

Table 1. Some popular types of free-fall interplanetary trajectories and their required hyperbolic excess velocities

No.	Mission	HEV (km/sec)
1	Escape from Earth	0
2	Earth-Venus and Earth-Mars (110- and 200-day fly-by's, respectively)	3.00
3	Earth-Venus-Earth (360-day reconnaissance fly-by)	3.50
4	Earth-Venus-Mars-Earth (600-day 1970, 480-day 1972 reconnaissance fly-by)	3.50
5	Earth-Mars-Earth (1000-day reconnaissance fly-by)	4.50
6	Earth-Mercury (85-day fly-by)	6.40
7	Earth-Mars-Earth (600-700 day reconnaissance fly-by)	6.50
8	Earth - 13-deg out-of-ecliptic ($a = 1$ A. U., $e = 0$)	6.74
9	Earth-Jupiter (800- 900-day minimum energy fly-by)	9.30
10	Earth-Saturn (6.05-yr minimum-energy fly-by)	10.43
11	Earth-Jupiter (450- 500-day fly-by)	11.00
12	Solar probe (to within 0.25 A. U. of Sun)	11.00
13	Earth-Uranus (16.00-yr minimum-energy fly-by)	11.23
14	Earth-Neptune (30.70-yr minimum-energy fly-by)	11.62
15	Earth-Pluto (45.70-yr minimum-energy fly-by)	11.63
16	Escape from solar system $(HEV)_{\text{Sun}} = 0$	12.43
17	Earth-Mars-Earth (480-day reconnaissance fly-by)	13.50

Table 2. The high-energy missions: deep space solar probe, out-of-ecliptic

No.	Mission	HEV (km/sec)
1	Deep space (escape from solar system $(HEV)_{\text{Sun}} = 20$ km/sec)	17.00
2	Earth - 45-deg out-of-ecliptic ($a = 1$ A. U., $e = 0$)	22.80
3	Sun impact (minimum energy)	29.77
4	Earth - 90-deg out-of-ecliptic ($a = 1$ A. U., $e = 0$)	42.20
5	Earth - 90-deg out-of-ecliptic ($a = 2.9$ A. U., $e = 0.74$)	48.50

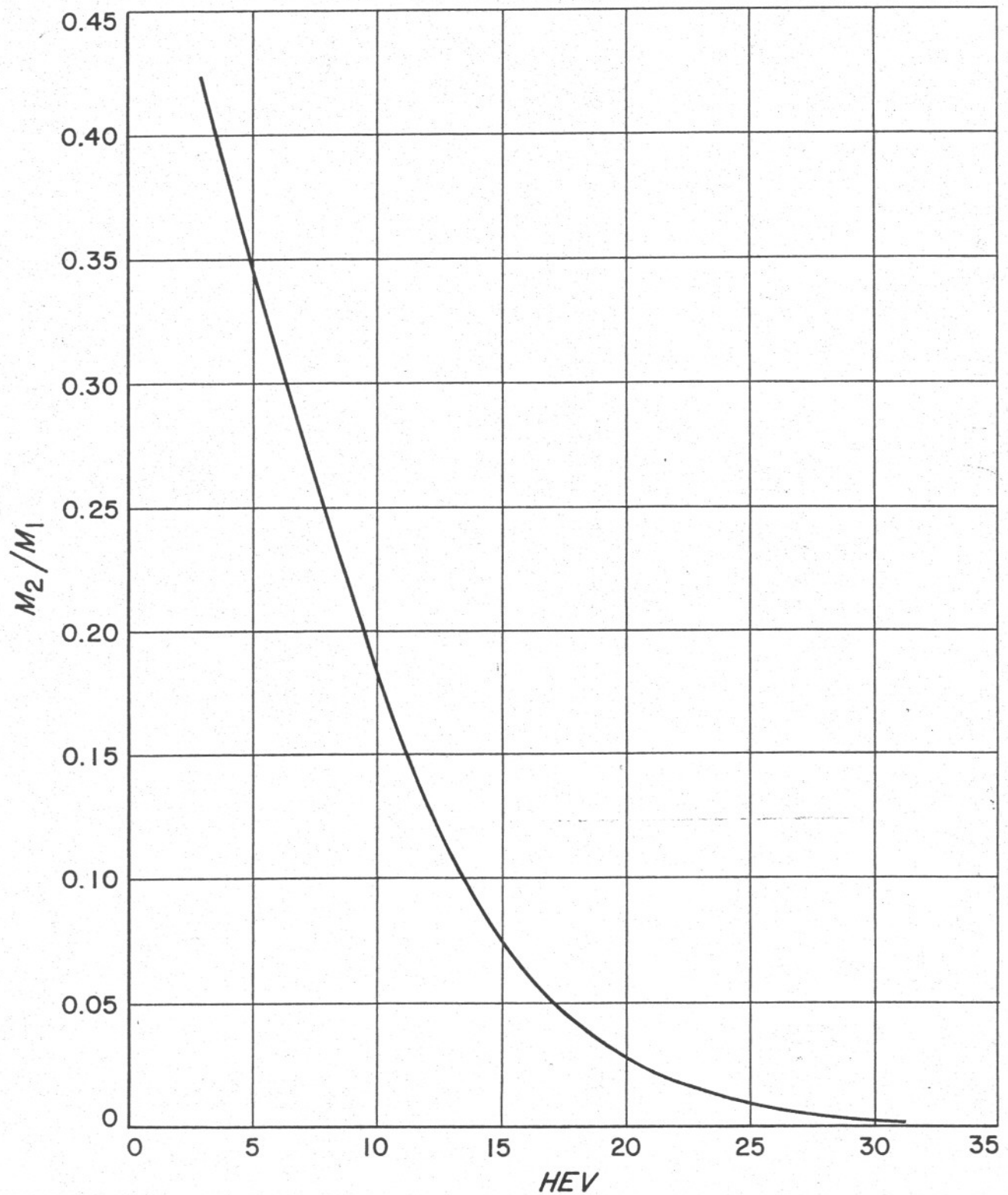


Fig. 1. Mass ratio vs V_h corresponding to a rocket engine in a circular parking orbit 200 km high

40,000 lb initial weight ($I_{sp} = 426 \text{ sec}$)

Mission number	Injected wt. (lb)	Non-payload wt. (lb)	Payload wt. (lb)
1.1	18440	4800	13440
1.2	16820	5000	11820
1.3	16200	5000	11200
1.4	16200	5000	11200
1.5	15450	5000	10450
1.6	12200	5100	7100
1.7	12060	5100	6960
1.8	11770	5200	6570
1.9	8170	5300	2870
1.10	6780	5400	1380
1.11	6200	5400	800
1.12	6200	5400	800
1.13	5930	5400	530
1.14	5560	5560	0

Table 4. Approximate payload weights corresponding to 220,000 lb initial weight ($I_{sp} = 426 \text{ sec}$)

Mission number	Injected wt. (lb)	Non-payload wt. (lb)	Payload wt. (lb)
1.14	30600	6000	24600
1.15	30600	6000	24600
1.16	26400	7000	19400
1.17	21600	9000	12600
2.1	11000	11000	0

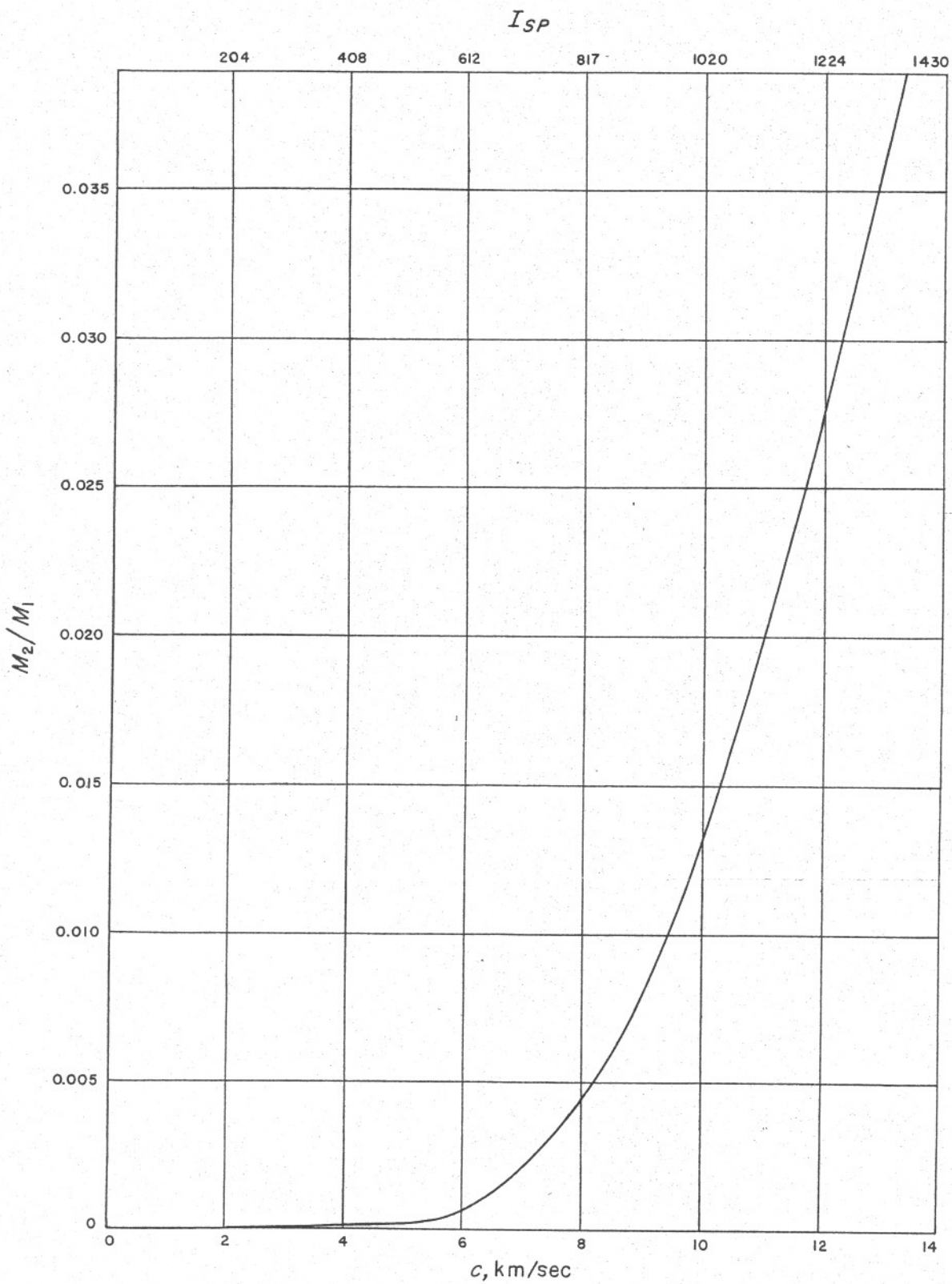


Fig. 2. Mass ratio vs c for constant HEV = 50 km/sec

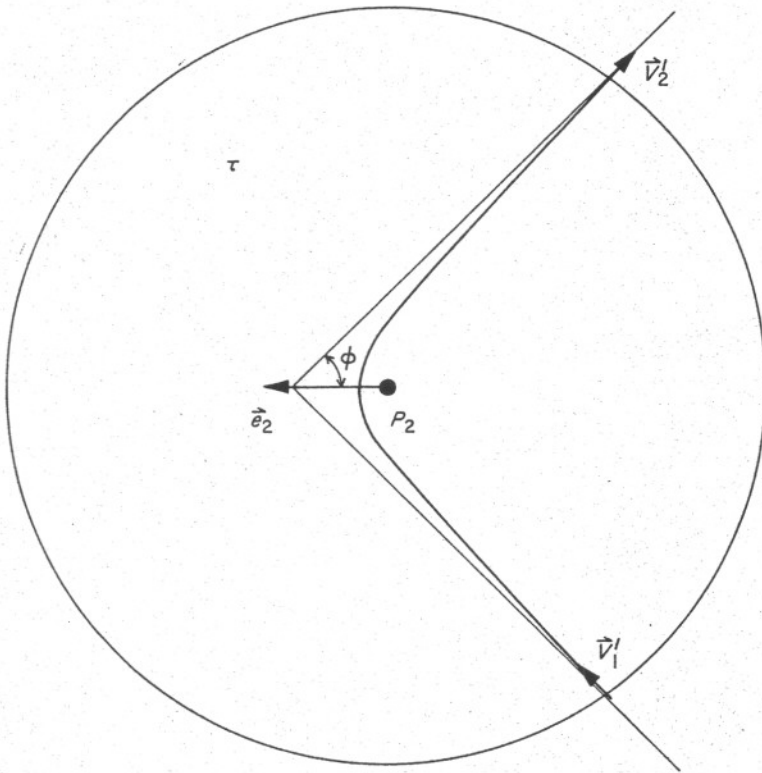


Fig. 3. Description of a typical trajectory in τ with respect to P_2

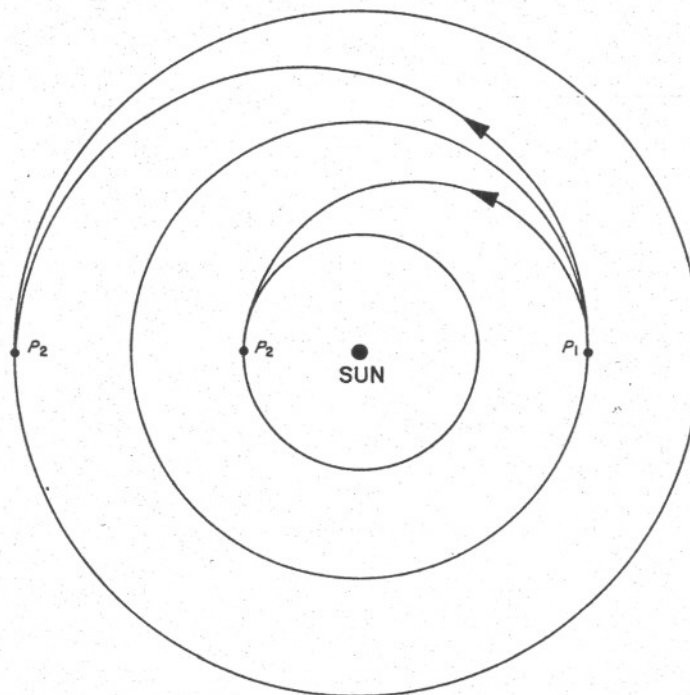


Fig. 4. Hohmann's transfer to P_2 lies inside or outside the orbit of P_1

Table 5. EARTH-VENUS deep space, launch date = Aug. 22, 1970

T_{12} (days)	HEV_1 (km/sec)	θ_{12} (deg)	ϕ_{12} (deg)	a_1 (A. U.)	e_1	Aphelion (A. U.)	$\vec{B} \cdot \hat{T}$ (km)	$\vec{B} \cdot \hat{R}$ (km)	V_1 (km/sec)	TISI (days)	DOCA (km)	DA (deg)	V_2 (km/sec)	a_3 (A. U.)	e_3	Aphelion ₃ (A. U.)	V_∞ (km/sec)
70.0	7.504	62.80	2.68	0.7019	0.4421	1.0122	-1019.	19.	34.444	0.90	-5754.	104.94	50.629	-7.854	1.0922	-	10.628
74.0	6.630	69.19	2.25	0.7238	0.3983	↓	-1320.	33.	35.020	1.00	-5630.	101.63	49.168	25.614	0.9718	50.507	-
78.0	5.872	75.59	1.85	0.7442	0.3595		-1715.	56.	35.525	1.10	-5461.	98.29	47.832	5.340	0.8646	9.957	-
82.0	5.218	81.99	1.47	0.7632	0.3255		-2234.	93.	35.964	1.21	-5229.	94.91	46.609	3.129	0.7692	5.5358	-
86.0	4.659	88.41	1.11	0.7804	0.2960		-2922.	154.	36.345	1.34	-4910.	91.46	45.491	2.285	0.6841	3.8482	-
90.0	4.185	94.84	0.74	0.7959	0.2707		-3839.	256.	36.672	1.48	-4465.	87.89	44.473	1.842	0.6084	2.9627	-
94.0	3.793	101.28	0.37	0.8096	0.2492		-5062.	434.	36.951	1.64	-3843.	84.18	43.551	1.572	0.5413	2.4229	-
98.0	3.476	107.72	0.02	0.8216	0.2312		-6686.	750.	37.188	1.81	-2974.	80.32	42.724	1.392	0.4824	2.0635	-
102.0	3.231	114.17	0.44	0.8319	0.2164		-8807.	1321.	37.386	2.00	-1770.	76.29	41.995	1.266	0.4314	1.8122	-
106.0	3.057	120.63	0.90	0.8405	0.2044		-11462.	2356.	37.551	2.19	-149.	72.18	41.370	1.177	0.3884	1.6341	-
110.0	2.955	127.09	1.43	0.8477	0.1948		-14460.	4174.	37.685	2.38	1890.	68.15	40.864	1.113	0.3540	1.5070	-
114.0	2.933	133.56	2.07	0.8535	0.1872	↓	-17082.	7101.	37.791	2.54	4090.	64.61	40.500	1.072	0.3294	1.4251	-
118.0	3.010	140.02	2.85	0.8580	0.1815		-17811.	10926.	37.874	2.63	5695.	62.22	40.317	1.052	0.3170	1.3855	-

Table 6. Unrealizable EARTH-MARS deep space, launch date = May 19, 1971

T_{12} (days)	HEV_1 (km/sec)	θ_{12} (deg)	ϕ_{12} (deg)	a_1 (A. U.)	e_1	Aphelion (A. U.)	$\vec{B} \cdot \hat{T}$ (km)	$\vec{B} \cdot \hat{R}$ (km)	V_1 (km/sec)	TISI (days)	DOCA (km)	DA (deg)	V_2 (km/sec)	a_3 (A. U.)	e_3	Aphelion ₃ (A. U.)	V_∞ (km/sec)
100.0	5.347	90.01	1.83	1.607	0.3706	2.2026	400.	0.	27.045	1.24	-3264.	97.18	36.216	-31.398	1.0440	-	5.316
106.0	4.879	93.82	1.81	1.519	0.3338	2.0260	466.	0.	26.456	1.37	-3245.	99.80	35.303	23.489	0.9412	45.5968	-
112.0	4.490	97.62	1.79	1.453	0.3037	1.8943	541.	-1.	25.956	1.51	-3225.	102.57	34.478	9.282	0.8512	17.1828	-
118.0	4.167	101.43	1.77	1.403	0.2789	1.7943	624.	-1.	25.529	1.66	-3205.	105.50	33.729	6.059	0.7720	10.7365	-
124.0	3.901	105.24	1.75	1.364	0.2586	1.7167	715.	-3.	25.162	1.83	-3185.	108.63	33.048	4.640	0.7021	7.8977	-
130.0	3.682	109.03	1.74	1.334	0.2419	1.6567	813.	-5.	24.844	2.01	-3166.	112.00	32.428	3.847	0.6404	6.3106	-
136.0	3.502	112.82	1.71	1.311	0.2283	1.6103	915.	-8.	24.567	2.20	-3151.	115.62	31.862	3.344	0.5859	5.3032	-
142.0	3.355	116.60	1.69	1.292	0.2173	1.5728	1017.	-13.	24.323	2.41	-3140.	119.55	31.347	2.999	0.5378	4.6134	-
148.0	3.236	120.37	1.67	1.277	0.2083	1.5430	1112.	-20.	24.107	2.63	-3137.	123.79	30.878	2.752	0.4955	4.1156	-
154.0	3.139	124.12	1.64	1.266	0.2012	1.5207	1193.	-29.	23.913	2.86	-3142.	128.36	30.454	2.569	0.4586	3.7471	-
160.0	3.061	127.85	1.62	1.257	0.1955	1.5027	1247.	-43.	23.737	3.10	-3157.	133.28	30.072	2.429	0.4266	3.4652	-
166.0	2.999	131.56	1.59	1.249	0.1911	1.4877	1263.	-60.	23.576	3.33	-3184.	138.53	29.730	2.323	0.3991	3.2501	-
172.0	2.949	135.25	1.55	1.244	0.1877	1.4775	1231.	-82.	23.426	3.55	-3220.	144.05	29.427	2.242	0.3760	3.0850	-
178.0	2.911	138.91	1.52	1.241	0.1852	1.4708	1141.	-108.	23.285	3.76	-3263.	149.80	29.160	2.180	0.3568	2.9578	-
184.0	2.882	142.54	1.47	1.238	0.1835	1.4652	994.	-137.	23.152	3.93	-3308.	155.65	28.927	2.135	0.3413	2.8637	-
190.0	2.861	146.15	1.42	1.237	0.1824	1.4626	795.	-168.	23.025	4.08	-3349.	161.48	28.727	2.102	0.3291	2.7938	-
196.0	2.847	149.73	1.36	1.236	0.1819	1.4608	558.	-199.	22.903	4.19	-3382.	167.07	28.556	2.079	0.3198	2.7439	-
202.0	2.839	153.27	1.29	1.236	0.1819	1.4608	300.	-231.	22.784	4.26	-3402.	171.92	28.411	2.065	0.3132	2.7118	-
208.0	2.837	156.79	1.19	1.237	0.1822	1.4624	41.	-265.	22.669	4.30	-3408.	174.34	28.289	2.059	0.3089	2.6950	-
214.0	2.840	160.27	1.07	1.238	0.1830	1.4645	-204.	-301.	22.556	4.30	-3403.	172.25	28.187	2.060	0.3064	2.6912	-
220.0	2.847	163.72	0.89	1.240	0.1840	1.4682	-423.	-344.	22.445	4.28	-3387.	168.12	28.103	2.066	0.3057	2.6976	-
226.0	2.858	167.13	0.63	1.242	0.1854	1.4723	-609.	-403.	22.336	4.22	-3362.	163.52	28.038	2.077	0.3068	2.7142	-
232.0	2.879	170.51	0.19	1.244	0.1870	1.4766	-754.	-494.	22.229	4.13	-3330.	158.56	28.001	2.097	0.3103	2.7477	-

Table 7. Earth-Jupiter escape, 1967 (launch HEV = 11.0 km/sec)

Launch Date (1967)	T ₁₂ (days)	θ_{12} (deg)	ϕ_{12} (deg)	a ₁ (A.U.)	e ₁	$\bar{B} \cdot \hat{T}$ (km)	$\bar{B} \cdot \hat{R}$ (km)	V ₁ (km/sec)	TISI (days)	DOCA (km)	DA (deg)	V ₂ (km/sec)	a ₃ (A.U.)	e ₃	V _∞ (km/sec)	TTS (yr)
10/21	556.0	156.60	3.27	5.714	0.8277	571286.	-2245.	13.050	92.21	94685.	115.17	24.326	-3.333	2.635	16.315	3.342
10/23	544.0	153.86	2.94	6.097	0.8382	548254.	-696.	13.420	89.73	90604.	114.16	24.692	-3.123	2.745	16.855	3.270
10/25	532.0	151.11	2.68	6.571	0.8497	525266.	433.	13.807	87.26	86251.	113.18	25.075	-2.927	2.862	17.411	3.198
10/27	524.0	148.67	2.49	6.930	0.8573	511128.	1106.	14.059	85.73	83493.	112.57	25.324	-2.811	2.938	17.766	3.152
10/29	516.0	146.22	2.32	7.349	0.8653	497049.	1635.	14.317	84.21	80635.	111.98	25.579	-2.700	3.018	18.127	3.106
10/31	510.0	143.92	2.19	7.686	0.8711	487304.	2007.	14.502	83.15	78607.	111.57	25.761	-2.625	3.075	18.383	3.073
11/2	506.0	141.77	2.09	7.896	0.8744	481846.	2278.	14.607	82.56	77455.	111.34	25.865	-2.584	3.108	18.528	3.052
11/4	504.0	139.77	2.00	7.943	0.8752	480633.	2482.	14.630	82.43	77193.	111.29	25.888	-2.575	3.115	18.560	3.045
11/6	504.0	137.91	1.93	7.820	0.8733	483656.	2643.	14.570	82.76	77821.	111.43	25.829	-2.598	3.096	18.478	3.050
11/8	506.0	136.21	1.87	7.546	0.8688	490939.	2776.	14.427	83.56	79323.	111.74	25.690	-2.654	3.052	18.283	3.069
11/10	512.0	134.81	1.82	7.037	0.8596	506846.	2869.	14.128	85.29	82552.	112.43	25.395	-2.779	2.961	17.868	3.113
11/12	522.0	133.70	1.79	6.415	0.8464	531616.	2918.	13.686	87.98	87366.	113.50	24.961	-2.982	2.827	17.247	3.183
11/14	538.0	133.05	1.78	5.721	0.8285	569895.	2871.	13.056	92.12	94281.	115.17	24.340	-3.324	2.639	16.336	3.291

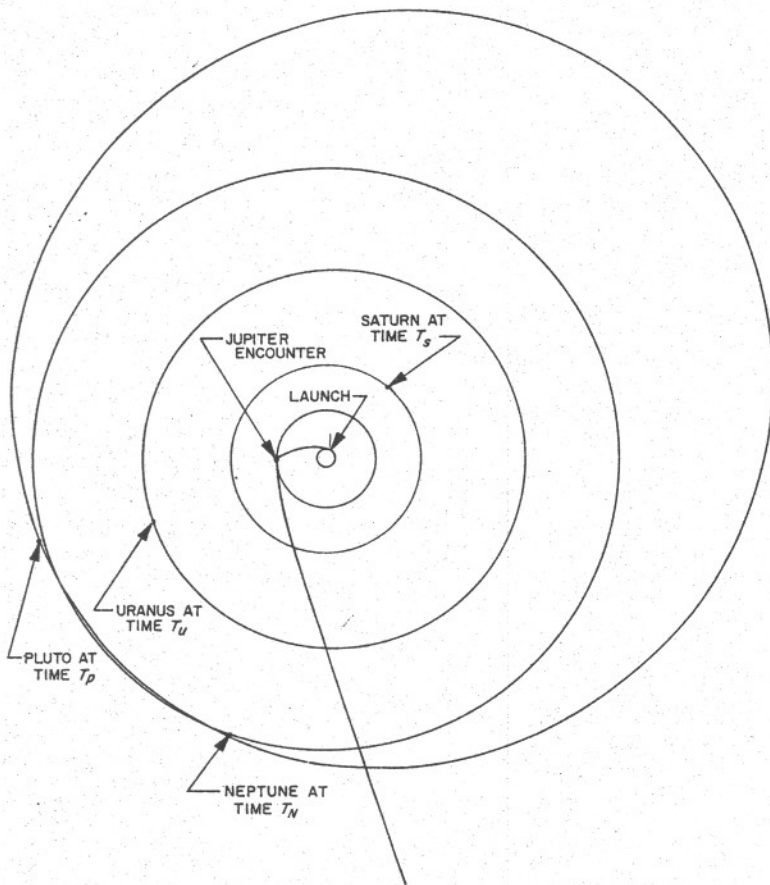


Fig. 5. Planetary configuration for Earth-Jupiter-escape, 1967 (Nov. 4 trajectory)

Fig. 6. November 4, 1967, Earth-Jupiter-escape trajectory during its closest approach to Jupiter

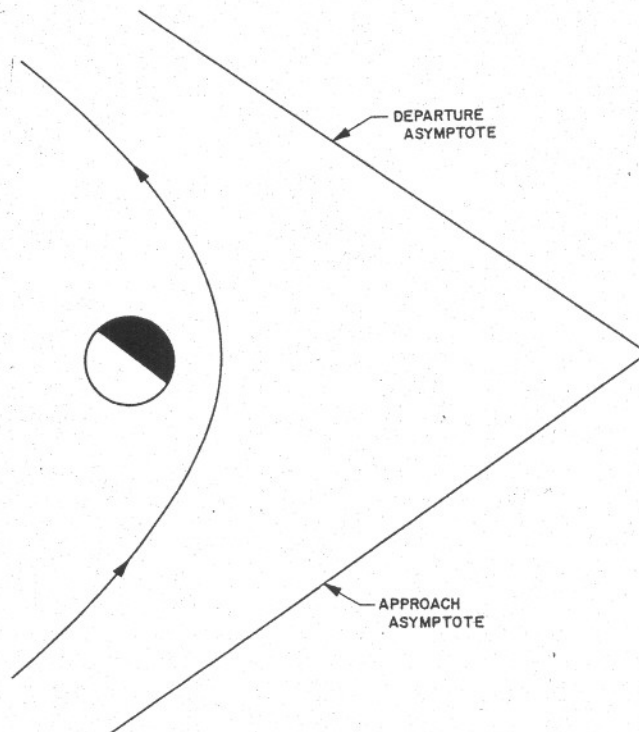


Table 8. Earth-Jupiter escape, 1968 (launch HEV = 11.0 km/sec)

Launch Date (1968)	T_{12} (days)	θ_{12} (deg)	ϕ_{12} (deg)	a_1 (A.U.)	e_1	$\bar{E}, \hat{T}$ (km)	$\bar{E}, \hat{R}$ (km)	V_1 (km/sec)	TISI (days)	DOCA (km)	DA (deg)	V_2 (km/sec)	a_3 (A.U.)	e_3	V_∞ (km/sec)	TTS (yr)
11/22	532.0	152.06	2.58	6.481	0.8488	492941.	-3748.	13.759	85.45	73899.	114.32	25.365	-2.797	2.944	17.809	3.208
11/24	522.0	149.44	2.39	6.957	0.8589	475565.	-2994.	14.094	83.51	70538.	113.54	25.694	-2.656	3.048	18.276	3.148
11/26	514.0	146.96	2.23	7.398	0.8671	462353.	-2467.	14.359	82.03	67896.	112.95	25.955	-2.553	3.131	18.643	3.102
11/28	508.0	144.63	2.11	7.756	0.8731	453241.	-2092.	14.550	81.01	66036.	112.54	26.142	-2.483	3.191	18.903	3.069
11/30	504.0	142.46	2.01	7.980	0.8766	448148.	-1822.	14.659	80.43	64986.	112.31	26.249	-2.444	3.226	19.051	3.048
12/2	500.0	140.28	1.91	8.217	0.8801	443052.	-1585.	14.768	79.86	63903.	112.08	26.356	-2.407	3.261	19.199	3.028
12/4	498.0	138.25	1.84	8.269	0.8808	441921.	-1412.	14.791	79.73	63650.	112.04	26.380	-2.399	3.268	19.231	3.020
12/6	498.0	136.37	1.77	8.126	0.8788	444744.	-1286.	14.727	80.06	64226.	112.18	26.318	-2.420	3.248	19.146	3.026
12/8	502.0	134.80	1.72	7.648	0.8714	455552.	-1222.	14.495	81.28	66460.	112.66	26.092	-2.501	3.175	18.833	3.057
12/10	508.0	133.37	1.67	7.102	0.8618	470475.	-1176.	14.186	82.96	69445.	113.35	25.790	-2.617	3.078	18.411	3.102
12/12	518.0	132.25	1.63	6.442	0.8482	493682.	-1171.	13.730	85.57	73889.	114.42	25.345	-2.806	2.938	17.780	3.172
12/14	536.0	131.74	1.60	5.647	0.8276	533761.	-1235.	13.012	90.04	81007.	116.27	24.640	-3.160	2.720	16.755	3.296
12/16	566.0	132.14	1.57	4.843	0.8003	599175.	-1420.	11.978	97.38	90880.	119.39	23.619	-3.837	2.415	15.206	3.499

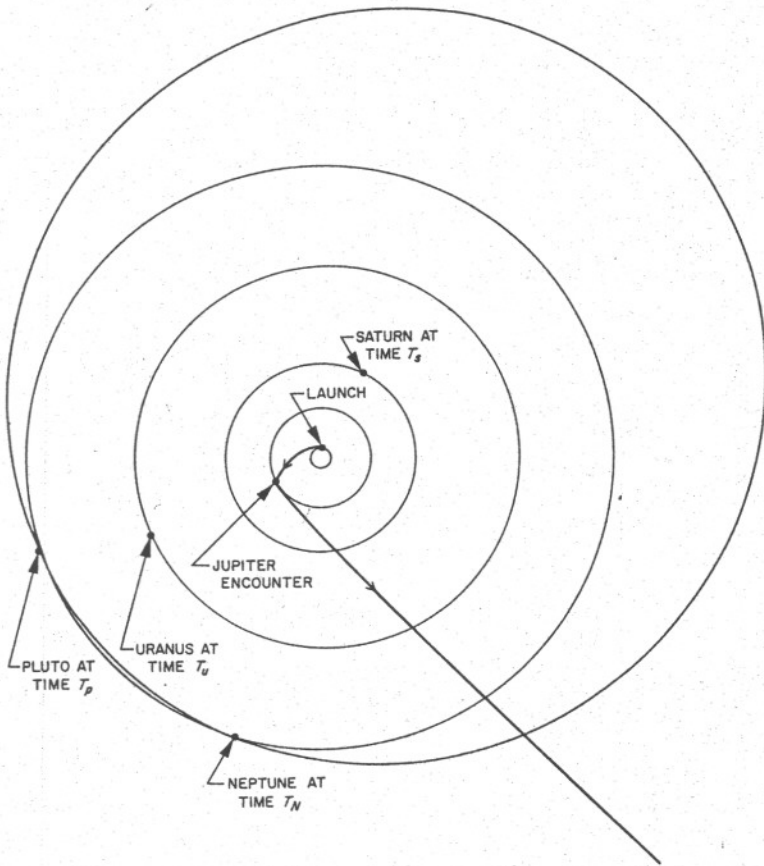


Fig. 7. Planetary configuration for Earth-Jupiter-escape, 1968 (Dec. 4 trajectory)

Fig. 8. December 4, 1968, Earth-Jupiter-escape trajectory during its closest approach to Jupiter

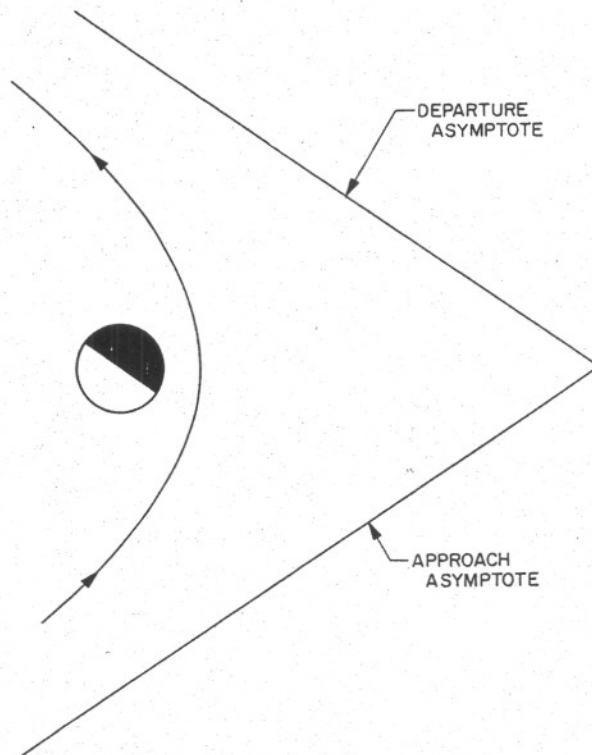


Table 9. Earth-Jupiter escape, 1969-70 (launch HEV = 11.0 km/sec)

Launch Date (1969-70)	T_{12} (days)	θ_{12} (deg)	ϕ_{12} (deg)	a_1 (A. U.)	e_1	$\vec{r}_{B \cdot T}$ (km)	$\vec{r}_{B \cdot R}$ (km)	V_1 (km/sec)	TISI (days)	DOCA (km)	DA (deg)	V_2 (km/sec)	a_3 (A. U.)	e_3	V_∞ (km/sec)	TTS (yr)
12/17	544.0	157.89	2.08	5.600	0.8266	495847.	-7663.	13.142	86.41	68278.	117.09	25.182	-2.928	2.828	17.407	3.308
12/19	532.0	155.08	1.89	6.008	0.8380	475084.	-6751.	13.538	84.04	64694.	116.08	25.572	-2.747	2.950	17.972	3.234
12/21	522.0	152.42	1.75	6.415	0.8479	458400.	-6113.	13.875	82.14	61669.	115.27	25.903	-2.608	3.055	18.443	3.174
12/23	514.0	149.91	1.63	6.790	0.8560	445702.	-5658.	14.144	80.68	59286.	114.65	26.166	-2.506	3.139	18.814	3.128
12/25	506.0	147.41	1.53	7.232	0.8646	433103.	-5275.	14.420	79.23	56830.	114.05	26.437	-2.409	3.226	19.191	3.081
12/27	498.0	144.90	1.45	7.758	0.8736	420590.	-4949.	14.703	77.79	54299.	113.46	26.715	-2.315	3.317	19.575	3.034
12/29	492.0	142.55	1.38	8.192	0.8801	411969.	-4713.	14.905	76.80	52520.	113.05	26.914	-2.252	3.382	19.847	3.001
12/31	488.0	140.36	1.32	8.467	0.8839	407158.	-4544.	15.021	76.24	51518.	112.82	27.028	-2.217	3.420	20.002	2.980
1/2	486.0	138.32	1.27	8.532	0.8848	406108.	-4429.	15.048	76.11	51302.	112.77	27.054	-2.209	3.428	20.037	2.973
1/4	484.0	136.28	1.22	8.591	0.8856	405042.	-4323.	15.072	75.99	51061.	112.73	27.078	-2.202	3.436	20.070	2.965
1/6	486.0	134.56	1.17	8.214	0.8804	411499.	-4290.	14.916	76.74	52413.	113.03	26.926	-2.249	3.385	19.862	2.983
1/8	488.0	132.83	1.13	7.870	0.8754	417968.	-4252.	14.759	77.49	53718.	113.36	26.774	-2.296	3.335	19.655	3.002
1/10	494.0	131.42	1.09	7.248	0.8649	432109.	-4265.	14.432	79.13	56539.	114.04	26.456	-2.403	3.231	19.215	3.047

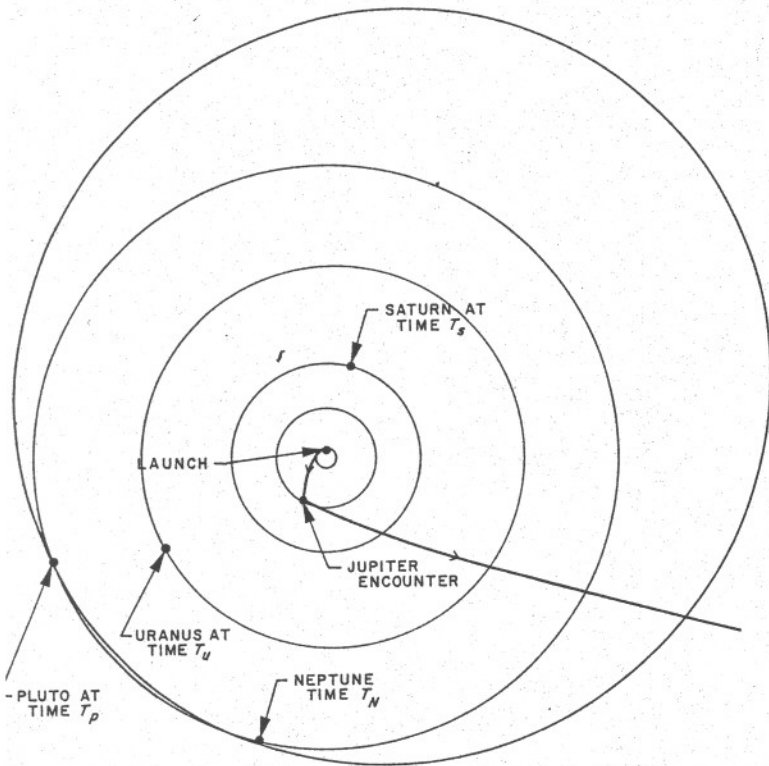


Fig. 9. Planetary configuration for Earth-Jupiter-escape, 1969-70 (Jan. 4 trajectory)

Fig. 10. January 4, 1970, Earth-Jupiter-escape trajectory during its closest approach to Jupiter

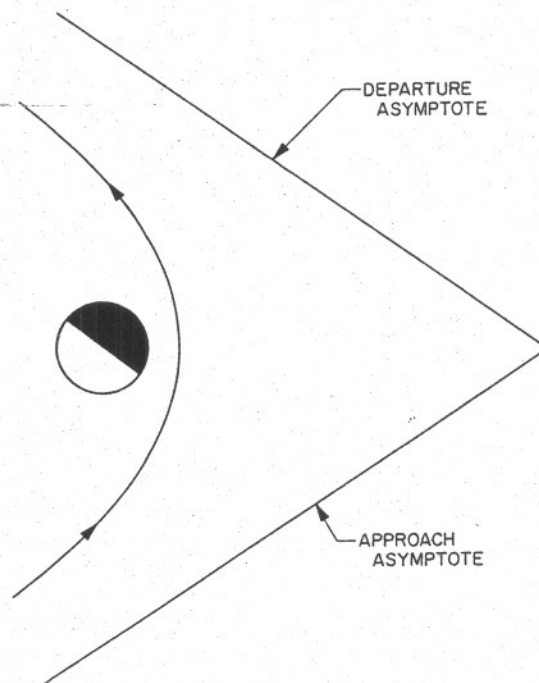


Table 10. Earth-Jupiter escape, 1971 (launch HEV = 11.0 km/sec)

Launch Date (1971)	T ₁₂ (days)	θ_{12} (deg)	ϕ_{12} (deg)	a ₁ A.U.	e ₁	$\hat{B} \cdot \hat{T}$ (km)	$\hat{B} \cdot \hat{R}$ (km)	V ₁ (km/sec)	TISI (days)	DOCA (km)	DA (deg)	V ₂ (km/sec)	a ₃ A. U.	e ₃	V _∞ (km/sec)	TTS (yr)
1/23	496.0	148.75	0.38	6.832	0.8568	416843.	-6328.	14.438	76.70	49962.	115.09	26.864	-2.314	3.263	19.579	3.055
1/25	490.0	146.39	0.37	7.168	0.8632	408320.	-6241.	14.644	75.70	48338.	114.65	27.065	-2.250	3.328	19.856	3.021
1/27	482.0	143.86	0.36	7.725	0.8728	396107.	-6123.	14.942	74.29	45890.	114.04	27.358	-2.162	3.424	20.258	2.974
1/29	478.0	141.67	0.35	7.985	0.8768	391419.	-6059.	15.064	73.73	44966.	113.79	27.477	-2.128	3.463	20.419	2.953
1/31	474.0	139.48	0.34	8.262	0.8808	386723.	-5997.	15.186	73.18	44008.	113.56	27.596	-2.095	3.503	20.580	2.935
2/2	470.0	137.28	0.33	8.560	0.8849	382033.	-5935.	15.307	72.64	43023.	113.33	27.716	-2.062	3.542	20.742	2.912
2/4	468.0	135.25	0.32	8.628	0.8858	381014.	-5904.	15.334	72.52	42805.	113.28	27.743	-2.055	3.551	20.777	2.904
2/6	468.0	133.39	0.30	8.448	0.8834	383656.	-5903.	15.264	72.82	43352.	113.41	27.675	-2.073	3.528	20.685	2.910
2/8	470.0	131.69	0.29	8.057	0.8779	389970.	-5928.	15.099	73.56	44646.	113.73	27.514	-2.118	3.475	20.468	2.929
2/10	474.0	130.15	0.26	7.525	0.8695	400048.	-5973.	14.843	74.73	46670.	114.25	27.264	-2.189	3.392	20.128	2.960
2/12	482.0	128.95	0.24	6.793	0.8559	417756.	-6043.	14.418	76.78	50123.	115.14	26.847	-2.321	3.256	19.552	3.018
2/14	494.0	128.07	0.20	6.029	0.8383	443323.	-6113.	13.844	79.73	54821.	116.45	26.284	-2.519	3.075	18.763	3.103
2/16	514.0	127.86	0.15	5.214	0.8141	484748.	-6092.	13.006	84.49	61715.	118.59	25.456	-2.874	2.817	17.571	3.240

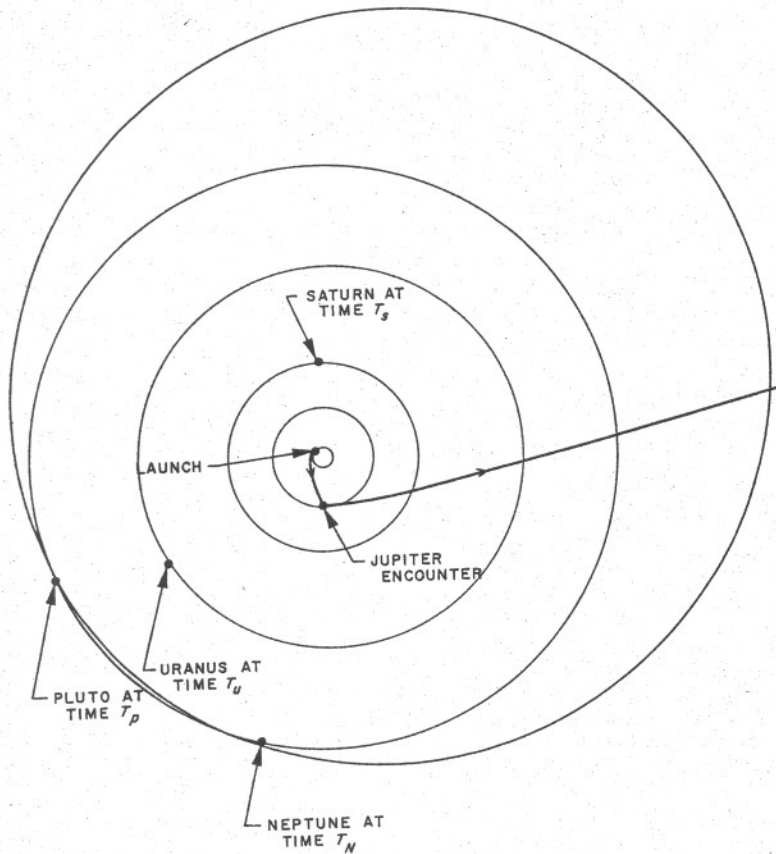


Fig. 11. Planetary configuration for Earth-Jupiter-escape, 1971 (Feb. 4 trajectory)

Fig. 12. February 4, 1971 Earth-Jupiter-escape trajectory during its closest approach to Jupiter

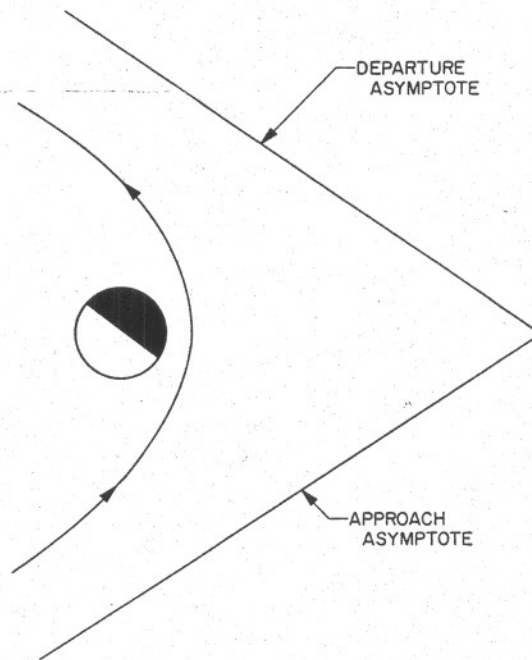


Table 11. Earth-Jupiter escape, 1972 (launch HEV = 11.0 km/sec)

Launch Date (1972)	T ₁₂ (days)	θ_{12} (deg)	ϕ_{12} (deg)	a ₁ (A. U.)	e ₁	$\vec{B} \cdot \hat{T}$ (km)	$\vec{B} \cdot \hat{R}$ (km)	V ₁ (km/sec)	TISI (days)	DOCA (km)	DA (deg)	V ₂ (km/sec)	a ₃ (A. U.)	e ₃	V _∞ (km/sec)	TTS (yr)
2/23	492.0	150.51	1.09	6.047	0.8375	428459.	-5185.	14.174	76.33	50843.	116.32	26.865	-2.371	3.150	19.342	3.067
2/25	484.0	147.98	0.99	6.416	0.8465	415915.	-5445.	14.464	74.90	48567.	115.66	27.151	-2.276	3.240	19.742	3.020
2/27	476.0	145.46	0.91	6.854	0.8560	403429.	-5624.	14.761	73.47	46199.	115.01	27.446	-2.185	3.335	20.149	2.973
2/29	470.0	143.10	0.85	7.215	0.8629	394839.	-5736.	14.976	72.48	44540.	114.56	27.658	-2.124	3.403	20.439	2.939
3/2	464.0	140.75	0.79	7.629	0.8702	386287.	-5815.	15.194	71.50	42835.	114.12	27.874	-2.064	3.473	20.732	2.905
3/4	460.0	138.58	0.75	7.894	0.8744	381536.	-5875.	15.320	70.95	41886.	113.87	27.998	-2.031	3.514	20.899	2.885
3/6	456.0	136.40	0.72	8.179	0.8787	376816.	-5920.	15.446	70.40	40918.	113.63	28.122	-1.999	3.554	21.066	2.864
3/8	454.0	134.40	0.69	8.245	0.8796	375803.	-5968.	15.474	70.28	40714.	113.58	28.150	-1.992	3.563	21.103	2.857
3/10	454.0	132.58	0.68	8.077	0.8772	378489.	-6028.	15.403	70.58	41274.	113.71	28.080	-2.010	3.540	21.009	2.862
3/12	456.0	130.92	0.67	7.709	0.8714	384962.	-6100.	15.235	71.32	42605.	114.04	27.913	-2.054	3.485	20.783	2.881
3/14	458.0	129.27	0.66	7.375	0.8658	391445.	-6170.	15.066	72.07	43889.	114.38	27.747	-2.099	3.431	20.558	2.899
3/16	464.0	127.97	0.67	6.776	0.8543	405605.	-6261.	14.715	73.68	46654.	115.11	27.401	-2.199	3.319	20.083	2.944
3/18	474.0	127.02	0.69	6.075	0.8382	427651.	-6344.	14.202	76.19	50760.	116.25	26.892	-2.363	3.157	19.376	3.015

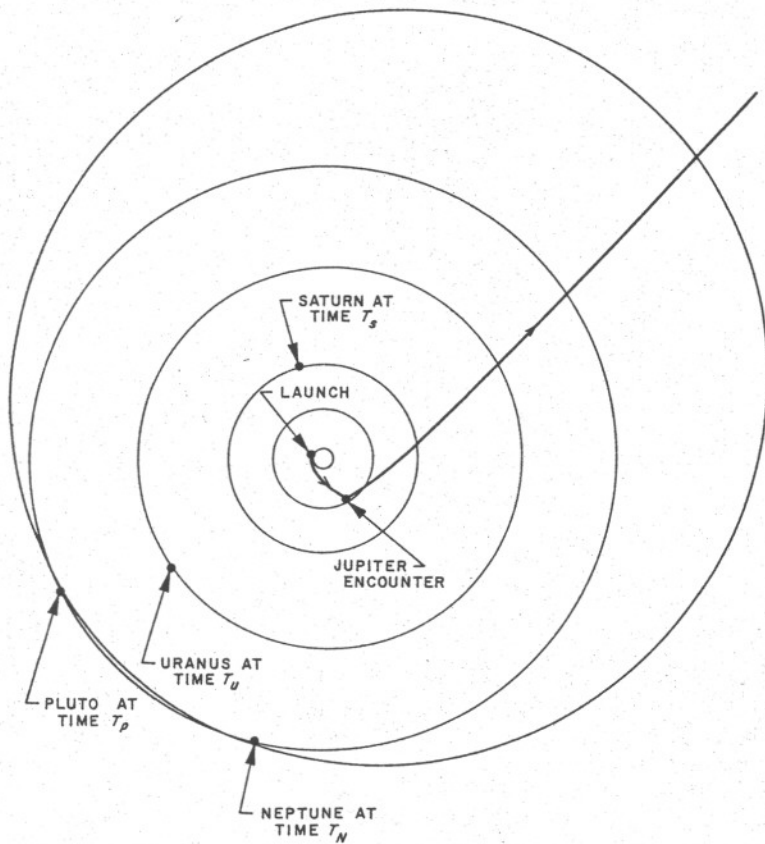


Fig. 13. Planetary configuration for Earth-Jupiter-escape, 1972 (Marth 8 trajectory)

Fig. 14. March 8, 1972, Earth-Jupiter-escape trajectory during its closest approach to Jupiter

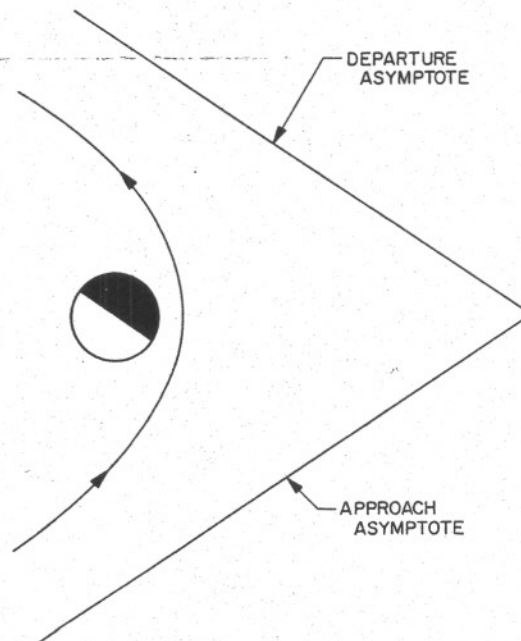


Table 12. Earth-Jupiter escape, 1973 (launch HEV = 11.0 km/sec)

Launch Date (1973)	T ₁₂ (days)	θ_{12} (deg)	ϕ_{12} (deg)	a ₁ (A. U.)	e ₁	$\bar{B} \cdot \hat{T}$ (km)	$\bar{B} \cdot \hat{R}$ (km)	V ₁ (km/sec)	TISI (days)	DOCA (km)	DA (deg)	V ₂ (km/sec)	a ₃ (A. U.)	e ₃	V _∞ (km/sec)	TTS (yr)
3/29	488.0	150.80	2.30	5.572	0.8220	455051.	-2033.	14.006	76.95	57502.	116.75	26.697	-2.482	3.010	18.904	3.072
3/31	478.0	148.11	2.11	5.966	0.8333	437723.	-2776.	14.372	75.04	54441.	115.86	27.066	-2.351	3.123	19.425	3.012
4/2	470.0	145.60	1.96	6.334	0.8427	424557.	-3263.	14.666	73.58	52025.	115.17	27.360	-2.255	3.214	19.835	2.965
4/4	464.0	143.27	1.85	6.635	0.8495	415485.	-3593.	14.879	72.57	50328.	114.70	27.572	-2.190	3.280	20.127	2.931
4/6	458.0	140.94	1.74	6.976	0.8567	406455.	-3860.	15.095	71.56	48580.	114.23	27.787	-2.127	3.348	20.422	2.897
4/8	454.0	138.79	1.67	7.193	0.8608	401433.	-4050.	15.221	71.00	47608.	113.96	27.911	-2.092	3.388	20.592	2.876
4/10	450.0	136.65	1.59	7.425	0.8650	396403.	-4211.	15.346	70.44	46601.	113.71	28.036	-2.058	3.427	20.761	2.856
4/12	448.0	134.69	1.54	7.481	0.8660	395346.	-4339.	15.375	70.31	46403.	113.65	28.064	-2.051	3.436	20.799	2.848
4/14	446.0	132.73	1.49	7.532	0.8669	394262.	-4456.	15.401	70.19	46177.	113.59	28.091	-2.044	3.445	20.835	2.841
4/16	446.0	130.96	1.45	7.392	0.8645	397135.	-4561.	15.330	70.51	46759.	113.74	28.019	-2.063	3.422	20.738	2.846
4/18	450.0	129.54	1.43	6.928	0.8556	408001.	-4657.	15.068	71.70	48951.	114.28	27.756	-2.136	3.338	20.379	2.878
4/20	454.0	128.13	1.41	6.530	0.8472	418941.	-4757.	14.810	72.91	51067.	114.84	27.498	-2.212	3.257	20.024	2.909
4/22	462.0	127.08	1.40	5.974	0.8335	438116.	-4842.	14.382	75.03	54645.	115.81	27.069	-2.351	3.123	19.426	2.968

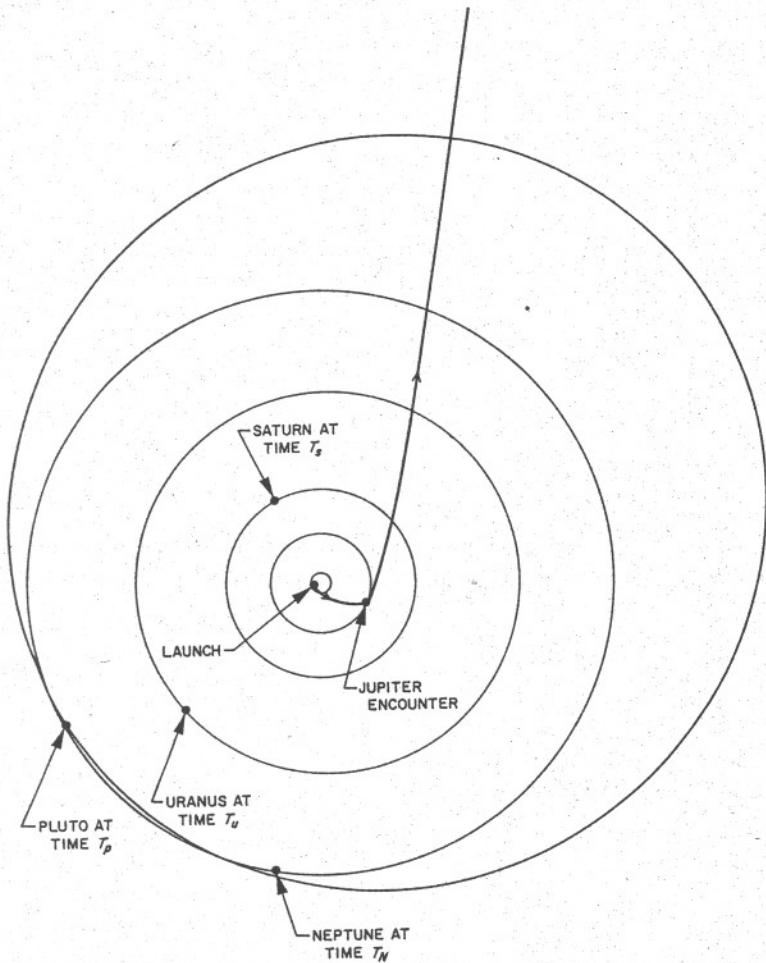


Fig. 15. Planetary configuration for Earth-Jupiter-escape, 1973 (April 14 trajectory)

Fig. 16. April 14, 1973, Earth-Jupiter-escape trajectory during its closest approach to Jupiter

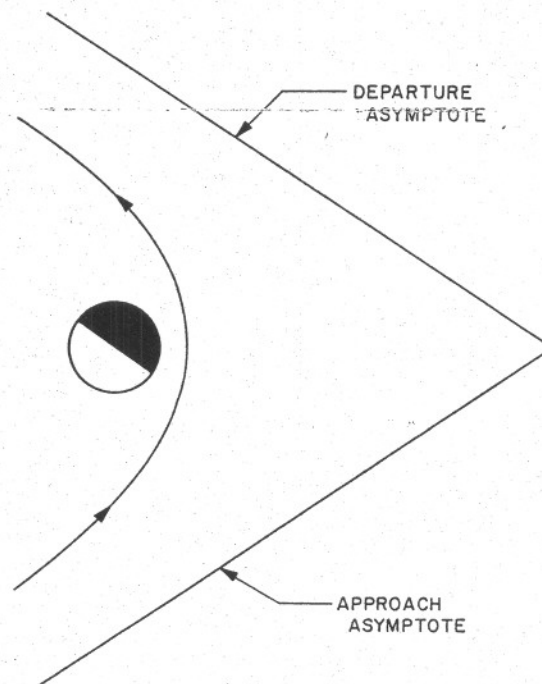


Table 13. EARTH-JUPITER-escape, 1974 (launch HEV = 11.5 km/sec)

Launch Date (1974)	T ₁₂ (days)	θ_{12} (deg)	ϕ_{12} (deg)	a ₁ (A.U.)	e ₁	$\bar{B} \cdot \hat{T}$ (km)	$\bar{B} \cdot \hat{R}$ (km)	V ₁ (km/sec)	TISI (days)	DOCA (km)	DA (deg)	V ₂ (km/sec)	a ₃ (A.U.)	e ₃	V ∞ (km/sec)	TTS (yr)
5/11	440.0	141.85	2.11	8.404	0.8803	399578.	-521.	15.896	68.93	51016.	111.88	28.349	-1.992	3.487	21.105	2.784
5/13	436.0	139.74	2.02	8.777	0.8851	394311.	-729.	16.037	68.34	49937.	111.60	28.486	-1.958	3.530	21.288	2.763
5/15	430.0	137.44	1.93	9.513	0.8939	384920.	-937.	16.278	67.32	47882.	111.14	28.729	-1.899	3.608	21.612	2.730
5/17	426.0	135.33	1.86	10.010	0.8990	379685.	-1087.	16.420	66.75	46737.	110.88	28.869	-1.867	3.653	21.798	2.709
5/19	422.0	133.23	1.79	10.565	0.9042	374476.	-1218.	16.561	66.18	45571.	110.63	29.010	-1.835	3.698	21.985	2.688
5/21	420.0	131.30	1.74	10.708	0.9055	373318.	-1320.	16.595	66.05	45323.	110.56	29.043	-1.828	3.709	22.028	2.680
5/23	420.0	129.56	1.69	10.395	0.9027	376201.	-1405.	16.520	66.36	45992.	110.69	28.966	-1.845	3.684	21.926	2.685
5/25	420.0	127.83	1.65	10.091	0.8998	379088.	-1490.	16.441	66.67	46638.	110.83	28.888	-1.863	3.659	21.823	2.691
5/27	422.0	126.27	1.62	9.441	0.8931	386084.	-1571.	16.257	67.43	48193.	111.17	28.702	-1.905	3.599	21.577	2.709
5/29	426.0	124.90	1.59	8.595	0.8828	397259.	-1652.	15.970	68.64	50624.	111.71	28.415	-1.975	3.508	21.193	2.741
5/31	432.0	123.72	1.57	7.699	0.8696	412754.	-1739.	15.589	70.32	53893.	112.47	28.034	-2.075	3.387	20.679	2.785
6/2	442.0	122.90	1.55	6.709	0.8510	437023.	-1830.	15.034	72.92	58800.	113.65	27.475	-2.237	3.214	19.915	2.856
6/4	458.0	122.64	1.54	5.718	0.8263	474766.	-1925.	14.251	76.95	65875.	115.50	26.683	-2.508	2.975	18.809	2.967

Table 14. EARTH-JUPITER-escape, 1975 (launch HEV = 11.5 km/sec)

Launch Date (1975)	T ₁₂ (days)	θ_{12} (deg)	ϕ_{12} (deg)	a ₁ (A.U.)	e ₁	$\bar{B} \cdot \hat{T}$ (km)	$\bar{B} \cdot \hat{R}$ (km)	V ₁ (km/sec)	TISI (days)	DOCA (days)	DA (deg)	V ₂ (km/sec)	a ₃ (A.U.)	e ₃	V ∞ (km/sec)	TTS (yr)
6/15	458.0	146.58	1.81	7.432	0.8644	455925.	4283.	15.352	73.77	68795.	111.64	27.327	-2.265	3.206	19.792	2.873
6/17	452.0	144.31	1.72	7.886	0.8719	445630.	3972.	15.576	72.69	66663.	111.16	27.551	-2.196	3.274	20.098	2.839
6/19	444.0	141.87	1.64	8.661	0.8831	430939.	3656.	15.899	71.16	63461.	110.50	27.877	-2.103	3.375	20.541	2.793
6/21	440.0	139.78	1.57	9.042	0.8879	425241.	3474.	16.035	70.56	62246.	110.23	28.011	-2.066	3.416	20.721	2.772
6/23	434.0	137.51	1.51	9.793	0.8964	415143.	3268.	16.270	69.50	59965.	109.78	28.248	-2.004	3.491	21.040	2.738
6/25	432.0	135.60	1.46	9.923	0.8976	413875.	3163.	16.306	69.36	59719.	109.70	28.281	-1.996	3.501	21.084	2.730
6/27	428.0	133.52	1.41	10.435	0.9026	408221.	3028.	16.441	68.77	58414.	109.45	28.418	-1.962	3.544	21.266	2.709
6/29	426.0	131.61	1.37	10.563	0.9038	406922.	2939.	16.472	68.63	58114.	109.39	28.449	-1.954	3.554	21.308	2.702
7/1	426.0	129.88	1.33	10.271	0.9011	409960.	2886.	16.399	68.95	58817.	109.53	28.375	-1.972	3.531	21.209	2.707
7/3	428.0	128.34	1.29	9.634	0.8947	417404.	2859.	16.222	69.73	60521.	109.86	28.196	-2.017	3.475	20.970	2.725
7/5	432.0	126.97	1.26	8.795	0.8848	429314.	2846.	15.946	70.98	63188.	110.39	27.917	-2.091	3.388	20.597	2.756
7/7	436.0	125.60	1.23	8.110	0.8755	441327.	2824.	15.674	72.25	65779.	110.95	27.645	-2.168	3.304	20.228	2.788
7/9	446.0	124.78	1.20	7.046	0.8572	467128.	2847.	15.131	74.92	71207.	112.11	27.096	-2.339	3.137	19.477	2.858

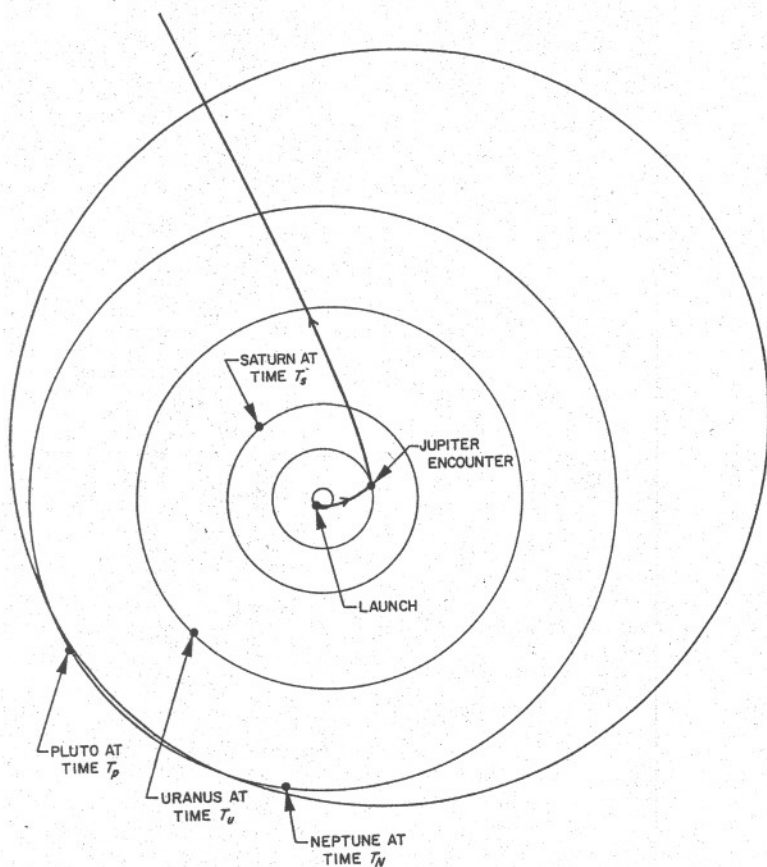
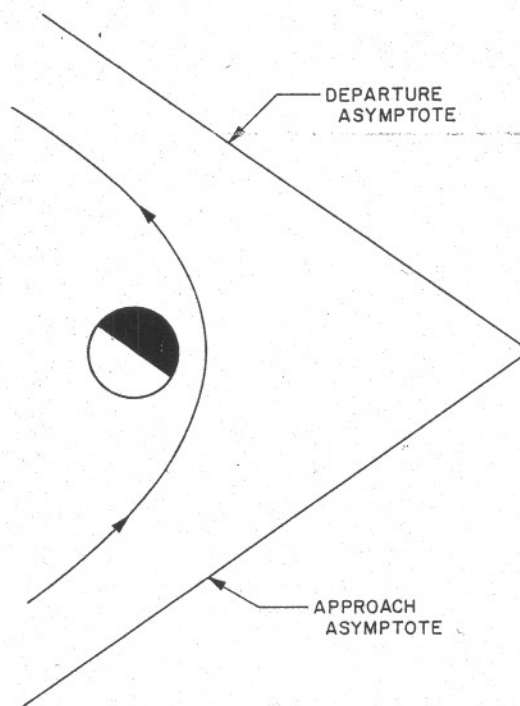


Fig. 17. Planetary configuration for Earth-Jupiter-escape, 1974 (May 21 trajectory)

Fig. 18. May 21, 1974, Earth-Jupiter-escape trajectory during its closest approach to Jupiter



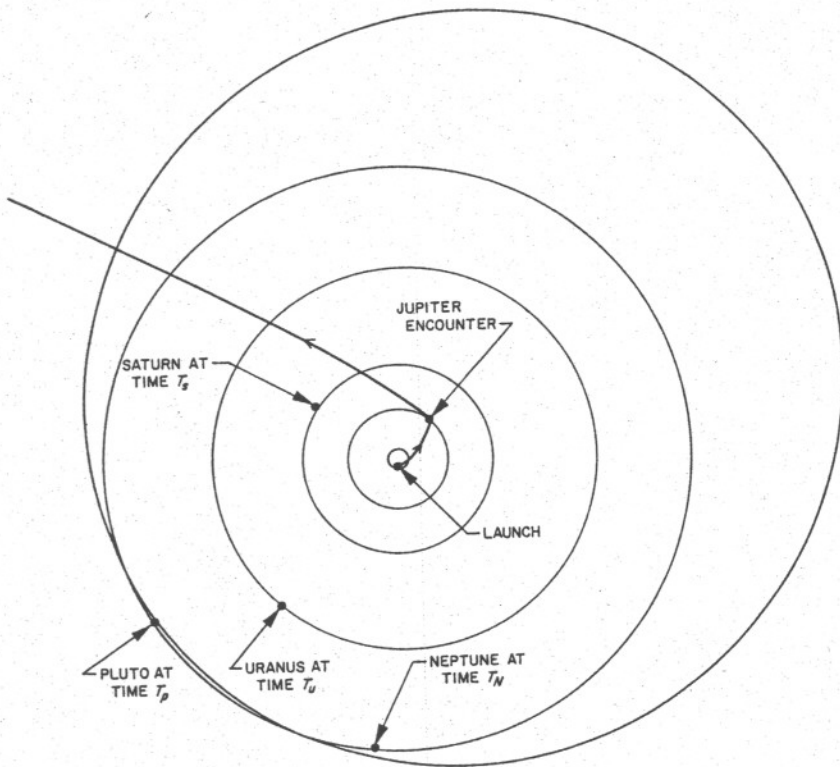
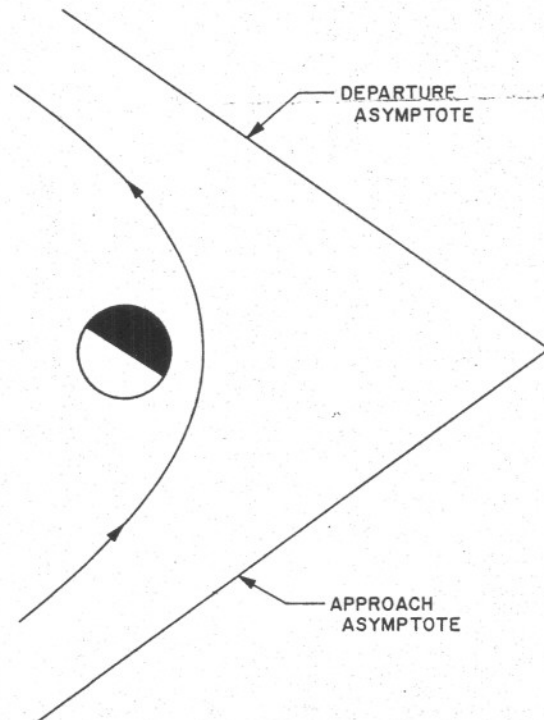


Fig. 19. Planetary configuration for Earth-Jupiter-escape, 1975 (June 29 trajectory)

Fig. 20. June 29, 1975, Earth-Jupiter-escape trajectory during its closest approach to Jupiter



Launch Date (1976)	T_{12} (days)	θ_{12} (deg)	ϕ_{12} (deg)	a_1 (A.U.)	e_1	$\vec{B} \cdot \hat{T}$ (km)	$\vec{B} \cdot \hat{R}$ (km)	V_1 (km/sec)	TISI (days)	DOCA (km)	DA (deg)	V_2 (km/sec)	a_3 (A.U.)	e_3	V_∞ (km/sec)	TTS (yr)
7/23	464.0	145.73	0.55	8.335	0.8790	471768.	7247.	15.504	75.70	77521.	109.94	27.003	-2.320	3.202	19.554	2.871
7/25	458.0	143.47	0.53	8.902	0.8865	461153.	7109.	15.724	74.60	75187.	109.48	27.223	-2.251	3.269	19.854	2.837
7/27	452.0	141.22	0.52	9.572	0.8943	450622.	6979.	15.947	73.52	72810.	109.04	27.447	-2.183	3.339	20.158	2.804
7/29	448.0	139.13	0.50	10.021	0.8989	444709.	6890.	16.078	72.90	71475.	108.78	27.576	-2.146	3.379	20.333	2.783
7/31	444.0	137.05	0.49	10.516	0.9036	438810.	6804.	16.208	72.29	70110.	108.53	27.707	-2.1092	3.421	20.509	2.763
8/2	442.0	135.14	0.47	10.649	0.9047	437444.	6763.	16.241	72.15	69806.	108.46	27.738	-2.101	3.431	20.551	2.755
8/4	440.0	133.22	0.46	10.774	0.9058	436060.	6723.	16.271	72.01	69475.	108.41	27.768	-2.092	3.440	20.591	2.747
8/6	440.0	131.48	0.44	10.488	0.9033	439182.	6727.	16.200	72.34	70202.	108.54	27.698	-2.112	3.418	20.497	2.752
8/8	442.0	129.91	0.42	9.863	0.8973	446841.	6764.	16.031	73.14	71972.	108.86	27.527	-2.159	3.365	20.269	2.770
8/10	446.0	128.50	0.40	9.035	0.8881	459142.	6839.	15.767	74.41	74765.	109.38	27.262	-2.238	3.283	19.911	2.801
8/12	452.0	127.27	0.37	8.142	0.8762	476174.	6936.	15.416	76.17	78514.	110.12	26.911	-2.349	3.176	19.431	2.845
8/14	462.0	126.38	0.34	7.138	0.8593	502889.	7065.	14.901	78.92	84178.	111.26	26.392	-2.533	3.020	18.715	2.914
8/16	478.0	125.99	0.29	6.115	0.8367	544441.	7176.	14.171	83.15	92402.	113.04	25.656	-2.841	2.803	17.673	3.023

Table 16. EARTH-JUPITER-escape, 1977 (launch HEV = 11.5 km/sec)

Launch Date (1977)	T_{12} (days)	θ_{12} (deg)	ϕ_{12} (deg)	a_1 (A.U.)	e_1	$\vec{B} \cdot \hat{T}$ (km)	$\vec{B} \cdot \hat{R}$ (km)	V_1 (km/sec)	TISI (days)	DOCA (km)	DA (deg)	V_2 (km/sec)	a_3 (A.U.)	e_3	V_∞ (km/sec)	TTS (yr)
8/23	498.0	152.07	1.05	7.297	0.8632	518786.	7431.	14.668	82.19	89963.	110.91	25.865	-2.669	2.971	18.229	3.025
8/25	488.0	149.49	0.94	8.000	0.8750	498799.	7621.	15.033	80.13	85708.	110.09	26.230	-2.526	3.082	18.739	2.967
8/27	480.0	147.07	0.86	8.685	0.8846	483607.	7718.	15.326	78.56	82382.	109.46	26.522	-2.421	3.171	19.142	2.921
8/29	474.0	144.82	0.80	9.271	0.8917	473133.	7774.	15.538	77.46	80059.	109.02	26.732	-2.350	3.236	19.429	2.887
8/31	468.0	142.56	0.74	9.960	0.8991	462716.	7797.	15.752	76.38	77684.	108.59	26.945	-2.281	3.303	19.719	2.854
9/2	462.0	140.30	0.70	10.785	0.9067	452377.	7795.	15.970	75.30	75266.	108.17	27.163	-2.215	3.372	20.013	2.821
9/4	458.0	138.20	0.66	11.336	0.9112	446558.	7803.	16.096	74.69	73895.	107.93	27.289	-2.178	3.412	20.183	2.801
9/6	456.0	136.26	0.64	11.482	0.9123	445206.	7836.	16.127	74.55	73586.	107.87	27.318	-2.169	3.421	20.223	2.793
9/8	454.0	134.32	0.62	11.619	0.9133	443838.	7864.	16.155	74.41	73248.	107.82	27.347	-2.161	3.431	20.262	2.785
9/10	454.0	132.54	0.61	11.296	0.9109	446914.	7926.	16.086	74.74	73969.	107.95	27.278	-2.181	3.409	20.170	2.790
9/12	458.0	131.08	0.61	10.241	0.9018	458962.	8060.	15.828	76.01	76806.	108.44	27.020	-2.258	3.328	19.823	2.821
9/14	462.0	129.62	0.61	9.387	0.8931	471099.	8189.	15.573	77.29	79569.	108.95	26.767	-2.338	3.249	19.479	2.852
9/16	470.0	128.48	0.62	8.261	0.8790	492546.	8371.	15.146	79.53	84332.	109.84	26.342	-2.484	3.118	18.897	2.908

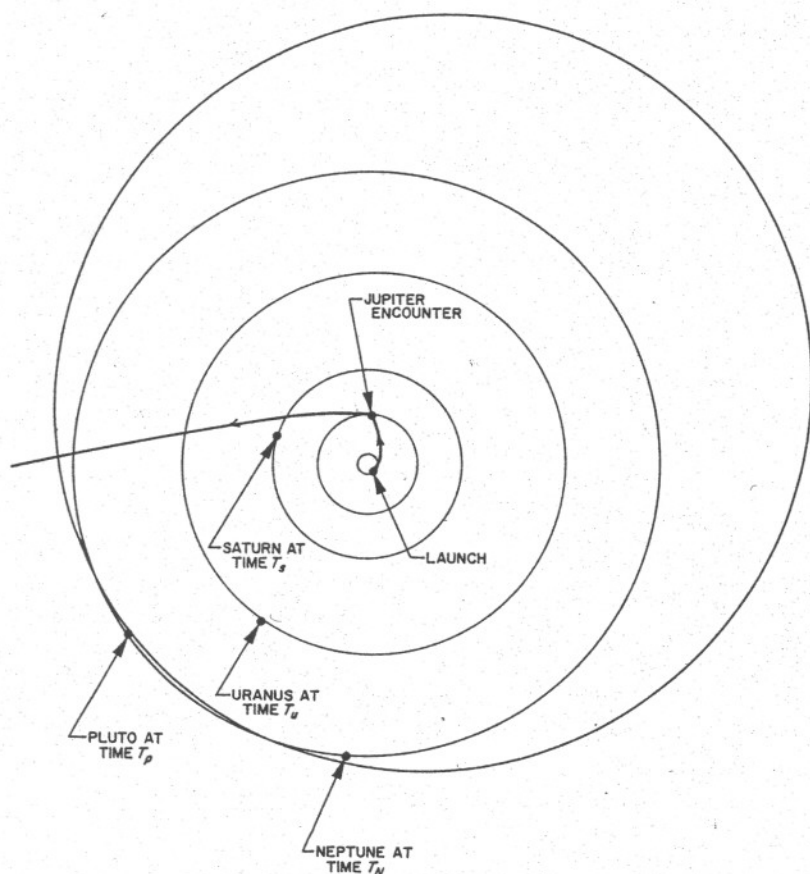
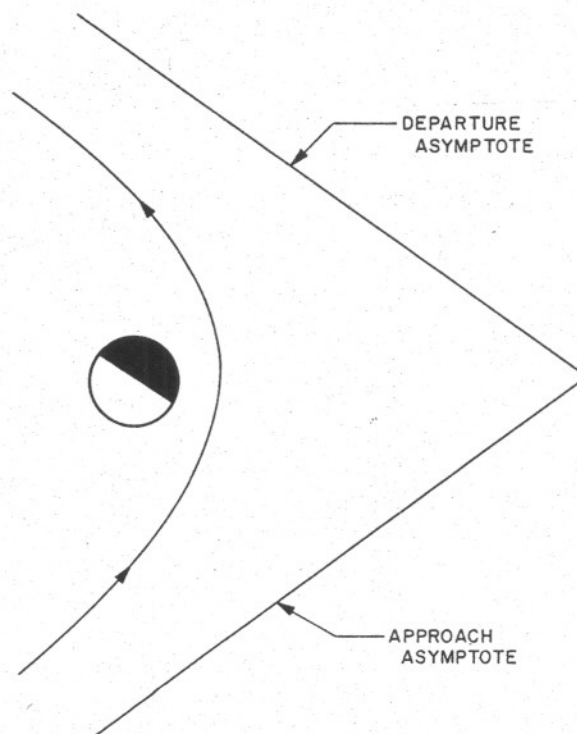


Fig. 21. Planetary configuration for Earth-Jupiter-escape, 1976 (Aug. 4 trajectory)

Fig. 22. August 4, 1976, Earth-Jupiter-escape trajectory during its closest approach to Jupiter



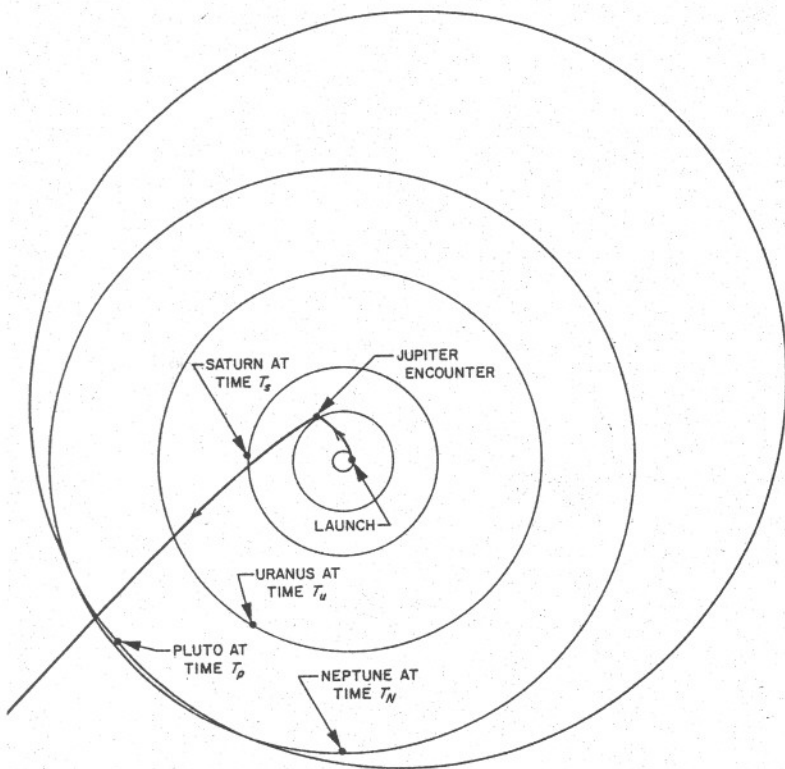


Fig. 23. Planetary configuration for Earth-Jupiter-escape, 1977 (Sept. 8 trajectory)

Fig. 24. September 8, 1977, Earth-Jupiter-escape trajectory during its closest approach to Jupiter

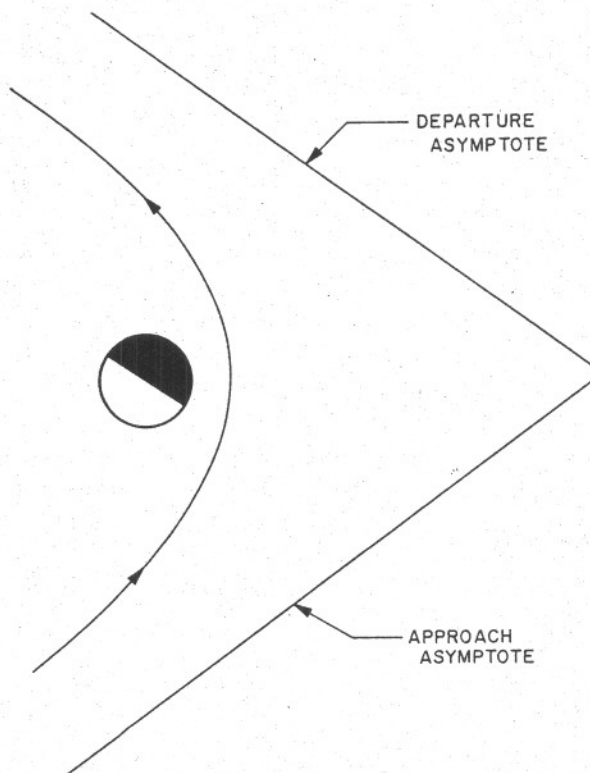


Table 17. Earth-Jupiter escape, 1978 (launch HEV = 11.5 km/sec)

Launch Date (1978)	T_{12} (days)	θ_{12} (deg)	ϕ_{12} (deg)	a_1 (A.U.)	e_1	$\hat{B} \cdot \hat{T}$ (km)	$\hat{B} \cdot \hat{R}$ (km)	V_1 (km/sec)	TISI (days)	DOCA (km)	DA (deg)	V_2 (km/sec)	a_3 (A.U.)	e_3	V_∞ (km/sec)	TTS (yr)
9/29	492.0	147.61	1.96	9.045	0.8902	473315.	5210.	15.208	79.79	78685.	109.64	26.348	-2.432	3.214	19.101	2.959
10/1	486.0	145.34	1.83	9.667	0.8970	436690.	5437.	15.416	78.72	76490.	109.21	26.551	-2.362	3.278	19.379	2.925
10/3	480.0	143.06	1.73	10.400	0.9042	453496.	5607.	15.626	77.65	74236.	108.80	26.758	-2.295	3.345	19.660	2.892
10/5	474.0	140.79	1.64	11.277	0.9115	443669.	5734.	15.839	76.60	71941.	108.40	26.969	-2.230	3.413	19.945	2.859
10/7	470.0	138.66	1.56	11.862	0.9159	438167.	5835.	15.962	76.00	70648.	108.17	27.091	-2.194	3.452	20.108	2.839
10/9	468.0	136.68	1.51	12.012	0.9169	436897.	5929.	15.991	75.87	70353.	108.11	27.119	-2.186	3.461	20.146	2.832
10/11	466.0	134.71	1.45	12.151	0.9179	435610.	6013.	16.017	75.73	70029.	108.07	27.146	-2.178	3.470	20.183	2.824
10/13	468.0	133.04	1.42	11.359	0.9122	442797.	6126.	15.856	76.52	71726.	108.37	26.986	-2.225	3.419	19.969	2.842
10/15	470.0	131.37	1.39	10.666	0.9066	450028.	6240.	15.693	77.31	73385.	108.68	26.827	-2.273	3.367	19.755	2.860
10/17	476.0	130.00	1.37	9.475	0.8952	465948.	6389.	15.352	79.03	77001.	109.35	26.492	-2.382	3.260	19.300	2.903
10/19	486.0	128.95	1.37	8.168	0.8788	490927.	6570.	14.851	81.71	82489.	110.40	25.996	-2.559	3.105	18.619	2.972

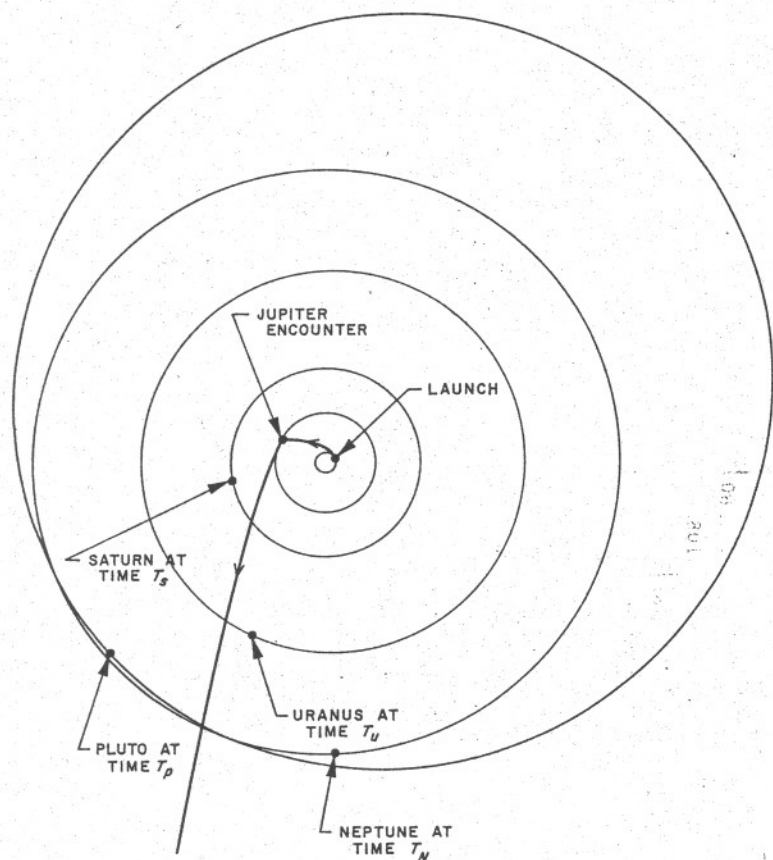


Fig. 25. Planetary configuration for Earth-Jupiter-escape, 1978 (Oct. 11 trajectory)

Fig. 26. October 11, 1978, Earth-Jupiter-escape trajectory during its closest approach to Jupiter

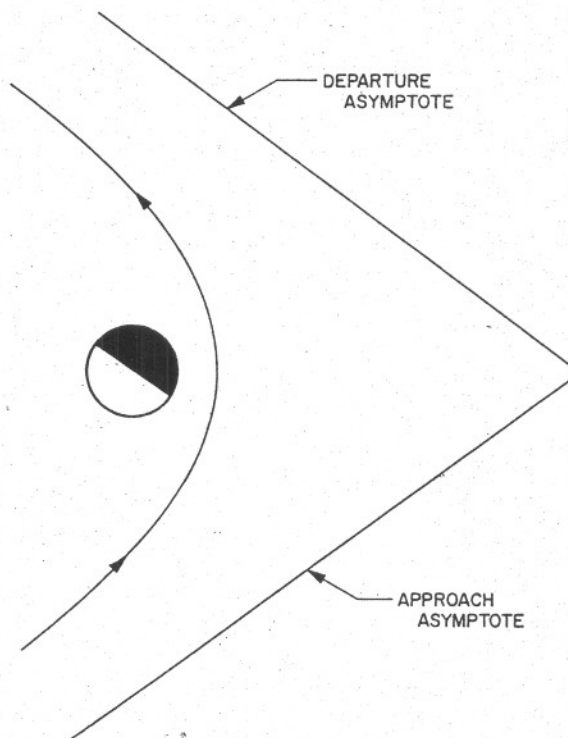


Table 18. Earth-Venus deep space launch date = Aug. 12, 1970

T_{12} (days)	HEV_1 (km/sec)	θ_{12} (deg)	ϕ_{12} (deg)	a_1 (A.U.)	e_1	Aphelion (A.U.)	$\hat{B} \cdot \hat{T}$ (km)	$\hat{B} \cdot \hat{R}$ (km)	V_1 (km/sec)	TISI (days)	DOCA (km)	DA (deg)	V_2 (km/sec)	a_3 (A.U.)	e_3	Aphelion ₃ (A.U.)
104.0	3.747	110.89	0.39	0.8169	0.2417	1.0143	-9881.	1119.	37.083	1.72	0.	53.90	42.364	1.3312	0.4659	1.951
↓	↓	↓	↓	↓	↓	↓	-10436.	1182.	↓	1.72	500.	51.41	42.221	1.3075	0.4575	1.906
↓	↓	↓	↓	↓	↓	↓	-10984.	1244.	↓	1.72	1000.	49.16	42.082	1.2853	0.4495	1.863
↓	↓	↓	↓	↓	↓	↓	-11529.	1305.	↓	1.72	1500.	47.09	41.947	1.2645	0.4418	1.823
↓	↓	↓	↓	↓	↓	↓	-	-	↓	-	-	-	-	-	-	-
105.0	3.664	112.50	0.30	0.8197	0.2374		-10039.	1163.	37.138	1.76	0.	55.54	42.316	1.3223	0.4610	1.9318
↓	↓	↓	↓	↓	↓	↓	-10597.	1228.	↓	1.76	500.	53.02	42.186	1.3011	0.4533	1.891
↓	↓	↓	↓	↓	↓	↓	-11149.	1292.	↓	1.76	1000.	50.73	42.058	1.2808	0.4459	1.852
↓	↓	↓	↓	↓	↓	↓	-11697.	1355.	↓	1.76	1500.	48.64	41.933	1.2617	0.4387	1.815
↓	↓	↓	↓	↓	↓	↓	-	-	↓	-	-	-	-	-	-	-
106.0	3.585	114.11	0.20	0.8223	0.2333		-10201.	1211.	37.190	1.81	0.	57.19	42.257	1.3118	0.4554	1.909
106.0	3.585	114.11	0.20	0.8223	0.2333	↓	-10763.	1278.	37.190	1.81	500.	54.65	42.140	1.2930	0.4486	1.873

Launch Date	T_{12} (days)	HEV_1 (km/sec)	θ_{12} (deg)	ϕ_{12} (deg)	a_1 (A.U.)	e_1	Aphelion (A. U.)	$\bar{B}_T$ (km)	$\bar{B}_R$ (km)	V_1 (km/sec)	TISI (days)	DOCA (km)	DA (deg)	V_2 (km/sec)	a_3 (A.U.)	e_3	Aphelion ₃ (A. U.)
12/13/66	198.0	3.883	160.85	1.23	1.304	0.2549	1.638	5190.	228.	22.078	1.86	1000.	18.56	24.372	1.5457	0.1953	1.8476
12/19/66	186.0	3.929	151.62	0.64	1.333	0.2687	1.691	5080.	84.	22.285	1.72	1000.	16.05	24.443	1.5715	0.2239	1.9234
12/25/66	180.0	3.785	145.51	0.54	1.341	0.2703	1.704	5049.	-356.	22.375	1.69	1000.	15.61	24.499	1.5791	0.2302	1.9426
12/31/66	168.0	3.953	136.29	0.30	1.380	0.2895	1.780	4959.	-176.	22.658	1.56	1000.	13.35	24.636	1.6154	0.2618	2.0383
1/6/67	162.0	3.894	130.18	0.27	1.389	0.2923	1.794	4944.	-141.	22.743	1.54	1000.	13.00	24.695	1.624	0.2673	2.0581
1/12/67	156.0	3.902	124.06	0.25	1.395	0.2952	1.807	4917.	392.	22.811	1.52	1000.	12.68	24.734	1.6298	0.2715	2.0723
1/18/67	150.0	3.997	117.95	0.24	1.400	0.2984	1.817	4920.	-88.	22.859	1.50	1000.	12.40	24.767	1.6347	0.2769	2.0874

Table 20. EARTH-MOON-escape, $\Delta V_1 = 3.1316$ km/sec; $T_{12} = 112.28$ hr; $\theta_{12} = 179.24^\circ$;
 $a_1 = 0.19598 \times 10^6$ km; $e_1 = 0.9664$; $V_1 = 0.200$ km/sec; injection altitude = 200 km

DOCA (km)	TISI (hr)	ΔV_2 (km/sec)	$\Delta \Delta V_1$ (km/sec)	DA (deg)	V_2 (km/sec)	a_3 (km $\times 10^6$)	e_3	V_∞ (km/sec)	ΔV_∞ (km/sec)
0.	35.22	1.413	0.1166	106.63	1.613	-0.7569	1.4217	0.7257	-
100.	35.26	1.405	0.1156	104.91	1.605	-0.7927	1.3998	0.7091	-
200.	35.31	1.399	0.1146	103.26	1.599	-0.8278	1.3804	0.6939	-
300.	35.35	1.393	0.1138	101.68	1.593	-0.8615	1.3633	0.6802	-
400.	35.39	1.387	0.1130	100.16	1.587	-0.8933	1.3486	0.6680	-
500.	35.44	1.383	0.1124	98.70	1.583	-0.9227	1.3360	0.6573	-
600.	35.48	1.379	0.1118	97.28	1.579	-0.9491	1.3253	0.6481	-
700.	35.52	1.376	0.1114	95.92	1.576	-0.9720	1.3166	0.6404	-
800.	35.56	1.374	0.1110	94.60	1.574	-0.9912	1.3097	0.6341	-
900.	35.60	1.372	0.1107	93.32	1.572	-1.0065	1.3044	0.6293	-
1000.	35.64	1.370	0.1105	92.09	1.570	-1.0177	1.3006	0.6259	-

Table 21. EARTH-MOON-escape, $\Delta V_1 = 3.3493$ km/sec; $T_{12} = 38.23$ hr;
 $\theta_{12} = 157.35^\circ$; $a_1 = -0.14410 \times 10^6$ km; $e_1 = 1.0457$; $V_1 = 2.200$ km/sec;
 injection altitude = 200 km; $HEV_1 = 1.6631$

DOCA (km)	TISI (hr)	ΔV_2 (km/sec)	$\Delta \Delta V_1$ (km/sec)	DA (deg)	V_2 (km/sec)	a_3 (km $\times 10^6$)	e_3	V_∞ (km/sec)	ΔV_∞ (km/sec)
0.	15.06	0.971	0.2318	39.68	3.171	-0.49935	7.5640	2.8253	1.1621
100.	15.07	0.978	0.2337	38.17	3.178	-0.4968	7.6390	2.8327	1.1695
200.	15.07	0.984	0.2354	36.77	3.184	-0.4944	7.7087	2.8395	1.1767
300.	15.08	0.989	0.2369	35.47	3.189	-0.49217	7.7736	2.8458	1.1826
400.	15.08	0.995	0.2384	34.26	3.195	-0.4902	7.8341	2.8517	1.1885
500.	15.09	1.000	0.2398	33.14	3.200	-0.4883	7.8905	2.8572	1.1940
600.	15.09	1.004	0.2411	32.08	3.204	-0.4866	7.9433	2.8622	1.1990
700.	15.10	1.008	0.2423	31.10	3.208	-0.4849	7.9928	2.8669	1.2037
800.	15.11	1.012	0.2434	30.17	3.212	-0.4835	8.0392	2.8714	1.2082
900.	15.11	1.016	0.2444	29.29	3.216	-0.4821	8.0827	2.8755	1.2123
1000.	15.12	1.019	0.2454	28.47	3.219	-0.4808	8.1237	2.8794	1.2162

Table 22. EARTH-MOON-escape, $\Delta V_1 = 3.9100$ km/sec; $T_{12} = 22.94$ hr;
 $\theta_{12} = 139.89^\circ$; $a_1 = -0.02561 \times 10^6$ km; $e_1 = 1.2569$; $V_1 = 4.200$ km/sec;
 injection altitude = 200 km; $HEV_1 = 3.9454$ km/sec

DOCA (km)	TISI (hr)	ΔV_2 (km/sec)	$\Delta \Delta V_1$ (km/sec)	DA (deg)	V_2 (km/sec)	a_3 (km $\times 10^6$)	e_3	V_∞ (km/sec)	ΔV_∞ (km/sec)
0.	8.49	1.068	0.4245	15.37	5.268	-0.01553	25.250	5.0670	1.1216
100.	8.49	1.070	0.4256	14.63	5.270	-0.01551	25.327	5.0696	1.1242
200.	8.49	1.072	0.4265	13.97	5.272	-0.01549	25.393	5.0718	1.1264
300.	8.49	1.074	0.4273	13.36	5.274	-0.01548	25.450	5.0738	1.1284
400.	8.49	1.076	0.4281	12.80	5.276	-0.01547	25.501	5.0755	1.1304
500.	8.49	1.077	0.4287	12.29	5.277	-0.01546	25.545	5.0770	1.1316
600.	8.49	1.079	0.4292	11.82	5.279	-0.01546	25.584	5.0784	1.1330
700.	8.49	1.080	0.4297	11.38	5.280	-0.01545	25.619	5.0795	1.1341
800.	8.49	1.081	0.4302	10.97	5.281	-0.01544	25.649	5.0806	1.1352
900.	8.49	1.082	0.4306	10.59	5.282	-0.01544	25.677	5.0815	1.1361
1000.	8.49	1.082	0.4309	10.24	5.282	-0.01543	25.702	5.0824	1.1370

Table 23. EARTH-MOON-escape, $\Delta V_1 = 4.7679$; $T_{12} = 16.27$ hr;
 $\theta_{12} = 126.66^\circ$; $a_1 = -10961$ km; $e_1 = 1.6002$; $V_1 = 6.200$ km/sec;
 injection altitude = 200 km; $HEV_1 = 6.0304$ km/sec

DOCA (km)	TISI (hr)	ΔV_2 (km/sec)	$\Delta \Delta V_1$ (km/sec)	DA (deg)	V_2 (km/sec)	a_3 (km)	e_3	V_∞ (km/sec)	ΔV_∞ (km/sec)
0.	5.85	1.031	0.5400	7.73	7.231	-7938.	47.944	7.0862	1.056
100.	5.85	1.029	0.5390	7.33	7.229	-7942.	47.848	7.0844	1.054
200.	5.85	1.028	0.5381	6.98	7.228	-7946.	47.760	7.0828	1.052
300.	5.85	1.026	0.5373	6.65	7.226	-7949.	47.679	7.0813	1.051
400.	5.85	1.025	0.5366	6.36	7.225	-7952.	47.604	7.0799	1.050
500.	5.85	1.024	0.5359	6.09	7.224	-7955.	47.534	7.0786	1.048
600.	5.85	1.022	0.5353	5.84	7.222	-7958.	47.648	7.0774	1.047
700.	5.85	1.021	0.5346	5.61	7.221	-7960.	47.407	7.0763	1.046
800.	5.85	1.020	0.5340	5.40	7.220	-7963.	47.350	7.0752	1.045
900.	5.85	1.019	0.5335	5.21	7.219	-7965.	47.297	7.0742	1.044
1000.	5.85	1.018	0.5330	5.03	7.218	-7967.	47.247	7.0733	1.043

Table 24. EARTH-MOON-escape, $\Delta V_1 = 5.867$ km/sec; $T_{12} = 12.56$ hr;
 $\theta_{12} = 117.16^\circ$; $a_1 = 6117.$; $e_1 = 2.0754$; $V_1 = 8.200$ km/sec; injection
 altitude = 200 km; $HEV_1 = 8.073$ km/sec

DOCA (km)	TISI (hr)	ΔV_2 (km/sec)	$\Delta \Delta V_1$ (km/sec)	DA (deg)	V_2 (km/sec)	a_3 (km)	e_3	V_∞ (km/sec)	ΔV_∞ (km/sec)
0.	4.45	0.872	0.541	4.58	9.072	-4968.	65.926	8.957	0.884
100.	4.45	0.870	0.540	4.34	9.070	-4971.	65.731	8.955	0.882
200.	4.45	0.868	0.538	4.12	9.068	-4973.	65.554	8.953	0.880
300.	4.45	0.866	0.537	3.93	9.066	-4975.	65.394	8.951	0.878
400.	4.45	0.864	0.536	3.75	9.064	-4977.	65.248	8.949	0.876
500.	4.45	0.863	0.535	3.59	9.063	-4979.	65.113	8.947	0.874 ³
600.	4.45	0.861	0.534	3.44	9.061	-4981.	64.989	8.946	0.873
700.	4.45	0.860	0.533	3.30	9.060	-4982.	64.876	8.945	0.872
800.	4.45	0.859	0.533	3.17	9.059	-4984.	64.770	8.943	0.870
900.	4.45	0.857	0.532	3.06	9.057	-4985.	64.672	8.942	0.869
1000.	4.45	0.856	0.531	2.95	9.056	-4986.	64.581	8.941	0.868

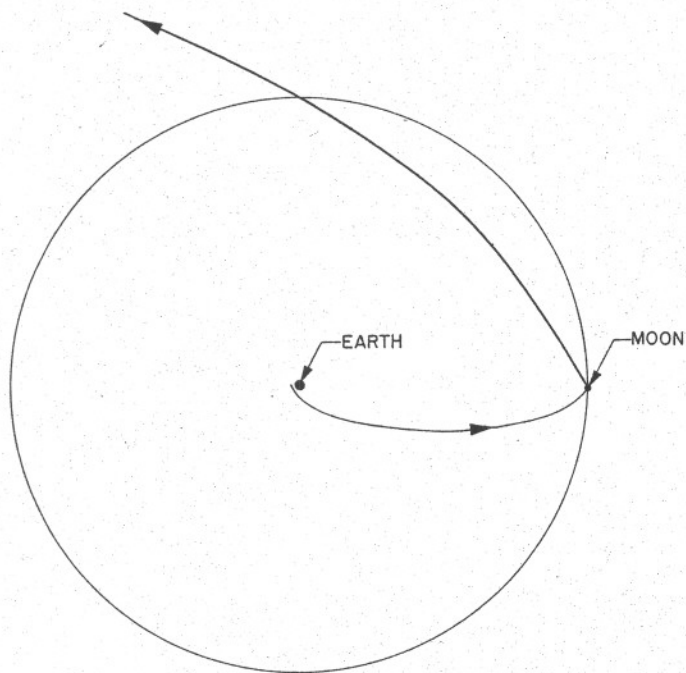


Fig. 27. Earth-Moon-escape,
 DOCA = 100 km

Fig. 28. Graph of the function
 of q_m in terms of orbital velocity
 at a distance R_1

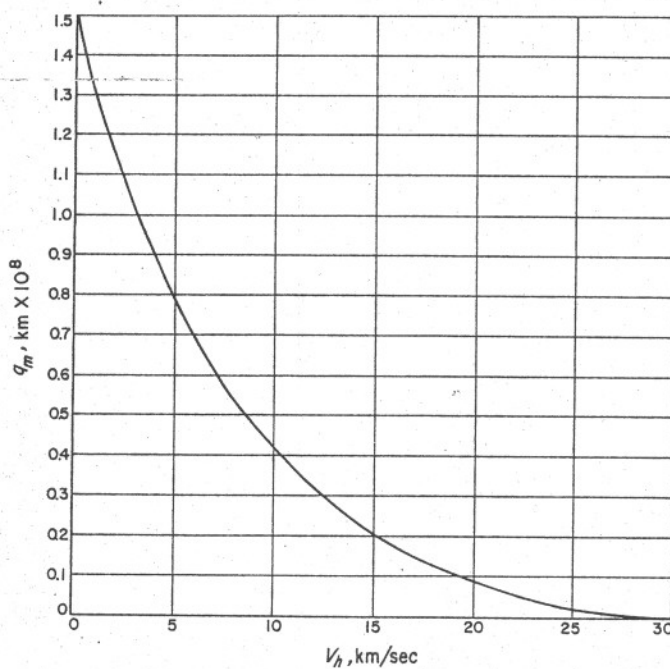


Table 25. EARTH-VENUS minimum perihelion, launch date = Aug. 22, 1970

T_{12} (days)	HEV_1 (km/sec)	θ_{12} (deg)	ϕ_{12} (deg)	a_1 (A.U.)	e_1	Perihelion ₁ (A. U.)	$\hat{B}_T$ (km)	$\hat{B}_R$ (km)	V_1 (km/sec)	TISI (hr)	DOCA (km)	DA (deg)	V_2 (km/sec)	a_3 (A.U.)	e_3	Perihelion ₃ (A. U.)
70.	7.504	62.80	2.68	0.7019	0.4421	2.393	1727.	-31.	34.444	0.90	-5249.	75.06	19.339	0.4273	0.6948	0.130
74.	6.630	69.19	2.25	0.7238	0.3983	0.436	1987.	-50.	35.020	1.00	-5156.	78.37	20.852	0.4398	0.6454	0.156
78.	5.872	75.59	1.85	0.7442	0.3595	0.477	2293.	-75.	35.525	1.10	-5051.	81.71	22.242	0.4528	0.5969	0.183
82.	5.218	81.99	1.47	0.7632	0.3255	0.514	2653.	-110.	35.964	1.21	-4933.	85.09	23.518	0.46624	0.5496	0.210
86.	4.659	88.41	1.11	0.7804	0.2960	0.549	3075.	-162.	36.345	1.34	-4802.	88.54	24.688	0.4800	0.5041	0.238
90.	4.185	94.84	0.74	0.7959	0.2707	0.581	3566.	-238.	36.672	1.48	-4658.	92.11	25.756	0.4939	0.4606	0.2664
94.	3.793	101.28	0.37	0.8096	0.2492	0.617	4130.	-354.	36.951	1.64	-4505.	95.82	26.726	0.5079	0.4196	0.2948
98.	3.476	107.72	0.02	0.8216	0.2312	0.632	4761.	-534.	37.188	1.81	-4349.	99.68	27.597	0.5215	0.3815	0.3225
102.	3.231	114.17	0.44	0.8319	0.2164	0.653	5433.	-815.	37.386	1.99	-4200.	103.71	28.367	0.5346	0.3469	0.3491
106.	3.057	120.63	0.90	0.8405	0.2044	0.669	6090.	-1252.	37.551	2.18	-4075.	107.82	29.029	0.5467	0.3164	0.3737
110.	2.955	127.09	1.43	0.8477	0.1948	0.683	6617.	-1910.	37.685	2.36	-3989.	111.85	29.569	0.5571	0.2911	0.3949
114.	2.933	133.56	2.07	0.8535	0.1872	0.695	6828.	-2838.	37.791	2.51	-3958.	115.39	29.961	0.5651	0.2725	0.4111
118.	3.010	140.02	2.85	0.8580	0.1815	0.703	6487.	-3979.	37.874	2.60	-3982.	117.78	30.167	0.5693	0.2627	0.4197

Table 26. EARTH-MARS minimum perihelion, launch date = May 19, 1971

T_{12} (days)	HEV_1 (km/sec)	θ_{12} (deg)	ϕ_{12} (deg)	a_1 (A.U.)	e_1	q_1 (A.U.)	$\bar{B}_1 \hat{T}$ (km)	$\bar{B}_1 \hat{R}$ (km)	V_1 (km/sec)	TISI (days)	DOCA (km)	DA (deg)	V_2 (km/sec)	a_3 (A.U.)	e_3	q_3 (A.U.)
100.	5.347	90.01	1.83	1.607	0.3706	1.0114	-514.	0.	27.045	1.24	-3183.	82.82	16.739	0.8844	0.5634	0.3861
106.	4.879	93.82	1.81	1.519	0.3338	↓	-657.	0.	26.456	1.37	-3109.	80.20	17.680	0.9132	0.5132	0.4446
112.	4.490	97.62	1.79	1.453	0.3037		-842.	1.	25.956	1.51	-3011.	77.43	18.514	0.9422	0.4662	0.5030
118.	4.167	101.43	1.77	1.403	0.2789		-1079.	2.	25.529	1.66	-2880.	74.50	19.254	0.9713	0.4226	0.5608
124.	3.901	105.24	1.75	1.364	0.2586		-1386.	5.	25.162	1.83	-2704.	71.37	19.908	1.0001	0.3825	0.6176
130.	3.682	109.03	1.74	1.334	0.2419		-1786.	10.	24.844	2.01	-2465.	68.00	20.484	1.0285	0.3459	0.6728
136.	3.502	112.82	1.71	1.311	0.2283		-2309.	20.	24.567	2.21	-2140.	64.38	20.987	1.0560	0.3128	0.7257
142.	3.355	116.60	1.69	1.292	0.2173		-2995.	37.	24.323	2.42	-1694.	60.45	21.422	1.0826	0.2833	0.7758
148.	3.236	120.37	1.67	1.277	0.2083		-3899.	68.	24.107	2.64	-1077.	56.21	21.793	1.1077	0.2575	0.8225
154.	3.139	124.12	1.64	1.266	0.2012		-5095.	126.	23.913	2.87	-219.	51.64	22.104	1.1312	0.2352	0.8651
160.	3.061	127.85	1.62	1.257	0.1955		-6685.	230.	23.737	3.11	982.	46.72	22.358	1.1527	0.2166	0.9030
166.	2.999	131.56	1.59	1.249	0.1911		-8813.	422.	23.576	3.35	2679.	41.47	22.556	1.1720	0.2017	0.9357
172.	2.949	135.25	1.55	1.244	0.1877		-11694.	782.	23.426	3.58	5105.	35.95	22.702	1.1889	0.1902	0.9628
178.	2.911	138.91	1.52	1.241	0.1852		-15675.	1484.	23.285	3.80	8644.	30.20	22.799	1.2031	0.1821	0.9841
184.	2.882	142.54	1.47	1.238	0.1835		-21360.	2941.	23.152	3.99	13991.	24.35	22.848	1.2146	0.1771	0.9995
190.	2.861	146.15	1.42	1.237	0.1824		-29915.	6312.	23.025	4.15	22577.	18.52	22.854	1.2235	0.1749	1.0095
196.	2.847	149.73	1.36	1.236	0.1819		-43419.	15523.	22.903	4.27	37764.	12.93	22.821	1.2299	0.1754	1.0142
202.	2.839	153.27	1.29	1.236	0.1819		-60218.	46419.	22.784	4.34	67437.	8.08	22.753	1.2339	0.1779	1.0143
208.	2.837	156.79	1.19	1.237	0.1822		-16779.	108127.	22.669	4.34	100727.	5.66	22.653	1.2359	0.1824	1.0104
214.	2.840	160.27	1.07	1.238	0.1830		44515.	65560.	22.556	4.37	70645.	7.75	22.527	1.2360	0.1885	1.0030
220.	2.847	163.72	0.89	1.240	0.1840		39075.	31757.	22.445	4.35	41969.	11.88	22.376	1.2346	0.1960	0.9926
226.	2.858	167.13	0.63	1.242	0.1854		29050.	19222.	22.336	4.29	26737.	16.48	22.201	1.2316	0.2049	0.9792
232.	2.879	170.51	0.19	1.244	0.1870		21044.	13791.	22.229	4.19	17429.	21.44	21.994	1.2264	0.2158	0.9617

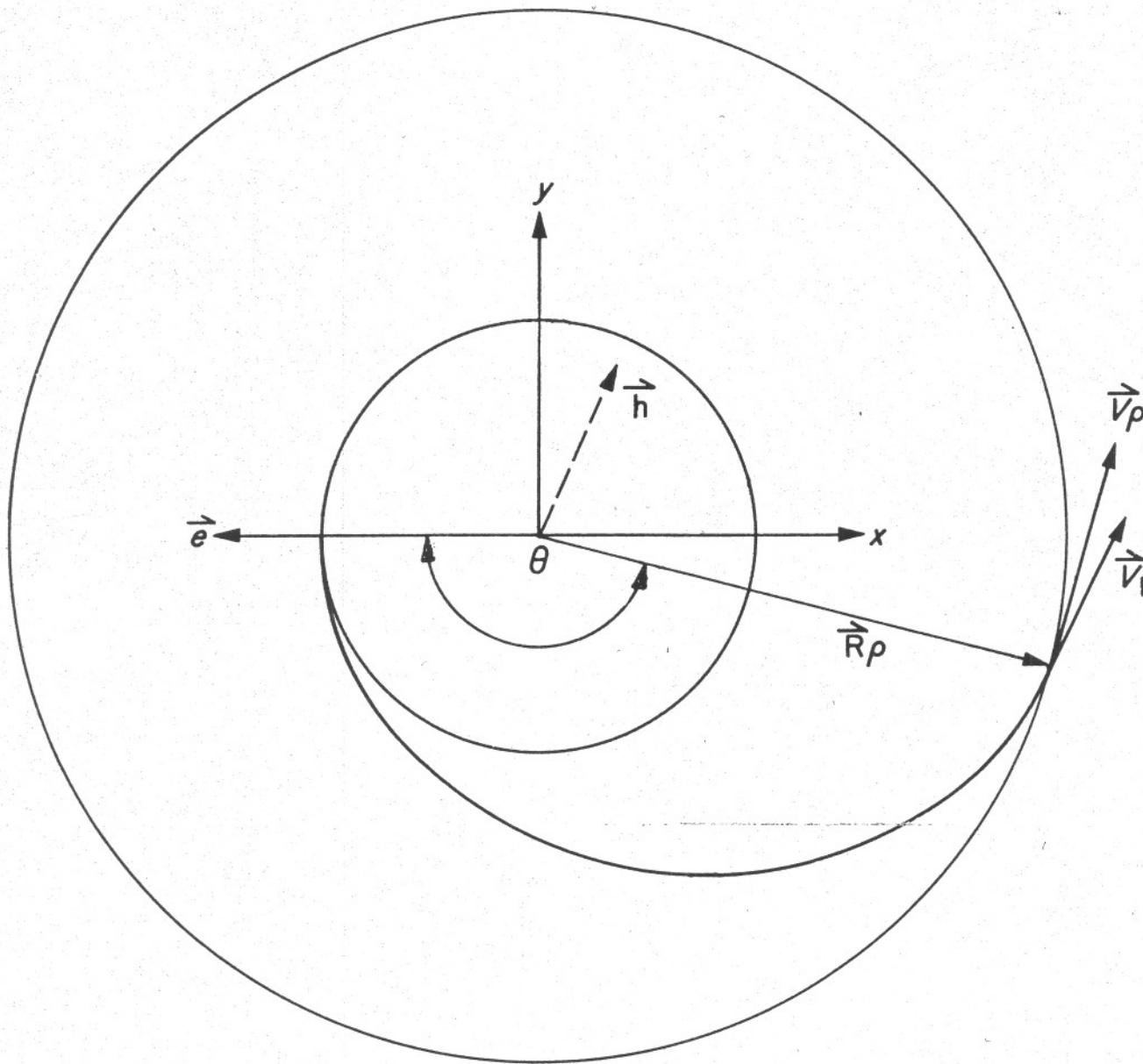


Fig. 29. Description of the functions of $\vec{V}_p$, $\vec{e}$, $\vec{h}$, and $\vec{R}_p$

Table 27. EARTH-JUPITER-SUN, 1967 (Launch HEV = 11.0 km/sec)

Launch Date (1967)	T ₁₂ (days)	θ_{12} (deg)	ϕ_{12} (deg)	$\overline{B} \cdot \hat{T}$ (km)	$\overline{B} \cdot \hat{R}$ (km)	V ₁ (km/sec)	TISI (days)	DOCA (km)	DA (deg)	V ₂ (km/sec)	T ₂₃ (days)	VAP (km/sec)	TFT (yr)
10/25	532.00	151.11	2.68	-1034421	-5217	13.807	87.70	437726	75.18	1.836	726.22	617.45	3.445
10/27	524.00	148.67	2.49	-894402	-7335	14.059	86.06	340222	81.16	3.054	673.75	617.45	3.279
10/29	516.00	146.22	2.32	-796024	-8069	14.317	84.46	276584	85.56	3.954	639.29	617.46	3.163
10/31	510.00	143.92	2.19	-739524	-8231	14.502	83.36	241801	88.20	4.498	619.98	617.46	3.094
11/2	506.00	141.77	2.09	-710782	-8231	14.607	82.75	224597	89.58	4.786	610.22	617.47	3.056
11/4	504.00	139.77	2.00	-704686	-8215	14.630	82.62	220988	89.87	4.848	608.15	617.47	3.045
11/6	504.00	137.91	1.93	-720348	-8242	14.570	82.96	230282	89.12	4.691	613.44	617.46	3.059
11/8	506.00	136.21	1.87	-760482	-8326	14.427	83.79	254552	87.21	4.296	627.05	617.46	3.102
11/10	512.00	134.81	1.82	-863444	-8447	14.128	85.60	319773	82.52	3.337	662.61	617.46	3.216
11/12	522.00	133.70	1.79	-1144673	-7652	13.686	88.52	520570	70.62	0.898	772.13	617.45	3.543

Table 28. EARTH-JUPITER-SUN, 1968 (Launch HEV = 11.0 km/sec)

Launch Date (1968)	T ₁₂ (days)	θ_{12} (deg)	ϕ_{12} (deg)	$\overline{B} \cdot \hat{T}$ (km)	$\overline{B} \cdot \hat{R}$ (km)	V ₁ (km/sec)	TISI (days)	DOCA (km)	DA (deg)	V ₂ (km/sec)	T ₂₃ (days)	VAP (km/sec)	TFT (yr)
11/20	544.00	154.84	2.83	-1223341	10188	13.365	88.47	584811	-67.17	0.537	788.87	617.45	3.649
11/22	532.00	152.06	2.58	-895963	2149	13.759	85.79	342197	80.89	3.380	659.40	617.46	3.263
11/24	522.00	149.44	2.39	-771497	404	14.094	83.76	262032	86.51	4.531	617.74	617.46	3.120
11/26	514.00	146.96	2.23	-696691	-272	14.359	82.22	216864	90.10	5.275	593.35	617.47	3.032
11/28	508.00	144.63	2.11	-651414	-535	14.550	81.17	190627	92.36	5.753	578.64	617.47	2.975
11/30	504.00	142.46	2.01	-627818	-606	14.659	80.57	177281	93.57	6.011	570.96	617.48	2.943
12/2	500.00	140.28	1.91	-605710	-643	14.768	79.99	164996	94.73	6.261	563.71	617.48	2.912
12/4	498.00	138.25	1.84	-601109	-602	14.791	79.86	162468	94.97	6.315	562.17	617.48	2.903
12/6	498.00	136.37	1.77	-613521	-509	14.727	80.19	169328	94.31	6.174	566.20	617.48	2.914
12/8	502.00	134.80	1.72	-663296	-312	14.495	81.45	197448	91.75	5.627	582.39	617.47	2.969
12/10	508.00	133.37	1.67	-742765	-25	14.186	83.19	244450	87.86	4.814	608.17	617.47	3.056
12/12	518.00	132.25	1.63	-906620	625	13.730	85.92	349423	80.41	3.290	662.75	617.46	3.233

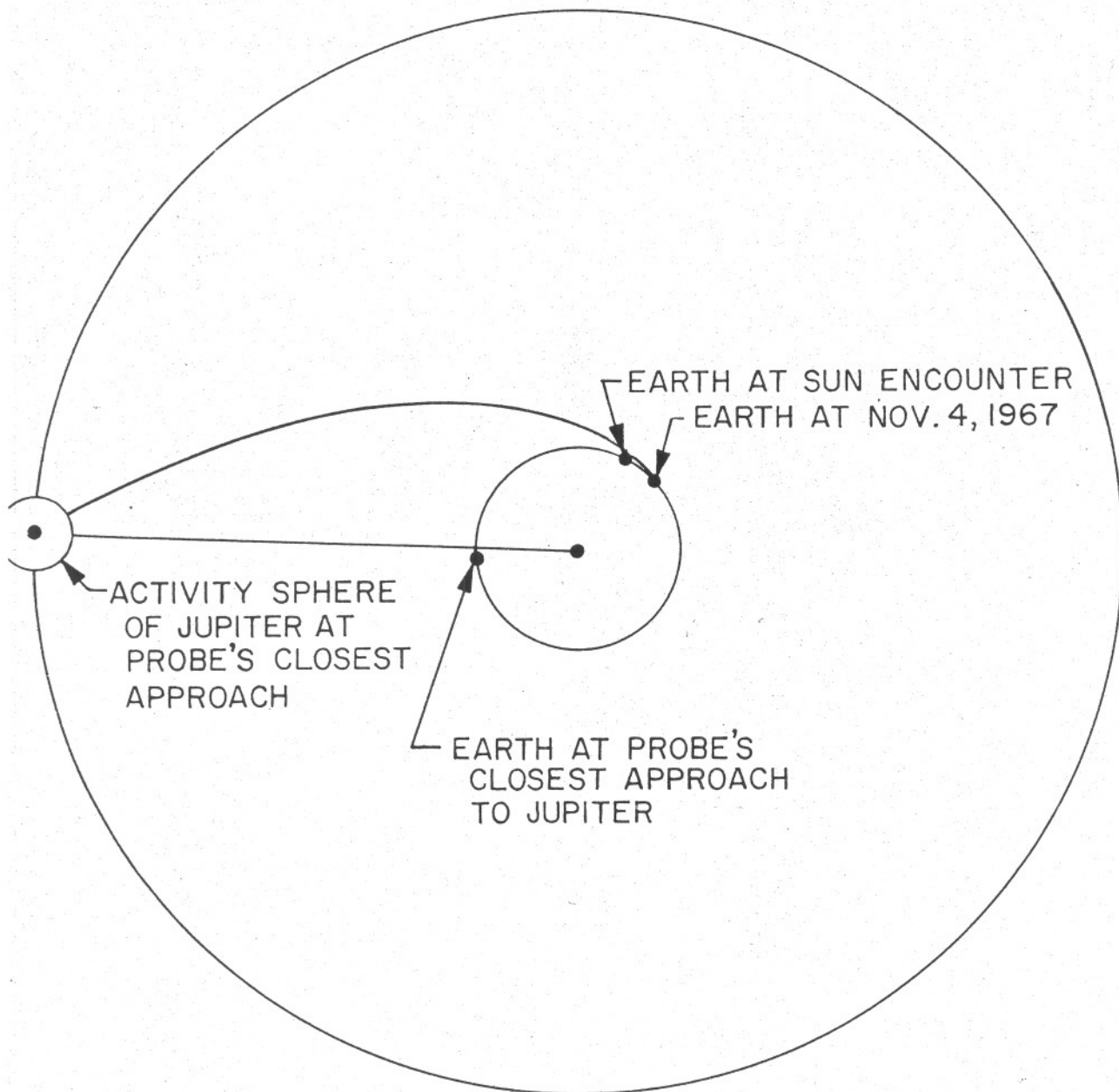


Fig. 30. Planetary configuration for Earth-Jupiter-Sun,
1967 (Nov. 4 trajectory)

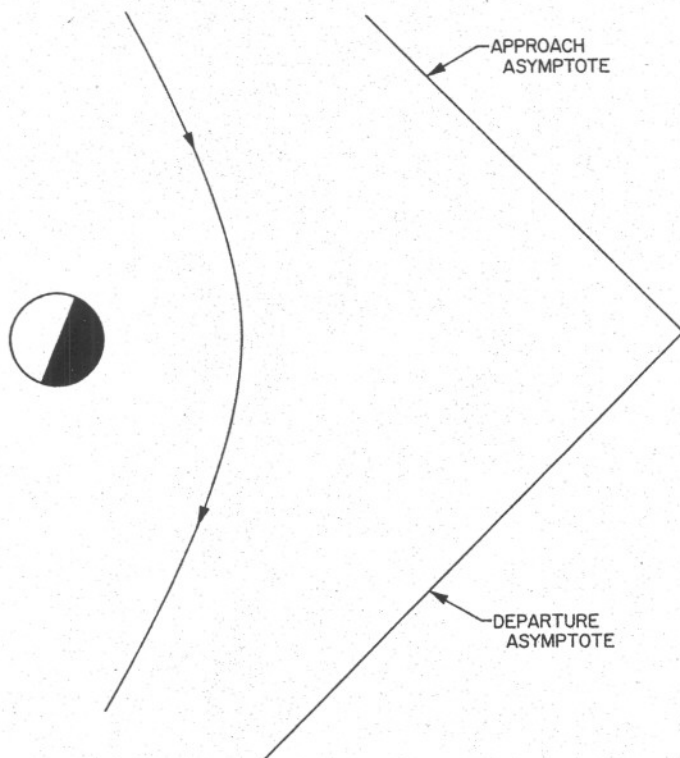
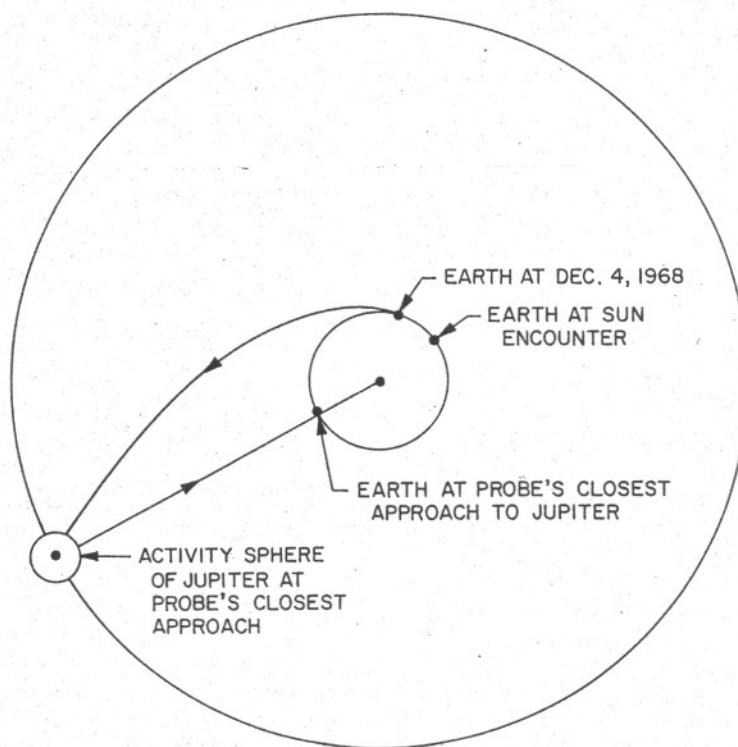


Fig. 31. November 4, 1967,
 Earth-Jupiter-Sun trajectory
 during its closest approach to
 Jupiter

Fig. 32. Planetary
 configuration for Earth-
 Jupiter-Sun, 1968 (Dec. 4
 trajectory)



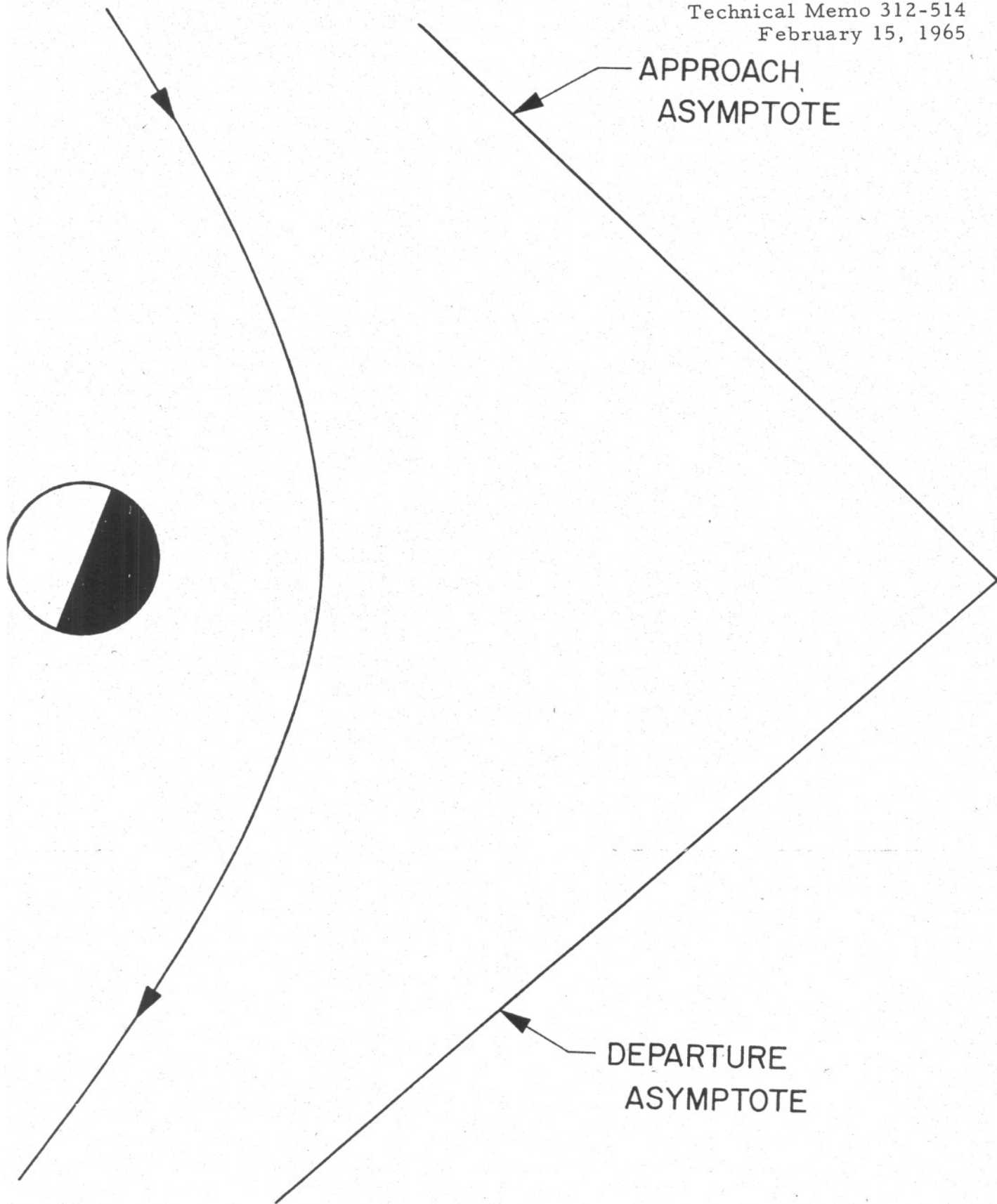


Fig. 33. December 4, 1968, Earth-Jupiter-Sun trajectory during its closest approach to Jupiter

Table 29. Earth-Jupiter-Sun, 1969-70 (launch HEV = 11.0 km/sec)

Launch Date (1969-70)	T ₁₂ (days)	θ_{12} (deg)	ϕ_{12} (deg)	$\bar{E}, \hat{T}$ (km)	$\bar{E}, \hat{R}$ (km)	V ₁ (km/sec)	TISI (days)	DOCA (km)	DA (deg)	V ₂ (km/sec)	T ₂₃ (days)	VAP (km/sec)	TFT (yr)
12/18	538.0	156.48	1.98	-1130395.	15563.	13.338	85.78	519614.	69.60	1.369	730.73	617.44	3.474
12/20	528.0	153.82	1.82	-890011.	10627.	13.667	83.66	343766.	79.98	3.536	640.49	617.45	3.199
12/22	518.0	151.16	1.69	-761202.	8563.	14.009	81.66	259897.	85.93	4.770	598.06	617.46	3.056
12/24	508.0	148.50	1.58	-664843.	7274.	14.362	79.70	201677.	90.69	5.774	567.27	617.47	2.944
12/26	502.0	146.15	1.49	-620987.	6770.	14.560	78.66	176452.	92.98	6.264	553.33	617.48	2.889
12/28	496.0	143.80	1.41	-581548.	6361.	14.761	77.64	154473.	95.11	6.728	540.71	617.48	2.838
12/30	490.0	141.46	1.35	-545740.	6012.	14.963	76.62	135103.	97.11	7.173	529.11	617.49	2.790
1/1	486.0	139.26	1.29	-526922.	5863.	15.079	76.05	125149.	98.19	7.417	522.95	617.49	2.762
1/3	484.0	137.22	1.24	-522948.	5875.	15.105	75.93	123070.	98.42	7.470	521.63	617.49	2.753
1/5	484.0	135.34	1.20	-533441.	6037.	15.038	76.25	128591.	97.81	7.332	525.04	617.49	2.763
1/7	486.0	133.62	1.15	-559667.	6350.	14.881	77.01	142599.	96.31	6.999	533.53	617.48	2.791
1/9	490.0	132.05	1.11	-604977.	6828.	14.637	78.23	167502.	93.82	6.452	548.03	617.48	2.843
1/11	498.0	130.79	1.07	-697467.	7705.	14.230	80.38	221036.	89.02	5.426	577.40	617.47	2.944

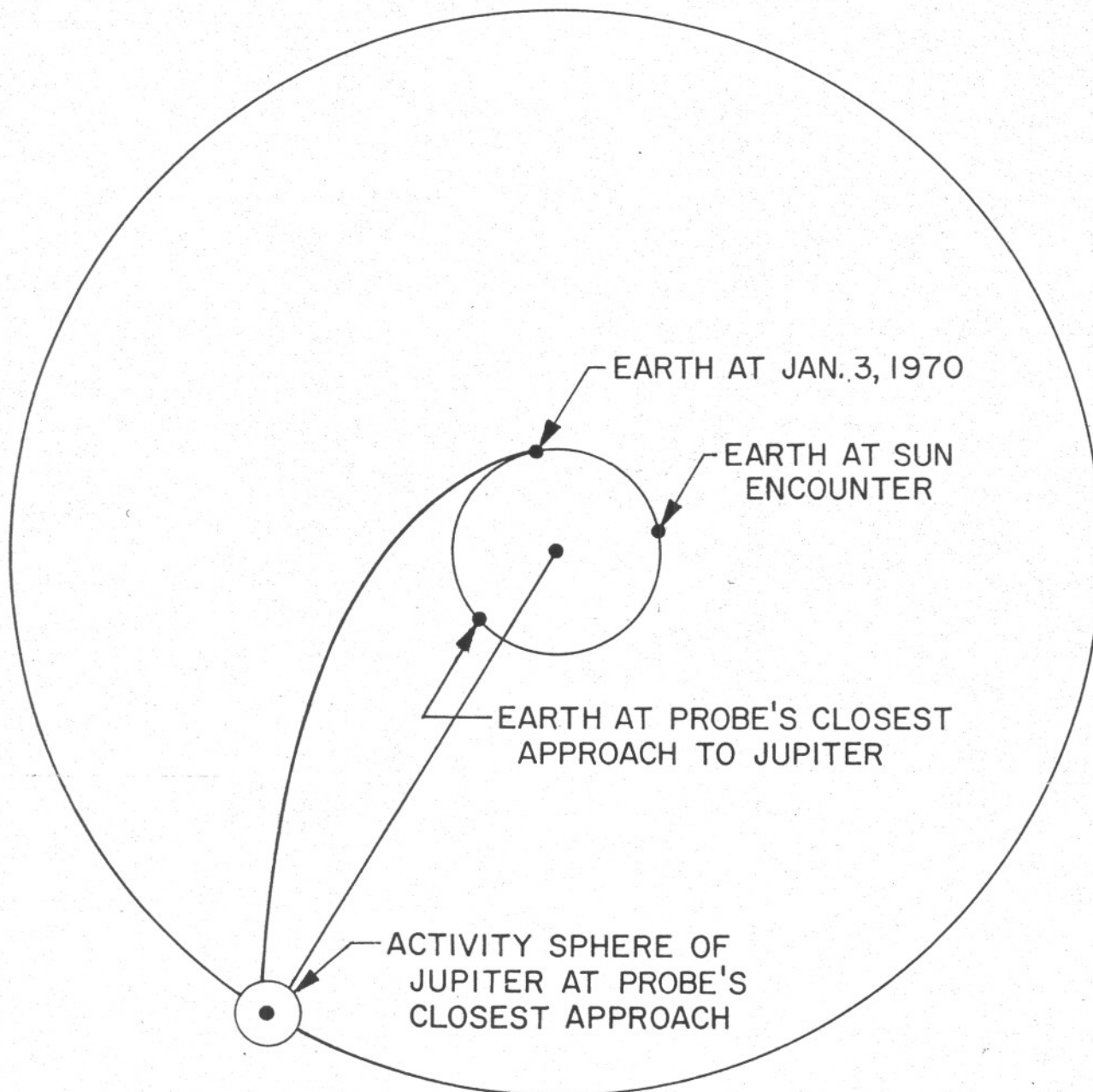


Fig. 34. Planetary configuration for Earth-Jupiter-Sun,
1969-70 (Jan. 3 trajectory)

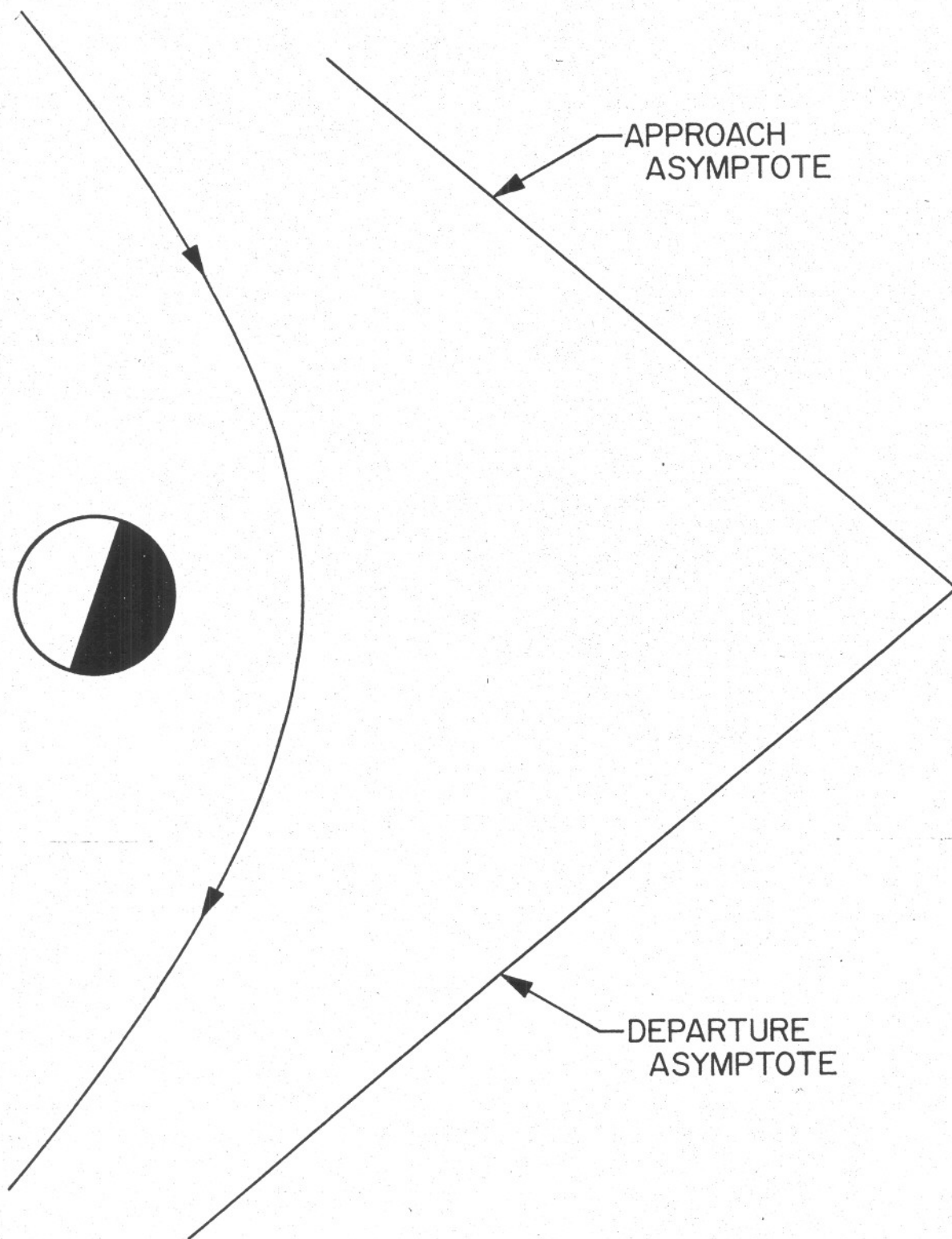


Fig. 35. January 3, 1970, Earth-Jupiter-Sun trajectory during its closest approach to Jupiter

Table 30. Earth-Jupiter-Sun, 1971 (launch HEV = 11.0 km/sec)

Launch Date (1971)	T_{12} (days)	θ_{12} (deg)	ϕ_{12} (deg)	$\bar{B} \cdot \hat{T}$ (km)	$\bar{B} \cdot \hat{R}$ (km)	V_1 (km/sec)	TISI (days)	DOCA (km)	DA (deg)	V_2 (km/sec)	T_{23} (days)	VAP (km/sec)	TFT (yr)
4/29	516.0	154.13	0.38	-925746.	15899.	13.720	80.84	377866.	76.47	3.012	639.10	617.44	3.162
5/1	506.0	151.44	0.38	-772353.	14264.	14.072	78.84	273829.	83.69	4.542	586.60	617.45	2.991
5/3	496.0	148.75	0.38	-666722.	12925.	14.438	76.90	208197.	89.02	5.685	552.47	617.46	2.870
5/5	490.0	146.39	0.37	-619864.	12294.	14.644	75.87	180627.	91.52	6.228	537.55	617.47	2.813
5/7	482.0	143.86	0.36	-561584.	11447.	14.942	74.42	147707.	94.77	6.951	518.87	617.48	2.740
5/9	478.0	141.67	0.35	-540649.	11142.	15.064	73.85	136241.	95.99	7.224	512.14	617.48	2.711
5/11	474.0	139.48	0.34	-520968.	10850.	15.186	73.28	125651.	97.15	7.489	505.74	617.48	2.682
5/13	470.0	137.28	0.33	-502440.	10570.	15.307	72.73	115852.	98.27	7.747	499.66	617.49	2.655
5/15	468.0	135.25	0.32	-498583.	10524.	15.334	72.60	113837.	98.50	7.802	498.37	617.49	2.646
5/17	468.0	133.39	0.30	-509019.	10706.	15.264	72.92	119330.	97.86	7.654	501.77	617.48	2.655
5/19	470.0	131.69	0.29	-535029.	11125.	15.099	73.67	133232.	96.30	7.298	510.21	617.48	2.684
5/21	474.0	130.15	0.26	-580138.	11803.	14.843	74.87	158071.	93.70	6.713	524.70	617.47	2.734
5/23	482.0	128.95	0.24	-672886.	13041.	14.418	76.98	211972.	88.67	5.612	554.27	617.46	2.837
5/25	494.0	128.07	0.20	-863492.	15027.	13.844	80.08	334548.	79.30	3.616	616.94	617.45	3.042

Table 31. Earth-Jupiter-Sun, 1972 (launch HEV = 11.0 km/sec)

Launch Date (1972)	T ₁₂ (days)	θ_{12} (deg)	ϕ_{12} (deg)	$\vec{B} \cdot \hat{T}$ (km)	$\vec{B} \cdot \hat{R}$ (km)	V ₁ (km/sec)	TISI (days)	DOCA (km)	DA (deg)	V ₂ (km/sec)	T ₂₃ (days)	VAP (km/sec)	TFT (yr)
2/23	492.0	150.51	1.09	-863697.	15459.	14.174	76.69	344199.	77.24	3.180	610.10	617.44	3.017
2/25	484.0	147.98	0.99	-746793.	15185.	14.464	75.16	264955.	83.04	4.443	568.90	617.45	2.883
2/27	476.0	145.46	0.91	-661269.	14536.	14.761	73.67	210994.	87.53	5.428	540.26	617.45	2.782
2/29	470.0	143.10	0.85	-611678.	13994.	14.976	72.65	181235.	90.26	6.035	523.95	617.46	2.721
3/2	464.0	140.75	0.79	-568098.	13423.	15.194	71.64	156028.	92.76	6.599	509.63	617.47	2.666
3/4	460.0	138.58	0.75	-545561.	13088.	15.320	71.07	143335.	94.09	6.902	502.22	617.47	2.634
3/6	456.0	136.40	0.72	-524578.	12751.	15.446	70.51	131742.	95.36	7.194	495.28	617.47	2.604
3/8	454.0	134.40	0.69	-520167.	12665.	15.474	70.39	129333.	95.63	7.256	493.81	617.47	2.595
3/10	454.0	132.58	0.68	-531816.	12836.	15.403	70.69	135724.	94.92	7.091	497.66	617.47	2.605
3/12	456.0	130.92	0.67	-561367.	13276.	15.235	71.45	152226.	93.15	6.684	507.41	617.47	2.638
3/14	458.0	129.27	0.66	-593856.	13738.	15.066	72.22	170856.	91.26	6.257	518.05	617.46	2.672
3/16	464.0	127.97	0.67	-674781.	14787.	14.715	73.89	219360.	86.78	5.260	544.70	617.45	2.762
3/18	474.0	127.02	0.69	-854568.	16458.	14.202	76.54	337923.	77.65	3.264	606.84	617.44	2.959

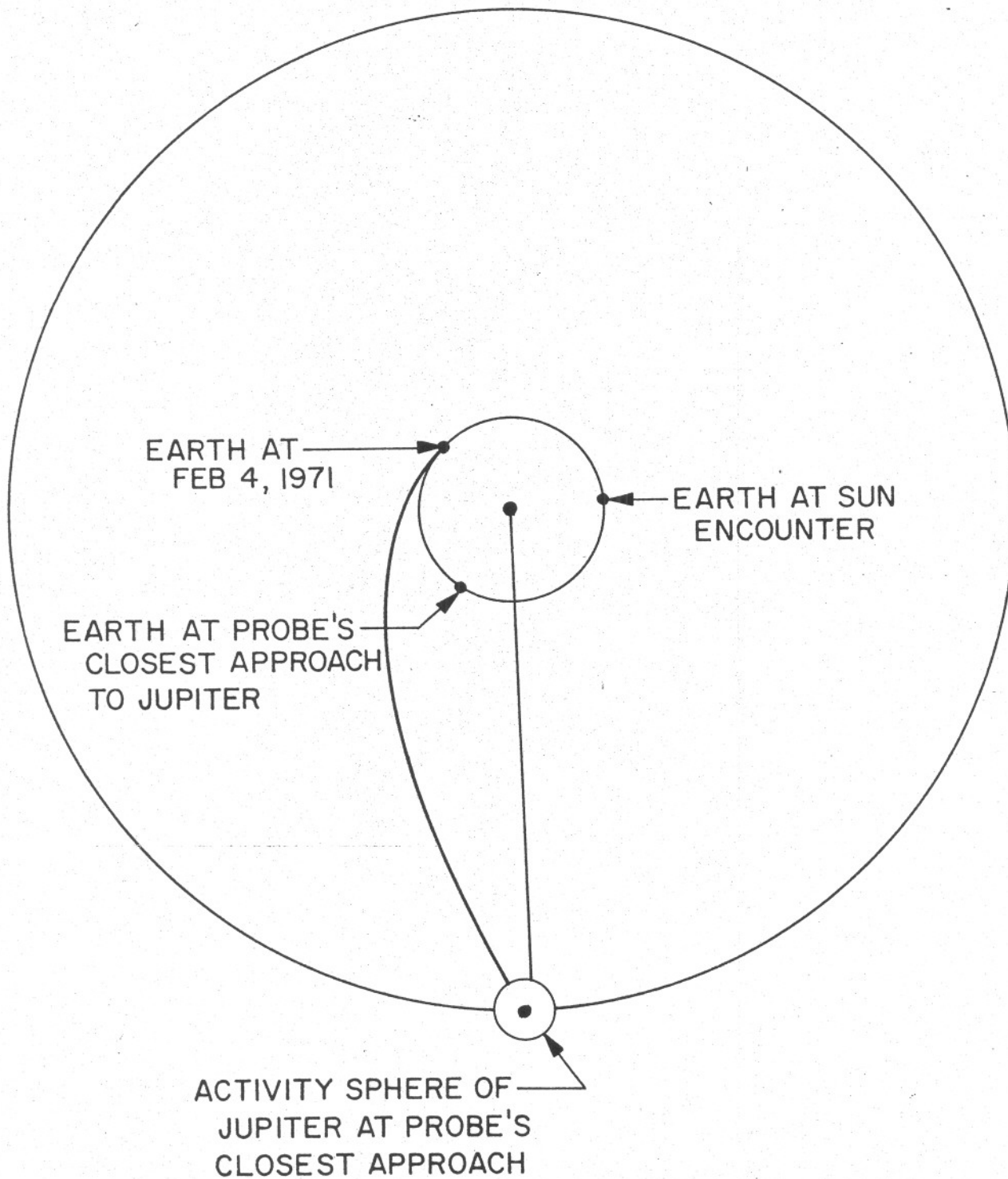


Fig. 36. Planetary configuration for Earth-Jupiter-Sun,
1971 (Feb. 4 trajectory)

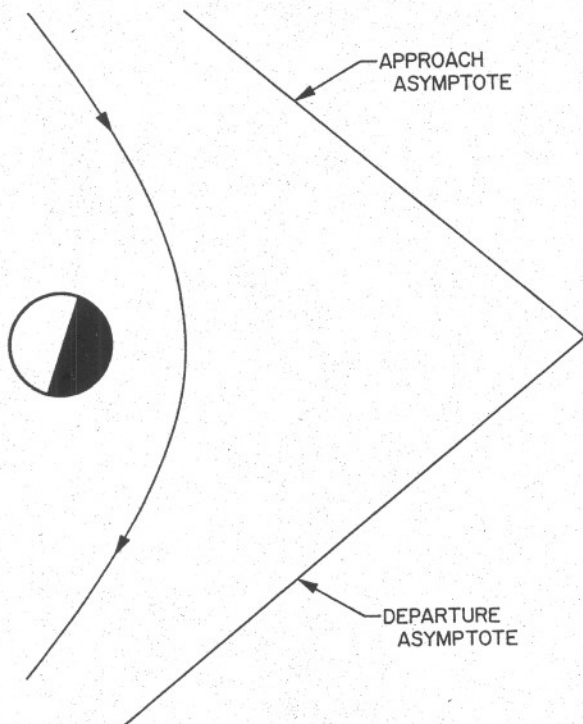
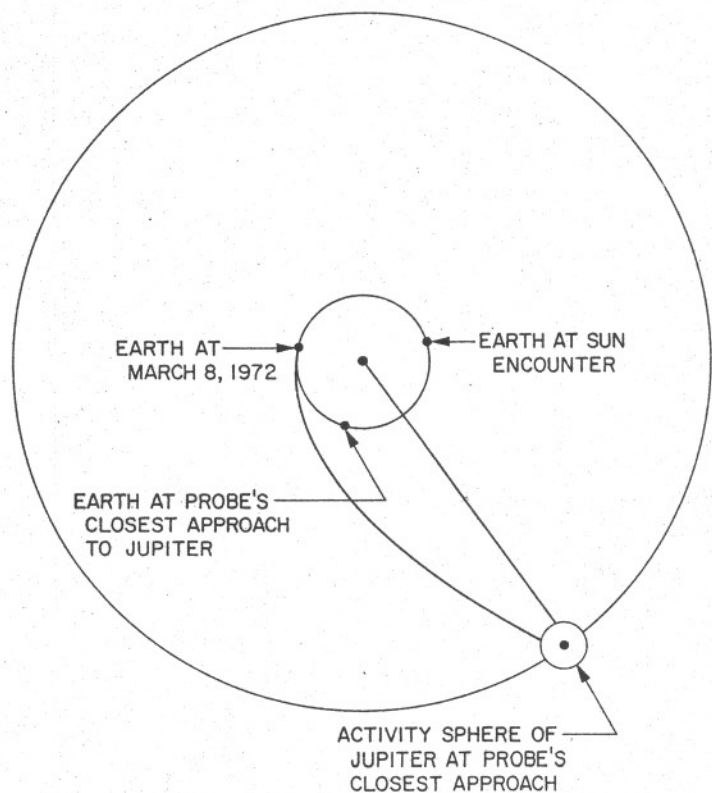


Fig. 37. Feb. 4, 1971, Earth-Jupiter-Sun trajectory during its closest approach to Jupiter

Fig. 38. Planetary configuration for Earth-Jupiter-Sun, 1972 (March 8 trajectory)



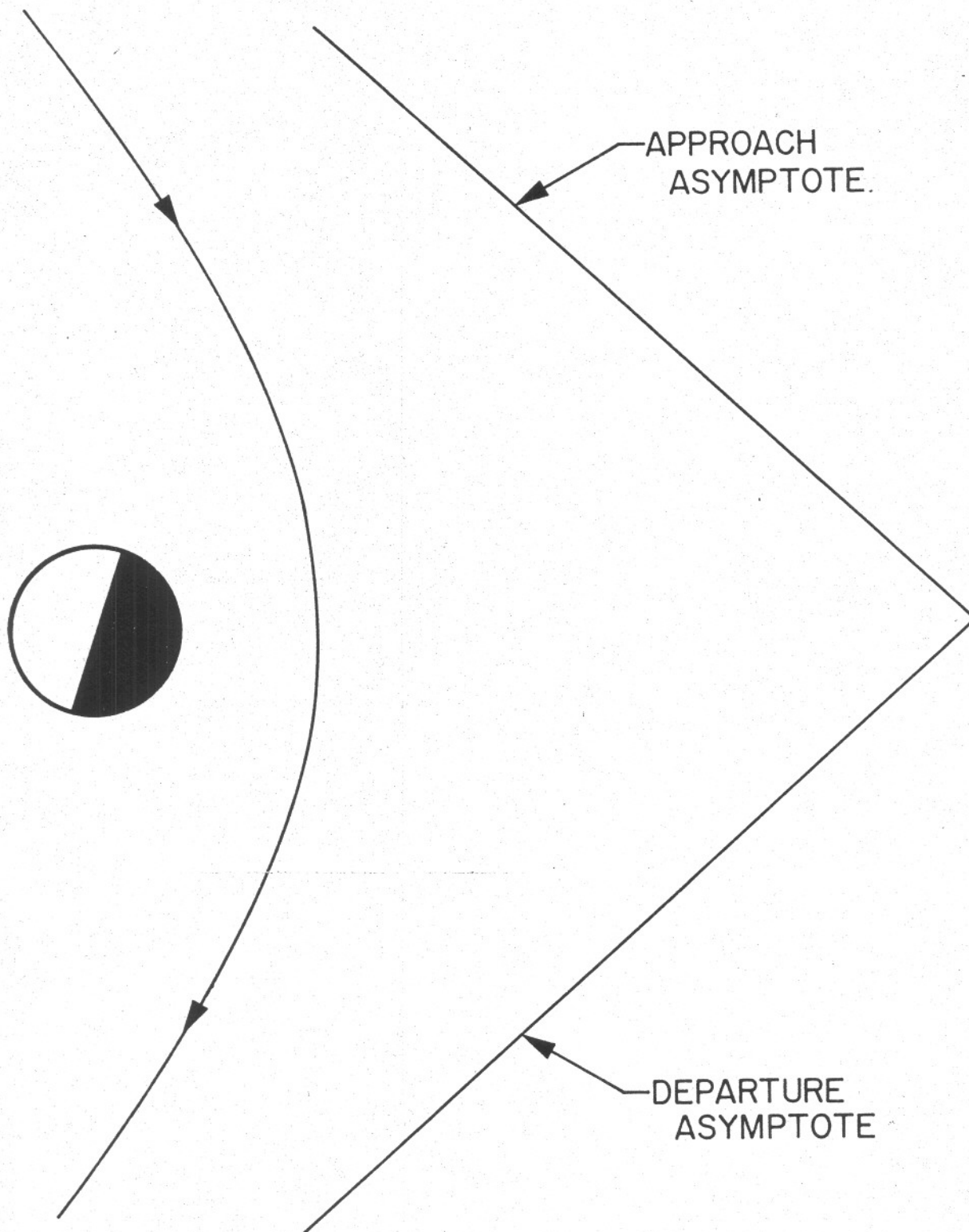


Fig. 39. March 8, 1972, Earth-Jupiter-Sun trajectory during its closest approach to Jupiter

Table 32. Earth-Jupiter-Sun, 1973 (launch HEV = 11.0 km/sec)

Launch Date (1973)	T ₁₂ (days)	θ_{12} (deg)	ϕ_{12} (deg)	$\bar{B} \cdot \hat{T}$ (km)	$\bar{B} \cdot \hat{R}$ (km)	V ₁ (km/sec)	TISI (days)	DOCA (km)	DA (deg)	V ₂ (km/sec)	T ₂₃ (days)	VAP (km/sec)	TFT (yr)
4/2	470.0	145.60	1.96	-863100.	10962.	14.666	73.93	351819.	75.53	2.558	613.60	617.43	2.967
4/4	464.0	143.27	1.85	-766549.	11552.	14.879	72.85	284287.	80.45	3.655	576.39	617.43	2.848
4/6	458.0	140.94	1.74	-695598.	11596.	15.095	71.79	237610.	84.21	4.493	550.70	617.44	2.762
4/8	454.0	138.79	1.67	-661492.	11510.	15.221	71.20	216032.	86.08	4.911	538.70	617.44	2.718
4/10	450.0	136.65	1.59	-630778.	11358.	15.346	70.62	197086.	87.79	5.299	527.98	617.45	2.678
4/12	448.0	134.69	1.54	-624367.	11322.	15.375	70.49	193186.	88.16	5.380	525.78	617.45	2.666
4/14	446.0	132.73	1.49	-618384.	11283.	15.401	70.36	189575.	88.50	5.457	523.69	617.45	2.655
4/16	446.0	130.96	1.45	-635093.	11420.	15.330	70.69	199737.	87.55	5.241	529.49	617.45	2.671
4/18	450.0	129.54	1.43	-705462.	11918.	15.068	71.94	243970.	83.67	4.367	554.32	617.44	2.749
4/20	454.0	128.13	1.41	-797341.	12410.	14.810	73.22	305366.	78.85	3.291	588.10	617.43	2.853

Table 33. Earth-Jupiter-Sun, 1974 (launch HEV = 11.5 km/sec)

Launch Date (1974)	T ₁₂ (days)	θ_{12} (deg)	ϕ_{12} (deg)	$\bar{B} \cdot \hat{T}$ (km)	$\bar{B} \cdot \hat{R}$ (km)	V ₁ (km/sec)	TISI (days)	DOCA (km)	DA (deg)	V ₂ (km/sec)	T ₂₃ (days)	VAP (km/sec)	TFT (yr)
5/9	448.0	144.33	2.24	-685441.	4073.	15.564	70.61	233224.	84.16	4.113	555.17	617.43	2.746
5/11	440.0	141.85	2.11	-603896.	4440.	15.896	69.08	182584.	88.77	5.164	525.08	617.44	2.642
5/13	434.0	139.56	2.01	-556462.	4482.	16.137	68.03	154618.	91.59	5.817	507.88	617.45	2.579
5/15	430.0	137.44	1.93	-531977.	4437.	16.278	67.43	140605.	93.10	6.168	499.05	617.45	2.544
5/17	426.0	135.33	1.86	-509277.	4360.	16.420	66.84	127888.	94.53	6.506	490.83	617.46	2.510
5/19	422.0	133.23	1.79	-488150.	4263.	16.561	66.26	116291.	95.89	6.832	483.14	617.46	2.478
5/21	420.0	131.30	1.74	-483440.	4199.	16.595	66.13	113733.	96.20	6.905	481.44	617.46	2.468
5/23	418.0	129.38	1.69	-479012.	4137.	16.626	66.00	111347.	96.48	6.976	479.81	617.46	2.458
5/25	420.0	127.83	1.65	-506357.	4188.	16.441	66.77	126267.	94.72	6.547	489.84	617.46	2.491
5/27	422.0	126.27	1.62	-536397.	4254.	16.257	67.54	143102.	92.83	6.099	500.77	617.45	2.526
5/29	426.0	124.90	1.59	-589952.	4391.	15.970	68.79	174225.	89.59	5.344	520.22	617.44	2.591
5/31	432.0	123.72	1.57	-680243.	4588.	15.589	70.53	229888.	84.45	4.170	553.45	617.43	2.698
6/2	442.0	122.90	1.55	-925792.	4639.	15.034	73.31	402051.	71.67	1.276	655.08	617.42	3.004

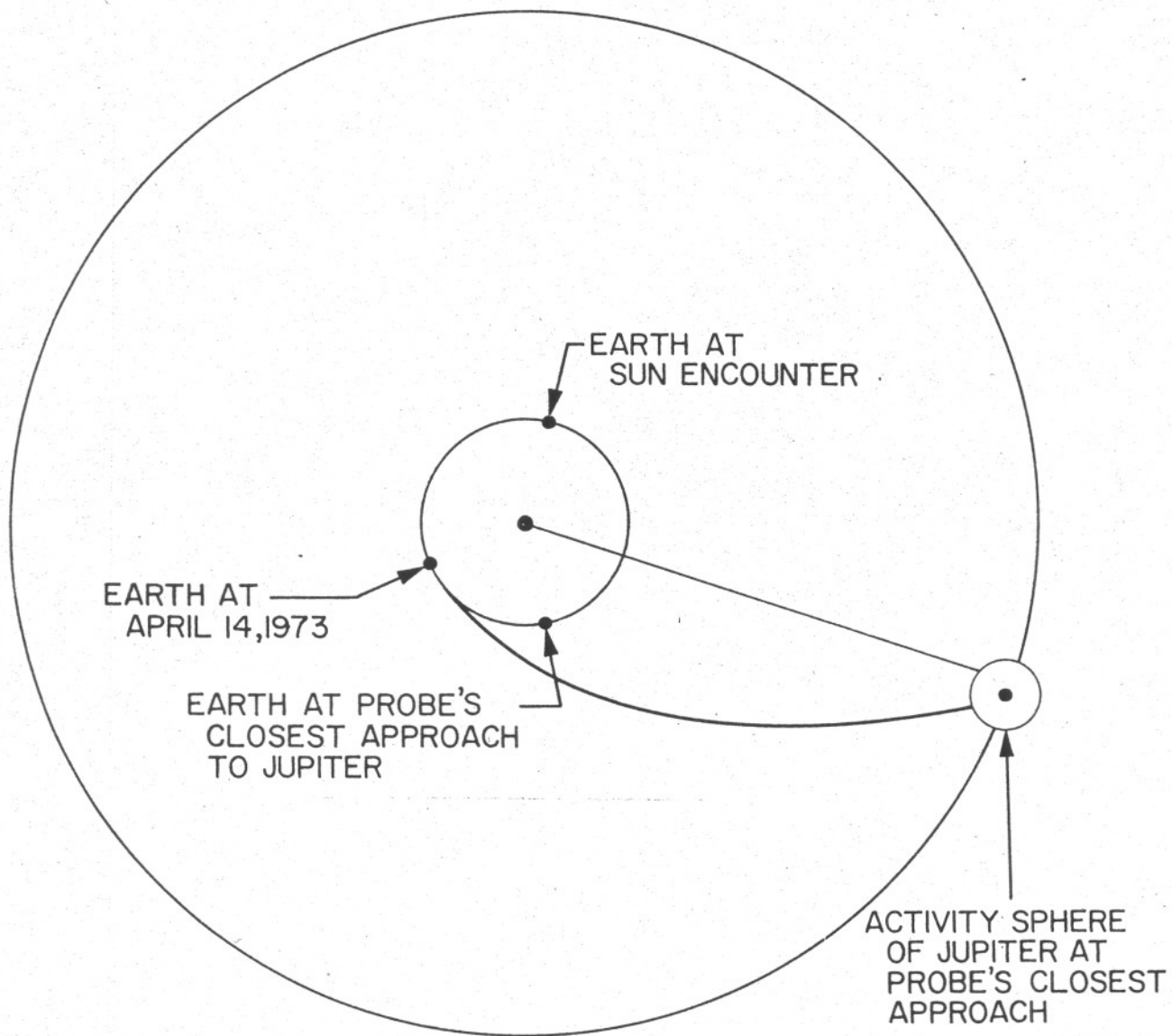


Fig. 40. Planetary configuration for Earth-Jupiter-Sun, 1973 (April 14 trajectory)

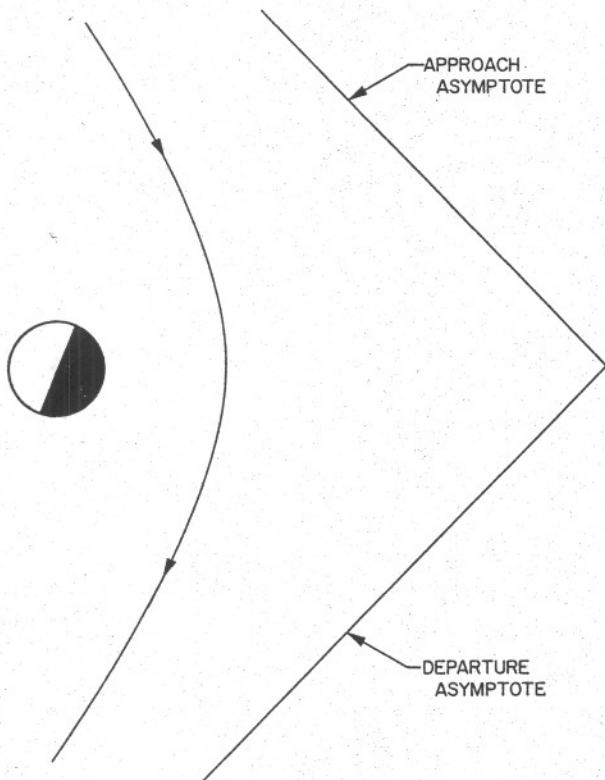


Fig. 41. April 14, 1973, Earth-Jupiter-Sun trajectory during its closest approach to Jupiter

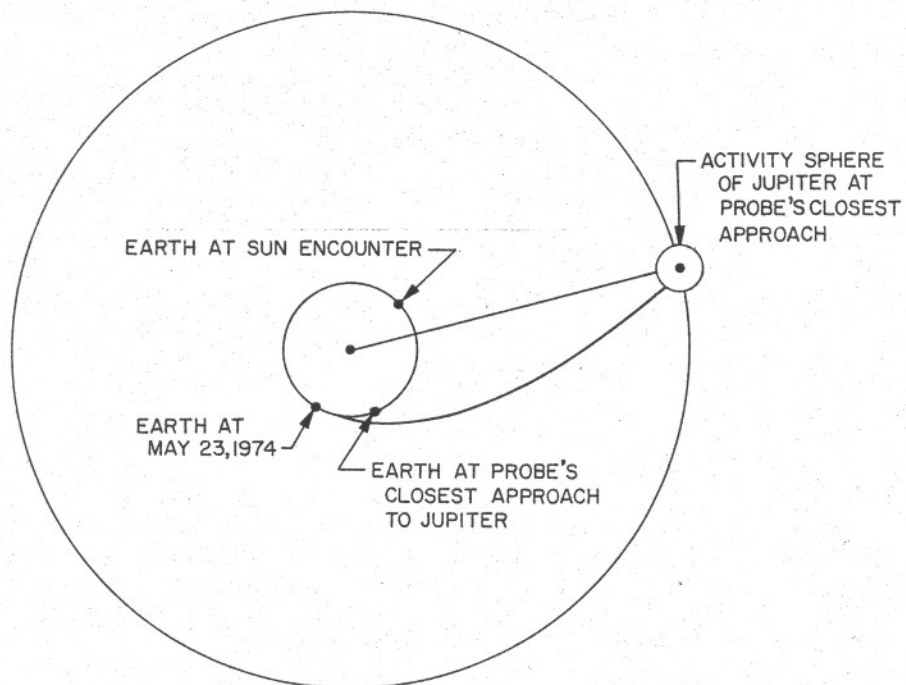


Fig. 42. Planetary configuration for Earth-Jupiter-Sun, 1974 (May 23 trajectory)

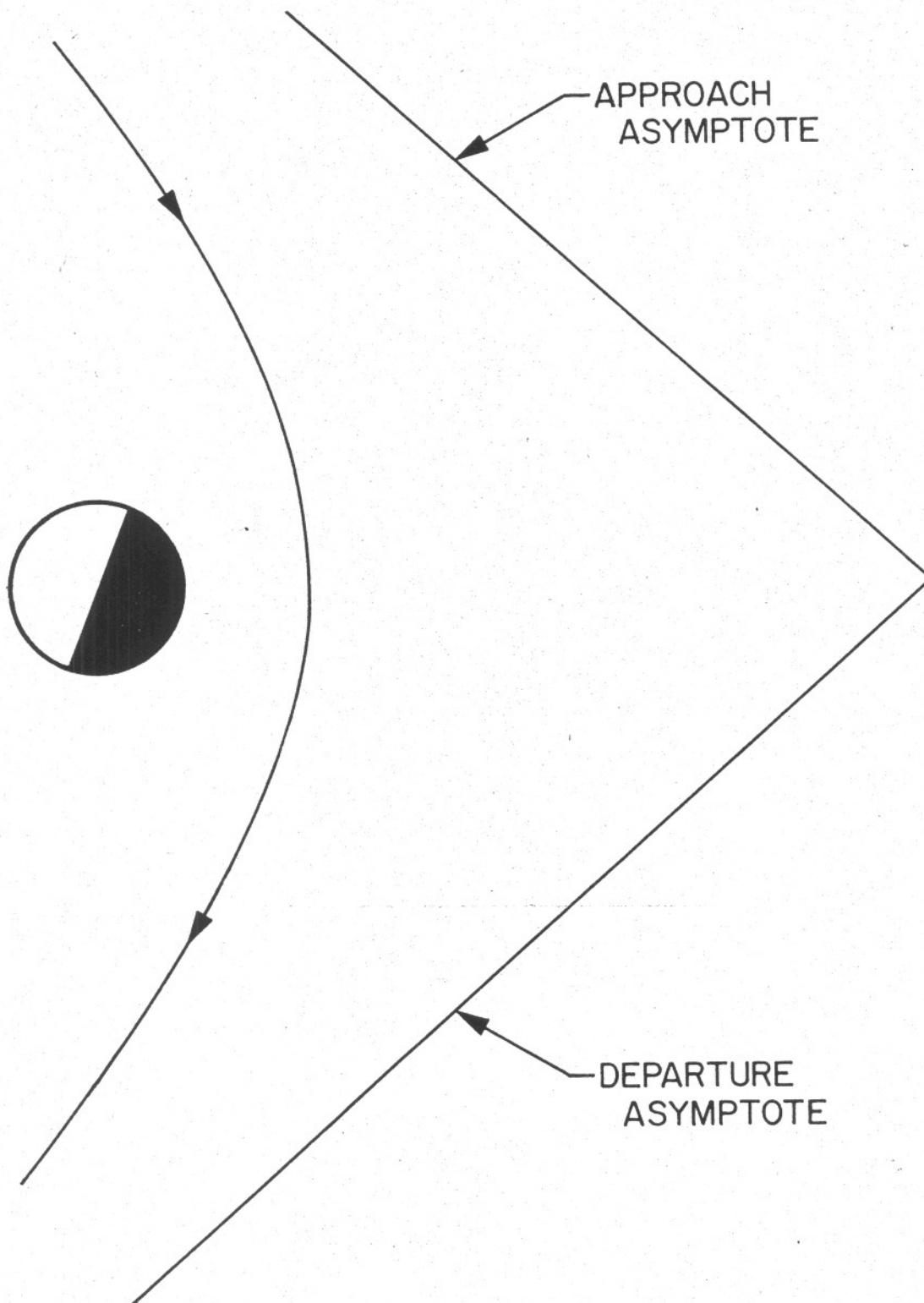


Fig. 43. May 23, 1974, Earth-Jupiter-Sun trajectory during its closest approach to Jupiter