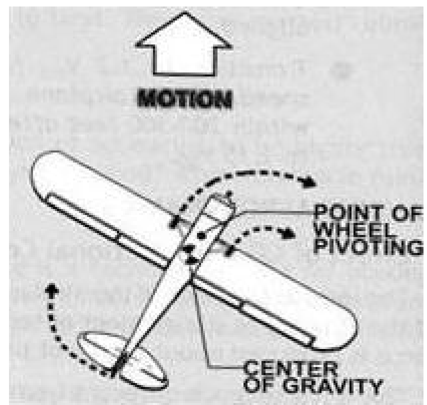
Things to remember when flying N102RE or any Taildragger…

1. The Center of Gravity (CG) is behind the main between a taildragger (i.e. conventional gear airplane) and a tricycle gear airplane where the CG is in front of the main gear. This little difference impacts a great many issues whenever the airplane is a "ground vehicle". The CG is the point around which the airplane rotates horizontally, longitudinally, and vertically. Horizontal rotation is the critical issue when a taildragger is on the ground. In the air, taildraggers and tricycle gear airplanes fly pretty much the same.

   Note in the diagram right, how it is necessary to move the tail to the left to make a right turn … because the CG is behind the pivot point of the main landing gear.



2. The key to successfully managing a taildragger of this nature is rudder movement. Keep the rudder pedals moving virtually all the time the airplane is on the ground … or in transition to/from being a ground-vehicle. There is a saying attributed to one Howard Ballew, "During any landing in a taildragger, if you aren't moving the rudders, you are close to a ground loop. Therefore …

   a. <u>Anticipate! Anticipate! Anticipate!</u>
      As soon as the airplane begins to move in the direction you want it to move, start stopping that direction of movement with opposite rudder pedal! Your feet need to be "dancing" on the rudder pedals; particularly during landing!

   b. <u>Speed on the ground is a factor!</u>
      If you are moving at taxi speed, more rudder movement is required to start and stop a directional turn and the response to your actions will not be as fast as when you're moving at speeds required for takeoff or when in the landing rollout. If you are moving at takeoff/landing speeds, less rudder movement is required but the action on the rudder pedals must be quicker to prevent over-steering.

3. While use of rudder is perhaps the single most important element of airplane control during ground operations of a taildragger, the inherent high angle of attack created by the lowered tail mandates careful elevator and aileron management as well. The easiest “rule of thumb” to remember is … “follow the thumb” with the stick. If one uses the fingers to grasp the control stick, the thumb will be pointing upward. If the pilot aligns his thumb parallel with the wind direction and moves the stick in that direction … the ailerons and elevator will assume their most protective positions. Note … if a tailwind is less than 10mph, it is generally better to keep the stick pulled back to get more weight on the tail wheel as the airplane moves forward. This is contrary to the “follow the thumb” rule. When in doubt, “follow the thumb” … and do so always if the tailwind exceeds 10mph. Pushing the rudder forward causes the elevator control surface to go downward, minimizing the possibility of the wind getting under the tail and lifting the airplane.

4. N102RE acts very much like a “light” Cessna 180 or Cessna 185. These airplanes require more “attention” than the smaller, slower taildraggers often used for pilot check-outs; because these planes have (a) bigger engines, (b) are faster, (c) aerodynamically cleaner, and (d) have bigger rudders. In N102RE, the big rudder is both bad and good … the bad is that there is greater surface area for a cross-wind to “leverage” against; the good is that the rudder itself becomes effective at low airspeeds (comparatively much sooner than most taildraggers relative to comparable lift-off airspeeds or angle of attack attitude).

5. On the ground, a taildragger with a tail moving rapidly in one direction or another is the beginning of a ground-loop and it must be immediately corrected at any speed.

    a. If the airplane is moving at a speed where there is no RUDDER control, pull the power back and use brakes judicially. Judicious braking is particularly true in N102RE where tail wheel effect is not strong, and concurrently, strongly applied brakes will put the plane on its nose.

    b. If the airplane has sufficient speed that the rudder is effective, it is almost always best to power out of a ground loop with more or maximum power … using judicious braking and full aileron into the wind to assist. This guideline applies to most taildraggers. The rudder typically becomes effective when there is sufficient speed to lift the tail; although in N102RE and most other

Sportsman/Glastar aircraft, the rudder is effective about 5mph before the elevator has lift capability.

6. Takeoff -- Because the CG is behind the pivot point of the airplane and the airplane sits at a high angle of attack … longitudinal torque, p-factor, drag friction created by greater downward force on the left tire, gyroscopic precession, the corkscrew effect of the propeller slipstream, centrifugal force, and changing weather vane tendencies combine during takeoff to have greater impact on a taildragger than is experienced in a tricycle geared airplane.

   Right rudder is generally needed at varying pressures during the takeoff roll as a function of changing power, attitude and crosswind effect. It is important to keep the airplane rolling straight during the takeoff roll.

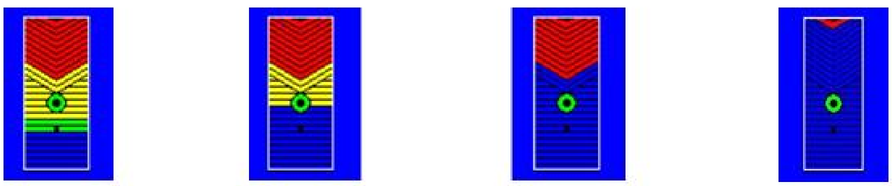
   In most tail wheel airplanes, the airplane is already positioned very close to the best angle of attack. As a general rule, the nose should be pushed forward slightly until the tail lifts clear of the runway; at which point, maintain that angle of attack during the initial climb. Strong cross winds or gusty wind conditions can sometimes be better handled by allowing the tail to come up a little higher and keeping the main gear on the runway a little longer … ensuring a slightly higher margin of airspeed to deal with any abnormal gust conditions. However, not lifting off in a timely manner can be risky in a taildragger.

7. Landing – As the saying goes, “There are three simple steps to making a successful tailwheel landing: First is the approach; second is airspeed control; and unfortunately, no one knows the third.” The key is in the approach. Final approach should be made with a consistent airplane configuration, a stable vertical flight path to a predetermined rotation/flare point … whether using power or not. While power helps keep the engine warm and ready for a go-around if needed, power approaches are not always possible. Stable descent and airspeed on final are, however, critical.

   The approach speed should be 1.3 times the landing configuration stall speed. This speed allows a margin of 30% above stall speed for maneuvering. This speed should be reduced to about 1.2 times the configuration stall speed “over the fence” (i.e. about 20 to 30 feet above the ground) … with a slow transition to landing configuration about 10 to 15 feet above the runway.

8. N102RE has an AOA (angle of attack) indicator with the following displays.

AOA Display
The center round donut will be green when the flaps are down and black when they are up. The numbers below the display is angle of attack in tenths. You will get the following displays. As the angle of attack increases, the display will lose bars.



L/D Max
Best engine out glide speed

Approach
Desired normal approach angle

Warning
15% above stall and verbal "Angle Angle Push"

Stall
Indication as reach stalled condition

9. If an AOA is installed in an airplane, it provides the best guidance to a stabilized approach. Use it! With an AOA installed, airspeed control should be used only as a back-up or for verification. The airspeeds will not always be as published in the Pilots Handbook; but the airspeeds should be stable at the desired angle of attack. As a note, in N102RE, the verbal Warning “Angle Angle Push” will be heard at any time the airplane is approaching a stall … including during takeoff as the airplane achieves flying speed! The AOA is a very useful tool to ensure stabilized flight at minimum flyable airspeeds.

   AOA indicators vary. However, in N102RE, the AOA has a series of colored bars … green, yellow, and red (i.e. safe, caution, and approaching stall). There are two targets on the indicator. There is a big circle (which is black if there are no flaps, green if you have lowered flaps) and a small dot below the big circle. The small dot is best engine out glide speed … and also, best rate of climb with power. The big circle with the dot in the middle is the best approach speed and max over-an-obstacle climb rate. The color bars disappear or re-appear as the AOA changes. In N102RE, it is easy to think in terms of “pitching the nose” to <u>move the colored bars toward the dot</u> or <u>pitch to the dot</u> (best angle or best rate) that you want. When the colored bar rests on the dot you seek … hold that pitch attitude.

10. The three-point or full stall landing configuration is almost identical to the attitude of the airplane during taxi! It is important to learn this attitude by noting it during taxi. Note the angle in your peripheral vision rather than by looking over the cowling. That said, in the Sportsman, as you look over the cowling, the far end of the runway (or the far horizon) will typically be just below the cowling line. Ideally, the main gear and tail wheel should touch down at the same time; with the wing fully stalled and the stick or control stick fully pulled into your stomach! DO NOT LET UP ON THE STICK once the plane has touched down. Keep the stick in your stomach … and concentrate on the rudder action needed to keep the airplane rolling straight. Return the flaps to normal state as soon as practical – but do not sacrifice directional control during roll-out to go looking for the flap handle.

11. There is a long-standing argument over the appropriateness of wheel landings during strong crosswind conditions. For some planes … bigger, faster war birds for example … a wheel landing may (key word, “may”) be appropriate.

    As a general rule, however, a three-point full-stall landing is generally a safer solution for landing any taildragger – as long as there is sufficient aileron control to ensure the airplane can track straight down the intended landing path. A note here … in a strong crosswind, the intended path might not be down the centerline of the runway. Rather it might be along a diagonal path that stretches across the runway left-to-right (or right-to-left) for the distance needed to stop … using that angle to minimize the effect of the crosswind.

    Remember also that in a taildragger, any crosswind must be compensated for during approach, flare, and continued throughout the landing roll – and subsequently during taxi.

    Whether a crab or slip is used during approach, the airplane must transition to a wing-low-into-the-wind during the flare and the wing/aileron down into the wind must be maintained throughout touchdown and roll-out. That means the pilot is side-slipping during the flare, touchdown, and rollout -- and USING RUDDER FOR DIRECTIONAL CONTROL during flare, landing and rollout.

    Sideways movement on touchdown is very hard on a tricycle geared airplane … but when the nose touches down, the plane will generally follow the nose. Sideways movement on touchdown in a taildragger almost always results in the start of a ground loop … and whether the resulting ground loop is controlled or not, always leads to vigorous hanger talk or rationalizations. As a general rule, it becomes almost impossible to control an impending ground loop once the center of gravity has gotten outside of the ground track of the main-wheels width.

12. The paragraph above might be construed to mean that there is never an appropriate time for a wheel landing in a taildragger. There are two types of wheel landings … a tail-high wheel landing and a tail low wheel landing (and pretty much any range between). Wheel landings do offer the advantages of better visibility, easier to execute a go-around, more weight on the main wheels potentially providing greater (but judicious) braking, and in some cases, better control response to counter drift.

    The major disadvantage of wheel landings is the combination of generally higher ground speed and the accompanying need to transition to a ground vehicle. A taildragger with its tail in the air is essentially a weather vane … with the crosswind leveraging the large aft section of the airplane in a direction counter to that necessary to track down the runway. As the airplane is slowed, the rudder and ailerons become increasingly less effective … and as a result, the transition from an air vehicle flying with its wheels on the ground to a ground vehicle under the control of the pilot/driver is actually more difficult and risky than a simple three-point landing where the plane becomes a ground vehicle at touchdown. The ability to make this transition in high crosswind situation – particularly if the wind is gusting for whatever reason; requires regular and repeated practice in those kinds of conditions. Such practice opportunities are, in fact, hard to come by in most environments … since most airports have their runways pointed into the prevailing winds.

    There are two approaches to wheel landings. Due to the sensitive rebound characteristics of the rolled steel landing gear of the Sportsman combined with the high-life characteristics of the deployed flaps, the Sportsman demands precise touchdown control. A modified power approach has proven most successful with N102RE. The desired touchdown speed is typically obtained by establishing the desired landing attitude (pitch) on approach, and the use of incremental power changes (mixed with appropriate attitude modification to maintain the desired attitude) are used to control the altitude descent!

    Obviously, if the descent rate is too fast, a bounce is likely. A minor touch of power will minimize sink in the final inches as necessary and provide a generally level flight attitude. As the wheels touch, the stick is moved forward to maintain contact with the runway. The wheel landing touchdown speed is generally faster than that of a full stall or three point landing.

With the wheels firmly on the runway and the airplane tracking down the runway under control (i.e. with wing down into the wind and direction under control with the rudder), power is slowly reduced until the tail begins to lose its lift capabilities. At this point, it is necessary to put the tail down aggressively.

If the pilot were to pull the tail down before the tail starts to lose its lift effect, then the plane is generally still moving fast enough that it will resume flight … with all sorts of potential exciting results depending on airspeed, wind conditions, and how the pilot reacts. A pilot caught in this predicament should immediately execute a go-around (assuming there is sufficient runway and/or obstacle clearance ahead).

The other touchdown technique is similar in that the airplane is leveled and sink rate minimized … sometimes with power. But prior to actual touchdown, power is removed and airspeed is “milked” from the airplane in a transition to a tail low condition. Done correctly, this technique lowers the relative ground speed – but increases the weather-vane effect of any crosswind component. On touchdown, the nose is forced down as above … and held there until the tail begins to lose its lift capabilities as noted above. At that point, the tail must be aggressively but smoothly planted on the runway by the pilot.

Many pilots like to do wheel landings without flaps. It is important to remember that without flaps; the airplane stall speed is higher – which means that the airplanes’ relative ground speed is greater along with the accompanying weather-vane effect of any crosswind component as the airplane transitions to a ground vehicle. Still, if a pilot has trained regularly in legitimate crosswind conditions, then it is argued by many experienced taildragger pilots that a no-flap wheel landing may be the only way to get a taildragger onto a runway with a strong gusting crosswind; ensuring control of the airplane down the runway path before planting the tail to the ground … and being prepared to go around should a gust coincide with the pilots attempt to plant the tail.

My personal experience would suggest that a safer alternative to a strong gusting crosswind would be to land diagonally across a wide runway in a three-point landing …

since the strong wind would lower relative ground speed and the minimum flying speed would inhibit the effect of a gust. This remains, however, a pilot's choice.

13. There is an axiom that says, "*It is necessary to fly a taildragger from the time you untie the tiedown ropes until you have re-tied them at the end of the flight".* It is a truism. The low tail wheel creates an angle of attitude for a taildragger which puts the airplane very close to the critical angle of attack needed for flight. A little gust of wind can lift a wing … or shove the tail … when it is least expected. And such a "gust" might just as easily come from the prop of another plane or jet-wash. Fly the airplane until it is tied down.

14. The above guidelines are offered in expectation that the reader is already a pilot and understands the dynamics of stick-and-rudder control. There are a number of places to get further information on how to fly a taildragger if needed. << www.taildragger.com >> is a good starting point on the web; Sparky Imeson's book "Taildragger Tactics" provides a reasoned and complete guide for flying conventional geared airplanes in various environments; and Damian DelGaizo's "Tailwheel 101" DVD provides insightful video examples. The "Point of Wheel Pivoting" diagram used above was "borrowed" from Imeson's book. And of course, feel free to ask me about anything you don't understand or questions that you may have.

// Richard Eastman