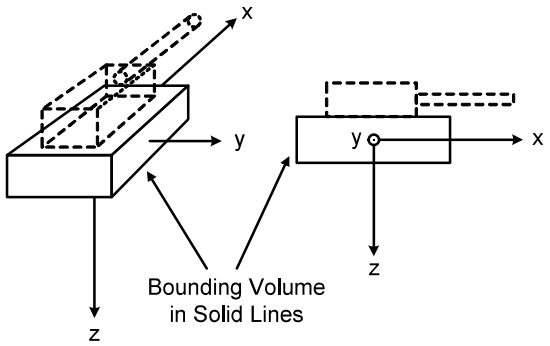

Figure 2—Entity coordinate system

The location of an entity is specified as the position of the origin of its entity coordinate system, expressed in world coordinates. The entity's orientation is specified using three angles that describe the successive rotations needed to transform from the world coordinate system into the entity coordinate system. These angles are called Euler angles and specify a set of three successive rotations about three different orthogonal axes as shown in Figure 3. The order of rotation is first, rotate about *z* by the angle psi (ψ), then about the new *y* (*y*') by angle theta (θ), and then about the newest *x* (*x*") by the angle phi (ϕ). The positive direction of rotation about an axis is defined as clockwise when viewed toward the positive direction along the axis of rotation.

1.6.3.3 Entity velocity and acceleration vectors

If an entity is moving, its linear velocity is required for dead reckoning. Linear acceleration and/or angular velocity can also be used, if available, to perform a more accurate extrapolation. Velocity and acceleration describe the motion of the entity relative to the rotating Earth, not relative to local effects such as wind or sea currents that can be modeled. For example, the velocity of an aircraft corresponds to ground speed, not to air speed.

Linear velocity and acceleration vectors are transmitted in either world or entity coordinates, depending on the dead reckoning algorithm in use. For linear velocity, the same vector (i.e., the same magnitude and direction from a world view) is represented with either method, only the coordinate axes for defining it are different. For acceleration, however, the centripetal component is removed when converting from world coordinates into body coordinates. For example, an entity turning in a circular path with constant speed has a nonzero, purely centripetal acceleration in world coordinates, but zero acceleration in entity coordinates.

Angular velocity is represented as rotation rates about the entity axes. The rotation rates are generally not the same as Euler angle rates. Instead, angular velocity is a vector $[\omega_x\ \omega_y\ \omega_z]$ in entity coordinates. The vector's direction represents the axis of rotation, and its magnitude $|\omega|$ represents the rate of rotation about that axis. Extrapolation of orientation can be visualized as rotation about the axis at a rate defined by the vector magnitude over a given amount of time.

1.6.3.4 Object coordinate system

All objects, except as noted below, use the same local coordinate system as described for entities in 1.6.3.2.