

Closure Rate Algorithm

$$\text{Closure Rate} = - \left[\frac{dx(\dot{dx}) + dy(\dot{dy}) + dz(\dot{dz})}{\text{Range}} \right]$$

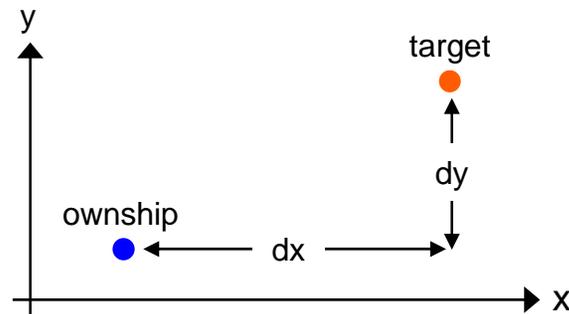
- Note: 1) Negative sign in the closure rate formula is due to convention.
 2) Prefix "d" refers to difference, "•" refers to derivative.

$$\text{Range} = \sqrt{dx^2 + dy^2 + dz^2}$$

$$dx = x_{\text{target}} - x_{\text{ownship}}$$

$$dy = y_{\text{target}} - y_{\text{ownship}}$$

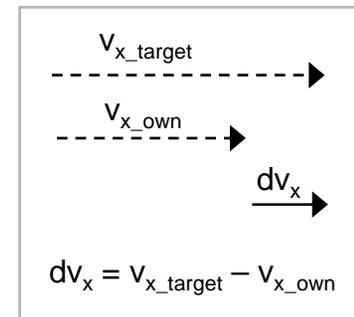
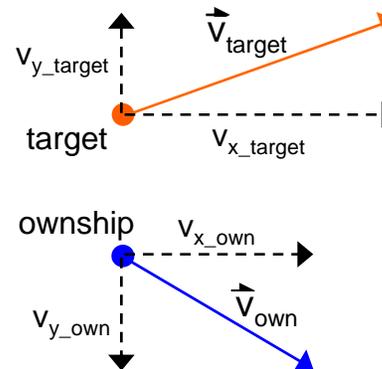
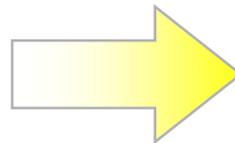
$$dz = z_{\text{target}} - z_{\text{ownship}}$$



$$\dot{dx} = dv_x = v_{x_target} - v_{x_ownship}$$

$$\dot{dy} = dv_y = v_{y_target} - v_{y_ownship}$$

$$\dot{dz} = dv_z = v_{z_target} - v_{z_ownship}$$



*Using position and velocity data from ADS-B reports, closure rates calculated with formula above will be within ± 6 knots of true values.