T-37 Pearls: A Discussion of Rudder Column Angle

Philip H:

I strongly advise that you **install the column square to the hull, not square to the deck** as the plans suggest.

Square to the hull surface allows you to mount the rudder pretty tight against the hull for reduced turbulence and drag without rubbing on the hull when the rudder is turned.

Pete L:

I'm **hesitant to rotate the rudder post backward** (a swept rudder). I've done some research and found the following article on sailboat keel and rudder design: http://www.sponbergyachtdesign.com/Keel%20and%20Rudder%20Design.pdf

For rudder it says:

"A well designed rudder should have a nearly vertical leading edge and **a rudderpost set as near vertical as practical**.

When there is excessive leading-edge sweep, rudder lift and drag performance will suffer in the same way as they will on a keel planform. But rudder performance is more seriously affected by the rotation needed for steering. A swept-back rudder and rudderpost cause the planform to rotate obliquely to the water flow. The greater the sweepback angle of the rudder, the more it functions as a brake and not as an efficient lifting surface that promotes steering through a true side force."

Philip counters:

Vacanti's article, which you cite, warns against "excessive" aft sweep of the rudder's leading edge and he specifically refers to 30 degrees aft sweep. The reason is that turning such a rudder would act as a brake pushing down on the water flow.

If you observe the rudders depicted **in his article, they are all mounted perpendicular to the hull surface**, not perpendicular to the deck.

In the case of the T-37, the angle between the deck plane and the hull plane at the rudder post is what, 2 degrees?

I contend (and apparently so does Vacanti) that the flow of water conforms to the hull, not the horizon. So the action on the rudder results in "purer" side force when the post is perpendicular to the hull.

The difference, though, because we are speaking of 2 degrees, is immeasurably tiny. Therefore it makes sense to go with a hull perpendicular, which can be achieved with a $10 drill guide rather than a drill press with a complicated method of aligning and securing the hull.

It also makes sense to achieve the tightest possible fit between the root of the rudder and the hull to approach what Vacanti names a "sealed" root or a perfectly reflecting end-plate. Otherwise the rudder experiences tip-loss at both ends.

It makes even more sense to leave as little gap as possible between the rudder and the hull to minimize the chance of eel grass becoming trapped in the gap.

Tom C:

An additional consideration should be the servo-rudder linkage. If the rudder is perpendicular to the deck it will be in the same plane and properly rotating with the servo. If it is at a different angle it will have more wear/friction as the servo control arm will not be in the same plane as the rudder-post's rotation.

Philip H:

As to the friction on the rudder arm and linkage rod, I suggest that first there is likely a greater angle disparity in the hand-bent wire rod than the deck/hull angle. Secondly, eyeing the technology and precision of the stainless wire and brass sleeve, it may in fact be smoother for the wire to ride on just the edge of the brass sleeve than to be flat against the full length of the sleeve (if indeed you could engineer it finely enough to do so.