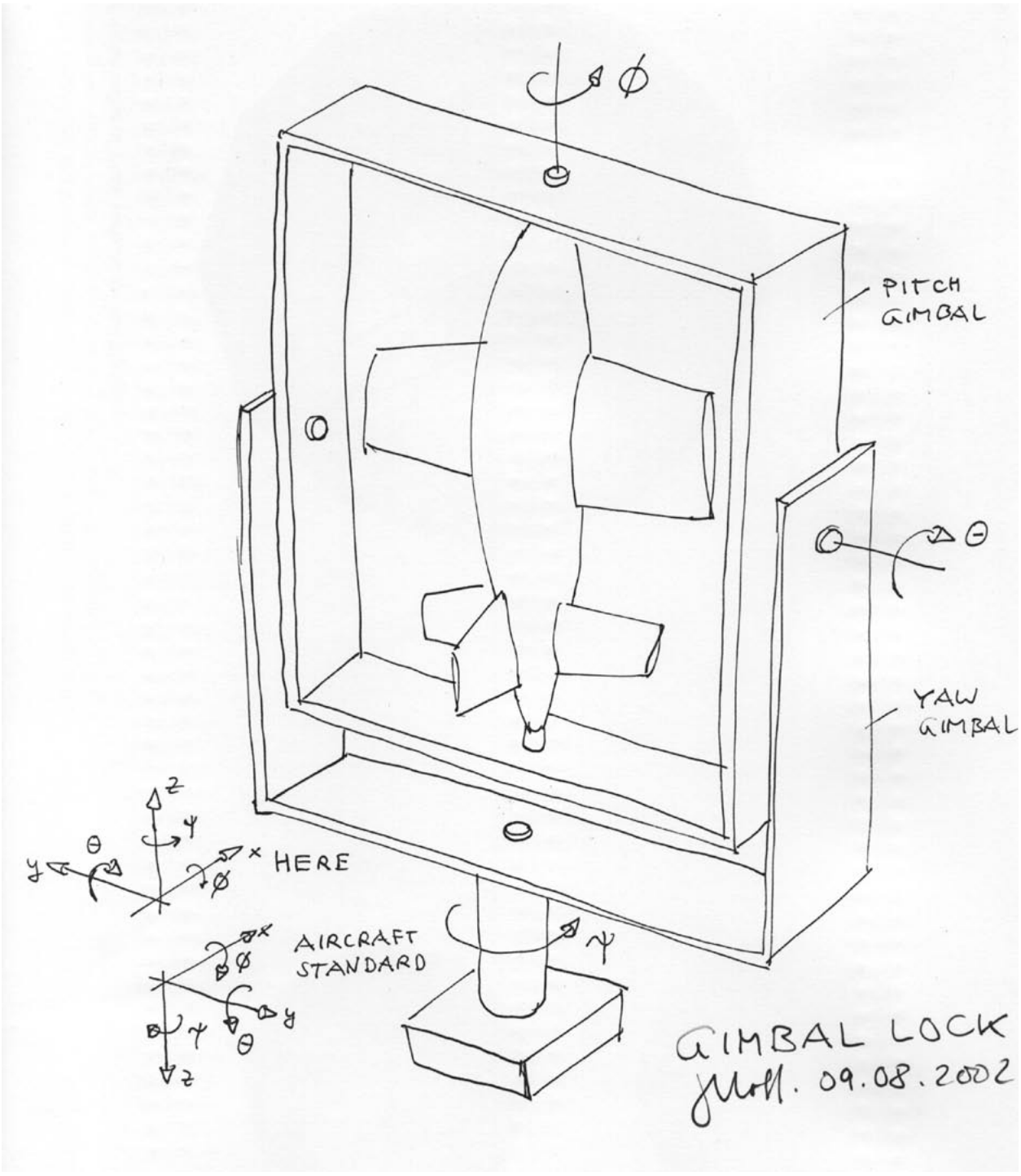


Infamous Gimbal Lock

For a free flight aircraft, gimbal lock is a pure kinematic problem

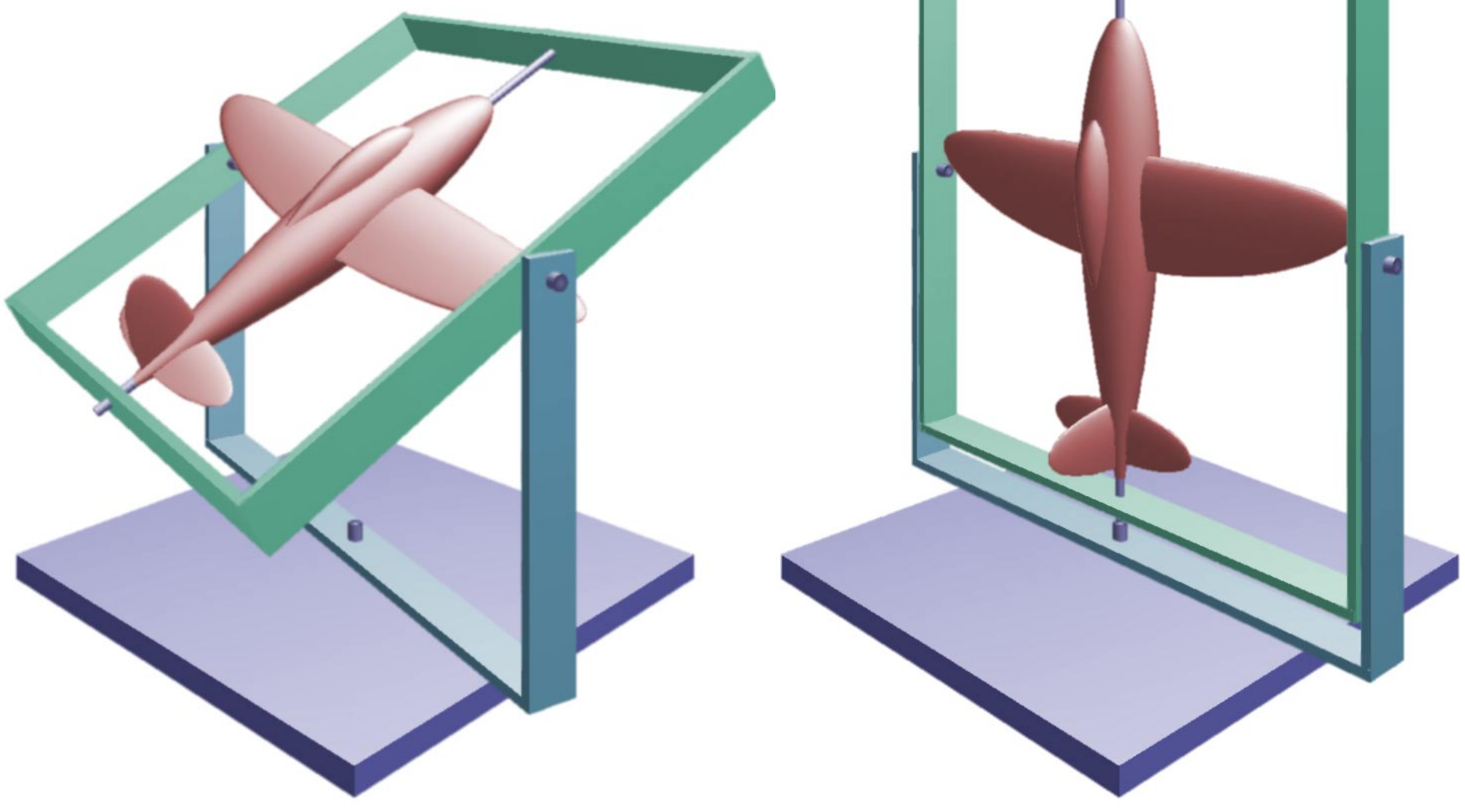
The integration of Euler´s differential equations for the rotation of a rigid body is executed by two steps:

1. Integrate angular acceleration
   Result: angular velocity
2. Integrate angular velocity
   Result: Euler angles or quaternion

The system below is equipped with a quaternion attitude controller.
The gimbals are only visualizations of Euler angles, thus not necessary here.

What happens if we apply in gimbal lock position a torque about the z-axis of the aircraft?
Gimbal flip! The yaw gimbal rotates 90° and the aircraft is free to move about the z-axis.

For a system with real gimbals, like a three-axis turntable, gimbal lock means a restriction.The aircraft bottom right cannot be moved about its z-axis.



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August 09 / 2002 — February 15 / 2013
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