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

SUBJECT: BIWEEKLY REPORT FOR 21 OCTOBER 1955

To: Jay W. Forrester

From: Division 6 Staff

Approved: John C. Proctor

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CONTENTS

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SAGE SYSTEM TEST AND PLANNING

(Group 61, J. F. Jacobs)

MASTER PROGRAM PREPARATION (H. D. Benington)

Program Design and Central Programs (A. R. Shoolman)

"Proposed Organization of the SAGE Master Direction Center Program (Operational Active)," 6M-3934, by W. F. Harris, dated 11 October 1955, has been published. The central programming tasks (preparation of coding specifications, coded programs, and documentation) have been allocated as follows:

Program Design, Sequence Control Program, and Input-Output Programs - W. F. Harris, A. R. Ginsberg.

Table Design and Central Bookkeeping Programs - L. B. Collins, M. E. Cary, T. A. Kurth, J. H. Stone.

Situation and Digital Display Programs - H. W. Briscoe, A. A. Schwartz, M. J. Loviglio, I. B. Hazel.

Switch Interpretation Programs - R. E. Olsen, M. Piatok, B. A. Rogers.

Utility Programs (C. H. Gaudette)

A compiler manual for programmers is being prepared by P. Bagley. Mrs. Audrey Benson of Rand has joined this subsection and will work with S. Knapp on the compiler. R. L. Carmichael, who is on loan from the checkout subsection, has started the programming of the Utility Control Program.

Checkout and Duplex Standby (P. R. Vance)

The responsibility for Group 61's duplex standby activity has been transferred to C. A. Zraket's section. A memorandum summarizing the duplex standby problem has been completed and will be distributed during the next biweekly period. A draft copy of the Operation Specification for XD-1 Startover has been distributed for concurrence. Criticisms and comments will be considered for inclusion in the final report.

A proposal for the ESS Table Simulation Program will be completed during the next biweekly period.

MASTER PROGRAM PREPARATION (continued)

Operational Programs (D. L. Bailey)

Five people are now actively engaged in work on air surveillance operational programs. Pat Haverty is responsible for the activities of this crew. Roy Schaub is concerned with the radar data input function. Lon Elias, Bob Klein and Bob Walsh are working on tracking and initiation.

Bob Krouss is working on the operational raid forming program. This is part of a coordinated "pilot plant" activity on raid forming, which will include participation of some of Shoolman's people concerned with swtich intepretation, display makeup and other "central program" activities connected with raid forming.

Peggy Strait is studying problems connected with height priority programming. She is also investigating the possible applications of track-sorting schemes to system function other than the correlation of radar data (e.g., crosstelling, AA).

Card Preparation Room (H. Newhall, Jr.)

Requisitions have been submitted for two additional machine operators, which will increase the total number of such operators to seven. The additional operators are considered essential to meet the anticipated increase in card preparation resulting from accelerated activity on Master Program preparation.

A program is underway allowing the machine operators to attend more formal courses in machine operation and machine functions. One operator has been attending card punch classes at IBM, Boston, for the past two weeks, and it is planned that others will follow during any periods when the work load here permits.

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

Air Surveillance (E. W. Wolf) CONFIDENTIAL

The following memoranda by D. L. Bailey have been issued:

"Operational Specifications for SAGE System Radar Data Inputs," 6M-3774-1.
"Operational Specifications for Track Detection and Initiation in the SAGE System," 6M-3766-1.
"Operational Specifications for Automatic Tracking in the SAGE System," 6M-3836-1.

Air Surveillance (continued) CONFIDENTIAL

Rough drafts have been completed of the "Mathematical Specifications for Radar Data Inputs in a SAGE Direction Center" and a "Functional Outline of the WW Facility for Checking Crosstell Operations with XD-1."

Paul Stylos is handling the air surveillance adaptation requirements and is currently determining the masking parameters for the XD-1, McGuire, and Stewart subsectors.

Weapons Direction (C. C. Grandy) CONFIDENTIAL

Work on operational specifications in this area is nearly completed as the first supplements and the first revision to most memoranda are either issued or being retyped for reproduction. The following table summarizes this work:

Operational Specification	Supp. 1	Rev. 1
Subsector Command Post (6M-3795, P. Bragar)	issued	being typed
Raid Forming (6M-3701, P. Bragar)	issued	issued
Height Finding (6M-3828, H. Frachtman)	issued	being typed
Antiaircraft Direction (6M-3739, J. Cahill)	issued	issued
Weapons Assignment (6M-3744, A. Heineck, A. Chandler)	being typed	being typed
Intercept Direction (6M-3786, A. Heineck, A. Chandler)	being typed	being typed

Preparation of mathematical specifications to accompany the above operation specifications continues. Rough drafts have been completed for most. Dan Ladd has joined the subsection. He will assist Phil Bragar with the raid forming specifications and will investigate the integration of missiles into SAGE. Ed Brande (IBM) will continue his work on intercept direction and weapons assignment specifications.

J. J. Cahill is expanding his cognizance of the subsection's work preparatory to assuming complete responsibility after the mathematical specifications are completed.

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

"Operational Specifications for Identification Function in SAGE," 6M-3780-1, and "Operational Specifications for the Manual-Input Function in SAGE," 6M-3714-1, were completed and published in the last biweekly period.

A draft of the mathematical specifications for the identification function is expected to be completed by 1 November.

After consultation with Col. Stiles, 4620th Experimental Wing, we will draft a proposal for the facilities and operation of an ESS Weather station.

Combat Center (W. Lone)

The draft of the "Guide to Combat Center Operations" will be available for discussion on 15 November.

MANUALS FOR PROGRAMMERS (P. R. Bagley)

A manual describing the Compiler, Read In, and Recompiler programs has been started. I am continuing to study, consult, and write about the facilities of FSQ-7 in the hope of issuing a complete edition of FSQ-7 Programming Data Sheets (described in 6M-3761).

COMPUTER OPERATION (XD-1) (P. L. Guinard)

Program Checkout (Utility Assembly)	13:45
Down Time (Computer Malfunction)	2:30
Time Returned to IBM	3:45
TOTAL ASSIGNED TIME	20:00

FSQ-7 PROTOTYPE DESIGN AND INSTALLATION

(Group 62, N. H. Taylor)

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

Building Modifications (H. F. Mercer)

Procurement delays have extended completion to week of 24 October.

XD-1 Core Memory, LRI Test Planning, and Systems Test (W. J. Canty)

During the past biweekly period meetings were held in Poughkeepsie with Mr. Ed Wildner of IBM, who is writing a note on core memory maintenance. That note is nearly complete. The majority of work left is on some whiffle-tree diagrams to aid computer maintenance personnel in diagnosing trouble in core memory.

Two meetings have been held with members of the LRI Test Team to discuss formulation of the Experimental Subsector, LRI Test Plan. A plan in outline form has been written and discussed.

A test plan for checking the accuracy of the 14-channel Ampex recorder in Building F has been formulated, and the first run of this test was made on 15 October 1955. This test uses MTC as a signal generator of LRI type messages. These messages are recorded by the Ampex tape recorder. When the messages are played back later, MTC analyzes them giving an easily interpreted display of errors. Due to equipment and program difficulties, no useful data was collected. However, this first run served as a training period for future tests.

Acceptance Test (J. Crane)

Three test demonstrations on the GFI element and the mapper consoles showed that the equipment could perform the functions listed in the test specifications. However, evidence of missing and/or spurious information caused the demonstration to be less convincing from the reliability standpoint.

The camera system was tested during the third display demonstration. The controls worked correctly, but the picture quality was not satisfactory.

Recording Camera (L. Sutro)

The camera mounted on a console at the ends of frames 24 and 25 has been called the semiautomatic camera, but is now called the SD Re-

Recording Cameras (continued)

cording Camera, to differentiate it from the automatic camera in the command post. The first photographs made with the recording camera have revealed three defects:

1. The bottom of the tube is further away from the camera than the top.

2. The camera is properly focussed for points near the center of the tube, but not for points near the edge, in spite of the effort made by Fairchild to make the focus equal.

3. The film selected for Whirlwind, and satisfactory in photographs of the P-11 Charactron in MTC, is not fast enough for the P-11 Charactron photographed in XD-1.

Efforts are being made to correct these faults.

DISPLAY DEVELOPMENT (E. Woolf, H. Zieman for C. Corderman)

A system to scan a Typotron to give an electrical readout is under construction. At present, the horizontal and vertical sweep circiuts are completed. The amplifiers to drive the position plates are being debugged. The video amplifier that monitors the collector current will have its output stage modified in order to increase the bandwidth.

An M-note describing the logic and circuitry of the display equipment in MTC will be issued in the near future.

M-note, 6M-3284, on the display line driver, was released. Another note on decoders and associated components will be released within the coming biweekly period.

The compensation of the display line drivers was finalized. At present, operational tests and margins are being taken.

Tests performed in MTC confirmed the previous specifications on the vector intensity modulator.

The point address plug-in-unit was completed and turned over to IBM.

John Swatton of IBM informed us that his trip to Lincoln was successful. Because of this visit, he was able to assembly the required information to complete the MRD reports pertaining to the analogue equipment in XD-1.

FSQ-7 PROTOTYPE DESIGN AND INSTALLATION (continued)

MEMORY TEST COMPUTER (W. A. Hosier)

At a meeting Thursday afternoon, 13 October, attended by Everett, Taylor, Arnow, O'Brien, Attridge, Hosier, Ziegler, Gates and Farley, it was agreed that Group 61 needs the tape and associated equipment on MTC, preferably by February. It was to be put up to Bill Jackman of IBM to expedite the necessary IBM items, including possibly a loan of the XD-2 tape adapter frame. Ziegler and Gates will proceed with the MTC control redesign and construction, and will probably have things ready in time to make the control change along with the tape installation. However, the tape installation will be planned in such a manner as to make possible its temporary use with an extension of the present control, in the event that unforeseen snags develop in the new one.

A new 9' x 18' development area, B-157, has been assigned to MTC at the expense of Test Equipment Section. DC and AC power is being brought in, and two 6' x 6' MTC frames are expected from the shop by 28 October. Equipment to mount in these frames will be coming along piecemeal, and as it does the new control will gradually be assembled and tested. Gates and Ziegler have pretty well completed logic for primary instruction decoding and the general technique of sequencing command pulses. Sequences for individual instructions are now being worked out, often with advice from outsiders such as Clark and Forgie. Dick Best's people are checking out power cathode follower circuits to drive 16 diode "&" gates, and are also experimenting with a positive trigger on the standard high-speed FF with the aim of chopping 0.1 μsec. off control switch setup time. It may also be possible to reduce the basic machine cycle time to the absolute minimum imposed by the memory cycle.

Art Hughes has Bill Canty's LRI test program sufficiently weaned to leave himself time to resume operations on the Soroban high-speed paper tape punch. He believes he can obtain reliable punch operation with some 5 FFS, 15 GTS, including alarm circuits. It is quite possible that sudden arrival of magnetic tape equipment from IBM would take priority over the Soroban punch and delay its installation a month or two. Meanwhile Art will continue to do all he can with it.

Vanderburgh has been teaching the second section of Wes Clark's course on digital computers. His services have also been requested by Jacobs in training four or five members of Group 61 to program magnetic tape processing on MTC.

Since losing John Newitt, the MTC section has been informed that we will also lose Don Richards to the Air Force at the end of the month. These losses have been compensated by the recent addition to the section of Tom Stockebrand and Ed Glover.

MEMORAY TEST COMPUTER (continued)

MTC operating time this period has been divided as follows:

	Hours	Per Cent
Analysis and Data-Processing	76.01	34.9
Development and Testing	100.89	46.3
Maintenance and Marginal Checking	14.38	6.6
Interrupting Failures	4.04	1.8
Reliability Check Programs	22.59	10.4
TOTAL	217.91	100.0

Summary of defects found in tubes and components, 10 to 21 October:

Tube or Component	Defect	Qty.	Hours Lost
2D21	high starting voltage	1	0
5965	gone to air	1	0
6145	low plate current	1	0
6145	tap short	1	0
7AK7	heater defect	1	3.05
Z2177	tap short	1	0
relay	sticking	1	0
socket	poor risk	1	0
socket	loose assembly	1	0
toggle switch	open	2	0
TOTAL		11	3.05

BASIC CIRCUITS (R. L. Best)

A slightly modified IBM sense amplifier was again demonstrated successfully on XD-1. Zopatti's amplifier has some basic diode problems that have yet to be solved, so that IBM's amplifier will be used in FSQ-7 production. (P. Murphy)

A power cathode follower circuit, having the required speed, has been developed and is presently being packaged in an MTC type pluggable unit. (D. Shansky, M. Flanagan)

The switch driver and the switch driver current regulator for the 256^2 core memory are now in the Division 4 drafting room. (D. Shansky)

The plane driver (production tester) which will furnish positive and negative half-amplitude current pulses into the selection lines of a 64 x 64 memory plane, is currently being designed. (D. Shansky)

BASIC CIRCUITS (continued)

A simple blocking-oscillator sweep circuit is being debugged. (B. Barrett)

The compensation circuits for the display line driver have been finalized. Work is being done on circuit margins and operational checks. (J. Kriensky)

Centralized Probe System (W. Santelmann, A. Hingston)

Experiments are being conducted to minimize the ringing on the cold probe by the use of resistance wire as the center lead of the eight-foot length of RG62 cable.

Construction of the breadboard model of the hot probe has been completed and experiments are being performed to improve the square wave response.

A new circuit has been designed for the hot probe and a model has been built up for the purpose of testing its performance. It consists of two tubes connected as a "cathanode follower," a hybrid cathode follower and two-stage feedback amplifier.

Digital Data Receiver (E. Glover)

Timing difficulties are delaying tests to determine the best value of the low pass filter. The fast rise time required to trigger the blocking oscillator was the original cause of trouble in the timing circuit. This problem has been eliminated by simply adding one resistor, which converts two of the amplifiers in the timing chain into a cathode-coupled multivibrator. This multivibrator free-runs at a relatively low frequency and is synchronized by the timing signal. Thus, due to the positive feedback action of the multivibrator, even small pulses have a rise time sufficient for triggering the blocking oscillator.

Present concern for the timing circuit stems from the fact that for some data patterns, the output of the high Q filter drops essentially to zero. At these points even the multivibrator is not triggered which, of course, results in loss of timing output. Investigation into this problem will continue into the next biweekly period.

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

A clamp circuit has been designed to limit the negative grid excursions. This has been incorporated into the flip-flop, together with a silicon diode in the cathode circuit to produce a biasing effect. These changes, with the divider ratio already changed to produce more

Flip-Flop Mod A (DC-2) (continued)

negative bias on the conducting tube, have been tested in the flip-flop employing symmetrical card arrangement. Tests to date show that this circuit equals or betters the specifications that existed on the original flip-flop using 5965 tubes.

SAGE SYSTEMS OFFICE (H. E. Anderson) CONFIDENTIAL

Tape Conversion Equipment

The results of the study to determine the need for the tape conversion equipment have been published in 6M-3902. A floor plan has been made for the installation of the tape conversion equipment in the basement of Building A.

XD-1 Raydist Output for Synchronization

A method has been proposed in 6M-3943, to be issued in the next biweekly period, to have XD-1 send synchronization pulses to the Raydist equipment. The method is quite similar to the system presently being used in Cape Cod and may use the same equipment or the same design.

Operational Specifications

The final operational specifications being published by Group 61 are being reviewed by the Systems Office.

Data Circuit Synchronizing Signal Format

At a WE-ADES meeting in New York on 20 October 1955, agreement was reached on the BTL proposal to expand the synchronizing format to five bits. The significance of the bits are 00100, i.e., the first two bits will be binary zeros, the third bit a binary one, and the fourth and fifth bits binary zeros. The meeting was attended by representatives of the contractors of the equipment affected by the change.

Talos Reply Back Study

The study of the Talos Defense Unit to determine possible reply-back systems was continued with a data-gathering trip to Johns Hopkins Applied Physics Laboratory in Silver Springs, Maryland.

Manual Insertion Feedback Indication

A study is being conducted to determine a method for providing a

feedback indicator to the console operator that his manual insertion has been read by the computer. This would prevent the operator from presenting overlapping indications to the computer.

Status of Mark X (SIF) and Its Effect on SAGE

Memorandum, 6M-3872, giving a brief description of the Mark X, IFF beacon, and its planned expansion, Selective Identification Feature (SIF), the automatic decoder for the AN/FST-2, and the operational use by SAGE, has been issued. Problems which are inherent in the SIF and will be a problem to all users, including SAGE, are also stated. A series of meetings have been planned with the cognizant components of ARDC to help resolve these problems.

ADVANCE DEVELOPMENT

(Group 63, D. R. Brown)

CHEMISTRY OF MAGNETIC MATERIALS (F. E. Vinal)

Memory Core Production (J. J. Sacco, R. Zopatti)

The production of memory cores for the TX-0 memory now stands at 1,715,235 double-tested and 150,000 single-tested. In addition, there are on hand 140,000 for testing and 350,000 for firing, making a grand total of 2,305,235 cores. The large number on hand for firing is a result of switching completely to the Colton press for production work. This press has been producing consistently good cores while "loafing along" at a half-maximum rate of about 500 cores per minute. The Stokes press has been temporarily removed from service for an overhaul after producing approximately 4,800,000 cores between 4-6-53 and 10-21-55.

The end of the current core production effort is in sight. Assuming no unforeseen events, the pressing of 3,000,000 cores will have been completed about November 4 and the firing will be completed about December 1. Testing will continue for a month or two longer.

A 64 x 64 plane of 4200 cores, selected especially for their uniformity, has been assembled for use as a sort of "standard plane." The assembly was carried out by the old hand-stringing method and no vibration of cores nor stringing needles were employed. It is thus interesting to observe that no cracked or chipped cores were found in the finished plane. The plane had a very uniform output, as expected, except for two cores. These cores were removed and upon retesting were found to peak slightly early, but were otherwise perfect. Replacement of these two cores will be made so that no outputs will fall outside the envelope which results from a plane made with such tight core specification limits.

Inorganic Chemistry

The observation of magnetic-domain patterns in polycrystalline ferrites, first reported in the Biweekly for 7 October 1955, has been continued. A number of compositions have been observed, all of which lie on or close to a line connecting the composition DCL-2-170B (15% MgO, 60% MnO, 25% Fe_2O_3) with our current memory core composition, DCL-2-870B (38% MgO, 22% MnO, 40% Fe_2O_3). As the memory core composition is approached, grain size and domain size decrease. Domain boundaries also become narrower, approaching the limit of resolution of the microscope, thus making difficult the task of recording the appearance and action of these domains on film. (F. S. Maddocks)

Recently a new approach has been made to one of our oldest problems,

the preparation of truly and precisely stoichiometric ferrites. Using known double salts which upon thermal decomposition will yield a ferrite, zinc ferrite has been prepared from the salt $ZnSO_4.Fe_2(SO_4)_3.2H_2SO_4$ and nickel ferrite has been prepared from $Ni_3Fe_6(CH_3CO_2)_{17}O_3OH.12CH(CHCH)_2N$. The products obtained are now being evaluated for purity and stoichiometry. (D. G. Wickham)

In the field of crystallography, the reference film collection is continued with recent additions of iron in all phases which might appear in our work. Assistance to Group 65 is being provided by examination of screen-grid-wire samples of the types used in the 7AK7 and its successors. Assistance is also provided to our own development work with lithium ferrites. (W. Croft)

The good promise of useful memory materials from lithium ferrite has required a more thorough approach. Work with memory cores themselves has been discontinued temporarily while a more thorough and firm grasp of the chemistry, stoichiometry, and processing is obtained. (D.Brown) Analytical problems with lithium ferrites are particularly troublesome and are a subject of current activity. Correlation of memory core composition and processing are continuing but the data are not as yet conclusive. (E.Keith, P. Reimers)

PHYSICS OF MAGNETIC MATERIALS (J. B. Goodenough)

Instrumentation

The large magnet for the vibrating-coil magnetometer is to be shipped from California 25 October. It will take about three weeks for it to arrive at Lincoln. Meanwhile a feedback circuit to stabilize the vibration amplitude of the vibrating coil has been designed and given to the drafting room, as also have designs for various sample holders, small furnaces, and other auxiliary parts for the magnetometer system. A jig has also been constructed for the winding of the two vibrating coils.

Work on the fast-rise-time current-pulse generator was interrupted by the failure of the high-voltage power supply. This should be back from Test Equipment by 25 October.

The galvanometer of the dc fluxmeter has been taken out of the instrument rack and is being built into a more stable holder to eliminate the mechanical disturbances which were causing difficulty.

Measurements

Measurements of the pulse permeabilities $\mu_{\Delta+}$, $\mu_{\Delta-}$, have been made on the current memory cores at remanence as a function of the maximum field amplitude H of the measuring pulse, $\mu_{\Delta+}$, representing the permeability when H is in the direction of the remanence, $\mu_{\Delta-}$, when H is

oppositely directed. The noise parameter $\delta = \mu_{\Delta -} - \mu_{\Delta +}$ turns out to be nearly proportional to H^3, whereas second-order theory had predicted $\delta \alpha H$. It is evident that the second-order theory is not capable of fitting the experiment for H in the range $H_c/5 < H < H_c$, where H_c is the coercivity of the maximum squareness loop.

B-H loops of 1 mil mo-Permalloy tape cores cut at various directions to the rolling direction have been taken. The B-H loops appear to be independent of the rolling direction.

Apparatus has been set up for the measurement of Young's Modulus on the 3% Si-Fe and 78% Ni-Fe specimens which are being used in domain pattern studies as a function of applied stress.

NEW COMPONENTS AND CIRCUITS (T. Meisling)

Circuits

Ed Cohler has designed and tested a nonsaturating flip-flop using surface barrier transistors. Such a flip-flop shows good promise. The rise and fall times are shorter than in the saturating circuits. On one model a maximum prf of 8 megacycles has been measured, but the circuit should be capable of greater speeds with some tailoring. The waveforms are not good, but may be improved by further engineering.

Paul Griffith has begun the testing of a matrix switch using SBT's in grounded-emitter configurations. Positive bias, RC combinations in the base connections, and load resistances are the factors which seem to have the greatest effect on turn-on and turn-off times.

Bob Freeman is attempting to measure the SBT turn-off time as a function of the static operating point chosen when the transistor is in saturation. In order to obtain meaningful measurements, it is necessary to provide well controlled input waveforms with rapid rise and fall times. This has been the principal difficulty so far. A high-impedance, mercury-relay driver (current source) has been built to solve this problem. The rise time of this driver is 15-20 millimicroseconds.

The emitter-follower inverter combination reported earlier (T. Meisling) has not been developed further because of lack of time.

Leo Jedynak is measuring the avalanche effect in a number of transistors. Some transistors possess amplification in the avalanche region. Since avalanche operation (similar to gas tube breakdown operation) is not hampered by hole storage, it could lead to a fast transistor switch.

SBT Hole Storage

An understanding of the hole storage phenomenon in the SBT is of importance to us because its control (in transistor production) is essential

to circuit performance with adequate time margins. C. T. Kirk has developed a model which takes into account essential effects not incorporated in previous analyses. Some months ago Philco introduced a practical hole storage measurement leading to a figure of merit M. Kirk has shown that a switching coefficient developed theoretically by Moll at BTL is related to M by the equation:

$$2M = \frac{\omega_n + \omega_i}{\omega_n \omega_i (1 - \alpha_n \alpha_i)}$$

where n is a forward or "normal" parameter
i an "inverse" parameter
ω the cutoff frequency
α the current amplification factor.

The above relation has been verified experimentally by Philco.

Kirk has also pointed out that Moll's analysis is inaccurate because it does not take into account the variation in emitter and collector efficiency due to varying emitter and collector concentrations.

Transistor Procurement

Thirty transistors, Texas Instruments 2N125, 2N126, and 2N127, have been received and tested. They are grown germanium n-p-n, 5-megacycle. Twenty Sylvania 2N94A's (n-p-n, 6-megacycle) are likewise available after testing.

Life Tests

Twenty-four of the very first SBT's put on operative life tests were removed and checked after 7000 hours of operation. One transistor was found to have an emitter-collector short. Photographs of wave shapes taken immediately before the testing show that the failure occurred during the checking operation rather than while the transistor operated in the circuit. The remaining 23 transistors showed no appreciable change.

Cryotron

Dudley Buck has tested three low-speed Cryotron multivibrators verifying the 4th power relationship between the L/R time constant and the central wire diameter when the control winding pitch is held constant. The circuit with the lowest frequency of operation delivers square waves at eight cycles per second. The highest delivers square waves at 2 KC.

A vacuum system has been assembled to vapor plate Cryotrons. By making a central wire which is effectively hollow, the normal resistance can be increased without modifying the zero-resistance superconducting state. Increasing the normal resistance will decrease the L/R circuit time constant. Because superconductivity is a skin effect with a skin

depth of a few hundred atom layers, the possible improvement in this direction is large. A further improvement can be had by filling the hollow central wire with a superconductor of higher transition field. Magnetic flux is thus exluded from the hollow, making the inductance of the control winding lower and decreasing the L/R time constant by a similar factor. The process then, consists of depositing a thin insulating layer on a fine niobium wire. Over this is deposited a thin tantalum layer, completing the central wire. Beyond this lies the possibility of depositing the control winding and automatically soldering the finished Cryotrons into place.

MEMORY (J. L. Mitchell)

Experimental Switch and Plane

The core switch has been operated with one, two-turn bias winding. The switch outputs are still not as uniform as we would like to have them. Most of this trouble is probably due to the driving circuitry. Three new switch-driver, current-regulator units will be installed next week, and should clear up most of our trouble. An investigation of the characteristics of the memory plane outputs has been started.

Cooling and Supplies

The Air Force has given us approval for the construction of the cooling systems, walls, ceilings, etc., in the basement of Bldg. A. The contractors will start work on 25 October and the job should be completed in five or six weeks.

256^2 Construction

Forty-five 64 x 64 memory planes have been accepted to date. A plane tester which will fit on a bench is being designed. If this unit is successful, it should help break the bottleneck which now exists in plane testing. Drawings have been started which show the location and wiring of all the units in memory.

Advanced Development

Efforts are being made to optimize Bradspies' sense amplifier. This work should be completed in the next few weeks. Work on the transistor core-driver is now centered around an effort to find a suitable transistor for the matrix output amplifier. In most of the units tested so far, the variation in beta is too wide.

The new punching jig which will be used for fabricating experimental printed memory planes has been received from the vendor and will be ready for test as soon as the alignment marks have been engraved.

LOGICAL DESIGN (W. A. Clark)

The TX-0 control is being reviewed by Mel Cerier. It appears to be desirable to provide for eight distinct modes of operation. These would include, in addition to a normal mode of operation, seven test modes to facilitate maintenance and marginal checking procedures, and to simplify "priming" the memory with read-in and test programs. Cerier will be assisted in this work by H. P. Petersen, who will join the section next week.

The course, "Logical Structure of Digital Computers," has had several meetings and the notes are being printed as 6M-3938 and subsequent supplements. The first two reports deal with the Turing machine.

SYSTEM DESIGN (K. H. Olsen)

Building 10

We sent the eight-digit multiplier, the magnetic tape handler, some test equipment and many components to Building 10 at MIT with the hope that our research assistants can work there with the same efficiency and inspiration that they worked with out here during the summer. We also plan to have our staff spend part time at MIT to help in the work there.

Power Supplies

Bob Hughes has designed and built several very promising transistor-regulated power supplies that have excellent dc and transient regulation. He is now packaging one that we will propose as standard test equipment.

TX-0 Control

Although we are influenced by the outside world that measures our success by how many transistors and how few vacuum tubes we use, we have just about decided to use a vacuum tube clock. This simplifies our register driver and will result in a significant saving of transistors.

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	298.0
Interrupting Incidents	21
Hours Lost	18.5
Percent Good Time	94.0
Mean Time Between Failures (hours)	13.3

The computer reliability decreased sharply during this biweekly period. There were three major sources of trouble:

1. Sudden failures of tubes and components
2. Loose connections of video cables and wires
3. Troubles introduced by maintenance personnel.

In several instances a considerable amount of time could have been saved if experienced personnel were on hand at the time of failures.

Fairchild Cameras

A steady-state failure of the camera to index was the result of the camera mainspring slipping out of its adjusting flange. An intermittent indexing failure, which shows up after several hundred consecutive operations, is being investigated.

Magnetic Drums

The GSR index on the si 1700 series of drum orders is now in operation on both drums and is being marginal checked regularly.

Four drum tracks were erased simultaneously without turning off the drum motor. The results obtained indicate that group erasure of the drum may be possible.

A cathode-follower in the coincidence circuits for the auxiliary drum failed (open heaters) and was not detected until a programmer obtained inconsistent results from the same program. The drum test programs did not indicate any fault. The nature of this trouble is such that a very sophisticated and lengthy program must be used to assure that failures do not go undetected. The program must be capable of selecting which register is in coincidence at the time the drum is addressed.

CAPE COD ENGINEERING (continued)

Personnel

W. Arnspiger, F. Sturm, and R. Barlow of WE-ADES have terminated their work with our section to accept new assignments.

A. Gumbs of WE-ADES will continue to work with T. Sandy in preparing for future Cape Cod and ESS semiautomatic height finder sub-system tests.

Cape Cod Direction Center - Mapping Room Camera System

A recent request from Group 22 to install seven cameras to take scan-by-scan pictures will soon be fulfilled. Four of the cameras will be installed at mappers to record the data from the following gap fillers: Chatham, Scituate, Derry, and Halibut Point (Rockport). The other cameras will be mounted on 16" display consoles to permit photographing of individual displays of FGD, Mark X, and all radar data.

To simplify the installation, the following gap filler inputs have been disconnected at the Barta Building: Chestnut Hill, Clinton, Martha's Vineyard, and Nantucket. Each of the remaining GFI sites will connect to two mappers having identical displays (one of the two mappers will have a mounted camera).

The camera control systems have been installed and checked out. We expect to receive the cameras and their mounts during the coming biweekly period.

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

Equipment Program Services Committee (EPSCOM) (R. P. Mayer)

Three memos are being prepared to describe the activities of EPSCOM: (1) "Equipment Program Services Committee (EPSCOM) Organization and Procedures," to outline the purpose of EPSCOM and the way in which it will work with other organizational groups; (2) "Programming Activity for Systems Tests and Maintenance," a revision of 6M-3876 to bring it up to date and to clarify some points; (3) "Proposed Detailed Tasks and Schedules for EPSCOM" to suggest the specific programs that may be required and to suggest (in more detail) the tasks which should be in process at all times.

EPSCOM programmers should bring their written Biweekly Reports to the EPSCOM biweekly meetings which are normally held at 2 p.m. on biweekly Fridays. It has been suggested that BTL and WE programmers who are working with EPSCOM should also follow this procedure so that a coor-

dinated Biweekly Report can be prepared.

A. Werlin and J. Mazza have prepared a detailed flow diagram and cross-referenced program instruction listing for the MTC DDT/DDR/GFI program, now known as the "General Data Transmission" program. This program has been used for checking DDT's, DDR's, phone lines, and magnetic tapes at both 1600 and 1300 cps, with both GFI and LRI types of messages.

Considerable effort was expended in debugging the GFI analysis feature of the program, which checks 14 bit parallel words from the GFI core registers.

Work was started in expanding the program to provide a tabular printout of transmission errors for use in checking phone lines with magnetic tapes.

A.Vanderburgh has started to prepare a detailed descriptive document for this generalized program. It has been estimated that this job will take several months.

XD-1 Pattern Checking

W. Marston (BTL) and B. Beatty (WE) have been working on a program which will detect duplicated, extra, and missing returns from sites generating a pattern. This program will accept any pattern of range and azimuth that can be punched on cards. This program is probably about 50 per cent completed, not counting debugging time.

A program which simulates the pattern generated by FST-1 equipment at gap filler sites is being prepared to test the above checking program. The control consisted of specifying the starting azimuth, and the number of expected range returns shipped at the azimuth, and the number of words to be computer test written on GF drums.

A previous program has been temporarily abandoned in favor of the more general purpose program above. The abandoned program predicted the next expected return from a GF site transmitting the FST-1 test pattern in order to detect and specify types of errors.

XD-1 Tracking

TESS0000, a single-track tracking program for the Experimental Subsector, is at present a skeleton program in partially working condition. It consists of C. S. Sherrerd's (BTL) Master Control Program, S. Thompson's conversion routine, and H. Rundquist's tracking display and print-out routines. It will read all GFI and LRI input radar

XD-1 Tracking (continued) CONFIDENTIAL

data from the drums and process the data of a single track. The radar source of the data to be used for the particular track shall be selected by push buttons on an auxiliary console, and the track and noise returns from that site shall be displayed in normal fashion.

The portion of TESS0000 which shall read and interpret the manual input core matrix has yet to be written. This portion is to be completed and checked out by the time the conversion and tracking routines are available. In the meantime, however, a program for the generation of simulated radar data (GSRD0000) is being written to furnish simulated noise and track data for the checkout of the above tracking program. Two subsidiary programs (GRNS0001 and ODFS0000) were just completed for the production and examination of 40008 random numbers to be used by GSRD0000 for generating simulated noise data. GSRD0000 shall be completed and available about 1 November and TESS0000 in complete form about 1 December.

The decimal printout routine is completely checked out. This prints:

1. Clock time
2. x, y predicted
3. The average x, y from all sites
4. The deviation from the average of each individual site return.

All numbers are to the nearest 0.05 except clock time which is to the nearest 0.01.

The correlation, smooth, and predict portion is written and nearly debugged.

A track display routine has been written, but not checked out. It displays the course and speed of the aircraft, and whether its current position is a Mark X, radar, or dead-reckoned position.

XD-1 Crosstelling with WWI CONFIDENTIAL

R. C. Mayberry (WE) is preparing an XD-1 program in which XD-1 will be slaved to WWI. WWI will originate messages in batches of 24 and send them to XD-1, where they will be counted and stored. When all messages have been received, or when sufficient time for 24 messages has elapsed, the 24 messages will then be sent back to WWI where each word received will be checked against the original word. The program has conditional halts for allowing the operator to stop the computer if the designated number of words (per batch) is not received, or if the parity is incorrect.

XD-1 Crosstelling with WWI (continued) CONFIDENTIAL

A program is also being written to check the above program before it is used in a crosstell test between the two computers.

G/A Output (C. W. Watt) CONFIDENTIAL

A test team consisting of I. Aronson and C. W. Watt of Division 6, J. E. O'Brien and Frank Boudreau of Group 311, and Ellsworth Johnson of IBM have met several times to discuss ways and means of producing adequate phone line test messages for the checkout of the GE data link equipment. The immediate problem of getting a repetitive phone line message to Prospect Hill so that the laboratory model demultiplexer can be made operative has been solved by the use of the output test word generator in the output section of XD-1. Starting Monday, 24 October, IBM will make this equipment available to Group 311 for about two hours a day. Group 311 will attempt to record this repetitive single word message on an Ampex single channel recorder for use at Prospect Hill when the XD-1 outputs are not available. No conclusion has been reached as to the exact method by which the more complicated test message that is needed by Group 311 can be produced. It seems clear that none of the computers can be tied up for long enough stretches to make it possible to use them as signal generators and even if this were not true, such output would be highly uneconomical. Presumably Group 311 will have to build some special test equipment to simulate for test and maintenance purposes the output of XD-1.

Crosstelling Output (C. W. Watt) CONFIDENTIAL

The test team for testing the XD-1 to WWI crosstelling link met 11 October to discuss plans for the immediate future. It was agreed that the crosstelling tests would start with WWI generating the test message and checking it again after it had been stored in XD-1 and retransmitted. Programs for both WWI and XD-1 to accomplish this are now being written and tested. The second phase of this test will be to reverse the situation with XD-1 sending and checking the message. It is expected that the first of these tests will be started by the end of October.

VACUUM TUBES

(Group 65, P. Youtz)

TUBE TECHNIQUES (J. S. Palermo)

A new design of the 5-inch display tube for the Kelvin & Hughes projector was processed and sent to Group 62 for evaluation. A Typotron tube which had failed on life test was reprocessed without the flood gun and with a P-14 phosphor instead of the P-1. The target assembly was removed and stripped of everything except the storage mesh. This mesh was used in the reprocessed tube to evaluate the characteristics of post-acceleration using a fine mesh near the screen. IBM reported that Hughes has been having production problems with the Typotron tubes for the past two months. The production and processing of the target assembly was the problem area. We have been dissecting all of the Typotron tubes that have failed on our life test to study the Hughes processing methods and have been making some target assemblies in our own laboratory with all parts from dissected Typotrons.

CHARACTRONS (P. C. Tandy)

Five MIT 19-inch tubes and one Convair Charactron have completed from 2038 to 6230 hours on life test. When transfer characteristics of pulse-matrix current and pulse-cathode current vs. pulse grid-cathode voltage were made on six tubes, one MIT and one Convair tube were rejected. A second Convair tube was rejected for grid-cathode leakage. All three tubes would have failed at the previous testing period for the same reason, but were continued on life for another period. The only Convair tube having a uniform cathode is 0174. It has completed 1967 hours.

A gas test was made on the above tubes and on six tubes to be started on life shortly. No significant changes between testing periods were noted.

Thirteen cathode-study tubes have completed from 2422 to 2733 hours. One tube has shown signs of grid-cathode leakage. Two tubes started by A. Zacharias are continuing to operate on test.

A Typotron production tester has been installed and is now operating. IBM personnel are now testing tubes which will be started on life test in the future.

The Typotron life test is operating. The eight tubes started by L. B. Martin are continuing on life test.

Four triode and six diode tubes with sintered cathodes are operating

CHARACTRONS (continued)

on life test. Twelve additional triode positions and two more diode positions are available for future tubes.

The cathode-study life test racks will have to be expanded from 60 to 72 positions to accommodate the proposed group of 12 sintered cathode tubes. The CT test position, which will be used for acceptance tests and other tests that cannot be taken in the life test rack, has been designed. Construction on this unit will be started shortly. The CT life test program can be started before this test position is completed, since other testing facilities can be used with the first tubes.

RECEIVER TUBES (S. Twicken)

I attended a meeting with IBM and GE at Clifton, New Jersey, relative to the impending change in 0528 production from the "normal" 220-alloy cathode sleeve to the "passive" P-50 alloy. The use of P-50 for the 0528 has been under investigation by GE for a considerable period of time. It should reduce markedly, if not eliminate completely, the cathode interface impedance problem. The minimum 2000-hour acceptance life test required of new materials by the tube specification has been completed by GE. The only remaining problems are those associated with a small grid design modification necessitated by the difference in processing required of the passive alloy and the use of a thicker cathode wall.

A detailed discussion was held with the Power Section relative to the ramifications of filament voltage cycling and regulation, operating bulb temperature and forced-air cooling, and tube problems in general. The basic problem is the method and criteria for applying filament voltage to a frame which has previously been shut down for some reason.

Bendix, as second source of the AN/FSQ-7 gate pentode, is unable to obtain from Sylvania the details of a patented process by which a black surface is formed on the screen grid lateral wire. After making inquiries in the industry, Bendix has tentatively obtained a supplier of the screen grid wire blackened by a similar, if not identical, process. Bendix has requested that we determine whether any differences exist between the surface films of the Sylvania wire and that of their tentative supplier. This investigation is being conducted by J. S. Palermo. Any differences may represent a potential source of tube production and life difficulties. Initial chemical analysis indicates a difference between the two samples of blackened "D" nickel grid wires. However, since these tests were inconclusive, F. E. Vinal of Group 63 will supplement our chemical analysis with X-ray diffraction studies.

RECEIVER TUBES (continued)

An insulation resistance test set for general use has been completed, debugged, and placed in operation.

COMMERCIAL TUBES (T. F. Clough)

"Lincoln Tube Process Specification" sheets for the exhaust and cathode processing cycles to be used in the cathode study program of Groups 62 and 65 are being prepared.

PRODUCTION COORDINATION OFFICE

(Group 66, B. E. Morriss)

TIR's AND COORDINATION (W. H. Ayer, H. J. Kirshner)

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

TIR #	DOCUMENT #	SUBJECT:
1-107	6M-3907	SAGE Growth and Flexibility Recommendations for Building Planning, dated 11 October 1955.
1-108	6M-3682	Mimic Panel for Maintenance and Programming Area, AN/FSQ-7, dated 13 September 1955.
1-109	ADES Manual	Western Electric - ADES Manual, Internal Communications Combat Center, dated August 1955.

FACILITIES (W. H. Ayer)

On October 18, 1955 a meeting was held at Western Electric Co. with representatives of IBM, Western Electric, Lincoln Laboratory, and the ADES Project Office to establish the general area requirements and layout for a combined DC-CC building, using the redesigned DC plan as a starting point. One-line sketches of the proposed design will be submitted to the ADES Project Office and all interested organizations for approval the latter part of this week. It is essential that any remaining problems in this joint design be resolved as rapidly as possible since the first opportunity for construction of the new DC design has turned out to be a combined DC-CC location.

POWER (J. J. Gano)

Equipment-Cooling Loads

At a conference between IBM and Lincoln personnel, IBM agreed to assume the responsibility of maintaining the loads up to date and presenting them in a useful form to Western Electric. Western Electric will be asked to determine what other information is required to enable them to design the equipment-cooling system. IBM and Lincoln will also give the problem some thought.

M-G Set Evaluation and Filament Cycling - SAGE

A meeting was held with the IBM power group to discuss elimination of the M-G sets. On the basis of Jackson and Moreland's study on transients and Coffin's tests on computer reliability, the reliability of a system without M-G sets is about the same as that with M-G sets, perhaps slightly higher. IBM will write a proposal for their elimination. IBM will also write a separate proposal for filament cycling on a frame basis using thermistors when the proper types are available and using resistors in the interim if necessary. The thermistors give a better cycling, but the resistors perform acceptably. This recommendation is not based on

POWER (continued)

M-G set elimination, but on the fact that frames of equipment will be de-energized frequently.

XD-1

A draft of a report on acceptance tests for the power system was reviewed with IBM personnel and minor differences were settled.

The GE project engineer on d-c supplies has indicated that GE will not replace components on all supplies if only one has broken down unless we can prove that the application is faulty. Several components have been criticized by our components section as not being the most reliable.

MTC

The motor-generator set for the d-c supplies has been bypassed on a trial basis. There is no filament generator.

COMMUNICATIONS (C. J. Carter, W. O. Glass, and F. E. Irish)

A preliminary edition of the SAGE Internal and External Communications documents published by WE-ADES has been reviewed by Divisions II, III, and VI. A meeting will be held at WE-ADES on 25 October 1955 to discuss these and other comments that have been made. The final editions should be published about 14 November 1955.

The key-designation strips for the XD-1 telephone key units have been typed and are now being photographed. We are having trouble obtaining in a small quantity a white lacquer needed for coating the back of these strips.

A temporary provision for forcing cooling air through the instrument bay of the XD-1 data patching console has been made.

The defense coordinators of the NET&T Co. visited Lincoln Laboratory on 18 October. They were briefed on SAGE operations and were given a tour of Building F.

ADMINISTRATION AND SERVICES

(Group 60, J. C. Proctor)

PERSONNEL

New Staff

Assigned to Group 61

Jean C. Bryan received her BA in Physics from Mt. Holyoke College in June.

Russell Collmer received his MS in Math from the State University of Iowa and was employed by Temco Aircraft.

Elsie M. Morrione received her BS in Civil Engineering from Northeastern University and was employed by Charles T. Main, Inc.

Louie M. Thomas received his BA in Math and Physics from the University of Minnesota and was employed by the Naval Ammunition Depot.

Marilyn J. Verdier received her AB in Chemistry from Radcliffe College in June and was employed as a Research Assistant at MIT in the Biology Department.

Assigned to Group 62

Michael J. Flanagan received his BS in EE from Rensselaer Polytechnical Institute and was employed by the Bell Aircraft Corp.

Thomas C. Stockebrand received his BS in Mechanical Engineering from the California Institute of Technology and was with the Army as a Field Engineer.

Assigned to Group 66

Geno L. Piantoni received his BS in EE from Indiana Technical College and was employed by Sprague Electric Company.

Terminations

John Russell is now employed by the A. O. Smith Company in Milwaukee, Wisconsin.

John Newitt is now employed by Hi-Vacuum Corporation.

PERSONNEL (continued)

Transfer

Norman Daggett has transferred from Group 63 to Group 62.

MATERIAL (H. B. Morley)

Because of the increasing use of our catalog file, it has been decided to expand our facilities by adding new and different catalogs, a manufacturer's representative file and a product cross-reference.

The Purchasing Department has received approval for the TX-0 Equipment Cooling installation in Building A and the order has been placed.

ENGINEERING (A. R. Smith)

Transistor Socket Punch Press

An air press for punching up to 1/8" linen base phenolic board for transistor sockets is expected to be completed during the coming week. The press itself has to be modified slightly to properly strip the board from the punch.

Air Flow Problems

Group 66 has informed this office that its orifice testing program is approaching completion. This presents an opportunity to study further problems, yet unanswered, involving air flow within a modular type construction.

If any individual is in search of such information, please contact L. B. Smith during the coming week to determine feasibility of a study program. Since the equipment has been borrowed or rented, investigations will, unfortunately, have to be limited to the more pertinent problems.

COMPONENT ANALYSIS (C. Morrione, H. W. Hodgdon)

Hodgdon and Morrione visited the new IBM Component Test facilities at Grand Street in Kingston, New York, The close liaison of the past months has effectively reduced duplication of effort between our component test lab and that of IBM.

TEST EQUIPMENT (L. Sutro)

The Test Equipment Committee has approved the purchase of the following:

TEST EQUIPMENT (continued)

Manufacturer	Unit	Type	Qty.
Burroughs	10 Mc Pulse Generator, pulse width 0.03 to 0.06 μsec	1050	5
Burroughs	Power Supply for above	9801	2
Simpson	Multimeter	260	12
ECA	Tubeless power supply, 2 outputs, 0-1/10/100 volts, 100 ma.	110 PM	6
Northeast Scientific Corp.	High voltage supplies for TX-0 display system		4

Test equipment headquarters has been compressed into a four-module area where the following services will be performed:

Supply - Chris Christopher will try to supply you with the test equipment you require either from stock in basement of A, from places in the laboratory where it is little used, or from Division 7 instrument room.

Maintenance and Repair - Anthony Bille will direct maintenance of the 2500 units of test equipment, at the rate of once a year for standard test equipment and once every six months for scopes and meters.

STUDIES IN PROCESS

Study	Responsibility of
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
Pattern Recognition (for Grp. 24, 34)	A. D. Hughes
Simulation (for Grp. 22)	H. Neumann, B. Stahl et al
New Control Design MTC	E. Gates, H. Ziegler
High-Speed Punch Installation MTC	A. D. Hughes
FSQ-7 Teletype Input System	R. Gerhardt
Bomarc, IM-99	H. E. Anderson, J. P. May
GFI Excess Target Alarm	S. B. Ginsburg

ACCESSIONS LIST

(CONFIDENTIAL)

(Frances Christopher)

The following documents were published by Division 6 or received from IBM during the period 10 - 21 October 1955:

NO. 6M	AUTHOR	TITLE	CLS.
ADMINISTRATION AND SERVICES (Group 60)			
3931	Div. 6 Staff	Biweekly Report for 7 October 1955	C
A-184	J. C. Proctor	Report Editor	U
A-185	F. P. Hazel	New Procedure for M Notes Distribution and Abstracting	U
SAGE SYSTEM TEST AND PLANNING (Group 61)			
2966-1	R. L. Smith	Telephone and Intercommunication Facilities for the 1954 CCS	C
3720 S#1	P. Bragar	Operational Specifications for Raid-Forming in a Sage Direction Center	C
3720-1	P. Bragar	Same title	C
3728 C#1	R. R. Reed	Category and Display Assignment BIT Assignments for Sage Situation Display Console	C
3766 S#1	D. L. Bailey	Operational Specifications for Track Detection and Initiation in Sage System	
3766-1	D. L. Bailey	Same Title	C
3774 S#1	E. Wolf F. Brooks	Operational Specification for Sage System Radar Data Inputs	C
3774-1	E. Wolf	Same Title	C
3826	J. Ishihara F. Brooks	Operational Specification for Track Monitoring in the Sage System	C
3828 S#1	H. Frachtman	Operational Specification for the Height Finding Function in a Sage Direction Center	C
3924	A. P. Hill	Syllabus for Sage Familiarization Course 17-28 October 1955	C
3932	A. Wright-BTL	Cape Cod System Weekly Operations Schedule	C
3934	W. F. Harris	Proposed Organization of the Sage Master Direction Center Program (Operational Active)	C
3937	P. R. Vance C. A. Zraket	Group 61 Duplex-Standby Activities	C

6M-3956

ACCESSIONS LIST (Continued)

NO. 6M	AUTHOR	TITLE	CLS.
SAGE SYSTEM TEST AND PLANNING (Group 61) Continued			
3944	A. Wright-BTL	Cape Cod System Weekly Operations Schedule	U
3948	S. Hibbard	Requirements for Air Force Operator Personnel to Man XD-1 Prior to 1 June 1955	U
5073	G. Lewitzky	Test Specifications: System Operation Tests, Series I	C
5074	H. A. Keit	Initiation Studies and Tests	C
FSQ-7 PROTOTYPE DESIGN AND INSTALLATION (Group 62)			
2877 S#8	R. S. Fallows	Changes in Display Specifications	U
3893	N. Jones R. Buzzard	Minutes of CP DD Desk Meeting of 13 September 1955	U
3902	F. R. Durgin	Preliminary Specifications for Modifications to Auxiliary Data Processing Equipment	U
3916	R. D. Buzzard	Inactivity Alarm for XD-1 and AN/FSQ-7, AN/FSQ-8	U
3929	R. D. Buzzard G. J. Essler	Proposed Specifications for Status Boards for the XD-1 Command Post	U
3939	L. L. Sutro	Test Equipment Committee Meeting 23 September 1955	U
3942	J. Giordano	Minutes of the IBM-LL/SO Concurrence Meeting #41 Held at Lincoln Laboratory 14 October 1955	U
3945	J. Giordano	Minutes of Two Sage Experimental Subsector Planning Approval Committee Meeting Held 10 October 1955 and 17 October 1955	C
ADVANCE DEVELOPMENT			
3938	W. E. Clark	The Logical Structure of Digital Computers-The Turing Machine	U
3938 S#1	W. E. Clark	Same Title	U
PRODUCTION AN/FSQ-7 AND CAPE COD DIRECTION CENTER			
3904	C. W. Watt	Minutes of Meeting to Discuss the Recommendations of the Committee on Failure Reporting	U

ACCESSIONS LIST - Continued

NO. 6M-	AUTHOR	TITLE	CLS.
PRODUCTION COORDINATION OFFICE (Group 66)			
2926-3 C#1	W. H. Ayer	Lighting Requirements for AN/FSQ-7 Direction Center	U
2926-3 S#1	E. L. Smiley	Same Title	U
3090 S#1	E. L. Smiley	Synchronized Clock System for Sage System Direction Center	U
3147-3	R. R. Shorey	Master Reference List, Lincoln Laboratory Requirements for Direction Center Bldgs.	U
3189-4	E. D. Lundberg	Summary of Lincoln Laboratory Technical Information Releases Pertaining to the Sage System Issued by the PCO Office (Cumulative List thru 30 Sept. 1955)	U
3515-2	J. J. Carson	Proposed Site and Equipment Locations in the Experimental Subsector	S
3682	A. S. Chopourian G. F. Sandy	Mimic Panel For Maintenance and Programming Area AN/FSQ-7	U
3907	W. H. Ayer	Sage Growth and Flexibility Recommendations for Building Planning	C
3919	E. D. Lundberg	ADES-Lincoln Engineering Meeting of 28 September 1955	U
3933	E. D. Lundberg	Sage System Meeting 10 October '55	U
3941	E. D. Lundberg	Sage System Meeting 17 October '55	U
OTHERS			
3914	P. Griffith Group 7007	The Application of Transistor to Multiposition Selection Switches	U

IBM DOCUMENTS

833	R. Lowrie	Methods of Radix Conversion--Project High Engineering Report	U
834	R. F. Murray et al	Phase XI System Test Plans for Long Range Radar Input System	U
835	M. M. Astrahan et al	Computer Reliability Through Marginal Checking and Maintenance Programming	U
836	J. H. Fraser	Progress Report AN/FSQ-7 & AN/FSQ-8	C
837	----------	Central Reference Room Bulletin #99	U
838	W. A. Jackson	Project High Engineering Report--Duplex Printed Card Assemblies (Basic Circuits)	U

ACCESSIONS LIST (Continued)

NO.	AUTHOR	TITLE	CLS.
		IBM DOCUMENTS (Continued)	
839	W. Rooney	Project High Semi-Monthly Report #62	C
840	J. H. Fraser	Progress Report AN/FSQ-7 & AN/FSQ-8	C
		LL-DR DOCUMENTS	
413	H. E. Anderson	Concurrence on the Proposal Warning Light Interconnection Unit for XD-1	U
431	R. A. Imm	Concurrence on Change to AN/FSQ-7 Console Equipment & Label Layouts	U
432	P. A. Beeby	Concurrence on the Changes to the Specifications for Duplex Maintenance Console	U
433	J. J. Coughlin	Changes in the Output System to make Possible Faster and More Thorough Diagnostic Programming Procedures for XD-1, XD-2	U
434	P. A. Beeby	Change to Specifications for Simplex Maintenance Console	U
435	R. A. Imm	Concurrence on 38-3	U
436	R. A. Imm	Concurrence on 95-1	U
437	P. A. Beeby	D72-1 change to D72, Proposal for Auxiliary Drum Marginal Checking and Distribution Unit for Production FSQ-7	U
438	P. A. Beeby	Minimum Equipment List for AN/FSQ-7 Combat Direction Centrals	U
439	Rand Corp.	Pact I Manual- Rand Corp. -- Project for the Advancement of Coding Techniques	U
440	Rand Corp.	Pact Primer - Rand Corp.	U
441	W. S. Squire	Display System Ground Rules	C
442	H. J. Barton	Change to Concurrence Letter for the Specifications for the Duplex Maintenance Console	U
443	H. Van Allen	Modification on Warning Light Specifications for Duplex Central	U
444	C. E. Langmack	Changes to Crosstelling Input Specifications Duplex Central	U
445	M. C. Portanova	Changes to DC Output System Specification	U

ACCESSIONS LIST (Continued)

NO.	AUTHOR	TITLE	CLS.
		LL-DR DOCUMENTS (Continued)	
446	R. J. Trivison	Perselbsn Codes	U
447	P. Longo	Concurrence on M Revision of Drawing 5001-31007	U
448	R. A. Imm	Concurrence on Changes to Specifications for Manual Input Frame Duplex Central	U
449	C. E. Langmack	Changes to Specifications for Manual Input Frame Duplex Central	U
450	C. E. Langmack	Change to Specifications for the Duplex Maintenance Console for the Prod. System	U
451	R. A. Imm	Concurrence on Change to Specifications for the Duplex Maintenance Console for the Production System	U
452	R. A. Imm	Concurrence on Change to the Concurrence Letter for the Specification for the Duplex Maintenance Console	U
453	R. A. Imm	Concurrence on Change to Crosstelling Input Specifications Duplex Central	U
454	R. A. Imm	Concurrence on Modification on Warning Light Specifications Duplex Central	U
455	R. A. Imm	Concurrence on Specifications for Utilizing the Kelvin-Hughes Rapid Processing Photographic Projector System in the Sage System, 6M-3913-1	U
456	H. J. Barton	Drum Specifications for the Production System (IC Drum Field Control)	U
457	R. A. Imm	Concurrence on IC Drum Field Controls	U
458	J. F. Mills	Concurrence on Change to AN/FSQ-7 Auxiliary Console Specifications for XD-1 and XD-2 and the Prod. Machine	U
459	R. J. Paddock	Installation of Operation Program Circuit on Xd-1, XD-2 and Prod. 723 Punch Machine	U
460	R. C. Marden	Concurrence on Command Post Digital Display Desk Specifications For XD-1	U
461	R. C. Marden	Changes in Selection Control to Make Possible Faster & More Thorough Programming Procedures in the Output System for XD-1, XD-2	U

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NO.	AUTHOR	TITLE	CLS.
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463	R. C. Marden	Concurrences on 6M-3583-1	U
464	R. J. Paddock	Supplement Sheets to Warning Light Cable Document	U
465	R. J. Paddock	Changes in Warning Light Cabling for Mapper Consoles	U
466	C. E. Langmack	Change to Duplex Central Specification for the GFI Mapper-Counter Frame	U
467	C. E. Langmack	Change to Duplex Central Specifications for the GFI Mapper Consoles	U
468	R. A. Imm	Concurrence on Minimum Equipment List (MEL) for AN/FSQ-8 Combat Control Center Modification A Site 3	U
469	H. Van Allen	Modification of AN/FSQ-7 Console Equipment and Label Layouts	U
470	R. A. Imm	Concurrence on Modification of AN/FSQ-7 Console Equipment Label Layouts	U
471	H. J. Barton	Clock Register	U
472	R. A. Imm	Concurrence on Clock Register	U

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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 and 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
DDT	digital data transmitter
ECM	electronic counter measure
ECP	engr'g change procedure
EMAR	experimental memory address register
ESS	experimental subsector
FGD	fine grain data
FF	flip-flop
FGRX	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
PRF	pulse repetition freq.
RAFD	Rome AF Depot
RD	radar data
SAGE	Semiautomatic Ground Environment
SBT	surface barrier transistor
SAR	storage address register
SD	situation display
SDG	SD generator
SDV	slowed down video
SIF	selective identification feature
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

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ADVANCE DEVELOPMENT (continued)