

Missions To Mercury

Transfers to Mercury are included here

The transfers use purely impulsive manoeuvres.

These examples use a sequence of gravity assist manoeuvres to reach Mercury. Gravity assists at Earth, Venus and Mercury are considered. The launch epochs are 2004 and 2005.

The transfer duration is relatively long, due to the large numbers of gravity assists. Shorter transfers are possible with lesser numbers of gravity assists..

The sequences considered are as follows:

1. V-V-M-M-M-M, free arrival, 2004 launch
2. V-V-M-M-M, free arrival, 2005 launch

The DeltaV calculations are based on initial and final target orbits.

Initial orbit at Earth: Perigee radius 6578km Apogee radius 42165 km
 Final orbit at Mercury: Pericentre radius 2800km Apocentre radius 15000 km

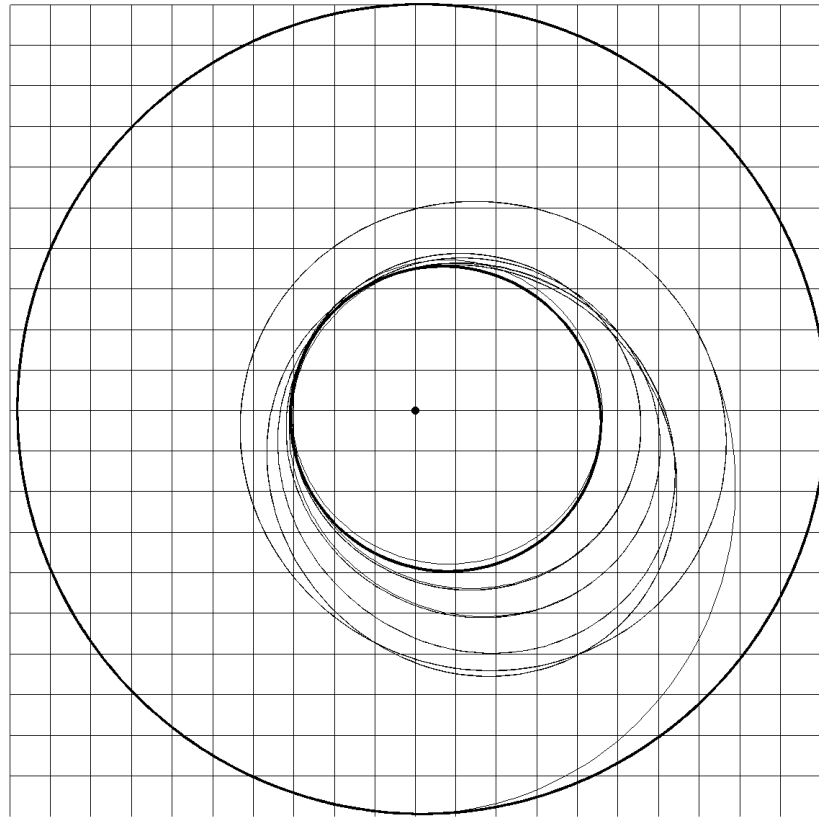
Case 1: V-V-M-M-M-M, free arrival, 2004 launch

A range of local minima exists for such a transfer. The following case is an example of an efficient sequence of gravity assists and manoeuvres.

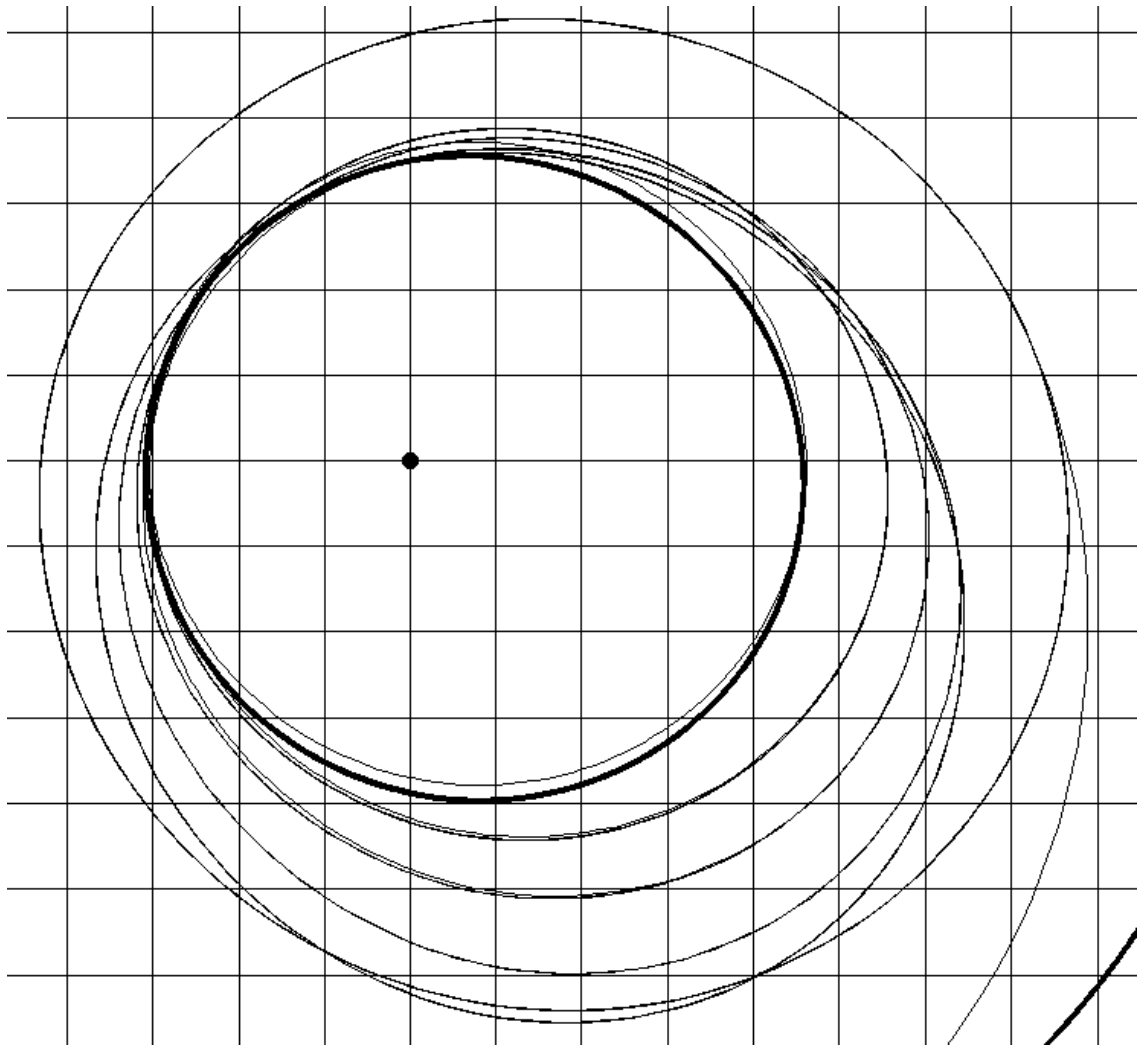
Vinfinity (m/s)	DV (m/s)	Apo (AU)	Peri (AU)	Inclination (deg)	Epoch:	Event
3840.68	1420	1.00	0.62	1.72	19-Mar-04	departure
8166.95		0.78	0.43	3.39	25-Jun-04	VGA
8147.75		0.73	0.33	6.35	17-Mar-06	VGA
5743.88		0.70	0.32	6.94	22-Jul-07	MGA
	43	0.70	0.32	6.92	04-Feb-08	
5379.09		0.63	0.30	7.00	12-Apr-08	MGA
	271	0.63	0.31	7.00	13-Jun-08	
3416.44		0.57	0.30	7.01	06-Apr-09	MGA
	174	0.57	0.31	7.01	10-Jun-09	
2277.01		0.47	0.31	7.47	21-Sep-10	MGA
2276.07	600	0.47	0.31	9.03	18-Dec-10	MGA
1500.08		0.47	0.31	9.03	30-Jan-11	arrival

Route V-V-M-M-M-M Arrival epoch fixed

DV including insertion	2507	m/s
DV no insertion	1908	m/s
Transfer duration	6.87	years



VVMMMM transfer with free arrival. Orbits of Earth and Mercury are shown. Grid size is 0.1AU squares



Inner phase of VVMMMMM transfer with free arrival. Orbits of Earth and Mercury are shown.
Grid size is 0.1AU squares

Case 2: V-V-M-M-M, free arrival, 2005 launch

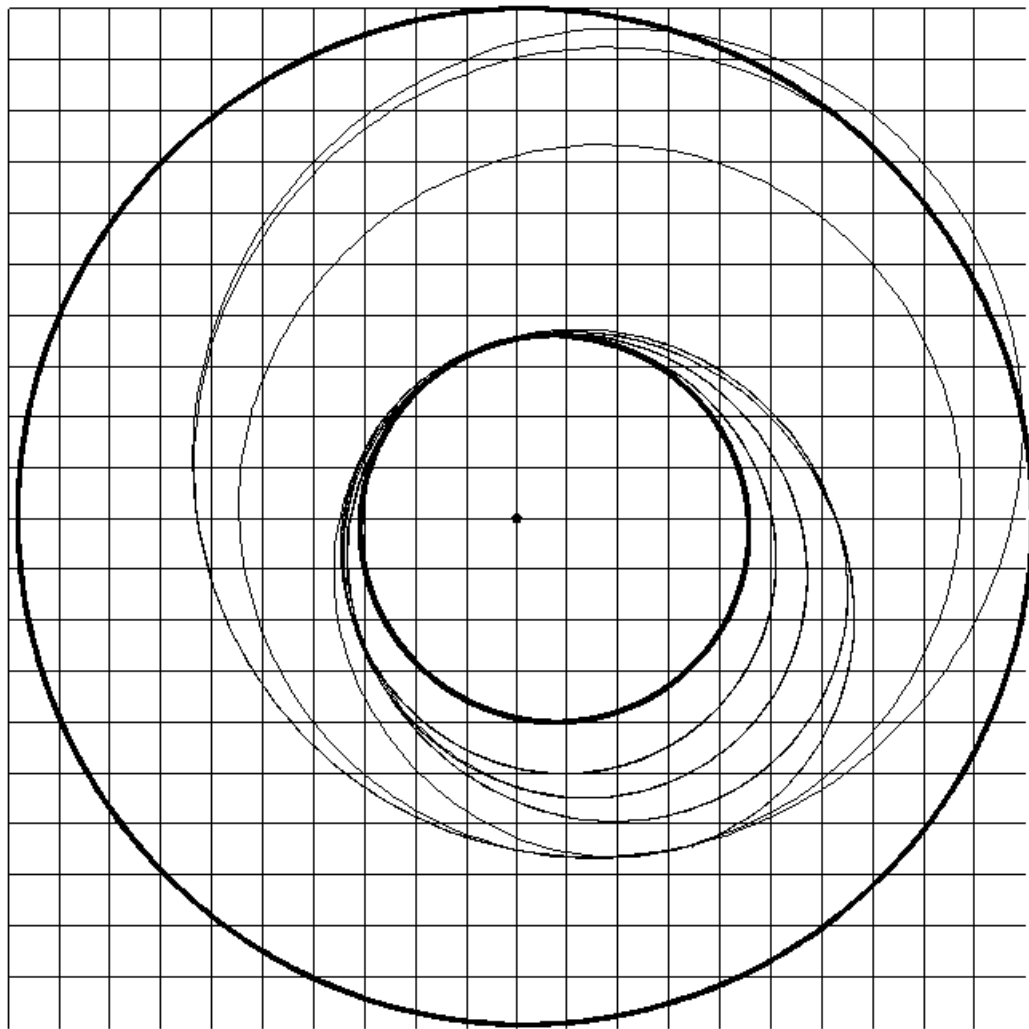
A range of local minima exists for such a transfer. The following case is an example of an efficient sequence of gravity assists and manoeuvres.

In the case of multi-resonant orbits and gravity assist, considerable mission design flexibility is obtainable by fine tuning of the gravity assist location (arising from multiple intersections of the transfer and planet orbits).

Vinfinity	DV	Apo	Peri	Inclin	Epoch:	Event
4060		1494	1.01	0.60	2.57 04-Aug-05	departure
		382	1.06	0.60	2.60 12-Dec-05	
9261			0.91	0.54	7.81 24-Oct-06	VGA
9270			0.75	0.33	6.69 05-Jun-07	
		145	0.75	0.32	6.71 18-Jun-07	VGA
5793			0.70	0.31	7.00 15-Jan-08	MGA
5488			0.62	0.31	7.00 13-Oct-08	MGA
		271	0.62	0.32	7.00 25-Nov-08	
3793			0.54	0.32	7.00 25-Sep-09	MGA
		224	0.55	0.33	7.00 31-Oct-09	
2561		1080	0.55	0.33	7.00 28-Feb-11	

Route V-V-M-M-M Arrival epoch fixed

DV including insertion	3597	m/s
DV no insertion	2516	m/s
Transfer duration	5.60	years



VMMM transfer with free arrival. Orbits of Earth and Mercury are shown. Grid size is 0.1AU squares