1. The figure below shows a plane in object space fas defined by its $x_p$, $y_p$, and $z_p$ local frame and which we can assume starts off centered at and aligned with the world frame. We want to transform the plane so that it heads in the direction given by the vector, $DOF$ (direction of flight), is centered at point $P$, and for which we have specified a vector, $T$, defined to represent the plane's tail fin, (also called a vertical stabilizer). Show the 4x4 transformation matrix that will properly position and orient the plane.

$$W = \frac{DOF}{|DOF|}$$

$$U = \frac{TxDOF}{|TxDOF|}$$

$$V = \frac{WxU}{|WxU|}$$

$$M = \begin{bmatrix} 1 & 0 & 0 & p_x \\ 0 & 1 & 0 & p_y \\ 0 & 0 & 1 & p_z \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$T = \begin{bmatrix} u_x & v_y & w_z & 0 \\ u_y & v_y & w_z & 0 \\ u_z & v_z & w_z & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$