FLIGHT TRAINING

TAKING OFF

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Operation of a traditional airplane requires mastery of two physical mediums; movement on a solid surface (runway) and in a gaseous air mass. Unlike most surface vehicles (cars, boats, trains), an aircraft must be capable of operating in both modes. Because an aircraft is intended to operate primarily as a flight vehicles, it functionality as a surface vehicle is intentionally limited by design. It has relatively small wheels and brakes, and is intended for high speed surface travel. Since an aircraft must operate in two mediums, the most crucial phases of operation are the transition from one mode to the other, from two dimensional movement on a solid surface to three dimensional movement through the air.

When there is no wind, there is no relative motion between the surface and flight operating mediums. Taking off then is a simple mater of accelerating the airplane to flying speed and lifting the wheels off of the surface to complete the transition to flight operation. The airplane will, though no longer in contact with the surface, continue to move forward in the same directional relationship with the surface. If there is air mass movement (wind) in the same direction as the runway, the take off transition will be much the same, except that the minimum flying speed (relative to the surface) will be higher or lower, depending on the direction of the air movement. (headwind or tailwind) When there is air mass movement (wind) not aligned with the direction of take off, then the aircraft is going to be "pushed" in that direction and add considerably to the control effort needed for a graceful and safe take off. Now we are transitioning between operating mediums which are not in synch.

A traditional glider is perhaps the best suited of airplane configurations for making a systematic transition from ground to air operations. The traditional glider has a single wheel undercarriage located near the C.G. of the glider. Almost immediately after the beginning of its take off run, it must be "flown" or balanced on its mono-wheel. Ailerons are used to keep the wings level, or to keep the upwind wing lowered to counter crosswind drift. Elevators are used to lift the tail (or nose) to control the pitch attitude during take-off acceleration. Rudder inputs provide directional control. By the time that flying speed is reached, the pilot is already controlling everything except altitude control. Thus, the transition from ground to air operation is easy. To a great degree, the pilot is already flying while the wheel is still on the ground.

He is able to somewhat "synch" the ground and air operation.

A common "by the numbers" description of a take off (tail wheel aircraft) might be: Stick forward to lift tail, accelerate, stick back to lift off, stick forward to establish climb angle. We disdain this strictly by-the-numbers system as a "push and shove" approach to flying. We prefer to think of the take off as being a more fluid process. Yes, the controls are moved generally as described, but ideally their movement is proportioned to the desired response and is ever-changing as the take off evolves. You don't just move the controls to a given position and wait for the time to move them to the next position.

With the simplest of landing gear configurations, the tricycle, take off is basically easy and can be done in one of two basic ways:

#1. One would be that of accelerating to above lift off speed before applying any pitch control. The nose wheel would be firmly on the surface until at or above lift off speed, at which time up elevator is rather rapidly applied to lift the nose wheel and increase the angle of attack sufficient to lift off of the surface. Then, elevator stick force and thus pitch attitude, can be adjusted to achieve desired climb speed and angle.

#2. The other is to apply up elevator, sufficient to lift the nose wheel, before lift off speed is reached. Thus, an angle of attack is established and held so that when lift off speed is reached, the airplane will lift off smoothly without further elevator control input. The elevator/stick position will be such that only very minor movement will be needed to attain the desired climb speed and angle.

In example #1, the pilot does not necessarily have any real elevator awareness until after he reaches flying speed and decides to rotate. The pilot in example #2 has exercised elevator control authority well before reaching flying speed, so he is already partially flying, and minimizing the effect of transitioning from surface to air operation.

For the pilot of a tailwheel airplane, differing styles of take off are also available. For instance, the pilot can raise the tail so high that all of the weight remains on the wheels until accelerated beyond lift off speed, and then yank it into the air. Or, he can as he approaches flying speed, begin lowering the tail to increase the wing angle of attack to begin lifting or "flying" the plane.

By way of brief summarization, one method consists of "yanking" the aircraft into the air, and then flying it. The other is to start flying, or at least position the controls in anticipation of flight, as soon as practical the take off roll begins.

All of the foregoing take off procedures presupposes that the pilot is able to steer the airplane straight down the runway. As basic as this sounds, it is not always that easy---just ask any tri-gear pilot who is transitioning into a tailwheel aircraft. It's all in the feet. While learning rudder steering mostly just takes practice, a couple of tricks of the trade might help.

#1. You gotta be able to see the runway! Refer back a couple of issue of the RVator and read what we had to say about sitting as tall in the cockpit as possible. You want a view of the runway ahead so that you can use a reference point on the engine cowl as a gun-sight and keep that point centered on the runway ahead. If the aircraft in question sits with its nose so high that the runway ahead is blocked, then the pilot must pick a point of reference looking obliquely out the side of the aircraft. It is essential that the pilot have a visual reference to a point on the runway as nearly in line with the aircraft as possible. We have encountered pilots who apparently didn't realize that they had an option, and looked only straight forward at the front of the airplane rather than taking advantage of the side vision available.

#2 Maintain an "almost" straight track down the runway. Even a take-off run which appears straight is really a series of small directional corrections. The key is to keep the corrections small by immediate detection of the directional deviation and application of a small rudder corrections. If you permit the aircraft to depart too much from a straight line, greater rudder correction is needed, with the probability of over correction. Then you start "chasing" the plane down the runway, sashaying along until you, hopefully, gain enough speed to fly before you run off of the runway or into something. (Remember your flight training days?) Now, if you take off in this manner, the "smooth transition" to flight has been seriously compromised. Your heading is probably off, and the distraction of chasing your nose back and forth across the runway has probably precluded any planning for cross wind correction or climb speed control. You have three strikes against you! You are in the air, but not really in control.

On one particular occasion, I recall watching various RV's departing Sunset Airpark during one of our Homecoming fly-ins. There was a quartering right wind blowing over an orchard of low trees adjacent to the runway. The runway had a slight upslope at the lift off point. Most of the pilots seemed to be experiencing difficulty making a graceful take-off. They would drift to the left and bobble around immediately upon lift off. However, a couple of other pilots executed very smooth lift offs under identical conditions. Why the difference? The later pilots had anticipated the prevailing wing conditions and had controlled their aircraft so as to permit a smooth transition from "ground" to "flight" operations. To the maximum degree possible, they were "flying" their planes before lifting the wheels from the runway. How did they do this? Unlike the glider, which can tilt and pivot around its single wheel, an RV cannot "bank" into the wind during most of its take off roll. However, the pilot can apply aileron into the wind so that as the aircraft nears lift off speed and gets light on its wheels, one wheel will lift off first, immediately putting the aircraft in a slight bank and automatically canceling part or all of the crosswind drift.

The worst case scenario for this take off would be lifting off at minimum speed without drift correction, followed by an immediate drift to the left, and then settling back down due to a diminishing wind gust. This would be an aborted transition to flight, and would also include a transition back to ground operation; a transition totally unplanned. Now, the simple process of taking off has become complicated and will require considerable skill to bring back under control. Better to get it right the first time.

Hopefully most of the foregoing is unnecessarily basic for your piloting skill level. However, perhaps I have covered a few things, or viewed them from a different perspective, which will cause you to re-think your take off techniques and make them even better. As you probably noticed, I like the concept of viewing the take off as a "transition"---- perhaps this viewpoint can help you better understand and execute your take offs. Hopefully a good take off is an omen of the remainder of the flight to come, like "putting your best foot forward".