July 2019

PROPWASH

A Newsletter of EAA Chapter 517, Inc.

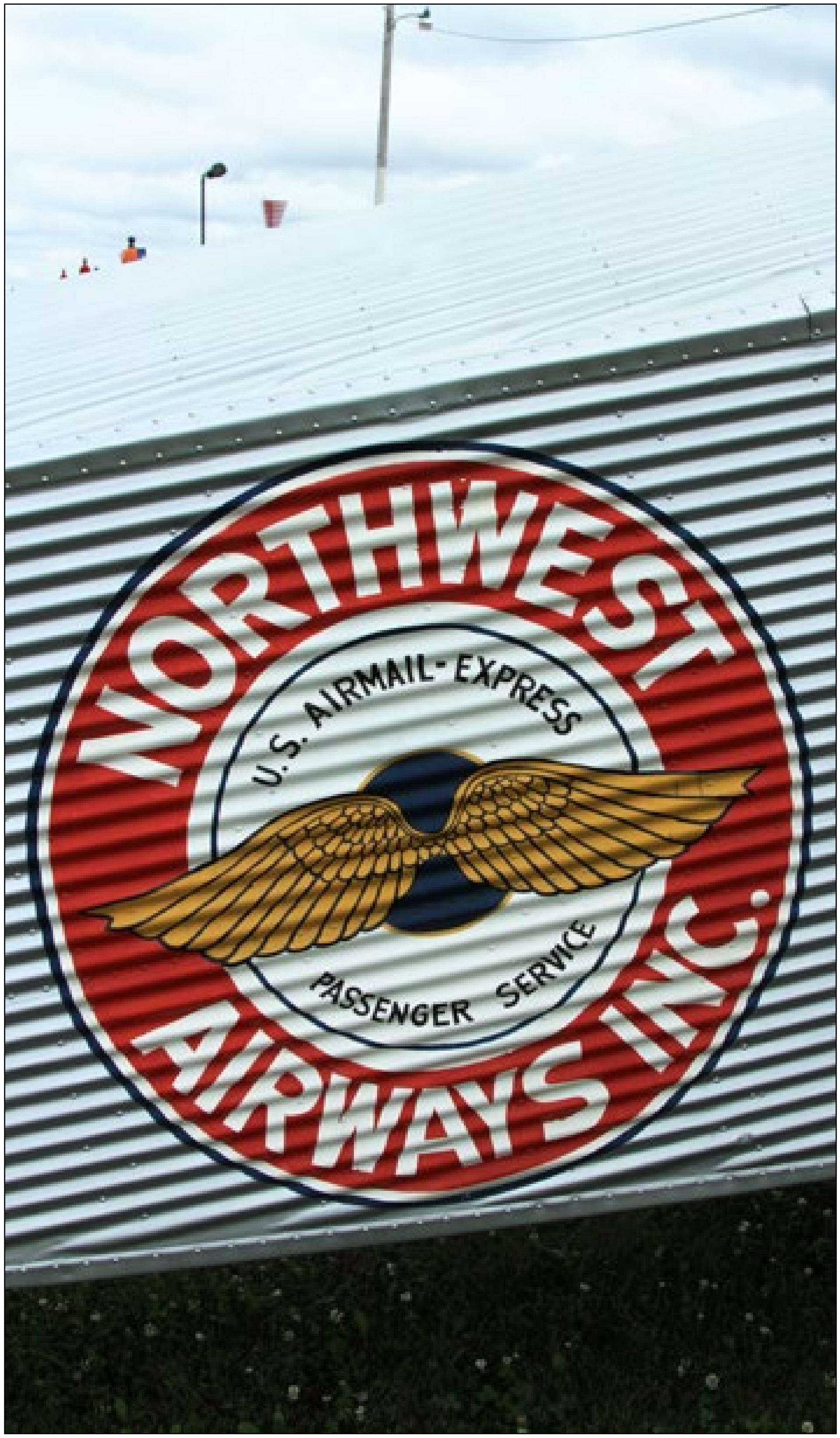
From the Chapter President

RALPH JOHNS

As we began the first day of summer with a "winter weather advisory" in the forecast, I am reminded of the volatility of our local weather and how it does not always follow the calendar. On my wall at home I have an article about record single day temperature changes in Montana. It shows a one day increase of 103 deg F and a 100 deg F decrease. Both occurred in January in different years and different locations. Some pretty impressive volatility.

I hope you have been enjoying our first Saturday of the month pancake breakfast/fly-in/Young Eagles events. They have been well-attended and are planned to continue through summer and into the fall. I hope you got a chance to meet our Ray Aviation Scholarship recipient at the June event.

On the subject of chapter events/activities, your chapter officers would like to hear what other activities you would like the chapter to organize. Please contact me at ralphjohns@bresnan.net with any suggestions you have.



CFI Corner

Aircraft stability and control

By Sherry Rossiter, CFI-I

While we credit the Wright Brothers for inventing the first "flyable" airplane, we often miss the most important point. *What makes the airplane flyable?* Many of the earlier airplane inventors focused exclusively on stability or thrust, but those two things alone would not produce a practical flying machine. An airplane suitable for everyday flight needs to not just be stable, but readily controllable by the pilot. The Wright Brothers were able to achieve a degree of control and stability never before achieved and that is the most remarkable thing about their airplane.

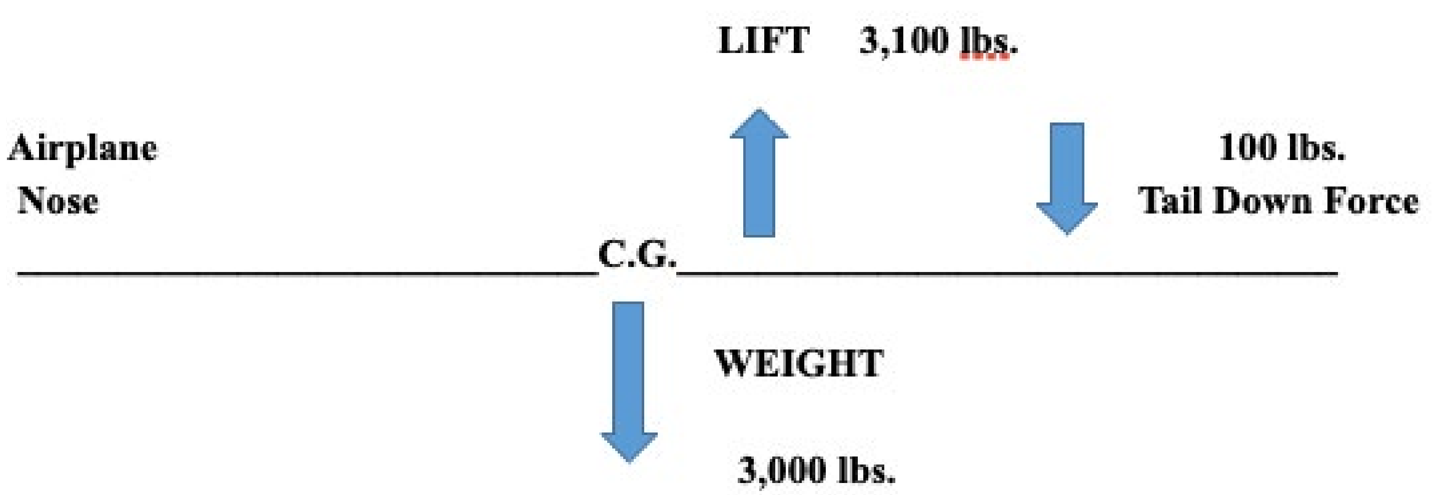
Let's look at some basic concepts regarding aircraft stability and control. As a pilot, you are already familiar with the three axes of flight: vertical (yaw), lateral (roll), longitudinal (pitch). By moving the aircraft controls, the pilot causes the airplane to rotate (or move) around one or more of these axes. A good portion of primary flight training is devoted to teaching the student about proper control input.

It isn't just about knowing which control (ailerons, rudder or elevator) to use, but it is also about learning *how much control* to use at any given time. Modern aircraft manufacturers have helped us out with some of those decisions by simply limiting the amount of control travel in order to maintain a certain level of aircraft stability.

Stability can manifest in three ways: positive, neutral, negative. In addition, stability can be described as either static or dynamic. Dynamic stability involves activity while static stability indicates no activity. Dynamic stability is considered to be *the time history* of a body's response to its inherent stability. Therefore, if an airplane exhibits positive static stability, it resists any attempt to displace it from its current position. If an airplane exhibits positive dynamic stability, it will return to its original position through a series of periodic (i.e., equal time) oscillations of decreasing amplitude.

The best way to demonstrate positive dynamic stability to a student pilot is to trim the airplane for straight and level, hands off flight. Then push the yoke or stick (i.e., the elevator control) forward a small amount and watch what happens. Within three oscillations, a general aviation airplane should return to its trimmed condition. (This is not true in a fighter jet, which we will discuss later.)

We have already established that the longitudinal stability of an aircraft is controlled by the elevator. Whether or not the elevator is effective is determined by the center of gravity (C.G.) of the airplane. That is because the upward lift forces must balance the downward forces in order for the airplane to maintain level flight.



Anyone who has flown for a few years has experienced what the elevator control (yoke or stick) feels like when the center of gravity (C.G.) is either too far aft or too far forward. The entire aircraft feels less stable and may even be dangerous to fly, if the elevator doesn't have enough control travel to compensate for the out-of-balance C.G.

This is probably a good time to discuss the difference between an elevator and a stabilator. A stabilator is preset by the manufacture at an angle that furnishes the correct downward force at the expected cruising airspeed and center of gravity position. A typical elevator travels about 30 degrees up and about 20 degrees down. A stabilator moves less than half that amount, so it is very sensitive at low airspeeds. This accounts for the difference in handling characteristics when landing a Cessna 172 Skyhawk versus a Cessna 177 Cardinal, which has a stabilator instead of an elevator.

Whether the airplane has an elevator or a stabilator, the tail down force is always the sum of the result of propeller, slipstream, downwash from the wing, and airspeed. If power is suddenly decreased, the airplane nose drops to increase airspeed. Conversely, if power is suddenly increased, the airplane nose automatically goes up to decrease airspeed. This arrangement of keeping the C.G. ahead of the center of lift (C.L.), along with a proper tail down force, insures the airplane will always return to a position of positive dynamic stability. In other words, the loading (weight and balance) of an airplane affects the longitudinal static stability of the airplane.

Directional stability on airplanes is achieved by the use of the rudder. Rudder deflections are usually held below 30 degrees as the effectiveness drops off past this amount. The rudder controls the airplanes movement (yaw) around the vertical axis. In other words, the rudder's purpose is to keep the airplane's tail behind you at all times, unless you are intentionally slipping to a landing or doing aerobatics.

Finally, we come to the topic of lateral stability (roll). The most common design factor for insuring positive lateral stability is dihedral. Dihedral is considered to be positive when the wing tips are higher than the wing roots. Excessive dihedral in the wing makes for poor rolling qualities. Boldmethod.com has a very good video explaining how dihedral keeps the wings level. (https://www.boldmethod.com/learn-to-fly/aerodynamics/dihedral-keeping-your-wings-level)

Here are a few last thoughts on the topic of aircraft stability. Military fighter jets need to be highly maneuverable, so the designers of these aircraft have traded stability for controllability. The more stable an aircraft is, the less controllable it is. Controllability refers to how easily the airplane can be disrupted from its current state by pilot control input. Military fighter jets need to be highly controllable, and hence maneuverable, in order to effectively do their job.

The bottom line is that the more a pilot understands the relationship between stability, controllability, and maneuverability, the greater the chance for a lifetime of safe flying. Blue Skies and Happy Landings!

Authors Note: This discussion about aircraft stability and control has been confined to airplanes because helicopters present an entirely different set of problems in terms of stability, controllability, and maneuverability.

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Michael Zielinski - EAA 517's First Ray Aviation Scholar

By Ray Aten

Michael Zielinski is our first Ray Aviation Scholar. He has applied and been accepted by EAA's Ray Aviation Scholarship program and will begin his flight training shortly. The purpose of the scholarship is motivational and financial support for an individual's flight training for private pilot certification. The motivational support will be from our chapter. The financial support is from the Ray Aviation Foundation and is worth a total of $10,000, distributed as specific milestones are achieved. The goal is a private pilot's certificate (passed practical exam) in 12 months or less with milestones of solo in three months or less and FAA written exam passed in six months or less.

Michael is an Eagle Scout, and his first merit badge was Aviation, which included a Young Eagle flight to meet one of the requirements. He is an honor student at Stevensville High School and is currently a Cadet Captain in the Civil Air Patrol with the Missoula Composite Squadron. Michael is enrolled with Bitterroot Aviation in Stevensville for his flight instruction and Greg Eastwood is his CFI.

We are delighted that Michael has accepted, with enthusiasm, these expectations and that he meets the applicant requirements: age of 16-19 for powered flight training; FAA medical certification; student pilot certification; the ability to begin flight training within 60 days; a willingness to provide two hours of volunteer service per month to the chapter.

The recognition of Michael Zielinski as a Ray Aviation Scholar began when EAA announced the program in late 2018. The program's goal is the distribution of $1,000,000 per year in flight training scholarships through EAA chapters. Our EAA chapter applied for and was chosen to administer a Ray Aviation Scholarship.

We hope each of you will join us in celebrating Michael's achievements (scholarship award, first solo, first solo cross-country, check ride passage) at our chapter events and meetings. And most certainly, please introduce yourself to Michael at our Young Eagle events and Fly-in Pancake Breakfasts and share your enthusiasm for aviation.

Your Ray Aviation Scholarship coordinator and committee members: Ray Aten, Ralph Jones, Sherry Rossiter

Soft-Field Takeoffs and Landings

By Steve Krog, EAA 173799

This story first appeared in the December 2018 issue of EAA Sport Aviation.

If you were asked to explain a soft-field takeoff and landing, could you do it? How long has it been since you've done one? Like many, you may not have attempted one since your initial checkride with an examiner. Others may have tried to demonstrate either, or both, during a flight review. To say soft-field procedures are seldom practiced would be a truthful statement.

Soft-field takeoff and landing techniques are a mandatory training segment for all sport, private, and commercial pilots. However, very few students ever experience true soft-field conditions. Rather, the procedure is taught on hard-surface runways and taught just well enough to pass the checkride. Unfortunately, this practice can lead to an unplanned incident.

We've experienced significant amounts of rainfall throughout the country throughout 2018. Too much rain, in fact. Farm fields are flooded, waterways are overflowing their banks, and turf runways are oftentimes unusable. We had to cancel numerous training flights this past summer and fall due to standing water on all our turf runways. When they do dry out somewhat, we practice a lot of soft-field takeoffs and landings out of necessity. We've had no problem practicing these procedures under real conditions due to the excess rainfall we've experienced.

I mentioned this to our local FAA Safety Team manager when he stopped by one day. He rolled his eyes and asked us to please keep doing this as he'd recently been involved in inspecting three incidents where the aircraft ended up on its back due to soft-field conditions.

What is the key objective when attempting a soft-field takeoff? Obviously, to get the aircraft out of the muck and off the muddy surface as quickly and safely as possible. But how do we do this? There may be several ways to teach soft-field techniques, but this is how I prefer teaching it.

If we know the takeoff is going to be made from a soft field and requires that we taxi on the soft field, it is imperative that we take care of all pre-takeoff checks prior to taxiing onto the soft field. Mags are checked, flaps are checked and set (if so equipped), and radio is checked. We do not want to have to stop our movement once on the soft surface. Should we stop, it may be very difficult to have enough power to get moving again. If back-taxiing is required, do so along either edge of the runway to allow room for making a 180-degree turn for takeoff. Clear the approach end of the runway visually while back-taxiing to prevent any conflict with landing traffic.

When flying a conventional gear or tailwheel aircraft, it is important to keep the tail wheel in contact with the runway surface for directional control, but use common sense and a bit of finesse so as not to bury the tail wheel in the muck. Light back-pressure on the stick or yoke should be applied rather than full back-pressure, which is the proper procedure under normal conditions.

As you approach the departure end of the runway and have visually cleared the final approach area, begin your 180-degree turn onto the center of the runway and continue adding power to keep the aircraft moving.

As full power is applied, begin moving the stick or yoke forward taking the downward pressure off the tail wheel. Once the tail wheel has broken ground, keep the tail low while accelerating, establishing a positive angle of attack. As groundspeed is increased, move the stick or yoke very slightly fore and aft, helping the main gear become free of the sticky muck. Once airborne, remain in ground effect by lowering the nose while building airspeed. As you approach either VX or VY, initiate a normal climb attitude and continue climbing out of the traffic pattern.

If flying a tricycle gear, it is important to keep the nose wheel from burrowing into the mud. This is done by holding back-pressure on the yoke and keeping as much weight off the nose wheel as is safely possible without compromising directional control. While back-taxiing, clear the approach end of the runway and then begin your turn onto the center of the runway. Hold the yoke in the full aft position while continuously adding power to prevent the soft surface from stopping you.

Once aligned with the approximate runway centerline, smoothly apply full power, keeping the yoke in the full aft position. As groundspeed increases and the full prop blast passes over the tail surfaces, the elevator becomes effective causing the nose to rise off the runway surface. Here is where a bit of finesse and practice becomes quite beneficial. Too much back-pressure and the nose is too high, creating a stall configuration for the wings as well as banging the tail off the runway. Too little back-pressure and the nose wheel drops onto the soft surface and begins digging in. Neither configuration is safe or desirable.

When teaching students in a tricycle-gear aircraft, I'll first practice soft-field takeoffs on a hard surface. I control the power while the students have all of the other controls. Just enough power is applied to feel the nose lifting off the runway. Then I'll work with the students to hold that attitude for four to five seconds before applying full power. As the aircraft becomes airborne, we push the nose over and fly in ground effect for several more seconds before initiating the climb. Assisting students through this procedure three or four times significantly increases their ability to recognize each step, safely execute the needed inputs, and then perform the procedure with confidence. Then I'll move students over to the soft field for demonstrating the takeoff under real circumstances. If the aircraft is flap equipped, flap application as recommended in the pilot's operating handbook is employed.

Landing on a soft field also requires some finesse. The primary objective is to get the aircraft to touch down as softly and lightly as possible while maintaining some

forward momentum, preventing the aircraft from bogging down and possibly going up on its nose or, even worse, flipping on its back.

When teaching soft-field landings in tailwheel aircraft, I begin by having students set up to make a normal three-point landing. Then, while in the flare attitude and just before touching down, I'll apply about 150-200 rpm. The airplane is suspended in ground effect well below the published stall speed. While students hold this attitude, I'll slowly reduce the power, and the airplane gently settles onto the runway. Once the wheels touch the runway, a slight bit of power is again added to help maintain a bit of forward momentum while the airplane continues settling onto the surface. Maintain some back-pressure on the stick or yoke, but not full back-pressure. We want to keep the tail wheel on the ground for handling directional control, but we don't want to bury it in the mud.

After students have experienced two or three approaches and landings with me operating the power, they're ready to take over and demonstrate it for me. I add one additional step, however. They are to explain to me every input they're making during the approach, touchdown, and rollout. Getting students to verbalize while flying a maneuver helps drive home the procedure so they never forget.

When landing a tricycle gear aircraft on a soft field, my approach to teaching is quite like the tailwheel approach. The student does the flying while I control the power for the first two or three landings. A normal approach is flown. Then, as the aircraft is leveled off and begins the flare, I'll add just enough power to keep the airplane airborne for a couple of seconds before slightly reducing power, allowing the main gear to touch down. Some power is still maintained, or slight additional power is even added, to keep the nose gear from touching while the groundspeed is dissipating. Once the nose wheel has touched down, I continue to hold enough back-pressure on the yoke to prevent the wheel from sinking or digging into the muck. It is also important at this stage to keep moving until reaching higher ground or a firm surface. If you allow the airplane to stop, you may need help to get it moving again. I never use a full flap setting when teaching soft-field landings in a flap-equipped aircraft. Too much flap and the nose has a tendency to drop hard onto the landing surface creating a problem that can easily be avoided.

Soft-field takeoffs and landings are not difficult, but they do require a bit of practice from time to time to establish and maintain the level of proficiency needed should you find yourself in a situation where they are required.

Steve Krog, EAA 173799, has been flying for more than four decades and giving tailwheel instruction for nearly as long. In 2006 he launched Cub Air Flight, a flight training school using tailwheel aircraft for all primary training. For more from Steve, check out his column The Classic Instructor every month in EAA Sport Aviation.

Join EAA's official Facebook group

By EAA

Have you joined the official EAA Facebook group? In conjunction with our normal Facebook page, our Facebook group will be a place for EAA members, pilots, and aviation enthusiasts in general to have discussions and share photos and ideas about aircraft, EAA AirVenture Oshkosh, other aviation events, homebuilding, flying tips, maintenance, and anything else related to aviation! Join today!

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