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Memorandum M-2505

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Page 1 of 5
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Division 6 - Lincoln Laboratory
Massachusetts Institute of Technology
Cambridge 39, Massachusetts

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By: R.R. Everett
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SUBJECT: SUMMARY OF MIT-IBM COLLABORATION ON DESIGN OF AN/FSQ-7
COMBAT INFORMATION CENTRAL -- October 1 thru October 31, 1953

To: J. W. Forrester, R. R. Everett, J. C. Proctor, C. R. Wieser,
N. H. Taylor, D. R. Brown, S. H. Dodd, P. Youtz

From: A. P. Kromer

Date: October 9, 1953

Abstract: Engineering work on AN/FSQ-7 equipment has included release of the pluggable unit design and concentrated activity in mechanical design, basic circuits, drum system design, the display system, and reduction of system tube count. The IBM Vestal Laboratory is handling engineering design and work on the display console. A choice between the Charactron tube or the IBM character generator is imminent. Additional building space for the AN/FSQ-7 (XD-1) installation at Lexington has been requested from the Air Force.

Engineering Visits

IBM people working on the project spent approximately 63 mandays at Cambridge, while MIT people spent a total of approximately 99 mandays at IBM, High Street. Ken Clsen has been assigned as systems engineer resident at IBM Project High.

Exchange of Publications

During this period we forwarded to IBM 44 M-Notes, 4 E-Notes, 1 R-Report, and miscellaneous drawings and standards sheets.

We have received from IBM 2 IM-Notes, 11 H-Notes, 5 CRR Bulletins, 2 Biweekly Reports, 8 Trip Reports, 19 Component Test Reports and the Minutes of Project Grind Meeting held 10-6-53.

General Comments

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MIT reports M-2456 and M-2478 have been issued during the month covering highlights of the progress regarding design work for the equipment.

A joint conference took place about the middle of the month to review the plans and status of mechanical design work for the plug-in unit.

~~CONFIDENTIAL~~

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Memorandum M-2505

Page 2 of 5

General Comments (Continued)

The design and model submitted by IBM at that time were generally regarded to be satisfactory. It met all foreseeable requirements regarding air circulation necessary for adequate equipment cooling, rigidity, mounting facilities for etched wire cards, accommodation of all contemplated sizes of vacuum tubes, etc. This design has been released by IBM for the construction of the initial quantity of plug-in units. The basic frame which will hold the tube sockets, the etched circuit cards and the connector plug will be of cold rolled steel with cadmium plating. The top plate and handle will be constructed either from stainless steel or mild steel with a satin chrome plate. A plan to have rack module units constructed from square steel tubing was continued, since IBM felt that modification in this plan would adversely affect the strength of the equipment.

Continued refinement of basic circuits has been carried on by both engineering groups. In the interest of reducing the number of vacuum tubes wherever possible, development of a high powered cathode-follower circuit using the 5998 tube and a medium power cathode-follower circuit using the 7AK7 tube has been started. Studies regarding application of these circuits to the computer indicates a sizable tube reduction may result from their use.

Participation of MIT in the preparation of standards sheets and purchase specifications for electronic parts has been curtailed as of the end of the month, since Project High has now set up a group to continue this activity. The Project High group will collaborate with the MIT personnel and with the electrical laboratory at IBM Plant 2 regarding this general field of work.

Considerable effort has been devoted to logic and circuits for the magnetic drums. A sample drum was received at MIT during the month. Proper circuits will be built, and this drum will be made a part of the MTC computer. The work of coupling the drum into a computer will be carried on jointly by both engineering groups to gain experience. After the drum has been tied in to MTC, it will be used to study the contemplated drum-display plan for the FSQ-7.

Since the drum system comprises a very large percentage of the vacuum tubes in the complete system, thorough study has been undertaken to determine whether there are any means of reducing the number of tubes, either by time sharing of electronic read, write and other circuits through switching means, or through the use of a larger physical drum having more storage area. Switching of circuits both magnetically and with crystal diodes is being studied.

The types of controls, number of flip-flop indicating lights, etc. to be included in the maintenance console was reviewed jointly, and further decisions regarding this were reached so that design work may proceed.

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SECURITY INFORMATION

~~CONFIDENTIAL~~

Memorandum M-2505

Page 3 of 5

General Comments (Continued)

Purchasing negotiations for certain of the major items of equipment for the two prototype systems were undertaken by IBM during this period. Units such as motor-generator sets, the associated starter and switch gear, D-C power supplies, amplidyne units, etc., are included in this category.

The IBM engineering group at Vestal Laboratory, Endicott, New York, have been brought into the project, and will do the engineering and design work for the display console. Joint conference with this group resulted in a decision to have IBM start immediately to build a mock-up of the console. This will be brought to MIT to be analyzed by those working with the Cape Cod System--operators, engineers and psychologists--in order to include all possible features which facilitate proper operation. It has been decided to have the high voltage power supply in each display console. Low voltage power will be distributed from a central D-C supply. In order to have the display operate rapidly enough, it may be necessary to use 6161 type tubes in place of 4X150 type tubes. This matter is currently under investigation.

Charactron tubes were received from Convair, and suitable circuits built to enable one of these tubes to be tied in with the MTC computer and used to demonstrate the use of the tube for track display purposes. This demonstration indicated that while the quality of the characters is very good, some engineering problems remain regarding intensification and registration. Early in November there will be a demonstration of the electronic character generating scheme which has been under development at IBM. This scheme uses magnetic core matrix for character formation. Following this demonstration, the two methods will be compared and a decision reached regarding which is to be selected for use in the FSQ-7 system.

Due to the pressure of other work in connection with display, time was not available this past month for study of digital versus analog methods of achieving expanded displays. It is expected that this will receive attention during the coming month.

A conference discussion (Project Grind #9) covering plans for the radar data input equipment and for cross-telling of track information was held. The details of this are covered by the IBM memo entitled, "Minutes of Project Grind Meeting No. 9, October 6, 1953," by D. C. Ross.

Design work has progressed sufficiently far in connection with memory to allow IBM to order materials and build a final breadboard version of the memory bank as it is planned for XD-1. This unit will be used to study the performance and characteristics of the various circuits, to develop a method of cooling the memory, and for other similar engineering purposes.

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SECURITY INFORMATION

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Memorandum M-2505

Page 4 of 5

General Comments (Continued)

The overall study regarding possible reduction in the number of vacuum tubes reveals that if two memory core arrays are housed in a single frame, other electronics associated with them may be shared so as to permit a reduction of between three and four hundred tubes in the memory section of the computer. Decision to follow this plan, as compared with having two completely independent memory banks, has not yet been reached.

Delivery of cores for the FSQ-7 (XD-1) and prototype memory has been started by General Ceramics against the order issued by IBM. It was agreed that MIT and IBM would share the core testing load for an initial period until IBM had sufficient facilities to handle the entire program.

The group studying the problem of data output have completed a preliminary study which allocates 4000 registers (i.e. two drum fields) for data to go out to all types of weapons under command of the system. This proposal also shows the amount and kind of data which will make up each message to the various weapons. This information is being prepared into a final proposal which will be available early during November.

A model SDV receiver-demodulator has been turned over to IBM Project High by Group 24 of Lincoln for use by IBM in connection with their work on inputs, video mapping and associated activity.

Studies regarding the installation of FSQ-7 (XD-1) into Lincoln Laboratory at Lexington, Massachusetts led to the conclusion that it would be necessary to erect additional building space at Lexington for use as an operations center if the XD-1 system was to approximate a full-scale system as described in report L-113. This new building would house all display and operations functions, as well as input and video mapping associated with radar data. The basement of Building A will be used to house the central computer, the drum systems, power equipment, output data transmission equipment, etc. Authorization to proceed with this has been requested from the Air Force by Lincoln, but no decision has been reached as of the end of the period.

Further consideration indicates that the operating conditions required for FSQ-7 and the large amount of capacity needed for this system made it appear doubtful that the central chilled water system in the Lexington Power House will be suitable. Thus it has been decided to include as part of XD-1 the necessary chilled water equipment to handle this system independent of the central supply at the Lincoln Power House.

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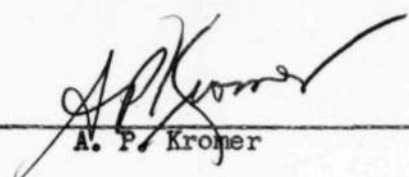
Memorandum M-2505

Page 5 of 5


General Comments (Continued)

The number of IBM staff personnel working on the project as of the end of October is 179. Total Project High personnel is about 300 people. It is expected that the organization will remain approximately at this level for the remainder of the project.

Signed: _____


A. P. Kroger

Approved: _____


N. H. Taylor

APK/mmt

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