Air Traffic Control Project
Servomechanisms Laboratory
Massachusetts Institute of Technology
Cambridge, Massachusetts

SUBJECT: BI-WEEKLY REPORT, JANUARY 20, 1950

1.0 GENERAL

(W. G. Welchman)

Mr. Gabelman of Watson Laboratories was here on January 18. The present and future objectives of our work on air traffic control were reviewed, together with allied air problems of a military nature that seem to be suitable for computer application and therefore for possible future study by this project. As a result of this discussion, we were asked to begin to look into the problem of tracking while scanning. Mr. Gabelman was interested in the programming for airways control that David Israel has been starting recently and also in our work on various types of curved paths for use in the approach zone. He promised to send us details of a system of control by radial distance that has been proposed in connection with another Watson Laboratories contract. This system seems to be somewhat analogous to the idea of control by azimuth that we have been considering.

(P. Franklin)

Studied some simple types of approach curves, in particular eccentric circles, and the relative variations of azimuth and deviations in heading.

(C. R. Wieser)

Professor Seamans was visited concerning the control work on Project DIC 6645. They have specialized in development of gyroscopic instruments for aircraft control. It was agreed that gyro instruments solve only part of the air traffic problem since the gyro with a suitable reference can measure only the direction of the aircraft's velocity vector and not the magnitude of the vector. However, tight control of direction is important since errors caused by wind gusts or imperfect control manifest themselves first as changes in direction.

The azimuth controlled descent system is still being studied. Analysis is difficult because of the non-linear nature of the system.

1.0 GENERAL (continued)

(W. K. Linvill)

Due to pressure of academic duties, I have no significant report for this period.

(A. Orden)

An analysis was made of several aspects of angular progress control: (a) What feedback quantities are needed for stabilization of constant angular rate? (b) Given a stable system, how long does it take to correct an initial deviation? (c) Assuming speed change in the form of a constant deceleration for a period of 1 or 2 minutes, how well does the aircraft stay on schedule? The procedure used was to convert polar coordinate equations of motion to linear differential equations, under the assumption that deviations from the proper angular rate remain small. A memo presenting the results is being prepared.

(F. A. Foss)

The first draft of the memorandum on characteristics of the private line for air traffic control has been completed.

An interesting recommendation was noted in a RTCA report. It was suggested that the ultimate DME equipment perform the following private line functions, automatic relaying of R-θ position of aircraft to the ground upon request or automatically, establishing identity of aircraft, etc. The communication facilities for control purposes may not therefore be entirely separated from the radio navigational aids.

(D. H. Israel)

A number of calculations of the distances travelled by an aircraft in attempting to introduce various amounts of time delay by speed reduction were included in M-2031, entitled, "Introduction of Delays by Speed Control."

Some time was spent in the consideration of how to represent the action of the computer in solving a problem - as for example, some phase of air traffic control. Towards this end it has been felt that the usual flow diagrams are insufficient in that they do not indicate the various bits of data from the storage which are used in the accomplishment of each box.

1.0 GENERAL

(D. R. Israel) - continued

As an example of computer application a preliminary investigation has been made of the possible use of a high-speed digital computer such as WWI in the present airways traffic control. The results seem to indicate that except for certain emergency conditions the computer might perform a good deal of the routine labor -- calculations of times over fixes, checking for proper separation en route, filing of position reports, proposing new schedules, etc. -- which is now done by airways controllers. In performing the jobs of the airways control center it appears that computer speeds as high as WWI would not be necessary, although a storage capacity of at least 2000 16-digit registers is indicated. Because of the speeds of proposed machines, it also seems that with the use of a digital computer a substantial improvement and extension of the present-day airways control could be achieved.

The above investigations have proved to be so interesting that the use of a computer as an aid to present day traffic control will be the subject of a S.M. thesis. Work on this thesis and a seminar on various phases of air traffic control will begin within two weeks.