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Memorandum 6M-4239

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

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SUBJECT: BIWEEKLY REPORT FOR PERIOD ENDING 9 MARCH 1956

To: Jay W. Forrester

From: Division 6 Staff

Date: 16 March 1956

Approved: *JW Forrester*

By: *JW Forrester*  
Date: *3-22-60*  
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SAGE OPERATIONAL PLANNING

(Group 61, D. R. Israel)

DIRECTION CENTER (J. Ishihara)

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Air Surveillance (E. Wolf)

S. Ornstein has issued a draft of Supplement #1 to the second draft of 6M-3816, "Operational Specifications for Crosstelling in the SAGE System." Paul Stylos is solving the problem of minimizing the maximum error associated with the required altitude correction for radar data. Revisions to 6M-3744-1, "Operational Specifications for SAGE System Radar Data Inputs," are being processed by R. Miller.

Identification, Manual Inputs, and Weather (S. Hauser)

A rough draft of a memorandum on XD-1 weather has been written and will be circulated for comment. A memo on the use of the O47 in the manual-input function is being written.

WWI-SAGE Crosstelling System (S. Hauser)

Programming and program checkout continue. Documentation of program specifications and coding specifications is being generated with the programs, and circulation of the specifications is limited now to the subsection.

Manual intervention and dynamic display	checked out
Sequence control and time buffer	checked out
Present radar display	checked out
Light gun action storage makeup	checked out
Switch read-in storage makeup	3-12-56
Geography display	3-12-56
Radar inputs	3-19-56
Track history display	3-19-56
Track situation display	3-19-56
Switch interpretation	9-19-56

COMBAT CENTER (W. Lone)

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A second draft of 6M-4031, "A Guide to Combat Center Operation," has been prepared which incorporates decisions reached with the 4820th Air Defense Wing regarding combat center operations. One decision was to eliminate a display of the air situation of each individual subsector of a sector. This results in a considerable saving (approximately 500) of display slots. Presently planned display requirements fall well within the 1536-slot capacity.

Operational specifications for the combat center are being prepared.

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WEAPONS DIRECTION (J. J. Cahill, Jr.)

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Preliminary approval has been given by the 4620th ADW with regard to existing drafts of corrections to the operational specifications for antiaircraft, intercept direction, raid forming, and weapons assignment. In order to shorten the time required to prepare a set of "firm" specifications in those areas, it has been decided to proceed to the preparation of drafts of second revisions to these specifications without the formality of issuing final drafts of all the correction memos. All the material required for the drafts of the corrected OPS specs is in hand, and no delays in issuing these drafts are expected.

The final draft of the antiaircraft mathematical specification has been issued. Informal approval has been granted by the 4620th to existing drafts of the intercept direction and weapons assignment math specs. Final drafts of these specifications are in preparation and are expected in the next few weeks. A few changes in the raid forming math spec have proven necessary, and a first revision of that specification is in preparation.

In view of the above, the list of "firm" master specifications in the weapons direction area is as follows:

	<u>Operational</u>	<u>Mathematical</u>
Antiaircraft	6M-3739-2 (in prep.)	6M-3982 (issued)
Intercept Direction	6M-3786-2 ( " " )	6M-3927 (in prep.)
Raid Forming	6M-3720-2 ( " " )	6M-3973-1 (in prep.)
Weapons Assignment	6M-3744-2 ( " " )	6M-3926 (in prep.)

DATA SIMULATION AND REDUCTION (W. S. Attridge, Jr.) CONFIDENTIAL

Data Reduction (R.Olsen)

The draft of the data reduction operational specification is being revised according to suggestions from other members of Group 61.

Recording

Ed Lafferty is working in Group 67 for a two-week period in order to help Group 67 provide the master operations recording tape format by March 26. This format is a necessary prerequisite to further work on data reduction program planning.

MTC Operation

Program checkout has been delayed because MTC is not yet operative.

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ESS DC IMPLEMENTATION AND COORDINATION

(Group 62, J. A. O'Brien)

ANALYSIS AND SCHEDULING (C. W. Watt)

The bar chart on the next page summarizes XD-1 operation on a bi-weekly basis for the past three months. The information for these charts is derived from the extensive records kept by IBM, and more detailed studies of the reliability by areas and of components are also made from these records. Information on these studies can be obtained from P.B. Harris or C.W. Watt, both at Ext. 822. This chart will be kept up to date in future BIWEEKLY reports.

XD-1 Maintenance Coordination

The operation of the various areas of XD-1 show, in general, a trend toward more reliable operation. Special attention is being currently given by both IBM and MIT to the magnetic tape units, where the cause of the troubles remains obscure. Biweekly meetings on maintenance policy and procedures are being held between MIT and IBM personnel and several improvements in logkeeping procedures and assignment of responsibility for trouble location have been made as a result of these meetings.

EXTERNAL EQUIPMENT AND COMMUNICATIONS (I. Aronson)

Wire Communications (F. Irish, C. Carter, W. Glass)

A meeting was held on 8 March with representatives of NET & T Co., AFRCRC, Rome AF Depot, and Middletown AMA to discuss the ESS communication facilities to TP-2. Responsibilities for performing the necessary details of installation and interconnection were discussed and assigned.

Lamicaid labels for the data patch panel were designed and will be installed.

Engineers from BTL are now at Lexington and So. Truro to install an experimental model of the SAGE type slot-signalling equipment to be used on G/A radio.

Nine new external telephone circuits have been installed including a manual tie line each to the Air Divisions at Roslyn AFS and Hancock AFB and a dial circuit to the 515th AAA Opns. Det. at Ft. Banks.

Three groups of Bell System visitors were escorted through Bldg. F.

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PROGRAMMING (R. P. Mayer)

EPSCOM

One programmer has joined EPSCOM, Glenn Paulsen, W.E., Co., and two have left for other duties at Western Electric, Bruce Beatty and James Jobb, leaving 29 people in EPSCOM.

Immediate maintenance of external equipment in ESS requires the coordinated use of several EPSCOM programs. Arnold Werlin (Lincoln) is working on this coordination. Longer range maintenance plans for ESS and SAGE are being initiated by Group 62. James Wong (RAND) is the EPSCOM representative in this planning.

The geographic vector display program used within the generalized single-track test program for sub-system testing is completed and operating successfully. Work is now being done to include the georef coordinates with the map.

A program is being written to analyze LRI data of targets from the sun during sunset hours. It is hoped that this data will be useful for antenna orientation for the sites.

A study will be made to see how some of the existing test programs can be incorporated into a maintenance program for ESS (A. Werlin)

EPSCOM Utility Program (M. Dolan, G. Sherrerd)

The EPSCOM utility and test program tape read-in system, for use until the Group 67 utility system becomes available, has been completed and a memorandum concerning its use has been written.

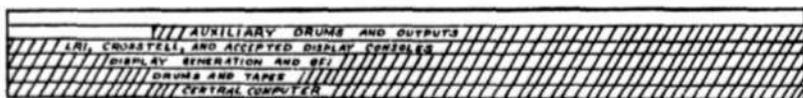
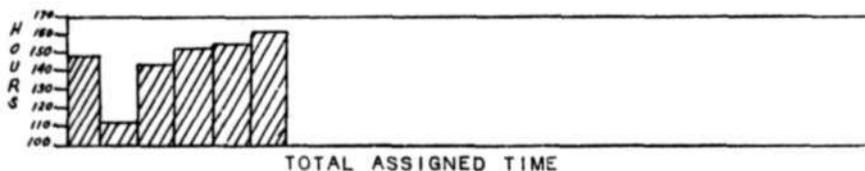
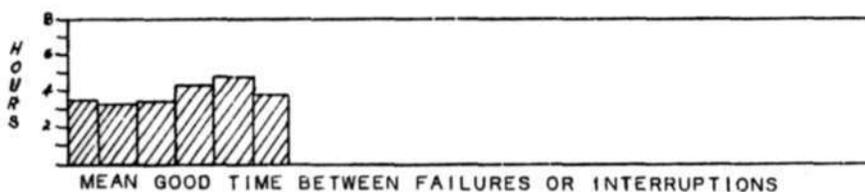
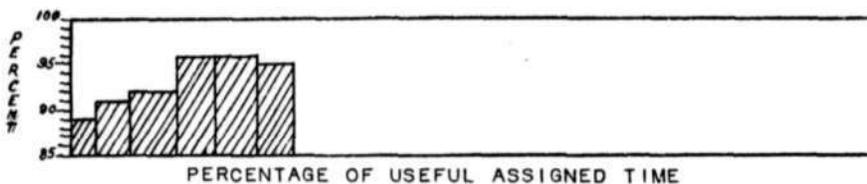
EPSCOM Tracking (C. Sherrerd, M. Dolan)

The rewriting of the tracking program for use with external equipment subsystem acceptance testing in SAGE production subsectors is progressing. A basic block of instructions comprising the skeleton of the program should be ready for compiling by 15 March.

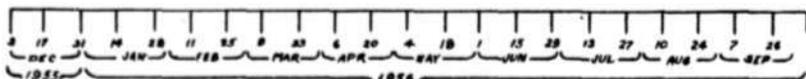
Requests have been received from the LRI test team for (1) far greater accuracy in the tracking equations, and (2) capacity for several tracks from separate radar sites. The incorporation of these requests into the program is now being planned. Work has been started on 15-bit accuracy sine-cosine table generation.

Work has begun on the height-finder tracking program. No scheduled date of completion has yet been set.

AN/FSQ-7(XD-1) SYSTEM RELIABILITY



EQUIPMENT INCLUDED IN RELIABILITY STUDIES



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EPSCOM (continued)

Documentation of the existing XD-1 tracking program is progressing. A final assembly printout has been obtained.

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Rewrites have been started of the tracking program, routine 33, and the data-sorting and conversion routine. A detailed flow diagram was written with Chris Sherrerd, BTL, and from this the coding of the GFI and LRI routines including LRI production and South Truro returns is well under way and approaching completion.

This routine now includes separating GFI and LRI returns; LRI production and So. Truro; LRI Production: Search, Mark X and Height returns; and LRI So. Truro: Search, Mark X and Height returns. These returns are placed in a common format ( $\rho, \theta$ ) returns are converted to x,y coordinates and also stored on an auxiliary drum ( $\rho, \theta$ ) and a table is constructed in core memory (area K) containing the number of returns from each site with the respective starting location on the drum for each 6-second reading scan.

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EPSCOM Quick Radar Check (H.E. Quirk)

Some major revisions have been made in the quick radar check program and at present, an equipment program specification is being drafted.

The general program itself has been divided into two sections. The first section will include the general beginnings of the program, read-in of current site data, data count analysis for maximum limit, azimuth repetition check, and time delay for scan time. The second section will include the minimum limit check, test pattern probability, conversion routine for ( $\rho, \theta$ ) coordinates, and figures of merit. In addition, a printout of the merits of each site and individual site status commentary will be included in the general program format.

EPSCOM Height Finder Test Program (G.C. Cox)

Printout refinements have been brought up to date according to the needs of the test team. Corrections to the rough draft of the equipment program test specification are in progress.

EPSCOM Teletype Test Program (G.C. Cox)

Study of the teletype function is being made. Some preliminary coding and flow-charting has been done.

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PROGRAMMING (continued)

EPSCOM Pattern Checking (W. J. Marston)

Glen Paulson (WE) will rewrite the pattern checking program for the compiler. The rewrite will include modifications which will improve routines and will make adaptation to SAGE easier.

The latest additions to the program limit it to one LR site. When these additions are completely checked out, the routines will be extended to more than one LR site.

Additional effort must be directed toward converting the program for PST-1 patterns. It should be possible to store only one fourth of the pattern and make an independent test on the two most significant azimuth bits.

The LRI test team asked for a percentage printout for their azimuth jitter problem on the pattern check program. What they want is the percentage of returns falling within -1 to +2 limits and the percentage of returns falling within -2 to +4 limits on azimuth. This printout will occur about once each minute. It will contain the figures for the two limits since the last printout, plus the cumulative percentage figures since the program started (four percentages in all). A new type error will be reported. Type 5 will be a return whose azimuth is within -2 to +4 of expected, but beyond the -1 to +2 limit. This new routine is written and assembled. (B. M. Beatty)

EPSCOM G/G Output Simulation (L. E. McHenry)

The OB simulation part of the program is still being debugged. Information is being partially displayed, but in the wrong place, or the wrong data is being displayed. Information will be appropriately placed on the G/G display format.

CIRCUIT SUPPORT (R. J. Callahan)

LRI Monitor (B. W. Barrett)

At Bendix in Baltimore, Joe McCusker, Bob Callahan, and I reviewed the Bendix LRI monitor logical design and emphasized the MRD specifications on components.

The information needed to cable the Bendix line drivers and consoles to our present system is now being gathered.

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CIRCUIT SUPPORT (continued)

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

Temporary installation of the two 227-foot probe systems (the passive and the 6197 follower types) have been completed. Flip-flop outputs and 0.1  $\mu$ sec pulses were observed with practically no distortion. When observing the square-wave chopper output on the passive system, a 5% transient distortion was noted which is believed to be caused by the change in capacitance with movement of the cable since the 10 mil center conductor is more or less floating in the 1/8" center hole of the cable. Special cable, incorporating a crimped center resistance wire, has been ordered from Federal Telephone & Radio Company to rectify this situation.

Charactron Vector Intensity Modulator (R. B. Paddock)

A modified circuit has been constructed and tests show encouraging possibilities of meeting most of the original specifications within an XD-1 pluggable unit.

DESIGN CONTROL (W. A. Hosier)

The Design Control section has moved to Building D, Room D-213.

First Floor Bldg. F Layout (J. Giordano)

The first floor of Building F, Drawing 5001-31007, is being revised to indicate:

1. The correct dimensions of frames
2. Proposed location of additional input and test equipment
3. The location of the New England Tel. & Tel. frame.

Raydist (J. Giordano)

It appears that there should be no difficulty in providing a real-time indication from XD-1 to Raydist to assist in correlating operational data between the two systems.

CER's

Rejected Proposals (F. R. Durgin)

CER 118, Proposed Change to Tape Adapter Frame for XD-1, was not recommended. This change which causes Operate 71, rewind tape, to also perform Operate 67, set prepare, is O.K. equipment-wise, but gains little program time for its trouble.

CER 126, Immediate Read Mode for Auxiliary Drum XD-1, was not

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DESIGN CONTROL (continued)

recommended. This change, which intends to save time by reducing the number of drum revolutions necessary for read, defeats its purpose by the amount of programming time required to unscramble the information put into core memory by this mode of drum reading.

New CER's (A. A. Rich)

<u>CER No.</u>		<u>Originator</u>
123	Error Checkers for XD-1	IBM
124	Display Console Tester for XD-1	IBM
125	G/G Message Rejection for XD-1	IBM
127	Change to Duplex Central Specs for the GFI Mapper Counter Frame, FSQ-7 (Azimuth & Excess Targer Alarms)	IBM
128	G/G, G/A, XT, LRI; Word Change and P/L Bit Assignment for XD-1	IBM
129	Automatic Shutdown of Power to Display Consoles of XD-1	IBM
130	Investigation of Magnetic Tape Reliability - XD-1, FSQ-7, and FSQ-8	IBM
131	Marginal Checking System for FSQ-7 and FSQ-8	IBM
132	Probe System Specifications for FSQ-7 and FSQ-8	IBM
133	Changes in the LRI Frame, XD-1	IBM
134	Changes in the Switching Module Requirements for the Duplexer	Group 61, H. K. Rising
135	Provide a Type C Auxiliary Console for Use with the Manual Inputs Supervisor, FSQ-8	Group 61
136	Command Post Digital Display Console Specifications, FSQ-7 and FSQ-8	IBM

Test Equipment for XD-1 Input Elements (J. D. Crane)

Plans have been made to install in XD-1 the necessary production type equipment to permit testing of GFI, LRI, and XT elements without utilizing the central computer and drums. Specifications for this equipment and installation details have been written by IBM and are being studied by the DCO prior to concurrence.

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DESIGN CONTROL (continued)

LRI Monitor for XD-1 (J. D. Crane)

The present LRI Monitor Control frame will be replaced with a modified production type frame; IBM's specifications for this installation are being considered.

Auxiliary Data-Processing Equipment (J. D. Crane)

An operate instruction has been added to XD-1 which facilitates read-in of tapes prepared by the auxiliary data-processing equipment. Although the operate instruction improves the usefulness of the auxiliary equipment, it is not considered to be a final solution. The reason for incompatibility is that the auxiliary equipment doesn't assign a parity to each word.

POWER (J. J. Gano)

XD-1 Power System

At the biweekly progress meetings, it was decided to organize a series of five or six weekly lectures for the benefit of the Division 1 electricians who are responsible for the maintenance of the motor-generator sets and switch gear. To give them a greater appreciation for the work, the material will cover the entire power system to the electronic frames. Dean DeSart, IBM engineer, will prepare the lectures which should start sometime in April.

With a reduction in the amount of work on modifications and debugging, interrupting failures will be more carefully catalogued to detect weaknesses. Lincoln will handle the equipment to the PCD frames and IBM beyond that.

Magnetic Amplifiers Control Circuits (G. Sandy, R. Jahn)

Bob Jahn is building a breadboard magnetic reset amplifier to determine whether it can be easily adapted to computer output circuits which now use thyratrons and relays.

In order to investigate the possibilities of using magnetic amplifiers to replace relays in computer circuits, Sandy has ordered a Westinghouse CYPACK simulator. This simulator is a rack with various magnetic amplifier logical elements mounted on panels with the signal leads brought out to jacks for easy set-up of logical circuits. The simulator should be delivered within two or three weeks.

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POWER (continued)

DC Supplies (S. T. Coffin)

A test setup has been assembled for testing magnetic amplifier cores and using them in experimental d-c power supply circuits.

The transistor regulator designed for the XD-1 magnetic power supplies has been tested in the bank A, +72-volt supply, and regulation is well within specifications. Although this regulator presently looks good, it will not be used in systems such as TX-0, where high reliability is sought, until further tests have been made.

TX-0 (J. D. Clarke)

A temporary arrangement to provide filament a-c power from the constant voltage transformers has been made.

The Lambda power supplies and the Power Equipment rectifiers with Coffin regulators are being laboratory-tested.

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ADVANCE DEVELOPMENT

(Group 63, D. R. Brown)

MAGNETIC MATERIALS (J. B. Goodenough)

Memory Core Testing (R. Zopatti)

The total number of memory cores double tested by this section to date for the 256 x 256 x 37 memory is 2,596,000. In addition, there are approximately 70,000 untested cores on hand and 75,000 single tested cores on hand, making a grand total of 2,741,000 cores.

Chemistry

Thin-Films Project (F. S. Maddocks)

Techniques for preparation of evaporated Permalloy films are being worked out. The problem of a suitable container for the melt has not yet been resolved.

Experimental Ferrites (D. L. Brown)

Compositions of 5-mole per cent from the line of stoichiometry between lithium ferrite and nickel ferrite are no longer square-loop ferrites and their magnetic properties, in general, degenerate progressively as the deviation from stoichiometry increases.

Refiring (W. J. Croft)

Experiments are in progress to determine the effects of different cooling rates after refiring on the properties of memory cores.

Physics

Instrumentation

An amplifier-integrator has been built to observe the hysteresis loops of thin magnetic films at frequencies between 1 kc and 10 kc. Tests will be conducted to determine the optimum operating point for the tubes being used, with special reference to flicker noise. (R. A. Pacl)

A feedback circuit to regulate the coil vibration of the vibrating-coil magnetometer has been designed. The applicability of this design has been tested successfully at 50 cps. However, the final operating frequency is to be 34 cps. This has required a change in frequency response of the mechanical vibrator, which has been

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MAGNETIC MATERIALS (cont)

accomplished. A special coil which operates efficiently at this low frequency has just been received. (N. Menyuk)

Equipment for studying the high-speed switching characteristics of thin magnetic films is being set up. A method of generating 2  $\mu$ sec magnetic-field pulses with a rise time of 20  $\mu$ sec, and of viewing the subsequent switching of the material is nearing completion. (D. O. Smith)

TRANSISTORS (D. J. Eckl)

Life Tests

The SBT life tests, including TM-1, have now reached a total of 2.4 million transistor-hours with 3 failures. The shielded shift register has to date been running 6,363 hours since its last error. The pattern in this shift register is checked morning and night for changes. The unshielded unit has reached 2,057 error-free hours and the TM-1 type unit 1,003 hours. The TM-1 register has been on test a much shorter period of time than the others and operates from lab a-c power.

Hole Storage in Surface-Barrier Transistors (C. T. Kirk)

A theoretical expression for the common-base storage time in SBT's was previously obtained (see 6M-3868) by taking into account (in the theory) the variation of emitter efficiency with hole density at the emitter junction. This expression is of the form

$$t_s = \frac{Q}{-I_{csat}} \left[ \frac{I_{e1}}{-I_{csat}} - \frac{1}{\alpha_{act}} \right]$$

where Q is a constant for a given transistor. This equation was obtained by using an approximate relation between emitter efficiency and hole density, and while the storage time equation successfully predicts the linear variation of  $t_s$  with  $I_{e1}$ , an

attempt to evaluate Q from experimental measurements revealed that Q (for the above expression) varied with  $I_{csat}$ .

The exact variation of emitter efficiency with current was derived during this biweekly period and led to the correct expression for storage time of the form,

$$t_s = \frac{Q}{-(I_0 + I_{csat})} \left[ \frac{I_{e1}}{-I_{csat}} - \frac{1}{\alpha_{act}} \right]$$

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TRANSISTORS (cont)

The experimental evaluation of Q for this expression resulted in obtaining a constant value for a large range of operating conditions.

MEMORY (J. L. Mitchell)

Cooling and Supplies

The two Westinghouse compressors have been delivered to room A-034 and will be installed the week of March 12th. The electrical wiring for the air conditioning is complete except for the electronic control panel for memory. The filament-voltage-regulating transformers are installed and ready for operation. The installation of the d-c supplies is temporarily being held up, awaiting the completion of mounting hardware.

256<sup>2</sup> Construction

To date 286 memory plane modules have been accepted. Six 256<sup>2</sup> memory planes have been assembled. The relay-operated plane tester has been modified so that each core output is sensed with a strobe pulse and, as a result, the defective cores are detected automatically. The tester is now operating effectively and is being used to test memory planes. The installation of the switch drivers in the 3-bay rack is still awaiting the arrival of the 5998 tubes from Tung Sol. The essential parts of the memory stall are here and the wiring of the stall is under way. The first plane should be ready to operate on or about March 19th.

Advance Development

Two prototype sense amplifiers are being built for use with the first plane. We are now taking marginal-checking data on the sense amplifier circuit.

Six sample core-driving transistors were received from Philco and are being tested.

An investigation in the problems of packaging of a memory containing 50-30 mil. cores is under way.

SYSTEM DESIGN

TX-0

A tester has been built to test TX-0 logic plug-in units and 1100 out of the 1500 are being tested. A flip-flop tester is being completed.

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SYSTEM DESIGN (continued)

The paper tape and Flexowriter system is being completed and will be operating during the next biweekly period.

Frame 2, the 36-digit, expanded portion of TX-0, is being scheduled. Models are being made of new packaging schemes and work has started on improved circuitry.

BASIC CIRCUITS (R. L. Best)

Design has started on a 32-register, 18-digit, core memory for index registers and program counters in the expanded TX-0. The present plan is to use two, 30-50 cores per bit, of low-coercive-force material, with register selection for fast reading. Write will be 3:1, making use of the register selection again.

DISPLAY (C. L. Corderman)

Development

The two methods under study for improving the brightness of the display involve additional storage in one of the following forms:

- a) Analogue storage in a composite screen, or
- b) Digital storage assigned to a given display scope which is scanned in a cyclic manner above the flicker rate.

A program has been initiated with Group 38 which should shed some light on the variables involved in b) above. They plan to study the repetition frequency required as a function of phosphor persistence, intensity and the rate with which an observer scans over a display. Group 63 will supply the tubes and electronic equipment for this study and make detailed photometric measurements of the various phosphors which are evaluated. To aid in these measurements a dark room has been set up in one corner of B-132.

Line Drivers (J. Kriensky, H. Zieman)

The measurement of resistances to ground on certain lines from the driver outputs to the consoles has led, after additional investigation, to the discovery of some faults existing in a few consoles. In two consoles defective relays were found, and in another console there was a wiring error. The seven command post consoles have no relays on the signal lines. There are pots connected between -150 V and ground so that with power off they cause a resistance to appear between each D.D. line and ground. An M-note is being drafted.

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ESS TEST PLANNING - WWI MPC OPERATION

(Group 64, E. S. Rich)

WWI COMPUTER OPERATION (L. L. Holmes)

Scheduled Computer Hours	328
Interrupting Incidents	19
Hours Lost	21.4
Percent Good Time	93.5
Mean Time Between Failures in Hours	16.1

This has been an infamous biweekly period for WWI reliability. Five incidents of interruption, resulting in 17.7 hours or 82.6% of the total downtime, were traced to new installation work. Included among our woes was a strange failure resulting in a total of one hour of lost time. The failure occurred when a power supply was unintentionally and unknowingly placed on "maintenance" when somebody caught his mop on the supply's power switch.

Magnetic Drum Switch

L. D. Healy has completed the preliminary design of a new system for providing buffer drum enables. The disadvantage in the existing method is that in the cascading of cathode followers, the "off" level in several situations is not satisfactory. The new method will correct this deficiency and also reduce the number of involved crystal diodes by a factor of 2.

Personnel Training Program

The training program has advanced through most of the central computer areas. The on-the-computer phase of the program has revealed that C. S. Lin, A. N. Blumenthal, and O. C. Wheeler have been very effective with their classroom lectures.

Status of Recently Started Studies

1. A study of a method for using the Flexowriter keyboard as a direct input to WWI has been completed by L. H. Norcott and O. C. Wheeler. The request for the study originated with D. T. Ross, M.I.T. Servomechanism Laboratory. If Mr. Ross feels the expense for the installation is not too much, he will forward a formal request to management.
2. A preliminary study was made by A. N. Blumenthal and C. S. Lin to determine the requirements for installing a computer micro-programming facility. We are now awaiting for further information from D. T. Ross, the originator of the study request.

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WWI COMPUTER OPERATION (cont)

3. I have completed a progress report to E. S. Rich, W. Z. Lemnios, and W. I. Wells concerning my study of the "time problem" Group 22 is having in the processing of SOT mission data. Group 22 now uses the WWI delayed printer system for obtaining the SOT mission information required for CCS evaluation. They would like to reduce the wait period for their results from one week to a few days.

MEMORY TEST COMPUTER (H. L. Ziegler)

Operation

Checkout of the new control has fallen somewhat behind schedule because of more "backsliding" than anticipated -- instructions and equipment checked and working one day failed to work the next day. In most cases this resulted from power plugs, video cables, tubes, etc. not being returned to their proper position after having been removed to facilitate installation and/or troubleshooting work. The frequency of these disturbing incidents has been reduced considerably by a tighter control over temporary changes and by the lower level of installation work as the few remaining instructions near completion.

At the time of this writing (March 9) all of the original instructions except op have been checked and are working correctly. The op instruction has been installed but not completely checked. Likewise, the IBM card machine which uses this instruction is ready for checkout.

The new instructions cb (copy block) and pf (perform) plus the variations added to the sof instruction are all designed and in various stages of completion. Block-type transfer of information between the core memory and the drum memory should be available early in the week of March 11. Magnetic tape facilities are being promised for 1 April and quite possibly may be provided a week sooner than that.

Magnetic Tape

Work still to be done on the magnetic tape system consists mainly of tie-in to computer control plus modifications to tape drive units and some pluggable units to convert them to MTC standard voltages.

Correction #2 to Memo 6M-2527, "MTC Changes and Additions Affecting Programmers," has been published and copies have been sent to known users of MTC. Any questions or comments on this memo should be directed to Art Hughes, B-151, Ext. 120.

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MEMORY TEST COMPUTER (cont)

Besides the changes listed in "correction #2" above there are peculiarities incidental to instruction logic that may crop up to alarm unsuspecting programmers. For example, an address on an ha instruction no longer copies the contents of the addressed register into the A register. No doubt other peculiarities of a similar nature will turn up from time to time.

Scheduled computer time started on 5 March even though not all sections of control were complete. This was done with the understanding that users might or might not get usable time during their assigned periods, depending upon the equipment needed to operate their programs as well as upon personal luck in having everything work as it should. We ask the less fortunate of these programmers to bear with us and the computer and to rest assured that their attempts to use the computer have uncovered deficiencies more rapidly than might have been possible otherwise. This situation should improve rapidly during the coming biweekly period.

Training

The MTC Programming class is working on the following utility programs:

1. Binary Card Input and Output
2. Magnetic Tape Octal Postmortem via IBM 717 Printer
3. Octal Hollerith Card Input (See memo 6M-3834 for card format)
4. Decimal Postmortem via Hollerith Cards.
5. MTC Subroutine Library
6. Binary-coded-Hollerith Magnetic Tape Input to Core Memory

Any comments or suggestions would be welcomed by A. Vanderburgh.  
B-149, Ext. 116

6M-4239

VACUUM TUBES

(Group 65, P. Youtz)

TUBE TECHNIQUES (J. S. Palermo)

Electron-Optics Studies

The development of the modified phosphor and aluminizing processes for the panel section of a 19-inch color bulb is almost completed. However, the remaining problems are still directly attributable to the difficulty of maintaining adequate conditions during the phosphor deposition and lacquering operations. As mentioned in a prior report, this situation is due to the necessity of processing the bulb panel and funnel sections separately.

Bariated-Nickel Cathode Program

The March status report of the B-N cathode program (6M-4231) was issued this week. On the basis of the preliminary data it has been decided to assign a 19-inch MIT (Charactron type) display tube with a bariated-nickel cathode in order to evaluate the performance of this type of cathode under Charactron operational conditions. The specific type of B-N cathode used in this tube will be determined by an analysis of all available data just prior to the construction of the electron gun.

Solid-State Display Studies

Considerably more time was spent during this period preparing components for Group 24 solid-state display studies. In addition to processing many plates for photoconductive studies, about two hundred small (0.150 diameter) glass beads were coated with SnO<sub>2</sub> for bistable cell application in display devices. The initial experiment indicated nonuniformity on the flat portion of the beads and poor continuity around the edge. This problem has been solved by modifying the flask design for retaining the beads during the spraying operation.

CHARACTRONS AND TYPOTRONS (P. C. Tandy)

Six MIT 19-inch tubes have completed between 324 and 9295 hours of life test, and seven Charactrons have completed between 1939 and 2694 hours. Charactron #562 was rejected from life test after 1946 hours for helical-accelerator breakdown which was first noted after 1800 hours. This tube in its mount was moved just prior to 1800 hours to enable repair of the air conditioning compressor. The movement vibration must have cause the helix or the insulation material to chip. Since the tube was handled carefully, it should

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CHARACTRONS AND TYPOTRONS (cont)

have been able to withstand this vibration easily. Two Convair tubes are now operating at pulse zero-bias because they fail to give 50- $\mu$ a pulse-matrix current at the 20% duty cycle life test condition but still give more than 50- $\mu$ a during the less than 1% duty cycle of the transfer-characteristic test. One MIT tube, CHT-113, was rejected from life test after 5576 hours for low beam current. This tube was operated at one-half cutoff d-c during life test.

Two tubes, CHT-121 and Charactron #551, have developed grid emission after 161 and 1895 hours, respectively.

Ten oxide-coated cathode-study tubes have completed between 766 and 7922 hours. No tubes have failed since the last report.

Thirty-eight bariated-nickel cathode tubes are on life test with between 212 and 3533 hours. Life test data are available. A report on the status of the program has been issued by Dr. W. L. Gardner in memorandum 6M-4231.

Eighteen Typotrons have operated between 1240 and 7850 hours on life test and a report on recent results has been issued by D. V. Mach.

RECEIVER TUBES

GE has submitted to ASES the proposed MIL specification for the 6414 (IBM 0528) on which mutual agreement had been reached.

Jointly with the IBM Tube Group, I attended several periodic progress meetings on the AN/FSQ-7 basic tubes:

At Sylvania, gate pentode production at Emporium is progressing fairly well with quantity shipments in excess of expectations, thus making further ADES allocation probably unnecessary. At Brookville, shrinkage is quite high as more girls are being trained; this can be resolved only by experience on the part of the operators. The dimensional analysis program has not yet yielded the hoped-for results. Our data analysis is in agreement with Sylvania's: Very little direct correlation between measured spacings and electrode currents. Nonuniformities in spacings and finite differences in grid lineup make the determination of "effective" spacings quite difficult. This work will continue.

At Bendix, gate pentode production is progressing well. All mounting areas are complete and the operators are gaining experience. They expect to make their first shipment to IBM late in April. Bendix is also experimenting with increasing the plate current on sample tests.

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RECEIVER TUBES (cont)

At Tung-Sol, production of the high-power, twin-triode DT-438 has not improved markedly. Major grid deformation during processing is causing high shrinkage due to shorts and wide variations in plate current. Arrangements were made to intensify Tung-Sol's efforts to get out of the woods and get the show back on the road. The lot-evaluation program to culminate in a final specification is being temporarily discontinued while intensive efforts are being made to straighten out the grid distortion problem.

COMMERCIAL TUBES (T. F. Clough)

On 29 February 1956 P. Youtz, S. Twicken, and I met with N. Nitschke of the Kingston Tube Group to discuss coordination of the activities of the IBM-MIT Tube Groups.

S. Twicken, N. Nitschke, E. J. Breiding, and I visited the Sylvania Plant (Brookville, Pennsylvania) which has started manufacturing SR-1782A's. Their yield is poor at this time principally because the new operators have not developed the required skill. Sylvania's Emporium Plant will continue to manufacture this tube until the new factory is able to produce.

In company of the above group, I also visited the Bendix Red Bank Division at Eatontown to inspect their facilities and discuss their program as second source of the gate pentode. Their plant has started production of the tube and will begin to ship upon completion of the specified life tests.

Electron Optics

On 28 February, P. Youtz, C. L. Corderman, Dr. W. L. Gardner, and I met with A. W. Dawson of Corning Glass Works to discuss the adaptation of the presently available glass bulbs to our electron-optics studies. As a result of this meeting we will receive from Corning the required quantity of bulbs modified to suit our present requirements.

P. Youtz and I met with Dr. J. H. Munier of Corning Photosensitive Glass Group on 7 March to discuss the properties of Fotoceram glass and its possible application here as an aperture mask.

Ferromagnetic Evaporated Films

Crucibles are being obtained which will be suitable for the vacuum melting process. Meanwhile, Fred Maddocks is adapting available crucibles and has attempted several runs. The evaporation system sprung a leak in the R-F lead. It will be necessary to repair the system by inserting a new R-F feedthrough.

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SAGE CC AND DC SITES

(Group 66, B. E. Morriss)

EQUIPMENT AND FACILITIES (W. H. Ayer)

C&E Duty Officer

As the result of a meeting held here on 29 February, it was agreed to provide space for the C&E Duty Officer in the in/out area of the DC building. The Air Force had rejected the original space allocation on the fourth floor as being too far away from the programming and maintenance room.

Specifications

Operational

Operational specifications defining the SAGE man-machine relationships and system limitations for each Air Defense function are being written by members of Group 61 in cooperation with the 4620th Air Defense Wing at Lincoln, and in general reflect the latest planning by both groups. However, in order to insure that these specifications are compatible with both the equipment and the program, they must be coordinated with other groups in Division 6 and with the appropriate groups in Divisions 2 and 3. To speed up this coordination, five copies of a particular memorandum are circulated for comments and sign-off at the same time. The comments are coordinated with Group 61 personnel, and a correction or supplement is issued if necessary. If supplements are accepted by the various groups involved, the memorandum is then rewritten incorporating these changes.

Seven operational specifications have thus far been released by TIR:

<u>TIR #</u>	<u>DOCUMENT #</u>	<u>TITLE</u>
1-121	6M-3720-1	Raid Forming
1-116	6M-3766-1	Track Detection
1-120	6M-3778-1	Weather
1-122	6M-3795-1	Subsector Command Post
1-119	6M-3814-1	Manual Inputs
1-143	6M-3814-1, Sup. #1	Manual Inputs
1-129	6M-3836-1	Automatic Tracking

Another Ten Operational Specifications are being coordinated by the PCO.

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EQUIPMENT AND FACILITIES (cont)

Mathematical

Mathematical specifications are also being written to further define and extend the concepts developed in the operational specifications. Since the mathematical specifications are actually a part of, rather than merely a refinement of the operational specifications, they also must receive the same degree of coordination. In order that this coordination may be properly documented and official recognition be given to both the operational and mathematical specifications, the final results of this process will be the release of each memorandum by a TIR.

Equipment

A set of design specifications has been written jointly by Lincoln and IBM defining the AN/FSQ-7 and -8. These have been itemized in the following two ways:

Master Reference List: The 6M-number and title of design specifications which have received Lincoln - IBM concurrence have been listed in 6M-3884-1, "Master Reference List, AN/FSQ-7 Specifications." This Master Reference List (MRL) has been broken down into nine, arbitrarily chosen, categories, but except in special cases, no attempt has been made to describe the documents. Change recommendations for specifications not included in the initial AN/FSQ7, -8 machines have been written to indicate proper phasing of the changes with the operational program. This MRL and its supplements have been released by TIR to expedite the writing of ECP's. The MRL is up to date as of 19 January 1956 (6M-3884-1, S #4).

Equipment Specification Memoranda: To aid in the writing of ECP's, a series of 6M-notes and their supplements, giving a brief description of each machine specification and notes on the time-phasing recommended by Lincoln, was issued by TIR. These memoranda apply generally to both AN/FSQ-7 and -8 and are known as Equipment Specifications memoranda.

In both the MRL and the Equip. Spec. memos, the specifications have been cross-referenced in the nine categories to make each category as complete as possible. Therefore, a specification may be listed several times in the MRL or in several of the Equip. Spec. memos.

Though MRL and the Equipment Specifications memoranda are equally valid for the purpose of specifying the AN/FSQ-7 machine, the MRL is usually issued several weeks before the corresponding Equipment Specifications memos.

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EQUIPMENT AND FACILITIES (cont)

The AN/FSQ-7 Equipment Specification memoranda were released as of 15 December 1955. A separate memo for AN/FSQ-8 Equipment Specifications was issued 19 January 1956 (6M-4106).

SITE PLANNING (K. E. McVicar)

Comments received on the preliminary draft of the plans for site activity are being incorporated in the rewrite. It was intended that the revised draft be issued during this biweekly period, but it has been decided instead to reorganize the entire report to make the presentation more straightforward. This will require another three weeks for completion.

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PROGRAM PRODUCTION

(Group 67, J. A. Arnow)

CENTRAL PROGRAMS (D. L. Bailey)

Table Design (L. Collins)

Program environment studies by B. J. Kollet and accompanying table documentation by M. Mineart have been completed for some 15 programs and the communication tag pool information will be up-dated to accommodate the 15 programs by 14 March. This effort encompasses roughly 25% of the DCA programs, 80% of the existing items and 80% of the existing tables. New table design is continuing and is a nearly full-time effort by J. H. Stone.

Central Bookkeeping (L. Collins)

The coding of the track history (CTH) program is complete, central track bookkeeping (CTA and CTB) programs will be coded by 14 March. The track monitor assignment (CMA) program transfer function and broad flow diagram has been under revision; coding of this program will probably not be completed until 30 March.

In-Out (W. Harris)

Preliminary coding specifications for crosstell to AA and manual DC's have been completed, and work is nearing completion on specification of the automatic subsector crosstell programs. (Schissell and Morse) Ardeth Miller has joined the subsection. She will work on the recording program, and is now working with E. Lafferty of Group 61 on specification of the exact items of information to be recorded on tape during ESS operation.

Display (H. Briscoe)

C. Meadow and J. Meyers have started work in the display subsection. Meadow will replace A. Schwartz who is returning to Hazeltine at the end of March, and Meyer has started coding in the DD area.

Coding of the air surveillance attention device program has been nearly completed.

Preliminary coding specifications have been completed for airbase SD, and SED, and have been nearly finished for alarm DD and WAD.

The input communications for the DD control program and the DD control table have been essentially designed.

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CENTRAL PROGRAMS (continued)

Switch Interpretation (A. Marshall)

The program for the manual input supervisor switch interpretation has received its first pass with the checker. Further processing is awaiting correction of several flaws in the utility system.

Three programs are nearly ready for parameter checkout. The mapping switch interpretation program is in the card room. Initiation and the ASO-AST switch interpretation programs are ready to go to the card room.

Loss of Barbara Rogers has slowed the subsection somewhat, but the addition of Charles Mossman is beginning to help this situation.

OPERATIONAL SPECIFICATIONS (J. P. Haverty)

Tracking Programs (J. P. Haverty)

The coding of all tracking programs has been completed and all programs with the exception of the correlation program, have been released to the card room. The correlation program is being delayed to incorporate changes and to give Bill Hoppe additional time to assume responsibility for the program. Parameter checkout planning is proceeding on all programs.

Weapons Direction Programs (J. Leavy)

Preliminary Sectional Drafts of the transfer functions for weapons assignment and intercept calculations will be completed shortly. Initial documentation has proceeded far enough so that coding will begin on these two programs 12 March.

Miscellaneous Operational Programs (F. E. Ogg)

The raid forming program has been compiled. After corrections, it will be recompiled and an initial run with the checker program will be made during the week of 12 March. Track sort and height priority have been released to the card room. Coding is nearly completed on the simulation I program and coding will start 12 March on the simulated tape input program.

UTILITY AND CHECKOUT (P. R. Vance)

The Lincoln utility system is beginning to shape up as a workable tool. Much time and effort is being devoted to checking out the system performance of the various utility programs. The following utility programs have been successfully stored on the master tape and operated from the utility control console:

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UTILITY AND CHECKOUT (continued)

Utility control program  
Read-in program  
Checker program  
Compiler program  
Library merge program  
Communication tag pool  
Editor catalog

To be added are:

Master tape load program  
CI and PP editors  
Assemble comm. pool program  
Library output program

The utility programs on tape are still being corrected and revised. The compiler has been expanded to handle editor requests, but still requires additional corrections. The read-in program has been operationally checked out. The checker program still requires some corrections and additions.

The system was used to successfully process the first air defense program (KDI). This program of about 100 registers was compiled (requiring the use of the com tag pool), read in, and operated with the checker.

Utility System Documentation (A. M. Hills)

Memorandum 6M-4229, "Description of the Lincoln Utility System I," was issued this biweekly period. In addition to describing the system, it lists the memos already published concerning the system.

The documents currently in preparation are:

Checker manual  
Read-in program specifications  
Storage print program specifications  
Utility control program specifications

In addition to supplements as necessary to existing documents on the utility system, the following documents are planned for the near future:

Editor manual  
Subroutine manual

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UTILITY AND CHECKOUT (continued)

Features which are planned for inclusion in the utility system (which will become System II), but which have not yet been scheduled for definite dates are:

1. Delayed input and output, using the magnetic tapes and the auxiliary data processing equipment in Bldg. A.  

Card-to-tape converter  
Tape-to-card converter  
Tape-to-printer converter
2. Automatic logging, wherein all pertinent logging information will be punched on cards, from which operating statistics can be derived on the 407 accounting machine.
3. Utility control cards, which will select the programs to be run and the operations to be performed, relieving the computer operator of most of the button-pushing which he is at present required to do.
4. Automatic compilation of subroutines into a program by the compiler.
5. An addition to the storage print program to display and photograph the contents of any portion of core or drum memory.

Programs contemplated for addition to the system are:

1. Examine, which will print out or display the contents of any core or drum register in the computer.
2. Modification by card, which will permit changes expressed in symbolic form to be introduced into a program stored in the core image.
3. Tape scan, which will permit the inspection of the contents of any portion of a magnetic tape.

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ADMINISTRATION AND SERVICES

(Group 60, J. C. Proctor)

PERSONNEL

Staff

New

Assigned to Group 60

Malcolm M. Ferguson received his AB in English from Harvard University. He was formerly employed by the Clarostat Mfg. Co. as Library Custodian.

Assigned to Group 63

John M. Frankovich received his BS in Mathematics from MIT. He was formerly employed by the Digital Computer Laboratory at MIT.

Assigned to Group 67

Beverly F. Char received her BA in Mathematics from Vassar College. She was formerly employed by the General Electric Company in Lynn, Massachusetts.

Terminations

David Shansky is now employed by the Hycon Eastern, Cambridge, Massachusetts.

William P. Walsh was called into active duty by the Air Force. He will be located at the CRC, Hanscom Field, Bedford.

Transfer

William A. Hosier has transferred from Group 64 to Group 62.

Nonstaff (W. A. Kates)

New Personnel

Frank Bond	Technician	Group 63
Peggy Brooks	Office	Group 67
Joseph Dellarocco	Office	Group 60
Frederick Garside	Technician	Group 64
Angelyn Leone	Office	Group 60
Carole Olson	Office	Group 60
Joan Pike	Office	Group 61

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PERSONNEL (cont.)

Transfers

George Gerelds	Technician	Group 60 to 63
Anthony Kyricos	Technician	Group 60 to 63
Frances Momo	Office	Group 63 to 35
Barbara Smith	Office	Group 60 to 61
Simeon Thompson	Technician	Group 64 to 60

Terminations

Evelyn Guinard	Office	Group 60
Wendell Wilson	Technician	Group 60

MATERIAL (H. B. Morley)

The move of the Material Requirements Section from Room D-213 to B-107 was accomplished with a minimum of delay and we are open for business as usual.

Division 6 Special Stockroom will no longer store any item listed in the L. L. Standards Book. We will stock only those items listed in the D. C. L. Standards Book that have shown repetitive use.

GENERAL ENGINEERING (A. R. Smith)

Partitions

The wooden partition design is currently being fabricated. It is hoped that partial installation can be made by the middle of next month.

Core Test Handler

The breadboard test for validating the proposed theory of transmitting cores to the test area has been proven satisfactorily. Design is continuing on the drive mechanism and packaging. Further breadboard tests are to be made to determine the feasibility of applying this equipment to automatic use where testing rates have been set at two cores per minute.

Miscellaneous

A large percentage of work which has been done by our service groups over the past month for the Memory and Transistor Sections on TX-0 is expected to continue in the same relative proportion well into the future. The 3- and 5- bay racks, shower stall, console and module frames are just a few of the assemblies of major activity at the present time.

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TEST EQUIPMENT (L. L. Sutro)

The last biweekly listed all of the new roster of the Test Equipment Committee except:

R. J. Callahan, Representative of Group 62

The five 10 mc pulse generators, built especially for us by Burroughs, have revealed a defect. As the amplitude of the output is varied, it jumps abruptly from 11 to 20 volts. Burroughs proposes that we replace the present amplitude control by a control of the screen voltage of the peaker. This, however, both introduces a noise pulse of 2 volts and greatly increases power consumption for low level output. The original circuit looks better than the improvement.

COMPONENT EVALUATION (H. W. Hodgdon, C. Morrione, Jr.)

Technical guidance of the Components Section activities has been placed under the Division 6 Test Equipment Committee, and Hodgdon has been appointed one of the Group 60 representatives on that Committee. Administration of the Components Section remains as before.

R. Hudson has been transferred from the Components Section to Group 63, Transistor Section. V. Tessari is now senior man in the Components Lab, and H. Atlas has been transferred from the Group 60 Inspection Shop to fill the vacancy in the Components Section.

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(P. E. Falcione)

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NO. 6M-	AUTHOR	TITLE --	CIS.
<b>ADMINISTRATION &amp; SERVICES (Group 60)</b>			
4166	R. R. Everett et al	ESS Systems Engineer	U
4208	Div. 6 Staff	Biweekly Report for Period Ending 24 February 1956	C
4212	Div. 6 Staff	Lincoln Laboratory Personnel List	U
<b>SAGE SYSTEM TEST &amp; PLANNING (Group 61)</b>			
3778-1 C#1	J. Bryan S. Hauser	Use & Presentation of Weather Data in the Sage System	C
4204 & C#1	A. P. Hill	Air Defense Indoctrination Lectures (Series Four)	U
<b>FSQ-7 PROTOTYPE DESIGN &amp; INSTALLATION (Group 62)</b>			
3851-1 S#3	J. Giordano	Master Reference List of Equipment Specifications for XD-1	C
4080-1 4161	W. J. Canty C. W. Watt	Test Pattern Generator for AN/FST-2 Specific Proposals for Developing a Technical Control Function in ESS	U
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932	F. D. Schulman R. Shur	Project High Engineering Report System Test Procedures and Results Phase VII AN/FSQ-7 Drum System	U

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933	J. D. Iannotti	Project High Engineering Report-- Magnetic Deflection Compensation for the Situation Display Cathode Ray Tubes of AN/FSQ-7	U
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937	R. P. Crago	Progress Report AN/FSQ-7 and AN/FSQ-8 January 1, 1956	C
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603 (P-36-5)	R. C. Marden	Concurrence on Changes to H-139A entitled "Design Specification for Situation Display Console for XD-1	U
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606 (P-270)	R. C. Marden	Concurrence on Proposed Change in the DD Filters for the XD-1 Situation & Auxiliary Display Consoles	U
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614 (D-46-5)	R. D. Buzzard	Concurrence on Controls on the Simplex Maintenance Console for the Test Pattern Generator	U
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616 (D-105-1)	W. S. Squire	Concurrence on AN/FSQ-7 DC-3 Building Floor Plans	U
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622 (P-138-1)	R. J. Paddock	Supplement to Mapping Material Specifications for XD-1	U