Co-ordinate transformations of this type maintain shape across the proceedure. There is a single scale factor.

Transforming (x, y, z) into (X, Y, Z) by:

ω	=	Rotation around the x axis.
ϕ	=	Rotation around the y axis.
κ	=	Rotation around the z axis.
k	=	Scaling.
X_S	=	Shift in X.
Y_S	=	Shift in Y.
Y_S	=	Shift in Z.
x_S	=	Shift in x.
y_S	=	Shift in x.
z_S	=	Shift in x.

Then:

$$\begin{bmatrix} X \\ Y \\ Z \end{bmatrix} = kR \begin{bmatrix} x \\ y \\ z \end{bmatrix} + \begin{bmatrix} X_S \\ Y_S \\ Z_S \end{bmatrix} \tag{1}$$

$$= kR \begin{bmatrix} x + x_S \\ y + y_S \\ z + z_S \end{bmatrix} \tag{2}$$

Where R, the rotation matrix, is defined to be:

$$R = \begin{bmatrix} \cos\phi\cos\kappa & -\cos\phi\sin\kappa & \sin\phi \\ \sin\omega\sin\phi\cos\kappa + \cos\omega\sin\kappa & -\sin\omega\sin\phi\sin\kappa + \cos\omega\cos\kappa & -\sin\omega\cos\kappa \\ -\cos\omega\sin\phi\cos\kappa + \sin\omega\sin\kappa & \cos\omega\sin\phi\sin\kappa + \sin\omega\cos\kappa & \cos\omega\cos\phi \end{bmatrix} \tag{3}$$

$$R^T = \begin{bmatrix} \cos\phi\cos\kappa & \sin\omega\sin\phi\cos\kappa + \cos\omega\sin\kappa & -\cos\omega\sin\phi\cos\kappa + \sin\omega\sin\kappa \\ -\cos\phi\sin\kappa & -\sin\omega\sin\phi\sin\kappa + \cos\omega\cos\kappa & -\sin\omega\sin\phi\sin\kappa + \cos\omega\cos\kappa \\ \sin\phi & -\sin\omega\cos\kappa & \cos\omega\cos\phi \end{bmatrix} \tag{4}$$

`$Id$`