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

SUBJECT: BIWEEKLY REPORT FOR PERIOD ENDING 16 DECEMBER 1955

To: Jay W. Forrester

From: Division 6 Staff

Date: 21 December 1955

Approved: J. C. Proctor

CONTENTS

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

SAGE SYSTEM TEST AND PLANNING

(Group 61, J. F. Jacobs)

MASTER PROGRAM PREPARATION (H. D. Benington)

Utility Programs (C. H. Gaudette)

A large portion of the Checker Program has been coded and is being checked out. "The Lincoln Checker: Operational Specifications," 6M-3994, has been completed and will be available by 22 December.

The Compiler is now being used by Group 61. The interpretive section of the Checker was the first program to be compiled satisfactorily. All sections of the checker and all other utility programs will use the compiler language.

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

ESS Planning and Operations (C. C. Grandy) CONFIDENTIAL

A draft of 6M-4051, "Group 61 Proposal for Operation of ESS Shakedown, Revision and Verification Exercises," (Callahan, Grandy) has been discussed. This memorandum presents Group 61's proposal for the conduct of operational exercises in ESS from 16 April to 15 October 1956, and includes the detailed requirements for computer time, AF operators, support aircraft, and simulated data tapes.

The study of requirements for standing operating techniques at external sites (Thomas, Grandy) has been completed. Arnold Thomas and Ro Raffa are preparing an M-note stating the requirements.

Preliminary job assignments have been made for members of this subsection as follows:

T. R. Callahan and C. C. Grandy:
- Exercise Design
- Simulated Data Tape Specifications
- Flight Exercise Specifications

R. Luscher and J. Wagoner:
- Analysis Specifications
- Recording Requirements
- Verification Specifications

A. Thomas and R. Raffa:
- Equipment Coordination
- Standing Operating Techniques
- Operating Personnel

OPERATIONAL SPECIFICATIONS FOR SAGE SYSTEM (continued)

Combat Center (W. Lone)

The first rough draft of the "Guide to Combat Center Operation" has been completed and distributed. It is expected that conferences on the content of the guide will take place during the coming bi-weekly period.

The operational plans for the Direction Center are being reviewed and their effect on the Combat Center determined.

Standby Computer Activity (A. Heineck)

A method for obtaining a variable interleave period has been proposed. This method requires that two auxiliary drum fields be reserved for startover data. A variable interleave period would allow most maintenance programs to be performed while the standby machine is communicating with the active machine.

Operational Specifications (J. J. Cahill) CONFIDENTIAL

Memorandum 6M-3930, "Operational Specifications for ESS Startover Function," has been completed by Dan Ladd. This ends Ladd's obligation to the startover program.

(Our apologies to Jack Cahill and Dan Ladd for not including the above item in the Biweekly for 2 Dec. Ed)

Corrections to the Weapons Assignment and Intercept Direction operational specifications (6M-3744-1 and 6M-3786-1, respectively) were rewritten. Only those changes required to correct errors or satisfy omissions in the operational specifications, or changes specifically requested by the Master Program Preparation Section, will be included in these corrections. Other changes, however desirable operationally, will be prepared as revisions to the specifications, to be included in the Master Program at some later date. Some revisions to the mathematical specifications for intercept direction and weapons assignment were required as a result of the change in structure of the corrections. These changes have delayed issuance of these specifications, which should be available in first draft form about 27 December.

For other information on weapons direction specifications, see STUDIES IN PROCESS.

Air Surveillance (E. W. Wolf)

Mary Kresge and George Dimock, both of RAND, have joined the section

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OPERATIONAL SPECIFICATIONS FOR SAGE SYSTEM (continued)

and have been assigned to the WISE System effort. They will be stationed in the Barta Building with Frona Brooks and David Latimer.

The second draft of 6M-3816, "Operational Specifications for Cross-telling in the SAGE System," by S. M. Ornstein and J. A. Ishihara, has been issued.

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

Data Analysis

Ray Olsen has joined the section and is heading up the Data Analysis effort.

TBS Mathematical Specifications (J. Levenson, R. Russo)

A draft of TBS mathematical specifications covering input of simulated data and interceptor simulation was issued. After conference with Steve Hauser and members of the MPPS, changes are being made which will simplify the programming of simulation in the Master Program and still satisfy operational requirements.

Data Generation (J. Levenson, R. Russo, R. Collmer)

Specifications for the Data Generation Program (DGP) are being formulated. A rough draft has been prepared describing the inputs to the DGP, and two studies have been completed in connection with it:

Series approximation for extrapolated aircraft positions.
Approximation for the times of successive radar beam intersections with an aircraft vector course.

Recording (E. Lafferty)

The recording mathematical specifications are approaching draft form. S. Tower of RAND has started work on this subject. The second draft of the recording OPS specifications has been issued.

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

Program Checkout (Utility Assembly)		26:52
Downtime		
In/Out Equipment	5:48	
Computer Malfunction	0:30	6:18
Returned to IBM		26:40
TOTAL ASSIGNED TIME		59:50

FSQ-7 PROTOTYPE DESIGN AND INSTALLATION

(Group 62, N. H. Taylor)

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

Acceptance Tests (J. Crane)

Acceptance tests, consisting of an individual check of each display console, are being performed. The results of checks are recorded on special log forms which will constitute the source of information to be used for acceptance.

LRI System Test (W. J. Canty)

During past months several tests have been run during which test pattern data generated by MTC and live data from South Truro has been displayed on XD-1 situation display consoles. During the week of December 12th an XD-1 single aircraft tracking program was completed and tried with apparent success. With this program, live aircraft in the vicinity of South Truro were tracked.

Much time and effort has been expended by members of the LRI Test Team in checkout of the 14-channel Ampex tape recorder in Bldg. F as a data-recording device. During the past two weeks, this recorder has been used for data recording and play back many times with excellent results. Now LRI signals (live data or test pattern) can be made available for use in XD-1, irrespective of the availability of the South Truro FGD equipment or MTC.

MEMORY TEST COMPUTER (W. A. Hosier)

Art Hughes has devised a suitable switching arrangement for marginal checking of the tape drive units using the MTC amplidyne. He is now laying out details.

The carry gates for the MAR, a necessary adjunct to the block transfer instructions for tape and drum, have been nearly finished in drafting, and will go into the shop the first of next week.

New Control

The sequence switch and clock control have been wired into the new control frame but not yet tested. Planning effort is now going into block transfer instructions and the new memory field switch. Some difficulty has been caused by diodes at high ambient temperatures in the test room, but cleared up when small blowers were applied to the offending circuits. Air conditioning in the computer room should be sufficient after installation of the new control there to eliminate these blowers.

MEMORY TEST COMPUTER (continued)

Display

We have received one K1354P7 from DuMont, installed it in the new scope mount, and so far, aside from a little initial sputtering, it has not shown any signs of the breakdown that destroyed the K1187's. The new display as seen on this scope is a joy to behold: it appears that alphanumeric printout of a whole memory field (2048 words) on one frame of film is now feasible! These point-by-point generated letters and numbers have, in fact, received the accolade of being mistaken for those of the Charactron. It should be possible to complete substitution of this scope for the old camera scope in about a week (nice Christmas present for MTC). A similar one will be installed in the operator's console early in January when we receive it from the shop.

Computer Operation and Reliability

There has been no pronounced change in computer operation this period. Except for some minor alignment difficulty in the card machine, everything has been behaving well. An interesting sidelight on MTC reliability, at least as far as core memory is concerned, is a figure recently compiled for Dave Brown, who wanted comparative figures on memories for a chapter he is writing in Wiley's forthcoming book. This particular figure, the average operating time between malfunctions during scheduled operating time, taken over the last six months for MTC, is 623 hours. Even when malfunctions during maintenance are counted, the figure is still 390 hours.

Operating time over the past two biweekly periods has been apportioned as follows:

	Hours	Per Cent
Analysis and Data Processing	197.3	40.4
Development and Testing	182.7	37.4
Maintenance and Marginal Checking	30.9	6.4
Reliability Check Programs	65.9	13.5
Interrupting Failures	11.7	2.3
Total	488.5	100.0

Defects in components and tubes:

Component	Defect	Time Lost	Qty.
5881	Gone to air	0	1
6080	Gone to air	0	2
6145	Tap short	0	4

MEMORY TEST COMPUTER (continued)

Component	Defect	Time Lost	Qty.
Capacitor	Shorted	1.00	1
Resistor	Burned out	.50	1
Resistor	Burned out	0	5
Socket	Loose connection	0	1
Toggle switch	Open	.03	1
Toggle switch	Open	0	3
Toggle switch	Shorted	.20	1
	Total	1.73	20

DISPLAY DEVELOPMENT (C. Corderman)

An M-note (6M-4060) has been written on a trip to the IRE Conference on Instrumentation and describes an analog-to-digital encoder and a suggested method for evaluating specifications on transducers.

A trip was made to the Computer Control Company in Wellesley to see their 3C-PAC gating package. The tube used in the PAC (a 5847) appears to be an excellent tube to be used in any future amplifiers which might be developed here.

A test rack has been supplied to Building F personnel for adjusting the magnetic deflections compensation circuitry. Some time was spent reviewing the theory of the compensation, the purpose and use of the test rack, and the procedure for the adjustments.

Notes are being prepared on eddy current problems in CRT shields, theory, and specifications of the XD-1 line drivers, and specifications of the XD-1 character selection and character positioning decoders. (Zieman, Woolf)

With members from Hazeltine and IBM, I visited CBS-Hytron, RCA, and Farnsworth Electronics Company to discuss characteristics of a large character-writing tube having controlled persistence. A final trip to A. B. DuMont is tentatively planned for this survey.

A visit to Bushmer-Meers Co. in Minneapolis is scheduled for the week of December 19th to discuss the manufacture and availability of various meshes suitable for storage screens in 5" and 19" tubes. Members of Groups 25 and 65 will also participate in this meeting.

Some discussion has come about recently concerning an inconsistency in the Typotron erase time in that the equipment has been designed for 40 ms while the Typotron specification allows 200 ms maximum. It is felt that the equipment being used to test tubes at Hughes is

DISPLAY DEVELOPMENT (continued)

less conducive to erasure than the equipment used in the consoles. This has been confirmed in testing approximately 200 tubes for which the Hughes erase times were consistently greater by a factor of between 2 and 4 than the times measured by IBM. It is hoped that some further experimentation by Hughes with different erase circuits will enable them to reduce the specification to a realistic value of erase time.

BASIC CIRCUITS (R. L. Best)

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

At a conference with Charles Bading of IBM it was decided to narrow the range of designs to cold probe units. Loren Prentice is now designing a "trigger tip" probe gun for such a cold probe system. It will drive eight feet of Federal K-109A cable with resistance wire damping which will terminate in a simple cathode follower built into a can attached to the cable. The follower will then drive 22 feet of RG-114/U coax which will lead to a junction box connected through another 200 feet of RG-114/U to the maintenance console patch board.

The cathode follower circuit will be one of the following, built into the cable can:

1. One 6216 (min.) and one 5718 (submin.); 10:1 ratio
2. Two 5639 and one 5718 (all submin.); 20:1 ratio
3. One 6197 (min.) and one 5718 (submin.); 20:1 ratio.

These three circuits are being constructed for final evaluation and selection.

An interesting possibility has developed of damping a 27-foot length of coax with resistance wire and thereby eliminating the cathode follower from the cable, placing it at the junction box instead. Resistance wire has been ordered for an experiment.

256^2 Core Memory Circuits (M. J. Flanagan, D. Shansky)

Tests of the production prototypes of these circuits are in progress. Thus far, three prototype pluggable units have been completed by the shop: the switch driver, switch driver input amplifier, and the digit plane driver. The only remaining unit of the memory selection circuits, the switch driver current regulator, will be completed in the next period.

Search-Radar Mapper-Sweep Circuit (B. W. Barrett)

A simple constant duty factor sweep circuit for the search radar has been breadboarded and other hardware for this job should arrive within two days.

BASIC CIRCUITS (continued)

High Speed Flip-Flop (MTC) (N. J. Ockene)

Final tests on the flip-flop are being run. Some time has been spent on making improvements in the PRF response.

Digital Data Receiver (E. Glover)

A new AGC circuit was designed and operated with sufficient margins for the 326-bit message length. We will not use this circuit, but will keep the data regarding it for any future needs.

The smaller message length has been operated successfully, but margins are slightly one-sided and indicate a need for minor rearrangements. It is hoped that the major portion of this work can be completed before I leave on vacation. The rest of the necessary data will be obtained by Paul Messenheimer during my absence.

Charactron Vector Intensity Decoder (R. B. Paddock)

Although fall and rise times can be improved at the expense of more cathodes, inductive "peaking" is being tried in the hope of saving these extra cathodes. A circuit has been added for gating the input with a signal from the vector register; this has not been tested.

BOEING-LINCOLN STUDY GROUP (H. E. Anderson) CONFIDENTIAL

The second joint meeting of the study group was held in Seattle during the week of 12 December. Considerable progress was made in formulating a plan for demonstrating SAGE-Bomarc compatibility. The plan is far from complete, but will recommend four major areas of work to be undertaken:

1. Preparation of a Bomarc-SAGE system description
2. Subsystem tests
3. Simulation of SAGE controlling Bomarc
4. Live firing of Bomarc under prototype SAGE control.

The third joint meeting will be held beginning 4 January 1956 in Lexington. Lincoln Laboratory representatives on the committee are: D. R. Israel, F. E. Heart, L. R. Jeffery, and H. E. Anderson.

SYSTEMS OFFICE (H. E. Anderson)

SAGE Antiaircraft Integration CONFIDENTIAL

Meetings were held on 13 and 14 December at Lincoln between AFCRC, ARDC, ADSOD, ARAACOM, SCEL, WE, BTL and Glenn L. Martin at which the automatic communications between SAGE and the AN/FSG-1 were discussed.

SYSTEMS OFFICE (continued) CONFIDENTIAL

The standard SAGE ground-to-ground data facilities (DDT-DDR-1300 pps) will be used from the AN/FSG-1 to the AN/FSQ-7. SCEL and Glenn L. Martin personnel have acquired the up-to-date specifications for the SAGE data facility. The standard (750 pps) AN/FSG-1 data facility will be used from the FSQ-7 to the FSG-1.

AFCRC, who called the meetings, acquired the schedules for equipment development and production and will recommend action to Hqs. ARDC and USAF for implementation. The recommendation will include the design and development of a new output section at 750 pps for AN/FSQ-7.

Height Finder Request Word Compatibility

A memorandum is being written as the result of a study to propose the method for having the FSQ-7 and FST-2 agree on the significance of the bits transmitted first over the data circuit.

Bomarc Data Link

A proposal for a Bomarc output section which would be compatible with the present G.E. demultiplex unit (G/A) was presented at a meeting at RADC on 2 December 1955.

AN/FSG-1 Integration

S. B. Ginsburg participated in a discussion at a TAPE task group meeting on communication problems which exist between a SAGE Direction Center and an AAOC for AN/FSG-1 integration.

Automatic Teletype Input

The automatic teletype input study is being extended to consider the use of teletype for reply back messages from Bomarc, AAOC and Talos sites.

Drawing E-58233-12, Second Floor Layout of Building F, received IBM concurrence and Group 61 approval.

RECORDING CAMERA (L. L. Sutro)

Experiments to achieve the best possible photographs continue. The film, developer and f-stop have been selected. IBM personnel are seeking, through experiment, the best adjustment of brightness controls. To aid them we have put graduated plates under these controls. A record of the best settings should be attached to the subpanel of the camera console so that brightness controls will be restored to these settings after any maintenance work.

ADVANCE DEVELOPMENT

(Group 63, D. R. Brown)

MAGNETIC MATERIALS (J. B. Goodenough)

Memory Core Production

Approximately 250,000 D397 memory cores were fired and sent to the testing section during the past biweekly period.

Memory-Core Testing

The total number of memory cores double-tested by this section to date for the 256x256x37 memory is 2,208,135. In addition, 120,000 cores have been single-tested and are now on their final test. There are also approximately 155,000 untested cores on hand, making a grand total of approximately 2,483,000.

Chemistry

Iodometric methods are being applied to the determination of lithium and the oxidation states of heavy metals heretofore analyzed without success. These samples include a series of substituted lithium ferrites and some mixed oxides containing lithium and nickel (+3). (D. Wickham, D. L. Brown)

Cobalt-substituted manganese-ferrite boules have been oriented and cut from window frame experiments. These are shown by microscopic and X-ray examination to be single crystallographic domains although they are badly cracked. (W. J. Croft)

Titles for the film on domain patterns in polycrystalline ferrites have been completed and are now being photographed. (F. Maddocks)

An investigation is being started of the two-phase region in the system Fe_3O_4-Mn_3O_4. (F. Maddocks)

Physics

Instrumentation:

The vibrator for the vibrating-coil magnetometer (VCM) is now in operation. The electrical performance of the instrument is being checked. The first magnetic measurements to be taken on the VCM will be the saturation moment of ferrite powders as a function of temperature. It is hoped that these measurements will be begun during the next biweekly period. (D. O. Smith)

ADVANCE DEVELOPMENT (continued)

Tests on the new high-gain power amplifier, which was built for use with the dc Fluxmeter, shows the circuit to be unstable. It was impossible to eliminate the oscillationsfrom the system without a drastic decrease in gain. Further experiments, involving major revisions in the circuitry, are being conducted. (R. A. Pacl)

Theory

A calculation has been made which indicates that by obtaining the best geometry of a magnetic-material array the applied current-magnetic field relationship will be improved by less than an order of magnitude. This improvement is achieved largely at the expense of the output voltage, which is reduced considerably. These results indicate that an order of magnitude improvement in the speed of a magnetic memory cannot be achieved by geometrical revisions alone; but must be accompanied by a magnetic material which is intrinsically faster switching than any presently employed and/or a memory system capable of using smaller signal outputs.(J. D. Childress)

In conjunction with the domain-wall-velocity experiments to be conducted on single ferrite crystals, a re-examination of the equation of domain-wall motion has been made. This examination has pointed up the limitations of the assumptions involved in the present theory.

A study is being made of the feasibility of using two solenoids in series opposition to obtain a magnetic field gradient of sufficient magnitude to be effective in separating small magnetic particles. (N. Menyuk)

SYSTEM DESIGN (K. H. Olsen)

EMAR

Most of the EMAR plug-in units have been received, and the system is now operating. The transistor decoders make a quite satisfactory memory display.

TX-0

The first TX-0 plug-in units are being assembled. The console has been designed and is on its way to the vendor.

Paper Punch

Ben Gurley has designed transistor circuits for driving the punch code magnets. He is having the coils rewound to take less voltage to keep within the transistor rating.

ADVANCE DEVELOPMENT (continued)

Transistors

SBT Life Tests

The shielded 8-digit shift register continues to run without error and has to date accumulated a total of 4640 hours running time since its last mistake.

In general, the 295 life-test transistors have been on test for 1.5 million transistor-hours with two failures, both of which occurred in testing. TM-1 has operated for 2600 hours with 480 transistors and has had one failure. This appeared as an intermittent open and was the result of a crack across the germanium at the base connection.

An M-note describing the results of all SBT tests in detail will be published shortly.

Transistor testing

The over-all yield of the last 1500 SBT's tested against the switching specifications has been about 70 per cent. Of these, 1006 SBT units have been delivered to TX-0 and another 1000 are presently available for testing. (P. A. Fergus)

SBT Hole Storage

A memorandum "SBT-Hole Storage - 2" is being written and will be published shortly. This is an extension of 6M-3888 on hole storage and deals with the generalized case of storage time in SBT's for the various circuit configurations of the transistor. (C. T. Kirk) Experimental work on hole storage is also being continued. (J. R. Freeman)

Transistor Test Equipment

Both the $r'_b C_c$ bridge and the f_{max} tester are now operating satisfactorily. These units make possible a determination of the cut off frequency of the transistor for high frequency units. (L. Jedynak)

Silicon Diode Noise

All the features of the noise in the near-Zener region of silicon diode conduction have not yet been determined. However, it has been observed that the noise results from an action very similar to the avalanche breakdown in a gas tube. The voltage across the diode rises, in the reverse direction, to a high value until suddenly the diode breaks down with a decrease in voltage, resulting in a current pulse. This discharge decays at a rate determined by the resistance

ADVANCE DEVELOPMENT (continued)

and stray capacity in the circuit. The "firing potential" is roughly constant. Some diodes show a quite uniform occurrence of these pulses. The rise time of the pulses is less than 15 μsec.

MEMORY (J. L. Mitchell)

Experimental Switch and Plane

The value of the damping resistors on the core switch driving lines was reduced. This change improved the shape and uniformity of the switch outputs.

Cooling and Supplies

Insulation of the ceiling in the basement of Building A is complete, and the lighting fixtures are now being installed. The Westinghouse air conditioning units will be delivered on December 19, without the compressors. The compressors will arrive when the Westinghouse strike is settled. One of the three Power Equipment Co. dc supplies and three of the four Lambda supplies were delivered. Remainder of the supplies will be shipped in the near future.

256^2 Construction

Eighty-two 64 x 64 memory plane modules have been accepted. The assembly of the first production 256 x 256 plane is underway. The small plane tester is completed and ready for test. Nineteen magnetic core switch plug-in units have been completed.

The drafting is essentially completed on all major parts of the memory system. Construction of all units is scheduled, and the construction of the selection equipment is well under way. A pluggable unit tester is being built and should be finished within the next week or so.

Advanced Development

The sense amplifier circuit is now being tested and polished. Ten Western Electric SA8320 transistors were received and are now under test. This unit looks like a good candidate for driving memories. More of these units are being ordered.

AN/FSQ-7 AND CAPE COD DIRECTION CENTER

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

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

G/A Data Link Test (C. W. Watt, I. Aronson)

The flight testing activity in Group 311 has been very active during the past two weeks. The messages which have been used to operate the airborne equipment during these flight tests have been derived mostly from the tape recorded messages at the Barta Building. Flight tests have also been run using messages directly from the output buffer drum of XD-1. The data obtained from the two types of tests (tape and OB drum) were recorded and are currently being analyzed to help in our evaluation of the tape as a message source. For the past two weeks, a daily schedule of operation of all of the equipment involved in these daily flight tests has been made ahead of time so that a minimum of confusion exists when tests are to be run at the various forms of activity, namely, Barta Building, XD-1, and Prospect Hill. The tests have, in general, been quite successful and are being used principally for personnel familiarization and for evaluation of the tapes and the drums as message sources.

A test was run on Thursday night, 15 December, to evaluate the reliability of the magnetic tape at the Barta Building when it is repeatedly rewound. Mylar tape was used for the recording. A program written by Mayer and Werlin was used in MTC which first sent a message to the Barta Building for recording and then checked the recording bit by bit. A run of about 3-1/2 hours was obtained with only two errors indicated for the whole period. This seems to show that, at least with Mylar tape, there should be no problem of deterioration when the tapes are used as a message source for the data link.

Crosstelling (C. W. Watt)

During the past two weeks, four two-hour sessions have been held with both computers tied into a crosstelling loop from the Barta Building to Building F and back. During the first two sessions, bugs in both the WWI and XD-1 programs were detected and corrected. The last run on Friday, 16 December, was almost completely successful. The loop ran with only two momentary interruptions for about 1-1/2 hours. One of the interruptions is thought to have been a power transient in one of the XD-1 input frames caused by a blown circuit breaker. The other error showed up as a parity error at the Barta Building and was probably due to phone line noise. The program used at the Barta Building checks each bit received against the messages sent in addition to checking the over-all word parity and the presence of the proper busy bit. No errors except those indicated above were recorded during the long run.

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SYSTEM TEST PLANNING AND COORDINATION CONFIDENTIAL

Four more two-hour sessions have been scheduled during the next two weeks and it is anticipated that the ability of both machines to reject incorrect messages will be thoroughly tested and techniques will be developed for identifying the causes of any errors that occur. It should be possible to complete this series of tests by the first of January as scheduled.

System Integration (A. J. Roberts)

I have been working with the crosstelling test team in order to determine the problem areas which exist in integrating external equipment with the computer. The results of these tests have been very good because of excellent cooperation between personnel at XD-1 and WWI. Program modifications have been accomplished rapidly and special test setups (combinations of Burroughs units) have been used to good advantage. The experience gained during these tests should help the other test teams avoid initial difficulties.

I am presently trying to define system tests for ESS integration and to determine those areas in which coordination between equipment and programming personnel is essential.

LRI Test Plans (W. J. Canty)

A test plan document - Test Specification of the South Truro to XD-1 Long Range Radar Input Subsystem - has been prepared by the LRI Test Team and is in the process of final typing. It will be published as an M-note shortly.

EPSCOM (R. P. Mayer)

On Friday, 9 December, XD-1 tracked an airplane for the first time. The program was the previously reported single-track program written by H. Rundquist, S. Thompson, and C. Sherrerd. The identity of the aircraft was unknown, the track lasted only a few scans, and only a single gap-filler site was used. Subsequent tracks have lasted longer. The LRI portion of the program is now nearly working.

On Friday, 16 December, MTC recorded a 5-second spoken message and reproduced it with sufficient clarity to be intelligible over a voice phone line. The program was a low-priority one written by R. Mayer as part of a study of the possibilities of using voice control for computer testing and of using spoken computer reports of progress. An XD-1 playback program, and an MTC code word decoder program are in progress.

Memorandum 6M-4047, "The Writing of Equipment Program Specifications,"

has been distributed. EPSCOM programmers should plan to write the documents described as soon as possible without interfering with the completion of high-priority programs now in process.

Memorandum 6M-3964, "The Program Input Process: A Manual on the Use of the Lincoln Compiler and Read-in Programs," (issued by Group 61) describes the programming procedure for the compiler. EPSCOM programs will make use of the compiler as soon as possible.

CAPE COD ENGINEERING (L. L. Holmes)

WWI Computer Operation

Scheduled Computer Hours:	331.5
Interrupting Incidents:	12.0
Hours Lost:	6.6
Percent Good Time:	98.0
Mean Time between Failures in hours:	27.0

The power was removed from the equipment for a period of 3.3 hours because of a Freon leak in the air conditioning system. The failure contributed to 50% of the down time.

An intermittently open delay line in the complement input to a flip-flop of the program counter caused three interrupting incidents and a total of 2.2 hours of lost time.

XD-1 and WWI Crosstelling

To aid in the localization of future intermittent failures, it is planned to connect parity checking devices to the sending and receiving ends of both phone lines. The addition of these devices will probably be the last crosstelling equipment changes necessary at WWI.

Magnetic Drum Equipment

The twelve intermittent auxiliary drum failures reported last period have been traced to a design defficiency in the drum's control system. The fault was with close timing in the synchronizing of the computer with the drum. The trouble was aggravated by recent changes in that area.

The new voltage interlock system for the equipment in the drum and MITE area has been installed and checked out. The new system provides added protection for the equipment whenever a power supply fails.

CAPE COD ENGINEERING

48 KVA Motor-Generator Set

The new M-G set was recently returned from the factory and tests were resumed. The mechanical regulator that was purchased with the new set meets the manufacturer's specifications but has a few undesirable conditions if used in our filament power system. Therefore, it is intended to test the new set with an electronic regulator similar to that used with operating M-G sets, and it is hoped to have the new set in service in January.

Computer Display System

Lin and Blumenthal have continued working on the computer display system noise problem. The noise that is always present causes distorted presentations only when the display system is used at low frequency. A new decoder output amplifier has been designed and will be tried in the next period.

G/A Output Coder

An error in the logic of the G/A output coder's control system was discovered and corrected. The system would be inoperative if a control flip-flop was on a "one", and the system was requested by a computer instruction. A small video cabling change corrected the difficulty.

VACUUM TUBES

(Group 65, P. Youtz)

TUBE TECHNIQUES (J. S. Palermo)

During the past two weeks 11 bariated-nickel cathode tubes have been fabricated and processed. The results from these tubes indicate that the modified pressing procedure has solved the interface problem between the two metallic mixtures. Since these tubes have been adequately reproduced, a supplementary 14-tube program has been started to evaluate and determine the effects of modified sintering cycles on cathode current.

Additional aluminum evaporated grids on glass for electroluminescent storage device studies of Group 25 have been prepared.

Three 5-inch Charactron tubes for projection studies have been started for Group 62.

RECEIVER TUBES (S. Twicken)

E. J. Braiding of IBM, P. Youtz, and I visited Sylvania at Emporium, Pa. An ADES meeting for allocation of the SR-1782A had requested that all possible specification relaxations be made to increase lot shipments until the present production difficulties are straightened out. Accordingly, on an interim basis, we have waived the median control on dc plate current and have increased the maximum pulse-screen-current by 5 ma. Intensive investigation and factory engineering are being applied to eliminate the high screen current problem which is the more important of the two. A dimensional change to increase the pulse plate current (the characteristic of primary importance) to the level of the 7AK7, after being in production satisfactorily for a month, has gotten out of hand resulting in high screen current.

The Brookville, Pa., operation which will eventually produce all Sylvania's SR-1782A's is moving along rapidly. Brookville, a factory production unit, is the only solution to the problem of quantity since Emporium by its very nature (product development) is not a large production setup. The SAGE movie was shown at Emporium and was taken by the Brookville people for showing at their plant.

The following week, at the request of Sylvania, I returned to Emporium to straighten out a pulse-test-equipment correlation problem.

We are investigating the effects on SR-1782A characteristics of the dimensional Changes to increase pulse plate current.

COMMERCIAL TUBES (T. F. Clough)

The Lincoln Tube Process Specifications for the bariated nickel cathode

COMMERCIAL TUBES (continued)

study tubes are nearly completed. These specifications will detail processing procedures for this program and minimize variations from tube to tube.

I attended a meeting on the type 2420 (improved 7AK7) shortage at ADES in New York City on 8 December 1955. Air Force, Western Electric, Burroughs, and IBM representatives were also in attendance. Specific suggestions on possible specification changes will be deferred until a report of the IBM-Sylvania-MIT discussions are reviewed. Sylvania's December shipments of the 2420 tubes were allocated. Burroughs and Lewyt will receive 100% of their December requirements which were small. The balance of the shipments will be made to IBM. Another meeting will be held in January for a further review and allocation. The possibility was mentioned that G.E.'s 0528 (improved 5965) production may also have to be allocated by ADES because the demand is exceeding the supply.

CHARACTRONS AND TYPOTRONS (P. C. Tandy)

Four MIT 19-inch tubes and 12 Charactron tubes have completed between 165 and 7497 hours on life test. No significant changes were noted on the Charactron tubes, although all the data taken has not been received. With the installation of the 35 mm scope camera, some delay has to be expected between the time data is taken and the results are received. The advantage of the 35 mm camera is that the data will be more easily disseminated.

Two MIT tubes, CHT-75 and CHT-113, failed to produce 50-μa matrix current (the life test end point) after 7424 and 3704 hours, respectively. The tubes will be rejected if similar results occur at the next testing period.

Eight cathode study tubes have completed between 3714 and 5093 hours. Six tubes which had given poor beam current at several testing periods were rejected. None of the six rejects show leakage after life test.

Twelve bariated-nickel cathode study tubes, six diodes and six triodes, have completed between 22 and 1700 hours. The diodes and three older triodes have shown no appreciable changes in the last 700 hours. The supply voltage has been decreased and series resistance increased on the triode panel to prevent the G2 from running red hot under electron bombardment. The beam currents of the three new tubes are operating at 1.4 to 1.9 ma and voltages between 1650 to 1910. Only one of the older tubes gives a similar current. CT-152, the most recent tube, started at 2.13 ma at 1340 volts but dropped to 1.4 ma at 1650 volts after 15.5 hours.

PRODUCTION COORDINATION OFFICE

(Group 66, B. E. Morriss)

POWER (J. J. Gano)

Thermister Application to Filament Cycling

GE intends to supply us with a 3"-diameter thermistor and the magnetics group with a 2"-diameter unit. They will be investigated for application to the large loads of AN/FSQ-7 frames.

MTC

Jahn is designing the auxiliary rectifier units to be superimposed on the standard voltages for accomodation of the tape units.

TX-0

The power sections of the power supplies for the memory portion of the computer have arrived from Power Equipment Co. The thyratron rectifiers will be controlled by the vacuum tube regulators constructed in our lab. This combination of thyratrons and vacuum tubes has proven very reliable in WWI. Coffin is testing the supplies for frequency response to synthesize compensating circuits. The Group 65 supplies which are similar are being prepared simultaneously.

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

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

TIR #	DOCUMENT #	SUBJECT
1-114	6M-3291 Supp. 4	Specifications for the Central Computer System for the AN/FSQ-7, Supplement 4, dated 24 October 1955.
	6M-3292 Supp. 3	Specifications for the Drum System for the AN/FSQ-7, dated 24 October 1955.
	6M-3293 Supp. 3	Specifications for the Display System AN/FSQ-7, dated 24 October 1955.
	6M-3298 Supp. 3	Specifications to the Manual Inputs System for the AN/FSQ-7, dated 24 October 1955.

TIR #	DOCUMENT #	SUBJECT
	6M-3299 Supp. 3	Specifications for the Output System AN/FSQ-7, dated 24 October 1955.
	6M-3300 Supp. 3	Specifications for the Maintenance Equipment of AN/FSQ-7, dated 24 October 1955.
	6M-3301 Supp. 3	Specifications for the Automatic Input Element of AN/FSQ-7, dated 26 October 1955.
	6M-3309 Supp. 2	Specifications to the Warning Light System, AN/FSQ-7, dated 24 October 1955.
1-116	6M-3766-1	Operational Specification for Track Detection and Initiation in the SAGE System, dated 4 October 1955.
1-116	6M-3766-1 Corr. #1	Operational Specification for Track Detection and Initiation in the SAGE System, dated 2 December 1955.
1-117	ADES Documents	Internal Communications-Direction Center and External Communications-Direction Center, both dated November 1955.
1-118		Reference: Memorandum 38-5505, Fourth Interim Report on Charactron Legibility: Comparison of P-7 and P-14 Phosphors, dated 17 August 1955.
1-119	6M-3814-1	Operational Specifications for the Manual Data-Input Function in the SAGE System, dated 19 October 1955.
1-120	6M-3778-1	Use and Presentation of Weather Data in the SAGE System, dated 8 September 1955.
1-121	6M-3720-1	Operational Specifications for Raid Forming in a SAGE Direction Center, dated 10 October 1955.
1-122	6M-3795-1	Operational Specification for Subsector Command Post in SAGE System, dated 25 October 1955.
1-123	6M-3884-1	Master Reference List AN/FSQ-7 Specification, dated 17 November 1955.

FACILITIES AND EQUIPMENT (W. H. Ayer)

A major effort is underway to bring up to date the documentation that defines the XD-1 and FSQ-7 machines. All specifications concurred with by the Systems Office must be compiled in Master Reference Lists and released by TIR, IBM can then use this information to make their contract definitive and to define the scope of their change procedures. Discussions are also going on with WE-ADES on the means by which they can be brought into this procedure, since their responsibilities include surveillance of all changes to SAGE equipments, including FSQ-7. It is hoped that they can take over some of the follow-up work on ECP's that is now being done by the Production Coordination Office.

OPERATIONS (H. J. Kirshner)

Five Operational Specifications were released by TIR during this biweekly period.

Concurrence is expected on installation of the Kelvin & Hughes Projection equipment in Building F. A TIR has been prepared to establish the requirement for the Kelvin and Hughes equipment.

A draft TIR covering a memorandum defining the functions of the C & E Duty Officer is being circulated.

COMMUNICATIONS (H. J. Kirshner)

A schedule has been prepared for the tests to be performed by the Communications Test Team.

ADMINISTRATION AND SERVICES

(Group 60, J. C. Proctor)

PERSONNEL

Termination

B. B. Paine has left Lincoln Laboratory to serve as General Manager of Microphase Corp., Greenwich, Connecticut.

MATERIAL (H. B. Morley)

Three of the four long overdue Lambda power supplies for TX-0 have finally arrived.

New catalogs of interest:

Driver-Harris	Sylvania
Jennings Radio Mfg.	G.E. (Trumbull)
Shallcross	

In cooperation with the space patrol we have reduced the Division 6 storage area (Bldg. A basement) to one bay.

Solve your space problems! Expand vertically! King-size 8-foot relay racks are now available in Division 6 Special Stockroom.

ENGINEERING (A. R. Smith)

Kelvin & Hughes Camera

From the information we now have at hand, it will take one more week to complete the design phase. The remaining design problems are the pitching of the projection mirror to an angle which will agree with the elevations relationship between the screens and the projector, and a new duct elbow to supply cooling air to the critical areas within the package.

Core Memory Program

The wiring of the CM chassis and pluggable units is slightly ahead of schedule. One three-bay rack has been received from the vendor and assembly of the chassis to the rack will begin 26 December. As soon as assembly design data is complete, we will be able to forecast the delivery date of a finished unit.

Marginal Checking Power Supply

R. Hughes has presented an interesting problem which combines an

ENGINEERING (continued)

electronic circuit selenium rectifier, composed of potentiometers, with mechanical design to provide a 100-0-100 volt, 50-watt marginal checking power supply packaged on a 3-1/2" rack panel. Formerly, MTC and WWI employed an amplidyne for this purpose with the disadvantage of dissipating two surplus amperes.

Spheroid Shaper Fixture

The design of a fixture to grind Fe crystals into an asperin-shaped pellet to agree with the predetermined domain structure, should be completed this week.

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

The Components Section, in addition to its routine work, is in a position to help Laboratory engineers in the development of new components and improvement of existing designs. With the staff experience and technical facilities available, we can undertake work of this nature quite easily. Such jobs could be either actual design, construction, and testing in our own laboratory or selection of and liaison with component manufacturers capable of designing and producing the needed item.

TEST EQUIPMENT (L. L. Sutro)

Meters and other commercial test equipment that are needed for measurements not lasting for more than a day or two are being loaned "for 48 hours" from Test Equipment Headquarters. The stock of this equipment is on new shelves erected against the right wall of Test Eq. Hq. The stock of this loan equipment will be increased by return of little-used equipment now on indefinite loan and by the purchase of other items.

The committee has approved purchase of the following:

Unit	Use	Group
Tektronix 541 Scope, 53G & 53/54K	Testing magnetic materials	63
Tektronix 541 Scope, 53/54K	Basic circuit development	62
Tektronix plug-in preamplifiers, one each of types 53B, 53C, 53/54D and 53/54K	Spares to permit maintenance of previously acquired units.	

DOCUMENT, DRAFTING, AND PRINT ROOMS (A. M. Falcione)

Xerox Copying Equipment

Anything written, printed, or drawn, within the limits of the equipment, can be reproduced to paper, glass, vellum, acetate, or other

DOCUMENT, DRAFTING, AND PRINT ROOMS (continued)

media, with the Xerox equipment now available for use of Division 6 personnel. This method compares with photography as it is capable of enlargements and reductions. (See 6M-4049.)

XD-1 Brownline File

IBM has established in Building F a complete brownline file of all drawings for XD-1. The Division 6 Print Room has on file brownlines of block schematics, pluggable units, card details, card assemblies, logic diagrams, and specifications. Brownlines that are not in our file will be available from IBM for filling print requests of MIT personnel.

Return of Classified Documents

The Division 6 Document Room will now accept returns of all documents or drawings classified up to CONFIDENTIAL. SECRET material must be retained until completion of the second phase of the recent inventory check by the Security Office. It is recommended that the return of all material be made on standard receipt forms.

Building F Drawings

Division 7 has accepted responsibility for Building F drawings, and are bringing current drawings up to date. All future modifications must be made through a Work Order accompanied by a drawing, indicating the changes to be made. Division 1 will inform Division 7 Drafting of the changes so master drawings on file will reflect latest up-to-date changes at all times. Division 6 Drafting will obsolete all building drawings, except equipment layouts.

Distribution Control of Unclassified Documents

A control system has been established in the Division 6 Document Room to record the distribution of certain basic unclassified memoranda. This control system will assure that all recipients of the basic memo will also receive the revisions, supplements, and corrections concerned with it. To place a memo under this system, type the words "DISTRIBUTION CONTROL" under the 6M-number on the first page. Inform the Document Room of any changes to the basic distribution list that may occur.

STUDIES IN PROCESS

GROUP 61

OPS Specs for Air Surveillance Stations of a SAGE DC	H. Gochman
OPS Specs for Tape Units, AN/FSQ-7	A. Heineck
XD-1 Startover Specs	A. Heineck

ID, Manual Inputs, Simulation — J. Bryan, F. Garth, S. Hauser

6M-4028, Math Specs for the ID Function in SAGE
6M-4032, Math Specs for Manual Data-Input Function in SAGE
6M-3814-1, Corr. 1, OPS Specs for Manual Data-Input Function in SAGE
6M-3899, Corr. 2, OPS Specs for TBS in the SAGE System
6M-3780-1, Corr. 1, OPS Specs for ID Function in SAGE
(above to be issued in the next biweekly period)

Specifications — J. J. Cahill

Math Specs for:

Antiaircraft	6M-3982, 1st draft issued	
Intercept Direction	1st draft expected week of	
Weapons Assignment	26 December 1955	
Raid Forming	6M-3973, final draft issued	

OPS Specs for:

Weapons Assignment	6M-3744-1, Corr 2	2nd rough draft expected
Intercept Direction	6M-3786-1, Corr 2	wk. of Dec 55
Interim Antiaircraft	6M-3739-1, Corr 1	final draft expected wk. of 26 Dec 55
Raid Forming	6M-3720-1, Corr 1	1st draft issued

GROUP 64

EPSCOM Program Catalog and Schedule Revs.(6M-4008,4009)	R. P. Mayer
EPSCOM Programmer's Reference Book (organization and procedures)	

GROUP 66

Power Generation CC-DC Installation	J. J. Gano
XD-1 Power System Debugging	G. L. Piantoni
TX-0 Power System Design	J. D. Clarke
Memo on Air Conditioning System, WWI	R. C. Jahn
ESS Teletype Facilities, revs. to M-Notes	H. J. Kirshner

GLOSSARY

AA	antiaircraft
AAOC	AA Operation Center
AD	Air Defense
ADC	AD Command
ADES	AD Engineering Service
ADSOD*	
AEW	Airborn Early Warning
AF	Air Force
AFB	AF Base
AFCRC	AF Cambridge Research Center
AFIRO	AF Installation Requirements Office
AGC	automatic gain control
AMC	Air Materiel Command
ARAACOM*	
ARDC	Air Research and Development Command
ASC	Air Situation Coordinator
ASC	Air Surveillance Officer
ASR	automatic send-receive
AST	Air Surveillance Technician
ATC	Air Training Command
ATCF	ATC Facility
BTL	Bell Telephone Laboratories
BSO	Battle Simulation Officer
CAA	Civil Aeronautics Administration
CBS	Columbia Broadcasting System
CC	combat center
CCDC	Cape Cod Direction Center
CDC	call direction code
CAT	category
CCS	Cape Cod System
CER	change evaluation request
CHT	Charactron tube
CM	core memory
CP	Command Post
CPO	command pulse output
CRT	cathode ray tube
C&E	communications and electronics
DAB	display assignment bit
DC	direction center
DD	digital display
DDG	DD generator
DDR	digital data receiver
DDT	digital data transmitter
DGP	Data Generation Program

EADF	Eastern Air Defense Force
ECM	electronic counter measure
ECP	engineering change procedure
EMAR	experimental memory address
EPSCOM	Equipment Program Services Committee
ESS	experimental SAGE subsector
FF	flip-flop
FGD	fine grain data
FM	frequency modulation
FORX	FGD orientation with Raydist and calibrated Mark X
G/A	ground to air
GFI	gap filler input
GSR	group selection register
HEC	Hazeltine Electronics Corp.
IBM	International Business Machines Corp.
ID	identification
INS	interceptor simulator
IRE	Institute of Radio Engineers
JETEC	Joint Electron Tube Engineering Council
KSR	keyboard send-receive
LPO	Lincoln Project Office
LRI	long-range radar input
LTPS	Lincoln Tube Process Specification
MAR	memory address register
MEL	minimum equipment list
M-G	motor-generator
MIL	Military
MISP	Manned Interceptor Simulation Program
MITE	multiple input terminal equipment
MPPS	Master Program Preparation Section
MTC	Memory Test Computer
NAS	Naval Air Station
NET&T	New England Telephone and Telegraph Co.
NRL	Naval Research Laboratory
OB	output buffer
OPS	operations
OT	Overlap Technician

PCO	Production Coordination Office
PIUMP	plug-in unit mounting panel
PPI	planned position indicator
PRF	pulse repetition frequency
PT	Plotting Technician
RADC	Rome Air Development Center
RAFD	Rome Air Force Depot
RAND	Research and Development Corp.
RC	register containing
RD	radar data
ROTR	receive-only typing reperforator
S&EC	Scientific and Engineering Computation
SAGE	Semiautomatic Ground Environment
SBT	surface barrier transistor
SAR	storage address register
SD	situation display
SDG	SD generator
SDV	slowed down video
SIF	selective identification feature
SC	Signal Corps
SCEL	SC Engineering Laboratory
SOP	standing operating procedure
SO	Systems Office
STP	System Training Program
TAPE*	
TBS	training and battle simulation
TD	track data
TIR	Technical Information Release
TT	Texas Tower
UHF	ultra high frequency
VCM	vibrating coil magnetometer
VHF	very high frequency
WE	Western Electric Co.
WISE	Whirlwind I SAGE Evaluation
WWI	Whirlwind I
XT	crosstell

*We were unable to find out what these letters stand for. If you know, would you call us at ext. 8467 Thank you. ED, Div. 6 Publications

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

DOCUMENTS ISSUED

(Frances Christopher)

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The following documents were published by Division 6 or received from IBM during the period 2 - 16 December 1955

NO. 6M-	AUTHOR	TITLE	CLS.
ADMINISTRATION & SERVICES (Group 60			
4022	Div. 6 Staff	Div. 6 Personnel List	U
4037	Div. 6 Staff	Biweekly Report for Period Ending 2 December 1955	C
4049	A. M. Falcione	Zerox Copying Equipment	U
SAGE SYSTEM TEST & PLANNING (Group 61)			
3930	D. W. Ladd	Operational Specifications for the XD-1 Startover Function	C
3964 S#1, 2	P. R. B agley	The Program Input Process: A Manual on the Use of the Lincoln Compiler and Read-in Programs	U
3973	D. W. Ladd P. Bragar	Mathematical Specifications for Raid Forming	C
4013	D. L. Bailey	Mathematical Specifications for Track Detection and Initiation in the Sage System	C
4020	F. Brooks J. Ishihara	Mathematical Specifications for Track Monitoring in the Sage System	C
4034	C. H. Gaudette	Installation of the Lincoln System of Utility Programs	U
4039	A. P. Hill	Sage Familiarization Course, 14-23 February 1956	U
4054	A. P. Hill	Air Defense Indoctrination Lectures (Second Series)	U
4059	A. W. Heineck	Outline & Schedule for Preparation of Operational Portion of Direction Center Standby-Computer Program	C
5084	M. Curran	Test Specification: Intercept Tracking Accuracy Test Maneuvering Courses	C

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FSQ-7 PROTOTYPE DESIGN & INSTALLATION (Group 62)			
4019	J. D. Crane	Results of the System Tests Performed on the AN/FSQ-7 (XD-1) During October 1955	U
4021	L. L. Sutro	Test Equipment Committee Meeting 4 November 1955	U
4027	B. W. Barrett	Gap-Filler Radar Mapper Sweep-Circuit	U
4033	J. Giordano	Minutes of the IBM/LL-SO Concurrence Meeting #46 Held at Lincoln Laboratory 2 December 1955	U
4046	J. Giordano	Minutes of the ESS Planning Approval Committee Meeting of 5 Dec. 1955	C
4047	R. P. Mayer H. I. Rundquist	The Writing of Equipment Program Specification	U
4050	L. L. Sutro	Test Equipment Committee Meeting 28 November 1955	U
4055	J. Giordano	Minutes of the ESS Planning Approval Committee of 12 December 1955	U
ADVANCE DEVELOPMENT (Group 63)			
3938 S#4	W. A. Clark	The Logical Structure of Digital Computers - The Turing Machine	U
4035	D. J. Eckl	Transistor Circuits Course. Number 5 Thermal Stability of Transistors	U
PRODUCTION COORDINATION OFFICE (Group 66)			
3291 S#4	R. R. Shorey	Specifications for the Central Computer System for the AN/FSQ-7	U
3292 S#3	R. R. Shorey	Specifications for the Drum System for the AN/FSQ-7	U
3293 S#3	R. R. Shorey	Specifications for the Display System	U
3298 S#8	R. R. Shorey	Specifications to the Manual Inputs System for the AN/FSQ-7	U
3299 S#3	R. R. Shorey	Specifications for the Output System AN/FSQ-7	U
3300 S#3	R. R. Shorey	Specifications for the Maintenance Equipment of AN/FSQ-7	U

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3301 S#3	R. R. Shorey	Specifications for the Automatic Input Element of AN/FSQ-7	U
3309 S#2	R. R. Shorey	Specifications to the Warning Light System AN/FSQ-7	U
4029	S, T. Coffin	Drift Studies - XD-1 DC Power Supplies	U
4038	E. D. Lundberg	Sage System Meeting 5 Dec. 1955	U
4052	C. J. Carter	The Connection of Telephone Circuits at the No. Truro Shore Station	C
4056	E. D. Lundberg	Sage System Meeting 12 Dec. 1955	U
OTHERS (Group 22)			
4036	A. Wright	Cape Cod System Weekly Operations Schedule	U
4053	A. Wright	Cape Cod System Weekly Operation Schedule	U
5070	D. C. Bomberger	Interceptor Vulnerability Limits for Nip Simulation of Lincoln System	S
5071	W. B. Rohn	Vectoring Limits for a Two-Variable Presentation of Interceptor Vectoring	C
5079	J. Curtis F. Ditto	The Occurrence of Precipitation Clutter on FPS-3 Radars	S
		IBM DOCUMENTS	
IBM-880	----------	Central Reference Room Bulletin #104	U
IBM-881	W. H. Van Tuyl	Project High Semi-Monthly Report #65	C
IBM-882	W. I. Congdon	Description of the AN/FSQ-7 Combat Direction Central As Contrasted with AN/FSQ-7 (XD-1) Combat Direction Central	S
IBM-883	F. J. Gordon R. L. Lindsay	Project High Engineering Report-Timing Consideration for Relay Operation	U
IBM-884	J. J. Moyer D. C. Lancto	Project High Engineering Report-Magnetic Tape System Test Plans and Summary of Results	U

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IBM-885	W. J. Johnson	Project High Engineering Report Investigation of Back Voltage Characteristics of a 128x128 Ferrite Memory Core Plane	U
IBM-886	D. C. Ross	Project High Engineering Performance Specification -- Memory Element Specifications for AN/FSQ-7 Combat Direction Central and AN/FSQ-8 Combat Control Central	U
IBM-887	M. Krayensky	Project High Engineering Report-DC and CC Building Redesign	C
		LL-DR DOCUMENTS	
DR-537	R. C. Marden	Concurrence on Proposed Expansion of the Marginal Check System for the Tape for XD-1	U
DR-538	R. C. Marden	LRI Parity Rate Counter for XD-1	U
DR-539	R. C. Marden	Concurrence on Proposal for the Addition of Two More Tape Drive Units to XD-1	U
DR-540	R. C. Marden	Concurrence for Placeing the Spare Amplidyne of XD-1 in a Standby Status	U
DR-541	R. C. Marden	Concurrence on Visor for Situation Display Console for XD-1	U
DR-542	L. V. Ruffino	Production Spare Parts Provisioning Policy dated Aug. 18, 1955 by C. F. Lynch	U
DR-543	L. V. Ruffino	Addition to Test Equipment List for AN/FSQ-7 and AN/FSQ-8	U
DR-544	L. V. Ruffino	Changes to the Simplex Input CB Specifications	U
DR-545	H. J. Barton	Change to the Specifications for the Tape Power Distribution System for AN/FSQ-7 Combat Direction Central and AN/FSQ-8 Combat Control Central	U
DR-546	L. V. Ruffino	Changes to Simplex Input PD Frame	U
DR-547	J. J. Coughlin	Output Storage Parity Alarm Check for XD-1, XD-2	U

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DR-548	P. Longo	Unlocking of the IO Address Counters	U
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DR-550	H. Van Allen	AN/FSQ-7 Auxiliary Console Specifications for XD-1, XD-2 and the Production Machine	U
DR-554	W. S. Squire	Concurrence on Change to Duplex Central Output System Specification	U
DR-555	W. S. Squire	Concurrence on Change to the Displa y Console, Specifications for AN/FSQ-7	U
DR-556	W. S. Squire	Concurrence on Changes to Simplex Input PD Frame	U
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