Air Traffic Control Project
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SUBJECT: BI-WEEKLY REPORT, JANUARY 6, 1950

1.0 GENERAL

(W. G. Welchman)

M-2029 contains a review of our reasons for studying the requirements of instrument flight. During the discussion of a preliminary draft of this note, C. R. Wieser and W. K. Linvill pointed out that we cannot hope to obtain sufficiently accurate control of a final approach turn by simply changing the settings of airborne guidance equipment when an aircraft is still some way from the final approach path. The possibility of using azimuth control for this purpose seemed to be worth investigating and E-2007, entitled, "Suggestions for Further Study of Azimuth Controlled Approach," was written with this in mind.

On January third, J. W. Forrester, C. R. Wieser and I visited Cornell Aeronautical Laboratory where there are two air traffic control projects sponsored by ANDB. The first, concerned with the air traffic control implications of aircraft evolution, is under the direction of Mr. R. Shatz, who hopes to be able to answer a good many of the questions raised in our note, E-2005, during the next 8 months. Perhaps our main impression from our talk with Mr. Shatz was that any system that we formulate must be capable of handling a high proportion of jet aircraft. The second project is concerned with airport time utilization equipment (ATUE) and is under the direction of K. D. Swartzel, although the actual work is supervised by Dr. Olshevsky. This project is primarily concerned with producing a means of regulating the flow of aircraft into an airport that can be brought into operation in the near future. Their proposals are bound to involve information processing that could be carried out by a high-speed digital computer. It seems probable however that we shall regard the ATUE function as only a part of a more comprehensive control program.

1.0 GENERAL (continued)

(C. R. Wieser)

A good deal of time in this period has been spent visiting Sperry and Cornell Aeronautical Laboratory. The former of these visits will be covered by a memo.

One interesting subject discussed at Sperry was auto-pilots. They have developed speed control as a feature of auto-pilots. While this is not quite the same as progress position control, it is closely approaching it. Our impression is that auto-pilot development is keeping pace with aircraft development, and that the newest developments in auto-pilots exploit the performance of the aircraft to the point where the aircraft itself is the limiting factor.

(W. K. Linvill)

Bob Wieser and I made a trip to Sperry. A memorandum describing our findings is being written. Effectively Sperry's equipment would allow an aircraft to be flown along a path drawn on a map in the plane. No provision is made so far for a time schedule on this path. They have under development means for short range navigation and airplane control. The proposed system requires that the path on the airborne map be generated or selected according to control instructions from a ground-based computer. No work has been done on the ground-based computer.

(A. Orden)

Calculations were made on three types of a/c path and progress guidance set up in simplified form: (1)Progress along a straight line, (2) Lateral deviations from a circle, (3) Angular progress. The first and second merely provide more detailed background for our current opinions, in particular, that speed stabilization systems for progress control may be of little value. The selection of feedback parameters to provide a stable system is more difficult for angular progress control than for the other two, and I am still working on setting up that system in satisfactory form.

1.0 GENERAL (continued)

(F. A. Foss)

A survey of the accuracy capabilities of existing telemetering techniques that might possibly be applied to the private line application has revealed some interesting facts. Radio telemetering systems in current usage have accuracies of the order of 0.5 to 3%. Consider such a system as a part of a servo loop being used for aircraft dynamic control. If the servo loop contains a digital computer on the ground, the azimuth information for example derived in the aircraft from an omni-range would have to be transmitted to the ground. An aircraft at an azimuth of 300° would have its position transmitted to the ground at best with an accuracy of $\pm 1.5^{\circ}$ to 9° (assuming zero error in the radio navigational aids). The position of adjacent aircraft would have the same azimuth uncertainty. If the aircraft were participating in an approach pattern using azimuth separation, provision would have to be made for greater that 3° to 18° separation of all aircraft to compensate for th transmission errors in the private line alone.

(D. R. Israel)

Work continued on the construction of a program and flow diagram for the sequencing and guidance of aircraft to the helix. The pre-scheduling section of the program has been coded and uses about 100 orders, with about 500 registers being used for storing aircraft data. A description of this program will be issued shortly.

Illustrative programs and flow diagrams are now being considered for systems similar to the present airways en-route control. A first attempt was a program in which all aircraft were scheduled only when flight clearance was applied for. More complex systems are also being investigated, in which information from fixed or published schedules is used.