

Apollo Launch Simulation: Flat Earth

payload mass	stage	time (s)	thrust (N)	S/C mass (kg)	S/R mass (kg)	S/RB mass (kg)	mass (kg)	g (m/s ²)	weight (N)	air density (kg/m ³)	drag (N)	net force (N)	accel (m/s ²)	velocity (m/s)	position (m)		
42000.00 kg	S/C	0.00	3.340E+07	2.355E+06	4.987E+05	1.218E+05	3.023E+06	9.800E+00	2.963E+07	1.200	0.000E+00	3.774E+06	1.25	12.49	100.00		
	rocket diameter	10.00	S/C	3.340E+07	2.198E+06	4.987E+05	1.218E+05	2.866E+06	9.800E+00	5.206E+06	1.885E+07	7.401E+06	5.063E+06	1.85	12.49	124.86	
	rocket diameter	20.00	S/C	3.340E+07	2.041E+06	4.987E+05	1.218E+05	2.709E+06	9.800E+00	2.655E+07	1.148E+08	4.422E+06	6.808E+06	2.51	31.00	434.85	
	rocket diameter	30.00	S/C	3.340E+07	1.884E+06	4.987E+05	1.218E+05	2.552E+06	9.800E+00	2.501E+07	2.086E+08	3.731E+06	1.254E+07	3.33	56.33	995.38	
	rocket diameter	40.00	S/C	3.340E+07	1.727E+06	4.987E+05	1.218E+05	2.395E+06	9.800E+00	2.347E+07	9.543E+01	1.118E+06	9.618E+06	4.02	88.48	1880.92	
	drag coefficient	50.00	S/C	3.340E+07	1.570E+06	4.987E+05	1.218E+05	2.238E+06	9.800E+00	2.191E+07	8.742E+01	5.797E+05	1.088E+07	4.87	128.64	3167.30	
	drag coefficient	60.00	S/C	3.340E+07	1.413E+06	4.987E+05	1.218E+05	2.081E+06	9.800E+00	2.034E+07	3.821E+01	9.220E+04	1.056E+07	5.97	177.30	4840.29	
	drag coefficient	70.00	S/C	3.340E+07	1.256E+06	4.987E+05	1.218E+05	1.924E+06	9.800E+00	1.877E+07	1.784E+01	1.284E+04	1.024E+07	6.89	235.38	7294.10	
	drag coefficient	80.00	S/C	3.340E+07	1.099E+06	4.987E+05	1.218E+05	1.767E+06	9.800E+00	1.721E+07	4.288E+01	1.583E+04	1.450E+07	8.21	304.32	10337.31	
	drag coefficient	90.00	S/C	3.340E+07	9.42E+05	4.987E+05	1.218E+05	1.610E+06	9.800E+00	1.564E+07	1.078E+02	1.732E+04	1.598E+07	9.87	384.61	14261.27	
	drag coefficient	100.00	S/C	3.340E+07	7.85E+05	4.987E+05	1.218E+05	1.453E+06	9.800E+00	1.405E+07	1.795E+01	1.983E+04	1.458E+07	12.03	485.12	19052.57	
	drag coefficient	110.00	S/C	3.340E+07	6.281E+05	4.987E+05	1.218E+05	1.296E+06	9.800E+00	1.247E+07	9.745E+02	1.481E+04	1.972E+07	14.87	605.45	25107.07	
	drag coefficient	120.00	S/C	3.340E+07	4.711E+05	4.987E+05	1.218E+05	1.139E+06	9.800E+00	1.118E+07	4.584E+02	1.044E+04	2.120E+07	18.62	754.19	32648.97	
	drag coefficient	130.00	S/C	3.340E+07	3.141E+05	4.987E+05	1.218E+05	9.82E+05	9.800E+00	9.620E+06	1.370E+02	6.841E+05	2.335E+07	23.88	940.35	40252.41	
	drag coefficient	140.00	S/C	3.340E+07	1.570E+05	4.987E+05	1.218E+05	8.246E+05	9.800E+00	8.081E+06	5.523E+03	3.000E+05	2.501E+07	30.34	1176.15	53814.03	
	drag coefficient	150.00	S/C	3.340E+07	2.941E+02	4.987E+05	1.218E+05	6.675E+05	9.800E+00	6.543E+06	1.258E+03	1.103E+05	2.675E+07	40.07	1479.41	68690.09	
	drag coefficient	160.00	S/R	5.115E+06	0.000E+00	0.000E+00	5.115E+06	6.596E+05	9.800E+00	6.400E+06	1.939E+04	2.717E+04	1.321E+06	4.03	1880.20	87413.84	
	drag coefficient	170.00	S/R	5.115E+06	0.000E+00	0.000E+00	4.716E+05	1.218E+05	6.404E+05	9.800E+00	6.275E+06	2.987E+05	4.139E+05	1.165E+06	1.82	1861.00	106112.21
	drag coefficient	180.00	S/R	5.115E+06	0.000E+00	0.000E+00	4.317E+05	1.218E+05	6.208E+05	9.800E+00	6.142E+06	4.735E+06	6.434E+06	1.028E+06	1.64	1841.82	124429.41
	drag coefficient	190.00	S/R	5.115E+06	0.000E+00	0.000E+00	3.918E+05	1.218E+05	6.012E+05	9.800E+00	6.009E+06	7.630E+07	1.018E+07	8.942E+05	1.46	1822.42	142843.61
	drag coefficient	200.00	S/R	5.115E+06	0.000E+00	0.000E+00	3.519E+05	1.218E+05	5.816E+05	9.800E+00	5.874E+06	1.048E+07	1.639E+07	7.609E+05	1.27	1803.84	161079.80
	drag coefficient	210.00	S/R	5.115E+06	0.000E+00	0.000E+00	3.120E+05	1.218E+05	5.620E+05	9.800E+00	5.740E+06	2.066E+08	2.676E+07	6.277E+05	1.07	1785.15	179733.44
	drag coefficient	220.00	S/R	5.115E+06	0.000E+00	0.000E+00	2.721E+05	1.218E+05	5.424E+05	9.800E+00	5.610E+06	3.433E+09	4.424E+01	4.944E+05	0.86	1767.33	196477.77
	drag coefficient	230.00	S/R	5.115E+06	0.000E+00	0.000E+00	2.322E+05	1.218E+05	5.228E+05	9.800E+00	5.479E+06	3.839E+10	7.611E+02	3.144E+05	0.65	1749.79	214455.35
	drag coefficient	240.00	S/R	5.115E+06	0.000E+00	0.000E+00	1.923E+05	1.218E+05	5.032E+05	9.800E+00	5.348E+06	9.923E+11	1.249E+02	2.282E+05	0.42	1732.33	232358.96
	drag coefficient	250.00	S/R	5.115E+06	0.000E+00	0.000E+00	1.524E+05	1.218E+05	4.836E+05	9.800E+00	5.216E+06	1.693E+11	2.121E+03	9.503E+04	0.18	1768.14	249480.36
	drag coefficient	260.00	S/R	5.115E+06	0.000E+00	0.000E+00	1.125E+05	1.218E+05	4.640E+05	9.800E+00	5.084E+06	3.497E+11	3.618E+04	3.618E+04	0.07	1803.84	266709.89
	drag coefficient	270.00	S/R	5.115E+06	0.000E+00	0.000E+00	7.26E+04	1.218E+05	4.444E+05	9.800E+00	4.948E+06	4.956E+13	6.166E+05	1.713E+05	0.34	1767.09	283974.78
	drag coefficient	280.00	S/R	5.115E+06	0.000E+00	0.000E+00	3.29E+04	1.218E+05	4.248E+05	9.800E+00	4.811E+06	8.419E+14	1.057E+06	3.045E+05	0.62	1770.49	302789.63
	drag coefficient	290.00	S/R	5.115E+06	0.000E+00	0.000E+00	1.32E+04	1.218E+05	4.052E+05	9.800E+00	4.674E+06	1.461E+16	2.807E+07	2.169E+06	0.72	1811.54	321942.92
	drag coefficient	300.00	S/R	5.115E+06	0.000E+00	0.000E+00	2.94E+03	1.218E+05	3.856E+05	9.800E+00	4.536E+06	2.385E+17	5.051E+07	5.795E+06	1.23	1758.86	339585.11
	drag coefficient	310.00	S/R	5.115E+06	0.000E+00	0.000E+00	2.81E+03	1.218E+05	3.660E+05	9.800E+00	4.411E+06	3.935E+16	5.132E+08	7.040E+06	1.56	1798.17	356846.81
	drag coefficient	320.00	S/R	5.115E+06	0.000E+00	0.000E+00	2.67E+03	1.218E+05	3.464E+05	9.800E+00	4.274E+06	4.888E+16	8.979E+08	8.979E+08	1.92	1813.81	374624.92
	drag coefficient	330.00	S/R	5.115E+06	0.000E+00	0.000E+00	2.53E+03	1.218E+05	3.268E+05	9.800E+00	4.137E+06	5.931E+17	1.330E+09	9.704E+08	2.29	1829.39	392545.84
	drag coefficient	340.00	S/R	5.115E+06	0.000E+00	0.000E+00	2.40E+03	1.218E+05	3.072E+05	9.800E+00	4.011E+06	1.612E+18	2.224E+10	1.104E+09	2.70	1855.94	411514.20
	drag coefficient	350.00	S/R	5.115E+06	0.000E+00	0.000E+00	2.26E+03	1.218E+05	2.876E+05	9.800E+00	3.874E+06	2.453E+19	3.448E+11	1.237E+09	3.13	1882.90	430043.17
	drag coefficient	360.00	S/R	5.115E+06	0.000E+00	0.000E+00	2.12E+03	1.218E+05	2.680E+05	9.800E+00	3.737E+06	3.481E+20	5.898E+12	1.310E+09	3.56	1910.45	448884.45
	drag coefficient	370.00	S/R	5.115E+06	0.000E+00	0.000E+00	1.98E+03	1.218E+05	2.484E+05	9.800E+00	3.612E+06	5.144E+21	7.838E+13	1.501E+09	4.08	1950.00	468084.61
	drag coefficient	380.00	S/R	5.115E+06	0.000E+00	0.000E+00	1.84E+03	1.218E+05	2.288E+05	9.800E+00	3.479E+06	7.028E+22	1.114E+14	1.683E+09	4.61	1990.78	488392.39
	drag coefficient	390.00	S/R	5.115E+06	0.000E+00	0.000E+00	1.70E+03	1.218E+05	2.092E+05	9.800E+00	3.346E+06	9.346E+23	1.537E+15	1.868E+09	5.18	2031.87	508911.18
	drag coefficient	400.00	S/R	5.115E+06	0.000E+00	0.000E+00	1.56E+03	1.218E+05	1.896E+05	9.800E+00	3.212E+06	1.135E+24	1.994E+16	1.903E+09	5.80	2088.71	530535.47
	drag coefficient	410.00	S/R	5.115E+06	0.000E+00	0.000E+00	1.42E+03	1.218E+05	1.700E+05	9.800E+00	3.079E+06	1.372E+24	2.449E+16	2.036E+09	6.48	2146.75	551671.15
	drag coefficient	420.00	S/R	5.115E+06	0.000E+00	0.000E+00	1.28E+03	1.218E+05	1.504E+05	9.800E+00	2.946E+06	1.632E+24	2.867E+17	2.169E+09	7.22	2211.54	573171.65
	drag coefficient	430.00	S/R	5.115E+06	0.000E+00	0.000E+00	1.14E+03	1.218E+05	1.308E+05	9.800E+00	2.813E+06	1.891E+24	3.094E+18	2.302E+09	8.02	2283.70	595027.11
	drag coefficient	440.00	S/R	5.115E+06	0.000E+00	0.000E+00	1.00E+03	1.218E+05	1.112E+05	9.800E+00	2.680E+06	1.939E+24	3.118E+19	2.435E+09	8.91	2362.90	618066.58
	drag coefficient	450.00	S/R	5.115E+06	0.000E+00	0.000E+00	8.6E+02	1.218E+05	9.16E+04	9.800E+00	2.547E+06	2.086E+24	3.090E+20	2.569E+09	9.88	2449.27	642346.64
	drag coefficient	460.00	S/R	5.115E+06	0.000E+00	0.000E+00	7.2E+02	1.218E+05	7.20E+04	9.800E+00	2.413E+06	9.341E+24	2.856E+21	2.702E+09	10.97	2532.82	667855.51
	drag coefficient	470.00	S/R	5.115E+06	0.000E+00	0.000E+00	5.8E+02	1.218E+05	5.24E+04	9.800E+00	2.279E+06	3.031E+24	1.851E+22	2.835E+09	12.18	2618.33	694670.30
	drag coefficient	480.00	S/R	5.115E+06	0.000E+00	0.000E+00	4.4E+02	1.218E+05	3.28E+04	9.800E+00	2.147E+06	4.044E+24	1.254E+23	2.988E+09	14.55	2698.77	724404.02
	drag coefficient	490.00	S/R	5.115E+06	0.000E+00	0.000E+00	3.0E+02	1.218E+05	1.32E+04	9.800E+00	2.015E+06	5.418E+24	7.418E+23	3.190E+09	17.00	2780.65	753825.51
	drag coefficient	500.00	S/R	5.115E+06	0.000E+00	0.000E+00	1.6E+02	1.218E+05	1.91E+03	9.800E+00	1.881E+06	1.011E+24	1.817E+24	3.244E+09	18.85	2863.77	784930.30
	drag coefficient	510.00	S/R	5.115E+06	0.000E+00	0.000E+00	2.0E+02	1.218E+05	1.714E+								