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

SUBJECT: BIWEEKLY REPORT FOR 23 SEPTEMBER 1955

To: Jay W. Forrester

From: Division 6 Staff

Approved: John C. Proctor

CONTENTS

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SAGE SYSTEM TEST AND PLANNING

(Group 61, J. F. Jacobs)

MASTER PROGRAM PREPARATION (H. D. Benington)

Program Organization (A. R. Shoolman)

Lectures for the Air Defense Programming Course have been prepared and are being delivered. This activity ends with the completion of the course on 30 September.

Peggy Strait is conducting study of the height priority scheme prepared in 6M-3828, "Operational Specifications for the Height Finding Function in a SAGE Direction Center"; this should be completed in the next two weeks.

Ray Olsen and Mary Cary are conducting a study of status and status changes in weapons assignment to determine switch interpretation and bookkeeping requirements.

Judith Stone and Thomas Kurth have joined the section and are working with Larry Collins to prepare detailed analyses of the data storage requirements indicated by each operational specification. Initial analyses cover height finding, track detection and initiation, and radar data inputs. These studies of the input, output, and memory requirements of each function are prerequisites to the analysis of program requirements and the design of data storage.

Utility Programs (C. H. Gaudette)

The proposal draft of the Utility Control Program has been written. All utility programs will be stored on a magnetic tape unit. Utility programs and associated parameters will be selected by the utility control console keyboards. The Utility Control Program will locate the selected program, read it into high-speed storage, and operate it. The Utility Control Program will also perform certain administrative functions during its operation.

The programming of the Compiler and Checker has started.

Card Preparation Room (H. Newhall)

Conversion of active card files from .006 to .009 card stock was completed on 31 August. The only cards now on hand and which have not been converted to heavy stock are obsolete programs. These have been left on thin card stock to minimize the storage problem. These cards can be reproduced in very short order if it is found necessary to use them.

MASTER PROGRAM PREPARATION (continued)

All "automatic" equipment has been working close to full capacity for this report period, and it has been necessary to allocate machine time according to a rigid schedule. The current condition is temporary, however, since it is caused by the recap of many back files in preparation for card file destruction.

All construction in the Card Room has been completed, and it is expected that production rate should now improve noticeably. Steps are being taken to improve operation skills and the degree of responsibility each operator assumes in the over-all production schedule. Justification is being prepared to add the equipment and personnel necessary to meet the increased demand for card preparation facilities expected in early November when the Master Program preparation gets under way.

OPERATIONAL SPECIFICATIONS FOR SAGE SYSTEM (C. A. Zraket)

Air Surveillance (J. Ishihara) CONFIDENTIAL

Drafts of operational specifications, 6M-3816, "Air Surveillance Crosstelling," and 6M-3826, "Track Monitoring," were discussed with 4620th representatives.

The memorandum for track monitoring will be issued during the next week. The specifications for crosstelling will be reviewed and redrafted to incorporate suggested changes.

A study of the over-all crosstelling requirements is being made and a preliminary draft will be prepared for discussion purposes. Clarification in some areas, especially definition of term, will be required prior to preparation of "math specs."

H. Gochman has been assigned to this subsection. He will assist E. Wolf in the preparation of the memorandum on air surveillance operating stations.

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

Memoranda 6M-3780, "Operational Specifications for Identification Function in SAGE," and 6M-3814, "Operational Specifications for Manual Data-Input Function in SAGE," are being revised as a result of comments received from ADC and Lincoln personnel. We expect to have completed first revisions of these memoranda by 3 October.

Preparation of an outline for the mathematical specifications of these functions is also in progress.

OPERATIONAL SPECIFICATIONS FOR SAGE SYSTEM (continued)

Training and Battle Simulation (J. Levenson) CONFIDENTIAL

The first draft of 6M-3899, "Interim Operational Specification for Training and Battle Simulation in SAGE," has been completed and is ready for distribution.

Weapons Direction (C. C. Grandy) CONFIDENTIAL

Revisions to the operational specifications for Weapons Assignment, Intercept Direction, Raid Forming, Weapons Direction Crosstelling, Subsector Command Post, and Height Finding will be completed by 3 October 1955, in accordance with comments submitted. Reviewers of these specifications will be informed of the disposition of their suggestions.

Basic study of mathematical specifications for Antiaircraft, Weapons Assignment, and Intercept Direction has been essentially completed and specifications are underway.

DATA SIMULATION AND ANALYSIS (W. S. Attridge) CONFIDENTIAL

Ed Lafferty has joined the section and is working on recording specifications.

Simulation (R. F. Russo)

In connection with the data generation problem, equations for the following have been derived:

The determination of a latitude and longitude position on a spherical earth given a previous position and the necessary time and velocity parameters of an aircraft on (1) a Great Circle course to some given position, (2) on an Earth Circle course to some given course angle.

The determination of the times of an aircraft-radar beam intersection on a cartesian plane in terms of the necessary time and velocity parameters and a given position of aircraft and radar beam angle at some time for an aircraft (1) on a given linear course, (2) on a given circular course.

The determination of the next position on a cartesian plane of an aircraft-radar beam intersection given the previous interception position and the necessary time and velocity parameters for an aircraft (1) on a linear course, (2) on a circular course.

STAFF TRAINING (P. R. Bagley)

I am transferring to the Program Organization Section. The staff training activity will be carried on by A. P. Hill and F. B. Johnson.

On 19 September a group of about 40 students (Lincoln, RAND, WE, and BTL) began their 12-week training in programming. They commenced with a three-day Programmer Orientation Course taught by Group 61 staff and are now in the seven-week FSQ-7 Programming Course given by IBM. This will be followed by a four-week Air Defense Programming Course, again taught by Group 61 and expected to be completed on 9 December.

The orientation course (unclassified) gives a broad picture of the SAGE System and Lincoln's role and an introduction to digital computers accompanied by tours of MTC and XD-1. The FSQ-7 course covers the art of programming and the programming rules for FSQ-7. The Air Defense course presents the SAGE Operational Specifications and an outline of the Master Program.

FSQ-7 PROTOTYPE DESIGN AND INSTALLATION

(Group 62, N. H. Taylor)

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

Building Modifications (H. F. Mercer)

Lighting and command post modifications are about two weeks behind schedule. Evaluating plastic powders required to form the filter tubes caused the lighting delay. The command post delay was due in part to a strike in the steel fabrication industry, now settled, and in part to our desire to incorporate latest projection booth changes in the contract requirements.

Long-range Radar Input (W. J. Canty, J. McCusker)

The LRI monitor has been moved into the input-output room. Connection was made to the LRI common equipment. Pulse lines are being tested. Work is progressing on checking circuit breaker surge currents for power to Frame 38 DDR's preparatory to firing up this frame. Several times MTC has been used as a generator of data signals and then as a receiver of data signals in preparation for a test which will attempt to evaluate the reliability of the Ampex 14 channel recorder.

The data patch panel in the gap filler input room of Bldg. F is essentially complete except for the marking of jacks. The recording patch panel, however, still needs some work and should be finished during the next week.

Acceptance Test (J. Crane)

The results of four demonstrations performed on the magnetic tapes and fifteen addressable magnetic drum frames showed that these units could perform all the required functions satisfactorily. Reliability analysis for these units, as part of the system, is being prepared.

Improvement in card machine and core memory reliability was noted since the first acceptance test in June 1955.

Light Gun Modifications (R. H. Gould)

Bausch and Lomb has modified a light gun by replacing the dichroic mirror with a front surface mirror and replacing the six-element, color-corrected, coated lens with a simple two-element lens. Tests on this modified gun in the experimental lighting room have shown an increase in output of about 75 per cent. Hazeltine has success-

fully incorporated the dynode voltage divider resistors into the light gun by correcting them directly to the photomultiplier socket and potting the whole assembly to insure adequate insulation.

Bausch and Lomb intends to build a light gun model incorporating the above changes and other improvements in mechanical design. It is planned to test this model here to evaluate all the changes.

Camera Systems (L. Sutro)

The automatic recording camera, finally mounted on its situation display console, was operated by XD-1 power and controls the week of 19 September. The -30V supply breaker, through which current passes to the camera, repeatedly dropped out. Rather than replace the breaker it has been decided to operate the camera from -48V. The changes will delay installation several days.

Two camera systems for large board display are being prepared. The manually controlled system has been designed in detail by Norman Wilson's group at I.B.M. to accord with our revised specifications, 6M-3439-3. At the same time an automatic system is coming closer to realization. Specifications are being prepared for M.I.T., I.B.M. concurrence. The one supplier that can meet these specifications immediately, Kelvin and Hughes of England, is sending representatives here during the last week of September and the first week of October.

Displays (R.S. Fallows)

The XD-1 display installation is entering what could be called the final phase. All remaining work either has been or very soon will be completely spelled out. Initial design system tests on frames and console will probably be completed in the next report period. Final modifications are ready for scheduling. The remaining work is fairly extensive and manpower may still be a problem. However, if IBM and Hazeltine efforts continue with the same cooperative spirit and enthusiasm that we have seen in the past few weeks, the situation appears very hopeful.

The digital display generator (frame 25) has operated without incident during the past two weeks providing test signals for console installation. The camera control circuits have been given preliminary checks and will be used in the next week or so. The last pluggable unit to complete the frame is being built.

The situation display generator (frame 24) has also operated without incident for several weeks. Recent effort has resulted in the cleanup of the frame in several respects, such as termination of pulse lines. The major tasks remaining in the frame area all con-

cern frame 24. A new output driver for all DAB lines has been designed by Hazeltine. This circuit, which will drive approximately fifteen consoles, will be substituted for the present drivers used for all 90 DAB outputs. A new module N will have to be designed to relieve the cable congestion in the present module N. The plans for these modifications will be crystalized and scheduled in the next period.

The console signal distribution cabling is essentially complete except for the grounding system, which is being installed. Measurements of cable capacitance and cross-talk will be made in the next period.

Some problem areas in the console circuit designs, such as the area discriminator amplifier, are still being investigated. The console installation work is continuing. Bill Mercaldi of IBM reports that, on the whole, we're finding troubles at a lower rate than we're fixing them. At present, the IBM-Hazeltine group outnumbers the consoles.

DISPLAY DEVELOPMENT (C. Corderman)

One of the problems in the magnetic deflection system of the Charactron has been an excessive deflection caused by eddy currents set up in the mu-metal shield during the initial period of deflection. These eddy currents give rise to an overshoot which has been corrected by compensating the output of the decoder. This compensation requires the matching of two exponentials and adjustment would require continuously variable resistors and capacitors. To simplify the adjustment, however, a fixed capacitor has been chosen leaving only a variable resistor. This does not permit an exact match of exponentials but leaves only secondary effects. However, steps are being taken to find a shield material which will not have this eddy current problem. Several sheets of ferrite materials have been received to study their shielding and eddy current properties.

It has been found that the flood gun bias on the Typotron falls below specs when the -3kv supply is turned off. Steps are being taken to correct this fault.

A report on the component circuits of a push-pull decoder is almost completed and should be ready for final typing next week.

Wickes Electric Company has demonstrated an amplitude vs phase plotting device (Nyquist) which should prove very helpful in designing and analyzing amplifiers and components in general. The range of the present instrument was 100 kc to 10 mc which was a trifle high for the present amplifier under investigation. Mr. Million, Vice President of Wickes, has promised to see if this range can be low-

ered to 10 kc and will let us know as soon as any definite results are achieved. (Zieman and Woolf)

BASIC CIRCUITS (R. L. Best)

Digit Plane Driver (FSQ-7) (D. Shansky)

The recent trip to Poughkeepsie (14 September 1955) uncovered an interesting anomaly from our approch to the philosophy of circuit evaluation. Two basically different types of circuits were presented - one with wider voltage margins and much greater passive component tolerances, and the other with better tolerance with regard to tube aging. The difference in behavior was due to the manner in which each circuit failed to meet the specifications. If the magnitude of voltage margin is all that counts, the first circuit would be preferred; if longevity of the circuit in the system is the most important (our normal criterion), the second circuit would be chosen. The matter is still under discussion.

Charactron Vector Intensity Decoder (R. B. Paddock)

The output rise and fall times now meet specifications. Linearity and available gain of the amplifier appears very good.

We hope next week to install the breadboard model in a display system to determine acceptability of the present circuit on the bases of both visual and photographic observations.

Flip-Flop Mod A (DC-2) (N. J. Ockene)

The symmetrical card layout for the Mod A Flip-Flop has been built and initial tests have shown that the margins are lacking under full load conditions at 2 mc. This is partly caused by the fact that the cathode does not recover sufficiently between pulses. Tests are now being run in the hope of improving this condition. Silicon diodes are being tried in the cathode circuit in order to obtain the required results.

Digital Data Receiver (E. B. Glover)

All tests conducted so far indicate that the present circuit changes will satisfy all conditions that the DDR must meet. Obtaining final margins on the receiver has been hindered by external equipment breakdown. This data should be available sometime during the week of 26 September 1955.

Gap Filler Sweep Circuit (B. W. Barrett)

This circuit meets all the specifications, but won't fit in the the space allowed.

IBM is writing a new specification which is more realistic and which can be implemented by a much simpler circuit. We are now breadboarding this simpler circuit.

Display Line Driver (J. Kriensky)

A sweep-frequency oscillator has been used to help properly compensate the amplifier. It has been observed that the frequency response varies with the setting of the position control of the amplifier.

Core Memory Sense Amplifier (P. Murphy)

Two different IBM sense amplifiers were tested here and show definite promise. IBM took with them our layout of the sense amplifier designed by R. Zopatti and are going to build it in a pluggable unit. It is hoped that one of these three amplifiers can be chosen for production during the next period.

MEMORY TEST COMPUTER (W. A. Hosier)

Bill Kellogg's summer at MTC terminates this period. He has done very good work on the MTC display system, including the new scope rack assembly and circuits and the light gun, enabling Herb Ziegler to devote more time to general computer problems. It is anticipated that Kellogg and Hazen (another summer staff member who terminated September 9), as well as John Newitt, who is scheduled to terminate about September 30, will be replaced by permanent staff; this is essential to carry out the recently initiated installation of magnetic tape and associated equipment requested by Group 61.

Arnow and Attridge have requested this addition of magnetic tape equipment compatible with XD-1 both to produce synthetic XD-1 input tapes and to analyze XD-1 output tapes. A drum block transfer facility will undoubtedly be a collateral effort. It also appears that from the standpoint of space, power, duplication of effort, and future usefulness, MTC control should be redesigned as an integral part of this program. Requirements of the experimental subsector dictate that this equipment be installed by April 1956 and in full use by June.

Computer applications and operation show no significant changes (see Studies in Process).

Installation

A slight logical change was made on 19 September so that CS +0 now

leaves -0 in the accumulator instead of the +0 formerly obtained. The change affects nothing else.

Reliability

General reliability has continued good (unscheduled down time less than 4 per cent of total time). Trouble experienced was largely ascribable to the drum and drum control. It appears that a periodic total erasure of the drum may be necessary to prevent the accumulation of excess noise due to repeated write-overs. Earle Gates is trying to obtain a full-length erasing magnet from IBM to facilitate such erasure when needed.

Distribution of operating time this period has been as follows:

	Hours	Per Cent
Analysis and Data-Processing	79.77	33.3
Development and Testing	88.08	36.9
Installation	6.41	2.7
Maintenance and Marginal Checking	23.25	9.7
Reliability Check Programs	34.02	14.2
Interrupting Failures	7.78	3.2
Total	239.31	100.0

Summary of defect found in tubes and components, 12 September to 23 September:

Tube or Component	Defect	Qty.	Hours Lost
2D21	High starting voltage	1	0
6080	Shorted	1	0
6145	Grid emission	1	0
6145	Low plate current	1	0
6145	Shorted	1	0
6145	Tap short	1	0
Z2177	Gone to air	1	.43
Z2177	Intermittent open	1	1.00
Z2177	Shorted	2	0
Capacitor	Shorted	1	.51
Crystal, Type 1N34A	Back resistance too low	8	3.50
Resistor	Burned out	8	3.00
Toggle switch	Intermittent	1	0
Toggle switch	Open	1	.25
Transformer	Shorted turns	1	.90
	Totals	30	9.59

Publications

Those interested in receiving MTC publications should write A. Vanderburgh, B-149, giving name and room number. John Newitt's manual of the MTC air conditioning system is finished in draft form with rough sketches.

SAGE SYSTEMS OFFICE (H. E. Anderson)

Building F Floor Layouts

Until such time as the layouts of the X Room, Y Room, and projection booth of the CR Room receive concurrence and are incorporated in the second floor layout of Building F, Drawing E-58233, refer to Drawing D-75609 for the projection booth and Drawing SB-75638-1 for the X and Y rooms.

A revision of the first floor layout of Building F, Drawing 5001-31007 Rev. L, incorporating all the latest changes is being drawn up. It will be submitted for IBM-SO concurrence during the next biweekly period.

XD-1 Auxiliary Data Processing Equipment

A purchase order has been placed with IBM for the required equipment. Specifications for the necessary modifications are in process.

Command Post Digital Display Desk

A meeting was held on 13 September that determined the final design of the Command Post Digital Display Desk for AN/FSQ-7 and XD-1 as agreed to by IBM, HEC, and Lincoln. See 6M-3893.

Operational Specifications

During the past biweekly period, the Systems Office has reviewed the following:

6M-3788, "Weapons Direction Crosstelling"
6M-3774, "Weapons Assignment"
6M-3836, "Automatic Tracking"
6M-3810, "Forward-Telling"

Mark X - IFF - Investigation Report

Memorandum 6M-3872 summarizes the investigations of Mark X-IFF and its modifications as well as the inherent problems which affect Air Defense and SAGE. It is planned to use this memorandum as a working document for further action.

ADVANCE DEVELOPMENT

(Group 63, D. R. Brown)

CHEMISTRY OF MAGNETIC MATERIALS (F. E. Vinal)

Memory Core Production

The total number of memory cores double-tested by this section to date for the 256 x 256 x 37 memory is 1,630,000. In addition, 75,000 cores have been single-tested and are now on their final test. There are also approximately 70,000 untested and 200,000 unfired cores on hand, making a grand total of approximately 1,975,000 cores. (Zopatti, Sacco)

Three test groups of 4500 cores each have been sent to Koch to be assembled into memory planes. These cores have been roughly vibrated (much more strongly than normal) and have been quadruple-checked. We are now waiting for these memory planes to be tested. (Zopatti)

For the past week, the Colton Press has been operating with 12 stations tooled. Test results of 10,000 cores prepared with this press show an acceptance yield of 96 percent at our current acceptance values. (Sacco, Smith)

Inorganic Chemistry

In continuation of the study of manganese compounds for possible magnetic properties, an attempt was made to prepare $LiMn^{+3}_{5}O_8$, an analogue of lithium ferrite. This was not successful, as a two-phase product of Mn_2O_3 and $LiMn^{+3}Mn^{+4}O_4$ was obtained repeatedly. It was found possible, however, to prepare some single-phase spinel compounds whose composition lies in a solid solution range for an $LiMn_5O_8$-$LiMn_2O_4$ system, near the $LiMn_2O_4$ end. (Wickham)

Attempts have been made to grow larger crystals of $Li_2Mn^{+4}O_3$ and $LiMn^{+3}Mn^{+4}O_4$ from fused salt melts. For Li_2MnO_3 three materials were obtained: (1) Unchanged Li_2MnO_3 powder, (2) hexagonal plates with metallic sheen which transmit red light and whose structure by X-ray diffraction is indicated to be the desired Li_2MnO_3, and (3) fine, black opaque needles which have not been identified. From the melt containing $LiMn^{+3}Mn^{+4}O_4$, fine black opaque needles were obtained which by X-ray diffraction have been shown to consist of a spinel phase and another phase not as yet identified. (Croft)

CHEMISTRY OF MAGNETIC MATERIALS (continued)

The system $CuFe_2O_4$-Mn_3O_4 has been suggested to be of interest and an investigation commenced with the preparation of a 50-50 molar mixture of these substances (DCL-4-414). This preparation was rather strongly magnetic and, as anticipated, exhibited inherent properties of loop-squareness. Other compositions and processing conditions for this system will be investigated. (Maddocks)

Experiments with lithium ferrite as a base for square-loop memory core material continue to look promising. However, a rather extensive amount of data must now be collected in order to put the processing of such materials on a firm basis. One problem has been that no satisfactory analytical methods for lithium have been found thus far. (D. L. Brown)

Chemical analyses of samples DCL-4-110, 111 and 112, the indates of zinc, magnesium and cadmium respectively, have shown that the stoichiometry of these compounds compares favorably with that intended. (Maddocks)

Analyses of seven special inorganic preparations have been completed and the correlation of analytical results with the memory core process is continuing. (Keith, Reimers)

PHYSICS OF MAGNETIC MATERIALS (J. B. Goodenough)

A theory for the ferromagnetic domain patterns observed on BiMn alloy by Roberts and Bean of G. E. and of those observed on tapes of SiFe alloy by Paxton and Nilan of U. S. Steel has been quantitatively worked out and will be written up as an M-note. These considerations affirm our mechanism of flux reversal in polycrystalline ferromagnetic materials in which domain walls are present. Whether domain walls actually exist in the 1/8-mil Mo-permalloy cores is still an open question; no one has as yet been able to observe them.

In earlier experiments on 1/4-mil Mo-permalloy cores, Menyuk observed a distinct variation between tapes cut at 0° and 45° to the rolling direction in the shape of the B-H loop and the value of the switching parameter, S_w. The differences observed were those predicted from a model in which domain walls are assumed to exist. During this last biweekly period Menyuk took S_w measurements and B-H loops on 1/8-mil Mo-permalloy tapes cut at 0°, 30°, 45°, 60° and 90° to the rolling direction. He found no significant angular correlation in either S_w or B-H loop shape in these cores. One must conclude that there is no favored direction in these tape cores.

PHYSICS OF MAGNETIC MATERIALS (continued)

The theoretical spin-relaxation switching parameter, based on a model containing domain walls in contrast to one without walls, contains a factor $\sqrt{K}$, where K is the anisotropy constant, and a parameter, d, which represents the largest distance a domain wall moves before the material is switched. In order to get a measurement of d for a polycrystalline sample, it is necessary to measure S_w for a material which is not an ultra-thin tape and has an intermediate eddy current contribution. Most ferrites have too low a conductivity; metals have so high a conductivity that the eddy current effects swamp out all others unless ultra-thin tapes are used. Magnetite, however, has a suitable conductivity; also its anisotropy, in contrast to other known ferrites, decreases with temperature in the range 140° to 270°K. Menyuk measured the conductivity of a polycrystalline bar sample as a function of temperature from room to liquid-nitrogen temperature. Using these results and the previously reported (Biweekly reports for August and September) magnetic characteristics of a polycrystalline magnetite core, the eddy current contribution to the switching parameter was calculated. This permitted an evaluation of d and of the spin-relaxation contribution. There was a definite decrease in the spin-relaxation effect with decreasing anisotropy in accordance with the domain-wall model. The work to date was reported at a joint IBM-Lincoln Laboratory meeting. Further experimental work and conclusions are awaiting the completion of the D. C. fluxmeter.

Pacl has returned the x-y recorder for the D. C. fluxmeter to the manufacturer for correction. The current-drive unit is being completed in the machine shop and will be ready within three weeks.

Childress has looked for a temperature range in which the present DCL memory core in a coincident-current application could be operated with a switching time of 0.5 μsec. No such range has been found for temperatures above -14°C. However, the modifications necessary to make a 0.5-μsec. core are known.

Menyuk subjected a nickel ferrite core to a magnetic field in excess of 10 oe. through a temperature range of 500-575°C. This produced no observable changes in the shape of the B-H loop.

MEMORY (J. L. Mitchell)

Experimental Switch and Plane

Experiments are still being conducted with various series and parallel connections of the bias winding in an attempt to find an optimum configuration.

TX-0 Cooling and Supplies

The construction of the cooling system, walls, ceiling, etc., is awaiting approval of the Air Force.

Drawings for the power supply racks and controls have been started and work is progressing satisfactorily.

256^2 Construction

Sixteen 64 x 64 memory plane modules have been accepted to date. Modifications are being made to Memory Test Setup VI in an attempt to speed up the memory plane testing rate. In addition, three planes have been wired with cores which were vibrated before they were tested. These planes will be tested in the next few days to see if there are any chipped or cracked cores present.

Two hundred vacuum tube plug-in units have been completed by the vendor and are ready for painting. The hardware for the 40 switch core plug-in units is completed and ready for assembly. A shipment of tape cores was received from Magnetics, Inc.

Drawings for the vacuum tube plug-in unit racks are completed with the exception of the air conditioning ducts. The circuit schematics for all the x-y selection circuits are being prepared.

Advanced Development

The attempts to limit the common mode signal in the sense amplifier being designed by Bradspies have not been successful. A conference with R. L. Best has led to a new circuit which is being investigated.

A new punching jig for the 4 x 4 plane is being made by an outside vendor.

SYSTEM DESIGN (K. Olsen)

EMAR

The back panel wiring of the experimental memory address register has been completed and the power supplies, marginal checking panel,

SYSTEM DESIGN (continued)

and neon indicator system have been installed.

Because the test area will not be finished for several weeks, we are not pressing to get the plug-in units for the scheduled completion date of October 1. We are now starting on TX-0.

Paper Tape Units

Two Ferranti photo-electronic tape units have been received, and while we are dickering with Texas Instruments Company for some photo-transistors, Bill Highleyman is transistorizing the clutch and break system.

Etched Board Contacts

The 8-digit multiplier made several errors last week that seem to be the result of corrosion on the etched plugs. Marvin Peterson has made tests on a number of plating materials and contact lubricants. The best combination seems to be nickel-rhodium contacts with molybdenum disulfide lubricant. This combination will be tried out on the multiplier.

NEW COMPONENTS AND CIRCUITS (T. H. Meisling)

Initial work on a non-saturating SBT flip-flop indicates longer rise and fall times than in saturating circuits. However, the flip-flop loop delay is less than in saturating circuits. (E. U. Cohler)

Work has begun on a SBT emitter-follower and inverter in combination. The idea is to design a unit which more nearly approximates an ideal switch in regard to tolerance to transistor parameter variations, amplification, transfer characteristics, etc. Initial measurements indicate that excellent characteristics can be obtained this way. (T. Meisling)

J. R. Freeman is studying methods by which the dynamic response of transistor circuits (hole storage time) can be related empirically to the various possible static operating points. The work done by C. T. Kirk on hole storage suggests that the hole storage time is a function of the degree of saturation which may be measured by $\beta_{sat}/\beta_{active}$.

Philco Sample Transistors

We have received from Philco seven new SBT sample transistors with an indicated max. of 90 megacycles. These are being evaluated now.

NEW COMPONENTS AND CIRCUITS (continued)

Philco Specification Committee Meeting

The monthly meeting of the Lincoln-Philco specification committee was devoted largely to a discussion of maximum inverse voltage ratings. The conventional SBT rating based on small-signal output impedance was considered undesirable for switching applications. A rating based on punch-through voltage seems more logical. Life tests will be started to determine the effect of "off" operation at high voltages.

Publications

Three memoranda have been issued:
6M-3843, Dudley A. Buck, "The Cryotron - A Superconductive Computer Component"
6M-3856, Melvin M. Cerier, "Pulse Transformer Amplifiers"
6M-3830, K. H. Konkle and E. U. Cohler, "Positive Bias as Applied to Surface-Barrier Transistor Switching Circuits"
The first memorandum (6M-3888 by C. T. Kirk) on the SBT hole storage effect will be issued in a few days.

LOGICAL DESIGN (W. A. Clark for N. Daggett)

On 23 September a meeting of representatives from Lincoln Lab, Philco Corp., and Moore School, University of Pennsylvania was held in Philadelphia to discuss aspects of logical design involving surface-barrier transistor circuits and techniques. The design of the TRANSAC family of machines was presented by the Philco representatives, and we in turn outlined the TX-0 computer. The question of an adequate symbology was discussed. The ideas of the Philco group are apparently very similar to our own. We have tentatively planned a second meeting to be held at Lincoln in a few weeks.

A revision of the TM-1 control has been studied and a block diagram of a new control completed. It differs from the previous design in using only one level of gating wherever possible.

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

Scheduled Computer Hours:	314.7
Interrupting Incidents:	28
Hours Lost:	6.9
Per cent Good Time:	97.8
Mean Time Between Failures	11.0

Four troubles were responsible for the majority of down time:

1. The magnetic-tape printout system failed to function reliably. The carriage-return contacts of two Flexowriters were adjusted to remedy the trouble. The exact nature of the difficulty has not been determined.

2. One of the status tracks for the buffer drum had to be erased because of "writing between the slots." A considerable amount of time was lost in determining that the status track was at fault.

3. A bad cathode-follower caused a steady state failure in the display of characters and vectors. The trouble symptoms were reported incorrectly and as a result an excessive amount of time was lost.

4. An intermittent trouble in the in-out delay counters has caused short periods of faulty operation on four occasions.

WWI Filament Alternator

The 400-ampere motor-generator unit purchased this summer as a replacement for our 600-ampere m-g set has been returned to the manufacturer for repairs requiring a period of 5 weeks. It was determined that as the generator's magnetic field built up with load, the stator vibrated due to poorly fitted supports.

Personnel Assignments

John Ackley terminated his Lincoln Laboratory work on Friday, 16 September 1955, to accept a National Science Foundation Fellowship at MIT.

CAPE COD ENGINEERING (continued)

Eric Ellingson of WE-ADES is no longer working at the Barta Building. He is now attending the AN/FSQ-7 Programming Course. Roger Barlow of WE-ADES has joined our section and has been assigned to work with Ted Sandy on planning and doing semi-automatic height finder sub-system tests.

SYSTEM TEST PLANNING AND COORDINATION (K. E. McVicar)

Systems Test Program for XD-1 (R. P. Mayer)

Checking GFI and LRI Test Patterns - W. J. Marston (BTL) and B. M. Beatty (WE) are now working on a computer program for XD-1 to check the patterns generated at the LRI and GFI sites. This program will print out any errors which occur in the signal finally received at the computer, knowing the pattern being generated at the site. In addition to checking an externally generated pattern, the program will contain the option of simulating these same patterns by the computer, writing them on the GFI and LRI drums, reading them off, and performing the same check. Any errors which occur in the reading on and writing from the drums will then be printed out. The source of errors could be pinpointed as occurring either on the OD or CD sides of the drums in this way.

Four different types of patterns were expected to be available from the pattern generators at each of the GFI and LRI sites. The program is expected to be able to handle any of these patterns. The program will be capable of handling all LRI sites simultaneously while working with one GFI site.

Progress to date has not yet included any serious coding of the program. A workable over-all flow chart has been drawn up, and a few more detailed flow charts have been worked on. It appears that neither time nor storage space will be a critical factor, and this program will be easily adaptable to future AN/FSQ-7 installations.

Single Track Programs - Conversion debugged, decimal print assembled.

Pattern Recognizer - Program now being studied.

Miscellaneous - The SDV transmitter test program study using MTC is underway. The DDT-DDR Loop check is complete. (A modification of this check to send to GFI, Bldg. F, is nearing completion.)

CAPE COD ENGINEERING (continued)

Gap Filler Equipment System Tests (H. W. Boyd)

The failures of the DDR to live up to system requirements, mentioned in the last Biweekly, have been corrected and the DDR can now work reliably as a unit with any combination of system parameters. However, the effects of P/L characteristics and the compatibility of specifications (in particular the P/L delay distortion) remains to be checked.

The MTC program for the shakedown tests of the GFI frame equipment isnearing completion and testing will commence on the week of 26 September. R. Mayer and A. Werlin have been doing the programming for these tests.

The MTC program, needed to shakedown test the SDV transmitter in Bldg. B, is expected to be ready for tests around the 10th of October. The program requirements have been written. (A. Werlin, J. Mazza).

The MTC program required for lining up all sites prior to the XD-1 over-all system tests will be ready about the 13th of October. This program will be a modification of the versatile program used for "worst case" testingthe DDT and DDR (R. Mayer).

The XD-1 program for the over-all gap filler system tests is now being written by S. Thompson, H. Rundquist, and by M. Sherrerd of BTL. A maintenance program for the various channels of equipment is being written by Mr. Beatty (WE) and Mr. Marston (BTL).

J. J. J. Kernahan (BTL) has finished preparing a first draft of the SAGE Gap Filler System Test Specifications, and has, together with F. Brooks (BTL), been instrumental in obtaining some P/L simulation equipment required for the DDR and P/L compatibility shakedown tests. F. Brooks will be in on the test planning on this activity and will maintain liaison with the BTL on our test results.

Mr. Myers, G. Gakoumis, and F. Daly (all WE) are responsible for the conducting of the systems tests. They will see to all test connections and the recording of all the required test data. However, the expert assistance of those people whose equipment will be used is still required.

The MTC and XD-1 programs being written by R. Washburn (IBM) for testing all 12 channels of the GFI frame equipment will be used around the first two weeks of October as a part of the IBM acceptance test of the GFI frame equipment.

CAPE COD ENGINEERING (continued)

Data Link Test Planning (C. W. Watt, Jr.)

Contact has been made with Jim O'Brien in Group 311 in order to start planning for the testing of the GE data link subsystem before its integration with XD-1. Division 3 expects to use a magnetic-tape-recorded data-link-test message for the purpose of setting up and aligning the data link equipment. This message would have been generated by MTC and recorded on magnetic tape. A program for doing this, using MTC, now exists and an evaluation is going on to determine whether or not the magnetic tape reliability is adequate for use with the data link. Mayberry of Western Electric is going to write an XD-1 program to provide data link output test messages from XD-1. Such a program may be useful in preliminary integration of the data link with XD-1.

VACUUM TUBES

(Group 65, P. Youtz)

TUBE TECHNIQUES - (D. C. Lynch - J. S. Palermo)

Additional components for individual electroluminescent storage studies were prepared for Group 25. This required the application of a conductive coating of Stannic Oxide onto "chemically machined" photo-sensitive glass plates.

An evaluation program of the spraying technique for aluminizing lacquer has been started, together with revised procedures for selective aluminizing techniques.

CHARACTRONS (A. Zacharias)

I am terminating my employment with the Laboratory on 14 October 1955 for induction into the Armed Forces, and the program for the next 3 weeks will be:

1. Life racks for life testing 1-1/4 inch diode, triode, and tetrode CT-100 types with sintered cathodes will be completed within a few days.

2. Basing of CT-100 types will be accomplished using a medium-shell, duodecal, 12-pin base.

3. All cathodes will be of the ZrH_2 activator type, totalling 16 in all. At least six will be in diodes, four in triodes, and the remainder in tetrodes.

4. One of the first triodes will be made using sintered glass supported guns. If this is successful, the remainder of the triodes and tetrodes will be made from this type of gun.

5. The tubes made will be life tested at cathode temperatures not over 850°C and current densities not under 0.2 amp/cm^2 d-c. In the case of diodes, this lower limit cannot be greatly exceeded at early life. This is due principally to breakdown of sublimated products on G_1 (the anode). For triodes and tetrodes, operation at zero bias will allow a minimum anode potential of 1.5KV.

The object of these above proposals is to establish more firmly than at present, principals and details for the production, handling, and processing of these cathodes. It is hoped that a comprehensive report can be written before 14 October.

CHARACTRONS (P. Tandy)

Six MIT 19-inch tubes and three Convair Charactrons have completed from 1297 to 5590 hours on life test. No tests have been made since the last report to determine if the three limit tubes have improved or failed. Six new Charactrons will be started on life test, when the testing procedure has been decided upon.

Thirteen cathode-study tubes have completed from 1809 to 2120 hours. One tube, CT-60-2, did not give 50μa beam current when the first transfer-characteristic measurement was made after 1906 hours of life test. This tube had been processed according to Convair Schedule "H.".

TYPOTRONS - (L. B. Martin)

The Typotron life-test has been expanded to 24 positions and is ready to test tubes. The R-F read-out of Typotrons has been abandoned by the writer since the necessary Whirlwind storage tube equipment has been salvaged. This may be reactivated by someone else if it is considered worthwhile to build the equipment.

The Automatic Transfer Characteristic Plotter has been tested with 35-mm camera and is satisfactory. A DuMont 35-mm scope camera should be obtained. The problem of identifying the pictures has been discussed and several schemes considered.

The Second Curve Plotter has been designed as far as practical, and will be carried through by P. Tandy and D. Mach.

Reports on the 8th- and 16th-position Typotron life-tests will be written next week.

Typotron Tube No. 12461 was retired after 3143 hours because of writing gun and cathode short.

Tubes and hours of the remaining life-test group are:

6 tubes for 4050.0 hours and all satisfactory.
2 tubes for 3324.3 hours and all satisfactory.

I terminate my services with the Laboratory on 30 September 1955.

RECEIVER TUBES (S. Twicken)

Further measurements of the electronic temperature indicate that the 2420's may be operating about 40°C hotter than the 7AK7's. This work is being continued.

RECEIVER TUBES (continued)

An investigation is being made of the adequacy of the test limits for cutoff voltage unbalance for WWI flip-flops. Several flip-flop pairs have been rejected by the flip-flop unit tester for unbalance, although they met laboratory test specifications.

A life-test panel has been completed for the Bendix 6385. This tube type has the same ceramic heater insulator as will the Bendix gate pentode for FSQ-7. An investigation will be made of the possible migration of impurities in the insulator to form a cathode interface impedance.

COMMERCIAL TUBES (T. F. Clough)

Hum difficulty which Group 24 experienced with one manufacturer's 5749 has been investigated. This application is in the preamplifier of a high-gain video amplifier. Tubes were obtained from each manufacturer of the type 5749 in an effort to find a construction which would be satisfactory. All 5749's had excessive hum output in this high gain application, although the prototype 6BA6 was satisfactory and the hum level in the 5749 was not high enough to be bothersome in a normal application.

Work is continuing to isolate the source of the hum.

PRODUCTION COORDINATION OFFICE

(Group 66, B. E. Morriss)

To strengthen Group 66 organization, two new sections have been established. It is expected that the PCO work will be distributed between the two sections depending upon whether the associated problems are primarily of an operational or programming nature and require close work with Group 61, or are of an equipment nature and require close work with Group 62 or Group 64. The Section Leaders of the respective sections are H. J. Kirshner and W. H. Ayer. The Group 66 personnel now working as a part of the PCO have been divided into these two sections with the exception of E. D. Lundberg who will work directly with B. E. Morriss.

Discussions have been held with the Air Force and IBM representatives on the XD-1 maintenance contract for the coming year. Our primary interest has been to insure that sufficient flexibility exists to handle the necessary changes. It now appears that a small fund can be made a part of the maintenance contract for this purpose, and a more rapid engineering change procedure can be established which will permit IBM to perform the necessary changes prior to Air Force processing.

POWER (J. J. Gano)

To increase the reliability of the systems within the buildings the following staff members have been assigned the definite responsibility of design installation and maintenance of the power sections: G. L. Piantoni, XD-1; J. D. Clark, TX-0; R. C. Jahn, MTC and D-C Laboratory Power.

Power Generation - SAGE System

At a meeting in New York between AFIRO, WE-ADES, Burns and Roe, Lincoln, and Jackson and Moreland, the AFIRO, despite the joint recommendation of all other parties, still insisted that for combined centers, generation be with 7-1250 kw units at 4160 volts. ADES will write a second and final letter of appeal pointing out the advantages in initial cost, simplicity, efficiency, and maintenance by going to 9 - 800 kw units generating at 480 volts. The direction centers will use 6 - 650 kw units at 480 volts.

M-G Set Evaluation - SAGE System

Jackson and Moreland has submitted a draft of the report on calculations of transient voltages in a direction center and probability of occurrence. With the aid of Coffin's tests on the susceptibility of XD-1 to errors caused by line transients, the frequency of computer errors in a system without M-G sets can be estimated.

POWER (continued)

Thermistor Application to Filament Voltage Cycling
(G. F. Sandy)

Thermistors of three current ratings of two types have been thoroughly investigated to determine the best number to use in series to obtain suitable control of the filament voltage and current of vacuum tubes when the filament power is applied to electronic equipment. The major difficulty has been the lack of a well-founded criterion for the amount of cycle time and the maximum allowable current while the tubes are warming up. A 1-1/2-minute cycle time with a maximum current of 120 per cent of the full voltage steady-state current has been suggested by the tube group.

COMMUNICATIONS (H. J. Kirshner)

W. O. Glass has joined the Communications Section. He will assist C. J. Carter in the Experimental Subsector telephone installation.

Test equipment has been added to the Data Circuit patch panel. The patch panel is now in operating condition.

Progress of the Experimental Subsector telephone installation as of 20 September:

External Circuits Installed:		48
External Circuits to be Installed:		91
Total Programmed:		139
Orders placed:	107	
Orders to be Placed:	32	139

Date Patch Panel - Installed.
Recording Console (Service date 18 July)-To be installed by 1 October.
Monitoring Console - To be installed 15 October.
Teletype Patch Panel - Temporary facilities are installed.
Maintenance Intercom System - Being held up by IBM. No difficulties expected.
112-Key Equipment - To be installed by 21 November. Some units to be installed by 1 November.
Ground-Air Radio Switching Equipment - Console equipment must be installed by 21 November. This may be difficult. Other equipment has been tentatively quoted for 15 April. When firmer information is available Lincoln will make a decision regarding an interim system.

FACILITIES (W. H. Ayer)

Experiments with reflection control techniques in the mapper room in building F have resulted in an "up-side-down" lighting system that appears quite effective. The lower walls and floor are illuminated and the ceiling and upper walls are painted dark gray to eliminate reflections in the face of the PPI tube. It was also determined that use of a light source that does not contain energy below approximately 500 millimicrons (blue light) would have no effect on the phototubes, and therefore allow a higher level of illumination in the room. Due to some fortuitous circumstances, an ample source of yellow light bulbs that met the requirements was available for immediate installation and proved quite satisfactory.

TIR's AND COORDINATION (E. D. Lundberg)

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

TIR #	DOCUMENT #	SUBJECT
101	6M-3851	Master Reference List of Equipment Specifications for AN/FSQ-7 (XD-1)
103	6M-3873	Ground-To-Air Data Link Subchannel Selector Switch

"Proposed Site and Equipment Locations in the Experimental Subsector," 6M-3515-2, giving the location, use, and operational date with the AN/FSQ-7 (XD-1) of the various equipments in the Experimental Subsector, should be released by TIR by 26 September.

Coordination is being effected on a TIR to release 6M-3682, "Mimic Panel for Maintenance and Programming Area AN/FSQ-7." IBM and Lincoln concurred on this specification on 20 September.

Memoranda 6M-3692 and 6M-3790 containing revised equipment cooling requirements for a Direction Center are expected to be released by TIR by 27 September.

ADMINISTRATION AND SERVICES

(Group 60, J. C. Proctor)

PERSONNEL

New Staff

Assigned to Group 61

Harry P. Bridge received his BA in Math from the University of Maine and was formerly employed by the Applied Physics Lab. at John Hopkins University.

William F. Holst received his MS in Electrical Engineering from M. I. T. this year and worked part time here under Walter I. Wells.

John C. Leavy received his BA in Math from New York University and was employed by North American Aviation, Inc.

Assigned to Group 62

Paul Murphy received his BS degree from M. I. T. in Electrical Engineering and was employed by the General Electronics Lab.

Robert L. Patton received his MS from Oklahoma A & M this year, where he was a Graduate Assistant in Math.

Terminations

John Ackley has returned to M. I. T. for further study.

Harold Seward is now employed by the Instrumentation Lab of M. I. T.

Willis Kellogg has returned to Harvard to study Applied Physics.

Stanley Hazen has returned to Boston University to finish his course in Aerial photography and city planning.

Richard Jeffrey has gone to Princeton for graduate study.

Transfer

Robert A. Nelson has transferred to Group 312 under D. E. Dustin.

MATERIAL (H. B. Morley)

We have prepared a complete list of standard components stocked in the Division 6 Special Stockroom. This list references the former DCL numbers to new LL numbers whenever the components are equivalent or nearly so. Labels on the stock boxes will also show this cross reference.

MATERIAL (continued)

A complete inventory of Division 6 stock is being taken.

ENGINEERING (A. R. Smith)

Hoist - Building F

Re-evaluation of equipment installation in both the Command Post spectator area and projection room has resulted in the substitution of a permanently installed two-ton hoist in the projection room for the two originally specified detachable one-ton hoists. The single hoist provides greater sensitivity in handling equipment, is capable of handling all assigned equipment with 33 per cent additional latitude of operation and will accomplish its objective more conveniently and effectively.

Projection Room - Command Post

Information has been forwarded to the contractor through the Installation Group, showing revisions in the partitions and floor for air conditioning, power, and water. Cal Waite of IBM is directing duct design for display console, Kelvin & Hughes air conditioning details on location, and requirements of outlets. Lights and power for Division 1 installation will be completed before the contractor has concluded his work.

Status Board

Determination of board specifications has been reactivated to conclude basic requirements for edge lighting under Command Post conditions and also investigate the possibility of redesigning the original board to utilize convenient techniques of displaying incoming information and still provide maximum transmission of data to the operator. This latter phase is considered necessary to realistically meet a December 1st operational date.

STANDARDS AND COMPONENTS TEST (H. W. Hodgdon, C. Morrione, Jr.)

Morrione visited Sprague Electric Co. for a general survey of facilities. A complaint had been received from the Kingston Components Group that some Sprague pulse transformers had been found with insufficient slack in internal winding leads. No evidence of this difficulty could be found in examining units on the production line.

Weekly or bi-weekly meetings of the Components Section are being held for discussions on items of general interest. Subjects covered thus far have been: Deposited Carbon Resistor Construction and Use of Standard Deviation Calculations in Component Test and Evaluation.

6M-3905

TEST EQUIPMENT (L. Sutro)

The committee is considering purchase of more Burroughs equipment both to meet the shortage of some existing types and to obtain the new variable-frequency, variable-duration pulse generator.

Test Equipment Headquarters has gained the services of Martin McMahon, formerly a technician with Whirlwind and Rod Johnson, a stock clerk.

We have sent the Valkers and Schaeffer differential-input VS-900 scope back to the factory in an effort to have it perform according to its specifications.

On 16 September I visited the factory of Burroughs' Electronic Instrument Division in Philadelphia. Burroughs demonstrated these new units of test equipment: Plug-in gate tube unit using printed wiring and plug-in mounting panel with two 1-Mc flip-flops and printed wiring; power supplies using series germanium diodes and no feed back.

STUDIES IN PROCESS

Study	Responsibility of	Expected Completion
GROUP 61		
Digital Data Display Program Specs	H. Briscoe	
In-Out Program Specs	A. Shoolman, A. Ginsberg	
Radar Input OPS Specs	F. Brooks	
Situation Display Program	A. Schwartz	
Switch Interpretation	R. Olsen	
Table Storage Requirements	L. B. Collins	
Track Scan	F. Ogg, P. Strait	
XD-1 Inactivity Alarm Proposal	M. Feldstein, P. Vance	
XD-1 Startover Program OPS Specs	P. R. Vance	
Lectures, AD Programming Course	A. R. Shoolman	
OPS Specifications	A. R. Shoolman	
GROUP 62		
Card and Tape Symbolic Address Assy	B. G. Farley	
Flight Test Analysis (for Grp 22)	G. Harris, C. Uskavitch	
Air Conditioning Manual	J. A. Newitt	
LRI Test Programs	A. D. Hughes	
Pattern Recognition (for Grp 24,34)	G. P. Dineen, O. Selfridge et al	
Simulation (for Grp 22)	H. Neumann, B. Stahl et al	
Technician's Training Manual, IV	A. Vanderburgh, Jr.	
XD-1 Parity Checking System	N. T. Jones	
Communication with Talos missiles	N. T. Jones, S. B. Ginsburg	
Inactivity Alarm Proposal	R. D. Buzzard	
AEW input to AN/FSQ-7	J. P. May	
Film processing facilities, AN/FSQ-7, AN/FSQ-8	J. P. May, L. Sutro	
GROUP 66		
Telephone System Test	F. E. Irish,	
Installation Follow-up & Scheduling	C. J. Carter, W. O. Glass	
Review of Operational Specifications	F. E. Irish, H. J. Kirshner	
Orifice Testing	F. Manning	Oct 55
Building Redesign Study	W. Ayer, E. Smiley	Oct 55
Blue Filter Specs	W. Ayer	Sep 55
XD-1 Schedules	J. Carson, F. Manning	---
Technical requirements for integration of Kelvin & Hughes Camera-projection equipment with the AN/FSQ-7 display system.	J. J. Carson	27 Sep 55

ACCESSIONS LIST

(Frances Christopher) CONFIDENTIAL

The following documents were published by Division 6 or received from IBM during the period 10 to 23 September 1955:

No. 6M-	Author	Title	Cls.
SAGE SYSTEM TEST AND PLANNING (Group 61)			
3732 C1	W. Lone	AN/FSQ-8 Console Equipment and Label Layouts	U
3739-1 S1	J. J. Cahill	OPS Spec for Interim AA Direction in SAGE	S
3751	J. A. Arnow	Concurrence Procedures for SAGE OPS Specs	U
3786	C. C. Grandy	OPS Specs for SAGE Intercept Direction	S
3810	P. Bragar W. Lone	OPS Specs for Forward Telling in the SAGE System	C
3877	W. Wells et al	Tracking Study Committee Report	C
3886	D. Israel	Staff Growth Necessary for SAGE Programming Responsibilities	U
3903	A. P. Hill	Proposal to Film SAGE Familiarization Course, 17 - 28 Oct 55	U
5037	C. Uskavitch	Failure Reporting in Air Force and Applicability to Cape Cod System	U
5053	C. Uskavitch	Variability of Weather Clutter	C
5054	SAGE Test Office	SAGE Test Committee Meeting #5	C
5062	G. C. Sponsler	General Raydist Equations	U
5065	H. D. Neumann W. I. Wells	Comparison of MISP and BTL Simulation Results	C
5069	H. K. Krist BTL	Estimation of Radar Clutter Due to Precipitation	C
FSQ-7 PROTOTYPE DESIGN AND INSTALLATION (Group 62)			
3851	J. Giordano R. D. Buzzard	Master Reference List of Equip. Specs for XD-1	C
3853	J. D. Crane	Results of System Test on AN/FSQ-7 and XD-1, June 1955	U
3881	J.Crane,S.Thompson	XD-1 Evaluation, 13 July 1955	U
3889	J. Giordano	Minutes, ESS Planning Approval Committee, 12 Sept 55	C
3892	R. Gerhardt	Normal Area Assignment Switch	U
3900	J. Giordano	Minutes, IBM-SO Concurrence Mtg #37 Held at Lincoln, 20 Sept 55	U

ADVANCE DEVELOPMENT (Group 63)

3805	R. A. Pacl	Mod. III Current Calibrator	U
3830	K. Konkle E. Cohler	Positive Bias as Applied to SBT Switching Circuits	U
3856	M. M. Cerier	Pulse Transformer Amplifier	U
3897	H. Peterson	Revisions to WWI Instruction Code	U

PRODUCTION COORDINATION OFFICE (Group 66)

3672	J. J. Carson	SAGE System Meeting, 6 June 55	U
3802	H. J. Kirshner	Revisions to 6M-3000, 6M-3000 Sup. 1 thru 11 and 6M-3275-1	U
3884	R. R. Shorey	Master Reference List AN/FSQ-7	
3884 S1	J. J. Carson	Specifications	U
3898	E. D. Lundberg	SAGE System Meeting, 19 Sep 55	C

ADMINISTRATION AND SERVICES (Group 60

3822	J. W. Forrester	Group Responsibilities for Group 61	U
3885	H. W. Hodgdon	Trip Report-HiQ Div., Aerovox Corp.	U
3887	Div. 6 Staff	Biweekly Report, 9 September 1955	C

OTHERS

2906-1	F. M. Verzuh	Tape Preparation Facility at Barta	U
3843	D. A. Buck	The Cryotron--A Superconductive Computer Component	U
3883	E. F. Ennis BTL	Report of Committee Studying Failure Reporting in the SAGE and Experimental Subsectors	U
3891	A. Wright	CCS Weekly Operations Schedule	U
3894	A. Wright	CCS Weekly Operations Schedule	U

IBM DOCUMENTS

IBM-820	W. R. Van Eysden	Project High Semi-Monthly Report#60	C
IBM-821	---	Electrical Drawings Released for AN/FSQ-7 Combat Direction Central Project High Engineering Report	U

LLDR DOCUMENTS

DR-417	R. A. Imm	Floor Plan Layouts for AN/FSQ-8 Combat Control Central	
DR-418	L. V. Ruffino	Maint. Tool List for Duplex Central	U

DR-419	L. V. Ruffino	Test Equip. List, AN/FSQ-7, -8	U
DR-420	R. J. Trivison	Changes to the Specifications for Duplex Maintenance Console	U
DR-421	H. E. Anderson	Concurrence on D-66, Fundamental Technical Requirements for Digital Transmitters, Receivers and Associated Equipment	U
DR-422	H. E. Anderson	Concurrence on Post Write Disturb	U
DR-423	N. H. Taylor et al	CP DD Desk for AN/FSQ-7, XD-1	U
DR-424	R. C. Marden	Concurrence on P-199, "Changes in Crosstell System so that it Will Accept Words of either Odd or Even Parity during Diagnostic Programming for XD-1, XD-2."	U
DR-425	R. C. Marden	Concurrence on P-202, "Changes in LRI System so that it Will Accept Words of Either Odd or Even Parity during Diagnostic Programming for XD-1, XD-2."	U
DR-426	R. C. Marden	Concurrence on the Proposal for Warning Light Interconnection Unit	U
DR-427	R. C. Marden	Concurrence on Increase of Teletype Lines for Output Systems of XD-1	U
DR-428	J. J. Coughlin	Changes in the Crosstell Systems so that it Will Accept Words of Either Odd or Even Parity During Diagnostic Programming	U
DR-429	J. J. Coughlin	Changes in LRI System so that it Will Accept Words of Either Odd or Even Parity during Diagnostic Programming for XD-1, XD-2.	U

GLOSSARY

AA	antiaircraft
AD	Air Defense
ADC	AD Command
ADES	AD Engr'g Service
AEW	Airborn Early Warning
AF	Air Force
AFB	AF Base
AFCRC	AF Camb. Res. Ctr.
AFIRO	AF Installation Requirements Office
ARDC	Air Research & Development Command
ATC	Air Training Command
ATCF	ATC Facility
BTL	Bell Telephone Labs
CC	combat center
CAT	category
CCS	Cape Cod System
CER	change evaluation request
CHT	charactron tube
CP	Command Post
CRT	cathode ray tube
C&E	communications and electronics
DAB	display assignment bit
DC	direction center
DD	digital display
DDG	DD generator
DDR	digital data receiver
ECM	electronic counter measure
ECP	engr'g change procedure
EMAR	experimental memory address register
ESS	experimental subsector
FGD	fine grain data
FF	flip-flop
FORX	FGD orientation with Raydist and calibrated Mark X
GFI	gap filler input
GSR	group selection register
IBM	International Business Machines
MAR	memory address register
MEL	minimum equipment list
MISP	Manned Interceptor Simulation Program
MITE	multiple input terminal equipment
MTC	Memory Test Computer
NAS	Naval Air Station
OPS	Operations
PIUMP	plug-in unit mounting panel
PCO	Production Coordination Office
PRF	pulse repetition freq.
RAFD	Rome AF Depot
RD	radar data
SAGE	Semiautomatic Ground Environment
SBT	surface barrier transistor
SAR	storage address registor
SD	situation display
SDG	SD generator
SDV	slowed down video
SIF	selective identification feater
SC	Signal Corps
SCEL	SC Engineering Lab
SOP	standing operating procedure
SO	Systems Office
STP	System Training Program
TBS	training and battle simulation
TD	track data
TIR	Technical Information Release
WE-ADES	Western Electric-ADES
WWI	Whirlwind I

INDEX