Digital Computer Laboratory
Massachusetts Institute of Technology
Cambridge, Massachusetts

6-30-53

SUBJECT: PROJECT GRIND MEETING, JUNE 30, 1953 (Fourth Day)

To: AN/FSQ-7 Planning Group

From: A. P. Kromer, R. P. Mayer

Date: July 6, 1953

Abstract: The output display system and the manual input buffer drum were discussed at this meeting. A display rate of once every 2 seconds was tentatively accepted. There will be 16 words per track,** allowing for a display of history on all tracks. It was stated that the system must operate with a minimum of degradation when only one center is functioning.

Members Present:

| MIT | IBM |
|---|---|
| R.R. Everett | M.M. Astrahan |
| D.R. Israel | * J.M. Coombs |
| J.F. Jacobs | R.P. Crago |
| R.P. Mayer | * D.J. Crawford |
| K.H. Olsen | N.P. Edwards |
| E.S. Rich | P.W. Rocco |
| N.H. Taylor | H.D. Ross |
| R. vonBuelow | W.H. Thomas |
| | * W.E. Triest |
| | * G.E. Whitney |

The reader is reminded that the object of the minutes of the Project Grind meetings is to put on record some of the decisions made and some of the reasons for these decisions. Any problems will be brought into the open so that decisions can be made as soon as possible. If there are any errors or ommissions in the minutes, they should be called to the attention of A.P. Kromer or R.P. Mayer.

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* Part time

** On the track display drum

I. Display System

It was decided that 16 words per track should be used in order to provide 18 points of history for hostiles and at least some history points for all other tracks. It has not been decided whether 18 points of history is enough for hostile tracks. A very few people will want a broad, sweeping picture of the attack and for such special purposes the history can be kept up to date by crayon marks on a scope face or by an automatic plotting board. If 18 points of dynamic history are not sufficient for all other purposes, extra fields could be added to the drum system. It may be desirable to allow each console to specify the number of scans worth of history to display. If vectors and points are desired for some history tracks, the display could be made more coarse, or extra drum fields could be added.

Seven fields will be required, allowing space for 896 tracks at 16 words per track. In order to display all the data without any waste of time, and without using too much buffer equipment, the data should probably be interleaved in a special way on the drum. Rocco and vonBuelow will prepare a block diagram of such a system and will make a study of interleaving to be used. This interleaving should provide data at the proper time necessary for use by the deflection system, and must work with the crosstelling system. It was decided that provisions should be made for changing interleaving and for changing the function of the words and digits so that the drum system can be changed to match any improvements in the deflection system.

The proposed deflection system uses an electromagnetic deflection system for positioning the beam for the spot. Vectors and characters are then superimposed on this position by a small-angle electrostatic deflection system.

It is estimated that it will take two seconds to display all tracks, flight plans, history points, uncorrelated data, and geography (assuming 50μsec per point, 25 μsec per vector, and 100μsec per character). This does not include "DID" (see Project Grind, Fifth Day). This figure of 2 seconds will be assumed in the rest of the discussion since there seems to be little advantage in displaying different categories at different rates. Thomas and Clark will prepare a program for MTC and WWI. This program will be for the purpose of studying phosphors, filters, psychological aspects of display rates, etc. Psychologists* will cooperate in this study. (The display test program must provide data randomly distributed over the scope face and over the various time intervals). The study will also include methods of operating light guns without presenting a flash** to humans. One suggestion is for the operator to wear filter glasses. Another is to use a phosphor without a flash and make the light gun differentiate the light output. Part of the problem here involves the ambient light and the proper timing of the light gun signal (so the light gun can be timed to see only the position points). Ed Rich will train an IBM man concerning light guns.

* from Division III

** i.e., So the people will not see flashes on the display scope even though the light gun must see flashes on it.

MIT is investigating the problem of deflection-expansion and off-centering and the problem of deflection distribution. Characters should not be expanded. The question was asked whether we should have a complete stand-by deflection system.

Vectors could be generated by running a sweep signal through binary-analogue decoders. A character generator is explained in IM-30 (page 62) and it must provide for 32 characters in the track display system.

The display selection scheme is outlined in Memorandum M-2262. It was decided that 2 display assignment words (DAW) should be sufficient. Some consoles will have 2 display assignment digits and some will have none.

In addition to the DAW's there will be a category selector switch controlled by at least 5 bits of one of the words on the drum. Provisions will be made at each console for selecting several of these categories at once as desired (increasing the number of things displayed on the scope).

Intensification amplifiers for controlling the intensity of spots displayed will be built into each console as desired. It was decided that the number of amplifiers in a given console, and their selection logic, can be determined later when the consoles are set up. (3 amplifiers might be used in some consoles: for forced display, for background catagories, and for selection of special displays).

II. Manual Input Buffer Drum (MIB)

The manual input buffer drum will use the drum demand system which was discussed in Project Grind on the first day. Inputs to this drum will come from a card reader, manual insertion switches, and light guns. One or two time-shared registers (perhaps magnetic core) could be used for most of the light-gun inputs with some sort of interlock to prevent consoles from interferring with one another.

It was decided that an 026 card reader will be connected first. The 056 verifier will be connected afterward and will be used only if it proves desirable (the verifier checks only one step of the insertion process, while a computed display to the originator of the data would check many more steps).

Consoles will not have identical input keyboards for manual insertion of data and requests, but a dozen or so standard panels will be provided for assembly as required on a 12-position frame provided at each console. Each standard keyboard will contain 1 or 2 columns of pushbuttons, a label for the whole panel or for each pushbutton, and may or may not have an "insert" button at the bottom. The 12-position frame will also include a master "insert" button, a switch to allow the light gun to insert the keyboard (plus track number or x, y from the deflection system), and a row of buttons to select the type of function to be inserted from the keyboard. Some keyboards will supply 64 bits of data, and so 2-word messages will be used on the drum. The keyboard frame might be placed between the scope face and console table. The labels might be illuminated from the back.

The following comments were made the Fifth day and should be brought to the attention of the members who were present only on the Fourth day. The input switches, consoles, etc., must be designed to work even when either of the other centers is inoperative, and to work with a minimum of degradation when both of the other centers are inoperative. Each item of weather, flight plan, etc. will be sent to all centers directly and will not be crosstold. It might be standard operating procedure to do all the identifying at one center.

Signed A. P. Kromer

R. P. Mayer

APK/RPM:jrt