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SUBJECT: Altitude Rate "GLITCH" of R10

The problem arises, as noted by various sources, when routine COPYCYC2 occurs during the 40 MS delay built into the R10 computations. (COPYCYC2 updates the permanent state vector from the one just navigated and computes, among other quantities, DALTRATE (The centrepital acceleration at the current altitude and inertial velocity)). COPYCYC2 occurring at this time results in inconsistency among the numbers used in the altitude rate computation, which immediately follows the 40 ms delay.

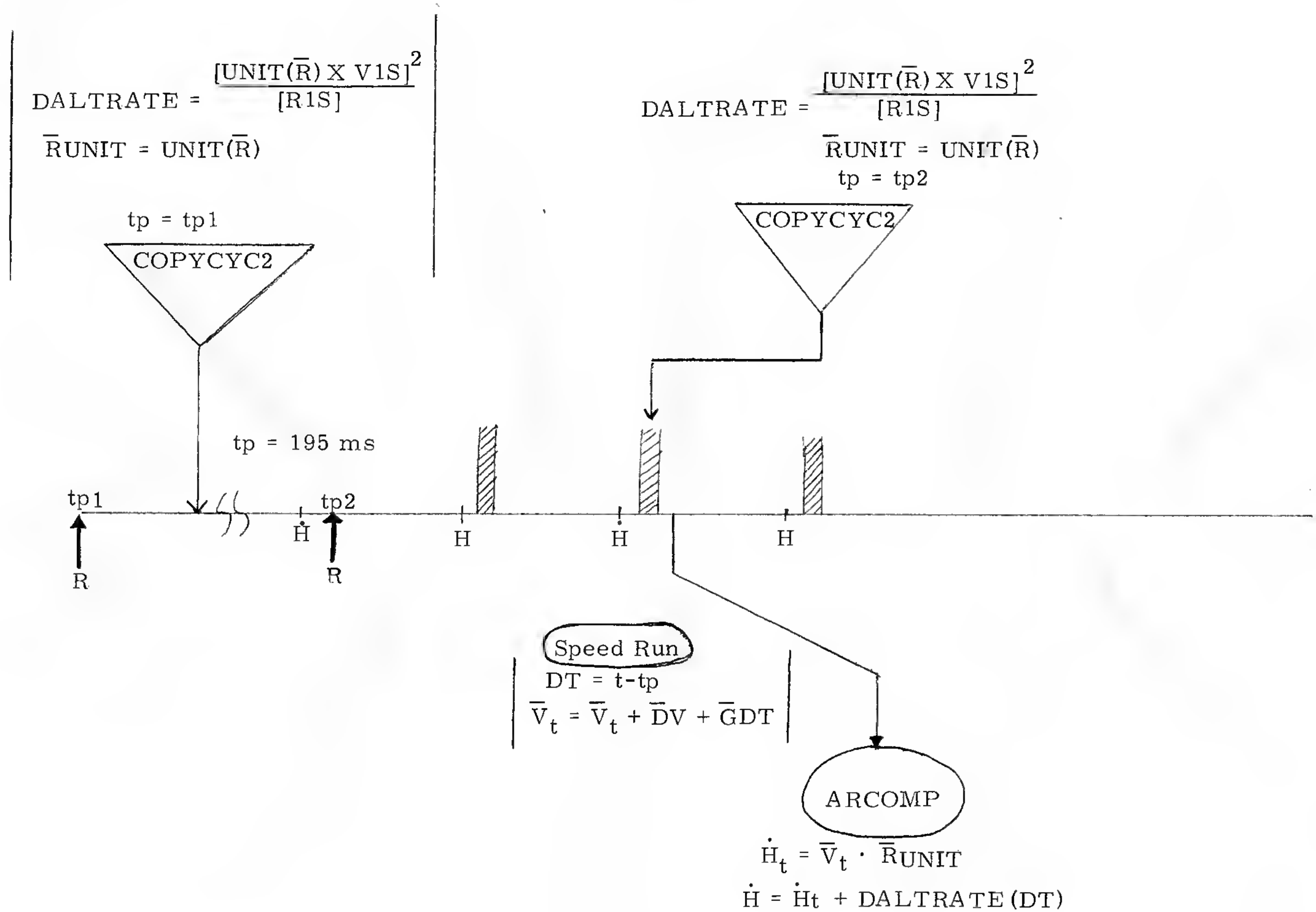
To be specific, the "DT" and "VVECT" computations are consistent (computed before the delay) and the "RUNIT" and "DALTRATE" computation from COPYCYC2 are consistent (during the delay). However, the computations performed after the delay are not performed on consistent data ($\dot{H}$ = VVECT · RUNIT + DALTRATE (DT)) since "RUNIT" and "DALTRATE" are based on current state vector information and "VVECT" is based on an old state vector.

"DALTRATE" will only change slightly in a 2-second cycle and can effectively be discounted in the glitch. Therefore, attention is turned to "RUNIT".

At PDI, the inertial velocity is near 5, 500 fps. In two seconds the LM traverses 11,000 ft. or roughly a central angle of 1/600 RAD., so that if VVECT is resolved into the new and inconsistent RUNIT, the vertical component is roughly $\frac{5500}{600}$ or 9 fps.

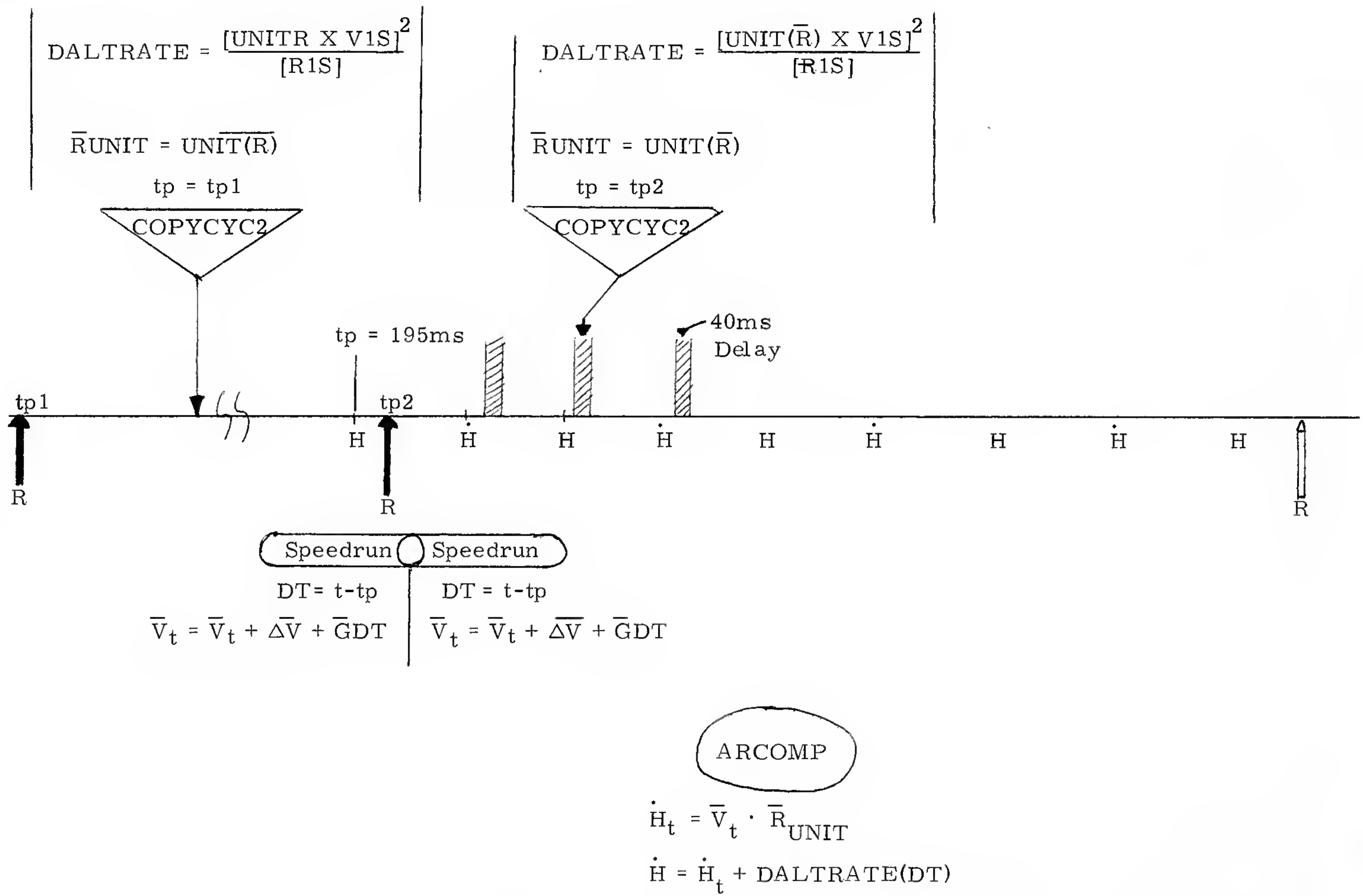
A possible resolution to the problem is to move as much of the altitude rate computation (ARCOMP) as necessary to a place before the 40 ms delay so that it will always be based on consistent data.

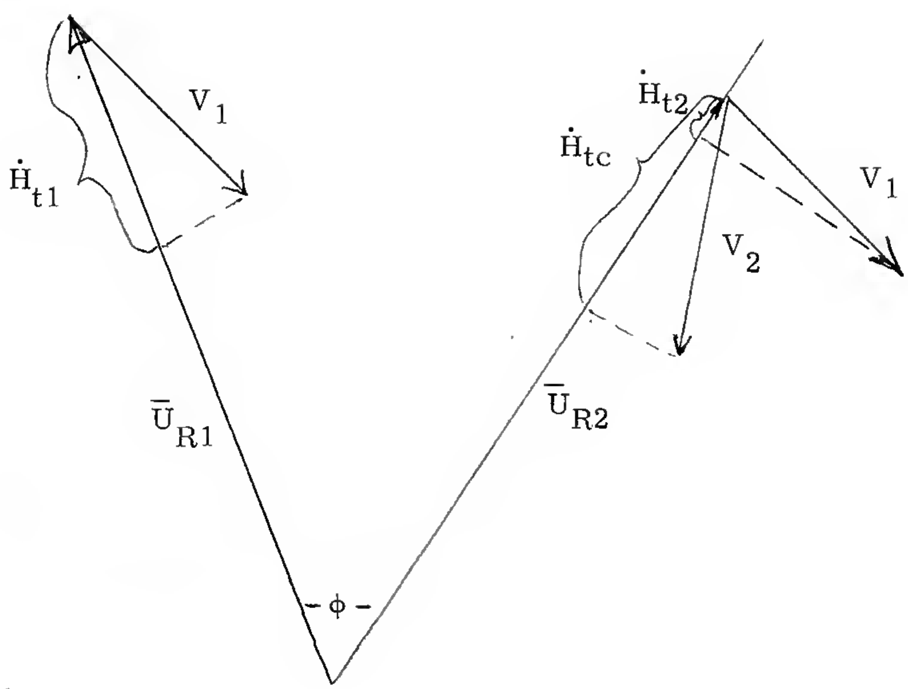
Twenty-three words from ARCOMP could be moved into speedrun. To keep the relative timing the same, the Y terms (out-of-plane components of VVECT) could be removed from the DOT-Products: VVECT· RUNIT, with no effect to the altitude rate.



DALTRATE = [UNIT(R̄) X V1S]² / [R1S]
R̄UNIT = UNIT(R̄)
tp = tp1
COPYCYC2
tp = 195 ms
tp1
R
Ḣ
tp2
R
H
H
H
DALTRATE = [UNIT(R̄) X V1S]² / [R1S]
R̄UNIT = UNIT(R̄)
tp = tp2
COPYCYC2
Speed Run
DT = t-tp
V̄t = V̄t + D̄V + ḠDT
ARCOMP
Ḣt = V̄t · R̄UNIT
Ḣ = Ḣt + DALTRATE(DT)

NORMAL OPERATION





$\phi \cong \frac{1}{600}$ RAD when V = 5500 fps

and $\dot{H}_{t2} - \dot{H}_{tc} \approx 9$ fps