21-P-WE-AG-029

A M megaton rocketship is flying near an intergalactic battleground space at $V\ \frac{m}{s}$. They are transporting medical supplies via Doctors Without Galaxies and wish to avoid conflict. The captain realizes that the ship needs to correct its course by θ degrees to avoid going into the edges of the battle. The ship's *X* thrusters are normal to the side of the ship and can all move to one side of the ship. How long should the *W* gigawatt thrusters be powered to successfully execute the maneuver?

Assume all passengers can survive the ship's acceleration

ANSWER:

First, we use the Pythagorean theorem to determine what sideways speed must be achieved.

$$\tan(\theta) = \frac{O}{A} = \frac{v_f}{V} \rightarrow v_f = V \cdot \tan(\theta)$$

Then, we determine the acceleration of the rocketship while the thrusters are active.

$$P \cdot X = F \cdot v = ma \cdot at = ma^2 t \rightarrow a = \sqrt{\frac{PX}{mt}}$$

Once we have the equation for acceleration, we plug it into the equation for final velocity.

$$v_f = v_i + at = 0 + \sqrt{\frac{PX}{mt}}t = \sqrt{\frac{PXt}{m}} \rightarrow t = \frac{m \cdot v_f^2}{PX}$$