

W. J. Melikman

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Memorandum M-1120

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SUBJECT: BI-WEEKLY REPORT, PROJECT 6782, OCTOBER 27, 1969
To: J. W. Forrester

2. THE FIRE CONTROL PROBLEM

2.1 Data Smoothing and Target Position Prediction

(R. A. Nelson)

With the help of several assumptions and some changes in notation I was able to analyze the behavior of the Linear Rates section of Mk 47 and express a simple form of it in terms suitable for digital use. As an example, an instantaneous generated bearing would be compared with the measured bearing and a fraction (depending on the amount of smoothing desired) of the difference applied as a correction to the computed bearing rate. In this way deflection rates, range rates, and altitude rates are computed. In the analog case Q , which is the fraction of error fed back, determines the time constant of the system, while in the digital case, both Q and the cycle time enter.

Consideration will be given to the possibility of using Whirlwind to check some of our codes.

3. CODING

(J. M. Dodd)

Work is continuing on the programming of the Computer Mark 47 solution. Tentative equations describing the performance of the Linear Rates and Acceleration Smoothing sections have been written and are now being coded.

An angle-reduction subroutine has been written which receives angles between -2π and 2π and reduces them to equivalent angles between $-\pi$ and π . The subroutine is accomplished in 8 operations and requires the storage of 2 constants.

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4. DATA CONVERSION

(R. A. Nelson)

As a result of our discussion with Linvill, Katz is investigating typical radar and gun characteristics. Knowledge of these is necessary to decide to what extent pre-sampling smoothing is required for the input data and what kind of information must be furnished the guns.

(A. Katz)

During this period I continued my exploratory reading in the fields of fire control and servomechanisms. This included:

Theory of Fire Control System Design--G. F. Floyd (Bldg. 32 Thesis)

Measurement and Analysis of Noise in
a Fire Control System --R. H. Eisengrein (Bldg. 32
Thesis)

Filters and Servos with Pulsed Data --Rad. Lab. Vol. 25, Chapt. 5

Some thought was given to the possibility of utilizing the computer and terminal equipment as part of the gun-drive servo. One example of this would be to compute the error between the computed command and the corresponding actual gun quantity. Another would be for clamping the signal between discrete order pulses; this would be necessary unless the order repetition frequency were much higher than the natural resonant frequency of the gun drive. Both of these functions could be accomplished easily and accurately by digital means.

Consideration was also given to the possibility of deriving gun velocity and acceleration signals from the gun motion by digital and by analog means.

An extremely interesting conference was held with Prof. W. K. Linvill and R. A. Nelson. At this time we discussed many of the problems relating to noise and spurious signals, to the relative merits of analog and digital smoothing and to the response of a gun drive to discrete orders.

In the next period I shall investigate the dynamics of some typical 5"-38 gun drives to familiarize myself with the various performance criteria and with the characteristics of the components.

5. PUBLICATIONS ISSUED

M-1118 Quarterly Report, July to September 1950 (CONFIDENTIAL)

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