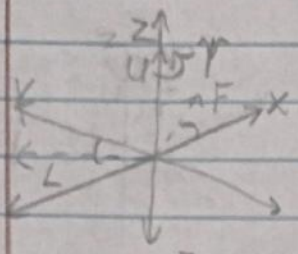
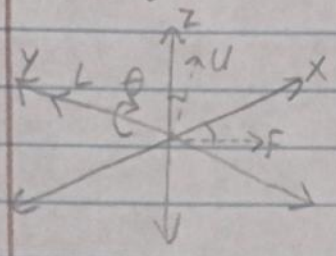
Roll := φ
Pitch := θ
Yaw := ψ
} Notated φ, θ, ψ by most papers on INS I've seen.

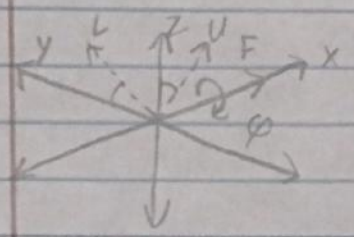
Device reads forward-, left-, and up-axes. We need x-, y-, and z-.



$$R_z(\psi) = \begin{bmatrix} \cos\psi & -\sin\psi & 0 \\ \sin\psi & \cos\psi & 0 \\ 0 & 0 & 1 \end{bmatrix}$$



$$R_y(\theta) = \begin{bmatrix} \cos\theta & 0 & \sin\theta \\ 0 & 1 & 0 \\ -\sin\theta & 0 & \cos\theta \end{bmatrix}$$



$$R_x(\varphi) = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos\varphi & -\sin\varphi \\ 0 & \sin\varphi & \cos\varphi \end{bmatrix}$$

$R_z(\psi)\, R_y(\theta)\, R_x(\varphi)\, \vec{\omega}$ is the same transformation as $R\vec{\omega}$, where $R = R_z(\psi)\, R_y(\theta)\, R_x(\varphi)$.

*After a lot of multiplication

$$R = \begin{bmatrix} \cos\psi\cos\theta & \cos\psi\sin\theta\sin\varphi - \sin\psi\cos\varphi & \cos\psi\sin\theta\cos\varphi + \sin\psi\sin\varphi \\ \sin\psi\cos\theta & \sin\psi\sin\theta\sin\varphi + \cos\psi\cos\varphi & \sin\psi\sin\theta\cos\varphi - \cos\psi\sin\varphi \\ -\sin\theta & \cos\theta\sin\varphi & \cos\theta\cos\varphi \end{bmatrix}$$

$$R\begin{bmatrix} \omega_F \\ \omega_L \\ \omega_U \end{bmatrix} = \begin{bmatrix} \omega_x \\ \omega_y \\ \omega_z \end{bmatrix}, \quad R\begin{bmatrix} a_F \\ a_L \\ a_U \end{bmatrix} = \begin{bmatrix} a_x \\ a_y \\ a_z \end{bmatrix}, \quad R\,\vec{V}_{FLU} = \vec{V}_{xyz}$$

$$\vec{\omega}_{xyz} = \begin{bmatrix} \omega_F\cos\psi\cos\theta + \omega_L(\cos\psi\sin\theta\sin\varphi - \sin\psi\cos\varphi) + \omega_U(\cos\psi\sin\theta\cos\varphi + \sin\psi\sin\varphi) \\ \omega_F\sin\psi\cos\theta + \omega_L(\sin\psi\sin\theta\sin\varphi + \cos\psi\cos\varphi) + \omega_U(\sin\psi\sin\theta\cos\varphi - \cos\psi\sin\varphi) \\ -\omega_F\sin\theta + \omega_L\cos\theta\sin\varphi + \omega_U\cos\theta\cos\varphi \end{bmatrix}$$