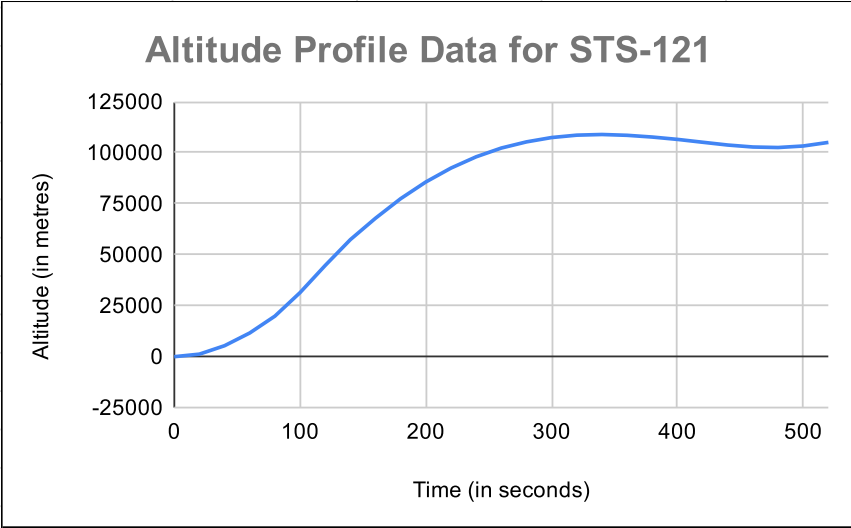
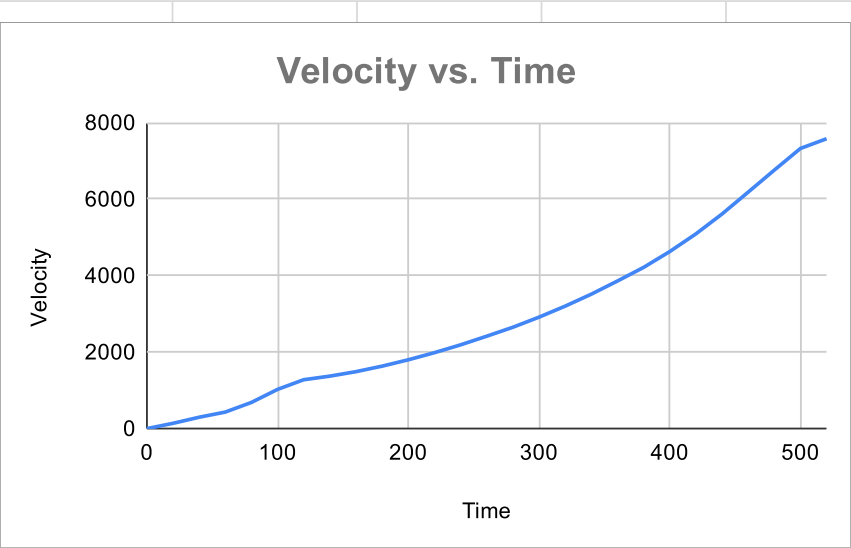


Time	Altitude	Velocity	velocity/g	Acceleration
0	-8	0	0	2.45
20	1244	139	14.16921509	18.62
40	5377	298	30.37716616	16.37
60	11617	433	44.13863405	19.4
80	19872	685	69.82670744	24.5
100	31412	1026	104.587156	24.01
120	44726	1279	130.3771662	8.72
140	57396	1373	139.9592253	9.7
160	67893	1490	151.8858308	10.19
180	77485	1634	166.5647299	10.68
200	85662	1800	183.4862385	11.17
220	92481	1986	202.4464832	11.86
240	98004	2191	223.343527	12.45
260	102301	2417	246.3812436	13.23
280	105321	2651	270.2344546	13.92
300	107449	2915	297.1457696	14.9
320	108619	3203	326.5035678	15.97
340	108942	3516	358.4097859	17.15
360	108543	3860	393.4760449	18.62
380	107690	4216	429.7655454	20.29
400	106539	4630	471.9673802	22.34
420	105142	5092	519.0621814	24.89
440	103775	5612	572.069317	28.03
460	102807	6184	630.3771662	29.01
480	102552	6760	689.0927625	29.3
500	103297	7327	746.8909276	29.01
520	105069	7581	772.7828746	0.1



# Space Shuttle Operational Orbit DataBase - retrieved from NASA Space Shuttle Education Series - Shuttle GNC Article

Time (in minutes)	Position (X)	Position(Y)	Position(Z)	Position Magnitude	Velocity (X)	Velocity (Y)	Velocity (Z)	Velocity Magnitude
0	6521479	-734565	1458505	6722835.036	-732	5020	5798	7704.09164
5	5924596	784838	3078097	6722461.572	-3207	5010	4893	7702.363144
10	4635033	2212521	4336801	6722099.598	-5305	4415	3416	7700.928905
15	2804233	3381908	5087694	6722027.572	-6780	3305	1541	7698.448285
20	646291	4156853	5243442	6722410.5	-7464	1811	-513	7697.674064
25	-1587017	4447125	4786055	6723233.313	-7278	105	-2507	7698.399704
30	-3635191	4218696	3768833	6724292.656	-6242	-1613	-4208	7698.804907
35	-5258953	3497785	2310392	6725250.758	-4476	-3146	-5419	7700.483946
40	-6268174	2368178	581241	6725779.764	-2186	-4311	-5995	7700.866315
45	-6544580	961726	-1216040	6725711.677	361	-4973	-5868	7700.290514
50	-6055983	-557150	-2870787	6725084.7	2864	-5053	-5054	7699.235092
55	-4860024	-2010971	-4189288	6724133.52	5030	-4544	-3649	7698.313906
60	-3096963	-3230170	-5017592	6723199.204	6608	-3505	-1819	7698.015978
65	-972801	-4072773	-5259205	6722578.295	7414	-2058	224	7697.592871
70	1264767	-4440582	-4885923	6722398.949	7356	-370	2241	7698.682809
75	3354753	-4290364	-3941001	6722579.849	6440	1362	3997	7700.951435
80	5052847	-3639037	-2534456	6722895.233	4769	2938	5287	7702.439484
85	6159973	-2562141	-830686	6723085.088	2539	4171	5959	7704.118574
90	6546101	-1185374	970565	6722986.408	10	4917	5931	7704.138498
			Rmax	6725779.764			Vmax	7704.138498
			Rmin	6722027.572			Vmin	7697.592871
			Ravg	6723423.352			Vavg	7700.307372
			Semi Major Axis	6723903.668				
			Eccentricity	0.0002790188836				

Reference - Space Shuttle GNC Data- NASA Education Series								

## Range Estimation Via Euler's Integration Method - Methodology explained in report

Time (in seconds)	Altitude ( in metres)	Velocity Magnitude (in m/s)	COS(theta)	Theta (in radians)	Theta (in degrees)	SIN (theta)	Horizontal Velocity (in m/s)	Range
0	-8	2	1	0	0	0	0	0
20	1244	139	31.3	0	0	0	0	0
40	5377	298	1.486690647	0	0	0	0	0
60	11617	433	1.046979866	0	0	0	0	0
80	19872	685	0.9532332564	0.3070370679	17.59192814	0.3022356018	207.0313872	0
100	31412	1026	0.8423357664	0.5691937749	32.61240102	0.5389531117	552.9658926	1251.445118
120	44726	1279	0.6488304094	0.8647499473	49.54652231	0.7609330456	973.2333653	7211.898888
140	57396	1373	0.495308835	1.052606024	60.30988267	0.8687169608	1192.748387	22023.20746
160	67893	1490	0.3822651129	1.178549988	67.52594028	0.9240526952	1376.838516	42746.42254
180	77485	1634	0.3218791946	1.243082682	71.22339126	0.9467807476	1547.039742	68191.84937
200	85662	1800	0.2502141983	1.317894842	75.50981231	0.9681905055	1742.74291	97485.99823
220	92481	1986	0.1894166667	1.380228303	79.0812565	0.9818968003	1950.047045	131232.141
240	98004	2191	0.1390483384	1.431295974	82.00721856	0.990285595	2169.715739	169527.0401
260	102301	2417	0.09806024646	1.472578242	84.37251824	0.9951804801	2405.351221	212499.8049
280	105321	2651	0.0624741415	1.508281474	86.41816279	0.9980465829	2645.821491	260374.9766
300	107449	2915	0.04013579781	1.530649745	87.69977033	0.9991942342	2912.651193	313188.0385
320	108619	3203	0.02006861063	1.550726369	88.85007611	0.9997986052	3202.354932	371394.1241
340	108942	3516	0.005042147986	1.565754157	89.71110498	0.9999872883	3515.955306	435428.324
360	108543	2860	-0.005674061433	1.576470419	90.32510152	0.9999839024	2859.953961	505746.5362
380	107690	4216	-0.01491258741	1.585709467	90.85445999	0.9998888012	4215.531186	562944.6947
400	106539	4630	-0.01365037951	1.58444713	90.78213343	0.9999068292	4629.568619	647245.9431
420	105142	5092	-0.01508639309	1.585883292	90.86441944	0.9998861939	5091.420499	739828.6887
440	103775	5612	-0.0134230165	1.584219746	90.76910529	0.9999099073	5611.4944	841645.51
460	102807	6184	-0.008624376336	1.57942081	90.49414649	0.9999628094	6183.770013	953865.2869
480	102552	6760	-0.002061772316	1.572858101	90.11813094	0.9999978745	6759.985632	1077536.088
500	103297	7327	0.00551035503	1.565285944	89.68427832	0.9999848179	7326.888761	1212735.513
520	105069	7581	0.0120922615	1.558703771	89.30714757	0.9999268859	7580.445722	1359271.063

6521479	-734565	1458505	<b>6722835.036</b>	0.9700489399	-0.1092641714	0.2169479085			
5924596	784838	3078097	<b>6722461.572</b>	0.8813134796	0.1167486034	0.457882424			
4635033	2212521	4336801	<b>6722099.598</b>	0.6895216194	0.3291413595	0.6451557191		Cross Products	
2804233	3381908	5087694	<b>6722027.572</b>	0.4171707078	0.5031083202	0.7568689574		-0.075358509 i	
646291	4156853	5243442	<b>6722410.5</b>	0.0961397701	0.6183575073	0.779994319		-0.2529692439 j	
-1587017	4447125	4786055	<b>6723233.313</b>	-0.2360496693	0.6614562953	0.7118680517		0.2095478461 k	
-3635191	4218696	3768833	<b>6724292.656</b>	-0.5406057091	0.6273813791	0.5604802159			
-5258953	3497785	2310392	<b>6725250.758</b>	-0.7819712884	0.5200973355	0.343539904		cos theta	0.2095478461
-6268174	2368178	581241	<b>6725779.764</b>	-0.9319624222	0.352104601	0.08641986809		theta	1.35968381
-6544580	961726	-1216040	<b>6725711.677</b>	-0.9730687717	0.1429924514	-0.1808046581		theta	77.87280359
-6055983	-557150	-2870787	<b>6725084.7</b>	-0.9005065766	-0.08284654021	-0.4268774489		theta	12.12719641
-4860024	-2010971	-4189288	<b>6724133.52</b>	-0.7227732742	-0.2990676783	-0.6230227267			
-3096963	-3230170	-5017592	<b>6723199.204</b>	-0.4606382923	-0.4804513301	-0.7463101788			
-972801	-4072773	-5259205	<b>6722578.295</b>	-0.1447065333	-0.6058349671	-0.7823196353			
1264767	-4440582	-4885923	<b>6722398.949</b>	0.1881422108	-0.6605650801	-0.7268124128			
3354753	-4290364	-3941001	<b>6722579.849</b>	0.4990276167	-0.6382020142	-0.5862334236			
5052847	-3639037	-2534456	<b>6722895.233</b>	0.7515879432	-0.5412901546	-0.3769887693			
6159973	-2562141	-830686	<b>6723085.088</b>	0.9162420109	-0.3810960246	-0.1235572641			
6546101	-1185374	970565	<b>6722986.408</b>	0.9736894592	-0.1763165843	0.1443651587			