B4.0   CHANGING THE SEMI-MAJOR AXIS OF AN INITIALLY ECCENTRIC ORBIT

Initial Orbital Elements a_1, e (Orbit 1)

Final Orbital Elements a_2, e (Orbit 2) $a_2 > a_1$

Semi-major axis increased by an initial burn at perigee followed by a correcting burn at apogee.

$$R_{P1} = a_1(1-e) \qquad R_{P2} = a_2(1-e)$$
$$R_{A1} = a_1(1-e) \qquad R_{A2} = a_2(1-e)$$

$$V_{P1} = \sqrt{\frac{2\mu}{R_{P1}+R_{A1}} \cdot \frac{R_{A1}}{R_{P1}}}$$ initial perigee velocity

$$V_{PT} = \sqrt{\frac{2\mu}{R_{P1}+R_{A2}} \cdot \frac{R_{A2}}{R_{P1}}}$$ transfer orbit perigee velocity

$$V_{AT} = \sqrt{\frac{2\mu}{R_{P1}+R_{A2}} \cdot \frac{R_{P1}}{R_{A2}}}$$ transfer orbit apogee velocity

$$V_{A2} = \sqrt{\frac{2\mu}{R_{A2}+R_{P2}} \cdot \frac{R_{P2}}{R_{A2}}}$$ final orbit apogee velocity

$$\Delta V = V_{PT} - V_{P1} + V_{A2} - V_{AT}$$