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

SUBJECT: BIWEEKLY REPORT FOR PERIOD ENDING 10 FEBRUARY 1956

To: Jay W. Forrester

From: Division 6 Staff

Date: 23 February 1956

Approved: J. C. Proctor



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## DIVISION 6 - DIGITAL COMPUTER

(J. W. Forrester, Division Head)

On February 9, several of us visited the Maguire, N. J., site of the first production SAGE direction center to inspect progress of the building and to check on the kind of living quarters in the area for the Lincoln Laboratory staff members who will work there after October of this year. The building is well advanced. The air conditioning ducts and control panel and the rectifier power supplies for AN/FSQ-7 are in place. Partitions are partly installed on the operational floor and cases of acoustic tile are in the building ready for installation.

We talked to the senior officers of the air base about motels and hotels in the area and drove out to see some of these. It appears that good places will be available.

Phil Bragar will return to Maguire soon with one or two others for several days of detailed discussion of office facilities on the base and nearby places to live. The Laboratory will lease living quarters in advance of sending men to Maguire.

## SAGE OPERATIONAL PLANNING

(Group 61, D. R. Israel)

DIRECTION CENTER (J. Ishihara) CONFIDENTIAL

### Air Surveillance (E. Wolf)

Work on the operational specifications for crosstelling and air surveillance adaptation, and on the revisions to the operational specifications for air surveillance stations is continuing.

Items completed include Correction #2 to 6M-4013, "Mathematical Specifications for Track Detection and Initiation in the SAGE System," a draft of 6M-4150, "Mathematical Specification for SAGE System Coordinate Transformation of Crosstold Data," and the second draft of 6M-4075, "Operational Performance Requirements for SAGE System Telephone Data Circuits."

### Identification and Manual Inputs (S. Hauser)

As a result of a meeting attended by Majors Chesler, Marks, and Burns, and Lt. Col. Stiles, 4620th Wing, and J. Bryan and S. Hauser, Lincoln, a revision card was designed to facilitate operating procedures at the data sources when the 0 47 tape-to-card converter is used in the manual inputs room. Details of the design are contained in a letter being circulated to interested people for their comments.

Revisions to the manual inputs operational specification and mathematical specifications will be made to accommodate the changes only after concurrence with ADC at Lincoln. However, since the 0 47 will certainly be used in ESS, operating procedures and program design for ESS must include the new card format.

Correction #2 to 6M-3760-1, operational specifications for identification, has been rough drafted and will be circulated for comment.

### Whirlwind I SAGE Evaluation (S. Hauser)

S. Bensen and W. Duffy have joined the WISE subsection. The operational and mathematical specifications have been drafted. Responsibilities for the program and coding specifications have been distributed among the members as follows:

Radar Inputs and Tracking: F. Brooks (in charge), J. Bryan, D. Latimer
Displays: D. Latimer (in charge), S. Benson, W. Duffy
Switch Interpretation: G. Dimock, M. Kresge, S. Hauser.

Program checkout will begin the week of February 13th.

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

Recording (E. L. Lafferty, S. F. Tower)

The following M-notes will be issued shortly:

6M-3989, "Interim Operational Specifications for the Recording Function in the Experimental Subsector."

6M-4086, "Mathematical Specifications for Recording in ESS."

Further revisions in the recording specification are being considered and the first revision will be issued in the near future.

Data Reduction (M. Clark, J. Slagle)

Under the direction of C. Grandy of Group 64, the data reduction requirements for ESS have been prepared. The outline of the data reduction operational specification has been prepared.

Simulated Data Generation (SDG) Program (J. Levenson, R. Russo)

The operational specification for simulated data generation (6M-4067) has been issued. The mathematical specification has been prepared in draft form for distribution to SDG programmers. Responsibility for the major subprograms has been delegated, and a first round of flow diagrams exists for most functions.

MTC Operation

During the month of February, MTC will not be available for our use. We expect to use this time to set up procedures for our future MTC operation and Don Bancroft, our new computer operator, is important to these plans.

MTC Programming

Subroutines (R. Collmer, B. Persell, J. Bockhorst, S. Tower)

New divide, sine-cosine, square root and arctangent subroutines have been programmed for MTC. Checkout has been hampered considerably by inadequate time available on MTC and lack of an MTC operator. Final checkout of these subroutines will be delayed until MTC is again operative.

Assembler (R. Olsen)

Revisions in the MTC control necessitate revisions to the MTC symbolic

floating address assembly program. A rough draft memo has been written describing the assembler. An M-note will be issued when the revised assembler has been checked out (after MTC becomes operative).

Read-In Program (E. Lafferty)

A binary card read-in program has been written which can read cards prepared by the assembler.

Other Utility Programs

This section will cooperate with Groups 22 and 64 in defining other useful MTC utility programs.

## ESS DC IMPLEMENTATION AND COORDINATION

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

### EXTERNAL EQUIPMENT AND COMMUNICATIONS (I. Aronson)

#### Ground-to-Air Data Link Subsystem

"Test Concepts for SAGE Ground-to-Air Data Link Subsystems," 6M-4094, has been reworked and is now in the TIR process.

Testing of the South Truro data link started on 9 February, with input data supplied from the XD-1 output buffer drum.

#### Automatic Teletype Subsystem

"Test Concepts for SAGE Automatic Teletype Output Subsystem," 6M-4136, has been released in draft form and is being circulated for comments.

#### Height-Finding Subsystem Testing (T. Sandy)

Five SAHL (semiautomatic height, line) tests with WWI and South Truro were scheduled, of which one was successful. One was canceled because the TIME Magazine photographers required more time to take pictures of the Barta Building direction center than was anticipated. One was canceled because of multiplexing trouble in the Lincoln Laboratory model of AN/FST-2 at South Truro. Two were canceled because of weather.

One SAHR (semiautomatic height, random) test with XD-1 and South Truro was scheduled to check for proper operation of the XD-1 program. The program worked very well except for some minor printing errors.

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

A meeting was held at the 1st Region CAA in New York City on 30 January 1956 to discuss the connection of ESS circuits into the ARTCC. Following this meeting, orders were placed for these circuits.

A meeting was held on 1 February 1956 with the teletype engineers from AT&T and NET&T to obtain information needed by Group 61 to program the teletype output of the computer.

The installation dates for the teletype circuits going to the air bases and the adjacent manual direction centers have been advanced from 1 March to 15 April 1956 at the request of the telephone company.

The memorandum, "Test Concept for the SAGE Wire Communications Subsystems," 6M-4102, has been approved and is being published.

PROGRAMMING (R. P. Mayer) CONFIDENTIAL

EPSCOM

The manpower expended by EPSCOM so far on its programs is being studied. The results of this study will be used in formulating a revision and extension of the EPSCOM schedule and catalog of programs. Coordination is necessary and is being established with the standby and duplex operation section of Group 61.

On 2 February, XD-1 program 830600, "Speech from MTC," plus MTC cards containing waveforms of words spoken into MTC, allowed XD-1 to "speak" the contents of registers selected by a toggle switch register. (See BIWEEKLY, 16 December 1955.)

EPSCOM Tracking Program

Most of the major errors in the existing tracking program, 820300, have been removed. At least four errors still exist, and debugging continues. The writing of the coding specifications of the revised tracking program is approximately one-quarter completed, including a flow diagram and a sketch of core memory allocation. (C. Sherrerd)

Considerable progress has been made in the initial phase of the revision and recoding of the tracking program. The program has been divided up into 26 subroutines, approximately 20 of which have been recoded into compiler symbology. Key punching should begin in about a week. (M. Dolan, W. Gramling, C. Kellogg, C. Sherrerd)

Range-azimuth printout and clock time control routines are being prepared. (N. Mardirosian)

EPSCOM Radar Quick Check

The quick check program will rate the radar sites on a merit system according to data being received from them. A preliminary flow diagram has been completed and the program is being coded. Methods of evaluating data are still under discussion. (H. Quirk)

EPSCOM Radar Pattern Check

The pattern checking program has been used to check LRI and GFI patterns, and seems to be working satisfactorily in most respects. Under consideration is a routine which will allow the operator some control over the allowable LRI azimuth jitter limits. The pattern checking program will probably be modified to process the FST-1 pattern, but will probably not be fast enough to process all data in each scan. (W. J. Marston.)

PROGRAMMING (continued) CONFIDENTIAL

EPSCOM Height Test Print Program

The decimal print program seems to perform well in spite of a recurring trouble which appears to be the fault of the printer plugboard, which will be rewired. Coding and flow chart data are generally complete. (G. C. Cox, F. J. Sweeney)

EPSCOM Crosstell Test

The desired alterations to Mayberry's earlier program have been coded and correction cards are being punched. The program will then be reassembled and tested, including Rundquist's print routine, with Whirlwind I bypassed. (K. Brock, L. J. Rose)

EPSCOM Ground-to-Air Output Test

The planning, programming, and coding phase of the G/A output test program has been completed. Verification, key punching, and final checkout will be reported in the next BIWEEKLY. (R. M. Bernards, J. P. Wong, Jr.)

EPSCOM Ground-to-Air Simulation

There are two parts to this program. The part which displays the message has been checked out. The part which reads the output buffer drum and sorts messages according to burst number and type (e.g., G/A) is being processed by the card room. (J. R. Jubb, W. T. Vollmer)

CIRCUIT SUPPORT (R. J. Callahan)

Switch Driver Input Amplifier (M. J. Flanagan)

This unit is in fairly good shape. It consists of two transistor amplifiers driving a difference amplifier-cathode follower combination. It requires an input of 0 to -2 volts and has an output of 0 to -100 volts. Into a load of 200 μμf the rise and fall times are about 0.6 μsec. Margins and fail-safe conditions are being checked.

Gap-Filler Radar Mapper Sweep Circuit (B. W. Barrett)

Extensive tests of the gap-filler radar mapper sweep circuit in a console under actual operating conditions showed that d-c supply decoupling had to be stiffened, but that the circuit is acceptable.

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

Two 227-foot lengths of K-109A coax have been damped with resistance

CIRCUIT SUPPORT (continued)

wire and equalized with a passive RLC circuit at the sending end. The over-all rise time including a Tektronix 541 scope is in the order of 15 mμsec, with a maximum transient error during the first few μsecs of about 3%. The attentuation ratio is 100:1 and the input impedance is 10 megohms and approximately 20 μμf. An attempt is being made to equalize the cable with a physically smaller R-C circuit.

One 227-foot passive cable is presently installed in XD-2 in parallel with an earlier follower plus RG-114/U probe system for relative comparison. The second cable will be installed in XD-1 alongside a single 6197 follower system being driven by a 27-foot passive probe. Data concerning relative noise, waveshape, circuit loading, and stability will be collected.

At the request of T. C. Stockebrand, we are preparing a 55-foot passive cable of 50:1 ratio for use in MTC.

Charactron Vector Intensity Decoder (R. B. Paddock)

The input gating circuit now seems to work fast enough, but a source of grid current, probably a power cathode follower, appears necessary to maintain a uniformly fast fall time in the output stage.

DESIGN CONTROL (J. A. O'Brien) CONFIDENTIAL

(Formerly the SYSTEMS OFFICE)

Test Pattern Generator (J. D. Crane)

The specifications for the production type test pattern generators for AN/FSQ-7 have been reviewed and are satisfactory. Provisions to incorporate a modified production type test pattern generator in XD-1 are being made.

(S. B. Ginsburg)

A draft of the specification for 750 type output section for AN/FSQ-7 was distributed for comments. This specification is intended to present the general requirements of the 750-pps section.

Operational specifications, 6M-3744-1, and 6M-3826-1, were reviewed for TIR release.

On 1 February 1956, I attended a WE-ADES meeting at 220 Church Street, N.Y.C., to discuss DDR output signal levels. Signal problems exist at locations containing a CC with adjacent DC and where data services are required between two users on the same Air Force reservation.

DESIGN CONTROL (continued) CONFIDENTIAL

Additional Magnetic Tape and Reels (J. Giordano)

Three hundred additional 1200-foot reels of magnetic tape have been ordered by IBM and 100 reels of the same tape have been ordered by Lincoln for use with XD-1, MTC, and TX-0.

Initial delivery of this tape is scheduled for 1 April 1956. The complete order (both IBM and MIT) should be delivered by 1 June.

Displays (R. H. Gerhardt)

Supplement 2 to 6M-3634, "Console Equipment and Label Layouts for AN/FSQ-7," was reviewed and a list of all changes since the original document was given to Group 67.

The area discriminators in Room S, Building F, are inoperative because the room's blue lighting is reflected into the photocell. I have received comments on the operational use of the area discriminator from Group 61.

I am writing an interoffice memo describing certain distortions which will occur in situation displays.

POWER (J. J. Gano)

XD-1 Power System

DeSart of IBM and Piantoni have tried various controls and have taken meter readings to supplement evidence in logs. Operationally, the system is satisfactory. In addition to several minor mechanical deficiencies, the main difficulties are the voltage drift in the d-c supplies, which has been discussed previously, and low settings of the filament transformers. Of the readings taken, 90% at the load frames and all at display consoles were below specifications.

D-C Supplies (S. T. Coffin)

I am assembling an experimental, magnetically controlled 3-phase rectifier, similar to the type in XD-1 but smaller in current capacity. This test unit will be used for designing a d-c power supply suitable for use in computers, and will probably use a transistor amplifier and silicon reference diode.

Filament Cycling (G. F. Sandy)

The thermistors used to cycle the filament voltage on a test console in Building F have gone through about 1000 cycles to date with no discernible change in characteristics.

## ADVANCE DEVELOPMENT

(Group 63, D. R. Brown)

### MAGNETIC MATERIALS (J. B. Goodenough)

#### Chemistry (W. J. Croft)

##### Memory Core Production (J. J. Sacco)

The difficulties which had been encountered through contamination of the Harper furnace have been eliminated. Full-capacity memory core production will be resumed during the coming biweekly period.

The F398 dies (.050" OD, .030" ID) have been installed in the Stokes Press. Twenty thousand cores have been pressed and approximately ten thousand fired. Test results indicate that, at one half the required drive of the F397 memory cores, the smaller cores have the same or better properties.

##### Experimental Ferrites (D. L. Brown)

Additions of $CoFe_2O_4$ to $Li_{0.5}Fe_{2.5}O_4$ lowered the $R_s$ and increased the coercivity. The $CoFe_2O_4$ was added in 1-mole per cent steps from 0-to 5-mole per cent.

##### Analytical Chemistry
(F. S. Maddocks, E. Keith, P. Reimers)

Development of a colorimetric method for determining traces of cobalt in memory core ferrites has been hindered by the difficulty in separating small quantities of cobalt from large amounts of iron.

Development of colorimetric methods for analysis of deposited metal films has begun. It is hoped that both composition and film thickness can be measured simultaneously by this means.

Chemical analysis of various types of thermistors is in progress.

##### Refiring (D. Wickham, W. J. Croft)

The chemical analysis of memory core compositions in the past has included a determination of the total iron ($Fe^{++} + Fe^{+++}$), the total manganese ($Mn^{++} + Mn^{+++}$) and the magnesium ($Mg^{++}$) present. It now appears possible to determine the quantity ($Mn^{+++} - Fe^{++}$) present in the solid material. The total number of trivalent or divalent ions can then be computed ($Fe^{++} + Fe^{+++} + Mn^{+++} - Fe^{++} = Mn^{+++} + Fe^{+++}$). A sample of fired memory cores and a sample of the same cores subjected to the refiring process have been so analyzed with the following results:

MAGNETIC MATERIALS (continued)

| | Not Refired | Refired | Theoretical Value for a Spinel $M^{++}(M^{+++}_2)O_4$ |
|---|---|---|---|
| $\frac{\text{Total } M^{+++}}{\text{Total Fe + Mn}}$ | 0.909 | 0.909 | --- |
| $\frac{M^{++}}{\text{Total M}}$ | 0.333 | 0.336 | 0.333 |

M = metal ions.

One more independent determination is required to find the quantity of any specific ion.

Further crystallographic studies are being made to try and understand the mechanism of change in memory cores during the refiring process.

Memory Core Testing (R. C. Zopatti)

The total memory cores double tested by this section to date for the 256 x 256 x 37 memory is 2,458,000. In addition, there are approximately 20,000 untested cores on hand, making a grand total of approximately 2,478,000.

There are also approximately 75,000 double-tested cores from various lots that have been returned from Koch which we will retest.

Physics (N. Menyuk)

Instrumentation

Improvement of the operation of the vibrating coil magnetometer is continuing. A thorough investigation of the ground problem was carried out and largely resolved. The magnetization output, temperature, and magnetic field input over all gaussmeter ranges can be set up on the x-y recorder and read directly. The sample holder unit for powder samples has been completed. While additional improvements and calibrations will be required for more sensitive measurements, the instrument is now capable of measuring the saturation magnetization of the powder samples prepared by D. Wickham. (D. O. Smith, N. Menyuk)

Analysis of the drift in the d-c fluxmeter indicates a need for

PHYSICS (continued)

close regulation of all voltages applied to the vacuum tubes in the system. At present, the filaments are regulated to 0.5 per cent and the high voltages to 0.25 per cent. Satisfactory performance will require a ten-fold improvement. (R. A. Pacl)

Experimentation (D. O. Smith)

Measurements of the saturation magnetization from room temperature to liquid nitrogen have been carried out on a ferrite powder. These measurements will be extended to liquid helium within a few days.

Theory

"Memory Core Heating by Switching at High Frequencies," 6M-4137, was released. In this report it was erroneously stated that the MTC memory is cooled by forced air circulation. This is not the case. In addition, the report did not emphasize that the heating effect was measured on a group of cores pressed tightly together; this grouping of cores accentuates the heating effect by reducing the effective heat dissipation area. (J. D. Childress)

The calculation of the exchange constant for the spinel structure has been completed. The result indicated that an error factor of 2 is introduced by assuming a body-centered cubic structure. Since this assumption was made in the domain wall studies published in the literature, the values of the relaxation frequency, $\Lambda$, calculated from these studies is off by a factor of 1.4. Substitution of the corrected $\Lambda$ values results in closer agreement with $\Lambda$ values obtained by microwave techniques. (N. Menyuk)

A study of the dynamics of wall motion in the presence of a transverse field is being made. Calculations to date indicate that a small transverse field is capable of establishing a large internal field within the material under certain specified conditions. (N. Menyuk)

An invited talk entitled "The Role of Covalence in Magnetic Oxides" was given at Brookhaven National Laboratory. Neutron-diffraction experiments there have corroborated our theories of lattice distortion as a result of directed bonds about $Cu^{++}$ ions in octahedral sites in $CuFe_2O_4$ and tetrahedral sites in $CuCr_4O_4$. They also confirm the concept of directed bonds about $Fe^{+++}$ in tetrahedral sites to stabilize the ion there. (J. B. Goodenough)

SYSTEM DESIGN (K. H. Olsen)

TX-0

Most of the logic plug-in units have been completed and the flip-

SYSTEM DESIGN (continued)

flop units are under way. Wiring charts for the back panel and panel wiring are nearing completion.

Console

The console was completed but the vender sent it back for repainting because of some scratches. It should be returned in a few days. The indicator, alarm, and control panels for the console have been wired.

Flexowriter

The circuits for driving the Flexowriters have been frozen and it is planned to test them with the transistorized photoelectric tape reader before the computer is completed.

TRANSISTORS (D. J. Eckl)

SBT Life Tests

A summary of the life test data up to December 14 has been published as 6M-4110.

The shielded 8-digit shift register has now been in operation for 5913 hours since it last made an error. The unshielded unit has been running for 1607 hours since its last error. Both units have 99 transistors and use direct-coupled circuits operating at 1 megapulse per second. The TM-1 type 8-digit register has operated for 553 hours without error using a-c power and a transistorized power supply. (R. L. Burke)

Transistor Test Facility

The testing area has been expanded to handle the increased number of tests now required. Efforts are continuing to mechanize these tests to increase the speed of transistor processing.

Intrinsic Barrier Transistors

We have received four Western Electric p-n-p transistors which have a cutoff frequency of about 110 megacycles per second. These units are experimental only and are mechanically and electrically fragile. They were designed for oscillator service.

Switching Time in Junction Transistors

The theoretical minimum turn-on time vs. d-c power gain has been plotted for the common-emitter configuration of various transistors using the relation:

TRANSISTORS (continued)

$$t^{o} = \frac{\lambda}{2\pi\alpha \int_{c\alpha} \frac{1}{1 + \frac{f}{f}}} \qquad \ln \left| \frac{\lambda/\Gamma}{\frac{\lambda}{\Gamma} - 1} \right|$$

where

$\Gamma$ = d-c power gain when transistor is saturated.

$\lambda$ $\frac{\alpha}{1 - \alpha}$, the available d-c power gain.

$f$ $\frac{\Gamma}{2\pi \cap_b' C_c}$

For power gains in the range 1-20 the graded-base transistor has the fastest switching time (1-10 μsec.). This does not consider turnoff time which is another problem entirely. (C. T. Kirk)

Transistor Transient Response (J. R. Freeman)

It has been assumed that the transient response of a transistor will be its active transient clipped at the saturation current when subjected to step impulses of base current sufficient to saturate it. This assumption has been checked with six types of transistors and present results indicate this to be a good approximation for high frequency transistors.

MEMORY (J. L. Mitchell)

Cooling and Supplies

The installation of the power supplies is now under way. The Sola voltage regulating transformers will be installed next week. The air conditioning controls are now being installed and within two weeks the cooling installation should be complete with the exception of the compressors.

$256^2$ Construction

To date, 142 memory plane modules have been accepted. Three $256^2$ memory planes have been soldered together and inspected. The electrical inspection procedures for the $256^2$ planes are being worked out. On February 13th the memory plane testing will go on a two-shift operation. This should allow us to meet the April 1st date for twenty $256^2$ planes. The relay-operated plane tester is complete and ready to go into service. The assembly of the mem-

MEMORY (continued)

ory stall in the basement of Bldg. A will get under way during the week of February 13th and should be complete around March 15th. The final modification of the switch driver input amplifiers has been made and these units are now being electrically tested. A few of the switch driver input amplifiers have been installed in the 3-bay rack and the connecting of the 3-bay rack to EMAR has started. The construction of EMAR control is under way and should be complete within the next week or so.

Advance Development

The work on the transistor sense amplifier is about finished and the packaging will start next week. We are about ready to assemble a few 4 x 4 "peg-type" planes. Jigs for further experiments on wiring planes by plating techniques are being constructed.

DISPLAY (C. Corderman)

Development

Several minor equipment revisions are desirable in the display consoles:

a) Change in the bias section of the 3.3KV supply to inhibit the bright flash whenever a console is turned off and add at least a 15-second delay between turn off and turn on.

b) Change in the bright character intensity gate level to permit full drive to zero bias with high cut-off tubes.

c) Increase the Typotron erase time to 200 ms. to agree with the tube specification.

d) Add electrical rotation to the compensation plates of both display tubes to improve the registration and lineup of vectors when drawing maps.

These changes will be worked out with IBM and Hazeltine and initiated through appropriate channels.

Modifications to the present Charactron tube are being considered with a view toward getting more brightness than the present 19" tube affords.

DISPLAY (continued)

Magnetic Deflection Drivers (H. E. Zieman)

A satisfactory Nyquist conpensation has been found for the magnetic deflection preamplifiers. On drawing #3015501 the required values are:

| | |
|---|---|
| R6-32 = 1.8K | R8-10 = 22K |
| C3-32 = 270 μμf | C3-19 = 150 μμf |

With these values the unorthodox swamping capacitor which had been used on the output of the preamp can be removed. Six preamps have been so modified and tested with six different drivers. In all cases the amplifiers settled in less than 25 μsecs.

Difficulty had been experienced in adjusting the magnetic deflection compensation of the driver stage using two operators. IBM has constructed a jig which will permit a single operator to make these adjustments while viewing the scope. The first model constructed was not entirely satisfactory mechanically because of poor gear boxes available at the time, but the general idea was very good. A second model should be available soon.

After the magnetic deflection system is compensated with the test rack, a slight blurring of the E character still remains. This can be practically eliminated by retouching the compensation using the test pattern from the display frames. However, even when this is completed, the clarity and position of the E character are not fixed but vary between display cycles in a random fashion. This problem is being investigated at present.

Line Drivers (J. Kriensky)

The marginal checking procedure for the line driver has been completed and all the tubes except one can be checked. Marginal checking lines are a +90-volt and two different -300-volt lines.

Some measurements were made in Building F of the loads presented to the various line drivers, but the bridge used developed some trouble. The readings will be repeated on Sunday, 19 February 1956, when the power in Building F will be off.

An M-note discussing the individual stages of the line driver is being prepared.

Recognition Studies (R. H. Gould)

Legibility tests will be made on a Charactron in the TBS room in Building F similar to the tests run in the experimental lighting

DISPLAY (continued)

room, B-034, on the Charactron mock-up console. The equipment for the tests is being assembled and the numbers needed for the display drum are being readied for the card punchers. The tests should be started in the next biweekly period.

## ESS TEST PLANNING - WWI MTC OPERATION

(Group 64, E. S. Rich)

### WWI COMPUTER OPERATION (L. L. Holmes)

| | |
|---|---|
| Scheduled Computer Hours: | 314.9 |
| Interrupting Incidents: | 12.0 |
| Hours of Down Time: | 2.5 |
| Percent Good Time: | 99.3 |
| Mean Time Between Failures in Hours | 26.3 |

The WWI computer reliability continues to be excellent. A subtle trouble caused by a sticky flip-flop in the display control system resulted in an incident of interruption lasting 1.2 hours (47% of the total computer down time).

The WWI magnetic core memory system operated from 21 November 1955 until 31 January 1956 without a failure. The parity alarm that occurred on 31 January 1956 marked the end of an error-free period of 1516.3 computer hours.

### G. E. G/A Data Link

CONFIDENTIAL

The G. E. G/A data link output system was successfully installed on 28 January 1956. The WWI equipment has been pulse checked and closed-loop marginal checked using a program written by L. D. Healy.

The closed-loop check employs a computer program that places information in the output shift register via the buffer storage section of the buffer drum. A digital data transmitter forwards the information through a digital data receiver (DDR) to MITE #1 where it is then recalled by the computer program and checked against the original information. The facility when marginal checked under these conditions has good margins.

During this biweekly period four subsystem tests, totaling nine hours were conducted using the WWI computer with its G. E. G/A data link output system in conjunction with the Division 3 installations at Prospect Hill and Lexington. At the aircraft mock-up in Lexington, the received information was racked up and checked. The tests were very successful with only infrequent failures caused by the DDR at Prospect Hill. Bill Karlsen of our section spent a day at the Prospect Hill installation and discovered the cause of the DDR troubles was with Group 311's failure to have their DDR modified to accomodate the long interval between reference pulses. Since that change has been made, the subsystem operates quite reliably.

WWI COMPUTER OPERATION (continued)

Though all the required subsystem tests have not been completed, it is intended to use the subsystem during the SAC mission on Tuesday, 14 February, and in the succeeding SOT and SAC missions.

Computer Display System CONFIDENTIAL

The noises that distorted the displays when certain programs were operated have been reduced to a satisfactory low level by A. N. Blumenthal and C. S. Lin. It was found that the noises were introduced into the display system at several points. The reduction of the display noises was accomplished by using a separate regulated power supply for the +150 V d-c employed in the 16" display scope deflection amplifiers, by installing a noise bucking arrangement in the display decoder output amplifiers, and by replacing several tubes that possessed extensive heater-cathode leakage which resulted in 60 cycle ripples on the displays.

The above changes improved both "scope post mortems" and presentations on the display scopes in the Cape Cod Direction Center. Investigations will be continued to further improve the displays.

Crosstelling

E. W. Pughe, Jr. has completed a memorandum (6M-4152) that describes the logic of the WWI crosstell input system.

MEMORY TEST COMPUTER (W. A. Hosier)

Shutdown and Installation

MTC was shut down as scheduled on 3 February. The new control was moved into place Monday morning, 6 February. Lab power was connected to it that same day, and checkout has been proceeding all week. The temporary in-out section, intended to handle drum and tape until such time as a comprehensive in-out control can be fully designed and installed, has not yet been constructed.

The console has been pretty thoroughly torn apart and rearranged, partly to make way for the new console scope, partly to accommodate various small additions such as marginal check controls for tape equipment, indicator lights, and alarm panels, and partly for general convenience.

Magnetic Tape Equipment

IBM confounded our prediction in the last BIWEEKLY of a month's delay on the tape adapter frame, and came through handsomely on Monday, 6 February, with a nearly complete frame. Three 728-tape drive

MEMORY TEST COMPUTER (continued)

units, instead of the two expected, had been delivered here on 1 February. Some pieces, such as 12 plug-in units, all cables, and various covers for air passages are missing, but should arrive next week. Work is proceeding to supply cooling air and power to the frame. By the time the cables and plug-in units arrive, we should be ready to turn the frame on and start to check it out. (It came completely untested from Kingston.) The unexpected acceleration of delivery, we are told, resulted from IBM's decision to substitute the more nearly complete No. 1 frame from FSQ-7 system No. 2 for the less complete No. 2 frame originally scheduled for shipment here.

Personnel

MTC has acquired one new technician, Nick Iodice, and is about to acquire another, Ed Sonier. We regret, however, that we are about to lose Elinor Albanese, who has been "Miss MTC" for more than two years now, to Bill Canty. Barbara Searle will take over Elinor's duties in addition to her present ones.

All interested parties are reminded again that Alex Vanderburgh is conducting training classes for MTC programming.

Operating statistics for the last week before the 3 February shutdown are as follows:

| | Hours | Percentage |
|---|---|---|
| Analysis and Data Processing | 111.8 | 58.6 |
| Development and Testing | 57.3 | 30.0 |
| Installation | 4.2 | 2.2 |
| Maintenance and Marginal Checking | 1.8 | 1.0 |
| Reliability Check Programs | 6.6 | 3.4 |
| Interrupting Failures | 9.2 | 4.8 |
| | 190.9 | 100.0 |

## VACUUM TUBES

(Group 65, P. Youtz)

### TUBE TECHNIQUES (J. S. Palermo)

On 2 February 1956 a review of the bariated-nickel program was conducted with W. L. Gardner at the Barta Building to analyze the data compiled during the past eight weeks. Since the initial objective of this program was to improve techniques and obtain preliminary life data, it was decided that a triode design would be adequate. However, in the past four weeks a series of B-N cathodes was processed in cathode study tubes in order to correlate their operational characteristics with oxide-coated cathodes. The six tubes in this series placed on life test indicated a problem in beam uniformity. Therefore, on 10 February 1956 a program was proposed to investigate the problem. This program projected over the next three months would evaluate the following basic variables:

1. Modified sintering cycles
2. Pressure variation in the fabrication of B-N cathodes
3. Variation in emission layer thickness
4. Variation in chemical techniques
5. Evaluation of $H_2Zr$ activator in cathode study tubes
6. Variation in activator content

In addition, significant life-test data (1000-2000 hours) would be compiled so that a definitive report could be submitted.

A 19-inch Charactron-type display tube with a Gurley matrix has been processed and will be forwarded to C. L. Corderman for studies in increased brightness.

Procedures for selecting CdS particles (25μ or smaller) have been attempted in our laboratory. The first sample produced by a modified version of the Andraeson sedimentation process seems to have a better dark-light ratio than previously tested samples for electroluminescent application. Additional samples will be prepared for Group 25 evaluation.

Miscellaneous Fotoform and glass components have been processed during the past two weeks for Group 25.

### RECEIVER TUBES (S. Twicken)

I attended a progress meeting at Tung-Sol on the DT-438. Sylvania's mold for bases is now completed; the strike at Westinghouse had cut off the only previous source of supply. Tung-Sol's production of evaluation lots is being held up by an outbreak of grid-plate shorts resulting from grid bowing. A new grid connector has been designed to allow for thermal expansion of the grid and hopefully

RECEIVER TUBES (continued)

eliminate the grid bowing problem. Tung-Sol's difficulties over the past several months with cathode emission, cathode peeling, and grid bowing have forced a six weeks' delay in the schedule; the final specification is not expected now until August.

An inspection was made, jointly with IBM, of the facilities of Chatham Electronics which had been selected to be the second source for the 5998 and will be second source of the DT-438 as well. Chatham gives promise of providing some stiff competition to Tung-Sol.

As a result of the dissolution of the tube group at High Street and the inability of the Kingston tube group to handle them, we have taken over responsibility for monitoring and life evaluation of the 1000 type Z-2177's in MTC.

Examination of the data from the first of Bendix' gate pentodes for AN/FSQ-7 shows the plate currents to be somewhat low. The results of the dimensional analysis program conducted with Sylvania, now almost complete, will be directly applicable to this problem.

I attended a meeting of the JETEC 5.5 Subcommittee on Computer Tubes. The proposed specification formats for twin triode and multigrid computer tubes are complete with the exception of a decision on whether the Computer Tube Subcommittee will go along with the military and JETEC as a whole in going over to "design maximum" rather than "absolute maximum" as a rating system. The "design maximum" system is expressed in terms of an average tube and leaves something to be desired for computer tube applications. GE has developed an electronic intermittent-shorts generator. Tests on telephone equipment have shown no troubles with shorts of less than 80 μsec duration. In order to convince all "doubting Thomases" that shorts of longer than 0.1 μsec are potential trouble-makers in our equipment, I am making arrangements for the shorts-generator to be brought to Cambridge and tried on WWI or AN/FSQ-7 pluggable units.

CHARACTRONS AND TYPOTRONS (P. C. Tandy)

Four MIT 19-inch tubes have completed between 4944 and 8665 hours of life test, and eight Charactrons have completed between 1358 and 2064 hours. Charactron 0287 has been rejected for helix breakdown after 2041 hours, but the symptoms have been present for a considerable period. This breakdown caused a smearing of the presentation on the screen. Latest screen capacitance and dissipation factor tests and helical-accelerator resistance checks have indicated no important changes.

Ten oxide-coated cathode study tubes have completed between 555 and 6398 hours. Four of the five which have operated more than 5000

CHARACTRONS AND TYPOTRONS (continued)

hours gave less than 50-μa beam current at the last testing period and will be rejected if similar results are obtained at the next testing time. Two of the five tubes showed less than 50% active area during a beam uniformity test.

Two tubes which pass all acceptance tests as given in memorandum 6M-3965 and eight tubes which pass all tests except grid cutoff voltage will probably be started on life test shortly.

Thirteen triode and five diode bariated-nickel cathode tubes in small envelopes, eight 5C guns, and four triode bariated-nickel cathode tubes in 2-inch diameter bulbs are now on life test. Life-test data on these tubes are available.

Eighteen Typotrons have completed between 552 and 7164 hours. More data is scheduled to be taken before the next report.

FERROMAGNETIC EVAPORATED FILMS (T. F. Clough)

As anticipated in the last report it was a problem to bring RF energy through the steel base plate of the evaporation unit in the quantity required by Group 63 for their work. Several methods were tried and proved inadequate. A design which has proved useful elsewhere has been agreed upon and components are under construction.

COMMERCIAL TUBES

The Lexington Tube Section has received a Tektronix 570 characteristic tracer which will be useful in plotting tube characteristics.

## SAGE CC AND DC SITES

(Group 66, B. E. Morriss)

(W. H. Ayer)

After a considerable amount of negotiation, the magnetic tapes for MTC will be lent to Lincoln under terms of the MIT-IBM bailment agreement. These units will be "borrowed" from the latest AN/FSQ-7 for which IBM has contractual coverage. The equipment has been delivered to MTC with the exception of a few pluggable units and cables, which are expected shortly.

ECP #12, covering three LRI monitor consoles for XD-1 was issued 12 January 1956 by IBM. Certain qualifications raised by AFCRC have been resolved, and a contract change notice should be supplied to IBM by 13 February.

The first two shipments of tape conversion equipment for the card preparation room have been received approximately on schedule, with the final shipment scheduled for 20 February.

Two magnetic tape units, one card-to-tape, and one tape-to-printer have arrived. The tape-to-card unit is not yet here.

It is desirable to have this type of equipment furnished by the Air Force as government-furnished equipment, rather than obtaining it on a rental basis or through a bailment agreement as is now done. Discussions will be continued with ARDC and the ADES Project Office to see if this can be accomplished.

Another meeting was held at the Laboratory last week to discuss the blue operational lighting system. Attendance included AFIRO, ADC, AMC, ARDC, WE-ADES and Lincoln personnel.

The specific subjects under discussion were cost reduction and the requirements for dimming controls. Without exception, all organizations were in favor of cost reduction and in agreement on the necessity for dimming. Selection of an organization to study the cost reduction problem was deferred, however, since Lincoln does not have the required manpower for this type of engineering study and the other organizations represented were doubtful if the necessary equipment and facilities exist outside of Lincoln Laboratory.

## PROGRAM PRODUCTION

(Group 67, J. A. Arnow)

### OPERATIONAL PROGRAMS (D. L. Bailey)

Three of the nontracking programs, track sort, height priority, and raid forming, are well into the coding phase.

Ed Gross, a checkout engineer, is now consulting with Bob Krouss on the parameter checkout of the raid forming program.

Coding has started on all programs in the tracking area. The correlation program is coded and final documentation is in process. A study of track status change is under way with the ultimate goal of issuing a memorandum covering this phase of the tracking programs.

### CENTRAL PROGRAMS (A. R. Shoolman)

Preliminary draft specification of the central programs affecting air surveillance functions is, in general, completed. However, resolution of program intercommunication problems continues. Most central table items have been specified; table layout and organization for use in parameter checkout will be completed next week. The tags for the central table items now in existence will be ready to be placed in the compiler library by 15 February.

Preliminary coding of card input track situation display, and most of air surveillance situation display has been completed. Coding of switch interpretation and central track processing programs is under way.

Design of central programs affecting the non-air-surveillance functions has begun, the functional responsibilities of the crosstell program are defined, and startover, weapons assignment, and miscellaneous situation and digital display program specifications have been started. Specification of remaining central bookkeeping programs will be completed during the next two weeks, and preliminary coding begun.

An estimate of in-out time requirements for the direction center active program has been issued as a preliminary sectional draft.

### CARD PREPARATION ROOM (H. Newhall)

The Card Room has been operating without serious backlog since it moved into the new area in Building A, with the exception of one or two minor disturbances caused mainly by the lack of consecutive numbering equipment (now installed and operating). Our primary re-

CARD PREPARATION ROOM (continued)

sponsibility, the preparation and documentation of SAGE programs, has been accomplished within the stated time limits. Many requests have been processed in less than the required minimum time, but such requests are being discouraged because, as the volume of high priority work increases, we will be unable to process requests in less than this stated minimum time.

There have been complaints about a backlog in Group 22 flight tests (secondary priority work). This backlog has been completely cleaned up, and in order to prevent its recurrence, we have guaranteed Group 22 a maximum of 16 man-hours per week to process this material. Since this agreement was reached, Group 22 has increased their processing requirements to include verification. In addition, they have brought several 1955 tests back to be verified. They have been informed that the Card Room can only accomplish this back verification as time becomes available.

Two of the three units of delayed-output equipment (card to magnetic tape and magnetic tape to printer) have arrived and are being installed. This equipment will be ready to operate by February 19th. However, there are several coding modifications which must be made before the equipment will be compatible with the XD-1 computer. The third unit (magnetic tape to punched card) will arrive before the end of February.

XD-1 Computer Operation (J. I. McGovern)

| | | |
|---|---|---|
| Program Checkout (Utility Assembly) | | 75:35 |
| Downtime | | |
| In/Out Equipment | 5:29 | |
| Computer Malfunction | 2:30 | 7:59 |
| Returned to IBM | | 1:11 |
| Assigned Time | 81:00 | |
| Extra Time Allotted | 3:45 | 84:45 |

## ADMINISTRATION AND SERVICES

(Group 60, J. C. Proctor)

### PERSONNEL

#### Staff

The only change in staff personnel this period has been Mary C. Lafferty, who has terminated.

#### Nonstaff

Following are the changes in nonstaff personnel:

**New**

| | | |
|---|---|---|
| John D. Coyne | Admin. Asst. | Group 64 |
| Kenneth Chin | Draftsman | Group 60 |
| William C. O'Brien | Draftsman | Group 60 |
| Leonard Sicard | Office | Group 60 |
| Barbara Riley | Office | Group 60 |
| Joan Pasquina | Office | Group 60 |
| Iris Teragawa | Office | Group 60 |
| Donald C. Bancroft | Office | Group 61 |

**Terminations**

| | | |
|---|---|---|
| Stanley Hazen | Student | Group 64 |
| Harvey Segal | Draftsman | Group 60 |
| Gail Howard | Office | Group 60 |
| Dominic DiLuca | Draftsman | Group 60 |
| Francis White | Draftsman | Group 60 |
| George Glass | Student | Group 65 |

**Transfers**

| | | |
|---|---|---|
| Maude Treamer | Technician | Group 63 to 45 |
| Marilyn Howard | Office | Group 60 to 23 |

### GENERAL ENGINEERING (A. R. Smith)

#### Movable Partitions

Movable acoustical partitioning is being designed for experimental use by Group 62 in D-232. An attempt is being made to develop a simple partition design which can be inexpensively fabricated in quantity as a stock item. Upon request, standard panels and supporting members are shipped to an aera and rapidly assembled in

GENERAL ENGINEERING (continued)

minutes to provide separate cubical office areas. This technique will provide some measure of privacy and segregation without adhering to the existing 9-foot square modules. Partitions of this nature will definitely reduce installation costs, interruption of work of office personnel during the installation period, and work load on the service group making the installation. It is hoped that fabrication cost will also be reduced measurably and the plan will be adopted for widespread use throughout the Laboratory wherever need is justified and its use applicable.

Stokes Press

The Stokes press has been completed one week sooner than anticipated. The Model Shop is to be congratulated for the skill and effort put forth on this job. Although outside vendors with superior knowledge and equipment twice failed to complete the job, the Model Shop finished the press in less time and with a greater degree of accuracy. The press has been in operation approximately one week, producing over 40,000 50-30 cores of superior performance without equipment failure or adjustments. For those not acquainted with the 50-30 core program and its associated problems, consider for a moment the problems encountered with the present memory core program, then speculate for a moment on the difficulties to be experienced with a 50-30 core which is capable of passing through the hole of a regulation memory core.

The design section is currently working with E. A. Guditz to develop wiring techniques for the miniature cores.

Miscellaneous

General Engineering's function of design, fabrication, and installation for the Kelvin and Hughes camera is complete and the equipment mechanically operative.

A new core test handler is to be designed. It will eliminate some of the inadequacies of past models and, in addition, be able to test either the memory or 50-30 size cores, using the same basic equipment.

The Command Post tote boards are currently being installed by IBM personnel. IBM is experiencing some difficulty to date with the commercial dimmable control equipment. Upon completion of their work, this section will make the final provisions for telephones, crayons, test, etc.

TEST EQUIPMENT (L. Sutro, A. Bille)

One book of the bible of the test equipment technicians is the book of test specifications. For each unit of standard test equipment,

TEST EQUIPMENT (continued)

there should be a page or more telling how to test that unit. Plug-in units have long been conspicuous by their absence from this book. Acceptance tests designed to check wiring as well as operation were used instead. Now we are preparing straightforward test specifications of plug-in units to be included in the book.

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

We now have a differential voltmeter capable of measuring voltages from 500V to 10 μV with an accuracy of ± 0.1%.

DOCUMENT ROOM (A. M. Falcione)

The perpetual list of Division 6 documents for all A- and M-series memoranda has recently been completed and distributed to all group secretaries. This list is broken down into classified and unclassified sections. Supplements will be published quarterly.

The Document Room will now distribute drafts of all numbered memoranda. This will relieve group secretaries from distributing large quantities of these drafts. It is my opinion that too many copies (up to 125) of draft memoranda are being distributed to Lincoln personnel. It seems to me that they should be sent to only those whose concurrence or approval is required.

The distribution list for Division 6 gets longer and longer. It is my suggestion that the abstract be distributed to those personnel who do not require the complete memorandum, a technique which is not being used as much as it should be. The Secretary's Security Committee has commented that Division 6 distributes too many documents to personnel who have no need for them. It is my suggestion that a careful scrutiny be made of all distribution lists to ascertain whether or not those listed really require the complete memo. In most cases, the abstract page of classified memoranda is unclassified and, therefore, the necessity of receipts and logging-in would be eliminated.

## STUDIES IN PROCESS

### GROUP 61

**Direction Center - Weapons Direction**

Math Specs for:

| | |
|---|---|
| Antiaircraft | 6M-3982, Final draft expected wk. of 13 Feb. |
| Intercept Direction | 6M-3927, 1st draft expected week of 13 Feb. |
| Weapons Assignment | 6M-3926, 1st draft issued. |
| Raid Forming | 6M-3973, final draft issued. |

OPS Specs for:

| | |
|---|---|
| Interim AA | 6M-3739-1,C1, final draft exp. wk. of 20 Feb. |
| Intercept Direction | 6M-3786-1,C2, final draft exp. wk. of 20 Feb. |
| Weapons Assignment | 6M-3744-1,C2, 1st draft issued. |
| Raid Forming | 6M-3720-1,C1, 2nd draft issued. |

### GROUP 62

**Memory Test Computer**

| | |
|---|---|
| Card and Tape Symbolic Address Assy. | B. G. Farley |
| Flight Test Analysis (Gr. 22) | G. Harris, C. Uskavitch |
| Pattern Recognition (Gr. 24, 34) | G. Dineen, O. Selfridge |
| Simulation (Gr. 22) | H. Neumann, B. Stahl |
| New Control Design, MTC | E. Gates, H. Ziegler |
| New Control Checklout and Installation | E. Glover, N. Ockene |
| Magnetic Tape Installation and Checkout | A. Hughes, T. Stockebrand |

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DOCUMENTS ISSUED

(Frances Christopher)

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The following documents were published by Division 6 or received from IBM during the period 30 January through 10 February 1956

| NO. 6M- | AUTHOR | TITLE | CLS. |
|---|---|---|---|
| ADMINISTRATION & SERVICES (Group 60) | | | |
| 4048 | J. W. Forrester | General Procedure for Integrating New Weapons with Sage | C |
| 4083 | Div. 6 Staff | Personnel List January 1, 1956 | U |
| 4139 | Div. 6 Staff | Biweekly Report for Period Ending 27 January 1956 | C |
| 4140 | Div. 6 Staff | Group Organization List, February 1, 1956 | U |
| 4148 | G. J. Essler | Method of Lighting, Marking and Cleaning of Edge-Lit Plexiglas Display Boards | U |
| SAGE SYSTEM TEST & PLANNING (Group 61) | | | |
| 3980-1 | D. Davis | Current Listing of Operational and Mathematical Specifications for Sage Direction Center | C |
| 4028 | S. J. Hauser<br>F. M. Garth | Mathematical Specifications for the Identification Function in Sage | C |
| 4120 | J. J. Cahill | Initial Program Specification: Additions and Revision of Operational Specifications for Interim Antiaircraft Direction in Sage System | C |
| 4121 | D. R. Israel | Organization and Responsibilities of Group 61 | U |
| 4129 | S. J. Hauser<br>F. M. Garth | Initial Program Specification: Mathematical Specifications for the Identification Function in Sage | C |
| 4130 | H. E. Prachtman | Initial Program Specification: Mathematical Specifications for Height-Finding | C |
| 4132 | S. Hauser<br>F. Garth | Initial Program Specification: Mathematical Specifications for Manual-Data Input Function in Sage | C |

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| 4133 | J. J. Cahill | Initial Program Specification: Mathematical Specification for Antiaircraft Direction in the Sage System | C |
| 4134 | E. W. Wolf | Initial Program Specification: Mathematical Specifications for Radar Data Inputs in a Sage Direction Center | C |
| **FSQ-7 PROTOTYPE DESIGN & INSTALLATION (Group 62)** | | | |
| 3834 | A. Venderburgh | MTC Utility Program | U |
| 3851-1 S#2 | J. Giordano | Master Reference List of Equipment Specifications for XD-1 | C |
| 4068 | W. J. Canty | Long-Range Radar Data Input Subsystem to Direction Center from S. Truro Site Test Specification | C |
| 4101 | T. Sandy et al | ESS Height Finding Subsystem Acceptance Test Specifications | C |
| 4102 | F. E. Irish | Test Concept for Sage Wire Communications | C |
| 4142 | W. J. Canty<br>J. C. Watson | Use of Magnetic Tape Recorders as Simulated Message Sources for LRI Sub-System Tests in Sage | U |
| 4149 | C. W. Watt | Three Month XD-1 Time Allocation Schedule | C |
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| 4123 | D. R. Brown | Organization and Responsibilities of Group 63 | U |
| 4137 | J. D. Childress | Memory Core Heating by Switching at High Frequencies | U |
| **PRODUCTION AN/FSQ-7 & CAPE COD DIRECTION CENTER (Group 64)** | | | |
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| 4124 | E. S. Rich | Organization and Responsibilities of Group 64 | U |
| 5303 | N. L. Daggett<br>H. K. Kirshner | Request for Statements of Scopes of Work Relating to ESS Integration & Operation | U |

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| 4125 | P. Youtz | Responsibilities & Responsibilities of Group 65 | U |
| PRODUCTION COORDINATION OFFICE (Group 66) | | | |
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| 4115 | J. J. Carson | Sage System Meeting, 16 January 1956 | S |
| 4116 | J. J. Carson | Sage System Meeting, 23 January 1956 | U |
| 4126 | B. E. Morriss<br>K. E. McVicar | Organization and Responsibilities of Group 66 | U |
| 4138 | J. J. Carson | Sage System Meeting, 30 January 1956 | U |
| 5302 | E. D. Lundberg | ESS-PCC Status Report for Week Ending 27 January 1956 | C |
| 5303 | E. D. Lundberg | ESS-PCC Status Report for Week Ending 3 February 1956 | U |
| PROGRAM PRODUCTION (Group 67) | | | |
| 3964-1 | P. R. Bagley et al | The Program Input Process: A Manual on the Use of the Lincoln Compiler and Read-in Programs | U |
| 3989 C#1 | E. Lafferty<br>S. Tower | Changes in the Interim Operational Specifications for the Recording Function in the Sage System | C |
| 4119 | D. W. Ladd | Initial Program Specification: Changes in Operational Specifications for Raid Forming in a Sage Direction Center | C |
| 4082 S#2 | D. L. Bailey | Initial Program Specification | U |

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| 5077-1 | J. B. Williams | Initiation Tests: Series III | C |
| | | IBM DOCUMENTS ISSUED | |
| 921<br>(S-46) | F. Gewicky | Delay Console Circuit Breaker Unit Specifications for AN/FSQ-7 Combat Direction Center & AN/FSQ-8 Combat Control | U |
| 922<br>(S-32) | J. J. Gano<br>P. Morrill | Prime Power Distribution Specification for AN/FSQ-7 Combat Direction Central | U |
| 923<br>(S-17) | D. Hallock<br>R. Imm | Magnetic Tape Element Specification for AN/FSQ-7 Combat Direction Center and AN/FSQ-8 Combat Control | U |
| 924<br>(S-45) | C. Rosenberger | Output Marginal Checking and Distribution Unit Specification for AN/FSQ-7 Combat Direction Central & AN/FSQ-8 Combat Control Center | U |
| 925<br>(S-44) | F. Gewicky | Simplex Input Marginal Checking Unit Specifications for AN/FSQ-7 Combat Direction Central 7 AN/FSQ-8 | U |
| 926<br>(S-14) | R. Martin | Program Element Specifications for AN/FSQ-7 Combat Direction for AN/FSQ-8 | U |
| 927<br>(IM-63-2) | R. Marden | Concurrence on IM-67-3 Joint IBM-MIT Equipment (XD-1) and XD-2 | U |
| 928<br>(S-29) | C. E. Langmack | General Display System Specifications for AN/FSQ-7 Combat Direction Central and AN/FSQ-8 Combat Control Central | C |
| | | LL-DR DOCUMENTS ISSUED | |
| 586<br>(P-36-3) | R. C. Marden | Concurrence on Modification of H-139-A, "Design Specification for Situation Display Console for XD-1". | U |
| 587<br>(P-255) | R. C. Marden | Concurrence on "Location of Telephone Units in the Maintenance Console of XD-1". | U |

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| 589 (P-264) | R. C. Marden | Concurrence on Additional Test Equipment for XD-1 | U |
| 590 (P-258-2) | R. C. Marden | Changes to 6M-3728 "Category and Display Assignment Bit Assignment for Sage Situation Display | U |
| 591 (P-207-2) | R. C. Marden | Concurrence on Changes to XD-1 Console Equipment and Label Layout | U |
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| 594 (D-47-1) | W. S. Squire | Emergency off Switches | U |
| 595 (D-66-1) | W. S. Squire | Concurrence on Change to Fundamental Technical Requirements for Digital Data Transmitters, Receivers and Associated Equipment | U |
| 596 (D-101-1) | R. A. Imm | Concurrence on D-101-1 Specifications for the AN/FSQ-8 Combat Control Central | U |
| 597 (D-108) | W. S. Squire | Concurrence on 6M-2921-3, Cooling System for AN/FSQ-7 Direction Centers | U |