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Memorandum M-1148

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Electronic Computer Division
Servomechanisms Laboratory
Massachusetts Institute of Technology
Cambridge, Massachusetts

SUBJECT: BI-WEEKLY REPORT, Project 6782, January 15, 1951.

To: J. W. Forrester

1. GENERAL

(R. A. Nelson)

I have been spending some time going through 3 filing cabinets of reports pertaining to the work of Division 7 (fire control) of NDRC, collected by Prof. Hazen and recently inherited by us. So far, about 10% the material seems to be of possible interest to this project or the Laboratory in general. The unwanted reports will be sent to CADO at Wright Field.

Time will also have to be given shortly to the preparation of our second quarterly report, that covering the period ending 31 December, 1950.

2. THE FIRE CONTROL PROBLEM

2.1 Data Smoothing and Target Position Prediction

(R. A. Nelson)

Having read what the Mk 65 report has on helical prediction, I have been thinking of how to determine the necessary constants and accomplish the calculation. Because the axis of curvature of the flight does not generally pass through own ship, it seems at first that using polar coordinates is more complicated than using rectangular coordinates. The equations considered in the Mk 65 work allow for a helix oriented any way in space, descent along the helix being at a uniform rate; I have so far worked only with a vertically oriented helix. To specify this (i.e., allowing the helix axis to be offset from own ship in both x and y, and assuming descent to be at a uniform rate) 7 constants are necessary. These could be got by using 7 of the 9 equations resulting from 3 observations of the target's position, but this involves inverse trigonometric functions excessively. A somewhat simpler way, although still introducing an inverse tangent and requiring simultaneous knowledge of position, velocity, and acceleration, is to differentiate the equations and let t=0 at this instant for calculation.

2.1 Data Smoothing and Target Position Prediction (Continued)

Further consideration will be given to these specialized problems, to the effect of wind on the target's actual path, to the value (both computational and tactical)of permitting more general courses, and to the problem of switching to linear prediction under certain tactical conditions.

2.2 Ballistic Considerations

(A. Katz)

In the past three days since my vacation, I have continued with the solution of a least-square system of 12 normal equations in 12 unknowns by the method of Banachiewicz. At present I am forming the square-root of the matrix cracovian. After this has been completed, I shall find the reciprocal of this root and the weights by which the probable error is to be multiplied. The end result of this work will be the desired coefficients for the approximating polynomial representing the relation of superelevation to predicted range and predicted elevation.

3.0 CODING

(J. M. Dodd)

The first six days of the past bi-weekly period were taken as vacation. The past four days have been devoted to work on the final coding of Mk 47.