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Memorandum 6M-4386

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

SUBJECT: BIWEEKLY REPORT FOR PERIOD ENDING 29 JUNE 1956

To: R. R. Everett

From: Division 6 Staff

Date: 5 July 1956

Approved: J. C. Proctor

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ESS DC IMPLEMENTATION AND COORDINATION

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

DESIGN CONTROL OFFICE (W. A. Hosier)

Film Read-ins and Projectors (L. L. Sutro)

Lloyd Sanford and I have investigated the problem of viewing film from the three types of cameras used in the AN/FSQ-7, XD-1, and AN/FSQ-8 computers. Film from all three cameras can be viewed in a microfilm reader or projected on a screen by a micro film projector. A strip film projector can also be used if its film advance mechanism can be rotated 180°. Motion picture projection is possible with film from two of the cameras. (Ref. 6M-4375)

Label Studies (R. H. Gerhardt)

IBM will start procurement procedures for the AN/FSQ-8 console equipment labels. Any further changes in labels or number of push buttons will require that a CER be sent to the Design Control Office for evaluation (6M-3732-1).

LRI Production Prototype Monitors for XD-1 (J. Giordano)

Three production prototype LRI monitors from Bendix are due to arrive for installation in Bldg. F the middle of July.

With only minor modification they will be able to use the Lincoln-built LRI breadboard control frame and no programming change will be required at this time.

They will be located as follows:

One in the outputs room, 1st floor, Bldg. F

Two in the R room, 2nd flr., Bldg. F.

Adequacy of LRI Monitor (J. D. Crane)

The display accuracy and jitter in the LRI monitor as it was being constructed was found to be intolerable (see CER #197). MIT feels that the specification should not be relaxed and Bendix is improving their present design in order to meet specifications. The circuit support section in Group 62 is active in this area.

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DESIGN CONTROL (continued)

New CER's (A. A. Rich)

<u>CER#</u>		<u>Originator</u>
199	Simplex Maintenance Console Specifications for FSQ-7 and FSQ-8, S-50. A rewrite of specifications.	IBM
200	Modification of LRI Parity Checking Circuitry for XD-1, P-301 Proposed parity check circuit which will cause a message to be rejected if both words of the message have the wrong parity.	IBM
201	Change the station nameplates on SD consoles of Identification Technicians from "Identification Technician, I 04" & "Identification Technician 2, I 02" to "Identification Technician 1, I 02" & "Identification Technician 2, I 04". To agree with 6M-3780-1, Operational Specifications for the Identification Function in SAGE.	Group 67
202	Change to Display System Specifications for FSQ-7 and FSQ-8, S-29-4. To provide a SD visor.	IBM

POWER AND CONTROLS (J. J. Gano)

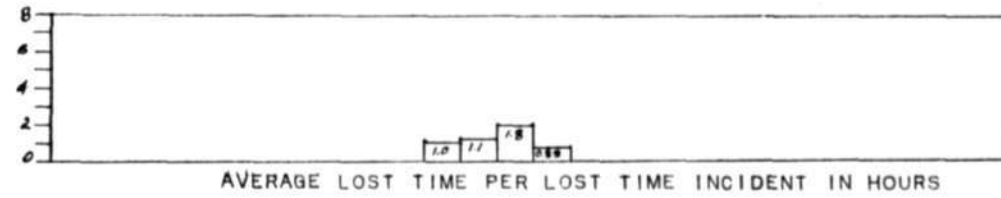
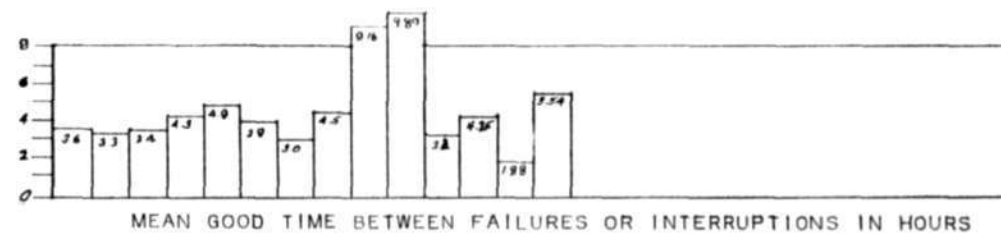
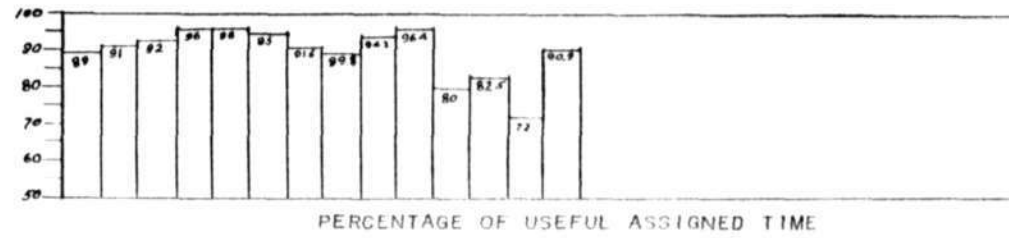
XD-1 (J. J. Gano)

Jim Leavitt and two electricians from Division I, Gardner and MacNeil, attended a one-week course on magnetic d-c power supplies which was sponsored by G. E. at Lynn. If, as is hoped, all electricians would take more interest in this subject, we would eventually be able to withdraw our Division 6 technicians who have been covering the magnetic d-c power supplies.

SAGE (J. J. Gano)

At a meeting at Kingston attended by IBM and WE representatives and me to review cable distribution philosophy, it was determined that only signal wiring and d-c service voltages need be separated from other wiring and, for short distances, the requirement is not necessary for the d-c voltages. This should help Western Electric in their redesign of the distribution near the PCD and MCD frames of the new arrangement.

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



DEC 3  
 DEC 17  
 DEC 31  
 JAN 14  
 JAN 28  
 FEB 11  
 FEB 25  
 MAR 9  
 MAR 23  
 APR 6  
 APR 20  
 MAY 4  
 MAY 18  
 JUN 1  
 JUN 23

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POWER AND CONTROLS (continued)

Laboratory D-C Power Supplies (S. Coffin, J.A. Malouin)

Plans are being made to produce several low-voltage transistor, magnetic d-c power supplies similar to the 15-volt, 8-ampere supply which has shown good performance. A modular construction will be used with a breakdown into three sections: The power section which will include the transformers, magnetic amplifiers and rectifiers; the capacitor section; and the transistor amplifier section.

The 15-volt, 1-ampere transistor power supply, designed by Group 63, was tested at the request of the test equipment committee. The regulation was very good.

Magnetic Amplifiers (G. F. Sandy)

One of the limitations of present magnetic amplifier logic circuits is the large number of amplifiers needed for applications requiring many independent outputs. An example of such a system is the marginal checking system for XD-1 where, by pushing four buttons out of a total of 25, any one of a possible 1440 outlets can be obtained. If the logic which can be used with the present magnetic amplifiers were employed, at least 1440 magnetic amplifiers would be needed. An investigation is being conducted into the possible use of matrices where the number of magnetic amplifiers can be reduced to a minimum (hopefully as low as 25).

XD-1 OPERATION (P. B. Harris)

In order to obtain more accurate figures of XD-1 performance, we have revised the method of log-keeping at the maintenance console to differentiate between computer failure resulting in lost time, and time lost to a programming group. Formerly, whenever a program failed prior to completion, the entire time the program ran prior to the halt, was charged against the computer. Under the new log-keeping format, only the time the computer is unavailable due to operational failure is considered as lost.

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ADVANCE DEVELOPMENT

(Group 63, D. R. Brown)

MAGNETIC MATERIALS (J. B. Goodenough)

Memory Core Testing (R. C. Zopatti)

There are approximately 45 mats of cores (180,000) for the 256 x 256 x 38 memory that will be taken apart and retested as they have an excessive amount of bad cores which would take longer to replace than it would to restring the mats completely. We have now approximately 110,000 double-tested cores on hand to do this job.

The grill work on the ducts of the air conditioner has been installed but we are still awaiting the thermostats and fresh air intakes.

Chemistry

Memory Core Production (D. L. Brown)

Approximately 1500 F-398 cores, memory composition with  $ZnFe_2O_4$  added, were made for R. Best.

It was found that the thickness of a large number of the memory composition F-398 cores already on hand exceed the limit of 18 mils. The cause of the nonuniformity has been corrected, production has been resumed, and 180,000 memory cores have been made.

Crystallography (D. Wickham, W. Croft)

Lattice parameter measurements have been made on the completed samples in the solid solution series  $NiO-LiNiO_2$ . The samples have a cubic, rock-salt-type structure with a decreasing unit-cell dimension as the  $Ni^{+++}$  content increases.

Experimental Chemistry (A. Wold)

Nickel oxide was reacted with lanthanum oxide at 850°C with sodium carbonate present as a flux.  $LaNiO_3$  formed which possessed a slightly distorted perovskite structure. The measured density of  $LaNiO_3$  was found to be 6.96 g/ml.

Samarium, gadolinium and yttrium oxides do not react appreciably with nickel oxide at 850°C. Reaction mixtures of these rare earth oxides with nickel oxide were fired at 1300°C. X-ray diffraction patterns are being studied to determine the possibility of compound formation. Cerium oxide was fired with nickel oxide at temperatures ranging from 800°C to 1350°C without any apparent reaction taking place.

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MAGNETIC MATERIALS (continued)

Analytical Chemistry (D. Wickham, E. Keith, L. Doctor)

A procedure for the analysis of nickel chromite samples has been developed.

Physics

Instrumentation

60-cycle Fluxmeter - An integrating amplifier designed for a frequency range between 60 and 100 kc with an error of less than 1% is being constructed. A transistorized preamplifier is also being constructed to be used in conjunction with the integrator.

(R. A. Pacl, Jr.)

Vacuum Evaporation Unit - The building and assembly has been completed, but an air leak has developed which has not been located.

(F. S. Maddocks)

Evaporated Films - A target holder for placing evaporated films in the electron microscope has been designed and built and a monitoring device for measuring the thickness of the films during evaporation is now ready for operation. The magnetic field coils in the evaporator have been calibrated and a power supply has been designed. (G. P. Weiss)

The sample apparatus for measurements down to liquid He is nearing the stage of finished design. (D. O. Smith)

Trip

A trip was made by J. B. Goodenough, D. O. Smith, F. S. Maddocks to Bell Telephone Laboratories to visit H. J. Williams, who is studying domain patterns in thin films by means of the colloidal magnetite technique, and Bob Fletcher whose Solid-State-Devices Group has initiated a ferrite program and is working on memory fabrication techniques and core-switching experiments.

Thin Films (J. Raffel)

Two experiments indicate that the thin magnetic films do not switch at speeds considerably greater than ordinary ferrite. (The validity of the possible loading effects of the pick-up loop used).

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MAGNETIC MATERIALS (continued)

For constant read excitation the read output from a film is a function of the duration of the write pulse out to at least 0.6  $\mu$ sec.

Decreasing the read excitation (with full write) produces output voltage signals which decrease in amplitude and appear to lengthen continuously.

The approximate switching time at coincident current appears to be somewhere between 0.3 and 0.4 microseconds.

TRANSISTORS (E. U. Cohler for D. J. Eckl)

Parameter Variations

A routine retest has revealed some interesting parameter variations in 99 transistors that were in TX-0 for 350 hours and have average shelf-computer lives ranging from 2900 to 6900 hours. Of the 99 retested, 17 showed significant changes in either  $\beta$  or  $I_{co}$ . Thirteen showed a  $\beta$  variation of from 10 to 30 per cent. It is perhaps significant that the initial  $\beta$  of these 13 units was considerably lower than average. The original  $\beta$  median of all 99 was 28 while the average of the 13 that varied was 21. Of those that varied in  $I_{co}$ , none had drifted beyond 5.0  $\mu$ a (The specification is 3.0  $\mu$ a). These orders of magnitude of parameter variations are to be expected, but we now have a better idea of just what percentage variations we should be specifying in circuit design and transistor specifications. These tests will be continued with routine rechecks every 1000 hours and further study will be made of the causes of parameter variation of these types. The details of these tests have been issued in an interoffice memo to K. H. Olsen.

New Samples of SBTT's

The latest sample of SBTT's has been tested and the results are very encouraging. The  $\beta$  at 50  $\mu$ a of emitter current has improved over a previous sample, going from an average of 11 to an average of 62. Moreover, the variation of  $\beta$  with emitter current has been considerably decreased as would be expected.

A Variable Power Supply (E.U. Cohler, R. H. Hudson)

An electronically variable power supply, capable of delivering from 1 to 40 volts d-c regulated to a 10-ohm load, has been designed and is now under construction. The input standard may be any voltage



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TRANSISTORS (continued)

source capable of providing 5.0  $\mu$ a of control current. Bob Hudson has designed and constructed a manually variable standard, and Ed Cohler is in the process of designing a programmable standard. As a result of the high dissipation requirements of this supply we found it necessary to do some tests on heat dissipators. The results of these tests will be published in an M-note shortly, but they indicate that an Eimac radiator with a small amount of cooling air is a truly remarkable heat sink. Under one condition of operation, its thermal resistance was 0.3°C/watt (compared to the junction-to-stud resistance of the transistor of 2.2°C/watt).

Production (E. U. Cohler)

Work has been completed on the latest Cohler, Geoffrey Lewis Cohler. All attempts at miniaturization failed, the final model being 22" long and weighing 9#14oz. There are some minor bugs in the model, consisting of various leaks and certain inexplicable noises. However, it is expected that these will be ironed out and the final engineering done within a year or two.

(Congratulations to Mr. & Mrs. Cohler....Editor)

LOGICAL DESIGN (W. A. Clark)

TX-2 Design (W. A. Clark, H. P. Peterson)

Detailed logical diagrams of the registers for the arithmetic element have been completed. The arithmetic element is designed in 9-bit units, each capable of independent operation, making it possible to combine them into 18-bit, 27-bit, or 36-bit arithmetic elements by means of interunit coupling of carry paths, shift paths, etc. The ratio of the number of transistors to the number of flip-flops is about 22:1.

Speech Recognition (J. W. Forgie)

Photographs of WWI numerical displays have been obtained which indicate that the speech input system and associated programs are working approximately as desired. Visual examination of a numerical display of data read into WWI and stored on the auxiliary drum shows that the speed input equipment is capable of presenting to the computer the spectrogram of a 2.5-second speech sample. The display photographs show the same characteristic features of the speech sounds as would be observed on a conventional spectrogram with the exception that the display is in numerical rather than graphical form. The photographs also indicate that some changes in the equipment are necessary to insure reliable operation, and that some changes in the program would be desirable to facilitate comparison of results with data from other sources. These changes are being made.

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LOGICAL DESIGN (continued)

ONR Conferences (J. Frankovich, B. Farley)

We attended the second ONR Conference on Automatic Coding Techniques in Washington on 28 and 29 June. Beyond the development of the techniques described two years ago and their extension to the computers built since, the conference demonstrated that little has been accomplished in the field.

SYSTEM DESIGN (K. H. Olsen)

TX-0

The computer is operating on toggle-switch storage, and daily margins show no deterioration. Cable covers have been installed on the front of the computer.

TX-2

Work has been proceeding on the new display system, and both the intensity amplifier and an inverter panel have been completed. A satisfactory register driver using SBTT's has been designed. An experimental, 5-mcps,  $2^0$  counter has been completed.

MEMORY (J. L. Mitchell)

$256^2$  Memory

To date, 555  $64 \times 64$  memory plane modules have been accepted and 30  $256 \times 256$  planes have been assembled. The sense winding interconnections have been installed in 20 of the planes. The assembly of the stack is under way, and to date three planes have been connected.

During the last week we have reduced cycle time and raised the prf of the first plane in the  $256^2$  memory. This plane is now operating with cycle time of less than 7  $\mu$ secs.

Transistorized Memory

Models of a jig to hold the 50/30-mil cores during assembly are under construction, and should be available for test in the near future. Small needles and beryllium copper wire are on order for possible use in the assembly of the small cores.

Further tests are being run on the Sylvania 2N94A transistors. In addition, a CBS 2N184 transistor is being investigated as another possible candidate for the core-switch application. A better system for testing the various transistors is being designed and constructed.

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MEMORY (continued)

Advanced Development

4 x 4 Printed Plane

Planes for setting up a laboratory facility for printed wiring work have been temporarily halted. In the meantime some exceptionally good results have been obtained in the plated-printed-plane experiments. Sixty-four conductors have been laid down simultaneously, and if a suitable photographic mask were available, there is no doubt that a working 4 x 4 printed plane with no soldered joints could be made. Such a mask has been ordered, and will take about two months to obtain.

DISPLAY (C. L. Corderman)

Charactron Legibility (R. H. Gould)

One set of legibility tests has been successfully completed on a Charactron in the TBS room by Group 38. When the data are analyzed a report will be written. It seems desirable to run a legibility-variation-with-time test over a period of a month or so using the Group 38 technique which provides a quantitative measure of legibility. Informal discussions have begun.

Radar Frequency Modulator (H.E. Ziemann, J. Kriensky)

A rush assignment has been received to design and build a radar frequency modulator, the actual oscillator to be modulated in a frequency sensitive to the d-c voltage between accelerator mode and cathode. The modulator will consist of an 8-bit, highly stabilized, digital-to-analog decoder with the necessary logical equipment to provide any random variation of d-c levels for the modulation. All the logical circuitry is now completed; a decoder has been designed and is in construction; a random-pulse generator is being designed; and preliminary testing of decoder circuits are under way.

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ESS TEST PLANNING - WWI MIC OPERATION

(Group 64, E. S. Rich)

CAPE COD ENGINEERING (L. L. Holmes)

Consideration has been given to expanding the present WWI facilities because of the growing importance of the Cape Cod System. The equipment changes now under consideration are as follows:

1. The addition of 4096 registers of magnetic core storage to supplement the existing 2048 registers.
2. The installation of a new facility capable of accepting FGD transmissions from the AN/FST-2 at Bath.
3. The adaptation of our existing WWI cross-telling equipment to manage program-generated height requests without slaving the computer to the output facility.
4. The reduction of the interlace of the WWI magnetic drums so as to reduce the block transfer time.
5. The improvement of the operation of the CCDC.

A report of the survey conducted by this section was prepared for R. R. Everett.

WWI Computer Operation

Scheduled Computer Hours	324.0
Interrupting Incidents	16
Hours Lost	6.1
Percent Good Time	98.2
Mean Time Between Failures in Hours	19.9

A general description of this period's failures is as follows:

- (1) The intensity adjustment for the computer's camera display scope was improperly set following the replacement of the cathode ray tube.
- (2) A faulty circuit breaker led to 20 minutes of down time.

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CAPE COD ENGINEERING (continued)

- (3) A mechanical failure in a microswitch rendered the system inoperative for 12 minutes.
- (4) A broken wire following an equipment installation period was the source of 20 minutes of lost time.
- (5) A power failure during a marginal checking period resulted in 1-1/2 hours of downtime.
- (6) The nine remaining incidents were recognized as computer alarms. The reasons for three of the alarms have not yet been determined.

G.E. G/A Data Link

The address arrangement of the WWI G.E. G/A data link output system has been changed to comply with a recent request from Group 311. A supplement to the 6M-4230 has been prepared to describe the modifications.

Raytheon Magnetic Tape System

Unit #4 has again been overhauled. The installation of the correct oil seal, the replacement of the chopper relay, and the readjustment of the torque controls have placed the unit in excellent operating condition.

The capstan on Unit #0 is scheduled for replacement on 2 July.

Magnetic Drum Equipment

A new type of chassis was introduced to service this period. The new chassis combines the functions of two plug-in units and provides improved levels to its loads.

WWI-XD-1 Crosstelling Subsystem Tests

There were two tests concluded, each consuming two hours. The first test was plagued with 12 failures attributable to the XD-1 area. The second test had two failures at the XD-1 machine. The majority of the failures are generated at the XD-1 output system.

MEMORY TEST COMPUTER (H. L. Ziegler)

Personnel

During the past biweekly period five new people joined the MTC section:

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MEMORY TEST COMPUTER (continued)

Emy P. Brooks will assist Alex Vanderburgh in the handling of time schedules, programming, and special facilities such as film and card-tape preparation.

Jane E. Duggan will take over the office duties formerly carried out by Barbara Searle while Barbara shifts over to full-time card and tape preparation work.

Chester Small, here for the summer, will work with Alex Vanderburgh on programming.

Donald Decof and William Plansky, also summer, will work with Herb Ziegler in a study of new input-output devices for digital computers.

Computer Research

The cable termination-pulse mixer study continues to show promise. Present design includes the use of taper-pin connectors, and plug-in mixers built around the new Amphenol Micro-Ribbon connectors. Careful design should realize a fairly high "packing factor" for video cables and mixing diodes without sacrificing accessibility or circuit performance.

Preliminary studies of the proposed input-output control for MTC indicate that a buffer memory might be the best approach for obtaining the desired flexibility of control. Study will continue along this line.

Magnetic Tapes (E. K. Gates)

The magnetic tape units are available for programmers' use in all modes of operation (read, write, and verify). The verify mode is used to check what has just been written on tape against the contents of memory without having to read the tape back into memory.

A check character is generated at the end of each record to make our tapes compatible with Bldg. A tape equipment. However, the tape parity alarm on MTC must be suppressed when reading tapes made in Bldg. A since they do not generate a parity bit.

The experimental high-speed tape drive, developed by Tom Stockebrand, is ready for Group 63 except for a few performance tests.

Photoelectric Tape Reader (E. K. Gates)

New circuits have been installed. Improved amplifiers allow the use of a lower light-source voltage which should lengthen the life of the bulb. Margins are greater than before and with the small, offset feedhole, greater variations in tape speed are permissible.

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MEMORY TEST COMPUTER (continued)

Display (E. K. Gates)

A modified version of the XD-1 light gun has been checked out and is working satisfactorily.

It appears that the trouble with the display power supply was due to a combination of high humidity and poor ventilation. Better ventilation inside the chassis seems to have solved the problem.

Power Supplies (E. K. Gates)

The new regulator for the marginal checking system has been installed and provides good amplidyne control. Marginal checking will be done temporarily with a continuously variable control until the preselector switches are available.

Programs and Training (A. Vanderburgh)

Test Programs

In Use

#7	Scope Display Test	Ziegler
#25	MTC Computer Operation Check	Holst
#27	MP60-MC100 on Drum	Farley-Hughes-Holden

In Preparation

Magnetic Tape Check and Display	Holden
Drum Test	Holden
Drum Test Display	Mazza
Card Machine Check (Read & Punch)	Callahan
MC100 Revision	Ockene-Holden-Callahan

New Utility Programs

Ready for Use

#28 Magnetic Tape Octal P.M. Ray Olsen

This program prepares magnetic tape for use with the IBM 705 tape-to-printer equipment in the Card Room (A-058). All of fields 1 + 2 (except for six registers at the end of field 2) are listed. Groups of more than eight 0's are not printed. Content of memory is destroyed.

In Preparation

SYADX - Symbolic (Floating) Address Assembly and Conversion - B.G.Farley

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MEMORY TEST COMPUTER (continued)

Technicians' Course

At least once a week, the Technician Training Course will have a guest lecturer. These periods will not require preparation. The intervening periods will follow up the material introduced by the guest lecturer and preparation will be required. We hope to schedule at least three sessions per week.

Programming Course

The programming class is in its third week and is engaged in writing a representative utility program. The first version of this program will load into storage any cards produced by the MTC octal Hollerith card punchout (Box #9 - Farley). If it seems desirable, the program will be revised to load decimal cards as well.

These programming courses are held whenever there is a group of five or more who need to know MTC programming. The classwork usually requires three to four weeks at about two hours a day. Each student is expected to write a useful program (Subroutine or Utility). Computer time is made available.

General

We would appreciate comments on the topics listed below:

- A. Utility Programs or Subroutines in Preparation
- B. Utility Programs or Subroutines Desired
- C. New Instructions Desired
- D. Instructions that are no longer needed (e.g. md)
- E. New Equipment Desired e.g. Real-Time Clock, Index Register, etc.

Address comments to:

- A. Vanderburgh X116, Rm. B-149



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VACUUM TUBES

(Group 65, P. Youtz)

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

Display Program

The components necessary for the redesign of the Charactron tube have been received. The redesign will increase the current density at the screen. Parallel experiments have been conducted on comparable components for the 19-inch tube in order to resolve anticipated problems. Prior to the processing of the initial tube for these electron-optics studies, the major problem had been one of high voltage breakdown between the aluminized screen and the accelerating color mask.

The initial tube (CHT-142) using CBS 19-inch Colortron components was sent to CBS-Hytron with the 19-inch, 6-phosphor tube for heliarc-welding. An electron gun was immediately sealed to the 19-inch Colortron tube and the tube was processed. However, there are indications in this processed tube that a contact problem between the panel pin seal and the aluminized screen may require attention before the actual electron-optics study tube is ready for evaluation. As a result, a redesign of the present contact method has been proposed and an additional tube is in process.

Bariated-Nickel Program

Since the most impressive group of bariated-nickel cathodes passing CT specifications after 3000 hours contains a strip of Ti metal for more effective gettering, three additional cathodes of this type have been prepared to supplement the present data.

RECEIVER TUBES (S. Twicken)

6414

A meeting was held at GE, Owensboro, on the 6414 twin-triode. Several additions were made to the proposed MIL spec, the most notable of which is a reduction in the AQL for intermittent shorts from 1.0 to 0 per cent. Arrangements were made for G.E. to look into the matter of long-term stability. Production has been cut back to an "absolute-minimum" of 6000 tubes per week. Quality remains at a high level although a microphonics problem has come up.

SR-1782A

I visited Burroughs at Paoli to discuss the effects of a change that may be made in the SR-1782A gate pentode to increase its plate

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RECEIVER TUBES (continued)

current some 10 per cent. In most of the FST-2 circuits there is no major cause for concern. Burroughs will have to make a detailed evaluation of this change in their drum writing circuits, however, where an increase in plate current into the writing heads may reduce pulse resolution. I have arranged to send some of the samples to Burroughs when they are made available.

5965 and Z2177

Serious heater-cathode leakage on the order of 0.5 ma or more has developed in 5965's and very early Z2177's in XD-2 at 7000 hours. This results, at best, in burning up the heater bus biasing resistors and, at worst, in noise problems in low-level circuits. Some similar troubles of lesser magnitude have developed in XD-1. Accepted practice is to bias the heaters negatively with respect to their cathodes when they cannot be tied together, which is the case throughout most of XD-1 and FSQ-7. IBM has some data to indicate that this may not be the better polarity arrangement; the Kingston Tube Group is following through on this problem.

The electrometer equipment has been rebuilt resulting in considerably less pickup; some debugging remains. Upon its successful completion an effort will be made to determine the feasibility of using measurements of the donor density to gauge the rate of deterioration of oxide cathodes in WWI.

COMMERCIAL TUBES (T. F. Clough)

Electron Optics

Lincoln Tube Process Specifications have been prepared for several electron-optics tube procedures and this work will be continued during the next period in order to minimize processing variations from tube to tube.

Arrangements were made with CBS-Hytron to heliarc weld the metal flange 2-piece bulbs which are used as envelopes for our electron-optics tubes. On 27 June I went to Newburypprt and had the first tube in this series heliarc-welded at the CBS-Hytron color tube laboratory.

DT-438

On 28 June, members of the IBM Tube Group and I visited Tung-Sol to review their progress on the DT-438 (improved 5998) development. They are still plagued with difficulties and have made no definite progress on the actual production of the tubes. They are, however,

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COMMERCIAL TUBES (continued)

exerting a real effort toward improving and controlling their processes. This effort, although overdue, is an encouraging and essential prelude to actual production. Tung-Sol has expended all of the funds which IBM has allotted to the development contract but has agreed to complete the program at their own expense.

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

Seven MIT 19-inch tubes have completed between 894 and 11,787 hours of life test while ten Charactrons have accumulated between 1417 and 5185 hours. Charactron #0259 was rejected from life test after 4925 hours for poor pulse beam current.

The one MIT 19-inch tube with a bariated-nickel cathode continues to operate satisfactorily. Transfer-characteristic curves taken after 870.8 hours of life show 330  $\mu$ a pulse zero-bias matrix current and 4150  $\mu$ a pulse zero-bias cathode current as compared to readings of 270 and 4500  $\mu$ a at 308 hours and 30 and 3100  $\mu$ a at 0 hours.

Twenty-seven cathode study tubes have completed between 55 and 9579 hours. The 25 tubes on the present program have accumulated up to 3735 hours. Since the last report three tubes have been rejected from life test. Tube #3033 was rejected for grid emission after 2364 hours while 3062 and 6052 were rejected for poor cathode uniformity after 2128 and 598.5 hours respectively.

Fifty-seven bariated-nickel cathode study tubes have operated up to 3735 hours. Twenty-three tubes will not produce 500  $\mu$ a d-c cathode current. The heater voltage on five of these tubes was raised from 6.3 to 8.3 volts for two days in an attempt at reactivation. None of the five tubes showed appreciable improvement.

Twelve triode and five diode bariated-nickel tubes have operated between 3931 and 5903 hours. No data has been taken since the last report.

Seventeen Typotrons have completed between 3832 and 10,445 hours. A report on life-test results will be issued after our new power supply system installation has been completed.

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SAGE DC AND CC SITES

(Group 66, B. E. Morriss)

PLANNING OF SITE ACTIVITY (K. E. McVicar)

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Utility System Checkout (A. J. Roberts)

Group 66 plans to install the utility system at Kingston in August. To become familiar with the operating procedures and facilities necessary for checkout of the utility system, Russ Shorey and Walt Thorpe are working in Phil Bagley's section of Group 67. Jim Croke and Paul Hicks, with the help of Paul Coakley, are making a flow diagram of the main utility control program.

DCA Checkout (A. J. Roberts)

A survey is being made of the procedures necessary for checkout of the DCA programs at the production sites. As an introduction to the problem flow diagrams have been made of two programs from the basic package and attempt is being made to produce diagrams which will indicate the flow of information through a series of programs. Plans are being made for an indoctrination and training program for the new RAND personnel.

PRODUCTION COORDINATION (A. H. Ayer)

McGuire Testing Study (P. J. Gray)

A second draft of the report by the committee studying the additional testing required at McGuire is being completed. The report will be reviewed with WE management in New York on Monday, 2 July 1956. In addition to describing the tests required in the first module, consideration has been given to the schedule, manpower requirements, and computer time allocations. There does not appear to be a severe shortage of computer time except for some peak demand periods.

Operational Supplies (P. J. Gray)

In the letter received from the Project Office this week, we discovered that the task of determining requirements for various types of operational supplies has officially been given to WE. Our many months of effort in the attempt to have the responsibility for this item decided have finally born fruit.

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PROGRAM PRODUCTION

(Group 67, J. A. Arnow)

PROGRAM ASSEMBLY (A. R. Shoolman)

The tasks of this section will be assumed by other sections in the Group, probably by the end of the next biweekly period. The Table Design and Documentation subsection will become a part of the Documentation section; the Special Programs subsection will become part of the Utility section; and the Adaptation subsection will become part of the Operational Programs section.

Table Design and Documentation (L. B. Collins)

The Table Handbook has been published and will be reissued periodically; one revision in future issues will be a correlation of "program isolable" tables with the associated program.

A complete description of peripheral tables is now in preparation.

Sequence Control - Program-Unit and Transfer sequence parameters are available as octal card decks for basic package operation. The Disassemble Sequence Parameters program (J. H. Stone) has been completed and may be used to translate sequence parameter tables into an item-by-item listing.

Environment Control - The ComPool has reached mod 09 with 894 items, 170 tables, and 80 program tags (including special entrances to the sequence control program and entrances to operations performed by sequence control) (operate DD, AD, etc.).

The ComPool is published weekly or as often as a new mod goes on tape and is available as a Design Note in Coding Specifications Section DCA 2.0.

Cost Accounting - An M-note will be issued summarizing a study made of in-out times for various combinations of:

- 1) Program sequence and allocation
- 2) System capacity
- 3) Core storage capacity.

Adaptation (J. J. Carson)

Basic Package - Dittos of all basic-package adaptation design notes have been approved and these notes should be distributed in the near future. Modifications continue to be made

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PROGRAM ASSEMBLY (continued)

to the ESS adaptation decks for the basic package as well as to the design notes. These modifications are the result of initial errors, changes in program requirements, the availability of external data which was not provided initially, and modified operational requirements. It is expected that continued updating of this nature will be required for the adaptation techniques and values of all programs. All changes and decisions which affect adaptability should be brought to the attention of this subsection.

This subsection should also be contacted before programs are recompiled with adaptation decks to insure that the latest mods are available. The status of the adaptation decks will be documented and distributed periodically.

Surveillance Package - Adaptation design notes have been written for all the programs of the surveillance package and have been forwarded to documentation for processing. However, the required values for adaptation of these programs to ESS are not yet available.

Raid Forming Package - Parameters of the raid forming package will not be defined until the programming task advances further and adaptation will be delayed until then.

Manual Input Package - Adaptation design notes for the manual input package have been sent to documentation. No parameters are required for CCP.

Program sheets have been completed for the ESS adaptation of the programs for card input - miscellaneous and switch interpretation-miscellaneous.

Digital Display Package - Design Notes for adaptation of track (DTK), alarm (DAA), and summary digital display programs (DSO) are being written. No adaptation parameters are required for digital display slot allocation (DDS).

It is expected that parameters for geography (DCO), control and warning light (DCW), and miscellaneous digital display programs (DMD) will be defined during the next biweekly period. Adaptation design notes and decks for this package will not be available for another two weeks.

Height Package - Adaptation for all programs of the height package are being written. All adaptation parameters have been defined and the design notes will be sent to documentation next week.

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PROGRAM ASSEMBLY (continued)

Identification Package - Parameters for all programs of this package are being defined. Though several programs were originally thought to contain no adaptation parameters, it has since been found necessary to adapt them.

Translation Program - The u,v translation sub-routine has been compiled and will be checked out during the next biweekly period.

Stereographic Charts - Stereographic charts are being prepared for each LRI site in ESS. These charts show the coverage pattern of the LRI radar, the intersecting coverage of all other heavy radars, the position of the GFI's, and the subsector boundaries. The charts will have u,v scales indicated and will be used for planning tests to be made in conjunction with the track data simulation (TDS) program.

The chart for South Truro has been sent to drafting.

All adaptation parameters which are functions of location will be referenced to and computed in the stereographic plane which is tangent to the earth at the subsector's center.

Index - The index for section 3.0 of the CS File has been completed and will appear in the next DCA outline. Provision is made for two adaptation design notes for each program, one of which specifies the adaptation method and the other contains the values for adapting the program to ESS.

Personnel - John Ornkovich of RAND has been temporarily assigned to this subsection until he enters programming school. He is working on computation and conversion methods.

Special Programs (H. Rundquist)

A memorandum, 6M-4379, describing features of the track (radar) data simulation program is available. A similar memorandum describing the keyboard input simulation program will be issued shortly. The Null Simulation Tape is available for use. It is described in Assembly Test Bulletin No. 1. The Table Simulation program, ATS, which reads and converts communication tags to the proper table values and stores them in the proper drum locations has been checked out and may be used. Parameter checkout of track (radar) data simulation and keyboard input simulation programs is almost completed. The fixed geography situation display program and assemble sequence parameters programs are coded.

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ASSEMBLY TEST PLANNING (H. J. Kirshner)

A system transfer function for the radar input operational area which will serve as a bridge between the Operational Specifications and the Coding Specifications is being prepared and will define the functioning of the DCA subprograms in a particular area (e.g. radar inputs). The system transfer function will eventually be the documents against which the Master Program is assembly-tested.

General specifications for radar input assembly testing are currently being prepared and will serve as the basis for initial testing in the radar input area.

A review of program timing with respect to tracking is being made in order to insure that consistent time corrections are being made in all programs involved in the tracking process.

DOCUMENTATION SECTION (H. K. Rising)

All the revised console equipment and label layout memos for XD-1 and AN/FSQ-7 have been completed and issued bringing the equipment and labels into agreement with the final operational specifications. Any changes to labels and equipment will henceforth be coordinated individually with the DCO and the Group 67 programming sections.

The measurement of differences between initial program specifications and the latest operational specifications will be completed during the next biweekly period. As final versions of the operational specifications are issued, deviations of the initial program from them will be documented as ESS supplements.

CENTRAL PROGRAMS (D. L. Bailey)

Program Operation (A. R. Marshall)

Assembly test #1 was run on Friday, June 29th. This test is made to prove that the sequence of operations in the computer agrees with the sequence documented in the coding specifications file. Several hurdles were encountered in running this test, but they have been overcome and a second run set up.

Concurrently AT #2 is being designed to prove that the timing of the operations in the computer agree with the timing documented in the coding specifications file. This test will be run on July 4th, if AT #1 has been completed by that date.

Output Instrumentation (M. D. Field)

The initial output instrumentation system will be able to record up to 300 blocks of data. One block of which can be located in either



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CENTRAL PROGRAMS (continued)

core storage or any drum field. Each block is recorded at a fixed period, either every subframe or every frame, after the completion of a specified program unit in the DCA system. The additional feature of recording up to eight single registers, located in core storage or drums, after every program unit is also provided.

The system is divided into three parts: A prelude, an active program, and a processing program. The prelude operates in nonreal time before starting a DCA system test. It processes cards, each of which contain the location and frequency of recording of a block of data, and stores the information in the machine. The active program operates in real time after every program unit and records the prescribed data blocks on magnetic tape. The processing program, operating in nonreal time after completion of a test, prints out each tape record as octal numbers with sufficient identification to uniquely define the record.

The three programs have been designed and the coding of the prelude and active program and 80 per cent completed. Within the next biweekly period, all the coding should be completed and checkout will begin. A manual describing the method of using the recording system will be prepared.

UTILITY AND CHECKOUT (P. R. Vance)

Utility (P. R. Bagley)

Newly discovered errors in the checker and compiler have required a large amount of debugging effort this biweekly period. The recompiling feature of the compiler is at last in service with, hopefully, only a few obscure errors remaining to be discovered. The delayed output feature of the Checker is ready, but is awaiting a thorough checkout of the auxiliary data processing equipment. The read-in program has a new modification which will log identification cards punched in Hollerith code.

Test decks and documentation for the Utility System are estimated at two-thirds complete and a memorandum describing and scheduling the changes approved for the Utility System is in preparation.

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ADMINISTRATION AND SERVICES

(Group 60, J. C. Proctor)

PERSONNEL

Staff

New

Emy P. Brooks, assigned to Group 64, received her A.B. in Mathematics from Radcliffe College.

Harry Goodman, assigned to Group 61, received his B.S. in Radio Engineering from Indiana Technical College. He was formerly employed by the U.S. Naval Air Development Center in Johnsville, Pennsylvania.

Socrates Litsios, assigned to Group 61, received his B.S. in Electrical Engineering from The Cooper Union.

Jan A. Malouin, assigned to Group 62, received his B.S. in Electrical Engineering from University of New Hampshire.

Gerald P. Weiss, assigned to Group 63, received his B.S. in Physics from Northeastern University and his A.M. in Physics from Harvard University. He was formerly a research assistant at Harvard University.

Aaron Wold, assigned to Group 63, received his B.S., M.S., and Ph.D. from Brooklyn Polytechnic Institute. He was formerly employed as an Assistant Professor at Hofstra College in Hempstead, New York.

Nonstaff (W. A. Kates)

New

Frank Palumbo	Technician	Group 60
Edward Boucher	Office	Group 67
Paul Sonier	Student	Group 60

Terminations

John Ackley	Technician	Group 63
Nancy Shaw	Office	Group 64
Elizabeth McCluskey	Office	Group 65
Wilbur Francis	Office	Group 67

GENERAL ENGINEERING (A. R. Smith)

Fire Annunciator

The breadboard model has been completed and tested under environmental

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GENERAL ENGINEERING (continued)

conditions. As was its original intent, the model will now serve as a determinant for the ultimate design of the panel.

Vacuum Deposition - Magnetic Materials Section

The basic structure has been completed and installed and the equipment in its present stage is capable of deposition; however, operation has been deferred until the micro-manipulator has been completed - sometime during the next period.

Coil Winder

A new concept of coil winding is being attempted through the development of a breadboard model for the Power Section. The winder will involve two phases: the first phase will be the fabrication of a simple mechanism for winding coils of wire on a sectional shuttle which can be later disassembled, leaving a coil form linked through a toroid core. The second phase will be the transfer of the winding from its initial stage directly into a toroid form in contact with the core. The immediate problems involved are cores ranging from 1 1/2" to 6" I.D., core heights from 1" to 3" and the handling of wire sizes from 16 to 30 gauge.

TX-O - Photocell Tape Reader

Based on recent discussion, the unit has been completely redesigned and the new model is currently in the fabrication stage. The latest version provides three planes of motion for the total assembly or cluster of photocells, plus the added feature of rotation motion for each individual cell. To make this new model practical, the bank of photocells will be prealigned in a fixture and later placed in the final equipment as a unit and thereafter will be readily replaceable in minutes with an interchangeable aligned unit in the event of any singular cell failure.

Sound Conditioning - A-058

Specifications as to the type of materials and methods of installing sound absorption materials have been finalized for this area and are ready for release. The specifications have been prepared in such a manner as to allow either Division 1 or outside-vendor participation.

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Requests for Classified Documents from Outside Contractors

Contrary to the item published in the BIWEEKLY of 1 June, centralized control of classified documents required by Division 6 personnel from concerns outside of the present Lincoln complex will be maintained by Group 3 Publications to whom all such requests should be made.

Documents to IBM

All documents to IBM (formerly addressed to Mr. D. B. Thompon) should now be addressed to:

Mr. M. A. Taylor  
Technical Publications Group  
Military Products Division  
Dept. 573, Bldg. 922  
105 Duchess Turnpike  
Poughkeepsie, New York

SAGE Master Floor Plans

The following reproducible drawings have been received from Western Electric, prints of which can be obtained from the Division 6 Print Room:

<u>Dwg. No.</u>	<u>Latest Issue</u>	<u>Class</u>	<u>Title</u>	<u>Replaces MIT Drawing</u>
T-3G35-04-G	2	C	4th Floor-Operations	D-75024
T-3G35-034-G	2	U	Plot Plans & Elevations Liaison Area	D-75025
T-3G35-03-G	2	U	3rd Floor Operations	D-75023
T-3G35-02-G	2	U	2nd Floor Operations	D-75022
T-3G35-01B-G	1	U	1st Floor - Power	
T-3G35-01A-G	2	U	1st Floor - Operations	D-75021

The "Change Description" sheet attached to each drawing is an amplification of the change column notes shown at the extreme right of the drawing itself. This sheet will accompany each reissued drawing.

Superseded issues of classified master floor plan drawings will be returned to Division 6 Print Room for destruction in accordance with established security regulations.

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(M. M. Ferguson)

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NO. GM-	AUTHOR	TITLE	CLS.
ADMINISTRATION & SERVICES (Group 60)			
4357	- - - - -	Lincoln Lab. Personnel List 1 June 1956	U
4370	Div. 6 Staff	Biweekly Report for Period End- ing 15 June 1956	C
SAGE SYSTEM TEST & PLANNING (Group 61)			
3739-2	J. J. Cahill, Jr.	Operational Specification for Antiaircraft Direction in the Sage System	C
4077 C#2	W. S. Attridge	Math. Specs. for Training and Battle Simulation in the Sage System	C
4237 S#1	W. Lone	Digital Display Slot Assignment for AN/FSQ-8	C
FSQ-7 PROTOTYPE DESIGN & INSTALLATION (Group 62)			
4019 S#1	J. D. Crane	Sup. to Results of the System Test Performed on the AN/FSQ-7 (XD-1) During October 1955	U
4080-2	W. J. Canty	Test Pattern Generator for AN/FST-2	U
4369	J. Giordano	Minutes of the IBM-DCO Concurrence Meeting No. 66 Held at Lincoln Laboratory 14 June 1956	U
4375	L. B. Sanford L. L. Sutro	Viewing of Film Exposed in XD-1, AN/FSQ-7 and AN/FSQ-8 Cameras	U
ESS TEST PLANNING - WWI & MTC OPERATION (Group 64)			
5339	H. F. Mercer	ESS-PCC Status Report For Week Ending 22 June 1956	U



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PRODUCTION COORDINATION OFFICE (Group 66)			
3884-1 S#5	E. L. Smiley	Master Reference List AN/FSQ-7 Specifications	U
4371	R. P. Mayer	Epscom Biweekly Report for 15 June 1956	C
4372	S. L. Thompson	Maintenance and Trouble - Shooting Standby Equipment in Sage	U
4377	P. J. Gray	Sage System Meeting, 18 June 1956	U
4378	P. J. Gray	Sage System Meeting, 25 June 1956	U
COMPUTER PROGRAM PRODUCTION (Group 67)			
3636-2	A. Rupp	AN/FSQ-7 Console Equipment and Label Layouts Part I Rooms T, I, M, R, and Computer	C
4082-5	D. L. Bailey	Initial Program Specification (IPS) List	U
4294-1	A. Rupp	Console Keyboard - Keyboard Input Matrix Relationship for XD-1	C
4118-1	T. A. Puorro	Latest Drum Bit Layouts for the Input Drums on XD-1 and FSQ-7	U
4358	P. R. Bagley	Utility Control Console Switch Assignments	U
4376	P. R. Bagley	Pseudo Control Cards for the Utility System	U
IBM DOCUMENTS ISSUED			
1009	F. Stern-Montagny	KMPD Engineering Report: AN/FSQ-7 (XD-1) Crosstell Input Element Special Circuits	U
1008	E. G. Bauer	KMPD Eng. Report: Project High Semi-Monthly Report #78	C
1010	R. E. Begley	KMPD Engineering Report: Theory of Operation of the A-C Conversion Element	U
1011	- - - - -	KMPD Library Report: Central Reference Room Bulletin #117	U

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1012	J. D. Iannotti	KMPD Eng. Report: Magnetic Deflection Compensation Alignment Procedure for Situation Display Consoles of XD-1	U
1013	D. J. Skelly R. J. Brennan	KMPD Engineering Report: Phase VI DC-1 Installation Test Procedures IM-219	U
LL-DR DOCUMENTS ISSUED			
DR-673 (IM-99)	- - - -	Employment of BOMARC (IM-99) in Sage Era	S
DR-674 (P-299)	R. C. Eisele	Concurrence on P-299: "Proposal to Unlock Tape Drive Select Switches on XD-1"	U
DR-675 (P-233-1)	R. C. Eisele	Concurrence on P-233-1: "Change in Document F-233, LRI Monitor Consoles for XD-1"	U
DR-676 (P-199-2)	R. C. Eisele	Concurrence on P-199-2: "Change in Document P-199-1, Crosstell Parity Disable for XD-1 and XD-2"	U
DR-677 (P-216-2)	R. C. Eisele	Concurrence on P-216-2: Supplement to Input and Output Converters for XD-1, P-216-1	U
DR-678	J. J. J. Kernahan	BTL Specs. Case 27443 Gap-Filler Subsystem Test Specifications	C
DR-679 (D-60-1)	W. R. Peavy . .	Change to Input Channel Switching Specifications for AN/FSQ-7 D-60-1	U

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1013	D. J. Skelly R. J. Brennan	KMPD Engineering Report: Phase VI DC-1 Installation Test Procedures IM-219	U
LL-DR DOCUMENTS ISSUED			
DR-673 (IM-99)	- - - -	Employment of BOMARC (IM-99) in Sage Era	S
DR-674 (P-299)	R. C. Eisele	Concurrence on P-299: "Proposal to Unlock Tape Drive Select Switches on XD-1"	U
DR-675 (P-233-1)	R. C. Eisele	Concurrence on P-233-1: "Change in Document F-233, LRI Monitor Consoles for XD-1"	U
DR-676 (P-199-2)	R. C. Eisele	Concurrence on P-199-2: "Change in Document P-199-1, Crosstell Parity Disable for XD-1 and XD-2"	U
DR-677 (P-216-2)	R. C. Eisele	Concurrence on P-216-2: Supplement to Input and Output Converters for XD-1, P-216-1	U
DR-678	J. J. J. Kernahan	BTL Specs. Case 27443 Gap-Filler Subsystem Test Specifications	C
DR-679 (D-60-1)	W. R. Peavy . .	Change to Input Channel Switching Specifications for AN/FSQ-7 D-60-1	U