Hohmann Transfer Between Circular Orbits: Delta-v and Time

The two burns, total delta-v and transfer time of a Hohmann transfer between two coplanar circular orbits around the Earth, Moon or Mars.

Method: Hohmann transfer with the vis-viva equation

Input parameters

Unit system: SI

Parameter	Value	Unit
Central body	Earth	
Initial orbit altitude	300.00	km
Final orbit altitude	35,786	km

Calculated results

Parameter	Value	Unit
First burn (into the transfer ellipse)	2,425.7	m/s
Second burn (circularise)	1,466.8	m/s
Total delta-v	3,892.6	m/s
Transfer time (half the ellipse period)	5.2751	h
Semi-major axis of the transfer orbit	24,421	km
Eccentricity of the transfer orbit	0.72654	

Notes for this case

- Impulsive two-burn Hohmann transfer between coplanar circular orbits (vis-viva equation). A plane change (for example from a 28° launch latitude to the equator) costs extra Δv.

Formula and method

$$\Delta v_1 = \sqrt{\mu\left(\frac{2}{r_1} - \frac{1}{a_t}\right)} - \sqrt{\frac{\mu}{r_1}}, \quad \Delta v_2 = \sqrt{\frac{\mu}{r_2}} - \sqrt{\mu\left(\frac{2}{r_2} - \frac{1}{a_t}\right)}$$

$$a_t = \frac{r_1 + r_2}{2}, \quad t_H = \pi\sqrt{\frac{a_t^3}{\mu}}$$

Variables

body	Central body	-
h_1	Initial orbit altitude	m
h_2	Final orbit altitude	m
Δv_1	First burn (into the transfer ellipse)	m/s
Δv_2	Second burn (circularise)	m/s
Δv	Total delta-v	m/s
t_H	Transfer time (half the ellipse period)	s
a_t	Semi-major axis of the transfer orbit	m
e_t	Eccentricity of the transfer orbit	-

Method and standards

Hohmann orbit transfer.

Assumptions and limits

- Coplanar circular orbits, impulsive burns, two-body motion.

References

Hohmann transfer with the vis-viva equation

Report details

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Release checks	4 reference cases of this calculator, computed independently, are checked on every release

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/mechanical/aerospace/hohmann-transfer-delta-v

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.