tube geometry, parts tolerances, and available test data indicated that further work is necessary in the program to meet SR-1782A objectives. Accordingly, a program was set up under which Sylvania will produce some special tubes with carefully chosen parts. These tubes will be polycast and cut open, leading toward a correlation of tube characteristics and dimensions.

(P. C. Tandy) (UNCLASSIFIED)

The five 19-inch Charactrons on life test, CHT-61, CHT-62-1, CHT-74, CHT-75, and CHT-80, now have operating times ranging from 651 to 2164 hours.

CHT-61, CHT-75, and CHT-80 have shown no appreciable change during the past 2 weeks. CHT-62-1, which has been operated at 500- μ a d-c cathode current for the last 857 hours, has not improved. The heater voltage was raised from 6.3 volts to 7.5 volts, but there was no great change in emission during the last 180 hours. Within the last 1000 hours the ion current on this tube changed from 0.8 to 5 millimicroamperes.

CHT-74 showed little change in matrix current at zero bias, but this current changed from 27 to 11 microamperes at a bias voltage of -25 volts. After 1013 hours the ion current on this tube was 1.8 millimicroamperes.

A leakage check has been made on all the tubes. The results are listed in the following table:

Tube	Elements Showing Leakage	Change in Leakage Current	Change of Hours on Life
CHT-61	A ₂ matrix	28 to 40 microamperes	1351 to 2132
CHT-62-1	A ₂ matrix SP2	43 to 48 microamperes 0.06 to 31 microamperes	1214 to 2035 1214 to 2025
CHT-74	A ₂ matrix	28 to 29 microamperes	213 to 994
CHT-75	A ₂ matrix	0.16 to 30 microamperes	0 to 781
CHT-80	A ₂ matrix	0.06 to 34 microamperes	0 to 620

The selection plate SP2 of CHT-62-1 is the first element other than the A₂ matrix to show leakage.

Memorandum 6M-3287

Page 18

SECTION II - AN/FSQ-7

2.1 Systems Office Activities (Groups 62 and 64)

(K. E. McVicar) (UNCLASSIFIED)

Work is continuing on scheduling activities for the first Subsector. Present efforts are directed towards reduction of time necessary to make the Subsector available for use by the Air Force.

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

On 12 January at Plant 2, Chan Watt and I attended a meeting with representatives of the IEM manufacturing organization to become acquainted with their procedures and personnel. W. Balk (IBM) presented an analysis of engineering, clerical, and recording effort involved in the release of a new part number or an engineering change.

We continued work on SAGE System manpower estimates: with the help of M. Raffensperger (IEM) we set up a few rules by which we can estimate manpower and time for development engineering and release procedures.

(C. W. Watt, Jr.) (UNCLASSIFIED)

I attended a joint production coordination meeting at IBM on Thursday, 13 January, at which IBM presented the status of the production program to the Air Force. The manufacturing schedules to which IBM is working were described, and the status of each of the various portions of the production job was outlined. It is planned to have the next meeting of this sort on Thursday, 3 March. IBM's summary schedules are well presented and easy to read, and their monthly posting of them should give an up-to-date evaluation of the production picture as they see it.

Progress of the Kingston Plant

(C. W. Watt, Jr.) (UNCLASSIFIED)

It is planned to move the production engineering and manufacturing functions completely to Kingston during February. At the end of the month they will have occupied about 80,000 square feet of space, and about 700 people will be working there.

2.1 Systems Office Activities (Groups 62 and 64) (Continued)Manufacturing Progress for Production Machine

(C. W. Watt, Jr.) (UNCLASSIFIED)

About 2000 of the approximately 15,000 parts for the production machine have been released by engineering. Actual manufacture has begun on the memory-plane frames; some 800,000 cores are on hand of which about 100,000 have been tested. This puts their work to date about on schedule. Delivery of the automatic card-assembly machine is expected some time early in February.

Input-Channel Switching

(F. E. Irish) (UNCLASSIFIED)

A draft of the specification for the input-channel switching for an AN/FSQ-7 has been completed by this writer and C. E. Walston of IEM. It will be published as Lincoln Laboratory Memorandum 6M-3286.

(R. H. Gould) (UNCLASSIFIED)

A meeting was held at IEM to discuss the kinds and quantities of test equipment that will be needed to maintain a duplex Central. Satisfactory agreement was reached on a list which will be published.

IEM has done some design thinking on a new pluggable-unit tester. We hope to contribute the results of some of our thinking while the design is embryonic.

XD-1 Communications

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

A meeting was held with New England Telephone & Telegraph Company for the purpose of determining the feasibility of use of Model 28 teletype equipment with XD-1. It was learned that this equipment will be available with a selective-calling feature for XD-1 use. Model 28 equipment will operate at either 60 wpm or 100 wpm. Regardless of the speed of the XD-1 teletype-output section, no incompatibilities will exist with the teletype equipment.

A revised traffic diagram for the XD-1 internal-communications system has been prepared jointly by Walquist, Ishihara, Benington, Grandy, Carter, and Kirshner. This diagram forms a basis for ordering the XD-1 internal system. The diagram will be issued as 6M-3000, Supplement 1.

Memorandum 6M-3287

Page 20

2.1 Systems Office Activities (Groups 62 and 64) (Continued)XD-1 Communications (Continued)

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

New England Telephone & Telegraph Co. has been given a working copy of the above-mentioned traffic diagram and is proceeding with the procurement and installation of the equipment required.

Temporary telephone service for XD-1 computer maintenance will be installed by 19 January 1955. It was hoped that the station equipment to be installed would be the final equipment provided for XD-1 maintenance. Unfortunately, the frame covers, in which the final station equipment is to mount, will not be delivered until 15 February 1955. The final equipment will be installed at that time.

A draft of 6M-3275, "Leased Telephone Circuits for XD-1," has been circulated for comment. This document contains a list of all the now known telephone-circuit requirements for XD-1.

SAGE System Communications

(H. J. Kirshner) (UNCLASSIFIED)

A meeting of the BTL, AT&T, ADES, Lincoln, IEM Data Service Committee was held. Should the Bell System supply DDR's and DDT's, a "coarse sensor" for detecting major circuit malfunctions (line open, line shut, high noise level) will be provided. This coarse sensor will operate in conjunction with Bell System switching, alarm, and comparison equipment so that a data circuit will be automatically switched from a malfunctioning circuit to a good circuit. The coarse sensor and associated equipment is required in order to meet the ADC circuit-restoration time requirement.

A draft of specifications for the Direction Center's ground/air radio switching equipment has been prepared by ADES. These specifications, with minor exceptions, meet the requirements for this equipment and generally follow the scheme outlined to AT&T, BTL, NET&T, and ADES by ADC and Lincoln.

Pluggable-Unit Tester

(H. L. Ziegler) (UNCLASSIFIED)

The basic logic and techniques have been worked out for a field-maintenance pluggable-unit tester. Sample tests of several fairly complex XD-1 units are being prepared as a check of the tester design.

~~CONFIDENTIAL~~

Memorandum 6M-3287

Page 21

UNCLASSIFIED

2.1 Systems Office Activities (Groups 62 and 64) (Continued)Pluggable-Unit Tester (Continued)

(H. L. Ziegler) (UNCLASSIFIED)

During the coming week (16-22 January) R. H. Gould and I plan a meeting at Poughkeepsie with interested IBM personnel there.

Crosstell Inputs

(R. Jeffrey) (CONFIDENTIAL)

A proposed set of crosstell-input (XTI) element specifications received from IBM is being circulated for comments together with a memorandum (6M-3268) outlining the basic requirements which the specifications are to meet. The principal questions continue to be (1) Should the system of interleaved messages be retained for the ground-to-ground output section and the XTI element? (2) Are 11 XTI channels (plus one spare) sufficient for the first three production machines? and (3) What number of XTI channels will be sufficient for the most heavily loaded production machine?

Output SystemTeletype Output

(H. Rising, M. Feldstein, S. Ginsburg) (CONFIDENTIAL)

A study of teletype requirements has shown that there is insufficient evidence to warrant a change from 60 wpm to 100 wpm. However, the Model No. 28 equipment, capable of handling either 60 wpm or 100 wpm with selective calling, will be provided with the prototype and the production machines. The line facilities will be designed for 100 wpm so that retrofit to 100 wpm in later production machines will be possible with minimum effort.

Ground-to-Ground Output

(H. Rising, M. Feldstein, S. Ginsburg) (CONFIDENTIAL)

A meeting was held in Poughkeepsie among P. Rocco, H. Rising, and R. Jeffrey to discuss the effects on the output and crosstell-input systems of a change in ground-to-ground output word from interleaved to sequential. It was agreed that the changes in the crosstell input could be made fairly easily by pluggable-unit and back-panel wiring changes and that such changes could be incorporated if a decision is made soon. The changes required in the output system involve no pluggable-unit or back-panel changes if the readout wiring in the core arrays can be changed.

~~CONFIDENTIAL~~

Memorandum 6M-3287

Page 22

2.1 Systems Office Activities (Groups 62 and 64) (Continued)Ground-to-Ground Output (Continued)

(H. Rising, M. Feldstein, S. Ginsburg) (CONFIDENTIAL)

Such a change could be tested in 5 months if manpower is available and could be phased in with the production schedule so that no delay would result from the change.

Enough information has been gathered on this problem to allow a decision to be made during the next biweekly period.

Input, Output, and Display Requirements for P-1

(H. J. Platt) (UNCLASSIFIED)

An M-note, 6M-3267, "Quantities of Input and Output Equipment for the First and Second AN/FSQ-7's," was circulated for comment. The comments have been received and are being incorporated into a revised edition. The final draft of the note will be released in a TIR by the PCO and will indicate what input and output equipment should be supplied by IBM.

Information on display-console equipment for these two machines is being gathered by Group 61 and will be reported on in a separate note and TIR.

DDR-DDT Frame

(I. Aronson) (UNCLASSIFIED)

All the production drawings and charts for frame 38 have been released to IEM.

Paul Messenheimer and Al West, respectively, are working on the pluggable-unit testers and the DDR monitor.

I am writing a proposal for the data-circuit patch-panel specifications.

Auxiliary Memory (UNCLASSIFIED)

(R. P. Mayer, W. A. Clark, J. Mitchell, N. T. Jones, R. Buzzard)

Memorandum 6M-3273 announces the formation of a study group to collect data for adding more auxiliary memory to the SAGE System. All reasonable methods of adding memory are being considered in detail. Daily

~~CONFIDENTIAL~~

Memorandum 6M-3287

Page 23

UNCLASSIFIED

2.1 Systems Office Activities (Groups 62 and 64) (Continued)Auxiliary Memory (UNCLASSIFIED) (Continued)

(R. P. Mayer, W. A. Clark, J. Mitchell, N. T. Jones, R. Buzzard)

meetings have been held with various people in Division 6 in order to cover all aspects of the problem.

R. Mayer and B. Housman visited Poughkeepsie on Thursday, 13 January, to discuss the subject with IBM core- and drum-memory development groups.

A trip to see the production group is planned for 20 January. A verbal report of the results of the study group with definite recommendations will be presented to Mr. Forrester on Friday, 21 January. A written report will be prepared the week of 24 January.

General

(J. Giordano) (UNCLASSIFIED)

The Systems Office activities during the period have included the following:

1. "Changes to Crosstelling Input Specification for XD-1 and XD-2" (W. S. Squire 12/13/54) has received IBM-SO concurrence;
2. "Proposed Changes in the Output System Specifications M-2697 for XD-1 and XD-2" (W. S. Squire 11/30/54) has received IBM-SO concurrence;
3. Systems Office Release Letter No. 9, released 1/14/55, completes all drawings, components, and charts necessary for IBM to construct Frame No. 38 of AN/FSQ-7 (XD-1);
4. Proposal for XD-1 Command Post has been submitted to the Systems Office for IBM-SO concurrence.

General

(P. R. Bagley, B. G. Farley, L. R. Jeffery) (UNCLASSIFIED)

We have been studying the relationship of maintenance programs and procedures to computer reliability in an attempt to devise a realistic goal for maintenance programs. Initially we have been trying to predict XD-1 reliability from a knowledge of Whirlwind I experience.

~~CONFIDENTIAL~~

~~CONFIDENTIAL~~

Memorandum 6M-3287

Page 24

UNCLASSIFIED

2.1 Systems Office Activities (Groups 62 and 64) (Continued)Gap-Filler Inputs (GFI)

(H. Anderson, A. Hughes, J. May, A. Werlin) (CONFIDENTIAL)

A thorough study of all documents describing the IBM mapper and the gap-filler radar equipment has been started. A data circuit from Lexington to Poughkeepsie has been ordered to facilitate testing of the mapper with live data. A demonstration of the mapper will be observed on 18 January in Poughkeepsie.

Long-Range-Radar Inputs (LRI)

(H. Anderson, A. Hughes, J. May, A. Werlin) (CONFIDENTIAL)

The new specification for this equipment should be available for distribution within a few days. It is hoped that concurrence among all parties concerned will be reached shortly thereafter.

Power Generation

(J. J. Gano) (UNCLASSIFIED)

Several preliminary copies of the Jackson and Moreland report on a study of power generation were delivered Wednesday, 12 January. The final copies are expected on Tuesday, 18 January. Diesel-engine drives are recommended over gas and steam turbines for reasons of economy and reliability. For better load matching and economy, 650-kw diesels are preferred over the present 1250-kw units. Generation at 480 volts permits the use of less costly, more compact, faster operating switchgear. At meetings with Western Electric, ADES, their power consultants, Burns and Roe, and the Air Force, these recommendations of size and generating voltage were accepted for the fourth Direction Center

Power Conversion

(J. J. Gano) (UNCLASSIFIED)

The purchase order for the d-c supplies for the Kingston test cells has been awarded to General Electric, the manufacturers for the XD-1 and XD-2 units. The performance specifications are about the same. At a meeting at Poughkeepsie, mechanical and electrical improvements were discussed with G.E. In order to reduce output capacitance by about 35%, the amplifier stages will be powered by a 1200-cps source. The increase from 360 cps will eliminate the time lags in the two stages. It has not yet been determined whether the frequency multiplication will be accomplished by a motor-generator or a static magnetic circuit. The reference

~~CONFIDENTIAL~~

Memorandum 6M-3287

Page 25

2.1 Systems Office Activities (Groups 62 and 64) (Continued)Power Conversion

(J. J. Gano) (UNCLASSIFIED) (Continued)

circuit will be revised so that one set of mercury cells with low drainage will be used for a complete set of voltage units.

To avoid the use of wet batteries which are necessary for carry-over in case of a line fault, the source of the 48-v supply was transferred from the unregulated transformer source to the computer motor-generator sets. This was made possible by a reduction in the load on the generator feeding the d-c supplies. Measurements on computer frames that consume 40% of the total load show that the measured d-c loads are about 58% of the estimated values and the a-c loads about 97%. Three of the nine d-c voltages used slightly more current than estimated. Groups were asked to review their estimates to justify the measured values and to allow further reductions. The estimates on the unmeasured equipment remained substantially the same.

Power Distribution and Control

(F. Sandy) (UNCLASSIFIED)

The Power Group at IEM has become convinced that "modular" design (as suggested by the MIT Power Group) is a far superior type of mechanical construction for the power-distribution frames than the construction now used. Modular design refers to the use of standard modules to build all power-distribution frames except the PCD (power control and distribution) frames. Three or four different types of modules can be combined in various combinations and numbers to make any MCD (marginal checking and distribution) frame. IEM hopes to make all the MCD frames for the production machine of this type of construction.

The concurrence document, D-48, about the duplex PCD frame for the production machine is being rewritten and should be concurred upon within the next 2 weeks.

XD-1 D-C Supplies

(S. T. Coffin) (UNCLASSIFIED)

The d-c supplies have been operating intermittently for the past 2 weeks, and we have begun recording their performance data. In the over-all performance of the supplies, there seems to be much room for improvement. The most objectionable feature of the supplies is their large drift. This seems to be caused by temperature-sensitive components, since it is less severe with the ventilation turned on.

Memorandum 6M-3287

Page 26

2.1 Systems Office Activities (Groups 62 and 64) (Continued)

XD-1 Equipment Cooling

(A. Chopourian) (UNCLASSIFIED)

The graphic panel-layout drawings have been approved by IEM, Francis Associates, and MIT, and delivery is expected by 15 March. The instrument panel is expected to be delivered some time between 17 and 20 January.

~~CONFIDENTIAL~~

Memorandum 6M-3287

Page 27

UNCLASSIFIED

2.2 XD-1 Testing

(W. J. Canty, J. D. Crane, S. L. Thompson) (CONFIDENTIAL)

A series of tests is being devised to help evaluate the progress of XD-1 towards its final goal as a component of the prototype Subsector. A memo outlining in some detail the tests to be performed and the expected results is nearly complete.

Meetings have been held with IBM personnel on allotment of time and keeping of records on XD-1.

2.3 Other Activities (Group 62)2.33 Vacuum-Tube CircuitsMagnetic-Drum System (MTC)

(E. Gates, J. McCusker, D. Shansky) (UNCLASSIFIED)

Preliminary investigations into increased storage density in the magnetic-drum system in MTC have succeeded in indicating the feasibility of at least one technique. We have succeeded in multiplying the existing maximum information density by 1.5 by reducing the peripheral velocity of the drum by a factor of 2 and using a pair of alternate-polarity current pulses to write either a ONE or a ZERO. This technique (writing the "derivative") offers the possibility of increased system margins at normal drum velocities.

Phone-Line Demodulator and Modulator

(E. B. Glover) (UNCLASSIFIED)

Work on the modulator has been completed, and the circuit has been approved by Basic Circuits.

Because of minor circuit changes that occurred after approval of the demodulator, most of the margins on this circuit have to be re-taken. This work is now being done in preparation for the final report on both circuits.

Flip-Flop, Model A

(N. J. Ockene) (UNCLASSIFIED)

The flip-flop breadboard has been rewired, and circuit logic has been set up preparatory to running tests on the flip-flop.

~~CONFIDENTIAL~~

UNCLASSIFIED

2.33 Vacuum-Tube Circuits (Continued)Sensing Amplifiers for Memory Planes

(R. C. Zopatti) (UNCLASSIFIED)

An input transformer for the Mod. IV MTC sense amplifier has been developed with a recovery time of approximately 1.5 microseconds and a delay of approximately 0.2 microsecond when critically damped. The present input transformer has a recovery time of approximately 6.0 microseconds and a delay of approximately 0.25 microsecond when critically damped. The gain of the new transformer is approximately 0.6 the gain of the present transformer because of the two shorted turns around the core needed to reduce the recovery time.

2.34 Memory Test Computer

(W. Hosier, W. Ogden) (UNCLASSIFIED)

Operation of MTC continued this period much as last period, with about the same general reliability and intermittent unexplained troubles with read-in and power-supply sequencing.

Most of the time devoted to the drum went toward investigating the double-density storage question for XD-1.

Charactron tests were run of vector intensity control, to make long and short vectors of equal brightness.

Some data-link work was accomplished, although Buzzard and his colleagues were plagued by minor difficulties.

The card input-output seems to be operating reliably at one-fourth of its intended bit capacity using breadboard circuits. On receipt and installation of final equipment about 15 February, card input-output should be available for general use.

Further time was spent in plotting received power contours and the like for Group 31 (a summary of this work is to be found in Division 3's forthcoming Quarterly Report); also, several pattern-recognition tests were run by members of Groups 22 and 34.

Freeman's "worst pattern" (systematically disturbed checkerboard) was run in part (i.e., testing one-fourth of the cores in the memory) for Jack Mitchell, with results which he thought encouraging. It is true that this program has the worst margins of any tried to date: -20-v to -35-v sense-amplifier bias margins taken simultaneously on all digits. However, these represent only a 5-v narrowing on one end from the standard "tapeworm" test margins of -15-v to -35-v; they do not seem to be as bad as the results reported by Bob West for a similar run on the XD-1 memory.

Memorandum 6M-3287

Page 29

2.34 Memory Test Computer (Continued)

(W. Hosier, W. Ogden) (UNCLASSIFIED) (Continued)

Two projects have been initiated by the Display Section: first, a 20-line output from the MTC accumulator to simulate XD-1 category and feature lines for the prototype IBM console expected at the end of this month; second, independent readout from extra heads, on the MTC drum to pipe display test data to Bldg. F after the display-generating frames arrive.

Computer operating time during this biweekly period was divided approximately as follows:

	<u>Hours</u>	<u>Per Cent</u>
Development	75	50
Programming	30	20
Scheduled Maintenance and Installation	30	20
Unscheduled Maintenance	<u>15</u>	<u>10</u>
	150	100

Card Machine

(F. R. Durgin) (UNCLASSIFIED)

Optimistically, I expect the card machine to be available for use in the middle of February. Anyone interested in using the card machine at this time should see me.

The breadboard setup of the circuits to be used indicates that both reading and punching will work well. Final circuits should be through construction by the end of January.

The problem being worked on now is the proper interlocking of card "run-in" and "run-out." It is also expected that there may be some trouble with stacking a laced card.

Camera Displays

(L. L. Sutro) (UNCLASSIFIED)

A Group 61 programmer has asked for displays of 128 x 128 discrete dots. The camera display scope cannot present these in straight lines until the decoders and deflection amplifiers have been so improved that they will not pick up 60-cycle ripple. Hoping that Charactron would do better, I took photographs of 128 x 128 dots there. The first photographs show uneven brightness and uneven lines of dots.

Memorandum 6M-3287

Page 30

2.34 Memory Test Computer (Continued)

Technician Training

(A. Vanderburgh, Jr.) (UNCLASSIFIED)

The MTC Technician Training Manual will consist of five chapters. Chapters I and II have been finished in class. Notes of Chapter I and an outline for the entire course have been distributed. (See Memorandum 6M-3004.) Chapter II, which covers the over-all block diagram of MTC (D-47039) and the MTC Central Control Block Diagram (SE-37460), will be distributed early in February. The class is now considering Chapter III. In this chapter specific circuits (e.g., accumulator, B-register, etc.) are being described in some detail (i.e., at the flip-flop - gate level). Chapter IV will be programming. Chapter V will consist of trouble-shooting practice.

A class in specific XD-1 circuits has been established for the new group of XD-1 technicians. The class will be taught by J. Delmege and A. Vanderburgh and will meet Wednesdays and Fridays, 9-10 A.M., in Room B-110.

Programming Effort

(A. Vanderburgh, Jr.) (UNCLASSIFIED)

A program has been written that will print out the contents of specified ranges of memory as octal numbers or as mnemonic instructions with octal address sections. At present the program uses the Flexowriter, but in the near future a similar program that uses the Charactron will be ready.

A program that will allow the use of the Charactron with the Flexo code should be ready about 28 January 1955.

SD Camera Control for XD-1

(L. L. Sutro) (UNCLASSIFIED)

Working with Ron Mayer on logic and with Chuck Corderman on connections to the camera console, I have completed a block schematic of the SD camera-control system. The system will be located principally in the display frame and partly in the selection frame and in the camera. The camera console will provide only jacks for through connections from the display frame to the camera.

Memorandum 6M-3287

Page 31

2.35 System Liaison (See also page 35)

(A. P. Kromer) (UNCLASSIFIED)

The monthly review meeting for the SAGE program was held by ADES on Tuesday, 11 January 1955. Discussion covered the IBM production program, Direction Center building status, and other phases of the project. The pace of the program at this time seems satisfactory with regard to meeting the desired end date for the initial installation.

The committee planning a program for installation and testing of the AN/FSQ-7 at the first site presented its proposal to top-level personnel of Western Electric Co., IBM, and Lincoln Laboratory for review. The time phasing was not considered entirely satisfactory, and the committee was asked to review certain aspects in order to reduce the total elapsed time.

Consideration of the desired type of power generation, voltage to be generated, and layout of power equipment for the fourth Direction Center has been discussed with Western Electric Co., Burns & Roe, Inc., and the Air Force to establish a basis for architectural design work.

Exhibit 17

(P. J. Gray) (UNCLASSIFIED)

Some problems have arisen with regard to the release of Exhibit AFCRC-17 by Cambridge Research Center. It is hoped that these difficulties can be resolved and release effected within the next 2 weeks.

Remote-Location Study

(P. J. Gray) (UNCLASSIFIED)

Work is continuing on gathering background information concerning the various remote locations which are candidates for inclusion in the proposed BTL study. It is expected that a draft of a proposal can be written by 28 January 1955.

Production Coordination Office

(P. Bragar, F. Manning, E. Lundberg, J. Carson) (UNCLASSIFIED)

<u>TIR</u>	<u>M-Note</u>	<u>Subject</u>
1-53	6M-3198	Master Reference List; Lincoln Laboratory Requirements for Combined C.C.-D.C. Buildings (including release of memoranda 6M-2993, 6M-2994,

2.35 System Liaison (Continued)

(P. Bragar, F. Manning, E. Lundberg, J. Carson) (UNCLASSIFIED)
(Continued)

<u>TIR</u>	<u>M-Note</u>	<u>Subject</u>
		6M-2995, 6M-2996, 6M-3224 and drawings D-60319-7, E-75054-2, E-75055-2, E-75056-2, and D-75057-1).
1-54	6M-3147-1	Revised Master Reference List; Lincoln Laboratory Requirements for D.C. Buildings (including release of memorandum 6M-3090 and drawings D-75021-1, D-75022-1, D-75023-1, D-75024-2, D-75025-1, D-75026-1, and R-75027-1).
1-55		Relay Clock and Master Clock, Production Machine (IBM Document D-22-1).
	6M-3189-1	Summary of Lincoln Laboratory TIR's pertaining to SAGE System issued by Production Coordination Office.

2.36 Display

(C. L. Corderman) (UNCLASSIFIED)

The Charactron tube having the final matrix layout has been installed in the prototype console in Room B-034. Switches at the input of the character-selection decoder have been arranged to allow many different patterns to be displayed. This equipment will be in use during the next few weeks for character-legibility studies under the direction of Group 38.

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

Ten pluggable units have been type tested. Anyone interested in the details of the pluggable units should contact one of us.

Some time has also been spent in the following activities:

Investigation of means for obtaining an active display for testing frames 24 and 25;

Preparation of a "Mayer like" drawing of the display tester;

The Display Seminar (see entry of R. H. Gerhardt).

Memorandum 6M-3287

Page 33

2.36 Display (Continued)

(R. H. Gerhardt) (UNCLASSIFIED)

All section diagrams for the situation-display-generator element have been given to the Drafting Room. All but one, the timing and control section, have been drawn and checked and are ready for release. The element diagram has also been given to the Drafting Room.

A new timing diagram for the situation-display-generator element (D-75046) has been drawn and is available in the Print Room.

I instructed in a Display System Seminar given for contract engineers, IBM people, and technicians.

(R. B. Paddock) (UNCLASSIFIED)

The design of the display-tester console and its panels is in progress; panel space requirements are not yet final.

(J. Woolf) (UNCLASSIFIED)

A circuit to equalize the light output between long and short vectors was installed in MTC. The tests proved that this circuit added corrections which compensated for unequal light output in vectors. This circuit will be modified in order to give a closer control on the correction applied. The intensity circuits used in XD-1 will be modified to incorporate this circuit.

In order to test the vector generator, three plug-in units are necessary. To date, I have received two units. When the third unit arrives, marginal-check data will be obtained.

Prints for the Charactron display equipment are being brought up to date. The Drafting Department is changing the existing prints to conform to the changes incorporated in the line drivers. New drawings will be issued which will include the Charactron compensation inhibit and vector intensity modulator circuits.

The display tester was received and assembled in T. Clough's area. Because of changes in power-supply voltages, the sweep and magnetic-deflection amplifiers had to be readjusted. The equipment is capable of performing all of its dynamic tests. A logbook will be maintained on this equipment.

Memorandum 6M-3287

Page 34

2.36 Display (Continued)

(H. E. Zieman) (UNCLASSIFIED)

Recent investigation has shown that the impedance of the cathode follower driving six parallel decoder bits was too high and was increasing the rise time in the output of the decoder. A new cathode follower was built, and the input to the decoders now rises in 0.4 microsecond with a 0.2- μ sec delay. From the input rise-time tests, it was determined that the input capacity of a single decoder bit from each plug-in unit input terminal to ground is approximately 45 μ f.

The shunt output capacity of the decoder ladder between plug-in unit output terminals is 40 μ f. With the new ladder, the output impedance of the ladder is 22.4K maximum. This gives the decoder a rise time of 4 microseconds to 90% of its final value with no external load. When loaded with the line-driver amplifier, the output of the decoder is within 1% of its final value in 7 microseconds.

Some work has been done on the compensation networks of the line-driver amplifier to speed up the output. At present, the amplifier reaches the peak of a 10% overshoot in 14 microseconds with a 420-v push-pull output. The initial rate of rise is constant so that the peak is reached sooner for smaller signals. Thus, the amplifier output reaches the peak of a 10% overshoot in 9 microseconds for a 340-v output signal.

Further investigation of the amplifier has been halted by the loss of a plug-in unit extender. Two new extenders have been obtained and are at present being wired in the shop.

(A. Grennell) (UNCLASSIFIED)

Status of drawings and drawing releases:

	<u>Frame 24</u>	<u>Frame 25</u>
Etched-card drawings released to IBM	100%	100%
Pluggable-unit design released to IBM	100%	100%
Logic drawings completed	98%	100%
Logic drawings released to IBM	0	90%
Frame drawings completed	100%	100%
Frame drawings released to IBM	100%	100%
Pluggable-unit test specs and test-adaptor designs released to IBM	100%	100%

Memorandum 6M-3287

Page 35

2.36 Display (Continued)

(A. Grennell) (UNCLASSIFIED) (Continued)

Status of experimental pluggable-unit construction and type testing:

Ordered through Production Control	100%	100%
Construction completed	88%	86%
Type test completed	67%	62%

2.35 System Liaison (Continued)

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

Several draft copies of the Jackson & Moreland report on the power-generation study for SAGE System power plants have been distributed for comments. The final report is due the week of 17 January.

The over-all design criteria for the buildings and facilities at the fourth SAGE System site were reviewed with Air Force Installations people from USAF Headquarters. WE-ADES was authorized to proceed with a design which differs from the first buildings in that the first-floor maintenance addition is a one-floor bay (150 x 30 feet). This additional bay will be designed to allow a second story to be added in the future if the present computer floor becomes too crowded.

Memorandum 6M-3287

Page 36

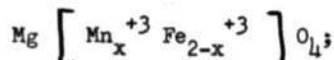
SECTION III - MAGNETIC MATERIALS AND ADVANCE DEVELOPMENT3.1 Magnetic Materials3.11 ChemistryProduction of Memory Cores

(J. Sacco) (UNCLASSIFIED)

Pilot-plant production of a new batch is under way. This composition, DCL-2-825, exhibits improved electrical characteristics. At the present time, 30,000 F397 size cores have been fired, and a stockpile of 50,000 "green" cores is on hand.

D. Wickham, F. S. Maddocks (UNCLASSIFIED)

A new Series, DCL-8-24 through DCL-8-34, is being prepared. Each member of this series should satisfy the formula:



to help insure this, the raw materials, MgO, MnO · OH, and Fe₂O₃, were prepared in the laboratory.

A-C Building Power

(R. C. Jahn) (UNCLASSIFIED)

Some furnaces in the ceramics lab have been slow in attaining peak temperature since the building voltage was reduced. These furnaces are designed for 220- to 230-v lines, so a special 100-amp boost transformer has been acquired from Boston Transformer Co. to raise the voltage for the Harper furnace to 230 volts. A second transformer will also be installed for the other furnaces.

Ferrites for Magnetostrictive Measurements

(D. L. Brown) (UNCLASSIFIED)

DCL 3-121 to 133 A and B series, nickel ferrite and nickel-manganese ferrite, and DCL 3-171 to 180 C and D series, magnesium-manganese ferrite and manganese ferrite, were fired. DCL 3-171 to 180 A and B series were refired. Micro-structure photographs of DCL 3-176 to 180 A and B series were made. The nickel-zinc ferrite series, DCL 3-155 to 165, and

Memorandum 6M-3287

Page 37

3.11 Chemistry (Continued)Ferrites for Magnetostrictive Measurements (Continued)

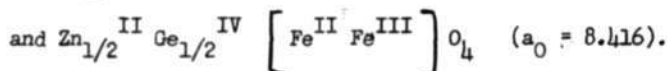
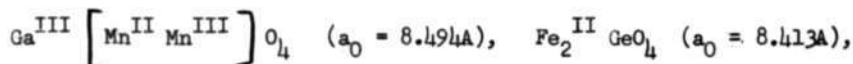
(D. L. Brown) (UNCLASSIFIED)

the nickel-manganese ferrite series, DCL 3-185 to 193, were pressed.

Inorganic Chemistry

(D. G. Wickham) (UNCLASSIFIED)

The installation of the Norelco X-ray spectrometer has been completed. With the aid of this instrument the following substances have been identified as spinels:



The zinc-germanium compound possesses a magnetic moment of approximately 2.0 Bohr magnetons per molecule at room temperature. The more significant saturation moment will be measured soon. The successful synthesis of $\text{Zn Ge} \left[\text{Fe}^{\text{II}} \text{Fe}^{\text{III}} \right] \text{O}_4$ from $\text{Zn Fe}_2^{\text{III}} \text{O}_4$ and $\text{Ge Fe}_2^{\text{II}} \text{O}_4$ ($a_0 = 8.42$ and 8.41 , respectively) indicates a new series of magnetic solid solutions between $\text{Zn Fe}_2^{\text{III}} \text{O}_4$ and $\text{Ge Fe}_2^{\text{II}} \text{O}_4$.

Chemical Analysis

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

Quantitative analyses of the following have been completed:

1. DCL-2-801, a memory-core composition;
2. Synthetic inorganic preparations of:
 - a. Iron oxide - DCL-8-21, batches I & II;
 - b. Mn_2O_3 - DCL-1-200;
 - c. MnO-OH - DCL-8-22.

Memorandum 6M-3287

Page 38

3.11 Chemistry (Continued)

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

Quantitative analyses of the following are in progress:

1. DCL-2-825 and DCL-2-811, memory-core compositions;
2. DCL-1-180, a magnesium-manganese ferrite of special composition.

Core Testing

(J. W. Schallerer) (UNCLASSIFIED)

The Memory Section of Group 63 has requested 66,000 good cores for an experimental 256 x 256 memory plane. The testing should be completed in 2 weeks. If the automatic tester is finished in time, the cores will be rechecked on it.

3.12 Physics

Trip to IBM

(J. B. Goodenough) (UNCLASSIFIED)

The first of a series of bimonthly meetings with the IBM research group was held in Poughkeepsie. Their primary interest at the moment is the measurement of an activation energy from measurements of (1) complex permeability, (2) resistivity, and (3) pulse measurements. They hope to learn whether the activation energies for the three different phenomena measured are the same and therefore whether they are all related to the same basic property of the material. Larry Bickford is also setting up apparatus to measure the magnetostriction in ferrites with small amounts of CoFe_2O_4 substituted. This work should supplement that of P. K. Baltzer in this Laboratory.

Switching Coefficients

(N. Menyuk) (UNCLASSIFIED)

The theoretical conditions for high squareness and low coercive force are being synthesized with the switching-coefficient (S_w) calculation in order to determine the limitations which these conditions impose upon S_w . On the basis of the resultant equations and empirical data presently available, it appears that grain orientation represents the most promising technique for reducing S_w significantly.

3.12 Physics (Continued,Magnetostriction Measurements in Ferrites

(P. K. Baltzer) (UNCLASSIFIED)

A thesis entitled "Magnetostriction in Ferrites Possessing a Square Hysteresis Loop" has been completed. A significant correlation has been found between magnetostriction data and B-H loop squareness over a compositional series of ferrites. It has been concluded that magnetostriction plays a major role in producing the magnetic characteristics of ferrites possessing a square hysteresis loop.

The isotropic saturation magnetostriction for these polycrystalline materials was found to go through zero, changing sign at the optimum composition for hysteresis-loop squareness in this compositional series. In addition, the sign of the magnetostriction at low fields, which in nearly all cases is opposite to that at high fields, also changes at this optimum composition.

An analysis of these results has led to the conclusion that the effective anisotropy determining the direction of magnetization of the individual crystallites goes through zero at the optimum composition. This change of sign in the effective crystalline anisotropy is believed to be the result of anisotropy in the single-crystal magnetostriction; the single-crystal magnetostriction can be large despite low magnetostriction effects for the polycrystalline material.

Incremental Permeability

(J. D. Childress) (UNCLASSIFIED)

Theoretical calculations of the incremental permeability at remanence have been made on the basis of two mechanisms:

1. Rotation of the direction of magnetization;
2. Growth of domains of reverse magnetization.

An admixture of the two processes will be considered.

A series of pulse tests is being planned to substantiate the calculations.

Memorandum 6M-3287

Page 40

3.12 Physics (Continued)

Gated-Amplifier Current Calibrator

(R. Pacl) (UNCLASSIFIED)

The calibrator was examined for susceptibility to pulse-repetition frequency and alternate-polarity pulses of varying amplitudes. It was found that increased bias was necessary to overcome the effects of higher prf on amplitudes approximating 10 volts. It is now believed that we can handle the highest prf compatible with the limits of the drivers at amplitudes up to 10 volts.

3.2 New Components and Circuits

(T. Meisling) (UNCLASSIFIED)

We now have available several possible sets of transistor circuits (all using the surface-barrier transistor) with speeds comparable to those of vacuum tubes. The simplest circuits operate with voltage swings of 0.6 volt; voltage swings up to 2 or 3 volts may be obtained with slightly more complicated circuits (more resistors and capacitors per transistor).

The choice of one particular set of circuit techniques for the eight-digit multiplier will be based on expected system performance. In making this choice we are particularly concerned about the following questions:

1. Will information transfer in the system be unduly sensitive to noise?
2. Do the circuits lend themselves to marginal checking?
3. How many transistors will be needed for fundamental operations such as counting and shifting?
4. What are the problems involved in matching the SBT circuits to other circuits and devices (indicator lights, for example) requiring larger signals?

3.21 Transistor Circuits

(N. L. Daggett) (UNCLASSIFIED)

Since "hole storage" may make pulse width difficult to control in transistor logical circuitry, the double-rank flip-flop such as is used in the IAS (Institute for Advanced Study) machine might offer a substantial advantage in its lack of dependence on pulse width. I have therefore been

3.21 Transistor Circuits (Continued)

(N. L. Daggett) (UNCLASSIFIED) (Continued)

considering what active elements are logically necessary to produce a complementing flip-flop which functions without any limitation on maximum trigger-pulse width. It appears the double-rank flip-flop is a logically minimum form of such a device. Further, it seems that it represents a limiting case of flip-flop development as an element of a system, since it offers maximum input tolerance at the expense of maximum numbers of active elements. The larger number of transistors required for this circuit suggests that it probably would be wiser to try to develop a system which has an inherent restriction on the maximum allowable pulse width and which, in return for this restriction, can allow a simpler transient-memory flip-flop.

(J. W. Forgie) (UNCLASSIFIED)

The application of Professor Huffman's synthesis technique for sequential-switching circuits to the design of a complementing device suitable for use in a counter has produced a transistor circuit which upon careful examination turns out to be a form of double-rank flip-flop. The appearance of this double-rank circuit from the formal procedure implies that the double-rank flip-flop is probably a minimum circuit realization for the logical specification of nontransient memory.

Transistor Core Drivers

(K. H. Olsen) (UNCLASSIFIED)

An M-note has been written on a scheme for driving coincident-current memories with transistors. This scheme may not make it possible to drive large memories with hearing-aid transistors, but it is believed that it eases the requirements significantly.

Transistor Shift Register

(J. R. Freeman) (UNCLASSIFIED)

By applying step-function pulses to the two-flip-flop simulated shift-register system reported in the previous Biweekly Report, the maximum shifting rate has been determined to be 5.1 megacycles.

Memorandum 6M-3287

Page 42

3.21 Transistor Circuits (Continued)Complementing Flip-Flop

(J. R. Freeman) (UNCLASSIFIED)

A complementing scheme for a Philco surface-barrier transistor flip-flop which used inverters to control the set gates was not successful. The circuit depended on transistor delays which proved too short.

Design of Arithmetic Elements

(A. L. Pugh III) (UNCLASSIFIED)

I found that surface-barrier-transistor inverter characteristics are not strongly dependent on α when I drive it with a voltage. I further found that the delay through an inverter due to saturation varies from 30 to 200 millimicroseconds.

Relay Chains

(E. U. Cohler) (UNCLASSIFIED)

Certain problems involving the characteristics of chains of transistors in relay-like circuits were investigated. The effect of driving a transistor on in the middle of a chain of off transistors was determined insofar as d-c phenomena are concerned. The current in successive transistors in a chain, all of whose transistors are on, was expressed in terms of circuit parameters and transistor characteristics. At present, there are no plans to put this work into a note, but it is expected to go into a compendium of work on these circuits to be issued somewhat later.

Equivalent Circuit of the Alloy Junction

(E. U. Cohler) (UNCLASSIFIED)

The small-area alloy junction has an approximately logarithmic voltage-current characteristic. In order to approximate this characteristic with a straight line, the problem of the error of a tangent was considered. It was shown by certain calculations that the tangent is a good approximation for values of current in a range about the current which we generally use. The result of this work is a piecewise-linear equivalent circuit for the alloy junction which will apply in certain areas and yield a reasonably accurate analysis of circuits which we are now employing. These results will be written up further when more experimental confirmation is available.

Memorandum 6M-3287

Page 43

3.21 Transistor Circuits (Continued)Flip-Flops

(E. U. Cohler) (UNCLASSIFIED)

Two types of flip-flops were tried out with a view to simplifying or improving present types. One of these flip-flops employed a dry cell in the feedback circuit and was found to have four times the swing of the ordinary directly coupled type. Moreover, its rise and fall times were each less than 0.1 μ sec. The second type tried was an ordinary capacitor-coupled type, and it was unsuccessful in that it was hard to trigger and required 0.4 μ sec to rise.

Surface-Barrier-Transistor Life Tests

(D. J. Eckl) (UNCLASSIFIED)

The first eight SBT life-test transistors have been operating for 1200 hours. The second group of 16 has been in operation 400 hours. These six flip-flops and 12 gates operate on four 3-v batteries in parallel.

Elevated-Temperature Tests

(D. J. Eckl) (UNCLASSIFIED)

Marvin Petersen has made elevated-temperature (80 C) tests on Germanium Products 2525 high-gain npn transistors. It was found that the α reached unity at around 70 C.

Characteristic Plotters

(D. J. Eckl) (UNCLASSIFIED)

A Dunn Transistor characteristic plotter is on order. In addition, two units of the type designed by W. Morrow are being constructed by Division 7 shops at the request of Group 35. This will help the curve-plotter situation considerably.

Thesis

(C. T. Kirk) (UNCLASSIFIED)

My thesis entitled "Investigation of Semiconductor Devices as Gated-Amplifiers for Digital Computers" is in the final stages of preparation. The rough draft has been edited, and it is ready for final typing. All of the sketches and figures have been completed by the Drafting Room. Currently, I am editing the Multiliths in preparation for final printing.

Memorandum 6M-3287

Page 44

3.23 Memory

(W. N. Papian) (UNCLASSIFIED)

I delivered a talk entitled "Core Memories for High-Speed Digital Computers" to an IRE Section meeting at Cornell University.

Messrs. Bauer and Lawrence of IBM (commercial development) were here for further exchange of information. Their work on 4000-register core memories, using switch-core drive, for IBM machines seems to be progressing well. Other visitors included Messrs. Horton and Dean of Computer Control Corp. and Schweitz and Kirby from Bu. Ord. who wanted general information on core-memory work. Representatives of the Sprague Co. were here to discuss packaging the cores for our big switches. A Westinghouse engineer discussed tape-wound cores during a short visit; he will send literature and samples.

Test Drive

(J. Raffel) (UNCLASSIFIED)

The 128 x 128, which was made by connecting up four 64 x 64 planes, has been test driven from the test section representing a selected row and column of a 256-position switch. First indications are that it operates about the same as the single 128 x 128 previously tested.

Post-write Disturb

(J. L. Mitchell) (UNCLASSIFIED)

The post-write-disturb pulse does not have to occur every memory cycle in order to be effective. For example, inserting a post-write-disturb pulse into a 256 x 256 plane every 32 memory cycles will keep the buildup of the "worst pattern" from getting any larger than it can in a 64 x 64 which received no post-write-disturb pulse at all. One way to accomplish this is to post-write disturb every time you do not refer to memory, such as during multiply, in-out interlock, etc. Another way would be to "hang up" the machine every 32 cycles and post-write disturb; this would make a 6- μ sec cycle effectively a 6.09- μ sec cycle.

Mechanical Design and Layout for 256 x 256 Memory

(E. A. Guditz) (UNCLASSIFIED)

The modular-memory-plane frames for the first 256 x 256 memory plane are almost completed. Wiring should begin during the next biweekly period.

Memorandum 6M-3287

Page 45

3.23 Memory (Continued)

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

A model of the mounting rack for the 256 x 256 memory has been constructed and is being studied.

A modular plug-in unit subrack has been designed and a model constructed for study.

Printed Plane

(E. A. Guditz) (UNCLASSIFIED)

Difficulties in obtaining satisfactory photographic-reduction ratios in film negatives for photo etching the 4 x 4 printed plane have been overcome. Attention is now being given to registration difficulties in punching the printed cards.

Memory Test Setup VI

(E. A. Guditz) (UNCLASSIFIED)

A 128 x 128 experimental memory plane has been wired into the tester, and a quadrant is being driven. Output signals from this quadrant are being observed as a function of information stored in the remainder of the plane.

Memory Plane with External Selection

(D. H. Ellis) (UNCLASSIFIED)

Tests are being made to determine the best way to build a memory plane in which the selection and memory functions are performed by separate cores. The primary objective of these tests is a cycle time of less than 1 microsecond using cores of minimum size.

Memorandum GM-3287

Page 46

SECTION IV - CENTRAL SERVICES

4.1 Material Requirements & Stock

(H. B. Morley) (UNCLASSIFIED)

A Fairchild recording camera was needed for photographing the CRT filter monitor display (Barta). We were successful in locating one by a canvass of the Laboratory rather than through a GFE requisition.

Fire extinguishers for Bldg. F will be provided as Government Furnished Equipment.

Certain standard government items of test equipment can be supplied when requested on the FY56 Definitive Buying List which is being prepared by the Project Office. Interested persons should review catalogs, and requests should be submitted to this office by Friday, 21 January 1955. For further information call ext. 816.

Technical personnel maintaining "private stocks" of catalogs are urged to donate them to this office where they will be available to all. Good conduct medals will be awarded to all who comply with this request.

4.2 Mechanical-Engineering Service

XD-1 Installation Information - Report 26 (Extract)

(W. Ahern, W. Kates, H. Mercer,
P. Morrill, H. Wainwright) (UNCLASSIFIED)

I. Building Construction

We have occupied the first floor west. The general contractor has been asked to prepare first floor east.

Many of the second-floor rooms have been painted and have linoleum down. Some of the rooms will be temporarily occupied by IBM and some MIT personnel to ease our "housing" problem.

III. Power Equipment

As reported in the last Biweekly, completion of the basement power installation still awaits delivery of the PCD amplidyne-control section. The starter has been delivered and installed; the control section has been promised by 20 January.

D-c supply testing for drift was started 14 January.

Memorandum 6M-3287

Page 47

4.2 XD-1 Installation Information (Continued)

IV. Equipment Cooling

The d-c supplies, central-computer frames, and M-G Sets are now receiving outside air for cooling.

V. Cabling and Method of Distribution

B. Cabling

All power connections have been made to the equipment delivered to date, MCD 19 and frames 2, 3, 4, 5, 6, 9, and 12. However, the marginal-checking lines have yet to be installed between the PCD amplidyne-control section and the central-computer MCD.

Cables have been pulled into place for the drum frames and will be pulled for display MCD during the week of 17 January. The drum-frame cables are now being tied into a dummy module in preparation for delivery of the actual frames. This procedure proved its worth as evidenced by the short installation time required to "fire up" the central-computer frames.

Central-computer signal cables have been installed. Some of the prefabricated signal cables are being remade, because the original ones were too short to fit the trough system provided.

VI. Equipment Layout

IBM basement - verbal concurrence was received the week of 10 January. Drawings are being prepared to submit for cost estimates.

Second floor - the Systems Office is currently trying for concurrence on the new projection-room layout.

VII. Lighting

Lighting in the central-computer area was installed and in operation prior to the delivery of computer frames.

In general, most of the effort has been applied to running conduit and wires without installing fixtures, except as noted. Within the next period we expect the contractor will concentrate on installing fixtures. We have requested occupancy of rooms on first floor east in the following order: maintenance room, old telephone room, output room, and input room.

VIII. General

Over-all progress is favorable. Our schedules have been compromised somewhat to pinpoint certain areas for occupancy.

The reconnection of the central computer was accomplished in an astonishingly short time, thanks to R. Winchell and others from IBM. Testing under Jerry Mills of IBM appears to be moving quite well.

Memorandum 6M-3287

Page 48

4.2 XD-1 Installation Information (Continued)

(W. Ahern, W. Kates, H. Mercer,
P. Morrill, H. Wainwright) (UNCLASSIFIED)

The splendid cooperation of the Air Force Installations Office (represented by D. Marshall, J. Callahan, and Lt. R. Molloy) in preparing the loading dock and access road helped greatly to make the moving operation smooth.

4.21 Mechanical Engineering and Design

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

Design has been completed on a coil winder capable of winding 0.004-inch niobium helical coils at the rate of 250 turns per inch, 1 inch per minute, on a 3-foot length of 0.010 tantalum wire.

4.22 Components

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

Components have been tested and approved for use in relay arc-suppression circuits. See Components Section Report #6-018-054 for details.

A tube-cap connector with built-in parasitic-suppressor resistor has been tested and approved for use in XD-1 consoles. This item should be useful in other circuits and will be included in Lincoln Laboratory general stock.

All transformers and chokes to be used in the XD-1 digital-data receiver have been evaluated and approved.

Long-term studies are now being conducted by the Components Section in the following categories:

1. Diodes;
2. Etched-circuit techniques;
3. Miniature components.

Memorandum 6M-3287

Page 49

4.3 Test Equipment

Test Equipment Committee

(L. Sutro) (UNCLASSIFIED)

Two engineers from General Radio demonstrated before the Committee a pulse-delay line variable from 0 to 0.5 microsecond. It is built on the circular form usually used by G-R for potentiometers. R. Best and B. Barrett tested the unit and found at full delay the output amplitude was 70% of the input. They will next try the unit in circuits, seeking a simple way of restoring the attenuated pulse.

Test Equipment Headquarters

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

This period has seen the beginning of work for Building F. We have serviced some of the IEM test equipment and have supplied test equipment for use in the new computer building. We have also tightened up our record keeping, requiring that everyone who checks out standard test equipment sign for it. This step has seemed important for accountability; now it is necessary to determine what equipment is being used by IEM and what by MIT personnel.

4.4 Drafting

Central Display

(A. M. Falcione) (UNCLASSIFIED)

Logic diagrams and central-display frames 24 & 25 are complete and ready for release to IEM. It was necessary to create new symbols on these diagrams which required concurrence by the IEM Standards Group. The new symbols used will be incorporated in the MRD Book in the very near future.

XD-1 Drawings

(A. M. Falcione) (UNCLASSIFIED)

IEM has informed us that there are approximately 3000 more drawings to be released on the XD-1 system. This will complete the browline file for the XD-1 computer.

4.4 Drafting (Continued)

Maintenance Drawings for XD-1 at Lexington

(A. M. Falcione) (UNCLASSIFIED)

In order to assure the availability of accurate up-to-date drawings for use in the installation and testing of the XD-1 system at Lexington, a set of drawings will be maintained by the IBM records Control Unit to be located in Building F. These prints will be furnished directly to them from IBM.

4.5 Administration and Service

New Staff

(J. C. Proctor) (UNCLASSIFIED)

Charles J. Carter is a new staff member assigned to Group 64. Mr. Carter received his SB from MIT and until recently was employed by the American Telephone and Telegraph Company.

John D. Clarke is a new staff member in Group 60. He received his BS from Rensselaer and until recently was employed by Crompton-Knowles as a research engineer.

Laurence B. Collins is a new staff member in Group 61. He received his SB from MIT and has had 2 1/2 years of working experience as an engineer.

New Non-Staff Personnel

(R. A. Osborne) (UNCLASSIFIED)

Frances Momo is the new secretary in the Chemistry Section of Group 63.

Dorothy Glover has joined the Memory Section of Group 63 as a secretary.

Priscilla Nix is the new secretary in the SAGE Planning Section of Group 61.

Transfers of Non-Staff

(R. A. Osborne) (UNCLASSIFIED)

Phyllis Porter has transferred to the Army Liaison Office.

Memorandum 6M-3287

Page 51

4.5 Administration and Service (Continued)

Terminated Non-Staff

(R. A. Osborne) (UNCLASSIFIED)

Priscilla Coleman

Jean Devereaux

Open Non-Staff Requisitions

(R. A. Osborne) (UNCLASSIFIED)

1 Computer Operator for Group 61

1 Mechanical Detailer

1 Layout Draftsman

1 Secretary for Group 62

1 Technical Assistant for Group 61

~~CONFIDENTIAL~~

Memorandum 6M-3287

Page 52

Accessions List

(D. B. Helwig) (CONFIDENTIAL)

The following documents were published by Division 6 or received from IBM during the period 3 - 17 January 1955:

Division 6 Reports

<u>NO.</u>	<u>AUTHORS</u>	<u>TITLE</u>	<u>CLS.</u>
6M-2966	O. Conant	Telephone and Intercommunication Facilities for the 1954 CCS	C
6M-2993	F. Irish	Physical Characteristics of SAGE System Combat Center Equipment	C
6M-2994	W. Ayer	Building Requirements for SAGE Combat Centers	C
6M-2995	W. Ayer	Cooling System for SAGE Combat Centers	C
6M-2996	W. Ayer	Lighting Requirements for SAGE System Combat Centers	C
6M-3012-2	E. Smiley A. Shoolman	Allocation of Consoles to Operational Areas of the AN/FSQ-7 Direction Centers	C
6M-3073	E. Bedrosian C. Gaudette S. Knapp	Program Specifications for 1954 CCS Simulation Functions	C
6M-3114-6-1	M. Feldstein	Proposal for Specifications of the Mapping Materials and the Mapper Utility Holder	U
6M-3114-7-1	W. Ayer	Master Reference List, Lincoln Laboratory Requirements for Direction Center Bldgs.	U
6M-3189-1	E. Lundberg	Summary of Lincoln Laboratory TIR's pertaining to SAGE System issued by the PCO	U
6M-3194, C3	R. Davis	Group 61 Operations Plan (20-54) for Direction Center Demonstration and General Purpose Missions	U
6M-3198	W. Ayer	Master Reference List, Lincoln Laboratory Requirements for Combined Direction Center-Combat Center Buildings	U C
6M-3224	W. Ayer	Acoustic Criteria for SAGE System Combat Centers	C
6M-3230	P. Bagley	Nature and Preparation of Maintenance Programs: A Preliminary Report	U
6M-3231	E. Cohler	The Diode Amplifier, A Preliminary Investigation	U
6M-3239	T. Clough et al.	Vacuum Tube Failures During the Month of August, 1954	U
6M-3240	J. Gano	Power Generation for the First Combined Direction and Combat Center for the Fourth Direction Center (IDO)	U
6M-3241	S. Ginsburg	Command Post DID Desk Requirements	C
6M-3242	A. Smalley	Mission Specifications (2-55) for RAYDIST Orientation on 5 and 7 January (LLUO)	U
6M-3243	A. Chandler	Programs for Punching Contents of Magnetic Drums on Paper Tape	U
6M-3244	S. Twicken	SR-1782A Meeting of December 8, 1954	U

~~CONFIDENTIAL~~

~~CONFIDENTIAL~~

Memorandum 6M-3287

Page 53

Accessions List (Continued)

<u>NO.</u>	<u>AUTHORS</u>	<u>TITLE</u>	<u>CLS.</u>
6M-3245	H. Platt	Minutes of a Meeting Concerning Production FSQ-7's for Subsectors 1 and 2	S
6M-3248	H. Seward	Auxiliary-Drum Storage Requirements for AN/FSQ-7 (SAGE)	C
6M-3249	R. Davis	Group 61 List of Operation Plans for Cancellation	C
6M-3250	D. Israel W. Wells	Report on Interviewing and Recruiting Activities During West Coast Trip, 12 Dec. to 22 Dec. 1954	U
6M-3253	R. Jeffrey	Rough Notes on 27 December 1954 Systems Planning Meeting	C
6M-3254	L. Jeffrey	Meeting on Maintenance Programming Activity, Dec. 30, 1954	U
6M-3256	T. Parkins	Rough Notes of Systems Planning Meeting, Jan. 3, 1955	C
6M-3257	- - -	Biweekly Report of 31 December 1954	C
6M-3258	P. Cioffi	Ground-to-Air Communications Facilities in the 1954 CCS	C
6M-3259	A. Smalley	Mission Specifications (4-55) for RAYDIST Orientation on 12 and 14 January 1955 (LLUO)	U
6M-3260	A. Smalley	Group 61 Mission Specifications (3-55) for Live Training Tests on 11 and 13 Jan. (LLUO)	U
6M-3262	J. Levenson J. Nolan E. Wolf	Program Specifications for Data Generation Program	C
6M-3263	D. Israel W. Wells	Report on Trip to Rand Corp. and Hughes Aircraft, 13 Dec. to 16 Dec., 1954	C (IDO)
6M-3265	A. Shoolman	Recommended Radar Coverage of SAGE Subsector I and II	S
6M-3267-1	B. Morriss H. Platt	Recommended Quantities of Input and Output Equipment for First and Second AN/FSQ-7's	S
6M-3268	R. Jeffrey H. Platt	Crosstell Input Element Specifications (IDO)	C
6M-3269	L. Sutro	Test Equipment Committee Meeting, Jan. 6	U
6M-3270	A. Kromer	Summary of MIT-IBM Collaboration, Dec. 31, 1954	C
6M-3271	J. O'Brien	XD-1 Test Specifications	U
6M-3272	L. Sutro	Test Equipment Committee Meeting, Jan. 7	U
6M-3273	W. Clark et al.	Auxiliary Memory Study Group	U
6M-3274	R. Sittler J. Levenson	Program Changes in Automatic Initiation	C
6M-3276	LRI Committee	Long-Range Radar Input Specifications for AN/FSQ-7	C
6M-3278	A. Smalley	Mission Specs. (6-55) for RAYDIST Orientation on 21 Jan. 1955	U
6M-3279	A. Smalley	Group 61 Specifications (5-55) for Live Demonstrations on 18, 19, 20 January, 1955	U
6M-3281	A. Hughes H. Platt	Fine Grain Data System	C

~~CONFIDENTIAL~~

~~CONFIDENTIAL~~

Memorandum 6M-3287

Page 54

Accessions List (Continued)

<u>NO.</u>	<u>AUTHORS</u>	<u>TITLE</u>	<u>CLS.</u>
6M-3282	A. Kromer	Vacuum Tube Types Used in AN/FSQ-7	U
6M-3289	J. O'Brien	Time Allocation	U
<u>IBM REPORTS</u>			
IBM-659	H. Hayden	Nomenclature Changes and Clarifications, H-157	U
IBM-660	- - -	AN/FSQ-7 Biweekly Progress Report, Dec. 3	C
IBM-661	R. Marden	Equipment List for AN/FSQ-7 Direction Center,	S
	D. Ross	IM-102-1	
IBM-662	H. Kurkjian	System Test Plans - Phases I to V (Central	U
	J. MacDonald	Computer)	
IBM-663	N. Jacobs	Warning Light System for Duplex Controls	U
		H-159	
IBM-664	- - -	General Information Concerning Instruction	U
		Manuals	
IBM-665	- - -	AN/FSQ-7 Biweekly Progress Report, Dec. 17	C
IBM-666	W. Carroll	Power Cathode Follower Limitations, H-158	U
IBM-667	P. Bagley	Some Descriptive Information of Value in	U
	J. MacDonald	Programming XD-1, IM-107	
IBM-668	M. Collins	Relay Pulse Switching Rules, H-160	U
	W. Slagle		
IBM-669	- - -	Drum System - CIC - AN/FSQ-7, FM-3	C
IBM-670	- - -	Central Computer, Vol. I, Engineering Data	U
		Book, AN/FSQ-7, FM-20	
IBM-671	- - -	Central Computer, Vol. II, Engineering Data	U
		Book, AN/FSQ-7, FM-20	
IBM-672	- - -	Drums, Vol. I, FM-21	C
IBM-673	W. E. Triest	Evaluation of Saturable Reactor Switch for	U
		Magnetic Drums, IM-41	
IBM-674	- - -	Gap-Filler Radar Input Element	C

~~CONFIDENTIAL~~