

~~CONFIDENTIAL~~
UNCLASSIFIED

Memorandum 6M-3835

COPY NO. 1 of 160 copies
Page 1 of 41

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

SUBJECT: BIWEEKLY REPORT FOR 12 AUGUST 1955

To: Jay W. Forrester

From: Division 6 Staff

Approved: John C. Proctor

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

CONTENTS

	<u>Page No.</u>
SAGE SYSTEM TEST AND PLANNING (Group 61)	2
FSQ-7 PROTOTYPE DESIGN AND INSTALLATION (Group 62)	10
ADVANCE DEVELOPMENT (Group 63)	17
AN/FSQ-7 AND CAPE COD DIRECTION CENTER (Group 64)	22
VACUUM TUBES (Group 65)	26
PRODUCTION COORDINATION OFFICE (Group 66)	28
ADMINISTRATION AND SERVICES (Group 60)	31
STUDIES IN PROCESS	33
DOCUMENTS ISSUED	34
GLOSSARY OF ABBREVIATIONS	38
<u>INDEX</u>	39

UNCLASSIFIED

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

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

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

~~CONFIDENTIAL~~

~~CONFIDENTIAL~~

Memorandum 6M-3835

UNCLASSIFIED

SAGE SYSTEM TEST AND PLANNING

(Group 61, J. F. Jacobs)

Master Program Preparation (H. D. Benington)

Supervision of the Card Preparation Room is no longer the responsibility of the Utility Program subsection. H. Newhall, a new Group 61 staff member, has taken over this work and reports directly to the section leader.

Program Organization (W. S. Attridge, Jr.)

All work is on schedule except for the sequence control and timing task which is less than one week behind. The members of the subsection have been reading the drafts of the operational specifications for requirements on the various Master Program functions. This has also served as an orientation for the newer people in the group. Major effort will continue to be study of operation specifications for concurrence.

Sequence Control and Timing (W. F. Harris)

Operational frequency requirements have been received from Zraket's section from which subprogram sequencing is being fixed and operational response time is being calculated.

Switch Interpretation (R. E. Olsen)

The switch interpretation phase of the program organization group is being studied in an attempt to classify the various actions into general categories. Combining of similar actions should reduce the size of the program.

Utility Programs (C. H. Gaudette)

CONFIDENTIAL

Specifications for the primary functions of the Lincoln Compiler will be issued during the next biweekly period as follows:

1. Translation of a program written in symbolic address form to a binary form for operation on the computer.
2. Relocation of programs by a relative address technique.
3. Communication with other programs in the framework in a symbolic language by a programmer unfamiliar with the full details of the framework in which his program is to be operated.
4. A subroutine library, including trigonometric and input-output subroutines.

UNCLASSIFIED

~~CONFIDENTIAL~~

Memorandum 6M-3835

Master Program Preparation (continued)

CONFIDENTIAL

5. An up-to-date file of all compiled programs on magnetic tape, and a method of putting these programs into the computer.
6. An up-to-date file of the master program and all utility programs on magnetic tape and a method for operating these programs.
7. Sufficient logging information for complete cost accounting of the above functions.

Specifications for the Lincoln Checker Programs are now being prepared. The Checker is an interpretative program which simulates XD-1. This program will be used during the parameter and system checkout phases of master program checkout and will mechanize a large number of the functions associated with this phase. The Checker is controlled by an executive program of pseudo-instructions, which are prepared by the programmer. Several modes of input and output are available and are specified in the executive program.

Duplex and Checkout Studies (P. R. Vance)

CONFIDENTIAL

The following work assignments have been made:

Operational Requirements and Liaison Activities - M. D. Feldstein
Preliminary Operational Specifications and Startover - D. Ladd

The proposal for Duplex Operation was discussed with representatives of Group 61 and 64, IBM, Rand, and the Systems Office. A final proposal is to be issued by 1 September.

Operational Specifications for SAGE System (C. A. Zraket)

Air Surveillance (J. Ishihara)

Operational Specifications for Track Detection and Initiation (6M-3766) and Radar Inputs (6M-3774) have been completed. First drafts for the remaining air surveillance functions will be available by 19 August 1955.

A memorandum describing the overall air surveillance function will be prepared by E. Wolf, and will summarize the functions and facilities of all our surveillance operating stations.

An interoffice memorandum by H. Seward, "Time and Storage Survey, FSQ-7 In-Out System," has been completed.

SAGE digital displays have been reviewed and redesigned for uniformity.

~~CONFIDENTIAL~~

Memorandum 6M-3835

UNCLASSIFIED

Operational Specifications for SAGE System (continued)Weapons Direction (C. C. Grandy)

CONFIDENTIAL

Operational specifications for SAGE Raid Forming, Antiaircraft and Subsector Command Post elements have been concurred with and released. Publication of final drafts of Weapons Assignment and Intercept Direction specifications has been delayed due to revisions required by reviewing agencies. It has been agreed that the specifications for Forward Telling, Weapons Direction Crosstelling, and Air Surveillance Crosstelling will be issued as separate documents instead of consolidated into one as reported in the 29 July Biweekly Report.

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

Memorandum 6M-3780, "Operational Specifications for SAGE Identification Function," has been issued for concurrence. Mathematical specifications of the identification function are now under study. Although the general objectives of mathematical specifications are defined, the detailed contents of these specifications have not yet been determined. An outline of the memorandum will be made and used as a guide for preliminary studies before writing the memo.

Manual Inputs and Weather (S. J. Hauser, F. M. Garth)

Memorandum 6M-3778, "Use and Presentation of Weather in the SAGE System," has been issued for concurrence. The final draft of a memorandum on the operational specifications for SAGE manual data input has been written. A rewrite will be issued for concurrence incorporating additions and corrections resulting from a discussion with ADC representatives at Lincoln.

Operational Specifications for TBS (J. P. Levenson) CONF.

Operational requirements for interceptor simulation are almost complete. A new feature, manual simulation of non-interceptor tracks at TBS stations, has been added and will be planned in detail within the next two weeks. A meeting is now necessary to determine how the introduction of simulated inputs in addition to real inputs affects the operation of all functions in the direction center. Programming and operational requirements throughout the direction center, arising from the use of simulated radar inputs, will be included in the TBS OPS specifications.

Operational Specifications for Recording (J. P. Levenson)

The need for an experienced ADC operations analysis man to help with the specifications for data collection and analysis has been recognized. When such a person is assigned, the recording specifications can be made.

- 4 -

~~CONFIDENTIAL~~

UNCLASSIFIED

Memorandum 6M-3835

Operational Specifications for SAGE System (continued)

Combat Center (W. Lone, Jr.)

A first draft of 6M-3810, "Forwardtelling in the SAGE System," has been written. A Guide to Combat Center Operations is being written.

Equipment Coordination (H. K. Rising)

The assignment of warning lights and audible alarms to warning light flip-flops has been made for XD-1 and AN/FSQ-7.

A final draft of 6M-3728, "Category and Display Assignment Bit Assignments for SAGE Situation Display Consoles," is being circulated for comment. The memorandum will be issued during the next biweekly period.

Mr. E. Brande of IBM has been assigned to the Equipment Coordination subsection in a liaison capacity.

Test and Analysis (W. I. Wells)

Test Planning (W. Z. Lemnios)

1954 Cape Cod System (E. Bedrosian, H. Peterson, S. Manber): Check-out has been completed with the exception of the monitoring programs. The Monitor II program is being completely rewritten to make it consistent with the Monitoring I and Monitoring III programs.

Interception Tests (A. Budd, F. Graham): Final details of Interception Series 2, 3, and 4 are being completed. Also, the program specifications for Interception Series 5, 6, and 7 are being prepared. A trip was made to the Naval Air Development unit at South Weymouth to brief the Navy pilots for these tests.

Tracking Accuracy Tests (M. Curran, M. Smith): A new data sorting program has been written and checked out.

Initiation Tests (H. Keit): The Series A Initiation Tests have been redesigned to use simulated rather than live data.

The Simulated Track Photograph Program has been written and checked out by M. Smith.

Test Direction (R. N. Davis)

CONFIDENTIAL

No missions were scheduled in support of SAGE test effort, but eleven FORX missions were scheduled in support of Division 2 FGD

~~CONFIDENTIAL~~

UNCLASSIFIED

Memorandum 6M-3835

Test and Analysis (continued)

development. Four were completed with varying degrees of success; three partially completed; and four cancelled. Of the three partially completed missions, one was interrupted by the hurricane evacuation requirement, one by Mark X quality, and one by Raydist system and B-29 engine difficulties. Of the four cancelled missions, two were cancelled by hurricane weather and two because of data input difficulties.

Azimuth Tracking (F. F. Gucker, D. Latimer) CONFIDENTIAL

The azimuth-only initiation program has been reorganized and modified to save time. This was done as part of an effort to demonstrate the feasibility of using such a program in an AN/FSQ-7 type computer. Estimates of the time and storage requirements of this program will be included in a forthcoming memorandum.

Test Program (D. Latimer) CONFIDENTIAL

Work on the "Detailed Single Track History" Program is continuing. A parameter tape is required to do a complete checkout of the program.

Analysis and Simulation CONFIDENTIAL

Simulation (C. Friedman, H. Houser, H. Neumann, B. Smulowicz): The weather clutter and tracking program which is to be added to MISP is approximately 40% checked out. The clutter generator and the correlation sections of the tracking program have been completely checked out on MPC.

Detailed specifications have been written for a data-recording program to be added to MISP. This data will be used to evaluate different tracking methods. The data-recording program is being written by R. Friedberg and A. Ipsen.

The program to compute means and standard deviations of the MISP parameters σ is approximately 80% checked out.

Data Characteristics (B. Stahl): The program written to analyze blip-scan data is now working. Chi-square values are calculated from data on punched cards and are presented as a scope display which may be photographed. It now remains to process sequences of cards with varying parameters to determine, if possible, what degree Markov process may be inferred from the data on the cards.

UNCLASSIFIED

- 6 -

~~CONFIDENTIAL~~

Memorandum 6M-3835

SAGE SYSTEM TEST AND PLANNING (continued)

Computer Operation Time

Whirlwind I (W. Vecchia)

Equipment Checkout	1 H 30 M	
Raydist and Analysis	49 H 45 M	
Program Checkout	84 H 55 M	
Mapping and Weather Studies	4 H 0 M	
CCS Operation	<u>6 H 40 M</u>	146 H 50M
Time given Group 64	9 H 30 M	
Time given Group 6343	<u>1 H 30 M</u>	11 H 0M
Time Lost (Computer Malfunction)		<u>4 H 40M</u>
TOTAL ASSIGNED TIME		<u>162 H 30M</u>

XD-1 (P. L. Guinard)

Total Time Used (Utility Assembly)	1 H 10 M
Down Time (tape drivers #1 thru #4 not working properly)	20 M
Time Returned to IBM	<u>8 H 30 M</u>
TOTAL ASSIGNED TIME	<u>10 H 0 M</u>

Training (S. B. Hibbard, G. C. Reed)

At a Training Sub-Committee Meeting at ADES, New York, on 11 August, attended by S. B. Hibbard, it was brought out that during the six weeks' period prior to the operational date for each Subsector, the operators would have to be orientated to the geographic situation peculiar to the Subsector if the testing of the Subsector was to be effective. This is because all ADC personnel will be trained at XD-1 or some site other than the one to which permanently assigned. It was not considered possible for XD-1 Training Programs to be oriented to each Subsector planned for SAGE for use at XD-1 or subsequent training site.

It was stated that the same programs used to train Air Research and Development Command operators could be used to train ADC operators at XD-1. Because of time and programmer limitations, Air Training Command personnel responsible for ADC operator training should assist in the training plans for ARDC operators.

In conclusion, it was decided that the Training Sub-Committee would

Memorandum 6M-3835

Training (continued)

be dissolved and a recommendation was made that a new committee, headed by ADES Project Office or WE-ADES, be appointed to act as a monitor. WE-ADES is making a formal proposal for such a committee.

The Report of Training Conference, mentioned in the last Biweekly Report, was published as Memorandum 6M-3781 (Secret).

Staff Training (P. R. Bagley, A. P. Hill)

F. Bancroft Johnson has been assigned to assist with the staff training function.

Lincoln Laboratory has every year a large number of visitors who have a legitimate need to know about the SAGE System. The staff time that would be required, however, to accommodate these visitors individually or in small groups is not available. To meet this need, a lecture course, the SAGE Familiarization Course, is periodically given to a large group. The next such course will be given 17 to 28 October. The exact location of the course has not been decided. Memorandum 6M-3804 gives an outline of the course.

To provide the necessary training for personnel programming the SAGE master program, a four-week Air Defense Programming Course will be given as a supplement to the AN/FSQ-7 Programming Course being taught by IBM. This course will treat in detail the Operational Specifications and the Master Program. Enrollment is limited to members of Group 61 (Lincoln and Rand). In order that the training can be completed by 1 October 1955, the AN/FSQ-7 Programming Course will be restricted to seven weeks, 18 July to 2 September, and the Air Defense Programming Course will be held the following four weeks, 6 to 30 September. Memorandum 6M-3767 (C) gives an outline of the course.

The schedule of the remaining lectures for the FSQ-7 Programming Seminar has been modified. The completed schedule is as follows:

<u>Date</u>	<u>Topic</u>	<u>Class.</u>	<u>Lecturer</u>
Aug 22	Air Defense Master Program	Conf.	Benington
Sep 19	FSQ-7 Display System	Conf.	Fallows
Sep 26	Training and Battle Simulation	Conf.	Levenson

Lectures will be held in A-166 on Mondays, 12:30 - 2:30.

A series of field trips to North and South Truro have begun. These

Memorandum 6M-3835

Staff Training (continued)

trips are part of the training program for the ADES group at Lincoln. To date, two trips have been made and there will be three more to accommodate the group. Each trip is limited to five people who spend one day at South Truro going over the equipment in some detail, and one-half day at the P-10 site getting a general briefing of the manual system.

Personnel Responsibilities (P. R. Bagley)

The responsibilities of the writer have been extended to include the following:

1. Interviews with job applicants of possible interest to Group 61.
2. Supervision of new staff until they complete their training period and are assigned to a working section.
3. Assistance to section leaders in assigning new personnel to sections.
4. Allocation of office space; arranging office moving, and providing office furnishings.
5. Maintaining and up-to-date directory of Group 61 and closely associated personnel (Rand and ADC).

Memorandum GM-3835

FSQ-7 PROTOTYPE DESIGN AND INSTALLATION

(Group 62, N. H. Taylor)

XD-1 Installation (J. A. O'Brien)

Testing and Test Planning (S. L. Thompson, H. I. Rundquist)

Plans are being made for an evaluation of the magnetic tape equipment.

Some existing test programs, modified as necessary, will be used to check the operation of the sandwich program. This work has been delayed because the XD-1 card punch has not been working properly.

Work has begun on a single-track tracking program for XD-1 to be used to compare computer tracks with Raydist tracks.

Acceptance Test (J. D. Crane)

A rough draft of the June acceptance test has been written.

We have forwarded to IBM suggestions for improving reports made by them for use in acceptance tests.

Large Board Display (L. Sutro)

The large board display required by the Air Force can be provided by a Kelvin & Hughes Photographic Display Unit modified to contain a 5" charactron instead of a radar display. This modification has now been made to the Kelvin & Hughes machine on loan to the Laboratory. The tube has been installed and is operating in synchronism with the camera. The next step is to obtain approval of this modified unit for use in the SAGE System.

XD-1 Displays (R. S. Fallows)

System testing of the display generation frames continues. The poor margins on frame 25 type C flip-flops were traced to the circuit loading. Apparently a 4.7K resistor is needed in series with outputs to gate tubes for good margins. Jack Baldwin and Jim Delmege of IBM are making the changes and evaluation. System Test pointed out a fault in the situation display generator which resulted from a combination of logic and circuit deficiency. This fault allowed radar data to be selected by a TD category line for certain values of RD information. A change has been made in the frame logic to prevent the reading of RD information into the category register.

Memorandum 6M-3835

XD-1 Displays (continued)

The major results of system testing in the past period have been the generation and debugging of several new test programs and the disclosure of one trouble in the drum system. The IEM drum group is actively trying to eliminate cross-talk between display drum outputs and other drum inputs.

Nine more SD consoles were delivered from Crosley, bringing our totals to nineteen SD consoles and two auxiliary consoles. The quality of workmanship from Crosley is still rather poor. Considerable mechanical rework is necessary. Bill Mercaldi of IBM is trying to apply pressure to improve this situation.

Four consoles have now been debugged on a dc basis and debugging under dynamic conditions has been started. Time sharing on frames 24 and 25 has proven enough of a bottleneck to warrant making special test racks for the preliminary dynamic tests.

Ben Gurley has started work on a console test rack to allow complete testing and adjustment of a console without need of frame signals. Such a rack will greatly facilitate the console test activity.

Bob Gerhardt and Chuck Corderman have been evaluating a request from Group 61 to facilitate changing of console expansion and off-center selection. A memorandum is being prepared.

All known console changes have been incorporated in the test console (168) and this console appears to be in good working condition. There are a few wiring changes and circuit adjustments still to be made in frame 24 before the situation display can be system tested.

Display Development (C. L. Corderman)

Magnetic Deflection Amplifier

A test rack for applying signals to a console for adjusting the magnetic deflection system has been completed, debugged, and tested on a console in Building F. Console #1 has been adjusted and appears to settle in somewhat less than 25 μ secs. Plans are being made to train several IBM and Hazeltine people to operate the test rack, to adjust the magnetic deflection systems on the remaining consoles.

A tendency for the magnetic deflection preamplifiers to oscillate had been temporarily overcome by slowing the preamp with capacitive loading. This temporary fix has been removed and the amplifier re-

Memorandum 6M-3835

Display Development (continued)

compensated to provide more stability and better rise time. The new compensation will be tried in several more consoles before a change request is made.

Light Guns

At a meeting here on August 9th, it was decided that the use of a photomultiplier type pick-up device would have to be continued for the time being. The present state of phototransistors does not allow sufficient signal-to-noise ratios for charactron use. This meeting was attended by members of the IBM tube group and Groups 38 and 62 of Lincoln.

Ten-volt transients on the -150V supply line have been causing the light gun to fire erratically. A modification has been incorporated to overcome this, but must still be tested on several more units before being definitely accepted.

Vector Generator and Intensity Modulator

Memorandum 6M-2823 has been written describing the present vector generator which is being used in XD-1. Ed Glover is modifying this unit at present so the memo is to be read as a description of the circuit.

R. Paddock of R. Best's group is debugging the vector intensity modulator.

Analogue Line Drivers

Noise on the +250V line has been causing trouble in the analogue line drivers. It now appears that the noise has frequency components in the vicinity of the ringing frequency of the amplifier so that the noise instead of being attenuated by the amplifier is actually amplified. A change in the compensation of the amplifier has cleared up some of this noise but more work remains to be done.

MTC Tests

A new circuit, using the new address for spots and vectors, has been added to the charactron display system in MTC. This circuit overcomes the beam center shift on focused spots.

A memorandum is being prepared by R. Gerhardt concerning a proposed addition to the digital expansion system requested by Group 61. This system was tried out on the MTC console to check the logic of the new circuits.

~~CONFIDENTIAL~~

Memorandum 6M-3835

UNCLASSIFIED

Display Development (continued)

Charactron tubes having P14 phosphors instead of the usual P7 were received from Group 65 and evaluated by Group 38 in the MTC console. The P14 phosphor seems to be preferred over the P7 because of enhanced contrast with blue lighting and reduced confusion from over-painting. The light gun signal from the P14 is essentially the same as from a P7. Additional tests must be completed before this phosphor is recommended for production and future XD-1 tubes. However, all interested parties will be kept informed of the test results so far.

Memory Test Computer (W. A. Hosier)

The pressure to install magnetic tape on MTC has relaxed for the time being. Instead, a tape-to-card-and-printer setup is to be put in Building F. Frank Durgin will leave MTC to join the Systems Office as coordinator of this Building F installation. In his place, Art Hughes will come to MTC from the Systems Office, and will get the ball rolling on our high-speed tape punch. Considerable machine time this period has been lost to misbehavior of the Ferranti tape reader, but there is good prospect of curing this (see Reliability below).

SAGE Subsystem Testing

CONFIDENTIAL

Mayer, Werlin, and Boyd have continued tests of DDT-DDR, SDV data analysis, and a few GFI margins. Corderman, Woolf, and Zieman have continued charactron tests and development, partly in cooperation with the psychologists of Group 38. It has been proposed to use MTC to perform tests over the next year on the tropospheric scatter link between South Truro and Newburgh.

Analysis and Data-Processing

Groups 61, 22, 24, and 34 have continued their respective operations. Howard Rundquist (Group 64) has used some 16 hours to run more of his simulated storing on the XD-1 buffer drum.

Maintenance and Records (H. L. Ziegler)

Efforts to improve reliability are still by necessity of the "better housekeeping" variety. Potential sources of trouble are gradually being minimized or eliminated entirely whenever possible. There remains a considerable amount of this type work to be done before work can be redirected to circuit improvement.

Work has been started on the writing of a "simple" instruction manual

~~CONFIDENTIAL~~ UNCLASSIFIED

Memorandum 6M-3835

Memory Test Computer (continued)

for MTC - one that presupposes correct operation in all cases and merely sets down correct procedures. This manual will probably take the form of a narrative bibliography (pertinent prints and memos) plus a minimum of step-by-step directions.

Installation

W. Kellogg made a trial installation of the transistor light gun on 11 August, but it has not been thoroughly tested yet. The light gun is so connected as to clear the sign digit of LR #4 (which is a 1 unless cleared to 0). This digit may be sensed with a tn instruction to interrogate the light gun.

Reliability

Misbehavior of the Ferranti photoelectric tape reader has been flagrant over the past fortnight. Some programmers have lost half their assigned time to it. The trouble has been part electrical, part mechanical, but largely the latter. Worn bearings in the tape drive sleeve interfere with rapid braking. It was discovered that a construction error had been overlooked in several plug-in amplifiers (no bias connection on control grid), one of which was in reader control. Adequate repair of the mechanical trouble depends on getting a substitute unit. This is promised by Ferranti for next week. The next Biweekly should report much improvement of the reader situation.

There have also been two circuit troubles with the drum: A low output timing pulse amplifier and two burned-out resistors in the write selection circuits. A grid-to-cathode short in a regulator tube kept the +90 Vdc supply down for a couple of hours. This was complicated by a faulty sensitrol relay in the +150 V supply, some loose wiring in the +90V rectifier, and a voltmeter with a weak permanent magnet. Aside from these things, operation has been satisfactory. Distribution of operating time this period has been as follows:

	<u>Hours</u>	<u>Per cent</u>
Programming	119.0	46.8
Development	47.5	18.7
Installation	8.6	3.4
Interrupting Failures	19.2	7.5
Reliability Check	36.9	14.5
Maintenance and Marginal Checking	<u>23.1</u>	<u>9.1</u>
Totals	<u>254.3</u>	<u>100.0</u>

Memorandum 6M-3835

Memory Test Computer (continued)Component Failures (18 July to 12 August):

<u>Tube or Component</u>	<u>Defect</u>	<u>Qty.</u>	<u>Hours Lost</u>
5965	Low plate current	3	0
6145	Gone to air	1	0
6145	Grid emission	1	0
6145	Shorted	3	0
6145	Tap short	4	0
Crystals, 1N38A	Back resistance too low	68	0
" 1N38A	Broken	1	1.2
" 1N38A	Open	1	1.2
Resistor	Burned out	5	1.0
Resistor	Intermittent	1	0
Resistor	Open	1	0
Transformer	Shorted	1	1.0
Totals		<u>90</u>	<u>4.4</u>

Basic Circuits (D. Shansky)Flip-Flop Mod A (DC-2)

Investigation of second order effects has shown that the ferrite core pulse transformer was considerably overdamped. The new highest value of damping resistance is now approximately 5 to 10 Kohms as compared to the initial value of 560 ohms. This increased damping resistance has eliminated the need for damping diodes. A deleterious overshoot, believed due to the transformer, is currently under investigation. New pluggable unit cards have been received from IBM. Components are being installed on these cards and it is expected the margins of r_{nAFF} using these cards will be investigated in the near future.

Sensing Amplifiers for Core Memory

Preliminary work to improve the circuitry of the sensing amplifier has been completed. The amplifier now displays the following characteristics:

Total Delay: 0.2 μ sec.
 PRF Sensitivity: 15% for 75 mv signals, 10% for 100 mv signals.
 Gain: 55 volts output for 75 mv input.
 Rise Time: 0.3 μ sec.
 Recovery Time (for 10% attenuation of information: 0.7 μ sec.

Memorandum 6M-3835

Basic Circuits (continued)

Data on the operating margins of the various stages in the amplifier will be taken in the next period.

Gap Filler Sweep Circuit

Marginal checking of this circuit has been completed and an M-note is being prepared.

Charactron Vector Intensity Decoder

Bob Paddock recently joined our section and is becoming familiar with this circuit. Although a reduction in the loop gain has eliminated an instability in this circuit, the linearity of the amplifier has suffered and a more feasible solution to this problem must be found.

Vector Generator

The necessary logic required for alignment and testing of this circuit has been designed.

Digital Data Receiver and Transmitter

Testing of the units in MTC has been inconclusive to date due to difficulty in isolating the troubles that occur when both the receiver and transmitter are tied into MTC.

Direct-Coupled Video Probe

Components required for the assembly of the prototype probe have been ordered.

256² Core Memory

Data concerning the operating margins of two of the vacuum tube circuits used have been collected. A note on each of these circuits (Digit Plane Driver and Matrix Output Amplifier) is being prepared. A new Gate Generator has been designed to overcome some of the difficulties experienced in the previous design. The need for a precisely controlled current pulse fall time and the older gate generator's load sensitivity with regard to this characteristic have made the new design necessary.

Memorandum 6M-3835

ADVANCE DEVELOPMENT

(Group 63, D. R. Brown)

Chemistry of Magnetic Materials (F. E. Vinal)Memory Core Production

The total number of memory cores manufactured and double tested by the Chemistry Section for the 256 x 256 memory is now 1,265,000. In addition, 400,000 green cores are on hand for firing. On July 30 a power failure interrupted a firing of 70,000 cores which were thought to be lost. Experiments have shown, however, that it will be possible to salvage these cores (Sacco, Schallerer). Alignment work on the rotary press has been completed and the first shipment of carbide tooling has been received (L. B. Smith).

Inorganic Chemistry

Substances containing both Mn^{+3} and Mn^{+4} have been prepared as follows: $LiMn_2O_4$, $1/2 LiMn_2O_4 + 1/2 Li_2MnO_3$ and Li_2MnO_3 whose ratios of Mn^{+4} to Mn^{+3} are respectively 1, ~ 2 , and ∞ . Two other compositions intermediate in this series are being prepared. The substance $LiMn_2O_4$ has been established to have the spinel structure, but Li_2MnO_3 has not as yet been defined. By examination of this series and a series yet to be made with $ZnMn_2O_4$ as a third component, the possibilities for ferromagnetism of Mn^{+4}/Mn^{+3} spinel compound will have been exhaustively examined (Wickham, Croft).

Preparation of tetragonal substances with internal lattice-bonding characteristics analogous to that proposed for Mn_3O_4 is progressing. $PdFe_2O_4$ is still under structural examination. Synthesis of $PtFe_2O_4$, $ZnIn_2O_4$, $MgIn_2O_4$, Cu_2GeO_4 , and Co_3O_4 are initiated (Maddocks, Croft).

Experimental ferrite preparations of lithium ferrite are continuing for the purpose of amassing sufficient magnetic and electrical data to observe trends in the magnetic properties (Brown).

Chemical analyses have been carried out in support of both the memory core production and the inorganic chemical programs (Keith, Reimers).

Physics of Magnetic Materials (N. Menyuk for J. B. Goodenough)

A study of the coincident-current memory is being made to devise a minimum-work, maximum-information evaluation test for magnetic materials. A promising test which gives S_v , S_v , I_d vs. I , and $\mu_{\Delta+}$ and $\mu_{\Delta-}$ vs. I is being evaluated. These measurements are to

Memorandum 6M-3835

Physics of Magnetic Materials (continued)

be made over a range of temperatures from 25°C to 45°C in order to determine the most favorable operating temperature.

The measurement of the switching coefficient of polycrystalline magnetite as a function of core thickness was carried down to .018". The core cracked on attempting further thickness reduction, so an unambiguous experimental determination of the relaxation contribution was unattainable. However, the calculated value based on results obtained at the larger thicknesses was consistent with the experimental value at .018". The results indicate a relaxation damping considerably lower than the value available in the literature, which is based on experiments performed on a single crystal of magnetite.

A sample holder has been designed and constructed for measurement of the switching characteristics of polycrystalline magnetite as a function of temperature. Preliminary measurements indicate that the effect of core geometry on switching will have to be studied before a final interpretation of the results can be made.

A new circuit for the integrating amplifier of the 60-cycle hysteresigraph has been designed, constructed, and is now being checked. If successful, it should provide a considerable gain in the signal-to-noise ratio.

New Components and Circuits (D. J. Eckl)

SBT Hole Storage Figure of Merit

One of the most important parameters for switching circuits still to be specified for the SBT is a hole storage figure of merit. At present, a storage coefficient, τ , is used to characterize the transistor. This is in principle a relatively simple experimental check which gives values ranging between 40 and 70 nms, the longer times corresponding to the poorer transistors.

A new approach to the problem, resting on a firm theoretical basis, has been developed. Experimental work with a grounded-emitter circuit has shown that plotting hole storage time, t , against β_{ACT}/β_{SAT} produces a family of curves for different values of I_C . These values can be calculated theoretically if the following assumptions are made: (1) the charge distribution is linear, (2) the collector current is made up of holes and flows by diffusion, and (3) α is a function of the hole distribution at the emitter (or the emitter current). With these assumptions the hole storage time is:

Memorandum 6M-3835

New Components and Circuits (continued)

$$t_1 = \frac{Q}{I_c(0)} \left\{ \frac{1}{\beta_{ACT}} \left(\frac{\beta_{ACT}}{\beta_{SAT}} - 1 \right) + \ln \left(\frac{\beta_{ACT}}{\beta_{SAT}} \right) \right\}$$

where $I_c(0)$ is the initial saturation collector current and Q is the figure of merit.

The above expression checks quite well with experiment and, as a result, can be used as a test of our present standard figure of merit, τ .

Transistor Deliveries

Delivery of surface barrier transistors has improved considerably in the past few weeks. Since 25 July, 800 units have been delivered. Of the first 400 units which have been completely tested, about 10% have had I_{c0} values above the limit of 3 μ a. Another 15% are outside our limits on α or τ , but within the manufacturer's ratings. This problem will be discussed in some detail at the next meeting of the Philco-MIT specifications committee to be held on 16 August at Lansdale.

Publications

Memorandum 6M-3830, "Positive Bias in Surface Barrier Transistor Switching Circuits," by K. H. Konkle and E. U. Cohler, should be available at the time of this Biweekly.

The first four of a series of notes on transistor switching circuits by D. Eckl, 6M-3770, 6M-3796, 6M-3800 and 6M-3815 are available in the print room.

Memory (J. L. Mitchell)

Experimental Switch and Plane

Regulation of the core-switch bias current has been improved by reducing the number of turns on the bias winding and adding series inductance to the circuit. The bias current was increased from 0.6 amperes to 1.2 amperes to compensate for the reduced turns level. The major effort now is being directed toward improving the operation of the gate generators.

TX-O Cooling and Supplies

The specifications for the cooling system are now complete and ready for the contractors. Letting of the contract is being held up until August 22, by which time Division 7 expects to complete the ceiling design.

Memorandum 6M-3835

Memory (continued)

256² Construction

A preliminary investigation into the source of bad cores in the completed modules has indicated that some of the cores are being damaged in the core-positioning unit. Further tests will be run during the next few weeks.

The eight prototype V.T. Plug-in units have been received. The bids for the production of the 200 units have been received and a vendor has been selected. Forty switch-core plug-in units have been ordered; these will be manufactured in the Division 7 shops.

Advanced Work

Both transistor sense-amplifier designs have only marginal common-mode rejection. Efforts are being made to improve this characteristic.

Techniques for driving the transistor memory-driver are being studied and one system is being tested.

System Design (K. Olsen, J. Fadiman)

During the past biweekly period the transistor control for the TM-1 multiplier has been put into operation. The present clock frequency is 4 mcps. At present, timing difficulties in control limit the maximum frequency of operation. These are being investigated, and it is hoped that the multiplier will operate at 5 mcps.

Pulse transformers are being used to provide control pulses, and these transformers are being thoroughly investigated in the system.

Rough drawings for all the multiplier circuits have been completed, and final drawings are being made up.

A new combination of register driver and modified flip-flop is being studied for possible use in the multiplier. The register driver will drive nine digits with 2.5-volt pulses through an input RC combination. The proposed flip-flop modifications would permit switching with lower pulse currents, by raising the impedance level. Chokes or shorter delay lines than those used at present would allow the transition time to be reduced by about 20 nps. Data is being taken on this new flip-flop in an attempt to determine optimum values of components.

Receptacles and plug-in boards are being made for a life test of

Memorandum 6M-3835

System Design (continued)

various contact materials. Combinations of 24K gold, gold alloy, and rhodium will be used.

A level amplifier is being designed which will provide a 9-volt level for memory address in TX-0. The cable-driving problem for TX-0 is also under consideration.

The semiconductor-regulated power supply to furnish 3 volts at 700 milliamperes is nearing completion. Tests will be made to determine the possibility of design modifications to extend the maximum current to over one ampere.

Several magnetic-regulated power supplies are under consideration for possible purchase in the future.

Memorandum 6M-3835

AN/FSQ-7 AND CAPE COD DIRECTION CENTER

(Group 64, S. H. Dodd, Jr., E. S. Rich)

Cape Cod Engineering (L. L. Holmes, A. J. Roberts)

WWI Computer Operation

Good operating time for this biweekly period was 96.5 per cent. There were 27 incidents of interruption resulting in 11 hours of down time during 313 computer operating hours. Several types of failure contributed to the decrease in reliability:

- (1) There were six incidents of phenolic breakdown on panels in the central computer area resulting in 3-1/4 hours of down time. The dielectric breakdowns occurred when silver ions migrated through laminated phenolic from silver plate lugs having +250 Vdc or +150 Vdc to grounded lugs. The failures resulted when, during the preceding 12-hour period, the computer air conditioning system was unintentionally left on while the computer power was off.
- (2) Two municipal power failures interrupted operations at the Barta building for 2-3/4 hours.
- (3) Five vacuum tube failures resulted in eight incidents of interruption for a total of two hours.

Input Terminal Equipment

Computer tests of the FGD equipment at South Truro continued during this period. A limited amount of testing of the crosstell control section was done using test equipment. The phone line for transmitting crosstell information from XD-1 to WWI has been installed.

Facilities are now available for mixing the tone from the Raydist timing generator with other audio signals for recording on Ampex. The tone is generated once for each si 16 order. The si 16 order should not be used more frequently than once every half second.

A new radio position will be installed at station E31 on 13 August.

Personnel Assignments

Earl Pughe is no longer working with the power group at Barta. All inquiries regarding power should be directed to Jim Lynch. Fred Sturm and Warren Arnsperger of WE-ADES have been assigned to C. S. Lin for orientation and instruction in digital techniques. They will work with personnel at the Barta building for approximately two months.

Memorandum 6M-3835

AN/FSQ-7 AND CAPE COD DIRECTION CENTER (continued)

SAGE Systems Office (H. E. Anderson)

SAGE-Manual Simultaneous Operation

The known problems of equipment compatibility during SAGE and Manual simultaneous operation were investigated and given to a Lincoln group scheduled to attend at meeting at ADC Headquarters. The major problems are in the sharing of radar and radio sites.

XD-1 Telephone Digital Data Circuits

XD-1 now uses the Lincoln type telephone digital data equipment. This equipment is different from that to be provided by the Bell System in the production system. New inputs or outputs being tested with XD-1 before use in SAGE should use the Bell System digital data service. WE-ADES has been asked to determine the availability of the Bell data service and IBM has been asked to furnish information concerning converting some XD-1 inputs and outputs to handle it. This decision would mean that each supplier of new components for the SAGE System would need design for only one type of data service.

Review of IBM R- and S- Specifications

The following specifications were reviewed and returned to IBM on 12 August with comments:

S-30 Command Post DD Desk	R-300 Drum System
S-54 Maintenance Intercom	S-11 Program Instructions
S-27 Selection and In-Out Control Element	

The only specification now on hand is R-601, Display System, which is undergoing review and will be ready for transmittal with comments by 16 August.

Second Floor Layout of Building F

The revision of drawing E-58233-11 has been completed and will be released after IBM-SO concurrence which will be sought 18 August. All other drawings affected will be brought into accord.

SO Review of Operational Specifications

The following Operational Specifications for SAGE were reviewed in draft form for equipment compatibility:

Memorandum 6M-3835

SAGE Systems Office (continued)

- 6M-3778 Use and Presentation of Weather Data in the SAGE System
- 6M-3786 Operation Specifications for SAGE Intercept Direction
- 6M-3766 SAGE Operation Specifications, Track Detection and Initiation
- 6M-3774 Operation Specifications for Radar Inputs.

XD-1 Display System

The schedule problems for the installation of the remaining display console equipment were studied. Modifications due to 6M-3583-87 were included. The probable cost of this change in the display system was also studied.

Test Planning and Coordination (K. E. McVicar)

The gap filler input system test activity is presently emphasizing the DDR, DDR and GFI frames. Programs for these tests have been written and further refinements are presently being made.

An initial outline of a test plan for the LRI system has been generated through a combined Division 2-Division 6-ADES effort. The present activity in this area involves further development of this initial test outline. Work has been started on a simple tracking program for the final system test.

A meeting has been held to present the results of preliminary thinking on equipment reliability goals for SAGE. It was discovered at this meeting that the definitions of the parameter used to define reliability were not yet sufficiently worked out to permit complete agreement on the goals. Further work is being put on the clarification of the term "reliability."

A combined Division 2-Division 6-ADES effort is in progress for the purpose of studying some of the problems involved in making the necessary preparations and arrangements for systems tests in the Experimental Subsector. This investigation includes the conflict between the Experimental Subsector and the manual air defense system during the system test period.

A study is in progress in conjunction with the Air Force and ADES for the purpose of working out in detail the duties of the C & E Officer in SAGE. It is the eventual goal of this activity to provide a working model of the C & E Officer's position for trial in the Experimental Subsector.

A study is in progress in conjunction with ADES and Division 2 for

Memorandum 6M-3835

Test Planning and Coordination (continued)

the purpose of providing the ground work for a compatible system-wide record-keeping system for the Experimental Subsector. This study group will issue a recommendation for a system of record-keeping analysis which might eventually be used in SAGE.

Memorandum 6M-3835

VACUUM TUBES

(Group 65, P. Youtz)

Tube Research and Development (J. S. Palermo)

Two 19-inch charactrons were processed during this period for the comparative evaluation of the P14 phosphor with the P7 for possible application in the Lincoln display system. A 19-inch charactron with a P11 phosphor has been processed and is ready for photographic application studies.

Charactrons (A. Zacharias)

All time has been devoted to the technique of producing sintered cathodes. Several are now ready to be evaluated in sealed-off tubes.

The structure for determination of beam size in a double-focus type charactron system is nearing completion.

Charactrons (P. C. Tandy)

Six MIT 19-inch tubes and three Convair charactrons have completed from 564 to 4757 hours on life test. Transfer characteristic curves have been made on seven of the tubes. No tube failed to give 50- μ a pulse-matrix current, which is the end-of-life point.

The gas pressure of CHT-106-2 has dropped from 1.2×10^{-8} to 0.2×10^{-8} mm of Hg after 500 hours of life test operation as measured with the ion gauge included on the tube.

Thirteen cathode-study tubes have completed from 1131 to 821 hours at one-half cutoff dc. Data indicates that no great changes have occurred.

Typotrons (L. B. Martin)

Five typotron life test mounts have been modified to allow for use of automatic transfer-characteristic plotter without disconnecting wires.

Collector-storage mesh ac current tests will be made on some of the typotrons.

Six tubes have been on life for 3162.2 hours and three tubes have been on for 2436.5 hours. All of these tubes are satisfactory.

Memorandum 6M-3835

VACUUM TUBES (continued)

Receiver Tubes (T. F. Clough)

It is most desirable that large potential tube demands, such as construction requisitions, be anticipated as much in advance as possible to insure against delays because the electron-tube industry is approaching its busy season and the balance between supply and demand is already close on some types.

Memorandum 6M-3835

PRODUCTION COORDINATION OFFICE

(Group 66, B. E. Morriss)

Power (J. J. Gano)

Power for CC and DC Sites

The considerable amount of data necessary to establish load requirements in the contemplated memorandum has been collected and the drawing for the proposal on combined sites after the first two has been completed. Because of the great amount of drafting required to duplicate a tracing with so much detail, a Bruning copy will be made in order to reduce the work involved in revising it to conform to the plans for the first two combined sites.

XD-1

Coffin has prepared a list of deficiencies in the power system and sent it to IBM power personnel. Several circuit modifications and mechanical design changes have been suggested to improve reliability. He is also refining the design of a three-state flip-flop, which he originated, to use as a dc voltage monitor for a 5% deviation, steady state or transient.

Filament Voltage Cycling Using Thermistors

With the use of various combinations of thermistors and parallel resistors in series with the heaters by way of filament transformers, Sandy has obtained filament cycling from several seconds to several minutes. Rotating machinery can be eliminated and simpler equipment such as constant-voltage transformers or induction regulators can be substituted to maintain voltage after the filaments are hot. Contactors for shorting out the thermistors after being heated are also necessary. For large scale computers where sections of the load are frequently turned on and off, the thermistors offer a definite advantage. Although thermistors only up to 8.4 amperes are commercially available, larger ones can be manufactured to order. Standard thermistors will be applied to TX-0.

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

The following documents are now available:

6M-3000, "Preliminary Specifications for a Tactical Telephone System for AN/FSQ-7 (XD-1)" suppl. 8-1, 1-1, 5-1, 4, and 7-1. (C)
6M-3275-2, "Leased Telephone Circuits for AN/FSQ-7 (XD-1). (C)

Memorandum 6M-3835

Communications (continued)

Meetings (Outside Organizations)

Teletype Facilities (BTL, ADES, AT&T, NET&T)
 G/A Radio Circuits (BTL, AT&T, NET&T)
 Otis Installation (Otis C&E, NET&T)
 New Dial Circuits (NET&T)
 Monitoring and Recording (ADES, Rand)

TIR's and Coordination (E. D. Lundberg)

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

<u>TIR #</u>	<u>Document Numbers</u>	<u>Subject</u>
1-86	6M-3147-3 (incl. release of 6M-2926-3 and dwgs: D-75021-2, D-75022-3, D-75023-4, D-75024-4, D-75025-3, D-75104-1)	Master Reference List of Lincoln Laboratory Requirements for Direction Center Buildings

Memorandum 6M-3515-1, "Proposed Site and Equipment Locations in the Experimental Subsector," has been rewritten by J. J. Carson to include new information. This gives the location, use, and operational date with AN/FSQ-7 (XD-1) of the various equipments in the Experimental Subsector. The revised memorandum, 6M-3515-2, is now being coordinated internally and will be released during the next biweekly period.

TIR's for the release of memoranda 6M-3753 through 6M-3758 and 6M-3765 have been written by J. A. Russell. These memoranda cover warning light and audible alarm bit assignments, manual intervention bit assignments, nomenclature for consoles and operating positions, light gun codes and core assignments and digital display slot assignments for both the AN/FSQ-7 and the AN/FSQ-7 (XD-1). It is anticipated that these two TIR's will be released by 15 August.

Supplemental specifications for the AN/FSQ-7 and a master reference list of AN/FSQ-7 specifications have been prepared by R. R. Shorey. Release of these documents has been delayed to incorporate minor changes, but is anticipated during the week of 15 August.

Facilities (W. H. Ayer)

Building Drawings

Both the Direction Center and Combat Center drawings have been re-

Memorandum 6M-3835

Facilities (continued)

vised to bring them up to date with the latest display console layouts. Several detail drawings, showing exact equipment locations, were eliminated since the IBM installation group has taken over responsibility for keeping them current.

Orifice Testing

The orifice testing apparatus, consisting of a small air handling and measuring system, a dummy electronic frame, and the necessary power supplies and data recorders, has been given preliminary tests this past week. Thermocouples are now being attached to the tubes in preparation for actual testing this week.

Building Redesign

The joint Western Electric-Lincoln-IBM study group on SAGE building redesign visited ADC headquarters for the purpose of clarifying their design requirements for these facilities. Actual building design will start this week now that the requirements have been clarified.

Schedules

A final set of revised XD-1 schedules should be available next month. Efforts at the present time are directed at obtaining information on programming and training activities and coordinating the external site schedules with Division 2.

Memorandum 6M-3835

ADMINISTRATION AND SERVICES

(Group 60, J. C. Proctor)

Personnel

New Staff

Horatio Newhall, Jr., is a new staff member assigned to Group 61. He attended the University of Connecticut and the University of Michigan. He was formerly employed by the Army Security Agency in Washington, D. C.

Thomas Callahan is a new staff member assigned to Group 61. He received his BS from MIT this year. He served with the Army as an officer.

Mary E. Cary is a new staff member assigned to Group 61. She received her BS from Aquinas College, and was employed by Dow Chemical Company.

Gordon Esseler is a new staff member assigned to Group 60. He has had many years of excellent experience.

Termination

Herbert J. Platt is now employed by the RCA Engineering Laboratory at Wellesley.

I N M E M O R I A M

Hugh Wainwright - July 31, 1955

Material (H. B. Morley)

Increased usage of certain Division 6 special stock items will necessitate a review of Kardex and possible increase of minimum quantities to assure ample stock. This should be accomplished before the end of August.

Efforts are being made to ease the congestion in our Building A Storage Area by disposing of unwanted items. We are returning base stores of Division 6 standard items to Building D Special Stockroom as space permits.

The requisition for typotron tubes has been approved and the order placed 9 August.

Memorandum 6M-3835

ADMINISTRATION AND SERVICES (continued)

Engineering (A. R. Smith)

A 5" charactron tube has been mounted in the Group 25 Kelvin and Hughes camera and is being tested.

Outside vendors are currently fabricating the redesigned supporting and alignment members for the 74 XD-1 display console cradle mounts. To minimize assembly time losses under the existing procedure, IBM has arranged with Crosley to ship to MIT ten additional cradle mounts to be reworked prior to console delivery and subsequent substitution. Until Crosley has incorporated the redesigned mount in its assembly line, fabrication, rework and assembly will continue at this end.

The test run of the Colton Rotary press, using steel alloy punches and dies, has demonstrated that cores can be reproduced within thickness and weight specifications. The machine is now being equipped with carbide tools. A trial run, to establish the required machine setting to fulfill core specifications, will indicate future production rates.

Test Equipment (L. Sutro)

At its meeting on 12 August, the committee approved purchase of the following test equipment:

<u>Unit</u>	<u>Mfr.</u>	<u>Model</u>	<u>Qty.</u>	<u>User</u>	<u>Group</u>
Scope	Tektronix	541	1	K. Olsen	63
Scope	"	541	1	W. Hosier	62
Scope	"	545	1	W. Hosier	62
Preamplifier	"	53C	1	E. Gates	62
Electrostatic Voltmeter	Sensitive Res. Instr.	0-150V	1	D. Mach	65
same	same	same	1	C. Corderman	62
Pulse Generator	Teletronics	PG-215	1	K. Olsen	63
Width and Delay Unit	"	PGA-220	1	K. Olsen	63

Document, Drafting and Print (A. M. Falcione)

It has become important that distribution lists indicate the location of BTL, IBM, Western Electric, Rand, and other outside personnel. Building and Room number and address if located outside the laboratory are essential to insure prompt delivery (e.g., Frank Brown, IBM, D-239; John Doe, BTL, Whippany, N.J.).

Memorandum 6M-3835

STUDIES IN PROCESS

<u>Study</u>	<u>Responsibility of</u>	<u>Expected Completion</u>
<u>GROUP 61</u>		
Analytical Tracking	R. F. Jenney	
CCS'54 Tracking	H. A. Keit	
Data Generation Program Rewrite	H. E. Fractman, H. A. Keit, W. Z. Lemnios	
Data Reduction Program Specs	F. W. Graham	
Display Requirements and Matrix	A. Schwartz	
Duplex Operation AN/FSQ-7	M. D. Feldstein A. R. Shoolman P. R. Vance	
FGD Characteristics	B. R. Stahl	
Input-Output Restrictions and Capabilities	A. R. Shoolman A. R. Ginsberg	
Interceptor Guidance Errors	C. Friedman	
Magnetic Tape Read-in Program	M. Curran	
Operations Specifications	W. S. Attridge	
Radar Input OPS Specs	F. Brooks	
Random Number Generation Test Program Checkout	H. D. Neumann	
SAGE Height Finding OPS Specs	H. E. Frachtman	
Single Track History Printout Prog.	D. P. Latimer	
Table Storage Requirements	L. B. Collins	
Track Log Printout Program	O. T. Conant	
Track Scan	F. E. Ogg, P. T. Strait	
XD-1 Inactivity Alarm Proposal	M. D. Feldstein A. R. Shoolman P. R. Vance	
<u>GROUP 62</u>		
Card and Tape Symbolic Address Assembly	B. G. Farley D. L. Richards	
Marginal Check System	J. A. Newitt	
Technicians' Training Manual, IV	A. Vanderburgh	
<u>GROUP 66</u>		
Building Design Changes	E. Smiley	Aug 55
Building Redesign Study	W. H. Ayer, E. Smiley	Oct 55
Blue Filter Specifications	W. H. Ayer	Sep 55
Large Board Display System	L. Sutro	--
Orifice Testing	F. Manning	Oct 55
XD-1 Schedules	J. Carson, F. Manning	--

~~CONFIDENTIAL~~

UNCLASSIFIED

Memorandum 6M-3835

Accessions List

(Frances Christopher) (CONFIDENTIAL)

The following documents were published by Division 6 or received from IBM during the period 1 August - 12 August 1955.

<u>NO.</u>	<u>AUTHOR</u>	<u>TITLE</u>	<u>CLS.</u>
SAGE SYSTEM TEST AND PLANNING (Group 61)			
6M-3606	J. E. Yienger	XD-1 Utility Programs: Octal Print: Basic Trace and Trap: Binary Punch	U
6M-3720	P. Bragar	Operational Specifications for Raid-Forming in a Sage Direction Center	C
6M-3739	J. J. Cahill	Operational Specification for Interim Antiaircraft Direction in the Sage System	S
6M-3753	H. K. Rising	XD-1 Warning Light and Audible Alarm Bit Assignments	U
6M-3754	H. K. Rising	AN/FSQ-7 Warning Light and Audible Alarm Bit Assignments	U
6M-3757	S#1 H. K. Rising	Nomenclature for Consoles and Operating Positions in AN/FSQ-7	U
6M-3761	S#1 P. R. Bagley	FSQ-7 Programming Data Sheets	U
6M-3767	P. R. Bagley	Air Defense Programming Course September 1955	C
6M-3778	S. J. Hauser	Use and Presentation of Weather Data in the Sage System	C
6M-3804	F. M. Garth		
	A. P. Hill	Sage Familiarization Course, October 17-28, 1955	U
6M-3827	P. R. Bagley	Minutes of Section Leader's Meeting July 29, 1955	C
	C. H. Gaudette		
FSQ-7 PROTOTYPE DESIGN AND INSTALLATION (Group 62)			
6M-2877	S#7 R. H. Gerhardt	Change of point Selection Address & Addition of Vector Intensity Control for Situation Display Generator	U
6M-3773	A. D. Hughes	Proposed Specification for AN/FSQ-8 Equipment	S
6M-3775	L. L. Sutro	Test Equipment Committee Meeting 1 July 1955	U
6M-3801	A. Vanderburgh	MTC Operation "Clear and Subtract"	U
6M-3803	R. J. Callahan	Protection of Console Diodes	U
	B. M. Gurley		
6M-3808	H. E. Anderson	Minutes of Experimental Sage Subsector Planning Approval Committee Meeting 1 August 1955	C
6M-3821	H. J. Platt	Minutes of Experimental Sage Subsector Planning Approval Committee Meeting of August 1955	C

- 34 -

~~CONFIDENTIAL~~

UNCLASSIFIED

Memorandum 6M-3835

Accessions List (Continued)

<u>NO.</u>	<u>AUTHOR</u>	<u>TITLE</u>	<u>CLS.</u>
ADVANCE DEVELOPMENT (Group 63)			
6M-3796	D. J. Eckl	Transistor Circuits Course #2. Equivalent Circuits of Transistors	U
6M-3800	D. J. Eckl		
AN/FSQ-7 AND CAPE COD DIRECTION CENTER (Group 64)			
6M-3507	D. A. Morrison	The Room 156 Consolidated Test Program T-3800 for WWI	U
6M-3784	J. N. Ackley C. S. Lin	Programming for the WWI Crosstell-Input System	U
6M-3793	S. H. Dodd	T.I.R. of Operational Specifications and XD-1 Equipment Specifications	U
6M-3794	J. N. Ackley	Drumless Read-In Program T-1800	U
6M-3811	C. W. Watt	Summary of the First Meeting of the Task Group on Definitions of the Duties of the C. & E. Officer	U
VACUUM TUBES (Group 65)			
6M-3807	T. Clough E. A. Searle	Vacuum Tube Failures During the Month of July, 1955	U
PRODUCTION COORDINATION OFFICE (Group 66)			
6M-3000 S#1-1	C. J. Carter	Sage Experimental Subsector Internal Telephone Traffic Diagram	C
6M-3000 S#4	F. E. Irish	Internal Equipment Requirements for AN/FSQ-7 (XD-1) Air/Ground Radio System	C
6M-3000 S#5-1	C. J. Carter	Sage Experimental Subsector External Voice Telephone Traffic Diagram	C
6M-3000 S#7-1	C. J. Carter	Sage Experimental Subsector External Voice Circuit Appearances in Dial System and Manual Switchboard	C
6M-3000 S#8-1	C. J. Carter	Sage Experimental Dial Telephone System	U
6M-3000 S#10			
6M-3275	H. J. Kirshner	Public Address System Specification for AN/FSQ-7 (XD-1)	U
6M-3275	H. J. Kirshner	Leased Telephone Circuits for AN/FSQ-7 (XD-1)	U
6M-3798	E. D. Lundberg	Sage System Meeting, 1 August 1955	C
6M-3799	E. D. Lundberg	ADES-Lincoln Biweekly Meeting 26 July 1955	C
6M-3813	E. D. Lundberg	Sage System Meeting August 8, 1955	U
6M-3824	H. L. Ziegler	Organization and Responsibilities of MTC Technicians	

~~CONFIDENTIAL~~

UNCLASSIFIED

Memorandum 6M-3835

Accessions List (Continued)

PRODUCTION COORDINATION OFFICE (Group 66) (Continued)

<u>NO.</u>	<u>AUTHOR</u>	<u>TITLE</u>	<u>CLS.</u>
6M-3825	H. L. Ziegler	Improving Reliability of MTC Operation	U

ADMINISTRATION AND SERVICES (Group 60)

6M-3781		Report of Training Conference Convened at Lincoln Laboratory	S
6M-3785	Division 6	Laboratory Personnel List August 1, 1955	U
6M-3797	Division 6	Biweekly Report for July 29, 1955	C

ADMINISTRATION MEMOS

6A-181	J. W. Forrester	Personnel	U
6A-182	J. C. Proctor	Personnel	U
6A-183	J. W. Forrester	Appointment to Associate Group Leader	U

UNCLASSIFIED

-36-

~~CONFIDENTIAL~~

Memorandum 6M-3835

Accessions List (Continued)

<u>NO.</u>	<u>AUTHOR</u>	<u>TITLE</u>	<u>CLS.</u>
<u>IBM DOCUMENTS</u>			
IBM-786	_____	Central Computer-Vol. 1-AN/FSQ-7 Combat Direction Central	U
IBM-787	W. Rooney	Project High Semi-Monthly Report #58	C
IBM-788	R. C. Eisele	Engineering Project High Report-- Gap-Filler Input Element Delay Register	U
IBM-789	R. C. Eisele	Gap-Filler Input Element Intensification Circuit	U
IBM-790	Z. T. Dearden	Decoder Simulator--Engineering Project High Report	U
IBM-791	G. E. Masters	Driver Panel Testing--Engineering Project High Report	U
IBM-792	R. Palmer	Programming for Engineers--Engineering Project High Report	U
IBM-793	W. H. Winkler	Drum Timing Pulse Generator-Engineering Report Project High	U
IBM-794	E. J. Smura	Variable Gate Amplifier Model A--Engineering Report Project High	U
IBM-795	C. J. Hesner	Shielding of Drum Heads--Engineering Report Project High	U
IBM-796	W. Y. Elliott	Gap-Filler Input Element Power Inverter Engineering Project High Report	U
<u>LE-DR DOCUMENTS</u>			
DR-298	R. C. Marden	Proposed Specifications for Large Board Display Prototype and Production AN/FSQ-7	U
DR-299	_____	Power Conversion System for the AN/FSQ-7 Duplex Central	U
DR-300	R. F. Keating	Document D-40 Power Conversion System for the AN/FSQ-7 Duplex Central	U
DR-301	C. E. Walston	Concurrence on D-25-5, Display Console Specifications for AN/FSQ-7 dated June 24, 1955	U
DR-303	R. J. Paddock J. E. Hamlin	.009 Card Stock for Binary Punching and Reading Equipment	U
DR-302	W. S. Squire	Concurrence on Output System Change for the Production Machine	U

Memorandum 6M-3835

GLOSSARY OF ABBREVIATIONS

AA	antiaircraft	GFI	gap filler input
AD	Air Defense	IBM	International Business Machines
ADC	AD Command	LRI	long-range radar input
ADES	AD Engr'g Service	MISP	Manned Interceptor Simulation Program
AEW	Airborn Early Warning	MITE	multiple input terminal equipment
AF	Air Force	MTC	Memory Test Computer
AFIRO	AF Installation Requirements Office	OPS	operations
ARDC	Air Research and Development Command	PIUMP	plug-in unit mounting panel
ATC	Air Training Command	PCO	Production Coordination Office
ATCF	ATC Facility	RAFD	Rome AF Depot
BTL	Bell Telephone Labs	RD	radar data
CC	combat center	SAGE	Semiautomatic Ground Environment
CAT	category	SBT	surface barrier transistor
CCS	Cape Cod System	SD	situation display
CER	change evaluation request	SDG	SD generator
CHT	charactron tube	SDV	slowed down video
CP	Command Post	SIF	selective identification feature
CRT	cathode ray tube	SC	Signal Corps
C&E	communications and electronics	SCEL	SC Engineering Lab
DAB	display assignment bit	SOP	standing operating procedure
DC	direction center	SO	Systems Office
DD	digital display	TBS	training and battle simulation
DEG	DD generator	TD	track data
DDR	digital data receiver	TIR	Technical Information Release
DDT	digital data transmitter	WE-ADES	Western Electric-ADES
ECM	electronic counter measure		
ECP	engineering change procedure		
ESS	experimental subsector		
FGD	fine grain data		
FF	flip-flop		
FORX	FGD orientation with Raydist and calibrated Mark X		

Memorandum 6M-3835

INDEX

	<u>Page No.</u>
<u>SAGE SYSTEM TEST AND PLANNING</u> (Group 61, J. F. Jacobs)	2
Master Program Preparation (H. D. Benington)	2
Program Organization (W. S. Attridge, Jr.)	2
Sequence Control and Timing (W. F. Harris)	2
Switch Interpretation (R. E. Olsen)	2
Utility Programs (C. H. Gaudette)	2
Duplex and Checkout Studies (P. R. Vance)	3
Operational Specifications for SAGE System (C. A. Zraket)	3
Air Surveillance (J. Ishihara)	3
Weapons Direction (C. C. Grandy)	4
Identification (S. J. Hauser, F. M. Garth)	4
Manual Inputs and Weather (same)	4
Operational Specifications for TBS (J. P. Levenson)	4
Operational Specifications for Recording (same)	4
Combat Center (W. Lone, Jr.)	5
Equipment Coordination (H. K. Rising)	5
Test and Analysis (W. I. Wells)	5
Test Planning (W. Z. Lemnios)	5
Test Direction (R. N. Davis)	5
Azimuth Tracking (F. F. Gucker, D. Latimer)	6
Test Program (D. Latimer)	6
Analysis and Simulation	6
Computer Operation Time	7
Whirlwind I (W. Vecchia)	7
XD-1 (P. L. Guinard)	7
Training (S. B. Hibbard, G. C. Reed)	7
Staff Training (P. R. Bagley, A. P. Hill)	8
Personnel Responsibilities (P. R. Bagley)	9
 <u>FSQ-7 PROTOTYPE DESIGN AND INSTALLATION</u> (Group 62, N. Taylor)	 10
XD-1 Installation (J. A. O'Brien)	10
Testing and Test Planning (S. Thompson, H. Rundquist)	10
Acceptance Test (J. D. Crane)	10
Large Board Display (L. Sutro)	10
XD-1 Displays (R. S. Fallows)	10
Display Development (C. L. Corderman)	11
Magnetic Deflection Amplifier	11
Light Guns	12
Vector Generator and Intensity Modulator	12
Analogue Line Drivers	12
MTC Tests	12
Memory Test Computer (W. A. Hosier)	13
SAGE Subsystem Testing	13
Analysis and Data-Processing	13

~~CONFIDENTIAL~~

Memorandum 6M-3835

UNCLASSIFIED

Memory Test Computer (continued)	
Maintenance and Records (H. L. Ziegler)	13
Installation	14
Reliability	14
Component Failures	15
Basic Circuits (D. Shansky)	15
Flip-Flop Mod A (DC-2)	15
Sensing Amplifiers for Core Memory	15
Gap Filler Sweep Circuit	16
Charactron Vector Intensity Decoder	16
Vector Generator	16
Digital Data Receiver and Transmitter	16
Direct-Coupled Video Probe	16
256 ² Core Memory	16
<u>ADVANCE DEVELOPMENT</u> (Group 63, D. R. Brown)	17
Chemistry of Magnetic Materials (F. E. Vinal)	17
Memory Core Production	17
Inorganic Chemistry	17
Physics of Magnetic Materials (N. Menyuk)	17
New Components and Circuits (D. J. Eckl)	18
SBT Hole Storage Figure of Merit	18
Transistor Deliveries	19
Publications	19
Memory (J. L. Mitchell)	19
Experimental Switch and Plane	19
TX-9 Cooling and Supplies	19
256 ² Construction	20
Advanced Work	20
System Design (K. Olsen, J. Fadiman)	20
<u>AN/FSQ-7 AND CAPE COD DIRECTION CENTER</u> (Group 64, S. Dodd)	22
Cape Cod Engineering (L. L. Holmes, A. J. Roberts)	22
WWI Computer Operation	22
Input Terminal Equipment	22
Personnel Assignments	22
SAGE Systems Office (H. E. Anderson)	23
SAGE-Manual Simultaneous Operation	23
XD-1 Telephone Digital Data Circuits	23
Review of IBM R- and S- Specifications	23
Second Floor Layout of Building F	23
SO Review of Operational Specification	23
XD-1 Display System	24
Test Planning and Coordination (K. E. McVicar)	24
<u>VACUUM TUBES</u> (Group 65, P. Youtz)	26
Tube Research and Development (J. S. Palermo)	26
Charactrons (A. Zacharias)	26
Charactrons (P. C. Tandy)	26

UNCLASSIFIED

- 10 -

~~CONFIDENTIAL~~

Memorandum 6M-3835

VACUUM TUBES (continued)

Typotrons (L. B. Martin) 26
Receiver Tubes (T. F. Clough) 27

PRODUCTION COORDINATION OFFICE (Group 66, B. E. Morriss) 28

Power (J. J. Gano) 28
Power for CC and DC Sites 28
XD-1 28
Filament Voltage Cycling Using Thermistors 28
Communications (C. Carter, F. Irish, H. Kirshner) 28
Meetings 29
TIR's and Coordination (E. D. Lundberg) 29
Facilities (W. H. Ayer) 29
Building Drawings 29
Orifice Testing 30
Building Design 30
Schedules 30

ADMINISTRATION AND SERVICES (Group 60, J. C. Proctor) 31

Personnel 31
New Staff 31
Terminations 31
Material (H. B. Morley) 31
Engineering (A. R. Smith) 32
Test Equipment (L. Sutro) 32
Document, Drafting, and Print (A. M. Falcione) 32