#8 M-934

FORM R-15 -1 (10-48)

MEMORANDUM

TO: L. E. Root

~~SECRET~~

DATE: 11, 15 May 194[illegible]

M-934

FROM: A. C. Reed

SUBJECT: MIT Visit

[redacted]

COPIES TO: L. A. Young, J. E. Lipp, J.D. Williams, E. E. Collbohm, L. W. Paxson

~~For RAND Use Only~~

MIT was a gold mine of information on the Air Tracking problem. Their work for the linear cases is so complete for longitudinal mode, there is probably little we could contribute basically. Not much has been done for the non-linear cases but what little there is shows little difference from the linear. Supersonics introduces a non-linearity that may not be so easy. The general equations including cross-coupling have been set up by Seamans in simplified form, but he can't solve them yet even with the super-duper analogue computer the Meteor Project has (the equations are non-linear and non-homogeneous). The big problem at present is the lateral mode with coupling and the non-linear extension of the longitudinal mode.

Draper has confined his work to the disturbed sight system. By that method he says calibration is eliminated. It also saves complication and weight per Draper. Draper, of course, is convinced that the "disturbed sight" system is the best. He says that all the basic principles are in a series of NavOrd publications: NavOrd Report 3-47, Vol. I, Vol. II (4 parts), Vol. III (2 parts), and Vol. IV.

They have all been published except two. They will be finished by June. We should request the set. The cognizant office is REAC, BuOrd, Navy. The system worked out is called the "GUNAR" system for AA control. It has automatic radar tracking with the computer in the tracking loop (so-called disturbed sight).

The second year Navy and Air Force graduate students are getting out a "Blue Book" on Draper's course on tracking systems. Much of the data has not been published.

Draper has AF contract for long range navigation systems: 1. FERE, for B-29 stellar navigation with sun tracker and earth's magnetic field as a reference. 2. SPIRE (SPace, Inertia Reference, referred to the Earth). This is simply an inertia device for measuring accelerations and a computer for integrating acceleration and velocity. For this he has developed a gyro that will hold to $1/10^{0}$ for 10 hours ($1/10^{0}$ of earth's rotation). He believes he can get it to $1/100^{0}$. This system is going to take several years to develop, but he (Draper) thinks he will know within 1 year whether it is feasible.

The S-9 fire control system for tail turret is basically an A-1 sight with automatic radar tracking and a flexible turret. It is in mockup and the early stages of testing are under way. Dr. Gordon Brown has this project in Instrumentation Lab. of Aero. Dept. (Draper heads Inst. Lab.)

~~SECRET~~

The Meteor Project is headed by Dr. L.G. Schneider of the Physics Department, and its tracking control has been delegated to Dr. A.C. Hall of the Electrical Engineering Dept. He (Hall) got the job because he is an expert in dynamic analysis.

He has developed a philosophy for approaching complicated problems. First he defines the problem, then he selects the independent parameters; third, he classifies the parameters according to first, second, or higher order. Fourth, he analyses the problem using constants for all parameters except the first order. He then by variations checks the effects of the other parameters at or near the optimum solutions. If his third step was right, he now has his answer. If not, it shows up in the fifth step, a reclassification is required, and the fourth and fifth steps must be repeated. (This is ACR interpretation of his remarks not a quotation, but I believe the essence is there.) To me this is the most straight-forward philosophy I have yet heard on this subject.

A. C. Reed