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Memorandum 6M-4302

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

SUBJECT: BIWEEKLY REPORT FOR PERIOD ENDING 20 APRIL 1956

To: Jay W. Forrester

From: Division 6 Staff

Date: 26 April 1956

Approved: J. C. Proctor *cut*

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SAGE OPERATIONAL PLANNING

(Group 61, D. R. Israel)

DIRECTION CENTER OPERATIONAL TEAMS (J. J. Cahill, Jr.)

This section of the Biweekly will henceforth contain notes on matters having to do with the operation of the SAGE Direction Center, and attendant equipment, which may be of general interest.

Effort required in other areas during the past few weeks has prevented me from completing the work required to issue the "firm" set of operational and mathematical specifications, in the Weapons Direction area, mentioned in the Biweekly of 9 March. There seem to be no remaining obstacles, and all these specs should be issued in the next period.

Except in the Weapons Direction area, the list of "firm" Direction Center specifications is virtually complete. When the WD specs have all entered typing, C. Zraket will write a memo listing both the operational and mathematical specifications which are firm requirements for the DC Master Program.

Identification & Manual Inputs (S. Hauser)

J. Bryan will assume responsibility for identification and B. Johnson that for the manual input function, particularly as these responsibilities are detailed for operational teams. Their familiarization with the functions should be sufficient by 15 May to enable them to assume full responsibility for their respective teams. Meanwhile they are reading memoranda, attending discussion meetings and visiting appropriate operations centers to accelerate their indoctrination.

They will each compile second revisions to their respective functions from the existing first revisions and corrections.

COMBAT CENTER (W. Lone)

On 17 April, one half of the personnel in the section visited the Air Defense Control Center at Roslyn, N. Y. and the other half visited the one at Syracuse, N. Y., to observe the operational procedures at those Centers.

The writing of the operational specifications for the combat center is continuing. Plans are for rough drafts of most of them to be ready early in May.

A revision to 6M-3732, "AN/FSQ-8 Console Equipment and Label Layouts," will be issued during the next biweekly period.

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DUPLEX-STANDBY

T. N. Hibbard has transferred to the data reduction section of Group 61 and may be contacted at extension 242 Murphy Army Hospital.

On 12 April 1956, a meeting was held with Maj. Janek and Capt. Hill of ADC in regard to the draft on 6M-4141 "Guide to Duplex and Standby Computer Operation at a SAGE Direction Center." No major points of disagreement were discovered and minor changes will be made in accordance with the wishes of the Air Force. It is planned to publish 6M-4141 in its final form within one month.

Good progress is being made in all portions of the duplex-standby operational specifications. However, some difficulty encountered with the problem of "startover data" may result in a delay in publication.

DATA SIMULATION AND REDUCTION (W. S. Attridge)

Data Reduction (R. Olsen)

Margot Long and Stu Tower are currently working on subroutines for use in the Station History phase of the Data Reduction program. Jack Keene and Dick Mackler have joined the subsection, recently having completed the IBM school.

Data Generation (J. Levenson)

The data generation program is in the stage of flow-charting and coding. Checkout has been held up due to the status of MTC. It is expected that the program will be 75% checked out by 20 May. The coding should be 75% complete by 1 May.

Recording (E. Lafferty)

The first revision to the recording operational specification has been issued within the last two weeks. Certain changes have been made as a result of concurrence with Group 67 and the data reduction section.

MTC Operation (D. Bancroft)

Operation for the period 9 to 21 April:

	<u>Hours</u>	<u>Per Cent of Scheduled Time</u>
Scheduled	8:50	100.0
Available (and used)	4:50	52.9
Satisfactory Operation	2:20	25.6

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BOMARC INTEGRATION (AN/GPA-35 STUDY) (H. Anderson)

A study was recently made by a joint committee consisting of representatives of Boeing, Westinghouse, IBM, and Lincoln. The purpose of the study was to determine if the AN/GPA-35 can be used with the SAGE System for control of the IM-99 (BOMARC). At the conclusion of the committee's last meeting, it appeared that there is a way for the SAGE System to assign hostiles to the AN/GPA-35 for interception by BOMARC. This method would apparently require less additional effort to demonstrate compatibility than would the pure SAGE mode of operation. This is true because considerable Westinghouse manpower is presently allocated to GPA-35 work (since it is used as the experimental guidance system for BOMARC), and because a minimum of reorientation and training would be required of the Boeing people.

The Boeing representatives are now preparing a draft of the final committee report. This will be reviewed at a joint meeting in Seattle about 7 May.

F-102A INTEGRATION (F. Garth, L. Jeffery, E. Johnson, D. Ladd)

The Convair and Hughes people who are participating in the SAGE/F-102A study will be at Murphy from 24 through 27 April. The committee has agreed upon a tentative outline for its final report and has begun to write its first rough draft. The most important single topic for discussion in the coming meeting is testing and evaluation for the SAGE/F-102A system.

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ESS DC IMPLEMENTATION AND COORDINATION

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

EXTERNAL EQUIPMENT AND COMMUNICATIONS (C. Carter, W. Glass, F. Irish)

On 17 April a conference was held at the New York ARTCC and plans for communications at that location were finalized.

Work has begun on a proposed maintenance and trouble-reporting procedure. Meetings have been held between the Lincoln and telephone company people that are concerned with this subject. Sample forms to be used in keeping records have been developed.

Operating instructions are being written for the voice communications facilities at the various sites associated with ESS. At present, the drafts of the instructions for the P-sites at Brunswick, No. Truro, and Montauk have been completed.

DESIGN CONTROL (W. A. Hosier)

AN/FSQ-7 Improvement Studies (W. A. Hosier) CONFIDENTIAL

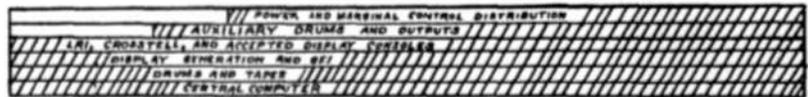
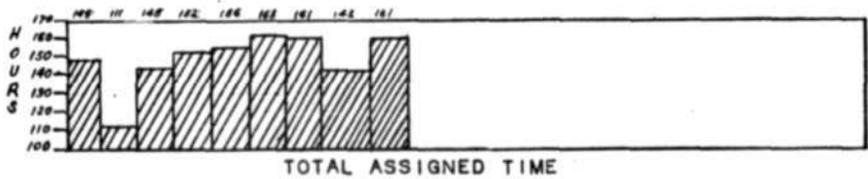
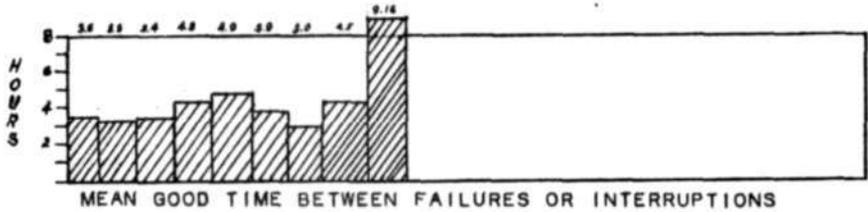
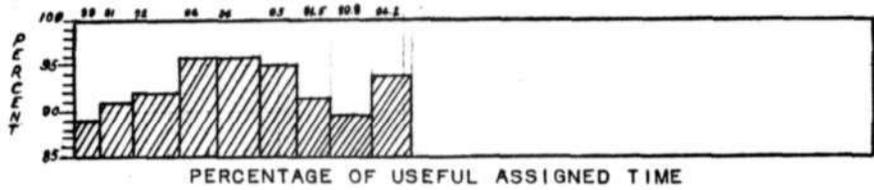
Lincoln and IBM are continuing their studies of possible ways of increasing the capacity of the FSQ-7. Effort at the moment is concentrated on short-range improvements and additions to increase operating speeds. Later, studies will be made of ways to increase flexibility or to provide major increases in capacity. The results of these studies can be used as a foundation for changes to the FSQ-7 needed to meet increased SAGE requirements.

IBM has paved the way for a fairly systematic generation and review of possible alterations to the central machine: Dick Shur, who is ultimately responsible to Rudy Cypser, manager of FSQ-7 development, will work with me on collecting, writing up, and tentatively evaluating suggested changes intended to decrease frame time. Each proposal we come across is being given a "dossier" without much initial critical weeding out. These are being forwarded to other members of Cypser's group working under Claude Walston and Ben Housman in Poughkeepsie, where IBM will look further into the ones which seem most important.

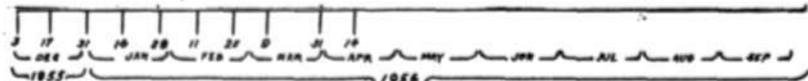
New Format for Presenting Minutes of the  
IBM-DCO Concurrence Meetings (J. Giordano)

A proposed format for presenting the minutes of the IBM-DCO concurrence meetings, which better organizes the presentation of items discussed, will be put into effect immediately. This new format is intended to facilitate the method for communicating information to all interested parties.

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



EQUIPMENT INCLUDED IN RELIABILITY STUDIES



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DESIGN CONTROL (continued)

GFI Alarms (XD-1 and AN/FSQ-7) (J. D. Crane)

A meeting between interested parties from IBM and MIT was held to discuss alarms in the GFI system. Both parties felt that some circuit modifications could be made to increase the effectiveness of the present excess target alarm. The proposed changes will be investigated by IBM.

IBM Equipment for Manual Data Inputs (R. H. Gerhardt)

A proposal to replace three Type 026 card punch machines and one Type 056 card verifier with two Type 047 tape-controlled card punch machines in the manual data inputs room has been received from the 4620th ADW.

The 047 machine may be programmed (by the program card and the control panel) to check for errors in format. If an error in the format occurs, a "4" will be punched in the 82nd column and machine operation will be stopped. In this case, the message must be re-transmitted or manually punched. The most serious question about this mode of operation is whether or not teletype operators can send messages which are sufficiently accurate to prevent excess loss of time due to retransmission or to prevent a traffic jam at the manual punch stations.

Equipment Specifications (S. B. Ginsburg)

Document S-52, "Duplex Switching Console Specifications for AN/FSQ-7 Combat Direction Central and AN/FSQ-8 Combat Control Central," was reviewed, minor modifications made, and concurrence received.

GFI Alarms (S. B. Ginsburg)

A meeting was held with IBM representatives on 17 April to clarify the use of the azimuth alarm and excess target alarm associated with the GFI channel equipment. It was pointed out that the excess target alarm, as presently designed, has no operational value, but with minor modifications may prove to be adequate. The proposed changes reduce the number of consecutive targets required to energize the alarm. The azimuth alarm is presently designed beyond the capabilities of the system, resulting in unnecessary delays.

New CER's (A. A. Rich)

<u>CER No.</u>		<u>Originator</u>
148	S-12-1, Change in Memory Element Specifications, AN/FSQ-7 and -8. Delete the mention of "1 SIDES"	IBM

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DESIGN CONTROL (continued)

- and "O SIDES" in reference to the lines entering and leaving the memory element. There will be two deletions of "1 SIDES" and one deletion of "O SIDES."
- |     |   |            |
|-----|---|------------|
| 149 | S-52, Duplex Switching Console Specifications. Review of a rewrite of specifications.   | IBM        |
| 150 | Replace Rubber Tips on Light Guns. An RECI was sent to IBM requesting a more durable tip be used. This is a design detail that IBM is now investigating.  | Group 66   |
| 151 | An Indication of Missing Sync Pulses, XD-1. A request for an alarm indication for missing syncs (LRI phone line) detected by the changes proposed in P-275.   | Group 62   |
| 152 | IBM Equipment for Manual Inputs. The replacement of three "026" with two "047" tape-to-card punches and the elimination of one OSC in order for faster data-handling process - AN/FSQ-7.  | 4620th ADW |
| 153 | S-56, Maintenance Card Machine Specifications for IBM AN/FSQ-7 and -8. Review of a rewrite of specifications.   |            |
| 154 | S-37, Central Computer Marginal Checking and Distribution Unit Specifications for AN/FSQ-7 and -8. Review of a rewrite of specifications.   | IBM        |
| 155 | D-18-3, Change to the Manual Input Frame, AN/FSQ-7. A change in the method for testing the encoder matrix by using the console light guns.  | IBM        |
| 156 | S-35-1 and D-32-8, Changes to Marginal Checking and Duplex Maintenance Console Specifications. Proposal for a switch, interlocked with the duplex switch on the duplex maintenance console to allow testing of marginal checking control circuitry of the standby computer. | IBM        |

CIRCUIT SUPPORT (R. J. Callahan)

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

Report 6M-4283 is being prepared. Data is being gathered on the effect of resistance variation in the coax center wire for the 227' passive probe for inclusion in this report.

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CIRCUIT SUPPORT (continued)

LRI Parity Alarm (M. J. Flanagan)

Work on the LRI parity alarm system continues. A magnetic amplifier was tried as a means of driving the indicating lamps. This magnetic amplifier was built here using tape cores borrowed from the memory section. The amplifier worked, but couldn't handle enough power for the lamps. Some new tape cores have been ordered from Magnetics, Inc.

A transistor driver has been made to drive the indicator lamps. This driver requires about 2.5 ma and supplies 40 ma to a 24E incandescent lamp. A transistor flip-flop to drive the lamp has been built and will be combined with a gate to serve as the LRI alarm counter.

LRI Monitor (B. W. Barrett)

Joe McCusker and I are reviewing the Bendix circuitry. The Bendix deflection amplifier seems, on the basis of data supplied by Bendix, to be susceptible to ripple; on the basis of small-signal analysis, this ripple should be considerably smaller than the data indicated.

POWER AND CONTROLS (J. J. Gano)

XD-1 (J. J. Gano)

The recent snowstorms raised havoc with power transmission lines and again the inability of the power control system to override transients was demonstrated. A pen recorder indicated six transients which dropped the average 3-phase voltage to about 70% of normal. Five of these incidents shut down the computer and three of them even shut down one or both of the m-g sets. As a first step in overcoming motor tripping, phase balance relays, which trip the motors if one of the phase voltages is substantially reduced, will be disconnected. With the present load of approximately two-thirds rating, the motors should continue to operate indefinitely with no permanent damage should single phasing occur. In the meantime, we will obtain information on breakers from Westinghouse and motor heating from GE to coordinate tripping time to override transients and prevent motor heating.

"Results of Tests on Power System, XD-1," 6M-4290, states that the d-c supplies do not meet performance specifications and filament transformers should have their taps reset to meet tolerances. Both items affect computer reliability, even though the computer may operate satisfactorily. IHM will be able to modify the filament transformer taps in short time, but at the rate GE is progressing,

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POWER AND CONTROLS (continued)

it will be many, many months before the d-c supplies will approximate the performance specifications. Lt. Camp, who is responsible for Air Force acceptance, has stated that they will not accept the computer unless the power system is acceptable. We are hoping that IBM will apply more pressure on GE to use more engineering talent to overcome the difficulties.

The experimental +72-volt transistor-magnetic d-c power supply in XD-1 was turned off during this biweekly period in order to switch operation from bank A to bank B power supplies. During approximately 700 hours of operation, this supply showed no significant change in characteristics. The switching of power was made so that bank A could be available to GE engineers for testing. They are investigating the static transfer characteristics of the various sections of one of the supplies to determine what changes in design should be made to overcome the drift, poor regulation, and complexity of controls.

Magnetic Amplifiers (G. F. Sandy)

The Westinghouse CYPAK simulator has been received. The simulator is a rack containing panels of standard Westinghouse logical magnetic amplifier circuits with the signal inputs and outputs of each logical element brought out to plus boards, so that any proposed system can be set up on the simulator to see if it will work properly and provide an easy means for modification of the system without extensive rewiring. The CYPAK simulator is at present being used to simulate a possible magnetic amplifier system to replace the relays now used in the XD-1 PCD frame.

The possibility of using magnetic amplifiers that could economically replace relays where multiple outputs are required (i.e., relay matrices) is being investigated.

Experiments to determine the advantages of power supply frequencies greater than 60 cycles are under way. The disadvantages of an oscillator will be weighed against any improvement in amplifier performance. (R. C. Jahn)

After the first test on filament cycling for a display console, two of a total of nine thermistors were found cracked, despite the fact that the brush pen recorder indicated every cycle had the same current-time curve. Since we suspected the cause was due to unequal pressures because of the uncentered spring, the tests were repeated for 4,500 cycles using a new construction for maintaining a central spring position. Results were very satisfactory, but we will make another run with another assembly to be sure.

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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 2,888,000. In addition, there are approximately 25,000 untested cores on hand and 39,000 single-tested cores on hand, making a grand total of 2,952,000 cores.

Memory Core Production (D. L. Brown)

During this period, 130,000 cores were produced, 50,000 are suitable for testing and 60,000 more soon will be.

Experimental Ferrite (D. L. Brown)

The hysteresis loop of lithium ferrite can be made square by the addition of copper ferrite.

Chemistry (D. Wickham, N. Menyuk)

The saturation magnetic moments of compositions in the solid solution range between ferrous germanate and zinc ferrite have been measured directly at liquid helium temperature in the VCM. Pure ferrous germanate has an observed moment of 0.7 Bohr magnetons per molecule. The moment increases linearly with increasing zinc ferrite content reaching a maximum value of  $3.28 \mu_B$  for a composition

30 percent ferrous germanate, 70 percent zinc ferrite. An attempt will now be made to reproduce the results and to give them a structural interpretation.

Analysis (D. Wickham, E. Keith)

Some modification in methods currently used to estimate iron and nickel in the same samples have been required for the analysis of Permalloy samples used in thin film preparation.

Crystallography (W. Croft)

Preliminary X-ray examination of a material synthesized from  $\text{CoO} + \text{Mn}_2\text{O}_3$  shows the material to possess tetragonal symmetry analogous to that of  $\text{Mn}_3\text{O}_4$  with  $a_0 = 8.10 \text{ \AA}$ ,  $c_0 = 9.28 \text{ \AA}$  and  $c/a = 1.14$  (for

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MAGNETIC MATERIALS (continued)

$Mn_3O_4$ ,  $a_o = 8.15$ ,  $e_o = 9.48$ ,  $e/a = 1.16$ ). More accurate measurements of this sample are being made.

Physics

Instrumentation

A unit has been built which we hope will eliminate the freezing of air into the liquid helium container. This effect has limited experiments at liquid helium temperature to one run a day. Since a large number of experiments at this temperature are contemplated, additional equipment has been ordered. Previous runs have been made using borrowed equipment. (N. Menyuk, D. O. Smith)

A 60-cycle fluxmeter is being built with which we hope to be able to measure the coercive force and flux of small toroids with 1% accuracy. (R. A. Pacl)

Design of the apparatus to be used in conjunction with the vacuum-coating unit for the fabrication of thin films of Ni-Fe has been started. The coating unit should arrive and be producing films in a few weeks. In addition, apparatus for measuring the sine wave magnetic response of thin films at high frequencies is being set up. (D. O. Smith)

Experimentation

The saturation magnetization of the zinc-germanium ferrite series has been measured at liquid helium temperature. The results of these measurements were turned over to D. Wickham. (N. Menyuk, D. O. Smith)

MEMORY (J. L. Mitchell)

Cooling and Supplies

The air conditioning system is now operating. Further balancing and adjustment of the system will be necessary.

256<sup>2</sup> Memory

To date, 434, 64 x 64 memory plane modules have been accepted. Twenty 256<sup>2</sup> memory planes have been shimmed together. The wiring of the memory stack is complete, and the testing of the first plane is under way. The first results look reasonably good, and the first plane should be in operation during the week of April 23rd. The air conditioning ducts have been installed on the 5-bay rack, and the power wiring to the rack will start next week.

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MEMORY (continued)

The first prototype sense amplifier has been received and debugged. Some difficulty has been encountered in that the clip levels of the four input stages are not the same. This problem is being investigated.

Advance Development

A method of producing precision masters of miniaturized printed wiring work by the use of an engraving machine has been tried with success and is being evaluated.

LOGICAL DESIGN (W. A. Clark)

TX-0

The carry circuit in the arithmetic element exhibits an interesting though unexpected property resulting from the use of "level" rather than "pulse" propagation. If the accumulator flip-flops all hold "1's", the carry circuit forms a closed ring and assumes one of two stable states, either the state in which a carry is present at each stage, or the state in which no carry is present at each stage. The particular state depends on whether a carry condition existed in any stage before the accumulator flip-flops are all set to "1's". The result is that adding a number to its complement yields "+0" instead of the previously expected "-0" (with the exception "+0" + "-0" = "-0"). Since this effect is determinate, no change of the circuit is planned.

Research

Belmont Farley has joined the section and will continue the investigation of self-organizing systems (see Proceedings of the Western Joint Computer Conference, March, 1955).

SYSTEM DESIGN (K. H. Olsen)

TX-0

The marginal checking system has been installed. Margins are being taken on all circuits and tolerances on all signal amplitudes and signal timing are being measured.

A 16-register toggle switch storage with one live register is being built. This was not part of the original plan but it will be helpful in testing the computer.

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BASIC CIRCUITS (R. L. Best)

TX-0 Index Register and Program Counter Memory

The memory has been simulated with a complete register and a complete digit-winding, and operates as expected. Transistor driving circuits are now under development.

DISPLAY (C. L. Corderman)

Line Drivers (H. E. Zieman, J. Kriensky)

Memorandum 6M-3284, SI, which analyzes the individual stages of the display line driver and discusses margins, frequency response, maintenance data, and power supply requirements, was completed. Supplement #2 is being prepared which analyzes the complete amplifier both theoretically and experimentally. Over-all frequency response and performance data will be included.

Development

Study is continuing on the remote display for FSQ-7. A summary of minimum requirements had been received from Group 61. Present plans are based upon displaying 64 tracks consisting of a vector and 10 characters. This will require about 6100 bits of storage and can be changed during a 5-second interval if desired.

TRANSISTORS (D. J. Eckl)

Random-Digit Generator (E. U. Cohler)

A model of the random-bit generator described in the last BIWEEKLY has been constructed. The silicon diodes do not have uniformly good noise characteristics and selection is necessary at present. It is hoped that some diodes with closer tolerance on breakdown voltage will solve this problem to some extent (they have been ordered). The theory of operation of these diodes is being studied, but major difficulties are being met in the form of second-order effects in avalanche breakdown. However, a better understanding of the mechanisms involved may lead to eventual control of the noise-generating properties of the diodes.

A computer test is planned for the noise generator already constructed. Toward this end I am studying the programming frills and foibles of TX-0 and preparing a program to test the randomness of the generator's output.

Grown Tetrode Transistors (E. U. Cohler)

Some Texas Instrument type 501 p-n-p tetrode "grown-diffused" germanium transistors have been ordered for evaluation. These units

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TRANSISTORS (continued)

have a design center maximum oscillation frequency about 250 mc/sec. We will test these in switching and pulse type circuits despite our previous lack of success with tetrode transistors.

Three-Stage Amplifier Ring (J. R. Freeman)

A three-stage inverter-amplifier ring circuit is being used to evaluate various types of experimental transistors. R-C coupling is used to the best advantage to get the fastest propagation time through the chain. Collector loads and supply voltages may be varied to make saturated and non-saturated tests.

Technicians' Course (C. T. Kirk)

The transistor course for technicians is continuing once a week. Lectures to date have covered fundamental ideas behind conduction in metals and semiconductors. These lectures are intended to build up the necessary background to allow intelligent discussion of transistor circuits.

Transistor Test and Procurement (P. A. Fergus)

During the past week 1000 L5122 SBT transistors were delivered. These are intended for TX-0. Delivery of Western Electric core drivers (M-2012) has lagged behind promises. We were to have 200 units by the end of March but have only 20 to date.

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ESS TEST PLANNING - WWI MTC OPERATION

(Group 64, E. S. Rich)

ESS SHAKEDOWN PLANNING (C. C. Grandy)

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Exercise Design

W. Johnson has completed the revision of 6M-4223 "Schedule for ESS System Test for Group 64 and Group 22". This revision will not be issued until some difficulties concerning schedule dates are resolved. A corresponding requirement for operating personnel has been completed and will likewise be delayed. The sample shakedown test specification being prepared by W. Johnson should be completed in the next two weeks.

T. R. Callahan and M. J. DiCarlo-Cottonne have completed their proposal for assembly test of the basic program package and have issued this as an Interoffice Memorandum, "Assembly Test Proposal", PLFC-27. M. J. DiCarlo-Cottonne is continuing this work writing four thread-testing specifications called for by the proposal. We are awaiting Assembly Test Committee consideration of this test proposal.

Memorandum 6M-4278, "ESS Shakedown Simulated Problem Design", has been prepared by J. D. Coyne and R. Lawrence and should be issued in the next biweekly period. This memorandum contains an example of a simulated problem.

Testing Requirements (System Verification)

"General Shakedown Test Requirements", 6M-4281, has been published in draft form. This memorandum is a list of questions to be answered by shakedown testing. While this document is being reviewed, detailed test requirements for each question are being prepared. This will include an indication of whether live testing is required, a statement of parameters and their range of variation, the conditions under which the testing must be done, and data that must be collected. The study of operator shakedown mentioned in the previous BIWEEKLY has resulted in requirements which have been integrated into those stated in 6M-4281. A large number of questions which were excluded from this draft have been printed in an Interoffice Memorandum, PLFC-29, "Prerequisites for Shakedown." These questions should be answered by assembly testing and have been submitted to the Assembly Test Committee for consideration.

The study of air defense function logic has been completed for automatic tracking and radar inputs by T. R. Callahan. The results of this study have been incorporated into the proposal for assembly testing. Further work in this area has been suspended until the Assembly Test Committee has considered that proposal.

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ESS SHAKEDOWN PLANNING (continued)

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A supplement to 6M-4203, "Initial Data Reduction Requirements for ESS Shakedown," has been prepared by J. Wagoner. Wagoner has also collected and written our comments on "Group 61 Data Reduction Requirements", 6M-4262. These comments are issued as an Interoffice Memorandum, PLFC-28. R. Watters has prepared "ESS Shakedown Requirements for Photographic Recording", PLFC-30. These requirements affect both the operational program and the display equipment. The ESS-POC is investigating the feasibility of the requirements. W. Johnson and J. D. Coyne have begun to consider the problem of filing data accumulated from the shakedown exercises.

Facilities

Our entire activity in this area has now been concentrated into an operational test team concept. A large amount of system shakedown testing time can be saved by doing operational subsystem testing. A group of four people have been assigned to this activity and they are at present, working with Group 23 on standing operating procedures and operational manuals for the various ESS sites.

New Personnel

A. Petrino and M. Schleppenback both RAND employees, have joined the section and have been assigned to the operational test teams. A. Shortell, on temporary loan from Group 66, has joined the testing requirements activity.

WHIRLWIND I (L. L. Holmes)Delayed Printout Equipment

The production, installation, and testing of the hardware is proceeding as planned. The equipment in rack E6 (Printout System C) is already in operation as a substitute for System B. The installation of the equipment necessary for the new and more flexible control of the three printout systems will be completed 28 April. The control equipment will be integrated into the Raytheon system when it is proven operational. The entire project should be completed by 12 May.

A new Flexwriter table has been designed and a prototype is now being constructed by Group 60. When the final design has received concurrence, six tables, capable of seeing service at any Flexwriter installation in the Barta Building, will be assembled. The erection of a new home for the three Flexwriter tables used in the three printout systems will also be completed by 12 May.

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WHIRLWIND I (continued)Computer Recognition of Speech

J. W. Forgie is making a study on computer recognition of speeches and is using the WWI computer in the preliminary investigations. His apparatus is now connected to the WWI computer via a bank of transfer switches.

Cape Cod Direction Center Marginal Checking

A. N. Blumenthal has outlined a plan for marginal checking some of the equipment in the CCDC. Light guns and display scope amplifiers will be checked with a program, while the mappers and associated hardware will be checked with a test message generator, which will require no computer time.

WWI - XD-1 Crosstelling

Pending the success of a closed-loop test at XD-1 during the week of 22 April, an XD-1 - WWI subsystem test will be conducted the week of 29 April.

A new test message generator has been designed by E. W. Pughe, Jr., which will replace the equipment employed by the height request and crosstelling output systems.

WWI Computer Operations

Scheduled Computer Hours	333
Interrupting Incidents	19
Hours Lost	6.1
Percent Good Time	98.2
Mean Time Between Failures in Hours	17.2

The system reliability dropped off slightly due in part to seven failure incidents totalling four hours of lost time. Two of the interruptions were caused by human interference on the part of Group 64 personnel. The other five incidents were due to a wiring error in the recently modified filament alternator regulator panel.

There were five failures due to three faulty tubes. One of the tubes should have been discovered by marginal checking. The check routine will be reviewed in an effort to determine the reason for missing it.

During this period, nine tubes were replaced through the use of the marginal checking facility.

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MEMORY TEST COMPUTER (H. L. Ziegler)

About four dozen type 6080 tubes are needed to complete the replacement of all suspect series-regulator tubes in the MTC power supplies. After the Tube Lab people have supplied these and a similar number of interim (spare) tubes they expect to evaluate our proposed method of marginal checking these tubes in place. If the method is satisfactory, it will be installed as soon as our work load permits.

A report from the Components Lab indicates that use of the slow-blow fuses in the series-tube circuit as current-metering shunts is not practical in our case. These fuses have a fairly good temperature coefficient but vary widely in actual resistive value; preselection of fuses with a certain "standard" resistance would be too time-consuming for the quantity needed in MTC supplies.

The improvement campaign has greatly reduced our difficulties with power supplies, and their performance is now quite satisfactory. Emphasis is now being shifted to power distribution, particularly marginal checking lines.

Magnetic tape is shaping up. Operation is still uncovering a fair number of back panel wiring errors. Some special modes with the tapes have not yet had logical checkout. Magnetic tape should be available to users sometime during the week of 22 April, but top reliability should not be expected for several weeks after that.

The new timing cam and gears have made the IBM card machine quite docile and well-behaved---three days have passed since the change was made and so far we've had no errors.

A letter from Charlie West of Soroban Engineering Inc., assures us that a model of the high-speed punch we have on order has been tested on our grey tape. Results were satisfactory and he adds that they have also perforated 0.01 Mylar with the punch.

Our recent scope display troubles were traced to oscillation of the final deflection amplifiers. With these oscillations eliminated, the display returned to the high quality expected of it. We are now in a position to resume the work of improving scope-camera-film parameters.

Work on the scope-probe system and on the intercom system is moving rather slowly due to the press of more urgent projects. Most of the parts for the probes are on hand and will be assembled soon.

The past few days have seen a sharp upturn in both time available to users and in reliability. Test programs are being written and marginal checking lines are being provided to aid in our quest for reliability. Users are again asked to be patient if results aren't as good as they expected; maximum reliability does not come as a step function!

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VACUUM TUBES

(Group 65, P. Youtz)

TUBE TECHNIQUES (F.H. Caswell, L.W. Nelson, J.S. Palermo)

Solid-State Display Studies

A demountable vacuum tube and the necessary glass apparatus were reconstructed for Group 24 studies of electron beam excitation of photoconductive powders. Due to the procedures to be used in this study, an electron gun with a bariated-nickel cathode was sealed onto the vacuum tube. This will allow the reactivation of the cathode several times without replacing the gun after admitting the tube to atmospheric conditions.

Cathode Study Program

The 72 cathode study tubes specified in the cathode life test program (memorandum 6M-3965) have been constructed with the exception of one tube for Lot 4 and the 12 bariated-nickel cathode tubes. The one remaining tube for Lot 4 will be processed 24 April 1956. However, the construction of the 12 bariated-nickel cathode tubes has been deferred until more conclusive data has been obtained.

Bariated-Nickel Program

The B-N program has been curtailed during the past two weeks due to problems associated with the presently used nickel powder.

Phosphor-Study Program of Group 63

Four 2-inch CT's have been processed to evaluate the characteristics of the P2 and P4 phosphors. The ten remaining scheduled tubes in this series are being prepared to evaluate the P7, P11, P12, P14, and P19 phosphors.

CHARACTRONS AND TYPOTRONS (D.V. Mach, P. C. Tandy)

Six MIT 19-inch tubes have completed between 1286 and 10,256 hours of life test, and seven Charactrons have completed between 2900 and 3654 hours. Test results received since the last report have indicated no significant changes.

Thirty-two oxide-coated cathode study tubes have completed between 206 and 7900 hours. Thirty of these tubes on the present program have accumulated up to 1850 hours. Six tubes have been rejected from life test. Four of the tubes were rejected for grid emission, and two for low pulse  $I_{A3}$  current at the 20% duty cycle used on life test. These rejects do not fall into any particular lot numbers.

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CHARACTRONS AND TYPOTRONS (continued)

Thirty-six bariated-nickel cathode tubes have operated up to 1850 hours. The heaters on these tubes are now operating at 6.3 instead of 5.0 volts.

Thirteen triode and five diode early bariated-nickel cathode tubes are continuing on life test. No data has been taken since the last report.

Eighteen Typotrons have completed between 2202 and 8814 hours. Several tubes have leakage and one tube has very low emission, but all tubes will be operated until extinction or until a replacement is obtained.

COMMERCIAL TUBES (T. F. Clough)

The program to improve the reliability of the MEC power supply in cooperation with N. J. Ockene is about half completed at the end of this period.

On 16 April 1956 C. A. Selzo of IBM and I visited the Tung-Sol plant in Bloomfield, New Jersey, to discuss the DT-438 (improved 5998) development. Some progress has been made in their efforts to reduce the incidents of short circuits in this tube. This should permit them to determine the median and range of the tube characteristics. Their program is still behind schedule and much work remains to be done, but the outlook is better now than it has been for some time.

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SAGE DC AND CC SITES

(Group 66, B. E. Morriss)

SITE PLANNING SECTION (K. E. McVicar)

The members of the site planning section have been temporarily farmed out to other Lincoln groups where they will work to gain the background needed for the site planning activity. It is expected that in their new jobs, they will make running adaptations of the ESS work to SAGE. As the workload in the Experimental SAGE Subsector decreases, these section members will return to Group 66 to put the finishing touches on the site plans. By this time it is expected that they will be reinforced by large numbers of Group 61, 67, and RAND personnel.

EPSCOM (R. P. Mayer)

EPSCOM is now in Group 66 and is being reorganized into three subsections: Planning, specification and documentation, and coding and checking. Memorandum 6M-4306 describes the functions of these subsections.

An interoffice memorandum, "Preparing Computer Operation Requests", by S. L. Thompson, 11 April 1956, describes how EPSCOM programmers should fill out Group 67's forms for XD-1 computer operation.

Two BTL programmers, Barbara Awad and Catherine Toohig, have joined EPSCOM. Margaret Varga (BTL) is now the official EPSCOM secretary at Murphy Hospital. Howard Rundquist (Lincoln) has left EPSCOM to do liaison work with Group 67. The EPSCOM manpower now stands at 25 BTL, Lincoln, and RAND people (including our secretary); 12 Western Electric people (subject to rotation); for a total of 37 people.

Further details on all of the EPSCOM programs can be found in the EPSCOM Biweekly Report, 6M-4307.

EQUIPMENT (W. H. Ayer)

Reorganization at IBM, Kingston

A management reorganization at IBM's Kingston Plant took place recently. The most significant of the several personnel shifts involved was the assignment of G. A. Cullen, former Kingston General Manager, to the new San Jose, California plant. R. P. Crago, previously Assistant General Manager, moved up to the General Manager's position. R. J. Whalen, former Manager of Engineering, took over as Assistant General Manager. H. D. Ross, previously Manager of Development Engineering, became Manager of all engineering. Finally, R. J. Cypser assumed the post of Manager of Development Engineering.

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EQUIPMENT (continued)

Operational Expendable Items

The Division 6 PCO wishes to be contacted by anyone having information or requests for operational expendable items such as film, IBM cards, magnetic tape, mapping fluid, etc., as we are trying to compile a list for AN/FSQ-7 and -8. The information will be transmitted to ARDC and WE in order to insure that design and procurement specifications will be made out where necessary. Final procurement will be handled by ADC.

IBM Product Improvement Program

The IBM development engineering department is planning to set up a meeting with S. H. Dodd, N. H. Taylor, J. A. O'Brien and others at Lincoln to discuss their product improvement program for the AN/FSQ-7. This meeting is to take place within the next two weeks. An attempt will be made at the conference to fit specific proposals into an over-all program to determine the proper balance of engineering effort between long- and short-range projects. It is intended also to establish a priority list for the proposals to avoid wasting engineering effort in relatively unimportant areas.

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PROGRAM PRODUCTION

(Group 67, J. A. Arnow)

DCA PROGRAMS (D. L. Bailey, J. P. Haverty)

Tape format information for the recording function in the DCA master program has been specified in two interoffice memos:

"Preliminary Specifications for Master Operational Recording Tape Format," W. F. Harris, A. R. Miller

"Extract of Table Items for Master Operational Recording Tape Format," A. R. Miller, W. M. Mineart

These memos specify the items to be recorded, the frequency of recording, and format for individual tape records. They do not specify the ordering of records within a frame. The latter information will be available when more complete program sequencing and environmental requirements are known.

DOCUMENTATION (H. K. Rising)

The backlog of coding specifications in typing, approval, and distribution has been reduced to 48, with an average processing time of 27 working hours. To date, 374 specifications have been distributed.

Gene Lundberg has joined the section on loan from Group 66 to aid in developing documentation procedures which can be continued at the DC sites.

SAGE programming information service has been added to this section. Carroll Andrews (IBM) has taken over Tom Puorro's (IBM) duties in this area.

PROGRAM ASSEMBLY (A. R. Shoolman)

The tasks of the Program Assembly Section are divided into three areas: Program and table design, special programs, and adaptation.

The program and table design subsection was formerly a part of the program preparation section and has been placed in this section since its effort no longer includes preparation of any DCA subprograms. The subsection is responsible for collection and publication of all data concerning tables in the Master Program, for design and specification of the sequence and timing of in-out transfers (programs, peripheral tables, and central tables), and for monitoring in-out time and program storage requirements on a continuing basis.

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PROGRAM ASSEMBLY (continued)

The special programs subsection is responsible for the specification and preparation of programs to be used in expediting parameter check, assembly check, and program adaptation.

The adaptation subsection's task consists of generation (with program aids supplied by the special programs subsection as required) of the values of adaptation parameters from data supplied by Group 61.

Program and Table Design (L. B. Collins)

Personnel

Nancy Hood, Lyle Haas and Tom Puorro have joined the subsection. Nancy is working on environment and storage control, Lyle on table documentation. Tom Puorro and Gerry Schissel have initiated a new and continuing study of in-out interlock time and program operating time.

Table Documentation

An entirely new glossary is in preparation and will include all item, table, and program tags with an expanded description of each.

Program Sequence and In-Out Time

A rough study of in-out interlock time has been completed. A more sophisticated study is under way and will be expanded into a continuing study with regular summarized reporting. Work will begin on sequence parameters for the first assembly test package during the next biweekly period. Operational specifications for the "assemble sequence parameters" program are being published.

Environmental Control

The next com pool, to be taped early in the next biweekly period, will contain parameters for the table simulation program. This com pool will also satisfy all programs of the basic assembly test package.

Special Programs (H. I. Rundquist)

Six special programs are planned to be completed between 18 May and 15 June:

Keyboard Input Simulation - to provide console switch and light gun inputs to the program without use of the consoles or keyboard input matrix.

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PROGRAM ASSEMBLY (continued)

Data Simulation - To provide radar data to the program for initial testing.

Table Simulation - To create an initial situation in terms of table data for parameter and assembly testing.

Tape Merge - To prepare test input tapes containing radar data plus switch simulation, for assembly testing.

Static Display Generation - To prepare situation display messages to "draw" geographic data on the scopes (coastlines, airbases, radar sites, etc.) for use in adaptation.

Coordinate Conversion and Transformation - To obtain subsector and display coordinates from latitude and longitude for preparation of program adaptation parameters.

The programs will be coded by experienced programmers in Group 67 and new coders loaned by EPSCOM.

Adaptation (M. D. Field)

Operational and program adaptation parameters, methods for calculating program adaptation parameters, and specific values for each parameter for each subsector will appear in subsections of Section 3.0 of the Coding Specifications File. The format for this section is being designed and procedures for obtaining, calculating, and installing adaptation parameters in the Master Program are being worked out. The parameters required for the basic package are being transmitted to Group 61 for early collection and processing. John Carson is presently working in this area, having been temporarily transferred from Group 66.

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ADMINISTRATION AND SERVICES

(Group 60, J. C. Proctor)

PERSONNEL

Staff

Terminations

Charles H. Gaudette is now employed by Datamatic Corporation in Newton Highlands.

Transfers

Philip Bragar has transferred from Group 60 to Group 66.

Frona Brooks and David P. Latimer have transferred from Group 61 to Group 67.

William E. Holden, Rollin P. Mayer, Howard I. Rundquist, and Samuel L. Thompson, Division 6 members of EPSCOM, have transferred from Group 62 to Group 66.

Belmont G. Farley has transferred from Group 64 to Group 63.

Nonstaff (W. A. Kates)

New

Edwin Rodham	Office	Group 60
Lewis Doctor	Student	Group 63
Rex Sinclair	Co-op Student	Group 63
Nancy Hood	Techn. Asst.	Group 67
Carl Putnam	Office	Group 67
Ruth Seymour	Office	Group 63
Edward Cooper	Office	Group 67
Catherine Garofano	Office	Group 67

Transfers

James Mazza	Admin. Asst.	Group 62 to 66
Barbara Riley	Office	Group 60 to 66
Nichola Iodice	Technician	Group 64 to 60

Terminations

Elizabeth Osenton	Office	Group 66
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GENERAL ENGINEERING (A. R. Smith)

Negative Frame Assembly

Results of an earlier report on an investigation of the possibility of reproducing a negative for printed circuit work by mechanical techniques with greater degree of accuracy than presently available through photographic techniques, appears to be rewarding. The negative photographic emulsion has been removed to a 0.0005-inch accuracy providing good line quality. Investigation continues to determine the proper selection of cutter material that will not experience wear or alter negative transparency characteristics.

Vacuum Deposition

During the interim, since our last report on this subject, the Magnetic Materials section has submitted a request comparable to Building 10 section requirements, but of lesser complexity. Due to their similarity of objective and our unfamiliarity with such problems, both requests will be resolved as one, placing emphasis on completion of the simpler version first. It has been concluded that a controlled hydraulic system will be necessary for the micro-manipulator referred to in our previous biweekly.

Butt Thermocouple

The attempt to butt-weld platinum and platinum-rhodium 0.010" diameter wires together for thermocouple use has been unsuccessful to date due to the uncontrolled rate of retraction of molten surfaces when exposed to resistance current. A spliced lap joint has been spot-welded by F. Caswell of Group 65, requiring subsequent refinishing to maintain consistent wire size. One final attempt will be made to butt-weld wires using a flash-welding principle.

Cryotron - 32-Position Switch

Design has started on an assembly for mounting 12 coils (spools) within a 4-inch length and 7/16-diameter and used in conjunction with flip-flop circuitry for low temperature installation and applicable as a 32-position slow-speed switch.

Fire Annunciator - Building F

A layout for locating and specifying the mounting of each annunciator is complete for 50% of the total area involved. The circuitry for the system will be established and supplied by Group 12 personnel. The completed smoke sample reference layout for bid proposals has been submitted to E. Reardon. The alarm display board design will begin within a week, assuming all circuitry components are known at that time.

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GENERAL ENGINEERING (continued)Core Test Handler

In order to accelerate this project, production of the final model has been advanced by one week and is currently in operation, consequently short-circuiting the need for complete details and relieving the design group for other pressing requirements.

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

Component test reports issued this period:

<u>JOB NUMBER</u>	<u>SUBJECT</u>	<u>AUTHOR</u>
6-015-M009	IBM Key Modules	E. J. Bertrand
6-018-110	A H & H Switch	E. J. Bertrand
6-026-008	M-H Transistor	S. W. Wood
6-026-009	Bussman Fuses	H. Atlas

Jobs now in process include: Miniature toggle switches (life test); resistance wire measurements; and curves for power-type junction diodes.

Test Equipment

Test equipment maintenance for this period:

<u>EQUIPMENT</u>	<u>CHECKED AND O.K.</u>	<u>CHECKED AND REPAIRED</u>
Standard Test Equipment	15	21
Oscilloscopes	--	6
Commercial Test Equipment	3	2

The Test Equipment Committee has approved the purchase of two EG&G scopes, each with a band width of 2000 mc and a push-pull sensibility of 0.015 volt per trace width.

Best, Hodgdon, and Morrione spent a day at DuMont in Clifton, N. J., looking at their new oscilloscopes. They have some promising developments in the works, but nothing of immediate interest to us. They have a components and test equipment lab very similar to ours, and it is felt that a mutually beneficial interchange of ideas and information can be developed.

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(P. E. Falcione)

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4285	A. P. Hill	Air Defense Indoctrination Lectures (Series Six)	U
4286	Div. 6 Staff	Biweekly Report for Period Ending 6 April 1956	C
A-189	D. R. Israel	Appointment of J. J. Cahill, Jr. as Section Leader in Group 61	U
<b>SAGE SYSTEM TEST &amp; PLANNING (Group 61)</b>			
3780-1 C#2	J. Bryan S. Hauser	Change in the Operational Spec- ifications for the Identifica- tion Function in Sage	C
3870-1	R. R. Reed	Operational Specifications for Digital Displays in a Sage Direction Center	C
3930-1 C#2	H. P. Bridge	Operational Specifications for the XD-1 Startover Function	C
3926 C#1	E. Braude et al	Mathematical Specifications for Weapons Assignment in the Sage System	C
3951	R. R. Reed	Operational Specifications for Situation Display in a Sage Direction Center	C
4237	R. R. Reed	Digital Display Slot Assignment for AN/FSQ-7	C
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3851-2	J. Giordano	Master Reference List of Equip- ment Specifications for XD-1	C
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3754-1	J. Berman	AN/FSQ-7 Warning Light and Audible Alarm Bit Assignments	U
3757 S#2	J. Berman	Nomenclature for Consoles and Operating Positions in AN/FSQ-7	U
4013-1	D. L. Bailey	Mathematical Specifications for Track Detection and Initiation in the Sage System	C

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4069-1	H. Newhall	Procedure for Use of Card Processing Facility	U
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