Stearman Wheel Landings

by Tom Lowe

Just mention the words, “wheel landings”, among any group of tailwheel pilots and you are certain to evoke a reaction that will lead to a lively discussion of the pros and cons of this maneuver that most likely will degenerate into an argument in which no one is willing to budge on his or her chosen position. The opinions will vary from those who highly favor the use of wheel landings to those who have no use for them whatever and feel that a full stall three point landing should be used under all conditions. There seems to be no middle ground on the subject of wheel landings and very seldom is anyone likely to succumb to the arguments of the other side and change their viewpoint.

Published opinions on wheel landings run the gamut from William K. Kershner who states in his book, The Advanced Pilot’s Flight Manual, “The wheel landing is the best means of landing the tailwheel airplane in strong and/or gusty wind conditions in that the plane contacts the ground at a low angle of attack”; to the popular novelist, Stephen Coonts, who as a neophyte tailwheel and Stearman pilot boldly states in his book, The Cannibal Queen, “This method of touching down on the main wheels and holding the tail off as the aircraft slows is fun to practice, but it is not the recommended method for getting a taildragger safely down on strange airports in gusty winds.” He also remarks, “The old tail-wheel pros I have talked to recommend the full-stall landing, which is precisely why I use it exclusively.”

In his book, The Compleat Taildragger Pilot, Harvey S. Plourde states the case for mastering the wheel landing thusly: “Some

pilots converted to taildraggers are convinced that they don't need to learn or practice wheel landings because three-point landings are 'just as good'. The pilot who believes this is seriously short changing himself, and won't realize his error until he finds himself attempting a landing in 15-18 knot gusting crosswinds. The reason that wheel landing training is mandatory is that it allows the pilot to place the landing gear on the ground with a lower angle of attack and higher speed, hence with a greater degree of control. It is of course natural for a beginning taildragger pilot to not understand this need. However, if your instructor shares this line of thinking, consider yourself lucky to have made the discovery, and keep on looking. Until the taildragger pilot can perform acceptable wheel landings, he should consider himself at the student level (regardless of how many hours grace his logbook), and stay close to his instructor where his solo flying can be supervised."

He goes on to say, "If your taildragger checkout ended this way, it is unfortunate since you were shortchanged and have been left high and dry with an incomplete checkout. The price you will pay (or have paid) for this is a serious limitation in your use of the taildragger. There will be days when wind conditions will render the wheel landing mandatory simply because the stall landing will result in a bent airplane. These wind conditions are high and gusty winds as well as gusty crosswinds. In summary, anything less than a complete taildragger checkout is a farce placing you in the position of an accident waiting for a place to happen. And a complete checkout includes proficiency in wheel landings."

While these last two quotes were aimed primarily at pilots just beginning their transition into tailwheel airplanes, they certainly

apply to all tailwheel pilots, regardless of their experience level, and to Stearman pilots in particular.

Those of you who attend fly-ins and air shows most likely have observed that almost every professional air show pilot who flies a 450 h.p. Stearman wheel lands his airplane. Also, most pilots of high performance tailwheel airplanes such as AT-6s, P-51s, D-18 Twin Beechs and DC-3s, etc. also prefer to make wheel landings. There is a reason for this, which I hope will become apparent as you read this article. To quote again from The Compleat Taildragger Pilot: "In fact, if you had been around a generation ago to watch the local pros shooting wheelies in the old twin Beech 18's or DC-3's, it would have appeared to be the easiest maneuver in the world. The pros use this type of landing so much because, once learned, it is so easy to perform."

Before launching into a further technical discussion of wheel landings I must state that I am a strong advocate of the use of wheel landings and believe that every tailwheel pilot should be proficient in this maneuver. Personally, I also prefer to make wheel landings whenever landing a Stearman on hard surfaced runways. Regardless of your feelings as to whether or not wheel landings are the thing to do, it is a maneuver and technique that every Stearman pilot should master and remain proficient in performing.

PROCEDURE

Fly a normal traffic pattern and carry an additional 5 mph or 5 kts (depending on your airspeed indicator) on the final approach. The landing transition is made at a lower height than for a full stall landing because the airplane must touch down at a higher airspeed and the attitude will be only slightly tail low – not three

point. As you begin to flare add in a small amount of power and carry it until the wheels make contact with the ground. The primary purpose of adding power throughout the landing, besides maintaining the additional airspeed, is to permit the wheels to contact the ground with a minimum downward velocity (rate of descent). You literally fly the airplane onto the ground and are "feeling" for the runway. Remember – a wheel landing is not an accuracy landing. With the extra airspeed and power, you will use up more of the runway than you would with a three point landing.

When the main gear contacts the ground you must simultaneously ease forward on the stick (down elevator) to keep the airplane on the ground (maintaining the low angle of attack of the wing) and reduce the throttle to idle. The amount of forward stick pressure required at the point of touchdown will be small if the downward momentum (rate of descent) of the airplane was low. Remember, the primary reason forward stick is applied at the moment of impact is to counteract the downward momentum of the C.G. of the airplane. Continue to increase the application of forward control stick movement as the airplane slows down to keep the tail up until it descends of its own accord with the stick full forward. Once the tail has lowered to the ground, apply full up elevator to keep the tail on the ground as you would do in a three point full stall landing. If you are landing with a crosswind, normal crosswind aileron and rudder control correction inputs should also be applied.

Use only the minimum amount of power during the landing as is required to maintain the airspeed and to arrest the rate of descent. Excessive power can lead to unnecessarily high airspeed and subsequently, a much longer runway requirement.

But as the pilot sees the runway disappearing behind him, he likely may become impatient and force the airplane onto the runway with forward stick pressure. A bounce usually will result which can then develop into a series of porpoises down the runway. Should this occur, add power, go around and try it again. A go-around after a botched wheel landing usually is preferable to trying to save it as you bounce down the runway.

There are also two additional aerodynamic factors which come into play during a wheel landing, particularly while the tail is descending from its initial high position down to the ground. These are torque, or propeller P factor, and the center of gravity of the airplane. Torque and P factor usually are discussed relative to making a take-off, but they also apply during a landing, however to a lesser degree since the engine power is being reduced rather than increased.

Torque is the term that is commonly used to describe the left turning tendency of most American built airplanes in which the propeller rotates counter-clockwise as viewed from the front of the airplane. What really is happening is more accurately described by an understanding of the phenomenon known as P factor. P factor is developed by the fact that the downward moving propeller blade (the one on the right side of the airplane as viewed from the cockpit) has a higher angle of attack than that of the upward moving blade on the left side of the airplane. Additionally, the downward moving blade also has a slightly higher relative velocity with respect to the air. The aerodynamic result is that the descending right blade produces more lift, or in this case – thrust – than the ascending left blade. The ultimate consequence of this is that the airplane wants to turn to the left.

The other factor that has an effect on the airplane during the landing is the location of its center of gravity. Tailwheel airplanes in which the C.G. is relatively close to the main landing gear tend to be more stable with respect to their ground looping tendency. The Stearman's C.G. location falls into this category, but I'm not really sure if its location has much effect on negating the Stearman's propensity to ground loop. The Stearman is also affected by the often forgotten consideration with respect to the height of the C.G. location above the wheels. In the case of the Stearman, the biplane configuration concentrates the weight of the fuel in the center section, high above the wheels on the ground. This additional moment to the height of the C.G. adds to the reduced stability of the Stearman on the ground and is a contributing factor to its well-known tendency to ground loop.

Both of these factors have an effect on the directional control of the Stearman during a wheel landing, especially as the tail is transitioning down to the ground. The P factor is present, although in a much reduced amount since the power is at idle, and the airplane will still have a tendency to want to turn to the left. The high center of gravity is always present and there is not much that can be done about that, it just is a constant factor contributing to the characteristics of the airplane. All of this is coming into play as the tail descends to the ground, exactly when the rudder is beginning to lose its effectiveness. This probably is the most critical time for the pilot during a wheel landing – maintaining the directional control of the Stearman while in this transitional phase. (But then again – maintaining directional control in ANY landing in a Stearman is the primary problem.)

The above mentioned problem during the time period when the

tail is transitioning from its landing attitude down to the ground is most likely the main concern of those pilots who oppose the use of wheel landings and favor full stall three point landings at all times. They will say, “The tail has to come down sometime, so you might as well make a three point landing in the first place.” There is a certain degree of validity to this argument. However, a good competent, proficient tailwheel pilot can maintain control of the airplane throughout the wheel landing with no problem and take full advantage of the benefits it offers.

Stearmans have a fairly high wing loading and another technique to take advantage of this particular characteristic during the transition phase is to maintain the forward stick pressure that was applied at touchdown. Don’t push forward further. This allows the tail to lower a bit more quickly as the airspeed decreases. The tailwheel will contact the runway before the rudder loses its effectiveness, but still at a speed which will allow the application of full up elevator without the danger of the airplane becoming airborne again.

Another factor that can have an impact on the performance of a wheel landing is the sitting position of the pilot in the cockpit. This is equally as important in three point landings and take-offs as well. It is important that the pilot’s body, and his head in particular, be aligned with the centerline of the fuselage along the longitudinal axis of the airplane. The common tendency of most pilots is to lean to one side of the cockpit or the other, in order to look around the side of the windshield and alongside the fuselage in order to gain better visibility. Usually, pilots lean to the left side as this is most natural since the left hand is on the throttle quadrant on the left side of the fuselage and the right hand is on

the stick. The consequence of this leaning is that the control stick is drawn to that side of the airplane, introducing up aileron on that side, resulting with a wing that is forced down whether that's where you want it or not. So it is imperative that the pilot should remain aligned with the centerline of the airplane to avoid this unneeded control input. You should sit straight and your eyes should look past the side of the windshield, between the wings, along the side of the fuselage at an angle so as to focus on the edge of the runway several hundred feet in front of the airplane. In this manner you can judge your height above the ground, as well as the drift and alignment of the airplane with the runway.

The height that a pilot sits in the seat also plays an important role in the landing. In the WW II U.S. Navy training films the Navy recommended that the seat height be adjusted so that the pilot's eyes are looking directly through the center of the windshield. Personally, I find this just a bit too low for me, I prefer to sit higher than that. Usually I sit as high as my seat will allow to permit maximum visibility around the nose. Whatever seat height position you are comfortable with and are accustomed to using in your Stearman is what you should continue to employ while making wheel landings. Don't change it. That way your site picture will remain constant regardless of whether you make a wheel landing or a three point landing.

Your feet position on the rudder pedals also is important. Your heels should rest on the floorboards with the balls of your feet on the lower portion of the rudder pedals. Don't have them raised up high so as to get onto the brake portion of the pedals. While this seems to be very basic and unnecessary to comment upon – rest assured – the absolute last thing you want during a wheel landing

is to have the brakes being applied when you touch down.

As noted several times before, one of the prime uses for wheel landings is in strong crosswinds. When landing in a crosswind it is imperative that at touchdown all drift has been eliminated and that the airplane is tracking STRAIGHT DOWN THE RUNWAY. To accomplish this, apply the normal crosswind control corrections; wing down into the crosswind with aileron to stop the drift and enough opposite rudder to insure that the airplane is going straight. This will result in touching down on the upwind wheel first, followed thereafter with the other wheel. As the airplane slows down continue to increase the aileron and rudder input as necessary to keep the wings level and the airplane going straight. Once the tailwheel is on the ground the steering will become more positive, but be sure to maintain the crosswind corrections and full up elevator to keep the tail firmly grounded.

Another method of making wheel landings that some pilots favor is what I call the power-off, tail low landing. In this scenario the pilot flies a normal approach, power-off and begins to flare as you normally would for a full stall three point landing. When the tail attitude is low, but not yet in contact with the ground, the pilot adds engine power, or sometimes keeps the power at idle, and then introduces forward control stick (down elevator) in an attempt to “roll” it onto the runway.

This method completely nullifies the purpose and advantages of a wheel landing which is to fly the airplane onto the ground at a higher airspeed with a minimum angle of attack on the wing. In this tail low method you place yourself into a sort of “never-never land” upon touchdown and introduce into the equation all the factors that are detrimental to maintaining directional control of the

airplane. The airplane is slow, the wing is at a higher angle of attack, the rudder is beginning to lose its effectiveness, and power possibly is being introduced which increases the P-factor and adds to the left turning tendency. Throw in some crosswind and a possible bounce on the touchdown and you are setting yourself up for a trip off the side of the runway into the weeds – or worse. If you choose to perform this type of wheel landing – you might as well go ahead and make a full stall three point landing. You'll be a lot better off!

I have been very fortunate throughout my Stearman flying days in that my home airport has three long grass runways and I have spent most of my time enjoying the pleasures that grass provides. As you know too well, the Stearman is a unique tailwheel airplane and has some ground handling characteristics uncommon to many other tailwheel airplanes. It really likes to ground loop and you must remain ever vigilant upon every landing, whether it's a three point or wheel landing. The Stearman is no respecter of persons or their experience level and is ever ready to humble the unwary pilot. What exactly it is that makes it so is really hard to pinpoint. The Stearman has a relatively narrow main landing gear, a high center of gravity, large side fuselage and tail surface areas and wheels with toe-in (cambered inwards). All of these contribute to its willingness to jump up and bite you in the buttocks (as Forrest Gump would say) at every opportunity.

Now take the Stearman to a paved runway and it will release the "beast" that is hidden within. The Stearman definitely is a different airplane on pavement than what it is on grass. Grass is the great equalizer! For whatever reason, the tires just seem to reach out and grab the pavement and bite into the ground. We have all

either observed, or most likely ridden through, landings on pavement where the screech of tires is heard above the rumble of the engine and the Stearman careens from one side of the runway to the other until it is finally brought under control by its breathless pilot. It doesn't seem to get much better as your experience level grows either. I have approximately 3000 hours of flying time in Stearmans and still to this day, every landing on a hard surfaced runway is preceded by a feeling of apprehension, a dry mouth, a tightening of the sphincter muscle which induces an advanced case of "pucker" that leaves me wondering if this will be the Stearman landing that will finally jump up and grab me. I constantly practice landings, both three point and wheel, on the paved runways at airports near my home field to maintain my proficiency. What all this rambling is leading up to is that I personally prefer to make wheel landings in Stearmans on paved runways. I feel that I have a greater degree of control over the vagaries of the Stearman with a wheel landing as opposed to the three point landing. Regardless of all the dire comments I have just uttered, the Stearman is a wonderful airplane with a mystique all its own and there is absolutely nothing more satisfying than making a squeaker landing in a Stearman.

ADVANTAGES OF THE WHEEL LANDING

Maximum controllability of the airplane through the touchdown point.

§ Reduced susceptibility to being adversely affected by wind gusts.

§ Improved visibility during the landing and rollout.

§ Ability to set the airplane on the ground at any airspeed (within reason) above stall speed.
§ Ease of transition from one tailwheel type to another.
§ Safety in face of unknown factors such as:
Night landings (when visual acuity and depth perception are reduced)
Overloaded airplane
Airplane with C.G. out of limits (particularly an aft C.G.)
Airplane iced up such that exact stall speed is uncertain

DISADVANTAGES OF WHEEL LANDINGS

§ More difficult to learn, master and maintain proficiency.
§ Uses a greater amount of runway during landing and rollout.
§ Potential for a bounced landing developing into a series of bounces which may lead to a loss of directional control.
§ Potential for loss of directional control during the transition phase while the tail is coming down to the ground.
§ Too much airspeed on approach – the airplane floats during the landing.
§ Excessive amount of power during the landing.
§ Failure to apply forward stick pressure and reduce power simultaneously at the time the main wheels touch the ground.
§ Excessive downward velocity (rate of descent) at touchdown. (not enough power)
§ Getting impatient – diving at the runway or trying to force the airplane onto the ground.
§ Too slow approach airspeed or leveling off in the flare too high –

the airplane settles fast onto the main gear and bounces.

§ Trying to salvage the landing after a bounce. (add the power and go around and try it again)

COMMON ERRORS IN MAKING WHEEL LANDINGS

There is one more final point to make. Wheel landings and soft field conditions do not mix. If you are going into a soft field, make a three point landing.

In summation, I would like to emphasize that the opinions and preferences presented in this article are entirely those of the author and in no way reflect any official position of the SRA. What I have described reflects the way in which I was taught to fly tailwheel airplanes and my observations gathered over 36 years of flying and instructing in tailwheel airplanes. This is how I fly my Stearman and how I teach my students.

I again would like to quote from The Compleat Taildragger Pilot where its author, Harvey S. Plourde states, “No maneuver in basic VFR flying is as poorly understood as the wheel landing. Yet, the wheel landing is vital to the taildragger pilot’s safety. Without the knowledge, experience, or skill to perform this maneuver, the pilot severely limits the use of his taildragger to relatively benign wind conditions. He also endangers the lives of his passengers, if, in such ignorance, he ventures forth in conditions which give him 90 degree crosswinds in the 12 gusting to 18 knot range.”

Whether or not you agree or disagree with me concerning the material and opinions I have presented in this article on wheel landings, I believe that every Stearman pilot should know how to

do a wheel landing and should maintain proficiency in its execution. To do so is to add another weapon into your arsenal of skills to be called upon for use whenever needed. Whether you choose to use the wheel landing, and under what conditions, always will remain the option of the pilot. If you have never mastered this skill or have let your wheel landing proficiency become encrusted with rust, I would urge you to locate a good tailwheel Flight Instructor in your area (preferably one with Stearman experience) and get a few hours of dual instruction. You'll be a better pilot for it.

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Editors Note:

Supporting or alternate views on Wheel Landings vs ThreePoint Landings are welcome for future publications of the ***Stearman flying Wire****.*