Flight Advisor Corner by Hobie Tomlinson

June 2005 **Tailwheel Transition, Part I**

Having just completed a couple of issues on landings, I thought it might be interesting to do a set of articles on Tailwheel Transition.

Tailwheel, or conventional gear, aircraft were "the norm" in the post war years. This lasted until the late '50s when Cessna resumed production of a two place trainer, introducing the C150 as replacement for the discontinued C140A. Its durable all metal construction, easier landing and ground handling qualities and economical operation made it the "gold standard" in the flight training business and an industry was changed.

Tailwheel airplanes rapidly went "out of vogue" and were displaced as working airplanes, except for a few special applications, (bush flying, etc). Most of them were retired to small fields and private owners as "cheap" airplanes, (I know that's an oxymoron). Over the next 30 years they gradually fell into low use and disrepair. Then a couple of things happened. Aerobatics returned to the national scene, and suddenly new production tailwheel aircraft were selling again. About this time EAA had a large influx of new members along with the growth of "type clubs" and the EAA Vintage Aircraft Association. Now large portions of the remaining aircraft in this category have seen restorations and are better than when they were new.

The popularity of the "Van's" series of experimental aircraft and the new sport aircraft category means many more people will be provided the opportunity to transition to a "taildragger". Even that euphemism, which started as a derogatory term, has become a compliment

All that being said, why the tailwheel aircraft in the first place? The design offers some natural advantages from the manufacturer's point of view. It is lighter, (no heavy nose gear and associated support structure), faster for the same horsepower, (less parasite drag without the nose gear) and easier to manufacture, (simpler structure) and lower maintenance. It also offers good propeller clearance and a rugged main gear for "rough field" operations. Its main drawback is **negative directional stability during landing roll** and more difficult ground handling in the wind.

Many originally tailwheel aircraft were converted to tricycle gear configuration by their manufacturers and had their flying qualities and performance degraded by the change. A good example of this is the Piper Pacer/Tripacer (PA20/PA22). With the resurgence of tailwheel popularity, many of these have been converted back to their original tailwheel configuration.

The reason for the **negative directional stability on landing** is that the center of mass is behind the point at which the deceleration force is being applied, (i.e. the main gear brakes). In terms of the laws of physics, this is akin to trying to shoot an arrow backwards, (i.e. the center of mass, the arrowhead, would be behind the center of drag, the feathers.) You can now understand why the natural tendency of tailwheel airplanes is

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to "swap ends" during the landing roll. Originally tailskids were used on grass runways, as they gave both directional stability and a deceleration force by digging into the sod. These early WWI vintage aircraft did not have brakes as they were not needed and operations were conducted into the wind. As paved runways became the norm, tailwheels, brakes and crosswinds were added, thus the directional control problem arose. The directional stability is not as large an issue on takeoff, as the center of thrust, the propeller, is forward of the center of resistance. However, gyroscopic precession from the propeller can provide some "interesting" moments if not managed properly.

The ground handling issues stem from two factors. The first is that the aircraft always sits on the ground at a positive angle of attack. This means that anytime air is flowing across the wing (either from wind, aircraft motion, or a combination of the two) it is producing lift, lowering the tire cornering force. The tricycle gear aircraft, on the other hand, sits on the ground at a slightly negative angle of attack. This means that even though the same wind is blowing across its wing, the wing is not producing lift due to its negative angle of attack.

The second is that the aircraft has a greater profile, or side surface area, behind the pivot point or main gear. This combined with the "full swiveling" function of modern tailwheels means that the aircraft is a natural weathervane and wants to pivot into the wind. Tricycle gear aircraft typically do not have swiveling nose gear and have a much smaller side area behind the main gear, thus this tendency is much less pronounced. Aircraft with a swiveling nose gear, such as the Grumman American series aircraft, show a more pronounced tendency to weathervane, but still nowhere near as much as a tailwheel aircraft.

As you might expect, **good brakes are very important on tailwheel aircraft** to aid in directional control. Brakes have evolved over the years as technology has improved. Early post war aircraft simply used a mechanical "shoe type" brake as was found in very early automobiles. This was not a very good brake, as the small wheel size of the typical light aircraft did not give much brake surface and its effectiveness was dependent on the foot pressure the operator was capable of applying. The mid 1950s saw a gradual evolution to hydraulic powered shoe brakes. These were better, but suffered from "brake fade" when hot and still provided a small braking surface. **Modern disk brakes** are now available for retrofit on most of these aircraft and **are one of the top safety improvements they can have.**

These older aircraft may have either "heel" brakes or "toe" brakes. The original installations were usually "heel" brakes. These consisted of a separate brake pedal in front of each rudder pedal, which was operated by heal of the respective foot. This was used because it was a simple installation and the heel was able to exert more force on the mechanical brakes. With the advent of hydraulic brakes, came "toe" pedals. Many aircraft simply switched the heel brakes to the hydraulic type and left them in place. Lastly the conversions came, to either disk brakes, toe pedals or both.

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Tailwheels come with different features. The old original tailwheels where short, causing the fuselage to block air across the rudder during landing roll and placing the wing at a high angle of attack on the ground. They also used small, hard rubber tires which provided a minimal tire cornering force. Modern, or conversion, tailwheels use large "air" type tires and are taller. They give a much better tire cornering force, less fuselage blocking of the rudder during landing roll and a lower wing angle of attack on the ground. Also tailwheels are either steerable (with the rudder), or when just swiveling, can be "locked" in the forward position for takeoff and landing.

Most tailwheel aircraft that developed a bad reputation did so during the area when pilots were no longer being initially trained on them and many of the retrofit upgrades had not appeared. These aircraft present no unusual level of difficulty when modernized and flown by tailwheel competent pilots.

A few aircraft (such as the C195 or Helio Currier), came with **"crosswind" gear**. On these aircraft, the main gear can swivel through a limited arc. The idea was that if the aircraft was landed in a crab, the wheels would swivel and align with the ground track. This would prevent side loads and a possible ground loop. (**Ground loop** is the term given when the pilot of a convention gear aircraft loses control and it does swap ends, usually destroying the gear and a wing tip in the process.) This caused a new problems, though – the law of unintended consequences. If the aircraft was landed aligned with the runway, as required for a non crosswind gear, the gear would still swivel and allow the aircraft to track sideways off the downwind side of the runway! *The crosswind gear required landing in a crab for control!* For obvious reasons, most of these were replaced with standard gear, or retrofitted with a locking mechanism that allowed the swivel feature to be "locked out" unless wanted.

Because of the differences in the ground handling characteristics of tailwheel aircraft, many accidents happened as pilots who were trained in tricycle gear aircraft attempted to fly them without proper instruction. This led the FAA into making a regulator change to FAR 61. It is now required that a pilot who has not logged prior tailwheel pilot in command time, obtain a flight instructor endorsement that he/she is competent to operate tailwheel aircraft before flying as pilot in command of such aircraft.

Also **the landing currency rule is different for tailwheel aircraft.** All of the 3 landings (each 90 days for passenger carrying currency) must be to a full stop in a tailwheel aircraft. Tailwheel landings count toward tricycle gear aircraft currency, but not vice versa. It is very similar to night currency, where all landings need to be to a full stop and night landings count for day currency, but not vice versa.

Modern tailwheel aircraft are quite docile and a proficient pilot who properly flies a tricycle gear aircraft should not have undue difficulty checking out in one. The problem is that while a tricycle gear aircraft's natural directional stability covers and corrects for a multitude of bad techniques, the tailwheel aircraft does not. The **tailwheel aircraft will in fact, exacerbate those errors** and as in part of Gill Rob Wilson's famous quote: "**is terribly unforgiving of any inability or neglect"!**

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Even if you are not planning to own or operate a tailwheel aircraft, **a tailwheel transition course is fun, a great confidence builder and will make you a far more competent tricycle gear pilot**. Try it, you'll like it!

Next issue we will pick up with flying techniques for tailwheel aircraft. The thought for this month is another famous Gill Rob Wilson quote. **"Money changes all the rules, except for aircraft and deep water yachts!"** So until next month, **Think Right to FliRite!**

FliRite Aviation's 1959 Champion 7FC ~ converted to "7EC" Config.

Ramp @ Franklin Co., VT – KFSO **FliRite Image by Shirley Chevalier**

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