Massachusetts Institute of Technology
Charles Stark Draper Laboratory
Cambridge, Massachusetts

MEMO:

TO: R. Larson
FROM: R. Covelli
DATE: July 6, 1970
SUBJECT: Errors in the Computation of FORVEL and LATVEL

Simulations at Grumman have indicated that there might be an error in the computation of the horizontal velocities displayed on the crosspointers during P66. The quantities in question, FORVEL and LATVEL, are computed once every 0.25 seconds in the R10 interrupt. Due to the high frequency of computation, the computations are made using single precision arithmetic in order to reduce the computer workload.

The velocity data is scaled in R10 so that the least significant bit has a value of approximately 0.6 feet per second. Since the inputs are truncated, the initial error may be this large. This error can propogate through the computation and may be as large as 3.6 feet per second in the output to the crosspointers.

An edit program was written to perform the same computations that R10 performs using the full precision of the 360. With the same inputs, the difference between the MAC edit and the AGC were as large as 3.4 feet per second. All of this error is due to the inaccuracies of the single precision computations.

The way to reduce this error is to use double precision arithmetic to compute FORVEL and LATVEL. This has the drawback of requiring more execution time and more fixed memory storage. Depending on the degree of improvement desired, a partial double precision calculation could be made, in which only key terms are handled in double precision. This might reduce the error to about 1.2 feet per second. For greater accuracy, full double precision would be needed.