

Apollo 11 launch simulation results – v4

24/6/24

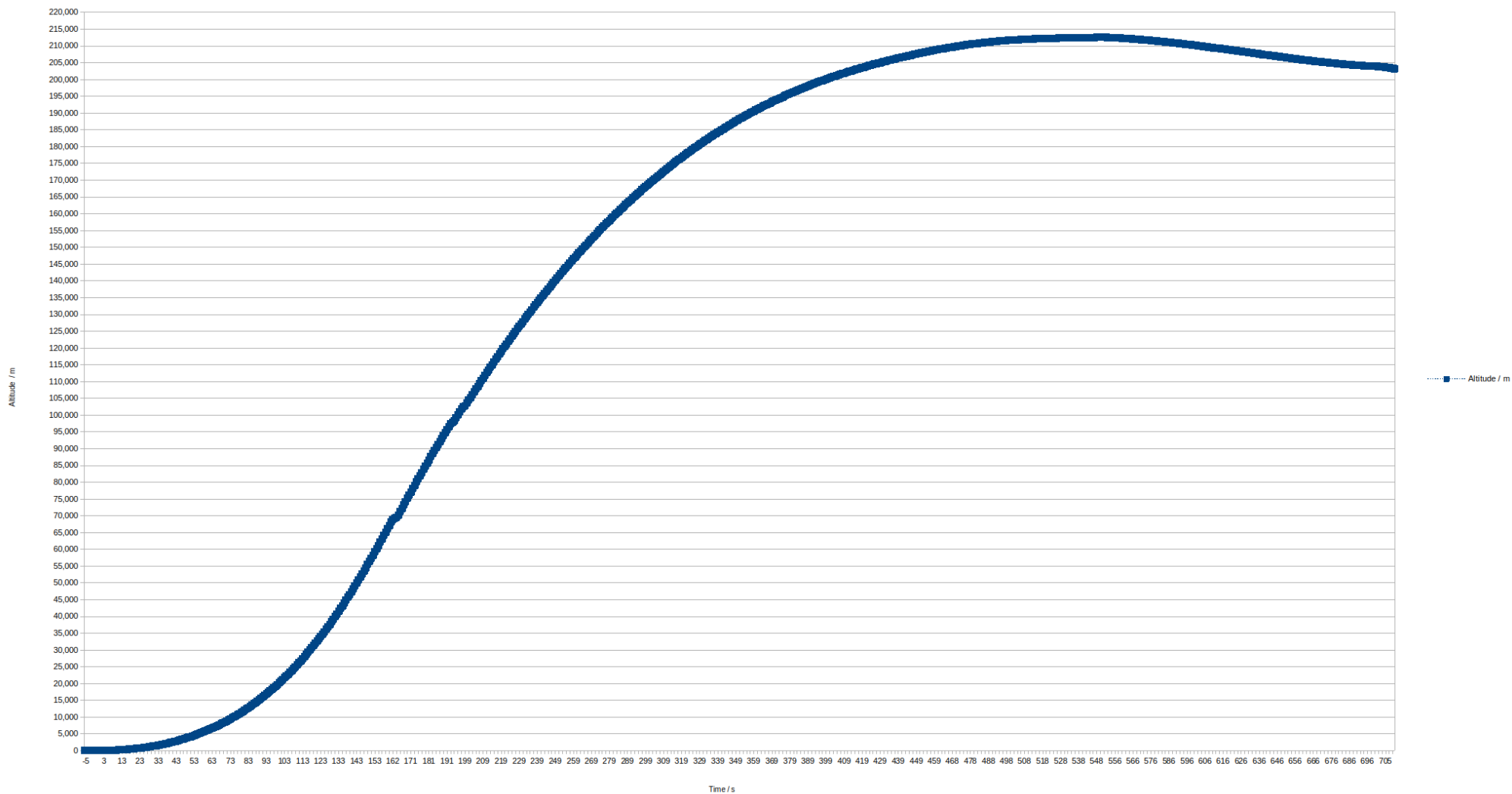
Event	Apollo 11 actual	v4 model results
Mach 1	t+66s	t+74s
S-IC center engine cutoff	44,005 m 1,570 m s ⁻¹	44,022 m 1,255 m s ⁻¹
S-IC outboard engine cutoff	66,118m 2,356 m s ⁻¹	68,772 m 1,841 m s ⁻¹
Staging: S-IC/S-II separation	66,726 m 2,365 m s ⁻¹	69,484 m 1,837 m s ⁻¹
S-II center engine cutoff	180,163 m 5,299 m s ⁻¹	209,027 m 5,415 m s ⁻¹
S-II outboard engine cutoff	186,315 m 6,508 m s ⁻¹	212,587 m 7,636 m s ⁻¹
Staging: S-II/S-IVB separation	187,376 m 6,510 m s ⁻¹	212,590 m 7,636 m s ⁻¹
S-IVB 1st burn cutoff	190,925 m 7,381 m s ⁻¹	203,934 m 7,790 m s ⁻¹
Earth orbit insertion	190,915 m 7,383 m s ⁻¹	203,129 m 7,791 m s ⁻¹

The v4 Apollo launch mathematical model has a +6.4% error in the altitude at EPO, with a +5.5% error in the spacecraft speed ($|\mathbf{v}|$).

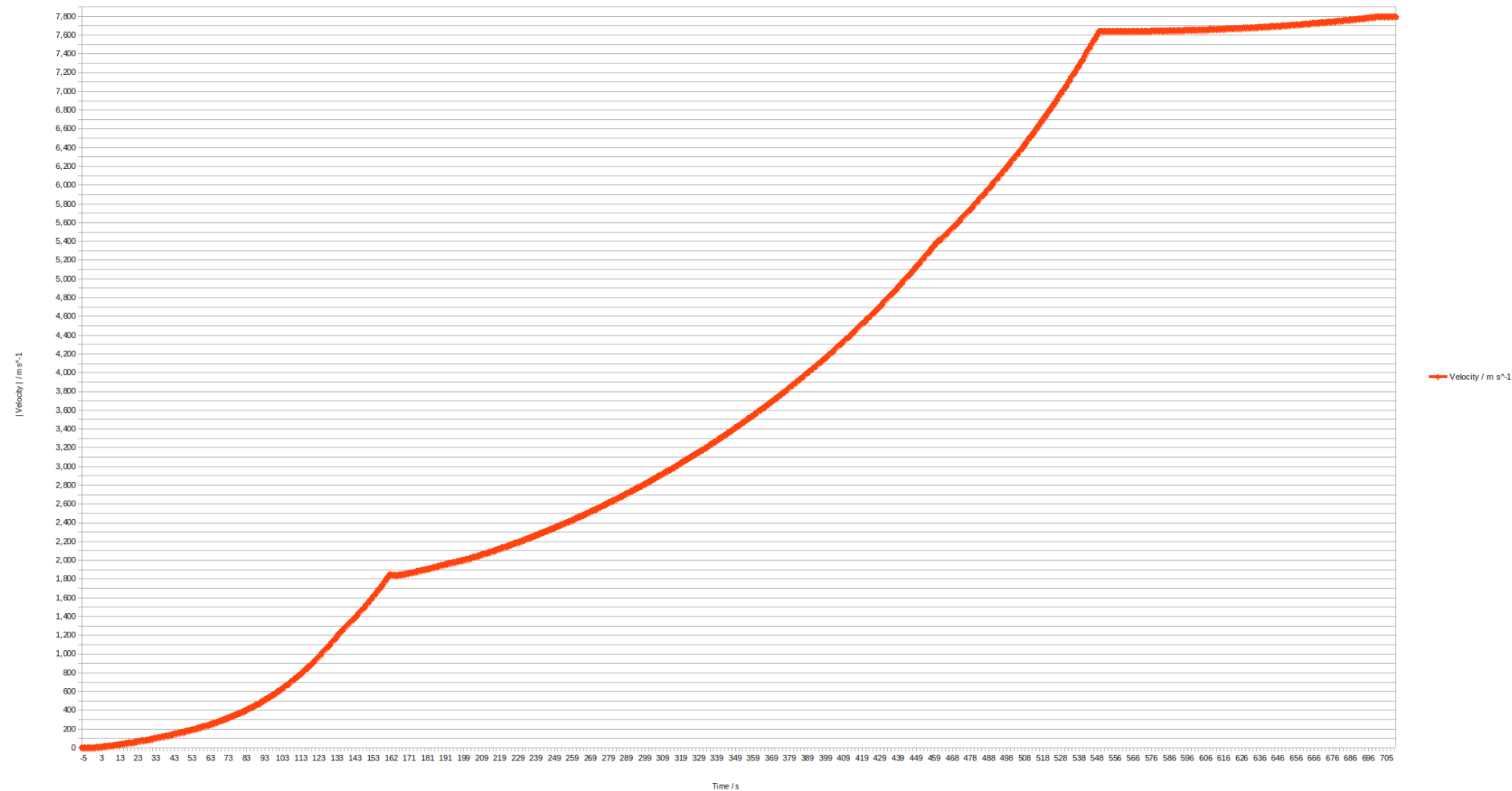
At Apollo 11's speed at EPO, these errors correspond to 1.7s of flight.

This is a good result for a model which treats the launch vehicle as a point mass and has not implemented the effect of torque on the gravity turn.

Apollo 11 launch simulation v4 - Altitude vs time



Apollo 11 launch simulation v4 - Velocity vs time



Apollo 11 launch simulation v4 - Velocity direction vs time

