

From the Mooney List December 3, 2005 by Bob Kromer

SLIPPING A MOONEY

Went up to the attic last night and dug through my old flight test data sheets from my Engineering Flight Test days at the factory. I did find the observed data for the slip tests I did. Looked over the data. From those test results, here is some additional information that might help answer some of the questions that have been raised:

1. The data shows that it's the airplanes that require lots of nose up trim for landing that are the most prone to experiencing the tail buffeting condition we talked about earlier when aggressively slipping at or below 85 KIAS. We simply could not get the M20J prototype to buffet in a full rudder sideslip at any CG and flap condition tested, down to 1.1 V_{stall}. From those test results, I think it is safe to say that the Pre-J models and the J model itself will not experience any tail buffeting/partial airflow separation over the horizontal tail in an aggressive sideslip maneuver. So the J and Pre-J models should be okay for slipping on approach. Not comfortable, and in my humble opinion not the way to fly a high performance airplane like a Mooney, but safe.

2. It's the K models (and variations thereof) and the "long body" models that showed the possibility of inducing a partial horizontal tail airflow separation in an aggressive sideslip condition. I got it in both the Mooney/Porsche and the M20K model prototypes in the landing approach configuration. These are the airplanes that require almost full (if not full) nose up trim for a hands off, trimmed condition on final approach. (Sometime, run your pitch trim to the full nose up position on the ground and look at the negative angle of attack of the horizontal tail. Quite impressive). It's this high negative angle of attack with full nose up trim that puts the airflow over the horizontal tail at a fairly extreme condition.

3. Extending the flaps adds to the downwash angle over the horizontal tail, making the negative angle of attack over the horizontal tail even greater. Mooneys spend a lot of their time at or near forward CG. As the CG moves forward the need for more nose up trim on the approach is required for trimmed flight. So does lower airspeed. So the worse condition for aggressive slipping in the K and up models is slow, forward CG, full flaps - just like we are when configured for landing. Remember, it's anything that requires the need for more nose up trim that adds to the possibility of experiencing horizontal tail buffeting when aggressively slipping on the approach.

4. Aggressive slipping does strange things to the local airflow over the horizontal tail. The bottom line is this - the horizontal tail will see a greater negative angle of attack in the slip maneuver. So add an aggressive slip to the conditions noted in #3 above and you can experience the partial airflow separation over the horizontal tail and the resulting buffeting that we found in the flight tests. The Mooney is such a good design that there is no danger here - just a buffet in the control wheel from the elevator, a slight nose down pitching moment and a little loss of elevator effectiveness. But I want to emphasize - THIS IS NO PLACE TO BE FLYING. Add a little ice to that horizontal tail leading edge or a gusty crosswind requiring heavy elevator input and look out. That minor buffeting and airflow separation can get worse.

5. Someone asked what would happen to an airplane if the horizontal tail completely stalled. The answer - bad news. A sharp nose down pitching moment and a loss of elevator control would result. With increased airspeed as a result of the nose down pitch, the tail might start flying again and elevator effectiveness might be restored. But we're talking a loss of aircraft control here - a pilot's worst nightmare. How much altitude might be lost in this loss of control experience? A guess - 2000 feet.

6. Incidentally, ground effect helps the condition - the downwash angle over the horizontal tail is slightly reduced with the wing/flaps in ground effect. This reduces the local negative angle of attack of the air flowing over the horizontal tail - a good thing when it comes to stalling the horizontal tail.

Again - the bottom line. Aggressive slips in your Pre-J or J should be okay from a safety of flight viewpoint. K models and up - margins here are thinner. Chances are you might experience some tail buffeting in the K models and up when aggressively slipping - not a place to be. From my flight test experience, I would avoid aggressive slips on approach in the K's and up. The Mooney is a wonderful design, but all designs have their limits.

I certainly don't have all the answers and would never claim to be an "expert" or tell anyone how they need to fly their airplanes, but maybe some of my engineering flight test experiences at Mooney will help you better understand your airplanes. I've got lots of good data in my attic. Hope to share more of it with you in the future.

Best Regards;

Bob Kromer