How To Get TRIMMED

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You can get where you are going quicker—and without skidding across the sky—if plane's trim tab is used properly

Plane A and Plane B were of the same model, make, and weight. They took off at the same time, cruised at the same altitude, and arrived at the same destination—many minutes apart. Why?

As readers of "Are You Skidding?" in the June issue of The PILOT know, one of the pilots knew how to use his ball indicator. He also knew how to get trimmed. This has no reference whatsoever to a night in Las Vegas, although that is another way to get trimmed.

What we're talking about is the way the plane is trimmed for level flight: clean, efficient, and aerodynamically smooth. Many an inspector has observed supposedly experienced pilots sliding sideways across the sky, with the broadside of the fuselage resisting airflow like an unresilient barn door.

I recall a flight, from Oklahoma City to Los Angeles, with a veteran pilot senior to me in position and chronology. For several hundred miles he flew with the ball out of the "cage" (off center several degrees). This condition is guaranteed to make a precision pilot itch unbearably, but sometimes it's better to itch than to lose one's job.

Finally, this veteran pilot asked me if I wanted to take over. We exchanged seats, and I surveyed the situation. Slowly, with what is hoped was adroit manipulation calculated not to offend, the rule mentioned in the referenced article was employed. Result: no itching, more comfortable flying, and an increase of several knots of airspeed.

The same thing happened in Planes A and B, except that the faster plane was trimmed, the other was not. One pilot observed his ball indicator, noting that the ball was to one side or the other. Then he used his handy rule: *press the ball by pressing the rudder.* (That is, right rudder will center a right-side ball, or left rudder centers a left-side ball.) But this is merely the *first* step in getting trimmed, and because it involves subsequent steps, many pilots are content to let the plane fly with the ball off center.

This is what happened to Pilot B, who arrived later than Pilot A. He had not pressed the ball to center, and his fuselage was flying sideways, resisting the airflow. His plane had more drag and consequently less cruising speed than the plane Pilot A was flying.

Let's see how Pilot A, the speedier pilot, got trimmed without losing a dollar. When he leveled off at cruise altitude and cleaned up his cockpit, he set his props to the recommended r.p.m.'s. Then he adjusted the power to desired manifold pressure (Hg—the symbol for mercury—measuring, in this case, inches of mercury in terms of barometric pressure). By carefully going through his checkoff list he was sure that the flaps were up, the landing gear retracted, the cowl flaps closed, the mixture leaned for correct operation, and the carburetor heat was properly adjusted.

But the airspeed wasn't satisfactory! Despite the fact that he was flying at the correct power setting, and despite the fact that his plane was flying "hands off," he wasn't flying nearly fast enough. Was something wrong?

Something was. As experienced pilots know, a plane should indicate a certain cruising airspeed at a given loading, altitude, and power setting. If every item on the checkoff list had been completed, Pilot A knew that he was flying with added drag.

The next item checked was the ball indicator, which was contained in a 10° gradually curved tube that indicated as little as 1° of slip or skid. (The steeply-curved 30° type is not satisfactory; it is mostly obsolete, but a few are still in use today.) A glance at the ball told Pilot A that he was skidding, inasmuch as his course was directionally stable and he wasn't turning.

The ball was off several degrees to the left. This was caused by the conventional setting of right rudder prior to takeoff. Some of the setting had later been removed, of course, but not enough of it. With excessive right rudder, the increased cruising airflow was causing the tab to move the rudder to the right, exactly as though someone were pressing right rudder. Ordinarily, this would have

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caused the plane to turn right, but today the aileron tab setting was counteracting the rudder. The result: a ball on the left, a fuselage flying sideways into the airflow and acting like a barn door, and—which is important—a plane that was flying more slowly than it should have been.

Pilot A reached up and cranked in left rudder, thereby pressing the ball to center just as though he'd pressed left rudder with his foot. (The actual aerodynamics of this is different, as will be explained in a moment.) The immediate effect was to turn the nose to the left.

Now the right wing came up, and his plane no longer flew "hands off." Pilot A, had he not known how to get trimmed, would have reacted as many amateur pilots do: they crank back the incorrect right rudder setting and skid merrily on their way. Inexperienced pilots believe they have incorrectly trimmed their plane when this happens.

Not so Pilot A. He next turned the aileron tab, lowered the right wing, and observed that he was holding his heading almost perfectly, and that the ball was centered. This was what he wanted, and this was what he had — momentarily.

He watched the airspeed. It did change slightly, but not enough. Furthermore, a glance at the altimeter showed him that the plane was climbing. This is another point at which the amateur pilot wishes he hadn't fooled with the trim tabs, and is convinced that the rudder tab shouldn't have been corrected. If the plane was flying hands off, why wasn't it in trim?

But Pilot A knew that it wasn't. Instead of going back to his untrimmed, right-rudder condition, he reached down and adjusted the elevator tab to create a "nose-down" position.

With the nose back on the horizon, the plane's airspeed gradually increased. As the speed increased, more nose-down tab was necessary, and as the plane regained and held its altitude, it began to fly several knots faster than the uncorrected plane that Pilot B was flying. Plane A was flying *almost* as fast as it should, but not quite.

The checkoff list gave a speed that was still a little faster than the one Pilot A had attained. Because r.p.m.'s, Hg, and carburetor heat were normal, he knew he was getting sufficient power. Something else was wrong, or perhaps the plane was still not properly trimmed.

A glance at the ball told the story. It is here that the beginner pilot says the job's impossible. It isn't; it merely seems complicated, whereas it requires only a modicum of patience. Plane A was now flying faster than it had been flying, and it was again flying "hands off," with the ball slightly off center.

As old-timers and military dive-bombing pilots know, a plane that is trimmed for level flight will *not* be trimmed at high speeds. After rolling into his dive, the bombing pilot is often compelled literally to stand on his left rudder in order to keep the ball centered. He wants it centered in a nonskid dive because a skidding bombing run results in the bomb being thrown far to one side. Accurate bombing of any kind, dive bombing or horizontal bombing, demands a clean, ball-centered, nonskid run.

Nonskid flight is equally important in civilian flying. As the airspeed increased, the increased airflow had struck the rudder tab, which in turn forced the rudder to the right, exactly as though someone were pressing right rudder, and the ball was again slightly to the left. Therefore, Pilot A again ground in left rudder; not much, but just enough to move the ball precisely to center.

As the ball moved to center, the nose turned slightly to the left, and the turning effect picked up the right wing. Pilot A rotated the aileron tab to right wing down; not much tab, but a slight amount. Now the airspeed increased another knot or so, to the exact speed which should have been produced by the power setting. Finally, the concluding adjustment was made by rolling in a bit of elevator tab (nose down) to maintain level flight.

Does this "trimmed" position exist for the entire flight? No, because as the fuel and weight decreases, the plane flies faster and the tab must be continually eased forward. For this reason, no "cruise" marking is painted on elevator-tab controls, which are continually readjusted from the beginning of the flight to the destination. But once the aileron and rudder tabs are adjusted for a certain cruise speed, they need not again be touched during a given flight, although the setting may change as the plane gets older. Thus, the readjustment of the elevator is automatic: it needs to be touched only occasionally (and almost automatically, without conscious effort) whenever the altimeter shows "climb."

"This is all very well and good," says the lightplane pilot who isn't flying a deluxe job, "but what if my plane doesn't have three cockpit trim tabs? All I've flown is a plane with a rudder tab. Although my plane flies hands off, the ball isn't in the middle."

This condition offers two alternatives; a pilot may skid to where he's going, or he may try for a "charley horse" by holding rudder and stick for several hours. Most of us prefer the skid. But this doesn't mean that *next time* we're going to skid from here to somewhere. We're going to jot down on our knee pad or progress chart, "Needs (much or little) down elevator and (much or little) right aileron." And, in planes with no rudder tabs, we'd add notes on the rudder.

At our destination, we get out and examine the fixed trim tabs. These are small pieces of metal, varying from a few inches wide to several inches long, riveted to the control surfaces. Adjustable tabs may be moved from the cock-

pit. If yours are fixed, they must be bent outside the cockpit.

A very slight bending of these tabs affects the pertinent control considerably. For example, bend the elevator tab down. Now the airflow will force the tab (and the elevator to which it is riveted) upward. This in turn places more of the elevator in the slipstream and causes the plane to climb. Glance at your knee pad and adjust the tab accordingly.

Your chartboard also says, "Slight left rudder required." Now reason like this: "A slight bend to the right will put the tab into the slipstream; the slipstream forces the tab (and of course, the entire rudder) to the left. Moving the rudder to the left is the same as pressing left rudder, which centers a left ball and moves the nose to the left. Therefore, bending the tab very slightly to the right will give me more effective left rudder."

Don't be so naive as to suppose that the first bend is going to do the trick. It may take several flights to adjust all the tabs precisely.

But what about the aileron tab? Here is where many pilots do not figure correctly. Remember, that if we raise the right wing, we lower the right aileron. Now recall that we wanted to lower the right wing in flight, because we applied right wheel or stick in order to fly laterally level. This means that the right aileron went *up*. In order to force the aileron up without having to constantly apply right stick, I must bend the tab *down*.

Now check the plane in flight. It isn't necessary to flight test it—a routine cross-country flight will do. But remember that several flights may be necessary before the plane will fly hands off at a particular power setting; remember, too, that any change of power setting or airspeed requires a change in tabs.

It's worth it. The comfort of . . . .

"Wait!" says another constituent. "I don't even have either fixed or adjustable tabs on my airplane." In this case, someone with an aircraft mechanic's ticket will have to show you how to adjust the aileron. Remove the inspection plate cover and look inside the wing. Here you'll find a turnbuckle, which may be loosened, turned, and adjusted to "droop" or "undroop" the aileron. Inasmuch as your life may depend upon the amount of turn and the cinching of the turnbuckle, it is suggested that a licensed person do the adjusting, or instruct you as to how it should be done.

It's worth it. The comfort and pleasure of . . . .

"Yeah, but," interrupts someone else, "I don't have tabs or turnbuckles. Now what?"

Don't give up. We can still make Old Nellie fly like a bird. In planes not having fixed or controllable tabs, or turnbuckles, rivet a tab to the aileron. This is approved by FAA, but the installation requires the services of a licensed aircraft mechanic.

Be alert to observe if tab adjustment raises or lowers your ailerons excessively to accomplish hands-off, ball-centered flight. If too much aileron is needed, your plane may be out of rig, which also eliminates some of the extra knots one should be getting.

As we said before, getting trimmed is worth the effort. Not only do we fly faster cross country, but the plane handles better, she's more directionally stable and doesn't hunt or seek. Let's take off, setting the elevator tab to the white mark we've painted on the cable or to the zero-takeoff setting. (Don't paint anything indicating a cruise setting, because of possible ambiguity and because settings vary.) Set the tab slightly nose-heavy for takeoff, in order to stay on the runway until you have the correct speed, at which time a bit of back pressure lifts you into the air. (The higher the horsepower, the more critical is this setting, so it should be precisely correct.)

Set the aileron tabs, if any, to zero setting—aileron tabs are not critical, so the adjustment of them in the cockpit isn't either. The rudder tab is more critical, so a white mark on the cable or indicator will prevent you from growing calluses on your right foot during takeoff.

Now, at cruise altitude, set the power for cruise and wait for the plane to accelerate to cruising speed. Be patient, and observe this procedure:

1. Center the ball by adding rudder on the same side the ball is situated.
2. Add aileron tab until the plane is level, laterally.
3. Obtain level flight longitudinally by adding elevator tab.
4. Repeat Steps 1, 2 and 3 until the ball is centered and hands-off flight is attained.

Finally, watch the airspeed needle creep toward a higher figure: your reward will be several knots of increased airspeed, and you'll be flying comfortably, without that unnecessary and irritating skidding feeling that makes checkpilots itch.

You'll arrive at your destination just as Pilot A did, long before your less-skilled brethren who are flying your make and model plane, knowing that you've been flying efficiently and well.

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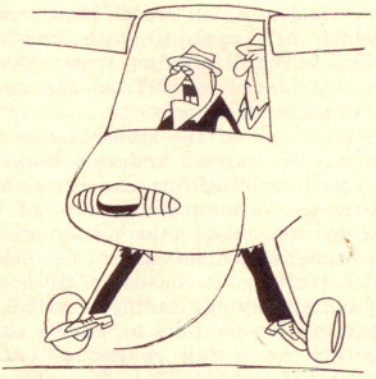

"I wish I could afford some wheel braces . . ."